ORDINANCE NO. 18-1004

AN ORDINANCE OF THE CITY OF OREGON CITY ADOPTING ALTERNATE MOBILITY TARGETS FOR THE INTERSECTION OF HIGHWAY 213 AND BEAVERCREEK ROAD THROUGH AMENDMENTS TO THE COMPREHENSIVE PLAN, TRANSPORTATION SYSTEM PLAN, AND THE OREGON CITY MUNICIPAL CODE CHAPTER 12.04

WHEREAS, the 2013 Transportation System Plan (TSP) is an ancillary document to the Oregon City Comprehensive Plan; and

WHEREAS, Oregon City's 2013 TSP determined that the intersection of Highway 213 and Beavercreek Road will exceed the current mobility target in 2035, resulting in more congestion than is allowed; and

WHEREAS, the 2013 TSP identified as Project #D0 as the OR 213/Beavercreek Road Refinement Plan to identify and evaluate circulation options to reduce motor vehicle congestion along the corridor and to explore alternative mobility targets; and

WHEREAS, the Alternate Mobility Targets project involved citizens through advisory groups, public meetings, flyers, and a project webpage, with input from Oregon City residents, property owners, affected agencies, city boards, Transportation Advisory Committee, Neighborhood Associations, Planning Commission and City Commission; and

WHEREAS, the previously identified intersection improvement projects and newly identified alternatives that would meet the existing mobility targets at the OR213/Beavercreek Road intersection are not cost feasible (≥$50 million), given the financial constraints of the City and other agency partners such as Clackamas County and ODOT; and

WHEREAS, the proposed amendments and projects balance the City's goals of livability, economic growth, safety, efficiency and equity; and

WHEREAS, the proposed amendments and projects represent a feasible investment in increased capacity at the intersection, while also allowing slightly higher congestion levels during peak travel times; and

WHEREAS, the Planning Commission, based on the oral and written testimony received during public hearings, made specific recommendations regarding the amendments and subsequently recommended that the City Commission approve the Alternate Mobility Targets project and associated amendments; and

WHEREAS, the proposed amendments comply and are consistent with State statutes and Metro regulations, Statewide Planning Goals, and the goals and policies of the Oregon City Comprehensive Plan; Oregon Highway Plan, Oregon Transportation Plan, Regional Transportation Functional Plan, and Oregon City Transportation System Plan; and

WHEREAS, adoption of the Alternate Mobility Targets project is in the best interest of Oregon City to ensure that the goals and policies of the City can be realized.

NOW, THEREFORE, OREGON CITY ORDAINS AS FOLLOWS:

Section 1. The amendments to Chapter 12.04 of the Oregon City Municipal Code, attached as Exhibit 1, is hereby adopted based on the findings contained in Exhibit 3, all of which are incorporated herein by reference.

Section 2. The amendments to the Transportation System Plan project List, attached as Exhibit 2, is hereby adopted based on the findings contained in Exhibit 3, all of which are incorporated herein by reference.

Section 3. The Oregon City Transportation System Plan, an ancillary document to the Oregon City Comprehensive Plan, is hereby amended.

Read for the first time at a regular meeting of the City Commission held on the 18th day of April, 2018, and the City Commission finally enacted the foregoing Ordinance this 2nd day of May, 2018.

DAN HOLLADAY, Mayor

Attested to this 2nd day of May 2018:

~~Kattie Riggs~~, City Recorder
Jaime Reed, Acting

Approved as to legal sufficiency:

City Attorney

Attachments:
Exhibit 1 - Attachment A. Amendments to Chapter 12.04.205 of the Oregon City Municipal Code
Exhibit 2 - Attachment B. Transportation System Plan Project List Amendments
Exhibit 3 - Attachment C. Staff Report and Exhibits for Legislative File LE 17-03

12.04.205 - Mobility standards.

Development shall demonstrate compliance with intersection mobility standards. When evaluating the performance of the transportation system, the City of Oregon City requires all intersections, except for the facilities identified in subsection ~~E~~F~~D~~ below, to be maintained at or below the following mobility standards during the two-hour peak operating conditions. The first hour has the highest weekday traffic volumes and the second hour is the next highest hour before or after the first hour. Except as provided otherwise below, this may require the installation of mobility improvements as set forth in the transportation system plan or as otherwise identified by the city transportation engineer.

A. For intersections within the regional center, the following mobility standards apply:

1. During the first hour, a maximum v/c ratio of 1.10 shall be maintained. For signalized intersections, this standard applies to the intersection as a whole. For unsignalized intersections, this standard applies to movements on the major street. There is no performance standard for the minor street approaches.

2. During the second hour, a maximum v/c ratio of 0.99 shall be maintained at signalized intersections. For signalized intersections, this standard applies to the intersection as a whole. For unsignalized intersections, this standard applies to movements on the major street. There is no performance standard for the minor street approaches.

3. Intersections located on the Regional Center boundary shall be considered within the Regional Center.

B. For intersections outside of the Regional Center but designated on the Arterial and Throughway Network, as defined in the Regional Transportation Plan, the following mobility standards apply:

1. During the first hour, a maximum v/c ratio of 0.99 shall be maintained. For signalized intersections, this standard applies to the intersection as a whole. For unsignalized intersections, this standard applies to movements on the major street. There is no performance standard for the minor street approaches.

2. During the second hour, a maximum v/c ratio of 0.99 shall be maintained at signalized intersections. For signalized intersections, this standard applies to the intersection as a whole. For unsignalized intersections, this standard applies to movements on the major street. There is no performance standard for the minor street approaches.

C. For intersections outside the boundaries of the Regional Center and not designated on the Arterial and Throughway Network, as defined in the Regional Transportation Plan, the following mobility standards apply:

1. For signalized intersections:

a. During the first hour, LOS "D" or better will be required for the intersection as a whole and no approach operating at worse than LOS "E" and a v/c ratio not higher than 1.0 for the sum of the critical movements.

b. During the second hour, LOS "D" or better will be required for the intersection as a whole and no approach operating at worse than LOS "E" and a v/c ratio not higher than 1.0 for the sum of the critical movements.

2. For unsignalized intersections outside of the boundaries of the Regional Center:

a. For unsignalized intersections, during the peak hour, all movements serving more than twenty vehicles shall be maintained at LOS "E" or better. LOS "F" will be tolerated at movements serving no more than twenty vehicles during the peak hour.

D. For the intersection of OR 213 & Beavercreek Road, the following mobility standards apply:

1. During the first, second & third hours, a maximum v/c ratio of 1.00 shall be maintained. Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.

~~E. For the intersection of OR 213 & Redland Road, the following mobility standards apply:~~

~~1. During the first & second hours, a maximum v/c ratio of 1.10 shall be maintained. Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.~~

~~2. During the third hour, a maximum v/c ratio of 1.05 shall be maintained. Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.~~

~~D~~F~~E~~. Until the city adopts new performance measures that identify alternative mobility targets, the city shall exempt proposed development that is permitted, either conditionally, outright, or through detailed development master plan approval, from compliance with the above-referenced mobility standards for the following state-owned facilities:

I-205/OR 99E Interchange

~~I-205/OR 213 Interchange~~

~~OR 213/Beavercreek Road~~

State intersections located within or on the Regional Center Boundaries

1. In the case of conceptual development approval for a master plan that impacts the above references intersections:
   a. The form of mitigation will be determined at the time of the detailed development plan review for subsequent phases utilizing the Code in place at the time the detailed development plan is submitted; and
   b. Only those trips approved by a detailed development plan review are vested.
2. Development which does not comply with the mobility standards for the intersections identified in [Section] 12.04.205.E~~F~~D shall provide for the improvements identified in the Transportation System Plan (TSP) in an effort to improve intersection mobility as necessary to offset the impact caused by development. Where required by other provisions of the Code, the applicant shall provide a traffic impact study that includes an assessment of the development's impact on the intersections identified in this exemption and shall construct the intersection improvements listed in the TSP or required by the Code.

(Ord. No. 10-1003, § 1(Exh. 1), 7-7-2010; Ord. No. 13-1003, § 1(Exh. 1), 7-17-2013)

Editor's note— Ord. No. 13-1003, § 1, Exhibit 1, adopted July 17, 2013, retitled § 12.04.205 from "Intersection level of service standards" to "Mobility standards."

Hwy 213 Corridor Alternative Mobility Targets

Transportation System Plan (TSP) Amendments

Add/revise the following projects to the TSP:

Project #	Project Description	Project Extent	Project Elements	Priority	Cost Estimate
D95	Hwy 213 & Beavercreek Road Westbound Right Turn Merge Lane	Hwy 213 & Beavercreek Road to the north	Addition of a free flow right turn lane from Beavercreek Road to Hwy 213 Northbound and associated merge lane on Hwy 213 northbound	Short-Term	$2,700,000
W83	Beavercreek Road Sidewalk Infill	South of the Coltrane Path to North of Marjorie Lane	Sidewalk Infill	Medium Term	$330,000
W84	Hwy 213 & Beavercreek Road Area Safety Improvements	Hwy 213 & Beavercreek Road Intersection to Beavercreek Road & Maple Lane Intersection	Implement feasible Safety Improvements as identified in the Hwy 213 Corridor Alternative Mobility Targets Final Report	Medium-Term	$275,000
S13	Newell Creek Canyon/ Holly Lane Shared Use Path	Donovan Road to ~~Maplelane Road~~Beavercreek Rd	Add a shared use path ~~on the east side of the street~~between Holly Lane and HWY 213 to Maplelane Ct and beyond, connecting to the Oregon City Loop Trail at Beavercreek Road. (RTP project 10147)	Long Term Phase 2	$1,515,000

OREGON CITY

Community Development – Planning

221 Molalla Ave. Suite 200 | Oregon City OR 97045
Ph (503) 722-3789 | Fax (503) 722-3880

STAFF REPORT AND RECOMMENDATION
REVISED March 22, 2018

FILE NO.: LE 17-03: Alternate Mobility Standards Code Amendments

APPLICANT: City of Oregon City
625 Center Street, Oregon City, Oregon 97045

REQUEST: Amendments to Chapter 12 of the Oregon City Municipal Code, and to the Oregon City Transportation System Plan (TSP), to adopt mobility standards for the Highway 213 and Beavercreek Road intersection. The amendment also includes changes to the TSP project list.

LOCATION: Highway 213 Corridor including Beavercreek Rd. intersection

RECOMMENDATION: Approval

REVIEWER: Kelly Reid, AICP, Planner

17.50.170 - Legislative hearing process.
A. Purpose. Legislative actions involve the adoption or amendment of the city's land use regulations, comprehensive plan, maps, inventories and other policy documents that affect the entire city or large portions of it. Legislative actions which affect land use must begin with a public hearing before the planning commission.
B. Planning Commission Review.
1. Hearing Required. The planning commission shall hold at least one public hearing before recommending action on a legislative proposal. Any interested person may appear and provide written or oral testimony on the proposal at or prior to the hearing. The community development director shall notify the Oregon Department of Land Conservation and Development (DLCD) as required by the post-acknowledgment procedures of ORS 197.610 to 197.625, as applicable.
2. The community development director's Report. Once the planning commission hearing has been scheduled and noticed in accordance with Section 17.50.090(C) and any other applicable laws, the community development director shall prepare and make available a report on the legislative proposal at least seven days prior to the hearing.
3. Planning Commission Recommendation. At the conclusion of the hearing, the planning commission shall adopt a recommendation on the proposal to the city commission. The planning commission shall make a report and recommendation to the city commission on all legislative proposals. If the planning commission recommends adoption of some form of the proposal, the planning commission shall prepare and forward to the city commission a report and recommendation to that effect.
C. City Commission Review.
1. City Commission Action. Upon a recommendation from the planning commission on a legislative action, the city commission shall hold at least one public hearing on the proposal. Any interested person may provide written or oral testimony on the proposal at or prior to the hearing. At the conclusion of the hearing, the city commission may adopt, modify or reject the legislative proposal, or it may remand the matter to the planning commission for further consideration. If the decision is to adopt at least some form of the proposal, and thereby amend the city's land use regulations, comprehensive plan, official zoning maps or some component of any of these documents, the city commission decision shall be enacted as an ordinance.

2. Notice of Final Decision. Not later than five days following the city commission final decision, the community development director shall mail notice of the decision to DLCD in accordance with ORS 197.615(2).

I. Proposal

This application is being submitted as a legislative amendment to amend the municipal code and the Transportation System Plan project list. The Transportation System Plan is an ancillary document to the Comprehensive Plan.

The applicant provided the following background information:

Oregon City's 2013 Transportation System Plan (TSP) determined that the Highway 213 (OR213) corridor from Redland Road to Molalla Avenue (including the intersection of Beavercreek Road) will exceed the current mobility target in 2035, resulting in more congestion than is allowed. The OR213 intersections with Molalla Avenue and Redland Road are anticipated to meet the target; however, Beavercreek Road is not anticipated to meet the target.

Highway 213/Beavercreek Road



Figure 1. Highway 213 and Beavercreek Road intersection

The existing mobility target at the OR213/Beavercreek Road intersection is a volume-to-capacity (v/c) ratio at or below 0.99 during the peak first and second hours. The previously identified intersection improvement projects and newly identified alternatives that would meet the existing mobility targets at the OR213/Beavercreek Road intersection are not cost feasible (≥$50 million), given the financial

constraints of the City and other agency partners such as Clackamas County and ODOT. However, adoption of the alternate mobility targets does not preclude further consideration of the financially infeasible improvements in the future if additional funding becomes available.

Lacking the financial capability of implementing major capacity-increasing projects at this location, the existing Transportation System Plan employs a variety of tools to alleviate congestion at the intersection of Highway 213 and Beavercreek. The adopted plan included identification of vehicular, pedestrian and bicycle accessways around the intersection including a wide variety of parallel and alternate routes to provide choices for the public. In addition, this study was identified to work with the community to identify investments in improvements to increase the capacity and safety for all modes at the intersection and adopt alternative mobility targets are necessary.

Adoption of the alternative mobility targets results in the identification of the following improvements at the intersection of OR213 and Beavercreek Road to increase the overall capacity and safety for all modes of transportation:

- Construct a westbound right-turn merge lane. High visibility pavement markings and signage are recommended for pedestrians and bicycles to cross the channelized lane safely, and consideration should be given to installing a rectangular rapid flash beacon (RRFB) for increased visibility.
- Infill sidewalk on Beavercreek Road from south of the Coltrane Path to north of Marjorie Lane.
- Install various safety improvements outlined on pages 33 and 35 of the final report.

After adoption of the plan, the City may begin to collect funding and a proportionate share of the cost of improvements from developments which impact the intersection.

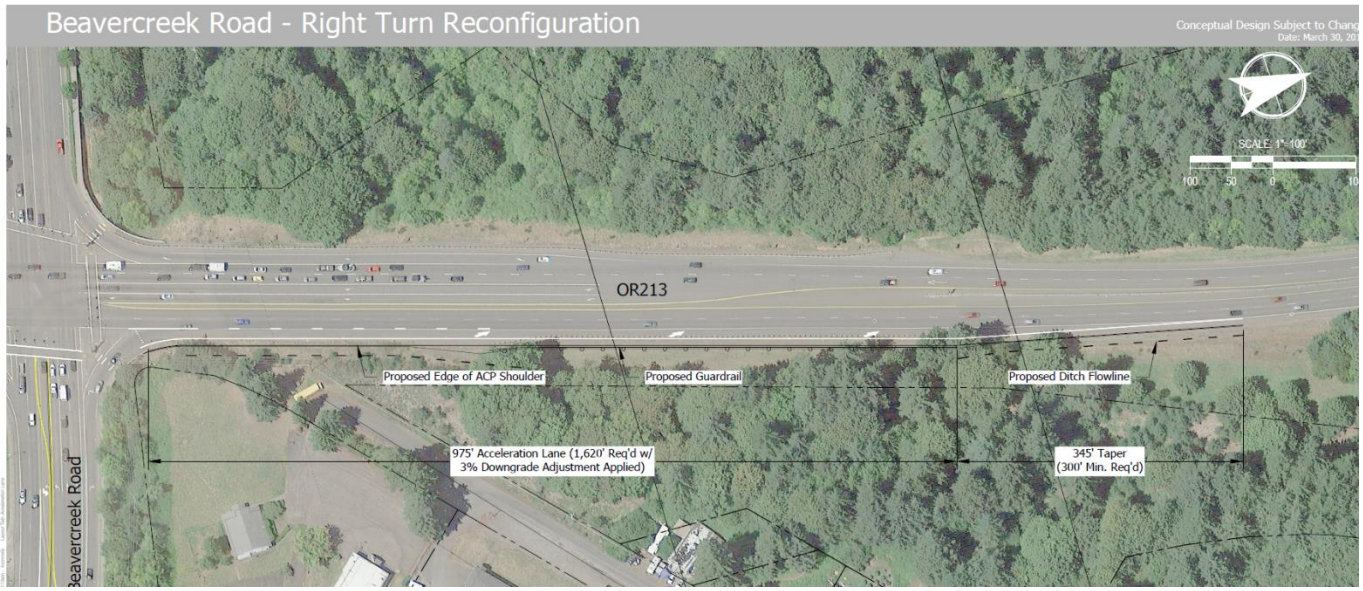


Figure 3. Depiction of right turn lane project at Beavercreek and Highway 213

For the intersection of OR213 and Beavercreek Road, the following mobility standards are proposed:

- Rather than a maximum v/c of 0.99 for the first and second hours, a maximum v/c ratio of 1.00 shall be maintained for the first, second and third hours (generally 3-6pm).
- Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.

Changes to the TSP to incorporate these improvements and the alternative mobility targets are part of this Legislative application to City's Planning Commission and City Commission. The alternative mobility

target and financially feasible improvements that are needed will need to be agreed upon by ODOT and approved by the Oregon Transportation Commission.

Highway 213/Redland Road

Improvements to the intersection of Highway 213 and Redland Road were identified as part of the TSP and are not proposed to change. The improvements identified in the TSP are part of Phase 2 of the "Jughandle" project, a project that focused on the intersection of OR213 and Washington Street that was implemented in 2013. The Phase 2 improvements, including improvements at OR213/Redland Road are already 90% designed. The improvements identified in Phase 2 future construction include an additional northbound and southbound through lane resulting in three northbound and three southbound lanes through the intersection, as showin in Figure 4 below.

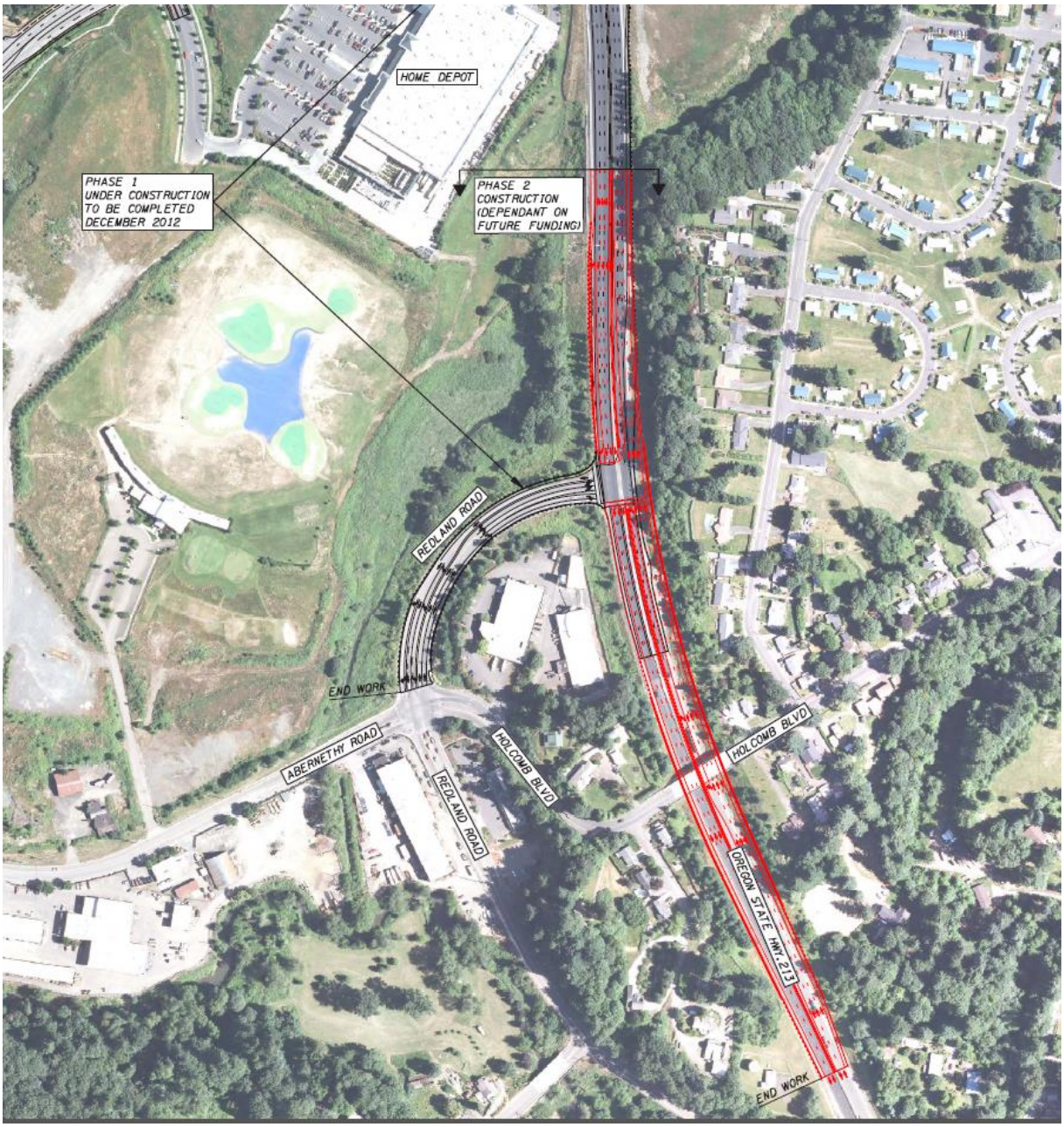


Figure 4. Depiction of Highway 213 at Redland Road planned improvements

The project at Highway 213 and Redland Road was anticipated for alternative mobility targets because it was not identified as likely to be funded in the Oregon City Transportation System Plan, however because it is identified in the Regional transportation System (RTP) it is feasible and thus no alternative mobility targets is not needed.

The attached full report (Exhibit 1) discusses the process and proposal in greater detail.

II. Draft Code Amendments

A copy of the draft code can be found in the Exhibits. The proposed amendments are to Chapter 12.04.205 – Mobility Standards.

III. Draft Transportation System Plan Project List Amendments

The proposal includes the addition of the following projects to the TSP Project List. Exhibits 5 and 6 includes a map of the projects.

Project #	Project Description	Project Extent	Project Elements	Priority	Cost Estimate
D95	Hwy 213 & Beavercreek Road Westbound Right Turn Merge Lane	Hwy 213 & Beavercreek Road to the north	Addition of a free flow right turn lane from Beavercreek Road to Hwy 213 Northbound and associated merge lane on Hwy 213 northbound	Short-Term	$2,700,000
W83	Beavercreek Road Sidewalk Infill	South of the Coltrane Path to North of Marjorie Lane	Sidewalk Infill	Medium Term	$330,000
W84	Hwy 213 & Beavercreek Road Area Safety Improvements	Hwy 213 & Beavercreek Road Intersection to Beavercreek Road & Maple Lane Intersection	Implement feasible Safety Improvements as identified in the Hwy 213 Corridor Alternative Mobility Targets Final Report	Medium-Term	$275,000
S13	Newell Creek Canyon/ Holly Lane Shared Use Path	Donovan Road to Beavercreek Rd	Add a shared use path between Holly Lane and HWY 213 to Maplelane Ct and beyond, connecting to the Oregon City Loop Trail at Beavercreek Road. (RTP project 10147)	Long Term Phase 2	$1,515,000

IV. Public Involvement and Public Comment

The Alternate Mobility Targets Project was led by Oregon City Public Works and included robust opportunities for public through the Community advisory group, Technical Advisory Group, open house,

public hearing process, multiple project mailings, newspaper noticing, meetings with the Transportation Advisory Committee, and Citizen Involvement Committee. A full description of the public engagement process is included in the full Report (Exhibit 2).

The City brought together a Community Advisory Group for the decisionmaking process that included a variety of stakeholders from the community. The 16 member Community Advisory Group met 4 times with the purpose of guiding the process to evaluate alternatives, and provide a recommendation to the City. The recommended trail alignments reflect the near-consensus of the Advisory Group, with one member unable to support the recommendation.

The Alternate Mobility Targets project and associated materials has been available for review on the Oregon City website at the following address: https://www.orcity.org/publicworks/project/ps-16-024

Notice of the first public hearing date was published in the newspaper on December 29, 2017. Notice of the public hearing was mailed to all property owners within the Oregon City limits and Urban Growth Boundary on December 29, 2017.

In accordance with ORS 197.610 and OAR 660-018-0020, a Notice of Proposed Amendment to the Oregon City Comprehensive Plan was provided to the Oregon Department of Land Conservation and Development 35 days prior to the first noticed Evidentiary Hearing).

Notice of the proposed amendment was provided to a variety of affected agencies including: South Fork Water Board (SFWB), Clackamas River Water (CRW), Clackamas County, Clackamas Fire District #1, Oregon City School District, Tri-City Services District, Metro, TriMet, and Oregon Department of Transportation (ODOT).

Public comments that have been received before, at the first hearing on January 22, 2018 and subsequent to the hearing are addressed in the Issues Matrix (Exhibit 1).

Commenter	**Summary of Comment**
Cathy Behrendt	Concerned about the lack of improvement to the City's road network. Supports light rail connections to the City, and HOV lanes on Highway 213. Would like to see Clackamas County bear responsibility for the improvement costs due to the traffic generated by County facilities, and would like to see an expansion of Beavercreek Road.
Carl and Roseann Sheeon	Concerned about overcrowded schools and traffic congestion.
Janine Offut	Would rather see the City cap development temporarily and encourage citizens to drive less.
Rose Holden, Oregon City Golf Club	Supports the alternative mobility standards in order to allow implementation of the Beavercreek Road Concept Plan area. Concerned that the lack of standards and resulting delays in the approval process has pushed developers to other parts of the region.
Jon Makler, Planning Manager, ODOT Region 1	Supports the City's proposed alternative mobility standards and right turn merge lane project. Confirmation that alternative standards are not needed at Redland Road. Commitment to work with the City to bring the proposal to the Oregon Transportation Commission.
Paul Edgar	Requested a continuance of the first hearing January 22nd, 2018. Raises concerns that increased congestion will have impact on freight routes. Points

	out that Seaside, OR has also gone through a process with ODOT for alternate mobility standards. Information on the experience in Seaside is attached to the comment.
Steve Callistini	Would like to see large intersection improvements rather than the alternate mobility standard. Supports the right turn merge lane and would like to see a speed limit reduction as well.
Lynn Andersen	Concerned that improvement projects are good ideas but they do not do enough to solve the congestion problem. Discussed sewer moratorium as example of how City handled the sewer capacity issue. Urges city to force County, state, and Metro to help fund real solutions.
Bill Merchant	Concerned that the intersection does not meet ADA requirements and that the Oregon Transportation Commission will not approve 1.0 v/c.
William Gifford	Urges the Planning Commission to approve the recommendation of the two committees that looked at this over the last year. A moratorium in Oregon City would not address the outside growth. Supports the plan as a reasonable compromise, acknowledges that it isn't fair that the City has to pay for all of it, but that is the reality.
Tammy Stevens, Hamlet of Beavercreek	Brought up the 1993 agreement for the interchange project. Concern about growth in the area and that development in enterprise zone does not pay full taxes or SDCs. There is a fear among Hamlet residents that Beavercreek Road won't be able to carry additional traffic generated by growth in the area.
Dave McNeel	As a former public works employee, remembers history of intersection planning and agreements between state, city, and county. Submitted a copy of a 1993 agreement signed by the City agreeing to plan for the grade separated interchanges. Concerned that state won't allow more than 0.99 v/c. Urges city to force County, state, and Metro to help fund a real solution. Businesses cannot afford to have their trucks tied up in traffic.
Christine Kosinski	Concerned that the merge lane will cause more rear end crashes. Supports grade separated intersection. Suggests putting the alternative mobility standards to a vote of the people.
Paul Edgar	Concerned that our projections do not account for the amount of growth that is occurring. Urges a larger solution than what is proposed, and that City demand more help from ODOT and Metro.
James Nicita	Suggests that the improvements to the intersection also include improvements to the Newell Creek culvert to provide better fish passage opportunities. Would like to see more inclusion of bicycle mobility, specifically the planned trail that parallels Highway 213 and Newell Creek. Concerned that there are no bus or transit improvements in plan.
Dan Fowler	Supports the proposal as a practical approach and a reasonable next step, but not the ultimate solution. Thinks the right turn merge lane will help people in the area. Suggested to keep the dialogue open with the state and county and consider a traffic shed, urban renewal funding. Wants the City to adopt this so they can begin collecting SDCs for the project
Robert Heiberg	Opposed to more growth and density; traffic system seems to be at capacity. Concerned that real problem is at I-205.

The above comments that pertain to approval criteria or otherwise raise issues for which the Planning Commission requested more information are addressed in the Issues Matrix (Exhibit 1). The request for a continuance was granted with a continuance of the hearing to February 26, 2018. None of the

comments provided indicate that an approval criterion has not been met or cannot be met through the Conditions of Approval attached to this Staff Report.

DECISION-MAKING CRITERIA:

Transportation System Plan

Finding: Complies as Proposed. The Transportation System Plan (TSP) adopted in 2013 identified the need to adopt Alternate Mobility Standards for these two intersections. Two of the objectives of the TSP include the identification of alternative standards for state highway corridors such as Highway 213. On page 38 of the TSP, the state highway mobility issues are outlined:

"State owned streets should comply with the mobility targets included in the Oregon Highway Plan. However, for proposed development that is permitted, either conditionally, outright, or through detailed development master plan approval, the OR 99E/I-205 SB Ramps, OR 99E/I-205 NB Ramps, OR 213/ Beavercreek Road, and I- 205/OR 213 Interchange intersections shall be exempt from meeting the state mobility targets until further solutions (beyond those included in the TSP) or alternative mobility targets are explored for the intersections."

The TSP also included a project, Project #D0, OR 213/Beavercreek Road Refinement Plan. The project was needed to Identify and evaluate circulation options to reduce motor vehicle congestion along the corridor and to explore alternative mobility targets.
Thus, this proposal fulfills the Transportation System Plan's identified need for alternative standards.

All of the City's mobility standards are found in Chapter 12.04 of the Municipal Code. This proposal includes amendments to Chapter 12.04 to adopt alternate standards for the HWY 213/Beavercreek intersection.

The proposal also includes the addition of the following projects to the TSP Project List.

Project #	Project Description	Project Extent	Project Elements	Priority	Cost Estimate
D95	Hwy 213 & Beavercreek Road Westbound Right Turn Merge Lane	Hwy 213 & Beavercreek Road to the north	Addition of a free flow right turn lane from Beavercreek Road to Hwy 213 Northbound and associated merge lane on Hwy 213 northbound	Short-Term	$2,700,000
W83	Beavercreek Road Sidewalk Infill	South of the Coltrane Path to North of Marjorie Lane	Sidewalk Infill	Medium Term	$330,000
W84	Hwy 213 & Beavercreek Road Area Safety Improvements	Hwy 213 & Beavercreek Road Intersection to Beavercreek Road & Maple Lane Intersection	Implement feasible Safety Improvements as identified in the Hwy 213 Corridor Alternative Mobility Targets Final Report	Medium-Term	$275,000

S13	Newell Creek Canyon/ Holly Lane Shared Use Path	Donovan Road to Beavercreek Rd	Add a shared use path between Holly Lane and HWY 213 to Maplelane Ct and beyond, connecting to the Oregon City Loop Trail at Beavercreek Road. (RTP project 10147)	Long Term Phase 2	$1,515,000

CHAPTER 17.68: ZONE CHANGES AND AMENDMENTS

17.68.020 Criteria.

The criteria for a zone change are set forth as follows:

A. The proposal shall be consistent with the goals and policies of the Comprehensive Plan.

Oregon City Comprehensive Plan

According to the 2004 Oregon City Comprehensive Plan (Introduction, "Implementing the Plan" Page 4): "Ancillary Plans are adopted by the City Commission for such things as parks and recreation, transportation systems, water facilities, and sewer facilities. Usually prepared by City departments through a public process, ancillary plans are approved by the City Planning Commission and adopted by the City Commission to provide operational guidance to city departments in planning for and carrying out city services. These plans are updated more frequently than the Comprehensive Plan."

This proposal amends the Transportation System Plan, which is an adopted ancillary document to the Oregon City Comprehensive Plan. The TSP is both a technical document and a conceptual guide that requires regular review.

Chapter O. Comprehensive Plan Maintenance and Update

Regular Review and Update. Another method of Plan maintenance and updating is a continuous technical review of the Plan by the Planning staff. This review and any subsequent recommendations for Plan updating should be presented to the Neighborhood Associations, Planning Commission and City Commission for input and discussion in the same manner as requested Plan changes. The continuous review should consider:

Plan implementation process;

Finding: Complies as Proposed. The applicant, Oregon City Public Works Department, has presented the update for input by the residents, affected agencies, property owners, the Transportation Advisory Committee, Neighborhood Associations, Planning Commission and City Commission in accordance with the recommended method described in the Comprehensive Plan and pursuant to the applicable process described in Oregon City Municipal Code section 17.50.170. The plan implementation process is consistent with the Comprehensive Plan.

Adequacy of the Plan to guide land use actions, including an examination of trends.

Finding: Complies as Proposed. The final report provides an analysis of existing conditions and provides direction for future development, funding and needs. The proposal is based on updated and advanced traffic models and on real traffic data collected within the last 18 months.

Whether the Plan still reflects community needs, desires, attitudes and conditions. This shall include changing demographic patterns and economics.
Finding: **Complies as Proposed.** The proposal was created through a robust public engagement process in order to reflect community needs, desires, attitudes, and conditions.

Addition of updated factual information including that made available to the City by regional, state and federal governmental agencies.
Finding: **Complies as Proposed.** The proposal includes an analysis of existing conditions including natural resources and slopes, ODOT plans and conditions, advanced traffic models that forecast future population and travel growth, and all updated master plans adopted by the City.

Section 1 Citizen Involvement
Goal 1.1 Citizen Involvement Program Implement a Citizen Involvement Program that will provide an active and systematic process for citizen participation in all phases of the land-use decision making process to enable citizens to consider and act upon a broad range of issues affecting the livability, community sustainability, and quality of neighborhoods and the community as a whole.
Policy 1.1.1 - Utilize neighborhood associations as the vehicle for neighborhood-based input to meet the requirements of the Land Conservation and Development Commission (LCDC) Statewide Planning Goal 1,
PWF Medical Center Master Plan Modification and Comprehensive Plan/Zone Change Application 20
Citizen Involvement. The Citizen Involvement Committee (CIC) shall serve as the officially recognized citizen committee needed to meet LCDC Statewide Planning Goal 1.
Goal 1.2 Community and Comprehensive Planning - Ensure that citizens, neighborhood groups, and affected property owners are involved in all phases of the comprehensive planning program.
Policy 1.2.1 - Encourage citizens to participate in appropriate government functions and land-use planning.
Goal 1.3 Community Education - Provide education for individuals, groups, and communities to ensure effective participation in decision-making processes that affect the livability of neighborhoods.
Goal 1.4 Community Involvement - Provide complete information for individuals, groups, and communities to participate in public policy planning and implementation of policies.
Policy 1.4.1 - Notify citizens about community involvement opportunities when they occur.
Finding: Complies as Proposed. The City brought together a Community Advisory Group and Technical Advisory Group for the planning process that included a wide variety of stakeholders. Recruitment for the Community Advisory Group was open to all and was promoted heavily among neighborhood associations, businesses, and community groups.
The Community Advisory Group included slots for the following stakeholder representatives:

- Planning Commission representative
- City Commission representative
- Citizen Involvement Committee representative
- Transportation Advisory Committee representative
- Resident/Property Owner:
    - Maple Lane/Thayer Road area
    - Forest Edge area
- City wide
- Advocate for:
    - Accessibility
    - Transit
    - Cycling
- Business/Property Owner: Commercial/Industrial
- Community Development Department Stakeholder Group representative
- Oregon City Chamber of Commerce representative

- Oregon City Business Alliance representative
- Clackamas Community College representative
- Hamlet of Beavercreek representative

Technical Advisory Group (TAG)

- Oregon Department of Transportation (ODOT)
    - Traffic
    - Transportation Planning
- Metro
- Oregon Department of Land Conservation and Development (DLCD)
- Clackamas County
    - Traffic
    - Transportation Planning
- TriMet
- City of Oregon City
    - Planning
    - Economic Development
    - Engineering
    - Traffic Consultant

The City shared information on a project webpage throughout the project, presented the project to the Citizen Involvement Committee, Development Stakeholder Group, Transportation Advisory Committee, and hosted an open house in December 2017. This application was noticed through mailings to all property owners in the city limits and UGB limits and was noticed in the newspaper. Neighborhood meetings were held as required.

Section 2: Land Use

Goal 2.1: Ensure that property planned for residential, commercial, office and industrial uses is used efficiently and that land is developed following principles of sustainable development.

Finding: Not Applicable. This proposal does not change development patterns or the use of land.

Goal 2.2 Downtown Oregon City Develop the Downtown area, which includes the Historic Downtown Area, the "north end" of the Downtown, Clackamette Cove, and the End of the Oregon Trail area, as a quality place for shopping, living, working, cultural and recreational activities, and social interaction. Provide walkways for pedestrian and bicycle traffic, preserve views of Willamette Falls and the Willamette River, and preserve the natural amenities of the area.

Finding: Not Applicable. This proposal does not change development patterns or plans for downtown.

Goal 2.4: Neighborhood Livability - Provide a sense of place and identity for residents and visitors by protecting and maintaining neighborhoods as the basic unit of community life in Oregon City while implementing the goals and policies of the other sections of the Comprehensive Plan.

Finding: Complies as Proposed. This proposal does not change Oregon City's neighborhood development patterns. The result of the proposed change will be a relatively small increase in congestion at the Highway 213/Beavercreek Road intersection (general a maximum v/c of 0.99 for the first two hours, to a v/c of 1.0 for the first three hours with a suite of capacity and safety improvements), which is balanced against the alternative of increasing fees and taxes to afford the costly infrastructure projects. The City does not find it to be equitable to increase fees or taxes in order to pay for improvements to one intersection, when the alternative standards can be implemented with relatively little additional congestion.

Alternatives to modify the existing intersection configuration and traffic control, which would bring the intersection into compliance with the current mobility standards in the year 2035, identified at a cost of ≥$50 million and included:

- Addition of lanes to current configuration,
- Quadrant road in the southwest quadrant of the intersection,
- Variations of displaced left-turns (also referred to as continuous flow intersection), and
- Grade-separated interchange forms.

Potential improvements for the intersection of Beavercreek Road and OR213 that focused on significantly increasing the intersection capacity to meet the current mobility target were presented to the TAG and CAG in December 2016 and January 2017. None of the alternatives were determined to be financially feasible, even by the 2035 horizon year of the TSP given the financial constraints of the city and other agency partners. In addition, some of the potential alternatives could have additional consequences including right-of-way impacts, environmental impacts, and could potentially complicate the provision of services for bicyclists, pedestrians, and transit users.

As a majority of trips neither start nor stop in Oregon City, additional trips are anticipated at the intersection regardless of the change in development within the City.

Goal 2.5: Retail and Neighborhood Commercial. Encourage the provision of appropriately scaled services to neighborhoods.

Finding: Not Applicable. This proposal does not change the scale or use of commercial areas.

Goal 2.6 - Industrial Land Development - Ensure an adequate supply of land for major industrial employers with family-wage jobs.

Finding: Not Applicable. This proposal does not change the industrial land supply.

Goal 2.7: Comprehensive Plan Map - Maintain and review the comprehensive plan map as the official long-range planning guide for land use development of the city by type, density and location.

Finding: Not Applicable. This proposal does not change the comprehensive plan map.

Section 5: Natural Resources

Goal 5.1 - Establish an open space system that conserves fish and wildlife habitat and provides recreational opportunities, scenic vistas, access to nature and other community benefits.

Finding: Not Applicable. This proposal does not change the open space system in Oregon City.

Goal 5.2 Scenic Views and Scenic Sites - Protect the scenic qualities of Oregon City and scenic views of the surrounding landscape.

Finding: Not Applicable. This proposal does not impact scenic views.

Goal 5.3 Historic Resources - Encourage the preservation and rehabilitation of homes and other buildings of historic or architectural significance in Oregon City.

Finding: Not Applicable. This proposal does not change the preservation program in Oregon City.

Goal 5.4 Natural Resources

Identify and seek strategies to conserve and restore Oregon City's natural resources, including air, surface and subsurface water, geologic features, soils, vegetation, and fish and wildlife, in order to sustain quality of life for current and future citizens and visitors, and the long-term viability of the ecological systems.

Policy 5.4.1 - Conserve and restore ecological structure, processes and functions within the city to closely approximate natural ecosystem structure, processes, and functions.
Policy 5.4.2 - Cooperate with Clackamas County, Metro and other agencies to identify and protect wildlife habitat, distinctive natural areas, corridors and linkages and other ecological resources within the Urban Growth Boundary and incorporate the information into the Urban Growth Management Agreement with Clackamas County.
Policy 5.4.4- Consider natural resources and their contribution to quality of life as a key community value when planning, evaluating and assessing costs of City actions.
Policy 5.4.8 - Conserve natural resources that have significant functions and values related to flood protection, sediment and erosion control, water quality, groundwater recharge and discharge, education, vegetation and fish, and wildlife habitat.
Policy 5.4.9 - Protect and enhance riparian corridors along streams in Oregon City to increase shade, reduce streambank erosion and intrusion of sediments, and provide habitat for a variety of plants, animals, and fish.
Policy 5.4.12 - Use a watershed-scale assessment when reviewing and planning for the potential effects from development, whether private or public, on water quality and quantity entering streams.

Finding: Complies as Proposed. The Oregon City Municipal Code contains review criteria for uses within overlay districts to assure that designated Goal 5 resources are appropriately considered when development is proposed. In particular, the Natural Resource Overlay District designation: "provides a framework for protection of Metro Titles 3 and 13 lands, and Statewide Planning Goal 5 resources within Oregon City. The Natural Resource Overlay District (NROD) in Chapter 17.49 implements the Oregon City Comprehensive Plan Natural Resource Goals and Policies, as well as Federal Clean Water Act requirements for shading of streams and reduction of water temperatures, and the recommendations of the Metro ESEE Analysis (Exhibit 13). Trails, paths, and roads are permitted either outright or with restrictions in the Natural Resource Overlay District as identified in OCMC 17.49.150 as part of a Type II or Type III review process.

Oregon City is in compliance with Metro Title 3 and Title 13 according to Metro's 2017 Compliance Report (Exhibit 11). Oregon City Municipal Code Chapter 17.49 provides equal protection of resources through the use of vegetated corridors which limit development. The width of the vegetated corridor is dependent on the type of feature, drainage basin, slope, and presence of anadromous fish.

The planning process for this proposal involved an assessment of each alternative's impact on natural resources, including nearby Newell Creek. No scenic, historic areas, or open spaces are identified in the project area. While some of the intersection improvements would have led to large impacts on the stream, the proposed project to add a right turn merge lane minimizes the addition of impervious surface in the Natural Resource Overlay District. It also avoids any changes to the north side of HWY 213 that would impact the stream or its regulated buffer area. The proposed right turn merge lane project will impact the NE quadrant of the intersection, which is within the Natural Resources Overlay District and contains both a mapped stream and mapped wetland (Exhibit 7). The mapped stream is Newell Creek, and the mapped wetland is wetland NE-8 in the City's Local Wetland Inventory Adopted in 1999 (Exhibit 8).

Public comments for this application included a concern about fish passage in Newell Creek and project impacts to the stream and wetlands. Newell Creek passes under HWY 213 at Beavercreek Road by means of a culvert. According to documentation from the Greater Oregon City Watershed Council (GOCWC), fish are present in the lower and middle reaches of Newell Creek, including juvenile coho, juvenile steelhead, trout, and lamprey (Exhibit 9). It is not clear if fish passage currently occurs at the HWY 213 culvert due to natural topography of the creek leading to the area, and lamprey are more likely to be able to pass than other fish species. The GOCWC's action plan does not include any specific fish passage improvements for Newell Creek (Exhibit 10). Another public comment on this application from

a member of the Natural Resources Committee stipulated that fish passage is not possible due to the steep terrain in the area.

In 2004, as part of a Highway 213 / Beavercreek improvement project, the City built a stormwater management pond on Beavercreek Road to detain and treat stormwater runoff from the roadways and Berry Hill Shopping Center before it enters Newell Creek. This project is described in Exhibit 12. The City initially set out to restore fish passage to the area, but according to the information in Exhibit 12, "the city's third objective pertaining to fish passage restoration was found to be unworthy at this site. Instead, the City achieved this objective by working with Clackamas County and the US and State Departments of Fish and Wildlife to construct an 'in lieu of' project with far greater benefits at another site off of Redland Road." This evidence shows that, to the extent additional water quality improvements are necessary, they can be implemented as part of the merge lane construction through direct or 'in lieu of' improvements.

Local governments are required to consider Goal 5 in limited circumstances. OAR 660–023–0250(3) provides, in part:

"Local governments are not required to apply Goal 5 in consideration of a PAPA unless the PAPA affects a Goal 5 resource. For purposes of this section, a PAPA would affect a Goal 5 resource only if:

(a) The PAPA creates or amends a resource list or a portion of an acknowledged plan or land use regulation adopted in order to protect a significant Goal 5 resource or to address specific requirements of Goal 5;

(b) The PAPA allows new uses that could be conflicting uses with a particular significant Goal 5 resource site on an acknowledged resource list; or

(c) The PAPA amends an acknowledged UGB and factual information is submitted demonstrating that a resource site, or the impact areas of such a site, is included in the amended UGB area."
The proposed plan amendment will not modify the City's existing Goal 5 resource list of modify any of the land use regulations in place to protect Goal 5 resources, most notably the City's Natural Resource Overlay zone protections set forth in OCMC 17.49. This proposal does not amend or have any impact on the Metro UGB.

The only way that Goal 5 could be triggered is if it allowed a "new use" that could conflict with a Goal 5 resource. The approval does not authorize any new uses. In NWDA v. City of Portland, the Court of Appeals found that allowing a parking garage use type that was not previously allowed in the commercial zone was a 'new use" for purposes of OAR 660–023–0250(3)(b). 198 Or App 286, 297-298 (2003) the opposite is true in this case. This approval does not authorize any different uses that were not previously allowed. Rather, this approval will allow for the continued urbanization of areas consistent with acknowledged concept plans and implementing zoning. All of this development will be subject to the City's Natural Resource Overlay standards. Further, new roads and the expansion of existing roads are permitted subject to the City's Natural Resource Overlay District requirements in OCMC 17.49.150.

If viewed as new uses, any development allowed as a result of the amendment to Chapter 12.04 and the TSP project amendments will not conflict with Goal 5 uses because it will be subject to the Natural Resource Overlay zone development requirements, ensuring that water quality values will be protected. OAR 660–023–0010(1) defines "conflicting use" to mean "a land use, or other activity reasonably and

customarily subject to land use regulations, that could adversely affect a significant Goal 5 resource * * *." Compliance with the NROD standards will ensure that land uses permitted through this approval will not adversely affect Goal 5 resources. For this reason, the requirements of OAR 660–023–0250(3)(b) have not been satisfied and Goal 5 does not apply.

Regardless of the proposed code changes to Chapter 12.04 and the TSP project amendments, the applicability of the Natural Resource Overlay District is the same. Addition of new impervious area within the NROD is expected to be necessary for the proposed right turn lane project, and this project will be required to undergo review per Chapter 17.49 of the Oregon City Municipal code. Mitigation will be required for any new impervious surface added. It is not expected that changes to the culvert will be required by City code. New stream crossings are required to be by bridge or bottomless culvert; upgrade to existing stream crossings are not likely to be required, but may be proposed by ODOT as part of an improvement project.

Section 6: Quality of Air, Water and Land Resources

Goal 6.1 Air Quality -Promote the conservation, protection and improvement of the quality of the air in Oregon City.

Policy 6.1.2 -Ensure that development practices comply with or exceed regional, state, and federal standards for air quality.

Finding: Complies as Proposed. The proposed amendment adds a TSP project for a right turn merge lane that adds a limited amount of capacity to the intersection.

The adoption of alternate mobility standards will result in the City's ability to accept greater levels of traffic congestion at these intersections during peak congestion times. This recommendation balances various goals, including the provision of public facilities, traffic safety, protection of natural resources, economic development, and livability. The proposal includes improvements to bicycle and pedestrian infrastructure that could result in greater use of alternative transportation modes, which promotes better air quality.

Goal 6.2: Water Quality - Control erosion and sedimentation associated with construction and development activities to protect water quality.

Finding: Complies as Proposed. This proposal does not change erosion control measures and policies, set forth in OCMC 15.48, that would protect riparian areas from erosion and sedimentation caused by road widening projects. The right turn lane project does include limited pavement widening along the edge of the right of way, which is partially within the Natural Resource Overlay District. The City will be required to undergo land use review for the impacts associated with the new impervious surface, and will be required to provide mitigation along with the construction of the new pavement as required by OCMC 17.49.180. The appropriate reviews will occur during and after the project is designed and engineered, and before construction.

The Advisory Groups considered, among the alternatives, infrastructure upgrades that would alleviate more congestion but that would also have a larger impact on nearby natural resources such as Newell Creek and associated wetlands and vegetated corridors.

Goal 6.3: Light - Protect the night skies above Oregon City and facilities that utilize the night sky, such as the Haggart Astronomical Observatory, while providing for night-lighting at appropriate levels to ensure safety for residents, businesses, and users of transportation facilities, reduces light trespass onto neighboring properties, conserves energy, and reduces light pollution via use of night-friendly lighting.

Finding: Not Applicable. This proposal does not change lighting regulations or uses.

Goal 6.4: Noise - To prevent excessive sound that may jeopardize the health, welfare, or safety of the citizens or degrade the quality of life.

Finding: Complies as Proposed. This proposal allows slightly higher congestion levels at the intersection of HWY 213 and Beavercreek, which will not have a significant impact on noise levels.

Goal 6.5: Solid Waste - Reduce solid waste and promote recycling.
Finding: Not Applicable. This proposal does not change solid waste measures in Oregon City.

Goal 6.6: Mineral and Aggregate Operations - Protect the livability and environment of Oregon City by prohibiting commercial aggregate extraction operations within the City and urban growth area.
Finding: Not Applicable. This proposal does not change the prohibition on mineral and aggregate operations.

Section 7: *Natural Hazards*
Protect life and reduce property loss from the destruction associated with natural hazards.
Finding: Complies as Proposed. This proposal does not change any regulations related to natural hazards in Oregon City, including Geologic Hazard and floodplain overlay districts. When the right turn merge lane project is implemented, it will be reviewed for compliance with the City's regulations found in Chapter 17.44 – Geologic Hazards.

Section 8 Parks and Recreation.
Finding: Not Applicable. This proposal does not affect any parks or recreation facilities in Oregon City.

Section 9: Economic Development
Goal 9.1 Improve Oregon City's Economic Health - Provide a vital, diversified, innovative economy including an adequate supply of goods and services and employment opportunities to work toward an economically reasonable, ecologically sound and socially equitable economy.
Finding: Complies as Proposed. This proposal allows for greater employment opportunities by allowing potential new development in industrial areas such as the Beavercreek Concept Plan Area which may not be implemented until zoning may be applied.

Section 10: Housing
Finding: Complies as Proposed. This proposal allows for greater housing opportunities by allowing potential new development in residential areas such as the Beavercreek Concept Plan Area which may not be implemented until zoning may be applied.

Section 11: Public Facilities
Goal 11.1 Provision of Public Facilities
Serve the health, safety, education, welfare, and recreational needs of all Oregon City residents through the planning and provision of adequate public facilities.
Policy 11.1.1
Ensure adequate public funding for the following public facilities and services, if feasible:
• Transportation infrastructure
Finding: Complies as Proposed. The City does not have funding to complete large infrastructure projects at this intersection to fully alleviate congestion. Thus, the Advisory Groups evaluated various alternatives, considering the costs and benefits of each.
Alternatives to modify the existing intersection configuration and traffic control, which would bring the intersection into compliance with the current mobility standards in the year 2035, were identified and included:

- Addition of lanes to current configuration,
- Quadrant road in the southwest quadrant of the intersection,
- Variations of displaced left-turns (also referred to as continuous flow intersection), and
- Grade-separated interchange forms.

Potential improvements for the intersection of Beavercreek Road and OR213 that focused on significantly increasing the intersection capacity to meet the current mobility target were presented to the TAG and CAG in December 2016 and January 2017. None of the alternatives were determined to be financially feasible, even by the 2035 horizon year of the TSP given the financial constraints of the city and other agency partners. In addition, some of the potential alternatives could have additional consequences including right-of-way impacts, environmental impacts, and could potentially complicate the provision of services for bicyclists, pedestrians, and transit users.

As a result of this study, some improvements were identified that, while not allowing the mobility standard to be fully met, would increase the intersection capacity, improve safety, and are within the financial capabilities of the city and its partner agencies.

The proposed projects for HWY 213 and Beavercreek are estimated to cost $2.7M, which is achievable with the City's current and projected resources.

Goal 11.2: Wastewater
Goal 11.3: Water Distribution
Goal 11.4: Stormwater Management
Goal 11.5: Solid Waste
Finding: Not Applicable. This proposal does not affect any of the above listed city utilities.

Goal 11.6 Transportation Infrastructure
Optimize the City's investment in transportation infrastructure.
Policy 11.6.1
Make investments to accommodate multi-modal traffic as much as possible to include bike lanes, bus turnouts and shelters, sidewalks, etc., especially on major and minor arterial roads, and in regional and employment centers.
Finding: Complies as Proposed. . The City does not have funding to complete large infrastructure projects at this intersection to fully alleviate congestion. Thus, the Advisory Groups evaluated various alternatives, considering the costs and benefits of each. The proposed project for HWY 213 and Beavercreek is estimated to cost $2.7M, which is achievable with the City's current and project resources.

Beavercreek Road in the immediate vicinity of the intersection currently includes bicycle lanes and sidewalks, except for a gap between Maplelane Road and the Coltrane pedestrian path. This proposal includes an additional TSP project to fill the sidewalk gap in the project area on Beavercreek Road. Highway 213 does not include bicycle and pedestrian infrastructure as a state highway. No changes to existing planned bike and trail TSP projects are proposed. All existing bike lanes and paths in the TSP will be retained.

Safety improvements identified by the City for further investigation, or to be included as part of future projects in the area include:

- Install intersection enhancements including potential raised crosswalks, bike lane striping continuation, ladder-style crosswalks, and lane narrowing.
- Add wayfinding signage for people walking and biking.
- Enhance bike lanes on Beavercreek Road with additional markings and green striping in transition areas.
- Add buffers to bike lanes on Beavercreek Road where feasible.
- Add ADA curb ramps in the OR213/Beavercreek Road area where missing.
- Add pedestrian facilities to Maple Lane Road between Beavercreek Road and Thayer Road.

- Add transit stop amenities to existing stops in the area.

These projects will contribute to the multi-modal goals of the Oregon City transportation system.

Goal 11.7: Non-City Utility Operations
Goal 11.8: Health and Education
Goal 11.9: Fire Protection
Goal 11.10: Police Protection
Goal 11.11: Civic Facilities
Goal 11.12: Library
Finding: Not Applicable. This proposal does not affect any of the above listed public services.

Section 12: Transportation
Goal 12.1 Land Use-Transportation Connection
Ensure that the mutually supportive nature of land use and transportation is recognized in planning for the future of Oregon City.
Policy 12.1.1 - Maintain and enhance citywide transportation functionality by emphasizing multi-modal travel options for all types of land uses.
Finding: Complies as Proposed. This proposal includes an additional TSP project to fill the sidewalk gap in the project area on Beavercreek Road and to add multimodal improvements in the project area. No changes to planned bike and trail TSP projects are proposed. All existing bike lanes and paths in the TSP will be retained.

Policy 12.1.4 - Provide walkable neighborhoods. They are desirable places to live, work, learn and play, and therefore a key component of smart growth.
Finding: Complies as Proposed. Beavercreek Road currently includes bicycle lanes and sidewalks, except for a gap between Maplelane Road and the Coltrane pedestrian path. This proposal includes an additional TSP project to fill the sidewalk gap in the project area on Beavercreek Road. Highway 213 does not include bicycle and pedestrian infrastructure as a state highway.

Goal 12.2 Local and Regional Transit
Promote regional mass transit (South Corridor bus, Bus Rapid Transit, and light rail) that will serve Oregon City.
Finding: Complies as Propsoed. This proposal does not change public transit service in the area. Currently, TriMet line 32 uses the Hwy 213 & Beavercreek intersection. They use the Beavercreek eastbound to 213 southbound, and 213 northbound to Beavercreek westbound movements. Neither of those movements are ones that see the heavy movements and delays.
The TriMet Southeast Service Enhancement Plan provides a vision for the future of transit in the southeast portion of TriMet's transit district. The plan identifies the area along Beavercreek Road (and areas of south Oregon City) as part of a new community/job connector service in the neighborhoods in South Oregon City.
The community/job connectors are identified to serve areas that would be uneconomical with full-fledged TriMet service. This vision recommends community/jobs connector service in places where the businesses and/or homes are so scattered or are located on so much land that there aren't enough people within walking distance of bus stops to cost-effectively provide traditional fixed route bus service. In some instances there aren't enough roadway connections to allow people to walk to and from bus stops safely. The Clackamas Industrial Area, generally between Highway 212 and Sunnyside, and South Oregon City are candidates for community/jobs connector service in the Southeast.
The Beavercreek Road Concept Plan mentions that transit-oriented land uses have been strategically located to increase the feasibility of transit service in the future.
In order for any transit service to be successful, the area would need to develop at appropriate densities to warrant service.

Goal 12.3 Multi-Modal Travel Options
Develop and maintain a transportation system that provides and encourages a variety of multi-modal travel options to meet the mobility needs of all Oregon
City residents.
Policy 12.3.1 -Provide an interconnected and accessible street system that minimizes vehicle miles traveled and inappropriate neighborhood cut through traffic.
Policy 12.3.2 -Provide an interconnected and accessible pedestrian system that links residential areas with major pedestrian generators such as employment centers, public facilities, and recreational areas.
Policy 12.3.3 - Provide a well-defined and accessible bicycle network that links residential areas, major bicycle generators, employment centers, recreational areas, and the arterial and collector roadway network.
Policy 12.3.4 -Ensure the adequacy of pedestrian and bicycle connections to local, county, and regional trails.
Policy 12.3.5 -Promote and encourage a public transit system that ensures efficient accessibility, mobility, and interconnectivity between travel modes for all residents of Oregon City.
Policy 12.3.6 -Establish a truck route network that ensures efficient access and mobility to commercial and industrial areas while minimizing adverse residential impacts.
Policy 12.3.8 -Ensure that the multi-modal transportation system preserves, protects, and supports the environmental integrity of the Oregon City community.
Policy 12.3.9 -Ensure that the city's transportation system is coordinated with regional transportation facility plans and policies of partnering and affected agencies.

Finding: Complies as Proposed. Beavercreek Road currently includes bicycle lanes and sidewalks, except for a gap between Maplelane Road and the Coltrane pedestrian path. This proposal includes an additional TSP project to fill the sidewalk gap in the project area on Beavercreek Road. Highway 213 does not include bicycle and pedestrian infrastructure as a state highway. This proposal includes an amendment to TSP project S13 to make it consistent with the Regional Transportation Plan Project 10147 for a shared use path parallel to Highway 213.
No changes to planned bike and trail TSP projects are proposed. All existing bike lanes and paths in the TSP will be retained.
Safety improvements identified by the City for further investigation, or to be included as part of future projects in the area include:

- Install intersection enhancements including potential raised crosswalks, bike lane striping continuation, ladder-style crosswalks, and lane narrowing.
- Add wayfinding signage for people walking and biking.
- Enhance bike lanes on Beavercreek Road with additional markings and green striping in transition areas.
- Add buffers to bike lanes on Beavercreek Road where feasible.
- Add ADA curb ramps in the OR213/Beavercreek Road area where missing.
- Add pedestrian facilities to Maple Lane Road between Beavercreek Road and Thayer Road.
- Add transit stop amenities to existing stops in the area.

These projects will contribute to the multi-modal goals of the Oregon City transportation system.

Goal 12.4: Light-Rail
Promote light rail that serves Oregon City and locate Park and Ride facilities at convenient neighborhood nodes to facilitate access to regional transit.

Finding: Complies as Proposed. This proposal does not change public transit service in the area. There is an existing park and ride location at Clackamas Community College which is not proposed to change. In order for any light rail service to be successful, the area would need to develop at appropriate densities to warrant service. The Beavercreek Road Concept Plan area will add increased density of housing and jobs to the area, improving the environment for successful transit service.

Goal 12.5 Safety

Develop and maintain a transportation system that is safe.

Policy 12.5.1 -Identify improvements that are needed to increase the safety of the transportation system for all users.

Policy 12.5.2 -Identify and implement ways to minimize conflict points between different modes of travel.

Policy 12.5.3 -Improve the safety of vehicular, rail, bicycle, and pedestrian crossings.

Finding: Complies as Proposed. The OR213/Beavercreek Road intersection was identified in the 2013 TSP as a high collision intersection. The intersection was in the top 5% of the ODOT Safety Priority Index System (SPIS) List for the years 2012-2014. The SPIS List is maintained by ODOT and updated each year with the latest available year of crash records and traffic volumes. 2012-2014 is the most current SPIS list. The intersection also has a crash rate that exceeds the Critical Crash Rate meaning that it exceeds the crash rate of other comparable intersections.

As shown in the final report, the most predominant crash type at the OR213/Beavercreek Road intersection is rear-end crashes. Beavercreek Road is the first at-grade intersection on OR213 for over two miles south of Redland Road, in a corridor that generally feels rural. A lack of driver expectation of southbound queues from the signal may contribute to the high number of reported rear-end crashes at the intersection. The reported fatality occurred in 2011, and was an angle crash in which the driver ran a red light under dark and rainy conditions. The 2010-2014 crash rate of 1.20 is already lower than the crash rate of 2.05 identified in the 2013 TSP, indicating that safety and/or driver attentiveness have improved in recent years. Lengthening the dual eastbound left-turn lanes to provide additional storage (Project D27; funded) and an advanced queue warning system on southbound 213 will further improve safety at the intersection.

As shown in the final report, the planned TSP and proposed improvements will reduce the number of expected annual crashes at the OR213/Beavercreek Road intersection. The potential financially feasible improvements at OR213/Beavercreek Road are predicted to reduce crashes at the intersection by almost 5%.

Public comments on this application raised concerns over ADA accessibility and pedestrian safety at the right turn lane from WB Beavercreek to NB HWY 213. The proposed merge lane will allow vehicles turning right to free flow onto HWY 213. The proposed project includes modifications to the existing pedestrian crossing to enhance safety. The project report (Exhibit 2) calls for high visibility pavement markings and signage for pedestrians and bicycles to cross the channelized lane safely, and calls for consideration of a rectangular rapid flash beacon (RRFB) for increased visibility. Detailed engineering and design of the project will address these items, along with required ADA improvements.

Goal 12.6 Capacity

Develop and maintain a transportation system that has enough capacity to meet users' needs.

Policy 12.6.1 - Provide a transportation system that serves existing and projected travel demand.

Policy 12.6.2 - Identify transportation system improvements that mitigate existing and projected areas of congestion.

Policy 12.6.3 - Ensure the adequacy of travel mode options and travel routes (parallel systems) in areas of congestion.

Policy 12.6.4 - Identify and prioritize improved connectivity throughout the city street system.

Finding: Complies as Proposed. The analysis in the final report shows that, without improvements, the OR213/Beavercreek Road intersection will exceed current mobility targets in 2040. With potentially financially feasible improvements in place (i.e. a westbound right-turn merge lane at OR213/Beavercreek), the intersection will still exceed the existing mobility targets under 30th highest hour traffic conditions. Therefore, it is recommended that alternative mobility targets be based on average annual conditions, allowing the v/c ratio to exceed 0.99 for one hour per day at the OR213/Beavercreek Road intersection (upper limit of 1.0).

The proposal maintains freight mobility, which peaks during midday and will not be affected by the allowance of higher levels of congestion in the AM and PM peak hours.

Goal 12.7 Sustainable Approach
Promote a transportation system that supports sustainable practices.
Policy 12.7.4 - Promote multi-modal transportation links and facilities as a means of limiting traffic congestion.
Finding: Complies as Proposed. No changes to planned bike and trail TSP projects are proposed. All existing bike lanes and paths in the TSP will be retained. Beavercreek Road currently includes bicycle lanes and sidewalks, except for a gap between Maplelane Road and the Coltrane pedestrian path. This proposal includes an additional TSP project to fill the sidewalk gap in the project area on Beavercreek Road. Highway 213 does not include bicycle and pedestrian infrastructure as a state highway. This proposal includes an amendment to TSP project S13 to make it consistent with the Regional Transportation Plan Project 10147 for a shared use path parallel to Highway 213 (See Exhibit 6). Safety improvements identified by the City for further investigation, or to be included as part of future projects in the area include:

- Install intersection enhancements including potential raised crosswalks, bike lane striping continuation, ladder-style crosswalks, and lane narrowing.
- Add wayfinding signage for people walking and biking.
- Enhance bike lanes on Beavercreek Road with additional markings and green striping in transition areas.
- Add buffers to bike lanes on Beavercreek Road where feasible.
- Add ADA curb ramps in the OR213/Beavercreek Road area where missing.
- Add pedestrian facilities to Maple Lane Road between Beavercreek Road and Thayer Road.
- Add transit stop amenities to existing stops in the area.

These projects will contribute to the multi-modal goals of the Oregon City transportation system.

Goal 12.8 Implementation/Funding
Identify and implement needed transportation system improvements using available funding.
Policy 12.8.1 - Maximize the efficiency of the Oregon City transportation system, thus minimizing the required financial investment in transportation improvements, without adversely impacting neighboring jurisdictions and facilities.
Finding: Complies as Proposed.
The cost of the westbound right-turn merge lane at OR213/Beavercreek Road is estimated to be approximately $2.7 million based on the design shown in Figure 2. This estimate does not include right of- way acquisition.

The KAI and OBEC cost estimates, as well as exhibits of the proposed financially feasible improvements at OR213/Beavercreek Road can be found in Appendix “G” of the final report.

The City is committed to nominating both the Redland project and the Beavercreek project for inclusion in a potential regional bond measure that is being considered.

Local funds that can be used for these projects include SDCs and gas taxes. SDCs are paid by new development and they apply to all development, even in enterprise zone areas. SDCs can only be reduced if a developers build improvement projects themselves that would otherwise be funded by SDCs. The City also analyzed what a local bond measure would mean if city residents voted to pay for a $10M project here – Each household would be assessed an average of $769. No changes to fees, SDCs,

taxes, or a bond are proposed at this time. Adding the project to the SDC financially constrained list means that the City can use SDCs collected to fund the right-turn merge lane project.

Section 13: Energy Conservation
Goal 13.1 Conserve energy in all forms through efficient land-use patterns, public transportation, building siting and construction standards, and city programs, facilities, and activities.
Finding: Complies as Proposed. This proposal allows the city's systems to be used more efficiently through the addition of a right turn merge lane on Highway 213, and avoids the overbuilding of infrastructure that can lead to increased energy use.

Section 14: Urbanization
Goal 14.2: *Orderly Redevelopment of Existing City Areas- Reduce the need to develop land within the Urban Growth Boundary by encouraging redevelopment of underdeveloped or blighted areas within the existing city limits.*
Finding: Not applicable. This proposal applies equally to all lands in the City and has no impact on policies that encourage redevelopment in underdeveloped areas.

17.68.020.B. That public facilities and services (water, sewer, storm drainage, transportation, schools, police and fire protection) are presently capable of supporting the uses allowed by the zone, or can be made available prior to issuing a certificate of occupancy. Service shall be sufficient to support the range of uses and development allowed by the zone.
Finding: Not Applicable. No zone map change is proposed.

17.68.020.C. The land uses authorized by the proposal are consistent with the existing or planned function, capacity and level of service of the transportation system serving the proposed zoning district.
Finding: Not Applicable. No zone map change is proposed.

17.68.020.D. Statewide planning goals shall be addressed if the comprehensive plan does not contain specific policies or provisions which control the amendment.
Finding: Complies as Proposed. While the Comprehensive Plan complies with statewide planning goals, staff provides additional findings as follows:

STATEWIDE PLANNING GOAL 1:
To develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process.
Finding: Complies as Proposed. This goal is implemented through the applicable Goals and Policies in Section 1 of the Oregon City Comprehensive Plan: Citizen Involvement. Development of the plan included an extensive public involvement effort.

STATEWIDE PLANNING GOAL 2:
To establish a land use planning process and policy framework as a basis for all decision and actions related to use of land and to assure an adequate factual base for such decisions and actions.
Finding: Complies as Proposed. This goal is implemented through the applicable Goals and Policies in Section 2 of the Oregon City Comprehensive Plan: Land Use. Because the plan is an ancillary document to the City's Transportation System Plan and Comprehensive Plan, the application was processed pursuant to the legislative hearing process outlined in Section 17.50.170 of the Oregon City Municipal Code.

STATEWIDE PLANNIG GOAL 3: Agricultural Lands and GOAL 4: Forest Lands

Finding: Not Applicable. By definition, Oregon City does not have rural resource lands such as for agricultural or forest use within its city limits or UGB and therefore those goals are not applicable.

STATEWIDE PLANNING GOAL 5:
To protect natural resources and conserve scenic and historic areas and open spaces.
Finding: Complies as Proposed. This goal is implemented through the applicable Goals and Policies in Section 5 of the Oregon City Comprehensive Plan: Open Spaces, Scenic and Historic Areas, and Natural Resources. The Oregon City Municipal Code contains review criteria for uses within overlay districts to assure that designated Goal 5 resources are appropriately considered when development is proposed. In particular, the Natural Resource Overlay District designation: "provides a framework for protection of Metro Titles 3 and 13 lands, and Statewide Planning Goal 5 resources within Oregon City. The Natural Resource Overlay District (NROD) implements the Oregon City Comprehensive Plan Natural Resource Goals and Policies, as well as Federal Clean Water Act requirements for shading of streams and reduction of water temperatures, and the recommendations of the Metro ESEE Analysis (Exhibit 13). Trails, paths, and roads are permitted either outright or with restrictions in the Natural Resource Overlay District as identified in OCMC 17.49.150 as part of a Type II or Type III review process. Oregon City is in compliance with Metro Title 3 and Title 13 according to Metro's 2017 Compliance Report (Exhibit 11).

No scenic, historic areas, or open spaces are identified in the project area. Natural resources include Newell Creek. The proposed right turn merge lane project will impact the NE quadrant of the intersection, which is within the Natural Resources Overlay District and contains both a mapped stream and mapped wetland (Exhibit 7). The mapped stream is Newell Creek, and the mapped wetland is wetland NE-8 in the City's Local Wetland Inventory Adopted in 1999 (Exhibit 8).

Public comments for this application included a concern about fish passage in Newell Creek and project impacts to the stream and wetlands. Newell Creek passes under HWY 213 at Beavercreek Road by means of a culvert. According to documentation from the Greater Oregon City Watershed Council (GOCWC), fish are present in the lower and middle reaches of Newell Creek, including juvenile coho, juvenile steelhead, trout, and lamprey (Exhibit 9). It is not clear if fish passage currently occurs at the HWY 213 culvert due to natural topography of the creek leading to the area, and lamprey are more likely to be able to pass than other fish species. The GOCWC's action plan did not include any specific fish passage improvements for Newell Creek (Exhibit 10). Rather, the GOCWC report notes that Newell Creek has cool water temperatures and remains in good condition. Another public comment on this application from a member of the Natural Resources Committee stipulated that fish passage is not possible due to the steep terrain in the area.

In 2004, as part of a Highway 213 / Beavercreek improvement project, the City built a stormwater management pond on Beavercreek Road to detain and treat stormwater runoff from the roadways and Berry Hill Shopping Center before it enters Newell Creek. This project is described in Exhibit 12. The City initially set out to restore fish passage to the area, but according to the information in Exhibit 12, "the city's third objective pertaining to fish passage restoration was found to be unworthy at this site. Instead, the City achieved this objective by working with Clackamas County and the US and State Departments of Fish and Wildlife to construct an 'in lieu of' project with far greater benefits at another site off of Redland Road." This evidence shows that, to the extent additional water quality improvements are necessary, they can be implemented as part of the merge lane construction through direct or 'in lieu of' improvements.

Local governments are required to consider Goal 5 in limited circumstances. OAR 660–023–0250(3) provides, in part:

> "Local governments are not required to apply Goal 5 in consideration of a PAPA unless the PAPA affects a Goal 5 resource. For purposes of this section, a PAPA would affect a Goal 5 resource only if:
>
> (a) The PAPA creates or amends a resource list or a portion of an acknowledged plan or land use regulation adopted in order to protect a significant Goal 5 resource or to address specific requirements of Goal 5;
>
> (b) The PAPA allows new uses that could be conflicting uses with a particular significant Goal 5 resource site on an acknowledged resource list; or
>
> (c) The PAPA amends an acknowledged UGB and factual information is submitted demonstrating that a resource site, or the impact areas of such a site, is included in the amended UGB area."

The proposed plan amendment will not modify the City's existing Goal 5 resource list of modify any of the land use regulations in place to protect Goal 5 resources, most notably the City's Natural Resource Overlay zone protections set forth in OCMC 17.49. This proposal does not amend or have any impact on the Metro UGB.

The only way that Goal 5 could be triggered is if it allowed a "new use" that could conflict with a Goal 5 resource. The approval does not authorize any new uses. In *NWDA v. City of Portland,* the Court of Appeals found that allowing a parking garage use type that was not previously allowed in the commercial zone was a 'new use" for purposes of OAR 660–023–0250(3)(b). 198 Or App 286, 297-298 (2003) The opposite is true in this case. This approval does not authorize any different uses that were not previously allowed. Rather, this approval will allow for the continued urbanization of areas consistent with acknowledged concept plans and implementing zoning. All of this development will be subject to the City's Natural Resource Overlay standards. Further, new roads and the expansion of existing roads are permitted subject to the City's Natural Resource Overlay District requirements in OCMC 17.49.150.

If viewed as new uses, any development allowed as a result of the amendment to Chapter 12.04 and the TSP project amendments will not conflict with Goal 5 uses because it will be subject to the Natural Resource Overlay zone development requirements, ensuring that water quality values will be protected. OAR 660–023–0010(1) defines "conflicting use" to mean "a land use, or other activity reasonably and customarily subject to land use regulations, that could adversely affect a significant Goal 5 resource * * *." Compliance with the NROD standards will ensure that land uses permitted through this approval will not adversely affect Goal 5 resources. For this reason, the requirements of OAR 660–023–0250(3)(b) have not been satisfied and Goal 5 does not apply.

Regardless of the proposed code changes to Chapter 12.04 and the TSP project amendments, the applicability of the Natural Resource Overlay District will continue to apply to all development so as to protect Newell Creek and any other regulated natural resource. Addition of new impervious area within the NROD is expected to be necessary for the proposed right turn lane project, and this project will be required to undergo review per Chapter 17.49 of the Oregon City Municipal code. Mitigation will be required for any new impervious surface added. It is not expected that changes to the culvert will be required by City code. New stream crossings are required to be by bridge or bottomless culvert; upgrade

to existing stream crossings are not likely to be required, but may be proposed by ODOT as part of an improvement project.

STATEWIDE PLANNING GOAL 6:
To maintain and improve the quality of the air, water and land resources of the state.
Finding: Complies as Proposed. This goal is implemented through the applicable Goals and Policies in Section 6 of the Oregon City Comprehensive Plan: Quality of Air, Water and Land Resources. By planning system improvements based on projected demand and land use patterns, the plan will ensure that land suited for development will be served efficiently. All new development will be subject to the City's Natural Resource Overlay District standards and erosion control standards, which implement state and local water quality standards.

The improvements recommended in the plan will result in less pollution by providing a safe opportunity for pedestrian and bicycle travel.

STATEWIDE PLANNING Goal 7:
To protect life and property from natural disasters and hazards.
Finding: Not Applicable. This proposal does not change any regulations related to natural hazards in Oregon City, including Geologic Hazard and floodplain overlay districts.

STATEWIDE PLANNING GOAL 8:
To satisfy the recreational needs of the citizens of the state and visitors, and, where appropriate, to provide for the siting of necessary recreational facilities including destination resorts.
Finding: Not Applicable. This proposal does not affect any parks or recreation facilities in Oregon City.

STATEWIDE PLANNING GOAL 9:
To provide adequate opportunities throughout the state for a variety of economic activities vital to the health, welfare, and prosperity of Oregon's citizens.
Finding: Complies as Proposed. The adoption of these standards will allow the City to approve new development in the area that contributes to economic vitality.

STATEWIDE PLANNING Goal 10:
To provide for the housing needs of citizens of the state.
Finding: Complies as Proposed. This proposal allows for greater housing opportunities by allowing potential new development in residential areas such as the Beavercreek Concept Plan Area to meet transportation requirements.

STATEWIDE PLANNING GOAL 11:
To plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development.
Finding: Complies as Proposed. This goal is implemented through the applicable Goals and Policies in Section 11 of the Oregon City Comprehensive Plan: Public Facilities. As stated in Section 11, the transportation infrastructure in Oregon City is governed by the Oregon City Transportation System Plan (Oregon City TSP). The relevant Public Facilities goals and policies and findings are discussed in greater detail above. The proposal includes upgrades to public facilities that balances costs, environmental impacts, livability, safety, and traffic congestion.

STATEWIDE PLANNING GOAL 12:
To provide and encourage a safe, convenient and economic transportation system.

Finding: Complies as Proposed. This goal is implemented at the local level through the applicable Goals and Policies in the updated TSP, Section 2 (The Vision). This goal is also implemented at the state level through the Transportation Planning Rule (TPR), OAR 660-012. The proposal will result in fewer crashes and will increase the capacity of the intersection.

STATEWIDE PLANNING GOAL 13: To conserve energy.
Land and uses developed on the land shall be managed and controlled so as to maximize the conservation of all forms of energy, based upon sound economic principles.
Finding: Complies as Proposed. This goal is implemented through the applicable Goals and Policies in Section 13 of the Oregon City Comprehensive Plan: Energy Conservation. The multimodal transportation system and improvements proposed will support efficient use of land and encourage walking and biking by providing a cohesive transportation system for a variety of modes.

Oregon Transportation Plan (2006)

The Oregon Transportation Plan (OTP) is the state's long-range multimodal transportation plan. The OTP is the overarching policy document among a series of plans that together form the state transportation system plan (TSP). A TSP must be consistent with applicable OTP goals and policies. Findings of compatibility will be part of the basis for TSP approval. The most pertinent OTP goals and policies for city transportation system planning are provided below.
POLICY 1.2 – Equity, Efficiency and Travel Choices
It is the policy of the State of Oregon to promote a transportation system with multiple travel choices that are easy to use, reliable, cost-effective and accessible to all potential users, including the transportation disadvantaged.
POLICY 4.1 - Environmentally Responsible Transportation System
It is the policy of the State of Oregon to provide a transportation system that is environmentally responsible and encourages conservation and protection of natural resources.
POLICY 5.1 – Safety
It is the policy of the State of Oregon to continually improve the safety and security of all modes and transportation facilities for system users including operators, passengers, pedestrians, recipients of goods and services, and property owners.
POLICY 7.1 – A Coordinated Transportation System
It is the policy of the State of Oregon to work collaboratively with other jurisdictions and agencies with the objective of removing barriers so the transportation system can function as one system.
POLICY 7.3 – Public Involvement and Consultation
It is the policy of the State of Oregon to involve Oregonians to the fullest practical extent in transportation planning and implementation in order to deliver a transportation system that meets the diverse needs of the state.
POLICY 7.4 – Environmental Justice
It is the policy of the State of Oregon to provide all Oregonians, regardless of race, culture or income, equal access to transportation decision-making so all Oregonians may fairly share in benefits and burdens and enjoy the same degree of protection from disproportionate adverse impacts.
Finding: Complies as Proposed. The City's Transportation System Plan has been found to be in compliance with the Oregon Transportation Plan. The proposed amendments to the TSP address equity, efficiency, choice, environmental issues and safety. The proposal was developed with Advisory Groups including multiple ODOT staff. The proposal will go before the Oregon Transportation Commission for final approval.

Oregon Highway Plan

The 1999 Oregon Highway Plan (OHP) establishes policies and investment strategies for Oregon's state highway system over a 20-year period and refines the goals and policies found in the OTP. Policies in the OHP emphasize the efficient management of the highway system to increase safety and to extend highway capacity, partnerships with other agencies and local governments, and the use of new techniques to improve road safety and capacity. These policies also link land use and transportation, set standards for highway performance and access management, and emphasize the relationship between state highways and local road, bicycle, pedestrian, transit, rail, and air systems. The policies applicable to the Oregon City TSP are addressed below.
Policy 1A (Highway Classification) defines the function of state highways to serve different types of traffic that should be incorporated into and specified through IAMPs.
Policy 1C (State Highway Freight System) states the need to balance the movement of goods and services with other uses.
Policy 1B (Land Use and Transportation) recognizes the need for coordination between state and local jurisdictions.
Policy 1F (Highway Mobility Standards) sets mobility standards for ensuring a reliable and acceptable level of mobility on the highway system by identifying necessary improvements that would allow the interchange to function in a manner consistent with OHP mobility standards.
Policy 1G (Major Improvements) requires maintaining performance and improving safety by improving efficiency and management before adding capacity. ODOT works with regional and local governments to address highway performance and safety.
Policy 2F (Traffic Safety) improves the safety of the highway system.
Finding: Complies as Proposed. The OHP Policy 1F establishes mobility targets (as defined by motorized vehicle volume-to-capacity ratios) for state facilities that vary by region, facility classification, and whether or not the roadway is located inside an urban growth boundary (UGB). It states, "It is the policy of the State of Oregon to maintain acceptable and reliable levels of mobility on the state highway system, consistent with expectation for each facility type, location and functional objectives. Highway mobility targets will be the initial tool to identify deficiencies and consider solutions for vehicular mobility on the state system.

Specifically, mobility targets shall be used for:
• Identifying state highway mobility performance expectations for planning and plan implementation;
• Evaluating the impacts on state highways of amendments to transportation plans, acknowledged comprehensive plans and land use regulations pursuant to the Transportation Planning Rule (OAR 660-12-0060); and
• Guiding operations decisions such as managing access and traffic control systems to maintain acceptable highway performance."

The OHP Policy 1F allows for development of alternative mobility targets in areas where it is "infeasible or impractical to meet the mobility targets". The policy allows for the use of alternative mobility targets to "balance overall transportation system efficiency with multiple objectives of the area being addressed." It requires that targets "shall be clear and objective and shall provide standardized procedures to ensure consistent application of the selected measure. The alternative mobility target(s) shall be adopted by the Oregon Transportation Commission as an amendment to the OHP." The OHP currently includes alternative mobility targets in many locations throughout the State; however, none have been adopted within the Portland Metro area to date.

The proposal maintains freight mobility, which peaks during midday and will not be affected by the allowance of higher levels of congestion in the AM and PM peak hours.

OAR 660 Division 12 Transportation Planning Rule (TPR)

The purpose of the TPR is "to implement Statewide Planning Goal 12 (Transportation) and promote the development of safe, convenient and economic transportation systems that are designed to reduce reliance on the automobile so that the air pollution, traffic and other livability problems faced by urban areas in other parts of the country might be avoided." A major purpose of the Transportation Planning Rule (TPR) is to promote more careful coordination of land use and transportation planning, to ensure that planned land uses are supported by and consistent with planned transportation facilities and improvements.

Finding: Complies as Proposed. Mobility targets for state highways, as established in this policy or as otherwise adopted by the Oregon Transportation Commission (OTC) as alternative mobility targets, are considered the highway system performance standards in compliance with the Transportation Planning Rule (TPR) (OAR 660-012), including applicability for actions that fall under Section -0060 of the TPR. The TPR Section -0060 applies when cities or counties are considering zone changes or plan amendments that would allow for additional development that would significantly impact or worsen the performance of existing or planned transportation facilities. Currently, significant impacts are found to exist when levels of automobile traffic cause roadway facilities to exceed motorized vehicle standards, such as mobility targets. If there is a significant impact, jurisdictions are required to "ensure that allowed land uses are consistent with the identified function, capacity, and performance standards of the facility measured at the end of the planning period identified in the adopted Transportation System Plan."

Regional Transportation Plan

The Regional Transportation Functional Plan (RTFP) directs how Oregon City should implement the RTP through the TSP and other land use regulations. The RTFP codifies existing and new requirements which local plans must comply with to be consistent with the RTP. If a TSP is consistent with the RTFP, Metro will find it to be consistent with the RTP.

Finding: Complies as Proposed. The RTP includes a project in the area for Southbound OR 213 Advanced Warning System. This project is retained in the existing proposal. The RTP also includes a project for Redland Road improvements, which will also be retained.

CHAPTER 17.50 ADMINISTRATION AND PROCEDURES

17.50.030 Summary of the City's Decision-Making Processes.

Finding: Complies as Proposed. The proposed Legislative application is being reviewed pursuant to the Type IV process. Notice was posted, online and mailed to all property owners in the City and UGB and posted in the paper.

17.50.050 Preapplication Conference

A. Preapplication Conference. Prior to submitting an application for any form of permit, the applicant shall schedule and attend a preapplication conference with City staff to discuss the proposal. To schedule a preapplication conference, the applicant shall contact the Planning Division, submit the required materials, and pay the appropriate conference fee. At a minimum, an applicant should submit a short narrative describing the proposal and a proposed site plan, drawn to a scale acceptable to the City, which identifies the proposed land uses, traffic circulation, and public rights-of-way and all other required plans. The purpose of the preapplication conference is to provide an opportunity for staff to provide the applicant with information on the likely impacts, limitations, requirements, approval standards, fees and other information that may affect the proposal. The Planning Division shall provide the applicant(s) with the identity and contact persons for all affected neighborhood associations as well as a written summary of the preapplication conference. Notwithstanding any representations by City

staff at a preapplication conference, staff is not authorized to waive any requirements of this code, and any omission or failure by staff to recite to an applicant all relevant applicable land use requirements shall not constitute a waiver by the City of any standard or requirement.
B.A preapplication conference shall be valid for a period of six months from the date it is held. If no application is filed within six months of the conference or meeting, the applicant must schedule and attend another conference before the city will accept a permit application. The community development director may waive the preapplication requirement if, in the Director's opinion, the development does not warrant this step. In no case shall a preapplication conference be valid for more than one year.
Finding: Complies as Proposed. On June 28, 2017, a pre-application conference was held. The application was filed with the City within six months of the pre-application conference. These criteria are met.

17.50.055 Neighborhood Association Meeting
Finding: Complies as Proposed. The applicant held neighborhood meetings with all neighborhoods bordering the HWY 213 intersections involved in the proposal, including Caufield, Gaffney Lane, Park Place, and Hillendale. The meeting notes are included in application materials. This standard has been met.

17.50.060 Application Requirements.
Finding: Complies as Proposed. All application materials required are submitted with this narrative.

17.50.070 Completeness Review and 120-day Rule.
Finding: Complies as Proposed. This land use application was submitted on December 15, 2017. The application was deemed complete on December 16, 2017.

17.50.080 Complete Application--Required Information.
Finding: Complies as Proposed. This land use application was submitted on December 15, 2017. The application was deemed incomplete on July 20, 2017.

17.50.090 Public Notices.
Finding: Complies as Proposed. Staff provided public notice citywide and in the Urban Growth Boundary via mail, posted on the Oregon City website and in a general circulation newspaper. Staff provided email transmittal or the application and notice to affected agencies, and to all Neighborhood Associations requesting comment.

17.50.100 Notice Posting Requirements.
Finding: Complies as Proposed. No signs were posted as there is no specific property involved for this proposed Legislative amendment.

RECOMMENDATION
Based on the findings identified above, the proposal to amend the mobility standards in Chapter 12.04 and revise the TSP Project list appears to comply with the review criteria. Staff recommends approval of Planning file L 17-03.

EXHIBITS
1) Planning Commission Issues Matrix
    a) 1993-05-19 City Commission Minutes
    b) Hwy 213 Improvements Before and After Images
    c) Hwy 213 Corridor Study 2000

    d) ODOT Stormwater Improvements Images
    e) GOCWC Watershed Action Plan
2) Alternate Mobility Targets Final Report and Appendices
    a) Final Report Appendices
3) OCMC 12.04.205 Proposed Changes
4) TSP Amendments
5) TSP Projects Map
6) Existing TSP/RTP Map of Newell Creek/Holly Lane Shared Use Path
7) Natural Resource Overlay District Maps
8) Adopted Local Wetland Inventory (Relevant Excerpts)
9) Greater Oregon City Watershed Assessment
10) Greater Oregon City Watershed Council Action Plan
11) Metro Compliance Report 2017
12) 2004 Drainage Improvements Fact Sheet
13) Metro Phase I and Phase II ESEE Analysis
14) Public Comments
15) Land Use Application Form
    a) Applicant's Narrative and Code Responses
    b) Combined Neighborhood Meeting Materials

Planning Commission Issues for February 26, 2018 Hearing

L 17-03 Alternate Mobility Targets

Issue	Description	Specific Concerns	Explanation or Proposed Change
1.	Half Diamond and Displaced Left turn projects	Clarify why the half diamond and the displaced left turn ideas were not brought forward	The half diamond project did have a significant improvement to capacity, however, the impacts to private property, natural resources, bicycle and pedestrian movement are high. The cost of that project is also very high. Alternative #3 (Southbound Displaced Left) provides nearly the same capacity as a full interchange, at a fraction of the costs. However, the following issues kept the CAG and TAG from recommending it: • This concept is new to ODOT and is not well-tested in Oregon. This creates uncertainty at ODOT when a new concept is proposed. A new type of facility that drivers are not accustomed to creates a risk of driver confusion. • ODOT is concerned with the close spacing of the signals. • Storage at the left-turn signal would likely require significant widening & earthwork, impacting the geologic hazard area and natural resource overlay district (NROD) significantly. It would also require significant acquisition of private property. • The pedestrian crossing distance, already long, would be increased. Staff believes that as these types of facilities become more common and are built in more areas this could be a viable long term option for the intersection. Please refer to item #7 in this matrix for a discussion of how this idea can be further investigated in the long term.
2.	ADA requirements	How is the project meeting ADA requirements?	Any new project would be built to current ADA standards. This was not explicitly noted in the report, but is understood and a requirement for any new construction or modifications to existing infrastructure. As an example, in order to construct the Meyers Road Extension and add the 4th leg to the intersection the City is required to update the entire signal (including pedestrian push buttons) & all the pedestrian ADA ramps to current standards.

Issue	Description	Specific Concerns	Explanation or Proposed Change
3.	1993 agreement for interchange	In 1993 the City, County, and ODOT signed a Memorandum of Understanding that agreed on an at-grade intersection and a future grade separated interchange. What happened to this agreement?	It appears that the County requested a change to the agreement that the City commit to denying new development at the intersection if traffic analysis demonstrates that the intersection will not operate at Level of Service D or better or if the development will impede implementation of or substantially increase cost of grade-separated interchange improvements. The City had concerns over this request and rescinded its approval of the agreement according to meeting minutes from May 19, 1993.[1] There is no evidence of a replacement agreement or a re-negotiation in the months and years following this decision. The City went through a TSP update in 2001 and identified an intersection expansion project that included exclusive right turn lanes, signal modification, and expansion of left turn lanes. The project cost was estimated at $5.45M with $2.5M to come from a City match through urban renewal funds. That project was built in 2004 with a combination of funds, including urban renewal funds.[2] The 2001 TSP also referred to the grade-separated interchange idea, and included a long term project for a single point diamond interchange. This 2001 TSP identified the interchange project cost as $20M, and noted that $5M would come from the City and $15M would come from ODOT/Metro. The two aforementioned projects were based on the Highway 213 Corridor Study completed in 2000.[3] The Advisory groups who participated in this project recommended the at-grade intersection expansion that became a 2001 TSP project. The Corridor Study notes that the expansion would provide capacity

[1] See document in record entitled 1993-05-19 City Commission Minutes

[2] See document in record entitles HWY 213 improvements before and after images

[3] See document in record entitled HWY 213 Corridor Study, 2000

Issue	Description	Specific Concerns	Explanation or Proposed Change
			through 2015, and the City would have to consider changes, such as the grade separated interchange, at that time. The study also indicated that other system connections may preclude the need for this interchange. When the City updated its TSP in 2013, the interchange project was eliminated from the project list due to livability, multi-modal access and funding constraints within the 2035 planning horizon. The TSP instead called for alternative mobility targets for this intersection, and said the interchange project should be reconsidered beyond the 2035 planning horizon if targets cannot be met.
4.	Newell Creek fish passage	• Stormwater outflows into culvert under HWY 213 that is connected to Newell Creek • Could the culvert and drainage be improved to allow fish passage?	The photo provided at the January 22nd hearing is older, and ODOT has since upgraded the stormwater infrastructure in the area.[4] They recently completed work to stop erosion under the retaining wall and in the outfall area, including additions of rip rap to the area and filling in under the retaining wall with concrete. Staff reviewed the Greater Oregon City Watershed Council Assessment and Action Plans for information on fish presence in Newell Creek. Fish are present in the lower and middle reaches of the creek, including juvenile coho, juvenile steelhead, trout, and lamprey. It is not clear if fish passage currently occurs at the culvert due to natural topography of the creek leading to the area, and lamprey are more likely to be able to pass than other fish species. The GOCWC's action plan does not include any specific fish passage improvements for Newell Creek.[5] Regardless of the proposed code changes to Chapter 12.04 and the TSP project

[4] See item in record titled ODOT Stormwater improvements images

[5] See item in record titled GOCWC Watershed Action Plan

Issue	Description	Specific Concerns	Explanation or Proposed Change
			amendments, the Natural Resource Overlay District will adequately protect designated riparian areas. Addition of new impervious area within the NROD is expected to be necessary for the proposed right turn lane project, and this project will be required to undergo review per Chapter 17.49 of the Oregon City Municipal code. Mitigation will be required for any new impervious surface added. It is not expected that changes to the culvert will be required by City code. New stream crossings are required to be by bridge or bottomless culvert; upgrade to existing stream crossings are not likely to be required, but may be proposed by ODOT as part of an improvement project.
5.	Bike routes	• Are the planned bike routes in the area still a possibility? • Would like to see a separated bike route to the high school along the south side of Beavercreek Road • There is a shared use path planned parallel to HWY 213 that could provide a bike route all the way to Washington Street area	• No changes to planned bike and trail TSP projects are proposed, other than the addition of a shared use path project explained below. Wayfinding signage and bike lane improvements on Beavercreek Rd are proposed as part of TSP project W84. All existing bike lanes and paths in the TSP will be retained. • The current plan for Beavercreek Rd includes bike lanes and sidewalks all the way south past the high school. As properties along Beavercreek Road redevelop, city staff will work with developers on the design details for the street improvements. Through the land use process, staff has the ability to modify the design of street improvements, and could potentially include a separated bike path instead of a bike lane on-street. This modification is a Type II process through Chapter 12.04.007. • The planned shared use path that parallels HWY 213 is a project in the Regional Transportation Plan (Project # 10147 Newell Creek Canyon/Holly Lane Shared-Use Path) and is in the City's trails master plan. The full path is not currently on the City's TSP project list; project #S12 covers a portion of the trail near Ogden Middle School. Metro has acquired properties within this corridor for future development of the trail. • Staff has added a revision to the # S13 shared use path project to the TSP project list proposed amendments in an effort to bring consistency to the

Issue	Description	Specific Concerns	Explanation or Proposed Change
			city's trail and transportation plans, and reflect regional plans. See revised TSP project list for project #S13.
6.	Trimet service	Why can't we improve transit service in the area or connect light rail down here?	Currently TriMet line 32 uses the Hwy 213 & Beavercreek intersection. They use the Beavercreek EB to 213 SB & 213 NB to Beavercreek WB movements. Neither of those movements are ones that see the heavy movements and delays. The TriMet Southeast Service Enhancement Plan provides a vision for the future of transit in the southeast portion of TriMet's transit district. The plan identifies the area along Beavercreek Road (and areas of south Oregon City) as part of a new community/job connector service in the neighborhoods in South Oregon City. The community/job connectors are identified to serve areas that would be uneconomical with full-fledged TriMet service. This vision recommends community/jobs connector service in places where the businesses and/or homes are so scattered or are located on so much land that there aren't enough people within walking distance of bus stops to cost-effectively provide traditional fixed route bus service. In some instances there aren't enough roadway connections to allow people to walk to and from bus stops safely. The Clackamas Industrial Area, generally between Highway 212 and Sunnyside, and South Oregon City are candidates for community/jobs connector service in the Southeast. The Beavercreek Road Concept Plan mentions that transit-oriented land uses have been strategically located to increase the feasibility of transit service in the future. In order for any transit service to be successful, the area would need to develop at appropriate densities to warrant service. The City may consider a future request that TriMet consider re-routing an existing line onto Meyers and Beavercreek Road once the Meyers Road extension is constructed and development begins to occur in the area.

Issue	Description	Specific Concerns	Explanation or Proposed Change
7.	Option to retain full interchange project	How can we ensure that the larger improvement project ideas are not lost and remain future possibilities?	The City is required to update its Transportation System Plan every 10 years. During the next TSP update, the City will study the HWY 213/Beavercreek Road intersection to determine if it will operate within the standards through 2045. If operations are shown to be above the adopted standard, the City will need to consider these larger improvement projects to improve capacity. Staff advises against adding a project at this time when models show that the City can meet the 1.0 v/c standard through 2035 without a large project. If the City were to add a larger improvement project to the current TSP, it would have to also add the project to the SDC list, which would further raise already high Transportation SDC rates. Alternative #3 (Southbound Displaced Left) provides nearly the same capacity as a full interchange, at a fraction of the costs. Other solutions analyzed through this process may also be viable projects in the future, such as the triple left turn alternative.
8.	V/C Ratio	• What does v/c 1.0 feel like? • Aren't we just going to exceed the standard in a few years and be back where we started?	The v/c ratio, also referred to as degree of saturation, represents the sufficiency of an intersection to accommodate the vehicular demand. A v/c ratio less than 0.85 generally indicates that adequate capacity is available and vehicles are not expected to experience significant queues and delays. As the v/c ratio approaches 1.0, traffic flow increases, and delay and queuing conditions may occur. Once the demand exceeds the capacity (a v/c ratio greater than 1.0), delay and queuing is expected. Under these conditions, vehicles may require more than one signal cycle to pass through the intersection (known as a cycle failure). For design purposes, a v/c ratio between 0.85 and 0.95 generally is used for the peak hour of the horizon year (generally 20 years out). Overdesigning for an intersection should be avoided due to negative impacts to pedestrians associated with wider street crossings, the potential for speeding,

Issue	Description	Specific Concerns	Explanation or Proposed Change
			land use impacts, and cost. Models show that we will stay within the standard through 2035.
9.	Freight impact	Will accepting higher congestion at this intersection hurt freight movement?	Peak freight movement occurs between 9AM and 3PM. The intersection operations are acceptable during these hours. The proposal to change the mobility standard only applies to peak hour (3-6PM) travel.
10.	Funding constraints	• Why can't ODOT or the County fund these improvements? • The City should demand that ODOT help with costs and should build the full interchange improvement as soon as possible.	The larger transportation bill at the state level is looking at I-205, I-5, Highway 217 and larger projects in the Portland region, where congestion affects a larger portion of the day and impacts freight movement more significantly. State priorities include Highway 217 widening, Cornelius Pass widening, completing the Sunrise Corridor project and upgrading the I-205 Abernethy Bridge. Hwy 213 is not a priority compared to these projects. Clackamas County priorities are focused solely on maintenance. The City is committed to nominating both the Redland project and the Beavercreek project for inclusion in a potential regional bond measure that is being considered. Local funds that can be used to fund City transportation projects include System Development Charges (SDCs) and gas taxes. SDCs are paid by new development and they apply to all development, even in enterprise zone areas. SDCs can only be reduced if a developers build improvement projects themselves that would otherwise be funded by SDCs. Fees could be collected from city residents via utility bills, in a similar fashion to the pavement maintenance fee. When sewer capacity upgrades were necessary, the City raised sewer rates citywide in order to afford the upgrades. The City also analyzed what a local bond measure would mean if city

Issue	Description	Specific Concerns	Explanation or Proposed Change
			residents voted to pay for a $10M project here – Each household would be assessed an average of $769. A $50M project would mean an assessment of almost $4,000 per household. No new fees or bond measures are proposed at this time. In a separate process in spring 2018, the City Commission will be considering SDC rate changes based on the new project list.
11.	Seaside, OR example	The City of Seaside adopted alternate mobility standards recently and we should learn from their experience	Staff reviewed the information about the Seaside Alternate Mobility Standards provided by Paul Edgar, and confirmed with the City of Seaside that the mobility standards are approved and officially adopted. The Oregon Transportation Commission approved a 1.0 mobility standard for four intersections along Highway 101, based on average annual conditions. The number of hours the new standard applies varies for each intersection with the maximum being 3 hours (from 3 to 6PM) for the intersection of US101 and Broadway. The standards used in Seaside, as approved by the Oregon Transportation Commission, are the same or very similar to what is being proposed for Highway 213 in Oregon City. Seaside similarly adopted transportation projects to enhance bicycle and pedestrian connectivity and safety in the area. They also invested in parallel local routes and made agreements with ODOT regarding pursuit of funding for bike, ped, and local street improvements.

scheduling, the Budget Committee meeting scheduled for Monday, May 24, 1993 will be canceled in favor of the Volunteer Appreciation Dinner also scheduled for that evening. Also attached was an agenda that is proposed to be followed for each meeting.

It was recommended that the Commission appoint the City Manager as Budget Officer for fiscal year 1993-94.

It was moved by Light, second by Ebert, to appoint the City Manager as Budget Officer for fiscal year 1993-94.

Roll call: Powell, Aye; VanOrman, Aye; Ebert, Aye; Light, Aye; Fowler, Aye.

Light requested that a resolution expressing City Commission opposition to the Jennings Lodge/Candy Lane withdrawal from the Oregon City School District be presented on a future agenda. Presentation approved by Commission consensus.

Fowler requested an Attorney General's opinion regarding the OCA ballot measure and to what extent the City Commission authority extends regarding this matter.

With no further business, the meeting adjourned with the Commission meeting in Executive Session pursuant to ORS 192.660 (1)(e) Real Property Transactions.

CHARLES LEESON, Recording Secretary

REGULAR MEETING Oregon City, Oregon, May 19, 1993

A regular meeting of the City Commission was held in the Commission Chambers of City Hall on the above date at 8:00 p.m.

Roll call showed the following present:

Mayor Daniel W. Fowler
Commissioner Suzanne VanOrman
Commissioner Robert M. Light
Commissioner James R. Ebert

Charles Leeson, City Manager
Edward J. Sullivan, City Attorney

The flag salute was lead by Mayor Fowler, after which he called for approval of the minutes. It was moved by VanOrman, second by Ebert, to approve the Special Meeting minutes of March 31, 1993. Approved unanimously.

On the call for citizen presentations and future agenda items, Bill Green, addressed the Commission regarding the proposed street of dreams in Newell Creek Canyon. He distributed a handout for Commission review. He advised the Commission on the cost of copies of City Codes and Comprehensive Plans in the following cities: Hillsboro, Comprehensive Plan is free and the

Municipal Code is $8.00; Wilsonville, $7.50 each for a total of $15.00; Milwaukie, $11.00 , City Code $5.00 (with a cover add $4.00 more); Lake Oswego, both for $25.00; Beaverton, $10.00 and $15.00; Tualatin, both for $50.00; West Linn, $25.00 and $30.00 or free specific pages if requested); Forest Grove, $95.00 and $11.00; Clackamas County, $45.00 for the Comprehensive Plan, $80.00 for Code; and, Oregon City, Comprehensive Plan is being revised and not available for another 6 months, City Code, $150.00 and photocopying is $.50 per page. Oregon City has copies of the City Code at the Library. He then asked why the high cost.

VanOrman noted that the $.50 per page photocopying has been in effect for years, and the Comprehensive Plan is in short supply. This was referred to staff for response.

An unidentified male addressed the Commission for the purpose of apologizing for prior testimony in which he came across as being sarcastic.

Denyse McGriff, Principal Planner, addressed the Commission on behalf of a citizen who was not able to be here. She was representing Darlene Trevino, one of the owners of The Heritage Coffee Shop, 212 7th Street, who was requesting to have two tables outside the restaurant, on public right-of-way on 7th Street.

The City Attorney advised that if the Commission were to allow right-of-way to be used, which right-of-way must be specified. Fowler noted assuming it to be directly in front of the business. He also noted this may not be the last request from the businesses and maybe the Commission should look at criteria that would allow staff approval. VanOrman then questioned why matters such as this and service of alcoholic beverages in City parks is brought before the Commission. The Attorney responded that the ordinance requires Commission approval. Fowler suggested setting criteria for the park issue and the use of public sidewalk right-of-way be brought back for Commission approval.

Commission Report No. 93-109, Authorization to Publish Notice of Intent to Issue Sewer Revenue Bonds - Resolution No. 93-34, was presented by the Manager. The report noted that added to the May 19, 1993 agenda was proposed Resolution No. 93-34 which requests authorization to publish Notice of Intent to Issue Sewer Revenue Bonds. There is need to publish this notice at the earliest possible time to meet an August 1 sale date.

The report continued by noting that the purpose for issuance of the sewer bonds is to finance the cost of reconstruction for sewer separation mandated by the Environmental Protection Agency as a condition of the grant used to build the Tri-City Sewer Plant. The current interest rate on financing through Tri-City Service District is 6.9 percent. The bond issue would be at approximately 5 percent interest which computes to a savings of about $90,000 in the first year.

Based upon the information above, it was recommended that Resolution No. 93-34 be adopted. Following adoption, the resolution will be published pursuant to ORS Chapter 288.

Scott Harper, Finance Officer, reiterated the information in the Commission Report.

It was moved by Ebert, second by Light, to adopt Resolution No. 93-34.

Roll call: VanOrman, Aye; Light, Aye; Ebert, Aye; Fowler, Aye.

RESOLUTION NO. 93-34

A RESOLUTION AUTHORIZING THE ISSUANCE OF SEWER REVENUE BONDS AND DIRECTING THE PUBLISHING OF A NOTICE OF INTENT TO ISSUE REVENUE BONDS.

WHEREAS, the City of Oregon City, Oregon (the "Issuer") plans to construct certain additions and improvements to the Issuer's sewer system (the "Facilities"); and

WHEREAS, the additions and improvements to the Facilities will cost an estimated $6,000,000 and the Issuer intends to issue bonds to finance the cost of the additions and improvements to the Facilities; and

WHEREAS, the Issuer finds it desirable to issue sewer revenue bonds (the "Bonds") in an amount not to exceed $6,000,000 to finance the cost of the additions and improvements to the Facilities pursuant to Oregon Revised Statutes 288.805 to 288.945, inclusive (the "Uniform Revenue Bond Act"), and to pledge for payment of the Bonds the unobligated net revenues of the Issuer's sewer system, being a revenue producing facility providing services related to the services to be financed by the Bonds.

NOW, THEREFORE, BE IT RESOLVED by the City Commission of the City of Oregon City, Oregon:

Section 1. The Issuer hereby authorizes the issuance of the Bonds in a principal amount not to exceed $6,000,000 for the purpose of financing the cost of construction of the additions and improvements to the Facilities and paying for engineering fees, attorney fees and other related costs.

Section 2. The Bonds shall not be general obligations of the Issuer or a charge upon the tax revenues of the Issuer. The unobligated net revenues of the Issuer's sewer system are hereby pledged to the payment of the principal of and interest on Bonds, after payment of the ordinary operation and maintenance expenses of the sewer system from the gross revenues thereof. So long as the Bonds are outstanding, the Issuer shall fix rates and collect charges for sewer services adequate to provide sufficient revenues to pay, in addition to all other expenses and obligated indebtedness, principal of and interest on the Bonds.

Section 3. The Issuer hereby designates the Bonds for purposes of paragraph (3) of Section 265(b) of the Internal Revenue Code of 1986, as amended, (the "Code") as "qualified tax-exempt obligations" and covenants that the Bonds do not constitute private activity bonds as defined in Section 141 of the Code, and that not more than $10,000,000 aggregate principal amount of obligations, the interest on which is excludable under Section 103(a) of the Code from gross income for federal income for tax purposes (excluding, however, private activity bonds other than qualified 501(c)(3) bonds) including the Bonds, have been or shall be issued by the Issuer, including all subordinate entities of the Issuer, if any, during the calendar year 1993.

Section 4. The Finance Officer is authorized and directed to publish a Notice of Intent to Issue Bonds describing the purposes for which the Bonds are to be sold, in the form attached hereto as Exhibit A, in one issue of THE REVIEW, a newspaper of general circulation within the geographical boundaries of the Issuer. In addition, the Finance Officer shall cause the Notice of Intent to Issue Bonds to be given in the same manner as are other public notices of the Issuer. The Bonds may not be sold at public competitive bid, nor shall a purchase agreement be executed for a private negotiated sale, for at least 60 days following publication of the Notice of Intent to Issue Bonds.

Section 5. Voters residing within the geographical boundaries of the Issuer may file a petition with the Issuer asking to have the question of whether to issue the Bonds referred to a vote. If the Issuer receives petitions containing valid signatures of the Issuer's electors totaling not less than five percent (5%) of the Issuer's electors, the question of issuing the Bonds shall be placed on the ballot at the next legally available election date. In the event the Issuer receives such a petition within 60 days from publication of the Notice of Intent to Issue Bonds, the Bonds shall not be sold until this Resolution is approved by a majority of the electors of the Issuer voting on this Resolution.

Section 6. The Bonds may be sold at a private negotiated sale in accordance with the Uniform Revenue Bond Act and Seattle-Northwest Securities Corporation is hereby designated to serve as underwriter in connection with the issuance of the Bonds.

Section 7. Rankin Mersereau & Shannon is hereby designated to serve as bond counsel in connection with the issuance of the Bonds.

Adopted, signed and approved this 19th day of May, 1993.

/s/Daniel W. Fowler
Mayor

/w/James R. Ebert
Commissioner

/s/Suzanne VanOrman
Commissioner

_____
Commissioner

/s/Robert M. Light
Commissioner

Comprising the City Commission
of Oregon City, Oregon

Request for continuance of Ordinance No. 93-1007, An Ordinance Amending the Natural Resources Element of the Comprehensive Plan to Add a New Section on Water Resources; and, request for continuance of Ordinance No. 93-1008, An Ordinance Amending Title 17: Zoning, Chapter 17.06.020 Classification of Zoning Districts, and Adding a New Chapter 49, of the Oregon City Municipal Code, 1991, was presented. At the March 31, 1993 meeting, the City Commission reviewed two proposals to adopt planning and zoning regulations for Water Resources. The Commission continued the request to allow for additional information to be obtained relating to the quality and quantity of the Water Resources. The City has entered into a contract with a consulting firm to assist in completing the work. A continuance for a period of 45 days to allow for staff and consultant to complete the work is requested.

It was moved by Ebert, second by Light, to continue this to the June 30, 1993, Special Meeting.

Roll call: VanOrman, Aye; Light, Aye; Ebert, Aye; Fowler, Aye.

Commission Report No. 93-96, Proposed Ordinance No. 93-1010, An Ordinance Deleting Title 13: Public Services, Chapter 12: Storm Drainage System, of the Oregon City Municipal Code, 1991, and Declaring an Emergency, was presented by the Manager. The report noted that at its July 17, 1991 meeting, the City Commission adopted Ordinance No. 91-1021 which added Chapter 13.20 and replaced a number of Municipal Code chapters that established a system development charge for individual public facilities. Ordinance No. 91-1021 did not specifically delete Chapter 13.12.

The report continued that on the May 19, 1993 agenda was proposed Ordinance No. 93-1010 which would delete Chapter 13.12 of the Municipal Code. This was presented as part of the continuing "housekeeping" of the Code.

Notice of proposed Ordinance No. 93-1010 was posted at City Hall, Courthouse and Senior Center by direction of the City Recorder. An emergency clause was included with the ordinance because Chapter 13.12 creates a conflict with Chapter 13.20; therefore, it was recommended that first and second readings be approved unanimously for enactment of the ordinance to become effective immediately.

It was moved by VanOrman, second by Ebert, to approve first reading of proposed Ordinance No. 93-1010.

Roll call: Light, Aye; Ebert, Aye; VanOrman, Aye; Fowler, Aye.

Second reading was called after which it was moved by VanOrman, second by Ebert, to approve second reading for final enactment to become effective immediately.

Roll call: Light, Aye; Ebert, Aye; VanOrman, Aye; Fowler, Aye.

Commission Report No. 93-101, Mausoleum Design Services Contract, was presented by the Manager. The report noted that at its April 21, 1993 meeting, the City Commission approved the recommendation for the City Manager to negotiate the terms of the contract with Milne Registered Engineers and to re-submit the signed agreement for the Commission to review and give final approval.

The report continued that the contract was attached and provided the City design services for the construction of the new Mausoleum structures. A lump sum amount of $25,500 was negotiated to perform those services identified in the contract to construct a structure totalling approximately $500,000. Based upon the information presented, it was recommended that the City Manager be authorized to sign the agreement.

VanOrman asked if the City Attorney was comfortable with the contract. He responded affirmatively.

It was moved by Light, second by VanOrman, to approve the agreement and authorize the City Manager to execute.

Roll call: Ebert, Aye; VanOrman, Aye; Light, Aye; Fowler, Aye.

Commission Report No. 93-102, City Commission Policy 1-16 - Development Reimbursement Agreements, was presented by the Manager. The report noted that during the 1993-94 budget preparation, it came to the attention of the Manager that the City needed a uniform policy to guide development construction cost-sharing because such a policy was occasionally desirable/necessary, and was a budgetable item. An established policy would provide assurance that developers were treated fairly and uniformly and would maintain the interests of the City in the areas of public safety, fiscal responsibility and consistency with long-term planning.

Attached was proposed Policy 1-16 for Commission review. It was recommended that Policy 1-16 be accepted and authorize inclusion in the City Policy Manual.

The Manager presented the report and explained that in dealing with persons who do business in Oregon City there is the position of negotiating things the City will and will not do. This is an attempt to specifically identify how the City can do certain things. This is not the answer to everything that can be done but this is the first step. It shows participation and partnership on the part of the City. This will be monitored with changes made as necessary.

It was moved by Ebert, second by VanOrman, to adopt Commission Policy 1-16 to be included in the City Policy Manual.

Roll call: Light, Aye; VanOrman, Aye; Ebert, Aye; Fowler, Aye.

Commission Report No. 93-105, Recommendation from Metro Enhancement Committee, was presented by the Manager. The report noted that on the May 19, 1993 agenda were two recommendations from the Oregon City Metro Enhancement Committee.

The report continued that at the May 6, 1993 meeting, the Metro Enhancement Committee reviewed two requests for funds, i.e. Straight Cemetery Restoration and Kelly Field/EOT Site Improvements.

The first request was for restoration of Straight Pioneer Cemetery monuments in the amount of $3,345. Kathy Wheeler and Lori Garcia, Park Place residents, were the project sponsors. The project would involve the placement of markers and monuments on graves at the cemetery. The Enhancement Committee voted to allocate $3,345 for the restoration project.

The second request was for the End of the Trail/Abernethy Green site improvements. This project was sponsored by the End of the Trail Foundation. The purpose of the project was to clean up the Preview Center project site prior to spring/summer activities. The Committee voted to allocate $12,000 for this project.

In addition, the Committee discussed the re-allocation of $30,000 given to the End of the Trail Foundation. The Foundation had requested and received approval of funding to purchase artifacts for the Preview Center. The Foundation asked the Committee to allow for the money to be used for staffing ($10,000). The remaining funds of $20,000 would be used for the purchase of artifacts. After a great deal of discussion, the Committee decided to allow for the one time only allocation of the $10,000 for staff to implement the projects. The Committee asked for Commission concurrence.

The report concluded that based upon the above information, it was recommended that the Commission approve the recommendation of the Oregon City Enhancement Committee for the Straight Cemetery Restoration in the amount of $3,345 and $12,000 for the Abernethy Green Site Improvements.

Light noted that one item in the application included a $4,500 hydro-seed application to the Abernethy Green site. He understood that this may be donated. Fowler responded that this is a donated project. The Committee, at the time noted that some of the items that were donated, they would allow the funds to be used so long as they were still used for the site.

VanOrman understood that the Enhancement Committee was recommending that the Commission approve the amounts of $3,345 and $12,000 for two different projects. This was affirmative.

It was moved by VanOrman, second by Ebert, to approve the two recommendations of the Enhancement Committee.

Roll call: Light, Aye; Ebert, Aye; VanOrman, Aye; Fowler, Abstain.

Fowler added that in the past weeks, the Foundation has received donations of approximately $50,000, in terms of trees, grading and hydroseeding and fencing, etc.

CONSENT AGENDA

The following items were routine and could be approved in one motion. On the call for discussion of a particular item, no discussion was requested.

With reference to Commission Report No. 93-98, 1993 Slurry Seal on Various Streets - Bid Award and Commission Report No. 93-99, 1993 Asphalt Overlay on Various Streets - Bid Award, VanOrman asked how the streets were selected for which process.

Rick McClung, Public Works Director, explained that the street are viewed to determine the condition of individual streets with that determining the process to be used. He advised that the department was going to try to do chip seal in addition to the other two process. with chip seal and slurry seal, the cost is less than overlay. Fowler asked if the department was moving toward a Pavement Management System. McClung responded affirmatively and when that is in place the computer will produce documentation on each street regarding traffic volume, when last upgrade was completed, etc.

It was moved by Light, second by Ebert, to approve the items on the Consent Agenda as recommended in the reports.

Roll call: VanOrman, Aye; Ebert, Aye; Light, Aye; Fowler, Aye.

Commission Report No. 93-100, Brendon Estates Subdivision - Construction Compliance Agreement II, was presented. The report noted that on the May 19, 1993 agenda was a Construction Compliance Agreement with the Brendon Estates Limited Partnership for Commission approval. The Compliance agreement required the Brendon Estates development to do certain on and off-site improvements and provided for City participation in the off-site improvements that benefit other property. The City storm participation would come from system development charges and reimbursement from the Glen Oak Advance Finance District.

* * * * *

Commission Report No. 93-94, Service of Alcoholic Beverages in City Parks, was presented. The report noted that at its November 21, 1990 meeting, the City Commission adopted Ordinance No. 90-1060 which states in part, the following: "...DRINKING IN PUBLIC PLACES...the City Commission may permit the service and consumption of alcoholic liquors within designated Municipal buildings and Municipal parks on such terms and conditions as the Commission provide."

On the May 19, 1993 agenda was the following request for Commission approval for the service of alcoholic liquors in Municipal parks for specific occasions: Mary Smith for Buena Vista Club House for August 20, 1993

A reservation has been submitted for the park of interest and the rental fee has been paid and a signed Indemnity Agreement submitted. It was recommended that the Commission approve the service of beer and wine and that the beverages be served in non-breakable containers only.

* * * * *

Commission Report No. 93-98, 1993 Slurry Seal on Various Streets - Bid Award, was presented. The report noted that Contained within the 1993 budget was funding for slurry seal of various streets within the City. Those streets proposed for this maintenance were depicted on a map attached for Commission review.

The report continued that on May 7, 1993, the City received and opened sealed bids for the slurry seal project. A Tabulation of the bids received was attached. Review of the bids showed that Asphalt Maintenance Associates, Inc. submitted the low bid in the amount of $32,994.81 with the bid being responsive and meeting the bid specifications. It was recommended that the low bid submitted by Asphalt Maintenance Associates, Inc. in the amount of $32,994.81 be accepted.

* * * * *

Commission Report No. 93-99, 1993 Asphalt Overlay on Various Streets - Bid Award, was presented. The report noted that contained within the 1993 budget was funding for the asphalt overlay of various streets within the City. Those streets proposed for maintenance were depicted on an attached map.

The report continued that on May 7, 1993, the City received and opened sealed bids for the asphalt overlay project. Attached was the Tabulation of the bids received. A review of the bids showed that Parker Northwest Paving Company submitted the low bid in the amount of $183,504.90 and the bid was responsive to and met the bid specifications. It was recommended that the low bid submitted by Parker Northwest Paving Company in the amount of $183,504.90 be accepted.

* * * * *

Commission Report No. 93-97, Dissolution of Funds - Resolution No. 93-31, was presented. The report noted that ORS 294.475 entitled "Elimination of unnecessary fund; disposition of balance" states as follows: "Subject to the provisions contained in the charter of any city or county or in any law relating to municipal corporations, when the necessity for maintaining any fund of the municipal corporation has ceased to exist and a balance remains in the fund, the governing body shall so declare by ordinance or other order and upon such declaration such balance shall forthwith be transferred to the general fund of the municipal corporation unless other provisions have been made in the original creation of the fund."

The report continued that on the May 19, 1993 agenda was proposed Resolution No. 93-31 which would dissolve the Brush Pickup Fund and transfer any fund balance to the General Fund with identification consistent with the purpose.

The Brush Pickup Fund was created to record tax receipts and payment of contract costs for yard debris pickup. The final payment on the contract was made in the year ended June 30, 1992.

In consultation with the Oregon Department of Revenue, three alternatives were discussed: 1) close the fund to the General Fund and budget the surplus for current usage; 2) return the excess to the

County and have them complete an offset for 1992-93; or, 3) close the fund to the General Fund and reserve the excess as a reduction of taxes to be levied in 1993-94.

The levying of Brush Pickup Funds was not capable of precise budgeting. To return the funds to the County would involve a complicated reapportionment. The balance of funds is low compared to any other use to which it could be applied. This type of incident is uncommon and both City and County costs for affecting a redistribution would be high. Therefore, closing the fund to the General Fund and budgeting the surplus for current usage is the most reasonable answer to closing the fund. The total resources of the fund in this fiscal year is expected to be $4,100. The monies will be received in the General Fund as a resource to add to the beginning fund balance for fiscal year 1993-94. It was recommended that Resolution No. 93-31 be adopted.

RESOLUTION NO. 93-31

WHEREAS, a fund known as the Brush Pickup Fund has been maintained to make payments for yard debris removal; and

WHEREAS, after the service was placed within the garbage service, a need no longer exists for the maintenance of said fund; and

WHEREAS, a surplus balance of $4,100 exists in said fund.

NOW, THEREFORE, BE IT RESOLVED by the City Commission of Oregon City that pursuant to ORS 294.475 said Brush Pickup Fund is dissolved and the proceeds thereof in the amount of $4,100 are hereby transferred to the General Fund.

Adopted, signed and approved this 19th day of May, 1993.

/s/Daniel W. Fowler
Mayor

/s/James R. Ebert
Commissioner

/s/Suzanne VanOrman
Commissioner

_____
Commissioner

/s/Robert M. Light
Commissioner

Comprising the City Commission
of Oregon City, Oregon

* * * * *

Commission Report No. 93-95, Utility Easement for Sanitary and Storm Drainage - Glen Oak Sanitary Sewer Project, was presented. The report noted that on the May 19, 1993 agenda was a Utility Easement for sanitary and storm drainage for the Glen Oak Sanitary Sewer Project. It was recommended that the easement be accepted and the Mayor and City Recorder be authorized to execute.

* * * * *

Commission Report No. 93-104, Request for Purchase of Installation and Staff Training of Metropolitan Transportation (MTC) Pavement Management System Software - Street Division - Bid Award, was presented. The report noted that contained within the 1993 Street Division of the Public

Works Department budget was funding for the installation and staff training of the Pavement Management System (PMS).

The report continued that the City received six requests for the Request for Proposal, however, only two proposals were returned to the City. The proposals were received and opened on March 26, 1993 with the following results:

Austin Research Engineering, Inc.	Option 1	$39,087
	Option 2	$33,030
Bowman & Williams		$36,530

Option 2 from Austin Research Engineering, Inc. (ARE) was the low bid but was not compatible with our previously purchased Pavement Management software.

Both AREs Option 1 and Bowman & Williams bids were responsive to and met the bid specifications. It was recommended that the bid submitted by Bowman & Williams in the amount of $36,530 be accepted.

* * * * *

Commission Report No. 93-103, Bikeway Agreement - Linn Avenue Bikeway Project, was presented. The report noted that in August 1992, application was made to the Oregon Department of Transportation, through its Bikeway Program, for grant funds to construct bikelanes on Linn Avenue, from Warner Parrott Road, north to Jackson Street. The grant for $50,000 was approved in December 1992, and required Commission approval of an intergovernmental agreement. The Commission held a work session on May 12 to discuss issues related to the project and directed staff to proceed with design.

The report continued that during grant review, State Bikeway Program personnel toured the route of the proposed bikelane project and agreed that the project would be beneficial to bicyclists and should be undertaken. The Transportation Master Plan identified Linn Avenue as a collector street which should have bike lanes. This project was not an attempt to bring Linn Avenue up to a full urban collector standard, but was intended to increase safety and capacity for bicyclists and pedestrians at a reasonable cost. The project also presents an opportunity to maximize City funds through partial State Bikeway funding.

The project would construct bikelanes (and possibly a shared roadway) on Linn Avenue. The "shared roadway" is sometimes the best solution when there is inadequate width to provide full bike lanes; it is basically a wide travel lane (typically 14 feet) which allows a motor vehicle and a bicycle to operate side-by-side. The project would need to be designed before any final decisions were made regarding bikelane versus shared roadway. When design work beings, a neighborhood meeting for properties along Linn Avenue would be held. Comments from Mt. Pleasant Elementary School (administration and PTA) were requested prior to the work session.

The project is estimated to cost $150,000 and is listed in the 5-Year Capital Improvement Program. Eighty-percent of the project cost (not to exceed $50,000) would be from the bikeway grant; the City's share would come from system development charges. Adequate funds are available for the project.

The report concluded by noting that the Bikeway Project Agreement was attached and specified State and City obligations under the approved grant. It was recommended that the Commission approve the agreement so design of the project could begin.

* * * * *

At this time, the Manager advised of two additions to the agenda. He requested discussion and action regarding the improvement of Highway 213/Beavercreek Intersection from Beavercreek Road up to and including intersection with Molalla Avenue and the Red Soils extension. The participation of financing of the project is confusing. He has identified the roles of responsibility and funding and expressed concern regarding what the City committed to do.

He requested that the Commission reconsider their February approval of an agreement between the State, the County and the City to participate in the eventual correction of the intersection of Highway 213 and Beavercreek Road. The City's participation in the agreement was that the City would restrict future land uses of some areas within the City's control. At the February meeting, the City Attorney advised that the Commission should be careful of restricting property because it amounted to the taking of property. After discussion at the February meeting, the Commission executed the agreement with it forwarded to the County and State.

He advised that the County has not yet executed the agreement and he has taken the opportunity to review the agreement and feels the City cannot afford to do what was stated. He was now asking the Commission to rescind the agreement and direct staff to re-negotiate the entire partnership and arrangement.

He noted that there was discussion at the February meeting regarding participation of Federal funds on the Abernethy realignment if the City did not sign the agreement. That should not be a factor in this decision.

The original decision was a bad decision that was recommended to the Commission and now there must be recognition of that fact and now recommends rescinding the decision.

It was moved by Light, second by Ebert, to rescind approval of the agreement and authorize staff to re-negotiate the City's partnership in the project.

Roll call: VanOrman, Aye; Light, Aye; Ebert, Aye; Fowler, Aye.

Fowler expressed hoping the City does not get involved in the right-of-way acquisition portion of the agreement because it is a County road and State highway.

At this time, Fowler advised of talking with the City Attorney regarding process procedure for the evaluation of the City Manager. The City Attorney noted that a two-step process was being considered. The forms for evaluation would be forwarded in the next packet and be discussed at the next regularly scheduled Commission meeting. Prior reviews and commitments made at that time would be reviewed. There would be need for an Executive Session to review the completed forms and to evaluate the Manager based on the same criteria that was used the last time. If the criteria were to be changed a public hearing would have to be held.

The Commission expressed comfortability with the criteria and did not feel a need for change. VanOrman asked if the last process was ever completed. The City Attorney felt that an

announcement had not been made after the process was complete. He suggested the evaluation be held at the second meeting after the Commission has a chance to review.

Fowler reiterated that the information would be in the packets with the Commission having an opportunity to review it, hold a meeting to discuss the information then fill out the forms and have a second review then announce the results at a third meeting, perhaps at the Special Meeting on June 30. This process was approved by consensus.

VanOrman announced a Trust meeting at 6:30 p.m. on June 9, 1993.

Light reminded of his earlier request for staff to review the necessity of newspaper recycling boxes in neighborhoods.

At this time, Mayor Fowler announced the appointment of Terri Powers to the Metro Enhancement Committee to represent the Planning Commission with term expiring June 30, 1994; and, appoint Thor Wegner to a vacant position on the Budget Committee through 1994.

Jack Lynch, Fire Chief, spoke calling attention to the project that is progressing in the Hillendale Park. This was the turning of an "eyesore" to an opportunity for the children in Oregon City to experience fishing blue gill and bass.

At this time, the Manager presented a videotape which outlined signage throughout the City. The project was researched and staffed by Denyse McGriff and Kate Daschel. McGriff explained that she and other employees took a tour of the City and examined where the signing is currently located and the size of the signs as they relate to the direction for tourists to see the sights in Oregon City. She presented the plan for a sign of up to 30 inches for the Main section which listed a number of places for tourists to visit. She noted feeling that the signage used by the City of Salem was clear and understandable.

Rick McClung, Public Works Director, spoke noting that two sign designs were being planned, one with the McLoughlin House and one with a covered wagon. VanOrman asked why the current pioneer sign could not be used. McGriff explained that sign was too detailed with the need for simplicity.

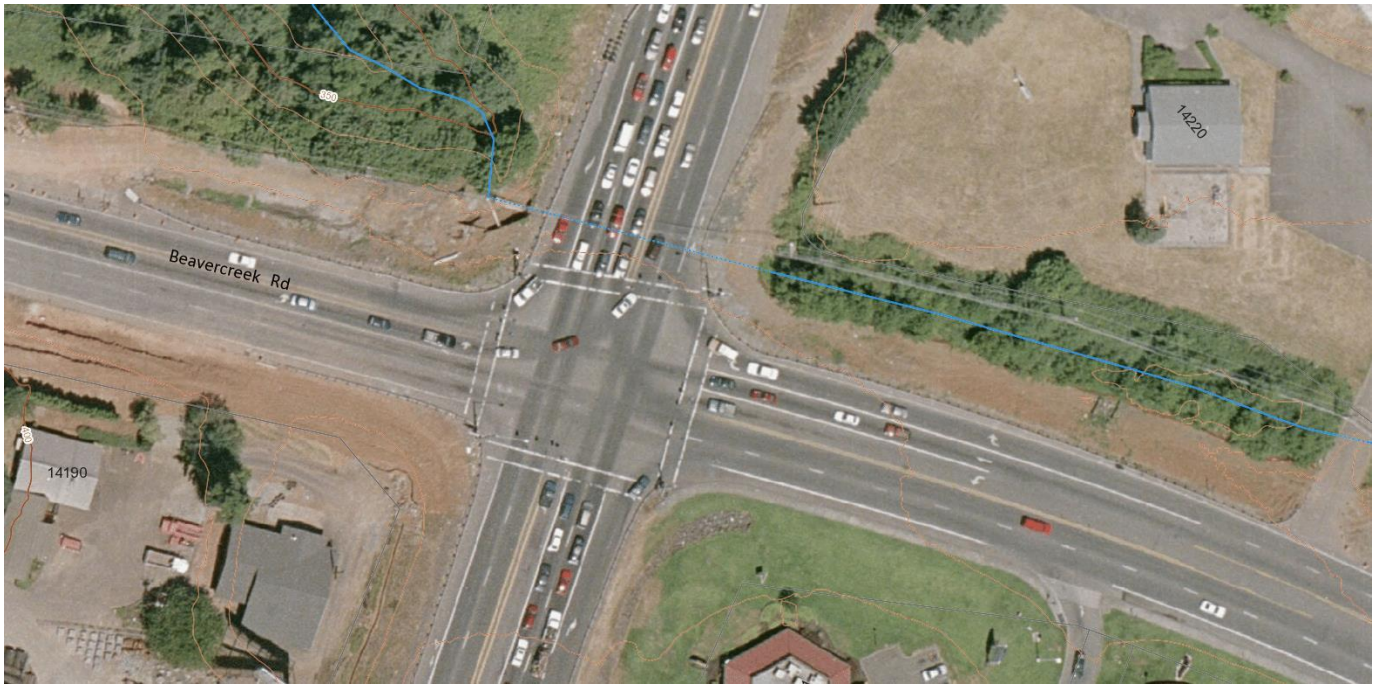
The video was viewed at this time.

After viewing and discussing the video, McGriff displayed samples of signs. VanOrman felt that the silhouette of the pioneers could be used as a silhouette only without the detail of the wagon. Commission consensus related to portions of samples that were viewed.

McClung then showed a portion of the video as it related to five trees that blew down at Clackamette Park this evening. He noted that they were Cottonwood trees that showed advanced heart rot. When the storm hit, the Park was packed with people who scrambled for safety. The only damaged vehicle belonged to Dave's Tree Service who was working in the Park.

With no further business, the meeting adjourned at 9:30 p.m.

CHARLES LEESON, Recording Secretary



HWY 213 and Beavercreek – 2003



HWY 213 and Beavercreek – 2004 (after expansion project)

Highway 213
Urban Corridor Design Study

June 2000

LONG TERM
- "System" connections between I-205 and Hwy 213
- "Service" connections between I-205/Hwy 213 and End of Oregon Trail area
- Interchanges overlap

SHORT TERM
- Capacity improvements on Hwy 213 - I-205 to Holcomb

Match Divided Highway Section

HIGHWAY 213

Adequate Long Term Capacity

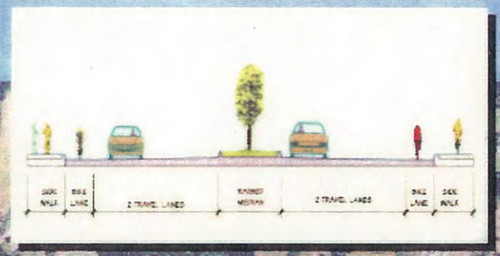
PHASE I - At-grade improvements

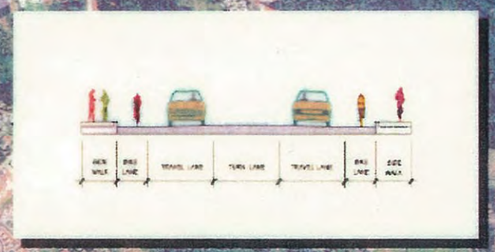
PHASE II - Grade separation improvements if needed

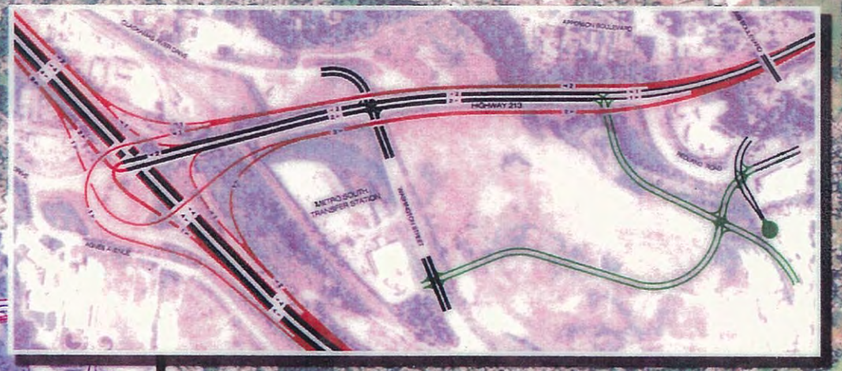
At-grade improvements

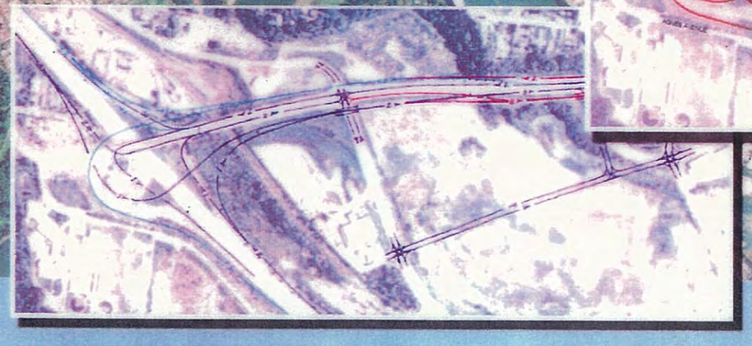
Signalize intersection

Match Rural Section









Connectivity needs between Gladstone and End of Oregon Trail area

Connectivity needs between Clackamette Cove and End of Oregon Trail area

Long term I-205 operations and design needs

I-205

CLACKAMAS RIVER DRIVE

WASHINGTON

ABERNETHY

MOLALLA

HENRICI

City of Oregon City, Oregon

Kittelson & Associates, Inc.

Final Report

Highway 213 Urban Corridor Design Study

Oregon City, Oregon

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Project No.: 2561
June 2000

Acknowledgments

The Highway 213 Urban Corridor Design Study was funded by Metro and sponsored by the City of Oregon City. ODOT, Metro, and the City of Oregon City worked diligently to create a successful plan to satisfy future travel demand on the Highway 213 Corridor. The project Technical Advisory Committee and Citizen Advisory Committee also contributed significantly to the success of this project. The Project Team thanks the City of Oregon City, Metro, ODOT the Technical Advisory Committee and Citizen Advisory Committee for all of their hard work and valuable contributions.

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Summary of Project, Findings and Recommendations

Purpose

The Highway 213 Urban Corridor Design Study was conducted to evaluate existing and future congestion on the Highway 213 corridor between Henrici Road and I-205 and to identify immediate and long-term transportation system improvements to mitigate this congestion.

Findings

Highway 213 between Henrici Road and I-205 changes from a high order facility, with limited pedestrian and bicycle facilities near I-205, to a rural two lane high access facility in the vicinity of Henrici Road. Under existing p.m. peak hour conditions, there is congestion and delay on the Highway 213 corridor between I-205 and Henrici Road at the key intersections of Washington Street, Redland Road, and Beavercreek Road. Motorists on I-205 between the Gladstone and the Highway 99E interchanges also experience p.m. peak hour congestion, particularly in the southbound direction.

Traffic volumes in this area are expected to continue to grow. The forecast increase in traffic comes from residential and commercial development in Oregon City and surrounding communities, as well as potential Urban Growth Boundary expansion to the south of Oregon City. With this growth in traffic volumes, peak hour congestion experienced by motorists today is expected to worsen.

The City of Oregon City is currently completing its Transportation System Plan (TSP). The City identified a need for more specific analysis along the Highway 213 corridor to develop the appropriate improvements for adoption into the TSP. This report documents the analysis and findings of the Highway 213 Urban Corridor Design Study. The study considered Highway 213 between I-205 and Henrici Road and, to assure system integration, I-205 between the Gladstone and Highway 99E interchanges.

Scope

In this study, the project team, Citizens Advisory Committee (CAC) and Technical Advisory Committee (TAC) completed the following significant tasks:

- Evaluated existing facilities, traffic operations, land uses, and environmental opportunities and constraints along the Highway 213 corridor between I-205 and Henrici Road, and on I-205 between the Gladstone Interchange and the Highway 99E Interchange,
- Forecasted and evaluated future travel demand in the study area,
- Evaluated forecast traffic operations and identified forecast future deficiencies,
- Identified alternative solution concepts to address the existing and future deficiencies, and
- Assisted the project Citizens Advisory Committee (CAC) and Technical Advisory Committee (TAC) with refining, evaluating, and identifying a most promising solution concept for the corridor.

Recommendations

To address the existing geometric and operational deficiencies as well as to serve forecast travel demand, the TAC and CAC recommended the solution concepts shown in Figures 1, 2, 3 and 4A through 4C. Figure 1 shows the solution concept preferred by the TAC and CAC at the north end of the project corridor. Considering the estimated construction costs and the current regional funding availability, Figure 2 was identified by the TAC and CAC as a preferred and financially feasible first phase of the larger solution concept shown in Figure 1. Additional I-205 corridor planning, environmental and engineering analysis will be required prior to adopting this specific solution concept. Metro and ODOT have plans for an I-205 corridor study. The future study will incorporate technical elements and recommendations from the Highway 213 Urban Corridor Design Study.

Figures 3, and 4A through 4C show the TAC and CAC preferred improvements for Highway 213 from Beavercreek Road south to Henrici Road. In this area, the City of Oregon City, the CAC and the TAC recommend pursuing at-grade improvements that:

- Expand capacity,
- Provide for pedestrian and bicycle accessibility,
- Serve future transit needs
- Safely transition from an urban facility to a rural facility, and
- Allow for continued direct, but managed access onto Highway 213.

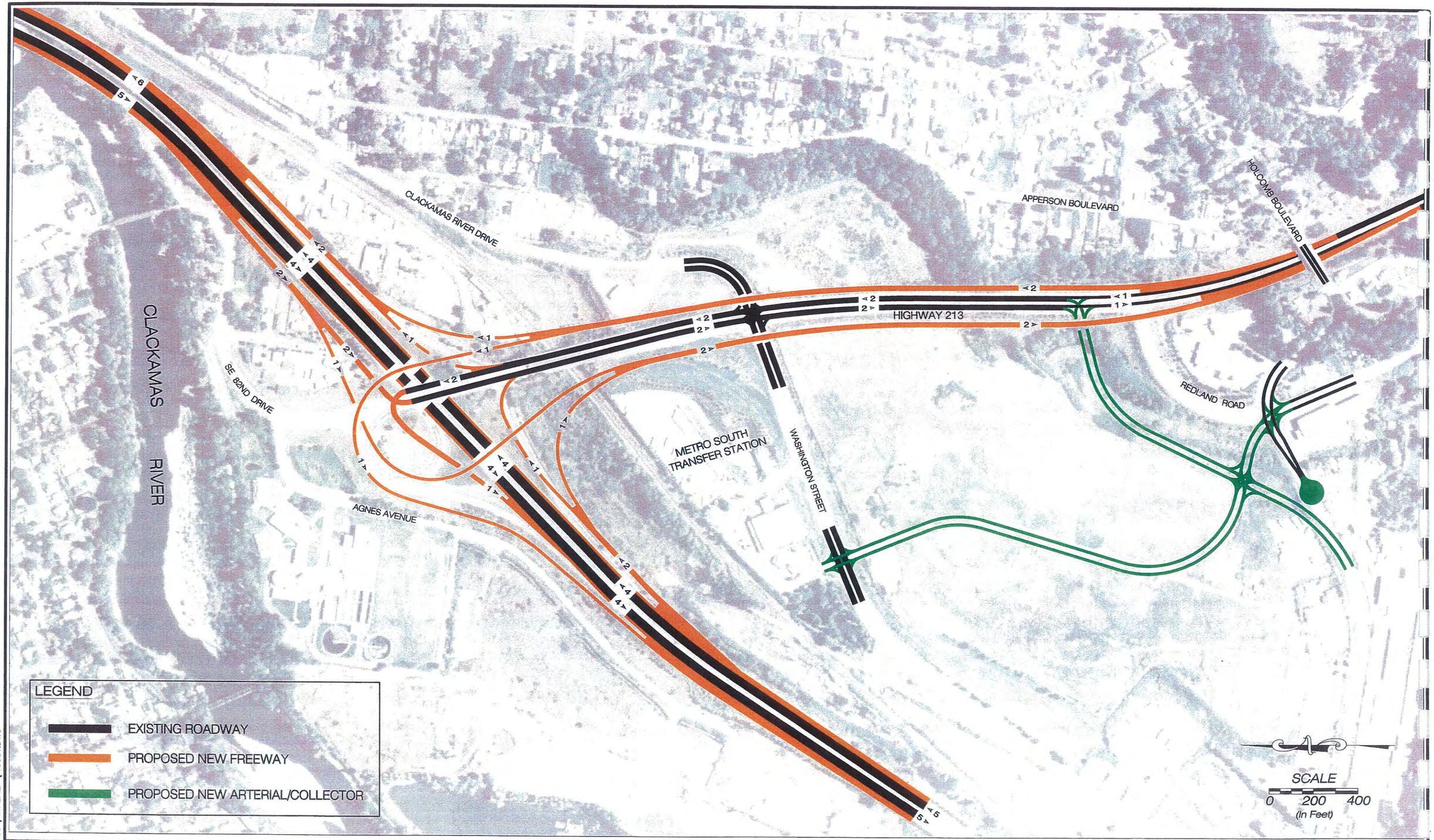
Implementation

Alternative 3 Phase 1 (Figure 2) will cost in the magnitude of $10 Million. This does not include right-of-way or environmental issues related to construction in a landfill. Metro has suggested that Alternative 3 Phase 1 is feasible from a financial perspective; however contributions would most likely be required from public agencies as well as from future public/private funding partnerships. However, no definitive funding plan has been outlined and, as any other identified improvement solution, this project would have to compete for MTIP support and to be listed on the Metro Regional Transportation Plan. Metro, the Oregon Department of Transportation (ODOT) and the City of Oregon City are planning to continue to develop the implementation strategy for Alternative 3 Phase 1.

The City of Oregon City has been awarded Metro Regional Transportation (Federal TEA-21) funds for an improvement project at Beavercreek Road/Highway 213, intersection. The City is planning to design and construct the at-grade improvement concept shown in Figure 3. It is estimated that the at-grade intersection will cost approximately $5.45 Million to construct (not including right-of-way acquisition and environmental factors).

South of Beavercreek Road, the City of Oregon City needs to pursue further refinement to the solution concept presented in Figures 4A through 4C. Traffic signals at Henrici Road/Highway 213 and Glen Oak Road/Highway 213 intersections will be required to maintain traffic operations at an acceptable level of service and should be included in the City's planning efforts. Further, access to Highway 213 south of Molalla will ultimately be more formally controlled than as existing. The amount and location of access onto the highway will need to be developed as part of an access management plan with a significant amount of public involvement. This effort should be undertaken with consideration of the possible UGB expansion in the south part of Oregon City.

Detailed documentation of the study process and findings is included in the following sections of this report.



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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

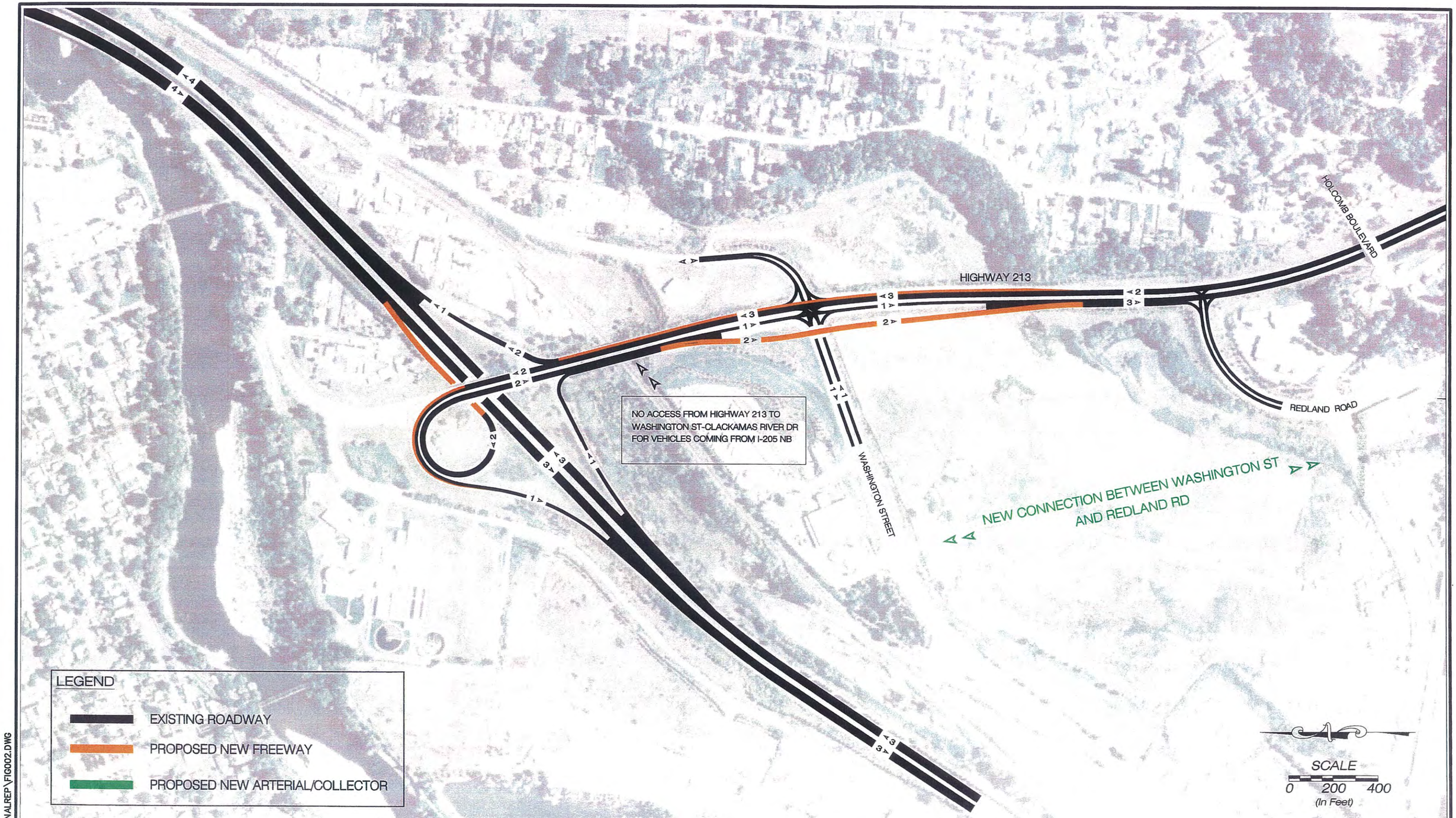
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JUNE 2000

HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 3

FIGURE NO. 1

PROJECT NO. 2561

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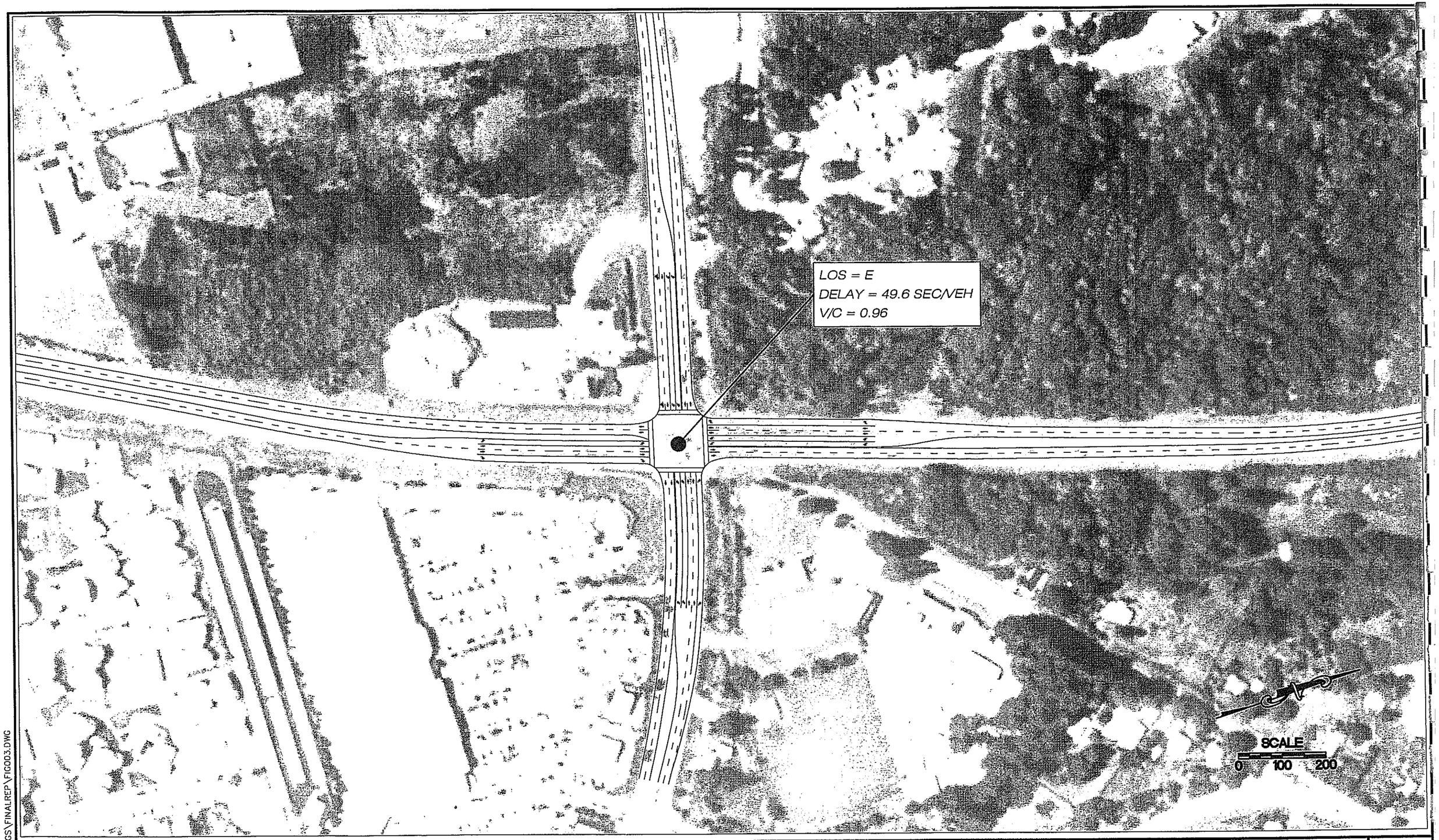
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HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 3 - PHASE 1 IMPROVEMENT

FIGURE NO. 2

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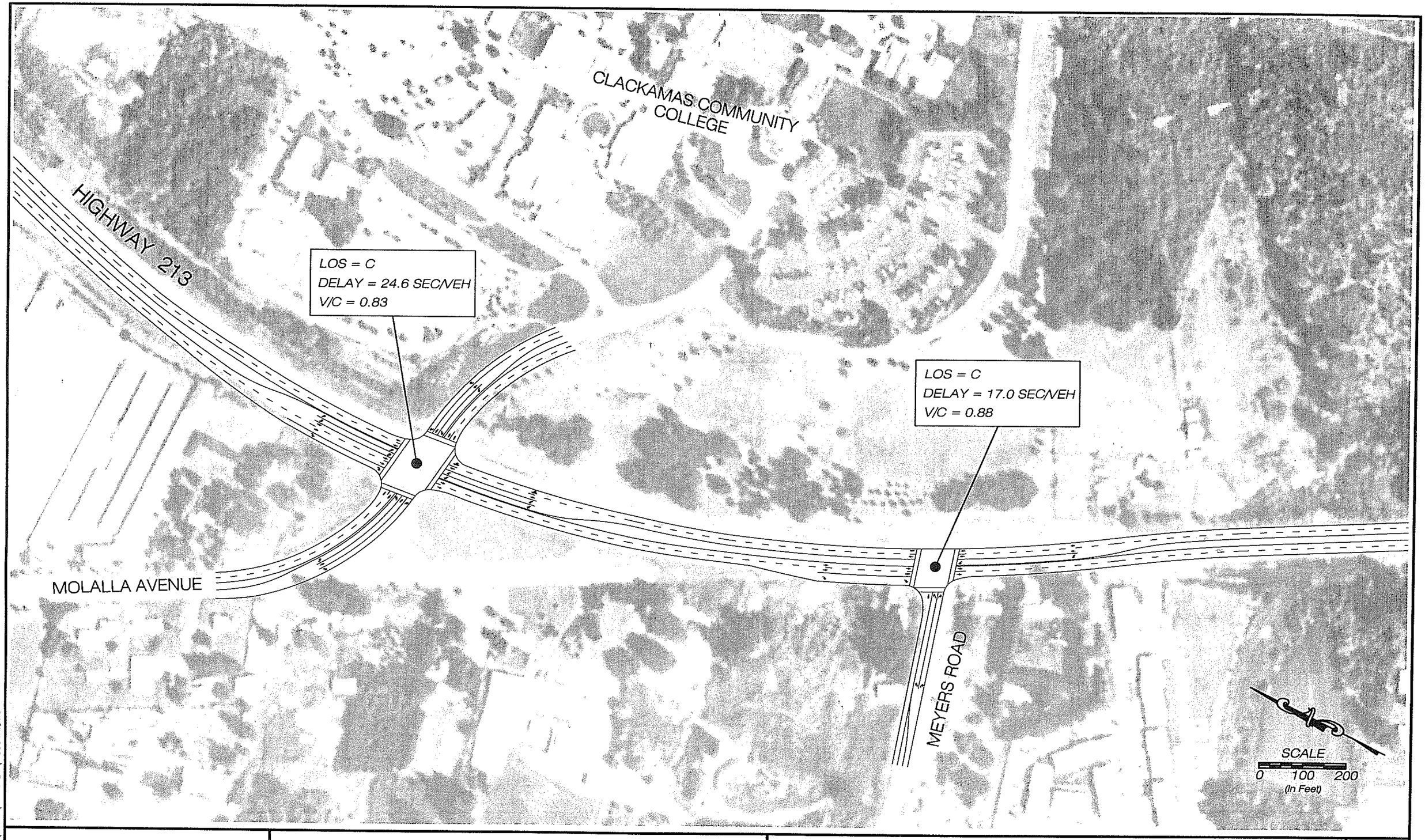
HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

BEAVERCREEK/HIGHWAY 213 IMPROVEMENT PLAN IMPROVED AT-GRADE INTERSECTION CONCEPT 2018 WEEKDAY PM PEAK LEVELS OF SERVICE

FIGURE NO.
3

PROJECT NO.
2561



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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213 IMPROVEMENT PLAN CONCEPT
MOLALLA AVENUE TO HENRICI ROAD
2018 WEEKDAY PM PEAK LEVELS OF SERVICE

FIGURE NO. 4A

PROJECT NO. 2561

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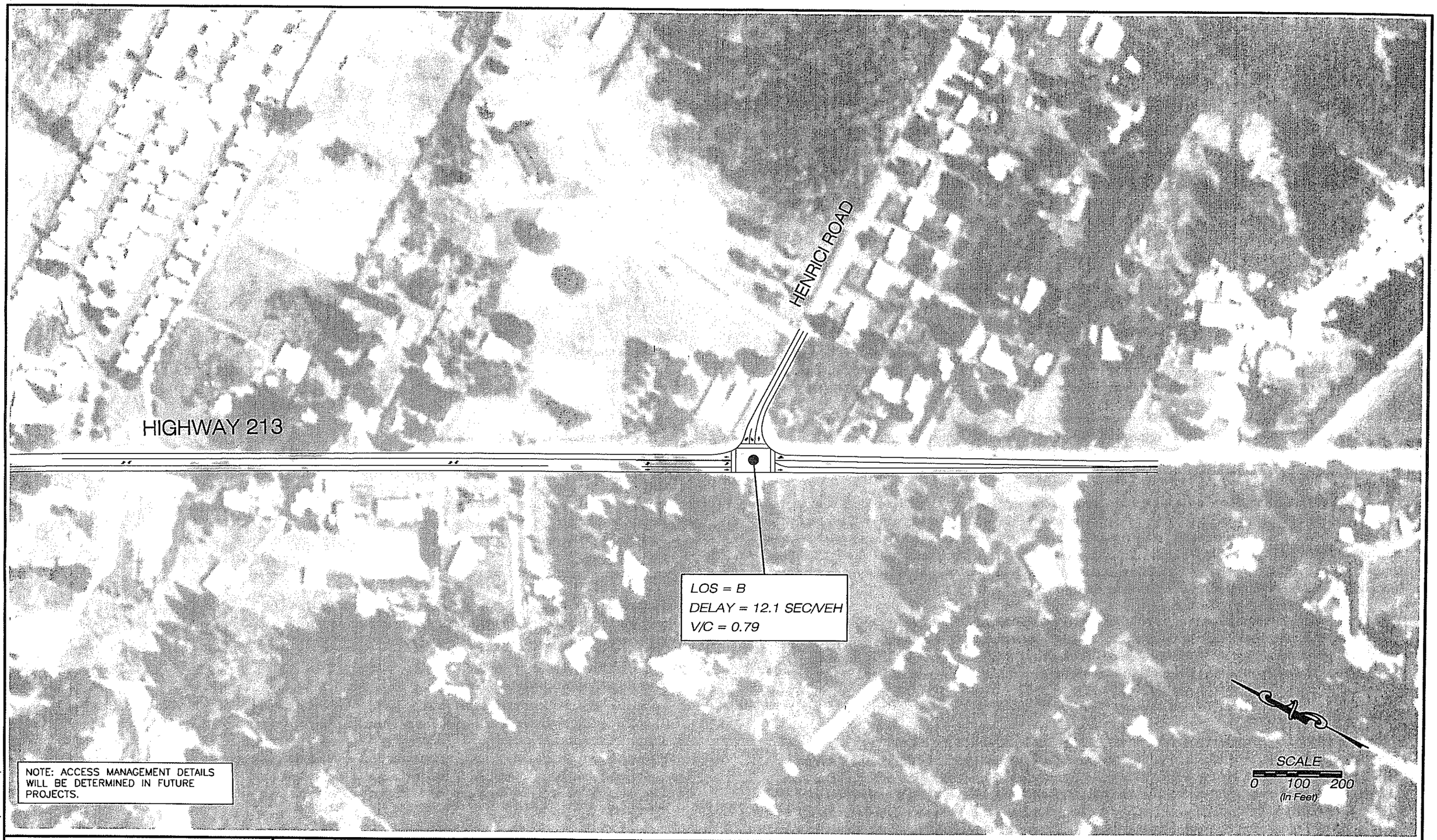
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HIGHWAY 213 IMPROVEMENT PLAN CONCEPT
MOLALLA AVENUE TO HENRICI ROAD
2018 WEEKDAY PM PEAK LEVELS OF SERVICE

FIGURE NO. 4B

PROJECT NO. 2561

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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213 IMPROVEMENT PLAN CONCEPT
MOLALLA AVENUE TO HENRICI ROAD
2018 WEEKDAY PM PEAK LEVELS OF SERVICE

FIGURE NO. 4C

PROJECT NO. 2561

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Introduction

Project Need

The Highway 213 facility between I-205 and Henrici Road has different characteristics and needs. At the north end of the study corridor, the I-205 interchange and the intersection of Washington Street/Highway 213 dominate the landscape. These are large, high-order facilities serving high volumes, with limited pedestrian and bicycle accessibility. The intersection of Washington Street/Highway 213 provides access to Oregon City and possible future development to the south and access to residential development to the north along the Clackamas River. Redland Road also provides access to residential development, Oregon City, and possible future development.

South of Redland Road to Beavercreek Road, Highway 213 is a high-speed, access-controlled facility through Newell Canyon. It is a four-lane facility with freeway characteristics. Beavercreek Road/Highway 213 is a high volume intersection providing access to and from Highway 213 from Beavercreek Road residential and retail development.

Between Beavercreek Road and Molalla Avenue, Oregon City would like Highway 213 to provide accessibility for pedestrian and bicyclists traveling along and across the roadway. However, the high traffic volumes and associated environment are not currently conducive to non-auto modes of transportation.

South of Newell Canyon, Highway 213 transitions from an urban arterial type facility in the vicinity of Beavercreek Road and Molalla Avenue to a rural two-lane highway in the vicinity of Henrici Road. This is a problematic transition in that under existing conditions the transition is abrupt and does not control travel speeds nor provide for pedestrians or bicyclists.

Under existing traffic volumes, there is significant congestion along the Highway 213 corridor. In the p.m. peak period (study design-volume period) the intersections of Washington Street/Highway 213, Redland Road/Highway 213, and Beavercreek Road/Highway 213 all operate under congested conditions. In the a.m. peak period, queues in the northbound direction from the northbound I-205 on-ramp at Highway 213 spill congestion back through the Highway 213/Washington Street intersection. As traffic volumes continue to grow in the future, congestion will worsen at these locations.

In addition, p.m. peak hour traffic volumes on I-205 currently exceed the facility capacity causing congestion and queuing along the freeway and at the Highway 213/I-205 interchange. In the future as traffic volumes continue to grow, congestion on I-205 will worsen. Without any modifications to I-205 in the study area, there will be unacceptable operational conditions during the forecast 20-year p.m. peak hour.

Planning Framework

The City of Oregon City is currently completing their Transportation System Plan (TSP). This project identified Highway 213 as a critical link in the City's transportation system. The City identified a need for this facility to provide mobility for motorists traveling within and to/from Oregon City. The TSP analysis showed existing congestion along the corridor and forecast future congestion as well. Therefore, for the TSP to be successfully implemented, the City of Oregon City needed to identify improvement concepts for the Highway 213 corridor and incorporate them into the TSP. The conceptual corridor improvements were to be developed in this Highway 213 Urban Corridor Design Study. This report documents the process, results and recommendations from this study.

Study Area

Figure 5 depicts the project study area, and the intersection traffic control at the key study intersections. The study primarily focuses on the Highway 213 corridor (principal study area). However, Interstate 205 between the Gladstone interchange and the Highway 99E interchange (secondary study area) was included to ensure that improvements identified at the Highway 213/I-205 interchange were compatible with the existing Interstate 205 and possible future improvements along the I-205 corridor.

Scope and Approach

The purpose of the study was to identify near-term and long-term solution concepts for existing and future transportation system deficiencies identified in the study area. The existing deficiencies were identified based on existing p.m. peak hour traffic operations analyses, field reviews and input from the project Technical Advisory Committee (TAC) and Citizen's Advisory Committee (CAC). 20-Year future p.m. peak hour traffic conditions were forecast from Metro's travel demand model, refined to more accurately reflect local conditions within Oregon City. Forecast p.m. peak hour operational deficiencies were identified based on traffic operations analyses and discussions with representatives from the City of Oregon City, Clackamas County, the Oregon Department of Transportation, Metro and the CAC.

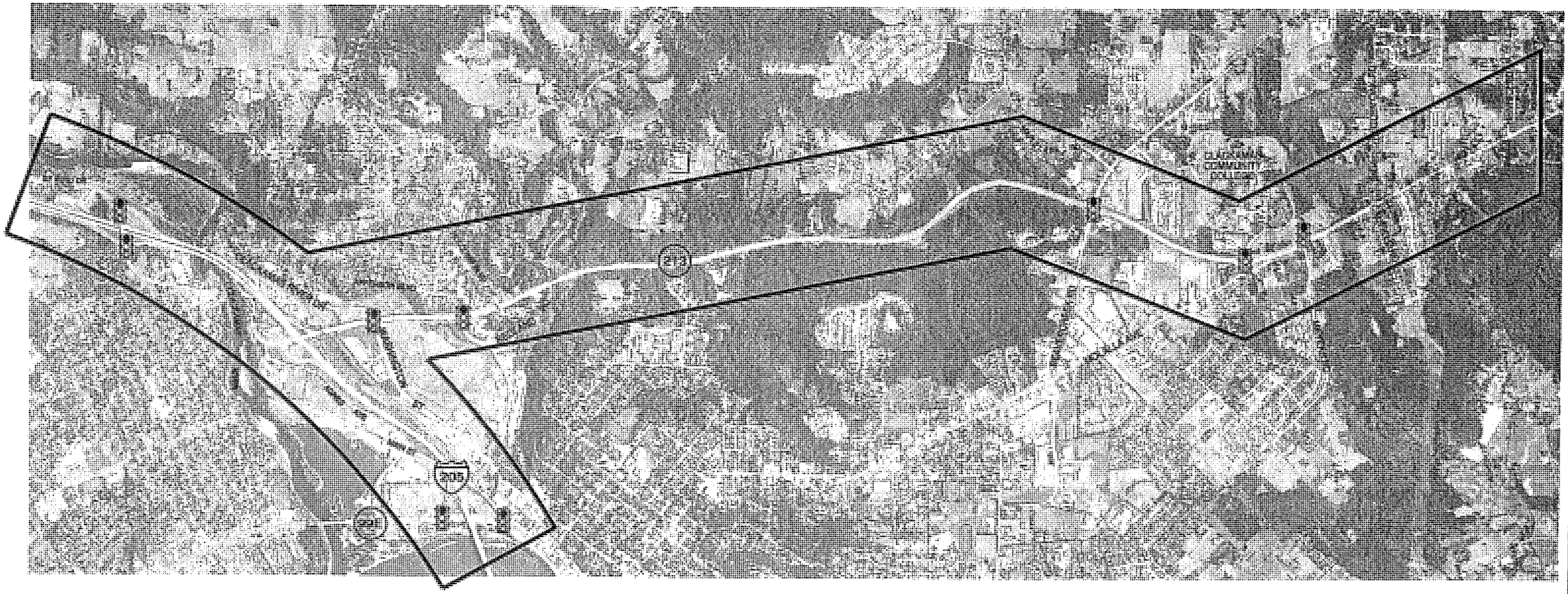
Solution concepts were developed using single-line techniques on aerial photography (see Figure 1) to efficiently generate a number of improvement alternatives. The concepts were refined with input from City of Oregon City, Clackamas County, the Oregon Department of Transportation, Metro, Tri-Met, the TAC, and the CAC. Functional plans of the most promising solution concepts between Beavercreek Road and Henrici Road, and single-line solution concepts in the vicinity of the I-205/Hwy 213 interchange document these efforts. In addition to the design considerations, traffic operations analyses and qualitative land use and environmental analyses were also conducted to verify that the solution concepts being generated were consistent with State and local policies.

The project process relied on close coordination between the TAC, CAC and the City of Oregon City to review project analysis, findings, concept development and recommendations as the project evolved. A brief overview of each of the project tasks follows:

Existing Conditions Analysis

Initial project activities focused on understanding the constraints and opportunities along the Highway 213 corridor. Surrounding land uses and environmental features were studied, as well as the traffic flow characteristics, roadway safety characteristics, and the roadway geometric features of the corridor. The Project Team relied on field visits, previously collected data and reports from the Oregon Department of Transportation (ODOT), the City of Oregon City, and Metro, and input from the City of Oregon City, TAC and CAC to complete these analyses. The findings from this task formed the basis and direction of the concept development phases of the project.

NORTH
(NOT TO SCALE)



LEGEND

STUDY AREA

TRAFFIC SIGNAL

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OREGON CITY, OREGON
JUNE 2000

PROJECT STUDY AREA

FIGURE NO. 5

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG005.DWG

Future No-Build Analysis

Future p.m. peak hour traffic volumes applied in this project are the same as those developed for the City of Oregon City Transportation System Plan. The forecast was developed using the Metro travel demand model. The Metro transportation analysis zones (TAZs) were refined in the local Oregon City area to better reflect existing and anticipated land use, and the land use inputs to the model are based on Oregon City's existing Comprehensive Plan. No significant modifications were made to the existing transportation network in the study area. These inputs yielded a 20-year no-build p.m. peak hour traffic volume forecast. Details of this process are included in the documentation for the TSP project.

A future conditions traffic operations analysis was performed on the 20-year future p.m. peak hour traffic volumes. The results provided an understanding of how significant future deficiencies would be with no improvements to existing conditions. Based on this analysis, forecast future traffic operations in the study corridor were evaluated and preliminary solution concepts were identified. This information was reported to the TAC and CAC.

Concept Development and Refinement

City of Oregon City, TAC and CAC input and assessment of the results of the existing conditions and future no-build conditions analysis led the development of single-line and double-line solution concepts to the identified corridor deficiencies. The concepts ranged from expanded at-grade intersections, to access management, to full interchanges at Beavercreek Road, and the Highway 213: I-205 to Redland Road corridor. Concept development included operational and design evaluations.

The City of Oregon City, TAC and CAC reviewed the preliminary solution concepts and provided input as to the financial, political, operational and engineering feasibility of each of the solution concepts. Given this input, the concepts were refined and revised. The most promising solution concepts throughout the corridor were identified as an outcome of this process.

Functional Plans

Functional plans of the most promising solution concepts were developed from Beavercreek Road to Henrici Road following final concept input from the TAC and CAC. Single-line exhibits were developed for the Highway 213 corridor between I-205 and Redland Road. The concepts plans are of sufficient detail to determine traffic operations and design features, estimate planning level order of magnitude cost estimates, and preliminary land use and environmental impacts. More detailed environmental and design analyses and public involvement activities will be required before a preferred alternative can be chosen.

Cost Proportionality

Highway 213 is a district-level state facility used by motorists making local, county and regional trips. Modifications to improve and maintain traffic operations will be almost exclusively on the state roadway. However, financial responsibility for these improvements should be shared among jurisdictions contributing to congestion on the Highway. The final step of the project was an assessment the City of Oregon City's, and ODOT's proportionate share financial responsibility for improvements on the corridor.

Organization of Report

This Highway 213 Urban Corridor Design Study Final Report is a compilation of technical memoranda and presentations prepared throughout the project. The document is intended to be a summary of the analysis and findings from the project. It is also intended to highlight key recommendations made as an outcome of project analyses and meetings. These recommendations should form the basis for future engineering and environmental planning activities. The report is organized into the following sections:

- Introduction
- Existing Conditions Analysis,
- Future Conditions Analysis,
- Concept Development and Preferred Solutions,
- Summary

Existing Conditions Analysis

The existing conditions analysis was conducted to develop an understanding of the opportunities and constraints in the study area. To complete the analysis, the project team evaluated existing land use and environmental constraints as well as the existing features and traffic operations of the transportation system. The results of this assessment formed the foundation of problem identification and preliminary solution concepts. The Project Team relied on input from the TAC and CAC to review the preliminary results of the analysis and provide context for the identified issues. The specific analyses performed include: geometrics, traffic operations, safety and a qualitative land use/environmental analyses.

Geometric/Operations Evaluation

As-built plans, aerial photography, and field observations were used to evaluate the existing geometric characteristics of Highway 213 and I-205 within the study area. The geometric evaluation was performed based on the criteria rating summarized in Appendix A. These criteria are based on American Association of State Highway and Transportation Officials (AASHTO) policy. Like many transportation departments, ODOT uses AASHTO criteria as the basis for its own design standards.

Each feature was assigned a Good, Fair, or Poor rating based on the how closely the facilities met the AASHTO guidelines for design speed. The features analyzed were grouped into three categories:

- Geometric (G): horizontal alignment, vertical alignment, stopping sight distance, cross section, decision sight distance, exit and entrance ramp design;
- Operational (O): lane and route continuity, lane balance, ramp sequence; and
- Performance Measure (PM): level of service, accident rates.

The geometric analysis is based on roadway design speeds. A roadway feature that met or exceeded the design speed was rated good. Features that were within 10 mph of the design speed were rated fair. Features that were more than 10 mph below the design speed were rated poor. Research indicates accidents increase when speed differentials exceed 10 mph. Operational features were based on AASHTO guidelines, while level-of-service and accident rates were compared to ODOT and Oregon City standards, respectively.

This exercise was performed for the sections of both northbound and southbound I-205 and Highway 213 in the study area. Figures 6A through 6H consist of an aerial photograph of the study area overlaid with a directional grid matrix that lists each performance measure and roadway feature evaluation result. For each direction of traffic, the matrix is shaded to reflect whether a criteria rating of "good" (single hatch), "fair" (cross-hatch), or "poor" (solid) was designated to the evaluation feature at that particular location along the facility.

With a few exceptions, the existing configuration and geometric conditions of I-205 and Highway 213 in the study area conforms to AASHTO criteria with regards to the majority of geometric and operational features. The exceptions are:

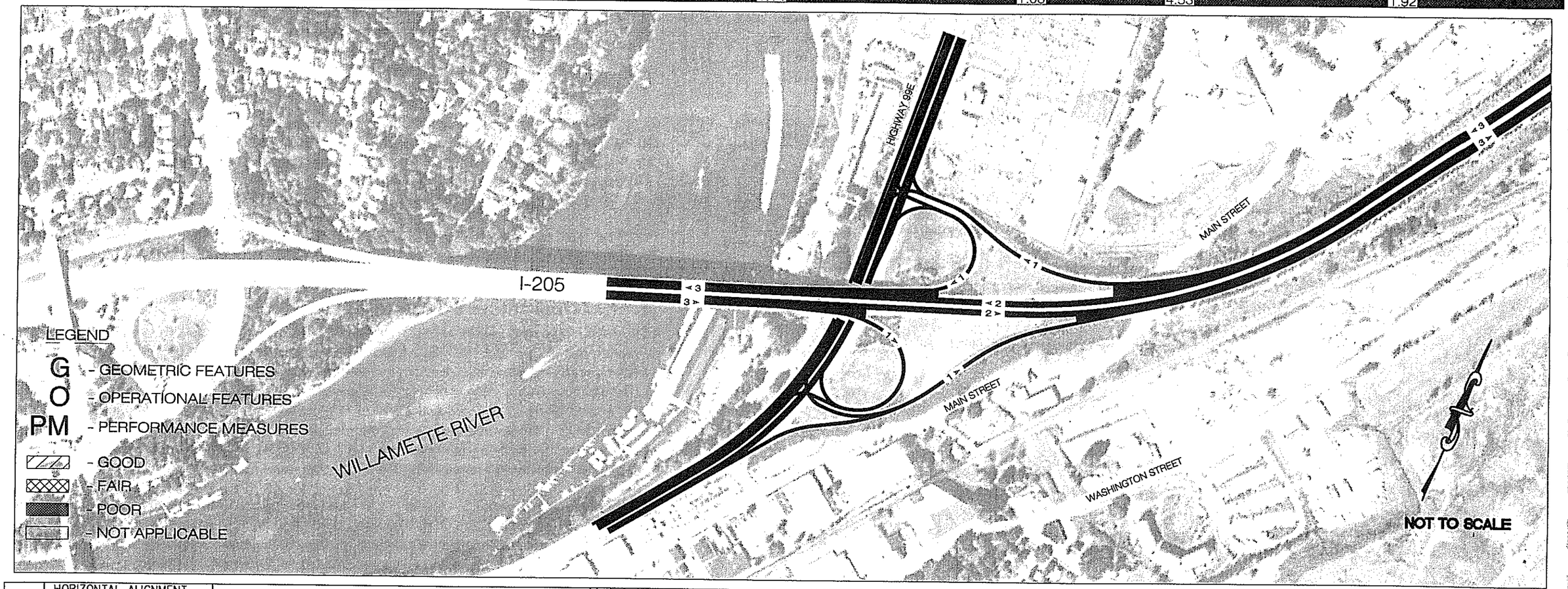
- The geometric design of both the I-205 SB/Highway 213 and I-205 NB/Highway 99E off-ramps provides insufficient deceleration distance for the controlling curvature of those ramp loops, requiring vehicles to decelerate on the freeway mainline.
- The cross-section of I-205 from the Gladstone-SE 82nd Drive interchange across the Clackamas River Bridge provides inadequate right shoulder width.
- True lane balance is not maintained at three locations along I-205 (I-205 Southbound/Highway 99E off-ramp, I-205
- At the Northbound/Highway 99E off-ramp, I-205 Northbound/Gladstone off-ramp), however, brief recovery areas are provided after the lane drop at these locations to allow vehicles in the drop lane to merge with mainline traffic after the off-ramp.
- The existing cross-section of Highway 213 between the Redland Road and Beavercreek Road intersections provide inadequate left shoulder width.

Traffic Operations Evaluation

The *1997 Highway Capacity Manual* (HCM) analysis methodology was used for all freeway operations evaluations. As per the 1997 HCM, the vehicle capacity for a freeway lane of traffic in the basic freeway segment and ramp merge/diverge sections was assumed to be 2,300 vehicles per hour per lane; in the weaving sections the vehicle capacity was assumed to be 2,000 vehicles per hour per lane. For I-205, a state highway of *Interstate Level of Importance*, the ODOT operational standard is level of service (LOS) "D" in urban regions of metropolitan areas. Because of limitations in the Highway Capacity Manual weaving methodology, the Joel E. Leisch methodology for weaving analysis was applied on Highway 213 between I-205 and Washington Street.

The operational performance of Highway 213 and Interstate 205 were rated based on the City of Oregon City, Clackamas County, and ODOT standards. These standards indicate that Level-of-Service (LOS) "A" through "D" are acceptable for existing signalized intersection operations, and LOS "E" and "F" are unacceptable. For unsignalized intersections, the City of Oregon City, Clackamas County, and ODOT standards outline operational LOS "A" though "D" as acceptable, LOS "E" as marginally acceptable, and LOS "F" as unacceptable.

G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	D, E, E
	ACCIDENT RATES	1.14, 1.08, 4.53, 1.92



G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	D, E, D
	ACCIDENT RATES	0.53, 2.22, 1.63, 0.76

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OREGON CITY, OREGON
JUNE 2000

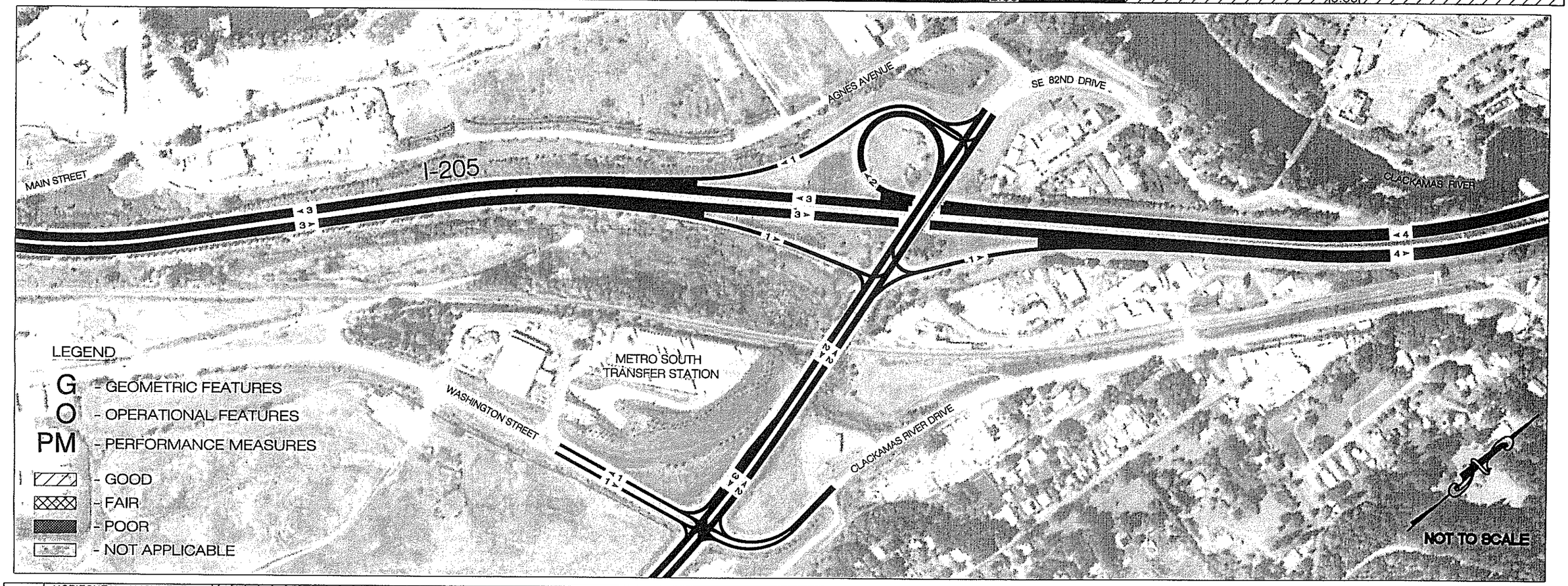
EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6A

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG006.DWG

G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	E | D | E
	ACCIDENT RATES	1.92 | 0.52 | 1.20 | 2.66 | 0.09



LEGEND

G - GEOMETRIC FEATURES

O - OPERATIONAL FEATURES

PM - PERFORMANCE MEASURES

- GOOD
- FAIR
- POOR
- NOT APPLICABLE

G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	D | D | D | C | E
	ACCIDENT RATES	0.76 | 0.98 | 3.27 | 1.48 | 0.07

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JUNE 2000

EVALUATION OF EXISTING CONDITIONS SUMMARY

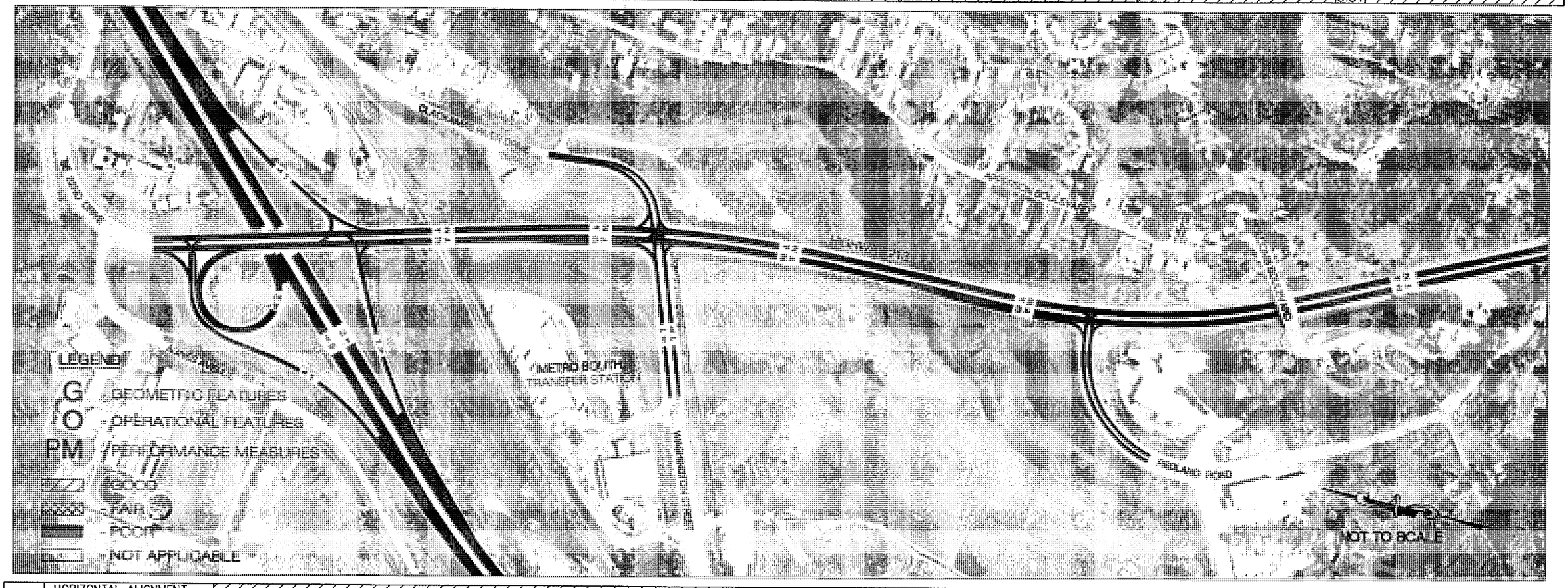
FIGURE NO. 6B

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG006B.DWG

| | | |

G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	[B] F [C] [B] [B]
	ACCIDENT RATES	3.37 2.21 10.31



G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	[B] F [C] [B] [C]
	ACCIDENT RATES	6.39 2.48 0.46

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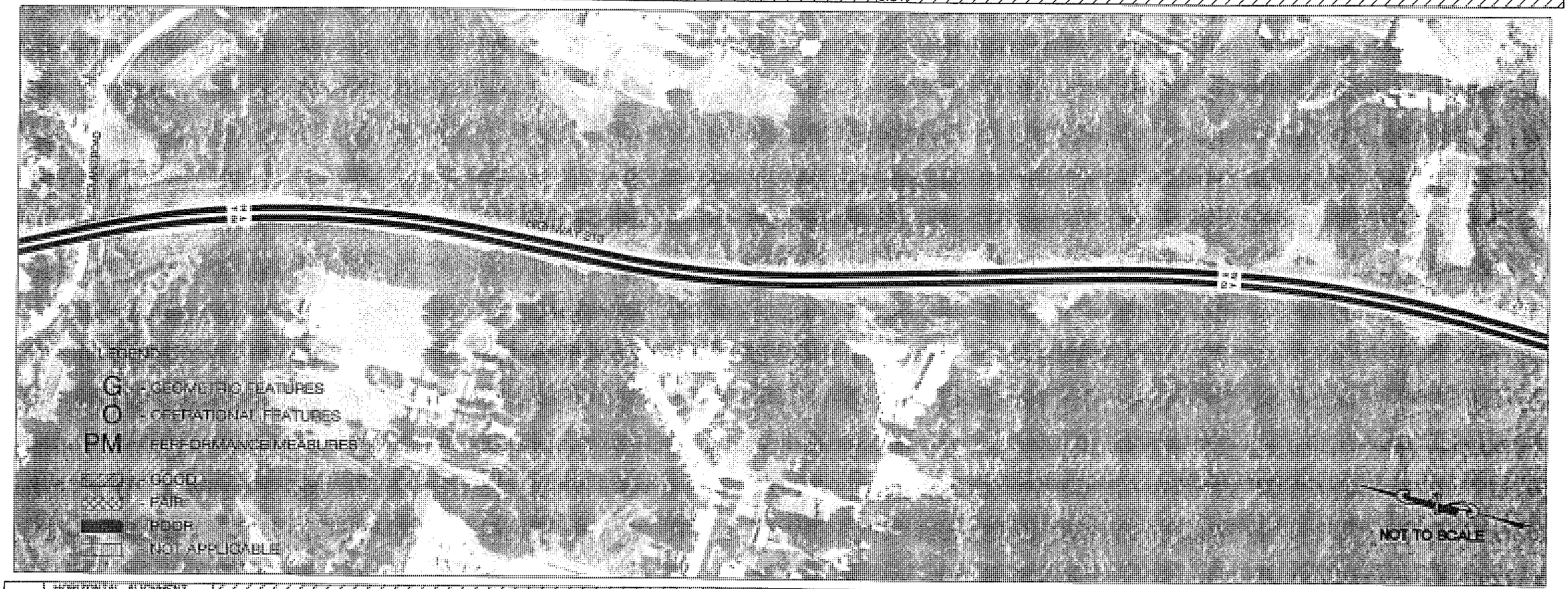
EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6D

PROJECT NO. 2561

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G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	
	ACCIDENT RATES	[B] 0.31



G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	
	ACCIDENT RATES	[C] 0.46

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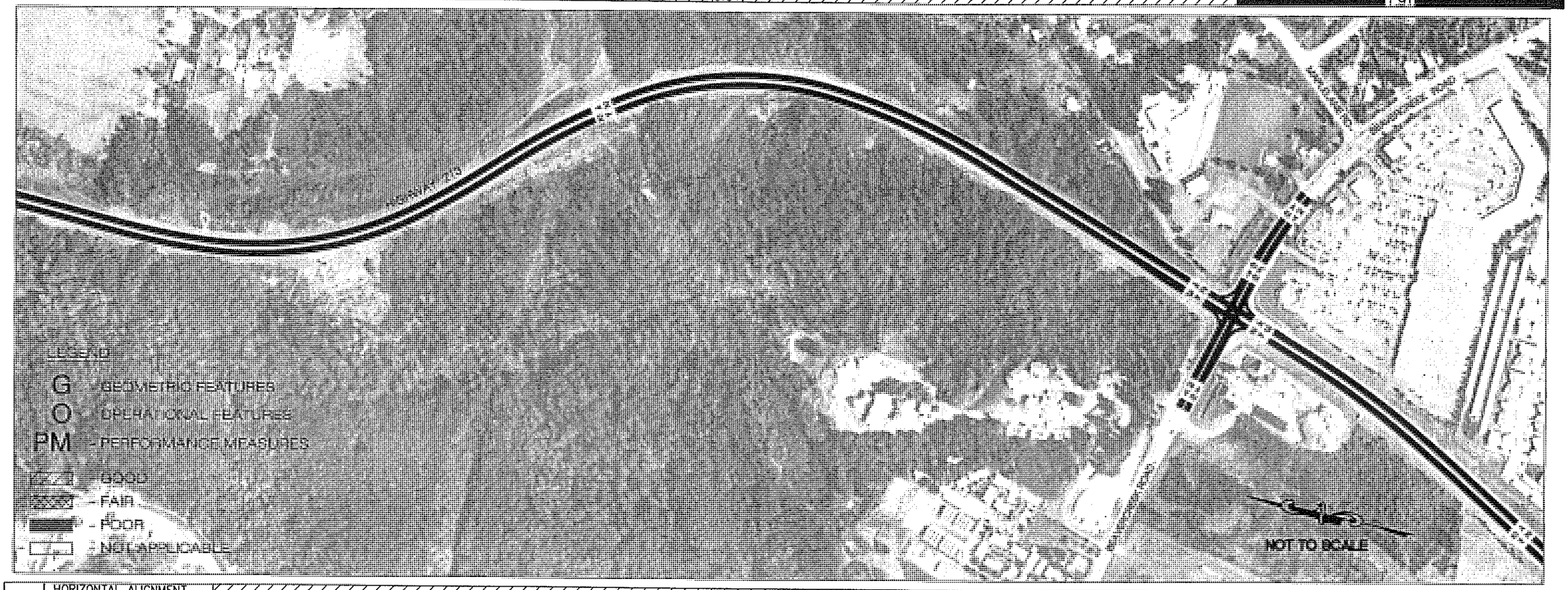
EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6E

PROJECT NO. 2561

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G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	B 0.31 F 1.91
	ACCIDENT RATES	



G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	C 0.46 F 1.70
	ACCIDENT RATES	

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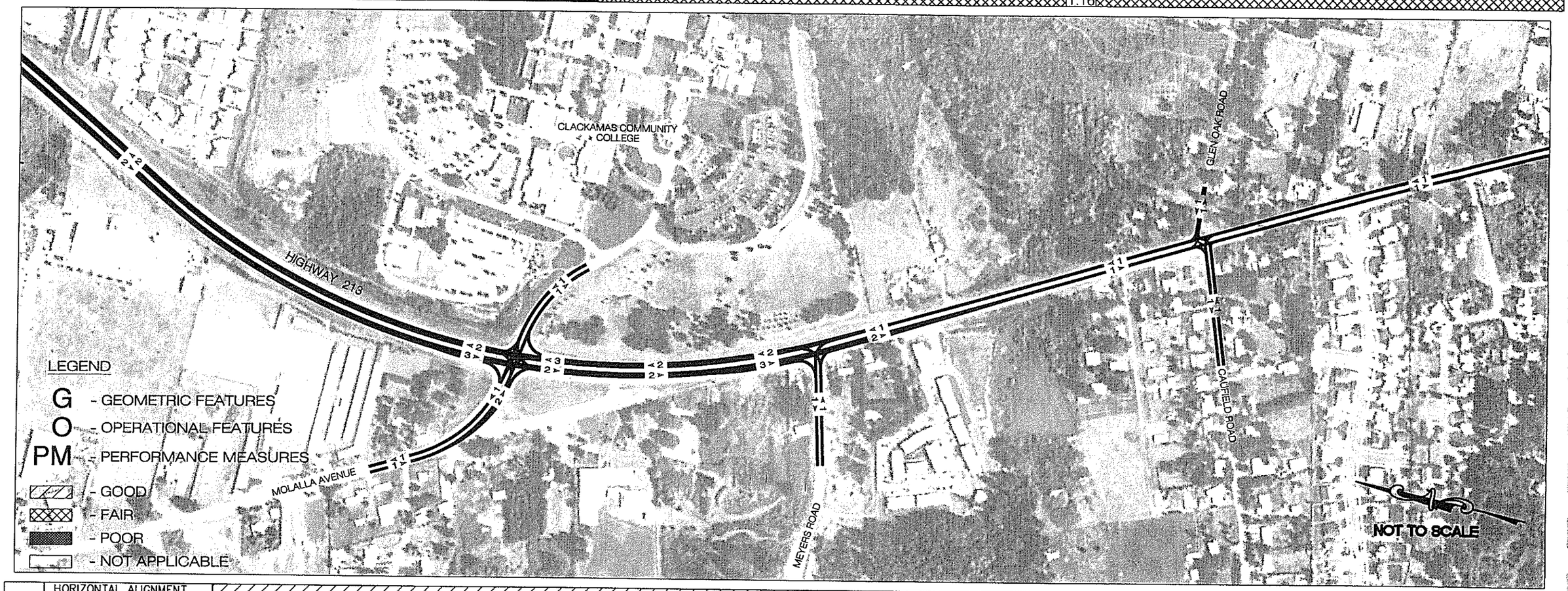
EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6F

PROJECT NO. 2561

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G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	C / B / F
	ACCIDENT RATES	1.91 / 1.16



G	HORIZONTAL ALIGNMENT	
	VERTICAL ALIGNMENT	
	STOPPING SIGHT DISTANCE	
	CROSS SECTION	
	DECISION SIGHT DISTANCE	
	EXIT & ENTRANCE DESIGN	
O	LANE & ROUTE CONTINUITY	
	LANE BALANCE	
	RAMP SEQUENCE	
PM	LEVEL OF SERVICE	C / B / F
	ACCIDENT RATES	1.70 / 0.75

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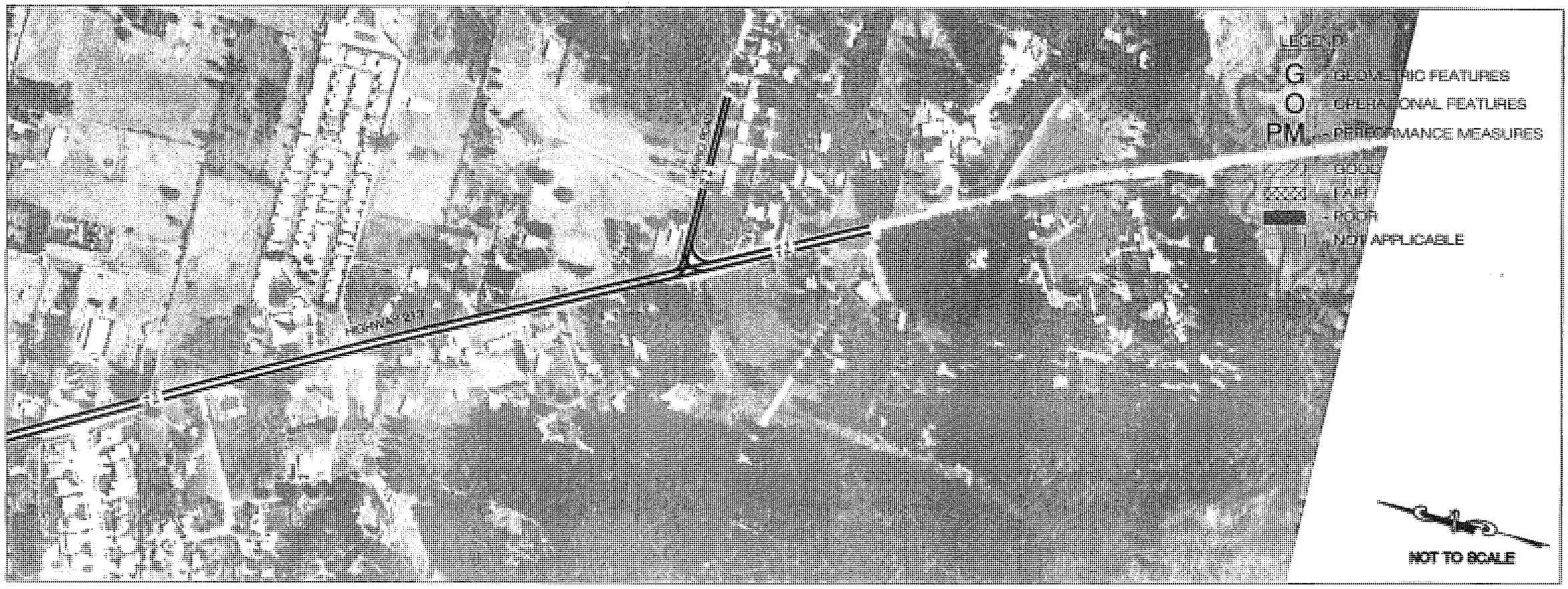
EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6G

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG006.DWG

G	HORIZONTAL ALIGNMENT		
	VERTICAL ALIGNMENT		
	STOPPING SIGHT DISTANCE		
	CROSS SECTION		
	DECISION SIGHT DISTANCE		
	EXIT & ENTRANCE DESIGN		
O	LANE & ROUTE CONTINUITY		
	LANE BALANCE		
	RAMP SEQUENCE		
PM	LEVEL OF SERVICE	JCI	
	ACCIDENT RATES	1.16	



G	HORIZONTAL ALIGNMENT		
	VERTICAL ALIGNMENT		
	STOPPING SIGHT DISTANCE		
	CROSS SECTION		
	DECISION SIGHT DISTANCE		
	EXIT & ENTRANCE DESIGN		
O	LANE & ROUTE CONTINUITY		
	LANE BALANCE		
	RAMP SEQUENCE		
PM	LEVEL OF SERVICE	JCI	
	ACCIDENT RATES	0.75	

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JUNE 2000

EVALUATION OF EXISTING CONDITIONS SUMMARY

FIGURE NO. 6H

PROJECT NO. 2561

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Existing PM Peak Intersection Operations

Several of the principal intersections in the study area are operating under congested conditions. The intersections of Washington Street/Highway 213, and Beavercreek/Highway 213 are both operating near or over capacity. The weaving movement between the northbound I-205 to southbound Highway 213 to Clackamas River Drive further exacerbates the capacity constraints at the Washington Street/Highway 213 intersection. In addition, the northbound I-205 ramp terminal intersection is also operating over capacity.

Figures 7A and 7B show the existing p.m. peak hour traffic volumes. Figure 8 shows the existing intersection lane configurations and traffic control devices. Figures 9 and 10 show the existing traffic operations along Highway 213 and I-205, respectively. Appendix B contains a detailed, tabular summary of the traffic operations analysis.

Existing PM Peak Hour Freeway Operations

Under existing conditions, traffic operations in the study corridor are congested during the p.m. peak hour. On I-205, queuing regularly occurs in the southbound direction between the Gladstone and the Highway 99E interchange. The weaving sections on SB I-205 between the Gladstone on-ramp and the Hwy 213 off-ramp, and the between the Hwy 213 on-ramp to the Highway 99E off-ramp operate at LOS E. The northbound weaving section between the Highway 213 on-ramp and the Gladstone interchange off-ramp operates at LOS D.

The basic freeway segments other than the above weaving segments operate in the LOS E and LOS D range. Northbound I-205 between the Highway 213 off-ramp and the Highway 213 on-ramp operates at LOS C due to the high volume of traffic exiting from northbound I-205 to Highway 213.

Safety Evaluation

A safety analysis and accident evaluation for the study corridor was performed using data provided by ODOT. The study period for this analysis was January 1, 1993 through May 30, 1997. The safety analysis was performed to identify whether there are any crash trends that need to be specifically addressed in this project. For example, a location with a high incidence of accidents may be attributed to a specific geometric or operational feature that could be eliminated with improvements.

The detailed segment analysis revealed that, while no fatalities were reported, the majority of the I-205 freeway segments analyzed experienced accident rates higher than the statewide average. The statewide accident rate for similar type facilities is 0.91 accidents/million vehicle miles (acc/mvm). Locations below statewide averages include:

- The Gladstone interchange area,
- I-205 southbound around the Highway 213 on-ramp,
- I-205 northbound around the Highway 99E off-ramp, and
- I-205 northbound in the basic section between Highway 99E and Highway 213.

The segment of I-205 southbound around the Highway 99E off-ramp was found to have the highest accident rate, 4.52 accidents/million vehicle miles traveled. The segment of I-205 northbound in the Highway 213 interchange area was also found to experience a substantially higher than average accident rate of 3.27 accidents/million vehicle miles. These high accident rates can likely be attributed to the congested conditions that occur along I-205. In addition, the inadequate freeway off-ramp geometry at the Highway 213 and Highway 99E interchanges influences freeway mainline operations, resulting in congestion and queuing particularly during the peak hour periods.

On Highway 213, a total of 221 crashes were reported during the 53-month period under review. While 117 of these accidents involved personal injury, there were no reported fatalities. Further evaluation of the reported accident locations revealed that the majority of the accidents occurring along Highway 213 could be attributed to conflicts in or around an intersection, with rear-end accidents being the most common type of accident occurring. These observations are consistent with the congested operational conditions at the intersections as discussed in the operational analysis review. Site-specific tabular summaries of this crash information are included in Appendix C.

Environmental Evaluation

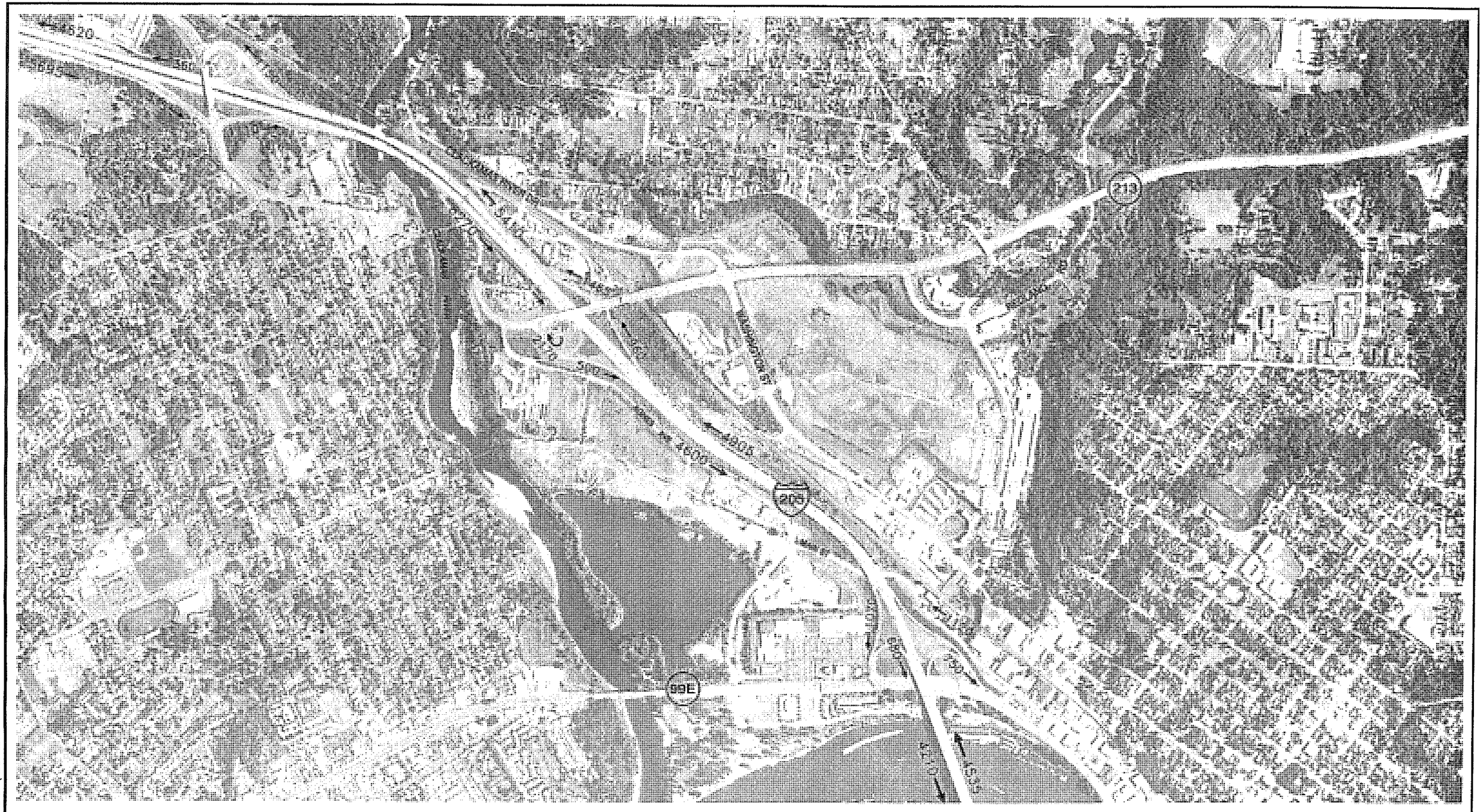
A baseline review of environmental issues and constraints identified the physical or regulatory constraints that were to be considered as part of the project planning process. The constraints include:

- Steep slopes along portions of the study corridor in the vicinity of Washington Street, the Canyon and Beavercreek Road.
- Stream crossings near Beavercreek Road and between Washington Street and Redland Road provide wildlife and potential fish habitat to be considered and protected in alternative solution concepts.
- Wetlands exist near Washington Street and I-205. These would also require protection. However, none of the identified issues represent a likely fatal flow for potential corridor improvements. Additional investigations will be required in latter phases of project development to determine the extent of jurisdictional wetlands and the presence of protected fish and wildlife species, or their critical habitat.

Summary of Existing Conditions

From the perspective of roadway geometric characteristics, Highway 213 and the I-205 corridor are in relatively good condition. There are a few geometric deficiencies on I-205 in the vicinity of the Highway 213, Highway 99E and the Clackamas River Bridge. However, these deficiencies are relatively minor and do not cause significant negative impacts.

There is insufficient capacity to meet existing southbound I-205 p.m. peak hour travel demand between the Gladstone Interchange and Highway 99E and on southbound Highway 213 between I-205 and Washington Street. Congestion also occurs at the Beavercreek/Highway 213 intersection. These congested locations cause delay and queuing for motorists and increase the propensity for traffic crashes.



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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

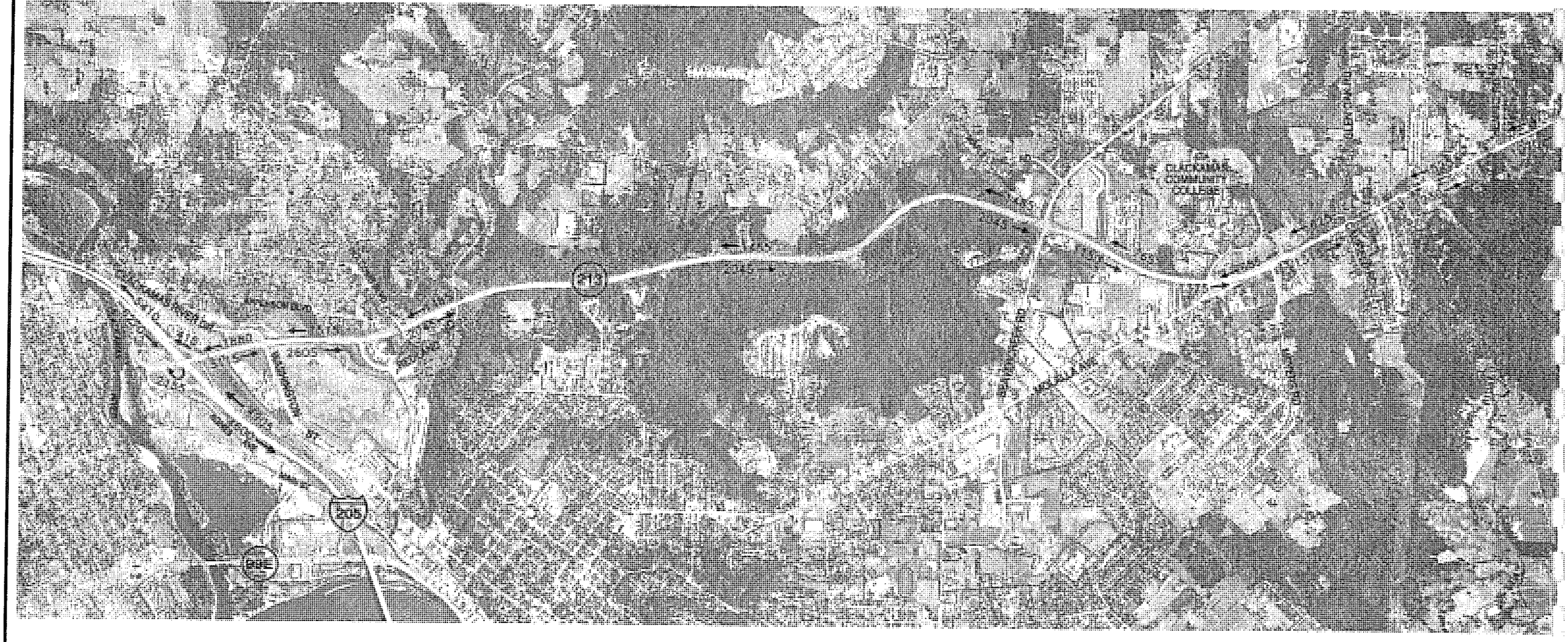
1998 EXISTING TRAFFIC VOLUMES WEEKDAY PM PEAK HOUR

FIGURE NO.
7A

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIGD7A.DWG

NORTH
(NOT TO SCALE)



h:\PROJFILE\2561\DWGS\FINALREP\FIG07B.DWG

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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

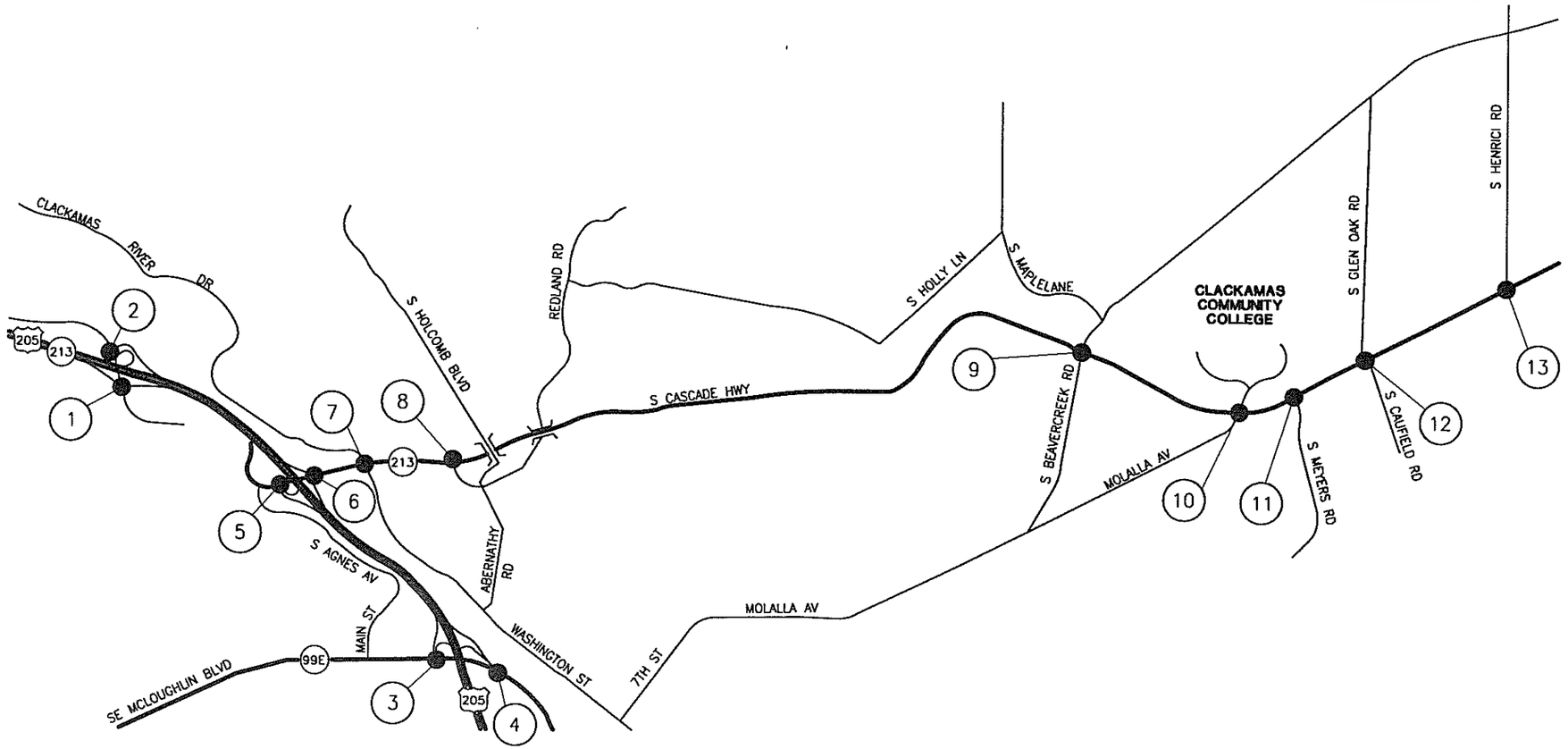
OREGON CITY, OREGON
JUNE 2000

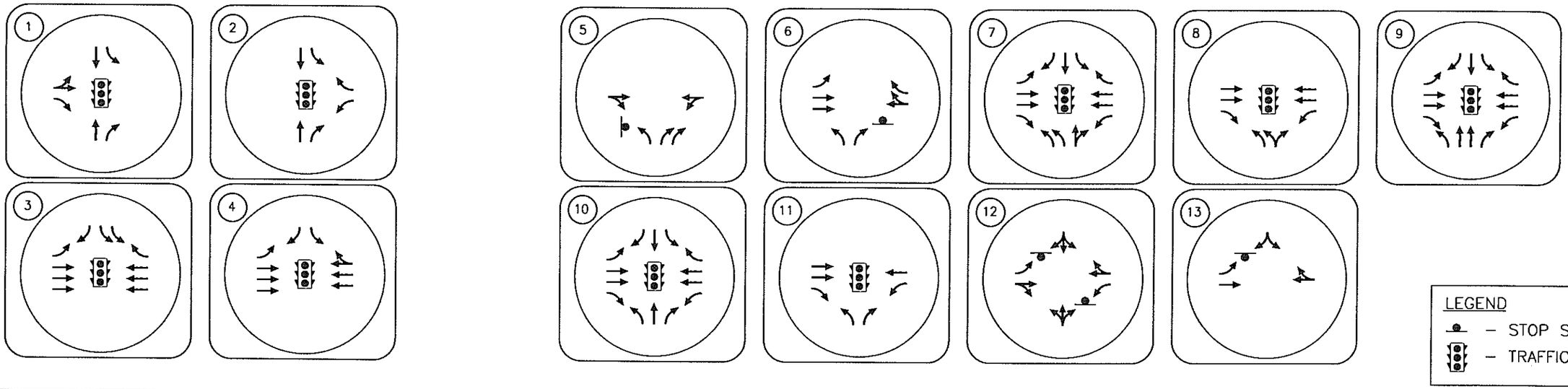
1998 EXISTING TRAFFIC VOLUMES WEEKDAY PM PEAK HOUR

FIGURE NO.
7B

PROJECT NO.
2561

NORTH
(NOT TO SCALE)





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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

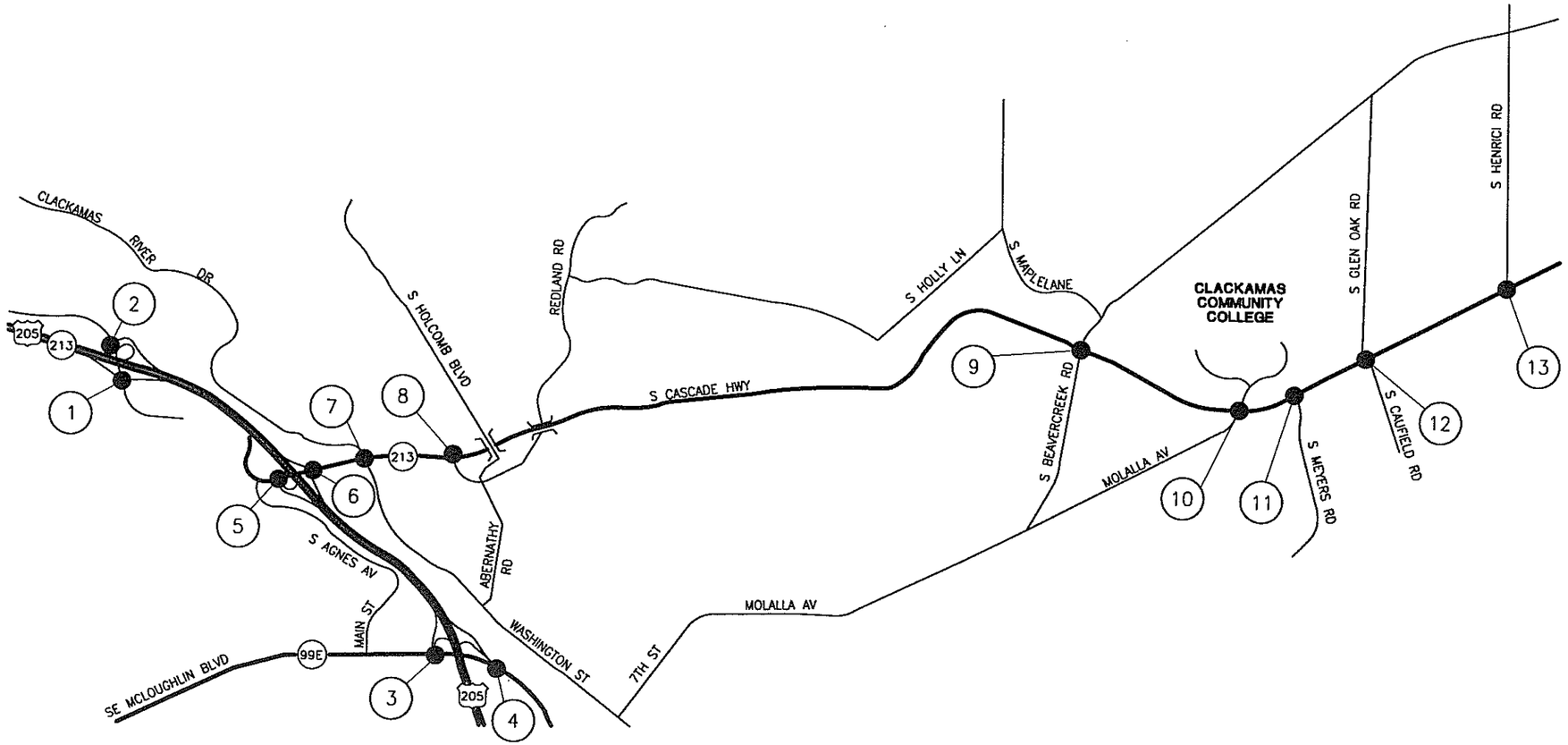
EXISTING LANE CONFIGURATIONS AND TRAFFIC CONTROL DEVICES

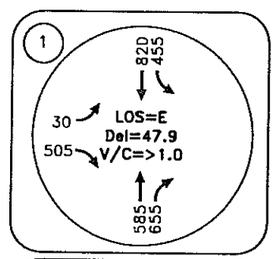
FIGURE NO. 8

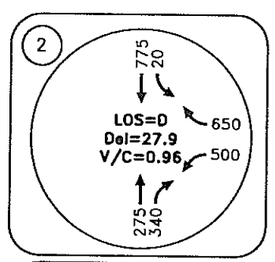
PROJECT NO. 2561

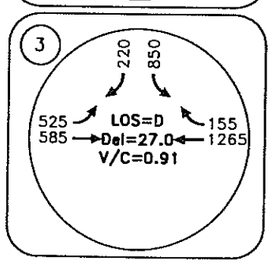
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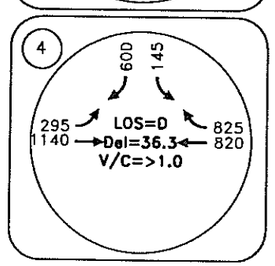
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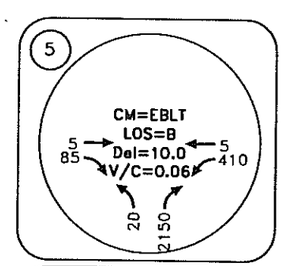


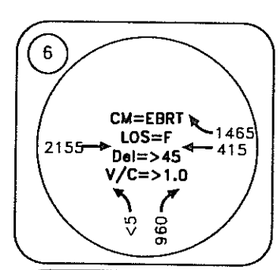


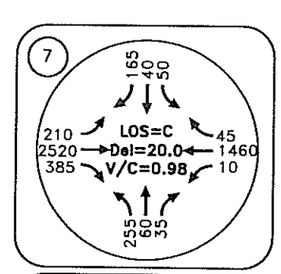


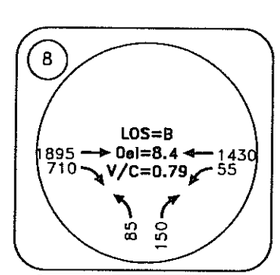


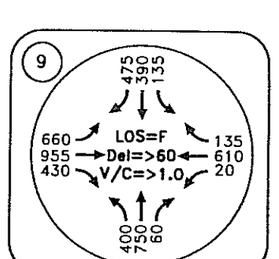


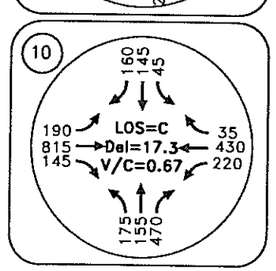


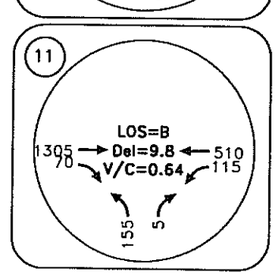


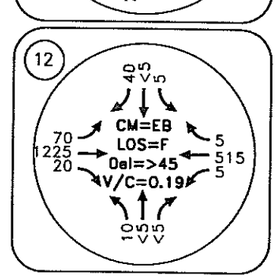


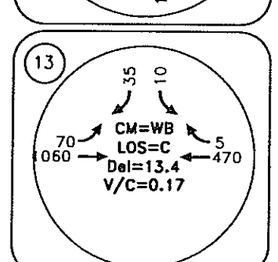












LEGEND
- CM = CRITICAL MOVEMENT (UNSIGNALIZED)
- LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/ CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
- Del = INTERSECTION AVERAGE DELAY (SIGNALIZED)/ CRITICAL MOVEMENT DELAY (UNSIGNALIZED)
- V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

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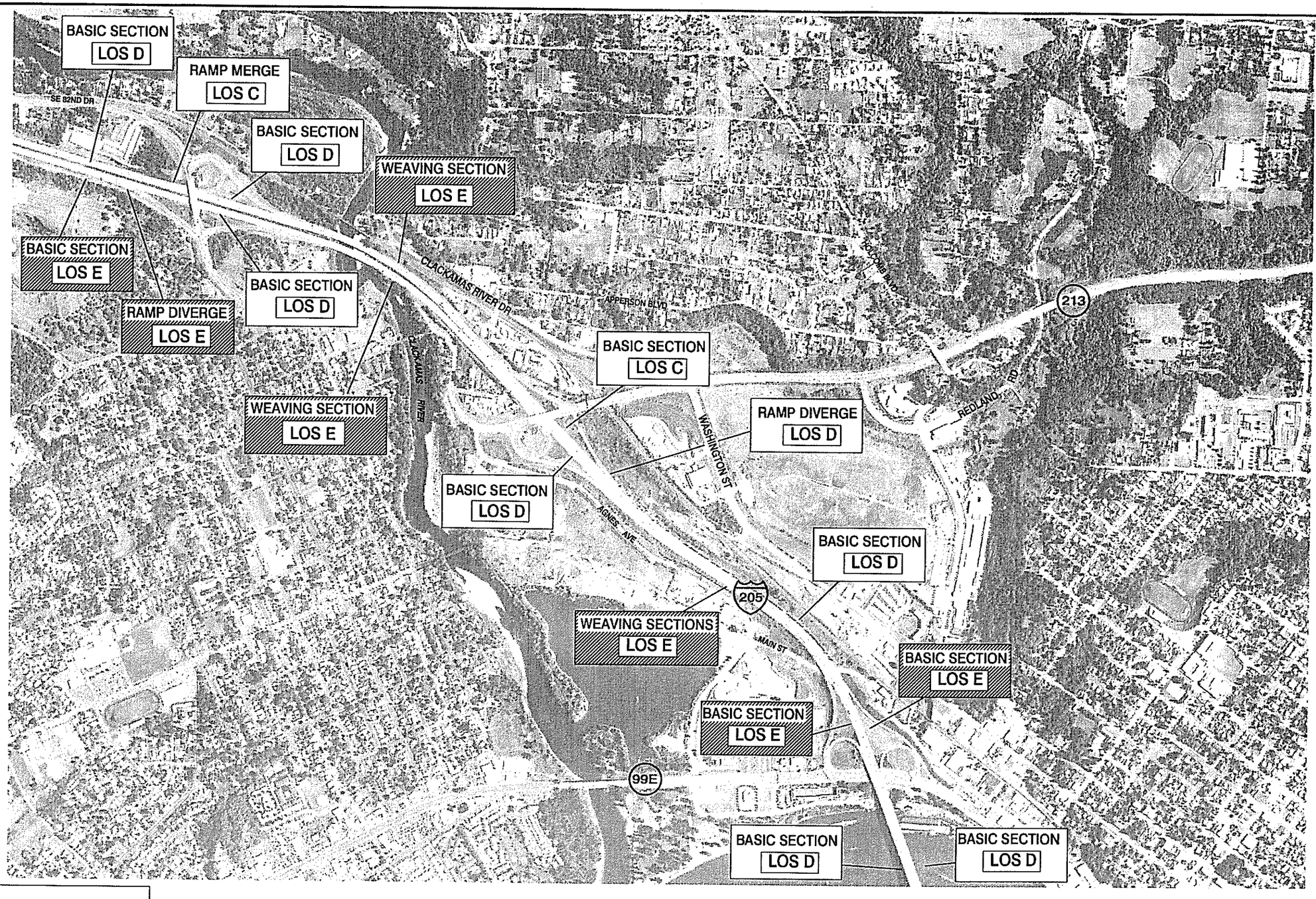
OREGON CITY, OREGON
JUNE 2000

EXISTING HIGHWAY 213 TRAFFIC OPERATIONS WEEKDAY PM PEAK HOUR

FIGURE NO.
9

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG009.DWG



NORTH
(NOT TO SCALE)

LEGEND

FAILS TO MEET ODOT LOS STANDARDS

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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

EXISTING I-205 TRAFFIC OPERATIONS WEEKDAY PM PEAK HOUR

FIGURE NO.
10

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG010.DWG

Future Conditions "No-Build" Analysis

The future conditions "No-Build" Scenario evaluates the traffic conditions likely to exist in the year 2018. This assumes there will be growth in travel demand and no modifications to the existing roadway network. The analysis of the forecast p.m. peak hour traffic volumes serves as the basis for identifying the projected future transportation system deficiencies at the study intersections and freeway segments. This information, in combination with the deficiencies identified through the existing conditions analysis, led to the development of the future Build Alternative design concepts for the study corridor.

The Metro 2015 travel demand model was used as the basis for determining a growth rate to forecast 2018 p.m. peak hour traffic volumes. This is consistent with the City of Oregon City Transportation System Plan work. No improvements were assumed for the model network because there are no committed projects along the Highway 213 or I-205 study area corridors, or projects acknowledged in the Metro 2015 regional model network. The land use inputs to the travel demand forecast were also consistent with the inputs for the Oregon City Transportation System Plan Study. These assumptions reflect the City of Oregon City's Comprehensive Plan with refinements to the transportation analysis zones to reflect more detail along the Highway 213 corridor.

2018 PM Peak Hour Traffic Volumes and Travel Desires

All roadways in the study area are forecast to experience significant growth in traffic volumes over the 20-year planning horizon. Over the course of 20 years, traffic volumes on I-205 are forecast to grow by approximately 35 percent. The ramps from I-205 into Oregon City at the Highway 99E interchange and the Highway 213 interchange could also experience dramatic growth in traffic volumes. This increase in demand for the two Oregon City I-205 interchanges is consistent with the significant future growth and development projected for the greater Oregon City area, particularly in the southern portion of the city.

On Highway 213, traffic volumes are projected to increase an average of 30 percent in the southbound direction and 40 percent in the northbound direction over the 20-year study time period. Consistent with the dramatic demand increase of the Highway 213/I-205 interchange, the travel demand on Highway 213 in the vicinity of the interchange (i.e. the segment from north of the interchange to Washington Street) is also forecast to increase at an above average rate (45 to 65 percent). These are significant traffic volume growth rates. The 2018 forecast p.m. peak hour traffic volumes are shown in Figures 11A and 11B.

Travel desires show that 70 percent of all traffic on southbound Highway 213 north of Redland Road have traveled from southbound I-205. Of the motorists on southbound Highway 213 at Redland Road, approximately 25 percent continue southbound on Highway 213 south of Henrici Road.

Southbound Highway 213 experiences the most significant travel demand between the northbound I-205 ramp terminal intersection and Clackamas River Drive. Of the motorists exiting northbound I-205 at the Highway 213 off-ramp, 40 percent will make a left-hand turn from southbound Highway 213 to Clackamas River Drive. The high increase in traffic demand for this travel pattern is expected due to the anticipated growth assigned to the Clackamas River Drive area. This is a significant movement that needs to be accommodated in the project design concepts. Several travel desires are summarized schematically in Figures 12A through 12D.

2018 PM Peak Hour Intersection Operations

Given this significant projected growth in p.m. peak hour traffic volumes with one exception, all of the study intersections will operate over capacity in the future. The one exception is at the Meyers Road/Highway 213 intersection. This is a substantial degradation over existing conditions. A schematic of forecast p.m. peak hour intersection operations is shown in Figure 13. A tabular summary of 2018 p.m. peak hour no-build intersection operations is included in Appendix D.

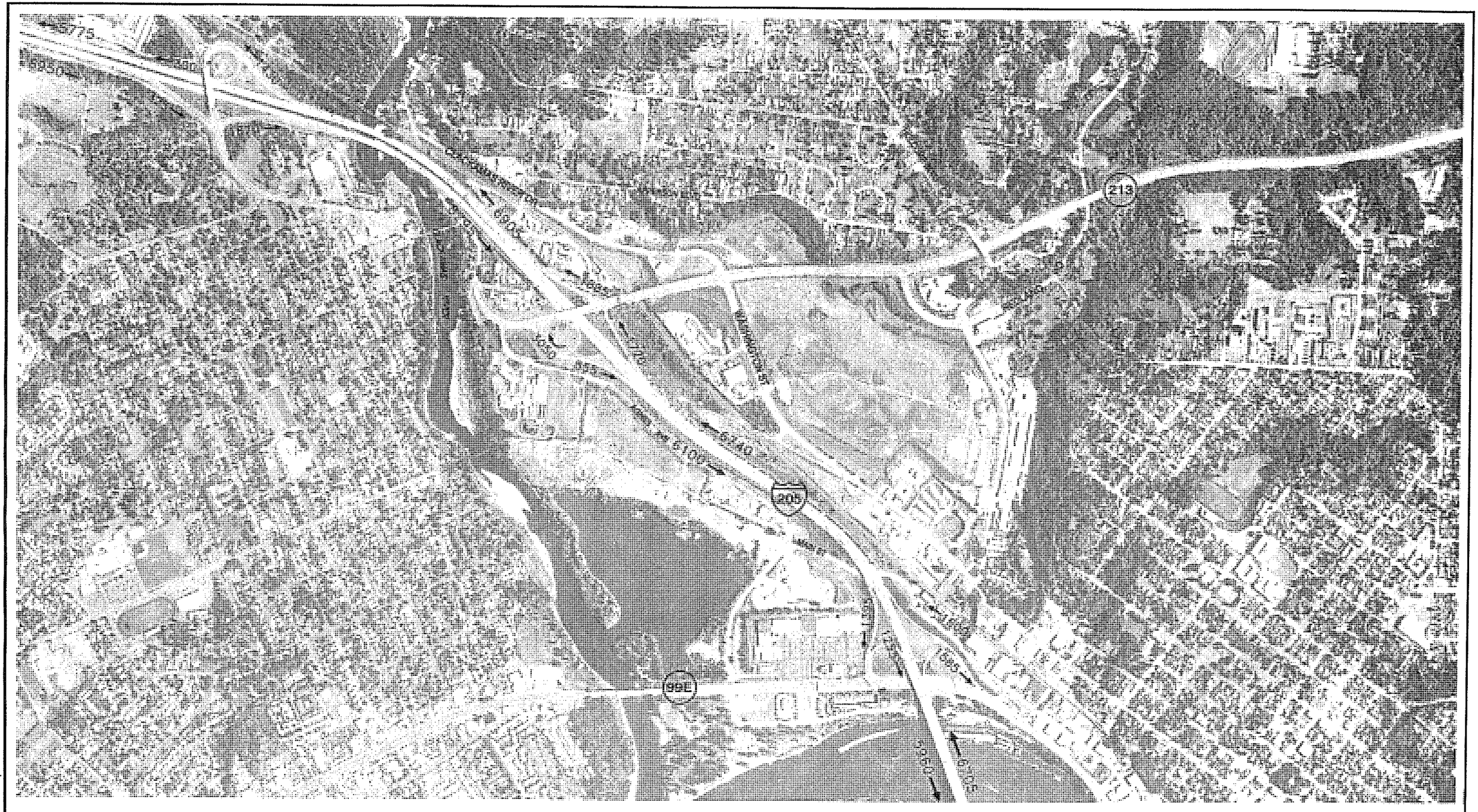
2018 PM Peak Hour Freeway Operations

On Highway 213 the two-lane freeway section between Redland Road and Beavercreek Road will have sufficient capacity to accommodate future travel demand through the corridor.

The growth in forecast p.m. peak hour traffic volumes has a significant impact on operations along I-205. All but one mainline segment of I-205 in the study corridor is forecast to operate at unacceptable levels of service. There will be significant roadway congestion and queuing. The exception is on northbound I-205 mainline between the Highway 213 off-ramp and the Highway 213 on-ramp, which will operate at level of service C.

The weaving sections on southbound I-205 between the Gladstone on-ramp and the Highway 213 off-ramp, and on southbound I-205 between the Highway 213 on-ramp to the Highway 99E off-ramp will both operate at level of service F.

Traffic operations at the merge/diverge locations will also operate below ODOT level of service standards. The exception is the I-205 northbound/Gladstone on-ramp merge. A schematic of forecast p.m. peak hour freeway operations is shown in Figure 14. A tabular summary of the 2018 p.m. peak hour freeway operations is included in Appendix D.



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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

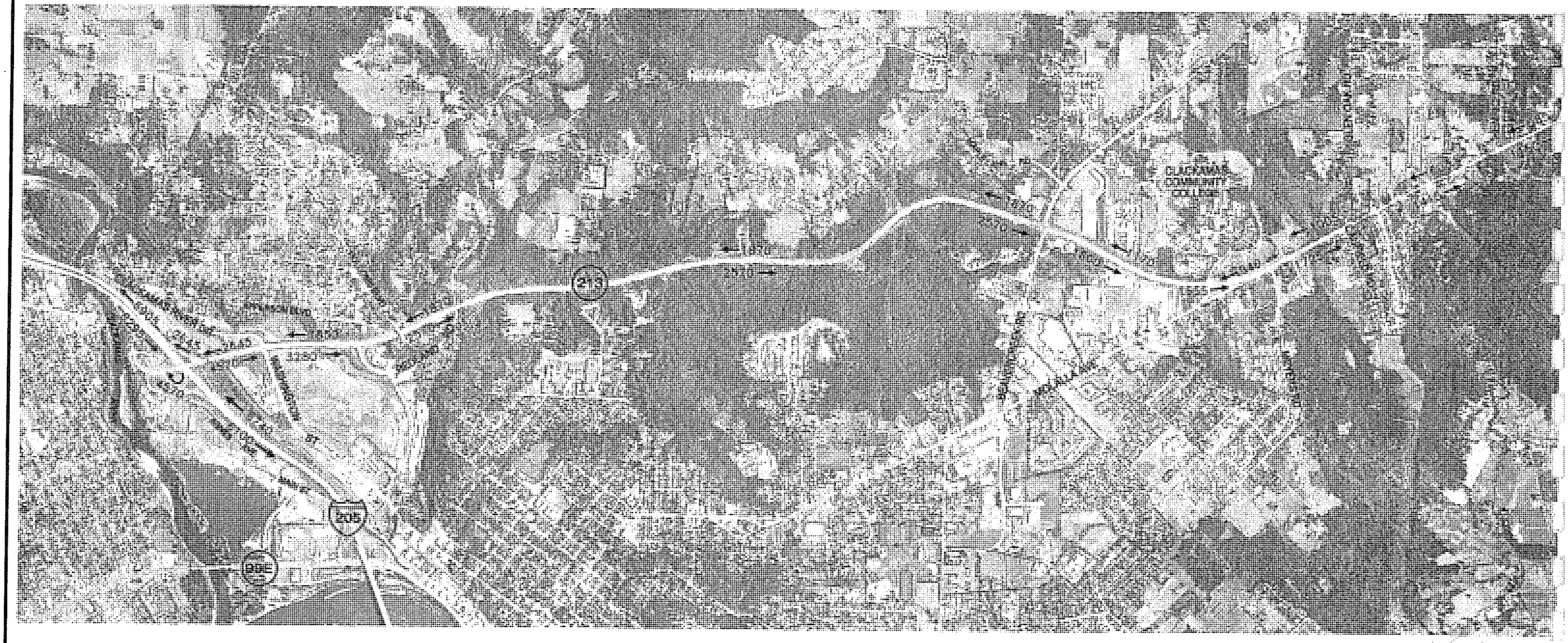
2018 FORECAST TRAFFIC VOLUMES WEEKDAY PM PEAK HOUR

FIGURE NO.
11A

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG11A.DWG

NORTH
(NOT TO SCALE)

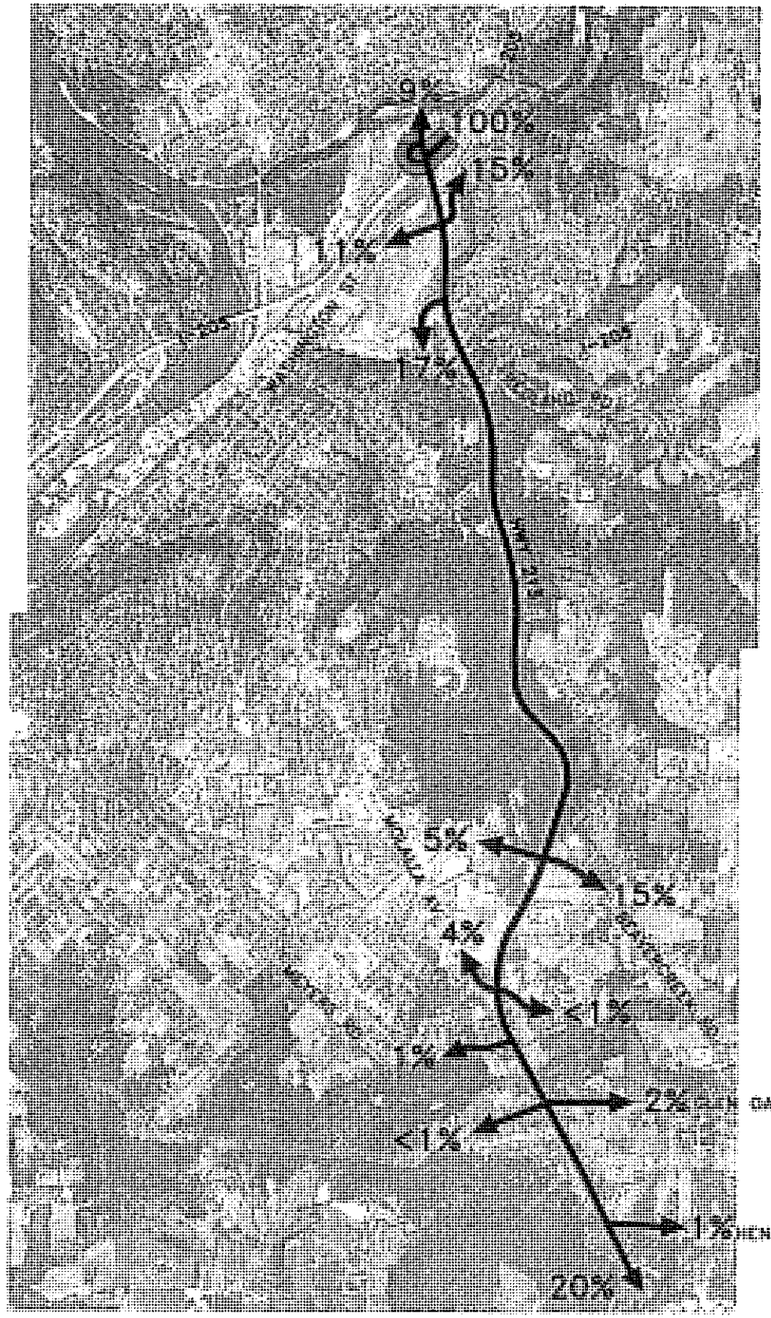


3,700

18,500 / 14,800 = X / 37,000
X = 24,300

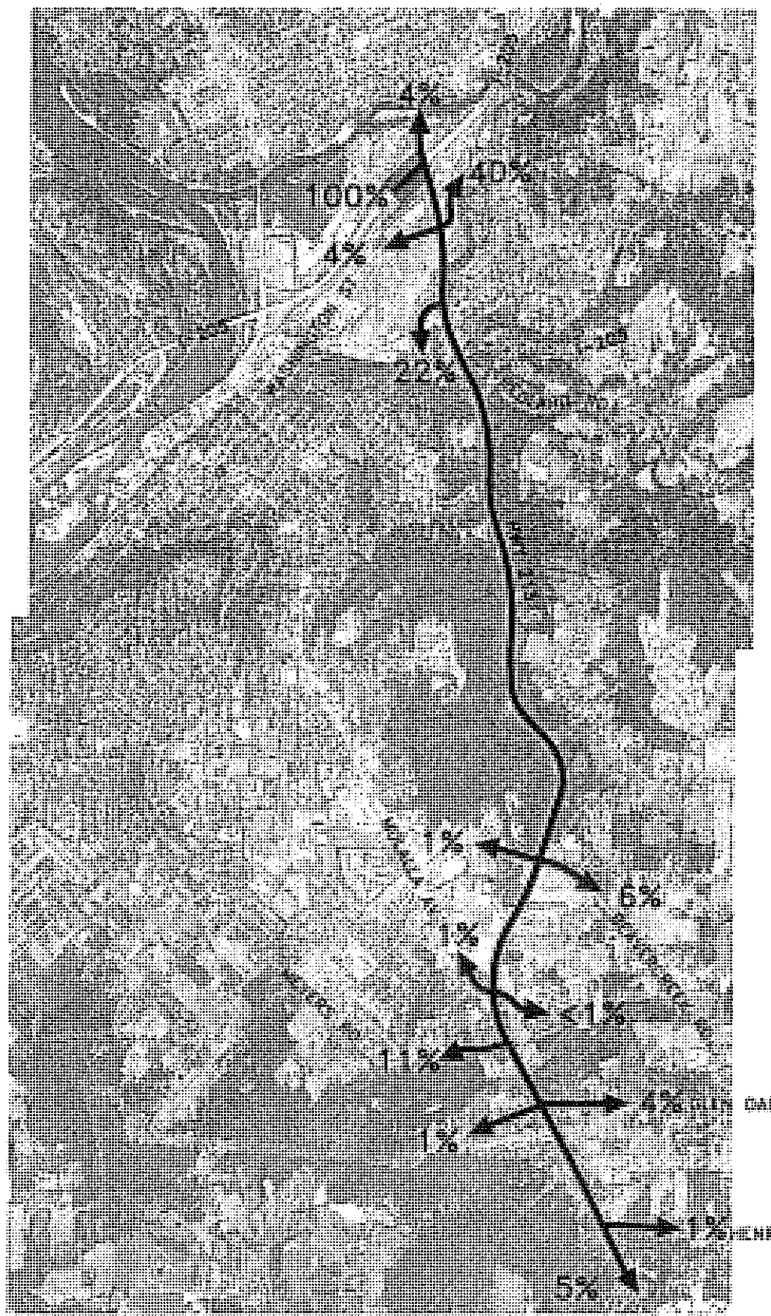
KITTELSON & ASSOCIATES, INC. 610 S.W. ALDER, SUITE 700 PORTLAND, OREGON 97205 (503) 228-5230 TRANSPORTATION PLANNING\TRAFFIC ENGINEERING	HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY OREGON CITY, OREGON JUNE 2000	*2018 FORECAST TRAFFIC VOLUMES* *WEEKDAY PM PEAK HOUR*	FIGURE NO. 11B PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG11B.DWG



HWY 213 FROM I-205 SOUTHBOUND

NOT TO SCALE



HWY 213 FROM I-205 NORTHBOUND

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HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

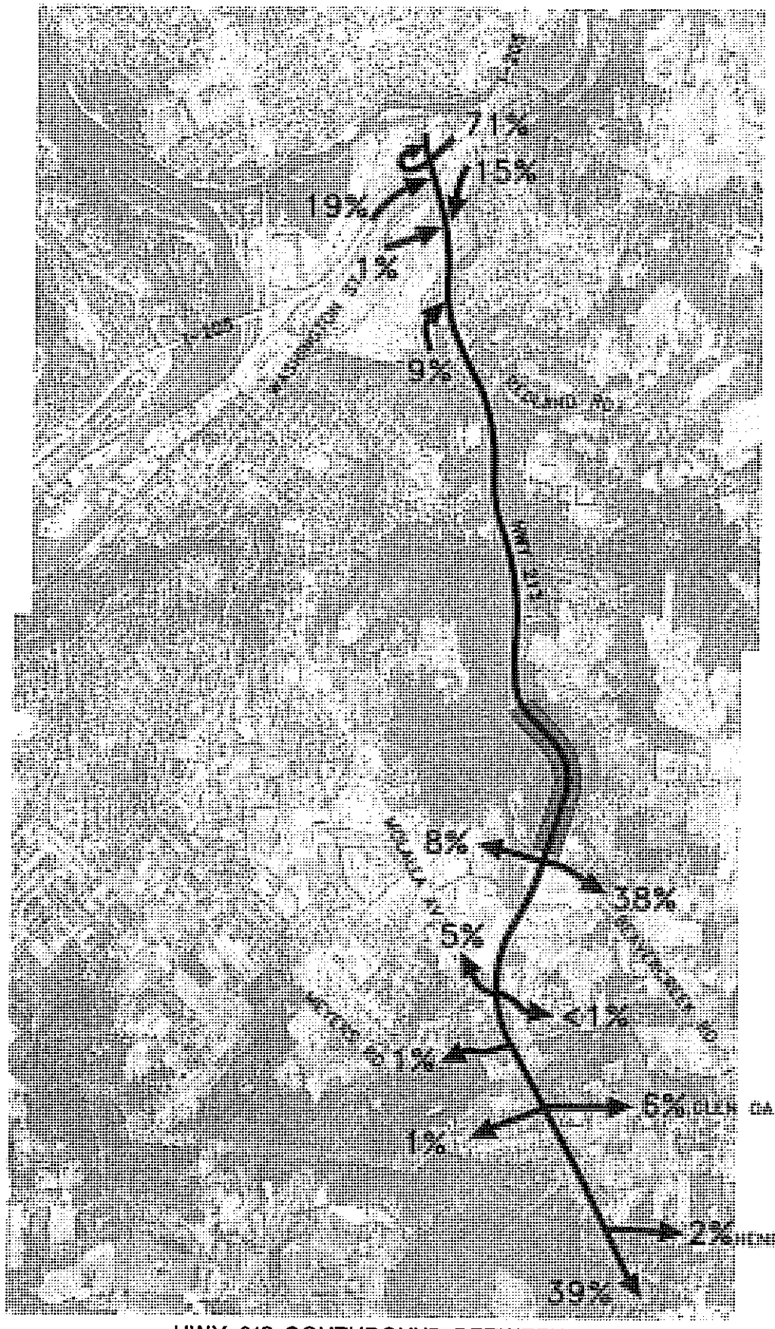
OREGON CITY, OREGON
JUNE 2000

2018 FORECAST TRAVEL DESIRES FROM I-205

FIGURE NO. 12A

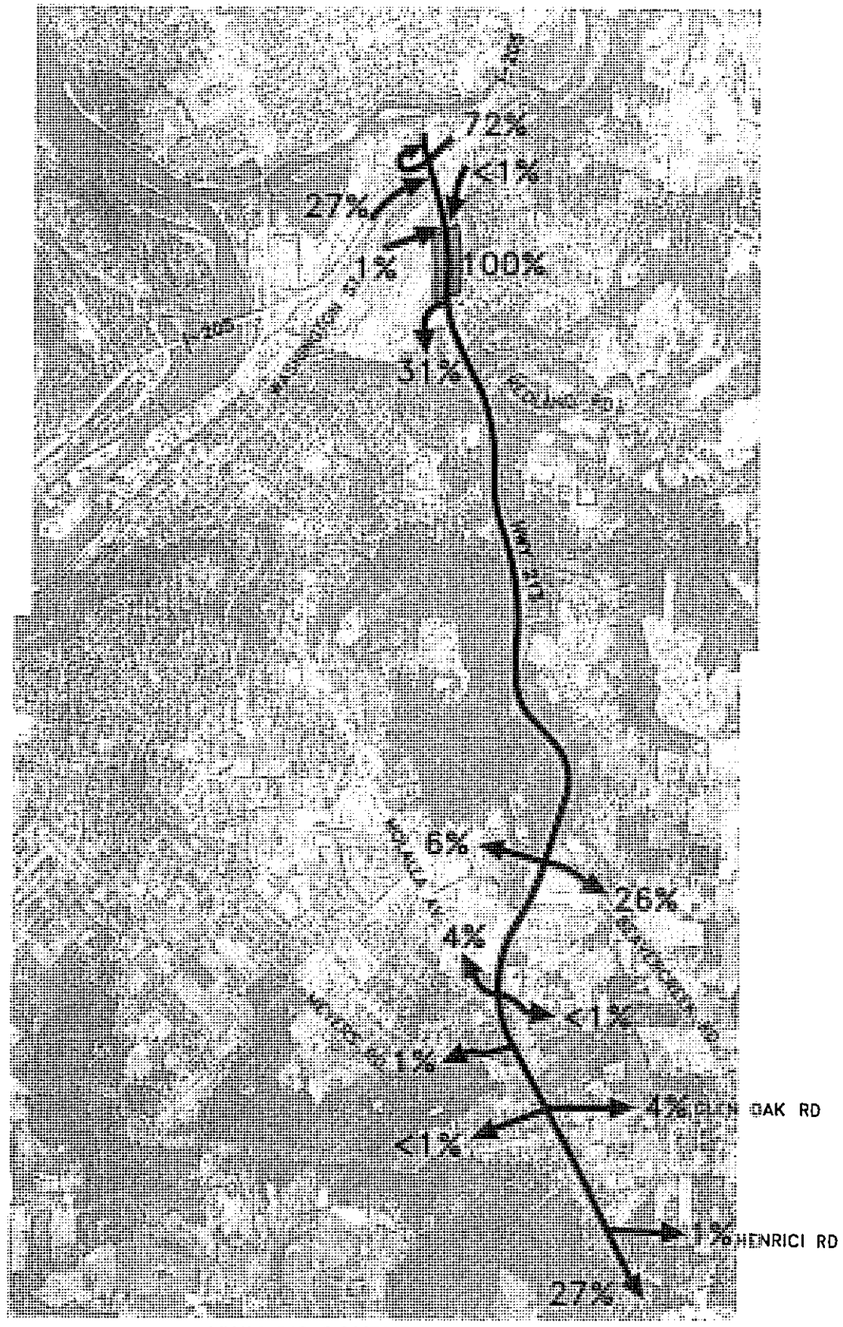
PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG12A.DWG



HWY 213 SOUTHBOUND BETWEEN
REDLAND ROAD AND BEAVERCREEK ROAD

NOT TO SCALE



HWY 213 SOUTHBOUND BETWEEN
WASHINGTON STREET AND REDLAND ROAD

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OREGON CITY, OREGON
JUNE 2000

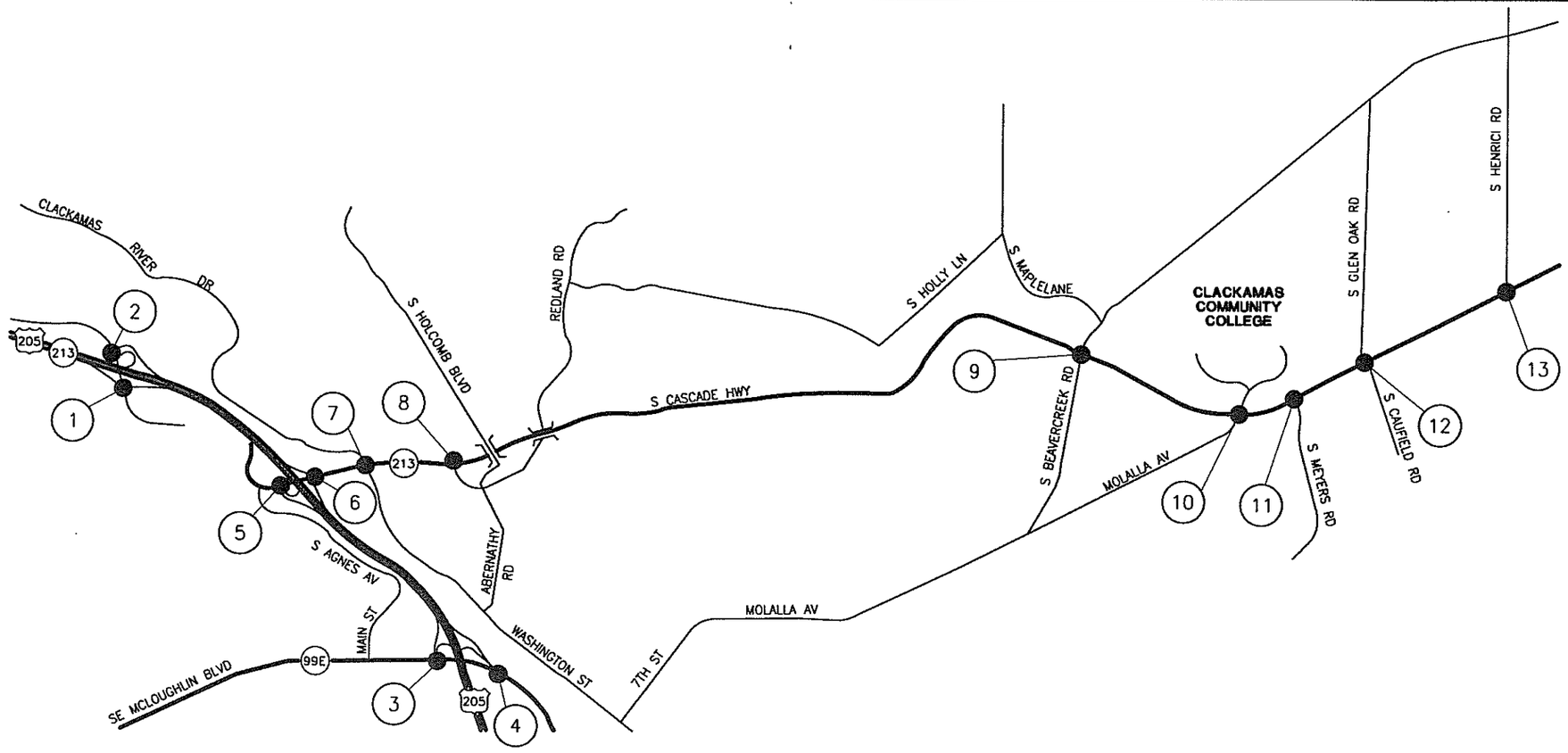
2018 FORECAST TRAVEL DESIRES ON HIGHWAY 213

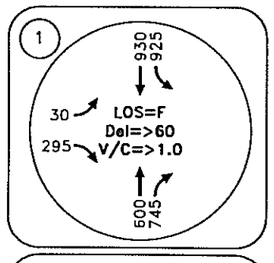
FIGURE NO. 12B

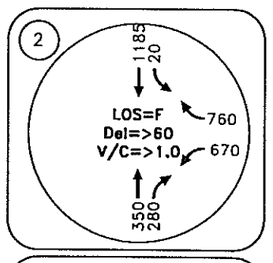
PROJECT NO. 2561

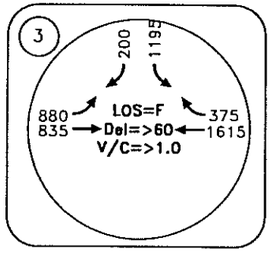
h:\PROJFILE\2561\DWGS\FINALREP\FIG12B.DWG

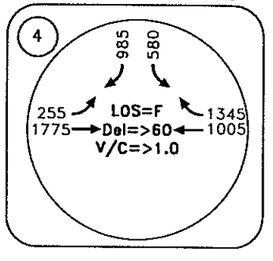
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(NOT TO SCALE)

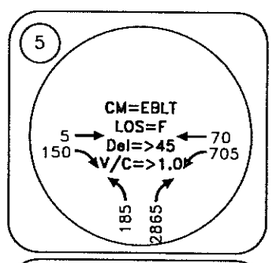


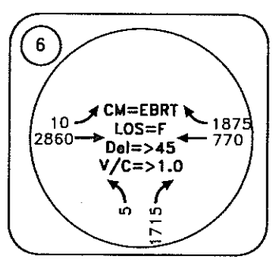


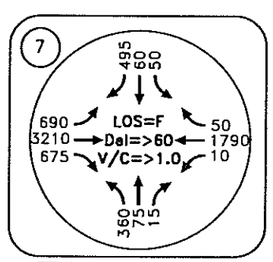


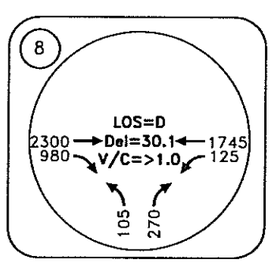


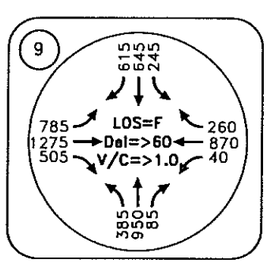


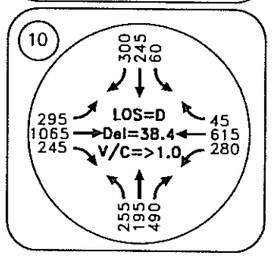


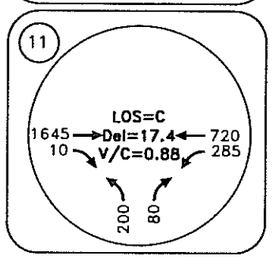


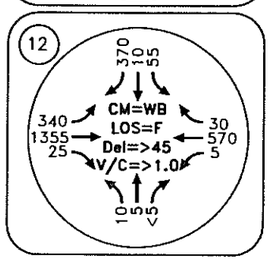


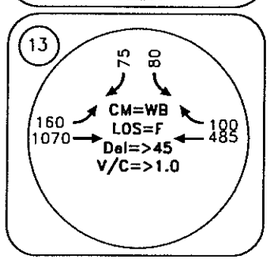












LEGEND
- CM = CRITICAL MOVEMENT (UNSIGNALIZED)
- LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/ CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
- Del = INTERSECTION AVERAGE DELAY (SIGNALIZED)/ CRITICAL MOVEMENT DELAY (UNSIGNALIZED)
- V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

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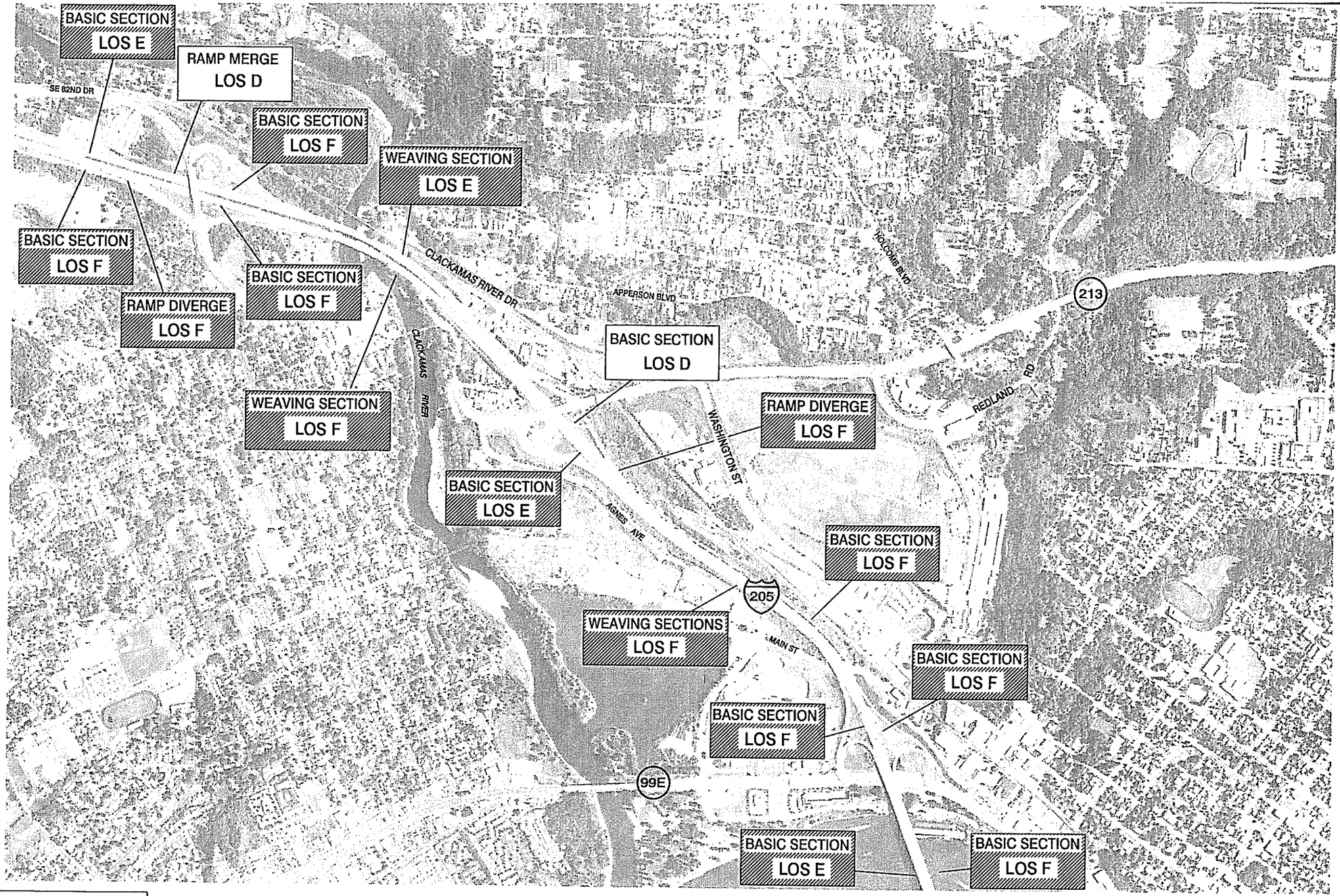
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2018 FORECAST INTERSECTION OPERATIONS WEEKDAY PM PEAK HOUR NO-BUILD ANALYSIS SCENARIO

FIGURE NO. 13

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG013.DWG



LEGEND

FAILS TO MEET ODOT LOS STANDARDS

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2018 FORECAST FREEWAY LEVELS OF SERVICE WEEKDAY PM PEAK HOUR NO-BUILD ANALYSIS SCENARIO

FIGURE NO. 14

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIGD14.DWG

Concept Development and Preferred Solutions

Concept Development

The project study area was divided into three distinct areas: the north area in the vicinity of the I-205/Highway 213 interchange (including Highway 213 between I-205 and Redland Road), and the south area from the Beavercreek/Highway 213 intersection, and Molalla Avenue south to Henrici Road. For each of these areas a number of improvement concepts were developed to address existing and forecast deficiencies, and to address the corridor vision developed by the TAC and CAC.

Initial alternatives were developed using single-line and double-line sketching techniques over aerial base mapping. These alternative solution concepts were presented to the TAC and CAC for review and refinement. Based on input from the TAC and CAC, the concepts were refined and prepared in a final format. Vertical and horizontal profile checks, planning level cost estimates, and traffic operations analyses were also conducted to verify that the solution concepts could be constructed and funded and would meet the appropriate level of service standards.

The TAC and CAC comparatively evaluated the concepts based on the following evaluation criteria:

- Traffic operations
- Phased implementation and expandability
- Constructability/maintenance of traffic
- Right-of-way requirements
- Compatibility with public transportation
- Compatibility with pedestrians/bicyclists
- Local access and circulation
- Satisfies operations and design requirements
- Compatibility with surrounding land uses
- Funding feasibility
- Cost/benefit

Good, Fair, and Poor ratings for the project evaluation criteria were assigned to each of the concepts to assist with alternatives evaluation and ranking. Details of the concept alternatives by sub-area are presented below.

North End Concepts

The forecast 2018 traffic volumes on I-205 cannot be accommodated without significant improvements on the I-205 facility. The analysis showed that improvements would be required on I-205 in the study area, throughout the adjacent I-205 corridor. These improvements could include capacity expansion on the I-205 Bridges over the Willamette and Clackamas Rivers. ODOT and Metro have recognized the potential congestion issues on the I-205 corridor and are beginning to plan for a corridor study to address future plans for the I-205 corridor. The Highway 213/I-205 interchange would be one component of this larger corridor analysis.

The TAC and CAC recommended the need for developing a most promising solution concept for the Highway 213/I-205 interchange that could be integrated into a plan for the I-205 corridor. The project team, TAC and CAC, recommended developing a concept that could be developed in phases to:

- Allow Oregon City to continue to evaluate development proposals in the vicinity of Washington Street,
- Be integrated efficiently with future interchange improvements, and
- Be a feasible way to immediately address congestion issues in this part of the Highway 213 corridor.

The CAC and TAC also identified that the north end of the Highway 213 corridor should be geared to moving vehicles under relatively high operating conditions. There should be limited delay, and to the extent feasible the intersections of Washington Street/Highway 213 and Redland Road/Highway 213 should be integrated with the Highway 213/I-205 interchange.

Three alternative solution concepts were developed and evaluated at the north end of the corridor. These are shown in Figures 15, 16, and 17. In all three Figures, the black lines depict existing roadway, the orange lines depict new freeway construction, and the green lines depict new arterial/collector streets off of the state highway system. All three alternatives introduced modifications that would reduce congestion at the Washington Street intersection, and accommodate the high volume p.m. peak hour movement from southbound I-205 to southbound Highway 213. Also each alternative relies on new arterial/collector connection(s) between Abernethy Road and Washington Street.

The concepts show two basic "system interchange" forms. A system interchange connects two high-type facilities (typically freeways) without sending traffic through an at-grade signalized intersection. A system interchange form is needed here to serve the forecast travel demand without degrading operations along I-205. The interchange concepts presented are trumpet forms and directional forms. Trumpet forms can have a loop ramp in advance or beyond the crossing highway (in this case, Highway 213). These forms serve the demand for the highway to freeway movements between I-205 and Highway 213 and minimize the potential for vehicle queues to back up onto the Interstate. Alternatives 1 and 2 are trumpet forms. Alternative 3 is a directional interchange. All of these alternatives include expanding I-205 to four basic lanes in each direction, plus auxiliary lanes in some locations.

In addition to serving the I-205 to Highway 213 (freeway to freeway) traffic, local access to Washington Street and Redland Road also needs to be served. This access is provided via "service interchange" forms. Service interchanges provide access between highways and local arterials, generally via signalized ramp terminal intersections. Given that the system and service interchanges need to be placed so close, the ramps must be physically separated on bridges to allow all the movements to occur in the

limited amount of space. Potential improvement phasing concepts for each of these alternatives are shown in Appendix F.

The traffic operations analysis conducted for Alternatives 1, 2 and 3 are summarized in Figures 18, 19, and 20 respectively. For each alternative, significant operational improvements on I-205 can be achieved through developing four basic lanes on the freeway. However, the weaving section on southbound I-205 between the Gladstone and the Highway 213 interchanges will continue to operate at LOS F in all alternatives. In addition in each alternative, p.m. peak hour congestion at the intersection of Washington Street/Highway 213 can be eliminated by grade separating the Highway 213 through movements from the more local trips turning to and from Washington Street and Clackamas River Drive.

North End Preferred Solution

The CAC and TAC reviewed the quantitative and qualitative evaluation criteria and developed the summary good, fair, poor alternatives evaluation shown in Table 1. The evaluation and the consensus of both the TAC and the CAC was, that in the long-term, Alternative 3 was the most promising solution concept and was ranked as the number one preference. Among other advantages, this concept appears to have the least right-of-way and environmental impacts. The construction costs are estimated to be the lowest of the three alternatives and this concept is the most expandable and conducive to being constructed in phases. It is estimated that these interchange concepts may cost in the range of $75 Million to $100 Million; possibly more depending upon environmental mitigation. Alternative 3 will be at the lower end of this cost range, Alternative 1 in the middle, and Alternative 2 at the higher end. These costs do not include cost for right-of-way acquisition nor system level I-205 improvements.

The ability to phase Alternative 3 such that congestion relief at the Highway 213/Washington Street intersection could be achieved in the near future was critical to the City of Oregon City, the TAC and the CAC. The preliminary phasing shown in Figure 21 depicts the Washington Street overcrossing for southbound Highway 213 traffic. Eliminating this traffic from the at-grade intersection allows the intersection of Washington Street/Highway 213 to continue to operate at acceptable p.m. peak hour levels of service through the year 2015. When traffic operations do degrade below acceptable levels of service, a grade-separated intersection will likely be required to minimize traffic congestion.

In the vicinity of Washington Street, 70 percent of the motorists from I-205 to Oregon City destinations or beyond. These are regional trips and are appropriate on the State Highway system. Therefore, in this area, the cost proportionality split for roadway improvement projects between ODOT and the City of Oregon City should be 70 percent ODOT and 30 percent City of Oregon City.

Beavercreek/Highway 213 Concept Development

Highway 213 between Beavercreek Road and Molalla Avenue was identified by the CAC and TAC as an urban corridor that will need to incorporate pedestrian and bicycle travel needs along and across the highway. With the retail development, Clackamas Community College and residential development in the surrounding area, pedestrian and bicyclist needs along and across the highway should be planned for and accommodated. This amount of activity also means relatively high forecast travel demands through the Beavercreek/Highway 213 intersection.

At the intersection of Beavercreek/Highway 213, the high p.m. peak hour left turning movements from southbound Highway 213 to eastbound Beavercreek Road cause the intersection to operate over capacity. Three solution concepts were developed to address this deficiency:

- A partial cloverleaf interchange concept,
- A diamond concept, and
- An expanded at-grade intersection concept.

The diamond concept could be in the form of a single point diamond or tight urban diamond. These are shown in Figures 22 and 23, respectively.

The forecast weekday p.m. peak hour traffic operations are also shown in these Figures. Acceptable traffic operations for the 20-year planning horizon can be achieved with the partial cloverleaf concept and the diamond concepts. The at-grade solution concept may exceed the ODOT volume to capacity ratio operational requirements of 0.95 by the year 2015. At this time, the intersection would most likely need to be grade-separated to accommodate the forecast travel demand.

Beavercreek/Highway 213 Preferred Solution

The project team reviewed the evaluation criteria and developed the alternatives evaluation rating shown in Table 2.

Following the review, refinement and evaluation of the alternatives, the CAC and TAC favored the at-grade expanded intersection solution concept.

- This concept has the greatest compatibility with pedestrians and public transportation
- Initially has the lowest construction costs
- Has the greatest potential for receiving project funding
- And appears to have the least adverse environmental and community impacts. There is a possibility for other roadways to be constructed across Highway 213 (but not connecting to Highway 213) that could extend the life of the Beavercreek Road/Highway 213 intersection.

At this location, approximately 50% of the motorists have destinations in Oregon City. Therefore, the cost proportionality split for improvements is 50% ODOT and 50% City of Oregon City.

Table 1. North End Alternatives Evaluation

● GOOD ◒ FAIR ○ POOR

	Alternative 1	Alternative 2	Alternative 3
Traffic Operations	◒	●	●
Phased Implementation and Expandibility	◒	○	●
Environmental and Community Impacts	○	○	◒
Constructability/ Maintenance of Traffic	◒	○	●
Construction Costs	◒	○	●
Right of Way Requirements	○	○	◒
Compatibility with Public Transportation	○	◒	●
Compatibility with Pedestrians/Bicyclists	○	○	◒
Local Access and Circulation	○	◒	◒
Satisfies Operations and Design Requirement	◒	◒	◒
Compatibility with Surrounding Land Uses	○	○	◒
Funding Feasibility	○	○	○
Cost/Benefit	◒	◒	●

These interchange concepts may cost in the range of $75 to $100 Million; possibly more depending upon environmental mitigation. Alternative 3 will be at the lower end of this range, Alternative 1 in the middle, and Alternative 2 at the higher end. These costs do not include right-of-way nor system-level I-205 improvements.

Table 2. Beavercreek/Highway 213 Alternatives Evaluation

● GOOD ◒ FAIR ○ POOR

	At Grade Intersection	Partial Cloverleaf Interchange	Single Point Diamond
Traffic Operations	○	●	●
Phased Implementation and Expandibility	○	○	○
Environmental and Community Impacts	●	○	◒
Constructability/ Maintenance of Traffic	●	○	◒
Construction Costs	●	◒	○
Right of Way Requirements	●	○	◒
Compatibility with Public Transportation	●	○	○
Compatibility with Pedestrians/Bicyclists	●	○	◒
Local Access and Circulation	●	●	●
Satisfies Operations and Design Requirement	○	◒	●
Compatibility with Surrounding Land Uses	◒	○	◒
Funding Feasibility	●	○	○
Cost/Benefit	●	○	○

The alternatives may cost in the magnitude of:

At Grade Intersection = $3 Million
Partial Cloverleaf Interchange = $15 Million
Single Point Diamond = $20 Million

These costs do not incude right-of-way nor environmental mitigatons.

CLACKAMAS RIVER

CLACKAMAS RIVER DRIVE

SE 82ND DRIVE

HIGHWAY 213

AGNES AVENUE

METRO SOUTH
TRANSFER STATION

WASHINGTON STREET

APPERSON BOULEVARD

HOLCOMB BOULEVARD

REDLAND ROAD

LEGEND

- EXISTING ROADWAY
- PROPOSED NEW FREEWAY
- PROPOSED NEW ARTERIAL/COLLECTOR

SCALE
0 200 400
(In Feet)

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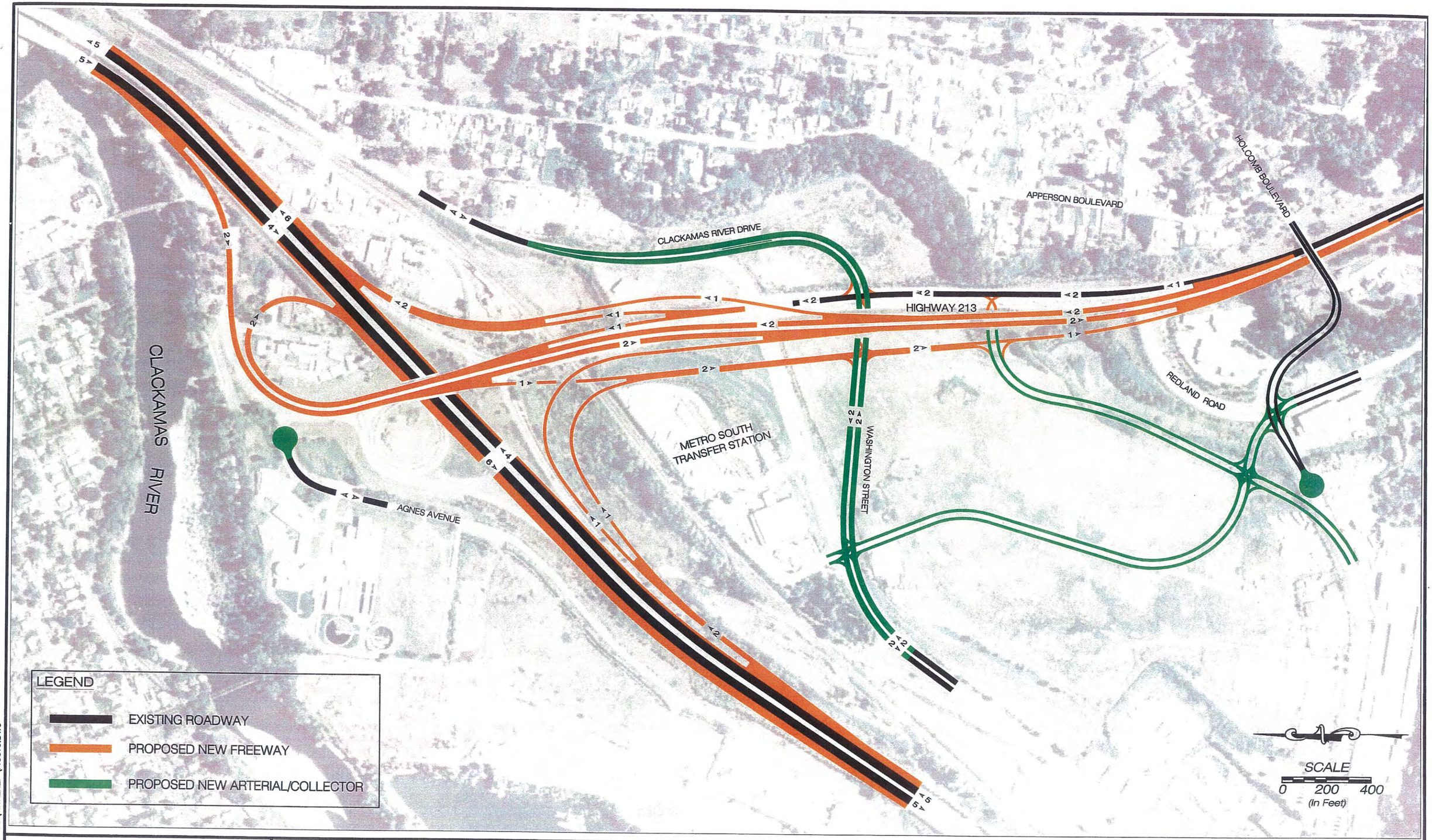
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HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 1

FIGURE NO.
15

PROJECT NO.
2561

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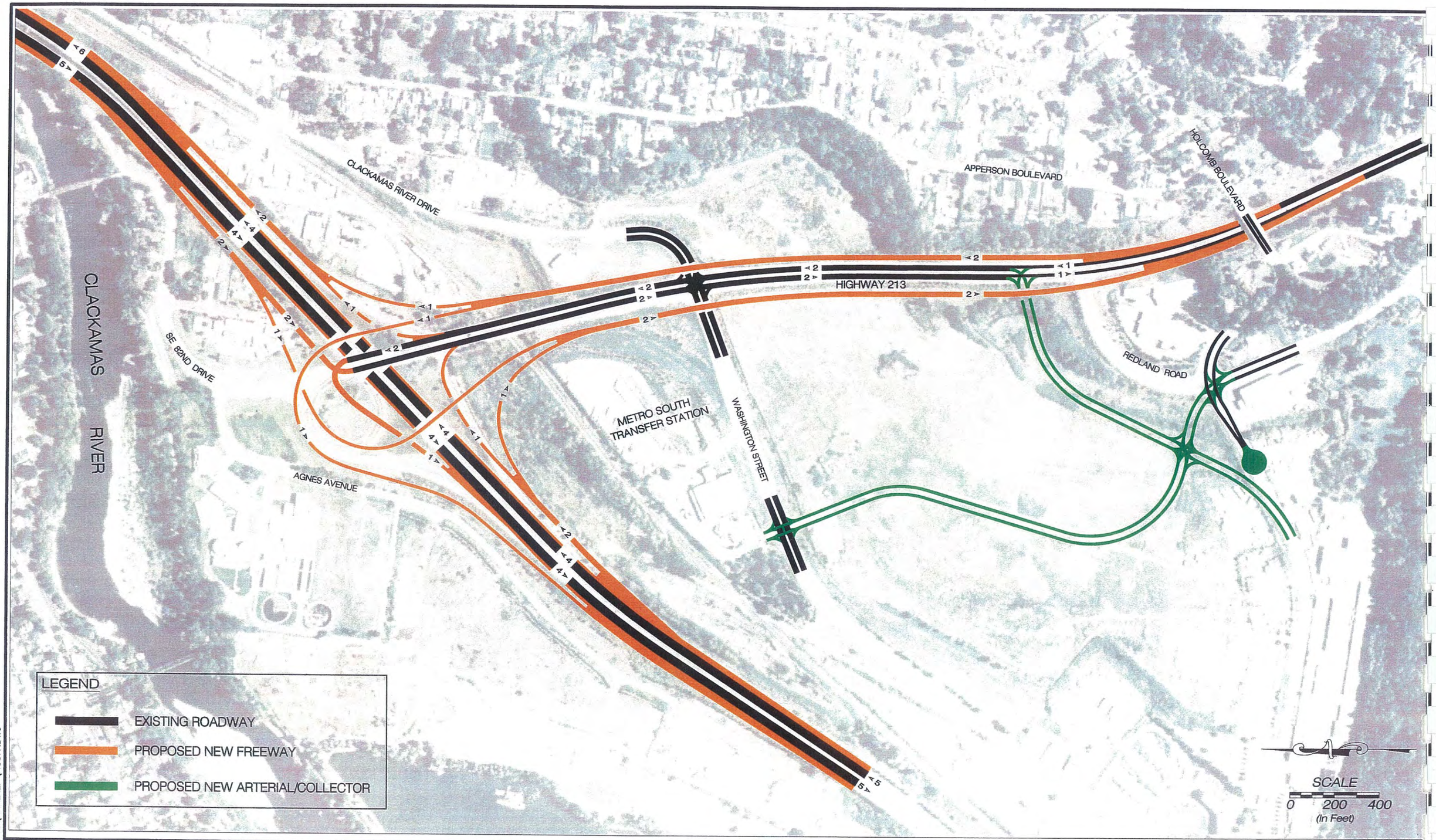
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HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 2

FIGURE NO. 16

PROJECT NO. 2561

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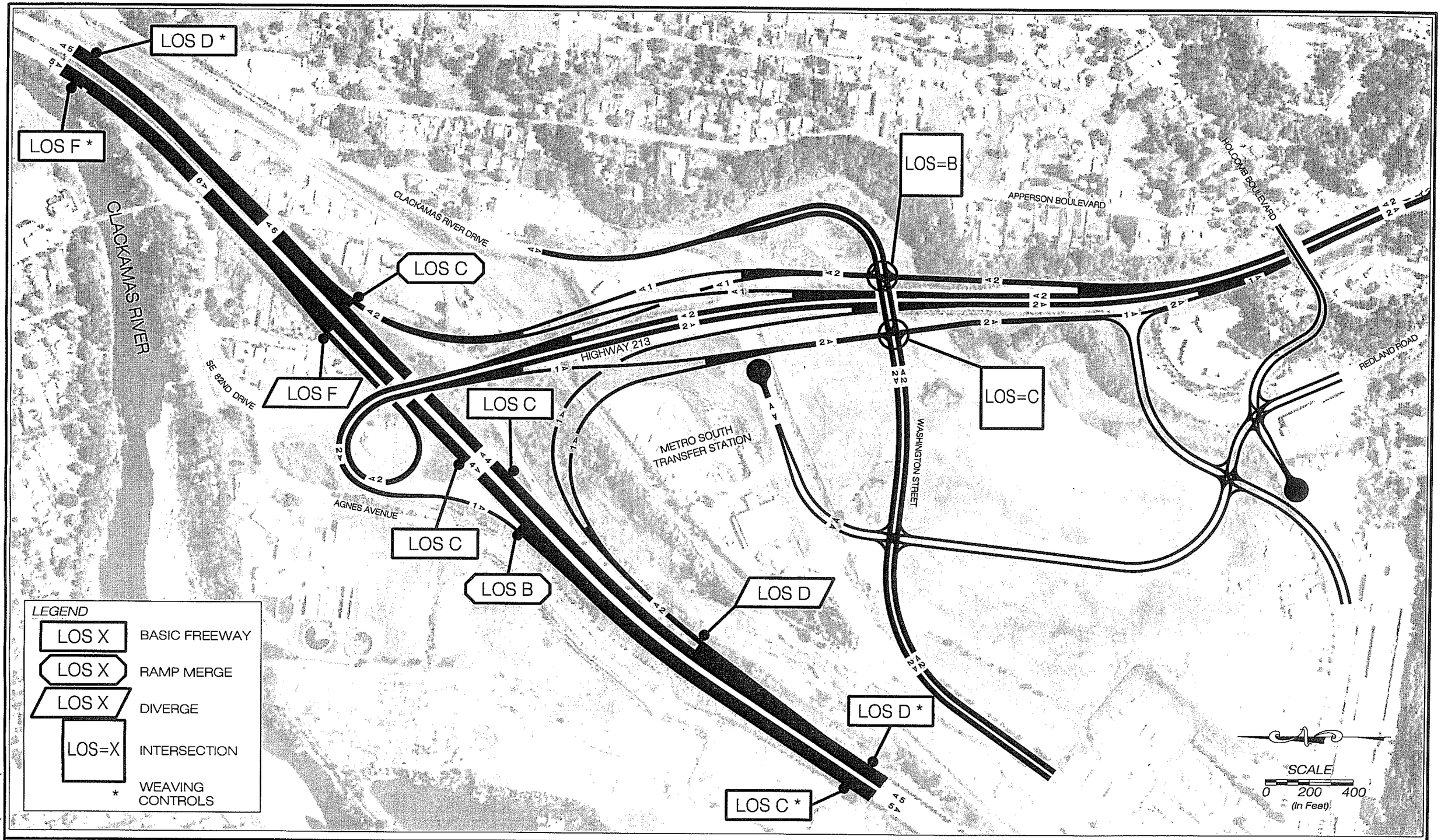
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HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 3

FIGURE NO. 17

PROJECT NO. 2561

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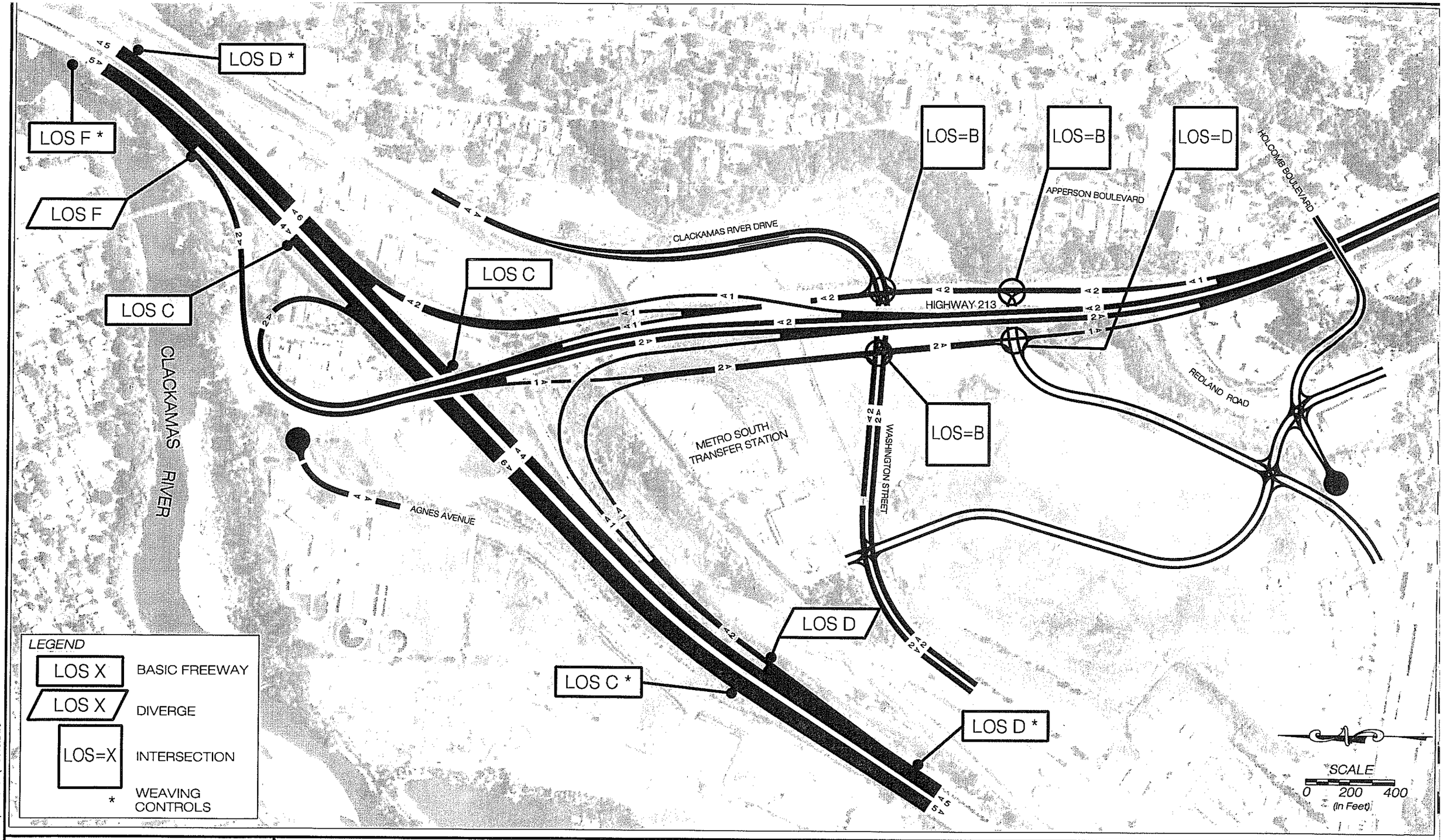
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FREEWAY LEVELS OF SERVICE
2018 WEEKDAY PM PEAK HOUR
HIGHWAY 213/I-205 ALTERNATIVE 1

FIGURE NO. 18

PROJECT NO. 2561

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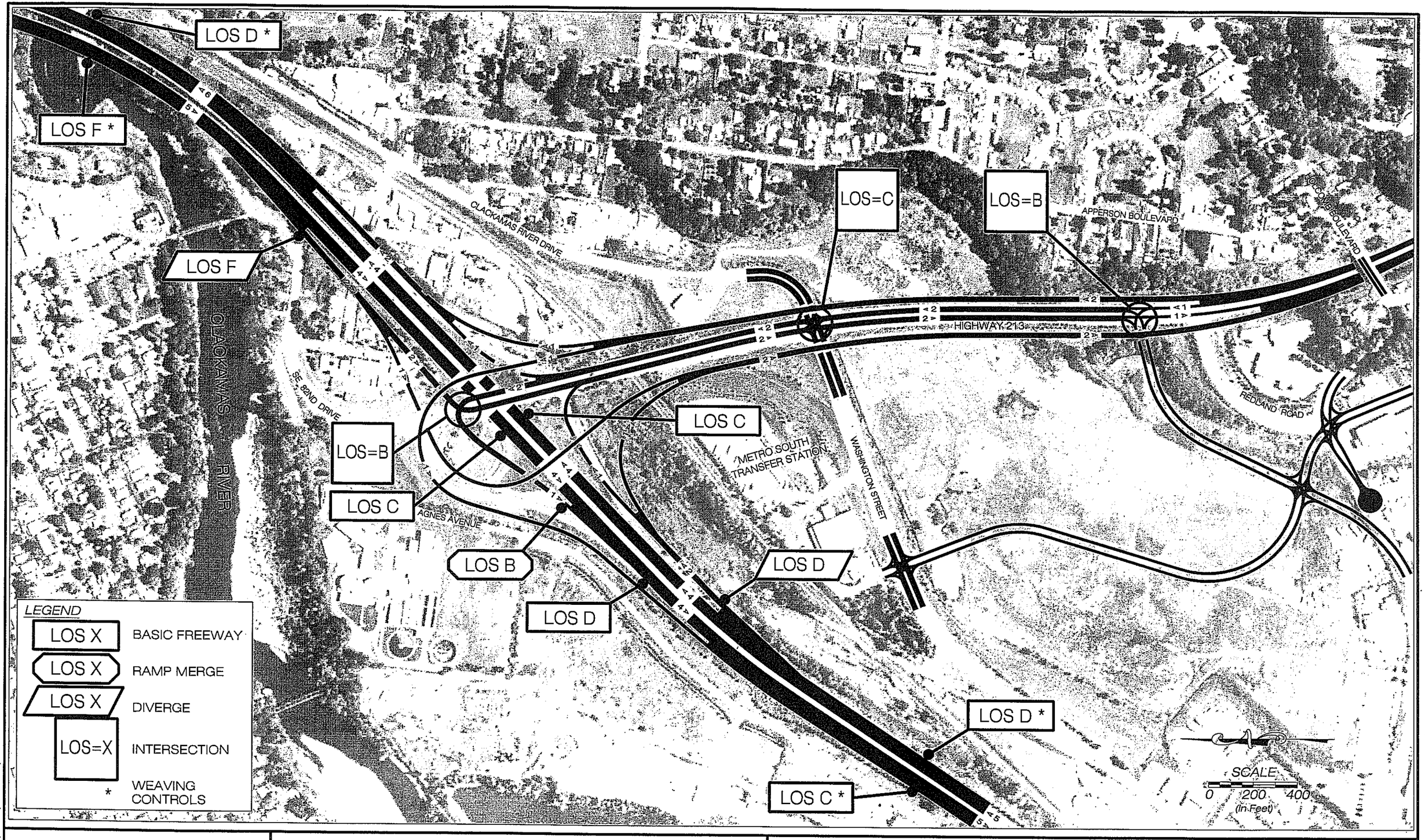
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FREEWAY LEVELS OF SERVICE
2018 WEEKDAY PM PEAK HOUR
HIGHWAY 213/I-205 ALTERNATIVE 2

FIGURE NO. 19

PROJECT NO. 2561

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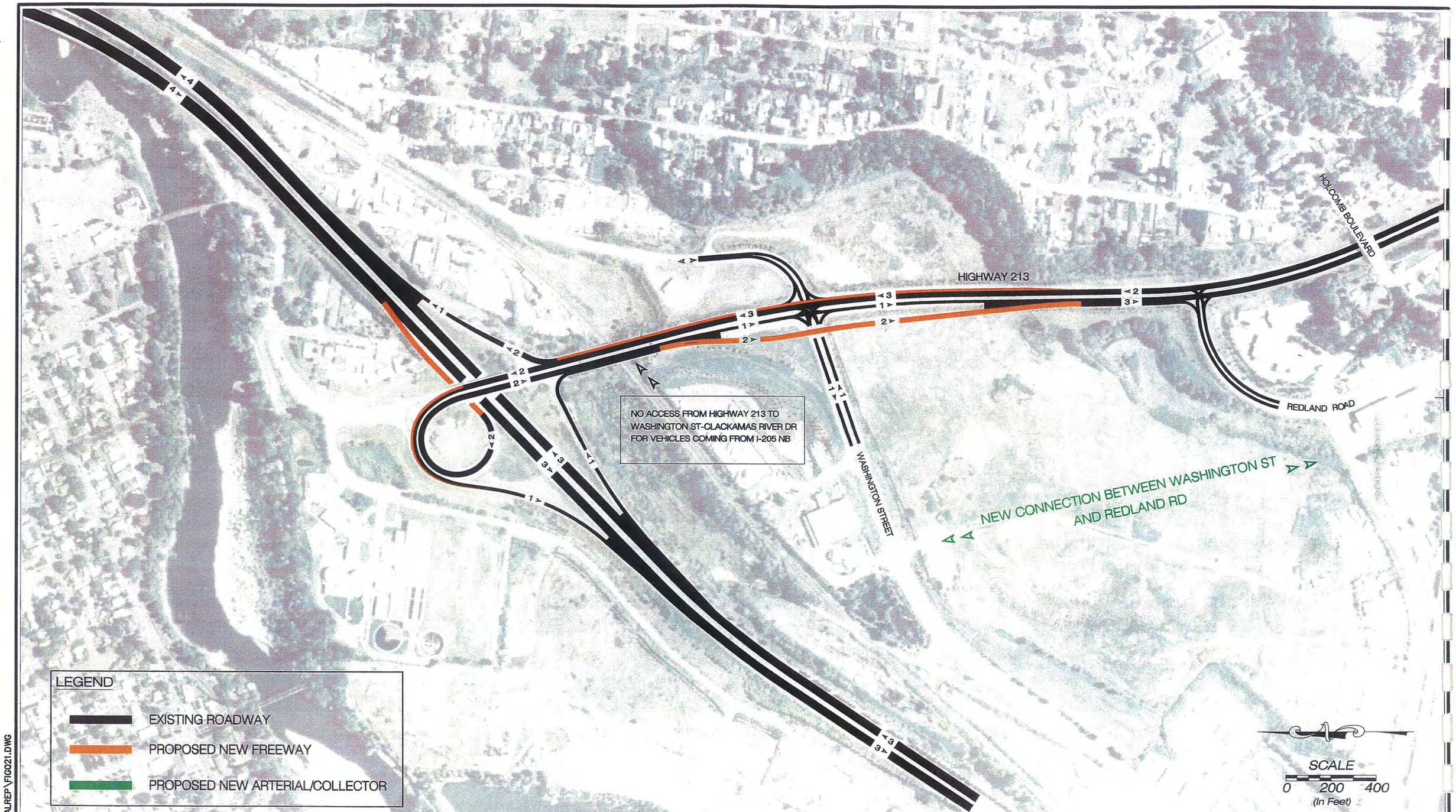
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FREEWAY LEVELS OF SERVICE
2018 WEEKDAY PM PEAK HOUR
HIGHWAY 213/I-205 ALTERNATIVE 3

FIGURE NO. 20

PROJECT NO. 2561

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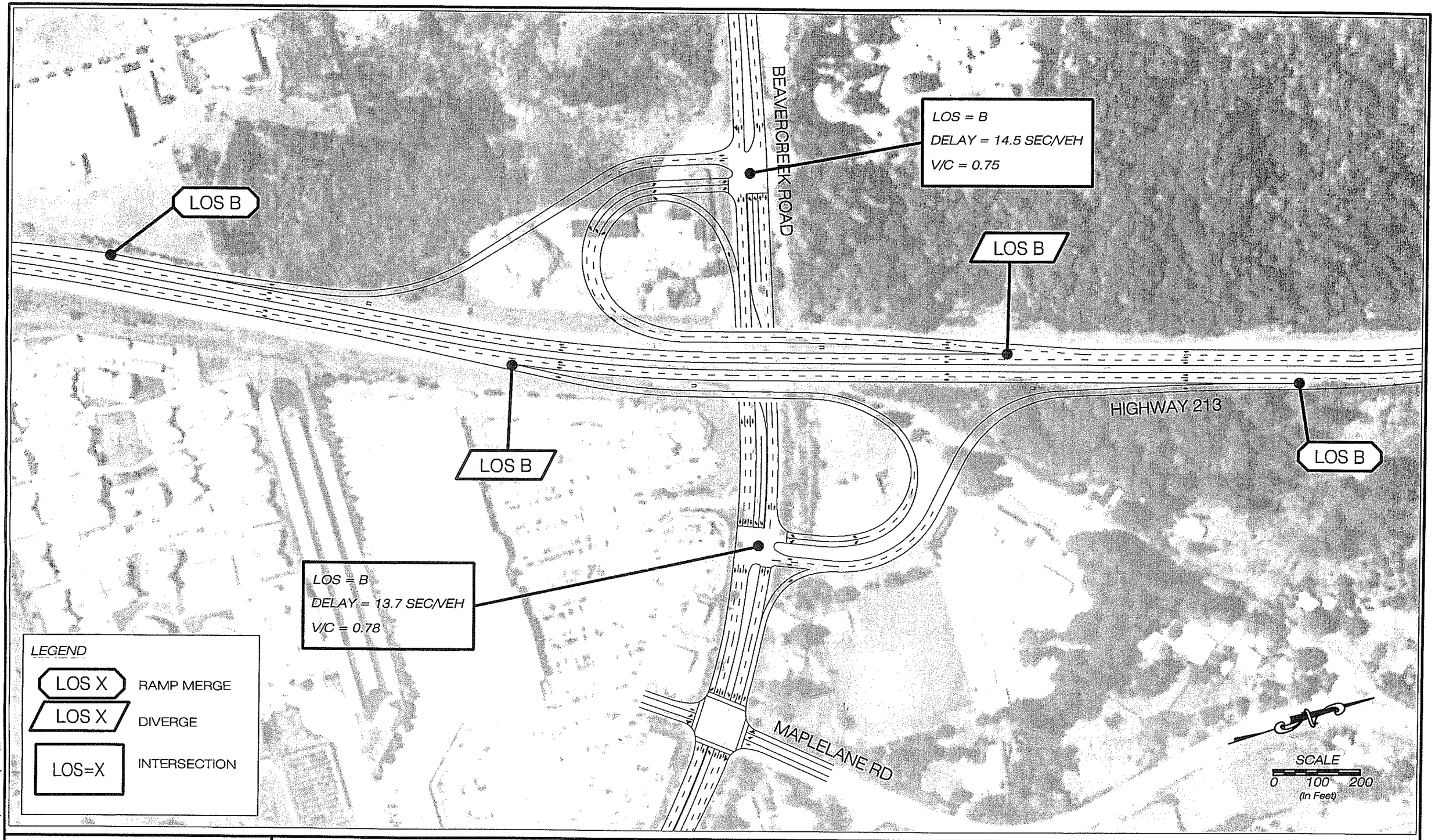
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HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 3 - PHASE 1 IMPROVEMENT

FIGURE NO. 21

PROJECT NO. 2561



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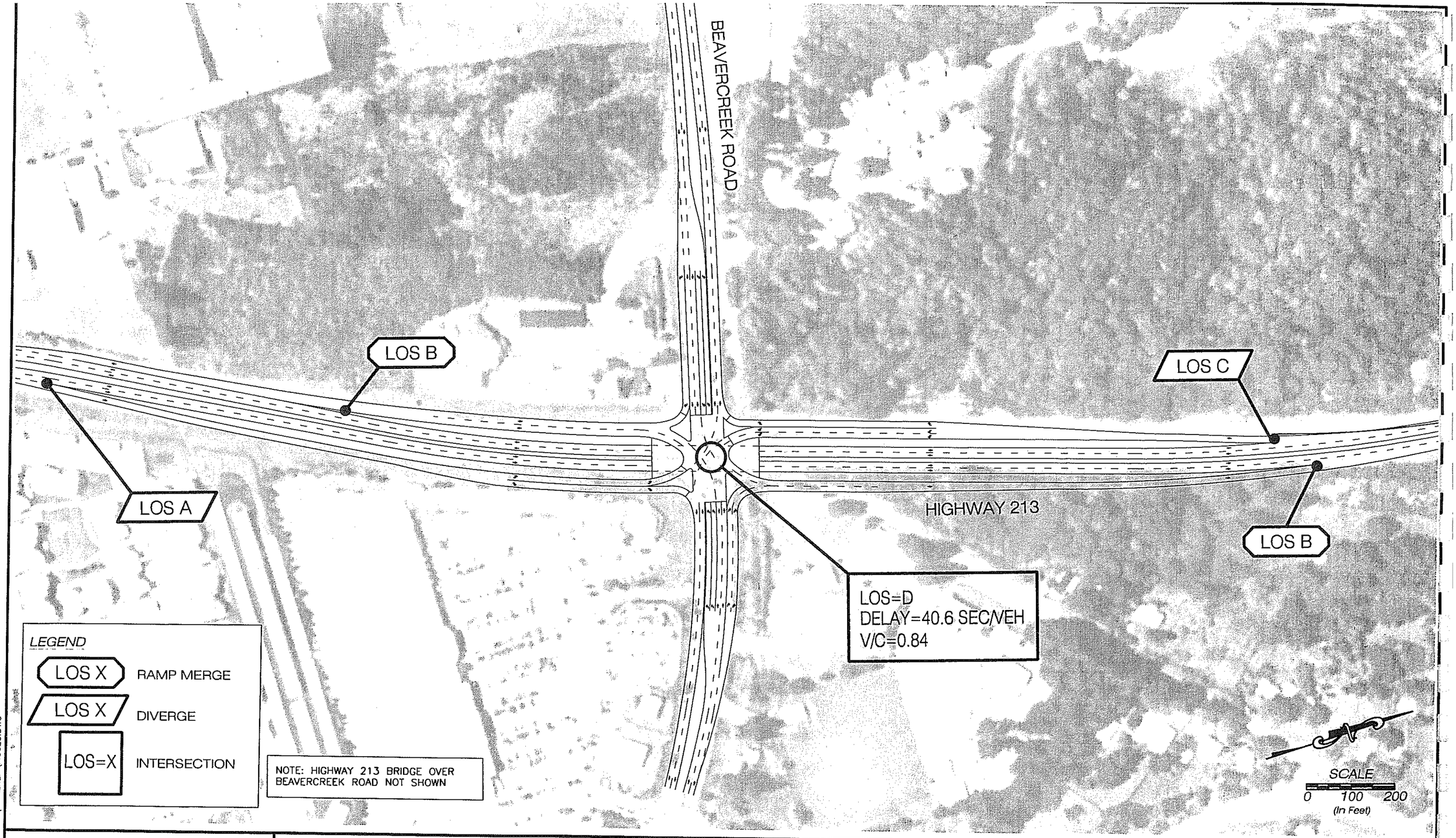
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BEAVERCREEK/HIGHWAY 213 IMPROVEMENT PLAN PARTIAL CLOVERLEAF INTERCHANGE CONCEPT

FIGURE NO. 22

PROJECT NO. 2561

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BEAVERCREEK/HIGHWAY 213 INTERCHANGE PLAN SINGLE POINT DIAMOND CONCEPT

FIGURE NO. 23

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG023.DWG

South End Preferred Solution Concept

From Molalla Avenue south to Henrici Road, the critical project issue was to develop a travel corridor that:

- Meets future capacity needs,
- Provides appropriate levels of direct, but managed access, and
- Safely transitions the Highway from a rural facility (Henrici Road) to an urban facility in the vicinity of Molalla Avenue and Beavercreek Road.

The concept shown in Figure 24 depicts the solution developed to meet these needs. South of Molalla Avenue, Highway 213 would be a four-lane facility with a median and turn lanes at critical intersections. At Glen Oak Road, the facility would transition to a three-lane facility with one travel lane in each direction plus a two-way median left turn lane. At Henrici Road, the facility would transition from a three-lane facility back to the rural two-lane facility. The location of direct accesses onto Highway 213 will need to be further evaluated as part of the future design and environmental evaluations.

Figures 25A, 25B and 25C also show the results of the 2018 weekday p.m. peak hour traffic operational analysis. If the improvements were implemented, all of the study intersections would operate under capacity and at LOS C or better. This concept also requires constructing traffic signals at the Henrici Road/Highway 213 and at Glen Oak/Highway 213 intersections, and re-aligning the Glen Oak Road-Caulfield Road/Highway 213 intersection.

In this area, the percentage of trips with trip ends in Oregon City decrease slightly to 45 percent. Therefore for the improvements identified in this area, the cost proportionality split should be 55 percent ODOT and 45 percent City of Oregon City.

Summary

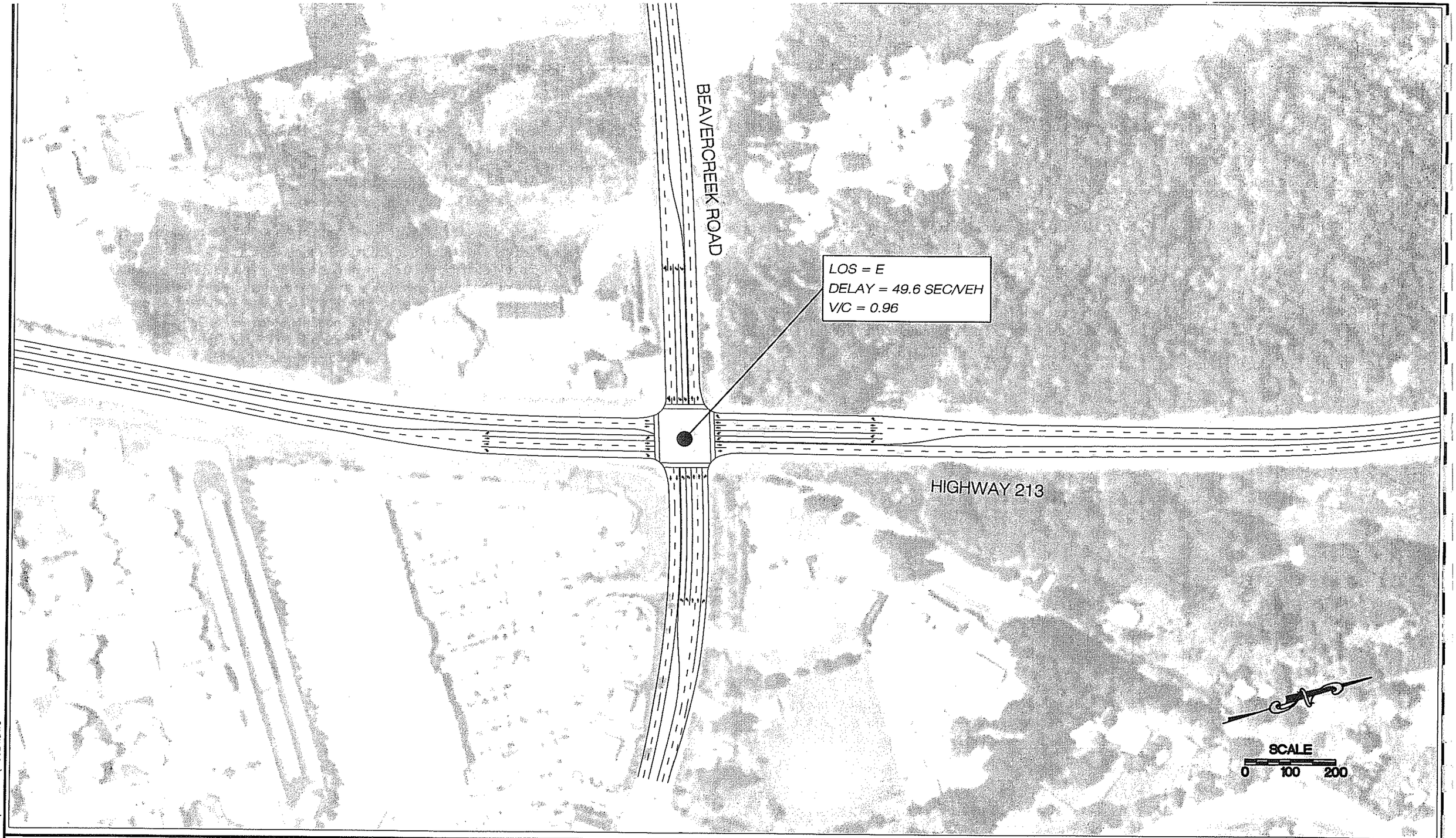
The City of Oregon City, and the project TAC and CAC voiced that congestion relief needs to be developed as soon as possible along the Highway 213 corridor. At the north end of the corridor, the project stakeholders recognized that solutions to the traffic congestion on I-205 would be developed as part of a longer-term I-205 corridor study. However, the stakeholders also strongly advocate that an interim solution, that would not preclude longer-term interchange concepts, should be implemented as soon as possible.

This interim solution is Alternative 3 Phase 1 (Figure 21). Implementing this concept provides immediate congestion relief at the intersection of Washington Street/Highway 213 and allows Oregon City to continue to plan for development in this vicinity. The construction costs associated with this facility would be shared at a local, regional, and state level, and likely also with private funding sources.

The City and ODOT will also plan to construct an expanded at-grade intersection at Beavercreek Road/Highway 213 (Figure 24). This expanded intersection will include double left-turn lanes at all intersection approaches. It requires significant expansion of Beavercreek Road to service forecast travel. Constructing this intersection provides capacity through the year 2015. At that time, ODOT and the City of Oregon City will need to consider constructing a grade-separated intersection. Other system connections under consideration may preclude the need for this. Funding has been secured for this at-grade improvement project through the Metro Regional Transportation Plan process.

South of Beavercreek Road, from Molalla Avenue to Henrici Road, the City of Oregon City and ODOT should include traffic signals at the intersections of Henrici Road/Highway 213 and Glen Oak Road/Highway 213 in their TSP and capital planning efforts. To implement this concept, an access management plan should also be developed with community input to ensure that an appropriate balance between access needs and traffic operations and safety is achieved.

The results of the Highway 213 Urban Corridor Design Study will be incorporated into the Oregon City TSP. As the TSP is adopted, so too will be the recommendations from this project. These project findings will provide direction for the City of Oregon City to proceed with community development plans in this corridor. Implementing the near-term improvements (Beavercreek Road/Highway 213 at-grade intersection expansion, Alternative 3 Phase 1), will provide mobility for today; however critical to the longer-term vitality of the Oregon City transportation system are identifying improvements on I-205 to accommodate future travel demand. In this regard, the City of Oregon City should begin working with ODOT and Metro to develop and implement a corridor study project.



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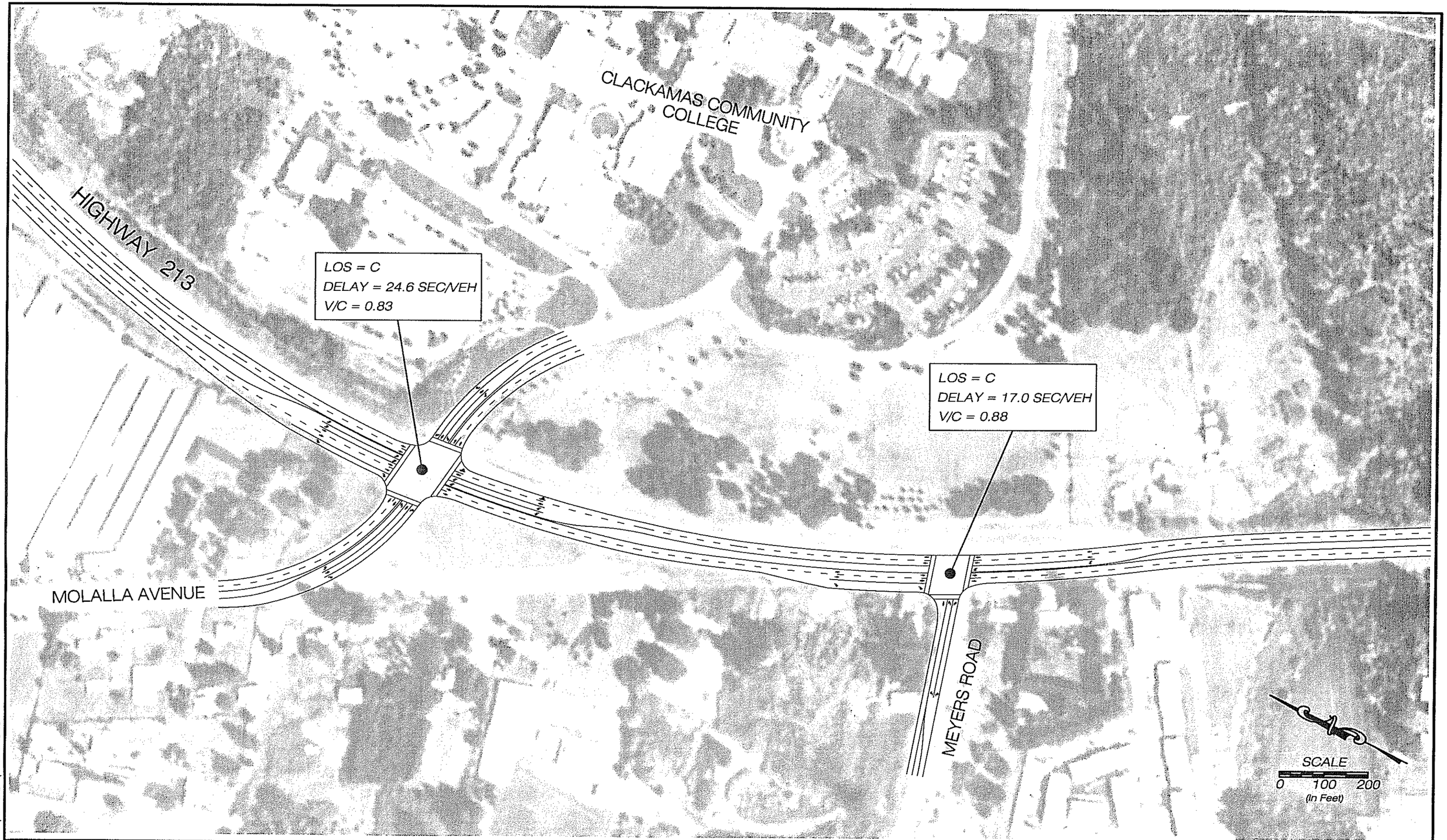
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BEAVERCREEK/HIGHWAY 213 IMPROVEMENT PLAN IMPROVED AT-GRADE INTERSECTION CONCEPT

FIGURE NO. 24

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG024.DWG



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HIGHWAY 213 IMPROVEMENT PLAN CONCEPT MOLALLA AVENUE TO HENRICI ROAD

FIGURE NO.
25A

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG025A.DWG



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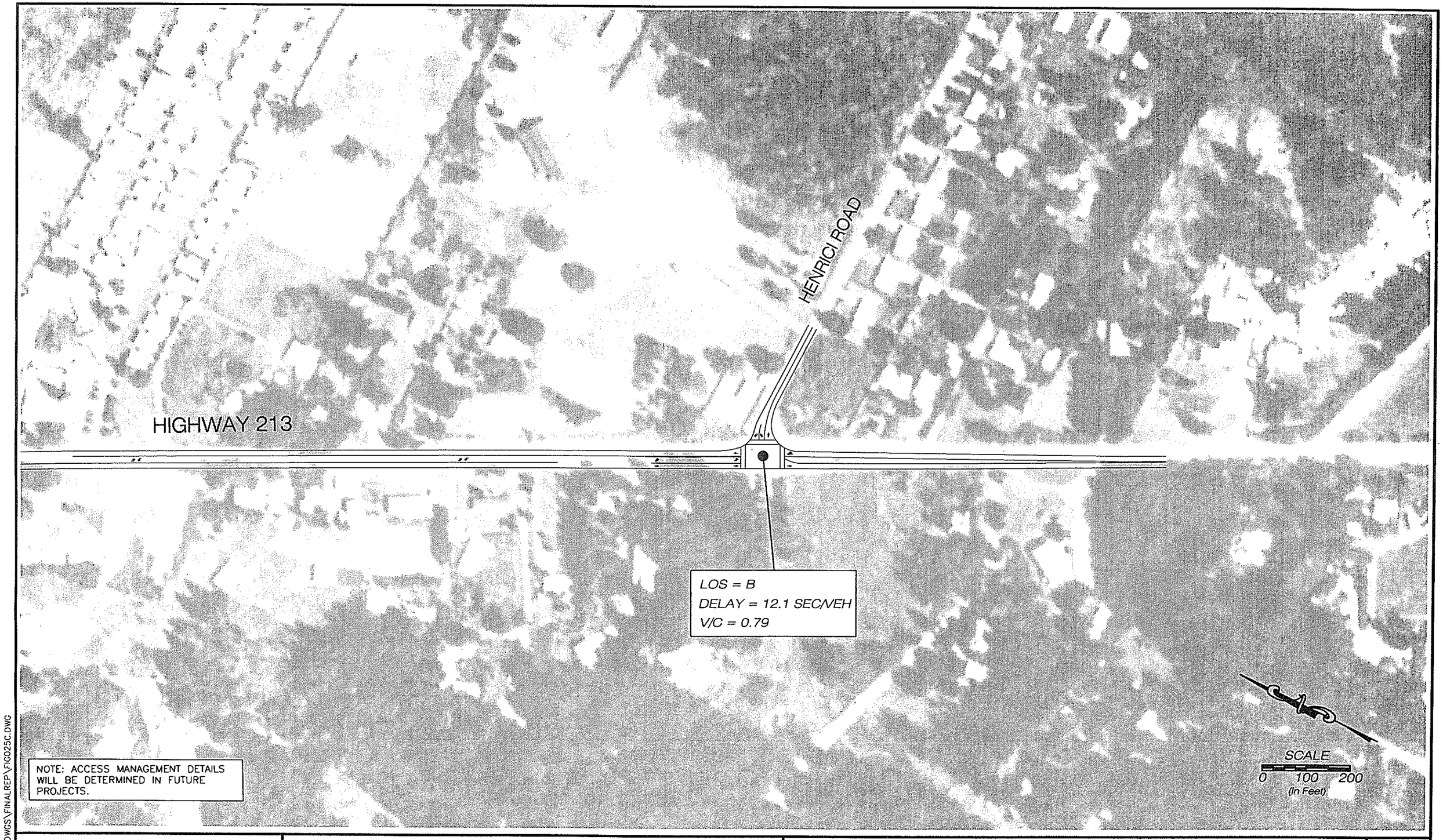
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HIGHWAY 213 IMPROVEMENT PLAN CONCEPT MOLALLA AVENUE TO HENRICI ROAD

FIGURE NO. 25B

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG025B.DWG



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HIGHWAY 213 IMPROVEMENT PLAN CONCEPT MOLALLA AVENUE TO HENRICI ROAD

FIGURE NO. 25C

PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIG025C.DWG

Appendix A
Geometric Conditions
Criteria Rating

Table A-1. Freeway & Interchange Rating Criteria (Assumed design speed= 60 mph)

Feature	Rating			1990 AASHTO Reference
	Good	Fair	Poor	
Geometric Features				
Horizontal Alignment Degree of Curvature	Less than 5°15'	5°15' to 8°15'	Greater than 8°15'	169
Vertical Alignment I-205 (level) HWY 213 (rolling)	Level to 3% Level to 4%	3% to 4% 4% to 6%	Greater than 4% Greater than 6%	585 585
Stopping Sight Distance	Greater than 525'	400' to 525'	Less than 400'	284
Cross Section	See Table A-2			
Decision Sight Distance	Greater than 1275'	1025' to 1275'	Less than 1025'	127
Exit/Entrance Design				
Entrance Taper	Greater than 50:1	40:1 to 50:1	Less than 40:1	985
Exit Diverge	Less than 4°	4° to 5°	Greater than 5°	989
Acceleration Length	Greater than 910'	500' to 910'	Less than 500'	986
Deceleration Length	Greater than 430'	315' to 430'	Less then 315'	991
Operational Features				
Lane & Route Continuity	Maintains Continuity	N/A	Lacks Continuity	938-941
Lane Balance	Maintains Balance	N/A	Lacks Balance	942-946
Ramp Spacing/Sequence				
Entrance-Entrance/Exit-Exit	Greater than 1500'	1000' to 1500'	Less than 1000'	983
Exit to Entrance	Greater than 750'	500' to 750'	Less than 500'	983
Entrance to Exit	Greater than 3000'	2000 to 3000'	Less than 2000'	983

Table A-1 continued

Feature	Rating			1990 AASHTO Reference
	Good	Fair	Poor	
Performance Measures				
Level of Service Volume-to-Capacity	A-C Less than 0.70	D 0.70 to 0.84	E-F Greater than 0.84	263
Accident Rate Million Vehicle Miles	<1.75	N/A	>1.75	ODOT Accident Rates

Table A-2. Cross Section Rating Criteria

RATING	DESIGN CRITERIA
GOOD (Each of the criteria must be met)	• Lane width of 12 feet. • Right shoulder width at least 10 feet. • Left shoulder width at least 4 feet. • Fore-slope designed to 6:1 for 0 to 5 feet of fill; and 4:1 for greater than 5 feet of fill. • Roadside Barrier designed and placed according to current AASHTO standards. • Median barrier provided for width and traffic volumes as described by current AASHTO standards.
FAIR (Each of the criteria must be met)	• Lane width of 12 feet. • Right shoulder width at least 4 feet paved. • Left shoulder width of 1 to 4 feet. • Fore-slope designed to 4:1 for 0 to 15 feet of fill; and 3:1 for greater than 15 feet of fill. • Roadside Barrier (concrete or guardrail) with only minor deficiencies relative to current AASHTO standards.
POOR (Rating warranted if any of the features has noted deficiency)	• Lane width less than 12 feet. • Right shoulder width less than 10 feet. • No left shoulder. • Unprotected fore-slope 3:1 or steeper.

Appendix B
Existing Conditions
Analysis of Operation

Table B-1.
Existing Conditions Intersection Level of Service

Intersection	Average Weekday PM Peak Hour						
	Signalized Intersection			Unsignalized Intersection			
	V/C[1]	Average Delay (sec/veh)	LOS[2]	Critical Movement	V/C[3]	Average Delay[4] (sec/veh)	LOS[5]
Hwy 213/I-205 SB Ramps				EB-LT[6]	0.06	10.0	B
Hwy 213/I-205 NB Ramps				EB-RT[7]	1.00	>45.0	F
Hwy 213/Washington Street	0.98	20.0	C				
Hwy 213/Redland Road	0.79	8.4	B				
Hwy 213/Beavercreek Road	>1.00	>60.0	F				
Hwy 213/Molalla Avenue	0.67	17.3	C				
Hwy 213/Meyers Road	0.64	9.8	B				
Hwy 213/Glen Oak Road				EB	0.19	>45.0	F
Hwy 213/Henrici Road				WB[8]	0.17	13.4	C
I-205 SB/Gladstone Ramps	>1.00	47.9	E				
I-205 NB/Gladstone Ramps	0.96	27.9	D				
I-205 SB/Hwy 99E Ramps	0.91	27.0	D				
I-205 NB/Hwy 99E Ramps	>1.00	36.3	D				

Table B-1. Legend

[1] V/C = Volume-to-Capacity ratio

[2] LOS = Level of Service

[3] Volume-to-Capacity ratio for the critical movement

[4] Average delay for the critical movement

[5] Level of Service ratio for the critical movement

[6] EB-LT = eastbound left-turn from I-205 SB off-ramp to northbound Highway 213

[7] EB-RT = eastbound right-turn from I-205 NB off-ramp to southbound Highway 213

[8] WB = westbound

Table B-2.
Existing Conditions Freeway Levels of Service – Basic Freeway Segments

Freeway Segment	Volume (veh/h)	Density (veh/mile/lane)	Speed of Traffic (mph)	Level of Service
I-205 Southbound				
North of Gladstone Off-Ramp	5695	35.6	56.1	E
Gladstone Off-Ramp to Gladstone On-Ramp	5160	30.8	58.7	D
Park Place Off-Ramp to Park Place On-Ramp	4100	24.0	60.0	D
Hwy 99E Off-Ramp to Hwy 99E On-Ramp	3530	32.0	58.1	E
South of Hwy 99E On-Ramp	4210	24.6	60.0	D
I-205 Northbound				
South of Hwy 99E Off-Ramp	4535	26.6	59.9	D
Hwy 99E Off-Ramp to Hwy 99E On-Ramp	3785	35.5	56.1	E
Hwy 99E On-Ramp to Park Place Off-Ramp	4605	27.0	59.8	D
Park Place Off-Ramp to Park Place On-Ramp	3945	23.1	60.0	C
Gladstone Off-Ramp to Gladstone On-Ramp	4260	24.9	60.0	D
North of Gladstone On-Ramp	4620	27.2	59.7	D

Table B-3.
Existing Conditions Freeway Levels of Service – Freeway Weaving Sections

Freeway Segment	Non-Weaving Volume	Weaving Volume	LOS
I-205 Southbound			
Gladstone On-Ramp to Hwy 213 Off-Ramp	3515	2755	E
Hwy 213 On-Ramp to Hwy 99E Off-Ramp	3170	1430	E
I-205 Northbound			
Hwy 213 On-Ramp to Gladstone Off-Ramp	3310	2100	E

Table B-4.
Existing Conditons Freeway Levels of Service – Ramp Merge/Diverge Segments

Freeway Segment	Ramp Volume (veh/h)	Density (veh/mile/lane)	Speed of Traffic (mph)	Level of Service
I-205 Southbound				
Gladstone Off-Ramp Diverge	535	36	54	E
I-205 Northbound				
Park Place Off-Ramp Diverge	960	30	53	D
Gladstone On-Ramp Merge	360	26	54	C

Appendix C
Crash Analysis

Table C-1.
I-205 Crash History - 1/1/93 to 5/30/97

Highway Section	Crash Severity			Crash Type				Total
	PDO[1]	Injury	Fatal	Side Swipe	Rear End	Fixed Object	Other	
I-205 Southbound								
Off-Ramp to SE 82nd Drive (MP 11.18 to 11.28)	4	1	0	3	1	1	0	5
Gladstone Interchange Area (MP 10.85 to 11.17)	7	5	0	4	4	2	2	12
On-Ramp from SE 82nd Drive (MP 10.74 to 10.84)	4	6	0	4	4	2	0	10
Basic Section (MP 10.31 to 10.73)	2	1	0	1	1	1	0	3
Off-Ramp to Highway 213 (MP 10.18 to 10.30)	14	11	0	1	16	2	6	25
Highway 213 Interchange Area (MP 10.04 to 10.17)	3	5	0	2	4	1	1	8
On-Ramp from Highway 213 (MP 9.93 to 10.03)	1	2	0	3	0	0	0	3
Basic Section (MP 9.62 to 9.92)	22	11	0	12	19	1	1	33
Off-Ramp to Highway 99E (MP 9.51 to 9.61)	12	14	0	5	16	1	4	26
Highway 99E Interchange Area (MP 9.29 to 9.50)	6	4	0	2	8	0	0	10
On-Ramp from Highway 99E (MP 9.18 to 9.28)	2	4	0	0	3	1	2	6

Table C-1. Continued

Highway Section	Crash Severity			Crash Type				Total
	PDO[1]	Injury	Fatal	Side Swipe	Rear End	Fixed Object	Other	
I-205 Northbound								
Off-Ramp to Highway 99E (MP 9.18 to 9.28)	2	1	0	1	1	1	0	3
Highway 99E Interchange Area (MP 9.29 to 9.50)	12	10	0	0	19	1	2	22
On-Ramp from Highway 99E (MP 9.51 to 9.61)	8	2	0	0	8	2	0	10
Basic Section (MP 9.62 to 9.92)	11	3	0	4	3	7	0	14
Off-Ramp to Highway 213 (MP 9.93 to 10.03)	1	5	0	3	2	1	0	6
Highway 213 Interchange Area (MP 10.04 to 10.40)	33	25	0	12	17	9	20	58
On-Ramp from Highway 213 (MP 10.41 to 10.51)	4	6	0	2	8	0	0	10
Basic Section (MP 10.52 to 10.73)	0	1	0	1	0	0	0	1
Off-Ramp to SE 82nd Drive (MP 10.74 to 10.84)	4	3	0	2	2	1	2	7
Gladstone Interchange Area (MP 10.85 to 11.17)	8	6	0	2	6	3	3	14
On-Ramp from SE 82nd Drive (MP 11.18 to 11.28)	1	2	0	0	2	1	0	3

PDO = property damage only. (2) Assumed 250 to 300 feet in each direction for ramp influence area.

Table C-2.
I-205 Crash Rates

Highway Section	Number of Crashes[1]	ADT[2]	Crash Rate (acc/mvm)[3]	Average Statewide Crash Rate (acc/mvm)[4]
I-205 Southbound				
Off-Ramp to SE 82nd Drive (MP 11.18 to 11.28)	5	56,950	0.70	0.91
Gladstone Interchange Area (MP 10.85 to 11.17)	12	51,600	0.58	0.91
On-Ramp from SE 82nd Drive (MP 10.74 to 10.84)	10	62,700	1.28	0.91
Basic Section (MP 10.31 to 10.73)	3	62,700	0.09	0.91
Off-Ramp to Highway 213 (MP 10.18 to 10.30)	25	62,700	2.66	0.91
Highway 213 Interchange Area (MP 10.04 to 10.17)	8	41,000	1.20	0.91
On-Ramp from Highway 213 (MP 9.93 to 10.03)	3	46,000	0.52	0.91
Basic Section (MP 9.62 to 9.92)	33	46,000	1.92	0.91
Off-Ramp to Highway 99E (MP 9.51 to 9.61)	26	46,000	4.53	0.91
Highway 99E Interchange Area (MP 9.28 to 9.50)	10	35,300	1.08	0.91
On-Ramp from Highway 99E (MP 9.18 to 9.28)	6	42,100	1.14	0.91

Table C-2. Continued

Highway Section	Number of Crashes[1]	ADT[2]	Crash Rate (acc/mvm)[3]	Average Statewide Crash Rate (acc/mvm)[4]
I-205 Northbound				
Off-Ramp to Highway 99E (MP 9.18 to 9.28)	3	45,350	0.53	0.91
Highway 99E Interchange Area (MP 9.28 to 9.50)	22	37,850	2.22	0.91
On-Ramp from Highway 99E (MP 9.51 to 9.61)	10	49,050	1.63	0.91
Basic Section (MP 9.62 to 9.92)	14	49,050	0.76	0.91
Off-Ramp to Highway 213 (MP 9.93 to 10.03)	6	49,050	0.98	0.91
Highway 213 Interchange Area (MP 10.04 to 10.40)	58	39,450	3.27	0.91
On-Ramp from Highway 213 (MP 10.41 to 10.51)	10	54,100	1.48	0.91
Basic Section (MP 10.52 to 10.73)	1	54,100	0.07	0.91
Off-Ramp to SE 82nd Drive (MP 10.74 to 10.84)	7	54,100	1.04	0.91
Gladstone Interchange Area (MP 10.85 to 11.17)	14	42,600	0.82	0.91
On-Ramp from SE 82nd Drive (MP 11.18 to 11.28)	3	46,200	0.52	0.91

[1]Number of accidents reported between 1/1/93 and 5/30/97
[2]ADT = average daily directional traffic volume
[3]acc/mvm = accident rate expressed in number of accidents per million vehicle miles traveled
[4]Average of 1993, 1996, 1997 average statewide accident rates for Urban Freeway Primary Highways

Table C-3.
Highway 213 Crash History - 1/1/93 to 5/30/97

Highway Section	Crash Severity			Crash Type				Total
	PDO[1]	Injury	Fatal	Turn	Rear-End	Fixed Object	Other	
I-205 (MP 0.00) to Washington Street (MP 0.14)	29	26	0	11	37	0	7	55
Washington Street (MP 0.14) to Redland Road (MP 0.48)	29	25	0	7	45	1	1	54
Redland Road (MP 0.48) to Beavercreek Road (MP 2.98)	22	33	0	5	41	4	5	55
Beavercreek Road (MP 2.98) to Molalla Avenue (MP 3.59)	15	19	0	8	17	1	8	34
Molalla Avenue (MP 3.59) to Henrici Road (MP 4.37)	9	14	0	5	14	1	3	23

[1] PDO = property damage only

Table C-4. Highway 213 Crash Rates

Highway Section	Number of Crashes[1]	ADT[2]	Crash Rate (acc/mvm)[3]	Average Statewide Crash Rate (acc/mvm)
Highway 213 Southbound				
I-205 to Washington Street (MP 0.00 – MP 0.14)	36	24,975	6.39	3.01[4]
Washington Street to Redland Road (MP 0.14 – MP 0.48)	28	20,600	2.48	3.01
Redland Road to Beavercreek Road (MP 0.48 – MP 2.98)	33	17,650	0.46	1.73[5]
Beavercreek Road to Molalla Avenue (MP 2.98 – MP 3.59)	16	9,575	1.70	1.73
Molalla Avenue to Henrici Road (MP 3.59 – MP 4.37)	9	9,590	0.75	1.73
I-205 to Washington Street (MP 0.00 – MP 0.14)	19	24,975	3.37	3.01[4]
Washington Street to Redland Road (MP 0.14 – MP 0.48)	25	20,600	2.21	3.01
Redland Road to Beavercreek Road (MP 0.48 – MP 2.98)	22	17,650	0.31	1.73[5]
Beavercreek Road to Molalla Avenue (MP 2.98 – MP 3.59)	18	9,575	1.91	1.73
Molalla Avenue to Henrici Road (MP 3.59 – MP 4.37)	14	9,590	1.16	1.73

[1]Number of accidents reported between 1/1/93 and 5/30/97
[2]ADT = average daily directional traffic volume
[3]Acc/mvm = accident rate expressed in number of accidents per million vehicle miles traveled
[4]Average of 1993, 1996, and 1997 average statewide accident rates for Urban Non-freeway Secondary Highways
[5]Average of 1993, 1996, and 1997 average statewide accident rates for Sub-urban Non-freeway Secondary Highways

Appendix D
Future Conditions
Operation Analysis

Table D-1.
2018 "No-Build" Scenario Intersection Levels of Service

Intersection	Average Weekday PM Peak Hour						
	Signalized Intersection			Unsignalized Intersection			
	V/C[1]	Average Delay (sec/veh)	LOS[2]	Critical Movement	V/C[3]	Average Delay[4] (sec/veh)	LOS[5]
Hwy 213/I-205 SB Ramps				EB-LT[6]	>1.20	>45.0	F
Hwy 213/I-205 NB Ramps				EB-RT[7]	>1.20	>45.0	F
Hwy 213/Washington Street	>1.20	>60.0	F				
Hwy 213/Redland Road	1.06	30.1	D				
Hwy 213/Beavercreek Road	>1.20	>60.0	F				
Hwy 213/Molalla Avenue	1.07	38.4	D				
Hwy 213/Meyers Road	0.88	17.4	C				
Hwy 213/Glen Oak Road				WB[8]	>1.20	>45.0	F
Hwy 213/Henrici Road				WB	>1.20	>45.0	F
I-205 SB/Gladstone Ramps	1.20	>60.0	F				
I-205 NB/Gladstone Ramps	>1.20	>60.0	F				
I-205 SB/Hwy 99E Ramps	>1.20	>60.0	F				
I-205 NB/Hwy 99E Ramps	>1.20	>60.0	F				

[1] V/C = Volume-to-Capacity ratio

[2] LOS = Level of Service

[3] Volume-to-Capacity ratio for the critical movement

[4] Average delay for the critical movement

[5] Level of Service ratio for the critical movement

[6] EB-LT = eastbound left-turn from I-205 SB off-ramp to northbound Highway 213

[7] EB-RT = eastbound right-turn from I-205 NB off-ramp to southbound Highway 213

[8] WB = westbound

Table D-2.
2018 "No-Build" Scenario Conditions Freeway Level of Service – Basic Freeway Segments

Freeway Segment	Volume (veh/h)	Density (veh/mile/lane)[1]	Speed (mph)[1]	Level of Service
I-205 Southbound				
North of Gladstone Off-Ramp	6950			F
Gladstone Off-Ramp to Gladstone On-Ramp	6625			F
Park Place Off-Ramp to Park Place On-Ramp	5245	31.5	58.4	E
Hwy 99E Off-Ramp to Hwy 99E On-Ramp	4705			F
South of Hwy 99E On-Ramp	5960	38.5	54.4	E
I-205 Northbound				
South of Hwy 99E Off-Ramp	6705			F
Hwy 99E Off-Ramp to Hwy 99E On-Ramp	5140			F
Hwy 99E On-Ramp to Park Place Off-Ramp	6740			F
Park Place Off-Ramp to Park Place On-Ramp	5020	29.8	59.1	D
Gladstone Off-Ramp to Gladstone On-Ramp	5475	33.6	57.2	E
North of Gladstone On-Ramp	5775	36.5	55.6	E

[1] Density and speed are highly variable at LOS "F".

Table D-3.
2018 "No-Build" Scenario Conditions Freeway Level of Service – Freeway Weaving Sections

Freeway Segment	Non-Weaving Volume	Weaving Volume[1]	Weaving Vehicles	
			Speed (mph)	LOS
I-205 Southbound				
Gladstone On-Ramp to Hwy 213 Off-Ramp	4645	3650	41	F
Park Place On-Ramp to Hwy 99E Off-Ramp	4205	1895	48	F
I-205 Northbound				
Hwy 213 On-Ramp to Gladstone Off-Ramp	4225	2680	42	F

[1] These volumes exceed the HCM parameters for weaving analysis; as such the Leisch Procedure for Analysis and Design of Weaving Sections was used.

Table D-4.
2018 "No-Build" Scenario Conditions Freeway Level of Service – Ramp Merge/Diverge Segments

Freeway Segment	Ramp Volume (veh/h)	Density[1] (veh/mile/lane)	Speed[1] (mph)	Level of Service
I-205 Southbound				
Gladstone Off-Ramp Diverge	325			F
I-205 Northbound				
Park Place Off-Ramp Diverge	1720			F
Gladstone On-Ramp Merge	300	31	52	D

[1] Density and Speed of Traffic are highly variable at LOS "F".

Table D-5.
Freeway Operational Analysis Comparison

Freeway Segment		Operational Level of Service	
		1998 Existing Conditions	2018 "No-Build" Scenario Conditions
Basic Freeway Segments			
I-205 SB	North of Gladstone Off-Ramp	E	F
	Gladstone Off-Ramp to Gladstone On-Ramp	D	F
	Park Place Off-Ramp to Park Place On-Ramp	D	E
	Hwy 99E Off-Ramp to Hwy 99E On-Ramp	E	F
	South of Hwy 99E On-Ramp	D	E
I-205 NB	South of Hwy 99E Off-Ramp	D	F
	Hwy 99E Off-Ramp to Hwy 99E On-Ramp	E	F
	Hwy 99E On-Ramp to Park Place Off-Ramp	D	F
	Park Place Off-Ramp to Park Place On-Ramp	C	D
	Gladstone Off-Ramp to Gladstone On-Ramp	D	E
	North of Gladstone On-Ramp	D	E
Freeway Weaving Segments			
I-205 SB	Gladstone On-Ramp to Hwy 213 Off-Ramp	E	F
I-205 SB	Hwy 213 On-Ramp to Hwy 99E Off-Ramp	E	F
I-205 NB	Hwy 213 On-Ramp to Gladstone Off-Ramp	E	F
Freeway Ramp Merge/Diverge Segments			
I-205 SB	Gladstone Off-Ramp Diverge	E	F
I-205 NB	Park Place Off-Ramp Diverge	D	F
	Gladstone On-Ramp Merge	C	D

Appendix E

Highway 213/I-205 Interchange Concept Phasing Plans

PHASE 1
PHASE 2
PHASE 3

SCALE
0 200 400
(In Feet)

KITTELSON & ASSOCIATES, INC.
610 S.W. ALDER, SUITE 700
PORTLAND, OREGON 97205
(503) 228-5230

TRANSPORTATION PLANNING\TRAFFIC ENGINEERING

HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY

OREGON CITY, OREGON
JUNE 2000

HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 2 -- PHASING PLAN

FIGURE NO.
E-1

PROJECT NO.
2561

h:\PROJFILE\2561\DWGS\FINALREP\FIGE_1.DWG

PHASE 1
PHASE 2
PHASE 3

SCALE
0 200 400
(In Feet)

KITTELSON & ASSOCIATES, INC. 610 S.W. ALDER, SUITE 700 PORTLAND, OREGON 97205 (503) 228-5230 TRANSPORTATION PLANNING\TRAFFIC ENGINEERING	HIGHWAY 213 URBAN CORRIDOR DESIGN STUDY OREGON CITY, OREGON JUNE 2000	*HIGHWAY 213/I-205 INTERCHANGE CONCEPT ALTERNATIVE 3 -- PHASING PLAN*	FIGURE NO. E-2 PROJECT NO. 2561

h:\PROJFILE\2561\DWGS\FINALREP\FIGE_2.DWG







Greater Oregon City Watershed Council **Watershed Action Plan** | May 2010









ICF INTERNATIONAL

GREATER OREGON CITY WATERSHED COUNCIL WATERSHED RESTORATION ACTION PLAN

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May 2010



ICF International. 2010. Greater Oregon City Watershed Council Watershed Restoration Action Plan. (ICF 00223.08.) Portland, OR. Prepared for Greater Oregon City Watershed Council, Oregon City, OR.

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Acronyms and Abbreviations

BMPs	best management practices
GOCWC	Greater Oregon City Watershed Council
NRCS	Natural Resources Conservation Service
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OWEB	Oregon Watershed Enhancement Board
OWRD	Oregon Water Resources Department
ROTC	Reserve Officers' Training Corps
SM	stream mile
SWCD	Soil and Water Conservation District
UGB	Urban Growth Boundary
USFWS	U.S. Fish and Wildlife Service

Introduction and Purpose

This action plan will serve as a guide for the Greater Oregon City Watershed Council (GOCWC) in its selection, implementation, and monitoring of projects in the Greater Oregon City Watershed over a 10-year period. The action plan describes:

- How GOCWC will engage in a long-term, science-based program to advance adaptive and accountable restoration within the Greater Oregon City subwatersheds: Abernethy Creek, Beaver Creek, and Willamette Tributaries.
- The GOCWC restoration priorities and strategies to reduce historical and current threats to watershed health and to restore streams, fish populations, and water quality.
- The range of activities that the GOCWC will engage in, including public outreach and education, restoration, and monitoring.
- A framework and roadmap for increasing the pace and improving the effectiveness of watershed restoration by implementing voluntary watershed restoration projects and landowner education.

The action plan builds on background information and restoration rationale outlined in the *Greater Oregon City Watershed Assessment* (ICF International 2010). The assessment described the characteristics of the three subwatersheds; provided detailed information on the watershed's physical characteristics, fish populations, streamside vegetation, and water quality; and delineated the threats that impair the viability of the watershed.

Watershed and Subwatershed Overview

This section summarizes information from the *Greater Oregon City Watershed Assessment* (ICF International 2010).

The watershed assessment area encompasses the stream network for three subwatersheds: Abernethy Creek, Beaver Creek, and Willamette River (Figure 1).

- Abernethy Creek enters the Willamette River at river mile 25.3 and is tidally influenced at its confluence with the river. Lower Columbia River anadromous (i.e., residing in the ocean as adults and returning to rivers and streams to spawn) runs of coho salmon and steelhead trout are present in this subwatershed.
- Beaver Creek, of which Parrott Creek is a large tributary, enters the river above Willamette Falls at river mile 31.4; this system is not tidally influenced. Because Beaver Creek is above the falls, which historically blocked some fish runs, this stream is part of the Upper Willamette River system. The Beaver Creek subwatershed contains resident cutthroat trout and Pacific lamprey and may now be accessible to Upper Willamette River steelhead.
- The Willamette River subwatershed consists of small tributaries that begin within the Oregon City Urban Growth Boundary (UGB) and flow over steep-sided bluffs directly into the river. These small streams are very high gradient and do not contain fish with the exception of lower channel habitats within the Willamette River floodplain. Fish occupy the lower floodplain portions of these small streams during high-flow periods.

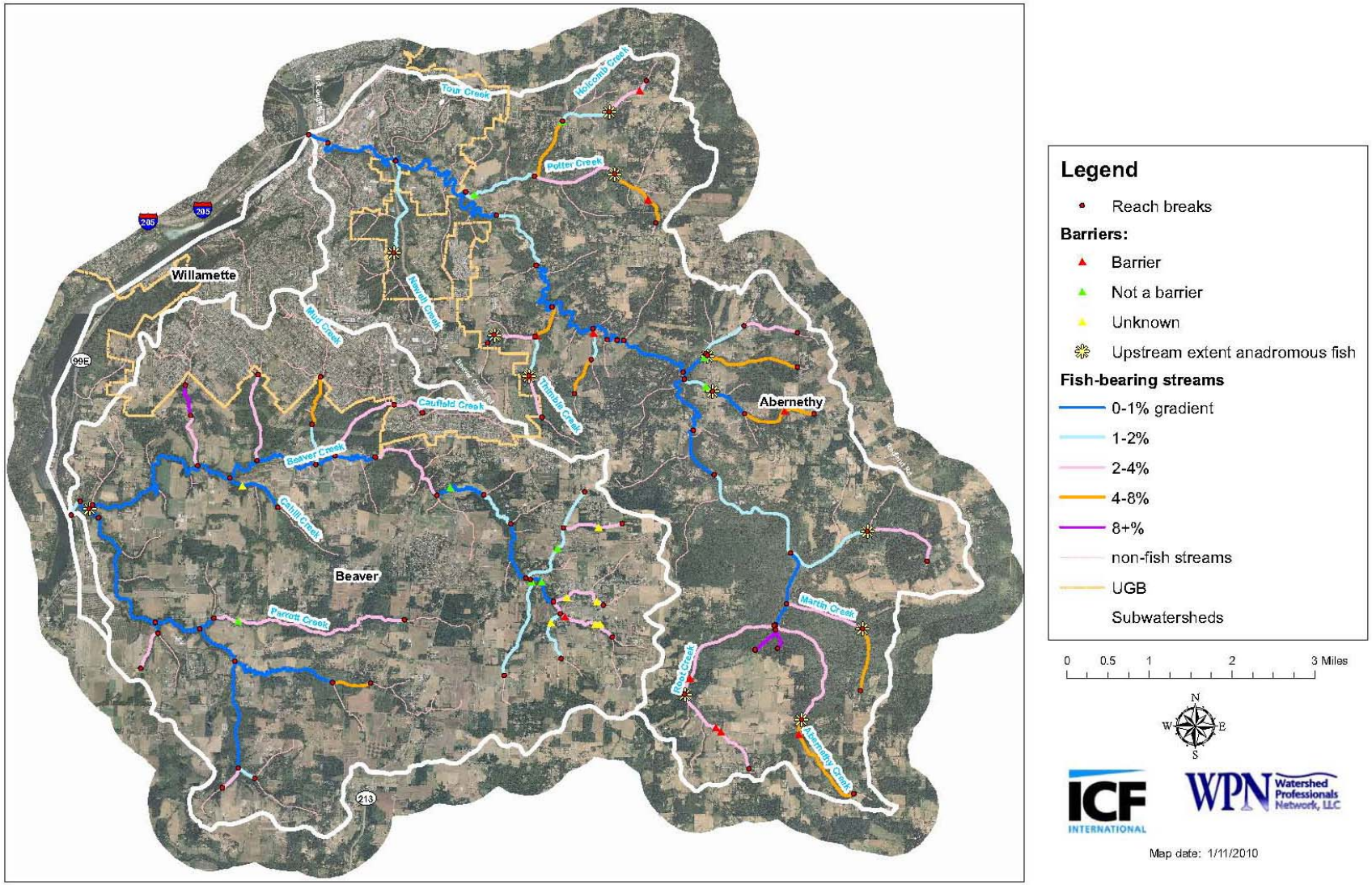
The watershed assessment area is within the Willamette River Basin in western Oregon. Abernethy and Beaver creeks begin at elevations of about 1200 feet above mean sea level and flow generally in a northwesterly direction to join the Willamette River. Because the entire watershed assessment area is within the low elevation portions of the Willamette Valley, there are no mountainous areas to capture winter snowpack. Consequently, most precipitation comes from rainfall. The largest quantities of rainfall occur between October and November; very little precipitation occurs during the summer and early fall, when stream flows are at their lowest.

The watershed assessment area encompasses 44,353 acres (Table 1). The Abernethy Creek and Beaver Creek subwatersheds are similar in size (21,573 and 20,083 acres, respectively); the Willamette subwatershed is the smallest (2,697 acres). The headwaters of Abernethy and Beaver creeks are largely in unincorporated Clackamas County. Approximately 17% of the watershed assessment area is within the Oregon City UGB). A significant portion of the Abernethy subwatershed, primarily the lower stream channel, is within the UGB (16%). A somewhat smaller portion of the Beaver Creek subwatershed is within the UGB (13%), primarily small streams that originate in Oregon City and flow north into Beaver Creek. Most of the Willamette River subwatershed is within the UGB (59%).

Table 1. Greater Oregon City Watershed Assessment Subwatershed Acreages and Proportions within the Oregon City Urban Growth Boundary

Subwatershed	Total Area Acres (Square Miles)	Oregon City UGB Acres (Square Miles)	Percentage within Urban Growth Boundary
Abernethy	21,573 (33.71)	3,471 (5.42)	16%
Beaver	20,083 (31.38)	2,562 (4.00)	13%
Willamette	2,697 (4.21)	1,596 (2.49)	59%
Total	44,353 (69.30)	7,629 (11.92)	17%

Figure 1. Watershed Assessment Area Base Map



Watershed Conditions, Limitations, and Opportunities

This section summarizes information from the *Greater Oregon City Watershed Assessment* that describes watershed conditions, factors limiting fish populations and water quality, and opportunities for restoration.

Conditions and Limitations

Urbanization, roads, and other land uses have modified stream habitat, riparian vegetation, fish populations, and water quality within the watershed assessment area. Table 2 summarizes the watershed conditions for the subwatersheds based on the watershed assessment.

The Abernethy Creek, Beaver Creek, and Willamette River subwatersheds have been dramatically altered over the years as a result of urbanization, agriculture, and other land uses. The greatest limitations to watershed health and fish populations within the three subwatersheds include:

- Water quality issues: temperature and sedimentation
- Stormwater from Oregon City headwater streams: modifications in water quality and flow patterns
- Stream habitat quality: channels incised and disconnected from floodplain; scarcity of wood in the channel limiting complex habitats
- Fish passage barriers on Abernethy Creek and Beaver Creek and tributaries
- Riparian areas: modified vegetation composition and narrowed corridor; weedy conditions prevail in many areas
- Water flow: water withdrawals probably reducing water flow during the late summer and early fall

Information is available on the general health of streams and riparian areas in the watershed assessment area; however, detailed, site-specific information for key watershed characteristics is limited, particularly for fish habitat and water quality. For example, no comprehensive inventory of fish habitat throughout the channel network exists; such an inventory would delineate the presence of pools and the quantity of large wood in the channel. Similarly, almost no water quality data exists for key parameters such as water temperature. Because of these data limitations, it is difficult to develop restoration actions that focus on the issues limiting fish populations and water quality for sections of the stream network or a specific landownership.

Collecting baseline information on stream habitat and water quality should be the GOCWC's first priority. Data collection efforts should use existing protocols, such as the Oregon Department of Fish and Wildlife (ODFW) Aquatic Habitat Inventory and the Oregon Department of Environmental Quality (ODEQ) stream temperature collection methods.

Opportunities

The GOCWC, in collaboration with landowners and other partners, should focus actions to improve watershed conditions on the following strategic areas and opportunities.

- During flood events the Willamette River creates a backwater area in Abernethy Creek as far upstream as Holcomb Creek, which creates a winter rearing area for Willamette Basin salmon and steelhead populations during floods.
- Abernethy Creek and key tributaries are important for coho, steelhead, and lamprey migration, rearing, and spawning.
- With the elimination of the fish passage issue at Sevick Pond, Beaver Creek is now accessible to Upper Willamette steelhead and lamprey.
- Habitat in the lower watershed within Oregon City and the surrounding areas, particularly in Newell Creek and Holcomb Creek, represents some of the highest quality salmon and steelhead habitat in the Portland area.
- The Metro property in the Newell Creek watershed and the Holcomb Creek area is a focus area for Metro's protection and restoration efforts.
- Oregon City is strategically located, with headwater streams within the city limits draining into all three subwatersheds and thus influencing water quality and fish habitat in downstream areas.

Table 2. A Summary of Watershed Conditions in the Watershed Assessment Area

Location	Condition Summary
Abernethy Creek Subwatershed	• Abernethy Creek and tributaries are important habitat for lower Willamette River populations of coho and steelhead and other native fish species • Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions prevail in many areas • Fish passage barriers are present, with several on the mainstem • Stream habitat is simplified with limited wood • Most of lower Abernethy Creek is within Oregon City • During flood events, the Willamette River creates a backwater area in Abernethy Creek as far upstream as Holcomb Creek • Important migration corridor for coho, steelhead, and lamprey • Winter rearing area for Willamette Basin salmon and steelhead populations during floods • Water quality issues: temperature, sedimentation, and stormwater • The stream channel is incised and disconnected from the floodplain • The headwaters of Newell Creek are within Oregon City • Metro property in the Newell Creek watershed and Holcomb Creek is a focus area for protection and restoration • Newell and Holcomb creeks are important for coho, steelhead, and lamprey spawning and rearing and contain areas with high quality habitat
Oregon City Headwater Streams encompassing all subwatersheds	• Headwater streams originate in Oregon City and flow into all three subwatersheds • Large area of impervious surfaces • Water quality issues: sedimentation and stormwater • Streams within the Willamette Subwatershed do not have fish use, with the exception of the lower portions within the Willamette River Floodplain
Beaver Creek Subwatershed	• Beaver Creek, Parrott Creek, and tributaries are now accessible to steelhead and lamprey • Water quality issues: sedimentation (other conditions are unknown) • Water withdrawals are probably reducing water flow during the late summer and early fall • Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions prevail in many areas • Fish passage barriers are present • Fish passage conditions are unknown at many road crossings • Stream habitat conditions are unknown • Sevick Dam washed out in the January 2, 2009, flood; upstream areas are now accessible to fish • A large quantity of sediment is exposed in the drained Sevick Pond area, which will become a weedy area • The channel is down-cutting through the sediments and may create fish passage issues

Watershed Restoration Strategy and Priorities

Roni et al. (2002) outlines an approach for prioritizing restoration projects. The strategy builds on key principles of watershed function and conservation biology. The first component is to focus efforts on protecting existing areas with high quality habitat. The second component is to indentify, based on the watershed assessment, the factors that are limiting water quality and fish populations. Combing these components creates an integrated watershed improvement strategy for the GOCWC, which focuses on activities that will protect and restore watershed processes that are essential for the creation and maintenance of fish habitat and water quality.

Based on this prioritization approach (Roni et al. 2002), the GOCWC watershed restoration strategy focuses on the following types of projects.

- **Protecting high quality habitats.** High quality habitats for salmon, trout and other species "anchor" the restoration effort and provide core areas that can be enhanced and then reconnected to the whole watershed through restoration actions. This strategy is centered on a key principal of conservation biology, which emphasizes the importance of protecting habitats that are better functioning while restoring degraded habitats.
- **Restoring fish passage.** Restoring fish passage is a high priority because it has a very high probability of success and it provides immediate access to historic habitat.
- **Restoring hydrologic and water quality processes because these actions help maintain and restore aquatic habitat.** Hydrologic processes include sediment delivery to stream channels, water flow regimes (low and high flows), and can be affected by stormwater management and water withdrawals. Riparian areas also affect hydrologic and water quality processes by providing floodplain connections, shading streams, and providing large wood that contributes to complex stream habitat.
- **Restoring instream flows.** Engaging in instream restoration projects, such as placement of instream large wood, which are best implemented in conjunction with reconnection of isolated high quality habitats and projects to restore watershed processes.
- **Educating landowners and other watershed stakeholders** on actions they can take to protect and restore the watershed.

The GOCWC will pursue this strategy through the following methods:

- Engaging in assessment and monitoring projects to better understand stream habitat quality, key areas for restoration (e.g., areas with riparian weeds), and water quality (e.g., water temperature patterns);
- Working with local jurisdictions, including Oregon City and Metro, to protect and restore key high quality habitat areas;
- Engaging landowners and jurisdictions in voluntary restoration projects;
- Educating landowners on best management practices and approaches for restoring habitat on their property; and
- Tracking trends in habitat, water quality, and stream flow as restoration proceeds.

GOCWC Restoration Project Accomplishments

The action plan will build on the GOCWC's restoration project accomplishments, described below, and expand efforts into new geographic areas and project types.

Abernethy Phase I

The GOCWC was awarded a $6,650 grant from the Oregon City/Metro Enhancement Fund for the Abernethy Phase I project. The project enhanced the riparian corridor along Abernethy Creek from Main Street to just east of the Washington Street Bridge. The project area covers four tax lots, which are owned by the Oregon Department of Transportation (ODOT), Oregon City, and Historic Properties LLC.

Two volunteer events were held (one in 2006 and one in 2007) to remove garbage, including debris remaining from the residence that was demolished on the Oregon City parcel, and nonnative invasive vegetation, including Himalayan blackberry, Clematis spp., English ivy, nightshade, laurel, English hawthorn, and holly.

Two planting events were held (one in 2006 and one in 2007) to revegetate the area with native riparian species. The long-term goal of the planting was to develop a structurally complex corridor that would provide habitat for wildlife and shade for Abernethy Creek. Subsequent volunteer events have been held to remove nonnative, invasive plants.

Abernethy Phase II

The GOCWC was awarded a $14,285 grant from the Oregon City/Metro Enhancement Fund for the Abernethy Phase II project. The project is located west of Washington Street on Oregon City park land. The GOCWC coordinated efforts to remove invasive species, plant natives, and mulch the ground along Abernethy Creek at Abernethy Park in Oregon City. This project supports the long-term goal of plant survival and successful establishment of a structurally complex corridor that will provide habitat for wildlife and shade for Abernethy Creek.

The bulk of the project was completed in 2008. Clackamas County Corrections' crews removed much of the invasive plants in the spring/summer. Students from Springwater Elementary Environmental Charter School and Oregon City High School Junior Reserve Officers' Training Corps (ROTC) planted 300 plants along the banks and slopes of the creek. The Junior ROTC volunteers also removed 40 cubic yards of invasive plants and 5 cubic yard of roofing material from the park. Echo Valley Natives nursery donated plants, Oregon City provided tools, and the National Guard provided a warming tent. The students had a lot of fun and learned about the value of riparian areas.

Tooze Pond

The GOCWC was awarded a $3,500 grant from the Oregon City/Metro Enhancement Fund for the Tooze Pond project. The project area includes two parcels. The northern perimeter of the pond is owned by Oregon City and the southeastern parcel is privately owned by City Councilmember Dan Tooze and contains a permitted dammed lake in Cauflield Creek just west of Highway 213. The majority of the project area lies beneath BPA power lines.

In 2008, 1 ton of garbage and nonnative, invasive vegetation, including Himalayan blackberry and Japanese knotweed, was removed from the site. Because of past harassment issues (e.g., garbage, rock throwing, BB guns directed at glass bottles and wildlife) associated with the residents of the apartment complex to the north, a strip of blackberries was left along the northern perimeter of the project area to limit human access from the north.

The site, which lies within an environmentally sensitive area, zoned by Oregon City as a Water Quality Resource Overlay, was degraded. Restoration of the riparian vegetation will support its ability to improve water quality and protect slope stability. Trees and shrubs improve water quality by reducing rapid stormwater runoff, increasing water infiltration, allowing groundwater recharge, and shading streams. Fish, such as cutthroat trout, and macroinvertebrates inhabiting Caufield Creek will benefit from any improvements to water quality. Waterfowl, wading birds, osprey, and wetland songbirds that frequent the pond will benefit from additional structure, cover, and prey base as the plants mature. In addition to providing wildlife habitat, the trees and tall shrubs will improve air quality and provide noise attenuation.

Coniferous trees and native dogwoods were planted along the northern perimeter of the project area, wherever possible, to buffer the pond from the adjacent development and to provide cover and shade for a remnant population of cutthroat trout. The property owner actively managed this project.

Younger Project

The Younger project was conducted by ODFW, the Younger family, and the GOCWC, with a $51,615 grant from Oregon Watershed Enhancement Board (OWEB). The project is on Potter Creek less that 0.33 mile upstream of the confluence of Holcomb and Potter creeks at 15822 Neibur Road near Oregon City. Potter Creek is a perennial tributary of Abernethy Creek that supports winter steelhead, Coho salmon, Pacific lamprey and cutthroat trout populations. Twin 48-inch culverts under the Younger's driveway were creating a barrier to upstream juvenile fish passage and hindering passage of adult salmon in the stream.

The grant application was submitted to OWEB, in 2008. In January 2009, rains washed out the culverts and the driveway, which provided the sole access to property owner's home.

The project, completed in 2009, replaced the twin culverts with a 13-foot-wide, 5-foot, 1-inch-tall, 46-foot-long bottomless arch pipe. Native plants and trees were planted on the slopes adjacent to the area of work. The OWEB grant covered engineering design, removal of the existing structure, purchase and installation of the crossing structure.

SOVL's Lower Abernethy Creek Project

The GOCWC is partnering with a local non-profit, SOLV, on a restoration project along lower Abernethy Creek. The project is currently in the planning stages. The project objectives center on floodplain modifications, weed control, and riparian restoration along a 0.13-mile length of Abernethy Creek and adjoining Park Place Creek. The project will reduce streambank erosion, improve the stream's access to the floodplain, and increase native vegetation and the riparian tree canopy.

Yodis Property: Potter Creek Fish Passage Project

The project replaced two culverts that were blocking fish passage, removed a small diversion dam, and created a wetland and side channel on the Potter Creek between stream miles (SM) 1.26 and 1.45. The project, completed in 2006, opened up 0.52 mile of fish spawning and rearing habitat; created riffles and pools in the area adjacent to where the diversion dam was removed; created 250 feet of stream-side channel area; and restored 0.5 acre wetland habitat. The following project partners provided funding or other support: the Yodis family, U.S. Fish and Wildlife Service (USFWS), Natural Resources Conservation Service (NRCS), OWEB, ODFW, and Clackamas Soil and Water Conservation District (SWCD). Total project cost was $131,500.

Saling Property: Potter Creek Fish Passage

The project replaced two side-by-side culverts that were blocking fish passage with a bridge on the Potter Creek at SM 0.85. The project, completed in 2006, opened up 0.4 mile of fish spawning and rearing habitat. The following project partners provided funding or other support: the Saling family, USFWS, NRCS, OWEB, ODFW, and Clackamas SWCD. Total project cost was $146,000.

Clackamas Soil and Water Conservation District's Holcomb Creek Fish Passage Project: Schmitz Property

The project replaced three side-by-side culverts that were blocking fish passage with a bridge on the Holcomb Creek at SM 0.82. The project, completed in 2009, opened up 1.9 miles of fish spawning and rearing habitat. Clackamas County SWCD wrote and administered the grant. The following project partners provided funding or other support: NRCS, OWEB, and ODFW. Total project cost was $75,600.

City of Oregon City's Redland Road Project

The City replaced a 6-by6-foot, concrete box culvert that was blocking fish passage with a 15-foot span metal arch pipe on Holcomb Creek at SM 0.22. The project, completed in 2003, opened up 0.6 mile of fish spawning and rearing habitat. The following project partners provided funding or other support: ODFW, USFWS, U.S. Forest Service, U.S. National Marine Fisheries Service, OWEB, Clackamas County, For the Sake of the Salmon, Portland General Electric Salmon Friendly Power Program, Northwest Resource Conservation and Development Board.

The following action plan priorities were determined based on the watershed assessment findings and the restoration strategy.

- Assess baseline conditions
- Protect and restore key tributary anchor habitats
- Enhance Oregon City stormwater quality and quantity
- Enhance habitat in the Beaver Creek–Parrott Creek confluence area
- Improve fish passage
- Improve habitat in the lower portions of Abernethy Creek
- Address water flows during the summer and early fall
- Educate watershed residents and stakeholders and conduct outreach to landowners
- Evaluate project success

These priorities provide a framework for selecting projects and the development of the GOCWC's annual work plan. The GOCWC should implement actions as much as possible within the geographic focus areas depicted in Figure 2 and described within each action plan priority. That said, the GOCWC should to continue to work with landowners who propose restoration projects, regardless of the location of the project, if the project is designed to address issues that are constraining fish habitat and water quality. The restoration strategy provides a framework for evaluating the merits of all projects, including those initiated for locations outside of the geographic focus areas.

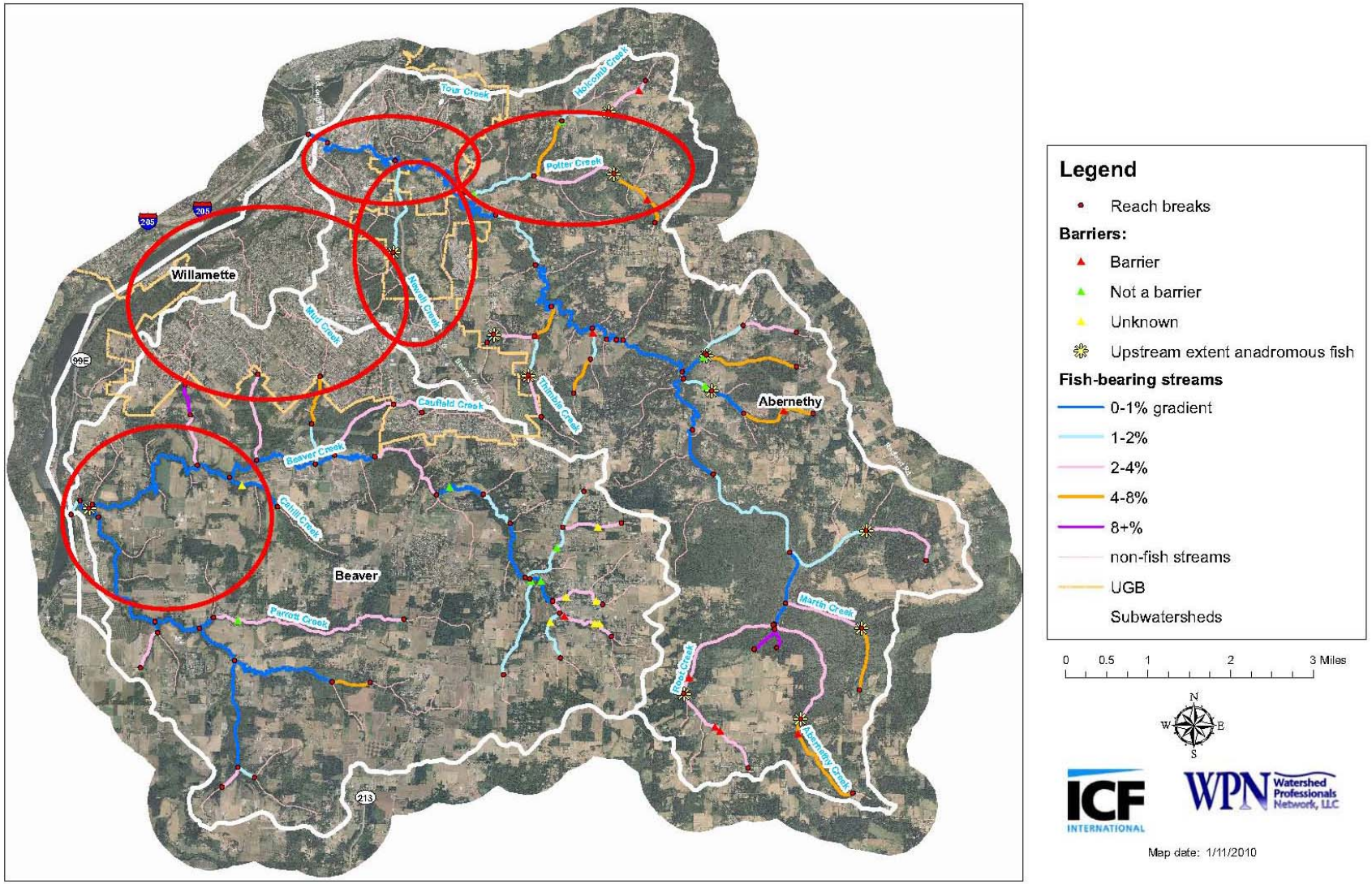
The following section describes the rationale, project categories, and geographic focus areas for each action plan priority.

Assess Baseline Conditions

Rationale

The *Greater Oregon City Watershed Assessment* provides information on the natural processes, current management practices, and land uses that influence stream habitat, fish populations, and water quality in the watershed assessment area. The assessment was based on limited information; key data were unavailable, particularly for stream habitat, water quality, and water quantity. Additional information on baseline conditions is necessary to identify specific locations and actions for restoration projects. Establishing this baseline data is the essential first step for the action plan. It will guide future project planning and provide the foundation for tracking changes in watershed conditions over time.

Figure 2. Geographic Focus Areas (circled) for Action Plan Implementation



Focus Areas

- Fish-bearing streams in the Abernethy and Beaver Creek subwatersheds.
- High quality habitat areas in lower Abernethy Creek that have not been inventoried, particularly the Holcomb Creek and Potter Creek systems.
- Fish passage barriers within the Beaver Creek subwatershed and on the mainstem of Abernethy Creek.
- Inventorying habitat conditions in the area within and below Sevick Pond (see section below for description).

Actions

- Conduct aquatic habitat inventories with according to ODFW protocols.
- After obtaining landowner cooperation, work with volunteers to monitor water temperatures according to ODEQ protocols.
- Work with the Oregon Water Resources Department (OWRD) to establish methods to assess streamflows during the late summer and early fall and to identify ways to restore them in key problem areas.
- With volunteers and landowner cooperation, work with Oregon City to monitor stormwater quality.

Partnerships

- ODFW
- ODEQ: 319 program grant funding
- OWRD
- OWEB: grant Funding
- Oregon City

Protect and Restore Key Tributary Anchor Habitats: Newell Creek and the Holcomb Potter Creek systems

Rationale

Newell Creek and the Holcomb Creek and Potter Creek systems, in the lower portions of the Abernethy Creek subwatershed (Figures 3 and 4), contain some of the highest quality stream and riparian habitat in the Abernethy Creek subwatershed. Historically, these tributary streams were important to the health of Abernethy Creek fish populations; the current presence, though at reduced population levels, of steelhead, coho, Pacific lamprey, and cutthroat trout in these stream means the streams could still support health populations. Opportunities exist in these systems to protect existing high quality aquatic and riparian habitat and to restore areas with poor habitat. It is also important to address issues in this area that are contributing to degraded habitat and water

quality, including stormwater runoff from Oregon City into Newell Creek and invasive weeds that are present and spreading throughout the system.

The reasons for focusing habitat protection and restoration on the Newell Creek and Holcomb/Potter Creek systems include:

- Within the context of the Portland metropolitan area and the lower Willamette river fish runs, Newell Creek and the Holcomb Creek/Potter Creek system provide important habitat for coho and steelhead spawning and rearing.
- Large portions of Newell Creek, particularly the middle portions, have high quality fish and riparian habitat.
- Metro manages over 300 acres in Newell Creek Canyon as open space, which offers opportunities for expanded protection and restoration. This acquisition is part of a larger strategy to protect natural corridors and uplands along the mainstem of Abernethy Creek and its major tributaries (particularly Holcomb and Potter creeks) to protect water quality and wildlife habitat.
- The presence of native fish and the relatively large size of the undeveloped land bordering the Newell Creek make the canyon area and Metro property biologically notable.
- Some sections of the Newell Creek aquatic and riparian habitat are degraded, particularly the lower and upper portions, providing opportunities to restore habitat and expand high quality habitat out from the middle sections.
- Water quality conditions in Newell Creek and the Holcomb Creek/Potter Creek system are unknown, but these streams appear to contribute cooler water to the system and provide areas of cold water were native fish can reside when water temperatures are elevated in Abernethy Creek.
- Stormwater from Oregon City appears to be contributing sediment to Newell Creek.
- Areas of Newell Creek and the Holcomb/Potter system contain degraded riparian vegetation and invasive weeds.

Focus Areas

- Newell Creek and tributaries (Figure 3): stream habitat restoration in the lower and upper fish-bearing sections and rectification of stormwater runoff issues in the headwater streams within Oregon City that affects downstream fish-bearing areas.
- Holcomb Creek, Potter Creek, and fish-bearing tributaries (Figure 4).

Actions

Newell Creek:

- Field inventory riparian weeds, particularly knotweed throughout system.
- Remove riparian weeds, plant native vegetation, and expand width of corridor.
- In the lower and upper sections of the creek, improve channel complexity by adding wood.
- Address stormwater issues through projects and outreach in headwater areas in collaboration with Oregon City.

- Monitor water temperature, sediment, and other water quality conditions.

Holcomb and Potter creeks (Figure 4):

- Remove riparian weeds, plant native vegetation, and expand the width of the corridor.
- Field inventory riparian weeds, particularly knotweed.
- In selected areas, improve channel complexity by adding wood.
- Monitor water temperatures.
- Address fish passage barriers.

Partnerships

- Metro: collaboration to restore habitat in the Newell Creek canyon area and to expand protection efforts into the Holcomb Creek/Potter Creek systems.
- Metro: grant funding
- Oregon City: coordinate stormwater management projects and public outreach activities.
- OWEB: grant funding

Figure 3. Newell Creek Action Area

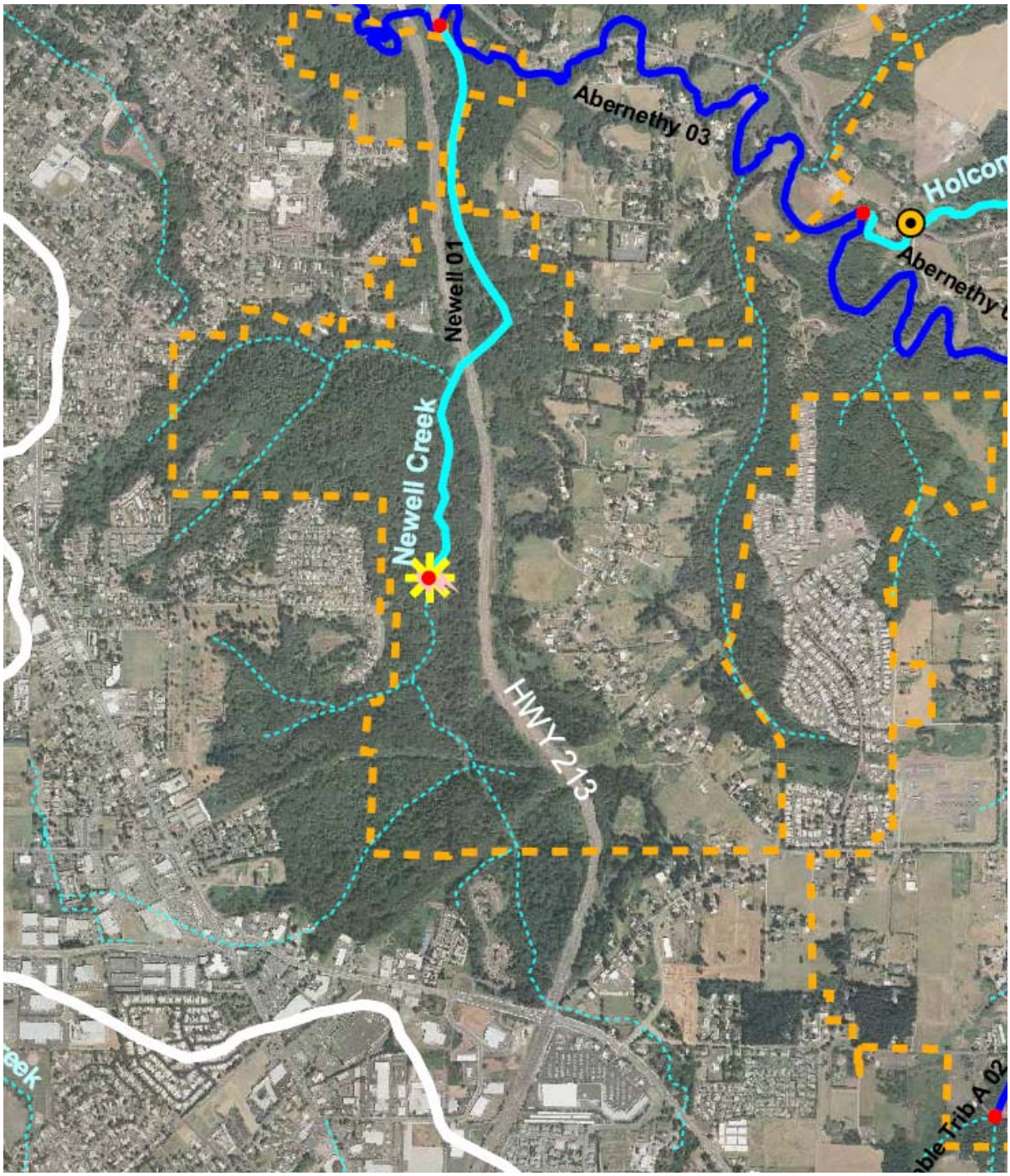
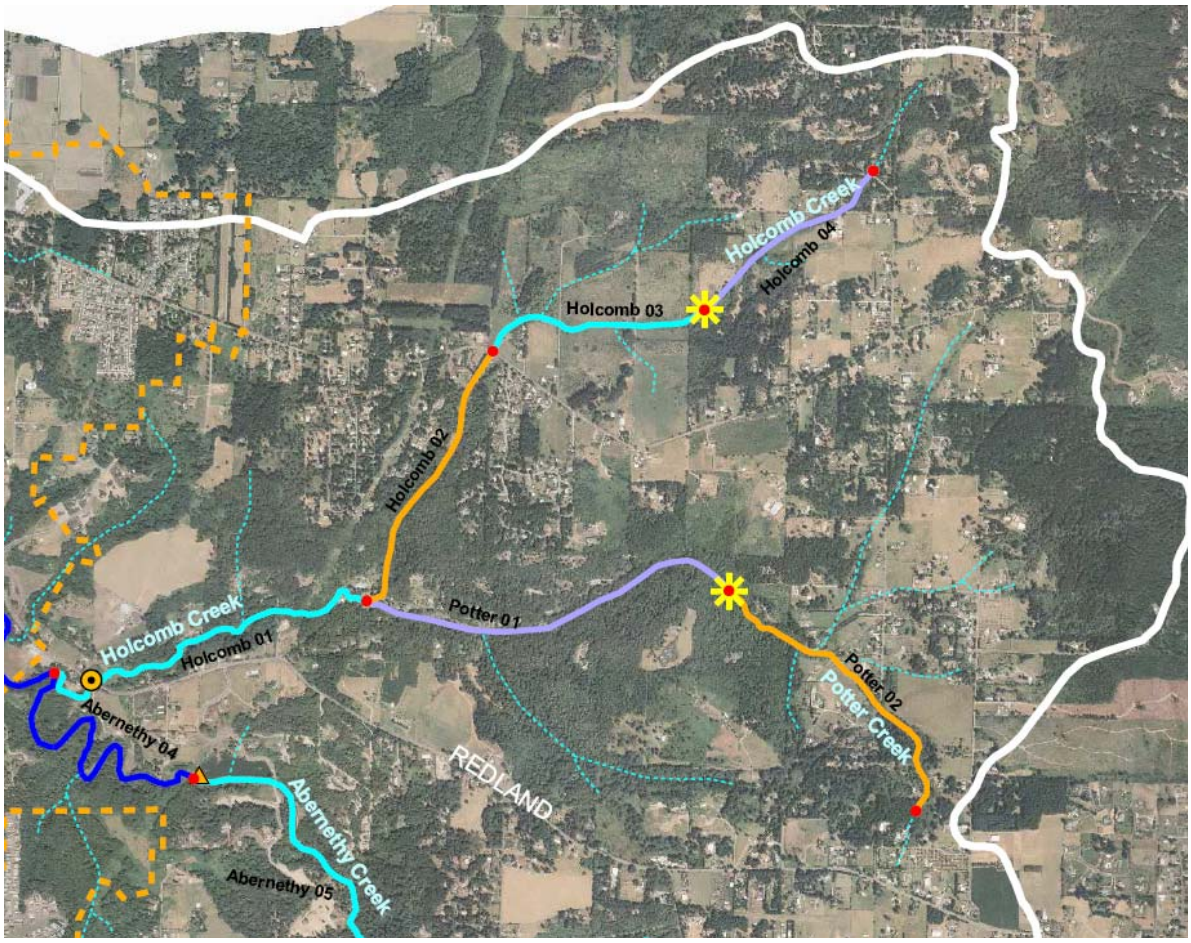


Figure 4. Holcomb and Potter Creek Action Area



Enhance Oregon City Stormwater Quality and Quantity

Rationale

Oregon City is strategically located, with headwater streams within its city limits that drain into all three subwatersheds: Abernethy, Beaver, and Willamette Tributaries (Figure 5). As a result, land use practices within the city strongly influence water quality and fish habitat in downstream areas.

A large area of the city is covered in impervious surfaces (roofs, pavement, and other areas that do not absorb rainfall). The amount and distribution of impervious surfaces has significant implications for watershed health. Unless steps are taken to control runoff, rainfall on in areas with impervious surfaces does not infiltrate into the ground. Instead, it rapidly runs off as stormwater into streams, negatively affecting streamflows, water quality, fish populations, and stream habitat. The Willamette subwatershed, which has the highest proportion of area within Oregon City, has the most impervious surfaces (22%). In addition, individual streams (e.g., Newell Creek, which has headwaters within Oregon City) can have a much greater proportion of the drainage area in impervious surfaces.

An impervious surface area of 5% of the watershed appears to be a threshold for negative effects on streams and fish populations. Negative effects can include increased flows during flood events, sedimentation, and other water quality concerns. The *Greater Oregon City Watershed Assessment* (ICF International 2010) classified reaches as follows by percent impervious surface in contributing area (Figure 6):

- 5% or less—good
- 5–10%—fair
- greater than 10%—poor

Based on these classifications, reaches that drain Oregon City are the most affected overall by impervious surfaces. This includes Newell Creek, a key tributary to Abernethy Creek that contains high quality habitat and significant steelhead and coho salmon populations.

Oregon City is taking active steps to control and monitor stormwater conditions. The City directs new developments to employ best management practices (BMPs) such as bioswales, wetland areas, and other facilities that retain stormwater and minimize water quality problems. In addition, the City has an ongoing monitoring program that assesses, evaluates, and reports on stormwater quality status and trends.

Focus Areas

- All areas within the Oregon City UGB (Figure 5).

Actions

- Work with Oregon City staff on public outreach efforts that educate landowners and other residents on actions they can take to minimize stormwater issues, including maintaining functioning riparian areas and taking steps to reduce erosion.
- Collaborate with Oregon City staff to identify and work with landowners on voluntary projects to improve stormwater conditions, including planting native riparian vegetation and efforts to reduce erosion.
- Work with Oregon City staff to identify, fund, and implement stormwater retention areas, including installing bioswales and creating wetland areas.
- Collaborate with Oregon City to monitor stormwater water quality conditions.

Partnerships

- Oregon City
- ODEQ: grant funding through the 319 program

Figure 5. Oregon City Headwater Streams Action Area

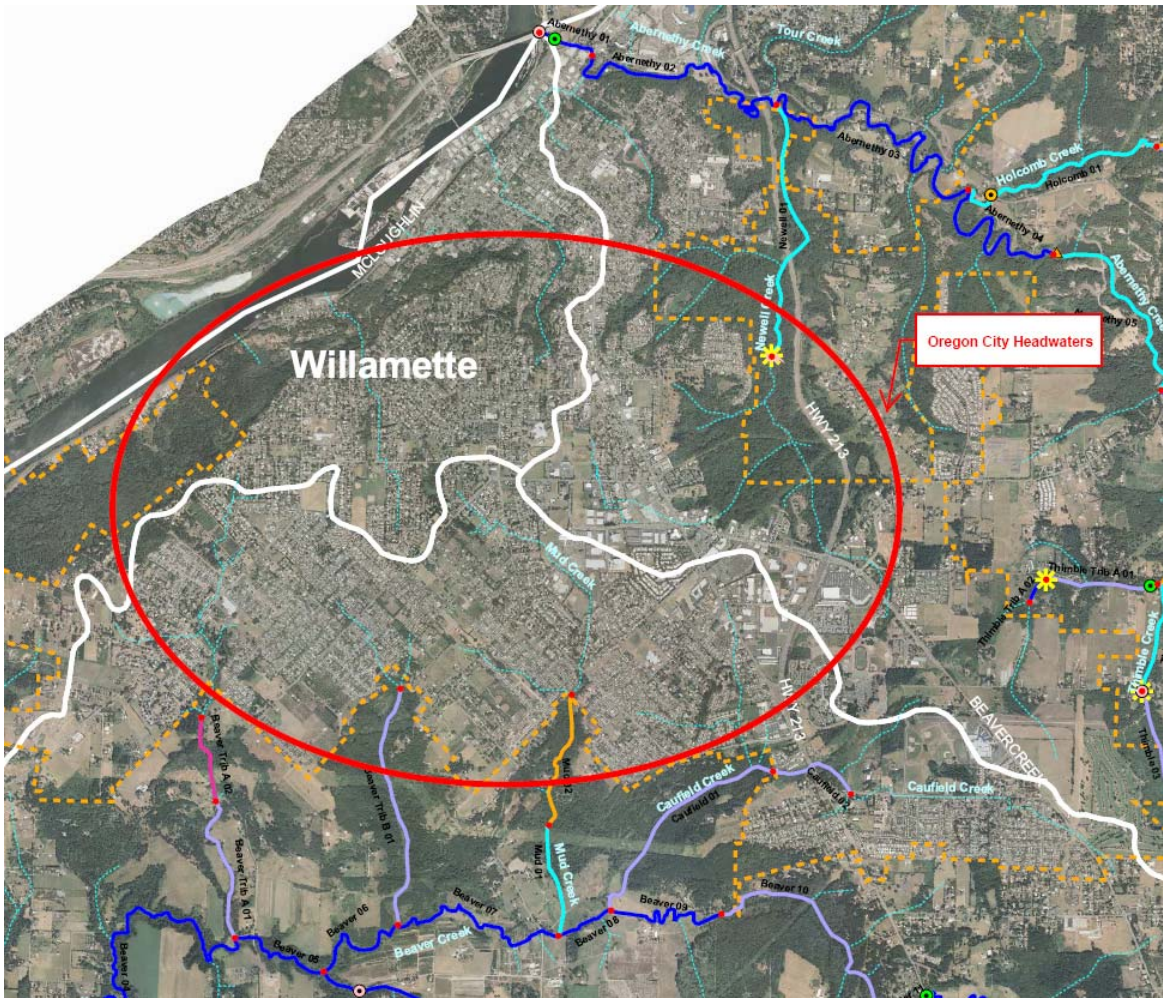
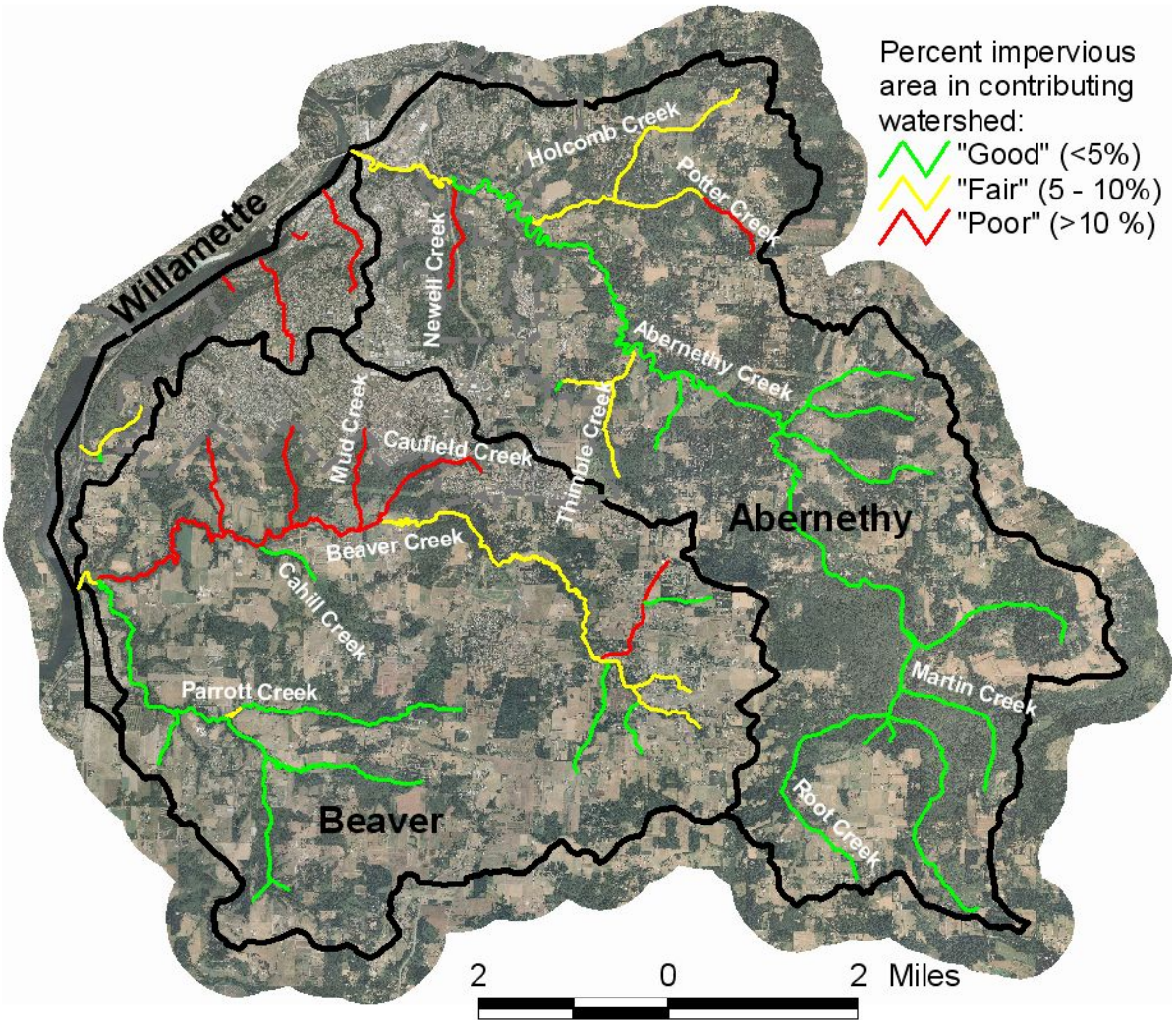


Figure 6. Percent Impervious Surface for the Contributing Watershed Area Upstream of the Midpoint of Each Stream Reach



Enhance Habitat in the Beaver Creek–Parrott Creek Confluence

Rationale

A dam near the confluence of Beaver and Parrott creeks created an impoundment, Sevick Pond, which backed up water in the area upstream and blocked fish access. Sevick Pond covered approximately 12 acres including the junction of Parrott and Beaver creeks. This dam remained in place until the January 2, 2009, flood. In this flood, Beaver Creek eroded the northern portion of dam, creating a channel that is passable to fish.

The Beaver Creek subwatershed is now accessible to steelhead and Pacific lamprey. Because steelhead will quickly move into new habitat, it is expected that that they will recolonize the system for spawning and juvenile rearing. Unfortunately, because no information is available on fish habitat

quality in the Beaver Creek subwatershed, it is not possible to predict the capability of the stream network to support steelhead or resident cutthroat trout populations.

Because Sevick Pond captured substantial sediments, the stream channel is now down-cutting through these sediments. As the stream erodes this large volume of sediment into the channel, a "headcut" in the deep sediments has developed. This headcut creates a steep fall over the sediments that could block upstream fish movement in the channel, but a field inventory would be necessary to confirm the ability of fish to pass through this area. In addition to the possible fish passage issue, the large quantity of sediment exposed in the drained Sevick Pond will evolve into a weed-infested area in the absence of efforts to control weeds and plant native vegetation.

The draining of Sevick pond and the new accessibility of the Beaver Creek subwatershed to anadromous fish presents an area for focused restoration actions in the Beaver Creek–Parrott Creek confluence area. Opportunities in this area to work with landowners to assess conditions and identify and pursue restoration projects include the following:

- Sedimentation is a water quality issue in the Sevick Pond area, but other water quality conditions (e.g., water temperature) are unknown.
- Water withdrawals are probably reducing water flow during the late summer and early fall; it is important to assess streamflow conditions during this period and work with landowners on voluntary mechanisms to reduce water withdrawals.
- Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions prevail in many areas.
- Fish passage conditions are unknown at many road crossings.
- Stream habitat conditions are unknown.

Focus Areas

- The area surrounding the Beaver Creek–Parrott Creek confluence (Figure 7).
- Sevick pond area (Figure 8).

Actions

- Remove riparian weeds, plant native vegetation, and expand width of corridor.
- Field inventory riparian weeds, particularly knotweed.
- Address fish passage barriers and assess unknown barriers at road crossings.
- Educate landowners on riparian area management and sediment-reduction actions.
- Explore opportunities to increase streamflows through voluntary actions.
- Collaboration with the landowner to develop a plan to restore the drained Sevick pond area with native vegetation.
- Study the Sevick Pond sediment accumulation and develop a plan to control sedimentation, reduce weeds, plant native vegetation, and maintain fish passage.

Partnerships

- Clackamas County SWCD
- OWEB: grant funding

Figure 7. The Beaver and Parrott Creek Confluence Action Area

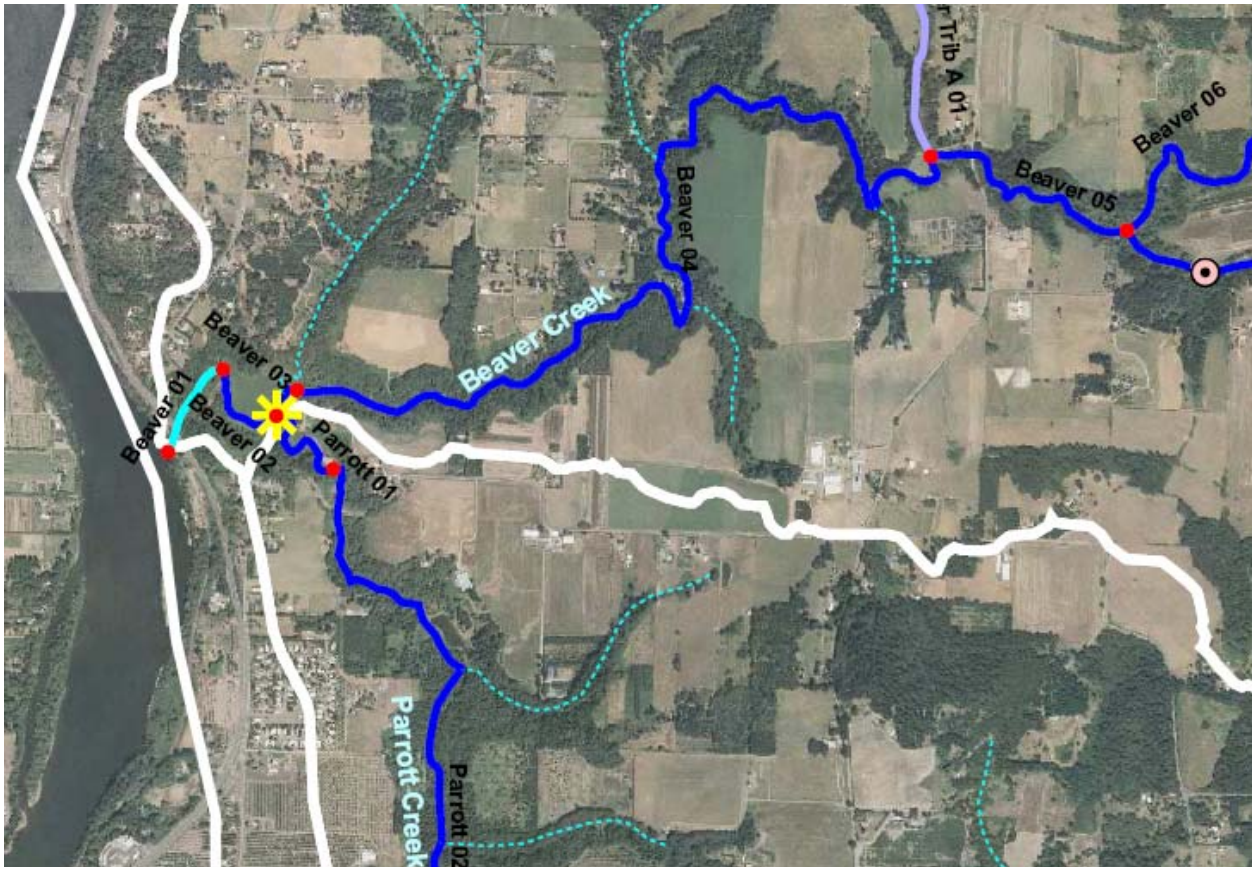
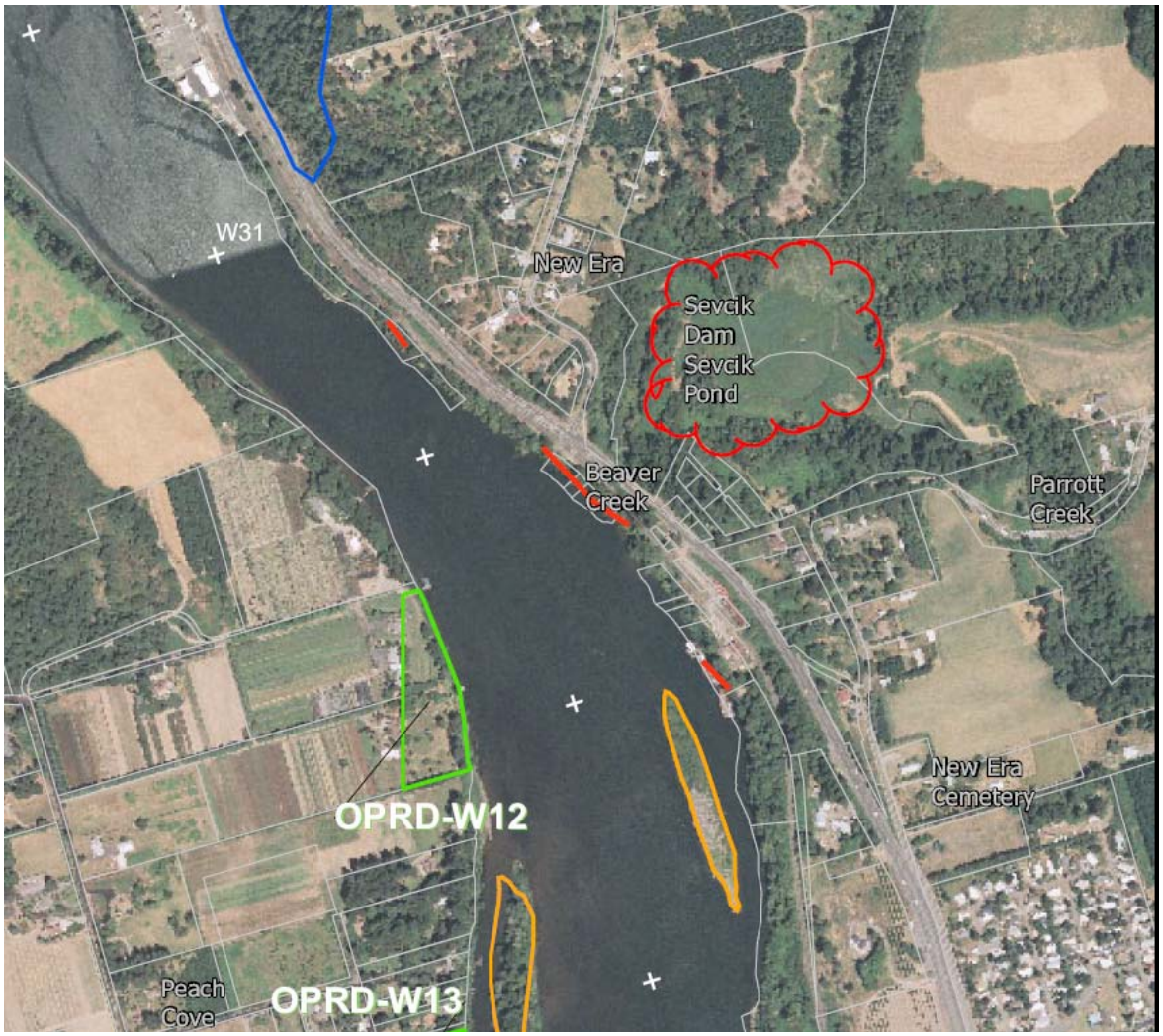


Figure 8. The Sevick Pond Site, Lower Beaver Creek Subwatershed



Source: Oregon State Parks and Oregon Watershed Enhancement Board 2008 (aerial photo), note that Sevick pond is spelled incorrectly in source map.

Improve Fish Passage

Rationale

Fish passage barriers on Abernethy Creek, Beaver Creek, and tributary streams can pose a significant problem for fish populations. Dams and road crossing culverts are examples of fish passage barriers in the watershed assessment area. Fish move around the stream network through the different phases of their life cycle and in response to changing conditions. Fish passage barriers, prevent fish from accessing important areas for spawning or from moving into cool tributary streams when Abernethy Creek or Beaver Creek warm during the summer months.

Fish passage barriers can totally block fish movement during all times or they can partially block movement during periods of high or low flows. Partial fish passage barriers can significantly slow the migration of coho and steelhead through the system. Fish will often hold in pools at the base of a

barrier waiting for conditions to change. This can delay migration and create problems such as stress on the fish, which provide opportunities for poaching and predation.

Dams, which are often constructed in streams to impound water for irrigation or recreation, can impede fish passage if fish ladders or other mechanisms are not in place. Several dams on Abernethy Creek may present obstacles to fish passage. The Hidden Lake water diversion dam just upstream from Holcomb Creek may be a fish passage barrier, but its status needs to be confirmed. The Beaver Lake dam on upper Abernethy Creek has a fish ladder in place. Although fish passage at this ladder has not been studied, some evidence shows that it impedes adult coho and steelhead movement into spawning and rearing streams above the lake.

The Sevick Pond dam on lower Beaver Creek washed out in the January 2, 2009, flood event. Because Sevick Pond captured substantial sediments, the stream channel is now down-cutting through these sediments. As the stream erodes this large volume of sediment into the channel, a "headcut" in the deep sediments has developed. This headcut creates a steep fall over the sediments that could block upstream fish movement in the channel, but a field inventory would be necessary to confirm the ability of fish to pass through this area.

Fish passage at many of the road crossings (primarily culverts) in the watershed assessment area has been evaluated using the ODFW criteria. Table 2 provides the fish passage status for 14 road crossings in the Abernethy Creek subwatershed and 13 road crossings in the Beaver Creek subwatershed. Most of the road crossings were inventoried by ODFW or Clackamas County, and their fish passage status is known. The road crossing inventory is comprehensive for Abernethy Creek subwatershed, but a number of crossings have not been assessed for fish passage (i.e., designated as unknown) in the Beaver Creek subwatershed.

With the absence of the Sevick Pond dam and its barrier to fish passage, upper Willamette steelhead and Pacific lamprey can now access the Beaver Creek subwatershed. Little is known about the status of fish passage in Beaver and Parrott creeks. Because it is now accessible to anadromous fish, this subwatershed should be the focus of fish passage assessments.

In addition to the road crossings identified below in Table 3, ICF evaluated fish passage for the Abernethy Creek culvert under Highway 99. This culvert is important because it is the first obstacle that salmon and steelhead encounter upon entering Abernethy Creek. The evaluation of fish passage through the Highway 99 culvert is based on the culvert diameter, length, and gradient, the characteristics of the weirs, and flow conditions in Abernethy Creek. The weirs appear to provide some fish passage at lower flows, though the jump height exceeds the 6-inch ODFW fish passage criterion and may impede juvenile fish. Adult salmon and steelhead do pass through the culvert, though they may have difficulty during very high-flow conditions when water velocities exceed fish swimming abilities. Upstream access does not appear to be severely limited, because fish have been observed.

Table 3. Fish Passage Status and Location for Road Crossings in the Watershed Assessment Area

Subwatershed	Stream and Reach Location	Responsible for Inventory and ID Number	Fish Passage Status/Notes
Abernethy			
	Holcomb 01a Holcomb 01b	County 01	Not a barrier
	Potter 02a Potter 02b	County 04	Barrier
	Holcomb 02 Holcomb 03	County 02	Not a barrier
	Holcomb 04a Holcomb 04b	County 03	Barrier
	Thimble 01a Thimble 01b	County 05	Barrier
	Thimble 02 Thimble 03	County 06	Barrier
	Abernethy Trib A 01a Abernethy Trib A 01b	County 07	Barrier
	Abernethy Trib B 01a Abernethy Trib B 01b	County 08	Not a barrier
	Abernethy Trib C 01a Abernethy Trib C 01b	County 09	Not a barrier
	Abernethy Trib C 03a Abernethy Trib C 03b	County 10	Barrier
	Root 02a Root 02b	County 11	Barrier
	Root 03a Root 03b	County 12	Barrier
	Root 03b Root 03C	County 13	Barrier
	Abernethy 16a Abernethy 16b	County 14	Barrier

Subwatershed	Stream and Reach Location	Responsible for Inventory and ID Number	Fish Passage Status/Notes
Beaver			
	Parrott 05a Parrott 05b	ODFW 01	Not a barrier
	Cahill 01a Cahill 01b	County 15	Unknown
	Beaver 11a Beaver 11b	ODFW 02	Not a barrier
	Beaver Trib C 01a Beaver Trib C 01b	ODFW 06	Not a barrier
	Beaver Trib C Trib A 01a Beaver Trib C Trib A 01b	County 16	Unknown
	Beaver Trib D 01a Beaver Trib D 01b	ODFW 03	Not a barrier
	Beaver 15a Beaver 15b	ODFW 04	Not a barrier
	Beaver Trib E 01a Beaver Trib E 01b	County 17	Unknown
	Beaver Trib E 01b Beaver Trib E 01c	County 18	Unknown
	Beaver Trib F 01a Beaver Trib F 01b	County 19	Unknown
	Beaver 17a Beaver 17b	ODFW 05	Barrier
	Beaver 17b Beaver 17c	County 20	Unknown
	Beaver 17c Beaver 17d	County 21	Unknown

Focus Areas

- Hidden Lake water diversion dam on Abernethy Creek.
- Sevick Pond, lower Beaver Creek.
- Beaver Creek subwatershed.

Actions

- Assess fish passage at the Hidden Lake water diversion dam and identify options for addressing any issues.
- Assess fish passage, in combination with a comprehensive habitat assessment, in the Sevick Pond area and upstream; identify options for addressing any fish passage issues.
- Assess fish passage throughout the Beaver Creek subwatershed and identify options for addressing any fish passage issues. The fish passage assessment could be combined with the aquatic habitat inventory.

Partnerships

- ODFW
- Clackamas County

Improve Habitat in the Lower Portions of Abernethy Creek

Rationale

Backwatering of Abernethy Creek during high flows adds to the limited availability of off-channel habitat in the lower Willamette River and contributes to the success of fish spawned in other areas of the Willamette River basin. The loss of shallow, complex, off-channel habitat is a major limiting factor for salmon in the lower Willamette River. Restoration of urban streams, including Abernethy, Kellogg, Tryon, and Johnson creeks, is one of the few opportunities to improve this kind of habitat in the lower Willamette River. Potential habitat improvements to the backwater areas in Abernethy Creek would contribute to the recovery of listed coho and steelhead by increasing the extent and diversity of productive stream habitats that flow into the lower Willamette River.

The incised channel, limited complex pools, and minimal large wood in lower Abernethy Creek constrain the quality of seasonal rearing habitat. The channel incision has reduced stream access to the floodplain during flood events. The limited quantities of large wood in the channel, particularly long pieces in complex accumulations, and minimal stream connection to the floodplain have severely degraded fish habitat quality. Key reasons why it is important to pursue restoration actions in the lower Abernethy Creek area include the following:

- Most of lower Abernethy Creek is within Oregon City.
- During flood events, the Willamette River creates a backwater area in Abernethy Creek as far upstream as Holcomb Creek.
- Provides an important migration corridor for coho, steelhead and Pacific lamprey.
- Provides winter rearing for Willamette Basin salmon and steelhead populations during floods.
- Water quality issues include temperature, sedimentation, and stormwater runoff.
- Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions prevail in many areas.
- The stream channel is incised and disconnected from the floodplain.
- Stream habitat is simplified with limited wood.

Focus Areas

- Lower Abernethy Creek (Figure 9).

Actions

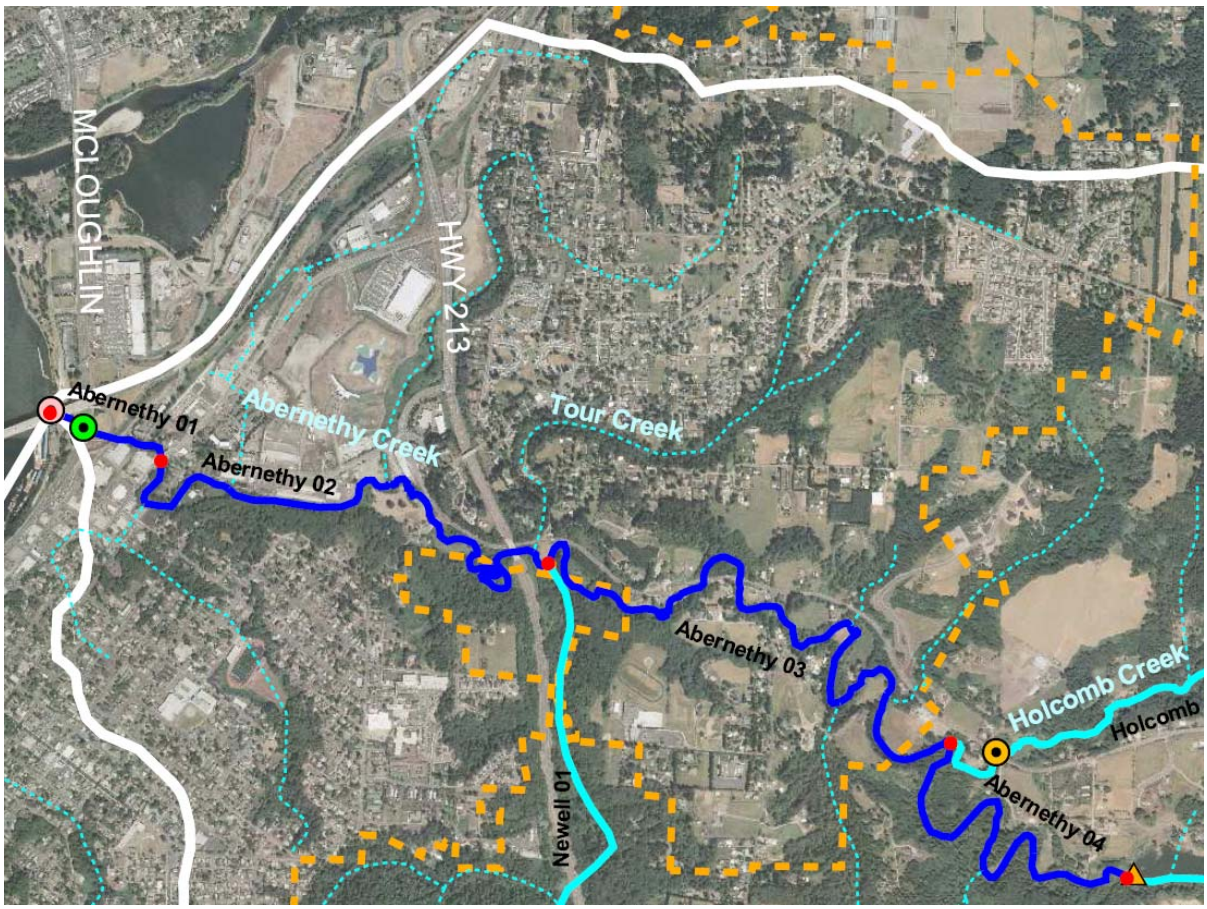
- Reconnect floodplain areas and add wood to the channel.
- Address stormwater issues in collaboration with Oregon City.

- Remove riparian weeds, plant native vegetation, and expand width of corridor.

Partnerships

- Oregon City

Figure 9. Lower Abernethy Creek Action Area.



Address Streamflows

Rationale

Withdrawing water from streams for agriculture, livestock, and other purposes can reduce streamflows and, in turn, affect the health of the aquatic environment. Reduced streamflows, particularly in the late summer and early fall when flows are naturally low, can increase water temperatures, reduce pool areas, and limit connectivity between stream habitats, all of which can adversely affect salmon, trout, and other aquatic organisms. The *Greater Oregon City Watershed Assessment* (ICF International 2010) found that water withdrawal activities were reducing low flows in Abernethy and Beaver creeks during the critical late summer and early fall period. It appears that the flow reductions are the greatest in Beaver Creek subwatershed, which includes Parrott Creek, although there is some uncertainty about the finding and it will need to be substantiated through

further assessment. With the recolonization of steelhead and Pacific lamprey in Beaver Creek, it is very important to understand and address the low flows in this system.

Voluntary incentives are in place to address water withdrawal issues, including temporary leasing of water rights. Water withdrawals, affected streamflows, and water rights are complex issues; the GOCWC should collaborate with OWRD to assess the water quantity issues in Beaver Creek subwatershed and develop a strategy for improving conditions during low-flow periods.

Focus Areas

- Beaver Creek subwatershed, including the Parrott Creek system (Figure 10).

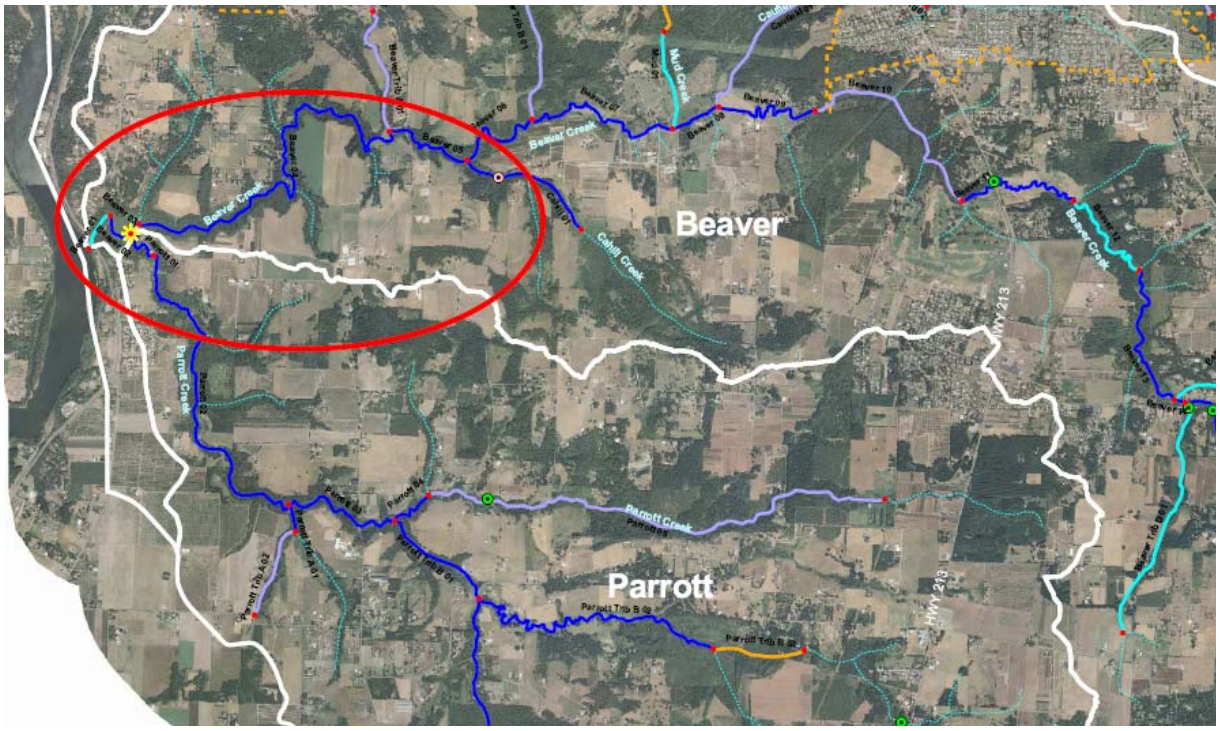
Actions

- Assess streamflow conditions and water right issues in collaboration with OWRD and ODFW.
- Develop a strategy, in collaboration with OWRD and ODFW, for addressing water withdrawals and maintaining adequate streamflows in.

Partnerships

- OWRD
- ODEQ
- Clackamas County Soil and Water Conservation District

Figure 10. The Beaver Creek Subwatershed and the Beaver and Parrott Creek Confluence Area



Education and Outreach to All Watershed Residents

Rationale

Successful restoration of the greater Oregon City watersheds depends on the goodwill, stewardship values, and participation of landowners and residents. Education and outreach builds community support and engages landowners and other residents in restoration projects. The watershed education and outreach effort complements all of the action plan strategies and actions, and serves as a tool for recruiting landowners and volunteers to participate in restoration projects.

The GOCWC can reach out to watershed residents through a variety of approaches including the following:

- Field tours of restoration activities
- Workshops and training on restoration activities and needs
- Speaking engagements with neighborhood groups and in other forums
- Printed and online informational materials to increase awareness on watershed issues and what individuals can do to improve the health of the watershed

Effective public education and outreach is a complex task. For that reason, it is recommended that the GOCWC develop a watershed education and outreach plan to guide its efforts. A number of Willamette Basin watershed councils have developed and implemented successful plans that can serve as examples. Development of the plan will take some time and in the interim, the GOCWC should continue to engage in outreach and education activities.

Focus areas

- Abernethy, Beaver, and Willamette Tributary subwatersheds.

Actions

- Engage in watershed outreach and education efforts in collaboration with partners.
- Develop an education and outreach plan and implement activities identified in the plan.

Partnerships

- Clackamas Soil and Water Conservation District
- Oregon City
- OWEB: grant funding
- SOLV

Project Phasing and Budgets

A number of factors control the GOCWC's capacity to plan and implement projects. It is anticipated that council staffing, project funding, and the ability to engage partner organizations and landowners will all increase over time. Figure 11 illustrates the proposed 10-year phasing of the action plan restoration strategies. Assessing baseline conditions and engaging landowners will help lay the foundation for future restoration actions.

Table 4 outlines year 1 action plan activities. The proposed activities will, by necessity, be modified based on grant funding levels, staffing, volunteer engagement, and landowner participation.

Figure 11. Restoration Action Plan Implementation Phasing

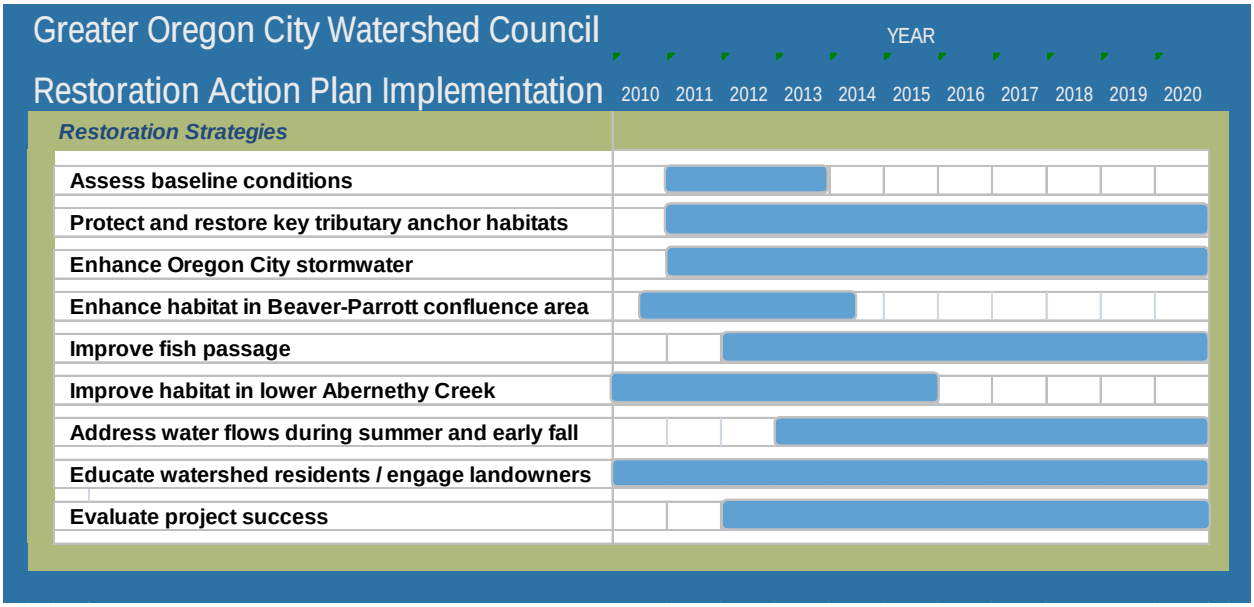


Table 4. Year 1 Restoration Action Plan Activities

Action Plan Component	Action	Estimated Cost	Notes
Protect and restore key tributary anchor habitats	Focus on Newell Creek and Holcomb Potter Creek systems		Work in partnership with Oregon City and Metro to identify restoration actions, volunteer activities, and public outreach approaches.
Assess baseline conditions	Aquatic habitat inventory (ODFW protocol)	$75,000	The Abernethy Creek subwatershed contains 38 miles of fish-bearing streams, 26 miles of which contain coho. The Beaver Creek subwatershed contains 32 miles of fish-bearing streams, though the extent of steelhead distribution is not known. The inventory will include assessing stream habitat, riparian conditions, and fish passage issues. ODFW aquatic habitat inventories cost approximately $1,500 per mile (Sanders pers. comm.). Estimated cost is for 50 miles of surveyed streams. Funding sources: OWEB; NOAA-Fisheries.
	Assess condition in the Sevick Pond Area	$50,000	Assess riparian conditions, sediment accumulation, and any potential fish passage barriers. Develop a channel, riparian and wetland restoration plan. Funding: DEQ EPA 319 program; OWEB; NOAA-Fisheries
	Assess fish passage at the Hidden Lake water diversion	$5,000	This dam should be examined by a fish passage specialist. If there is an issue, conceptual approaches to remedying the situation should be outlined. If a problem is identified, this assessment will lay the foundation for a grant to improve fish passage. Funding: OWEB; NOAA-Fisheries
Enhance habitat in Beaver-Parrott Confluence Area	Enhance habitat in the Sevick Pond Area	$60,000	Restore wetland, riparian, and channel habitats. Funding: OWEB
Improve habitat in lower Abernethy Creek	Cooperate with SOLV restoration project		Cooperate with SOLV on project implementation and public outreach. Plan landowner tours of the site.

Action Plan Component	Action	Estimated Cost	Notes
Watershed outreach & Education	Continue with ongoing outreach activities		Continue with current outreach activities, with an emphasis on geographic focus areas.
	Develop watershed outreach and education plan	$25,000	Develop a detailed public outreach and education plan in cooperation with Oregon City, Clackamas County SWCD and other partners. The plan should specify how outreach activities will help secure additional landowners to participate in restoration projects. Funding: DEQ EPA 319 program; OWEB.

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Sanders, Isaac. Fisheries Biologist. Oregon Department of Fish and Wildlife, Clackamas, OR. March 31, 2009—email.

Appendix A: Grant Funding Sources

Table A-1. Grant Funding Sources

Grant	Agency	Amount		Deadline	Website and Contact	Type of Projects Funded							
		Funds Available	Grant Range			Fish Passage	Water Quantity	Water Quality	Stormwater	Fish & Wildlife Habitat	Stream Restoration	Outreach & Education	Wetland Restoration
2010 Open Rivers Initiative	U.S. Department Commerce/NOAA	$6 Million	$100,000 – 3 Million	Nov 16	Steve Drescher; steve.j.drescher@noaa.gov http://www.nmfs.noaa.gov/habitat/restoration/projects_programs/crp/partners_funding/callforprojects3.html Also via grants.gov	X							
Oregon Watershed Enhancement Board (OWEB): Technical Assistance, Outreach, Education grants	Oregon Watershed Enhancement Board	$20 Million	$10,000–500,000		http://www.oregon.gov/OWEB/GRANTS/index.shtml Willamette Bain: Wendy Hudson 503-986-0061 wendy.hudson@state.or.us	X				X	X	X	X
North American Wetlands Conservation Act	U.S. Department of the Interior/ U.S. Fish and Wildlife Service		$1 Million	Mar, Jul & Oct	703-358-1784 or dbhc@fws.gov								X
Clean Water Act Section 319 Nonpoint Source Grant Program	Oregon Department of Environmental Quality		Varies	Varies	Lower Willamette Area: Doug Drake 503-229-5350 http://www.deq.state.or.us/wq/nonpoint/grants.htm			X	X		X	X	
Partners for Fish and Wildlife Program	U.S. Department of the Interior/ U.S. Fish and Wildlife Service	$9 Million	Up to $25,000	Sep 30	David Gordon: 703-358-2025 http://www07.grants.gov/search/search.do?&mode=VIEW&flag2006=false&oppId=47672					X	X		X
Whole Watershed Restoration Initiative	U.S. Department Commerce/NOAA		$20,000–100,000	Nov 20	Polly Hicks, 206-526-4861; polly.hicks@noaa.gov	X				X	X	X	
NOAA/American Rivers Partnership Funding	U.S. Department Commerce/NOAA		Up to $100,000	Apr & Nov	Jason Lehto, 206-526-4670; Jason.a.lehto@noaa.gov	X				X	X	X	

Final Report

Highway 213 Corridor Alternative Mobility Targets

Oregon City, Oregon

March 2018

Final Report

Highway 213 Corridor Alternative Mobility Targets

Oregon City, Oregon

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Project No. 20651

March 2018



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Section 1
Executive Summary

EXECUTIVE SUMMARY

Oregon City's 2013 Transportation System Plan (TSP) determined that the Highway 213 (OR213) corridor from Redland Road to Molalla Avenue (including the intersection of Beavercreek Road) will exceed the current mobility target in 2035, resulting in more congestion than is allowed. The OR213 intersection with Molalla Avenue is anticipated to meet the target; however, Beavercreek Road and Redland Road are not anticipated to meet the target.

The existing mobility target at the OR213/Beavercreek Road intersection is a volume-to-capacity (v/c) ratio at or below 0.99 during the peak first and second hours. The existing mobility target at the OR213/Redland Road intersection is a v/c ratio at or below 1.1 during the peak first hour and 0.99 during the peak second hour, as this intersection is located in a regional center. The alternatives that would meet the existing mobility target at the OR213/Beavercreek Road intersection are not cost feasible, given the financial constraints of the City and other agency partners. These alternatives can be further considered in the future if additional funding becomes available.

Lacking the financial capability of implementing major capacity-increasing projects at these locations, alternative mobility targets are necessary at each of these intersections; however, some improvements are feasible in the cost-constrained TSP to improve safety and minimize future congestion.

The following improvements are recommended for the intersection of OR213 and Beavercreek Road:

- Construct a westbound right-turn merge lane. High visibility pavement markings and signage are recommended for pedestrians and bicycles to cross the channelized lane safely, and consideration should be given to installing a rectangular rapid flash beacon (RRFB) for increased visibility.
- Infill sidewalk on Beavercreek Road from south of the Coltrane Path to north of Marjorie Lane.
- Install various safety improvements outlined on pages 33 and 35 of this report.

The above improvements will be added as projects in the TSP for future consideration.

For the intersection of OR213 and Beavercreek Road, the following mobility standards apply:

- During the first, second and third hours, a maximum v/c ratio of 1.00 shall be maintained. Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.

For the intersection of OR213 and Redland Road, improvements were identified as part of the TSP and are not proposed to change. The improvements identified in the TSP are part of Phase 2 of the "Jughandle" project, a project that focused on the intersection of OR213 and Washington Street that was implemented in 2013. The Phase 2 improvements, including improvements at OR213/Redland Road are already 90% designed. The improvements identified in Phase 2 future construction include an additional northbound and southbound through lane resulting in three northbound and three southbound lanes through the intersection. The project included in the 2013 TSP was identified as not likely to be funded in the Oregon City Transportation System Plan. However because it is identified in the adopted 2014 and

the draft 2018 Regional Transportation System Plan (RTP) as financially constrained it is considered likely to be constructed and no alternative mobility targets is needed.

Changes to the TSP to incorporate these improvements and the alternative mobility targets will require a Legislative public review process before the City's Planning Commission and City Commission. The alternative mobility target and financially feasible improvements that are needed will need to be agreed upon by ODOT and approved by the Oregon Transportation Commission.

Section 2
Introduction

INTRODUCTION

Oregon City's 2013 Transportation System Plan (TSP) determined that the Highway 213 (OR213) corridor from Redland Road to Molalla Avenue (including the intersection of Beavercreek Road) will exceed the current mobility target in 2035, resulting in more congestion than is allowed. The TSP recommended a project be conducted to identify what improvements would be necessary to meet the current target or whether an alternative mobility target is justified. The OR213 intersection with Molalla Avenue is anticipated to meet the target; however, Beavercreek Road and Redland Road are not anticipated to meet the target.

This project provides an overview of these two intersections including safety, operations, and cost analysis of the potential improvements at these intersections and identifies potential alternative mobility targets that would be necessary in conjunction with financially feasible operational and safety improvements. If alternative mobility targets are not adopted for the corridor, Oregon City will not be able to approve zone changes consistent with the Beavercreek Concept Plan. Outright zoned development will also be hindered until funding can be secured for long-term improvements.

The intersection of OR213 and Beavercreek Road is shown in **Exhibit 1**, and the intersection of OR213 and Redland Road is shown in **Exhibit 2**.

Exhibit 1 – Highway 213 (OR213) and Beavercreek Road Intersection



Exhibit 2 – Highway 213 (OR213) and Redland Road Intersection



POLICY CONTEXT

Mobility targets are the measure by which the state assesses the existing or forecasted operational conditions of a facility. As such, they are a key component the Oregon Department of Transportation (ODOT) uses to determine the need for, or feasibility of providing highway, or other transportation system improvements. They impact local land use and transportation planning as well as development review. Recent years have seen notable changes to Oregon's transportation planning and land use policies and requirements. These changes reflect statewide policy to support transportation solutions that encourage economic development, contribute to public health, offer multi-modal choices for all users, and reflect the uncertain fiscal realities and limited transportation funding.

Oregon's Transportation Planning Rule (TPR)

Mobility targets for state highways, as established in this policy or as otherwise adopted by the Oregon Transportation Commission (OTC) as alternative mobility targets, are considered the highway system performance standards in compliance with the Transportation Planning Rule (TPR) (OAR 660-012), including applicability for actions that fall under Section -0060 of the TPR.

The TPR Section -0060 applies when cities or counties are considering zone changes or plan amendments that would allow for additional development that would significantly impact or worsen the performance of existing or planned transportation facilities. Currently, significant impacts are found to exist when levels of automobile traffic cause roadway facilities to exceed motorized vehicle standards, such as mobility targets. If there is a significant impact, jurisdictions are required to *"ensure that allowed land uses are consistent with the identified function, capacity, and performance standards of the facility measured at the end of the planning period identified in the adopted Transportation System Plan."*

Oregon Highway Plan Policy 1F

The Oregon Highway Plan (OHP) defines polices and investment strategies for Oregon's state highway system for the next 20 years. The OHP gives policy and investment direction to corridor plans and transportation system plans that are being prepared around the state, but it leaves the responsibility for identifying specific projects and modal alternatives to those plans.

The OHP Policy 1F establishes mobility targets (as defined by motorized vehicle volume-to-capacity ratios) for state facilities that vary by region, facility classification, and whether or not the roadway is located inside an urban growth boundary (UGB). It states, *"It is the policy of the State of Oregon to maintain acceptable and reliable levels of mobility on the state highway system, consistent with expectation for each facility type, location and functional objectives. Highway mobility targets will be the initial tool to identify deficiencies and consider solutions for vehicular mobility on the state system. Specifically, mobility targets shall be used for:*

- *Identifying state highway mobility performance expectations for planning and plan implementation;*
- *Evaluating the impacts on state highways of amendments to transportation plans, acknowledged comprehensive plans and land use regulations pursuant to the Transportation Planning Rule (OAR 660-12-0060); and*
- *Guiding operations decisions such as managing access and traffic control systems to maintain acceptable highway performance."*

The OHP Policy 1F allows for development of alternative mobility targets in areas where it is "infeasible or impractical to meet the mobility targets". The policy allows for the use of alternative mobility targets to *"balance overall transportation system efficiency with multiple objectives of the area being addressed."* It requires that targets *"shall be clear and objective and shall provide standardized procedures to ensure consistent application of the selected measure. The alternative mobility target(s) shall be adopted by the Oregon Transportation Commission as an amendment to the OHP."* The OHP currently includes alternative mobility targets in many locations throughout the State; however, none have been adopted within the Portland Metro area to date.

EXISTING PERFORMANCE MEASURE AND TARGET

Mobility, or congestion, may be measured and regulated in a variety of ways. In the context of this project, mobility performance measures are methods to objectively measure the transportation system, such as travel time, or reliability. Mobility targets describe an acknowledged acceptable level of performance for a measure, such as a certain level of congestion.

The existing mobility targets for the OR213 corridor set forth in the Oregon Highway Plan (OHP) and the 2013 TSP are based on volume-to-capacity Ratio (v/c). The v/c ratio is a measure that reflects mobility and quality of travel. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). For example, a v/c of 1.00 indicates the roadway facility is operating at its capacity. An intersection can have an overall v/c ratio of 1.00 yet have v/c ratios greater than 1.00 for individual

movements where it may take more than one signal cycle to get through the intersection and queues build up. The following mobility target is set forth in the 2013 TSP for the two study intersections:

- OR213/Beavercreek Road intersection: required to operate at or below a v/c ratio of 0.99 during the peak first and second hours.
- OR213/Redland Road intersection: required to operate at or below a v/c ratio of 1.1 during the peak first hour and 0.99 during the peak second hour.

The Synchro model (a traffic model used to evaluate v/c ratios and other metrics) analysis completed for the 2013 TSP shows the OR213/Beavercreek Road intersection operating with an intersection v/c ratio of 0.83 for the p.m. peak hour under 2011 existing conditions. The TSP did not include an analysis of the intersection of OR213 and Redland Road. Under 2017 existing traffic volumes and conditions, the intersection operates with a v/c ratio of 0.91. The TSP analysis also indicates that by 2035, without improvement, the intersection will function beyond the current mobility target. Under 2035 Planned System Conditions (which includes planned, but potentially unfunded, roadway improvements), the intersection is expected to operate with a v/c ratio of 1.05, exceeding the existing mobility target (a maximum v/c ratio of 0.99). The southbound left-turn and eastbound left-turn movements exhibit higher than average v/c ratios, while the westbound left-turn and northbound left-turn movements exhibit lower than average v/c ratios.

Table 1 – OR213/Beavercreek Road Intersection Operations

Year	PM Peak Volume-to-Capacity Ratio (v/c)
2011 (2013 TSP Existing Conditions)	0.83
2017 Existing Conditions (May Counts)	0.91
2035 (2013 TSP Forecast)	1.05

The 2013 TSP did not include analysis of the OR213/Redland Road intersection. However, a long-term project to improve capacity at the OR213/Redland Road intersection is identified (project D79). The improvements identified in the TSP are part of Phase 2 of the "Jughandle" project, a project that focused on the intersection of OR213 and Washington Street that was implemented in 2013. The Phase 2 improvements, including improvements at OR213/Redland Road are already 90% designed. The improvements identified in Phase 2 future construction include an additional northbound and southbound through lane resulting in three northbound and three southbound lanes through the intersection. As this long-term solution has been identified, much of the analysis in the following sections of this report is focused on the OR213/Beavercreek Road intersection for the purpose of identifying a long-term improvement which will meet the existing mobility target for the corridor.

Section 3
Process

PROCESS

A Community Advisory Group (CAG) and Technical Advisory Group (TAG) were formed to help the City evaluate the feasibility and practicality of the alternatives set forth in this project. Three technical memorandums were produced and presented individually to the TAG and CAG. The following section outlines the contents of these memorandums and outcomes of the conversations with each group. All meeting notes and technical memorandums can be found in Appendix "A".

TECHNICAL MEMORANDUM #1/TAG AND CAG MEETING #1

Potential improvements for the intersection of Beavercreek Road and OR213 that focused on significantly increasing the intersection capacity to meet the current mobility target were presented to the TAG and CAG in December 2016 and January 2017. None of the alternatives were determined to be financially feasible, even by the 2035 horizon year of the TSP given the financial constraints of the city and other agency partners. In addition, some of the potential alternatives could have additional consequences including right-of-way impacts, environmental impacts, and could potentially complicate the provision of services for bicyclists, pedestrians, and transit users. Nonetheless, it is recommended that the alternatives be documented in the TSP for additional future consideration as part of the TSP's unconstrained plan. The unconstrained plan includes projects that are not currently anticipated to be financially feasible by 2035 but are projected to be needed and could be implemented if additional funding becomes available in the future.

TECHNICAL MEMORANDUM #2/TAG AND CAG MEETING #2

Because achieving the mobility target through a major capacity-expanding project at this intersection was determined to be beyond the financial capabilities of the city and its partner agencies, an alternative mobility target is necessary. A menu of potential alternative performance measures, reasonable target ranges, and a list of potentially feasible improvements to increase capacity and safety in the corridor was presented to the TAG and CAG in March 2017. The majority of TAG and CAG members agreed that an alternative mobility target allowing intersection volume-to-capacity ratios to exceed the current targets for no more than a specified number of hours per day would be appropriate for the corridor. The TAG and CAG were also in favor of further investigation of potential improvements to increase safety and capacity at the Beavercreek Road and OR213 intersection. Some improvements were identified that, while not allowing the mobility standard to be fully met, would increase the intersection capacity, improve safety, and are within the financial capabilities of the city and its partner agencies. The specific projects identified by the TAG and CAG for additional analysis were: 1) the provision of a merge lane for westbound right-turning vehicles at the OR213/Beavercreek Road intersection and 2) elimination of the second westbound left-turn lane at the OR213/Beavercreek Road intersection to increase left-turn storage on eastbound Beavercreek Road at Maple Lane Road. These improvements minimize future congestion and could be included in the cost-constrained TSP.

TECHNICAL MEMORANDUM #3/TAG AND CAG MEETING #3

The CAG and TAG reaffirmed support of an alternative mobility target allowing intersection volume-to-capacity ratios to exceed the existing targets for no more than a specified number of hours per day. In conjunction with alternative mobility targets, both groups were supportive of providing a merge lane for westbound right-turning vehicles at OR213/Beavercreek Road, but were not in favor of near-term or partial improvements at OR213/Redland Road, as it was determined that these would not be cost-feasible.

Section 4
Existing Conditions

EXISTING CONDITIONS

The existing conditions analysis identifies the transportation conditions and current operational and geometric characteristics of the roadways within the study area.

GEOMETRIC CHARACTERISTICS

At the OR213/Beavercreek Road intersection, OR213 has a 4-lane section and a speed limit of 55 mph and is classified as an Expressway to the north and a District Highway to the south. Beavercreek Road is classified as a Major Arterial with a 4/5-lane section and a speed limit of 35 mph. OR213 is under the jurisdiction of the Oregon Department of Transportation (ODOT), the west leg of Beavercreek Road is under the jurisdiction of Oregon City, and the east leg is under the jurisdiction of Clackamas County. OR 213 and Beavercreek Road are both designated as a Local Truck Routes in the City's TSP at the study intersection. The City designated truck routes in the TSP to ensure trucks can efficiently travel through and access major destinations in the City.

Sidewalks are provided along the north and south sides of Beavercreek Road, and a multi-use path is provided along OR213 south of Beavercreek Road along the east side of the highway. Bicycle lanes are provided along Beavercreek Road. TriMet operates Bus Route 32 between Clackamas Community College and Milwaukie City Hall. There are stops located on the west leg of Beavercreek Road at the intersection for both directions of travel (i.e. far-side for westbound and near-side for eastbound).

There is a stream running under the north leg of OR213 at the intersection, with corresponding wetlands. There are also geologic hazards in the vicinity of the intersection, with steep slopes and landslides primarily on the northwest corner. More details can be found in the Oregon City GIS maps in Appendix "B". The presence of these features increases the expense of any improvements requiring additional widening, as significant earthwork, culvert extensions, or wetland mitigation may be necessary.

PLANNED AREA IMPROVEMENTS

The City's TSP includes projects which may impact operations, safety, and travel patterns at the OR213/Beavercreek Road intersection. Many of the projects will increase connectivity in the vicinity of the OR213/Beavercreek Road intersection via parallel routes and roadway extensions between these parallel routes, providing alternate routes for those who do not need to pass through the intersection. All new roads and roadway upgrade projects will include facilities for bicycles and pedestrians. In addition, the TSP includes projects specifically to complete and enhance the bicycle and pedestrian networks. The roadway projects listed in the TSP which are likely to increase connectivity and impact safety and operations at the OR213/Beavercreek Road intersection are included in **Table 2** and **Figure 1.** **Figure 1** includes only those projects impacting vehicle travel and capacity.

Table 2 – 2013 Oregon City Transportation System Plan Projects located in the southeast part of the City

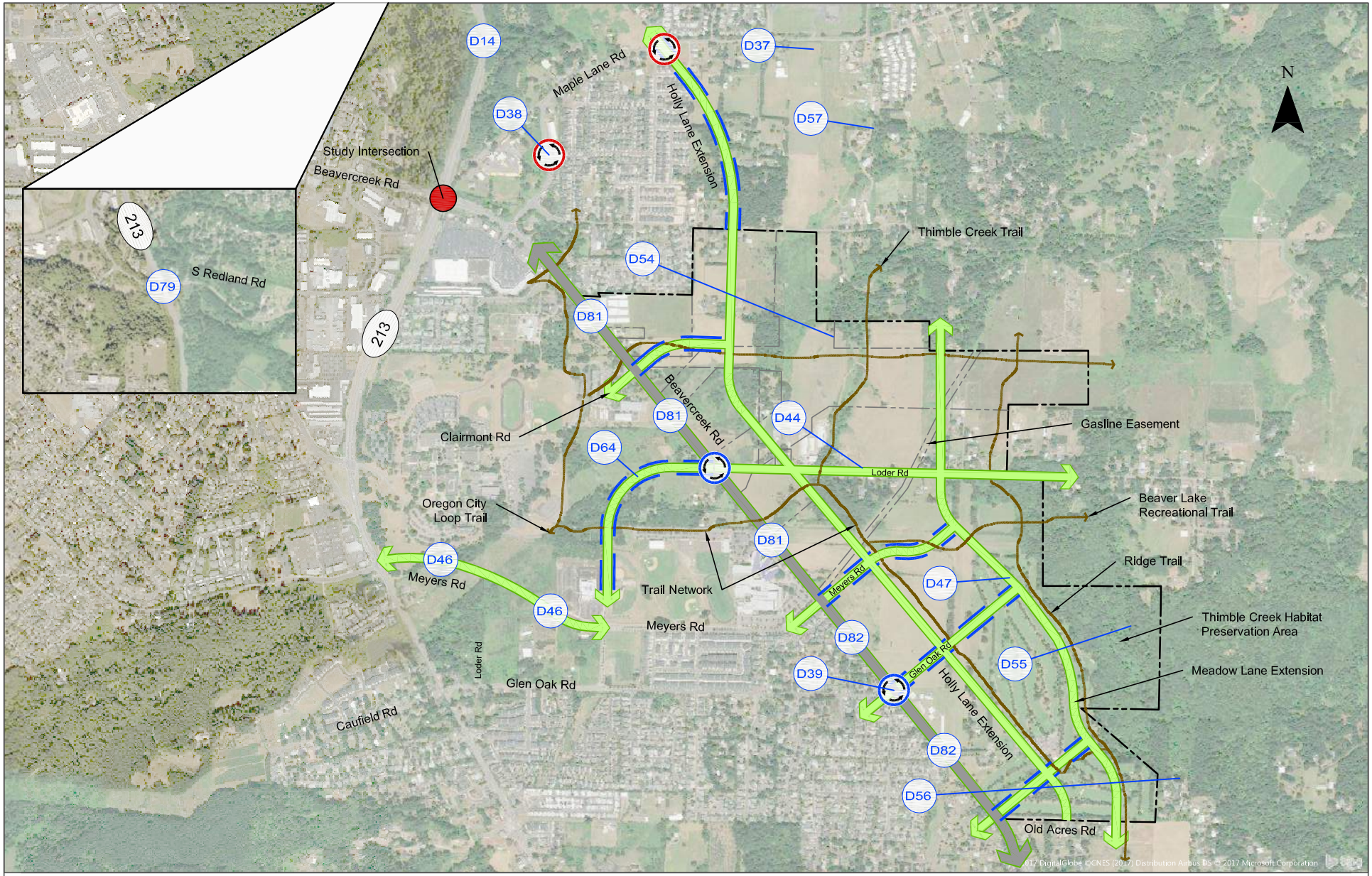
Project #	Project Description	Project Extent	Project Elements	Priority	Funded ?
D14	Southbound OR 213 Advanced Warning System	Southbound OR 213, north of the Beavercreek Road intersection	Install a queue warning system for southbound drivers on OR 213 to automatically detect queues and warn motorists in advance via a Variable Message Sign	Short-term	Likely
D37	Maple Lane Road/Holly Lane Operational Enhancement	Maple Lane Road/Holly Lane	Install a single-lane roundabout	Long-term	Unlikely
D38	Maple Lane Road/Walnut Grove Way Operational Enhancement	Maple Lane Road/Walnut Grove Way	Install a single-lane roundabout or realign Maple Lane Road in correlation with development	Long-term	Unlikely
D39	Beavercreek Road/Glen Oak Road Operational Enhancement	Beavercreek Road/Glen Oak Road	Install a roundabout	Long-term	Unlikely
D44	Beavercreek Road/Loder Road Extension Operational Enhancement	Beavercreek Road/Loder Road Extension	Install a roundabout	Medium-term	Likely
D46	Meyers Road West Extension	OR 213 to High School Avenue	Extend Meyers Road from OR 213 to High School Avenue as an Industrial Minor Arterial. Create a local street connection to Douglas Loop.	Short-term	Likely
D47	Meyers Road East extension	Beavercreek Road to the Meadow Lane Extension	Extend Meyers Road from Beavercreek Road to the Meadow Lane Extension as an Industrial Minor Arterial. Between the Holly Lane and Meadow Lane extensions, add a sidewalk and bike lane to the south side of the street, with a shared-use path to be added on north side per project S19. Modify the existing traffic signal at Beavercreek Road	Medium-term	Likely
D54	Clairmont Drive extension	Beavercreek Road to Holly Lane South Extension	Extend Clairmont Drive from Beavercreek Road to the Holly Lane South extension as an Industrial Collector. Add a sidewalk and bike lane to the south side of the street, with a shared-use path to be added on north side per project S17	Long-term	Likely
D55	Glen Oak Road extension	Beavercreek Road to the Meadow Lane Extension	Extend Glen Oak Road from Beavercreek Road to the Meadow Lane Extension as a Residential Collector. Install a roundabout at Beavercreek Road (per project D39)	Long-term	Likely
D56	Timbersky Way extension	Beavercreek Road to the Meadow Lane Extension	Extend Timbersky Way from Beavercreek Road to the Meadow Lane Extension as a Residential Collector. Add a sidewalk and bike lane to the south side of the street, with a shared-use path to be added on north side per project S20	Long-term	Likely

Table 2 – 2013 Oregon City Transportation System Plan Projects located in the southeast part of the City

Project #	Project Description	Project Extent	Project Elements	Priority	Funded ?
D57	Holly Lane South extension	Maple Lane Road to Thayer Road	Extend Holly Lane from maple Lane Road to Thayer Road as a Residential Collector. Add a sidewalk and bike lane to the west side of the street, with a shared-use path to be added on east side per project S14. Install a roundabout at Maple Lane Road (per project D37)	Medium-term	Likely
D58		Thayer Road to Meyers Road	Extend Holly Lane from Thayer Road to the Meyers Road extension as an Industrial Collector. Add a sidewalk and bike lane to the west side of the street, with a shared-use path to be added on east side per project S15	Medium-term	Likely
D59		Meyers Road to the Meadow Lane Extension	Extend Holly Lane from the Meyers Road extension to the Meadow Lane Extension as a Mixed-Use Collector. Add a sidewalk and bike lane to the west side of the street, with a shared-use path to be added on east side per project S16	Long-term	Likely
D64	Loder Road Extension	Beavercreek Road to Glen Oak Road	Extend Loder Road from Beavercreek Road to High School Avenue as an Industrial Collector. Add a sidewalk and bike lane to the west side of the street, with a shared-use path to be added on east side per project S18. Create a local street connection to Douglas Loop.	Short-term	Likely
D79	OR 213/Redland Road Capacity Improvements	Redland Road to Redland Road undercrossing	Add a third northbound travel lane on OR 213 north of the Redland Road undercrossing. Extend the third southbound travel on OR 213 south of the Redland Road intersection and merge the third lane before the Redland Road undercrossing. Add a right-turn lane (southbound OR 213 to westbound Redland). Convert the Redland Road approach to OR 213 to 1 receiving lane, 2 left-turn approach lanes, and 1 right-turn lane.	Long-term	Unlikely
D81	Beavercreek Road Upgrade	Clairmont Drive (CCC Entrance) to Meyers Road	Improve to Industrial Major Arterial cross-section	Medium-term	Likely
D82		Meyers Road to UGB	Improve to Residential Major Arterial cross-section	Long-term	Likely
B20	Holly Lane Bike Lanes	Donovan Road to Maple Lane Road	Add a bike lane to the west side of the street. A shared-use path will be added on east side per project S13	Included with project D83	Unlikely
B21	Maple Lane Bike Lanes	Walnut Grove Way to UGB	Add bike lanes to both sides of the street	Included with project D84	Unlikely
B22	Thayer Road Bike Lanes	Elder Road to UGB	Add bike lanes to both sides of the street	Long-term Phase 3	Unlikely
B23	Loder Road Bike Lanes	Beavercreek Road and the Holly Lane Extension	Add a bike lane to the north side of the street. A shared-use path will be added on south side per project S18	Included with project D85	Unlikely

Table 2 – 2013 Oregon City Transportation System Plan Projects located in the southeast part of the City

Project #	Project Description	Project Extent	Project Elements	Priority	Funded ?
B24	Loder Road Bike Lanes	Holly Lane Extension to the UGB	Add bike lanes to both sides of the street	Included with project D85	Unlikely
B25	High School Avenue Shared Roadway	Meyers Road to Glen Oak Road	Add wayfinding and shared lane markings	Long-term Phase 4	Unlikely
B26	Glen Oak Road Bike Lanes	Coquille Drive to Augusta Drive	Add bike lanes to both sides of the street	Long-term Phase 3	Unlikely
B27	Coquille Drive Shared Roadway	Glen Oak Road to Turtle Bay Drive	Add wayfinding and shared lane markings	Long-term Phase 4	Unlikely
B29	Beavercreek Road Bike Lanes	Pebble Beach Drive to UGB	Add bike lanes to both sides of the street	Included with project D82	Likely
W22	Holly Lane Sidewalk Infill	Donovan Road to Maple Lane Road	Complete sidewalk gaps on west side of the street. A shared-use path will be added on east side per project S13	Included with project D83	Unlikely
W23	Maple Lane Road Sidewalk Infill	Beavercreek Road to UGB	Complete sidewalk gaps on both sides of the street	Included with project D84	Unlikely
W24	Thayer Road Sidewalk Infill	Maple Lane Road to UGB	Complete sidewalk gaps on both sides of the street	Long-term Phase 3	Unlikely
W25	Loder Road Sidewalk Infill	Beavercreek Road to the Holly Lane Extension	Complete sidewalk gaps on north side of the street. A shared-use path will be added on south side per project S18.	Included with project D85	Unlikely
W26	Loder Road Sidewalk Infill	Holly Lane Extension to the UGB	Complete sidewalk gaps on both sides of the street	Included with project D85	Unlikely
W27	High School Avenue Sidewalk Infill	Meyers Road to Glen Oak Road	Complete sidewalk gaps on the west side of the street	Long-term Phase 3	Unlikely
W28	Glen Oak Road Sidewalk Infill	OR 213 to High School Avenue	Complete sidewalk gaps on both sides of the street	Long-term Phase 2	Unlikely
W29		Coquille Drive to Augusta Drive	Complete sidewalk gaps on both sides of the street	Long-term Phase 3	Unlikely
W31	OR 213 Sidewalk Infill	Molalla Avenue to Conway Drive	Complete sidewalk gaps on both sides of the street	Included with project D77	Unlikely



Conceptual Planned Area Connectivity Improvements Oregon City

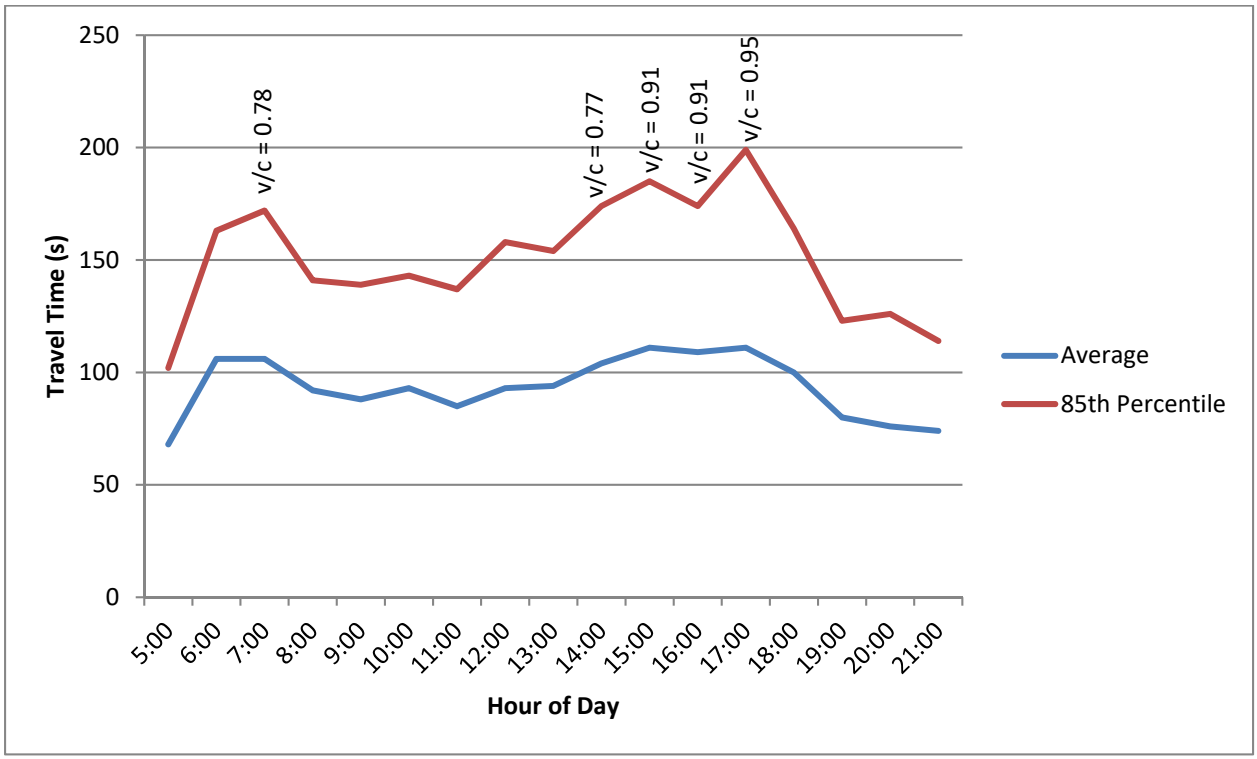
Figure 1

\\kittelson.com\fs\H_Projects\20\20651 - Hwy 213 and Beavercreek Rd\dwgs\Figs\Beaver_Creek_Plans_(expanded).dwg Nov 27, 2017 - 9:28am - bcullimore Layout Tab: Layout1

OPERATIONS

A travel time study was conducted at the OR213/Beavercreek Road intersection in January 2017 to evaluate the variability of traffic conditions throughout the day. This study utilized Bluetooth data collection units (BlueMAC) at each leg of the intersection to identify the travel speed and travel time for each movement (northbound left, northbound through, northbound right, etc.) separately[1]. The data was collected 24-hours per day for 7 days, allowing comparison of results by time of day and day of week. Appendix "C" provides the differences in travel time by time of day for each movement at the intersection. The data in Appendix "C" reflects typical weekday conditions (Tuesday, Wednesday, and Thursday). **Exhibit 3** shows the travel time through the intersection averaged for all movements. Note that the graph provides the average travel time to traverse the intersection; some movements may experience higher travel times. The weekday PM peak hour represents the highest travel times of the day, with higher than average travel times extending from 3:00 to 6:00 PM. Above average travel times also occur during weekday midday and AM peak hours. There are approximately 5 hours per day currently experiencing high travel times compared to the rest of the day which could indicate congestion and possible cycle failure for some movements. This can be considered in evaluating the potential performances measures in the following section.

Exhibit 3 – Travel Time through OR213/Beavercreek Road Intersection



[1] Data was collected at a distance of approximately 1000' from the intersection on each leg, with the exception of the north leg, where data was collected approximately 2000' from the intersection.

The cycle length of the traffic signal at the OR213/Beavercreek intersection is approximately 120 seconds. **Exhibit 3** shows that during the a.m. and p.m. peak hour periods, the average time it takes to traverse the intersection is 110 seconds. Average travel time and v/c ratio are not directly linked; however, the average travel times increase and decrease with v/c ratio. **Table 3** provides volume-to-capacity ratios for the five highest volume hours of the day[2]. These v/c ratios are noted on **Exhibit 3** during their corresponding hour.

Table 3 – 2017 Existing Intersection Operations for the Five Highest Volume Hours (OR213/Beavercreek Road)

Highest Hour	Time of Day	Total Entering Volume	V/C
1st	4-5 PM	6052	0.91
2nd	5-6 PM	5983	0.95
3rd	3-4 PM	5808	0.91
4th	2-3 PM	4948	0.77
5th	7-8 AM	4626	1.07[3]

[2] 2017 30th highest hour volumes were estimated by adjusting May 2017 count data by a seasonal factor of 7% to summer peak volumes.

[3] The v/c ratio for the AM peak hour is 1.07 due the high volume of westbound right-turns. If the westbound right-turns are excluded the intersection v/c is 0.78.

Section 5
Alternatives Analysis

ALTERNATIVES ANALYSIS

ALTERNATIVES DEVELOPMENT – OR213 AND BEAVERCREEK ROAD

Alternatives to modify the existing intersection configuration and traffic control, which would bring the intersection into compliance with the current mobility standards in the year 2035, were identified and include:

- Addition of lanes to current configuration,
- Quadrant road in the southwest quadrant of the intersection,
- Variations of displaced left-turns (also referred to as continuous flow intersection), and
- Grade-separated interchange forms.

The potential operational impacts of each alternative are shown in **Table 4** and evaluated for a variety of additional considerations in **Table 5**.

Alternative 1: Triple Left-Turns

To maintain the current mobility standard with the existing intersection control, a third southbound left-turn lane and a third northbound through lane through the intersection would be required to bring the intersection back to a v/c ratio of 0.90. A conceptual sketch of Alternative 1 can be seen in **Exhibit 4**. The existing separate northbound right-turn lane (not reflected in **Exhibit 4**) would be maintained. The effectiveness of the additional northbound through lane is dependent on the planned extension of Meyers Road from Beavercreek Road to OR213 which would allow some eastbound right-turns at the intersection to be converted to northbound through movements based on the new network connectivity.

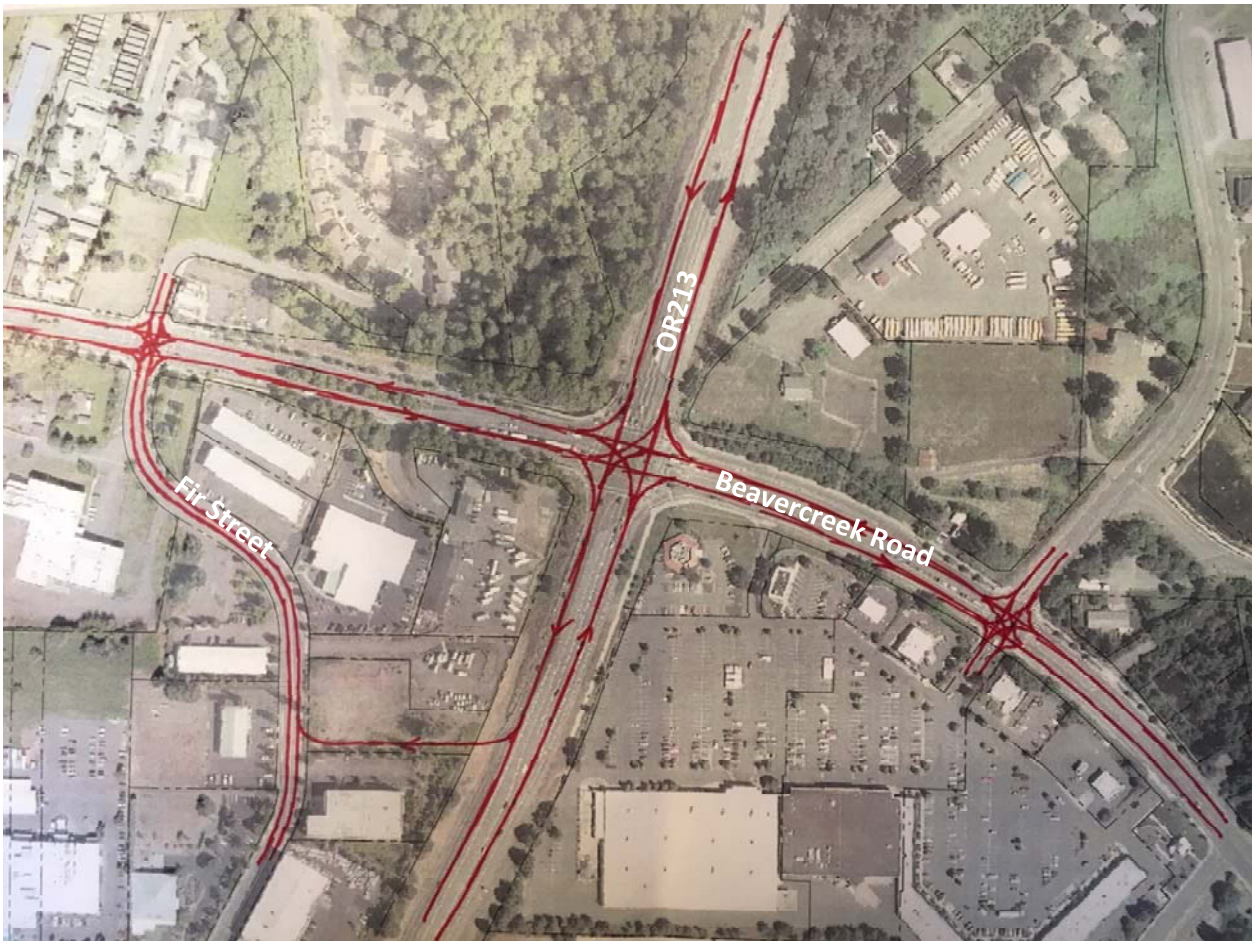
Exhibit 4 – Alternative 1: Triple Left-Turns



Alternative 2: Quadrant Road

A quadrant road, or indirect left, in the southwest corner of the intersection would allow southbound left-turns to be prohibited at the OR213/Beavercreek Road intersection. These vehicles would instead travel southbound through the intersection, turn right onto a new street to the south that would connect to Fir Street, and make a right-turn onto Beavercreek Road to continue east on their desired route. A third southbound through lane and third eastbound through lane would be necessary to accommodate the large volumes traveling through the intersection twice instead of once. This would reduce overall intersection delay but increase travel time for the southbound left-turn movement. The widening is likely to impact the culvert and retaining walls on the northwest and northeast corners of the intersection. The parcel where the connection to Fir Street shown in **Exhibit 5** is currently under development, making this connection infeasible. A quadrant road on the southeast corner was also considered, but the additional travel time incurred by circling the shopping center, or the impacts of cutting through the shopping center, made this alternative infeasible.

Exhibit 5 – Alternative 2: Quadrant Road Alternative



Alternatives 3 & 4: Displaced Left-Turns

In a displaced left-turn[4], or continuous flow, intersection, left-turns are removed from the main intersection and relocated to a new upstream signal. With proper coordination, vehicles are able to make a left-turn simultaneously with opposing through traffic. Displaced left-turn intersection alternatives would reduce the number of signal phases and conflict points in the OR213/Beavercreek Road intersection, thereby improving capacity and safety, but would require coordinated partial signals on the approaches with displaced left-turns. The heaviest left-turn movements at the OR213/Beavercreek Road intersection are on the southbound and eastbound approaches. **Exhibit 6** shows a sketch of a displaced left-turn for the southbound approach only. **Exhibit 7** shows a sketch of displaced left-turns for both the southbound and eastbound approaches. In either case, the southbound approach requires dual left-turn lanes. Consideration could be given to prohibiting the northbound and westbound left-turn movements as these movements have minimal traffic volumes and have alternate routes; however, these restrictions are not mandatory. Additional analysis (microsimulation) is necessary to fully understand the benefits of these potential restrictions.

Alternative 3 includes impacts to the culvert and retaining walls in the northeast corner of the intersection. Alternative 4 includes culvert and retaining wall impacts to both the northwest and northeast corners of the intersection.

[4] Steyn, H., Z. Bugg, B. Ray, and A. Daleiden. *Displaced Left-Turn Informational Guide.* FHWA, Washington, D.C., 2014. http://safety.fhwa.dot.gov/intersection/alter_design/pdf/fhwasa14068_dlt_infoguide.pdf

Exhibit 6 – Alternative 3: Displaced Southbound Left-Turns

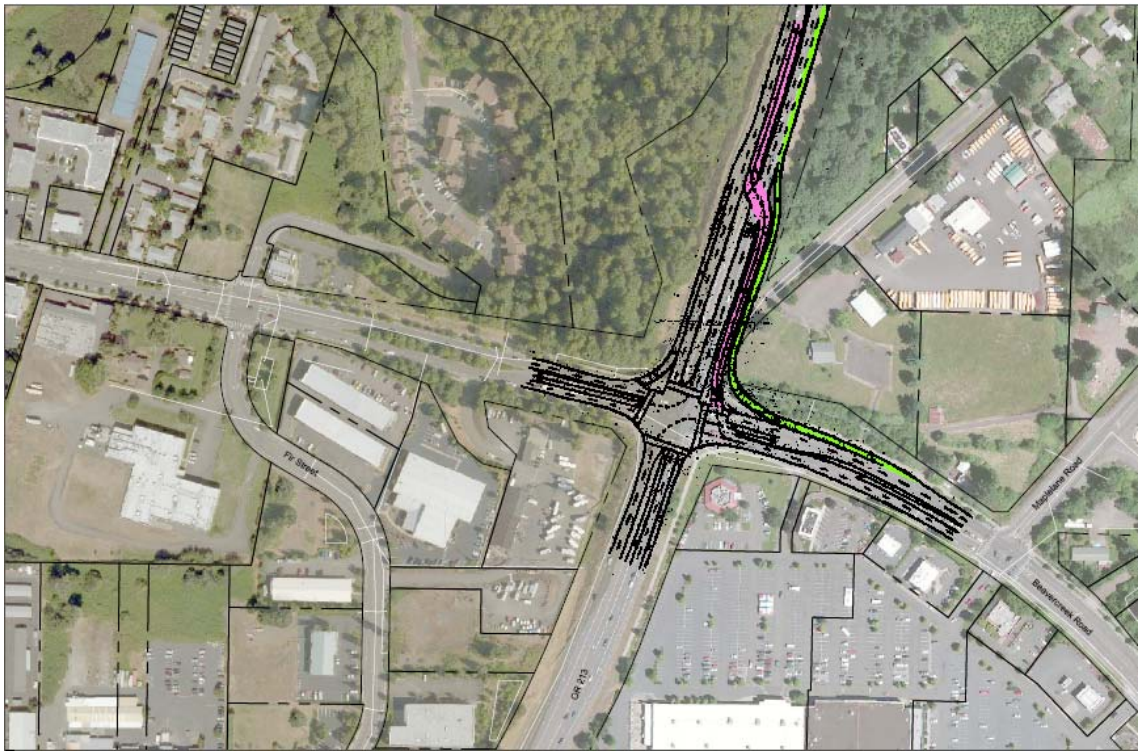


Exhibit 7 – Alternative 4: Displaced Southbound and Eastbound Left-Turns



Alternatives 5 – 7: Grade-Separated Interchange Alternatives

Several grade-separated interchange configurations were considered including full diamond, half diamond (i.e., southbound off-ramp and northbound on-ramp only) and single-point interchanges. A project to construct an interchange at this location was removed from the 2013 TSP Update. The interchange was eliminated due to livability, multi-modal access and funding constraints within the 2035 planning horizon. Additionally, at the request of ODOT as it was determined to be financially infeasible given other regional priorities. The construction of an interchange at the OR213/Beavercreek Road intersection would have many challenges and impacts on surrounding land uses as shown in **Exhibit 8** through **Exhibit 10**.

Exhibit 8 – Alternative 5: Half Diamond Interchange Alternative

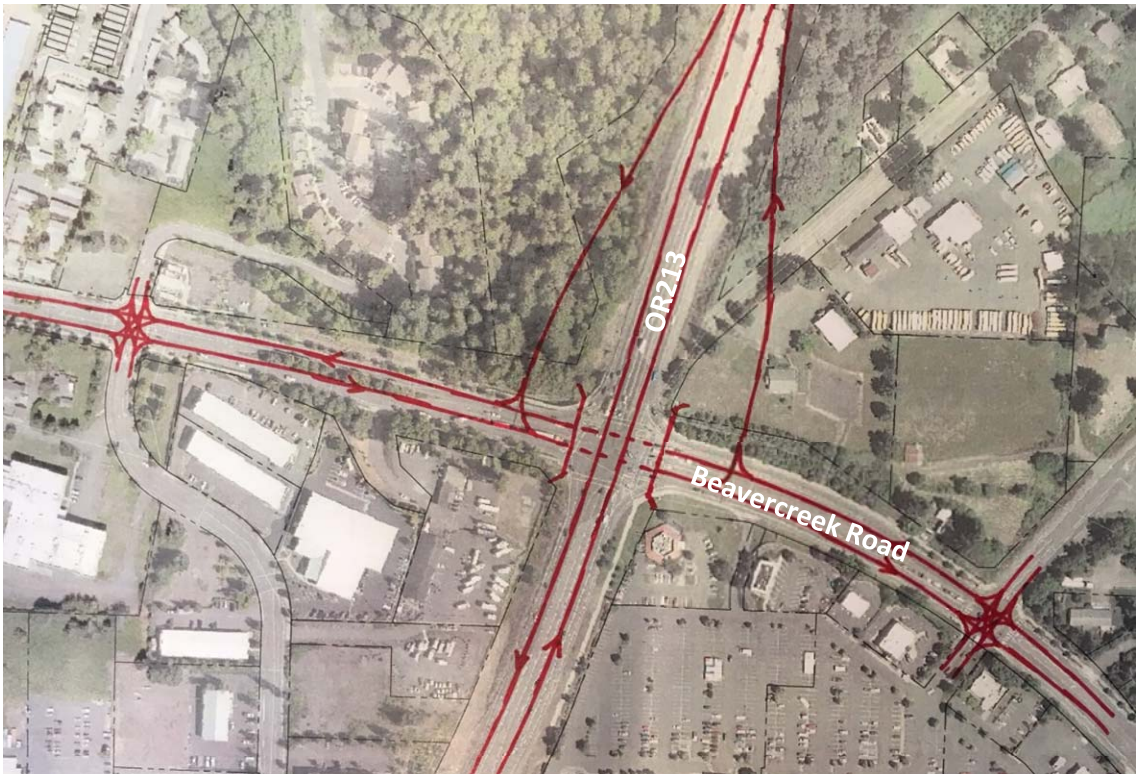


Exhibit 9 – Alternative 6: Full Diamond Interchange Alternative

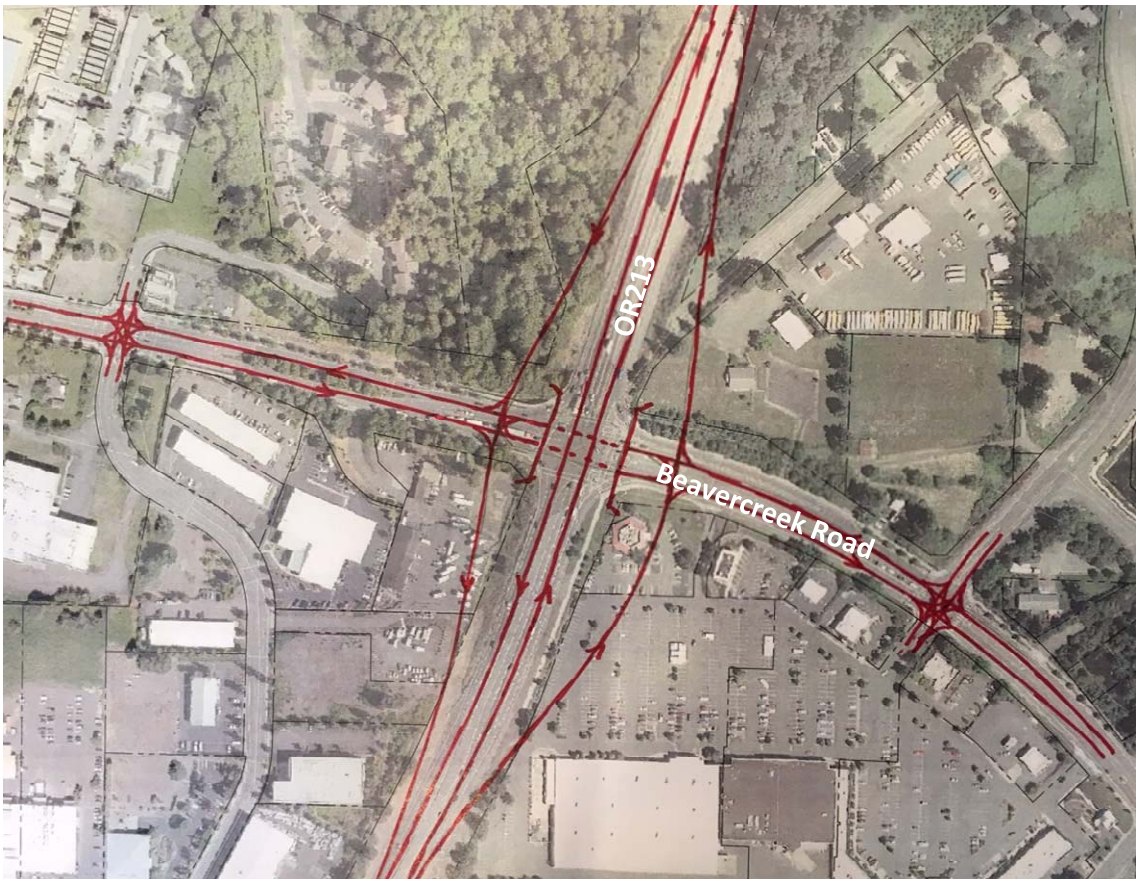
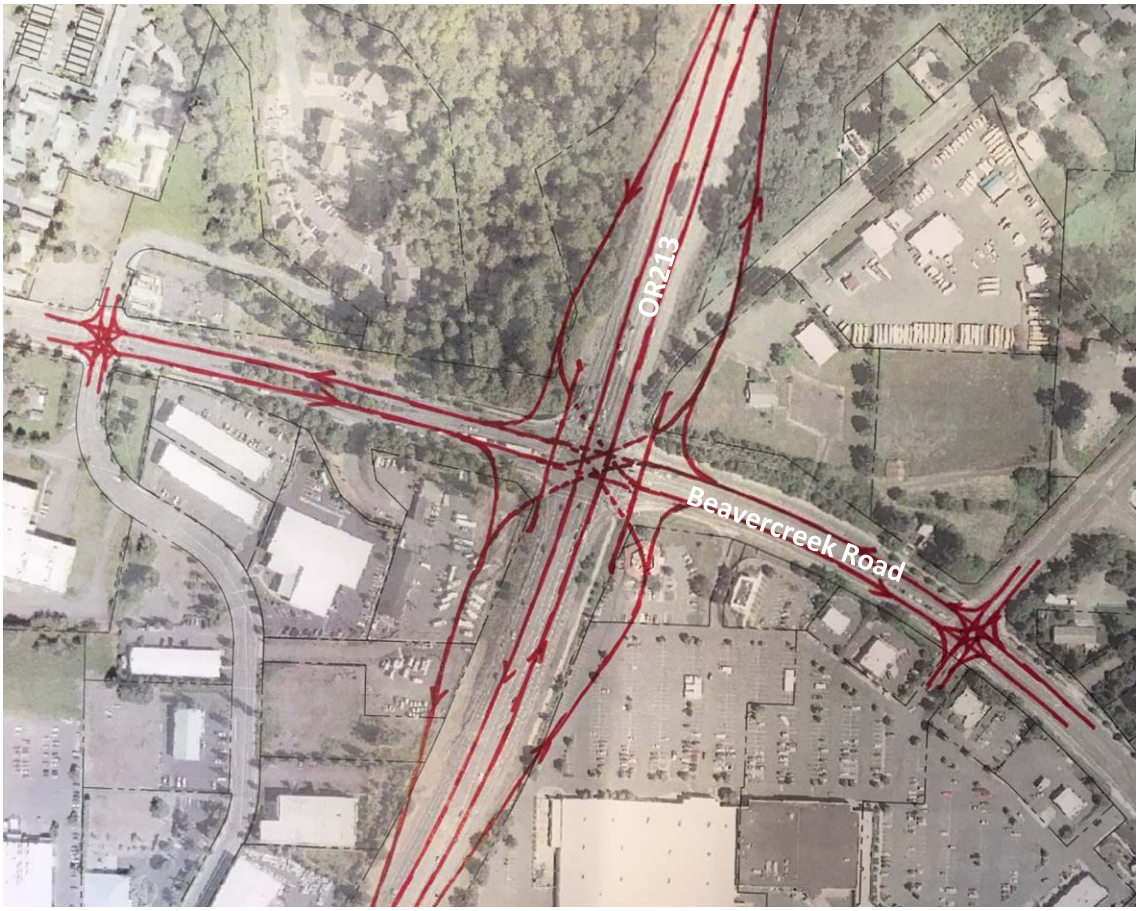


Exhibit 10 – Alternative 7: Single Point Interchange Alternative



ALTERNATIVES EVALUATION – OR213 AND BEAVERCREEK ROAD

The following provides an overview of operational analysis conducted on each alternative and summarizes the qualitative assessment for each alternative.

Operations Analysis

Planning level operational analysis was conducted using the CAP-X tool developed by FHWA[5], which can be used to evaluate alternative intersection forms and interchanges. The tool provides a total intersection (v/c) ratio. It was used for all alternatives to provide a consistent comparison of alternatives, but was found to be less conservative than Synchro in the base condition. **Table 4** summarizes the v/c ratios provided by CAP-X for each alternative. If one of these alternatives is identified as potential viable solution, it should be modeled in VISSIM to refine the forecast v/c ratio.

[5] Transportation Systems Institute (TSI). *Capacity Analysis for Planning of Junctions*. Version 1.2. 2011. http://tsi.cecs.ucf.edu/index.php/cap-x

Table 4 – CAP-X Alternatives Operations Analysis Summary (Year 2035[6])

Alternative		v/c	Exhibit
1	Lane Additions: Triple Southbound Left-Turn Lanes and Three Northbound Thru Lanes	0.90	Exhibit 4
2	Indirect Left (S/W Quadrant Road) with Three Southbound and Eastbound Thru Lanes	0.94	Exhibit 5
3	Southbound Displaced Left-Turn	0.86	Exhibit 6
4	Southbound and Eastbound Displaced Left-Turns	0.81	Exhibit 7
5	Full Diamond Interchange with Dual Eastbound and Westbound Left-Turn Lanes	0.82	Exhibit 8
6	Half Diamond Interchange with Dual Eastbound Left-Turn Lanes	0.79	Exhibit 9
7	Single Point Interchange with Dual Eastbound and Westbound Left-Turn Lanes	0.80	Exhibit 10

As shown, all alternatives meet the mobility target. Differences on their costs and impacts are provided in the following section.

Alternatives Assessment

Each of the alternatives was qualitatively evaluated for its impact to the intersection capacity, right-of-way impacts, environmental impact, bicycle and pedestrian impacts, cost, connectivity, and dependence on other projects. These factors are discussed below and summarized in **Table 5**.

Capacity

Each of the alternatives provides sufficient capacity to meet the current mobility standard in 2035. However, the triple left-turns and indirect left alternatives (Alternatives 1 and 2) still have an overall v/c ratio equal or greater than 0.90 and may represent a short-term fix rather than a long-term solution or may not provide benefit commensurate with the costs. The displaced left-turn alternatives (Alternatives 3 and 4) provide additional capacity nearly equal to the grade-separated interchange alternatives (Alternatives 5, 6 and 7) at a significantly lower cost.

Right-of-Way Impacts

Alternatives 1, 3, and 4 may be feasible within the existing right-of-way. Alternative 2 would require right-of-way through a vacant but developing parcel to connect OR213 to Fir Street. All of the grade separated interchange alternatives include large impacts to the right-of-way. The half diamond interchange reduces right-of-way takes as compared to the full diamond interchange without eliminating necessary movements through the intersection.

[6] 2035 30th highest hour volumes were estimated by adjusting winter count data by a seasonal factor of 8.5% to summer peak volumes. The count data, 2015 Base Year and 2040 Future Year volumes were post-processed using the NCHRP 255 methodology to produce 2035 turning movement volumes at each intersection.

Environmental Impacts

For all alternatives, any widening on the north side of Beavercreek Road, east or west of OR213 would impact the stream and wetlands and require mitigation. They would also require extending the existing culvert crossing under OR213 on the north side of Beavercreek Road and reconstruction of the retaining walls in the northwest and northeast corners of the intersection. Additional investigation is necessary to fully understand the costs of these potential impacts and to determine if the culvert can be extended or has to be upgraded or if the widening could be accommodated utilizing existing right-of-way on the south side of Beavercreek Road.

Alternative 1 is the only alternative with the potential to not impact the northwest and northeast corners. Alternative 3 may impact the northeast corner only. Alternatives 2 and 4 would impact the northwest and northeast corners and Alternatives 5, 6, and 7 would have significant impacts in the northwest and northeast quadrants.

Bicycle and Pedestrian Impacts

All alternatives can accommodate bicycles and pedestrians; however, Alternatives 1 and 2 include additional through lanes and would increase the intersection crossing distances which is an undesirable impact. Alternatives 3 and 4 reduce the crossing distances but result in two-stage crossing of some legs of the intersection. Alternatives 5, 6, and 7 increase and decrease crossing distances depending on the leg of the intersection and result in cyclists and pedestrians navigating two major intersections instead of one.

Cost

The costs of adding additional lanes, indirect lefts, or displaced left-turns are all of similar magnitude and may require extending or reconstructing the culvert and reconstructing retaining walls. Alternatives 3 and 4 also require the addition of partial signals on one or both of the southbound and eastbound legs of the intersection, respectively. Each of the interchange alternatives (Alternatives 5, 6 and 7) are assumed to be cost-prohibitive at a minimum cost of $25,000,000.

Connectivity

Turning movements to and from the south leg of OR213 are minimal due to the presence of parallel routes and/or other road network connections. The half diamond interchange alternative (Alternative 6) eliminates these movements, thereby improving capacity at the intersection. There is the potential to further improve the capacity of the displaced left-turn alternatives (Alternatives 3 and 4) by prohibiting the northbound and westbound left-turn movements as these movements have minimal traffic volumes; however, this is not a requirement of the alternatives. The connectivity improvements in the TSP are important to the flexibility and viability of these alternatives.

Dependence on Other Projects

As noted in the discussion of connectivity above, the half diamond interchange alternative (Alternative 6) is dependent on other projects in the area to provide the parallel routes necessary to accommodate the movements eliminated from the OR213/Beavercreek Road intersection. The practicality of the additional northbound through lane in the triple left-turns alternative (Alternative 1) is also dependent on the provision of road extensions, particularly the planned Meyers Road extension to OR213.

Table 5 – Alternatives Evaluation

Alternative		Additional Capacity	Right-of-Way Impacts	Environmental Impact	Bike/Ped Impacts	Cost	Eliminates Movements?
	Existing	None	None	None	No Improvement	NA	No
1	Triple Southbound Left / Three Northbound Thru	Some	None to Minimal	None to Minimal	Increased Crossing Distances	Medium ($5-$10M)	No
2A	Indirect Left (S/W Quadrant Road)	Some v/c=0.90	New Connection on Industrial Land	NW and NE Corners	Increased Crossing Distances	Medium ($5-$8M)	No
2B	Indirect Left (S/W and S/E Quadrant Roads)	Unknown	New Connection on Industrial Land and Shopping Center Impacts	NW and NE Corners	Increased Crossing Distances	Medium ($10-$15M)	No
3	Southbound Displaced Left-Turn	Significant v/c=0.86	None to Minimal	NE Corner	Reduced Crossing Distances	Medium ($5-$10M)	Would provide additional benefit
4	Southbound and Eastbound Displaced Left-Turns	Significant v/c=0.81	None to Minimal	NW and NE Corners	Reduced Crossing Distances	Medium ($8-$12M)	Would provide additional benefit
5	Full Diamond Interchange	Significant v/c=0.82	High	NW and NE Quadrants	Two intersections	High (>$25M)	No
6	Half Diamond Interchange	Significant v/c=0.79	High	NW and NE Quadrants	Two intersections	High (>$25M)	Yes
7	Single Point Interchange	Significant v/c=0.80	High	NW and NE Quadrants	Increased Crossing Distances	High (>$25M)	No

The following alternatives were identified for further review to determine physical and financial feasibility:

- Alternative 1: Triple Left-Turns
- Alternative 3: Displaced Southbound Left-Turns
- Alternatives 5 & 7: Full Diamond Interchange and Single Point Interchange

Table 6 lists these alternatives, as well as their relative benefits, constraints, opportunities, and risks.

Table 6 – Intersection Alternatives Considered

Alternative	Benefits	Opportunities	Constraints	Risks
Alternative 1: Triple Left-Turns	Meets current mobility target in 2035	North and east legs of intersection	Cost; vehicle navigation of three left-turn lanes	Increase sideswipe crashes through turn and downstream weave
Alternative 3: Displaced Southbound Left Turns	Meets current mobility target in 2035	North leg of intersection	Cost; impact to existing culvert and retaining walls	Driver confusion with new intersection type for Oregon
Alternative 5: Full Diamond Interchange	Meets current mobility target in 2035; greatly increases capacity for through traffic on OR213	All approaches of the intersection	Cost; right-of-way	Increased intersection exposure (i.e., two large ramp terminals) for pedestrians and bicyclists
Alternative 7: Single-Point Interchange	Meets current mobility target in 2035; greatly increases capacity for through traffic on OR213	All approaches of the intersection	Cost; right-of-way	

Potential improvements for the intersection of Beavercreek Road and OR213 that focused on significantly increasing the intersection capacity to meet the current mobility target were presented to the TAG and CAG in December 2016 and January 2017. None of the alternatives were determined to be financially feasible, even by the 2035 horizon year of the TSP given the financial constraints of the city and other agency partners. In addition, some of the potential alternatives could have additional consequences including right-of-way impacts, environmental impacts, and could potentially complicate the provision of services for bicyclists, pedestrians, and transit users. These alternatives can be further considered in the future if additional funding becomes available.

ALTERNATIVES – OR213 AND REDLAND ROAD

As Phase 2 of the "Jughandle" Project (D79 in the TSP) has already been identified to resolve capacity deficiencies at OR213/Redland Road, no additional alternatives were developed for the intersection.

Section 6
Alternative Mobility Target and Financially Feasible Improvements Assessment

ALTERNATIVE MOBILITY TARGET AND FINANCIALLY FEASIBLE IMPROVEMENTS ASSESSMENT

ALTERNATIVE MOBILITY TARGET

The OR213/Beavercreek Road and OR213/Redland Road intersections are currently experiencing deficiencies in capacity and safety for vehicular modes of travel. Mobility is currently measured by using v/c to measure the average level of congestion for motorists entering all legs of an intersection. Technical Memo #2 in Appendix "A" documents the menu of performance measure options that were discussed with the TAG and CAG to measure congestion both at an intersection and along the Highway 213 corridor, from Redland Road to Molalla Avenue.

The majority of TAG and CAG members agreed that an alternative mobility target allowing intersection volume-to-capacity ratios to exceed the existing targets for no more than a specified number of hours per day would be appropriate for the corridor based on a range of considerations including ease of application and applicability to development review. The following sections describe the safety and operational analysis that was used to recommend cost-feasible improvements and corresponding alternative mobility targets.

SAFETY AND CAPACITY ANALYSIS

The TSP does not identify a large capacity project at the intersection of OR213 and Beavercreek Road, but several smaller feasible projects are identified. The TSP identifies a large capacity project at the intersection of OR213 and Redland Road, but it is not likely to be funded. Because achieving the mobility standard through a major capacity-expanding project at these intersections has been determined to be beyond the financial capabilities of the city and its partner agencies, an alternative mobility target will be necessary. As a result of this study, some improvements were identified that, while not allowing the mobility standard to be fully met, would increase the intersection capacity, improve safety, and are within the financial capabilities of the city and its partner agencies. Safety and operational improvements are identified below that minimize future congestion and can be included in the cost-constrained TSP.

SAFETY AND CAPACITY IMPROVEMENTS

Safety and capacity improvements to OR213 from Redland Road to Molalla Avenue (including the Beavercreek Road intersection) could be implemented in tandem with the proposed alternative mobility targets. These approaches, while not providing adequate capacity to meet the current mobility target, would increase capacity and/or safety at the intersection, providing an overall improvement. **Table 7** lists these improvements, as well as their relative benefits, constraints, opportunities, and risks.

Table 7 – Intersection Improvement Approaches Considered

Improvement	Benefits	Opportunities	Constraints	Risks
Increase all-red time	Reduces red-light running crashes, particularly turning and angle crashes	All approaches of the intersection	Reduces intersection capacity and increases queueing. Helps reduce turning and angle crashes, which are not prevalent at this intersection.	Increase rear-end crashes, the most common type at signalized intersection
Install red-light cameras	Reduces red-light running crashes, particularly turning and angle crashes	All approaches of the intersection	Community Opposition. Helps reduce turning and angle crashes, which are not prevalent at this intersection.	Increase rear-end crashes, the most common type at signalized intersection
Increase shoulder width	Safer bicycle travel	North leg of intersection	Costs/Impacts to retaining wall	N/A
Improve lighting	Increase safety for all modes	North and south legs of intersection	N/A	N/A
Provide merge lane for WB to NB right turning vehicles	Reduce queuing between OR213 and Maple Lane, and increase capacity of westbound approach	North leg of intersection	Retaining wall in northeast corner of the intersection	Increase sideswipe crashes
Eliminate westbound left-turn lane and extend eastbound left turn storage onto Maple Lane	Reduce queuing and crashes related to queues on Beavercreek Road at Maple Lane	East leg of intersection	Rerouting of westbound lefts to Meyers Road and potential increased travel time	Confusion by drivers resulting in illegal maneuvers

The TAG and CAG were in favor of further investigation of potential improvements to increase safety and capacity at the Beavercreek Road and OR213 intersection. The specific projects identified by the TAG and CAG for additional analysis included: 1) the provision of a merge lane for westbound right-turning vehicles and 2) elimination of the second westbound left-turn lane to increase left-turn storage on eastbound Beavercreek Road at Maple Lane Road. The provision of a westbound right-turn merge lane is described in the following sections and shown in **Figure 2**. The elimination of the second westbound left-turn lane to increase left-turn storage on eastbound Beavercreek Road at Maple Lane Road was highly supported by the CAG and was found to be viable and not impact the intersection v/c ratio; however it is recommended that this be considered at a later date in combination with potential improvements at the Beavercreek Road/Maple Lane intersection.

Beavercreek Road - Right Turn Reconfiguration

Conceptual Design Subject to Change
Date: March 30, 2017

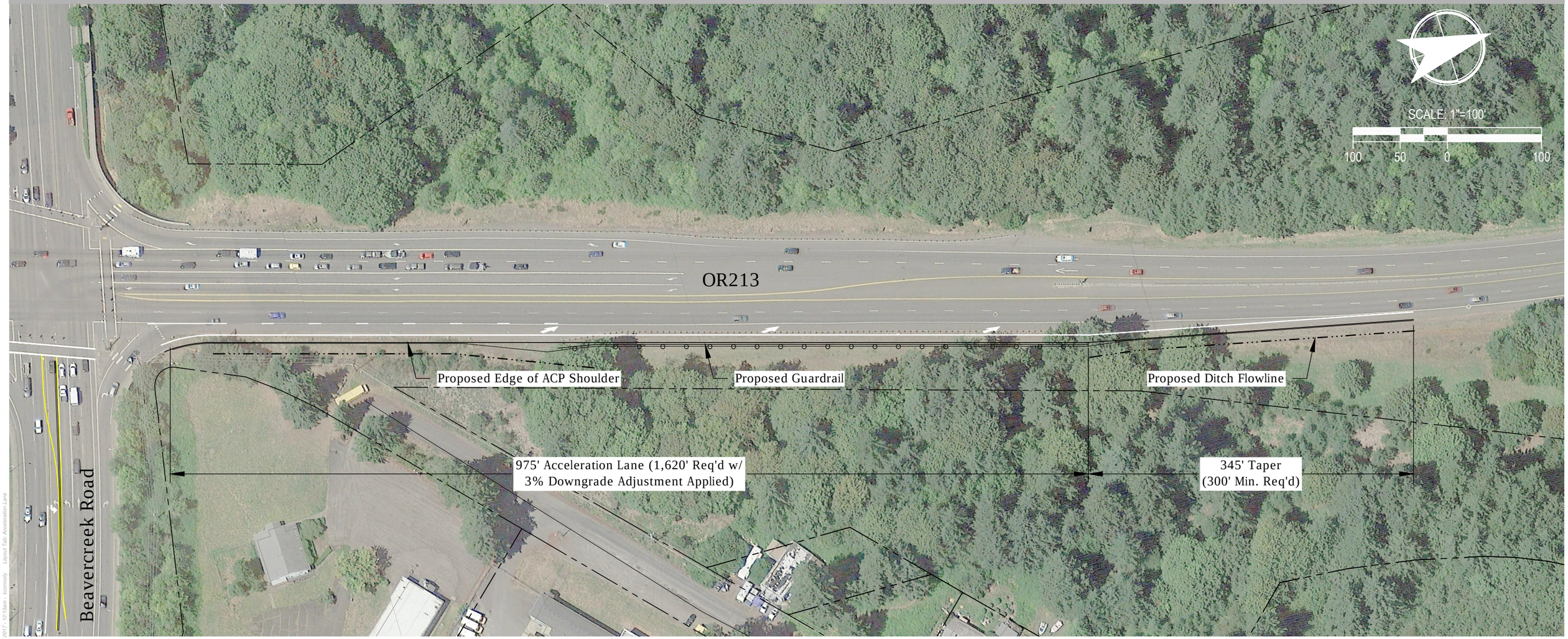


Figure 2

KITTELSON & ASSOCIATES
PHONE: (503) 228-5230 CONTACT: Susan Wright or Hermanus Steyn

OR213 & Beavercreek Road
City of Oregon City

H:\20\20681 - Hwy 213 and Beavercreek Rd\dwgs\design\RT Turn Lane Add\20681-Exhb-RT Lane Add-2017-03-30.dwg Dec 05, 2017 - 12:13am - kconnolly Layout Tab: Acceleration Lane

Additional safety improvements identified by the City for further investigation, or to be included as part of future projects in the area include:

- Install intersection enhancements including potential raised crosswalks, bike lane striping continuation, ladder-style crosswalks, and lane narrowing.
- Add wayfinding signage for people walking and biking.
- Enhance bike lanes on Beavercreek Road with additional markings and green striping in transition areas.
- Add buffers to bike lanes on Beavercreek Road where feasible.
- Add ADA curb ramps in the OR213/Beavercreek Road area where missing.
- Add pedestrian facilities to Maple Lane Road between Beavercreek Road and Thayer Road.
- Add transit stop amenities to existing stops in the area.

The following provides an overview of safety and operations at OR213/Beavercreek Road and OR213/Redland Road, and cost estimates of potential cost-feasible safety and operational improvements that could be implemented at the OR213/Beavercreek Road intersection in conjunction with alternative mobility targets.

Safety Analysis

The OR213/Beavercreek Road intersection was identified in the 2013 TSP as a high collision intersection. The Oregon Department of Transportation (ODOT) Crash Analysis and Reporting Unit provided crash records at the intersection for the 5-year period from January 2010 through December 2014. **Table 8** summarizes the reported crash data. The crash data is included in Appendix "D".

Table 8 - OR213/Beavercreek Road Intersection Crash Summary and Crash Rate Assessment (2010-2014)

Crash Type				Severity			Total	Critical Crash Rate by Intersection Type	Critical Crash Rate by Volume	Observed Crash Rate at Intersection	Observed Crash Rate>Critical Crash Rate?
Rear-End	Turning	Angle	Other	PDO	Injury	Fatal					
116	7	5	5	58	74	1	133	0.59	0.50	1.20	Yes

PDO = Property Damage Only
Crash Rate = crashes per million entering vehicles

The intersection was in the top 5% of the ODOT Safety Priority Index System (SPIS) List for the years 2012-2014. The SPIS List is maintained by ODOT and updated each year with the latest available year of crash records and traffic volumes. 2012-2014 is the most current SPIS list. The intersection also has a crash rate that exceeds the Critical Crash Rate meaning that it exceeds the crash rate of other comparable intersections.

As shown in **Table 8**, the most predominant crash type at the OR213/Beavercreek Road intersection is rear-end crashes. Beavercreek Road is the first at-grade intersection on OR213 for over two miles south of Redland Road, in a corridor that generally feels rural. A lack of driver expectation of southbound queues from the signal may contribute to the high number of reported rear-end crashes at the

intersection. The reported fatality occurred in 2011, and was an angle crash in which the driver ran a red light under dark and rainy conditions. The 2010-2014 crash rate of 1.20 is already lower than the crash rate of 2.05 identified in the 2013 TSP, indicating that safety and/or driver attentiveness have improved in recent years. Lengthening the dual eastbound left-turn lanes to provide additional storage (Project D27; funded) and an advanced queue warning system on southbound 213 will further improve safety at the intersection.

Crash data for the OR213/Redland Road intersection was obtained from the February 2017 Serres Farm Annexation Traffic Impact Study for the 3-year period from January 2013 through December 2015. **Table 9** summarizes the reported crash data. The crash data is included in Appendix "D".

Table 9 - OR213/Redland Road Intersection Crash Summary and Crash Rate Assessment (2013-2015)

Crash Type				Severity			Total	Critical Crash Rate by Intersection Type	Critical Crash Rate by Volume	Observed Crash Rate at Intersection	Observed Crash Rate>Critical Crash Rate?
Rear-End	Turning	Angle	Other	PDO	Injury	Fatal					
22	4	0	1	8	19	0	27	0.39	0.54	0.44	Yes

PDO = Property Damage Only
Crash Rate = crashes per million entering vehicles

Both the OR213/Beavercreek Road and OR213/Redland Road intersections have observed crash rates which exceed the Critical Crash Rate, meaning that they exceed the crash rate of other comparable intersections. For this reason, applicable TSP planned improvements and other potential improvements were analyzed at each intersection to determine their impact on the expected crash frequency at each intersection. **Table 10** summarizes the improvements in the TSP.

Table 10 – 2013 Oregon City Transportation System Plan Projects located in the southeast part of the City

Project #	Project Description	Project Extent	Project Elements	Priority	Funded?
D14	Southbound OR 213 Advanced Warning System	Southbound OR 213, north of the Beavercreek Road intersection	Install a queue warning system for southbound drivers on OR 213 to automatically detect queues and warn motorists in advance via a Variable Message Sign	Short-term	Likely
D79	OR 213/Redland Road Capacity Improvements	Redland Road to Redland Road Undercrossing	Add a third northbound travel lane on OR 213 north of the Redland Road undercrossing. Extend the third southbound travel on OR 213 south of the Redland Road intersection and merge the third lane before the Redland Road undercrossing. Add a right-turn lane (southbound OR 213 to westbound Redland). Convert the Redland Road approach to OR 213 to 1 receiving lane, 2 left-turn approach lanes, and 1 right-turn lane.	Long-term	Not Likely

In addition to these planned improvements, the impact of a westbound right-turn merge lane at OR213/Beavercreek Road and an additional southbound through lane (shared with the southbound right-turn lane) at OR213/Redland Road were analyzed. The intersections and improvements were analyzed

using HiSafe[7] software and crash modification factors (CMF) from the CMF Clearinghouse. **Tables 11 and 12** show the 2035 expected annual crashes with and without these improvements.

Table 11 – OR213/Beavercreek Road 2035 Expected Annual Crashes

Existing Configuration	With Westbound Right-Turn Merge Lane (CMF #295 applied to westbound rear-end crashes)	With Southbound Advanced Queue Warning System (CMF #76 applied to southbound rear-end injury crashes)	With Both Improvements
26.39	25.75	25.77	25.13
-	-2.4%	-2.3%	-4.8%

Table 12 – OR213/Redland Road 2035 Expected Annual Crashes

Existing Configuration	With 3rd Southbound Through/Right Lane (CMF #7924 applied to southbound crashes)	With 3 Northbound and 3 Southbound Through Lanes (CMF #7924 applied to northbound and southbound crashes)
8.82	8.24	7.92
-	-6.6%	-10.2%

As shown in **Tables 11 and 12**, the planned TSP and potential financially feasible improvements will reduce the number of expected annual crashes at the OR213/Beavercreek Road and OR213/Redland Road intersections. The potential financially feasible improvements at OR213/Beavercreek Road are predicted to reduce crashes at the intersection by almost 5%, and planned improvements at OR213/Redland Road are predicted to reduce crashes by more than 10%.

Operations Analysis

Count data for OR213 at Beavercreek Road and Redland Road was collected in May 2017. The five highest volume hours were collected for each intersection, based on historical count data at the OR213/Beavercreek Road intersection, under the assumption that they follow the same hourly volume profile. Due to the large amount of commuter traffic from outlying communities, a large portion of the traffic through each intersection is made up of the same vehicles a matter of seconds apart. The raw count data can be found in Appendix "E". The raw data represents annual average conditions and was adjusted to represent summer peak volumes[8]. The adjustment calculations can be found in Appendix "E".

[7] HiSafe companion software to the Highway Safety Manual (HSM) applies HSM Predicative Method for estimating the average number of expected annual crashes for quantitative assessment of safety performance.

[8] In order to calculate the 30th highest hour, the data was seasonally adjusted to summer peak volumes using the average of two representative Automatic Traffic Recorder (ATR) locations in Clackamas County (03-017 and 03-018). A factor of 7% was calculated using the procedures outlined in ODOT's Analysis Procedures Manual (APM) and applied to the May counts to adjust them to summer peak volumes.

Metro provided 2015 Base Year and 2040 Future Year hourly turn movement volumes for OR213/Beavercreek Road and OR213/Redland Road. These volumes reflect the most current land use assumptions and include full build-out of Oregon City's urban growth boundary areas in addition to growth in the rest of the region, including through traffic from outlying communities. These hourly plots can be found in Appendix "E". The count data, 2015 Base Year and 2040 Future Year volumes were post-processed using the NCHRP 255[9] methodology to produce 2040 turning movement volumes at each intersection under both the annual average and 30th highest hour conditions. The calculations for this process can be found in Appendix "E".

A Synchro (traffic model used to evaluate v/c ratios and other metrics) analysis was conducted for the five highest traffic volume hours at the OR213/Beavercreek Road and OR213/Redland Road intersections under both the annual average (typical May peak hours) and 30th highest hour (typical August peak hour) conditions. The results of this analysis are summarized in **Tables 13 and 14**. The full reports can be found in Appendix "F".

Table 13 – 2040 Synchro Volume-to-Capacity Analysis Summary: Annual Average Conditions

Scenario	Peak Hour 4:00 pm	2nd Highest Hour 5:00 pm	3rd Highest Hour 3:00 pm	4th Highest Hour 2:00 pm	5th Highest Hour 7:00 am
213/Beavercreek	1.11	1.11	1.10	0.96	1.34[1]
213/Beavercreek with Right-Turn Merge Lane	0.98	1.00	0.99	0.87	0.90
213/Redland	1.10	1.09	1.04	0.99	0.91

[1]The 5th highest overall volume hour at OR213/Beavercreek Road under the existing intersection configuration has a higher v/c because certain movements in this hour exhibit higher volumes than in the peak hour. For example, during the morning peak the westbound right-turn movement is significantly higher than during the afternoon peak, impacting v/c.

Table 14 – 2040 Synchro Volume-to-Capacity Analysis Summary: 30th Highest Hour Conditions

Scenario	Peak Hour 4:00 pm	2nd Highest Hour 5:00 pm	3rd Highest Hour 3:00 pm	4th Highest Hour 2:00 pm	5th Highest Hour 7:00 am
213/Beavercreek	1.15	1.15	1.14	1.00	1.39[1]
213/Beavercreek with Right-Turn Merge Lane	1.01	1.04	1.03	0.90	0.93
213/Redland	1.13	1.12	1.07	1.02	0.94

[1]The 5th highest overall volume hour at OR213/Beavercreek Road under the existing intersection configuration has a higher v/c because certain movements in this hour exhibit higher volumes than in the peak hour. For example, during the morning peak the westbound right-turn movement is significantly higher than during the afternoon peak, impacting v/c.

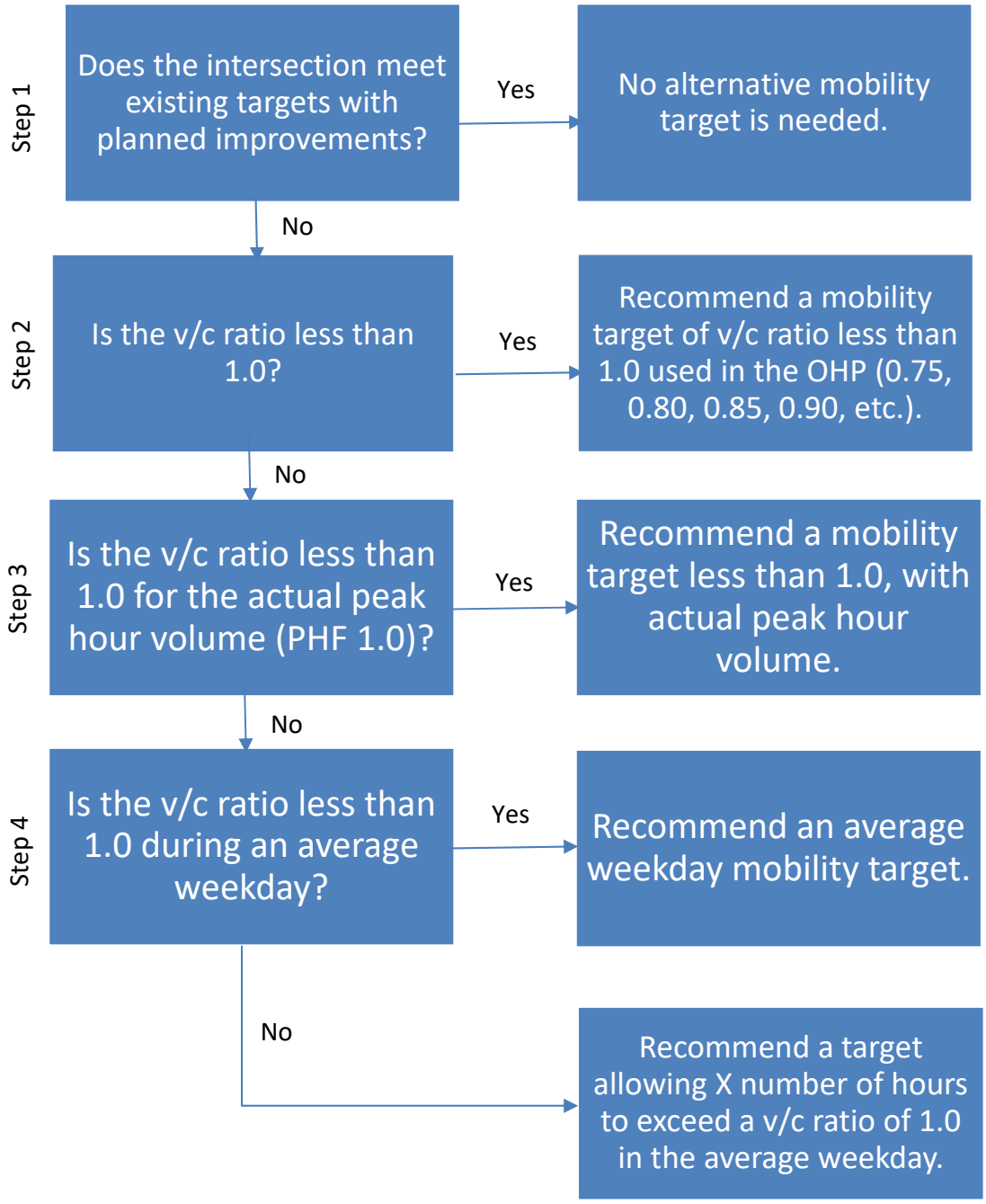
The analysis in **Tables 13 and 14** shows that, without improvements, the OR213/Beavercreek Road and OR213/Redland Road intersections will exceed current mobility targets in 2040 (shown in red). With potentially financially feasible improvements in place (i.e. a westbound right-turn merge lane at

[9] This document sets forth procedures to refine computerized traffic volume forecasts by comparing base year and future year volumes to count data.

OR213/Beavercreek), the intersections will still exceed the existing mobility targets under 30th highest hour traffic conditions. Therefore, it is recommended that alternative mobility targets be based on average annual conditions, allowing the v/c ratio to exceed 0.99 for one hour per day at the OR213/Beavercreek Road intersection (upper limit of 1.0) and three hours per day at the OR213/Redland Road intersection (upper limit of 1.1).

Exhibit 11 shows the methodology ODOT Region 2 developed for determining alternative mobility targets.

Exhibit 11 – ODOT Region 2 Alternative Mobility Target Methodology



The following summarizes how the ODOT Alternative Mobility Target Methodology relates to Highway 213 and the study intersections. The analysis results for each step are shown in **Table 15** for the OR213/Beavercreek Road intersection.

Step 1: The intersections will not meet the existing mobility target in 2040.

Step 2: The intersections have a v/c greater than 1.0.

Step 3: The intersections have a v/c greater than 1.0 for the actual peak hour.

Step 4: During the average weekday peak hour, and with the implementation of the right-turn merge lane at OR213/Beavercreek, the v/c ratio is 1.0 for one hour and below 1.0 for the additional peak hours. Therefore, an average weekday mobility target is recommended at OR213/Beavercreek. At OR213/Redland Road, three hours are over 1.0 under average weekday conditions without improvements; however, no alternative mobility target is recommended at OR213/Redland Road as there are cost-constrained improvements ("Jughandle" Phase 2) for this location in the Regional Transporting Plan which are consistent with the City's TSP.

Table 15 – ODOT Region 2 Alternative Mobility Target Methodology Applied to OR213/Beavercreek Road

213/Beavercreek with Right-Turn Merge Lane	Existing OHP Mobility Target	Step 1: Compare to Existing Targets	Step 2: Compare to V/C of 0.99	Step 3: Use of a PHF of 1.00	Step 4: Use Average Weekday Volumes	Recommended Alternative Mobility Target
		2035 (30 HV) Intersection Operations	2035 (30 HV) Intersection Operations	2035 (30 HV) Intersection Operations	2035 Average Weekday Intersection Operations	
1st Hour	0.99	1.04	1.04	1.04	1.00	1.0
2nd Hour	0.99	1.03	1.03	1.03	0.99	1.0
3rd Hour	NA	1.01	1.01	1.01	0.98	1.0

Note: Step 1, 2, and 3 have the same results based on an existing v/c target equal to 0.99 and a PHF of 1.0 applied to all scenarios.

Merge Analysis

The intersection of OR213 and Beavercreek Road was evaluated to ensure that the segment north of Beavercreek Road on OR213 would provide acceptable traffic operations with the proposed merge lane. The evaluation was performed both for a merge length of 1,300' and 2,000'. A 1,300' merge meets ODOT standards based on a length reduction for grade. A 2,000' merge exceeds ODOT standards for the existing grade on OR213 and places the end of the merge within a horizontal curve. Additionally, the analysis below shows that the 2,000' merge has a negative impact on delay due to greater difficulty merging at higher speeds.

Segment Analysis Methodology

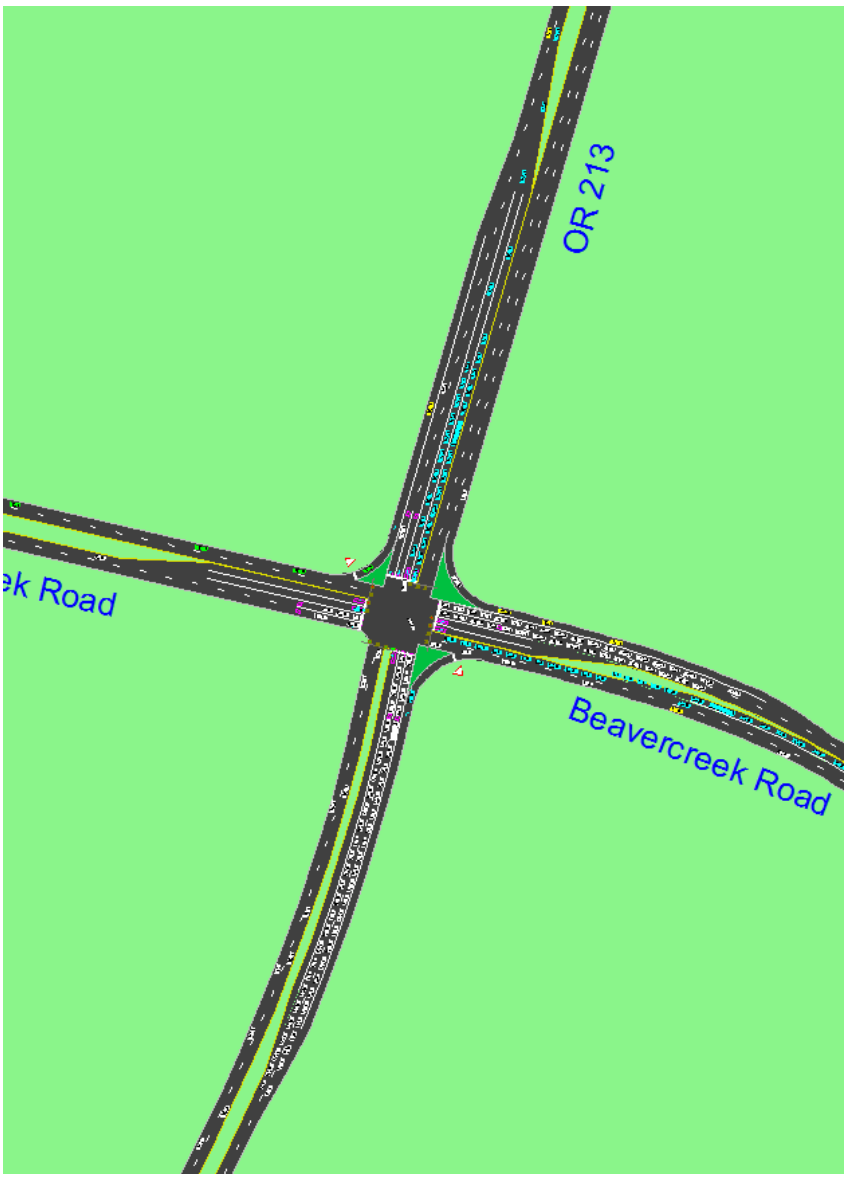
A traffic simulation analysis was conducted using the 2040 annual average traffic volumes and the proposed westbound right-turn merge lane. The simulation analysis used the SimTraffic software (sample

graphic shown in **Exhibit 12**). The parameters were adjusted according to the ODOT Analysis and Procedures Manual (APM). The traffic simulation generates random patterns of vehicle movements consistent with the peak hour traffic volumes, so that no single simulation generates "the" answer. The AM and PM peak hour traffic volumes were each run through the SimTraffic simulation five times. The results of the five simulation runs were averaged to generate the final results. This is consistent with standard recommended methodologies for reporting results from traffic simulations. The outputs include:

- Average speeds and delays on the segment in the northbound direction.
- Average delays on the westbound right-turn movement.

The simulation is sensitive to delays caused by difficult merge or lane-change movements. If any of these movements are particularly difficult, the simulation would report slow speeds or queues on the affected segments.

Exhibit 12 – Sample Traffic Simulation (SimTraffic), OR213/Beavercreek Road Intersection



Segment Speeds

The Highway Capacity Manual defines level of service for urban street segments based on travel speed as a percentage of free-flow speed. Level of service (LOS) C corresponds to an average speed between 50 and 67 percent of free-flow speed. Assuming a free-flow speed of 55 mph on OR213 north of Beavercreek Road, LOS C operation would be an average speed between 27.5 and 36.9 mph.

The average speeds and delays for OR213 through the westbound to northbound merge from Beavercreek Road (north of the signal) based on the simulation analysis are reported in **Table 16**.

Table 16 – OR213 and Beavercreek Road Speeds and Delays, 2040 Annual Average Volumes

Scenario	Peak Hour	Average Speed (mph)	Average Delay per Vehicle (seconds)
1300' Merge	AM	34.0	9.8
	PM	36.0	8.1
2000' Merge	AM	39.0	10.1
	PM	41.0	8.3

Average speeds are within an acceptable (LOS C) range for the proposed 1,300' merge and even higher for the 2,000' merge. Keeping in mind that most vehicles are accelerating from a stop through the Beavercreek Road signal, and will not have to slow significantly during the merge, the difference in speeds is primarily attributed to the additional distance for vehicles already on OR213 to accelerate. Additionally, the average delay per vehicle is higher with the 2,000' merge, indicating that the merging maneuver actually creates more conflicts when there are higher speeds on OR213.

The segment merge analysis shows that acceptable levels of service can be maintained with a 1,300' merge lane for the westbound right-turn movement. A 2,000' merge would occur within a horizontal curve on OR213, increasing the risk of sideswipe and run-off-the-road crashes. Therefore, it is recommended that a 1,300' merge length be provided.

Westbound Right Turn Operations

The traffic simulation tested the operations of the proposed free-right turn lane from westbound Beavercreek Road to northbound OR213. The operational analysis considered the capacity of the right-turn lane as well as the capacity of the merge with northbound traffic on OR213, but does not reflect delay caused by pedestrian movements at the intersection.

Table 17 – OR213 and Beavercreek Road Westbound Right-Turn Delay, 2040 Annual Average Volumes

Scenario	Peak Hour	Average Delay per Vehicle (seconds)
1300' Merge	AM	13.6
	PM	16.6
2000' Merge	AM	13.9
	PM	16.5

The average delays on the right-turn movement are similar with either the 1300' or 2000' merge, as shown in **Table 17**. The longer merge does not significantly reduce delay, and in fact increases delay during the AM peak hour, which is the critical westbound right-turn movement volume.

Pedestrian Crossing

High visibility pavement markings and signage are recommended for pedestrians and bicycles to cross the channelized lane safely, and consideration should be given to installing enhanced pedestrian

improvements. This could include a rectangular rapid flash beacon (RRFB) for increased visibility. This type of treatment has been installed at similar locations in Boise, Idaho (see **Exhibit 13**).

Exhibit 13 – RRFB on the west leg of E Myrtle St and S Broadway Ave in Boise, Idaho



Queuing Analysis

The capacity improvements identified in Phase 2 of the "Jughandle" Project were evaluated to determine the impact of these improvements on queuing. **Table 18** provides a summary of Synchro queuing results in the southbound direction at OR213 and Redland Road under existing conditions and with the implementation of Phase 2 of the "Jughandle" Project.

Table 18 – 2040 Synchro Queuing Analysis Summary: 30th Highest Hour Conditions, Southbound Direction

Scenario	Peak Hour 4:00 pm	2nd Highest Hour 5:00 pm	3rd Highest Hour 3:00 pm	4th Highest Hour 2:00 pm	5th Highest Hour 7:00 am
213/Redland Existing Configuration	1947	1998	1701	1430	985
213/Redland with TSP Improvements	982	998	870	774	620

The results in **Table 18** show that the TSP improvements reduce the queues towards the I-205 interchange by approximately half. However, without the TSP improvements the southbound queues in Synchro are around 1800-1900 feet which is just past 213/Washington St/Clackamas River Drive.

Cost Estimates

The cost of adding an additional northbound and southbound through lane at OR213/Redland Road, consistent with TSP project D79, was recently estimated by OBEC to be almost $10 million.

The cost of the westbound right-turn merge lane at OR213/Beavercreek Road is estimated to be approximately $2.7 million based on the design shown in **Figure 2**. This estimate does not include right-of-way acquisition.

The KAI and OBEC cost estimates, as well as exhibits of the proposed financially feasible improvements at OR213/Beavercreek Road can be found in Appendix “G”.

CONCLUSIONS

The intersection improvement alternatives that would meet the existing mobility target at the OR213/Beavercreek Road intersection are not cost feasible, given the financial constraints of the City and other agency partners. These alternatives can be further considered in the future if additional funding becomes available.

Lacking the financial capability of implementing major capacity-increasing projects at the OR213/Beavercreek Road intersection, alternative mobility targets are necessary at this intersection; however, some improvements may be feasible in the cost-constrained TSP to improve safety and minimize future congestion.

For the intersection of OR213 and Beavercreek Road, the following mobility standards apply:

- During the first, second and third hours, a maximum v/c ratio of 1.00 shall be maintained. Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.

In conjunction with these alternative mobility targets, the financially feasible improvement to construct a westbound right-turn merge lane at OR213/Beavercreek Road should be included in the City's financially constrained plan. High visibility pavement markings and signage are recommended for pedestrians and bicycles to cross the channelized lane safely, and consideration should be given to installing a rectangular rapid flash beacon (RRFB) for increased visibility.

Phase 2 of the "Jughandle" project at the OR213/Redland Road intersection is not part of the financially constrained plan in the 2013 TSP, but is included in the adopted 2014 and draft 2018 RTP as financially constrained. It is recommended that this planned improvement for three through lanes in the northbound and southbound directions remain in the City's unconstrained TSP project list. It is also recommended that the City continue to seek funding sources for both the OR213/Beavercreek Road and the OR213/Redland Road projects as opportunities arise.

Appendix A
CAG and TAG Meeting Notes and Technical Memorandums

Appendix B
Oregon City GIS Maps

Appendix C
BlueMAC Data

Appendix D
Crash Data

Appendix E
Traffic Volumes

Appendix F
Operations Analysis

Appendix G
Cost Estimates

Appendix H
ODOT Letter of Support

KITTELSON & ASSOCIATES, INC.
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MEMORANDUM

Date: January 12, 2017

Project #: 20651

To: Dayna Webb
City of Oregon City
PO Box 3040
625 Center Street
Oregon City, OR 97045

From: Susan Wright, P.E., and Kristine Connolly

Project: Highway 213 and Beavercreek Road Alternative Mobility Targets

Subject: CAG Meeting #1 Minutes

On January 5, 2017, the first Citizens Advisory Group (CAG) Meeting for the Highway 213 and Beavercreek Road Alternative Mobility Targets project was held at the Oregon City's City Hall. *See Attachment 1 for the Meeting Agenda.*

The meeting began with introductions, and Susan presented the project. *See Attachment 2 for the presentation slides*. The advisory group provided comments throughout the presentation. These comments are summarized below.

- Damon suggested that it would be helpful to have a representative from ODOT at future CAG meetings.
- Laura introduced the background of the project
    - There are a few locations in the City where solutions present themselves but the City cannot afford to implement the solutions
    - This project was designed to set aside time with the community to collectively discuss solutions
    - In this case, there is a capacity problem and the solutions are not financially feasible
    - Development is stunted without a resolution to the problem, so we are looking at alternative mobility standards
    - Most trips through the intersection do not start or end in Oregon City, so the burden is unfairly placed on the city to resolve the capacity issue
- Susan pointed out that an interchange solution at the intersection was removed though the TSP update because it was determined not to be feasible
    - Accepting a higher level of congestion would allow the City to continue planning a solution

  - Note: Alternative 1 would require maintaining a northbound exclusive right turn deceleration lane. Corrections will be made to future exhibits.
- Comments on Alternative 1:
  - Mike: concern with left turns onto Maple overfilling the left turn lane.
    - The third receiving lane in this alternative would help alleviate that issue
  - Rick: seems like a short-term solution to a long-term mess
  - Dan: did you look into extending the existing southbound left turn lanes? Could the third receiving lane become a dual left onto Maple? What is the AM peak traffic impact? Do future conditions take into account ITS and connected vehicles?
  - Christine: fear that the capacity solution will be cancelled out by future development
    - Volume projections assume full buildout of development/redevelopment
  - Christine: need to take the cottages into account. Additionally, when there is a crash or landslide, there are no parallel routes available for people to avoid the congestion.
  - Damon: It would be beneficial to move the lane closer to 1st. The WB to NB right turn doesn't have any runout—extending the merge would improve flow. The 3rd receiving lane allows space for queuing, which will alleviate the issue with rear ends from people making the southbound left taking gaps without looking for vehicles stopped ahead. Perhaps the 3rd receiving lane alone would be beneficial without the 3rd southbound left.
    - Dan: a 1200' extension of the WB to NB merge has been studied. City to share drawings with Kittelson.
  - Bill: overall growth may be 2% but rural areas are experiencing higher levels. How many crashes were red light runs? Consider red light cameras.
    - John: cameras have been considered but they increase rear end crashes. Speed is more of the issue.
  - Henry: move the entry/exit to shopping center further south? Pay attention to pedestrian crossings. There was a recent fatality at the intersection. Contra-flow lane? Morton road should be extended.
  - Bob: this is a major intersection in the county, but it is outside of the urban growth boundary. This alternative will not keep up with growth. Need to spend more money to come up with a solution that solves the long-term problem.
    - Susan: Preferred solution will need to be adopted in the TSP before funding can be sought
    - John: $5-10M solutions seem obtainable and could be funded through SDC's. But larger project would have to be state-driven. Can we live with congestion for a longer portion of the day?
- Comments on Alternative 2:
  - Everyone agrees to discard this alternative
- Comments on Alternative 3:
  - Renate: it doesn't seem like there is enough space between signals

        - Susan: the distance would need to be fine-tuned to store the number of vehicles arriving each cycle. Kittelson to distribute a video of how this innovative intersection works. Other DOTs are implementing this solution in multiple locations along corridors.
    - Luke: this is better for pedestrians since it does not increase crossing distance as much as other alternatives. Is there an opportunity for looking into a shared use path on Beavercreek instead of the existing bike lanes?
    - Dan: eliminate pedestrian crossings on the north side and enhance them on the south side? Keep slope in mind for the displaced left turn crossover.
    - Christine: Morton Road has the 2nd largest landslide on 213.
    - Mike: is the propose storage for the displaced left turn signal within a curve? With this alternative, storage for the left turn onto Maple is reduced
- Comments on Alternative 4:
    - Henry: Beavercreek has a need for left turn stacking.
    - Michelle: Why didn't the TAG recommend this alternative?
        - Susan: this was mostly due to the cost of impacting the northwest corner
    - John: City is hesitant about both Alternatives 3 and 4
    - Dan: consider shifting the centerline of Beavercreek south to avoid geological hazards on north side.
        - Susan: this would require shifting east as well, which would impact developed land
    - Committee recommends continued analysis of Alternative 4
- Comments on Alternatives 5-7:
    - Susan: note the negatives in the comparison chart. Alternatives 5 and 6 create 2 intersections for vulnerable users to traverse instead of 1.
    - Damon: Alternative 6 is functionally useless—it directs people too far out of their way. Consider a solution somewhere between alternatives 5 and 7. Was a traffic circle considered?
        - Susan: since this is an ODOT facility, the footprint of the roundabout would be too large and impactful
    - Renate: suggest keeping an interchange on the table. Alternative 7 seems to have the least impact.
    - Christine: does Alternative 6 leave room in the future to have lower cost improvements?
        - Susan: other bottlenecks in the area make an interchange at this location less effective
    - Committee recommends keeping a full tight interchange on the table
    - Kelly: TSP has 2011 data. Have you looked at current 2016 v/c? Kittelson to run 2016 counts in Synchro. Why spend $25M to be back at the same LOS we were at in 2011?
    - Laura: asked ODOT and County if they had funding to support the project, and they responded in the negative.

        - Susan: it is a risk for the City to put an expensive solution in the TSP without funding. There is potential for a hybrid between short-term and long-term strategies: implement alternative mobility target until there is regional support for a roadway improvement. The preferred alternative from this project could be a starting point.
    - Rick: timeline for implementation?
    - Bob: inefficient infrastructure costs businesses money—delay is a cost to industry

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MEMORANDUM

Date: January 3, 2017

Project #: 20651

To: Dayna Webb
City of Oregon City
PO Box 3040
625 Center Street
Oregon City, OR 97045

From: Susan Wright, P.E., and Kristine Connolly

Project: Highway 213 and Beavercreek Road Alternative Mobility Targets

Subject: TAG Meeting #1 Minutes

On December 14, 2016, the first Technical Advisory Group (TAG) Meeting for the Highway 213 and Beavercreek Road Alternative Mobility Targets project was held at the Oregon City's City Hall. *See Attachment 1 for the Meeting Agenda.*

The meeting began with introductions, and Susan presented the project. *See Attachment 2 for the presentation slides*. The advisory group provided comments throughout the presentation. These comments are summarized below.

- In addition to the intersection of Highway 213 and Beavercreek Road, Lidwien pointed out that the entire stretch of 213 from Beavercreek to I-205 did not meet standards. The intersection of Highway 213 and Redland Road was included in the jug handle project design but has not yet funded. Lidwien said the modeling assumed this project and still failed to meet standards. John Replinger suggested that the TSP be reviewed to determine what was concluded at Highway 213/Redland Road. John Lewis was unsure but thought SDC's were being collected for the Hwy 213/Redland Road project.
- Delay at Hwy 213/Beavercreek Road is affecting zone changes and development near the intersection, as well as larger projects farther away.
- Dayna asked whether the TAG would be open to an evening meeting on April 20th.
- The culvert outfalls on the northern leg have eroded and created concern. ODOT is working on a long-term solution. The cost of this solution would be considered in intersection alternatives.
- Oregon City sees the Holly Lane improvements as a significant benefit to congestion. However, the community is opposed to any changes to Holly Lane which would impact properties. The Holly connection would change travel patterns through the Hwy 213/Redland Road intersection.
- John Replinger to send 2040 volumes.

- There are TDM measures in place at Clackamas Community College. The regional travel model already takes regional TDM efforts into account in the forecast.
- The County did not adopt the Beavercreek Concept Plan. The City would need to take the lead on constructing/implementing the connections in this plan.
- Alternative 1
    - Avoid shifting the highway to the west where there is a landslide area
    - Would intersection improvements require ADA updates?
    - Third lane could enhance issues with weaving exiting the intersection, despite signage.
    - Safety concerns make this alternative unfavorable with ODOT
    - Would need to maintain an exclusive northbound right turn lane for safety
    - Vulnerable users have a tougher time traversing a wider intersection
    - The triple left turn would be a difficult maneuver if future bus service utilizes that movement.
    - Is there a way to make this alternative safe? Possible to limit the intersection to 2 turn lanes off-peak?
- Alternative 2
    - Avi interested in investigating a second quadrant road serving the eastbound left turn that would wrap around the shopping center.
    - A storage facility development was just approved where the quadrant road connection is shown for Alternative 2. If the connection is moved north, there is an issue with right turn safety. If moved south, travel time will further increase.
    - It would be difficult to make a left turn into businesses north of the connection due to the increase in oncoming traffic on the quadrant road.
    - The Fir/Beavercreek intersection has operational concerns, including bus stops.
    - Increase cost for retaining wall and right-of-way.
    - Clarify in memo why this alternative is infeasible.
- Alternative 3
    - ODOT concerned with close spacing of signals if the cross-over signal would be considered a new signal rather than part of one large signalized intersection.
    - Storage at the left-turn signal may require widening and earthwork, impacting the geologic hazard area.
    - KAI to distribute video simulation of Alternative 3 signal interaction and queueing, look into shifting east to utilize existing pavement, and provide some explanation of how other DOTs are implementing displaced left turns.
- Alternative 4
    - As drawn, Alternative 4 is impactful to the northwest corner of Hwy 213/Beavercreek Road
    - Would impact TriMet, as bus stop would have to be west of Fir Street
    - Need to provide a clear picture of the geologic hazards in northwest corner
- How would an alternative be funded? Is there a possibility of cost-share with ODOT?

- Eliminate discussion of connectivity since predicted failure of intersection already assumes a high level of connectivity planned in the TSP. State that the same amount of connectivity is assumed regardless of the Alternative.
- Include v/c results in comparison table. It would be helpful to have a column related to safety. Include column for issues that may make an alternative infeasible.

Direction from TAG:

- Further investigation of alternatives 1 and 3
- Move toward alternative mobility target

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MEMORANDUM

Date: April 12, 2017

Project #: 20651

To: Dayna Webb
City of Oregon City
PO Box 3040
625 Center Street
Oregon City, OR 97045

From: Susan Wright, P.E., and Kristine Connolly

Project: Highway 213 and Beavercreek Road Alternative Mobility Targets

Subject: CAG Meeting #2 Minutes

On March 2, 2017, the second Community Advisory Group (CAG) Meeting for the Highway 213 and Beavercreek Road Alternative Mobility Targets project was held at the Oregon City's City Hall. *See Attachment 1 for the Meeting Agenda.*

The meeting began with introductions. John Makler of ODOT and Mike Bezner of Clackamas County were also in attendance. Susan presented an overview of Technical Memorandum #2, including policy, the travel time study, performance measures, feasible improvements and funding. The advisory group provided comments after the presentation. These comments are summarized below.

- Bill: travel time data collected in January—how reliable? Susie: collected the last week, not during a snow event
- Henry: have not defined mobility. Also what is regional? Could you do a destination survey to see how many Molalla residents use the intersection?
- Susie: we know many northbound and southbound movements are regional, as well as some turning movements. We did not collect specific OD data. Traditional mobility measure is v/c, strictly based on vehicle. But we want to think about other modes. This project is to decide what measure to use to measure mobility and how we want to define mobility at the intersection.
- Damon: how accurate if there are a lot of older cars?
- Susie: Pickup rate was about 11%. Does data match what we think is happening in the intersection?
- Bill Avison: why was the north leg collector farther away? Susie: no physical pole to mount the equipment.
- Susie: main goal was to see the variability throughout the day.

- Henry: what is the cycle time? Susie: 120 seconds. Henry: so average person gets through in one cycle but 85th percentile takes two? Susie: Yes.
- Bill: 2035 v/c projection seems low. Susie: Intersection can only accommodate so much traffic. The peak hour will spread out. Kirstin: growth is incremental but small proportion of total volume. Laura: model takes into account growth as well as planned improvements. Damon: model only takes into account Oregon City's growth. If other areas grow, will this blow up? Laura: model accounts for all of the regions traffic growing. The City's growth is one portion of a larger area growth. John Replinger: Model assumes growth in all four counties. John Lewis: Metro model assumes widespread growth, not just in the region. Assumes growth at the rate those communities are planned. Jon: vouches for the models accounting for all growth.
- Rick Givens: what is advantage of v/c over LOS? Susie: for consistency with the measure currently in place and other ODOT intersections on the corridor. Rick: any studies to look at how LOS compares to v/c? Susie: no direct correlation. Can have D over capacity and F under capacity.
- Bob: knee deep in housing crisis. Keep in mind that all appeals to LUBA for zone changes and concept plans have to do with a lot of traffic . One of the elements in land use planning for the state. Need to coordinate the LUBA so they know what we're doing when we approve land use changes. Extends to state planning as well. Susie: City obligated to study since the TSP showed that there is a problem on the corridor. Still want the land use plans but need an exception at this intersection. Need exception to get concept plans approved and withstand an appeal to LUBA. Cannot solve every problem. This exception process allows the City to have control over where standards are exceeded. Laura: balancing many needs as a region.
- Eric Lee: is this intersection the biggest/worst bottleneck? John Lewis: for Oregon City, this is the most challenging because there isn't an affordable improvement to solve the capacity issue. Eric: why was v/c chosen instead of travel time? Susie: travel time is good for long-range planning, and requires costly data collection and tools for measurement. v/c is much more accessible and measurable.
- Damon: you would only need to eliminate one lane. Susie: will investigate eliminating one vs. both lanes.
- Mike: to get money for a $50M project, it would usually be part of a large transportation bill. Looking at I-205, I-5, Highway 217 and larger projects in the Portland region. Other grants like TIGER go to larger jurisdictions. Sunrise Phase 1 was $150M, 30 years in the making. Enacted by Oregon legislature. Opportunities to raise large sums of money. Jon: Washington County wants Highway 217 widened. Cornelius Pass widening is $1B. In Clackamas County ODOT is focusing on completing Sunrise and upgrading Abernethy Bridge. Not on ODOT's radar to put millions into this intersection. Mike: first ask is for maintenance. Jon: mobility for whom? What would it cost to provide commuters with desirable level of service? What would it cost to provide goods? That's 9-3. And the graph shows that this is fine here. There are places in the region where that is not true, and that is where ODOT is focusing. Tradeoff between goods movement during day and people movement during peak.

- Kristina: desirable communities like Sellwood have walkability. Live work and play within community. No need for commuting. One way to address these issues is to look at providing a livable community.
- Henry: because half of people using intersection aren't residents, why should the City have to pay for the entire cost. Kirstin: does not preclude funding agreement. Mike: no city would pay for this in entirety. Would have to come from a federal or regional pot.
- Redland Road: because improvement is not constrained, needs alternative mobility target in order to stand up to LUBA.

Question 1: Could you live with an alternative mobility standard?

- Kristina: could live with the delay. What if there was a camera/app to determine whether to leave at a certain time?
- Bill Merchant: can live with v/c ratio. Concerned with amount of time we allow the intersection to be gridlocked. May begin to impact the middle of the day. Jon: would set a limit to the number of hours.
- Damon: ditto
- Luke: could live with it
- Nathan: feasible to accept higher v/c for certain amount of hours, especially when new development would be impacted by SDCs. Regional capacity—other areas impacted along the corridor. Constraints from other signals and highway.
- Michelle: yes
- Rick Givens: have to accept something like that but hopes to limit the number of hours. Kirstin: look at next meeting at what does 3 hours or 4 hours solve
- Eric: would like a more quantitative look. OR213 is called a bypass. Bypass is not a vehicle for economic development. But yes open to alternative target.
- Bill Avison: in Molalla there is OR211 and OR213, and that's it. City is trying to grow—OR213 is a major route. The purpose of the ACT in Region 1 is to work for all four counties and look at rural and urban dollars. There will be some priorities for rural areas, not $50M but perhaps $5M. Don't give up on getting some money from ODOT. Feel like we have to develop alternative mobility target. Not opposed to looking at that.
- Mike: thinks this is the right way to measure, but we're kidding ourselves if we think it will only be 1.05. Thinks it will affect the worst peak hour just as much as other time of day. What happens when we exceed the allowed X hours? Important to get Damon's comment—only looking at removing ONE westbound left turn lane. Low-cost project. Do countdown ped signals save lives? Kicking can down the road. Need to do lower cost solutions now, but will be back to this in a few years. Kirstin: still possible to continue to advocate for long-term solution. Want to be realistic in the short term.
- Renata: if v/c is how ODOT looks at facilities, makes sense to look at that here. We're already almost at capacity. People are going to be upset about additional delay. Political issue.

- Henry: too easy to continue to move the line. Should keep the current standard and put a long-term solution in the TSP. dislikes v/c because you cannot define terms adequately. V is definable but c is not. Acknowledges that there is no viable solution.
- Bob: can get through the issue technically but not politically. How to justify approving the alternative mobility target? If we had the money, wouldn't be talking. Convince public that we will eventually solve the problem. Can't give up—this is the job of planners to find a solution. We have a choice. Deny applications because we don't have capacity to serve them.
- Luke: did you consider widening sidewalks to provide shared use paths? With increased vehicle traffic, less safe for peds and bikes. Susie: something to consider and bring back, but retaining walls have impact on cost. Luke: look at it along Beavercreek.
- Damon: change ped access to just southbound? Get people used to crossing at other intersections. Would be useful on average graph to see how long it would take you if you don't stop at all going 20mph through intersection. Question why there is a spike at 8pm for westbound left. v/c of 0.79 in morning ignores westbound rights. 1.04 is a failure. Where is the v/c failure happening? Jon: small sample size. Damon: smaller improvements could fix the movements experiencing delay. Why no roundabout? Solution is tollbooths. Susie: profile is different based on movement. Westbound left is one of the lowest movements. Southbound left is critical movement. We looked at that in the first memo. How to solve the capacity issues at critical movements. Certain amount of green time to those four movements. That's how we came up with triple left and displaced left alternatives. Roundabout would need 4 circulating lanes.
- Mike: westbound right is also critical movement. Takes 40 seconds to go through intersection without stopping.
- Bob: computerize state highway system? Get on cell and find out what congestion is occurring. Mike: already have apps like Waze.

Question 2: If we accept higher v/c ratio, How many hours do we accept? (to be addressed at the next CAG meeting)

Direction from CAG:

- Clear support for using alternative mobility target v/c.
- Preserve the right to advocate for longer-term solution.
- Determine when/where the v/c failure occurs.

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MEMORANDUM

Date: April 12, 2017

Project #: 20651

To: Dayna Webb
City of Oregon City
PO Box 3040
625 Center Street
Oregon City, OR 97045

From: Susan Wright, P.E., and Kristine Connolly

Project: OR213 and Beavercreek Road Alternative Mobility Targets

Subject: TAG Meeting #2 Minutes

On March 1, 2017, the second Technical Advisory Group (TAG) Meeting for the OR213 and Beavercreek Road Alternative Mobility Targets project was held at the Oregon City's City Hall. *See Attachment 1 for the Meeting Agenda.*

The meeting began with a summary of the first Community Advisory Group (CAG) meeting. The CAG requested that an interchange alternative be kept on the table. They also thought it was important to have a County and ODOT representative at CAG Meeting #2. The CAG was comfortable looking at alternative mobility standards but want to build regional support for a long-term improvement. Lidwien suggested recommending taking an improvement to the regional table and having someone else convey that it is not a priority for the State/Region. Alternatives 1 and 3 have not yet been refined. Several lower cost solutions were suggested, but they do not address the 2035 capacity issue. Alternatives refinement is on hold in order to talk about the travel time study and funding. Outcome of these meetings will make a decision on what alternatives to continue to pursue.

Susan presented an overview of Technical Memorandum #2, including policy, the travel time study, performance measures, feasible improvements and funding. The advisory group provided comments throughout the presentation. These comments are summarized below.

Travel Time Study

- Note that AM peak analysis does not take queuing at the westbound right turn into account.
- Cycle length consistent throughout the day?
- Christian: recent signal timing changes impacting EBL vs. WBL green times
- SBL and WBR in particular have some challenges.

- Aleta: add volumes to each graph (to explain some erratic high delay)
- Christian: what is the free-flow travel time?

Alternative Mobility Targets

- Lidwien: isn't current standard 2 hours? KAI to verify current standard (1 or 2 hours?)
- Laura: 1st highest hour cannot exceed 0.99 and 2nd highest hour cannot exceed 0.99
- Susie: no direct correlation between v/c and travel time. Cannot reliably draw a line on the graph indicating v/c = 1.
- Whatever performance measure we choose, leave room for potential zone changes which could increase trips
- Laura: will likely come back to the intersection before 2035 and reevaluate then
- Lidwien: not obligated to approve zone changes
- Laura: most zone changes are through annexations
- Laura: What is the split between local trips and outside trips through the intersection? Was that included in the TSP analysis?

Performance Measures

- Susie: How to develop a 4th highest hour in 2035?
- Includes morning and afternoon.
- Easy to measure and easy to replicate and review. Require a 10-hour count. What is the trip generation during the 4th highest hour? Off-peak trip generation. Will need to develop methodology.
- Kelly: burden of additional study falls on private developers and reviewers.
- Lidwien: As far as the State goes, ODOT standard only applies to plan amendments. Up to the City what to do with permitted uses (already accounted for in TSP). ODOT standard does not apply to permitted uses.
- Replinger: Require developers to conduct TIAs to identify needs in immediate vicinity. Also to assess proportional share. Assess whether to move an improvement from 'not likely to be funded' to 'financially constrained'.
- Replinger: concerned that calculation of v/c in the 4th hour is going to be higher than we estimated.
- Susie: we know peak to daily ratio today. What is the peak to daily ratio in the future model? What is the expected daily profile in 2035? Will determine as part of next steps.
- Replinger: pass-by percent off peak? Changes throughout the day.
- Lidwien: ODOT has not had an opportunity for traffic to look at the memo. Peak hour spreading is already anticipated in OHP. Lidwien would start with three hours instead of jumping to four. Consider supplementing with one of the safety measures—could even be measuring queuing.
- Kelly: first goal in the TSP is safety. Can easily tie safety measure to the TSP goals.

- Susie: from development standpoint, hard to get into predictive crash rates. Set threshold? Make sure everyone mitigates impact? Apply just to TPR, not outright zoned properties? What improvements are reasonable? Then we can get into crash rate. Make sure what we propose does not increase future crash rate. Increased trips=increased crashes no matter what. What is City's standard for this intersection when it comes to outright zoned properties? Do you want to impose standard for outright zoned development? Have a different measure?
- Laura: TSP applied ODOT standard to all development, not just zone changes. Helps to calculate proportional share. Self-imposed analysis for permitted uses.
- Lidwien: can require traffic analysis to calculate SDC's and not call it a standard.
- Replinger: can require that the applicant calculate the volume of traffic entering the State Highway, not actually require analysis. Then charge per car, for example.
- Susie: can have improvements in the TSP and still have alternative mobility target
- John Lewis: what safety standard would you recommend in conjunction with v/c?
- Susie: predict future crash rate with improvements and compare to what the crash rate would be without the improvement. Set as standard? Improvements do not come in small increments though.
- Kelly: why is average travel time not a better measure than v/c?
- Susie: ease of application of predicting future travel time and cost of data collection. Difficult to model and expensive data for calibrating.
- John Lewis: for community group, more robust explanation of recommendation.
- Lidwien: public will not want to go over each measure
- Aleta: could we have the same graph for v/c in 2035?
- Lidwien: explain that this is existing, and it is very difficult to forecast. Then when you explain the recommendation, say it is because it is so difficult to forecast travel time. Could do travel time for intersection or corridor. Corridor would be more appropriate than intersection.
- Susie: will come up with something illustrative to show future v/c.

Operations and Safety Improvements

- What to implement in tandem with alternative mobility targets? What to go in TSP? What to consider financially constrained? What to include in unconstrained plan?
- John Lewis: see a lot of cross traffic crashes. In favor of the lighting, pedestrian countdown display and medium cost improvements.
- Susie: removing left turns from the intersection will improve safety.
- Lidwien: look at critical movement v/c? only look at v/c on 213 but not on Beavercreek?
- Susie: would build queues on the side street.
- Christian: does this get adopted into OHP? Susie: Yes
- Christian: anything like this implemented? Susie: some have increased v/c.

Funding

- Check the math on the households (numbers don't add up and the number of houses doesn't seem right)
- Lidwien: mentioned extending from Redland to Molalla. But we do not have improvements at Redland. They would also have to be added to the SDC list.
- Susie: Redland Road has improvement in TSP but project is unfunded.
- Lidwien: Have to have a way to fund, and have to get onto financially constrained RTP
- Susie: Redland Road needs alternative mobility target as well. Demonstrate how a 2/3/4 year target looks today and how it would look in the future.
- Replinger: financial infeasibility would justify alternative mobility target at Redland Road as well.
- Lidwien: need to demonstrate to ODOT why project is infeasible. Show your work.
- Dayna: Redland Road project is in RTP unconstrained list, but needs to be in constrained list to qualify for TPR analysis
- Susie: no conflict with having project in TSP and having alternative mobility target. Would not preclude City from having alternative in the constrained TSP and still pursue alternative mobility target
- Lidwien: would keep from implementing anything that would preclude TSP project in the future.
- Laura: did we look at Molalla in 2035?
- Replinger: decision not to analyze 213/ Molalla was because it had been studied recently for the Clackamas College. We'll be ok there with Meyers Road extension.
- Can we come up with alternative to constantly measure travel time? How much would it cost to have the equipment out there all the time?
- Having alternatives on the list will help the public accept an alternative mobility standard. May be some support for lower to moderate cost alternatives.

Direction from TAG:

- Continue looking at v/c for certain # of hours recommendation
- Work with City on looking at what improvements are easy to financially constrain
- Determine whether additional meetings will be necessary.

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MEMORANDUM

Date: April 27, 2017

Project #: 20651

To: Dayna Webb
City of Oregon City
625 Center Street
Oregon City, OR 97045

From: Nicholas Gross and Susan Wright, P.E.
Project: Highway 213 and Beavercreek Road Alternative Mobility Targets
Subject: CAG Meeting #3

On April 20, 2017 the third Community Advisory Group (CAG) meeting for the Highway 213 and Beavercreek Road Alternative Mobility Targets project was held at the Oregon City's City Hall. *See Attachment 1 for the Meeting Agenda:*

WELCOME, MEETING PURPOSE AND AGENDA REVIEW

The meeting was kicked-off by John Lewis of Oregon City's Engineering Department who welcomed back the group and thanked those in attendance for their continued participation. Kirstin Greene of Cogan Owens Green provided an overview of the meeting's agenda and reminded CAG members that their comments and opinions regarding the mobility targets would be documented and used to help guide the process moving forward.

John Replinger of Replinger & Associates provided an overview of the hierarchy of transportation planning and how it translates to the development review process. John began with an overview of the City's approach to a refinement plan, highlighting that for this project, a refinement plan is being carried out by the City Oregon for the intersection of Highway 213. John also provided an overview of the development review process discussing land-use actions, rezoning, subdividing and how these actions require a develop to conduct a traffic impact study as well as mitigation measures in compliance with City standards.

OVERVIEW OF TECHNICAL MEMORANDUM #2

Susan Wright of Kittelson & Associates, Inc. provided a recap of the CAG meeting #2 and an overview of the existing mobility targets specific to the intersections of Highway 213/Beavercreek Road and

Highway 213/Redland Road. Susan discussed the projects currently in Oregon City's Transportation System Plan (TSP) and potential new projects for the Highway 213/Beavercreek Road including a west-bound right-turn acceleration lane and southbound advance warning system improvements predicted to reduce crashes by approximately 5%.

Susan then provided an overview of 2040 operations at both intersections highlighting the volume over capacity (V/C) ratios with and without the recommended improvements. The key takeaways were that the intersections of Highway 213/Beavercreek and Highway 213/Redland Road will exceed the current mobility target in the City's TSP for the horizon year of 2035 and that the alternatives that would meet the existing targets are not currently cost-feasible. The following recommendations for targets and improvements were provided:

Highway 213/Beavercreek Road

- Mobility Target – V/C not to exceed 0.99 for more than give hours of the day
- Improvements added to costs-constrained TSP
    - Westbound right-turn acceleration lane

Highway 213/Redland Road

- Mobility Target – V/C not to exceed 0.99 for more than three hours of the day
- Improvements added to TSP
    - Third southbound through lane (if const-feasible)

DISCUSSION

The following section provides a recap of the discussion points and questions/answer dialogue between the CAG and the project team:

Dan Fowler (DF): Have you considered using the Holcom Boulevard overpass as an exit point off of Highway 213?

Susan Wright (SW): No, I can say that we haven't looked into that.

Dan Fowler: I'm not saying it's feasible, it's just an idea.

Damon Mabee: Even if it were just an off-ramp for northbound traffic heading onto Holcom Boulevard it would eliminate all of the traffic using Redland Road to get onto Holcomb Boulevard from Highway 213.

Susan Wright: The good thing about the improvements in the TSP is that they mitigate the intersection to the current standards. I don't know think constructing an off-ramp at Holcom Boulevard would be any cheaper.

Dan Fowler: Is this area inside the urban renewable district of downtown? I ask because I'm curious of potential funding strategies.

John Lewis (JL): I don't know but I know it includes the driving range.

Damon Mabee: The concern about storage of the left-turn lane is irrelevant to me. The City has a plan to push Meyers Road through. The number of people the left-turn lane is going to affect is minimal compared to the queue to get into Maple Lane.

Eric Lee: Does your model factor in the concept of induced demand?

Susan Wright: The latest model from Metro considers the spreading of the peak hour. Because our system is constrained, it is considering the peak hour spreading.

Rick Givens: Did you run the numbers for the combined effect of the acceleration lane plus the left-turn lane?

Susan Wight: We did and it was negligible.

Luke Norman: It sounds like the free flow right-turn will affect the pedestrian movement at the intersection.

Susan Wright: Yes, assuming vehicles will not have to stop, they will still need to yield. We spoke with the technical advisory group (TAG) about this topic. Currently, pedestrian traffic is not high enough to warrant a pedestrian button. It will be an important design consideration.

Kristina Browning: I live in the adjacent neighborhood and there are a few areas of sidewalks that aren't connected to the rest of the network. My neighbors and I would do a lot more walking if they were connected. Pedestrian activity would increase if we were able to get to that intersection and if we could walk there safely.

Susan Wright: That's a great point and a topic that is addressed in the City's TSP.

John Replinger: The City's TSP did a great job at identifying network gaps throughout the city for bicycles and pedestrians. There are a substantial number of projects proposed to fill those gaps as well as a policy that any time a developer moves forward, they need to provide sidewalks at the frontage of the development.

Susan Wright: This will ultimately go to the Oregon Transportation Commission (OTC) and part of our findings will demonstrate other solutions for bicycles, pedestrians, and street connectivity.

Henry Mackenroth: Given that a pedestrian button is tied into the signal controller and there is already a controller operating, sending an additional $10k seems like pocket change to install a pedestrian

button. It should not be a consideration, it needs to be done. We should be thinking about bicycles and pedestrians for any improvement that is recommended to move forward.

Rick Givens: Do you have a sense of how many years out you are before getting to the 0.99?

Susan Wright: We looked at 2035 to see what the difference of that change would be and those five years helped. If you want to get technical we've included the 2035/2040 comparisons as an appendix online. We are still targeting the 2040 year which is consistent with the regional model.

Rick Givens: I have no sense of the differential between 0.99 and 1.02. Is that an incremental difference? Is there anything to do to bring those additional hours down to 0.99?

Susan Wright: Those were some of the improvements we first talked about such as a triple left-turn lane, etc. We received strong consensus that those were not viable solutions. We see the $1.5million right-turn lane providing significant benefit to the intersection operations.

Rick Givens: What does 0.99 compared to 1.02 feel like operationally?

Susan Wright: You wouldn't notice much of a different. This is more about setting up the methodology that we are going to use to set the rules for the future which everyone will follow.

Mike Mitchell: What is the most stressed movement at Highway213/Redland Road?

Susan Wright: The left turning movement from Highway 213 onto Redland Road. The morning is worse than the evening.

Bob Mahoney: Rick said it best. Nothing is cheaper to build than building now. It's only going to get more expensive the longer this gets pushed out. If we don't make improvements now, what is the cost the city will face? Including those facts and figures for your following presentations would be valuable.

Dan Fowler: For the Highway213/Beavercreek intersection, did you look at the most optimum signal sequence for the right-turn movement?

Susan Wright: Yes we did.

Eric Lee: Are the two operation tables dependent or independent from one another?

Susan Wright: There is some dependency but the analysis was treated separated for both.

Damond Mabee: My feeling is that money would be better spent putting in an intelligent signal system. I think it will reduce the V/C ratio. I also don't see the benefit between the red and yellow difference shown in the table for Highway213/Redland Road for the expense it is shown at.

Nathan McCarty: I want to revisit the alternative for the P.M. traffic heading southbound and turning left onto Beavercreek Road.

Dan Fowler: What does bullet point 2 mean? Document alternatives considered and add policy to TSP to recognize merits of a regional solution?

Susan Wright: Essentially this is referencing an interchange. ODOT also has interest in a jug-handle concept. We want to document everything to show that we've looked at the pros and cons of all options.

Henry Mackenroth: Bullet point 2 needs to be shown for Highway213/Redland Road in the future. That is also going to end up being a regional solution. You also can't put pedestrians and bicycles in a separate category from vehicles. We have to make sure all modes can get across the intersection(s) safely. They will do it whether there is a facility provided to them or not.

Bob Mohoney: We're being ushered into a digital age of technology. Technology is taking over our lives and its taking over our highways. We are losing V/C because our intersections are not smart. I think the solution to a lot of the V/C conversation is technology. If it cost $250k to upgrade to a smart signal and increase the efficiency by 10% that is money well spent.

Dan Fowler: I agree. A lot of the near-term solutions are going to end up being funded by developers.

Kristina Browning: I want to reemphasize the importance for walkability. We need to focus on connecting the existing sidewalks and encouraging bicycling. When this all gets built out it needs to accommodate everyone and what you've presented only seems to be focused on cars.

COMMENTS ON THE RECOMMENDED ALTERANTIVE MOBILTIY TARGET

Kristine Connelly: At this point the alternative mobility target recommendations have been through the TAG and they seem to be generally comfortable. I think we all recognize the benefits and drawbacks to each recommendation. Now we want to hear from everyone around the table on your thoughts about the Alternative Mobility Target.

Rick Givens: I agree with a lot of what Dan said regarding the smart signals. I have no problem with the proposed changes to the alternative mobility target. I also like the idea of doing something at the Holcom Boulevard overpass.

Mike Mitchell: I think it is extremely important to separate the two projects entirely when it comes to funding. Highway213/Beavercreek Road is a big bang for the buck. Highway213/Redland Road doesn't have nearly the same impact and it costs more. Let's get creative with development projects and where sidewalks are proposed. I'm comfortable with all the alternative mobility targets.

Eric Lee: Thank you for the presentation, I'm comfortable with the alternative mobility target recommendations. I think there needs to be additional recommendations to include pedestrian and bicycle accessibility. I don't think cutting pedestrian access off is ever a good thing. Let's focus on the safety of bicyclists and pedestrians and move forward with recommendations that help those modes.

Bill Merchant: I'm happy with the alternative mobility target you presented and I want to echo the point about intelligent signals. The existing signals can talk to each other and they can be smart.

Mike Mitchell: I think the acceleration lane is a great idea. I also think you diminish the benefit if you allow pedestrians to cross there. The sidewalk could be removed and used as a shoulder or an emergency lane.

Luke Norman: I'm comfortable with the alternative mobility target exceeding the times and V/C. Regarding the acceleration lane, I will not support anything that makes it less safe for pedestrians and bicyclists.

Damon Mabee: Incremental changes open up possibilities for technical changes. I agree we need to add the second bullet point to the Highway213/Redland Road discussion. I cannot support the alternative mobility target with additional time added to the V/C. I think we need to stay at our targets, look to technology, and get the funding to relieve the pressure.

Nathan McCarty: I can accept the three recommendations as they relate to the alternative mobility options. We need to continue to look at cost-effective solutions.

Kirstin Greene: It sounds like the majority of folks are comfortable with the proposed solution. Some additional high level thoughts I am hearing is the adopting of smart technology practices to optimize signal operations and the consideration of balancing pedestrian and bicycles.

Commission Renate Mengelberg: Seeing the V/C ratio over accepting levels for five hours a day makes me uncomfortable. It doesn't seem like a good policy. Let's get the most out of our existing system. Technology is going to help.

Kirstin Greene: Thank you everyone for coming out.

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MEMORANDUM

Date: December 8, 2016

Project #: 20651

To: Dayna Webb, P.E.
Public Works Department
City of Oregon City
PO Box 3040
625 Center Street
Oregon City, Oregon 97045

From: Susan Wright, P.E., Hermanus Steyn, P.E., and Kristine Connolly

Project: Highway 213 & Beavercreek Road Alternative Mobility Targets (PS 16-024)

Subject: Memorandum #1: Project Background and Preliminary Alternatives Evaluation

Oregon City's 2013 Transportation System Plan (TSP) determined that the intersection of Highway 213 (OR213) and Beavercreek Road will not meet mobility standards in 2035. The TSP recommended a project be conducted to identify what improvements may be necessary to meet current standards or whether an alternative mobility target is necessary. A Community Advisory Group (CAG) and Technical Advisory Group (TAG) have been formed to help the City evaluate the feasibility and practicality of the alternatives set forth in this project. This memorandum provides background information, operational and safety information, and identifies preliminary alternatives for the improvement of the OR213/Beavercreek Road intersection. These alternatives will be reviewed with the CAG and TAG to determine if any may be feasible and merit further exploration, or if an alternative mobility target needs to be pursued.

ALTERNATIVE MOBILITY TARGET BACKGROUND

The Oregon Highway Plan (OHP) defines polices and investment strategies for Oregon's state highway system for the next 20 years. The OHP gives policy and investment direction to corridor plans and transportation system plans that are being prepared around the state, but it leaves the responsibility for identifying specific projects and modal alternatives to those plans.

Policy 1F: Highway Mobility Policy states, "It is the policy of the State of Oregon to maintain acceptable and reliable levels of mobility on the state highway system, consistent with expectation for each facility type, location and functional objectives. Highway mobility targets will be the initial tool to identify deficiencies and consider solutions for vehicular mobility on the state system. Specifically, mobility targets shall be used for:

- Identifying state highway mobility performance expectations for planning and plan implementation;
- Evaluating the impacts on state highways of amendments to transportation plans, acknowledged comprehensive plans and land use regulations pursuant to the Transportation Planning Rule (OAR 660-12-060); and
- Guiding operations decisions such as managing access and traffic control systems to maintain acceptable highway performance."

Mobility targets for state highways, as established in this policy or as otherwise adopted by the Oregon Transportation Commission as alternative mobility targets, are considered the highway system performance standards in compliance with the Transportation Planning Rule (TPR) (OAR 660-012), including applicability for actions that fall under Section -0060 of the TPR.

Mobility targets are the measure by which the state assesses the existing or forecasted operational conditions of a facility and, as such, are a key component ODOT uses to determine the need for or feasibility of providing highway or other transportation system improvements; and therefore impact local land use and transportation planning as well as development review. The OHP currently includes alternative mobility targets in many locations throughout the State.

EXISTING CONDITIONS

The existing conditions analysis identifies the transportation conditions and current operational and geometric characteristics of the roadways within the study area. Exhibit 1 below provides an overview of the intersection.

Exhibit 1. Highway 213 (OR213) and Beavercreek Road Intersection



At the OR213/Beavercreek Road intersection, OR213 has a 4-lane section and a speed limit of 55 mph and is classified as an Expressway to the north and a District Highway to the south. Beavercreek Road is classified as a Major Arterial with a 4/5-lane section and a speed limit of 35 mph. OR213 is under the

jurisdiction of the Oregon Department of Transportation (ODOT), the west leg of Beavercreek Road is under the jurisdiction of Oregon City, and the east leg is under the jurisdiction of Clackamas County. OR 213 and Beavercreek Road are both designated as a Local Truck Routes in the City's TSP at the study intersection. The City designated truck routes in the TSP to ensure trucks can efficiently travel through and access major destinations in the City.

Sidewalks are provided along the north and south sides of Beavercreek Road, and a multi-use path is provided along OR213 south of Beavercreek Road along the east side of the highway. Bicycle lanes are provided along Beavercreek Road. TriMet operates Bus Route 32 between Clackamas Community College and Milwaukie City Hall. There are stops located on the west leg of Beavercreek Road at the intersection for both directions of travel (i.e. far-side for westbound and near-side for eastbound).

There is a stream running under the north leg of OR213 at the intersection, with corresponding wetlands. There are also geologic hazards in the vicinity of the intersection, with steep slopes and landslides primarily on the northwest corner. More details can be found in the Oregon City GIS maps in **Appendix A**. The presence of these features increases the expense of any improvements requiring additional widening, as significant earthwork, culvert extensions, or wetland mitigation may be necessary.

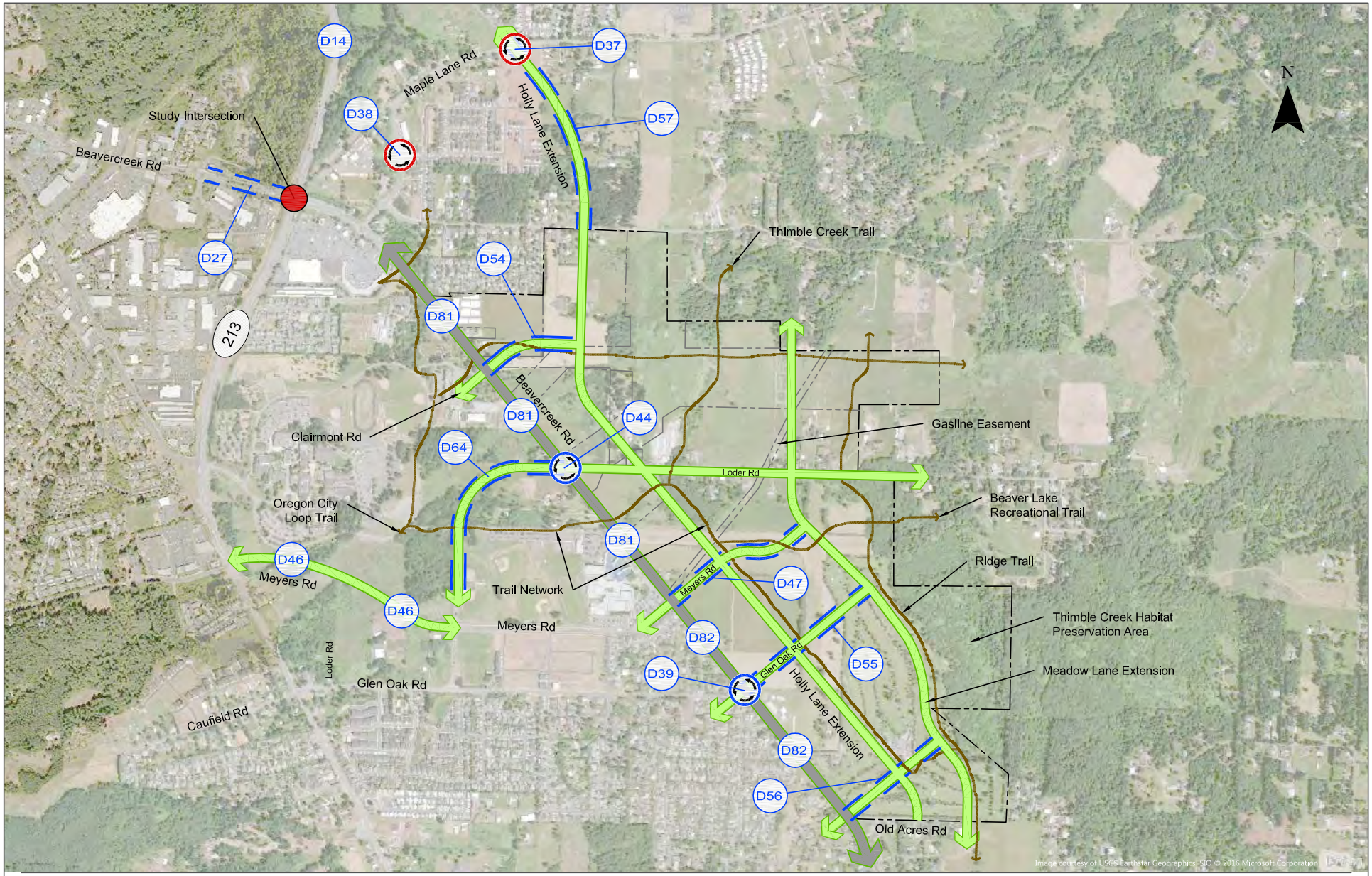
The City's TSP includes projects which may impact operations, safety, and travel patterns at the OR213/Beavercreek Road intersection. Many of the projects will increase connectivity in the vicinity of the OR213/Beavercreek Road intersection via parallel routes and roadway extensions between these parallel routes, providing alternate routes for those who do not need to pass through the intersection. All new roads and roadway upgrade projects will include facilities for bicycles and pedestrians. In addition, the TSP includes projects specifically to complete and enhance the bicycle and pedestrian networks. The roadway projects likely to increase connectivity and impact safety and operations at the OR213/Beavercreek Road intersection are included in **Table 1** and **Figure 1.**

Table 1 – 2013 Oregon City Transportation System Plan Projects located in the southeast part of the City

Project #	Project Description	Project Extent	Project Elements	Priority	Funded ?
D14	Southbound OR 213 Advanced Warning System	Southbound OR 213, north of the Beavercreek Road intersection	Install a queue warning system for southbound drivers on OR 213 to automatically detect queues and warn motorists in advance via a Variable Message Sign	Short-term	Likely
D27	OR 213/Beavercreek Road Operational Enhancement	OR 213/Beavercreek Road	Lengthen the dual left-turn lanes along Beavercreek Road to provide an additional 200 feet of storage for the eastbound approach	Short-term	Yes
D37	Maple Lane Road/Holly Lane Operational Enhancement	Maple Lane Road/Holly Lane	Install a single-lane roundabout	Long-term	Unlikely
D38	Maple Lane Road/Walnut Grove Way Operational Enhancement	Maple Lane Road/Walnut Grove Way	Install a single-lane roundabout or realign Maple Lane Road in correlation with development	Long-term	Unlikely

D39	Beavercreek Road/Glen Oak Road Operational Enhancement	Beavercreek Road/Glen Oak Road	Install a roundabout	Long-term	Unlikely
D44	Beavercreek Road/Loder Road Extension Operational Enhancement	Beavercreek Road/Loder Road Extension	Install a roundabout	Medium-term	Likely
D46	Meyers Road West Extension	OR 213 to High School Avenue	Extend Meyers Road from OR 213 to High School Avenue as an Industrial Minor Arterial. Create a local street connection to Douglas Loop.	Short-term	Likely
D47	Meyers Road East extension	Beavercreek Road to the Meadow Lane Extension	Extend Meyers Road from Beavercreek Road to the Meadow Lane Extension as an Industrial Minor Arterial. Between the Holly Lane and Meadow Lane extensions, add a sidewalk and bike lane to the south side of the street, with a shared-use path to be added on north side per project S19. Modify the existing traffic signal at Beavercreek Road	Medium-term	Likely
D54	Clairmont Drive extension	Beavercreek Road to Holly Lane South Extension	Extend Clairmont Drive from Beavercreek Road to the Holly Lane South extension as an Industrial Collector. Add a sidewalk and bike lane to the south side of the street, with a shared-use path to be added on north side per project S17	Long-term	Likely
D55	Glen Oak Road extension	Beavercreek Road to the Meadow Lane Extension	Extend Glen Oak Road from Beavercreek Road to the Meadow Lane Extension as a Residential Collector. Install a roundabout at Beavercreek Road (per project D39)	Long-term	Likely
D56	Timbersky Way extension	Beavercreek Road to the Meadow Lane Extension	Extend Timbersky Way from Beavercreek Road to the Meadow Lane Extension as a Residential Collector. Add a sidewalk and bike lane to the south side of the street, with a shared-use path to be added on north side per project S20	Long-term	Likely
D57	Holly Lane South extension	Maple Lane Road to Thayer Road	Extend Holly Lane from maple Lane Road to Thayer Road as a Residential Collector. Add a sidewalk and bike lane to the west side of the street, with a shared-use path to be added on east side per project S14. Install a roundabout at Maple Lane Road (per project D37)	Medium-term	Likely
D58		Thayer Road to Meyers Road	Extend Holly Lane from Thayer Road to the Meyers Road extension as an Industrial Collector. Add a sidewalk and bike lane to the west side of the street, with a shared-use path to be added on east side per project S15	Medium-term	Likely
D59		Meyers Road to the Meadow Lane Extension	Extend Holly Lane from the Meyers Road extension to the Meadow Lane Extension as a Mixed-Use Collector. Add a sidewalk and bike lane to the west side of the street, with a shared-use path to be added on east side per project S16	Long-term	Likely
D64	Loder Road Extension	Beavercreek Road to Glen Oak Road	Extend Loder Road from Beavercreek Road to High School Avenue as an Industrial Collector. Add a sidewalk and bike lane to the west side of the street, with a shared-use path to be added on east side per project S18. Create a local street connection to Douglas Loop.	Short-term	Likely
D81	Beavercreek Road Upgrade	Clairmont Drive (CCC Entrance) to Meyers Road	Improve to Industrial Major Arterial cross-section	Medium-term	Likely
D82		Meyers Road to UGB	Improve to Residential Major Arterial cross-section	Long-term	Likely

DRAFT



- TSP Improvements Likely to be Funded
- TSP Roundabout Likely to be Funded
- TSP Roundabout Not Likely to be Funded
- Beavercreek Road Upgrades
- Conceptual Road Network

Conceptual Planned Area Connectivity Improvements Oregon City

Figure 1

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Planning level operations and safety analyses were conducted at the OR213/Beavercreek Road intersection, and compared to the 2013 TSP. The (2011 base) volumes from the 2013 TSP were compared to 2016 weekday p.m. peak hour count data (see **Appendix B**) collected by the City at the following intersections:

- OR213 and Beavercreek Road
- OR213 and S Caufield Road/Glen Oak Road
- S Holly Lane and S Maple Lane Road

This comparison showed an overall 2% linear annual growth rate for the area from 2011 to 2016. Based on this calculation, the growth rate experienced during the last five years appears consistent with the long term growth trend predicted in the TSP.

It should be noted that there is larger than average growth for the southbound right-turn movement from Holly Lane to Maple Lane Road. This is likely due, in part, to S Holly Lane functioning as a parallel alternative route to OR213. Drivers may be using S Holly Lane to avoid making a southbound left-turn from OR213 to Beavercreek Road due to long queues and delays for this movement.

The existing mobility standard for the OR 213/Beavercreek Road intersection set forth in the 2013 TSP is based on volume-to-capacity Ratio (v/c). The v/c ratio is a measure that reflects mobility and quality of travel. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). For example, a v/c of 1.00 indicates the roadway facility is operating at its capacity. The following mobility standard is set forth in the 2013 TSP for the OR213/Beavercreek Road intersection:

- During the highest one-hour period of the day, a maximum volume-to-capacity (v/c) ratio of 0.99 shall be maintained.

The analysis completed for the 2013 TSP shows the intersection operating with a v/c ratio of 0.83 under 2011 existing conditions.

The OR213/Beavercreek Road intersection was identified in the 2013 TSP as a high collision intersection. The ODOT Crash Analysis and Reporting Unit provided crash records at the intersection for the 5-year period from January 2010 through December 2014. **Table 2** summarizes the reported crash data. The crash data is included in **Appendix C**.

Table 2 - OR213/Beavercreek Road Intersection Crash Summary and Crash Rate Assessment (2010-2014)

Crash Type				Severity			Total	Critical Crash Rate by Intersection Type	Critical Crash Rate by Volume	Observed Crash Rate at Intersection	Observed Crash Rate>Critical Crash Rate?
Rear-End	Turning	Angle	Other	PDO	Injury	Fatal					
116	7	5	5	58	74	1	133	0.59	0.50	1.20	Yes

PDO = Property Damage Only
Crash Rate = crashes per million entering vehicles

The intersection was in the top 5% of the ODOT Safety Priority Index System (SPIS) List for the years 2012-2014. The SPIS List is maintained by ODOT and updated each year with the latest available year of crash records and traffic volumes. 2012-2014 is the most current SPIS list. The intersection also has a crash rate that exceeds the Critical Crash Rate meaning that it exceeds the crash rate of other comparable intersections.

Beavercreek Road is the first at-grade intersection on OR213 for over two miles south of Redland Road, in a corridor that generally feels rural. A lack of driver expectation of southbound queues from the signal may contribute to the high number of reported rear-end crashes at the intersection. The reported fatality occurred in 2011, and was an angle crash in which the driver ran a red light under dark and rainy conditions. The 2010-2014 crash rate of 1.20 is already lower than the crash rate of 2.05 identified in the 2013 TSP, indicating that safety and/or driver attentiveness have improved in recent years. Lengthening the dual eastbound left-turn lanes to provide additional storage (Project D27; funded) and an advanced queue warning system on southbound 213 will further improve safety at the intersection.

ALTERNATIVES DEVELOPMENT

The Synchro analysis in the 2013 TSP indicates that by 2035, without a major improvement, the intersection will function beyond the current mobility standard. Under 2035 Planned System Conditions, the intersection is expected to operate with a v/c ratio of 1.05, exceeding the existing mobility standard of a maximum v/c ratio of 0.99.

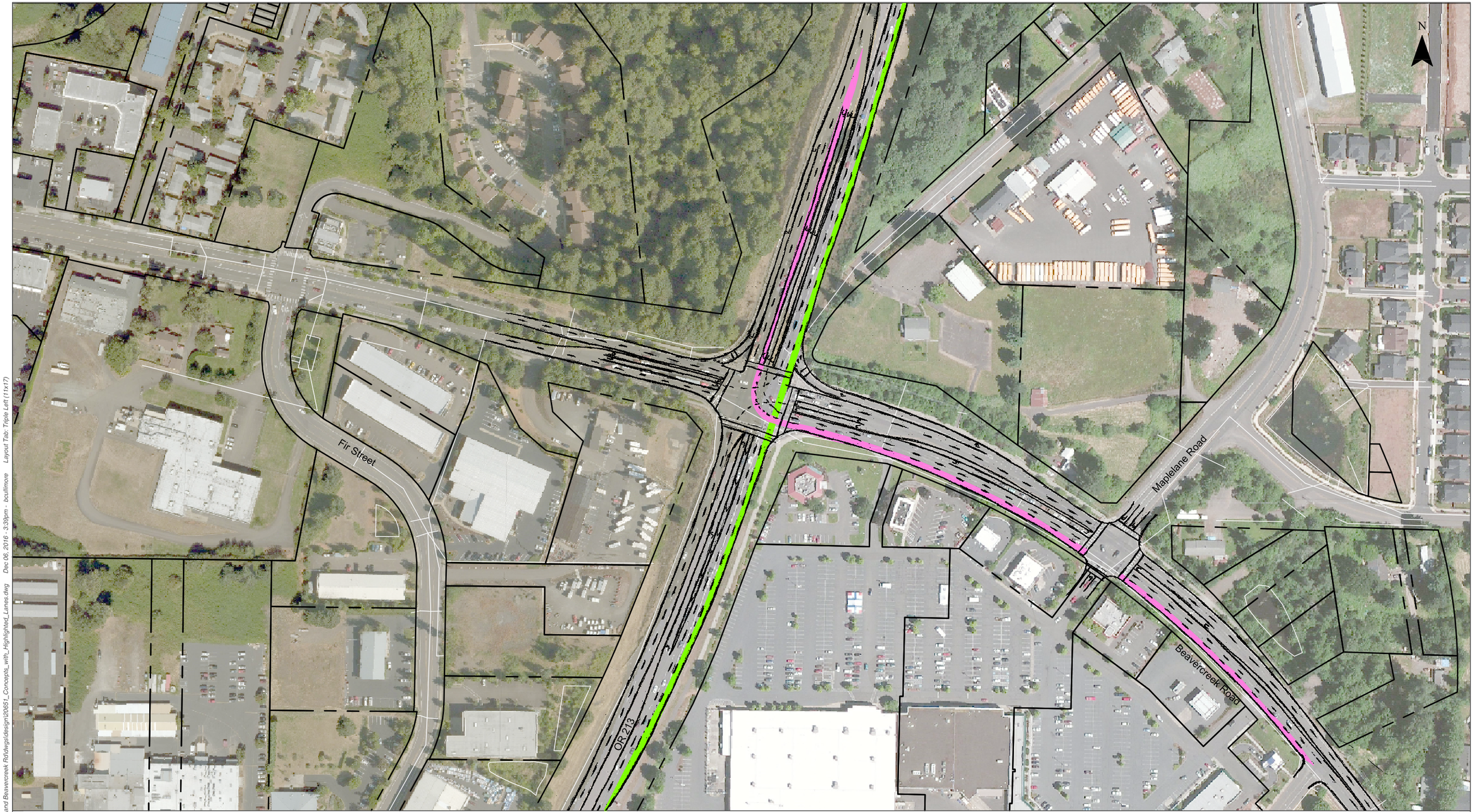
Alternatives to modify the existing intersection configuration and traffic control, which would bring the intersection into compliance with the current mobility standards in the year 2035, were identified and include:

- Addition of lanes to current configuration
- Quadrant road in the southwest quadrant of the intersection,
- Variations of displaced left-turns (also referred to as continuous flow intersection), and
- Grade-separated interchange forms.

The potential operational impacts of each alternative are shown in **Table 3** and evaluated for a variety of additional considerations in **Table 4**.

Alternative 1: Triple Left-Turns

To maintain the current mobility standard with the existing intersection control, a third southbound left-turn lane and a third northbound through lane through the intersection would be required to bring the intersection back to a v/c ratio of 0.90. The effectiveness of the additional northbound through lane is dependent on the planned extension of Meyers Road from Beavercreek Road to OR213 which would allow some eastbound right-turns at the intersection to be converted to northbound through movements based on the new network connectivity. **Figure 2** shows a sketch of these potential lane additions.



SCALE
0 200 400

= New Lanes

Alternative 1: Triple Southbound Left Turn Lanes
& Three Northbound Through Lanes
Oregon City, Oregon

Figure
2

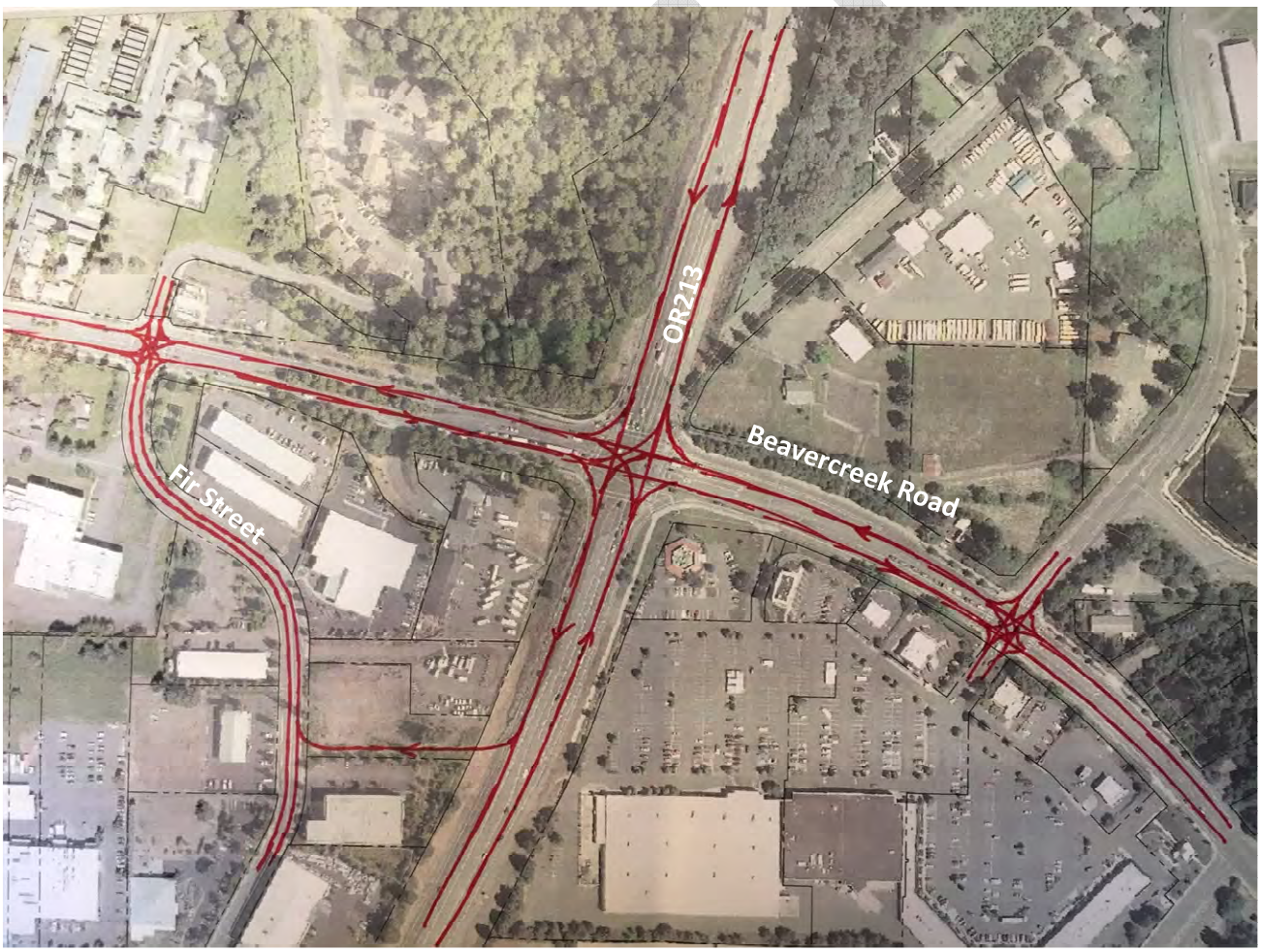
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Alternative 2: Quadrant Road

A quadrant road, or indirect left, in the southwest corner of the intersection would allow southbound left-turns to be prohibited at the OR213/Beavercreek Road intersection. These vehicles would instead travel southbound through the intersection, turn right onto a new street to the south that would connect to Fir Street, and make a right-turn onto Beavercreek Road to continue east on their desired route. A third southbound through lane and third eastbound through lane would be necessary to accommodate the large volumes traveling through the intersection twice instead of once. This would reduce overall intersection delay but increase travel time for the southbound left-turn movement. The widening is likely to impact the culvert and retaining walls on the northwest and northeast corners of the intersection.

Exhibit 2. Quadrant Road Alternative



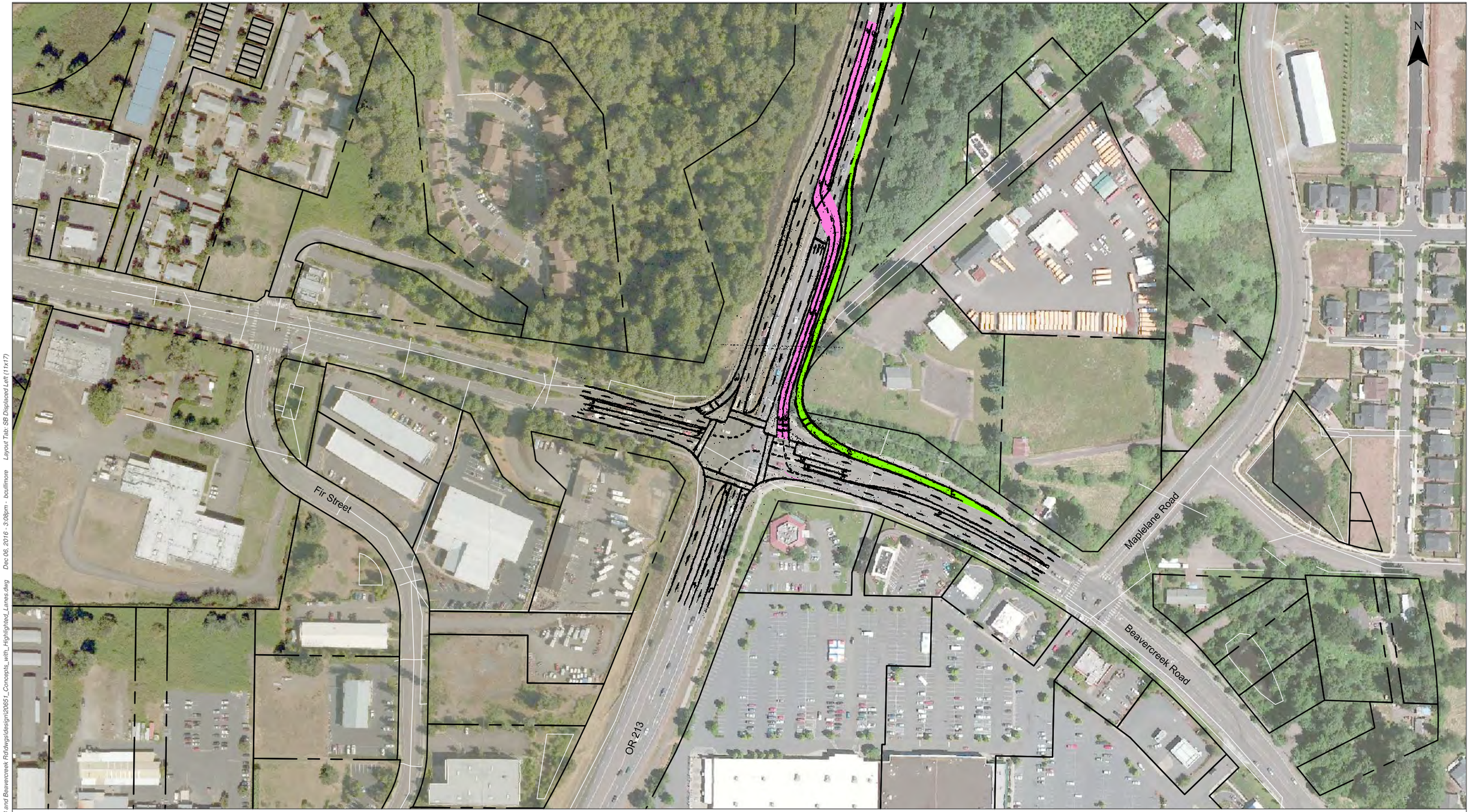
Alternatives 3 & 4: Displaced Left-Turns

In a displaced left-turn[1], or continuous flow, intersection, left-turns are removed from the main intersection and relocated to a new upstream signal. With proper coordination, vehicles are able to make a left-turn simultaneously with opposing through traffic. Displaced left-turn intersection alternatives would reduce the number of signal phases and conflict points in the OR213/Beavercreek Road intersection, thereby improving capacity and safety, but would require coordinated partial signals on the approaches with displaced left-turns. The heaviest left-turn movements at the OR213/Beavercreek Road intersection are on the southbound and eastbound approaches. **Figure 3** shows a sketch of a displaced left-turn for the southbound approach only. **Figure 4** shows a sketch of displaced left-turns for both the southbound and eastbound approaches. In either case, the southbound approach requires dual left-turn lanes. Consideration could be given to prohibiting the northbound and westbound left-turn movements as these movements have minimal traffic volumes and have alternate routes; however, these restrictions are not mandatory. Additional analysis (microsimulation) is necessary to fully understand the benefits of these potential restrictions.

Alternative 3 includes impacts to the culvert and retaining walls in the northeast corner of the intersection. Alternative 4 includes culvert and retaining wall impacts to both the northwest and northeast corners of the intersection.

DRAFT

[1] Steyn, H., Z. Bugg, B. Ray, and A. Daleiden. *Displaced Left-Turn Informational Guide.* FHWA, Washington, D.C., 2014. http://safety.fhwa.dot.gov/intersection/alter_design/pdf/fhwasa14068_dlt_infoguide.pdf



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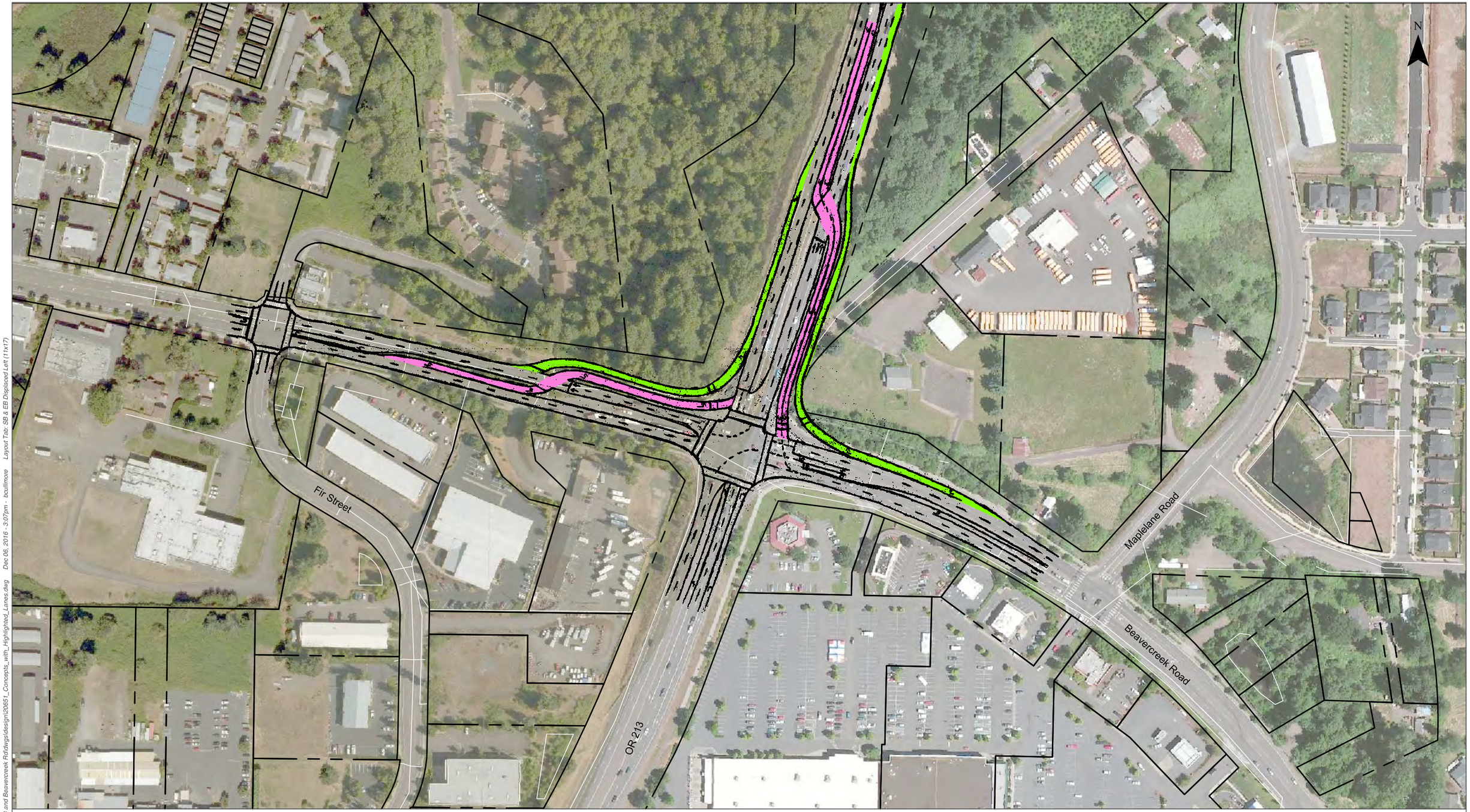
= New Lanes

Alternative 3: Southbound Displaced Left Turn
Oregon City, Oregon

Figure
3

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

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= New Lanes

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Alternative 4: Southbound & Eastbound Displaced Left Turn
Oregon City, Oregon

Figure
4

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

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Alternatives 5 – 7: Grade-Separated Interchange Alternatives

Several grade-separated interchange configurations were considered including full diamond, half diamond (i.e., southbound off-ramp and northbound on-ramp only) and single-point interchanges. A project to constructing an interchange at this location was removed from the TSP in the 2013 Update at the request of ODOT as it was determined to be financially unfeasible given other regional priorities.

The construction of an interchange at the OR213/Beavercreek Road intersection would have many challenges and impacts on surrounding land uses as shown in Exhibits 3 through 5.

Exhibit 3. Half Diamond Interchange Alternative



Exhibit 4. Full Diamond Interchange Alternative

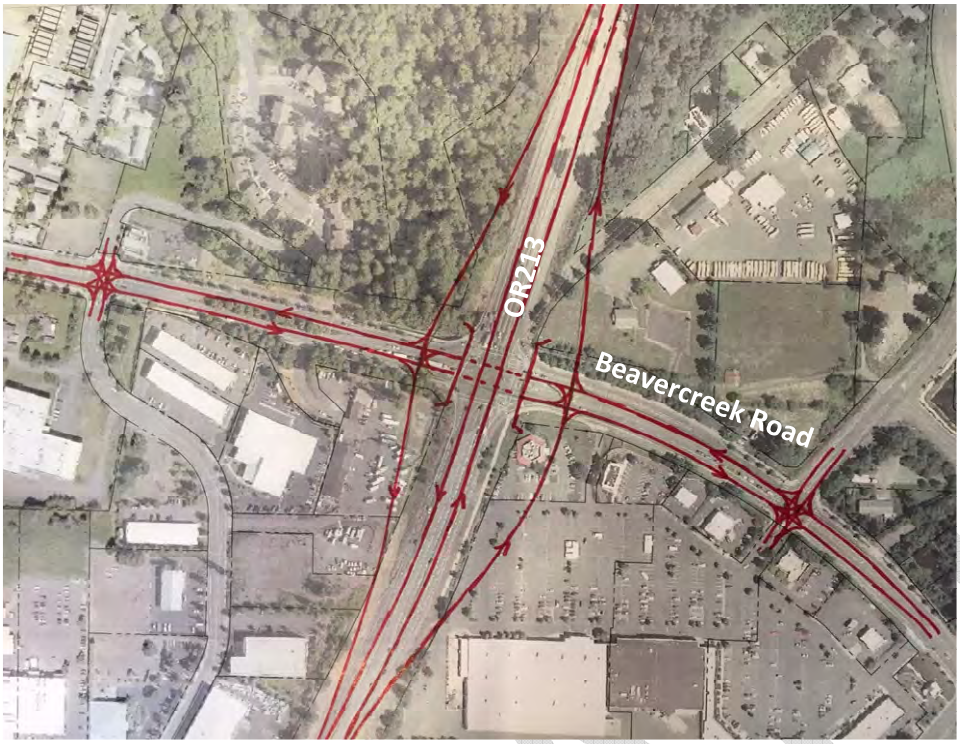
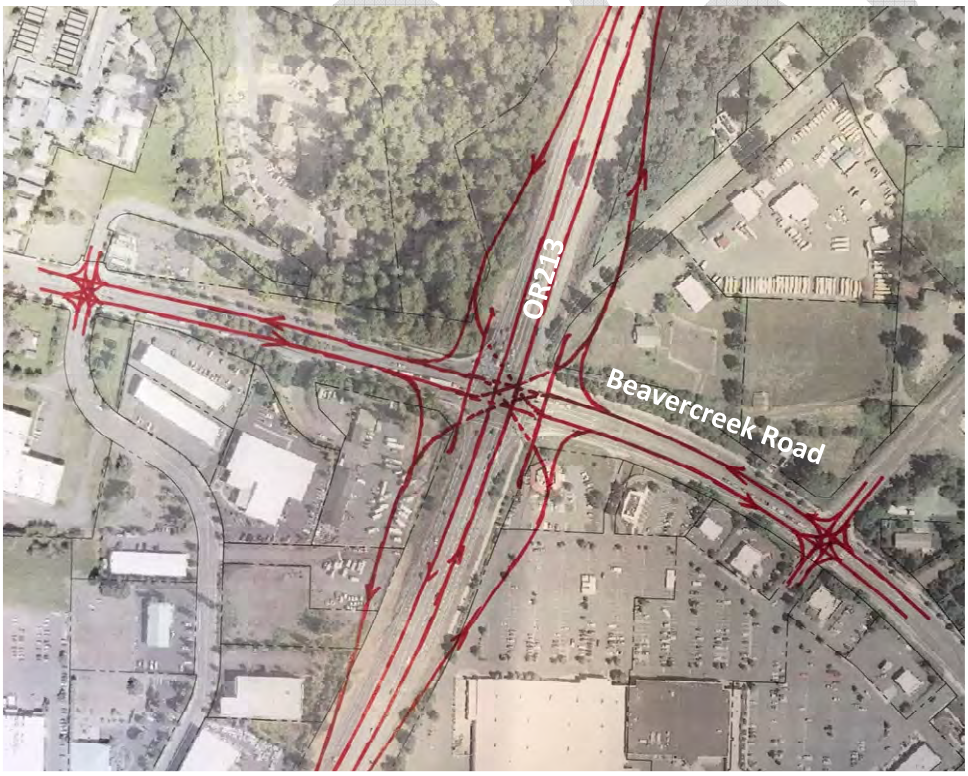


Exhibit 5. Single Point Interchange Alternative



ALTERNATIVES EVALUATION

The following provides an overview of operational analysis conducted on each alternative and summarizes the qualitative assessment for each alternative.

Operations Analysis

Planning level operational analysis was conducted using the CAP-X tool developed by FHWA[2], which can be used to evaluate alternative intersection forms and interchanges. The tool provides a total intersection (v/c) ratio. It was used for all alternatives to provide a consistent comparison of alternatives, but was found to be less conservative than Synchro in the base condition. **Table 2** summarizes the v/c ratios provided by CAP-X for each alternative. If one of these alternatives is identified as potential viable solution, it should be modeled in VISSIM to refine the forecast v/c ratio.

Table 3 – CAP-X Alternatives Operations Analysis Summary (Year 2035)

Alternative		v/c	Figure/Exhibit
1	Lane Additions: Triple Southbound Left-Turn Lanes and Three Northbound Thru Lanes	0.90	Figure 2
2	Indirect Left (S/W Quadrant Road) with Three Southbound and Eastbound Thru Lanes	0.94	Exhibit 2
3	Southbound Displaced Left-Turn	0.86	Figure 3
4	Southbound and Eastbound Displaced Left-Turns	0.81	Figure 4
5	Full Diamond Interchange with Dual Eastbound and Westbound Left-Turn Lanes	0.82	Exhibit 3
6	Half Diamond Interchange with Dual Eastbound Left-Turn Lanes	0.79	Exhibit 4
7	Single Point Interchange with Dual Eastbound and Westbound Left-Turn Lanes	0.80	Exhibit 5

As shown, all alternatives meet the mobility standard. Differences on their costs and impacts are provided in the following section.

Alternatives Assessment

Each of the alternatives was qualitatively evaluated for its impact to the intersection capacity, right-of-way impacts, environmental impact, bicycle and pedestrian impacts, cost, connectivity, and dependence on other projects. These factors are discussed below and summarized in **Table 4**.

[2] Transportation Systems Institute (TSI). *Capacity Analysis for Planning of Junctions*. Version 1.2. 2011. http://tsi.cecs.ucf.edu/index.php/cap-x

Capacity

Each of the alternatives provides sufficient capacity to meet the current mobility standard in 2035. However, the triple left-turns and indirect left alternatives (Alternatives 1 and 2) still have an overall v/c ratio equal or greater than 0.90 and may represent a short-term fix rather than a long-term solution or may not provide benefit commensurate with the costs. The displaced left-turn alternatives (Alternatives 3 and 4) provide additional capacity nearly equal to the grade-separated interchange alternatives (Alternatives 5, 6 and 7) at a significantly lower cost.

Right-of-Way Impacts

Alternatives 1, 3, and 4 may be feasible within the existing right-of-way. Alternative 2 would require right-of-way through a vacant parcel to connect OR213 to Fir Street. All of the grade separated interchange alternatives include large impacts to the right-of-way. The half diamond interchange reduces right-of-way takes as compared to the full diamond interchange without eliminating necessary movements through the intersection.

Environmental Impacts

For all alternatives, any widening on the north side of Beavercreek Road, east or west of OR213 would impact the stream and wetlands and require mitigation. They would also require extending the existing culvert crossing under OR213 on the north side of Beavercreek Road and reconstruction of the retaining walls in the northwest and northeast corners of the intersection. Additional investigation is necessary to fully understand the costs of these potential impacts and to determine if the culvert can be extended or has to be upgraded or if the widening could be accommodated utilizing existing right-of-way on the south side of Beavercreek Road.

Alternative 1 is the only alternative with the potential to not impact the northwest and northeast corners. Alternative 3 may impact the northeast corner only. Alternatives 2 and 4 would impact the northwest and northeast corners and Alternatives 5, 6, and 7 would have significant impacts in the northwest and northeast quadrants.

Bicycle and Pedestrian Impacts

All alternatives can accommodate bicycles and pedestrians; however, Alternatives 1 and 2 include additional through lanes and would increase the intersection crossing distances which is an undesirable impact. Alternatives 3 and 4 reduce the crossing distances but result in two-stage crossing of some legs of the intersection. Alternatives 5, 6, and 7 increase and decrease crossing distances depending on the leg of the intersection and result in cyclists and pedestrians navigating two major intersections instead of one.

Cost

The costs of adding additional lanes, indirect lefts, or displaced left-turns are all of similar magnitude and may require extending or reconstructing the culvert and reconstructing retaining walls.

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Alternatives 3 and 4 also require the addition of partial signals on one or both of the southbound and eastbound legs of the intersection, respectively. Each of the interchange alternatives (Alternatives 5, 6 and 7) are assumed to be cost-prohibitive at a minimum cost of $25,000,000.

Connectivity

Turning movements to and from the south leg of OR213 are minimal due to the presence of parallel routes and/or other road network connections. The half diamond interchange alternative (Alternative 6) eliminates these movements, thereby improving capacity at the intersection. There is the potential to further improve the capacity of the displaced left-turn alternatives (Alternatives 3 and 4) by prohibiting the northbound and westbound left-turn movements as these movements have minimal traffic volumes; however, this is not a requirement of the alternatives. The connectivity improvements in the TSP are important to the flexibility and viability of these alternatives.

Dependence on Other Projects

As noted in the discussion of connectivity above, the half diamond interchange alternative (Alternative 6) is dependent on other projects in the area to provide the parallel routes necessary to accommodate the movements eliminated from the OR213/Beavercreek Road intersection. The practicality of the additional northbound through lane in the triple left-turns alternative (Alternative 1) is also dependent on the provision of road extensions, particularly the planned Meyers Road extension to OR213.

Table 4 – Alternatives Evaluation

Alternative		Additional Capacity	Right-of-Way Impacts	Environmental Impact	Bike/Ped Impacts	Cost	Eliminates Movements ?	Dependent on Connectivity Extensions?
	Existing	None	None	None	No Improvement	NA	No	Yes
1	Triple Southbound Left / Three Northbound Thru	Some	None to Minimal	None to Minimal	Increased Crossing Distances	Medium ($5-$10M)	No	Yes
2	Indirect Left (S/W Quadrant Road)	Some	New Connection on Industrial Land	NW and NE Corners	Increased Crossing Distances	Medium ($5-$8M)	No	No
3	Southbound Displaced Left-Turn	Significant	None to Minimal	NE Corner	Reduced Crossing Distances	Medium ($5-$10M)	Would provide additional benefit	No
4	Southbound and Eastbound Displaced Left-Turns	Significant	None to Minimal	NW and NE Corners	Reduced Crossing Distances	Medium ($8-$12M)	Would provide additional benefit	No
5	Full Diamond Interchange	Significant	High	NW and NE Quadrants	Two intersections	High (>$25M)	No	No
6	Half Diamond Interchange	Significant	High	NW and NE Quadrants	Two intersections	High (>$25M)	Yes	Yes
7	Single Point Interchange	Significant	High	NW and NE Quadrants	Two intersections	High (>$25M)	No	No

Consistency with Policies

The City will continue to assess if any of the alternatives are in conflict with regional land use or transportation policy frameworks or with state or locally adopted policies. Input from the Technical Advisory Group will be collected on this issue.

SUMMARY

The OR213/Beavercreek Road intersection is forecast to not meet the current mobility standard by 2035. Each of the alternatives identified above provides sufficient capacity to meet the current standard in 2035; however, the additional capacity is provided at varying degrees and each alternative has cost and other impacts to consider in determining if they are feasible solutions for the City. If none of the alternatives is found to be feasible, an alternative mobility target approach needs to be pursued.

NEXT STEPS

Alternatives will be reviewed with the TAG and CAG to determine if any should be further explored in more detail and/or if an alternative mobility target should be pursued.

Future meetings with the TAC and CAG are planned to discuss potential alternative mobility targets and ultimately select an alternative mobility target and/or preferred improvement(s) to be adopted into the city's TSP by the Planning Commission and City Council. Alternative mobility targets will also need to be agreed upon by ODOT and approved by the Oregon Transportation Commission.

DRAFT

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MEMORANDUM #2

Date: February 24, 2017

Project #: 20651

To: Dayna Webb, P.E.
Public Works Department
City of Oregon City
625 Center Street
Oregon City, Oregon 97045

From: Susan Wright, P.E. and Kristine Connolly

Project: Highway 213 & Beavercreek Road Alternative Mobility Targets (PS 16-024)

Subject: Alternative Mobility Target Methodology and Feasible Improvements

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Oregon City's 2013 Transportation System Plan (TSP) determined that the Highway 213 (OR213) corridor from Redland to Molalla Avenue (including the intersection of Beavercreek Road) will exceed the current mobility target in 2035, resulting in more congestion than is allowed. The TSP recommended a project be conducted to identify what improvements may be necessary to meet the current target or whether an alternative mobility target is necessary. Potential improvements for the intersection of Beavercreek Road and Highway 213 were presented to the Technical Advisory Group (TAG) and Community Advisory Group (CAG) in December 2016 and January 2017, respectively. The feasibility of these alternatives is still under review; however, it is likely that none of the alternatives will be found to be cost-feasible in the near-term and although portions of the improvements may be implemented, an alternative mobility target will be necessary. This memorandum provides a menu of potential measures that could be used for establishing an alternative mobility target, reasonable target ranges, and a list of potentially feasible improvements to increase capacity and safety in the corridor. If mobility cannot be achieved, these measures and improvements will be reviewed and discussed with the TAG and CAG to select a target methodology and appropriate range, as well as recommend improvements.

POLICY CONTEXT

Mobility targets are the measure by which the state assesses the existing or forecasted operational conditions of a facility. As such, they are a key component the Oregon Department of Transportation (ODOT) uses to determine the need for, or feasibility of providing highway, or other transportation system improvements. They impact local land use and transportation planning as well as development review. Recent years have seen notable changes to Oregon's transportation planning and land use

policies and requirements. These changes reflect statewide policy to support transportation solutions that encourage economic development, contribute to public health, offer multi-modal choices for all users, and reflect the uncertain fiscal realities and limited transportation funding.

Oregon's Transportation Planning Rule (TPR)

Mobility targets for state highways, as established in this policy or as otherwise adopted by the Oregon Transportation Commission (OTC) as alternative mobility targets, are considered the highway system performance standards in compliance with the Transportation Planning Rule (TPR) (OAR 660-012), including applicability for actions that fall under Section -0060 of the TPR.

The TPR Section -0060 applies when cities or counties are considering zone changes or plan amendments that would allow for additional development that would significantly impact or worsen the performance of existing or planned transportation facilities. Currently, significant impacts are found to exist when levels of automobile traffic cause roadway facilities to exceed motorized vehicle standards, such as mobility targets. If there is a significant impact, jurisdictions are required to *"ensure that allowed land uses are consistent with the identified function, capacity, and performance standards of the facility measured at the end of the planning period identified in the adopted Transportation System Plan."*

EXISTING PERFORMANCE MEASURE AND TARGET

Mobility, or congestion, may be measured and regulated in a variety of ways. In the context of this project, mobility performance measures are methods to objectively measure the transportation system, such as travel time, or reliability. Mobility targets describe an acknowledged acceptable level of performance for a measure, such as a certain level of congestion.

The existing mobility target for the OR213/Beavercreek Road intersection set forth in the Oregon Highway Plan (OHP) and the 2013 TSP is based on volume-to-capacity Ratio (v/c). The v/c ratio is a measure that reflects mobility and quality of travel. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). For example, a v/c of 1.00 indicates the roadway facility is operating at its capacity. An intersection can have an overall v/c ration of 1.00 yet have v/c ratios greater than 1.00 for individual movements where it may take more than one signal cycle to get through the intersection and queues build up. The following mobility target is set forth in the 2013 TSP for the OR213/Beavercreek Road intersection:

- During the highest one-hour period of the day, a maximum volume-to-capacity (v/c) ratio of 0.99 shall be maintained.

The Synchro model (a traffic model used to evaluate v/c ratios and other metrics) analysis completed for the 2013 TSP shows the intersection operating with an intersection v/c ratio of 0.83 for the p.m. peak hour under 2011 existing conditions. The TSP analysis also indicates that by 2035, without improvement, the intersection will function beyond the current mobility target. Under 2035 Planned

System Conditions (which includes planned, but potentially unfunded, roadway improvements), the intersection is expected to operate with a v/c ratio of 1.05, exceeding the existing mobility target (a maximum v/c ratio of 0.99). Under 2016 traffic volumes, the intersection operates with a v/c ratio of 0.97, just below the existing mobility target. The southbound left-turn and eastbound left-turn movements exhibit higher than average v/c ratios, while the westbound left-turn and northbound left-turn movements exhibit lower than average v/c ratios.

Table 1 – OR213/Beavercreek Road Intersection Operations

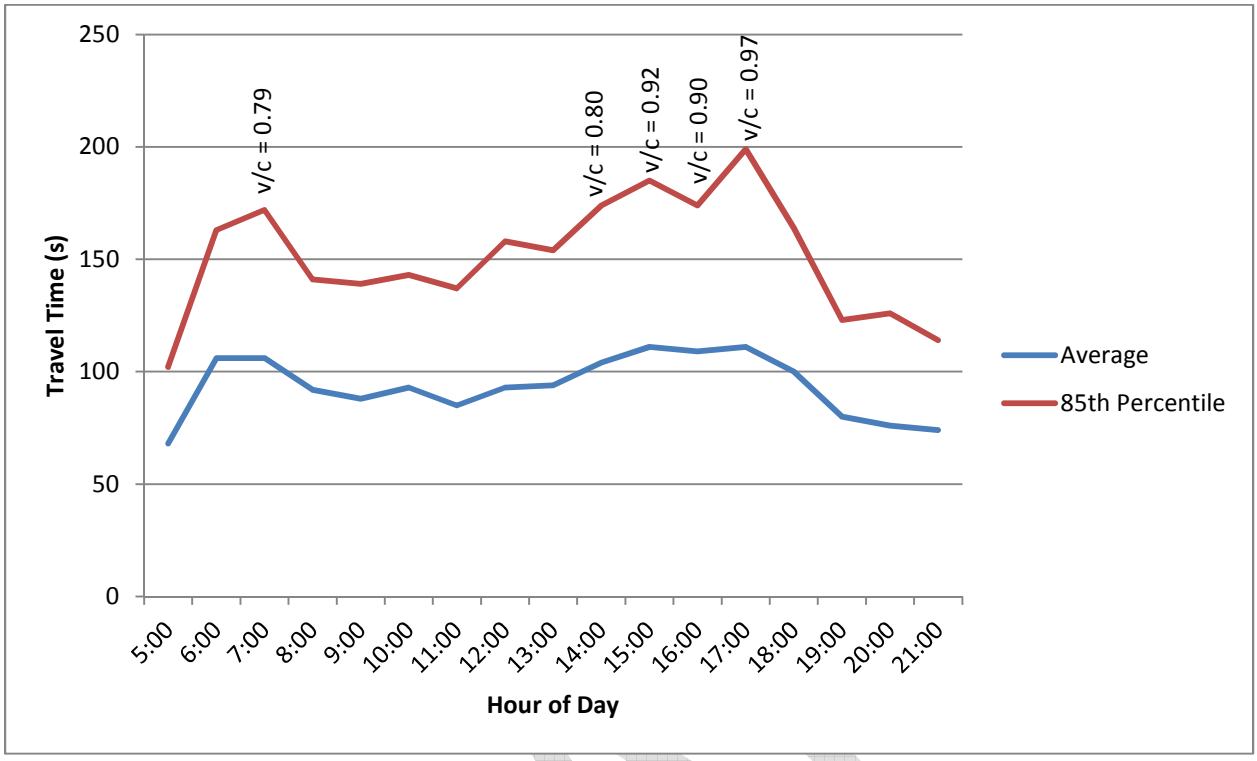
Year	PM Peak Volume-to-Capacity Ratio (v/c)
2011 (2013 TSP Existing Conditions)	0.83
2016 Traffic Volumes	0.97
2035 (2013 TSP Forecast)	1.05

Peak Hours

A travel time study was conducted at the OR213/Beavercreek Road intersection in January 2017 to evaluate the variability of traffic conditions throughout the day. This study utilized BlueTooth data collection units (BlueMAC) at each leg of the intersection to identify the travel speed and travel time for each movement (northbound left, northbound through, northbound right, etc.) separately[1]. The data was collected 24-hours per day for 7 days, allowing comparison of results by time of day and day of week. Attachment "A" provides the differences in travel time by time of day for each movement at the intersection. The data in Attachment "A" reflects typical weekday conditions (Tuesday, Wednesday, and Thursday). Exhibit 1 shows the travel time through the intersection averaged for all movements. Note that the graph provides the average travel time to traverse the intersection; some movements may experience higher travel times. The weekday PM peak hour represents the highest travel times of the day, with higher than average travel times extending from 3:00 to 6:00 PM. Above average travel times also occur during weekday midday and AM peak hours. There are approximately 5 hours per day currently experiencing high travel times compared to the rest of the day which could indicate congestion and possible cycle failure for some movements. This can be considered in evaluating the potential performances measures in the following section.

[1] Data was collected at a distance of approximately 1000' from the intersection on each leg, with the exception of the north leg, where data was collected approximately 2000' from the intersection.

Exhibit 1 –Travel Time through OR213/Beavercreek Road Intersection



The cycle length of the traffic signal at the OR213/Beavercreek intersection is approximately 120 seconds. Exhibit 1 shows that during the a.m. and p.m. peak hour periods, the average time it takes to traverse the intersection is 110 seconds. Average travel time and v/c ratio are not directly linked; however, the average travel times increase and decrease with v/c ratio. Table 2 provides volume-to-capacity ratios for the five highest volume hours of the day. These v/c ratios are noted on Exhibit 1 during their corresponding hour.

Table 2 – 2016 Existing Intersection Operations for the Five Highest Volume Hours (OR213/Beavercreek Road)

Highest Hour	Time of Day	Total Entering Volume	V/C
1st	5-6 PM	6059	0.97
2nd	4-5 PM	5858	0.90
3rd	3-4 PM	5623	0.92
4th	2-3 PM	4972	0.80
5th	7-8 AM	4619	1.04[2]

[2] The v/c ratio for the AM peak hour is 1.04 due the high volume of westbound right-turns. If the westbound right-turns are excluded the intersection v/c is 0.79. This is under further review.

Oregon Highway Plan Policy 1F

The Oregon Highway Plan (OHP) defines polices and investment strategies for Oregon's state highway system for the next 20 years. The OHP gives policy and investment direction to corridor plans and transportation system plans that are being prepared around the state, but it leaves the responsibility for identifying specific projects and modal alternatives to those plans.

The OHP Policy 1F establishes mobility targets (as defined by motorized vehicle volume-to-capacity ratios) for state facilities that vary by region, facility classification, and whether or not the roadway is located inside an urban growth boundary (UGB). It states, *"It is the policy of the State of Oregon to maintain acceptable and reliable levels of mobility on the state highway system, consistent with expectation for each facility type, location and functional objectives. Highway mobility targets will be the initial tool to identify deficiencies and consider solutions for vehicular mobility on the state system. Specifically, mobility targets shall be used for:*

- *Identifying state highway mobility performance expectations for planning and plan implementation;*
- *Evaluating the impacts on state highways of amendments to transportation plans, acknowledged comprehensive plans and land use regulations pursuant to the Transportation Planning Rule (OAR 660-12-0060); and*
- *Guiding operations decisions such as managing access and traffic control systems to maintain acceptable highway performance."*

The OHP Policy 1F allows for development of alternative mobility targets in areas where it is "infeasible or impractical to meet the mobility targets". The policy allows for the use of alternative mobility targets to *"balance overall transportation system efficiency with multiple objectives of the area being addressed."* It requires that targets *"shall be clear and objective and shall provide standardized procedures to ensure consistent application of the selected measure. The alternative mobility target(s) shall be adopted by the Oregon Transportation Commission as an amendment to the OHP."* The OHP currently includes alternative mobility targets in many locations throughout the State; however, none have been adopted within the Portland Metro area to date.

MAJOR IMPROVEMENT ALTERNATIVES (MEMORANDUM #1)

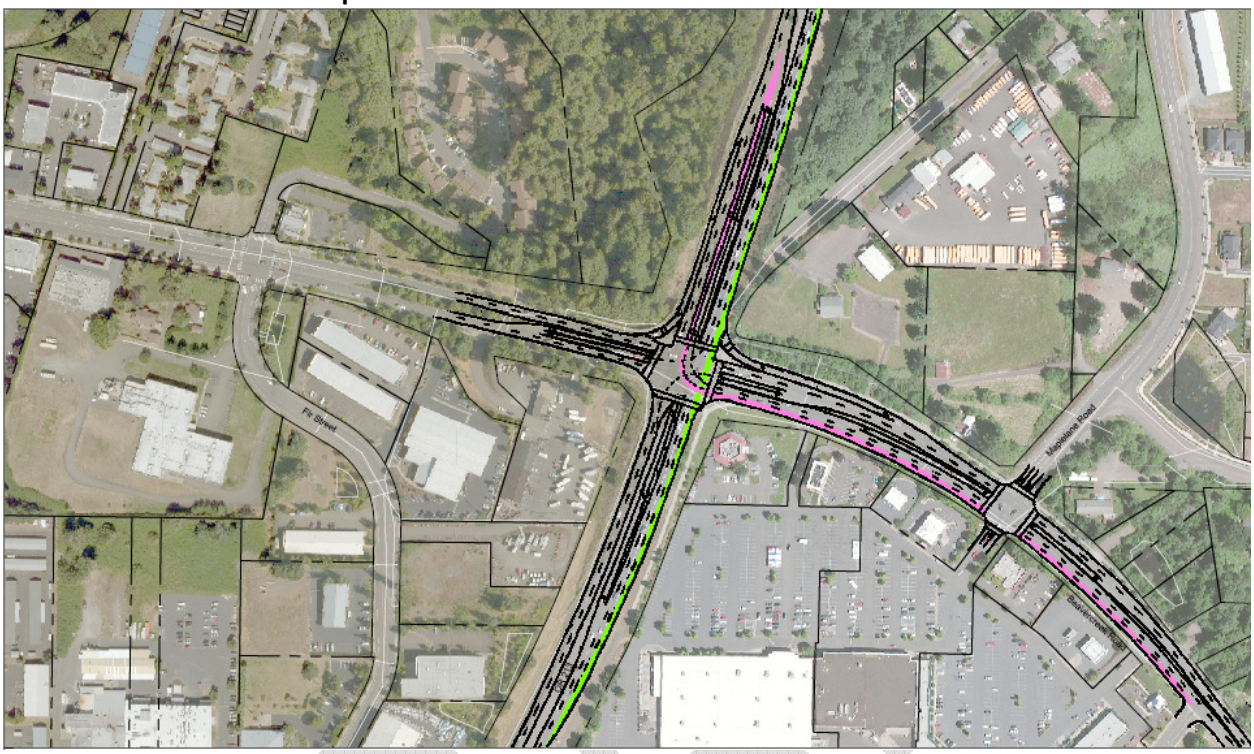
The following alternatives from Technical Memorandum #1 are still under review to determine physical and financial feasibility. This additional work will discussed at the next set of advisory committee meetings. Table 5 lists these alternatives, as well as their relative benefits, constraints, opportunities, and risks.

Alternative 1: Triple Left-Turns

Add a third southbound left-turn lane and a third northbound through lane through the intersection while continuing to maintain a separate northbound right-turn lane (not reflected in Exhibit 2). This is

projected to operate at a v/c ratio of 0.90 in the 2035 TSP horizon year. A conceptual sketch of Alternative 1 can be seen in Exhibit 2.

Exhibit 2 – Alternative 1: Triple Left-Turns

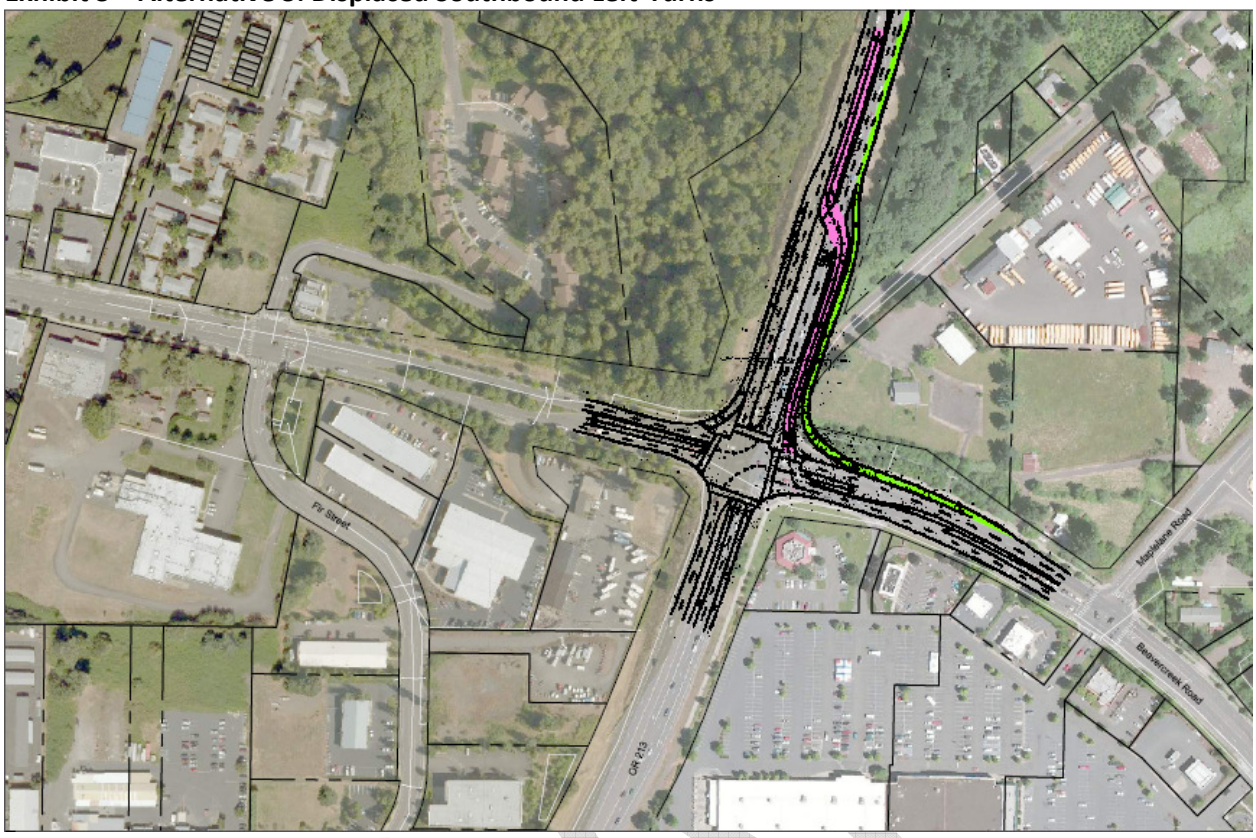


Alternative 3: Displaced Southbound Left-Turns

Construct a southbound displaced left-turn[3] (or continuous flow) intersection. Displaced left-turns reduce the number of signal phases and conflict points at the intersection, thereby improving capacity and safety, but require coordinated partial signals on the approaches with displaced left-turns. Alternative 3 likely includes impacts to the culvert and retaining walls in the northeast corner of the intersection. A conceptual sketch of Alternative 3 can be seen in Exhibit 3.

[3] Steyn, H., Z. Bugg, B. Ray, and A. Daleiden. *Displaced Left-Turn Informational Guide.* FHWA, Washington, D.C., 2014. http://safety.fhwa.dot.gov/intersection/alter_design/pdf/fhwasa14068_dlt_infoguide.pdf

Exhibit 3 – Alternative 3: Displaced Southbound Left-Turns



Alternatives 5 and 7

A project to construct an interchange at this location was removed from the 2013 TSP Update. The interchange was eliminated due to livability, multi-modal access and funding constraints within the 2035 planning horizon. Additionally, at the request of ODOT as it was determined to be financially infeasible given other regional priorities. Conceptual sketches of Alternatives 5 and 7 can be seen in Exhibits 4 and 5, respectively.

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Exhibit 4 – Full Diamond Interchange

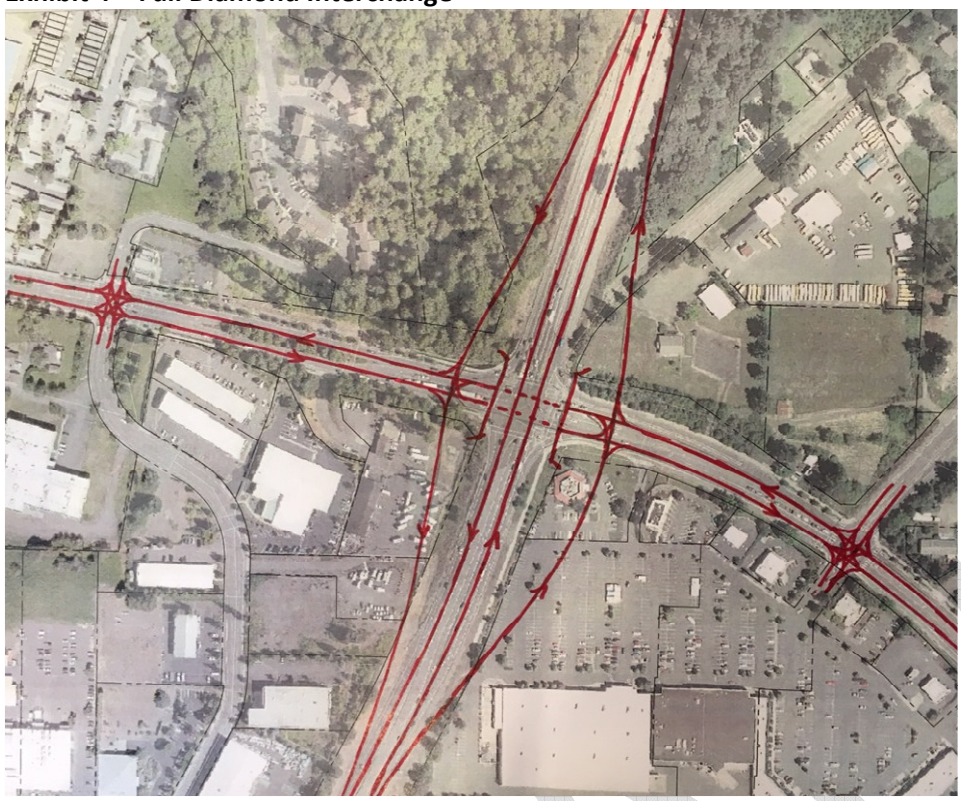


Exhibit 5 – Single Point Interchange

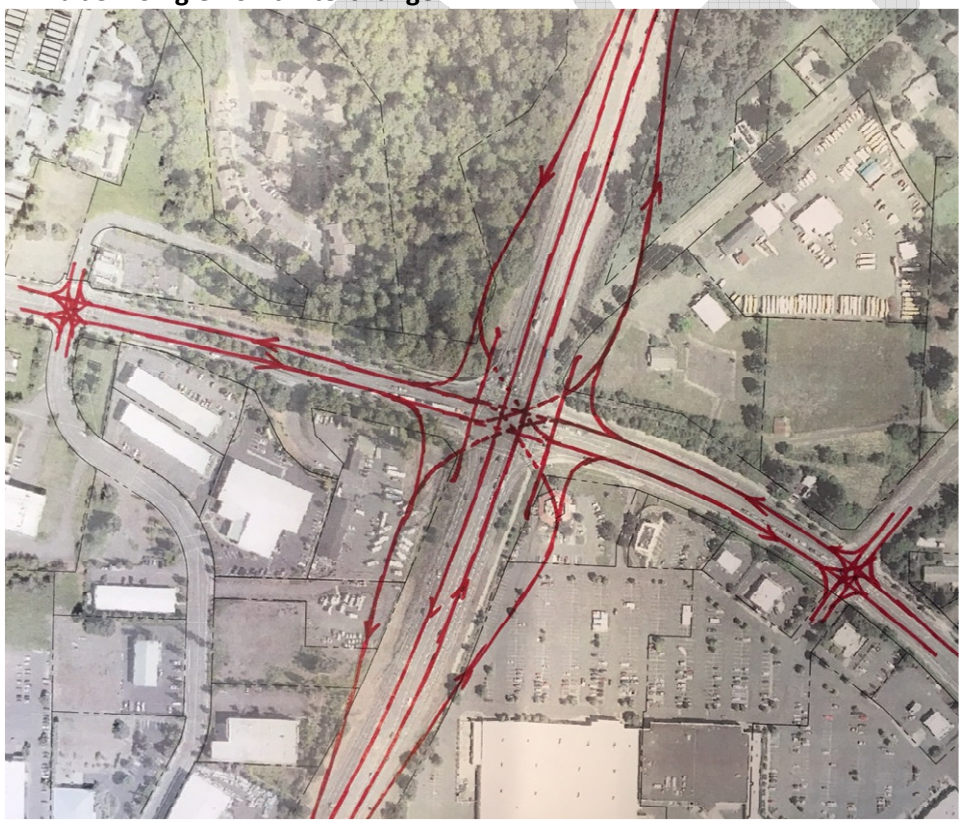


Table 3 – Intersection Alternatives Considered

Alternative	Benefits	Opportunities	Constraints	Risks
Alternative 1: Triple Left-Turns	Meets current mobility target in 2035	North and east legs of intersection	Cost; vehicle navigation of three left-turn lanes	Increase sideswipe crashes through turn and downstream weave
Alternative 3: Displaced Southbound Left Turns	Meets current mobility target in 2035	North leg of intersection	Cost; impact to existing culvert and retaining walls	Driver confusion with uncommon intersection type
Alternative 5: Full Diamond Interchange	Meets current mobility target in 2035; greatly increases capacity for through traffic on OR213	All approaches of the intersection	Cost; right-of-way	Increased intersection exposure (i.e., two large ramp terminals) for pedestrians and bicyclists
Alternative 7: Single-Point Interchange	Meets current mobility target in 2035; greatly increases capacity for through traffic on OR213	All approaches of the intersection	Cost; right-of-way	

POTENTIAL PERFORMANCE MEASURES

The OR213/Beavercreek Road intersection is currently experiencing deficiencies in capacity and safety for vehicular modes of travel. Mobility is currently measured by using v/c to measure the average level of congestion for motorists entering all legs of an intersection. With this project, we will explore the menu of options available to measure congestion both at an intersection and along the Highway 213 corridor, from Redland Road to Molalla Avenue. While it is important that the intersection be complete and accessible by all modes, the potential performance measures set forth in this memorandum primarily address vehicle mobility. Table 3 provides a menu of potential alternative mobility measures and reasonable target ranges which can be used in development review. The menu was developed based on a performance measure literature review of published engineering manuals, rating systems, and academic sources conducted by Kittelson & Associates, Inc.

DRAFT

Table 4 – Potential Performance Measures and Alternative Mobility Target Ranges

Measure	Definition	Potential Target	Ease of Application
Mobility			
Volume to Capacity (v/c) Ratio	This is the current performance measure, measured as an average of all potential movements through an intersection. V/C ratio is a measure that reflects mobility and quality of travel. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). For example, a v/c of 1.00 indicates the roadway facility is operating at capacity. *Existing and Forecast v/c ratios:* Year 2011: 0.83 Year 2016: 0.97 Year 2035: 1.05	Maintain current target of 0.99, but allow intersection to exceed this ratio for no more than a specified number of hours per day. OR Increase current target to a higher ratio, such as 1.1, not to be exceeded during the peak hour of the day.	Could be applied with existing analysis tools used in Traffic Impact Studies. May require additional hours of traffic count data collection.
Intersection Delay	The average total vehicle delay of all movements through an intersection. Vehicle delay is a method of quantifying several intangible factors, including driver discomfort, frustration, and lost travel time. *Existing and Forecast Intersection Delay:* 2011: 40.7s 2016: 56.8s 2035: 73.4s	Average intersection delay shall not exceed "X" seconds during the peak hour of the day. OR Average intersection delay shall not exceed "X" seconds for more than a specified number of hours per day.	Could be applied with existing analysis tools used in Traffic Impact Studies. May require additional hours of traffic count data collection.
Intersection Level of Service (LOS)	A quantitative stratification on an A through F scale that represents a traveler's perceptions of quality of service by a facility. For autos, level of service is based on the average delay. *Existing and Forecast Intersection LOS:* 2011: D 2016: E 2035: E	Maintain overall intersection LOS of "X" or better during the peak hour of the day. Individual movements may exceed this LOS. OR Maintain overall intersection LOS of "X" or better for more than a specified number of hours per day.	Could be applied with existing analysis tools used in Traffic Impact Studies. May require additional hours of traffic count data collection.
Critical Movement Delay	A measure of delay at an intersection for the critical movement. *Existing and Forecast Critical Movement Delay:* 2011: EBL 60s 2016: EBL 112s 2035: EBL 123s	Critical movements (southbound left turn, northbound through, eastbound left turn and westbound through) may not exceed a delay of "X" seconds per vehicle during the peak hour of the day. OR Critical movement delay may not exceed "X" seconds per vehicle for more than a specified number of hours per day.	Could be applied with existing analysis tools used in Traffic Impact Studies. May require additional hours of traffic count data collection.

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Average Travel Time	A measure of the time it takes, on average, for a vehicle to navigate the intersection, including queued time for red light or congestion.	Average travel time through the intersection or corridor may not exceed "X" minutes for any movement. OR Average travel time through the intersection or corridor may not exceed "X" minutes for any movement for more than a specified number of hours per day.	Would require travel time data collection and additional tools to predict future travel time.
Travel Time Reliability	Travel time reliability measures the variability in the expected travel time vs. the actual travel time experienced due to demand fluctuations, traffic control devices, traffic incidents, weather, work zones, and physical capacity. ▪ Buffer Index – compares the 95th percentile travel time to the average travel time. 95th percentile travel time is the time you would plan for your trip in order to be on-time 95% of the time. A buffer index of 45% means the 95th percentile travel time is 45% longer than the average travel time and you must plan 45% more time for your trip to be on time 95% of the time. ▪ Planning Time Index –compares the 95th percentile travel time to the free flow travel time. For example, 2.25 means the 95th percentile travel time is 2.25 times as long as when conditions are free-flowing. Can be measured by comparing peak hour travel time to off-peak travel time through the intersection.	Buffer Index shall not exceed "X"%. OR Planning Time Index shall not exceed "X".	Would require travel time data collection and use of Dynamic Travel Assignment model to predict future travel time reliability.
Average Speed	The average speed (including stopped time) at which a vehicle is able to navigate through the intersection. This is typically slower for turning vehicles than for through vehicles.	Average speed through the intersection or corridor shall be within a specified range during the peak hour of the day.	Would require speed data collection and additional tools to predict future travel speeds.
Congestion Duration	The proportion of the day, in hours, that an intersection experiences congestion.	Allow the intersection to exceed one of the above targets for a specified number of hours per day.	Could be applied with existing analysis tools used in Traffic Impact Studies. May require additional hours of traffic count data collection.

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Intersection Completeness	Percent of facilities that are constructed. May consider whether facilities are built to current standards.	Intersection shall include: ▪ Complete bicycle facilities up to stop bar ▪ Bicycle boxes and bicycle pavement markings to serve designated bicycle routes ▪ Detection and actuation for bicycles ▪ Countdown signal displays for pedestrians ▪ Lighting	No new data or analysis required.
Safety			
Crash Rate	The rate of crashes occurring at an intersection or on a segment, often measured in crashes per million entering vehicles or crashes per million VMT.	Lower predicted crash rate than existing condition ▪ Total crashes by mode per million entering vehicles ▪ Total fatal and serious injury crashes by mode per million entering vehicles	Easy to calculate. Any increase in trips from development would have an impact on the measure. These could be difficult to mitigate once all identified safety improvements at a location are complete but could result in implementation of systemic safety countermeasures.
Crash Frequency	The number of crashes occurring at a site, facility, or network in a one year period. Can be differentiated by severity.	Lower predicted crash frequency than existing condition ▪ Total crashes by mode ▪ Total fatal and serious injury crashes by mode	
Excess Proportions of Specific Crash Types	This is the difference between the observed proportion of a specific crash type for a site and the threshold proportion (such as a statewide average) for the reference population.	Specific crash type rates shall not exceed average statewide crash rates by more than ”X%”.	

In the context of long-term planning, safety measures and intersection completeness can be used to determine whether planned improvements are adequate to accommodate growth. However, in development review they can only be used to make sure that the appropriate improvements or proportionate share of improvements have been provided.

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SAFETY AND CAPACITY IMPROVEMENTS

Safety and capacity improvements to OR213 from Redland Road to Molalla Avenue (including the Beavercreek Road intersection) could be implemented in tandem with the proposed alternative mobility target. These approaches, while not providing adequate capacity to meet the current mobility target, would increase capacity and/or safety at the intersection, providing an overall improvement. Table 4 lists these improvements, as well as their relative benefits, constraints, opportunities, and risks.

Table 5 – Intersection Improvement Approaches Considered

Improvement	Benefits	Opportunities	Constraints	Risks
Increase all-red time	Reduces red-light running crashes, particularly turning and angle crashes	All approaches of the intersection	Reduces intersection capacity and increases queueing. Helps reduce turning and angle crashes, which are not prevalent at this intersection.	Increase rear-end crashes, the most common type at signalized intersection
Install red-light cameras	Reduces red-light running crashes, particularly turning and angle crashes	All approaches of the intersection	Community Opposition. Helps reduce turning and angle crashes, which are not prevalent at this intersection.	Increase rear-end crashes, the most common type at signalized intersection
Increase shoulder width	Safer bicycle travel	North leg of intersection	Costs/Impacts to retaining wall	N/A
Install pedestrian countdown signal displays	Increase safety and ease for pedestrians	All approaches of the intersection	N/A	May require costly improvements to comply with the Americans with Disabilities Act (ADA)
Improve lighting	Increase safety for all modes	North and south legs of intersection	N/A	N/A
Provide acceleration lane for WB to NB right turning vehicles	Reduce queuing between OR213 and Maple Lane, and increase capacity of westbound approach	North leg of intersection	Retaining wall in northeast corner of the intersection	Increase sideswipe crashes
Eliminate westbound left-turn lane and extend eastbound left turn storage onto Maple Lane	Reduce queuing and crashes related to queues on Beavercreek Road at Maple Lane	East leg of intersection	Rerouting of westbound lefts to Meyers Road and potential increased travel time	Confusion by drivers resulting in illegal maneuvers

SUMMARY

The OR213 corridor from Redland Road to Molalla Avenue (including the Beavercreek Road intersection) is forecasted to exceed the current mobility target by 2035. Each of the alternatives identified in the Technical Memorandum #1 provides sufficient capacity to meet the current standard

in 2035; however, the additional capacity is provided at varying degrees and each alternative has cost and other impacts to consider in determining if they are feasible solutions for the City. If none of the alternatives is found to be feasible, an alternative mobility target approach needs to be pursued.

This memorandum provided the policy context for intersection performance measures, a menu of potential measures that could be used for establishing an alternative mobility target, reasonable target ranges, and a list of potentially feasible low-cost improvements to improve operations and increase safety at the intersection.

NEXT STEPS

Potential measures and alternative mobility target ranges will be reviewed with the TAG and CAG. Future meetings with the TAG and CAG are planned to discuss the feasibility of intersection improvements and potential alternative mobility measures and targets. Any changes will likely require a Legislative public review process before the City's Planning Commission and City Commission. If the project concludes that alternative mobility targets and measures will be needed, they will need to be agreed upon by ODOT and approved by the Oregon Transportation Commission.

DRAFT

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MEMORANDUM

Date: April 14, 2017

Project #: 20651

To: Dayna Webb, P.E.
Public Works Department
City of Oregon City
PO Box 3040
625 Center Street
Oregon City, Oregon 97045

From: Susan Wright, P.E., and Kristine Connolly

Project: Highway 213 Corridor Alternative Mobility Targets (PS 16-024)

Subject: Memorandum #3: Financially Feasible Improvements and Alternative Mobility Target Assessment

Oregon City's 2013 Transportation System Plan (TSP) determined that the Highway 213 (OR213) corridor from Redland Road to Molalla Avenue (including the intersection of Beavercreek Road) will exceed the current mobility target in 2035, resulting in more congestion than is allowed. The TSP recommended a project be conducted to identify what improvements would be necessary to meet the current target or whether an alternative mobility target is justified. The OR213 intersection with Molalla Avenue is anticipated to meet the target; however, Beavercreek Road and Redland Road are not anticipated to meet the target. The following memorandum provides an overview of these two intersections including safety, operations, and cost analysis of the potential improvements at these intersections and identifies potential alternative mobility targets that would be necessary in conjunction with financially feasible operational and safety improvements.

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OR213/Beavercreek Road

Exhibit 1 below provides an overview of the intersection.

Exhibit 1. Highway 213 (OR213) and Beavercreek Road Intersection



Potential improvements for the intersection of Beavercreek Road and OR213 that focused on significantly increasing the intersection capacity to meet the current mobility target were presented to the Technical Advisory Group (TAG) and Community Advisory Group (CAG) in December 2016 and January 2017. None of the alternatives were determined to be financially feasible, even by the 2035 horizon year of the TSP given the financial constraints of the city and other agency partners. In addition, some of the potential alternatives could have additional consequences including right-of-way impacts, environmental impacts, and could potentially complicate the provision of services for bicyclists, pedestrians, and transit users. Nonetheless, it is recommended that the alternatives be documented in the TSP for additional future consideration as part of the TSP's unconstrained plan. The unconstrained plan includes projects that are not currently anticipated to be financially feasible by 2035 but are projected to be needed and could be implemented if additional funding becomes available in the future.

Because achieving the mobility standard through a major capacity-expanding project at this intersection has been determined to be beyond the financial capabilities of the city and its partner agencies, an alternative mobility target will be necessary. As a result of this study, some improvements were identified that, while not allowing the mobility standard to be fully met, would increase the intersection capacity, improve safety, and are within the financial capabilities of the city and its partner agencies. Safety and operational improvements are identified below that minimize future congestion and can be included in the cost-constrained TSP.

The existing mobility standard for the OR 213/Beavercreek Road intersection set forth in the 2013 TSP is based on volume-to-capacity ratio (v/c). The v/c ratio is a measure that reflects mobility and quality of travel. It compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). For example, a v/c of 1.00 indicates the roadway facility is operating at its capacity. The following mobility

standard is set forth in the 2013 TSP for the OR213/Beavercreek Road intersection: a maximum volume-to-capacity (v/c) ratio of 0.99 shall be maintained during the peak first and second hours.

A menu of potential alternative performance measures, reasonable target ranges, and a list of potentially feasible improvements to increase capacity and safety in the corridor was presented to the TAG and CAG in March 2017. The majority of TAG and CAG members agreed that an alternative mobility target allowing intersection volume-to-capacity ratios to exceed the existing target of 0.99 for no more than a specified number of hours per day would be appropriate for the corridor. The TAG and CAG were also in favor of further investigation of potential improvements to increase safety and capacity at the Beavercreek Road and OR213 intersection. The specific projects identified by the TAG and CAG for additional analysis were: 1) the provision of an acceleration lane for westbound right-turning vehicles and 2) elimination of the second westbound left-turn lane to increase left-turn storage on eastbound Beavercreek Road at Maple Lane Road.

The following sections provide an assessment of the alternative mobility target and potential financially feasible improvements identified by the TAG and CAG for further consideration at the intersection of OR213 and Beavercreek Road.

OR213/Redland Road

Exhibit 2 below provides an overview of the intersection.

Exhibit 2. Highway 213 (OR213) and Redland Road Intersection



The TSP includes a project to improve capacity at the OR213/Redland Road intersection (identified as project D79). The improvements identified in the TSP are part of Phase 2 of the "Jughandle" project, a project that focused on the intersection of OR213 and Washington Street that was implemented in 2013. The Phase 2 improvements, including improvements at OR213/Redland Road are already 90% designed. The improvements identified in Phase 2 future construction include an additional northbound and southbound through lane resulting in three northbound and three southbound lanes through the intersection. However, these improvements are not part of the financially constrained

plan. Like the OR213/Beavercreek Road intersection, major capacity-increasing improvements at this intersection were determined to be beyond the financial capabilities of the city and its partner agencies during the TSP development process. Lacking the financial capability to implement the identified project, this intersection also requires an alternative mobility target. The target for this intersection should use a similar measure to that of OR213/Beavercreek Road but may have a different number of hours that are expected to exceed the target.

As the intersection of OR213/Redland Road is within the corridor, the scope of this study has been extended to include assessment of financially viable projects that provide safety and operational benefits at the OR213/Redland Road intersection. The specific project identified for additional analysis includes converting the southbound right-turn lane to a shared through/right-turn lane.

The following sections provide an assessment of the alternative mobility target and potential financially feasible improvements for further consideration at the intersection of OR213 and Redland Road.

ALTERNATIVE MOBILITY TARGET AND FINANCIALLY FEASIBLE IMPROVEMENTS ASSESSMENT

The following provides an overview of safety analysis, operations analysis, and cost estimates of potential cost-feasible safety and operational improvements that could be implemented at the OR213/Beavercreek Road and OR213/Redland Road intersections in conjunction with an alternative mobility target.

Safety Analysis

The OR213/Beavercreek Road intersection was identified in the 2013 TSP as a high collision intersection. The Oregon Department of Transportation (ODOT) Crash Analysis and Reporting Unit provided crash records at the intersection for the 5-year period from January 2010 through December 2014. **Table 1** summarizes the reported crash data. The crash data is included in **Appendix A**.

Table 1 - OR213/Beavercreek Road Intersection Crash Summary and Crash Rate Assessment (2010-2014)

Crash Type				Severity			Total	Critical Crash Rate by Intersection Type	Critical Crash Rate by Volume	Observed Crash Rate at Intersection	Observed Crash Rate>Critical Crash Rate?
Rear-End	Turning	Angle	Other	PDO	Injury	Fatal					
116	7	5	5	58	74	1	133	0.59	0.50	1.20	Yes

PDO = Property Damage Only
Crash Rate = crashes per million entering vehicles

As shown in Table 1, the most predominant crash type at the OR213/Beavercreek Road intersection is rear-end crashes. The TSP includes a project to implement an advance warning system to help mitigate these types of crashes for the southbound approach.

Crash data for the OR213/Redland Road intersection was obtained from the February 2017 Serres Farm Annexation Traffic Impact Study for the 3-year period from January 2013 through December 2015. **Table 2** summarizes the reported crash data. The crash data is included in **Appendix A**.

Table 2 - OR213/Redland Road Intersection Crash Summary and Crash Rate Assessment (2013-2015)

Crash Type				Severity			Total	Critical Crash Rate by Intersection Type	Critical Crash Rate by Volume	Observed Crash Rate at Intersection	Observed Crash Rate>Critical Crash Rate?
Rear-End	Turning	Angle	Other	PDO	Injury	Fatal					
22	4	0	1	8	19	0	27	0.39	0.54	0.44	Yes

PDO = Property Damage Only
Crash Rate = crashes per million entering vehicles

Both the OR213/Beavercreek Road and OR213/Redland Road intersections have observed crash rates which exceed the Critical Crash Rate, meaning that they exceed the crash rate of other comparable intersections. For this reason, applicable TSP planned improvements and other potential improvements were analyzed at each intersection to determine their impact on the expected crash frequency at each intersection. **Table 3** summarizes the improvements in the TSP.

Table 3 – 2013 Oregon City Transportation System Plan Projects located in the southeast part of the City

Project #	Project Description	Project Extent	Project Elements	Priority	Funded?
D14	Southbound OR 213 Advanced Warning System	Southbound OR 213, north of the Beavercreek Road intersection	Install a queue warning system for southbound drivers on OR 213 to automatically detect queues and warn motorists in advance via a Variable Message Sign	Short-term	Likely
D79	OR 213/Redland Road Capacity Improvements	Redland Road to Redland Road Undercrossing	Add a third northbound travel lane on OR 213 north of the Redland Road undercrossing. Extend the third southbound travel on OR 213 south of the Redland Road intersection and merge the third lane before the Redland Road undercrossing. Add a right-turn lane (southbound OR 213 to westbound Redland). Convert the Redland Road approach to OR 213 to 1 receiving lane, 2 left-turn approach lanes, and 1 right-turn lane.	Long-term	Not Likely

In addition to these planned improvements, the impact of a westbound right-turn acceleration lane at OR213/Beavercreek Road and an additional southbound through lane (shared with the southbound right-turn lane) at OR213/Redland Road were analyzed. The intersections and improvements were analyzed using HiSafe[1] software and crash modification factors (CMF) from the CMF Clearinghouse. **Tables 4 and 5** show the 2035 expected annual crashes with and without these improvements.

[1] HiSafe companion software to the Highway Safety Manual (HSM) applies HSM Predicative Method for estimating the average number of expected annual crashes for quantitative assessment of safety performance.

Table 4 – OR213/Beavercreek Road 2035 Expected Annual Crashes

Existing Configuration	With Westbound Right-Turn Acceleration Lane (CMF #295 applied to westbound rear-end crashes)	With Southbound Advanced Queue Warning System (CMF #76 applied to southbound rear-end injury crashes)	With Both Improvements
26.39	25.75	25.77	25.13
-	-2.4%	-2.3%	-4.8%

Table 5 – OR213/Redland Road 2035 Expected Annual Crashes

Existing Configuration	With 3rd Southbound Through/Right Lane (CMF #7924 applied to southbound crashes)	With 3 Northbound and 3 Southbound Through Lanes (CMF #7924 applied to northbound and southbound crashes)
8.82	8.24	7.92
-	-6.6%	-10.2%

As shown in **Tables 4 and 5**, the planned TSP and proposed financially feasible improvements will reduce the number of expected annual crashes at the OR213/Beavercreek Road and OR213/Redland Road intersections. The proposed financially feasible improvements at OR213/Beavercreek Road are predicted to reduce crashes at the intersection by almost 5%, and planned improvements at OR213/Redland Road are predicted to reduce crashes by more than10%.

Operations Analysis

Count data for the intersection of OR213 and Beavercreek Road collected in February 2016 and for the intersection of OR213 and Redland Road collected in January 2017 was provided by Oregon City. The raw count data can be found in **Appendix B**. This winter data was seasonally adjusted to summer peak volumes using the average of two representative Automatic Traffic Recorder (ATR) locations in Clackamas County (03-017 and 03-018). A factor of 8.5% was calculated using the procedures outlined in ODOT's Analysis Procedures Manual (APM) and applied to the winter counts to adjust them to summer peak volumes. These calculations can be found in **Appendix B**.

Metro provided 2015 Base Year and 2040 Future Year hourly turn movement volumes for OR213/Beavercreek Road and OR213/Redland Road. These volumes reflect the most current land use assumptions and include full build-out of Oregon City's urban growth boundary areas in addition to growth in the rest of the region, including through traffic from outlying communities. These hourly plots can be found in **Appendix B**. The count data, 2015 Base Year and 2040 Future Year volumes were post-processed using the NCHRP 255[2] methodology and interpolated to produce 2035 turning movement volumes at each intersection. Only four hours of count data were provided for Redland Road. The remaining hours were estimated under the assumption that OR213/Redland Road follows

[2] This document sets forth procedures to refine computerized traffic volume forecasts by comparing base year and future year volumes to count data.

the same hourly volume profile as OR213/Beavercreek Road. Due to the large amount of commuter traffic from outlying communities, a large portion of the traffic through each intersection is made up of the same vehicles a matter of seconds apart. Finally, volumes were adjusted to provide balanced counts between the two intersections. The calculations for this process can be found in **Appendix B**.

A Synchro[3] analysis was conducted for the six highest traffic volume hours at the OR213/Beavercreek Road intersection and for the five highest traffic volume hours at the OR213/Redland Road intersection. The analysis was conducted with and without proposed improvements at the intersections. The results of this analysis are summarized in **Tables 6 and 7**. The full reports can be found in **Appendix C**. The TSP analysis is for year 2035 but the most recent Metro model is for year 2040. Therefore, the analysis presented in this summary is for year 2040. Analysis was also conducted for year 2035, and is included in **Appendix B**.

Table 6 – 2040 Synchro Volume-to-Capacity Analysis Summary: OR213/Beavercreek Road

OR213/Beavercreek Road Scenario	Peak Hour 4:00 pm	2nd Highest Hour 5:00 pm	3rd Highest Hour 3:00 pm	4th Highest Hour 2:00 pm	5th Highest Hour 7:00 am	6th Highest Hour 12:00 pm
Total Entering Volume	8,201	8,017	7,855	6,881	6,705	6,589
Without Improvements	1.29	1.31[1]	1.33[1]	1.12	1.49[1]	1.12
With Westbound Right-Turn Acceleration Lane	1.13	1.13	1.10	1.01	1.02	0.96

[1]The 2nd, 3rd and 5th highest overall volume hours at OR213/Beavercreek Road under the existing intersection configuration have a higher v/c because certain movements in these hours exhibit higher volumes than in the peak hour. For example, during the morning peak the westbound right-turn movement is significantly higher than during the afternoon peak, impacting v/c.

Table 7 – 2040 Synchro Volume-to-Capacity Analysis Summary: OR213/Redland Road

OR213/Redland Road Scenario	Peak Hour 4:00 pm	2nd Highest Hour 5:00 pm	3rd Highest Hour 3:00 pm	4th Highest Hour 2:00 pm	5th Highest Hour 7:00 am
Total Entering Volume	7,054	6,920	6,764	6,085	5,933
Without Improvements	1.19	1.19	1.08	0.98	0.96
With Southbound Through/Right Lane	1.10	1.08	1.02	0.92	0.96
With Six Lanes	0.91	0.90	0.83	0.75	0.73

The analysis in **Tables 6 and 7** shows that, without improvements, the OR213/Beavercreek Road and OR213/Redland Road intersections will exceed current mobility target of a v/c ratio of 0.99 in 2040 (shown in red). With financially feasible improvements in place (i.e. a westbound right-turn acceleration lane at OR213/Beavercreek and a southbound through/right lane at OR213/Redland), the intersections will still exceed 0.99 for five hours and three hours (shown in yellow) per day, respectively. As shown in **Appendix B**, in the year 2035, the OR213/Beavercreek Road and OR213/Redland Road intersections will only exceed 0.99 for three hours and two hours, respectively.

[3] Traffic model used to evaluate v/c ratios and other metrics

It should be noted that the analysis of OR213/Beavercreek Road was also conducted with a single westbound left-turn lane, instead of the existing dual lanes. This change did not significantly affect the intersection v/c ratio, but did have the effect of double westbound left-turning queues beyond the available storage. The full reports for this analysis can also be found in **Appendix C**. This potential improvement can be evaluated further in tandem with potential future improvements at the Beavercreek Road/Maple Lane Road intersection.

Cost Estimates

The cost of the proposed financially feasible improvements at OR213/Beavercreek Road was estimated by Kittelson & Associates, Inc. (KAI) to be approximately $1.5 million based on the design shown below in **Exhibit 3**. The principal elements of this are 1) the provision of an acceleration lane for westbound right-turning vehicles and 2) elimination of the second westbound left-turn lane to increase left-turn storage on eastbound Beavercreek Road at Maple Lane Road.

Exhibit 3. Highway 213 (OR213) and Redland Road Westbound Right-turn Acceleration Lane



The cost of adding an additional northbound and southbound through lane at OR213/Redland Road, consistent with TSP project D79, was recently estimated by OBEC to be almost $10 million. The potential lower cost improvement proposed based on this study, converting the southbound right-turn lane to a through/right lane, is expected to cost approximately $3-4 million.

The KAI and OBEC cost estimates, as well as exhibits of the proposed financially feasible improvements at OR213/Beavercreek Road can be found in **Appendix D**.

SUMMARY

Oregon City's 2013 Transportation System Plan (TSP) determined that the Highway 213 (OR213) corridor from Redland Road to Molalla Avenue (including the intersection of Beavercreek Road) will exceed the current mobility target in 2035, resulting in more congestion than is allowed. The OR213

intersection with Molalla Avenue is anticipated to meet the target; however, Beavercreek Road and Redland Road are not anticipated to meet the target.

The alternatives that would meet the existing mobility target of a v/c ratio of 0.99 at the OR213/Beavercreek Road and OR213/Redland Road intersections are not cost feasible, given the financial constraints of the City and other agency partners. Nonetheless, it is recommended that the alternatives at OR213/Beavercreek Road be documented in the TSP for additional future consideration as part of the TSP's unconstrained plan and that the existing planned improvement at OR213/Redland Road for three through lanes in the northbound and southbound directions remain in the unconstrained TSP project list.

Lacking the financial capability of implementing major capacity-increasing projects at these locations, alternative mobility targets will be necessary at each of these intersections; however, some improvements may be feasible in the cost-constrained TSP to improve safety and minimize future congestion.

OR213/Beavercreek Road

In conjunction with an alternative mobility target allowing intersection v/c to exceed 0.99 for up to five hours of the day, financially feasible improvements to increase safety and capacity in the near-term could include a westbound right-turn acceleration lane at OR213/Beavercreek Road.

OR213/Redland Road

In conjunction with an alternative mobility target allowing intersection v/c to exceed 0.99 for up to three hours of the day, financially feasible improvements to increase capacity in the near-term could include a third southbound through lane (shared with the right-turn lane).

NEXT STEPS

Potential financially feasible improvements to improve capacity and safety at OR213/Redland Road and OR 213/Beavercreek Road, as well as an alternative mobility target to allow intersection v/c to exceed 0.99 for up to five hours of the day at Beavercreek Road and three hours of the day at Redland Road, will be reviewed with the TAG and CAG. Changes to the TSP to incorporate these improvements and the alternative mobility target will require a Legislative public review process before the City's Planning Commission and City Commission. The alternative mobility target and financially feasible improvements that are needed will need to be agreed upon by ODOT and approved by the Oregon Transportation Commission.

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Oregon City GIS Map



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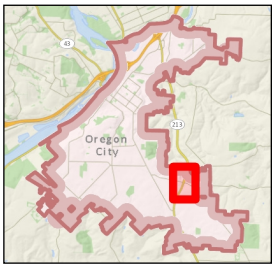
Slope Categories

- 0 - 10%
- 10 - 25%
- 25 - 35%
- > 35%

Basemap

Notes

Overview Map



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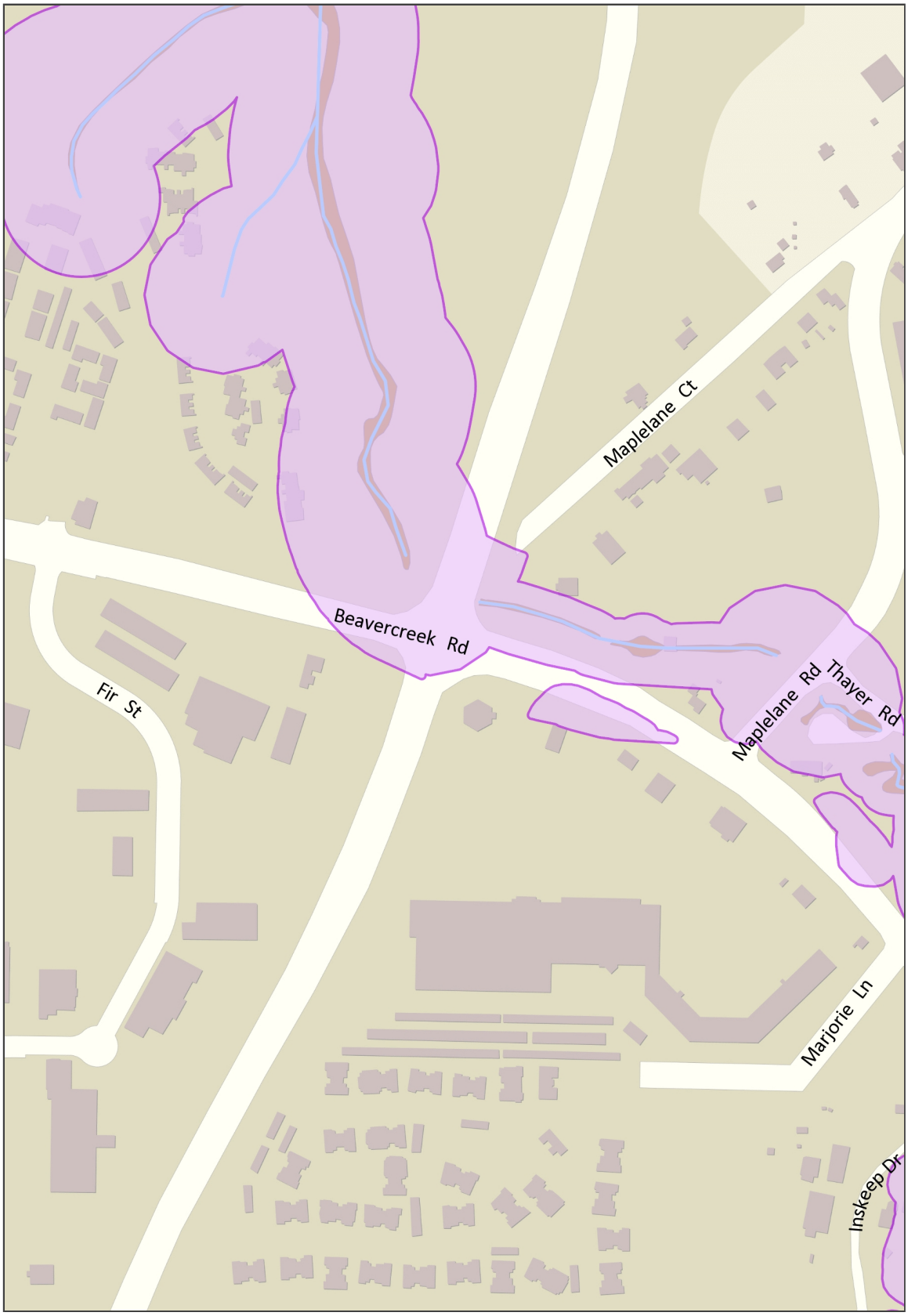
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Map created 11/16/2016

Oregon City GIS Map

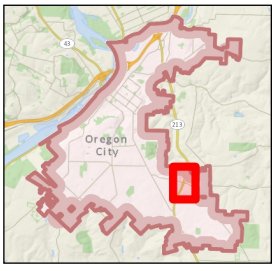


Legend

- All Streets (labels only) - 4800
- NROD - Natural Resource Ove
- Title 3 - Streams
- Title 3 - Wetlands
- Basemap

Notes

Overview Map



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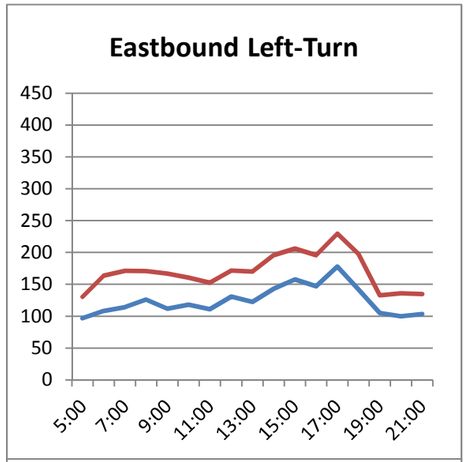
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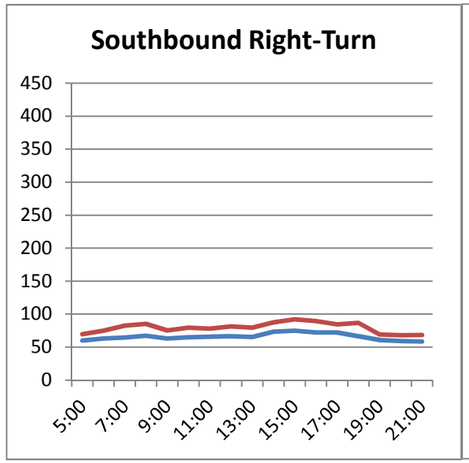
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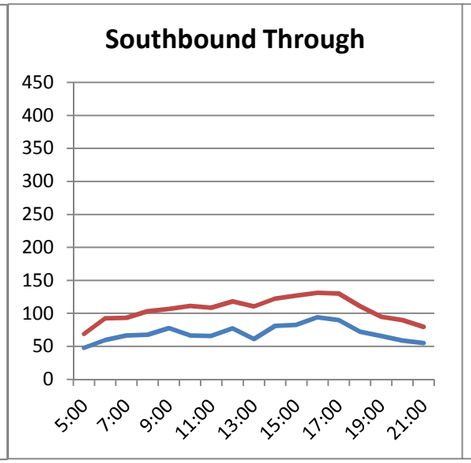
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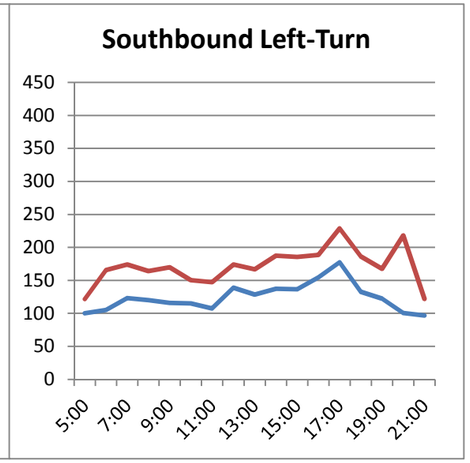
Map created 11/16/2016

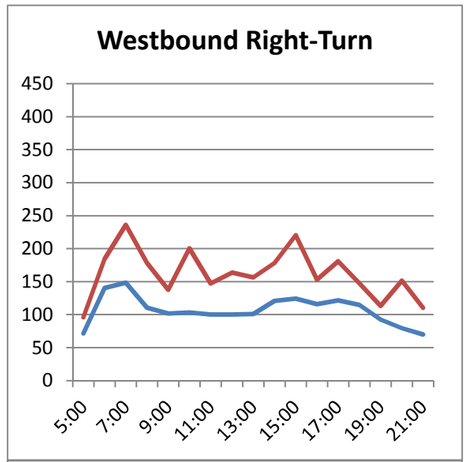
Attachment A: OR213/Beavercreek Road Intersection Travel Times (2017)

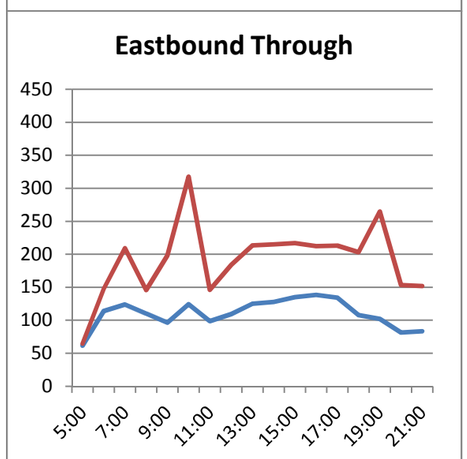


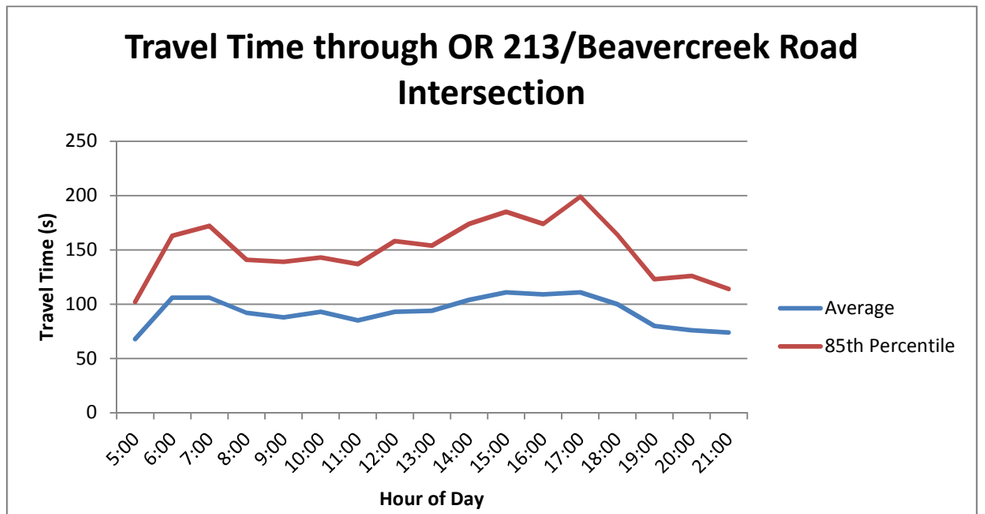


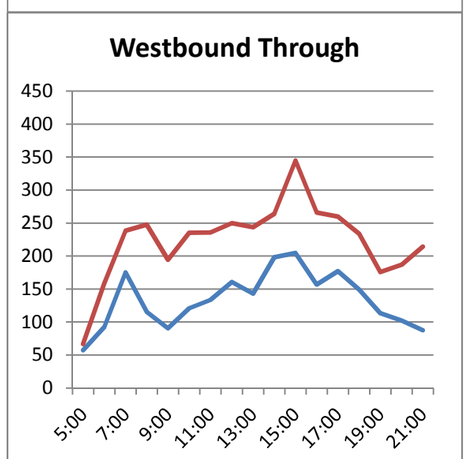


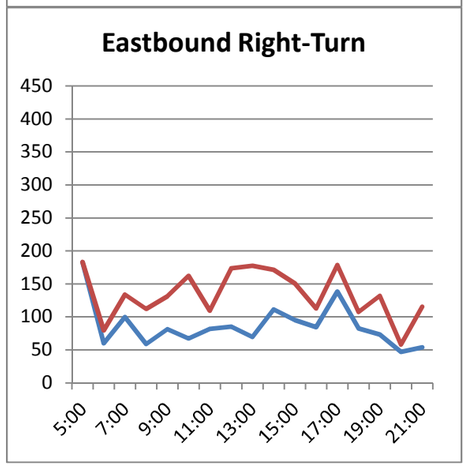


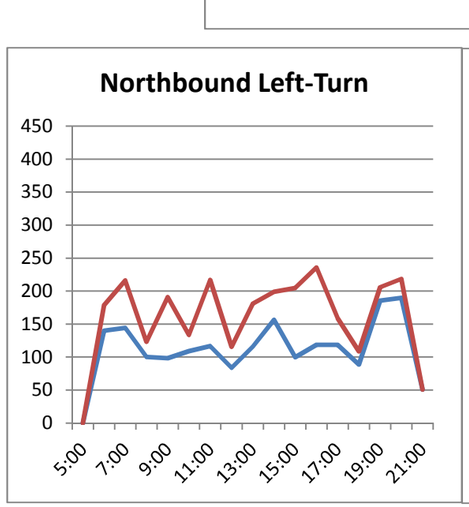


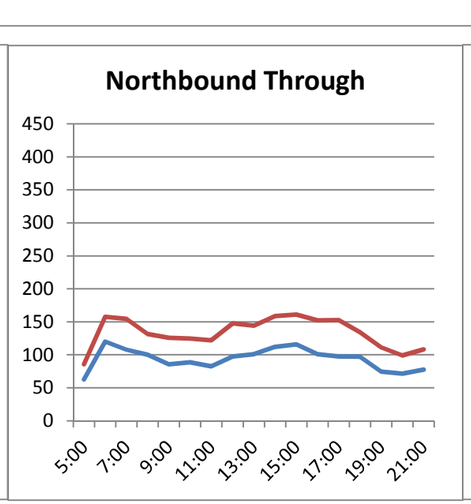


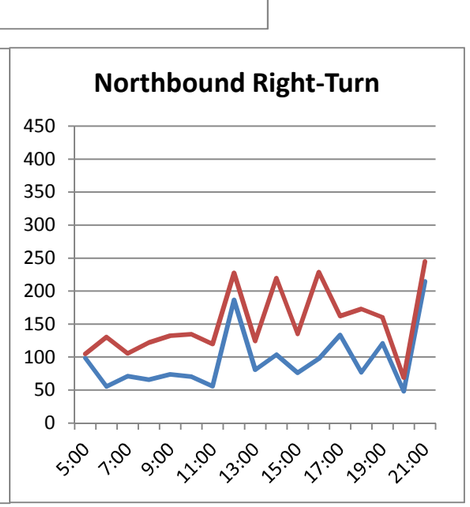


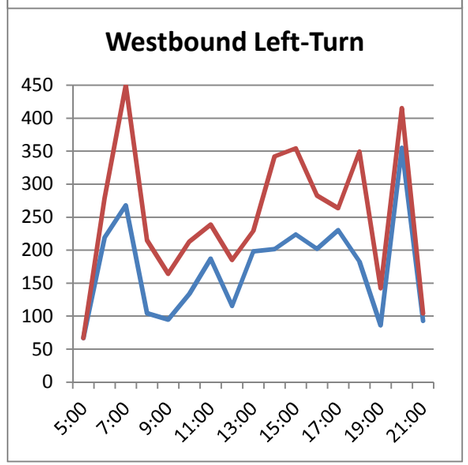












TRANSPORTATION DATA SECTION - CRASH ANALYSIS AND REPORTING UNIT

CRASH SUMMARIES BY YEAR BY COLLISION TYPE

OR 213 Cascade Highway (160) & Beavercreek Road

January 1, 2010 through December 31, 2014

COLLISION TYPE	FATAL CRASHES	NON-FATAL CRASHES	PROPERTY DAMAGE ONLY	TOTAL CRASHES	PEOPLE KILLED	PEOPLE INJURED	TRUCKS	DRY SURF	WET SURF	DAY	DARK	INTER-SECTION	INTER-SECTION RELATED	OFF-ROAD
YEAR: 2014														
REAR-END	0	9	10	19	0	11	0	16	2	11	7	19	0	0
SIDESWIPE - OVERTAKING	0	0	1	1	0	0	0	0	1	1	0	1	0	0
TURNING MOVEMENTS	0	0	1	1	0	0	0	0	1	0	1	1	0	0
2014 TOTAL	0	9	12	21	0	11	0	16	4	12	8	21	0	0
YEAR: 2013														
ANGLE	0	0	1	1	0	0	0	0	1	0	1	1	0	0
BACKING	0	0	1	1	0	0	0	0	1	0	0	1	0	0
REAR-END	0	17	11	28	0	18	0	22	5	20	8	28	0	0
SIDESWIPE - OVERTAKING	0	0	1	1	0	0	0	1	0	1	0	1	0	0
TURNING MOVEMENTS	0	2	0	2	0	3	1	2	0	1	1	2	0	0
2013 TOTAL	0	19	14	33	0	21	1	25	7	22	10	33	0	0
YEAR: 2012														
ANGLE	0	0	1	1	0	0	0	1	0	1	0	1	0	0
FIXED / OTHER OBJECT	0	1	0	1	0	1	0	1	0	1	0	1	0	1
PEDESTRIAN	0	1	0	1	0	1	0	1	0	1	0	1	0	0
REAR-END	0	18	6	24	0	24	0	16	6	16	8	24	0	0
TURNING MOVEMENTS	0	2	0	2	0	3	0	2	0	0	2	2	0	0
2012 TOTAL	0	22	7	29	0	29	0	21	6	19	10	29	0	1
YEAR: 2011														
ANGLE	1	0	2	3	1	2	1	1	2	2	1	3	0	0
REAR-END	0	12	13	25	0	13	0	19	6	18	7	25	0	0
TURNING MOVEMENTS	0	2	0	2	0	3	0	0	2	0	2	2	0	0
2011 TOTAL	1	14	15	30	1	18	1	20	10	20	10	30	0	0
YEAR: 2010														
REAR-END	0	10	10	20	0	13	0	13	7	17	3	20	0	0
2010 TOTAL	0	10	10	20	0	13	0	13	7	17	3	20	0	0
FINAL TOTAL	1	74	58	133	1	92	2	95	34	90	41	133	0	1

Disclaimer: A higher number of crashes may be reported as of 2011 compared to prior years. This does not reflect an increase in annual crashes. The higher numbers result from a change to an internal departmental process that allows the Crash Analysis and Reporting Unit to add previously unavailable, non-fatal crash reports to the annual data file. Please be aware of this change when comparing pre-2011 crash statistics.

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEC	DEAD	DRUG	SCHL	WORK	DATE / DAY / TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC / CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS / (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
02085	N	N	N			06/12/2013	CLACKAMAS	1 14		INTER	CROSS	N	N	UNK	S-1STOP	01	NONE 0	STRGHT										07
NONE						Wed 10A	OREGON CITY	MN 0	S BEAVERCREEK RD	N		TRF SIGNAL	N	UNK	REAR		PRVTE	N S									000		00
							PORTLAND UA	2.96	CASCADE HY SOUTH	06	3		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	39	F	OR-Y		026	000		07
No						*45 19 55.86 -122 34 29.95*		016000100S00	1															OR<25					
																02	NONE 0	STOP									011		00
																	PUBLC	N S											
																	PSNGR CAR		01	DRVR	NONE	00	M	OR-Y		000	000		00
																								UNK					
04839	N	N	N			11/29/2014	CLACKAMAS	1 14		INTER	CROSS	N	N	UNK	S-1STOP	01	NONE 0	STRGHT										29
NO RPT						Sat UNK	OREGON CITY	MN 0	S BEAVERCREEK RD	UN		TRF SIGNAL	N	UNK	REAR		PRVTE	UN UN									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	06	3		N	UNK	PDO		PSNGR CAR		01	DRVR	NONE	39	F	OR-Y		026	000		29
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					
																02	NONE 0	STOP									011		00
																	PRVTE	UN UN											
																	PSNGR CAR		01	DRVR	NONE	27	M	OR-Y		000	000		00
																								OR<25					
01828	N	N	N			05/25/2011	CLACKAMAS	1 14		INTER	CROSS	N	N	RAIN	S-1STOP	01	NONE 0	STRGHT										013	07
NONE						Wed 2P	OREGON CITY	MN 0	S BEAVERCREEK RD	N		TRF SIGNAL	N	WET	REAR		PRVTE	N S									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	76	M	OR-Y		026	000		07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					
																02	NONE 0	STOP									011	013	00
																	PRVTE	N S											
																	PSNGR CAR		01	DRVR	NONE	00	M	OR-Y		000	000		00
																								UNK					
																03	NONE 0	STOP									022		00
																	PRVTE	N S											
																	PSNGR CAR		01	DRVR	NONE	00	U	UNK		000	000		00
																								UNK					
02674	N	N	N			07/27/2011	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										07
NONE						Wed 7P	OREGON CITY	MN 0	S BEAVERCREEK RD	N		TRF SIGNAL	N	DRY	REAR		PRVTE	N S									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	06	2		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	29	M	OR-Y		026	000		07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					
																02	NONE 0	STOP									011		00
																	PRVTE	N S											
																	PSNGR CAR		01	DRVR	NONE	27	M	OR-Y		000	000		00
																								OR<25					
																			02	PSNG	INJC	05	F			000	000		00
01982	N	N	N	N	N	05/30/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	PED	01	NONE 0	STRGHT										18,14
STATE						Wed 4P	OREGON CITY	MN 0	S BEAVERCREEK RD	N		TRF SIGNAL	N	DRY	PED		PRVTE	N S									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	06	2		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	32	F	OR-Y		000	000	082	00
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					
																		STRGHT	01	PED	INJB	14	M		01	028,020	035		18,14
																		E W											

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCOHL	DRUGS	SCHL	WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / LRS	FC / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	CONN #	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
00662	N	N	N	N	N	02/25/2013	CLACKAMAS	1 14			INTER	CROSS	N	N	CLR	O-1STOP	01	NONE 0	BACK										10
CITY						Mon 6P	OREGON CITY	MN 0	S BEAVERCREEK RD		N		TRF SIGNAL	N	SNO	BACK		PRVTE	S N									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH		06	3		N	UNK	PDO		PSNGR CAR		01	DRVR	NONE	34	F	SUSP		011	000	10
No						*45 19 54.96 -122 34 30.30*		016000100	S00	1															OR<25				
																	02	NONE 0	STOP										
																		PRVTE	N S									011	00
																		PSNGR CAR		01	DRVR	NONE	31	F	OR-Y		000	000	00
																									OR<25				
02051	N	N	N			06/10/2013	CLACKAMAS	1 14			INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										10
NONE						Mon 12P	OREGON CITY	MN 0	S BEAVERCREEK RD		N		TRF SIGNAL	N	DRY	SS-O		PRVTE	N S									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH		06	3		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	18	F	OR-Y		080	000	10
No						*45 19 54.96 -122 34 30.30*		016000100	S00	1															OR<25				
																	02	NONE 0	STOP										
																		PRVTE	N S									011	00
																		PSNGR CAR		01	DRVR	NONE	87	F	OR-Y		000	000	00
																									OR<25				
03700	N	N	N			10/01/2013	CLACKAMAS	1 14			INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										07
NONE						Tue 1P	OREGON CITY	MN 0	S BEAVERCREEK RD		N		TRF SIGNAL	N	DRY	REAR		UNKN	N S									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH		06	3		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	F	UNK		026	000	07
No						*45 19 54.96 -122 34 30.30*		016000100	S00	1															UNK				
																	02	NONE 0	STOP										
																		PRVTE	N S									011	00
																		PSNGR CAR		01	DRVR	NONE	52	M	OR-Y		000	000	00
																									OR<25				
04798	N	Y	N			12/11/2013	CLACKAMAS	1 14			INTER	CROSS	N	N	FOG	S-1STOP	01	NONE 0	STRGHT										07
CITY						Wed 8P	OREGON CITY	MN 0	S BEAVERCREEK RD		N		TRF SIGNAL	N	DRY	REAR		PRVTE	N S									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH		06	3		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	64	M	OR-Y		026	000	07
No						*45 19 54.96 -122 34 30.30*		016000100	S00	1															OR<25				
																	02	NONE 0	STOP										
																		PRVTE	N S									011	00
																		PSNGR CAR		01	DRVR	INJC	58	M	OR-Y		000	000	00
																									OR<25				
01637	N	N	N			04/29/2014	CLACKAMAS	1 14			INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										29
NO RPT						Tue 2P	OREGON CITY	MN 0	S BEAVERCREEK RD		N		TRF SIGNAL	N	DRY	REAR		PRVTE	N S									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH		06	3		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	M	OR-Y		026	000	07
No						*45 19 54.97 -122 34 30.30*		016000100	S00	1															OR<25				
																	02	NONE 0	STOP										
																		PRVTE	N S									011	00
																		PSNGR CAR		01	DRVR	NONE	65	F	OR-Y		000	000	00
																									OR<25				

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALC	DRUGS	SCHL	WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
03308	N	N	N			08/25/2014	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											29
NONE						Mon 4P	OREGON CITY	MN 0	S BEAVERCREEK RD	N		TRF SIGNAL	N	DRY	REAR		PRVTE	S N										000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	06	3		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	22	F	OR-Y		026	000		29
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					
																02	NONE 0	STOP											
																	PRVTE	S N									011		00
																	PSNGR CAR		01	DRVR	NONE	28	F	OR-Y		000	000		00
																								OR<25					
04757	N	N	N			11/22/2014	CLACKAMAS	1 14		INTER	CROSS	N	N	UNK	S-STRGHT	01	NONE 0	STRGHT											13
NO RPT						Sat 1P	OREGON CITY	MN 0	S BEAVERCREEK RD	N		TRF SIGNAL	N	WET	SS-O		UNKN	N S									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	06	3		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	F	OR-Y		045	000		13
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															UNK					
																02	NONE 0	STRGHT											
																	PRVTE	N S									000		00
																	PSNGR CAR		01	DRVR	NONE	19	F	OR-Y		000	000		00
																								OR<25					
00766	N	N	N			03/10/2010	CLACKAMAS	1 14		INTER	CROSS	N	N	CLD	S-1STOP	01	NONE 0	STRGHT										013	07
NO RPT						Wed 4P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		TRF SIGNAL	N	DRY	REAR		PRVTE	NE SW									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	25	F	OR-Y		026	000		07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					
																02	NONE 0	STOP											
																	PRVTE	NE SW									011	013	00
																	PSNGR CAR		01	DRVR	INJC	25	M	OR-Y		000	000		00
																								OR<25					
																03	NONE 0	STOP											
																	PRVTE	NE SW									022		00
																	PSNGR CAR		01	DRVR	NONE	24	M	OR-Y		000	000		00
																								OR<25					
00115	N	N	N			01/10/2011	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											07
NO RPT						Mon 5P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		TRF SIGNAL	N	DRY	REAR		PRVTE	NE SW									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	06	2		N	DLIT	PDO		PSNGR CAR		01	DRVR	NONE	00	F	OR-Y		026	000		07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					
																02	NONE 0	STOP											
																	PRVTE	NE SW									011		00
																	PSNGR CAR		01	DRVR	NONE	21	M	OR-Y		000	000		00
																								OR<25					
00222	N	N	N			01/18/2010	CLACKAMAS	1 14		INTER	CROSS	N	N	CLD	S-1STOP	01	NONE 0	STRGHT											07
NONE						Mon 6A	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD	N	DRY	REAR		PRVTE	SE NW									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	2		N	DARK	PDO		PSNGR CAR		01	DRVR	NONE	62	F	OR-Y		026	000		07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCHL	DRUGS	SCHL WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC / CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
															02	NONE 0 PRVTE	STOP SE NW									011	00
																PSNGR CAR		01	DRVR	NONE	53	M	OR-Y OR<25		000	000	00
01346	N	N	N		04/22/2010 Thu 3P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 2	N YIELD	N CLR N DRY N DAY	S-STRGHT REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	62	M	OR-Y OR<25	026	000 000	07 00 07	
NONE No					*45 19 54.97 -122 34 30.30*		016000100S00	1																				
															02	NONE 0 PRVTE	STRGHT SE NW									006	00
																PSNGR CAR		01	DRVR	INJC	24	F	OR-Y OR<25		000	000	00
03556	N	N	N		10/01/2010 Fri 7A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 2	N YIELD	N CLR N DRY N DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	70	F	OR-Y OR<25	026	000 000	07 00 07	
NO RPT No					*45 19 54.97 -122 34 30.30*		016000100S00	1																				
															02	NONE 0 PRVTE	STOP SE NW									011	00
																PSNGR CAR		01	DRVR	NONE	72	F	OR-Y OR<25		000	000	00
04388	N	N	N		11/20/2010 Sat 12P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 3	N YIELD	N CLR N DRY N DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT S N	01	DRVR	NONE	30	F	OR-Y OR<25	026	000 000	07 00 07	
NONE No					*45 19 54.97 -122 34 30.30*		016000100S00	1																				
																		02	PSNG	NO<5	03	M			000	000	00
															02	NONE 0 PRVTE	STOP S N									011	00
																PSNGR CAR		01	DRVR	NONE	00	M	UNK OR<25		000	000	00
00158	N	N	N		01/13/2011 Thu 4A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 2	N YIELD	N CLR N DRY N DLIT	S-STRGHT REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT NE SW	01	DRVR	INJC	36	F	OR-Y OR<25	042	000 000	07 00 07	
NONE No					*45 19 54.97 -122 34 30.30*		016000100S00	1																				
															02	NONE 0 PRVTE	STRGHT NE SW									000	00
																PSNGR CAR		01	DRVR	NONE	55	F	OR-Y OR>25		000	000	00
00268	N	N	N		01/22/2011 Sat 1P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 2	N YIELD	N CLR N DRY N DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	48	F	OR-Y OR<25	026	000 000	07 00 07	
NONE No					*45 19 54.97 -122 34 30.30*		016000100S00	1																				

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCHL	DRUGS	SCHL	WORK	DATE / DAY/TIME / LAT/LONG	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	CONN #	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
																	02	NONE 0 PRVTE	STOP SE NW									011	00
																		PSNGR CAR		01	DRVR	INJC	47	M	OR-Y OR<25		000	000	00
00504 NONE	N	N	N			02/10/2011 Thu 3P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH		INTER NE 09	CROSS 2	N YIELD	N N	CLR DRY DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE	STRGHT SE NW									000	07 00 07
No	*45 19 54.97*		*-122 34 30.30*					016000100	S00 1									PSNGR CAR		01	DRVR	NONE	35	M	OR-Y OR<25		026	000	
																	02	NONE 0 PRVTE	STOP SE NW									011	00
																		PSNGR CAR		01	DRVR	NONE	20	M	OR-Y OR<25		000	000	00
00807 NO RPT	N	N	N			03/07/2011 Mon 6A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH		INTER NE 09	CROSS 3	N YIELD	N N	CLR DRY DAWN	S-1STOP REAR PDO	01	NONE 0 PRVTE	STRGHT SE NW									000	07 00 07
No	*45 19 54.97*		*-122 34 30.30*					016000100	S00 1									PSNGR CAR		01	DRVR	NONE	45	M	OR-Y OR>25		026	000	
																	02	NONE 0 PRVTE	STOP SE NW									011	00
																		PSNGR CAR		01	DRVR	NONE	53	M	OR-Y OR<25		000	000	00
81746 NONE	N	N	N			04/04/2011 Mon 10A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH		INTER NE 09	CROSS 3	N YIELD	N N	RAIN WET DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE	STRGHT SE NW									000	07 00 07
No	*45 19 54.97*		*-122 34 30.30*					016000100	S00 1									PSNGR CAR		01	DRVR	NONE	44	M	OR-Y OR<25		026	000	
																	02	NONE 0 PRVTE	STOP SE NW									011	00
																		PSNGR CAR		01	DRVR	NONE	19	F	OR-Y OR<25		000	000	00
02297 NONE	N	N	N			06/30/2011 Thu 12P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH		INTER NE 09	CROSS 3	N YIELD	N N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE	STRGHT SE NW									000	07 00 07
No	*45 19 54.97*		*-122 34 30.30*					016000100	S00 1									PSNGR CAR		01	DRVR	NONE	30	M	OR-Y OR<25		026	000	
																	02	NONE 0 PRVTE	STOP SE NW									011	00
																		PSNGR CAR		01	DRVR	INJC	48	M	OR-Y OR<25		000	000	00
03876 NONE	N	N	N			10/15/2011 Sat 12A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH		INTER NE 09	CROSS 3	N YIELD	N N	CLR DRY DLIT	S-1STOP REAR PDO	01	NONE 0 UNKN	STRGHT SE NW									000	07 00 07
No	*45 19 54.97*		*-122 34 30.30*					016000100	S00 1									PSNGR CAR		01	DRVR	NONE	00	F	OR-Y UNK		026	000	

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALC	DRUGS	SCHL	WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / LRS	FC	CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
																	02	NONE 0 PRVTE	STOP SE NW									011		00
																		PSNGR CAR		01	DRVR	NONE	22	F	OR-Y OR<25		000	000		00
03993	N	N	N			10/25/2011 Tue 6P	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 2	N YIELD	N	N FOG N WET N DARK	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	00	F	OTH-Y OR<25	026	000 000			07 00 07
NO RPT																													
No						*45 19 54.97 -122 34 30.30*		016000100S00		1																			
																	02	NONE 0 PRVTE	STOP SE NW									011		00
																		PSNGR CAR		01	DRVR	NONE	64	M	OR-Y OR<25		000	000		00
04755	N	N	N			12/09/2011 Fri 8A	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 2	N YIELD	N	N CLR N DRY N DAY	S-1STOP REAR PDO	01	UNKN 0 UNKN UNKNOWN	STRGHT SE NW	01	DRVR	NONE	00	U	UNK UNK	026	000		013	07 00 07
NONE																													
No						*45 19 54.97 -122 34 30.30*		016000100S00		1																			
																	02	NONE 0 PRVTE	STOP SE NW									011	013	00
																		PSNGR CAR		01	DRVR	NONE	25	F	OR-Y OR<25		000	000		00
																	03	NONE 0 PRVTE	STOP SE NW									022		00
																		PSNGR CAR		01	DRVR	NONE	00	F	UNK UNK		000	000		00
00376	N	N	N	N	N	01/28/2012 Sat 7P	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 2	N YIELD	N	N CLR N DRY N DLIT	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	45	F	OR-Y OR<25	026	000 000			07 00 07
STATE																													
No						*45 19 54.97 -122 34 30.30*		016000100S00		1																			
																	02	NONE 0 PRVTE	STOP SE NW									011		00
																		PSNGR CAR		01	DRVR	INJC	19	F	OR-Y OR<25		000	000		00
																				02	PSNG	INJC	20	F			000	000		00
00436	N	N	N			02/02/2012 Thu 4P	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 2	N YIELD	N	N CLR N DRY N DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	85	M	OR-Y OR<25	026	000 000			07 00 07
NONE																													
No						*45 19 54.97 -122 34 30.30*		016000100S00		1																			
																	02	NONE 0 UNKN	STOP SE NW									011		00
																		PSNGR CAR		01	DRVR	NONE	00	M	UNK UNK		000	000		00

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALC	DRUG	SCHL	WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC / CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
00485	N	N	N	N	N	02/06/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										07
CITY						Mon 6P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		TRF SIGNAL	N	DRY	REAR		PRVTE	SE NW									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	65	M	OTH-Y		043,026	000	07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															N-RES				
																02	NONE 0	STOP										
																	PRVTE	SE NW									011	00
																	PSNGR CAR		01	DRVR	INJC	26	M	OR-Y		000	000	00
																								OR>25				
00679	N	N	N			02/22/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										07
NONE						Wed 1P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD	N	DRY	REAR		UNKN	SE NW									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	2		N	DAY	INJ		UNKNOWN		01	DRVR	NONE	00	M	UNK		026	000	07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															UNK				
																02	NONE 0	STOP										
																	PRVTE	SE NW									011	00
																	PSNGR CAR		01	DRVR	INJC	23	F	OR-Y		000	000	00
																								OR<25				
																			02	PSNG	INJC	28	F			000	000	00
																			03	PSNG	INJC	55	F			000	000	00
00763	N	N	N			02/29/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	RAIN	S-1STOP	01	NONE 0	STRGHT										07
NONE						Wed 7P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD	N	WET	REAR		PRVTE	SE NW									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	00	F	OR-Y		026	000	07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25				
																02	NONE 0	STOP										
																	PRVTE	SE NW									011	00
																	PSNGR CAR		01	DRVR	INJC	17	F	OR-Y		000	000	00
																								OR<25				
00972	N	N	N			03/15/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	RAIN	S-1STOP	01	NONE 0	STRGHT										07
NONE						Thu 6A	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD	N	WET	REAR		PRVTE	SE NW									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	2		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	59	F	OR-Y		026	000	07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25				
																02	NONE 0	STOP										
																	PRVTE	SE NW									011	00
																	PSNGR CAR		01	DRVR	INJC	56	F	OR-Y		000	000	00
																								OR<25				
01301	N	N	N			04/07/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										07
NO RPT						Sat 9A	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD	N	DRY	REAR		PRVTE	SE NW									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	2		N	DAY	INJ		MTRCYCLE		01	DRVR	INJC	33	M	OR-Y		026	000	07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25				
																02	NONE 0	STOP										
																	PRVTE	SE NW									011	00
																	PSNGR CAR		01	DRVR	NONE	28	M	OR-Y		000	000	00
																								OR<25				

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCOHOL	DRUGS	SCHOOL BUS	WORK ZONE	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC / CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
01649	N	N	N			05/05/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											07
NONE						Sat 2P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD	N	DRY	REAR		PRVTE	SE NW										000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	2		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	35	M	OR-Y		026	000		07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					
																			02	PSNG	NO<5	01	F			000	000		00
																02	NONE 0	STOP											
																	PRVTE	SE NW									011		00
																	PSNGR CAR		01	DRVR	NONE	53	M	OR-Y		000	000		00
																								OR<25					
																			02	PSNG	INJC	49	F			000	000		00
01694	N	N	N			05/08/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											07
NONE						Tue 8P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD	N	DRY	REAR		PRVTE	SE NW										000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N	DUSK	PDO		PSNGR CAR		01	DRVR	NONE	72	M	OR-Y		026	000		07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					
																02	NONE 0	STOP											
																	PRVTE	SE NW									011		00
																	PSNGR CAR		01	DRVR	NONE	00	M	UNK		000	000		00
																								OR<25					
02190	N	N	N			06/18/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 1	STRGHT											07
NONE						Mon 12P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD	N	DRY	REAR		PRVTE	SE NW										000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	70	M	OTH-Y		026	000		07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					
																02	NONE 0	STOP											
																	PRVTE	SE NW									011		00
																	PSNGR CAR		01	DRVR	INJC	43	F	OR-Y		000	000		00
																								OR<25					
																			02	PSNG	INJC	07	M			000	000		00
																			03	PSNG	INJC	09	F			000	000		00
02429	N	N	N			07/06/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											07
NONE						Fri 2P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD	N	DRY	REAR		PRVTE	SE NW										000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	61	M	OR-Y		026	000		07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					
																02	NONE 0	STOP											
																	PRVTE	SE NW									011		00
																	PSNGR CAR		01	DRVR	INJC	54	M	OTH-Y		000	000		00
																								N-RES					
02909	N	N	N			08/07/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											07
NONE						Tue 3P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD	N	DRY	REAR		PRVTE	SE NW										000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	27	M	OR-Y		026	000		07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1															OR<25					

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALC	DRUG	SCHL	WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC	CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / WTHR / RNDBT / SURF / DRVWY / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
																02	NONE 0 PRVTE	STOP SE NW									011	00
																	PSNGR CAR		01	DRVR	INJC	70	M	OR-Y OR<25		000	000	00
04569 NONE	N	N	N			11/26/2012 Mon 3P	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 3	N YIELD	N N N	CLD DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	66	F	OR-Y OR<25		026,026	000 000	27,07 00 27,07
No						*45 19 54.97 -122 34 30.30*		016000100S00		1																		
																02	NONE 0 PRVTE	STOP SE NW									011	00
																	PSNGR CAR		01	DRVR	INJB	27	F	OR-Y OR<25		000	000	00
																			02	PSNG	NO<5	02	M			000	000	00
00193 NONE	N	N	N			01/17/2013 Thu 10A	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 3	N YIELD	N N N	CLR DRY DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	00	U	UNK OR<25		026	000 000	07 00 07
No						*45 19 54.96 -122 34 30.30*		016000100S00		1																		
																02	NONE 0 PRVTE	STOP SE NW									011	00
																	PSNGR CAR		01	DRVR	NONE	29	F	OR-Y OR<25		000	000	00
00296 NONE	N	N	N			01/25/2013 Fri 7A	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 3	N YIELD	N N N	UNK WET DLIT	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	25	F	OR-Y OR<25		026	000 000	07 00 07
No						*45 19 54.96 -122 34 30.30*		016000100S00		1																		
																02	NONE 0 PRVTE	STOP SE NW									011	00
																	PSNGR CAR		01	DRVR	INJC	24	F	OR-Y OR<25		000	000	00
																			02	PSNG	NO<5	03	M			000	000	00
03686 NONE	N	N	N			03/27/2013 Wed 9A	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 3	N YIELD	N N N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	00	F	OR-Y OR<25		026	000 000	07 00 07
No						*45 19 54.96 -122 34 30.30*		016000100S00		1																		
																02	NONE 0 PRVTE	STOP SE NW									011	00
																	PSNGR CAR		01	DRVR	INJC	59	M	OR-Y OR<25		000	000	00
01343 NONE	N	N	N			04/10/2013 Wed 5P	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 3	N YIELD	N N N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	00	F	OR-Y OR<25		026	000 000	07 00 07
No						*45 19 54.96 -122 34 30.30*		016000100S00		1																		

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCHL	DRUGS	WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC / CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
															02	NONE 0 PRVTE	STOP SE NW									011	00
																PSNGR CAR		01	DRVR	INJC	41	F	OR-Y OR<25		000	000	00
01405	N	N	N	N	N 04/24/2013	CLACKAMAS	1 14		INTER	CROSS	N		N CLR	S-1STOP	01	NONE 0	STRGHT											27,07
CITY					Wed 1P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD		N DRY	REAR		PRVTE	SE NW									000	00
						PORTLAND UA	2.98	CASCADE HY SOUTH	09	3			N DAY	INJ		PSNGR CAR		01	DRVR	NONE	23	F	OR-Y OR<25		016,043,026	000		27,07
No	*45 19 54.96*	*-122 34 30.30*					016000100S00	1																				
															02	NONE 0 PRVTE	STOP SE NW									011	00
																PSNGR CAR		01	DRVR	INJC	27	F	OTH-Y OR<25		000	000	00
01782	N	N	N		05/21/2013	CLACKAMAS	1 14		INTER	CROSS	N		N CLR	S-1STOP	01	NONE 0	STRGHT											07
NONE					Tue 7A	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD		N DRY	REAR		PRVTE	SE NW									000	00
						PORTLAND UA	2.98	CASCADE HY SOUTH	09	3			N DAY	PDO		PSNGR CAR		01	DRVR	NONE	50	F	OR-Y OR<25		026	000		07
No	*45 19 54.96*	*-122 34 30.30*					016000100S00	1																				
															02	NONE 0 PRVTE	STOP SE NW									011	00
																PSNGR CAR		01	DRVR	NONE	62	F	OR-Y OR<25		000	000	00
02276	N	N	N		06/27/2013	CLACKAMAS	1 14		INTER	CROSS	N		N CLR	S-1STOP	01	NONE 0	STRGHT											07
NONE					Thu 10A	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD		N DRY	REAR		PRVTE	SE NW									000	00
						PORTLAND UA	2.98	CASCADE HY SOUTH	09	3			N DAY	INJ		PSNGR CAR		01	DRVR	NONE	00	M	UNK OR<25		026	000		07
No	*45 19 54.96*	*-122 34 30.30*					016000100S00	1																				
															02	NONE 0 PRVTE	STOP SE NW									011	00
																PSNGR CAR		01	DRVR	INJC	63	F	OR-Y OR<25		000	000	00
																		02	PSNG	NO<5	01	F			000	000		00
03212	N	N	N		08/29/2013	CLACKAMAS	1 14		INTER	CROSS	N		N RAIN	S-1STOP	01	NONE 0	STRGHT											07
CITY					Thu 11A	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		TRF SIGNAL		N WET	REAR		PRVTE	SE NW									000	00
						PORTLAND UA	2.98	CASCADE HY SOUTH	09	3			N DAY	INJ		PSNGR CAR		01	DRVR	NONE	19	M	OR-Y OR<25		026	000		07
No	*45 19 54.96*	*-122 34 30.30*					016000100S00	1																				
															02	NONE 0 PRVTE	STOP SE NW									011	00
																PSNGR CAR		01	DRVR	INJC	24	F	OR-Y OR<25		000	000	00
03276	N	N	N	N	N 09/01/2013	CLACKAMAS	1 14		INTER	CROSS	N		N CLR	S-1STOP	01	NONE 0	STRGHT											07
CITY					Sun 12P	OREGON CITY	MN 0	S BEAVERCREEK RD	NE		YIELD		N DRY	REAR		PRVTE	SE NW									000	00
						PORTLAND UA	2.98	CASCADE HY SOUTH	09	3			N DAY	INJ		PSNGR CAR		01	DRVR	NONE	62	M	OR-Y OR<25		043,026	000		07
No	*45 19 54.96*	*-122 34 30.30*					016000100S00	1																				

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCHL	DRUGS	SCHL WRK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# FC / CMPT/MLG / MILEPNT / LRS	CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / WTHR / RNDBT / SURF / DRVWY / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
														02	NONE 0 PRVTE	STOP SE NW									011	00
															PSNGR CAR		01	DRVR	INJC	48	F	OR-Y OR>25		000	000	00
																	02	PSNG	INJC	49	F			000	000	00
03531 NONE	N	N	N		09/21/2013 Sat 9A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 3	N YIELD	N CLR N DRY N DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	00	M	UNK		026	000 000	07 00 07
No	*45 19 54.96*		*-122 34 30.30*				016000100S00	1														N-RES				
														02	NONE 0 PRVTE	STOP SE NW									011	00
															PSNGR CAR		01	DRVR	INJC	44	F	OR-Y OR<25		000	000	00
04072 NONE	N	N	N		10/24/2013 Thu 7A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 3	N YIELD	N FOG N DRY N DLIT	S-1STOP REAR PDO	01	NONE 0 UNKN UNKNOWN	STRGHT SE NW	01	DRVR	NONE	00	U	UNK		026	000 000	07 00 07
No	*45 19 54.96*		*-122 34 30.30*				016000100S00	1														OR<25				
														02	NONE 0 PRVTE	STOP SE NW									011	00
															PSNGR CAR		01	DRVR	NONE	69	M	OR-Y OR<25		000	000	00
00987 NONE	N	N	N		03/11/2014 Tue 6P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 3	N YIELD	N CLR N DRY N DUSK	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	INJB	38	F	OR-Y		026	000 000	07 00 07
No	*45 19 54.97*		*-122 34 30.30*				016000100S00	1														OR<25				
														02	NONE 0 PRVTE	STOP SE NW									011	00
															PSNGR CAR		01	DRVR	NONE	36	M	OR-Y OR<25		000	000	00
00120 NONE	N	N	N		01/09/2014 Thu 5P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER E 03	CROSS 3	N TRF SIGNAL	N RAIN N WET N DUSK	ANGL-OTH TURN PDO	01	NONE 0 PRVTE PSNGR CAR	TURN-R W S	01	DRVR	NONE	56	F	OR-Y		028	016 000	02 00 02
No	*45 19 54.97*		*-122 34 30.30*				016000100S00	1														OR<25				
														02	NONE 0 PRVTE	STRGHT N S									000	00
															PSNGR CAR		01	DRVR	NONE	63	M	UNK OR>25		000	000	00
03359 NONE	N	N	N		09/17/2010 Fri 1P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER E 06	CROSS 2	N TRF SIGNAL	N RAIN N WET N DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT E W	01	DRVR	NONE	00	M	UNK		026	000 000	07 00 07
No	*45 19 54.47*		*-122 34 30.52*				016000100S00	1														UNK				

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCOHOL	DRUGS	SCHOOL BUS	WORK ZONE	DATE / DAY/TIME / LAT/LONG	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC / CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
																02	NONE 0 PRVTE	STOP E W									011		00
																	PSNGR CAR		01	DRVR	NONE	19	M	OR-Y OR<25		000	000		00
04643 STATE	N	N	Y	N	N	12/06/2010 Mon 10P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER E 06	CROSS 2	N TRF SIGNAL	N	CLD DRY DLIT	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT E W	01	DRVR	NONE	40	F	OR-Y	026		000 000	093	07 00 07
No						*45 19 54.97 -122 34 30.30*		016000100S00 1																OR<25					
																02	NONE 0 PRVTE	STOP E W									011		00
																	PSNGR CAR		01	DRVR	NONE	55	F	OR-Y OR<25		000	000		00
01893 CITY	N	N	N			05/30/2013 Thu 2P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER E 06	CROSS 3	N TRF SIGNAL	N	CLD DRY DAY	ANGL-STP TURN INJ	01	NONE 1 PRVTE SEMI TOW	TURN-R S E	01	DRVR	NONE	29	M	OR-Y	017		000 017		22 22 00
No						*45 19 54.96 -122 34 30.30*		016000100S00 1																OR<25					
																02	NONE 0 PRVTE	STOP E W									012		00
																	PSNGR CAR		01	DRVR	INJC	48	F	OR-Y OR<25		000	000		00
00353 NONE	N	N	N			01/25/2012 Wed 7P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER SE 09	CROSS 2	N YIELD	N	RAIN WET DLIT	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SW NE	01	DRVR	NONE	18	M	OR-Y	026		000 000		07 00 07
No						*45 19 54.97 -122 34 30.30*		016000100S00 1																OR<25					
																02	NONE 0 PRVTE	STOP SW NE									011		00
																	PSNGR CAR		01	DRVR	INJC	50	F	OR-Y OR<25		000	000		00
02025 NONE	N	N	N			06/03/2012 Sun 5P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER SE 09	CROSS 3	N YIELD	N	UNK UNK DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT SW NE	01	DRVR	NONE	00	M	OR-Y	026		000 000		07 00 07
No						*45 19 54.97 -122 34 30.30*		016000100S00 1																OR<25					
																02	NONE 0 PRVTE	STOP SW NE									011		00
																	PSNGR CAR		01	DRVR	NONE	46	M	OR-Y OR<25		000	000		00
03609 NO RPT	N	N	N			09/29/2012 Sat 8A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER SE 09	CROSS 3	N YIELD	N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SW NE	01	DRVR	NONE	38	M	OR-Y	026		000 000		07 00 07
No						*45 19 54.97 -122 34 30.30*		016000100S00 1																OR<25					

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCHL	DRUGS	SCHL	WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / LRS	FC / CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / WTHR / RNDBT / SURF / DRVWY / LIGHT	CRASH TYP / COLL TYP / SVRTY	V# / VEH TYPE	SPCL USE / TRLR QTY / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
															02	NONE	0 STOP										
																PRVTE	SW NE									011		00
																PSNGR CAR		01	DRVR	INJC	24	M	OR-Y		000	000		00
																							OR<25					
																		02	PSNG	INJC	24	F			000	000		00
00303	N	N	N			01/25/2013	CLACKAMAS	1 14		INTER	CROSS	N	N	CLD S-1STOP	01	NONE	0 STRGHT										004	07
NONE						Fri 11A	OREGON CITY	MN 0	S BEAVERCREEK RD	SE		YIELD	N	DRY REAR		PRVTE	SW NE									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N	DAY PDO		PSNGR CAR		01	DRVR	NONE	00	M	OR-Y		026	000		07
No	*45 19 54.96*	*-122 34 30.30*						016000100S00	1														OR<25					
															02	NONE	0 STOP										
																PRVTE	SW NE									011	004	00
																PSNGR CAR		01	DRVR	NONE	73	M	OR-Y		000	000		00
																							OR<25					
01066	N	N	N			03/29/2013	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR S-1STOP	01	NONE	0 STRGHT											07
NONE						Fri 5P	OREGON CITY	MN 0	S BEAVERCREEK RD	SE		YIELD	N	DRY REAR		PRVTE	SW NE									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N	DAY INJ		PSNGR CAR		01	DRVR	NONE	53	M	OR-Y		026	000		07
No	*45 19 54.96*	*-122 34 30.30*						016000100S00	1														OR<25					
															02	NONE	0 STOP										
																PRVTE	SW NE									011		00
																PSNGR CAR		01	DRVR	INJC	32	F	OR-Y		000	000		00
																							OR<25					
03374	N	N	N			09/11/2013	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR S-1STOP	01	NONE	0 STRGHT											07
NONE						Wed 8A	OREGON CITY	MN 0	S BEAVERCREEK RD	SE		YIELD	N	DRY REAR		PRVTE	SW NE									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N	DAY INJ		PSNGR CAR		01	DRVR	NONE	32	F	OR-Y		026	000		07
No	*45 19 54.96*	*-122 34 30.30*						016000100S00	1														OR<25					
															02	NONE	0 STOP										
																PRVTE	SW NE									011		00
																PSNGR CAR		01	DRVR	INJC	74	M	OR-Y		000	000		00
																							OR<25					
04298	N	N	N			11/05/2013	CLACKAMAS	1 14		INTER	CROSS	N	N	RAIN S-1STOP	01	NONE	0 STRGHT											07
NONE						Tue 5P	OREGON CITY	MN 0	S BEAVERCREEK RD	SE		YIELD	N	WET REAR		PRVTE	SW NE									000		00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N	DLIT PDO		PSNGR CAR		01	DRVR	NONE	22	F	OR-Y		026	000		07
No	*45 19 54.96*	*-122 34 30.30*						016000100S00	1														OR<25					
															02	NONE	0 STOP										
																PRVTE	SW NE									011		00
																PSNGR CAR		01	DRVR	NONE	59	F	OR-Y		000	000		00
																							OR<25					
00483	N	N	N			02/06/2014	CLACKAMAS	1 14		INTER	CROSS	N	N	SNOW S-STRGHT	01	NONE	0 STRGHT										124	07
CITY						Thu 10P	OREGON CITY	MN 0	S BEAVERCREEK RD	SE		YIELD	N	SNO REAR		UNKN	SW NE									000	124	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N	DLIT PDO		PSNGR CAR		01	DRVR	NONE	00	M	UNK		042	000		07
No	*45 19 54.97*	*-122 34 30.30*						016000100S00	1														UNK					

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCHL	DRUGS	SCHL WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# FC / CMPT/MLG / MILEPNT / LRS	CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
														02	NONE 0 PRVTE	STRGHT SW NE									006	00
															PSNGR CAR		01	DRVR	NONE	18	M	OR-Y OR<25		000	000	00
01591 NONE	N	N	N		04/26/2014 Sat 4P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER SE 09	CROSS 3	N YIELD 2	N CLR N DRY N DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT SW NE	01	DRVR	NONE	28	M	OR-Y OR<25	026		000 000	29 00 29
No					*45 19 54.97 -122 34 30.30*		016000100S00	1																		
														02	NONE 0 PRVTE	STOP SW NE									011	00
															PSNGR CAR		01	DRVR	NONE	69	M	OR-Y OR<25		000	000	00
00146 CITY	N	N	N		01/12/2011 Wed 4P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 2	N TRF SIGNAL 2	N CLD N WET N DUSK	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT S N	01	DRVR	NONE	22	F	OR-Y OR<25	026		000 000	07 00 07
No					*45 19 54.97 -122 34 30.30*		016000100S00	1																		
														02	NONE 0 PRVTE	STOP S N									011	00
															PSNGR CAR		01	DRVR	INJC	24	F	OR-Y OR<25		000	000	00
																	02	PSNG	INJC	24	F			000	000	00
00864 NONE	N	N	N		03/11/2011 Fri 1P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 2	N L-GRN-SIG 2	N CLR N DRY N DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT S N	01	DRVR	NONE	24	M	OR-Y OR<25	026		000 000	07 00 07
No					*45 19 54.97 -122 34 30.30*		016000100S00	1																		
														02	NONE 0 PRVTE	STOP S N									012	00
															PSNGR CAR		01	DRVR	INJB	51	M	OR-Y OR<25		000	000	00
01684 NONE	N	N	N		05/16/2011 Mon 8A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 0	N TRF SIGNAL 2	N CLR N DRY N DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT S N	01	DRVR	INJC	24	F	OR-Y OR<25	026		000 000	07 00 07
No					*45 19 54.97 -122 34 30.30*		016000100S00	1																		
														02	NONE 0 PRVTE	STOP S N									011	00
															PSNGR CAR		01	DRVR	NONE	39	M	OR-Y OR>25		000	000	00
03992 NONE	N	N	N		10/25/2011 Tue 10A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 2	N TRF SIGNAL 2	N CLR N DRY N DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT S N	01	DRVR	NONE	57	M	OR-Y OR<25	026		000 000	07 00 07
No					*45 19 54.97 -122 34 30.30*		016000100S00	1																		

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	DRUG	ALC	SCHL	WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC	CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
																	02	NONE 0 PRVTE	STOP S N									011		00
																		PSNGR CAR		01	DRVR	NONE	32	F	OR-Y OR<25		000	000		00
04652 NONE	N	N	N	N	N	12/03/2011 Sat 9A	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 2	N TRF SIGNAL	N N N	FOG DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE	STRGHT S N									000		27,07 00 27,07
No	*45 19 54.97*		*-122 34 30.30*					016000100		S00 1								PSNGR CAR		01	DRVR	NONE	45	M	OR-Y OR<25		016,026	000		
																	02	NONE 0 PRVTE	STOP S N									011		00
																		PSNGR CAR		01	DRVR	INJC	73	M	OR-Y OR<25		000	000		00
00069 STATE	N	N	N	N	N	01/06/2012 Fri 2P	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 3	N TRF SIGNAL	N N N	RAIN WET DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE	STRGHT S N									000	004	07 00 07
No	*45 19 54.97*		*-122 34 30.30*					016000100		S00 1								PSNGR CAR		01	DRVR	NONE	16	F	OR-Y OR<25		043,026	000		
																	02	NONE 0 PRVTE	STOP S N									011	004	00
																		PSNGR CAR		01	DRVR	INJC	55	F	OR-Y OR<25		000	000		00
02327 UNK	N	N	N	N	N	06/29/2012 Fri 7A	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 2	N TRF SIGNAL	N N N	CLD DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE	STRGHT S N									000		07,27 00 07,27
No	*45 19 54.97*		*-122 34 30.30*					016000100		S00 1								PSNGR CAR		01	DRVR	NONE	53	M	OR-Y OR<25		026,016	038		
																	02	NONE 0 PRVTE	STOP S N									011		00
																		PSNGR CAR		01	DRVR	INJC	44	F	OR-Y OR<25		000	000		00
03411 NONE	N	N	N			09/13/2013 Fri 11A	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE	STRGHT S N									000		07 00 07
No	*45 19 54.96*		*-122 34 30.30*					016000100		S00 1								PSNGR CAR		01	DRVR	NONE	63	F	OR-Y OR<25		026	000		
																	02	NONE 0 PRVTE	STOP S N									011		00
																		PSNGR CAR		01	DRVR	NONE	00	M	UNK UNK		000	000		00
03520 NONE	N	N	N			09/20/2013 Fri 6A	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DAWN	S-1STOP REAR INJ	01	NONE 0 PRVTE	STRGHT S N									000		07 00 07
No	*45 19 54.96*		*-122 34 30.30*					016000100		S00 1								PSNGR CAR		01	DRVR	NONE	37	M	OR-Y OR<25		026	000		

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCOHOL	DRUGS	SCHL BUS	WORK ZONE	DATE / DAY/TIME / LAT/LONG	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC / CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
																02	NONE 0 PRVTE	STOP S N									011	00
																	PSNGR CAR		01	DRVR	INJC	29	M	OR-Y OR<25		000	000	00
03630 NONE	N	N	N			09/27/2013 Fri 5A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DAWN	S-1STOP REAR PDO	01	NONE 0 PRVTE	STRGHT S N									000	07 00 07
No						*45 19 54.96 -122 34 30.30*		016000100S00	1								PSNGR CAR		01	DRVR	NONE	34	F	OR-Y OR<25		026	000	
																02	NONE 0 PRVTE	STOP S N									011	00
																	PSNGR CAR		01	DRVR	NONE	49	F	OR-Y OR<25		000	000	00
00463 COUNTY	Y	N	N	N	N	02/05/2014 Wed 5A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DLIT	S-1STOP REAR INJ	01	NONE 0 PRVTE	STRGHT S N									000	07,01 00 07,01
No						*45 19 54.97 -122 34 30.30*		016000100S00	1								PSNGR CAR		01	DRVR	NONE	19	M	OTH-Y N-RES		026,047	000	
																02	NONE 0 PRVTE	STOP S N									011	00
																	PSNGR CAR		01	DRVR	INJC	44	F	OR-Y OR<25		000	000	00
00709 NONE	N	N	N			02/17/2014 Mon 5A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 3	N TRF SIGNAL	N N N	RAIN WET DLIT	S-1STOP REAR INJ	01	NONE 0 UNKN	STRGHT S N									000	07 00 07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1								PSNGR CAR		01	DRVR	NONE	00	M	UNK UNK		026	000	
																02	NONE 0 PRVTE	STOP S N									011	00
																	PSNGR CAR		01	DRVR	INJC	55	M	OR-Y OR<25		000	000	00
01295 NONE	N	N	N			04/03/2014 Thu 9A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE	STRGHT S N									000	07 00 07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1								PSNGR CAR		01	DRVR	NONE	20	F	OR-Y OR<25		026	000	
																02	NONE 0 UNKN	STOP S N									011	00
																	PSNGR CAR		01	DRVR	NONE	00	M	UNK UNK		000	000	00
02651 NO RPT	N	N	N			06/26/2014 Thu 2P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE	STRGHT S N									000	29 00 29
No						*45 19 54.97 -122 34 30.30*		016000100S00	1								PSNGR CAR		01	DRVR	NONE	00	F	UNK OR<25		026	000	

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCHL	DRUGS	WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC	CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
																02	NONE 0 PRVTE	STOP S N									011	00
																	PSNGR CAR		01	DRVR	NONE	22	M	OR-Y OR<25		000	000	00
02801 NONE	N	N	N		07/21/2014 Mon 11A	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER S 06	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE	STRGHT S N												29 00 29
No	*45 19 54.97*		*-122 34 30.30*				016000100S00		1															OR<25				
																02	NONE 0 PRVTE	STOP S N									011	00
																	PSNGR CAR		01	DRVR	INJC	20	F	OR-Y OR<25		000	000	00
03583 NO RPT	N	N	N		10/04/2010 Mon 3P	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER W 06	CROSS 2	N TRF SIGNAL	N N N	RAIN WET DAY	S-1STOP REAR INJ	01	NONE 1 PRVTE	STRGHT W E												07 00 07
No	*45 19 54.47*		*-122 34 30.52*				016000100S00		1															OR<25				
																02	NONE 0 PRVTE	STOP W E									011	00
																	PSNGR CAR		01	DRVR	INJC	21	M	OR-Y OR<25		000	000	00
01378 NONE	N	N	N		01/12/2011 Wed 12P	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER W 06	CROSS 2	N TRF SIGNAL	N N N	RAIN WET DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE	STRGHT W E												07 00 07
No	*45 19 54.97*		*-122 34 30.30*				016000100S00		1															OR<25				
																02	NONE 0 PRVTE	STOP W E									011	00
																	PSNGR CAR		01	DRVR	NONE	54	M	OR-Y OR<25		000	000	00
03959 NONE	N	N	N		10/07/2014 Tue 7A	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER W 06	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE	STRGHT W E												29 00 29
No	*45 19 54.97*		*-122 34 30.30*				016000100S00		1															OR<25				
																02	NONE 0 PRVTE	STOP W E									011	00
																	PSNGR CAR		01	DRVR	NONE	28	M	OR-Y OR<25		000	000	00
03636 NONE	N	N	N		10/08/2010 Fri 6A	CLACKAMAS OREGON CITY PORTLAND UA	1 MN 0 2.98	14	 S BEAVERCREEK RD CASCADE HY SOUTH	INTER NW 09	CROSS 2	N YIELD	N N N	CLR DRY DAWN	S-1STOP REAR PDO	01	NONE 0 PRVTE	STRGHT NE SW												07 00 07
No	*45 19 54.97*		*-122 34 30.30*				016000100S00		1															OR<25				

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED / ALC / SCHL	DRUG / WORK	DATE / DAY/TIME / LAT/LONG	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC / CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V# / SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P# / PRTC TYPE / INJ SVRTY	AGE / SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
												02 NONE 0	STOP						011	00
												PRVTE	NE SW							
												PSNGR CAR		01 DRVR NONE	00 M	OTH-Y		000	000	00
																UNK				
03710	N N N		10/11/2010	CLACKAMAS	1 14		INTER	CROSS	N	N CLR	S-1STOP	01 POLCE 0	STRGHT							07
NONE			Mon 7A	OREGON CITY	MN 0	S BEAVERCREEK RD	NW		YIELD	N WET	REAR	UNKN	NE SW						000	00
				PORTLAND UA	2.98	CASCADE HY SOUTH	09	2		N DAY	INJ	PSNGR CAR		01 DRVR NONE	00 U	UNK		026	000	07
No	*45 19 54.97*		*-122 34 30.30*		016000100S00	1										UNK				
												02 NONE 0	STOP						011	00
												PRVTE	NE SW							
												PSNGR CAR		01 DRVR INJC	56 F	OR-Y		000	000	00
																OR<25				
01141	N N N		04/04/2011	CLACKAMAS	1 14		INTER	CROSS	N	N RAIN	S-1STOP	01 NONE 0	STRGHT							07
NONE			Mon 11A	OREGON CITY	MN 0	S BEAVERCREEK RD	NW		YIELD	N WET	REAR	PRVTE	NE SW						000	00
				PORTLAND UA	2.98	CASCADE HY SOUTH	09	2		N DAY	PDO	PSNGR CAR		01 DRVR NONE	00 F	OR-Y		026	000	07
No	*45 19 54.97*		*-122 34 30.30*		016000100S00	1										UNK				
												02 NONE 0	STOP						011	00
												PRVTE	NE SW							
												PSNGR CAR		01 DRVR NONE	44 M	OR-Y		000	000	00
																OR<25				
04735	N N N		12/08/2011	CLACKAMAS	1 14		INTER	CROSS	N	N CLR	S-1STOP	01 NONE 0	STRGHT							07
NONE			Thu 1P	OREGON CITY	MN 0	S BEAVERCREEK RD	NW		YIELD	N DRY	REAR	PRVTE	NE SW						000	00
				PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N DAY	PDO	PSNGR CAR		01 DRVR NONE	70 M	OR-Y		026	000	07
No	*45 19 54.97*		*-122 34 30.30*		016000100S00	1										OR<25				
												02 NONE 0	STOP						011	00
												PRVTE	NE SW							
												PSNGR CAR		01 DRVR NONE	64 F	OR-Y		000	000	00
																OR<25				
03846	N N N		10/15/2012	CLACKAMAS	1 14		INTER	CROSS	N	N RAIN	S-1STOP	01 NONE 0	STRGHT							07
NONE			Mon 5P	OREGON CITY	MN 0	S BEAVERCREEK RD	NW		YIELD	N WET	REAR	PRVTE	NE SW						000	00
				PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N DUSK	PDO	PSNGR CAR		01 DRVR NONE	46 M	OR-Y		026	000	07
No	*45 19 54.97*		*-122 34 30.30*		016000100S00	1										OR<25				
												02 NONE 0	STOP						011	00
												PRVTE	NE SW							
												PSNGR CAR		01 DRVR NONE	00 F	OR-Y		000	000	00
																OR<25				
04066	N N N		10/29/2012	CLACKAMAS	1 14		INTER	CROSS	N	N CLR	S-1STOP	01 NONE 0	STRGHT							07
NONE			Mon 12P	OREGON CITY	MN 0	S BEAVERCREEK RD	NW		YIELD	N DRY	REAR	PRVTE	NE SW						000	00
				PORTLAND UA	2.98	CASCADE HY SOUTH	09	3		N DAY	INJ	PSNGR CAR		01 DRVR NONE	24 M	OR-Y		026	000	07
No	*45 19 54.97*		*-122 34 30.30*		016000100S00	1										OR<25				

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCOHOL	DRUGS	SCHL BUS	WORK ZONE	DATE / DAY/TIME / LAT/LONG	COUNTY / CITY / URBAN AREA	RD# FC / CMPT/MLG / LRS	CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
															02	NONE 0 PRVTE	STOP NE SW									011	00
																PSNGR CAR		01	DRVR	INJC	52	F	OR-Y OR<25		000	000		00
04076 NONE	N	N	N			10/29/2012 Mon 4P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NW 09	CROSS 3	N YIELD	N CLR N DRY N DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE	STRGHT NE SW									000		07 00 07
No						*45 19 54.97 -122 34 30.30*		016000100S00	1							PSNGR CAR		01	DRVR	NONE	50	M	OR-Y OR<25		026	000		
															02	NONE 0 PRVTE	STOP NE SW									011	00
																PSNGR CAR		01	DRVR	INJB	46	M	OR-Y OR<25		000	000		00
04216 CITY	Y	N	N			11/08/2012 Thu 2P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NW 09	CROSS 3	N YIELD	Y CLD N DRY N DAY	FIX OBJ FIX INJ	01	NONE 0 PRVTE	STRGHT NE SW									000	055 055	01 00 01
No						*45 19 54.97 -122 34 30.30*		016000100S00	1							PSNGR CAR		01	DRVR	INJC	51	F	OR-Y OR<25		047,081	000		
02430 NONE	N	N	N			07/07/2013 Sun 12P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NW 09	CROSS 3	N YIELD	N CLR N DRY N DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE	STRGHT NE SW									000		07 00 07
No						*45 19 54.96 -122 34 30.30*		016000100S00	1							PSNGR CAR		01	DRVR	NONE	00	F	UNK OR<25		026	000		
															02	NONE 0 PRVTE	STOP NE SW									011	00
																PSNGR CAR		01	DRVR	INJC	36	M	OR-Y OR<25		000	000		00
03349 CITY	N	N	N	N	N	09/10/2013 Tue 1P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NW 09	CROSS 3	N YIELD	N CLR N DRY N DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE	STRGHT NE SW									000		07 00 07
No						*45 19 54.96 -122 34 30.30*		016000100S00	1							PSNGR CAR		01	DRVR	NONE	60	F	OR-Y OR<25		043,026	000		
															02	NONE 0 PRVTE	STOP NE SW									011	00
																PSNGR CAR		01	DRVR	INJC	30	F	OR-Y OR<25		000	000		00
04790 NONE	N	N	N			12/12/2013 Thu 2P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NW 09	CROSS 3	N YIELD	N CLR N DRY N DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE	STRGHT NE SW									000		07 00 07
No						*45 19 54.96 -122 34 30.30*		016000100S00	1							PSNGR CAR		01	DRVR	NONE	54	M	OR-Y OR<25		026	000		
															02	NONE 0 PRVTE	STOP NE SW									011	00
																PSNGR CAR		01	DRVR	INJC	56	F	OR-Y OR<25		000	000		00

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALC	DRUG	SCHL	WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	CONN #	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
00348	N	N	N			01/26/2014	CLACKAMAS	1 14			INTER	CROSS	N		N CLR	S-1STOP	01	NONE 0	STRGHT										07
NONE						Sun 4P	OREGON CITY	MN 0	S BEAVERCREEK RD		NW		YIELD		N DRY	REAR		PRVTE	NE SW									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09		3			N DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	F	UNK		026	000	07
No						*45 19 54.97 -122 34 30.30*		016000100	S00	1															OR<25				
																	02	NONE 0	STOP										
																		PRVTE	NE SW									011	00
																		PSNGR CAR		01	DRVR	NONE	18	F	OR-Y		000	000	00
																									OR<25				
00768	N	N	N			02/21/2014	CLACKAMAS	1 14			INTER	CROSS	N		N CLR	S-1STOP	01	NONE 0	STRGHT										07
NONE						Fri 7A	OREGON CITY	MN 0	S BEAVERCREEK RD		NW		YIELD		N DRY	REAR		PRVTE	NE SW									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09		3			N DAY	PDO		PSNGR CAR		01	DRVR	NONE	61	M	OR-Y		026	000	07
No						*45 19 54.97 -122 34 30.30*		016000100	S00	1															OR<25				
																	02	NONE 0	STOP										
																		PRVTE	NE SW									011	00
																		PSNGR CAR		01	DRVR	NONE	49	F	OR-Y		000	000	00
																									OR<25				
01784	N	N	N			05/09/2014	CLACKAMAS	1 14			INTER	CROSS	N		N CLR	S-1STOP	01	NONE 0	STRGHT										07
NONE						Fri 10A	OREGON CITY	MN 0	S BEAVERCREEK RD		NW		YIELD		N DRY	REAR		PRVTE	NE SW									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09		3			N DAY	INJ		PSNGR CAR		01	DRVR	NONE	23	F	OR-Y		026	000	07
No						*45 19 54.97 -122 34 30.30*		016000100	S00	1															OR<25				
																	02	NONE 0	STOP										
																		PRVTE	NE SW									011	00
																		PSNGR CAR		01	DRVR	INJC	41	M	OR-Y		000	000	00
																									OR<25				
02955	N	N	N			08/01/2014	CLACKAMAS	1 14			INTER	CROSS	N		N CLR	S-1STOP	01	NONE 0	STRGHT										29
NONE						Fri 9P	OREGON CITY	MN 0	S BEAVERCREEK RD		NW		YIELD		N DRY	REAR		PRVTE	NE SW									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09		3			N DLIT	INJ		PSNGR CAR		01	DRVR	NONE	29	F	OR-Y		026	000	29
No						*45 19 54.97 -122 34 30.30*		016000100	S00	1															OR<25				
																	02	NONE 0	STOP										
																		PRVTE	NE SW									011	00
																		PSNGR CAR		01	DRVR	INJC	34	M	OR-Y		000	000	00
																									OR<25				
																				02	PSNG	INJC	36	F			000	000	00
04683	N	N	N			11/18/2014	CLACKAMAS	1 14			INTER	CROSS	N		N CLR	S-1STOP	01	NONE 0	STRGHT										29
NO RPT						Tue 5P	OREGON CITY	MN 0	S BEAVERCREEK RD		NW		YIELD		N DRY	REAR		PRVTE	NE SW									000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	09		3			N DLIT	INJ		PSNGR CAR		01	DRVR	NONE	50	M	OR-Y		026	000	29
No						*45 19 54.97 -122 34 30.30*		016000100	S00	1															OR<25				
																	02	NONE 0	STOP										
																		PRVTE	NE SW									011	00
																		PSNGR CAR		01	DRVR	INJB	35	M	OR-Y		000	000	00
																									OR<25				

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCOHOL	DRUGS	SCHOOL BUS	WORK ZONE	DATE / DAY / TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MILEPNT / LRS	FC / MLG / CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF	LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
00825	N	Y	N			03/09/2011	CLACKAMAS	1 14		INTER	CROSS	N	N	RAIN	O-OTHER	01	NONE 0	TURN-L											08
CITY						Wed 9P	OREGON CITY	MN 0	S BEAVERCREEK RD	CN		TRF SIGNAL	N	WET	TURN		PRVTE	N E										000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	01	2		N	DLIT	INJ		PSNGR CAR		01	DRVR	INJC	46	M	OR-Y		001	000	08
No	*45 19 54.97*	*-122 34 30.30*						016000100S00	1																OR<25				
																02	NONE 0	TURN-L											
																	PRVTE	S W										000	00
																	PSNGR CAR		01	DRVR	NONE	21	M	OR-Y		000	000	00
																								OR<25				
																			02	PSNG	INJC	21	M			000	000	00
03642	N	N	N			10/01/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	CLR	O-1 L-TURN	01	NONE 0	STRGHT											04
NO RPT						Mon 6A	OREGON CITY	MN 0	S BEAVERCREEK RD	CN		TRF SIGNAL	N	DRY	TURN		PRVTE	N S										000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	01	3		N	DAWN	INJ		PSNGR CAR		01	DRVR	NONE	19	F	OR-Y		020	000	04
No	*45 19 54.97*	*-122 34 30.30*						016000100S00	1																OR<25				
																02	NONE 0	TURN-L											
																	PRVTE	S W										000	00
																	PSNGR CAR		01	DRVR	NONE	28	F	OR-Y		000	000	00
																								OR<25				
																			02	PSNG	NO<5	01	M			000	000	00
																			03	PSNG	INJC	03	F			000	000	00
00286	N	N	N	N	N	01/23/2011	CLACKAMAS	1 14		INTER	CROSS	N	N	CLD	O-1 L-TURN	01	NONE 0	TURN-L											02,04
STATE						Sun 6A	OREGON CITY	MN 0	S BEAVERCREEK RD	CN		TRF SIGNAL	N	WET	TURN		PRVTE	SW NW										000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	02	2		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	65	F	OR-Y		028,003	000	02,04
No	*45 19 54.97*	*-122 34 30.30*						016000100S00	1																OR<25				
																02	NONE 0	STRGHT											
																	PRVTE	NE SW										000	00
																	PSNGR CAR		01	DRVR	NONE	21	M	OR-Y		000	000	00
																								OR<25				
																			02	PSNG	INJC	27	F			000	000	00
04463	N	N	N			11/22/2011	CLACKAMAS	1 14		INTER	CROSS	N	N	RAIN	ANGL-OTH	01	NONE 1	STRGHT											04
NONE						Tue 10A	OREGON CITY	MN 0	S BEAVERCREEK RD	CN		TRF SIGNAL	N	WET	ANGL		PRVTE	S N										000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	02	0		N	DAY	PDO		SEMI TOW		01	DRVR	NONE	44	M	OR-Y		097	000	00
No	*45 19 54.97*	*-122 34 30.30*						016000100S00	1																OR<25				
																02	NONE 0	STRGHT											
																	PRVTE	E W										000	00
																	PSNGR CAR		01	DRVR	NONE	77	F	OR-Y		097	000	00
																								OR<25				
00857	N	N	N	N	N	03/06/2012	CLACKAMAS	1 14		INTER	CROSS	N	N	CLD	O-1 L-TURN	01	NONE 0	STRGHT											04
CITY						Tue 9P	OREGON CITY	MN 0	S BEAVERCREEK RD	CN		TRF SIGNAL	N	DRY	TURN		PRVTE	S N										000	00
							PORTLAND UA	2.98	CASCADE HY SOUTH	02	2		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	27	M	OR-Y		020	000	04
No	*45 19 54.97*	*-122 34 30.30*						016000100S00	1																OR<25				

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCHL	DRUGS	SCHL WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# FC / CMPT/MLG / MILEPNT / LRS	CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
															02	NONE 0 PRVTE	TURN-L N E									000	00
																PSNGR CAR		01	DRVR	INJC	45	M	OR-Y OR<25		000	000	00
																		02	PSNG	INJA	39	F			000	000	00
00083 NONE	N	N	N		01/08/2013 Tue 7A	CLACKAMAS OREGON CITY	1 14 MN 0	S BEAVERCREEK RD	INTER CN	CROSS	N TRF SIGNAL	N	N RAIN N WET	S-1STOP REAR	01	NONE 0 PRVTE	TURN-L W N											000	07 00
						PORTLAND UA	2.98	CASCADE HY SOUTH	02	3		N	N DARK	PDO		PSNGR CAR		01	DRVR	NONE	35	F	OR-Y OR<25		026	000	07
No					*45 19 54.96 -122 34 30.30*		016000100S00	1																				
															02	NONE 0 PRVTE	STOP W N									013	00
																PSNGR CAR		01	DRVR	NONE	38	M	OR-Y OR<25		000	000	00
05036 NONE	N	N	N		12/26/2013 Thu 7A	CLACKAMAS OREGON CITY	1 14 MN 0	S BEAVERCREEK RD	INTER CN	CROSS	N TRF SIGNAL	N	N UNK N WET	ANGL-OTH ANGL	01	NONE 0 PRVTE	STRGHT S N											000	04 00
						PORTLAND UA	2.98	CASCADE HY SOUTH	02	3		N	N DLIT	PDO		PSNGR CAR		01	DRVR	NONE	30	M	OR-Y OR<25		020	000	04
No					*45 19 54.96 -122 34 30.30*		016000100S00	1																				
															02	NONE 0 PRVTE	STRGHT E W									000	00
																PSNGR CAR		01	DRVR	NONE	57	F	OR-Y OR<25		000	000	00
03843 STATE	N	Y	N	N N	09/18/2011 Sun 1A	CLACKAMAS OREGON CITY	1 14 MN 0	S BEAVERCREEK RD	INTER CN	CROSS	N TRF SIGNAL	N	N RAIN N WET	ANGL-OTH ANGL	01	NONE 0 PRVTE	STRGHT N S										000	04 00
						PORTLAND UA	2.98	CASCADE HY SOUTH	03	2		N	N DLIT	FAT		PSNGR CAR		01	DRVR	INJC	58	M	OR-Y OR<25		000	000	00
No					*45 19 54.97 -122 34 30.30*		016000100S00	1																				
															02	NONE 0 PRVTE	STRGHT W E									000	00
																PSNGR CAR		01	DRVR	KILL	29	F	OR-Y OR<25		020	000	04
																		02	PSNG	INJB	26	M			000	000	00
02536 STATE	N	N	N	N N	07/13/2012 Fri 7P	CLACKAMAS OREGON CITY	1 14 MN 0	S BEAVERCREEK RD	INTER CN	CROSS	N TRF SIGNAL	N	N CLR N DRY	ANGL-OTH ANGL	01	NONE 0 PRVTE	STRGHT W E										000	02,14 00
						PORTLAND UA	2.98	CASCADE HY SOUTH	03	2		N	N DAY	PDO		PSNGR CAR		01	DRVR	NONE	28	M	OR-Y OR<25		028,024	000	02,14
No					*45 19 54.97 -122 34 30.30*		016000100S00	1																				
															02	POLCE 0 PUBLC	STRGHT N S									000	00
																PSNGR CAR		01	DRVR	NONE	45	M	OR-Y OR<25		000	000	00
04829 NONE	N	N	N		12/13/2012 Thu 7A	CLACKAMAS OREGON CITY	1 14 MN 0	S BEAVERCREEK RD	INTER CN	CROSS	N TRF SIGNAL	N	N UNK N UNK	S-1STOP REAR	01	NONE 0 PRVTE	STRGHT W E											000	07 00
						PORTLAND UA	2.98	CASCADE HY SOUTH	03	3		N	N DAWN	PDO		PSNGR CAR		01	DRVR	NONE	35	M	OR-Y OR<25		026	000	07
No					*45 19 54.97 -122 34 30.30*		016000100S00	1																				

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCHL	DRUGS	SCHL WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# FC / CMPT/MLG / MILEPNT / LRS	CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
															02	NONE 0 PRVTE	STOP W E									011	00
																PSNGR CAR		01	DRVR	NONE	00	F	UNK OR<25		000	000	00
04601 STATE	N	N	N		12/03/2010 Fri 1P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER CN 04	CROSS 0	N TRF SIGNAL	N N N	CLR DRY DAY	S-OTHER REAR INJ	01	NONE 0 PRVTE PSNGR CAR	TURN-R S E	01	DRVR	NONE	19	M	OR-Y OR<25		026	000	07 00 07
No					*45 19 56.31 -122 34 29.78*		016000100S00	1																			
															02	NONE 0 PRVTE	STOP S E									013	00
																PSNGR CAR		01	DRVR	NONE	81	M	OR-Y OR<25		000	000	00
																		02	PSNG	INJC	77	F			000	000	00
00804 NONE	N	N	N		03/07/2011 Mon 10A	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER CN 04	CROSS 2	N TRF SIGNAL	N N N	CLR DRY DAY	ANGL-OTH ANGL PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT S N	01	DRVR	NONE	00	F	UNK OR<25		020	000	04 00 04
No					*45 19 54.97 -122 34 30.30*		016000100S00	1																			
															02	NONE 0 PRVTE	STRGHT W E									000	00
																PSNGR CAR		01	DRVR	NONE	67	M	OR-Y OR<25		000	000	00
03336 CITY	N	N	N	N	N 09/09/2013 Mon 11P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.98	S BEAVERCREEK RD CASCADE HY SOUTH	INTER CN 04	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DLIT	O-1 L-TURN TURN INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT S N	01	DRVR	INJC	29	M	OR-Y OR<25		000	000	04 00 00
No					*45 19 54.96 -122 34 30.30*		016000100S00	1																			
																		02	PSNG	INJB	21	F			000	000	00
															02	NONE 0 PRVTE	TURN-L N E									000	00
																PSNGR CAR		01	DRVR	NONE	42	F	OR-Y OR<25		003	000	04
01847 NONE	N	N	N		05/26/2010 Wed 1P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.99	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 2	N YIELD	N N N	RAIN WET DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	00	M	OR-Y OR<25		016,026	000	27,07 00 27,07
No					*45 19 54.47 -122 34 30.52*		016000100S00	1																			
															02	NONE 0 PRVTE	STOP SE NW									011	00
																PSNGR CAR		01	DRVR	NONE	20	M	OR-Y OR<25		000	000	00
03021 NONE	N	N	N		08/27/2010 Fri 2P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.99	S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS 3	N YIELD	N N N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	29	M	OR-Y OR<25		026	000	07 00 07
No					*45 19 54.47 -122 34 30.52*		016000100S00	1																			
																		02	PSNG	NO<5	01	M			000	000	00

160 CASCADE HWY SOUTH

OR 213 Cascade Highway (160) & Beavercreek Road
January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPEED	ALCHL	DRUGS	SCHL	WORK	DATE / DAY/TIME / *LAT/LONG*	COUNTY / CITY / URBAN AREA	RD# / CMPT/MLG / MILEPNT / LRS	FC	CONN # / FIRST STREET / SECOND STREET / INTERSECTION SEQ#	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CNTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN EVENT	CAUSE
																	02	NONE 0 PRVTE	STOP SE NW									011	00
																		PSNGR CAR		01	DRVR	INJC	30	F	OR-Y OR<25		000	000	00
																				02	PSNG	NO<5	02	M			000	000	00
03164 NONE	N	N	N			09/05/2010 Sun 2P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.99		S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS (3)	N YIELD 3	N N N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	41	M	OR-Y OR<25		026	000	07
No	*45 19 54.47*		*-122 34 30.52*					016000100S00		1																		
																	02	NONE 0 PRVTE	STOP SE NW									011	00
																		PSNGR CAR		01	DRVR	INJC	20	M	OR-Y OR<25		000	000	00
03715 NONE	N	N	N			10/13/2010 Wed 3P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.99		S BEAVERCREEK RD CASCADE HY SOUTH	INTER NE 09	CROSS (2)	N YIELD 2	N N N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT SE NW	01	DRVR	NONE	20	F	OR-Y OR<25		026	000	07
No	*45 19 54.47*		*-122 34 30.52*					016000100S00		1																		
																	02	NONE 0 PRVTE	STOP SE NW									011	00
																		PSNGR CAR		01	DRVR	INJC	27	F	OR-Y OR<25		000	000	00
03163 NONE	N	N	N			09/05/2010 Sun 4P	CLACKAMAS OREGON CITY PORTLAND UA	1 14 MN 0 2.99		S BEAVERCREEK RD CASCADE HY SOUTH	INTER NW 09	CROSS (3)	N YIELD 3	N N N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT NE SW	01	DRVR	NONE	19	M	OR-Y OR<25		026	000	07
No	*45 19 54.47*		*-122 34 30.52*					016000100S00		1																		
																	02	NONE 0 PRVTE	STOP NE SW									011	00
																		PSNGR CAR		01	DRVR	INJC	17	M	OR-Y OR<25		000	000	00

CITY OF OREGON CITY, CLACKAMAS COUNTY — OR 213 Cascade Highway (160) & Beavercreek Road

January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPED	ALC	DRUGS	SCHL	WORK	DATE / DAY/TIME / *LAT/LONG*	FC / DISTNC	CITY STREET / FIRST STREET / SECOND STREET / INTERSECTION SEQ #	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS / (#LANES)	INT-REL / TRAF- / CONTL	OFF-RD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
04472	N	N	N			11/25/2010	19	S BEAVERCREEK RD	INTER	CROSS	N	N	CLR	S-1STOP	01	NONE	STRGHT											07
NONE						Thu 12P	0	CASCADE HY SOUTH	NE		YIELD	N	DRY	REAR		PRVTE	SE NW									000		00
No	*45 19 54.97*					*-122 34 30.30*		1	09	1		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	27	F	OR-Y OR<25		026	038		07
															02	NONE	STOP											
																PRVTE	SE NW									011		00
																PSNGR CAR		01	DRVR	NONE	57	M	OR-Y OR<25		000	000		00
00577	N	N	N	N	N	02/19/2013	16	S BEAVERCREEK RD	INTER	CROSS	N	N	RAIN	S-1STOP	01	NONE 0	STRGHT											07
CITY						Tue 6A	0	CASCADE HY SOUTH	NE		YIELD	N	WET	REAR		PRVTE	SE NW									000		00
No	*45 19 54.97*					*-122 34 30.30*		1	09	3		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	53	M	OR-Y OR<25		043,026	000		07
															02	NONE 0	STOP											
																PRVTE	SE NW									011		00
																PSNGR CAR		01	DRVR	INJB	57	M	OR-Y OR<25		000	000		00
00942	N	N	N			03/21/2010	16	S BEAVERCREEK RD	INTER	CROSS	N	N	RAIN	S-1STOP	01	NONE 0	STRGHT											07
NONE						Sun 10A	0	CASCADE HY SOUTH	E		YIELD	N	WET	REAR		PRVTE	E W									000		00
No	*45 19 54.97*					*-122 34 30.30*		1	06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	65	M	OR-Y OR<25		026	000		07
															02	NONE 0	STOP											
																PRVTE	E W									011		00
																PSNGR CAR		01	DRVR	NONE	56	M	OR-Y OR<25		000	000		00
04125	N	N	N			11/07/2010	16	S BEAVERCREEK RD	INTER	CROSS	N	N	CLD	S-1STOP	01	NONE 0	STRGHT											07
NONE						Sun 9A	0	CASCADE HY SOUTH	E		YIELD	N	WET	REAR		PRVTE	E W									000		00
No	*45 19 54.97*					*-122 34 30.30*		1	06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	26	M	OR-Y OR<25		026	000		07
															02	NONE 0	STOP											
																PRVTE	E W									011		00
																PSNGR CAR		01	DRVR	NONE	00	F	UNK UNK		000	000		00
04322	N	N	N			11/17/2010	16	S BEAVERCREEK RD	INTER	CROSS	N	N	RAIN	S-1STOP	01	NONE 0	STRGHT										013	07
NONE						Wed 4P	0	CASCADE HY SOUTH	E		TRF SIGNAL	N	WET	REAR		PRVTE	E W									000		00
No	*45 19 54.97*					*-122 34 30.30*		1	06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJC	27	M	OR-Y OR<25		026	000		07
															02	NONE 0	STOP											
																PRVTE	E W									011	013	00
																PSNGR CAR		01	DRVR	INJB	83	F	OR-Y OR<25		000	000		00
															03	NONE 0	STOP											
																PRVTE	E W									022		00
																PSNGR CAR		01	DRVR	INJC	47	M	OR-Y OR<25		000	000		00
																		02	PSNG	INJC	24	F			000	000		00
																		03	PSNG	NO<5	04	M			000	000		00

CITY OF OREGON CITY, CLACKAMAS COUNTY — OR 213 Cascade Highway (160) & Beavercreek Road

January 1, 2010 through December 31, 2014

SER# / INVEST / UNLOC?	SPED	ALC	DRUGS	SCHL	WORK	DATE / DAY/TIME / *LAT/LONG*	FC / DISTNC	CITY STREET / FIRST STREET / SECOND STREET / INTERSECTION SEQ #	RD CHAR / DIRECT / LOCTN	INT-TYP (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CONTL	OFF-RD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH TYP / COLL TYP / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / VEH TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACTN	EVENT	CAUSE
																		04	PSNG	NO<5	02	F			000	000		00
00355	Y	N	Y	N	N	01/30/2011	16	S BEAVERCREEK RD	INTER	CROSS	N		N	CLD	S-1STOP	01	NONE 0	STRGHT											16,32
CITY						Sun 3P	0	CASCADE HY SOUTH	E		TRF SIGNAL		N	DRY	REAR		PRVTE	E W											00
Yes						*45 19 54.98 -122 34 30.29*		1	06	2			N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	72	F	OR-Y OR<25		053,026,011	025		16,32
															02	NONE 0	STOP											
																PRVTE	E W											00
																PSNGR CAR		01	DRVR	INJB	51	F	OR-Y OR<25		000	000		00
															03	NONE 0	STOP											
																PRVTE	E W											00
																PSNGR CAR		01	DRVR	NONE	54	M	OR-Y OR<25		000	000		00
01217	N	N	N			04/11/2011	16	S BEAVERCREEK RD	INTER	CROSS	N		N	CLR	S-OTHER	01	NONE 0	STRGHT											07
NONE						Mon 8P	0	CASCADE HY SOUTH	E		UNKNOWN		N	DRY	REAR		PRVTE	E W											00
Yes						*45 19 54.98 -122 34 30.29*		1	06	0			N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	47	F	OTH-Y N-RES		042	000		07
															02	NONE 0	STRGHT											
																PRVTE	E W											00
																PSNGR CAR		01	DRVR	NONE	56	F	OR-Y OR<25		000	000		00
																		02	PSNG	INJC	18	F			000	000		00
01368	Y	N	N	N	N	04/22/2011	16	S BEAVERCREEK RD	INTER	CROSS	N		N	CLR	S-1STOP	01	NONE 0	STRGHT										013	01
STATE						Fri 2P	0	CASCADE HY SOUTH	E		TRF SIGNAL		N	DRY	REAR		PRVTE	S N											00
Yes						*45 19 54.98 -122 34 30.29*		1	06	0			N	DAY	INJ		PSNGR CAR		01	DRVR	INJC	41	F	OR-Y OR<25		047,026	000		01
															02	NONE 0	STOP											
																PRVTE	S N											00
																PSNGR CAR		01	DRVR	NONE	17	F	OR-Y OR<25		000	000		00
															03	NONE 0	STOP											
																PRVTE	S N											00
																PSNGR CAR		01	DRVR	NONE	22	M	OR-Y OR<25		000	000		00
04115	N	N	N			11/03/2011	16	S BEAVERCREEK RD	INTER	CROSS	N		N	CLR	S-1STOP	01	NONE 0	STRGHT											07
NONE						Thu 11A	0	CASCADE HY SOUTH	E		TRF SIGNAL		N	DRY	REAR		PRVTE	E W											00
Yes						*45 19 54.98 -122 34 30.29*		1	06	0			N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	00	M	UNK UNK		026	000		07
															02	NONE 0	STOP											
																PRVTE	E W											00
																PSNGR CAR		01	DRVR	INJC	25	F	OR-Y OR>25		000	000		00
00750	N	N	N			02/27/2012	16	S BEAVERCREEK RD	INTER	CROSS	N		N	UNK	S-1STOP	01	NONE 0	STRGHT											07
NONE						Mon 2P	0	CASCADE HY SOUTH	E		TRF SIGNAL		N	WET	REAR		PRVTE	E W											00
No						*45 19 54.97 -122 34 30.30*		1	06	3			N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	19	M	OR-Y OR<25		026	000		07

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															02	NONE 0 PRVTE PSNGR CAR	STOP E W										011 000	00 00
05319	N	N	N			12/31/2014 Wed 9P *45 19 54.97 -122 34 30.30*	16 0	S BEAVERCREEK RD CASCADE HY SOUTH 1	INTER E 06	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DLIT	S-1STOP REAR INJ	01	NONE 0 UNKN PSNGR CAR	STRGHT UN UN	01	DRVR	NONE	00	U	UNK UNK		026		29 000 000	29 00 29
															02	NONE 0 PRVTE PSNGR CAR	STOP UN UN	01 02	DRVR PSNG	INJC INJC	16 18	F F	OR-Y OR<25		000 000		011 000 000	00 00 00
04873	N	N	N			12/19/2011 Mon 2P *45 19 54.96 -122 34 30.29*	16 0	S BEAVERCREEK RD CASCADE HY SOUTH 1	INTER W 06	CROSS 1	N TRF SIGNAL	N N N	CLR DRY DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT W E	01	DRVR	NONE	00	M	OR-Y OR<25		026		07 000 000	07 00 07
															02	NONE 0 PRVTE PSNGR CAR	STOP W E	01	DRVR	NONE	30	F	OR-Y OR<25		000		011 000	00 00
02778	N	N	N			07/29/2012 Sun 10A *45 19 54.97 -122 34 30.30*	16 0	S BEAVERCREEK RD CASCADE HY SOUTH 1	INTER W 06	CROSS 2	N L-TURN REF	N N N	CLR DRY DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT W E	01	DRVR	NONE	37	F	OR-Y OR<25		026		07 000 000	07 00 07
															02	NONE 0 PRVTE PSNGR CAR	STOP W E	01	DRVR	NONE	51	F	OR-Y OR<25		000		012 000	00 00
02536	N	N	N			07/15/2013 Mon 6P *45 19 54.97 -122 34 30.30*	16 0	S BEAVERCREEK RD CASCADE HY SOUTH 1	INTER W 06	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	STRGHT W E	01	DRVR	NONE	44	M	OR-Y OR<25		026		07 000 000	07 00 07
															02	NONE 0 PRVTE PSNGR CAR	STOP W E	01	DRVR	NONE	60	F	OR-Y OR<25		000		011 000	00 00
04147	N	N	N			10/29/2013 Tue 3P *45 19 54.97 -122 34 30.30*	16 0	S BEAVERCREEK RD CASCADE HY SOUTH 1	INTER W 06	CROSS 3	N TRF SIGNAL	N N N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT W E	01	DRVR	NONE	20	F	OR-Y OR>25		026		07 000 000	07 00 07
															02	NONE 0 PRVTE PSNGR CAR	STOP W E	01	DRVR	INJC	34	F	OR-Y OR<25		000		011 000	00 00

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00273	N	N	N	N	N	01/01/2014	16	S BEAVERCREEK RD	INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											07
CITY						Wed 9A	0	CASCADE HY SOUTH	W		TRF SIGNAL	N	DRY	REAR		PRVTE	W E										000		00
No						*45 19 54.97 -122 34 30.30*		1	06	3		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	65	F	SUSP OR<25		026	000		07
															02	NONE 0	STOP											
																PRVTE	W E										011		00
																PSNGR CAR		01	DRVR	INJC	21	F	OR-Y OR<25		000	000		00

ACTION CODE TRANSLATION LIST

ACTION CODE	SHORT DESCRIPTION	LONG DESCRIPTION
000	NONE	NO ACTION OR NON-WARRANTED
001	SKIDDED	SKIDDED
002	ON/OFF V	GETTING ON OR OFF STOPPED OR PARKED VEHICLE
003	LOAD OVR	OVERHANGING LOAD STRUCK ANOTHER VEHICLE, ETC.
006	SLOW DN	SLOWED DOWN
007	AVOIDING	AVOIDING MANEUVER
008	PAR PARK	PARALLEL PARKING
009	ANG PARK	ANGLE PARKING
010	INTERFERE	PASSENGER INTERFERING WITH DRIVER
011	STOPPED	STOPPED IN TRAFFIC NOT WAITING TO MAKE A LEFT TURN
012	STP/L TRN	STOPPED BECAUSE OF LEFT TURN SIGNAL OR WAITING, ETC.
013	STP TURN	STOPPED WHILE EXECUTING A TURN
015	GO A/STOP	PROCEED AFTER STOPPING FOR A STOP SIGN/FLASHING RED.
016	TRN A/RED	TURNED ON RED AFTER STOPPING
017	LOSTCTRL	LOST CONTROL OF VEHICLE
018	EXIT DWY	ENTERING STREET OR HIGHWAY FROM ALLEY OR DRIVEWAY
019	ENTR DWY	ENTERING ALLEY OR DRIVEWAY FROM STREET OR HIGHWAY
020	STR ENTR	BEFORE ENTERING ROADWAY, STRUCK PEDESTRIAN, ETC. ON SIDEWALK OR SHOULDER
021	NO DRVR	CAR RAN AWAY - NO DRIVER
022	PREV COL	STRUCK, OR WAS STRUCK BY, VEHICLE OR PEDESTRIAN IN PRIOR COLLISION BEFORE ACC. STABILIZED
023	STALLED	VEHICLE STALLED OR DISABLED
024	DRVR DEAD	DEAD BY UNASSOCIATED CAUSE
025	FATIGUE	FATIGUED, SLEEPY, ASLEEP
026	SUN	DRIVER BLINDED BY SUN
027	HDLGHTS	DRIVER BLINDED BY HEADLIGHTS
028	ILLNESS	PHYSICALLY ILL
029	THRU MED	VEHICLE CROSSED, PLUNGED OVER, OR THROUGH MEDIAN BARRIER
030	PURSUIT	PURSUING OR ATTEMPTING TO STOP A VEHICLE
031	PASSING	PASSING SITUATION
032	PRKOFFRD	VEHICLE PARKED BEYOND CURB OR SHOULDER
033	CROS MED	VEHICLE CROSSED EARTH OR GRASS MEDIAN
034	X N/SGNL	CROSSING AT INTERSECTION - NO TRAFFIC SIGNAL PRESENT
035	X W/ SGNL	CROSSING AT INTERSECTION - TRAFFIC SIGNAL PRESENT
036	DIAGONAL	CROSSING AT INTERSECTION - DIAGONALLY
037	BTWN INT	CROSSING BETWEEN INTERSECTIONS
038	DISTRACT	DRIVER'S ATTENTION DISTRACTED
039	W/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER WITH TRAFFIC
040	A/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER FACING TRAFFIC
041	W/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT WITH TRAFFIC
042	A/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT FACING TRAFFIC
043	PLAYINRD	PLAYING IN STREET OR ROAD
044	PUSH MV	PUSHING OR WORKING ON VEHICLE IN ROAD OR ON SHOULDER
045	WORK ON	WORKING IN ROADWAY OR ALONG SHOULDER
046	W/ TRAFIC	NON-MOTORIST WALKING, RUNNING, RIDING, ETC. WITH TRAFFIC
047	A/ TRAFIC	NON-MOTORIST WALKING, RUNNING, RIDING, ETC. FACING TRAFFIC
050	LAY ON RD	STANDING OR LYING IN ROADWAY
051	ENT OFFRD	ENTERING / STARTING IN TRAFFIC LANE FROM OFF ROAD
052	MERGING	MERGING
055	SPRAY	BLINDED BY WATER SPRAY
088	OTHER	OTHER ACTION

ACTION CODE TRANSLATION LIST

ACTION CODE	SHORT DESCRIPTION	LONG DESCRIPTION
099	UNK	UNKNOWN ACTION

CAUSE CODE TRANSLATION LIST

CAUSE CODE	SHORT DESCRIPTION	LONG DESCRIPTION
00	NO CODE	NO CAUSE ASSOCIATED AT THIS LEVEL
01	TOO-FAST	TOO FAST FOR CONDITIONS (NOT EXCEED POSTED SPEED
02	NO-YIELD	DID NOT YIELD RIGHT-OF-WAY
03	PAS-STOP	PASSED STOP SIGN OR RED FLASHER
04	DIS SIG	DISREGARDED TRAFFIC SIGNAL
05	LEFT-CTR	DROVE LEFT OF CENTER ON TWO-WAY ROAD; STRADDLING
06	IMP-OVER	IMPROPER OVERTAKING
07	TOO-CLOS	FOLLOWED TOO CLOSELY
08	IMP-TURN	MADE IMPROPER TURN
09	DRINKING	ALCOHOL OR DRUG INVOLVED
10	OTHR-IMP	OTHER IMPROPER DRIVING
11	MECH-DEF	MECHANICAL DEFECT
12	OTHER	OTHER (NOT IMPROPER DRIVING)
13	IMP LN C	IMPROPER CHANGE OF TRAFFIC LANES
14	DIS TCD	DISREGARDED OTHER TRAFFIC CONTROL DEVICE
15	WRNG WAY	WRONG WAY ON ONE-WAY ROAD; WRONG SIDE DIVIDED RO
16	FATIGUE	DRIVER DROWSY/FATIGUED/SLEEPY
17	ILLNESS	PHYSICAL ILLNESS
18	IN RDWY	NON-MOTORIST ILLEGALLY IN ROADWAY
19	NT VISBL	NON-MOTORIST NOT VISIBLE; NON-REFLECTIVE CLOTHIN
20	IMP PKNG	VEHICLE IMPROPERLY PARKED
21	DEF STER	DEFECTIVE STEERING MECHANISM
22	DEF BRKE	INADEQUATE OR NO BRAKES
24	LOADSHFT	VEHICLE LOST LOAD OR LOAD SHIFTED
25	TIREFAIL	TIRE FAILURE
26	PHANTOM	PHANTOM / NON-CONTACT VEHICLE
27	INATTENT	INATTENTION
28	NM INATT	NON-MOTORIST INATTENTION
29	F AVOID	FAILED TO AVOID VEHICLE AHEAD
30	SPEED	DRIVING IN EXCESS OF POSTED SPEED
31	RACING	SPEED RACING (PER PAR)
32	CARELESS	CARELESS DRIVING (PER PAR)
33	RECKLESS	RECKLESS DRIVING (PER PAR)
34	AGGRESV	AGGRESSIVE DRIVING (PER PAR)
35	RD RAGE	ROAD RAGE (PER PAR)
40	VIEW OBS	VIEW OBSCURED
50	USED MDN	IMPROPER USE OF MEDIAN OR SHOULDER

COLLISION TYPE CODE TRANSLATION LIST

COLL CODE	SHORT DESCRIPTION	LONG DESCRIPTION
&	OTH	MISCELLANEOUS
-	BACK	BACKING
0	PED	PEDESTRIAN
1	ANGL	ANGLE
2	HEAD	HEAD-ON
3	REAR	REAR-END
4	SS-M	SIDESWIPE - MEETING
5	SS-O	SIDESWIPE - OVERTAKING
6	TURN	TURNING MOVEMENT
7	PARK	PARKING MANEUVER
8	NCOL	NON-COLLISION
9	FIX	FIXED OBJECT OR OTHER OBJECT

CRASH TYPE CODE TRANSLATION LIST

CRASH TYPE	SHORT DESCRIPTION	LONG DESCRIPTION
&	OVERTURN	OVERTURNED
0	NON-COLL	OTHER NON-COLLISION
1	OTH RDWY	MOTOR VEHICLE ON OTHER ROADWAY
2	PRKD MV	PARKED MOTOR VEHICLE
3	PED	PEDESTRIAN
4	TRAIN	RAILWAY TRAIN
6	BIKE	PEDALCYCLIST
7	ANIMAL	ANIMAL
8	FIX OBJ	FIXED OBJECT
9	OTH OBJ	OTHER OBJECT
A	ANGL-STP	ENTERING AT ANGLE - ONE VEHICLE STOPPED
B	ANGL-OTH	ENTERING AT ANGLE - ALL OTHERS
C	S-STRGHT	FROM SAME DIRECTION - BOTH GOING STRAIGHT
D	S-1TURN	FROM SAME DIRECTION - ONE TURN, ONE STRAIGHT
E	S-1STOP	FROM SAME DIRECTION - ONE STOPPED
F	S-OTHER	FROM SAME DIRECTION-ALL OTHERS, INCLUDING PARKING
G	O-STRGHT	FROM OPPOSITE DIRECTION - BOTH GOING STRAIGHT
H	O-1 L-TURN	FROM OPPOSITE DIRECTION-ONE LEFT TURN,ONE STRAIGHT
I	O-1STOP	FROM OPPOSITE DIRECTION - ONE STOPPED
J	O-OTHER	FROM OPPOSITE DIRECTION-ALL OTHERS INCL. PARKING

DRIVER LICENSE CODE TRANSLATION LIST

LIC CODE	SHORT DESC	LONG DESCRIPTION
0	NONE	NOT LICENSED (HAD NEVER BEEN LICENSED)
1	OR-Y	VALID OREGON LICENSE
2	OTH-Y	VALID LICENSE, OTHER STATE OR COUNTRY
3	SUSP	SUSPENDED/REVOKED

DRIVER RESIDENCE CODE TRANSLATION LIST

RES CODE	SHORT DESC	LONG DESCRIPTION
1	OR<25	OREGON RESIDENT WITHIN 25 MILE OF HOME
2	OR>25	OREGON RESIDENT 25 OR MORE MILES FROM HOME
3	OR-?	OREGON RESIDENT - UNKNOWN DISTANCE FROM HOME
4	N-RES	NON-RESIDENT
9	UNK	UNKNOWN IF OREGON RESIDENT

ERROR CODE TRANSLATION LIST

ERROR CODE	SHORT DESCRIPTION	FULL DESCRIPTION
000	NONE	NO ERROR
001	WIDE TRN	WIDE TURN
002	CUT CORN	CUT CORNER ON TURN
003	FAIL TRN	FAILED TO OBEY MANDATORY TRAFFIC TURN SIGNAL, SIGN OR LANE MARKINGS
004	L IN TRF	LEFT TURN IN FRONT OF ONCOMING TRAFFIC
005	L PROHIB	LEFT TURN WHERE PROHIBITED
006	FRM WRNG	TURNED FROM WRONG LANE
007	TO WRONG	TURNED INTO WRONG LANE
008	ILLEG U	U-TURNED ILLEGALLY
009	IMP STOP	IMPROPERLY STOPPED IN TRAFFIC LANE
010	IMP SIG	IMPROPER SIGNAL OR FAILURE TO SIGNAL
011	IMP BACK	BACKING IMPROPERLY (NOT PARKING)
012	IMP PARK	IMPROPERLY PARKED
013	UNPARK	IMPROPER START LEAVING PARKED POSITION
014	IMP STRT	IMPROPER START FROM STOPPED POSITION
015	IMP LGHT	IMPROPER OR NO LIGHTS (VEHICLE IN TRAFFIC)
016	INATTENT	INATTENTION (FAILURE TO DIM LIGHTS PRIOR TO 4/1/97)
017	UNSF VEH	DRIVING UNSAFE VEHICLE (NO OTHER ERROR APPARENT)
018	OTH PARK	ENTERING/EXITING PARKED POSITION W/ INSUFFICIENT CLEARANCE; OTHER IMPROPER PARKING MANEUVER
019	DIS DRIV	DISREGARDED OTHER DRIVER'S SIGNAL
020	DIS SGNL	DISREGARDED TRAFFIC SIGNAL
021	RAN STOP	DISREGARDED STOP SIGN OR FLASHING RED
022	DIS SIGN	DISREGARDED WARNING SIGN, FLARES OR FLASHING AMBER
023	DIS OFCR	DISREGARDED POLICE OFFICER OR FLAGMAN
024	DIS EMER	DISREGARDED SIREN OR WARNING OF EMERGENCY VEHICLE
025	DIS RR	DISREGARDED RR SIGNAL, RR SIGN, OR RR FLAGMAN
026	REAR-END	FAILED TO AVOID STOPPED OR PARKED VEHICLE AHEAD OTHER THAN SCHOOL BUS
027	BIKE ROW	DID NOT HAVE RIGHT-OF-WAY OVER PEDALCYCLIST
028	NO ROW	DID NOT HAVE RIGHT-OF-WAY
029	PED ROW	FAILED TO YIELD RIGHT-OF-WAY TO PEDESTRIAN
030	PAS CURV	PASSING ON A CURVE
031	PAS WRNG	PASSING ON THE WRONG SIDE
032	PAS TANG	PASSING ON STRAIGHT ROAD UNDER UNSAFE CONDITIONS
033	PAS X-WK	PASSED VEHICLE STOPPED AT CROSSWALK FOR PEDESTRIAN
034	PAS INTR	PASSING AT INTERSECTION
035	PAS HILL	PASSING ON CREST OF HILL
036	N/PAS ZN	PASSING IN "NO PASSING" ZONE
037	PAS TRAF	PASSING IN FRONT OF ONCOMING TRAFFIC
038	CUT-IN	CUTTING IN (TWO LANES - TWO WAY ONLY)
039	WRNGSIDE	DRIVING ON WRONG SIDE OF THE ROAD (2-WAY UNDIVIDED ROADWAYS)
040	THRU MED	DRIVING THROUGH SAFETY ZONE OR OVER ISLAND
041	F/ST BUS	FAILED TO STOP FOR SCHOOL BUS

ERROR CODE TRANSLATION LIST

ERROR CODE	SHORT DESCRIPTION	FULL DESCRIPTION
042	F/SLO MV	FAILED TO DECREASE SPEED FOR SLOWER MOVING VEHICLE
043	TOO CLOSE	FOLLOWING TOO CLOSELY (MUST BE ON OFFICER'S REPORT)
044	STRDL LN	STRADDLING OR DRIVING ON WRONG LANES
045	IMP CHG	IMPROPER CHANGE OF TRAFFIC LANES
046	WRNG WAY	WRONG WAY ON ONE-WAY ROADWAY; WRONG SIDE DIVIDED ROAD
047	BASCRULE	DRIVING TOO FAST FOR CONDITIONS (NOT EXCEEDING POSTED SPEED)
048	OPN DOOR	OPENED DOOR INTO ADJACENT TRAFFIC LANE
049	IMPEDING	IMPEDING TRAFFIC
050	SPEED	DRIVING IN EXCESS OF POSTED SPEED
051	RECKLESS	RECKLESS DRIVING (PER PAR)
052	CARELESS	CARELESS DRIVING (PER PAR)
053	RACING	SPEED RACING (PER PAR)
054	X N/SGNL	CROSSING AT INTERSECTION, NO TRAFFIC SIGNAL PRESENT
055	X W/SGNL	CROSSING AT INTERSECTION, TRAFFIC SIGNAL PRESENT
056	DIAGONAL	CROSSING AT INTERSECTION - DIAGONALLY
057	BTWN INT	CROSSING BETWEEN INTERSECTIONS
059	W/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER WITH TRAFFIC
060	A/TRAF-S	WALKING, RUNNING, RIDING, ETC., ON SHOULDER FACING TRAFFIC
061	W/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT WITH TRAFFIC
062	A/TRAF-P	WALKING, RUNNING, RIDING, ETC., ON PAVEMENT FACING TRAFFIC
063	PLAYINRD	PLAYING IN STREET OR ROAD
064	PUSH MV	PUSHING OR WORKING ON VEHICLE IN ROAD OR ON SHOULDER
065	WORK IN RD	WORKING IN ROADWAY OR ALONG SHOULDER
070	LAY ON RD	STANDING OR LYING IN ROADWAY
071	NM IMP USE	IMPROPER USE OF TRAFFIC LANE BY NON-MOTORIST
073	ELUDING	ELUDING / ATTEMPT TO ELUDE
079	F NEG CURV	FAILED TO NEGOTIATE A CURVE
080	FAIL LN	FAILED TO MAINTAIN LANE
081	OFF RD	RAN OFF ROAD
082	NO CLEAR	DRIVER MISJUDGED CLEARANCE
083	OVRSTEER	OVER-CORRECTING
084	NOT USED	CODE NOT IN USE
085	OVRLOAD	OVERLOADING OR IMPROPER LOADING OF VEHICLE WITH CARGO OR PASSENGERS
097	UNA DIS TC	UNABLE TO DETERMINE WHICH DRIVER DISREGARDED TRAFFIC CONTROL DEVICE

EVENT CODE TRANSLATION LIST

EVENT CODE	SHORT DESCRIPTION	LONG DESCRIPTION
001	FEL/JUMP	OCCUPANT FELL, JUMPED OR WAS EJECTED FROM MOVING VEHICLE
002	INTERFER	PASSENGER INTERFERED WITH DRIVER
003	BUG INTF	ANIMAL OR INSECT IN VEHICLE INTERFERED WITH DRIVER
004	INDRCT PED	PEDESTRIAN INDIRECTLY INVOLVED (NOT STRUCK)
005	SUB-PED	"SUB-PED": PEDESTRIAN INJURED SUBSEQUENT TO COLLISION, ETC.
006	INDRCT BIK	PEDALCYCLIST INDIRECTLY INVOLVED (NOT STRUCK)
007	HITCHIKR	HITCHHIKER (SOLICITING A RIDE)
008	PSNGR TOW	PASSENGER OR NON-MOTORIST BEING TOWED OR PUSHED ON CONVEYANCE
009	ON/OFF V	GETTING ON/OFF STOPPED/PARKED VEHICLE (OCCUPANTS ONLY; MUST HAVE PHYSICAL CONTACT W/ VEHIC
010	SUB OTRN	OVERTURNED AFTER FIRST HARMFUL EVENT
011	MV PUSHD	VEHICLE BEING PUSHED
012	MV TOWED	VEHICLE TOWED OR HAD BEEN TOWING ANOTHER VEHICLE
013	FORCED	VEHICLE FORCED BY IMPACT INTO ANOTHER VEHICLE, PEDALCYCLIST OR PEDESTRIAN
014	SET MOTN	VEHICLE SET IN MOTION BY NON-DRIVER (CHILD RELEASED BRAKES, ETC.)
015	RR ROW	AT OR ON RAILROAD RIGHT-OF-WAY (NOT LIGHT RAIL)
016	LT RL ROW	AT OR ON LIGHT-RAIL RIGHT-OF-WAY
017	RR HIT V	TRAIN STRUCK VEHICLE
018	V HIT RR	VEHICLE STRUCK TRAIN
019	HIT RR CAR	VEHICLE STRUCK RAILROAD CAR ON ROADWAY
020	JACKNIFE	JACKKNIFE; TRAILER OR TOWED VEHICLE STRUCK TOWING VEHICLE
021	TRL OTRN	TRAILER OR TOWED VEHICLE OVERTURNED
022	CN BROKE	TRAILER CONNECTION BROKE
023	DETACH TRL	DETACHED TRAILING OBJECT STRUCK OTHER VEHICLE, NON-MOTORIST, OR OBJECT
024	V DOOR OPN	VEHICLE DOOR OPENED INTO ADJACENT TRAFFIC LANE
025	WHEELOFF	WHEEL CAME OFF
026	HOOD UP	HOOD FLEW UP
028	LOAD SHIFT	LOST LOAD, LOAD MOVED OR SHIFTED
029	TIREFAIL	TIRE FAILURE
030	PET	PET: CAT, DOG AND SIMILAR
031	LVSTOCK	STOCK: COW, CALF, BULL, STEER, SHEEP, ETC.
032	HORSE	HORSE, MULE, OR DONKEY
033	HRSE&RID	HORSE AND RIDER
034	GAME	WILD ANIMAL, GAME (INCLUDES BIRDS; NOT DEER OR ELK)
035	DEER ELK	DEER OR ELK, WAPITI
036	ANML VEH	ANIMAL-DRAWN VEHICLE
037	CULVERT	CULVERT, OPEN LOW OR HIGH MANHOLE
038	ATENUATN	IMPACT ATTENUATOR
039	PK METER	PARKING METER
040	CURB	CURB (ALSO NARROW SIDEWALKS ON BRIDGES)
041	JIGGLE	JIGGLE BAR OR TRAFFIC SNAKE FOR CHANNELIZATION
042	GDRL END	LEADING EDGE OF GUARDRAIL
043	GARDRAIL	GUARD RAIL (NOT METAL MEDIAN BARRIER)
044	BARRIER	MEDIAN BARRIER (RAISED OR METAL)
045	WALL	RETAINING WALL OR TUNNEL WALL
046	BR RAIL	BRIDGE RAILING OR PARAPET (ON BRIDGE OR APPROACH)
047	BR ABUTMNT	BRIDGE ABUTMENT (INCLUDED "APPROACH END" THRU 2013)
048	BR COLMN	BRIDGE PILLAR OR COLUMN
049	BR GIRDR	BRIDGE GIRDER (HORIZONTAL BRIDGE STRUCTURE OVERHEAD)
050	ISLAND	TRAFFIC RAISED ISLAND
051	GORE	GORE
052	POLE UNK	POLE - TYPE UNKNOWN
053	POLE UTL	POLE - POWER OR TELEPHONE
054	ST LIGHT	POLE - STREET LIGHT ONLY
055	TRF SGNL	POLE - TRAFFIC SIGNAL AND PED SIGNAL ONLY
056	SGN BRDG	POLE - SIGN BRIDGE
057	STOPSIGN	STOP OR YIELD SIGN
058	OTH SIGN	OTHER SIGN, INCLUDING STREET SIGNS
059	HYDRANT	HYDRANT

EVENT CODE TRANSLATION LIST

EVENT CODE	SHORT DESCRIPTION	LONG DESCRIPTION
060	MARKER	DELINEATOR OR MARKER (REFLECTOR POSTS)
061	MAILBOX	MAILBOX
062	TREE	TREE, STUMP OR SHRUBS
063	VEG OHED	TREE BRANCH OR OTHER VEGETATION OVERHEAD, ETC.
064	WIRE/CBL	WIRE OR CABLE ACROSS OR OVER THE ROAD
065	TEMP SGN	TEMPORARY SIGN OR BARRICADE IN ROAD, ETC.
066	PERM SGN	PERMANENT SIGN OR BARRICADE IN/OFF ROAD
067	SLIDE	SLIDES, FALLEN OR FALLING ROCKS
068	FRGN OBJ	FOREIGN OBSTRUCTION/DEBRIS IN ROAD (NOT GRAVEL)
069	EQP WORK	EQUIPMENT WORKING IN/OFF ROAD
070	OTH EQP	OTHER EQUIPMENT IN OR OFF ROAD (INCLUDES PARKED TRAILER, BOAT)
071	MAIN EQP	WRECKER, STREET SWEEPER, SNOW PLOW OR SANDING EQUIPMENT
072	OTHER WALL	ROCK, BRICK OR OTHER SOLID WALL
073	IRRGL PVMT	OTHER BUMP (NOT SPEED BUMP), POTHOLE OR PAVEMENT IRREGULARITY (PER PAR)
074	OVERHD OBJ	OTHER OVERHEAD OBJECT (HIGHWAY SIGN, SIGNAL HEAD, ETC.); NOT BRIDGE
075	CAVE IN	BRIDGE OR ROAD CAVE IN
076	HI WATER	HIGH WATER
077	SNO BANK	SNOW BANK
078	LO-HI EDGE	LOW OR HIGH SHOULDER AT PAVEMENT EDGE
079	DITCH	CUT SLOPE OR DITCH EMBANKMENT
080	OBJ FRM MV	STRUCK BY ROCK OR OTHER OBJECT SET IN MOTION BY OTHER VEHICLE (INCL. LOST LOADS)
081	FLY-OBJ	STRUCK BY ROCK OR OTHER MOVING OR FLYING OBJECT (NOT SET IN MOTION BY VEHICLE)
082	VEH HID	VEHICLE OBSCURED VIEW
083	VEG HID	VEGETATION OBSCURED VIEW
084	BLDG HID	VIEW OBSCURED BY FENCE, SIGN, PHONE BOOTH, ETC.
085	WIND GUST	WIND GUST
086	IMMERSED	VEHICLE IMMERSED IN BODY OF WATER
087	FIRE/EXP	FIRE OR EXPLOSION
088	FENC/BLD	FENCE OR BUILDING, ETC.
089	OTHR CRASH	CRASH RELATED TO ANOTHER SEPARATE CRASH
090	TO 1 SIDE	TWO-WAY TRAFFIC ON DIVIDED ROADWAY ALL ROUTED TO ONE SIDE
091	BUILDING	BUILDING OR OTHER STRUCTURE
092	PHANTOM	OTHER (PHANTOM) NON-CONTACT VEHICLE
093	CELL PHONE	CELL PHONE (ON PAR OR DRIVER IN USE)
094	VIOL GDL	TEENAGE DRIVER IN VIOLATION OF GRADUATED LICENSE PGM
095	GUY WIRE	GUY WIRE
096	BERM	BERM (EARTHEN OR GRAVEL MOUND)
097	GRAVEL	GRAVEL IN ROADWAY
098	ABR EDGE	ABRUPT EDGE
099	CELL WTNSD	CELL PHONE USE WITNESSED BY OTHER PARTICIPANT
100	UNK FIXD	FIXED OBJECT, UNKNOWN TYPE.
101	OTHER OBJ	NON-FIXED OBJECT, OTHER OR UNKNOWN TYPE
102	TEXTING	TEXTING
103	WZ WORKER	WORK ZONE WORKER
104	ON VEHICLE	PASSENGER RIDING ON VEHICLE EXTERIOR
105	PEDAL PSGR	PASSENGER RIDING ON PEDALCYCLE
106	MAN WHLCHR	PEDESTRIAN IN NON-MOTORIZED WHEELCHAIR
107	MTR WHLCHR	PEDESTRIAN IN MOTORIZED WHEELCHAIR
108	OFFICER	LAW ENFORCEMENT / POLICE OFFICER
109	SUB-BIKE	"SUB-BIKE": PEDALCYCLIST INJURED SUBSEQUENT TO COLLISION, ETC.
110	N-MTR	NON-MOTORIST STRUCK VEHICLE
111	S CAR VS V	STREET CAR/TROLLEY (ON RAILS OR OVERHEAD WIRE SYSTEM) STRUCK VEHICLE
112	V VS S CAR	VEHICLE STRUCK STREET CAR/TROLLEY (ON RAILS OR OVERHEAD WIRE SYSTEM)
113	S CAR ROW	AT OR ON STREET CAR OR TROLLEY RIGHT-OF-WAY
114	RR EQUIP	VEHICLE STRUCK RAILROAD EQUIPMENT (NOT TRAIN) ON TRACKS
115	DSTRCT GPS	DISTRACTED BY NAVIGATION SYSTEM OR GPS DEVICE
116	DSTRCT OTH	DISTRACTED BY OTHER ELECTRONIC DEVICE
117	RR GATE	RAIL CROSSING DROP-ARM GATE

EVENT CODE TRANSLATION LIST

EVENT CODE	SHORT DESCRIPTION	LONG DESCRIPTION
118	EXPNSN JNT	EXPANSION JOINT
119	JERSEY BAR	JERSEY BARRIER
120	WIRE BAR	WIRE OR CABLE MEDIAN BARRIER
121	FENCE	FENCE
123	OBJ IN VEH	LOOSE OBJECT IN VEHICLE STRUCK OCCUPANT
124	SLIPPERY	SLIDING OR SWERVING DUE TO WET, ICY, SLIPPERY OR LOOSE SURFACE (NOT GRAVEL)
125	SHLDR	SHOULDER GAVE WAY
126	BOULDER	ROCK(S), BOULDER (NOT GRAVEL; NOT ROCK SLIDE)
127	LAND SLIDE	ROCK SLIDE OR LAND SLIDE
128	CURVE INV	CURVE PRESENT AT CRASH LOCATION
129	HILL INV	VERTICAL GRADE / HILL PRESENT AT CRASH LOCATION
130	CURVE HID	VIEW OBSCURED BY CURVE
131	HILL HID	VIEW OBSCURED BY VERTICAL GRADE / HILL
132	WINDOW HID	VIEW OBSCURED BY VEHICLE WINDOW CONDITIONS
133	SPRAY HID	VIEW OBSCURED BY WATER SPRAY

FUNCTIONAL CLASSIFICATION TRANSLATION LIST

FUNC CLASS	DESCRIPTION
01	RURAL PRINCIPAL ARTERIAL - INTERSTATE
02	RURAL PRINCIPAL ARTERIAL - OTHER
06	RURAL MINOR ARTERIAL
07	RURAL MAJOR COLLECTOR
08	RURAL MINOR COLLECTOR
09	RURAL LOCAL
11	URBAN PRINCIPAL ARTERIAL - INTERSTATE
12	URBAN PRINCIPAL ARTERIAL - OTHER FREEWAYS AND EXP
14	URBAN PRINCIPAL ARTERIAL - OTHER
16	URBAN MINOR ARTERIAL
17	URBAN MAJOR COLLECTOR
18	URBAN MINOR COLLECTOR
19	URBAN LOCAL
78	UNKNOWN RURAL SYSTEM
79	UNKNOWN RURAL NON-SYSTEM
98	UNKNOWN URBAN SYSTEM
99	UNKNOWN URBAN NON-SYSTEM

HIGHWAY COMPONENT TRANSLATION LIST

CODE	DESCRIPTION
0	MAINLINE STATE HIGHWAY
1	COUPLET
3	FRONTAGE ROAD
6	CONNECTION
8	HIGHWAY - OTHER

INJURY SEVERITY CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
1	KILL	FATAL INJURY
2	INJA	INCAPACITATING INJURY - BLEEDING, BROKEN BONES
3	INJB	NON-INCAPACITATING INJURY
4	INJC	POSSIBLE INJURY - COMPLAINT OF PAIN
5	PRI	DIED PRIOR TO CRASH
7	NO<5	NO INJURY - 0 TO 4 YEARS OF AGE

LIGHT CONDITION CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	DAY	DAYLIGHT
2	DLIT	DARKNESS - WITH STREET LIGHTS
3	DARK	DARKNESS - NO STREET LIGHTS
4	DAWN	DAWN (TWILIGHT)
5	DUSK	DUSK (TWILIGHT)

MEDIAN TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	NONE	NO MEDIAN
1	RSDMD	SOLID MEDIAN BARRIER
2	DIVMD	EARTH, GRASS OR PAVED MEDIAN

MILEAGE TYPE CODE TRANSLATION LIST

CODE	LONG DESCRIPTION
0	REGULAR MILEAGE
T	TEMPORARY
Y	SPUR
Z	OVERLAPPING

MOVEMENT TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	STRGHT	STRAIGHT AHEAD
2	TURN-R	TURNING RIGHT
3	TURN-L	TURNING LEFT
4	U-TURN	MAKING A U-TURN
5	BACK	BACKING
6	STOP	STOPPED IN TRAFFIC
7	PRKD-P	PARKED - PROPERLY
8	PRKD-I	PARKED - IMPROPERLY

PEDESTRIAN LOCATION CODE TRANSLATION LIST

CODE	LONG DESCRIPTION
00	AT INTERSECTION - NOT IN ROADWAY
01	AT INTERSECTION - INSIDE CROSSWALK
02	AT INTERSECTION - IN ROADWAY, OUTSIDE CROSSWALK
03	AT INTERSECTION - IN ROADWAY, XWALK AVAIL UNKNWN
04	NOT AT INTERSECTION - IN ROADWAY
05	NOT AT INTERSECTION - ON SHOULDER
06	NOT AT INTERSECTION - ON MEDIAN
07	NOT AT INTERSECTION - WITHIN TRAFFIC RIGHT-OF-WAY
08	NOT AT INTERSECTION - IN BIKE PATH OR PARKING LANE
09	NOT-AT INTERSECTION - ON SIDEWALK
10	OUTSIDE TRAFFICWAY BOUNDARIES
13	AT INTERSECTION - IN BIKE LANE
14	NOT AT INTERSECTION - IN BIKE LANE
15	NOT AT INTERSECTION - INSIDE MID-BLOCK CROSSWALK
16	NOT AT INTERSECTION - IN PARKING LANE

ROAD CHARACTER CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	INTER	INTERSECTION
2	ALLEY	DRIVEWAY OR ALLEY
3	STRGHT	STRAIGHT ROADWAY
4	TRANS	TRANSITION
5	CURVE	CURVE (HORIZONTAL CURVE)
6	OPENAC	OPEN ACCESS OR TURNOUT
7	GRADE	GRADE (VERTICAL CURVE)
8	BRIDGE	BRIDGE STRUCTURE
9	TUNNEL	TUNNEL

PARTICIPANT TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	OCC	UNKNOWN OCCUPANT TYPE
1	DRVR	DRIVER
2	PSNG	PASSENGER
3	PED	PEDESTRIAN
4	CONV	PEDESTRIAN USING A PEDESTRIAN CONVEYA
5	PTOW	PEDESTRIAN TOWING OR TRAILERING AN OB
6	BIKE	PEDALCYCLIST
7	BTOW	PEDALCYCLIST TOWING OR TRAILERING AN
8	PRKD	OCCUPANT OF A PARKED MOTOR VEHICLE
9	UNK	UNKNOWN TYPE OF NON-MOTORIST

TRAFFIC CONTROL DEVICE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
000	NONE	NO CONTROL
001	TRF SIGNAL	TRAFFIC SIGNALS
002	FLASHBCN-R	FLASHING BEACON - RED (STOP)
003	FLASHBCN-A	FLASHING BEACON - AMBER (SLOW)
004	STOP SIGN	STOP SIGN
005	SLOW SIGN	SLOW SIGN
006	REG-SIGN	REGULATORY SIGN
007	YIELD	YIELD SIGN
008	WARNING	WARNING SIGN
009	CURVE	CURVE SIGN
010	SCHL X-ING	SCHOOL CROSSING SIGN OR SPECIAL SIGNAL
011	OFCR/FLAG	POLICE OFFICER, FLAGMAN - SCHOOL PATROL
012	BRDG-GATE	BRIDGE GATE - BARRIER
013	TEMP-BARR	TEMPORARY BARRIER
014	NO-PASS-ZN	NO PASSING ZONE
015	ONE-WAY	ONE-WAY STREET
016	CHANNEL	CHANNELIZATION
017	MEDIAN BAR	MEDIAN BARRIER
018	PILOT CAR	PILOT CAR
019	SP PED SIG	SPECIAL PEDESTRIAN SIGNAL
020	X-BUCK	CROSSBUCK
021	THR-GN-SIG	THROUGH GREEN ARROW OR SIGNAL
022	L-GRN-SIG	LEFT TURN GREEN ARROW, LANE MARKINGS, OR SIGNAL
023	R-GRN-SIG	RIGHT TURN GREEN ARROW, LANE MARKINGS, OR SIGNAL
024	WIGWAG	WIGWAG OR FLASHING LIGHTS W/O DROP-ARM GATE
025	X-BUCK WRN	CROSSBUCK AND ADVANCE WARNING
026	WW W/ GATE	FLASHING LIGHTS WITH DROP-ARM GATES
027	OVRHD SGNL	SUPPLEMENTAL OVERHEAD SIGNAL (RR XING ONLY)
028	SP RR STOP	SPECIAL RR STOP SIGN
029	ILUM GRD X	ILLUMINATED GRADE CROSSING
037	RAMP METER	METERED RAMPS
038	RUMBLE STR	RUMBLE STRIP
090	L-TURN REF	LEFT TURN REFUGE (WHEN REFUGE IS INVOLVED)
091	R-TURN ALL	RIGHT TURN AT ALL TIMES SIGN, ETC.
092	EMR SGN/FL	EMERGENCY SIGNS OR FLARES
093	ACCEL LANE	ACCELERATION OR DECELERATION LANES
094	R-TURN PRO	RIGHT TURN PROHIBITED ON RED AFTER STOPPING

095	BUS STPSGN	BUS STOP SIGN AND RED LIGHTS
099	UNKNOWN	UNKNOWN OR NOT DEFINITE

VEHICLE TYPE CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
01	PSNGR CAR	PASSENGER CAR, PICKUP, LIGHT DELIVERY, ETC.
02	BOBTAIL	TRUCK TRACTOR WITH NO TRAILERS (BOBTAIL)
03	FARM TRCTR	FARM TRACTOR OR SELF-PROPELLED FARM EQUIPMENT
04	SEMI TOW	TRUCK TRACTOR WITH TRAILER/MOBILE HOME IN TOW
05	TRUCK	TRUCK WITH NON-DETACHABLE BED, PANEL, ETC.
06	MOPED	MOPED, MINIBIKE, SEATED MOTOR SCOOTER, MOTOR BIKE
07	SCHL BUS	SCHOOL BUS (INCLUDES VAN)
08	OTH BUS	OTHER BUS
09	MTRCYCLE	MOTORCYCLE, DIRT BIKE
10	OTHER	OTHER: FORKLIFT, BACKHOE, ETC.
11	MOTRHOME	MOTORHOME
12	TROLLEY	MOTORIZED STREET CAR/TROLLEY (NO RAILS/WIRES)
13	ATV	ATV
14	MTRSCTR	MOTORIZED SCOOTER (STANDING)
15	SNOWMOBILE	SNOWMOBILE
99	UNKNOWN	UNKNOWN VEHICLE TYPE

WEATHER CONDITION CODE TRANSLATION LIST

CODE	SHORT DESC	LONG DESCRIPTION
0	UNK	UNKNOWN
1	CLR	CLEAR
2	CLD	CLOUDY
3	RAIN	RAIN
4	SLT	SLEET
5	FOG	FOG
6	SNOW	SNOW
7	DUST	DUST
8	SMOK	SMOKE
9	ASH	ASH

CITY OF OREGON CITY, CLACKAMAS COUNTY

REDLAND RD at CASCADE HY SOUTH, City of Oregon City, Clackamas County, 01/01/2013 to 12/31/2015

Total crash records: 27

SER# / INVEST	SPEED	ALCOHOL	DRUGS	SCHL BUS	WORK ZONE	DATE / DAY / TIME	CLASS / DIST FROM	CITY STREET / FIRST STREET / SECOND STREET	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) LEGS (#LANES)	INT-REL / TRAF-CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER	MOVE FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACT EVENT	CAUSE
01593	N	N	N			05/08/2013	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										27,07
NO RPT						WE		REDLAND RD	N		TRF SIGNAL	N	DRY	REAR		PRVTE	N -S									000	00
						12P			06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	27	F	OR-Y OR<25		016,026	000	27,07
															02	NONE 0	STOP										
																PRVTE	N -S									011	00
																PSNGR CAR		01	DRVR	INJC	63	F	OR-Y OR<25		000	000	00
04034	Y	N	N			10/22/2013	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										01,07
CITY						TU		REDLAND RD	N		TRF SIGNAL	N	DRY	REAR		PRVTE	N -S									000	00
						8P			06	0		N	DLIT	INJ		PSNGR CAR		01	DRVR	INJC	57	F	OR-Y OR<25		047,043,026	000	01,07
															02	NONE 0	STOP										
																PRVTE	N -S									011	00
																PSNGR CAR		01	DRVR	NONE	16	M	OR-Y OR<25		000	000	00
04654	N	N	N			11/17/2014	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										29
NONE						MO		REDLAND RD	N		TRF SIGNAL	N	DRY	REAR		PRVTE	N -S									000	00
						12P			06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	60	M	OTH-Y N-RES		026	000	29
															02	NONE 0	STOP										
																PRVTE	N -S									011	00
																PSNGR CAR		01	DRVR	NONE	66	F	OR-Y OR>25		000	000	00
															02	NONE 0	STOP										
																PRVTE	N -S									011	00
																PSNGR CAR		02	PSNG	INJC	61	F			000	000	00
01056	N	N	N			03/26/2015	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										29
NONE						TH		REDLAND RD	N		TRF SIGNAL	N	DRY	REAR		PRVTE	N -S									000	00
						2P			06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	53	F	OR-Y OR<25		026	000	29
															02	NONE 0	STOP										
																PRVTE	N -S									011	00
																PSNGR CAR		01	DRVR	NONE	44	F	OR-Y OR<25		000	000	00
02925	N	N	N			07/20/2015	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										29
NONE						MO		REDLAND RD	N		TRF SIGNAL	N	DRY	REAR		PRVTE	N -S									000	00
						3P			06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	35	F	OR-Y OR<25		026	000	29
															02	NONE 0	STOP										
																PRVTE	N -S									011	00
																PSNGR CAR		01	DRVR	NONE	19	M	OR-Y OR<25		000	000	00
00947	N	N	N			03/19/2013	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	RAIN	S-1STOP	01	NONE 0	STRGHT										07
NONE						TU		REDLAND RD	S		TRF SIGNAL	N	WET	REAR		UNKN	S -N									000	00
						1P			06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	M	OR-Y UNK		026	000	07
															02	NONE 0	STOP										
																PRVTE	S -N									011	00
																PSNGR CAR		01	DRVR	NONE	18	F	OR-Y		000	000	00

Disclaimer: The information contained in this report is compiled from individual driver and police crash reports submitted to the Oregon Department of Transportation as required in ORS 811.720. The Crash Analysis and Reporting Unit is committed to providing the highest quality crash data to customers. However, because submittal of crash report forms is the responsibility of the individual driver, the Crash Analysis and Reporting Unit can not guarantee that all qualifying crashes are represented nor can assurances be made that all details pertaining to a single crash are accurate. Note: Legislative changes to DMV's vehicle crash reporting requirement, effective 01/01/2004, may result in fewer property damage only crashes being eligible for inclusion in the Statewide Crash Data File.

CITY OF OREGON CITY, CLACKAMAS COUNTY

REDLAND RD at CASCADE HY SOUTH, City of Oregon City, Clackamas County, 01/01/2013 to 12/31/2015

Total crash records: 27

SER# / INVEST	S P E D	A L C	U G S	C H L	O R K	W	DATE / DAY / TIME	CLASS / DIST / FROM	CITY STREET / FIRST STREET / SECOND STREET	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS / (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE
																								OR<25					
02451	N	N	N	N	N		07/09/2013	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											013	27,07
CITY							TU		REDLAND RD	S		TRF SIGNAL	N	DRY	REAR		PRVTE	S -N									000		00
							3P			06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	21	F	OR-Y		016,026	038		27,07
																								OR<25					
																02	NONE 0	STOP											
																	PRVTE	S -N									011	013	00
																	PSNGR CAR		01	DRVR	NONE	46	F	OR-Y		000	000		00
																								OR<25					
																03	NONE 0	STOP											
																	PRVTE	S -N									022		00
																	PSNGR CAR		01	DRVR	INJC	35	M	OR-Y		000	000		00
																								OR<25					
																03	NONE 0	STOP											
																	PRVTE	S -N									022		00
																	PSNGR CAR		02	PSNG	NO<5	04	M			000	000		00
03817	N	N	N				09/29/2014	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	RAIN	S-1STOP	01	NONE 0	STRGHT												29
NO RPT							MO		REDLAND RD	S		TRF SIGNAL	N	WET	REAR		PRVTE	S -N									000		00
							3P			06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	35	M	OR-Y		026	000		29
																								OR<25					
																02	NONE 0	STOP											
																	PRVTE	S -N									011		00
																	PSNGR CAR		01	DRVR	NONE	19	F	OR-Y		000	000		00
																								OR<25					
04185	N	N	N				10/21/2014	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT												29
NONE							TU		REDLAND RD	S		TRF SIGNAL	N	DRY	REAR		PRVTE	S -N									000		00
							UNK			06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	28	M	OTH-Y		026	000		29
																								OR<25					
																02	NONE 0	STOP											
																	PRVTE	S -N									011		00
																	PSNGR CAR		01	DRVR	INJC	44	M	OR-Y		000	000		00
																								OR<25					
01123	N	N	N				03/31/2015	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	UNK	S-1STOP	01	NONE 0	STRGHT												29
NONE							TU		REDLAND RD	S		TRF SIGNAL	N	WET	REAR		PRVTE	S -N									000		00
							6A			06	0		N	DAWN	INJ		PSNGR CAR		01	DRVR	NONE	44	F	OR-Y		026	000		29
																								OR<25					
																02	NONE 0	STOP											
																	PRVTE	S -N									011		00
																	PSNGR CAR		01	DRVR	INJC	35	M	OR-Y		000	000		00
																								OR<25					
																02	NONE 0	STOP											
																	PRVTE	S -N									011		00
																	PSNGR CAR		02	PSNG	INJC	34	F			000	000		00
02150	N	N	N				06/04/2015	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT												29
NO RPT							TH		REDLAND RD	S		TRF SIGNAL	N	DRY	REAR		PRVTE	S -N									000		00
							10A			06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJC	55	M	OR-Y		026	000		29
																								OR<25					
																02	NONE 0	STOP											
																	PRVTE	S -N									011		00

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CITY OF OREGON CITY, CLACKAMAS COUNTY

REDLAND RD at CASCADE HY SOUTH, City of Oregon City, Clackamas County, 01/01/2013 to 12/31/2015

Total crash records: 27

SER# / INVEST	SPE	ALC	DRS	SWK	DATE / DAY / TIME	CLASS / DIST / FROM	CITY STREET / FIRST STREET / SECOND STREET	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS / (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE TRLR QTY / OWNER / TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	AGE	SEX	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE
															PSNGR CAR		01	DRVR	INJC	62	F	OR-Y OR<25		000	000		00
04080	N	N	N		10/04/2015	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT											013	29
NONE					SU		REDLAND RD	S		TRF SIGNAL	N	DRY	REAR		PRVTE	S -N									000		00
					1P			06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJC	18	F	OR-Y OR<25		026	000		29
														02	NONE 0	STOP										011	013	00
															PRVTE	S -N												
															PSNGR CAR		01	DRVR	NONE	18	F	OR-Y OR<25		000	000		00
														03	NONE 0	STOP										022		00
															PRVTE	S -N												
															PSNGR CAR		01	DRVR	INJC	77	F	OR-Y OR<25		000	000		00
04189	N	N	N		10/11/2015	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT												29
NONE					SU		REDLAND RD	S		TRF SIGNAL	N	DRY	REAR		PRVTE	S -N									000		00
					7P			06	0		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	29	F	OR-Y OR<25		026	000		29
														02	NONE 0	STOP										011		00
															PRVTE	S -N												
															PSNGR CAR		01	DRVR	NONE	19	M	OR-Y OR<25		000	000		00
														02	NONE 0	STOP										011		00
															PRVTE	S -N												
															PSNGR CAR		02	PSNG	INJC	26	F			000	000		00
														02	NONE 0	STOP										011		00
															PRVTE	S -N												
															PSNGR CAR		03	PSNG	INJC	48	M			000	000		00
														02	NONE 0	STOP										011		00
															PRVTE	S -N												
															PSNGR CAR		04	PSNG	INJC	45	F			000	000		00
04343	N	N	N		10/21/2015	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	FOG	S-1STOP	01	NONE 0	STRGHT												29
NONE					WE		REDLAND RD	S		TRF SIGNAL	N	DRY	REAR		PRVTE	S -N									001		00
					7A			06	0		N	DAWN	INJ		PSNGR CAR		01	DRVR	NONE	24	M	OR-Y OR<25		026	000		29
														02	NONE 0	STOP										011		00
															PRVTE	S -N												
															PSNGR CAR		01	DRVR	INJC	52	M	OR-Y OR<25		000	000		00
05452	N	N	N		12/18/2015	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	RAIN	S-1STOP	01	NONE 0	STRGHT												29
NONE					FR		REDLAND RD	S		TRF SIGNAL	N	WET	REAR		PRVTE	S -N									000		00
					6A			06	0		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	42	F	OR-Y OR<25		026	000		29
														02	NONE 0	STOP										011		00
															PRVTE	S -N												
															PSNGR CAR		01	DRVR	INJC	51	M	OR-Y OR<25		000	000		00
00828	N	N	N		02/25/2014	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	ANGL-STP	01	NONE 0	TURN-R												08

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CITY OF OREGON CITY, CLACKAMAS COUNTY

REDLAND RD at CASCADE HY SOUTH, City of Oregon City, Clackamas County, 01/01/2013 to 12/31/2015

Total crash records: 27

SER# / INVEST	S P E D	A L C	U G S	C H L	O R K	W S	DATE / DAY / TIME	CLASS / DIST / FROM	CITY STREET / FIRST STREET / SECOND STREET	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS / (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE
NONE							TU 2P		REDLAND RD	W 06	0	TRF SIGNAL	N N	DRY DAY	TURN PDO		PRVTE PSNGR CAR	N -W	01	DRVR	NONE	32	M	OR-Y OR<25		001	000		00 08
																02	NONE 0 PRVTE	STOP W -E									012		00
																	PSNGR CAR		01	DRVR	NONE	50	M	OR-Y OR<25		000	000		00
02177 NO RPT	N	N	N				06/06/2015 SA 5P	14	CASCADE HY SOUTH REDLAND RD	INTER W 06	3-LEG 0	N TRF SIGNAL	N N N	CLR DRY DAY	ANGL-STP TURN INJ	01	NONE 0 PRVTE PSNGR CAR	TURN-R N -W	01	DRVR	INJC	32	M	OR-Y OR<25		001	000 000		08 00 08
																02	NONE 0 PRVTE TRUCK	STOP W -E	01	DRVR	NONE	35	M	OR-Y OR<25		000	012 000		00 00
																02	NONE 0 PRVTE TRUCK	STOP W -E	02	PSNG	INJC	42	M			000	012 000		00 00
00301 NONE	N	N	N				01/25/2013 FR 11A	16 0	CASCADE HY SOUTH REDLAND RD	INTER W 06	3-LEG 0	N R-GRN-SIG	N N N	UNK WET DAY	S-1STOP REAR PDO	01	NONE 0 PRVTE PSNGR CAR	TURN-R W -S	01	DRVR	NONE	59	M	OR-Y OR<25		006	000 000		08 00 08
																02	NONE 0 PRVTE PSNGR CAR	TURN-R W -S	01	DRVR	NONE	40	F	OR-Y OR<25		000	000 000		00 00
00847 NONE	N	N	N				03/12/2013 TU 10A	16 0	CASCADE HY SOUTH REDLAND RD	INTER W 06	3-LEG 0	N L-GRN-SIG	N N N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT W -E	01	DRVR	NONE	00	F	UNK OR<25		026	000 000		07 00 07
																02	NONE 0 PRVTE PSNGR CAR	STOP W -E	01	DRVR	INJC	74	F	OR-Y OR<25		000	012 000		00 00
																02	NONE 0 PRVTE PSNGR CAR	STOP W -E	02	PSNG	INJC	56	F			000	012 000		00 00
02290 NONE	N	N	N				06/28/2013 FR 8A	16 0	CASCADE HY SOUTH REDLAND RD	INTER W 06	0	N TRF SIGNAL	N N N	CLR DRY DAY	S-1STOP REAR INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT W -E	01	DRVR	NONE	74	M	OR-Y OR<25		026	000 000	013	07 00 07
																02	NONE 0 PRVTE PSNGR CAR	STOP W -E	01	DRVR	INJC	43	M	OR-Y OR<25		000	011 000	013	00 00
																03	NONE 0 PRVTE PSNGR CAR	STOP W -E	01	DRVR	NONE	46	F	OR-Y OR<25		000	022 000		00 00

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CITY OF OREGON CITY, CLACKAMAS COUNTY **REDLAND RD at CASCADE HY SOUTH, City of Oregon City, Clackamas County, 01/01/2013 to 12/31/2015**

Total crash records: 27

SER# / INVEST	S P E D	A L C	U G S	C H L	O R K	W	DATE / DAY / TIME	CLASS / DIST FROM	CITY STREET / FIRST STREET / SECOND STREET	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE
03843	N	N	N				10/09/2013	16	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										07
NONE							WE	0	REDLAND RD	W		TRF SIGNAL	N	DRY	REAR		PRVTE	E -W									000	00
							9A			06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJC	22	M	OR-Y OR<25		026	000	07
																02	NONE 0	STOP										
																	PRVTE	E -W									012	00
																	PSNGR CAR		01	DRVR	NONE	56	F	OR-Y OR<25		000	000	00
04583	N	N	N				11/25/2013	16	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										07
NONE							MO	0	REDLAND RD	W		TRF SIGNAL	N	UNK	REAR		PRVTE	W -E									000	00
							4P			06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	00	M	OTH-Y N-RES		026	000	07
																02	NONE 0	STOP										
																	PRVTE	W -E									012	00
																	PSNGR CAR		01	DRVR	INJC	51	F	OR-Y OR<25		000	000	00
00188	N	N	N				01/14/2014	16	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										07
NONE							TU	0	REDLAND RD	W		TRF SIGNAL	N	DRY	REAR		PRVTE	W -E									000	00
							4P			06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	M	OR-Y OR<25		026	000	07
																02	NONE 0	STOP										
																	PRVTE	W -E									011	00
																	PSNGR CAR		01	DRVR	NONE	37	F	OR-Y OR<25		000	000	00
																02	NONE 0	STOP										
																	PRVTE	W -E									011	00
																	PSNGR CAR		02	PSNG	NO<5	01	M			000	000	00
04409	N	N	N				11/02/2014	16	CASCADE HY SOUTH	INTER	3-LEG	N	N	UNK	S-1STOP	01	NONE 0	STRGHT										29
NONE							SU	0	REDLAND RD	W		TRF SIGNAL	N	WET	REAR		PRVTE	W -E									000	00
							9A			06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	61	M	OR-Y OR<25		026	000	29
																02	NONE 0	STOP										
																	PRVTE	W -E									011	00
																	PSNGR CAR		01	DRVR	INJC	35	M	OR-Y OR<25		000	000	00
																02	NONE 0	STOP										
																	PRVTE	W -E									011	00
																	PSNGR CAR		02	PSNG	INJC	12	F			000	000	00
04081	Y	N	N	N	Y		10/25/2013	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLD	S-STRGHT	01	NONE 0	STRGHT										13,01,07
STATE							FR		REDLAND RD	CN		TRF SIGNAL	N	WET	SS-O		PRVTE	S -N									007	00
							7A			04	0		N	DAWN	PDO		TRUCK		01	DRVR	NONE	54	M	OR-Y OR<25		045,047,026	000	13,01,07
																02	LOG 0	STRGHT										
																	PRVTE	S -N									006	00
																	BOBTAIL		01	DRVR	NONE	60	M	OTH-Y N-RES		000	000	00
																03	NONE 0	STOP										
																	PRVTE	S -N									011	00
																	PSNGR CAR		01	DRVR	NONE	58	F	OR-Y		000	000	00

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CITY OF OREGON CITY, CLACKAMAS COUNTY **REDLAND RD at CASCADE HY SOUTH, City of Oregon City, Clackamas County, 01/01/2013 to 12/31/2015**

Total crash records: 27

SER# / INVEST	S P E D	A L C	U G S	C H L	O R K	W	DATE / DAY / TIME	CLASS / DIST FROM	CITY STREET / FIRST STREET / SECOND STREET	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE
																								OR<25					
04321	Y	N	N				11/07/2013	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	RAIN	ANGL-OTH	01	NONE 0	STRGHT											124	04,01
NO RPT							TH		REDLAND RD	CN		TRF SIGNAL	N	WET	TURN		PRVTE	N -S									000		00
							2P			03	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	44	M	OR-Y		000	000		00
																								OR<25					
																02	NONE 0	TURN-L											
																	PRVTE	W -N									001		00
																	PSNGR CAR		01	DRVR	INJC	59	F	OR-Y		047,020	000		04,01
																								OR<25					
05054	N	N	N				11/29/2015	14	CASCADE HY SOUTH	INTER	3-LEG	N	N	CLR	ANGL-OTH	01	NONE 0	STRGHT												04
NO RPT							SU		REDLAND RD	CN		TRF SIGNAL	N	DRY	TURN		PRVTE	N -S									000		00
							10A			03	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJC	80	F	OR-Y		020	038		04
																								OR<25					
																02	NONE 0	TURN-L											
																	PRVTE	W -N									000		00
																	PSNGR CAR		01	DRVR	NONE	64	F	OR-Y		000	000		00
																								OR<25					

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Type of peak hour being reported: Intersection Peak

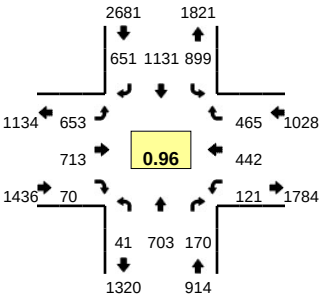
Method for determining peak hour: Total Entering Volume

LOCATION: Cascade Hwy -- Beavercreek Rd

CITY/STATE: Oregon City, OR

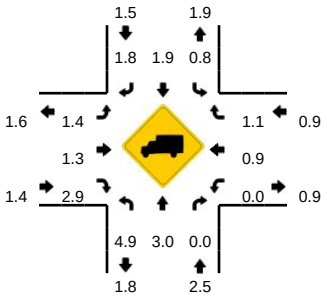
QC JOB #: 13715401

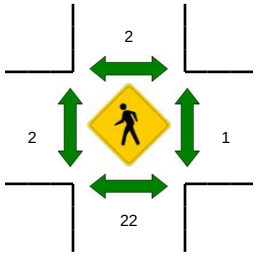
DATE: Tue, Feb 23 2016

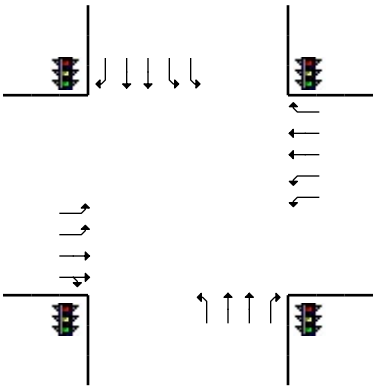


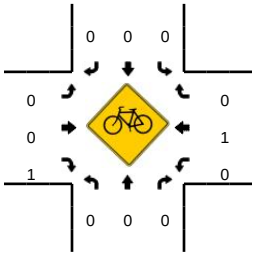
Peak-Hour: 4:55 PM -- 5:55 PM

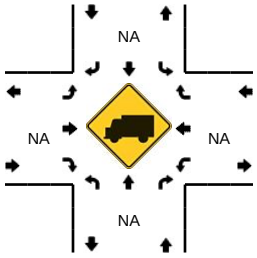
Peak 15-Min: 5:15 PM -- 5:30 PM

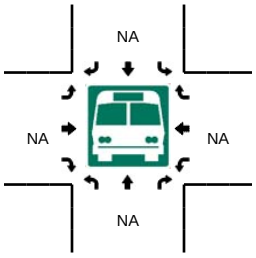












5-Min Count Period Beginning At	Cascade Hwy (Northbound)				Cascade Hwy (Southbound)				Beavercreek Rd (Eastbound)				Beavercreek Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:25 PM	5	62	14	0	63	76	60	0	47	60	5	0	14	50	30	0	486	5909
4:30 PM	1	64	14	0	59	96	59	0	34	53	5	0	17	34	25	0	461	5936
4:35 PM	3	71	13	0	78	99	55	0	38	51	15	0	11	24	35	0	493	5947
4:40 PM	2	37	8	0	65	78	54	0	60	66	11	0	6	53	30	0	470	5947
4:45 PM	7	33	13	0	53	77	60	0	70	66	1	0	11	29	28	0	448	5919
4:50 PM	4	44	13	0	82	123	51	0	39	46	7	0	6	29	38	0	482	5886
4:55 PM	3	65	15	0	53	81	63	0	55	52	3	0	11	37	45	0	483	5858
5:00 PM	2	84	10	0	73	68	50	0	41	55	6	0	7	42	37	0	475	5830
5:05 PM	7	51	12	0	72	76	60	0	72	70	10	0	9	32	31	1	503	5818
5:10 PM	4	79	25	0	57	104	49	0	66	54	7	0	11	34	34	0	524	5835
5:15 PM	5	47	15	0	80	94	58	0	64	63	6	0	8	35	38	0	513	5823
5:20 PM	0	61	21	0	75	98	60	0	66	60	6	0	15	32	36	0	530	5868
5:25 PM	6	58	12	0	81	102	50	0	58	64	6	0	14	41	36	0	528	5910
5:30 PM	0	49	15	0	72	108	54	0	39	55	3	0	6	36	35	0	472	5921
5:35 PM	1	48	9	0	88	100	52	0	69	50	7	0	6	33	43	0	506	5934
5:40 PM	4	77	14	0	87	99	53	0	36	50	1	0	11	40	44	0	516	5980
5:45 PM	5	44	8	0	81	115	48	0	46	63	7	0	13	39	48	1	518	6050
5:50 PM	4	40	14	0	80	86	54	0	41	77	8	0	8	41	38	0	491	6059
5:55 PM	5	47	10	0	69	76	39	0	45	68	9	0	12	36	36	0	452	6028
6:00 PM	2	59	11	0	69	92	41	0	45	50	4	0	11	41	38	0	463	6016
6:05 PM	2	41	8	0	46	55	31	0	73	63	6	0	14	35	40	0	414	5927
6:10 PM	1	72	9	0	48	85	34	0	53	48	6	0	9	28	29	0	422	5825
6:15 PM	1	39	15	0	78	80	43	0	38	45	4	0	5	20	27	0	395	5707
6:20 PM	0	42	19	0	47	57	51	0	35	57	4	0	11	38	26	0	387	5564

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	44	664	192	0	944	1176	672	0	752	748	72	0	148	432	440	0	6284
Heavy Trucks	4	24	0		12	20	20		20	4	0		0	4	0		108
Pedestrians		32				0				0				0			32
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

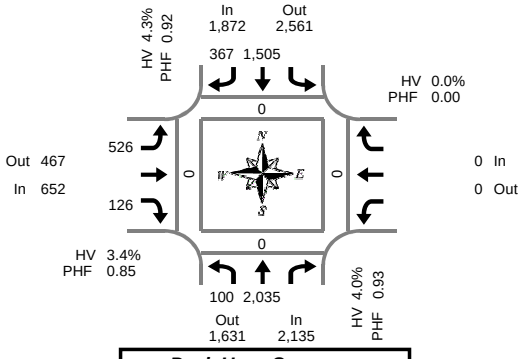
Comments:

Report generated on 3/1/2016 11:30 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
7:20 AM to 8:20 AM

Hwy 213 & Redland Rd

Wednesday, January 25, 2017
7:00 AM to 9:00 AM

5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R		Bikes	L		R	Bikes				Bikes		North	South	East	West
7:00 AM	8	139		0	75	17		0	55		18	0				0	312	0	0	0	0
7:05 AM	7	183		0	100	24		0	49		6	0				0	369	0	0	0	0
7:10 AM	0	164		0	93	16		0	43		17	0				0	333	0	0	0	0
7:15 AM	7	154		0	105	26		0	67		15	0				0	374	0	0	0	0
7:20 AM	10	197		0	125	40		0	34		12	0				0	418	0	0	0	0
7:25 AM	4	189		0	116	35		0	40		18	0				0	402	0	0	0	0
7:30 AM	4	172		0	109	29		0	58		16	0				0	388	0	0	0	0
7:35 AM	14	179		0	112	31		0	48		12	0				0	396	0	0	0	0
7:40 AM	10	178		0	168	35		0	33		9	0				0	433	0	0	0	0
7:45 AM	7	169		0	116	32		0	50		10	0				0	384	0	0	0	0
7:50 AM	13	149		0	132	26		0	45		13	0				0	378	0	0	0	0
7:55 AM	8	160		0	149	25		0	32		4	0				0	378	0	0	0	0
8:00 AM	6	148		0	121	30		0	35		9	0				0	349	0	0	0	0
8:05 AM	7	154		0	90	31		0	62		10	0				0	354	0	0	0	0
8:10 AM	8	181		0	119	31		0	41		4	0				0	384	0	0	0	0
8:15 AM	9	159		0	148	22		0	48		9	0				0	395	0	0	0	0
8:20 AM	6	132		0	89	41		0	58		13	0				0	339	0	0	0	0
8:25 AM	3	137		0	112	25		0	32		4	0				0	313	0	0	0	0
8:30 AM	6	141		0	148	33		0	40		14	0				0	382	0	0	0	0
8:35 AM	5	142		0	106	15		0	40		8	0				0	316	0	0	0	0
8:40 AM	11	154		0	128	33		0	53		9	0				0	388	0	0	0	0
8:45 AM	9	129		0	147	21		0	41		8	0				0	355	0	0	0	0
8:50 AM	4	143		0	118	26		0	43		4	0				0	338	0	0	0	0
8:55 AM	12	123		0	124	18		0	49		11	0				0	337	0	0	0	0
Total Survey	178	3,776		0	2,850	662		0	1,096		253	0				0	8,815	0	0	0	0

15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R		Bikes	L		R	Bikes				Bikes		North	South	East	West
7:00 AM	15	486		0	268	57		0	147		41	0				0	1,014	0	0	0	0
7:15 AM	21	540		0	346	101		0	141		45	0				0	1,194	0	0	0	0
7:30 AM	28	529		0	389	95		0	139		37	0				0	1,217	0	0	0	0
7:45 AM	28	478		0	397	83		0	127		27	0				0	1,140	0	0	0	0
8:00 AM	21	483		0	330	92		0	138		23	0				0	1,087	0	0	0	0
8:15 AM	18	428		0	349	88		0	138		26	0				0	1,047	0	0	0	0
8:30 AM	22	437		0	382	81		0	133		31	0				0	1,086	0	0	0	0
8:45 AM	25	395		0	389	65		0	133		23	0				0	1,030	0	0	0	0
Total Survey	178	3,776		0	2,850	662		0	1,096		253	0				0	8,815	0	0	0	0

Peak Hour Summary
7:20 AM to 8:20 AM

By Approach	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	2,135	1,631	3,766	0	1,872	2,561	4,433	0	652	467	1,119	0	0	0	0	0	4,659	0	0	0	0
%HV	4.0%				4.3%				3.4%				0.0%				4.1%				
PHF	0.93				0.92				0.85				0.00				0.96				

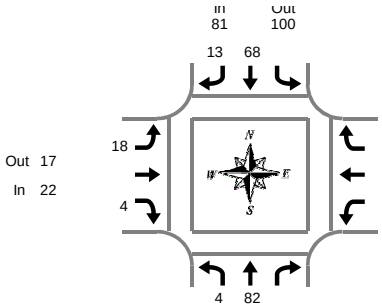
By Movement	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Total
	L	T		Total		T	R	Total	L		R	Total				Total	
Volume	100	2,035		2,135		1,505	367	1,872	526		126	652				0	4,659
%HV	4.0%	4.0%	NA	4.0%	NA	4.5%	3.5%	4.3%	3.4%	NA	3.2%	3.4%	NA	NA	NA	0.0%	4.1%
PHF	0.81	0.91		0.93		0.90	0.88	0.92	0.87		0.68	0.85				0.00	0.96

Rolling Hour Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R		Bikes	L		R	Bikes				Bikes		North	South	East	West
7:00 AM	92	2,033		0	1,400	336		0	554		150	0				0	4,565	0	0	0	0
7:15 AM	98	2,030		0	1,462	371		0	545		132	0				0	4,638	0	0	0	0
7:30 AM	95	1,918		0	1,465	358		0	542		113	0				0	4,491	0	0	0	0
7:45 AM	89	1,826		0	1,458	344		0	536		107	0				0	4,360	0	0	0	0
8:00 AM	86	1,743		0	1,450	326		0	542		103	0				0	4,250	0	0	0	0

Heavy Vehicle Summary

Clay Carney
(503) 833-2740



Hwy 213 & Redland Rd

Wednesday, January 25, 2017
7:00 AM to 9:00 AM

Peak Hour Summary
7:20 AM to 8:20 AM

Heavy Vehicle 5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total
	L	T		Total	T	R	Total		L		R	Total				Total	
7:00 AM	1	5		6	9	2	11		1		1	2				0	19
7:05 AM	1	5		6	1	0	1		3		2	5				0	12
7:10 AM	0	10		10	3	0	3		4		0	4				0	17
7:15 AM	2	7		9	8	2	10		4		1	5				0	24
7:20 AM	1	6		7	4	0	4		1		0	1				0	12
7:25 AM	0	8		8	10	0	10		3		0	3				0	21
7:30 AM	0	3		3	5	0	5		1		1	2				0	10
7:35 AM	0	5		5	0	2	2		2		0	2				0	9
7:40 AM	0	2		2	8	0	8		2		0	2				0	12
7:45 AM	1	12		13	7	2	9		4		0	4				0	26
7:50 AM	0	9		9	4	2	6		1		0	1				0	16
7:55 AM	0	11		11	3	2	5		1		1	2				0	18
8:00 AM	1	10		11	4	1	5		0		2	2				0	18
8:05 AM	0	3		3	6	0	6		1		0	1				0	10
8:10 AM	0	6		6	8	4	12		1		0	1				0	19
8:15 AM	1	7		8	9	0	9		1		0	1				0	18
8:20 AM	0	5		5	8	2	10		2		2	4				0	19
8:25 AM	0	5		5	12	3	15		5		0	5				0	25
8:30 AM	0	7		7	3	4	7		3		1	4				0	18
8:35 AM	1	13		14	4	4	8		2		0	2				0	24
8:40 AM	0	8		8	9	0	9		2		0	2				0	19
8:45 AM	0	6		6	4	1	5		1		1	2				0	13
8:50 AM	0	7		7	15	2	17		0		0	0				0	24
8:55 AM	0	5		5	9	3	12		1		0	1				0	18
Total Survey	9	165		174	153	36	189		46		12	58				0	421

Heavy Vehicle 15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total
	L	T		Total	T	R	Total		L		R	Total				Total	
7:00 AM	2	20		22	13	2	15		8		3	11				0	48
7:15 AM	3	21		24	22	2	24		8		1	9				0	57
7:30 AM	0	10		10	13	2	15		5		1	6				0	31
7:45 AM	1	32		33	14	6	20		6		1	7				0	60
8:00 AM	1	19		20	18	5	23		2		2	4				0	47
8:15 AM	1	17		18	29	5	34		8		2	10				0	62
8:30 AM	1	28		29	16	8	24		7		1	8				0	61
8:45 AM	0	18		18	28	6	34		2		1	3				0	55
Total Survey	9	165		174	153	36	189		46		12	58				0	421

Heavy Vehicle Peak Hour Summary
7:20 AM to 8:20 AM

By Approach	Northbound Hwy 213			Southbound Hwy 213			Eastbound Redland Rd			Westbound Redland Rd			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	86	72	158	81	100	181	22	17	39	0	0	0	189
PHF	0.65			0.75			0.69			0.00			0.79

By Movement	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Total
	L	T		Total	T	R	Total		L		R	Total				Total	
Volume	4	82		86	68	13	81		18		4	22				0	189
PHF	1.00	0.64		0.65	0.74	0.54	0.75		0.56		0.33	0.69				0.00	0.79

Heavy Vehicle Rolling Hour Summary
7:00 AM to 9:00 AM

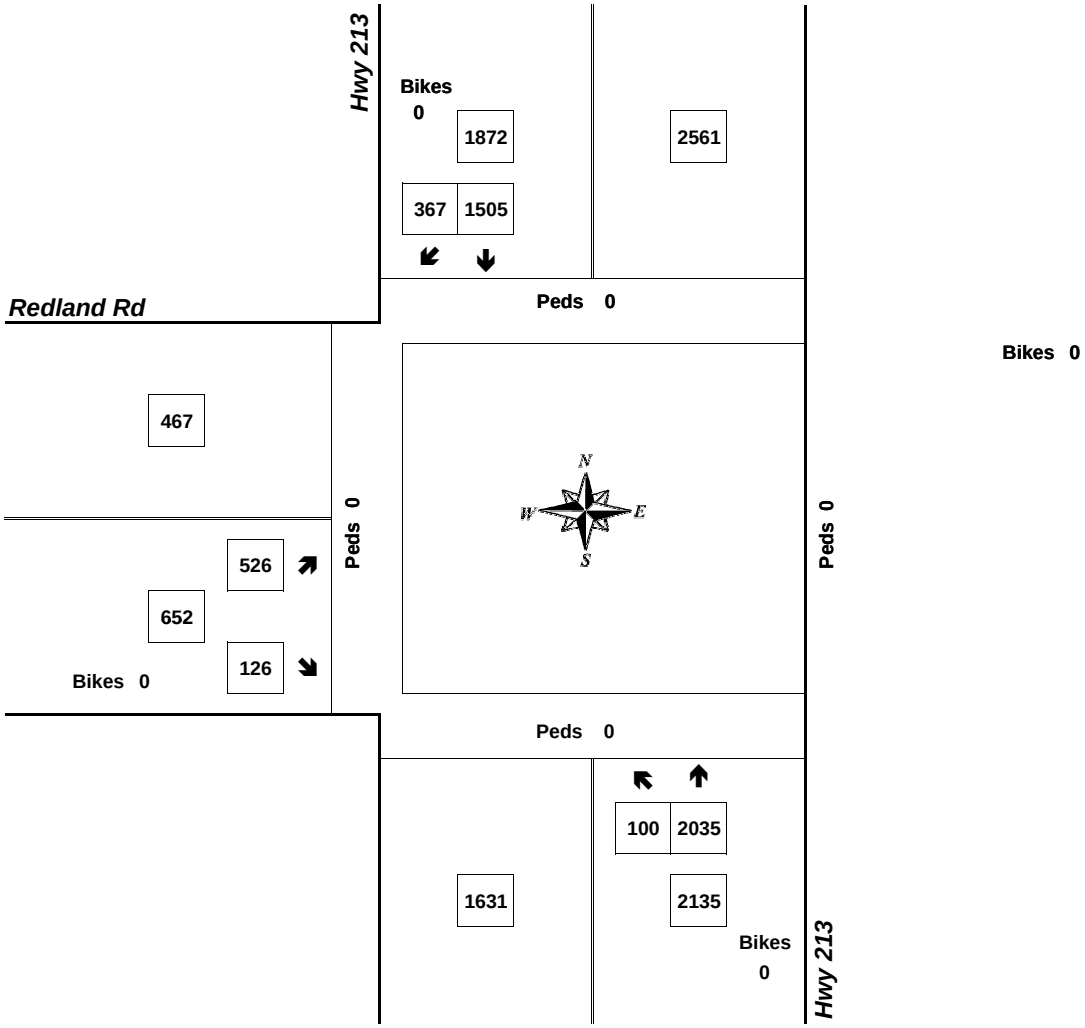
Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total
	L	T		Total	T	R	Total		L		R	Total				Total	
7:00 AM	6	83		89	62	12	74		27		6	33				0	196
7:15 AM	5	82		87	67	15	82		21		5	26				0	195
7:30 AM	3	78		81	74	18	92		21		6	27				0	200
7:45 AM	4	96		100	77	24	101		23		6	29				0	230
8:00 AM	3	82		85	91	24	115		19		6	25				0	225

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

Hwy 213 & Redland Rd

7:20 AM to 8:20 AM
Wednesday, January 25, 2017

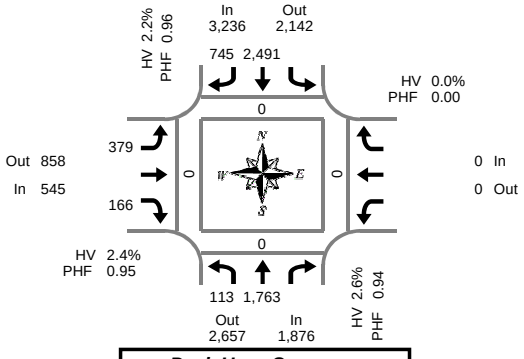


Approach	PHF	HV%	Volume
EB	0.85	3.4%	652
WB	0.00	0.0%	0
NB	0.93	4.0%	2,135
SB	0.92	4.3%	1,872
Intersection	0.96	4.1%	4,659

Count Period: 7:00 AM to 9:00 AM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
4:10 PM to 5:10 PM

Hwy 213 & Redland Rd

Tuesday, January 24, 2017
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R		Bikes	L		R	Bikes				Bikes		North	South	East	West
4:00 PM	11	148		0	204	67		0	26		6	0				0	462	0	0	0	0
4:05 PM	7	140		0	216	54		0	28		12	0				0	457	0	0	0	0
4:10 PM	9	160		0	187	58		0	42		15	0				0	471	0	0	0	0
4:15 PM	14	153		0	202	63		0	26		12	0				0	470	0	0	0	0
4:20 PM	11	151		0	207	65		0	32		13	0				0	479	0	0	0	0
4:25 PM	6	113		0	216	57		0	34		10	0				0	436	0	0	0	0
4:30 PM	14	128		0	194	60		0	34		15	0				0	445	0	0	0	0
4:35 PM	8	140		0	232	74		0	29		15	0				0	498	0	0	0	0
4:40 PM	3	157		0	228	51		0	30		9	0				0	478	0	0	0	0
4:45 PM	12	147		1	181	61		0	42		18	0				0	461	0	0	0	0
4:50 PM	8	144		0	221	71		0	24		10	0				0	478	0	0	0	0
4:55 PM	8	169		0	223	68		0	30		10	0				0	508	0	0	0	0
5:00 PM	15	148		0	178	54		0	31		20	0				0	446	0	0	0	0
5:05 PM	5	153		0	222	63		0	25		19	0				0	487	0	0	0	0
5:10 PM	11	144		0	226	46		0	32		11	0				0	470	0	0	0	0
5:15 PM	11	130		0	198	56		0	44		8	0				0	447	0	0	0	0
5:20 PM	17	148		0	194	44		0	28		4	0				0	435	0	0	0	0
5:25 PM	6	127		0	229	69		0	26		6	0				0	463	0	0	0	0
5:30 PM	6	114		0	205	58		0	25		17	0				0	425	0	0	0	0
5:35 PM	14	137		0	177	58		0	32		9	0				0	427	0	0	0	0
5:40 PM	8	134		0	217	63		0	21		4	0				0	447	0	0	0	0
5:45 PM	7	148		0	220	60		0	18		8	0				0	461	0	0	0	0
5:50 PM	8	129		0	177	62		0	32		6	0				0	414	0	0	0	0
5:55 PM	9	115		0	197	40		0	19		9	0				0	389	0	0	0	0
Total Survey	228	3,377		1	4,951	1,422		0	710		266	0				0	10,954	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R		Bikes	L		R	Bikes				Bikes		North	South	East	West
4:00 PM	27	448		0	607	179		0	96		33	0				0	1,390	0	0	0	0
4:15 PM	31	417		0	625	185		0	92		35	0				0	1,385	0	0	0	0
4:30 PM	25	425		0	654	185		0	93		39	0				0	1,421	0	0	0	0
4:45 PM	28	460		1	625	200		0	96		38	0				0	1,447	0	0	0	0
5:00 PM	31	445		0	626	163		0	88		50	0				0	1,403	0	0	0	0
5:15 PM	34	405		0	621	169		0	98		18	0				0	1,345	0	0	0	0
5:30 PM	28	385		0	599	179		0	78		30	0				0	1,299	0	0	0	0
5:45 PM	24	392		0	594	162		0	69		23	0				0	1,264	0	0	0	0
Total Survey	228	3,377		1	4,951	1,422		0	710		266	0				0	10,954	0	0	0	0

Peak Hour Summary
4:10 PM to 5:10 PM

By Approach	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	1,876	2,657	4,533	1	3,236	2,142	5,378	0	545	858	1,403	0	0	0	0	0	5,657	0	0	0	0
%HV	2.6%				2.2%				2.4%				0.0%				2.4%				
PHF	0.94				0.96				0.95				0.00				0.98				

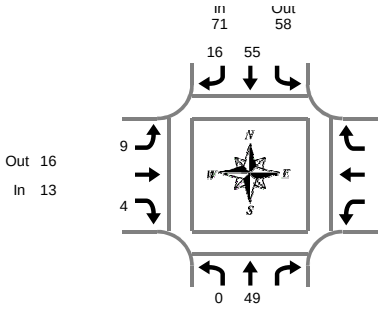
By Movement	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Total
	L	T		Total	T	R		Total	L		R	Total				Total	
Volume	113	1,763		1,876	2,491	745		3,236	379		166	545				0	5,657
%HV	0.0%	2.8%	NA	2.6%	2.2%	2.1%		2.2%	2.4%	NA	2.4%	2.4%	NA	NA	NA	0.0%	2.4%
PHF	0.83	0.94		0.94	0.95	0.93		0.96	0.94		0.85	0.95				0.00	0.98

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total	Pedestrians Crosswalk			
	L	T		Bikes	T	R		Bikes	L		R	Bikes				Bikes		North	South	East	West
4:00 PM	111	1,750		1	2,511	749		0	377		145	0				0	5,643	0	0	0	0
4:15 PM	115	1,747		1	2,530	733		0	369		162	0				0	5,656	0	0	0	0
4:30 PM	118	1,735		1	2,526	717		0	375		145	0				0	5,616	0	0	0	0
4:45 PM	121	1,695		1	2,471	711		0	360		136	0				0	5,494	0	0	0	0
5:00 PM	117	1,627		0	2,440	673		0	333		121	0				0	5,311	0	0	0	0

Heavy Vehicle Summary

Clay Carney
(503) 833-2740



Hwy 213 & Redland Rd

Tuesday, January 24, 2017
4:00 PM to 6:00 PM

Peak Hour Summary
4:10 PM to 5:10 PM

Heavy Vehicle 5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total
	L	T		Total	T	R	Total		L		R	Total				Total	
4:00 PM	0	4		4	4	3	7		1		0	1				0	12
4:05 PM	1	8		9	8	0	8		1		3	4				0	21
4:10 PM	0	7		7	5	0	5		1		1	2				0	14
4:15 PM	0	4		4	9	1	10		1		0	1				0	15
4:20 PM	0	5		5	8	1	9		0		0	0				0	14
4:25 PM	0	4		4	4	3	7		0		0	0				0	11
4:30 PM	0	4		4	2	1	3		2		0	2				0	9
4:35 PM	0	3		3	11	2	13		2		0	2				0	18
4:40 PM	0	6		6	0	1	1		0		1	1				0	8
4:45 PM	0	3		3	4	1	5		0		1	1				0	9
4:50 PM	0	2		2	4	4	8		0		0	0				0	10
4:55 PM	0	3		3	4	1	5		1		0	1				0	9
5:00 PM	0	4		4	2	1	3		1		0	1				0	8
5:05 PM	0	4		4	2	0	2		1		1	2				0	8
5:10 PM	0	4		4	4	1	5		0		0	0				0	9
5:15 PM	0	1		1	6	0	6		1		0	1				0	8
5:20 PM	1	3		4	3	0	3		1		0	1				0	8
5:25 PM	0	2		2	3	1	4		0		1	1				0	7
5:30 PM	0	2		2	3	2	5		1		0	1				0	8
5:35 PM	0	3		3	5	0	5		1		0	1				0	9
5:40 PM	0	3		3	2	1	3		0		0	0				0	6
5:45 PM	0	3		3	6	0	6		0		1	1				0	10
5:50 PM	0	1		1	5	1	6		2		0	2				0	9
5:55 PM	0	2		2	1	2	3		0		0	0				0	5
Total Survey	2	85		87	105	27	132		17		9	26				0	245

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total
	L	T		Total	T	R	Total		L		R	Total				Total	
4:00 PM	1	19		20	17	3	20		3		4	7				0	47
4:15 PM	0	13		13	21	5	26		1		0	1				0	40
4:30 PM	0	13		13	13	4	17		4		1	5				0	35
4:45 PM	0	8		8	12	6	18		1		1	2				0	28
5:00 PM	0	12		12	8	2	10		2		1	3				0	25
5:15 PM	1	6		7	12	1	13		2		1	3				0	23
5:30 PM	0	8		8	10	3	13		2		0	2				0	23
5:45 PM	0	6		6	12	3	15		2		1	3				0	24
Total Survey	2	85		87	105	27	132		17		9	26				0	245

Heavy Vehicle Peak Hour Summary
4:10 PM to 5:10 PM

By Approach	Northbound Hwy 213			Southbound Hwy 213			Eastbound Redland Rd			Westbound Redland Rd			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	49	59	108	71	58	129	13	16	29	0	0	0	133
PHF	0.77			0.68			0.65			0.00			0.77

By Movement	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Total
	L	T		Total	T	R	Total		L		R	Total				Total	
Volume	0	49		49	55	16	71		9		4	13				0	133
PHF	0.00	0.77		0.77	0.63	0.67	0.68		0.56		0.50	0.65				0.00	0.77

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

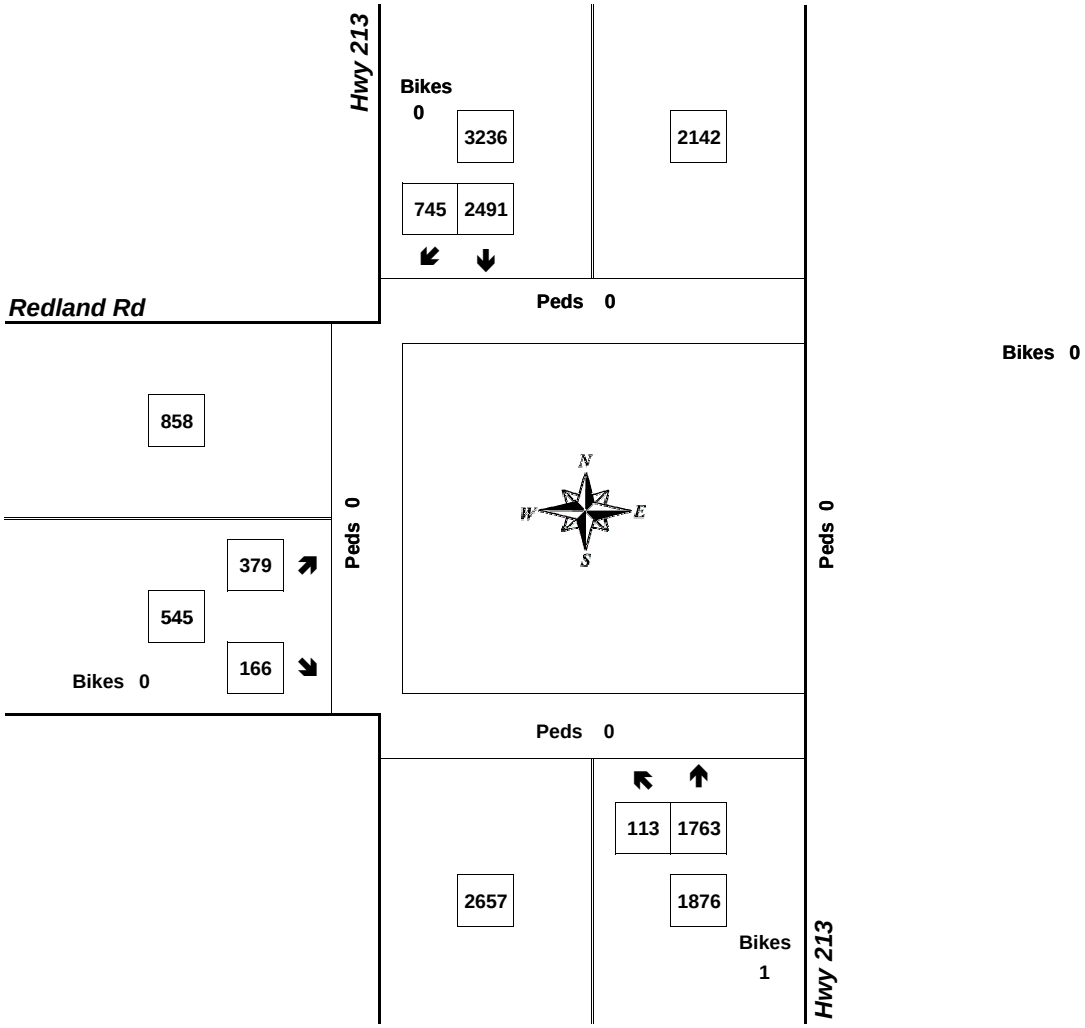
Interval Start Time	Northbound Hwy 213				Southbound Hwy 213				Eastbound Redland Rd				Westbound Redland Rd				Interval Total
	L	T		Total	T	R	Total		L		R	Total				Total	
4:00 PM	1	53		54	63	18	81		9		6	15				0	150
4:15 PM	0	46		46	54	17	71		8		3	11				0	128
4:30 PM	1	39		40	45	13	58		9		4	13				0	111
4:45 PM	1	34		35	42	12	54		7		3	10				0	99
5:00 PM	1	32		33	42	9	51		8		3	11				0	95

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

Hwy 213 & Redland Rd

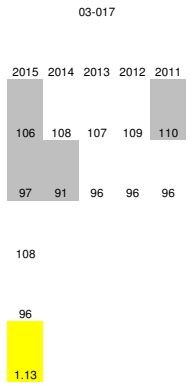
4:10 PM to 5:10 PM
Tuesday, January 24, 2017

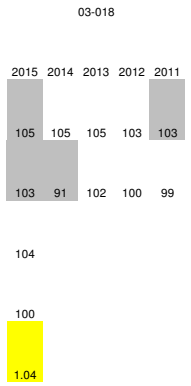


Approach	PHF	HV%	Volume
EB	0.95	2.4%	545
WB	0.00	0.0%	0
NB	0.94	2.6%	1,876
SB	0.96	2.2%	3,236
Intersection	0.98	2.4%	5,657

Count Period: 4:00 PM to 6:00 PM

ATR CHARACTERISTIC TABLE (Printed: 9/30/2016)										
2015 SEASONAL TRAFFIC TREND	AREA TYPE	# OF LANES	WEEKLY TRAFFIC TREND	2016 AADT	OHP CLASSIFICATION	2015 ATR	COUNTY	HIGHWAY ROUTE, NAME, & LOCATION	MP	STATE HWY NUMBER
COM	URBANIZED	4	WEEKDAY	112800	STATEWIDE HWY	34-010	WASHINGTON	US26, 0.73 MILE EAST OF 185TH AVENUE OVERCROSSING	65.02	47
COM	URBANIZED	4	WEEKDAY	46200	STATEWIDE HWY	09-009	DESCHUTES	US97, THE DALLES-CALIFORNIA HIGHWAY, 0.23 MILE SOUTH OF REVERE AVENUE	137.36	4
COM	URBANIZED	4	WEEKDAY	35600	STATEWIDE HWY	03-018	CLACKAMAS	OR224, CLACKAMAS HIGHWAY, 0.13 MILE WEST OF JOHNSON ROAD	3.60	171
COM	URBANIZED	4	WEEKDAY	34200	STATEWIDE HWY	03-017	CLACKAMAS	OR212, CLACKAMAS HIGHWAY, 0.14 MILE WEST OF S.E.130TH AVENUE	6.80	171
COM	URBANIZED	4	WEEKDAY	33900	STATEWIDE HWY	34-009	WASHINGTON	OR8, TUALATIN VALLEY HIGHWAY, 0.28 MILE WEST OF N.W. 334TH AVENUE	14.84	29
COM	URBANIZED	4	WEEKDAY	32100	STATEWIDE HWY	26-003	MULTNOMAH	US26, MT. HOOD HIGHWAY, 0.18 MILE SOUTHEAST OF S.E. POWELL VALLEY ROAD	14.36	26
COM	URBANIZED	4	WEEKDAY	27000	STATEWIDE HWY	20-028	LANE	OR569, BELTLINE HIGHWAY, 0.42 MILE SOUTH OF BARGER DRIVE INTERCHANGE	5.20	69
SUM	URBANIZED	4	WEEKDAY	24300	STATEWIDE HWY	09-003	DESCHUTES	US97, THE DALLES-CALIFORNIA HIGHWAY, 0.17 MILE SOUTH OF CHINA HAT ROAD	142.41	4
COM	URBANIZED	4	WEEKDAY	24100	STATEWIDE HWY	30-008	UMATILLA	US395, PENDLETON-JOHN DAY HIGHWAY, 0.09 MILE SOUTH OF OLD OREGON TRAIL	1.77	28





2016 Count Data - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00														
1:00														
2:00														
3:00														
4:00														
5:00	48	108	155	12	74	452	9	720	18	150	45	4	1,795	16
6:00	168	338	422	39	239	818	17	1,071	58	294	136	7	3,607	12
7:00	423	538	552	99	425	791	21	1,006	97	286	367	14	4,619	5
8:00	350	604	512	100	363	601	42	802	106	312	227	27	4,046	10
9:00	271	541	388	82	347	444	43	706	79	378	277	39	3,595	13
10:00	371	650	567	96	362	402	38	576	80	462	369	46	4,019	11
11:00	306	589	550	107	384	431	58	659	107	472	391	71	4,125	9
12:00	412	739	591	117	383	408	72	717	116	489	474	83	4,601	6
13:00	366	567	615	122	395	404	52	617	124	474	453	64	4,253	8
14:00	528	903	602	97	374	440	34	791	101	510	525	67	4,972	4
15:00	602	968	662	133	446	524	83	777	135	624	579	90	5,623	3
16:00	790	1,124	713	130	448	405	50	680	166	594	676	81	5,857	2
17:00	915	1,126	627	120	441	456	43	685	165	643	729	76	6,026	1
18:00	590	749	418	103	334	376	23	535	119	481	552	55	4,335	7
19:00	353	467	277	93	220	283	15	360	93	282	370	47	2,860	14
20:00	298	425	191	53	131	255	7	285	47	155	211	31	2,089	15
21:00														
22:00														
23:00														
Total												AADT	68,477	
												Major	46,624	
												Minor	21,854	

2016 Count Data - Seasonally Adjusted - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00														
1:00														
2:00														
3:00														
4:00														
5:00	52	117	168	13	80	490	10	781	20	163	49	4	1,948	16
6:00	182	367	458	42	259	888	18	1,162	63	319	148	8	3,914	12
7:00	459	584	599	107	461	858	23	1,092	105	310	398	15	5,012	5
8:00	380	655	556	109	394	652	46	870	115	339	246	29	4,390	10
9:00	294	587	421	89	376	482	47	766	86	410	301	42	3,901	13
10:00	403	705	615	104	393	436	41	625	87	501	400	50	4,361	11
11:00	332	639	597	116	417	468	63	715	116	512	424	77	4,476	9
12:00	447	802	641	127	416	443	78	778	126	531	514	90	4,992	6
13:00	397	615	667	132	429	438	56	669	135	514	492	69	4,615	8
14:00	573	980	653	105	406	477	37	858	110	553	570	73	5,395	4
15:00	653	1,050	718	144	484	569	90	843	146	677	628	98	6,101	3
16:00	857	1,220	774	141	486	439	54	738	180	644	733	88	6,355	2
17:00	993	1,222	680	130	478	495	47	743	179	698	791	82	6,538	1
18:00	640	813	454	112	362	408	25	580	129	522	599	60	4,703	7
19:00	383	507	301	101	239	307	16	391	101	306	401	51	3,103	14
20:00	323	461	207	58	142	277	8	309	51	168	229	34	2,267	15
21:00														
22:00														
23:00														
Total												AADT	74,298	
												Major	50,587	
												Minor	23,711	

2015 Base Model - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00	96	211	28	3	9	47		100	4	59	14		571	
1:00	70	159	15	2	6	23		50	3	40	11		379	
2:00	71	165	16	2	5	24		49	2	42	10		386	
3:00	45	95	54	3	16	99		203	2	31	7		555	
4:00	70	138	105	7	28	186		422	6	41	14		1,017	
5:00	180	346	245	18	79	454		941	15	100	39		2,417	16
6:00	344	502	435	43	171	757		1,325	38	132	96		3,843	8
7:00	551	599	491	46	196	781		1,305	46	178	216		4,409	3
8:00	607	624	466	41	187	674		1,134	38	217	214		4,202	5
9:00	607	596	354	32	176	625		977	25	244	190		3,826	9
10:00	619	621	314	27	118	504		859	24	277	188		3,551	12
11:00	475	715	328	28	112	473		814	27	345	119		3,436	13
12:00	555	778	349	29	137	524		790	26	375	141		3,704	10
13:00	475	800	356	32	136	516		827	28	362	105		3,637	11
14:00	583	918	311	35	166	568		823	34	392	175		4,005	6
15:00	635	997	299	40	185	583		834	42	429	215		4,259	4
16:00	709	1,072	271	45	184	578		833	45	465	250		4,452	2
17:00	783	1,119	229	47	203	625		780	46	448	239		4,519	1
18:00	610	1,008	255	38	142	504		815	37	366	173		3,948	7
19:00	483	779	171	23	116	418		520	25	252	111		2,898	14
20:00	412	703	109	17	121	392		358	20	194	103		2,429	15
21:00	335	661	87	14	123	380		259	17	178	73		2,127	
22:00	237	478	68	10	31	119		222	12	130	47		1,354	
23:00	182	398	41	6	16	72		142	7	102	31		997	
Total	9,734	14,482	5,397	588	2,663	9,926	0	15,382	569	5,399	2,781	0	66,921	
		29,613			13,177			15,951			8,180			
								68%			32%			

2040 Model - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00	123	234	32	4	24	107		125	5	69	28		751	
1:00	85	177	17	3	16	61		66	4	47	20		496	
2:00	86	183	19	3	16	67		66	4	50	18		512	
3:00	106	118	64	4	30	130		225	3	35	22		737	
4:00	185	176	123	10	49	224		463	8	46	43		1,327	
5:00	435	415	284	27	141	572		1,092	21	112	110		3,209	15
6:00	779	581	507	52	344	1,005		1,477	46	169	251		5,211	7
7:00	1,052	694	585	59	384	1,099		1,431	43	193	397		5,937	2
8:00	1,036	714	513	54	320	982		1,273	45	256	410		5,603	5
9:00	883	684	407	44	301	892		1,064	37	319	373		5,004	9
10:00	863	705	367	40	257	790		921	34	322	366		4,665	12
11:00	709	807	372	41	255	763		922	39	391	272		4,571	13
12:00	835	844	392	45	302	853		903	38	431	297		4,940	10
13:00	801	879	396	61	324	818		942	41	413	258		4,933	11
14:00	929	969	377	67	355	905		926	49	429	303		5,309	6
15:00	933	1,138	311	66	369	985		932	64	463	347		5,608	4
16:00	961	1,248	293	55	369	1,055		927	67	501	410		5,886	3
17:00	1,000	1,321	276	49	360	1,077		881	63	512	424		5,963	1
18:00	834	1,108	283	59	304	821		923	52	407	282		5,073	8
19:00	636	852	196	33	246	654		621	36	292	219		3,785	14
20:00	521	780	122	24	231	590		432	29	223	182		3,134	16
21:00	417	724	99	19	195	576		320	25	206	130		2,711	
22:00	306	541	78	14	70	237		270	17	150	87		1,770	
23:00	223	438	46	9	43	175		179	11	119	55		1,298	
Total	14,738	16,330	6,159	842	5,305	15,438	0	17,381	781	6,155	5,304	0	88,433	
		37,227			21,585			18,162			11,459			
								63%			37%			

2040 Post-Processed - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															
5:00	208	161	200	20	139	608	13	913	26	178	123	6	2,596	16	32%
6:00	496	432	529	51	463	1,144	25	1,299	73	379	329	10	5,231	12	65%
7:00	893	673	699	128	756	1,176	31	1,202	101	330	640	20	6,649	5	83%
8:00	711	744	605	131	588	940	61	988	122	386	445	39	5,760	9	72%
9:00	490	671	476	111	561	707	61	840	97	506	522	55	5,097	13	63%
10:00	595	791	690	117	526	690	54	676	96	562	661	66	5,524	11	69%
11:00	521	722	656	129	554	741	84	812	128	567	571	102	5,587	10	69%
12:00	688	866	700	142	724	731	104	885	137	595	664	120	6,356	6	79%
13:00	681	682	722	160	788	704	77	769	147	573	638	94	6,036	7	75%
14:00	898	1,030	751	165	709	772	49	959	124	596	693	96	6,842	4	85%
15:00	941	1,189	738	169	794	945	119	937	168	719	872	129	7,720	3	96%
16:00	1,122	1,400	814	151	800	837	72	823	201	686	1,030	116	8,051	2	100%
17:00	1,228	1,424	769	134	726	879	62	838	195	776	969	109	8,108	1	101%
18:00	859	899	491	151	630	680	32	669	144	570	704	77	5,905	8	73%
19:00	514	564	334	111	424	502	21	475	111	348	505	67	3,976	14	49%
20:00	416	522	225	64	255	437	10	375	66	194	349	43	2,957	15	37%
21:00															
22:00															
23:00															
Total												AADT	92,134		
												Major	57,707		
												Minor	34,427		

2040 Balanced - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															
5:00	273	212	262	20	139	493	13	741	26	144	123	6	2,453	16	30%
6:00	566	493	603	51	463	1,005	25	1,140	73	333	329	10	5,092	13	62%
7:00	914	690	716	128	756	1,177	31	1,203	101	330	640	20	6,705	5	82%
8:00	743	777	632	131	588	959	61	1,007	122	394	445	39	5,898	9	72%
9:00	542	742	527	111	561	720	61	856	97	515	522	55	5,309	12	65%
10:00	606	806	703	117	526	758	54	743	96	617	661	66	5,753	11	70%
11:00	559	775	704	129	554	779	84	853	128	595	571	102	5,832	10	71%
12:00	737	929	750	142	724	754	104	913	137	614	664	120	6,589	6	80%
13:00	756	757	802	160	788	686	77	749	147	559	638	94	6,214	7	76%
14:00	933	1,070	779	165	709	751	49	933	124	580	693	96	6,881	4	84%
15:00	1,004	1,269	788	169	794	923	119	916	168	703	872	129	7,855	3	96%
16:00	1,132	1,412	821	151	800	880	72	865	201	721	1,030	116	8,201	1	100%
17:00	1,202	1,394	753	134	726	872	62	831	195	770	969	109	8,017	2	98%
18:00	885	927	506	151	630	657	32	646	144	550	704	77	5,908	8	72%
19:00	550	604	357	111	424	479	21	453	111	332	505	67	4,014	14	49%
20:00	422	529	228	64	255	413	10	354	66	183	349	43	2,916	15	36%
21:00															
22:00															
23:00															
Total												AADT	93,196		
												Major	58,372		
												Minor	34,824		

2035 - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															
5:00	176	152	193	19	127	583	12	886	25	175	107	6	2,461	16	32%
6:00	431	419	514	49	421	1,091	24	1,270	71	367	292	9	4,957	12	64%
7:00	802	655	678	124	694	1,110	29	1,179	101	326	590	19	6,308	5	81%
8:00	642	725	595	126	548	880	58	963	120	376	403	37	5,475	9	70%
9:00	449	653	465	106	523	660	58	825	95	486	476	52	4,848	13	62%
10:00	555	773	675	114	498	637	51	666	94	549	607	63	5,282	11	68%
11:00	482	705	644	126	525	684	80	792	125	555	541	97	5,356	10	69%
12:00	637	853	687	139	660	671	99	863	135	582	633	114	6,072	6	78%
13:00	622	668	711	154	713	648	73	748	144	561	608	89	5,740	7	74%
14:00	831	1,020	730	153	646	711	46	938	121	587	667	91	6,540	4	84%
15:00	881	1,160	734	164	730	866	113	918	163	710	821	122	7,383	3	95%
16:00	1,067	1,362	806	149	735	754	68	805	197	677	968	110	7,698	2	99%
17:00	1,179	1,382	751	133	675	799	59	818	192	760	932	103	7,781	1	100%
18:00	813	881	483	143	574	624	31	651	141	560	682	73	5,654	8	73%
19:00	487	552	327	109	385	461	20	458	109	340	484	64	3,794	14	49%
20:00	397	509	222	63	231	404	9	361	63	189	324	41	2,813	15	36%
21:00															
22:00															
23:00															
Total												AADT	88,418		
												Major	55,380		
												Minor	33,038		

2035 Balanced - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															
5:00	234	203	257	19	127	473	12	719	25	142	107	6	2,324	16	30%
6:00	492	478	586	49	421	958	24	1,115	71	322	292	9	4,817	13	61%
7:00	819	668	692	124	694	1,112	29	1,181	101	326	590	19	6,356	5	81%
8:00	668	755	619	126	548	899	58	984	120	384	403	37	5,602	9	71%
9:00	494	718	511	106	523	673	58	841	95	496	476	52	5,043	12	64%
10:00	561	782	682	114	498	702	51	734	94	606	607	63	5,495	11	70%
11:00	514	753	687	126	525	723	80	837	125	587	541	97	5,594	10	71%
12:00	681	910	734	139	660	693	99	892	135	601	633	114	6,290	6	80%
13:00	691	743	790	154	713	629	73	725	144	544	608	89	5,904	7	75%
14:00	864	1,061	760	153	646	688	46	908	121	569	667	91	6,574	4	84%
15:00	940	1,238	783	164	730	844	113	894	163	692	821	122	7,505	3	96%
16:00	1,075	1,372	812	149	735	793	68	846	197	712	968	110	7,837	1	100%
17:00	1,153	1,352	735	133	675	791	59	810	192	753	932	103	7,687	2	98%
18:00	837	907	497	143	574	600	31	626	141	538	682	73	5,648	8	72%
19:00	519	589	348	109	385	439	20	436	109	323	484	64	3,824	14	49%
20:00	400	514	223	63	231	380	9	340	63	178	324	41	2,766	15	35%
21:00															
22:00															
23:00															
Total												AADT	89,057		
												Major	55,780		
												Minor	33,277		

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total
0:00													
1:00													
2:00													
3:00													
4:00													
5:00													
6:00													
7:00		1,400	336				92	2,033		554		150	4,565
8:00		1,450	326				86	1,743		542		103	4,250
9:00													
10:00													
11:00													
12:00													
13:00													
14:00													
15:00													
16:00		2,511	749				111	1,750		377		145	5,643
17:00		2,440	673				117	1,627		333		121	5,311
18:00													
19:00													
20:00													
21:00													
22:00													
23:00													
Total												AADT	64,125
												Major	57,229
												Minor	6,896

2017 Count Data - Seasonally Adjusted - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	
0:00														
1:00														
2:00														
3:00														
4:00														
5:00														
6:00														
7:00		1,519	365				100	2,206		601		163	4,953	3
8:00		1,573	354				93	1,891		588		112	4,611	4
9:00														
10:00														
11:00														
12:00														
13:00														
14:00														
15:00														
16:00		2,724	813				120	1,899		409		157	6,123	1
17:00		2,647	730				127	1,765		361		131	5,762	2
18:00														
19:00														
20:00														
21:00														
22:00														
23:00														
Total												AADT	69,576	
												Major	62,094	
												Minor	7,482	

2015 Base Model - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00		324	77				13	193		48		12	667	
1:00		234	56				8	105		27		9	439	
2:00		244	55				8	106		28		8	449	
3:00		190	39				20	313		62		5	629	
4:00		304	63				45	604		127		9	1,152	
5:00		748	162				97	1,399		222		22	2,650	15
6:00		1,199	259				125	2,088		618		82	4,371	6
7:00		1,579	212				154	2,110		674		62	4,791	3
8:00		1,651	195				150	1,875		623		46	4,540	5
9:00		1,499	210				102	1,745		356		58	3,970	10
10:00		1,494	207				103	1,536		299		60	3,699	13
11:00		1,465	271				114	1,519		312		54	3,735	12
12:00		1,612	265				122	1,567		308		70	3,944	11
13:00		1,568	313				120	1,585		329		64	3,979	9
14:00		1,746	356				97	1,687		332		65	4,283	7
15:00		1,850	462				152	1,694		415		81	4,654	4
16:00		1,972	472				171	1,704		443		81	4,843	2
17:00		2,050	493				168	1,685		411		80	4,887	1
18:00		1,798	371				108	1,576		352		74	4,279	8
19:00		1,382	307				119	1,072		221		51	3,152	14
20:00		1,180	309				93	851		157		44	2,634	16
21:00		1,034	279				81	736		131		49	2,310	
22:00		749	195				40	431		111		34	1,560	
23:00		598	146				22	294		77		23	1,160	
Total	0	28,470	5,774	0	0	0	2,232	28,475	0	6,683	0	1,143	72,777	
		34,244			0			30,707			7,826			
								89%			11%			

2040 Model - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00		369	91				22	279		66		20	847	
1:00		264	67				13	161		39		15	559	
2:00		273	66				14	170		41		14	578	
3:00		278	48				31	359		80		10	806	
4:00		468	81				68	665		164		17	1,463	
5:00		1,091	199				121	1,655		332		44	3,442	15
6:00		1,723	176				204	2,447		560		144	5,254	7
7:00		2,138	202				268	2,455		597		193	5,853	3
8:00		2,108	211				280	2,232		601		156	5,588	5
9:00		1,832	233				220	2,056		491		142	4,974	10
10:00		1,806	207				240	1,793		400		130	4,576	13
11:00		1,753	305				240	1,836		394		135	4,663	12
12:00		1,917	311				258	1,929		387		154	4,956	11
13:00		1,924	364				265	1,908		400		152	5,013	9
14:00		2,063	392				290	1,970		437		212	5,364	6
15:00		2,125	455				259	2,121		430		256	5,646	4
16:00		2,244	482				253	2,231		431		258	5,899	2
17:00		2,374	493				255	2,215		421		223	5,981	1
18:00		2,054	437				257	1,893		421		172	5,234	8
19:00		1,576	311				172	1,395		228		108	3,790	14
20:00		1,330	301				131	1,114		162		93	3,131	16
21:00		1,157	319				111	992		138		83	2,800	
22:00		866	232				63	594		139		58	1,952	
23:00		668	173				35	439		102		39	1,456	
Total	0	34,401	6,156	0	0	0	4,070	34,909	0	7,461	0	2,828	89,825	
		40,557			0			38,979			10,289			
								89%			11%			

2040 Post-Processed - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total		
0:00															
1:00															
2:00															
3:00															
4:00															From Beavercreek
5:00		787	137				72	987		208		140	2,332		32%
6:00		1,587	277				145	1,989		420		282	4,700		65%
7:00		2,017	352				184	2,528		534		358	5,973	3	83%
8:00		1,979	374				188	2,219		568		266	5,594	4	72%
9:00		1,752	331				166	1,963		503		235	4,950		63%
10:00		1,898	359				180	2,128		545		255	5,365		69%
11:00		1,920	363				182	2,152		551		258	5,426		69%
12:00		2,284	532				176	2,173		471		294	5,931		79%
13:00		2,265	619				138	1,803		299		280	5,402		75%
14:00		2,567	701				156	2,043		339		317	6,123		85%
15:00		2,896	791				176	2,306		382		358	6,909		96%
16:00		3,021	825				184	2,405		398		373	7,206	1	100%
17:00		2,987	730				196	2,258		370		292	6,832	2	101%
18:00		2,175	532				143	1,645		269		212	4,976		73%
19:00		1,465	358				96	1,108		181		143	3,351		49%
20:00		1,089	266				71	824		135		106	2,492		37%
21:00															
22:00															
23:00															
Total												AADT	81,886		
												Major	72,507		
												Minor	9,380		

2040 Balanced - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	From Beavercreek
0:00															
1:00															
2:00															
3:00															
4:00															
5:00		634	138				94	1,284		214		113	2,478	16	32%
6:00		1,411	279				168	2,310		431		251	4,851	12	65%
7:00		1,970	355				184	2,526		548		350	5,933	5	83%
8:00		1,897	370				184	2,176		573		255	5,455	7	72%
9:00		1,597	327				163	1,928		507		214	4,827	13	63%
10:00		1,865	355				165	1,953		549		250	5,137	10	69%
11:00		1,797	359				174	2,053		555		241	5,179	9	69%
12:00		2,141	529				171	2,110		474		275	5,700	6	79%
13:00		2,060	617				141	1,853		300		255	5,226	8	75%
14:00		2,476	699				161	2,103		341		306	6,085	4	85%
15:00		2,724	789				180	2,362		384		337	6,764	3	96%
16:00		2,995	822				175	2,291		401		370	7,054	1	100%
17:00		3,051	730				198	2,275		368		298	6,920	2	101%
18:00		2,112	532				148	1,705		268		206	4,971	11	73%
19:00		1,377	358				101	1,163		181		134	3,314	14	49%
20:00		1,074	266				76	874		134		105	2,530	15	37%
21:00															
22:00															
23:00															
Total															

AADT	78,639
Major	69,632
Minor	9,008

2035 - OR213/Redland Road

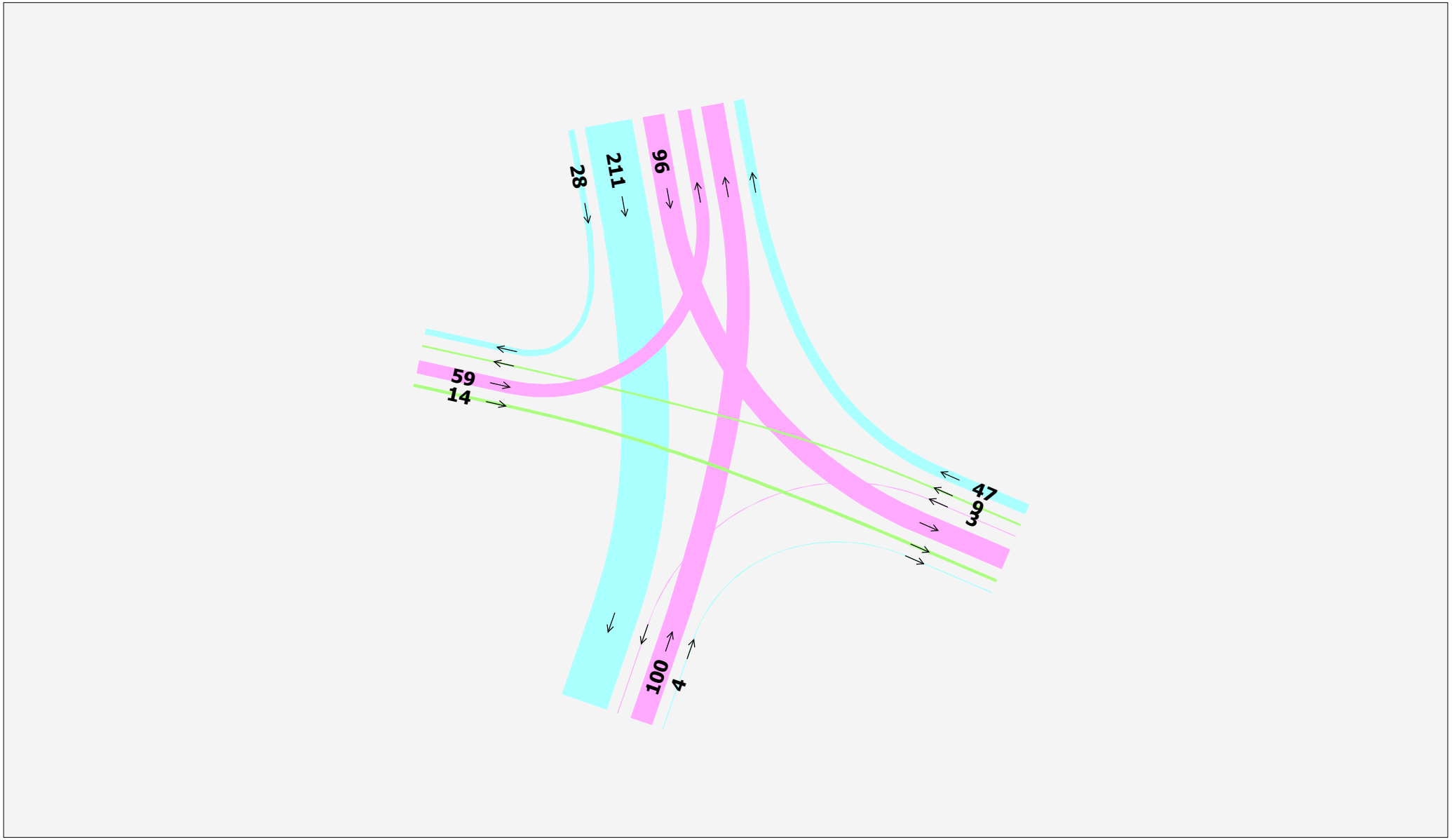
Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	From Beavercreek
0:00															
1:00															
2:00															
3:00															
4:00															
5:00		745	138				65	959		214		123	2,244	16	32%
6:00		1,500	279				130	1,932		431		248	4,520	13	64%
7:00		1,909	355				166	2,458		548		316	5,752	5	81%
8:00		1,891	370				167	2,147		573		232	5,380	7	70%
9:00		1,675	328				148	1,902		507		206	4,765	12	62%
10:00		1,824	357				161	2,072		552		224	5,191	10	68%
11:00		1,850	362				164	2,101		560		227	5,264	8	69%
12:00		2,215	529				160	2,096		476		257	5,733	6	78%
13:00		2,204	613				127	1,711		299		243	5,198	9	74%
14:00		2,512	699				144	1,950		340		277	5,922	4	84%
15:00		2,835	789				163	2,201		384		313	6,685	2	95%
16:00		2,956	822				170	2,295		401		326	6,970	1	99%
17:00		2,913	730				181	2,151		368		257	6,600	3	100%
18:00		2,117	531				132	1,563		267		187	4,796	11	73%
19:00		1,420	356				88	1,049		179		125	3,218	14	49%
20:00		1,053	264				65	778		133		93	2,386	15	36%
21:00															
22:00															
23:00															
Total												AADT	74,998		
												Major	66,407		
												Minor	8,591		

2035 Balanced - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															From Beavercreek
5:00		595	138				84	1,250		214		99	2,380	16	32%
6:00		1,335	279				151	2,244		431		221	4,661	12	64%
7:00		1,870	355				166	2,453		548		309	5,701	5	81%
8:00		1,819	370				164	2,103		573		223	5,252	7	70%
9:00		1,535	328				145	1,865		507		188	4,650	13	62%
10:00		1,804	357				148	1,894		552		221	4,976	10	68%
11:00		1,740	362				155	1,992		560		214	5,023	9	69%
12:00		2,085	529				155	2,030		476		242	5,517	6	78%
13:00		2,003	613				131	1,767		299		221	5,034	8	74%
14:00		2,418	699				149	2,017		340		267	5,890	4	84%
15:00		2,667	789				168	2,261		384		294	6,553	3	95%
16:00		2,935	822				162	2,189		401		324	6,833	1	99%
17:00		2,978	730				183	2,171		368		262	6,692	2	100%
18:00		2,060	531				137	1,627		267		181	4,803	11	73%
19:00		1,338	356				93	1,105		179		118	3,190	14	49%
20:00		1,045	264				70	828		133		92	2,432	15	36%
21:00															
22:00															
23:00															
Total															

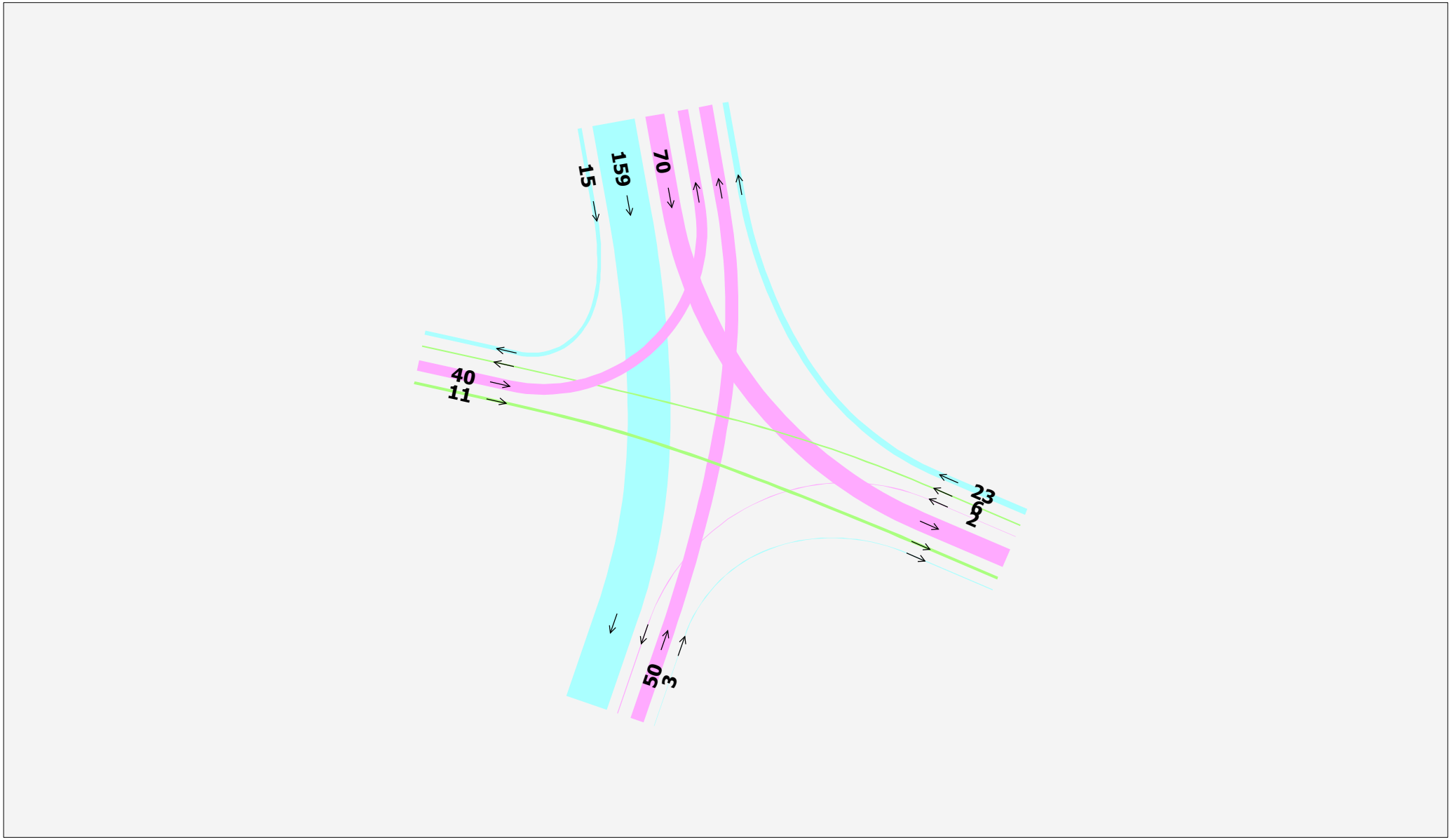
AADT	76,049
Major	67,338
Minor	8,711

2015



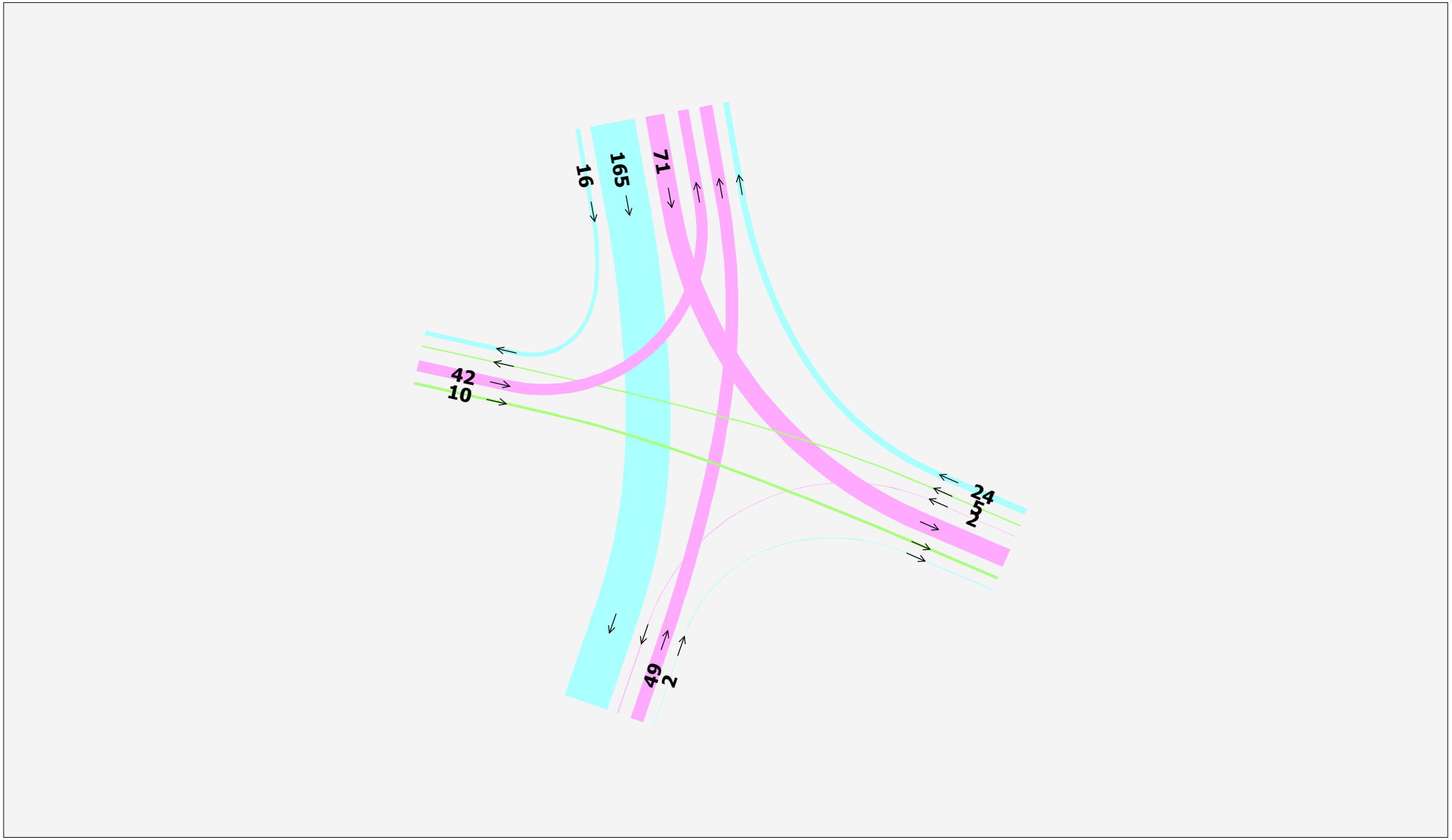
Beavercreek 0:00

2015



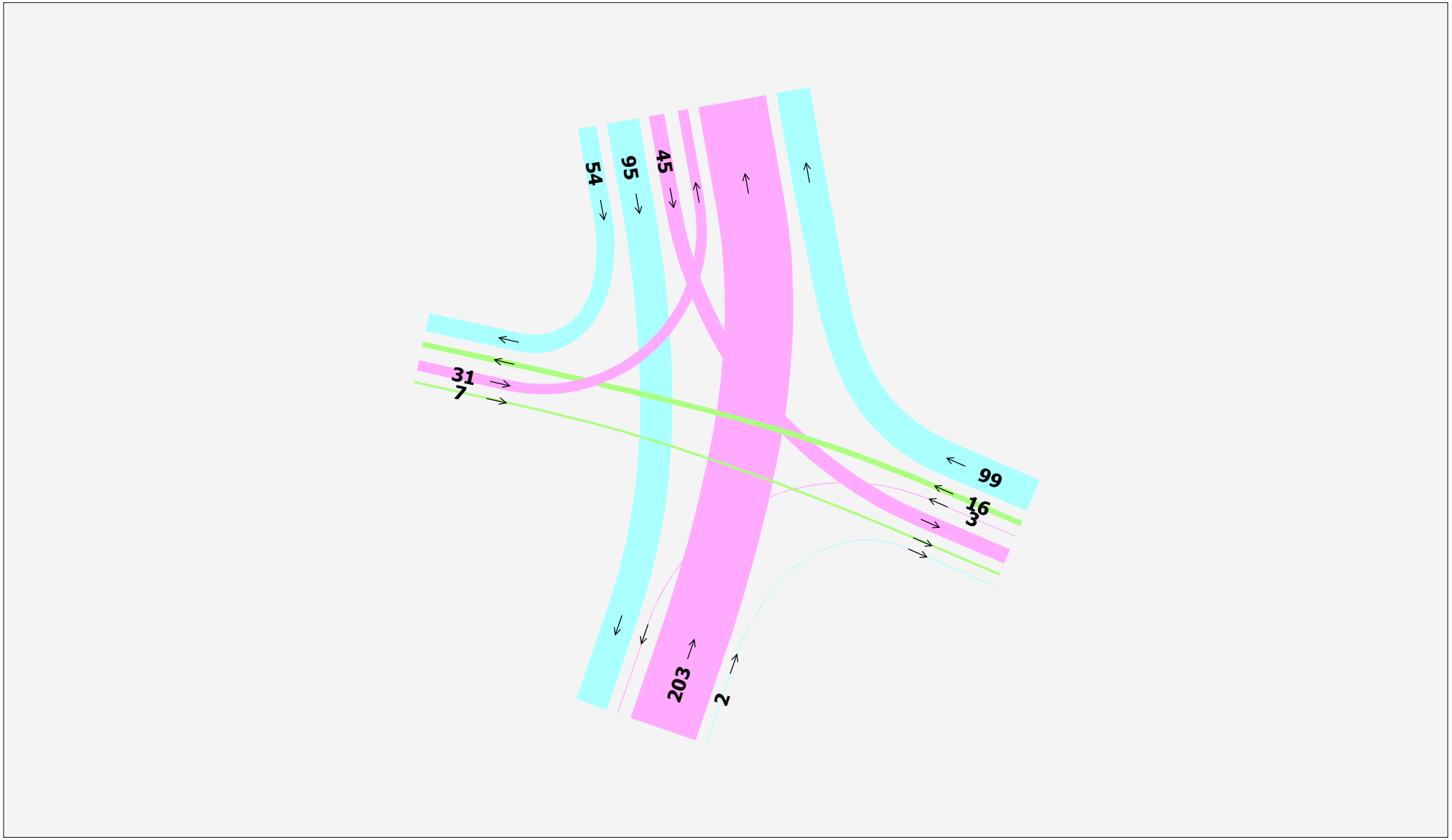
Beavercreek 1:00

2015



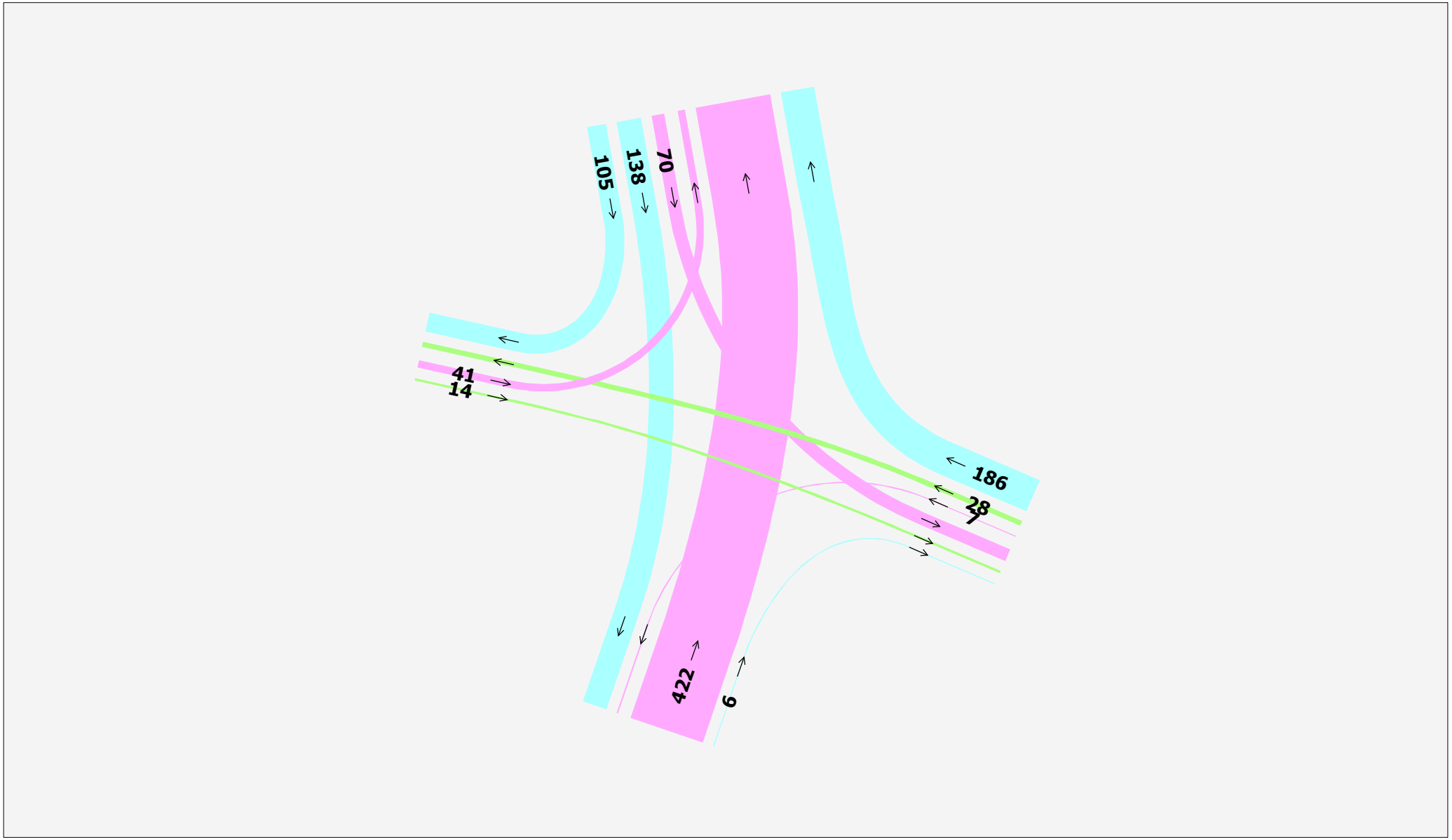
Beavercreek 2:00

2015



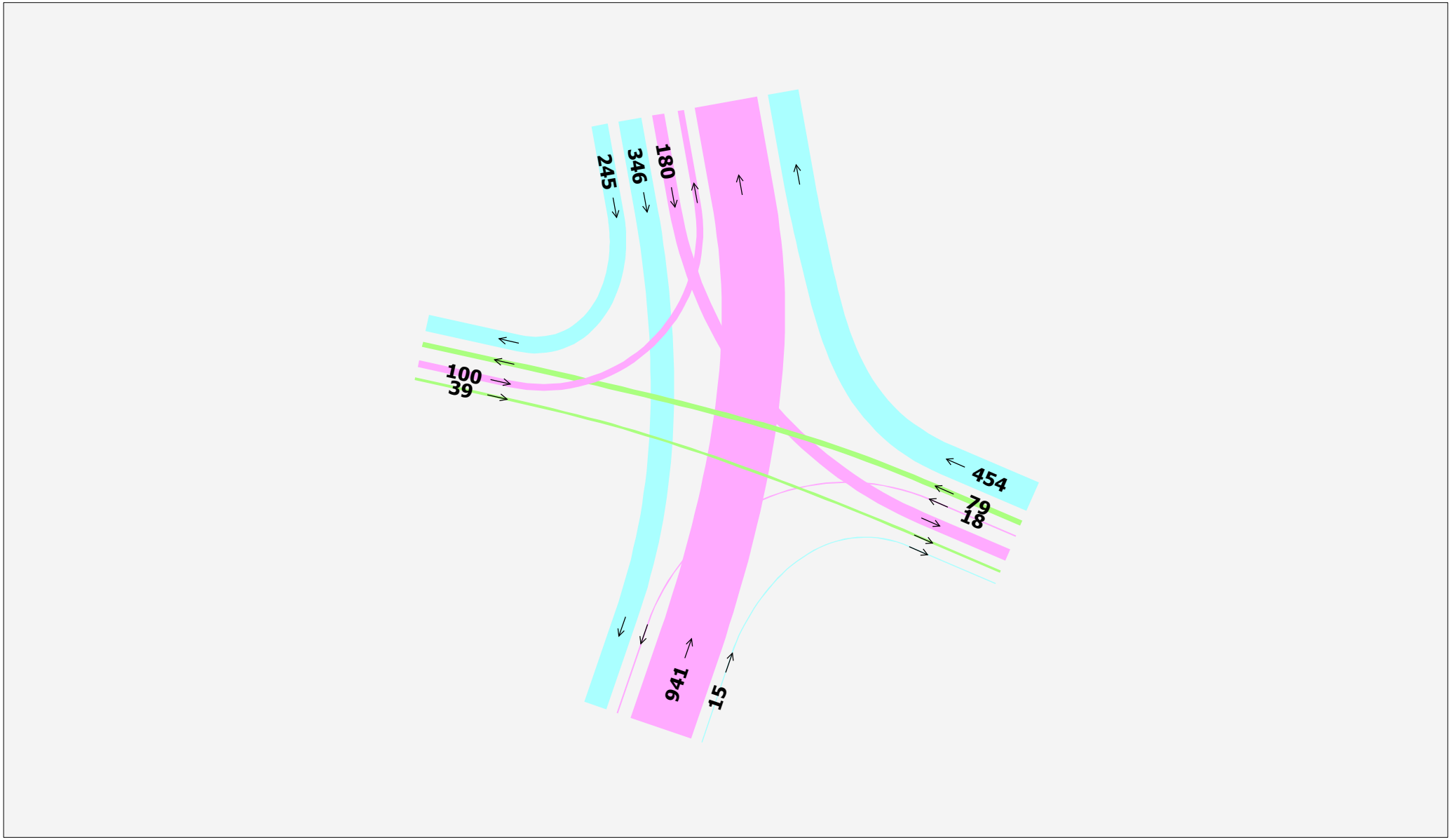
Beavercreek 3:00

2015



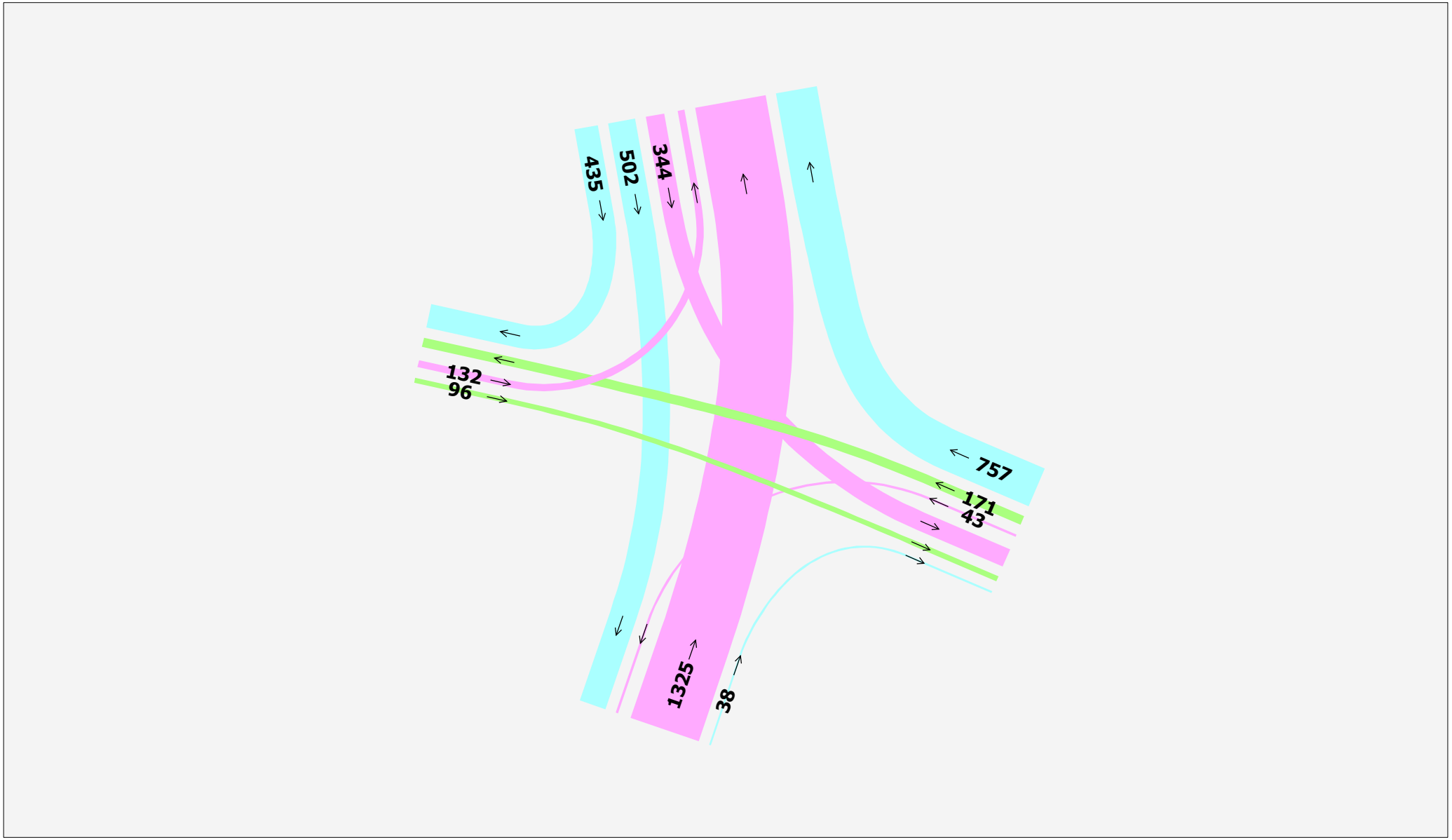
Beavercreek 4:00

2015



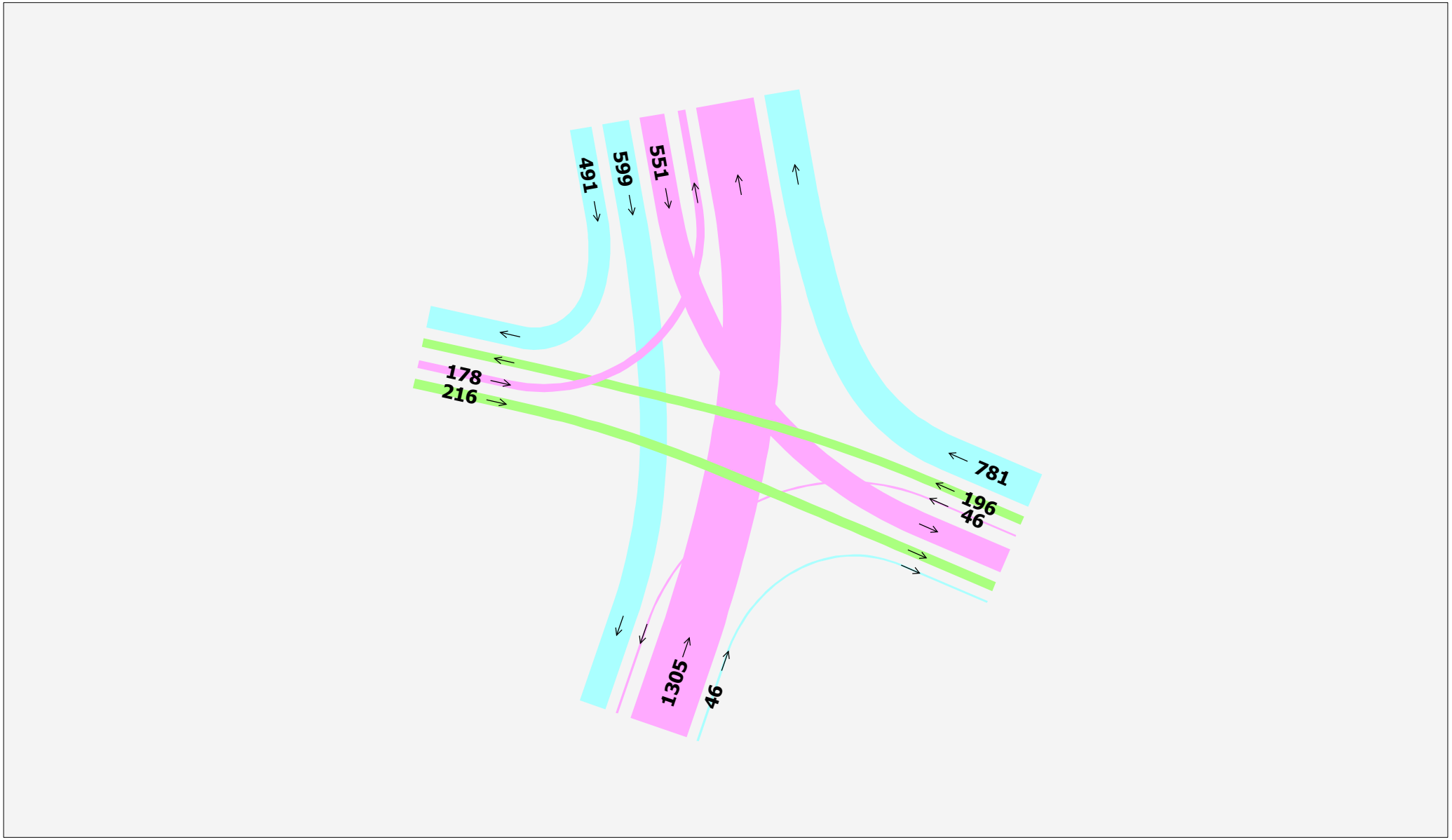
Beavercreek 5:00

2015



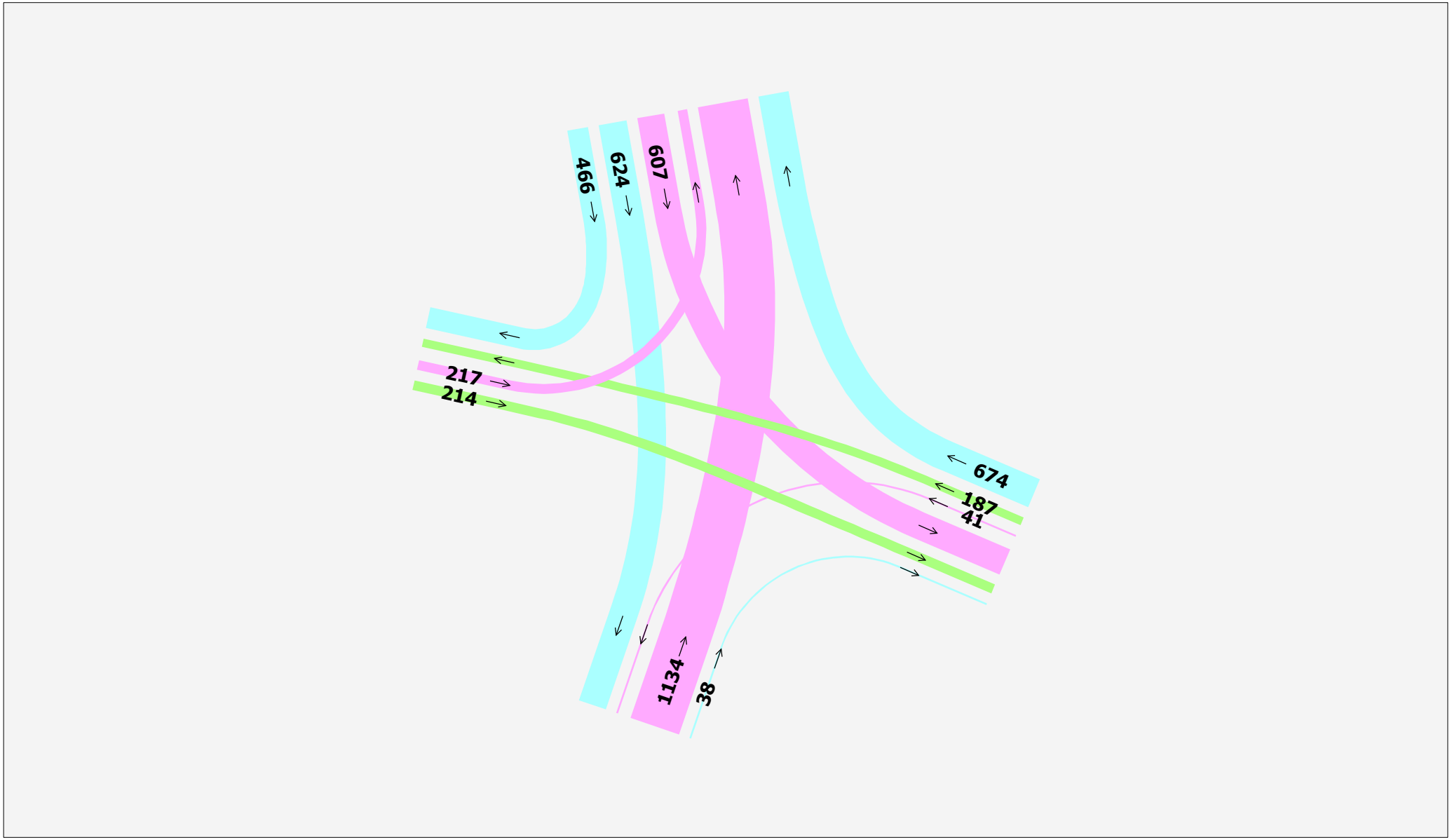
Beavercreek 6:00

2015



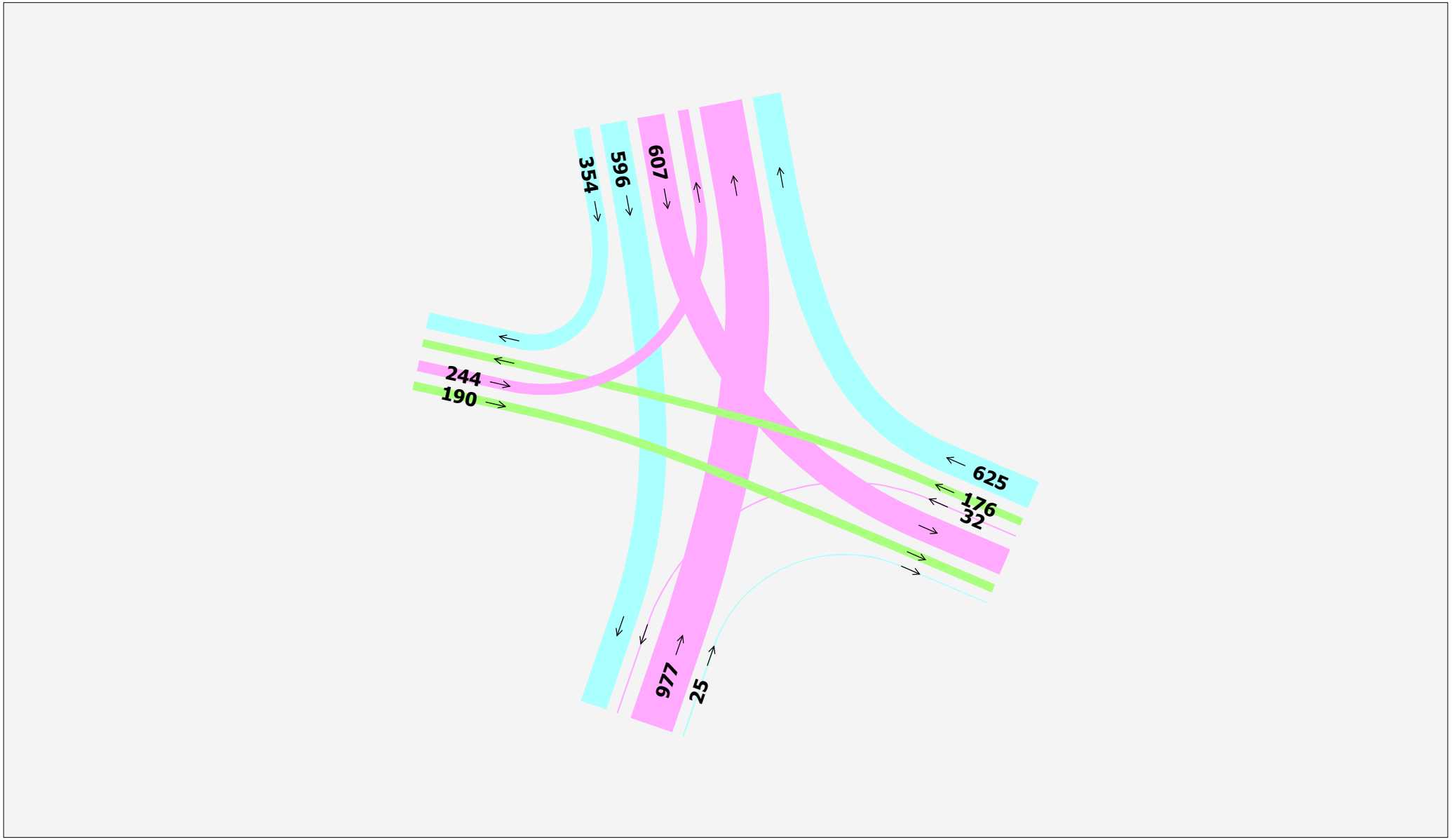
Beavercreek 7:00

2015



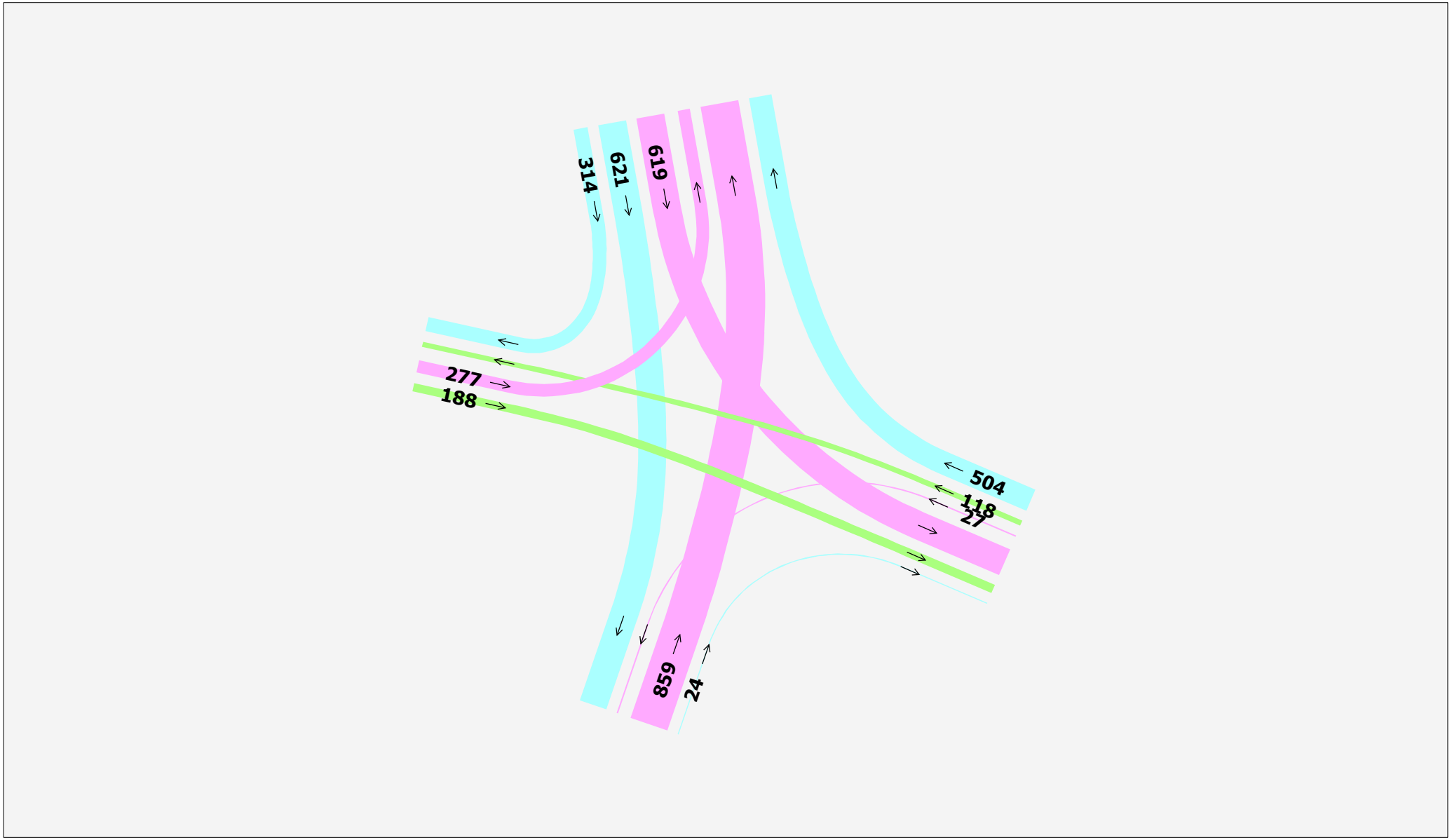
Beavercreek 8:00

2015



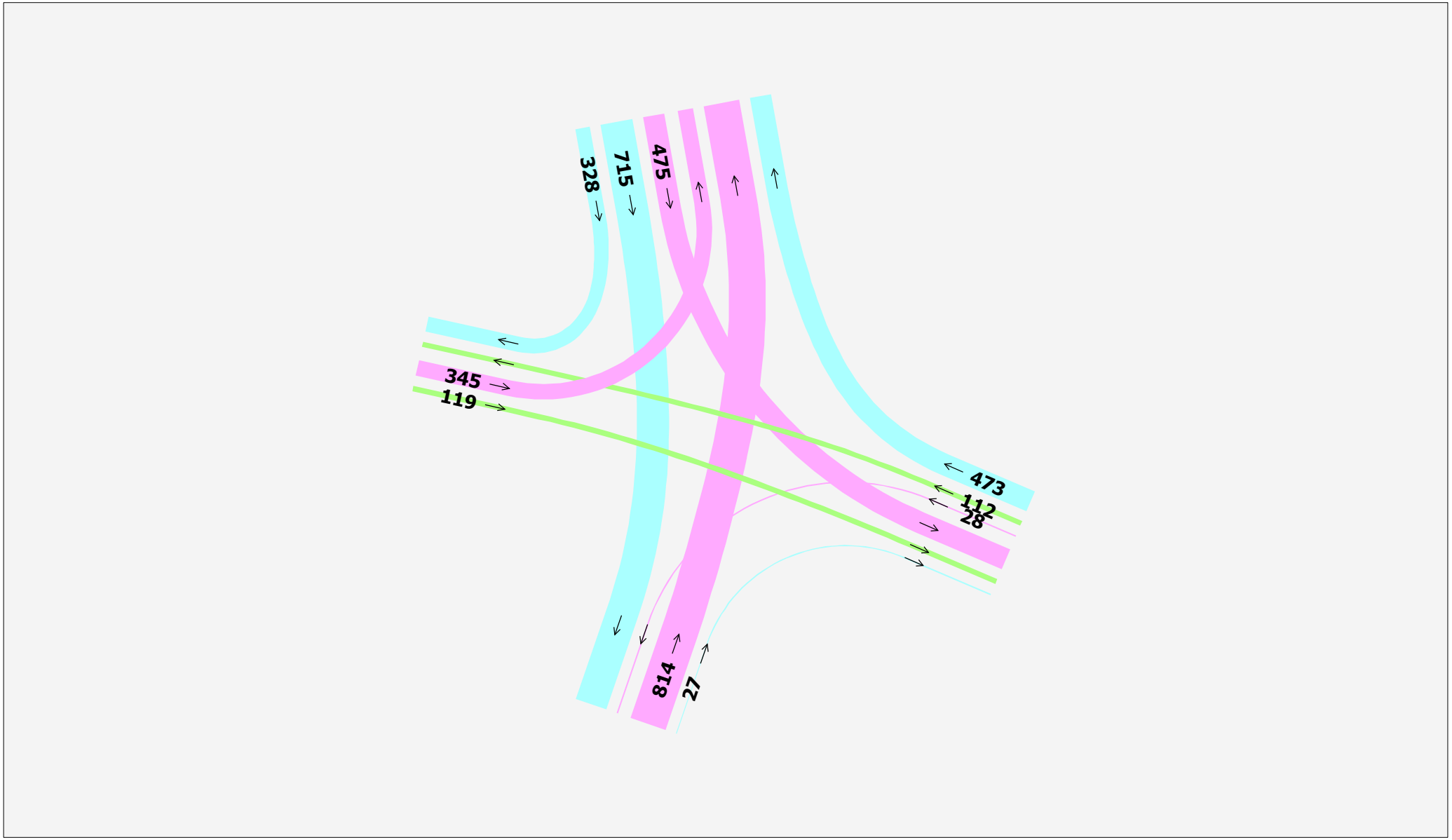
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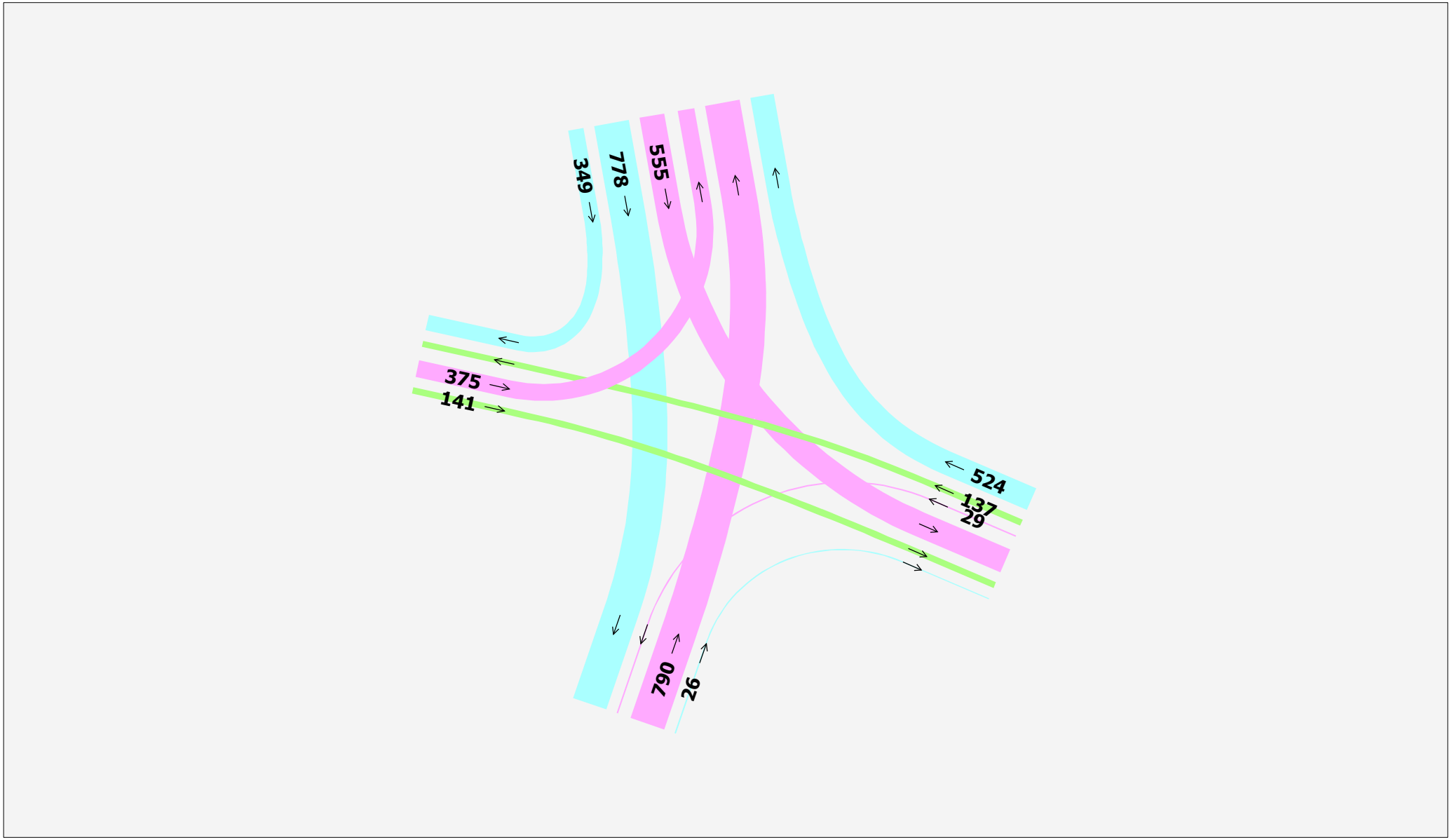
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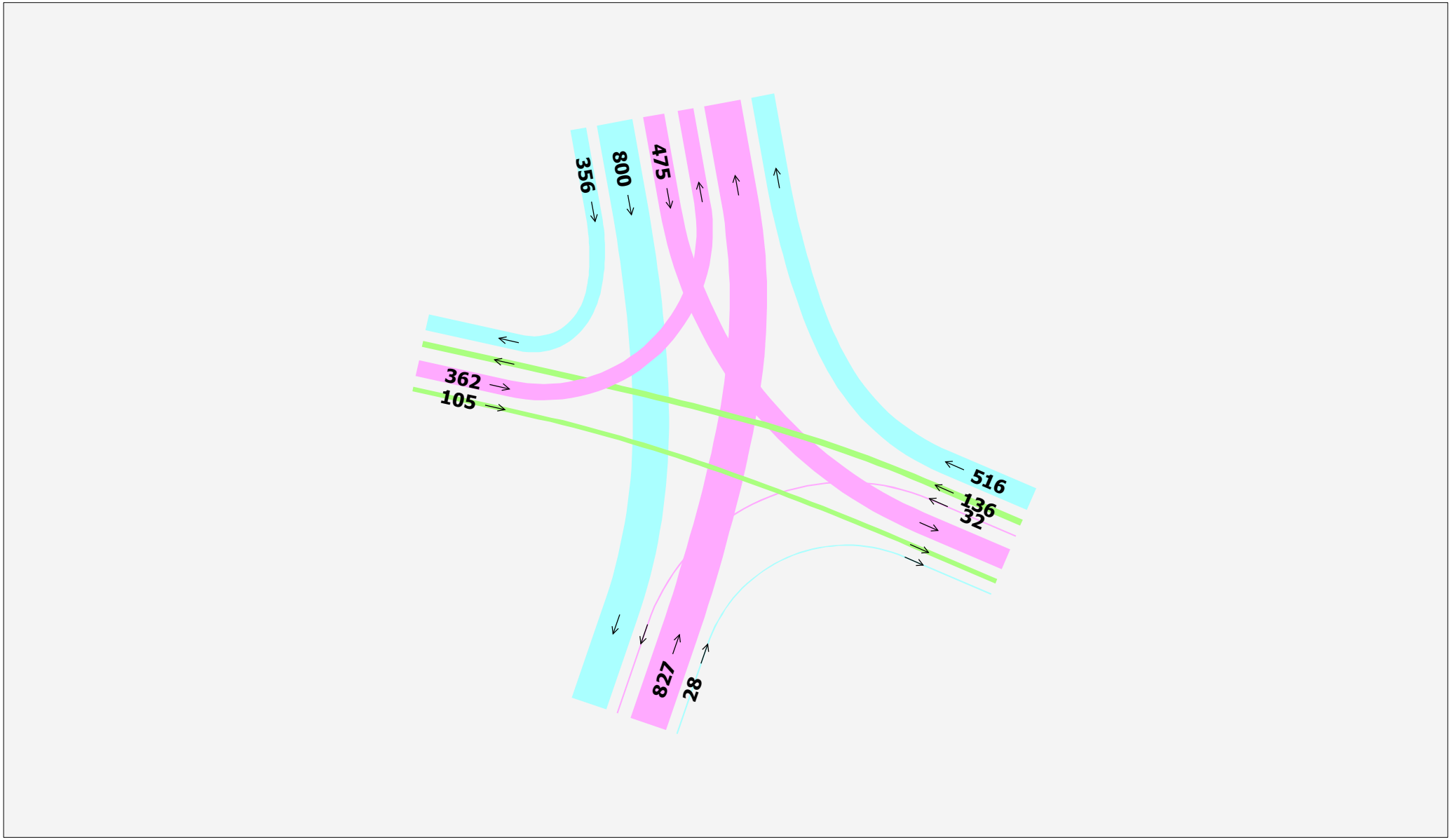
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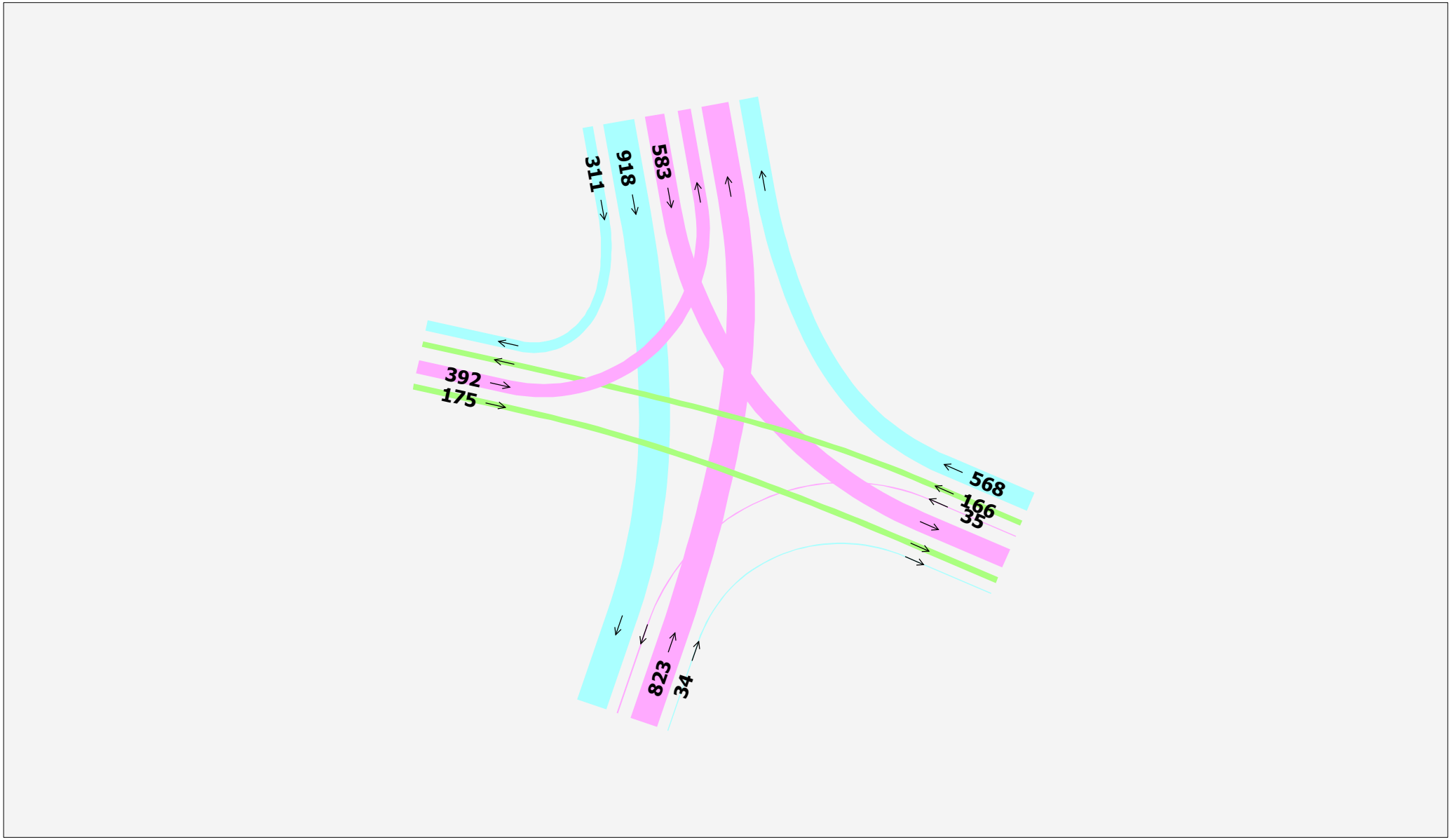
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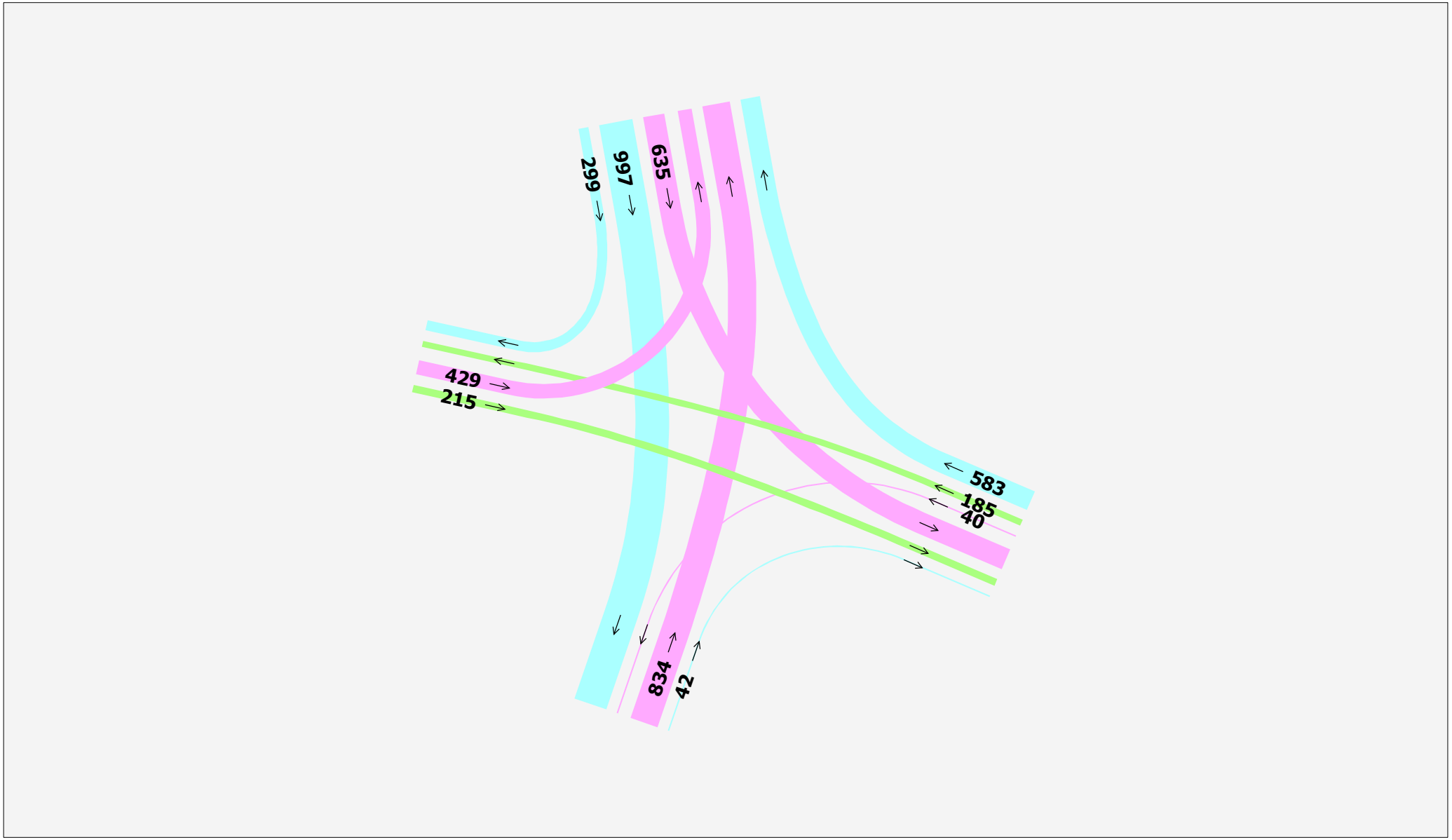
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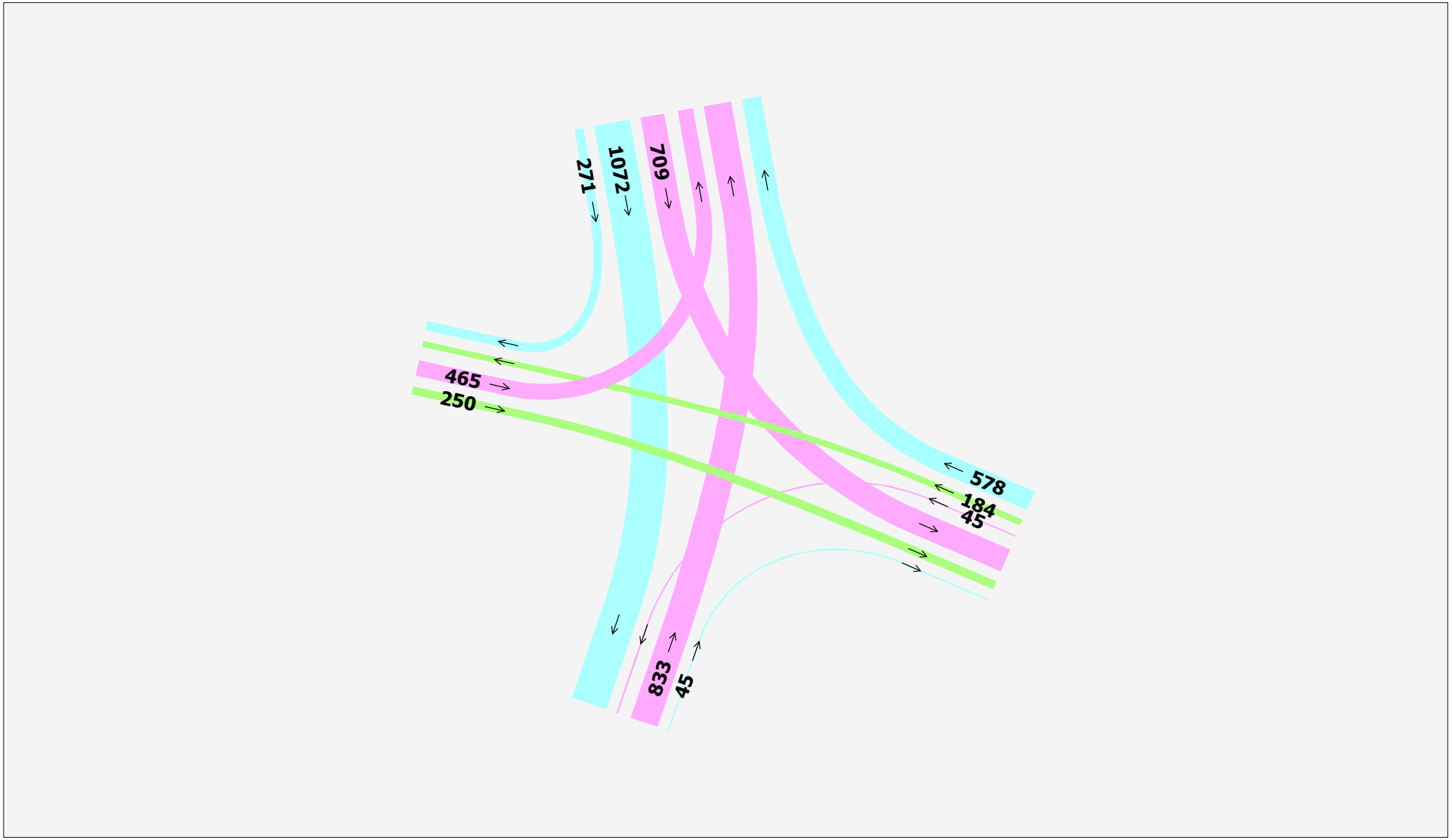
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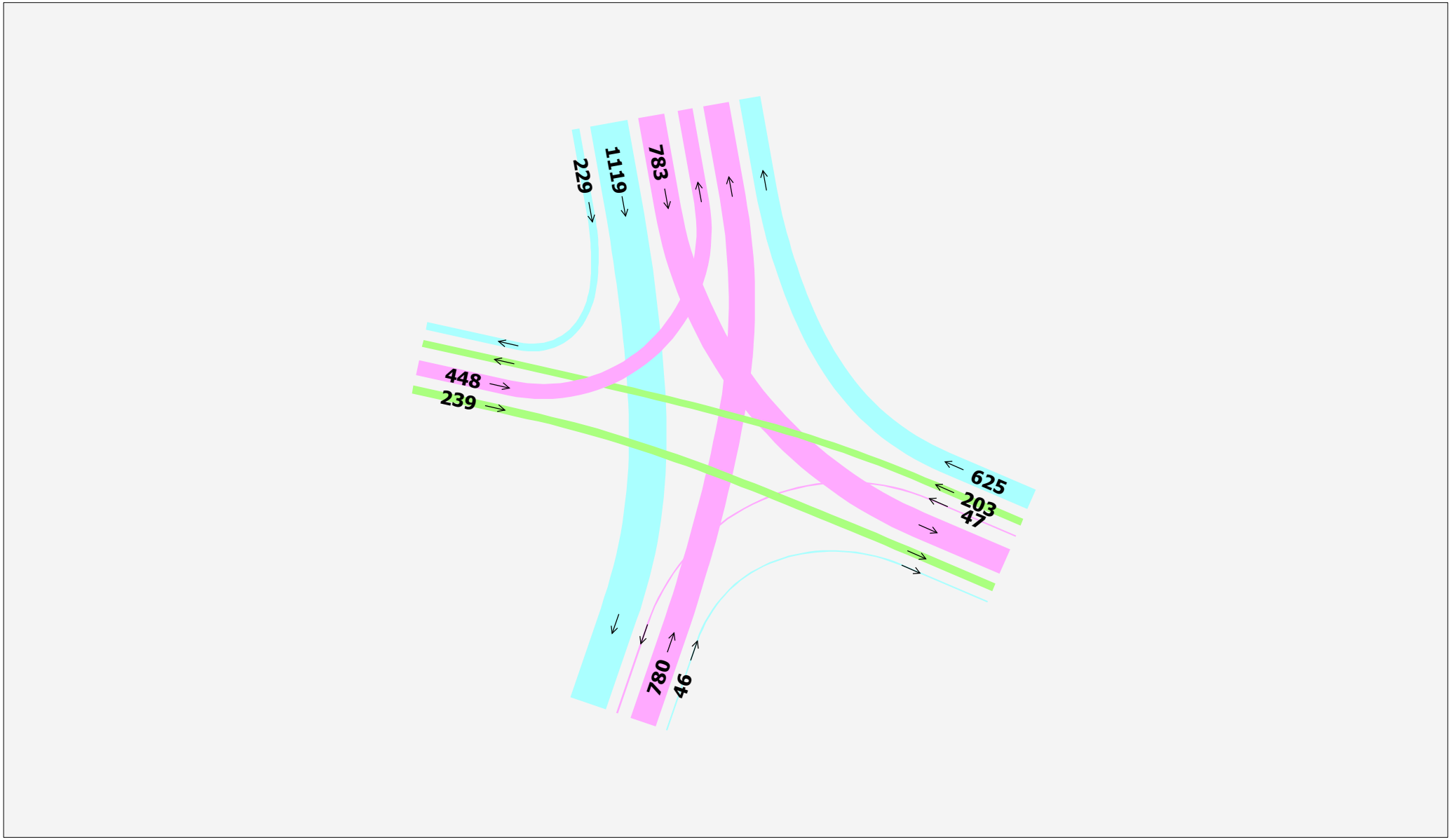
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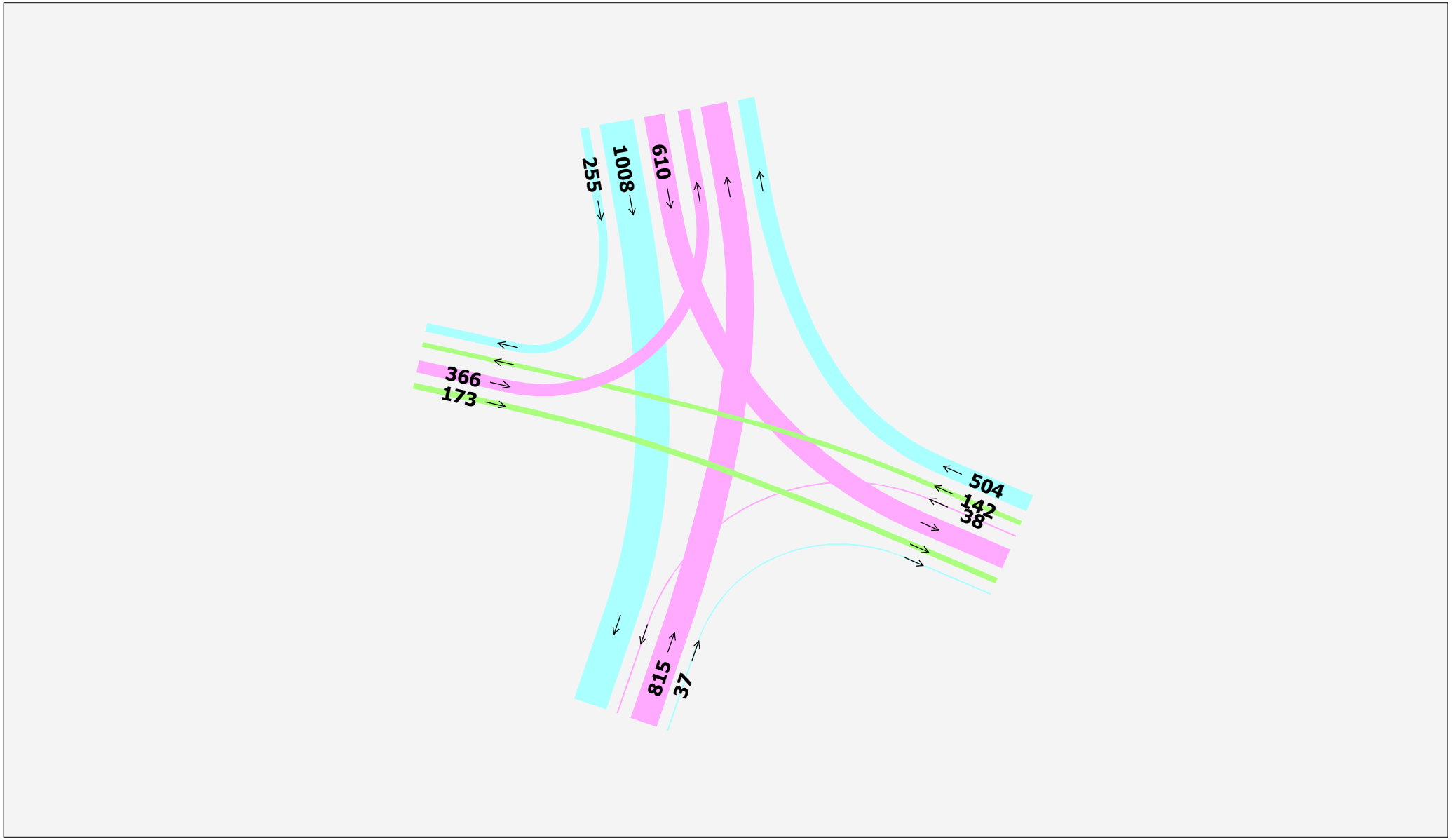
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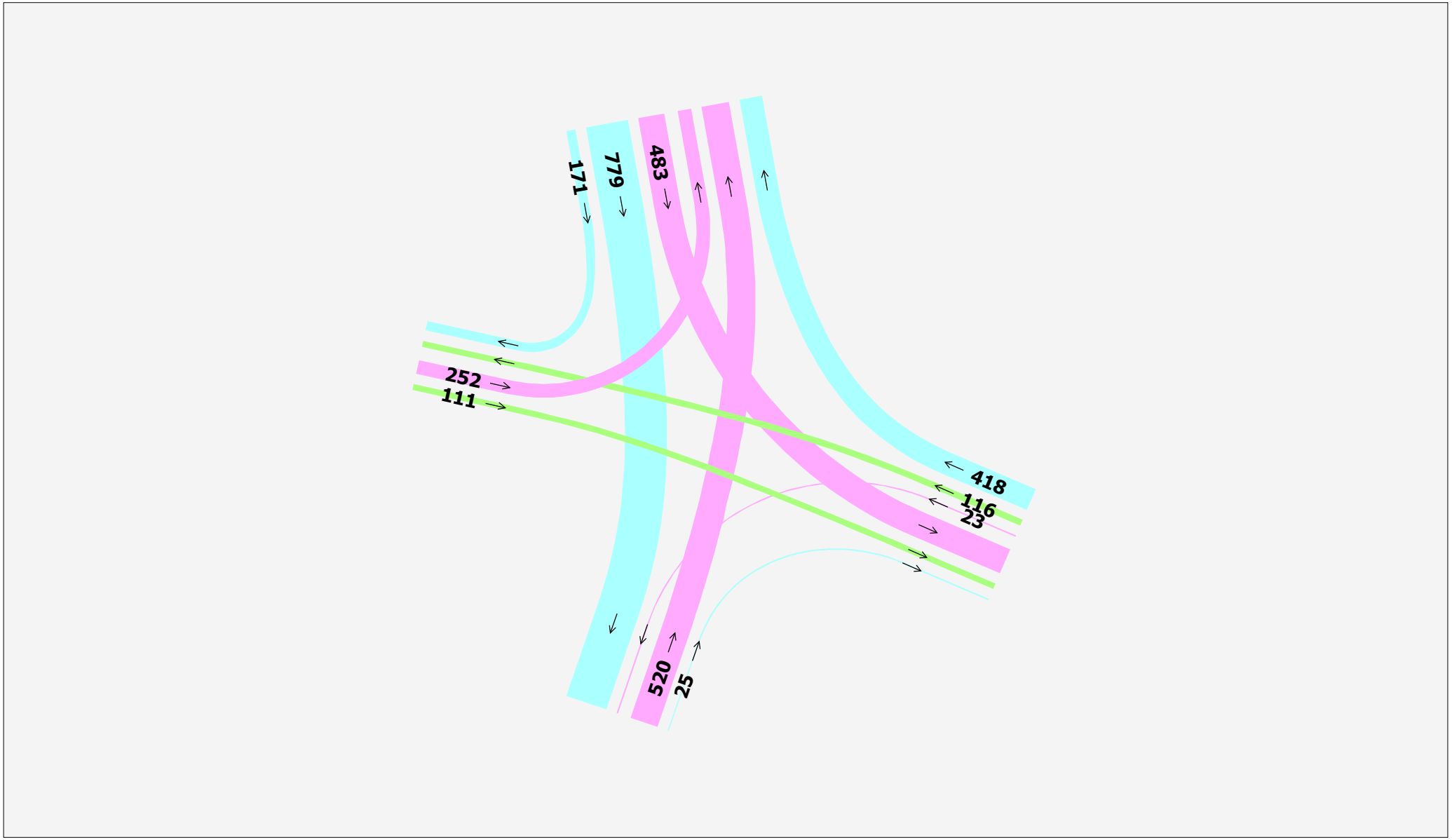
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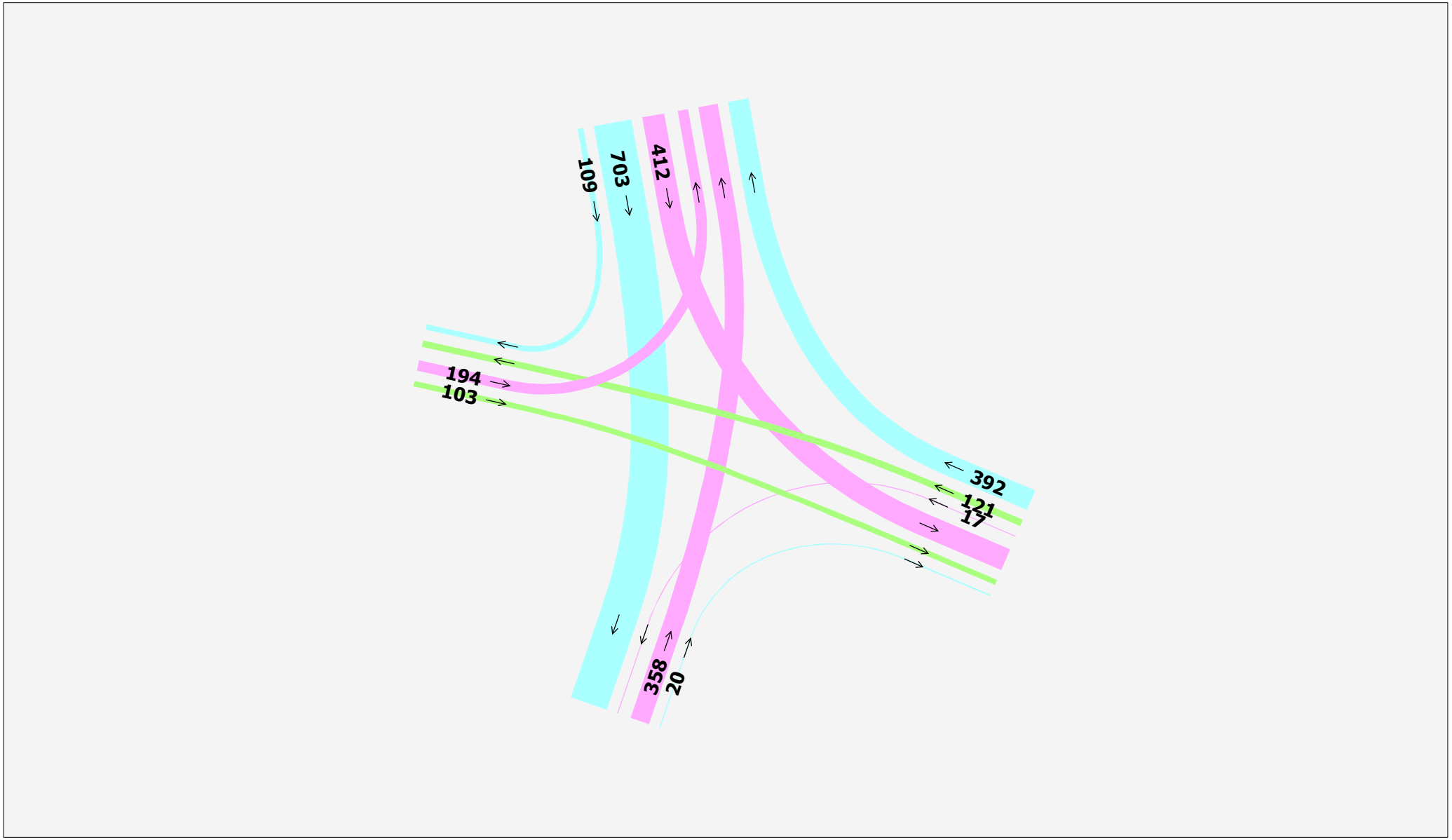
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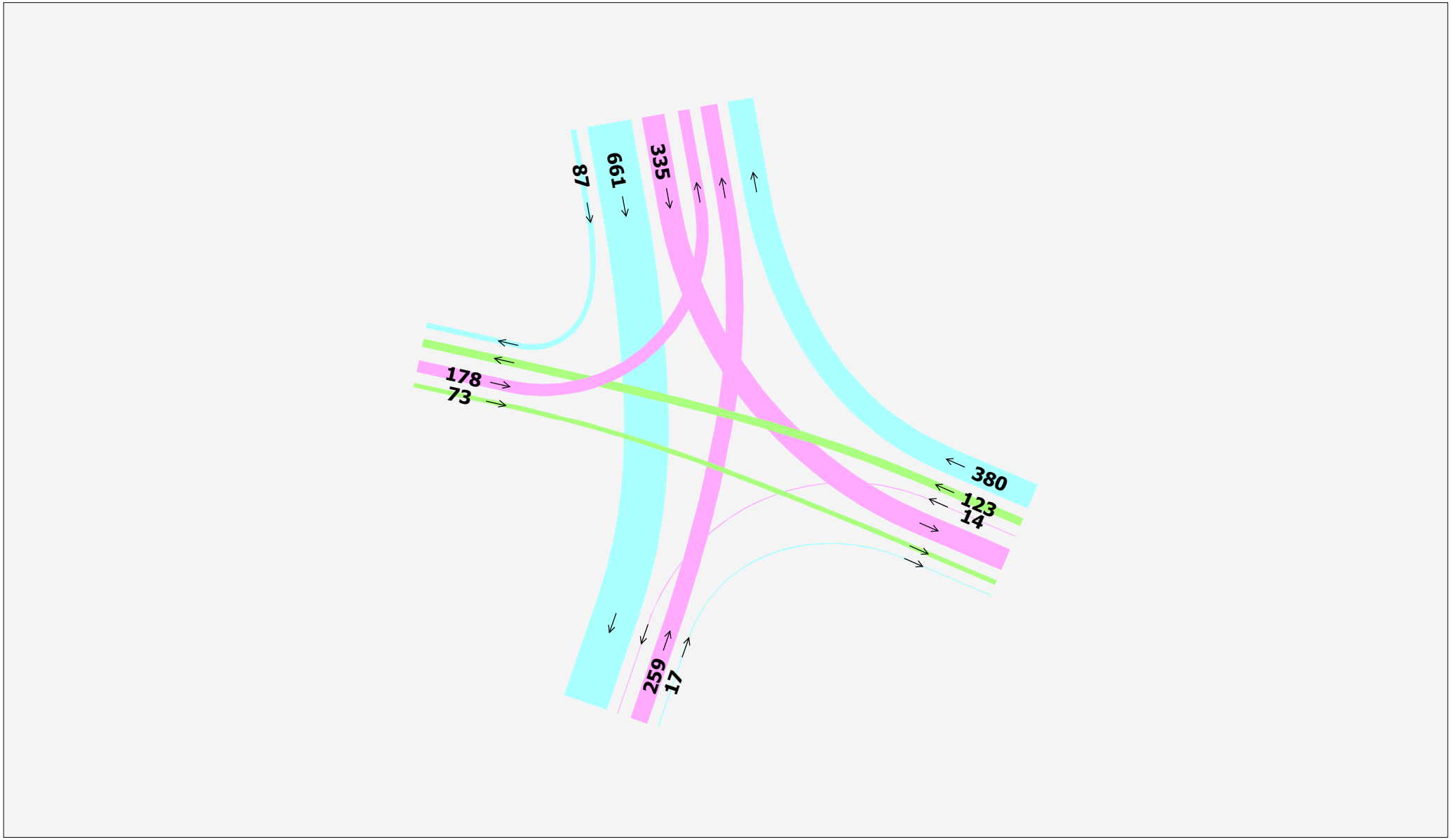
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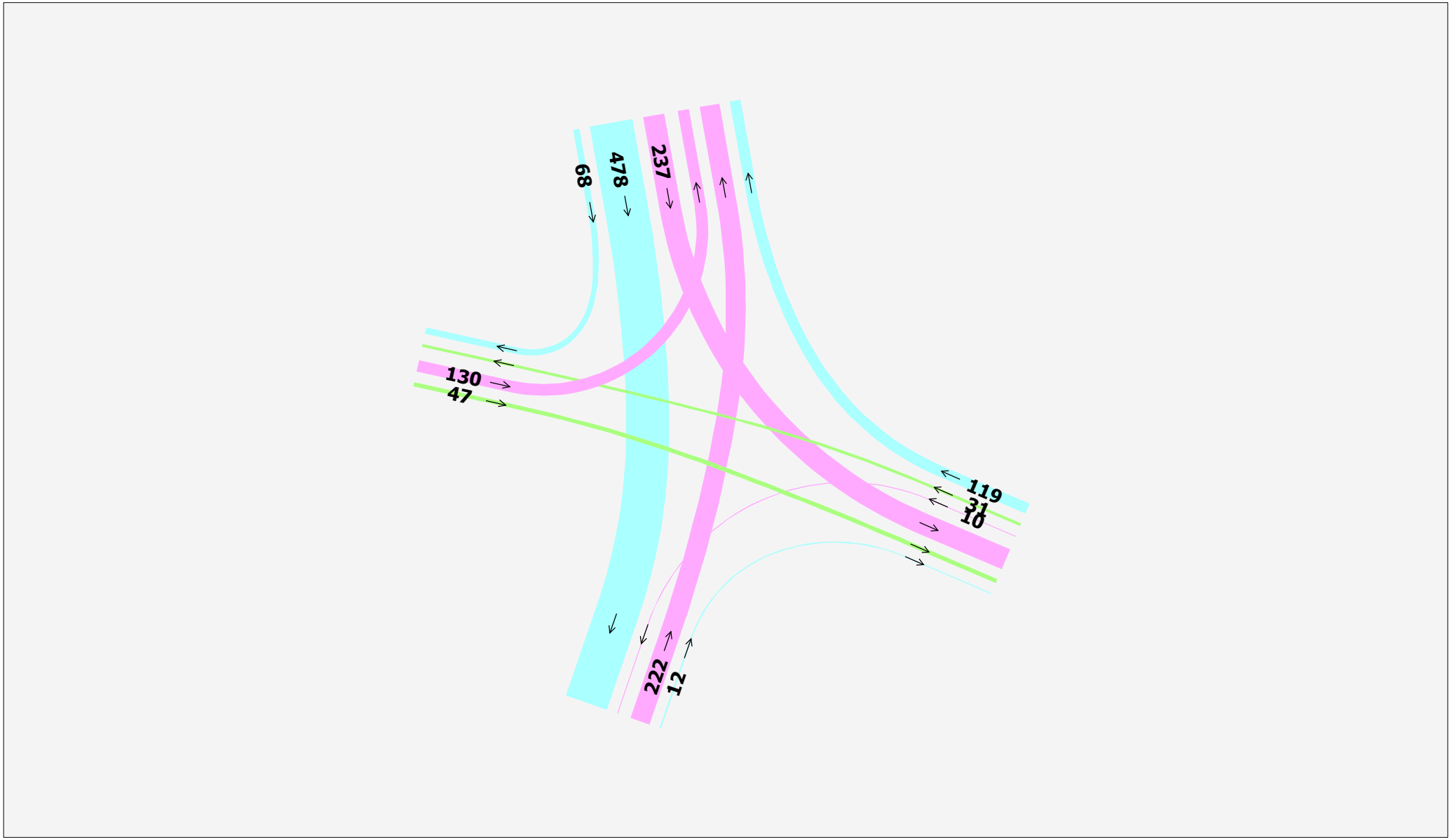
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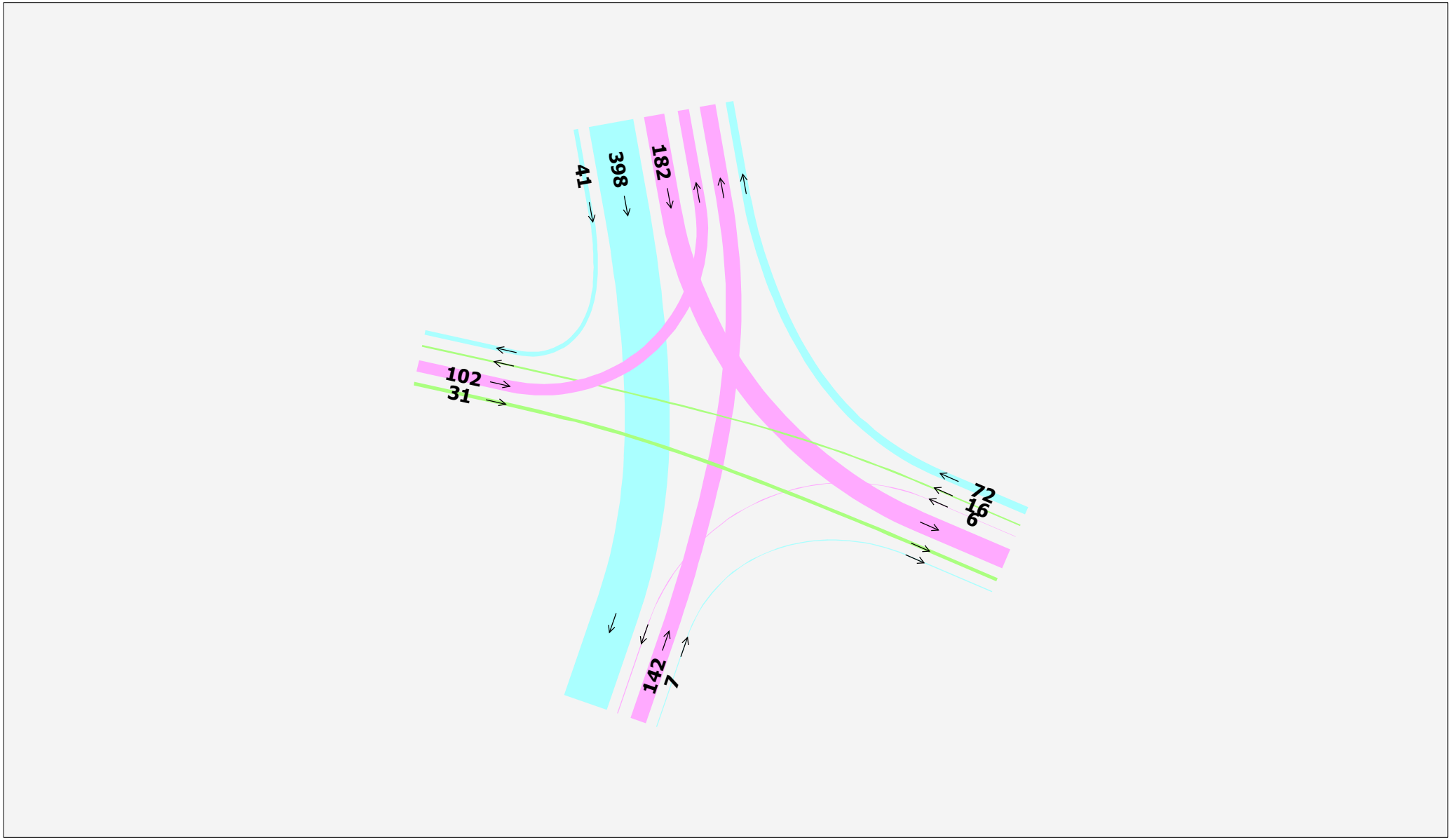
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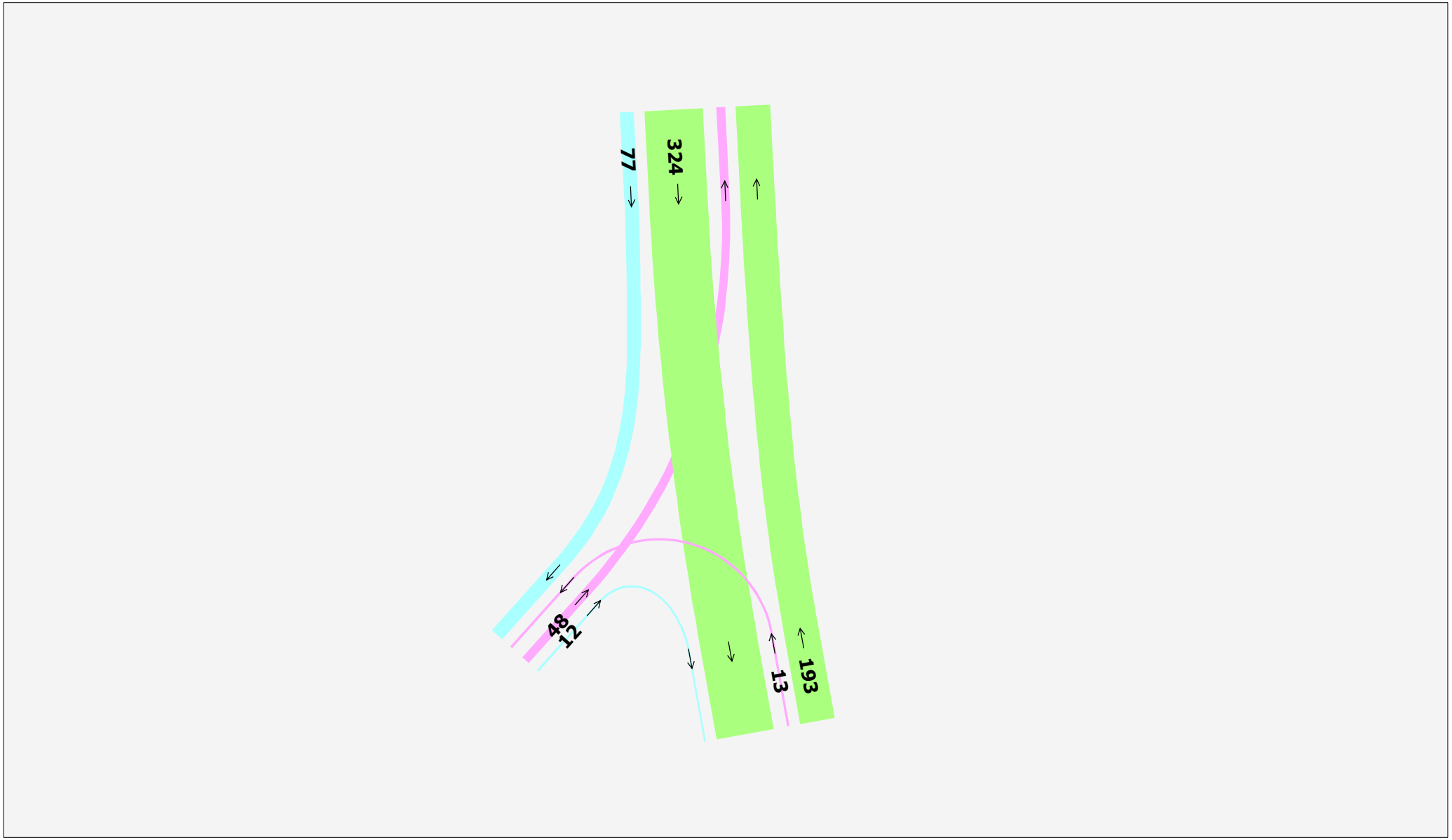
Beavercreek 22:00

2015



Beavercreek 23:00

2015



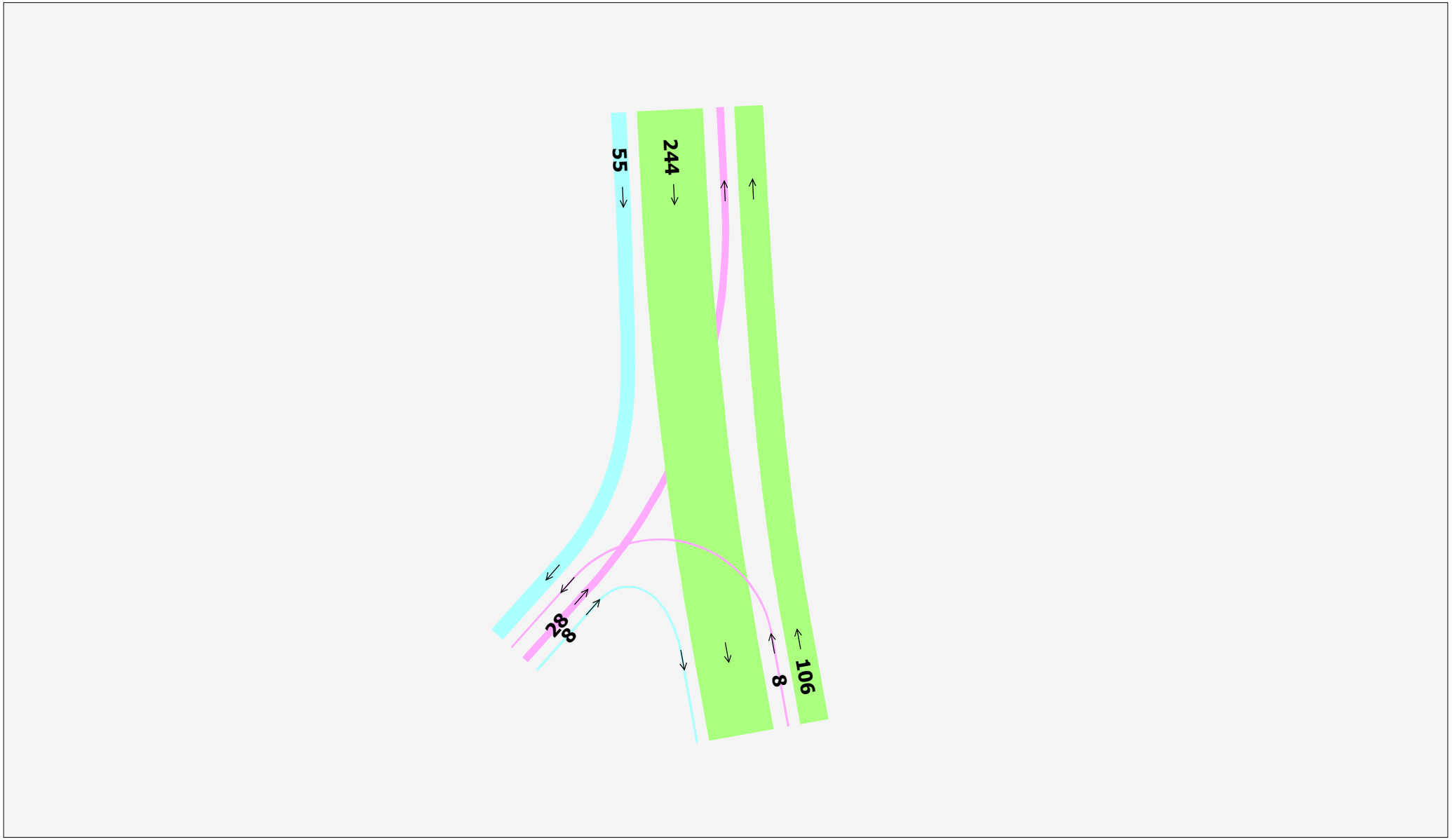
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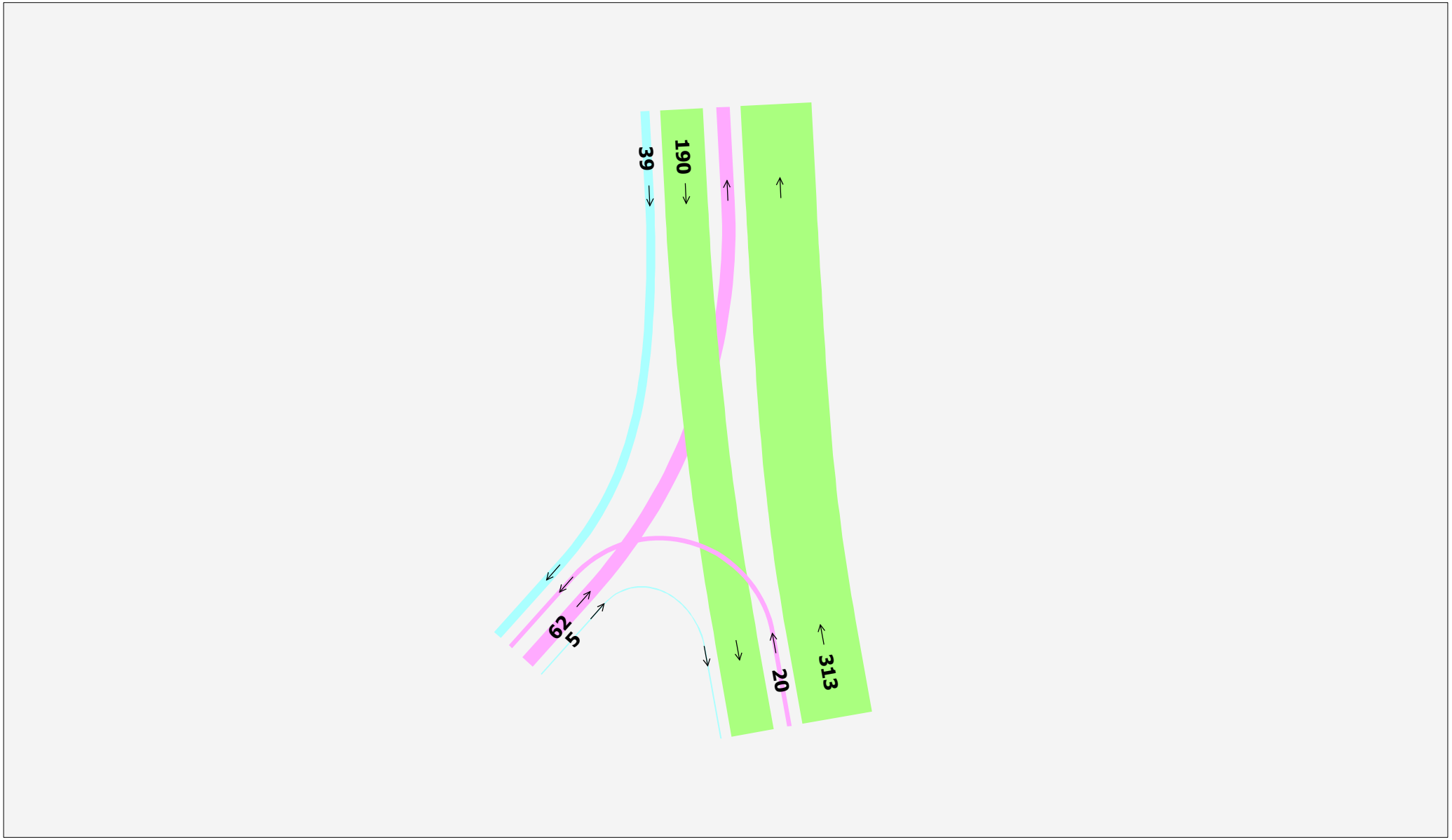
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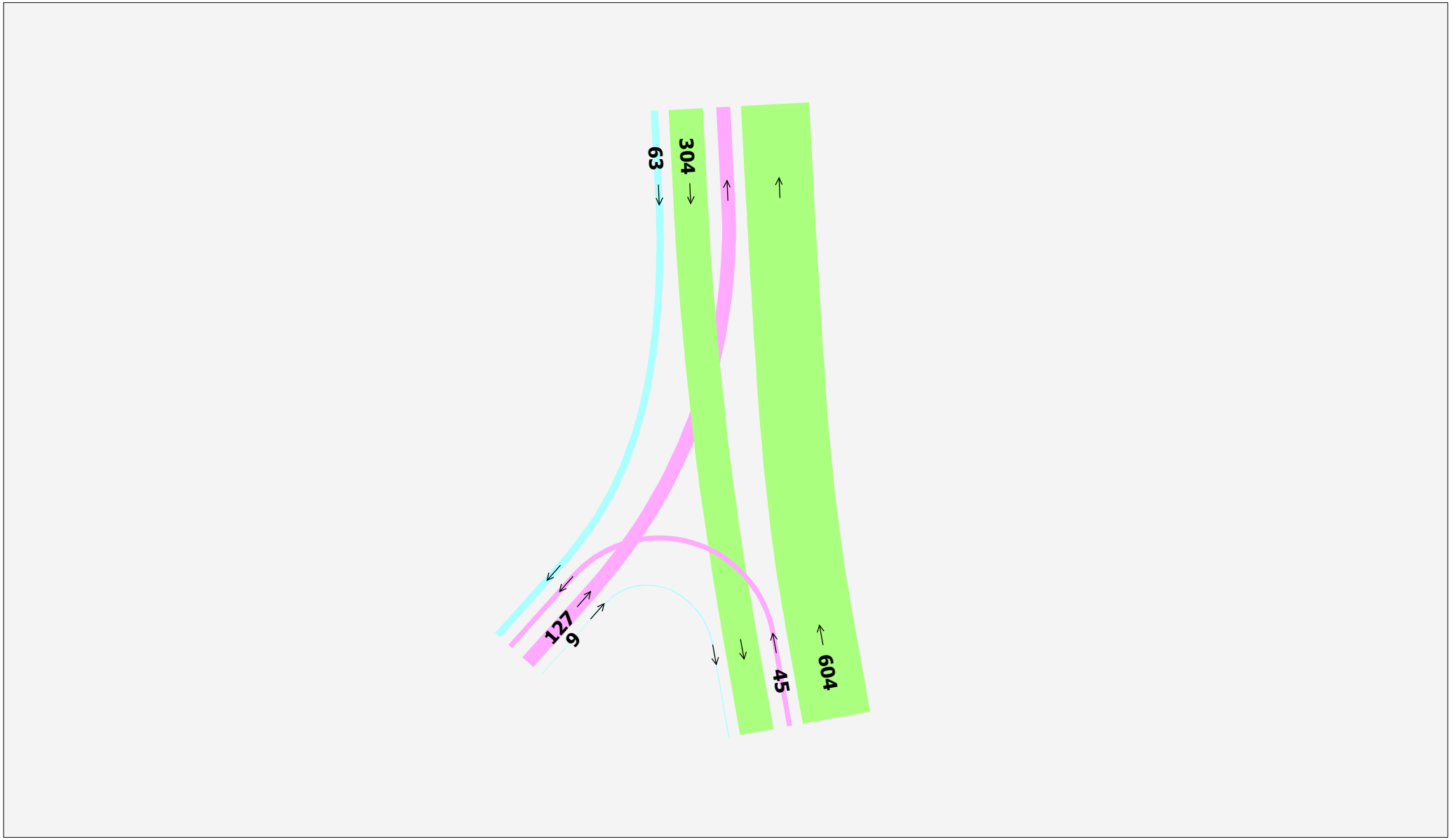
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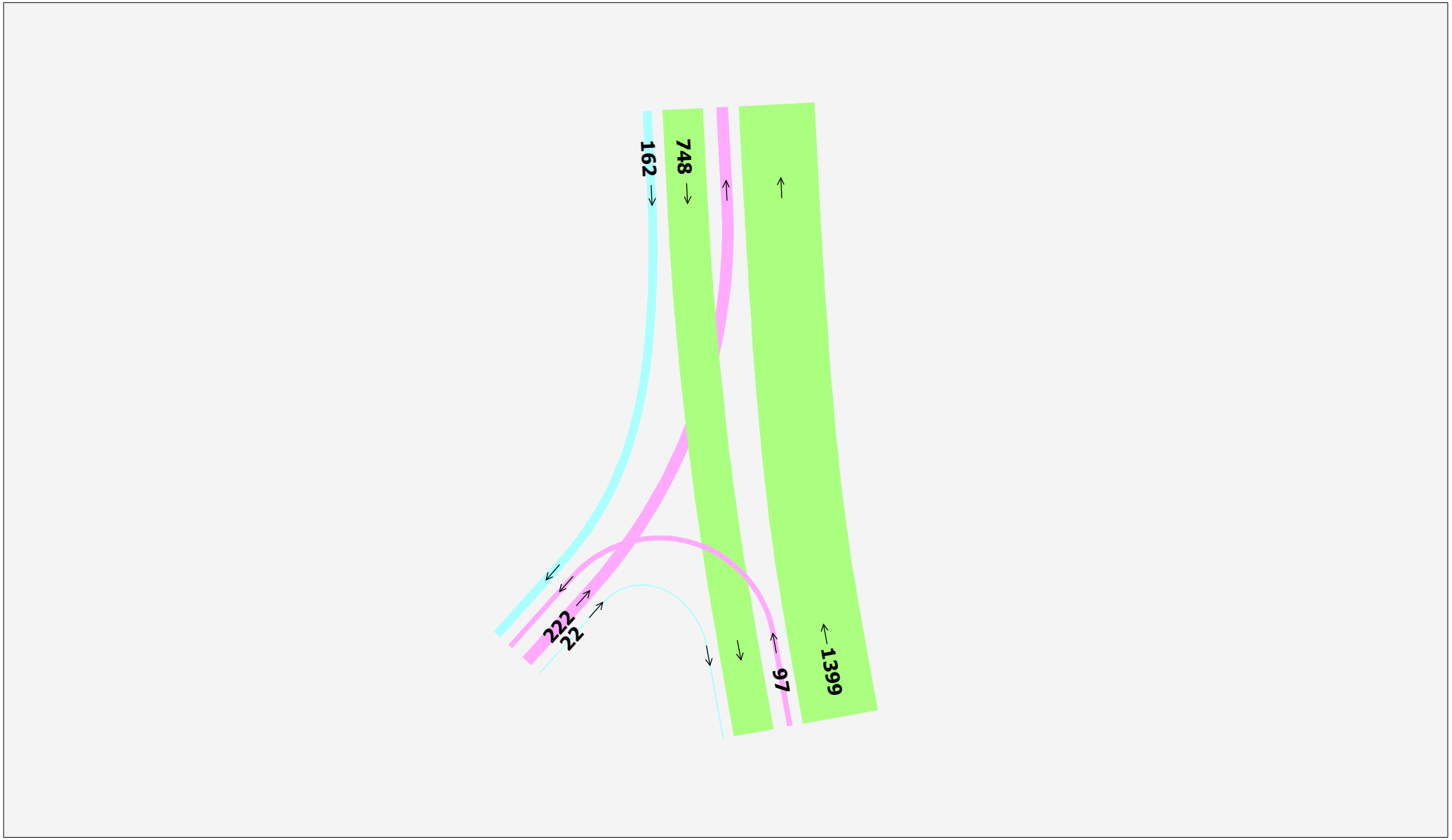
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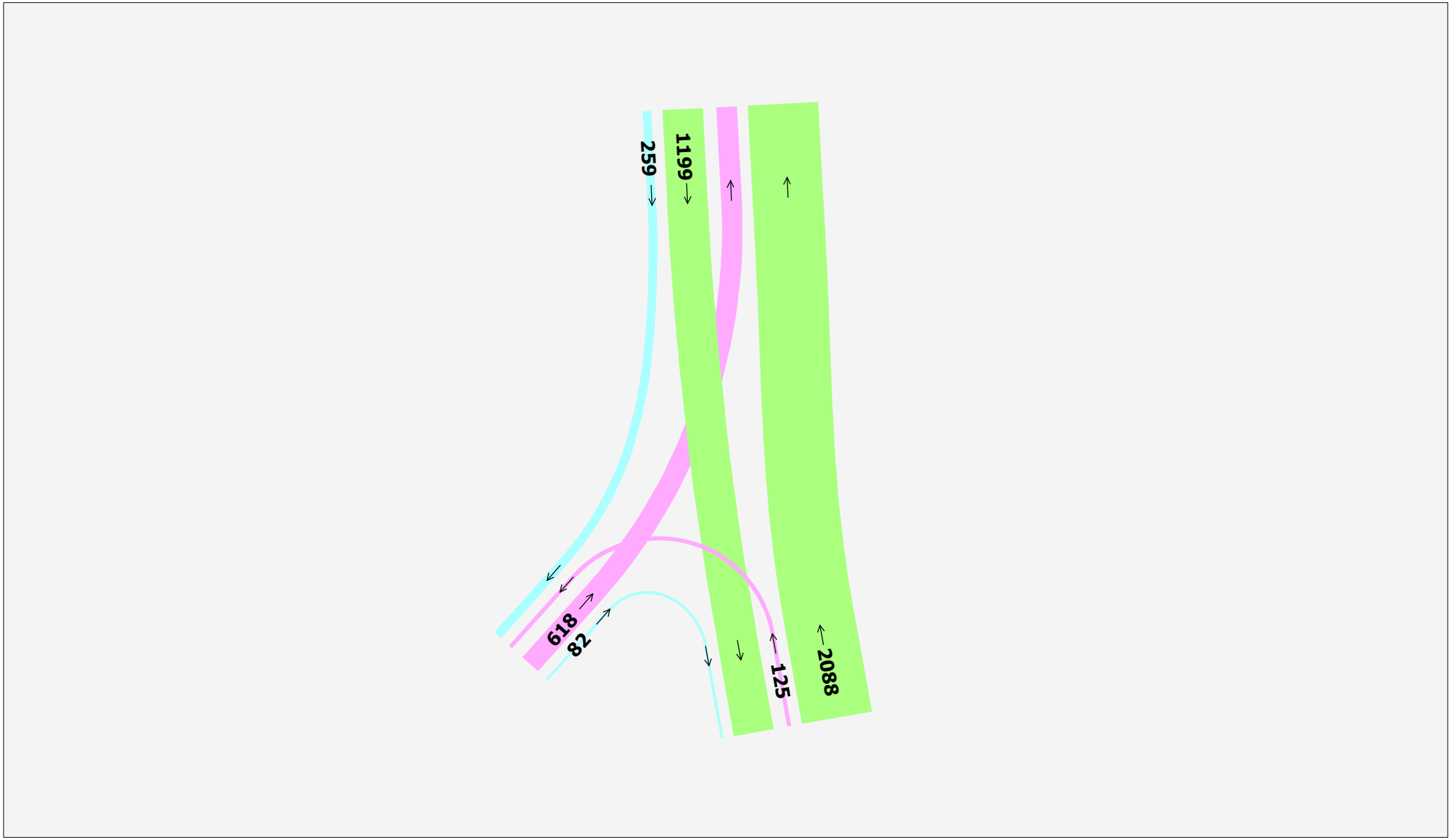
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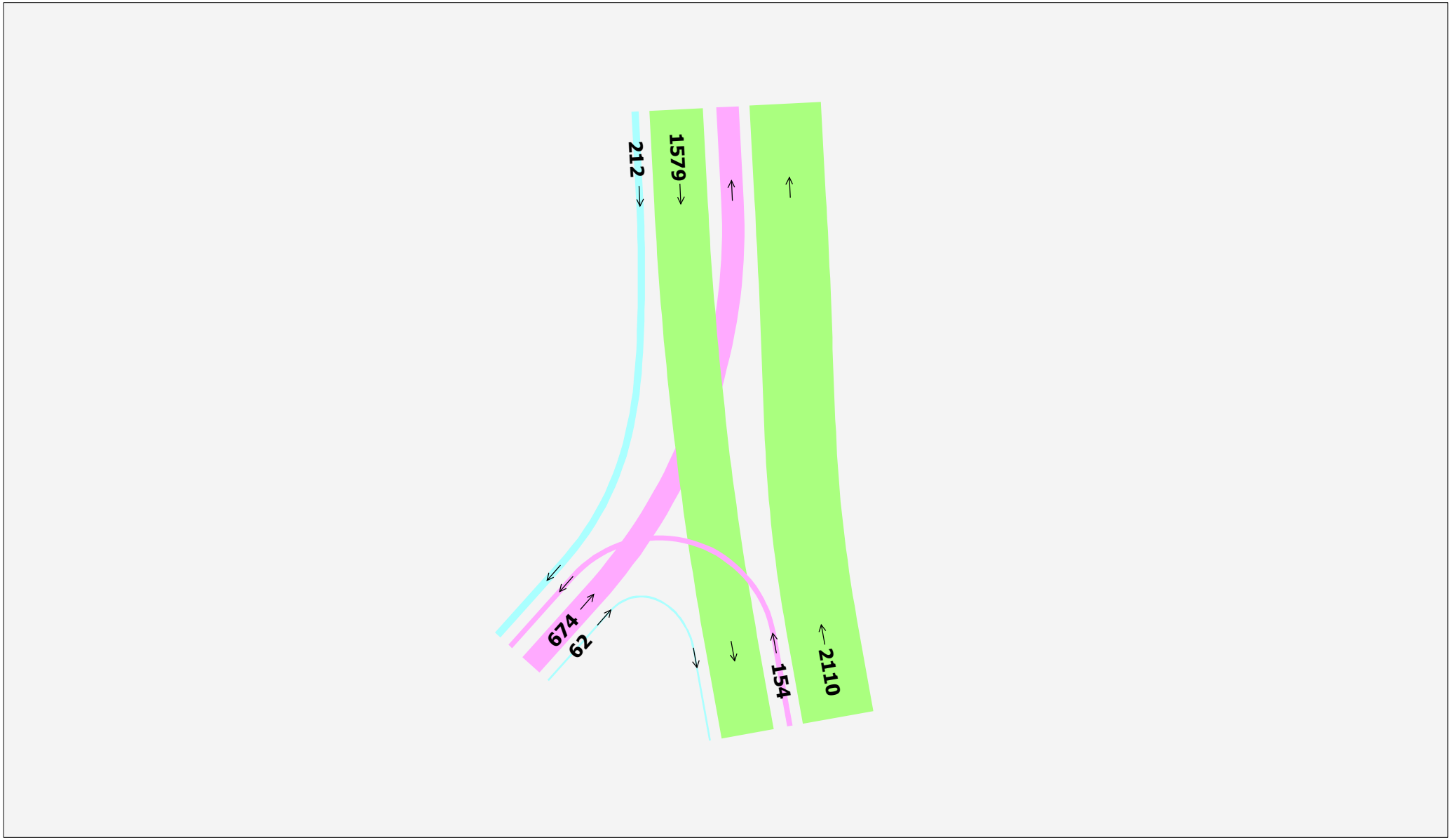
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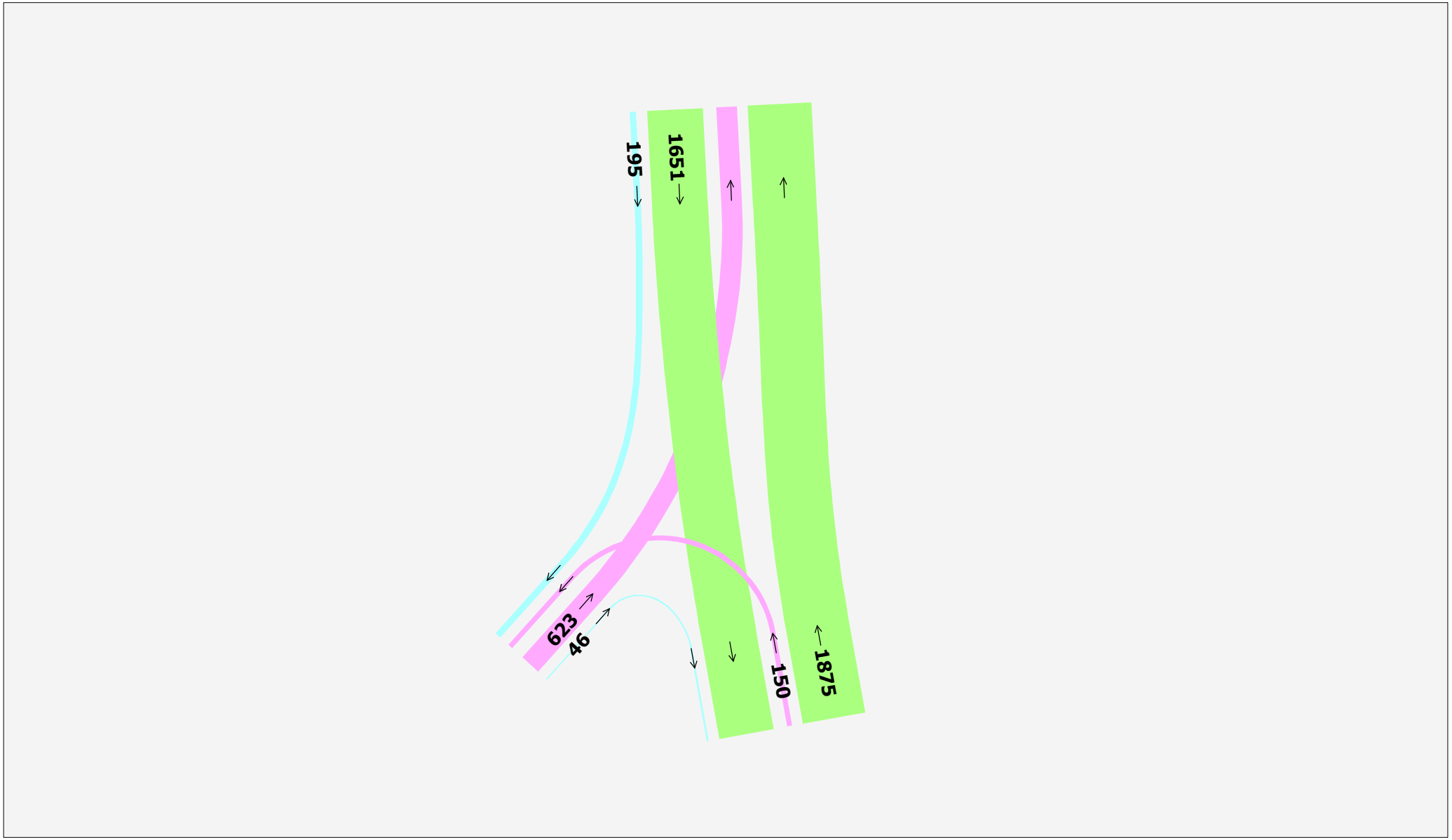
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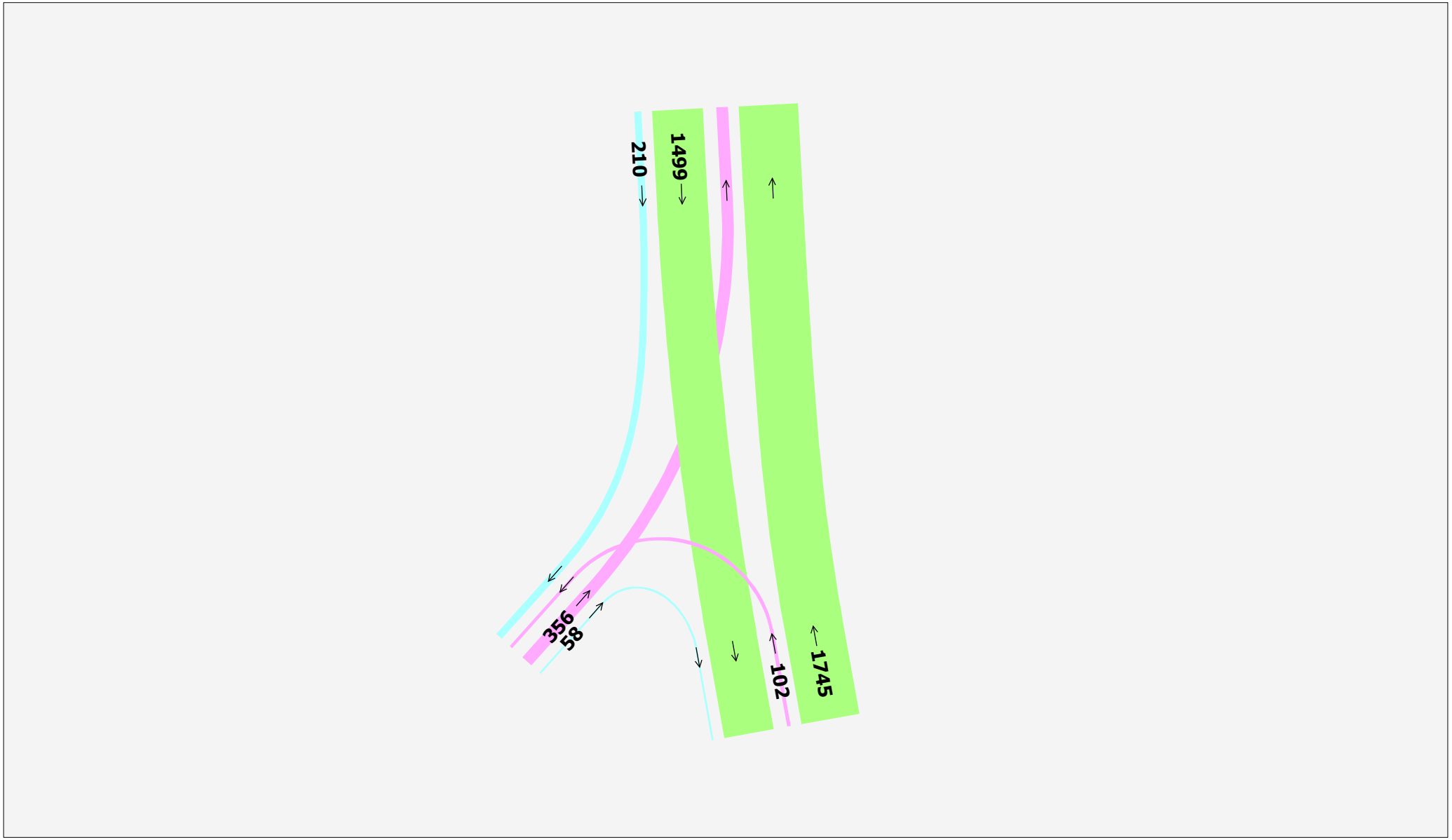
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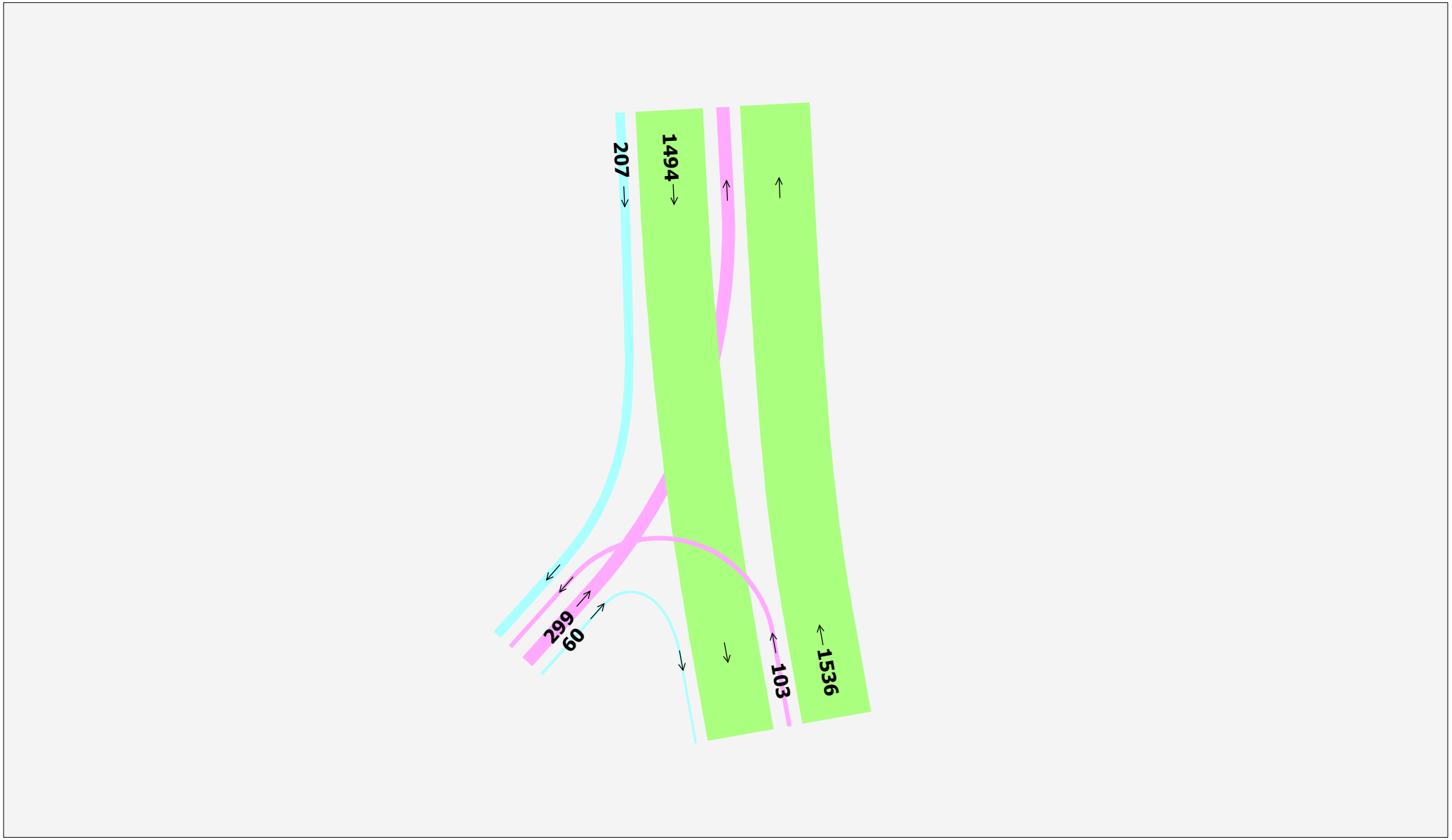
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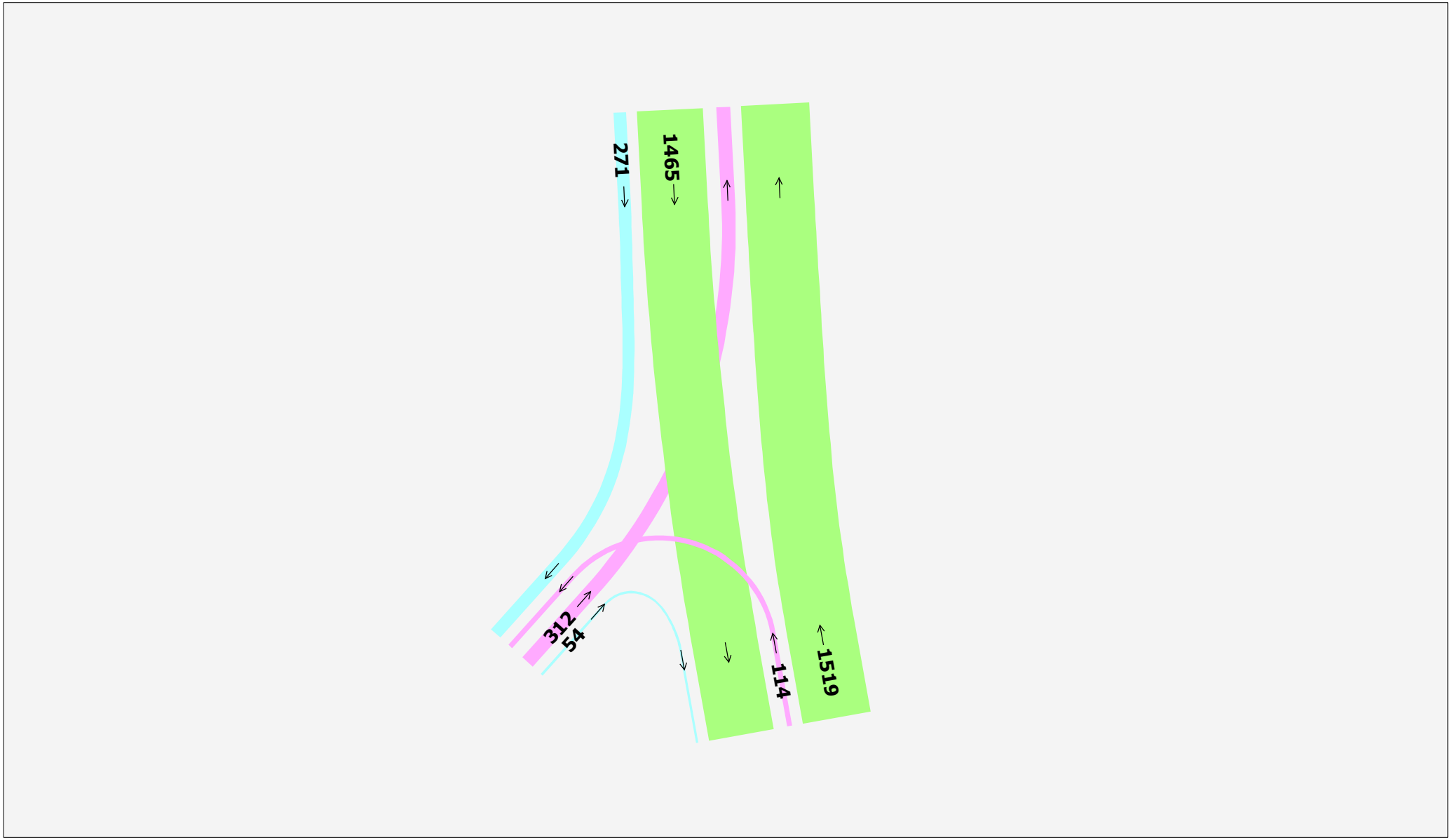
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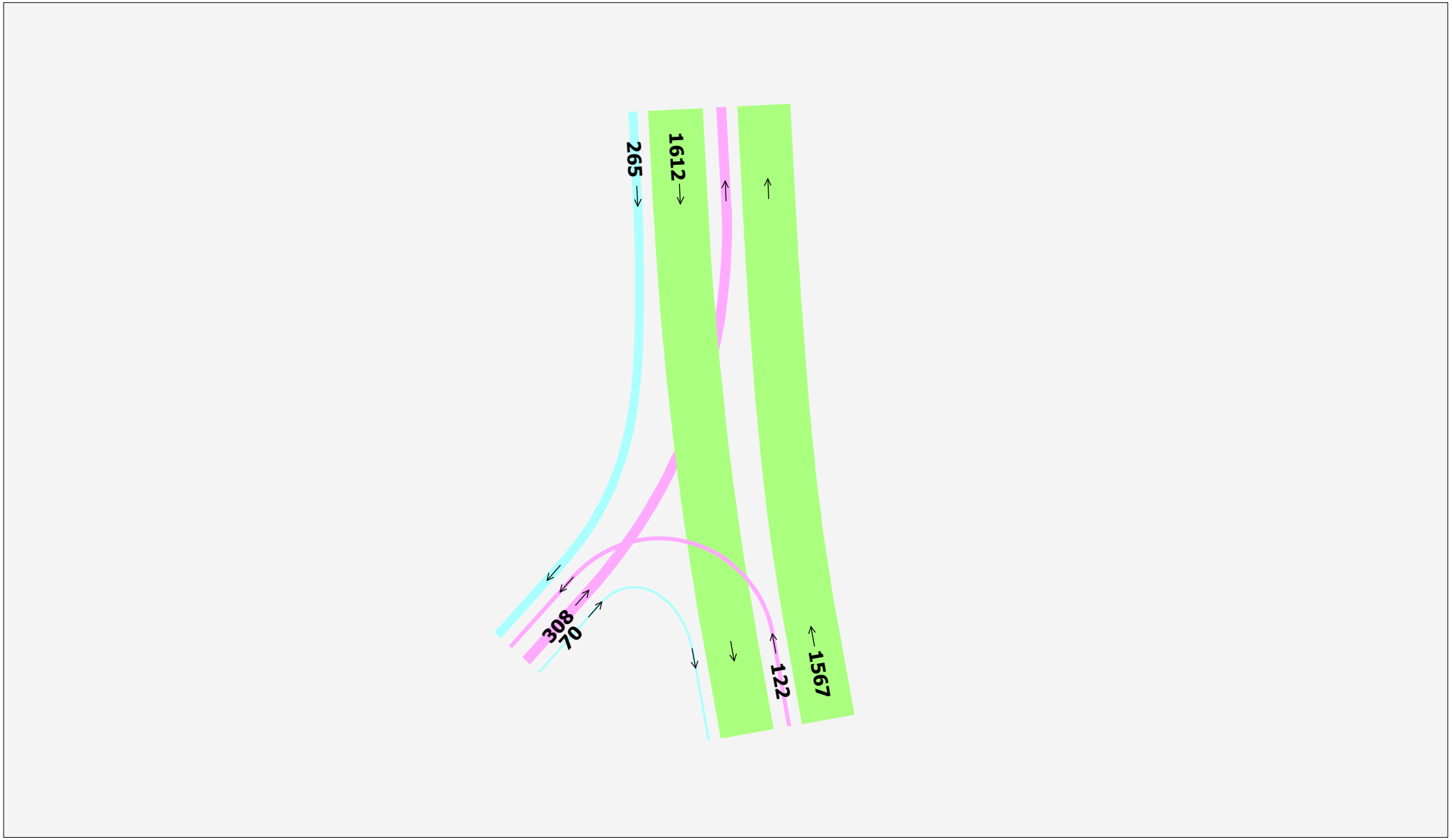
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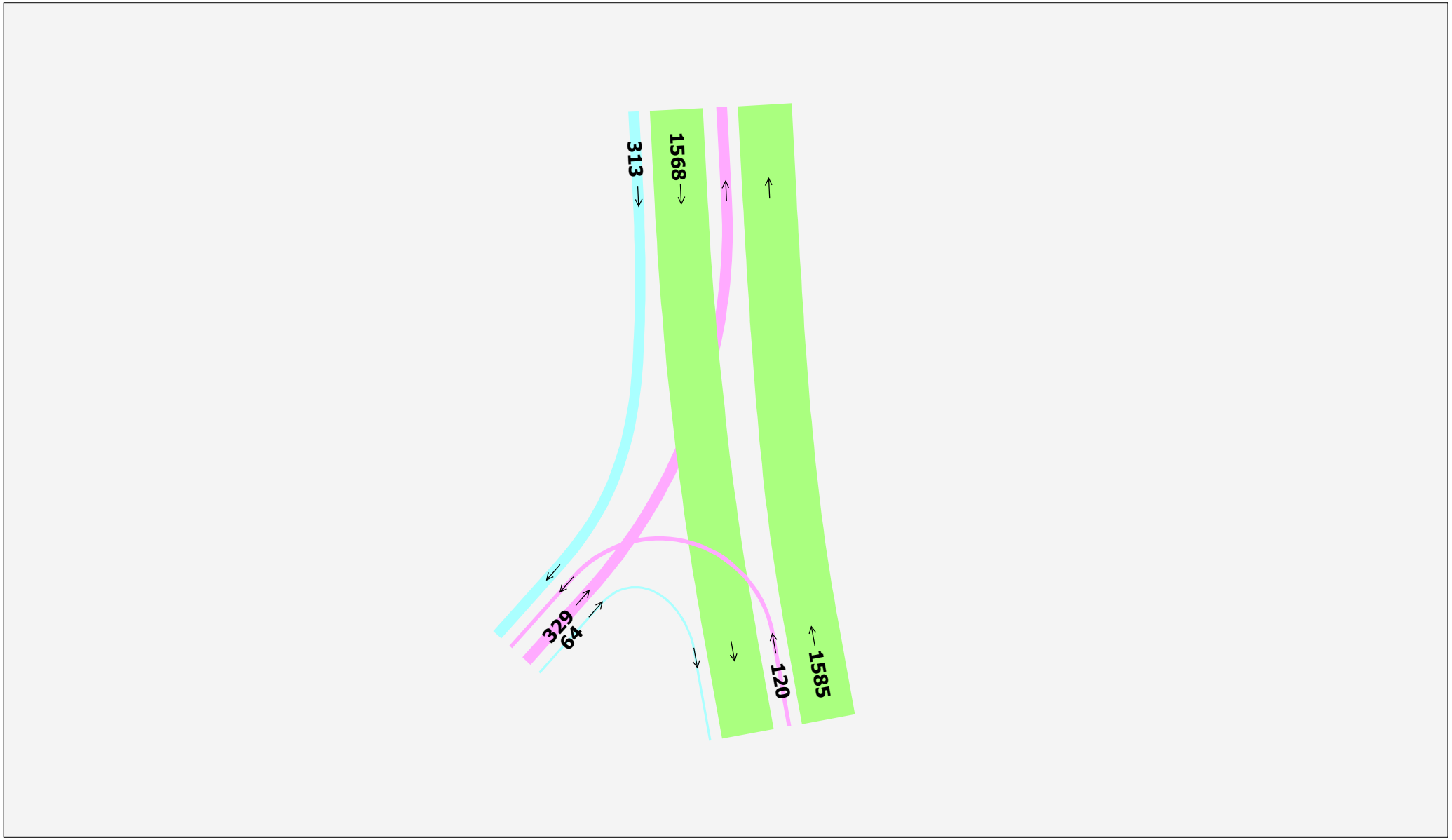
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Redland 12:00

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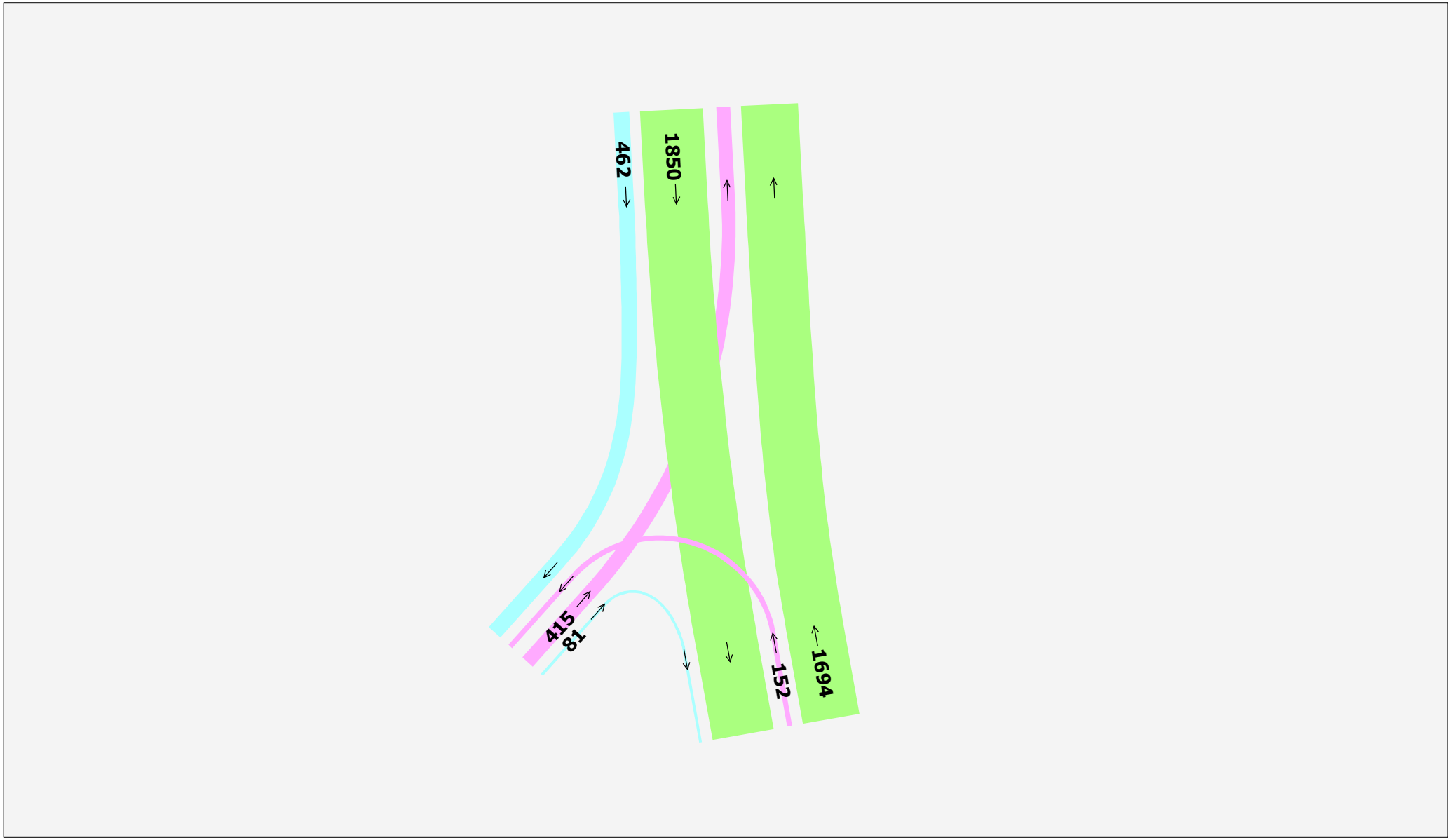
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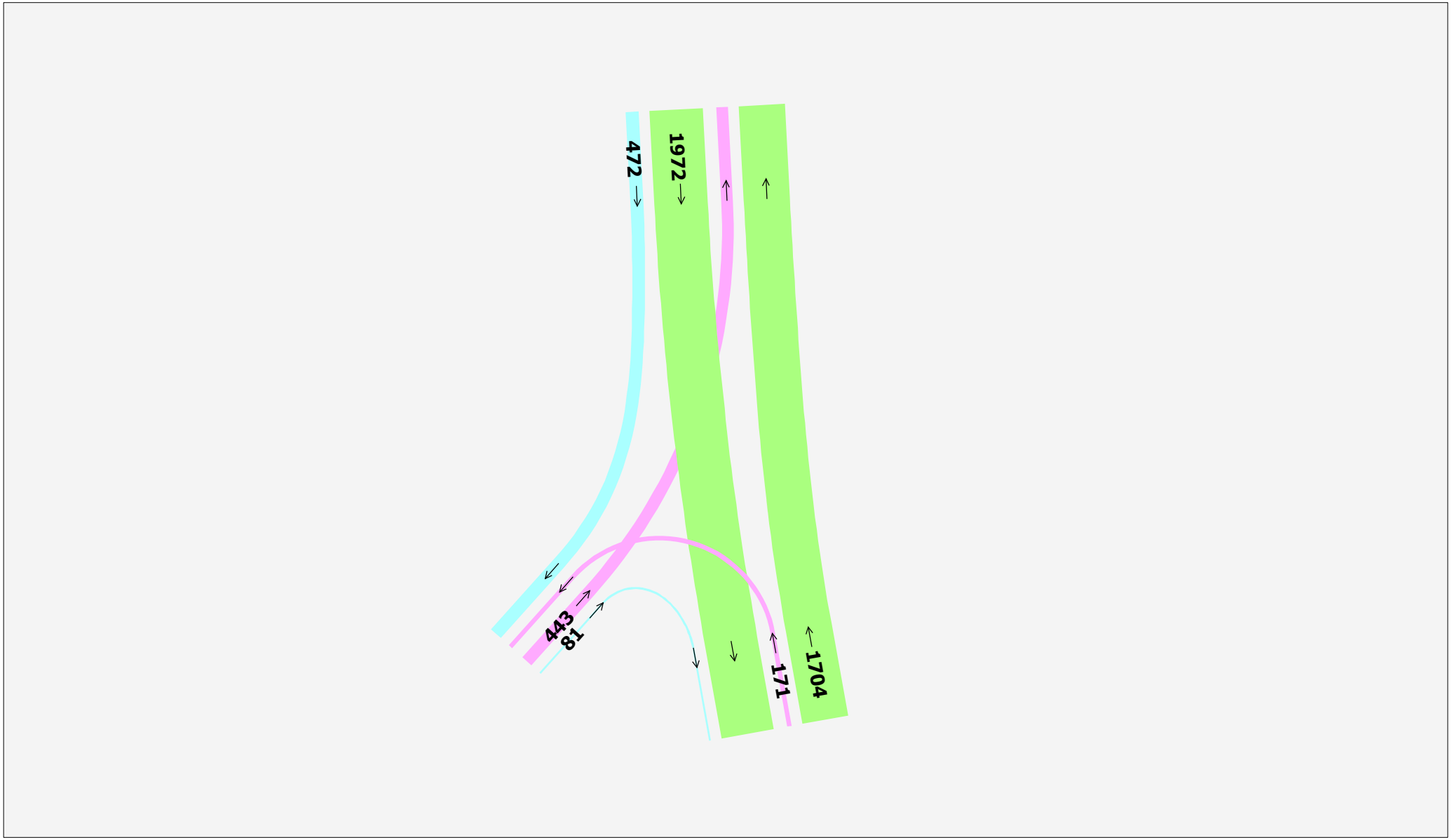
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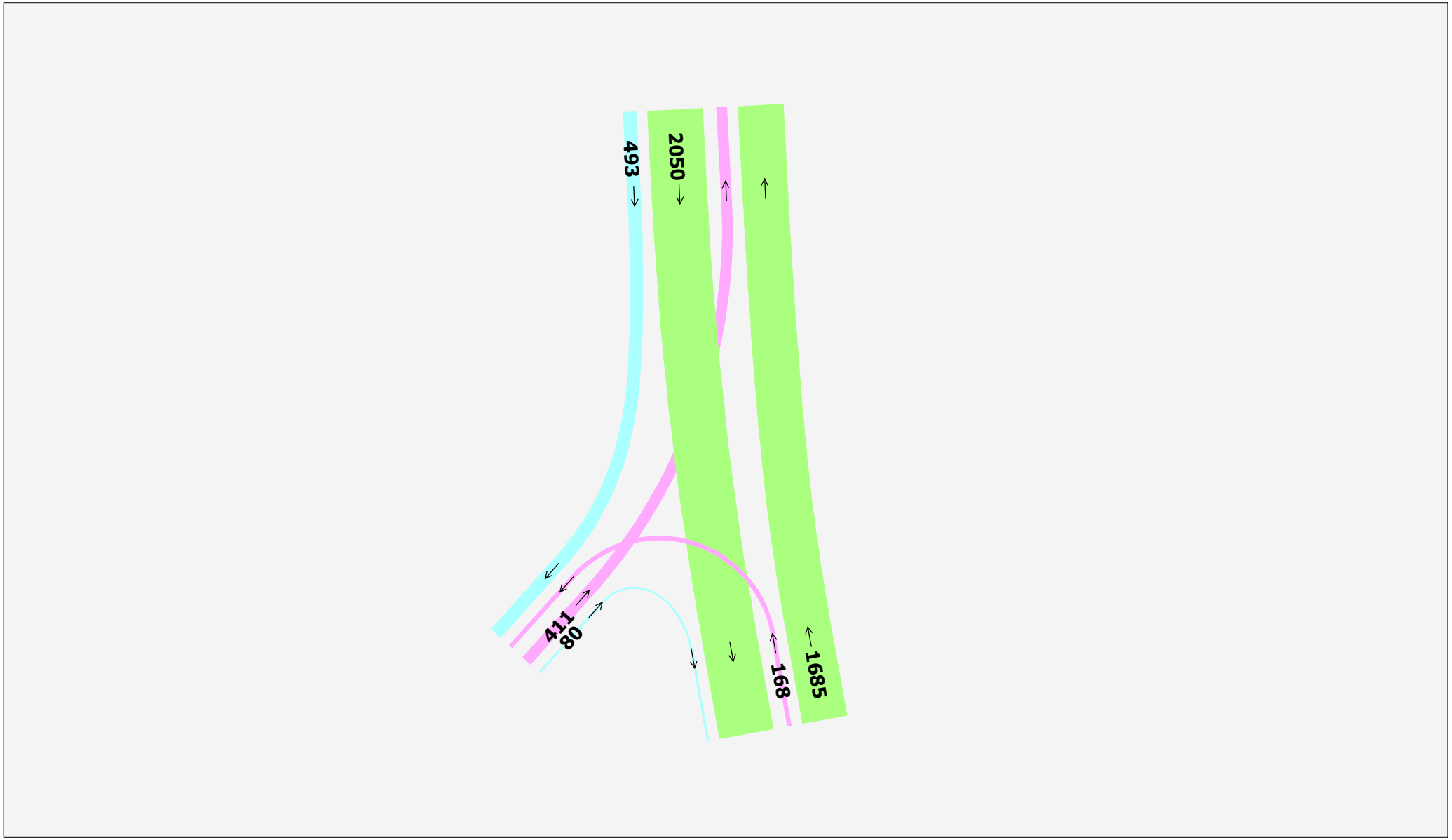
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Redland 16:00

2015



Redland 17:00

2015



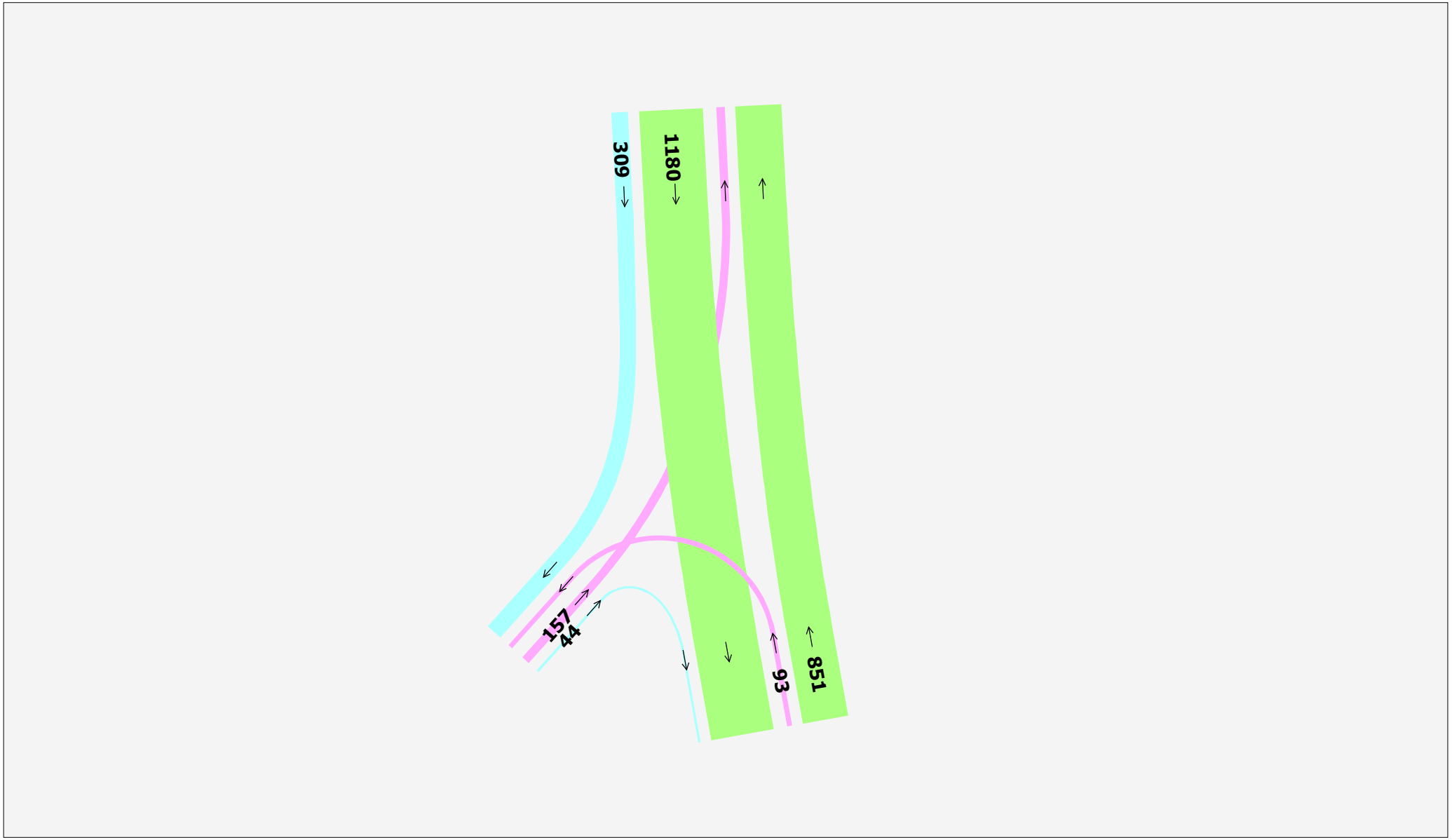
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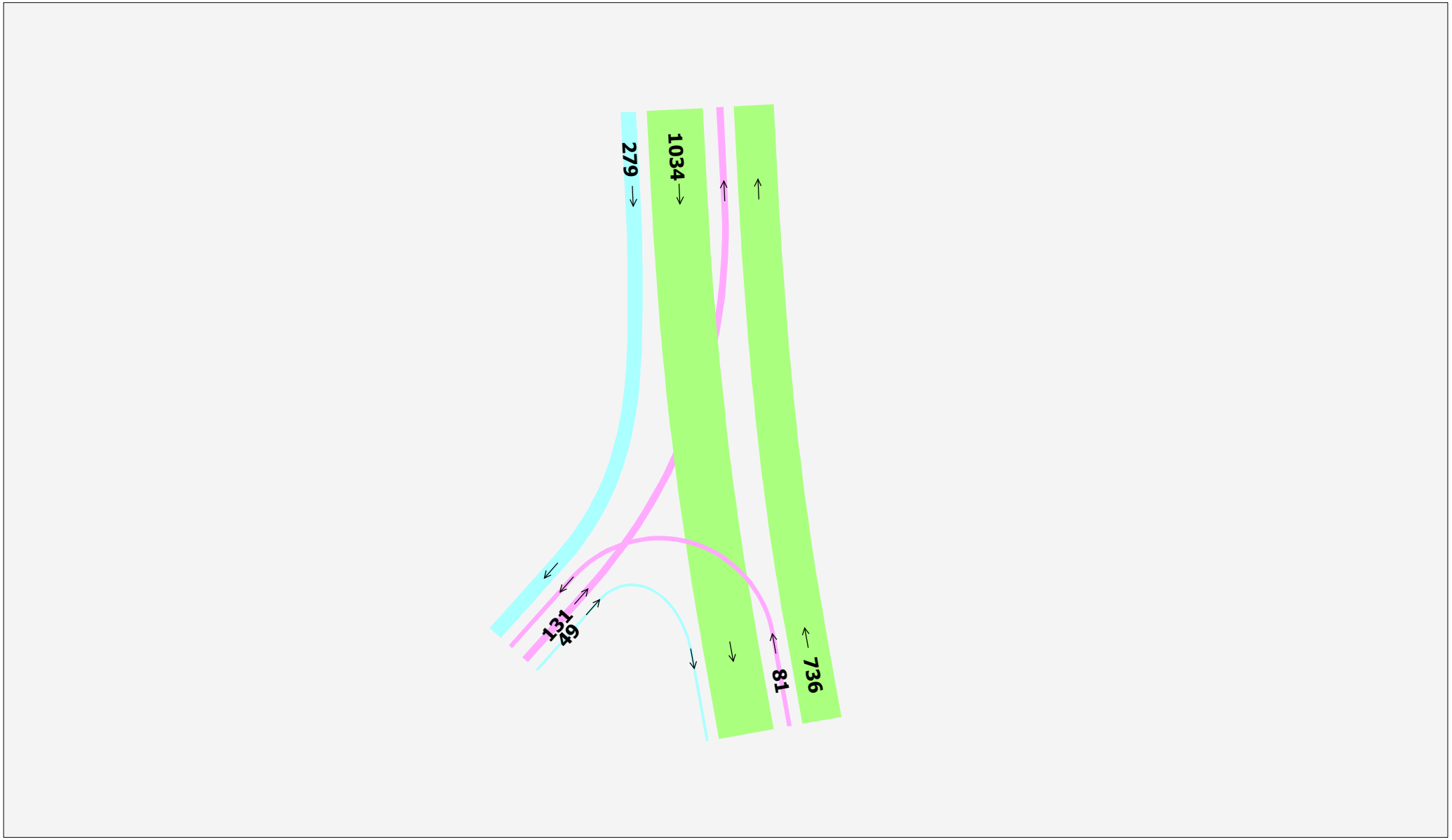
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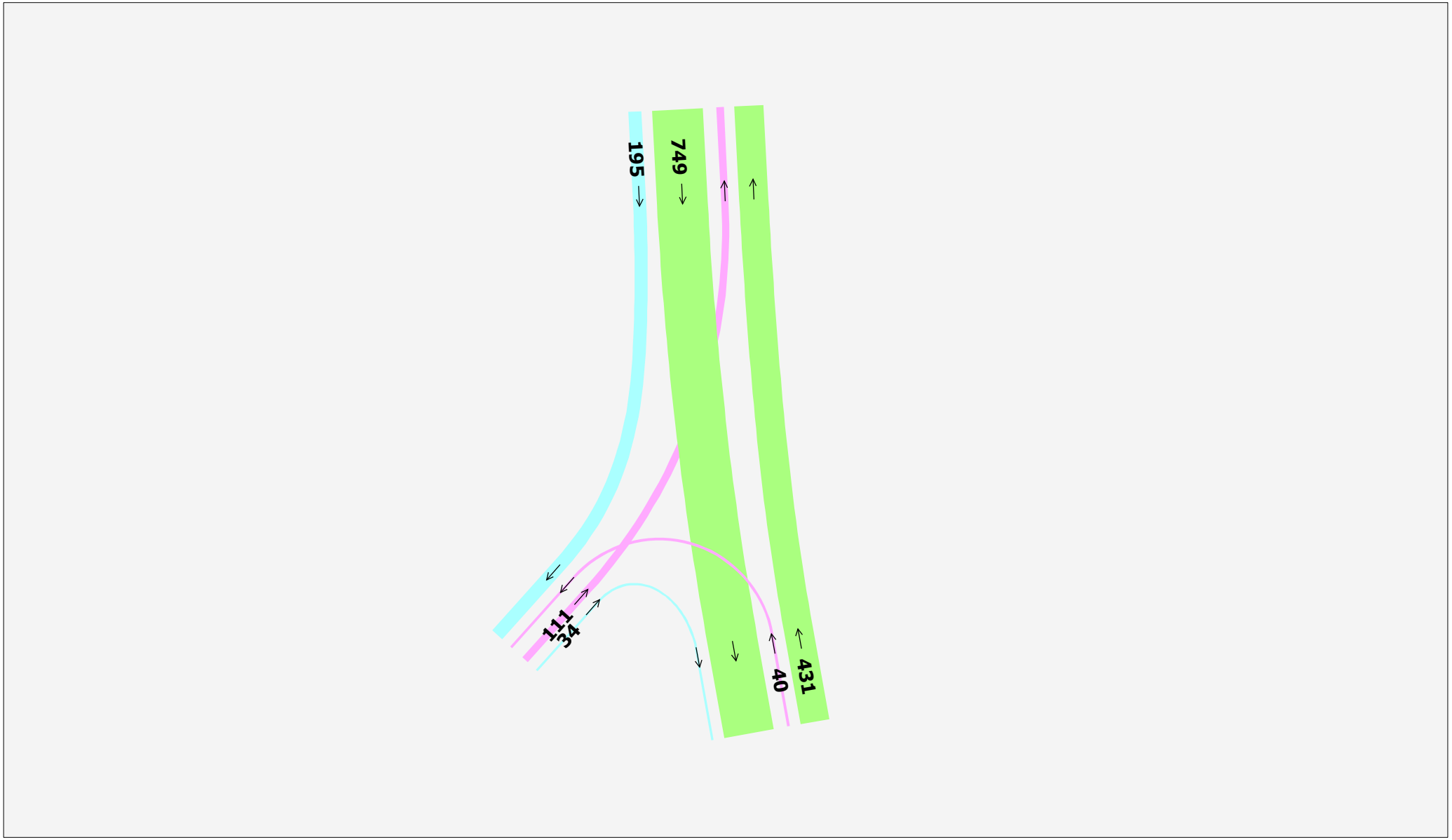
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Redland 21:00

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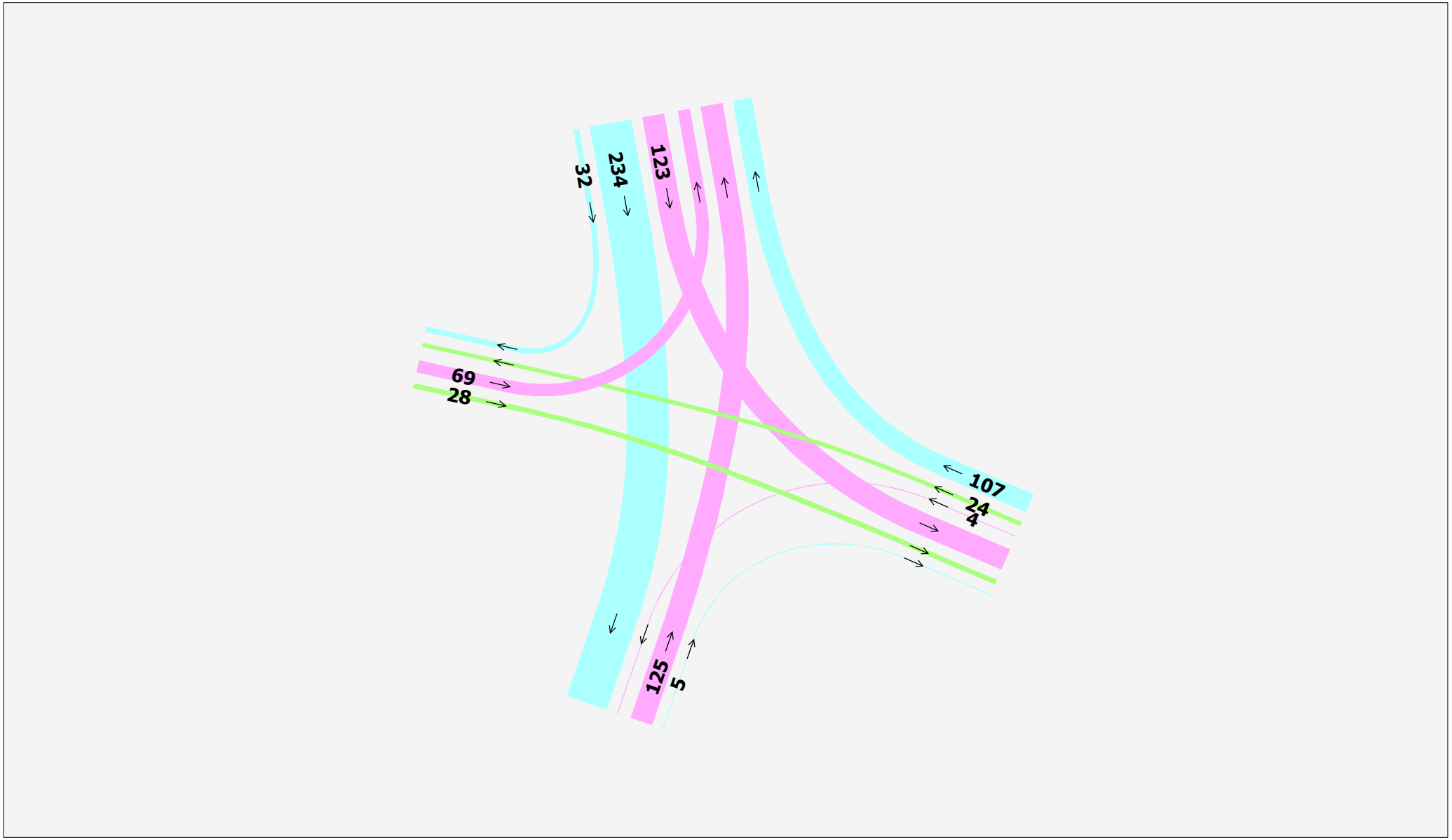
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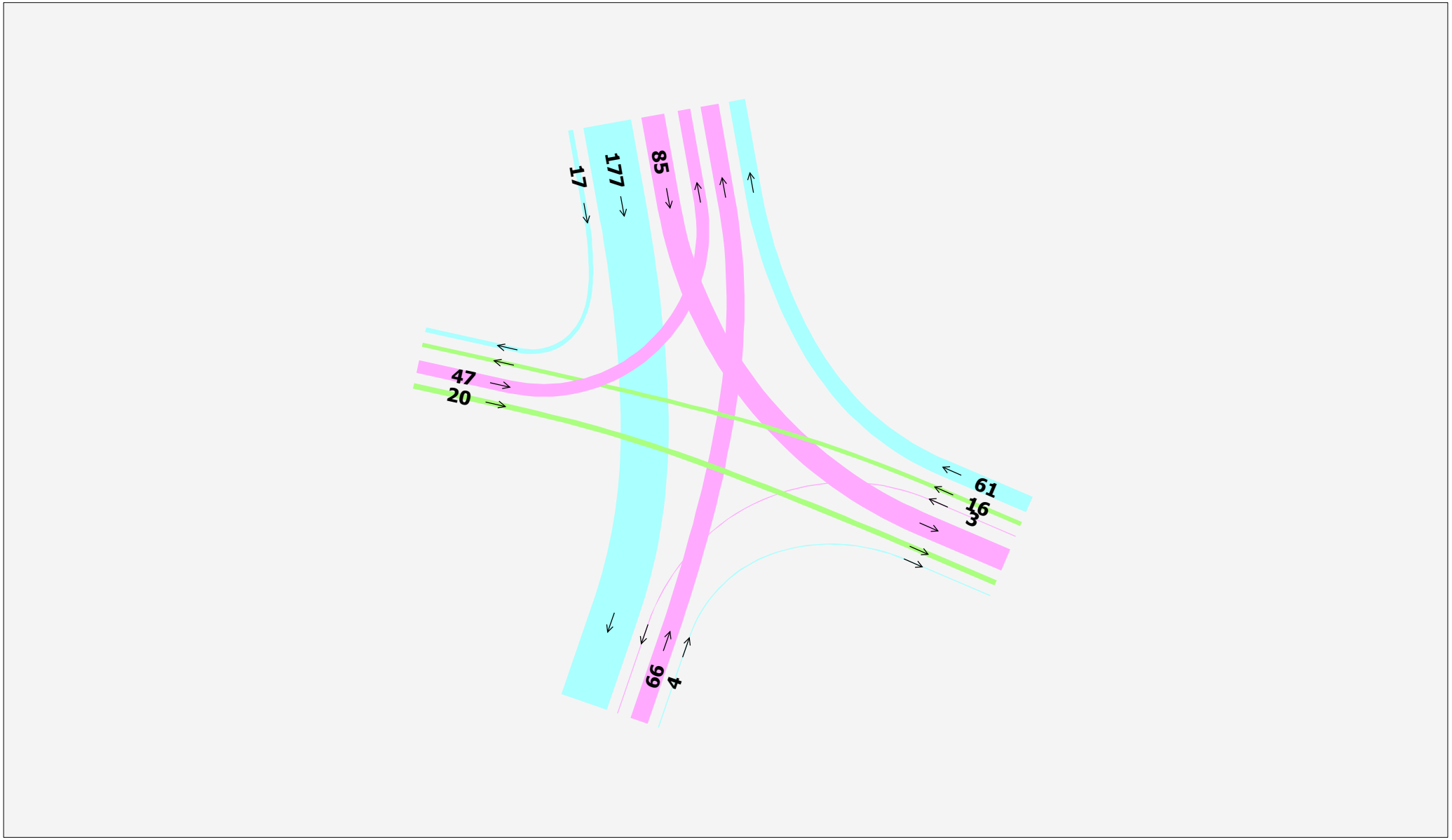
Redland 23:00

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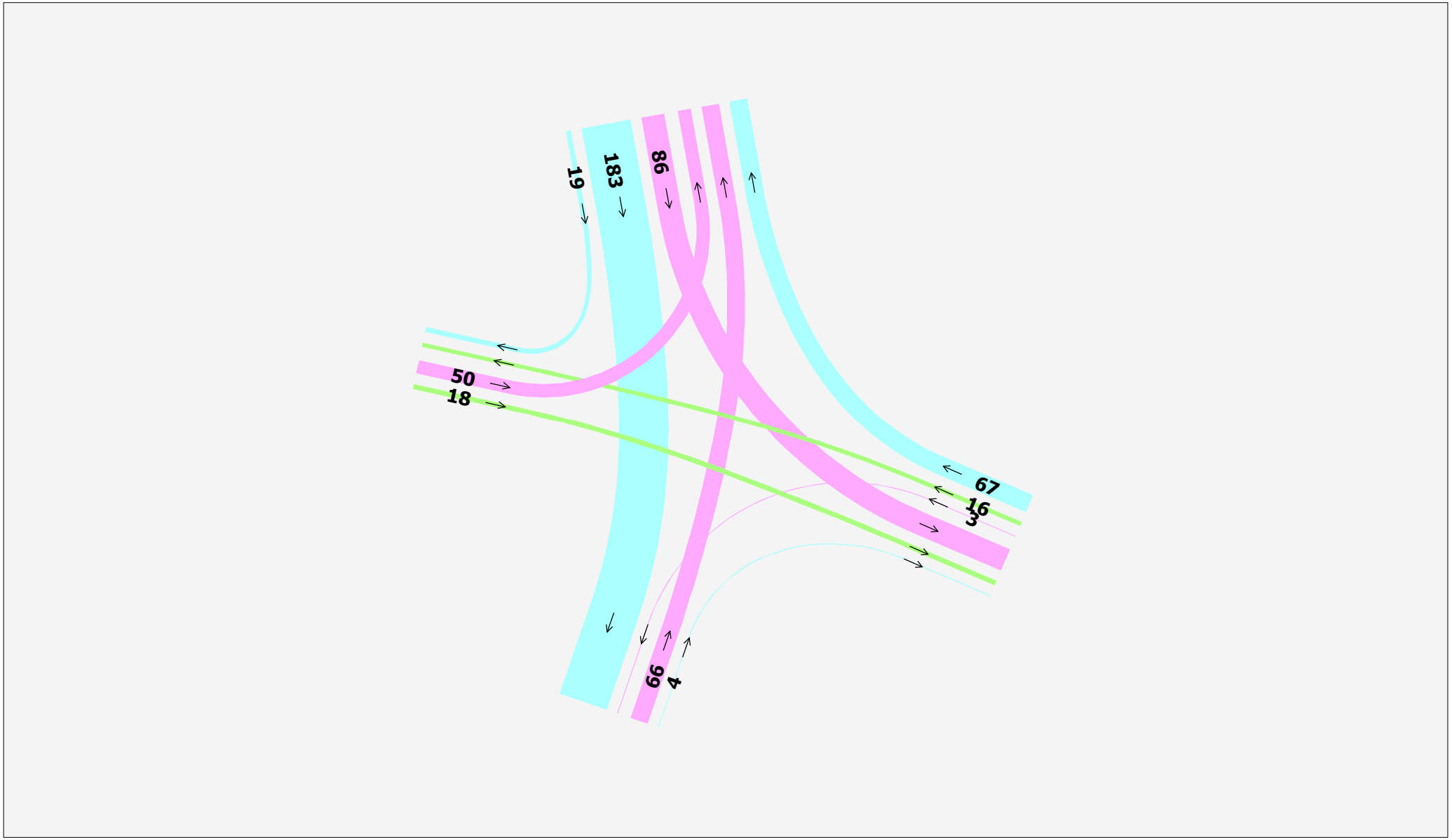
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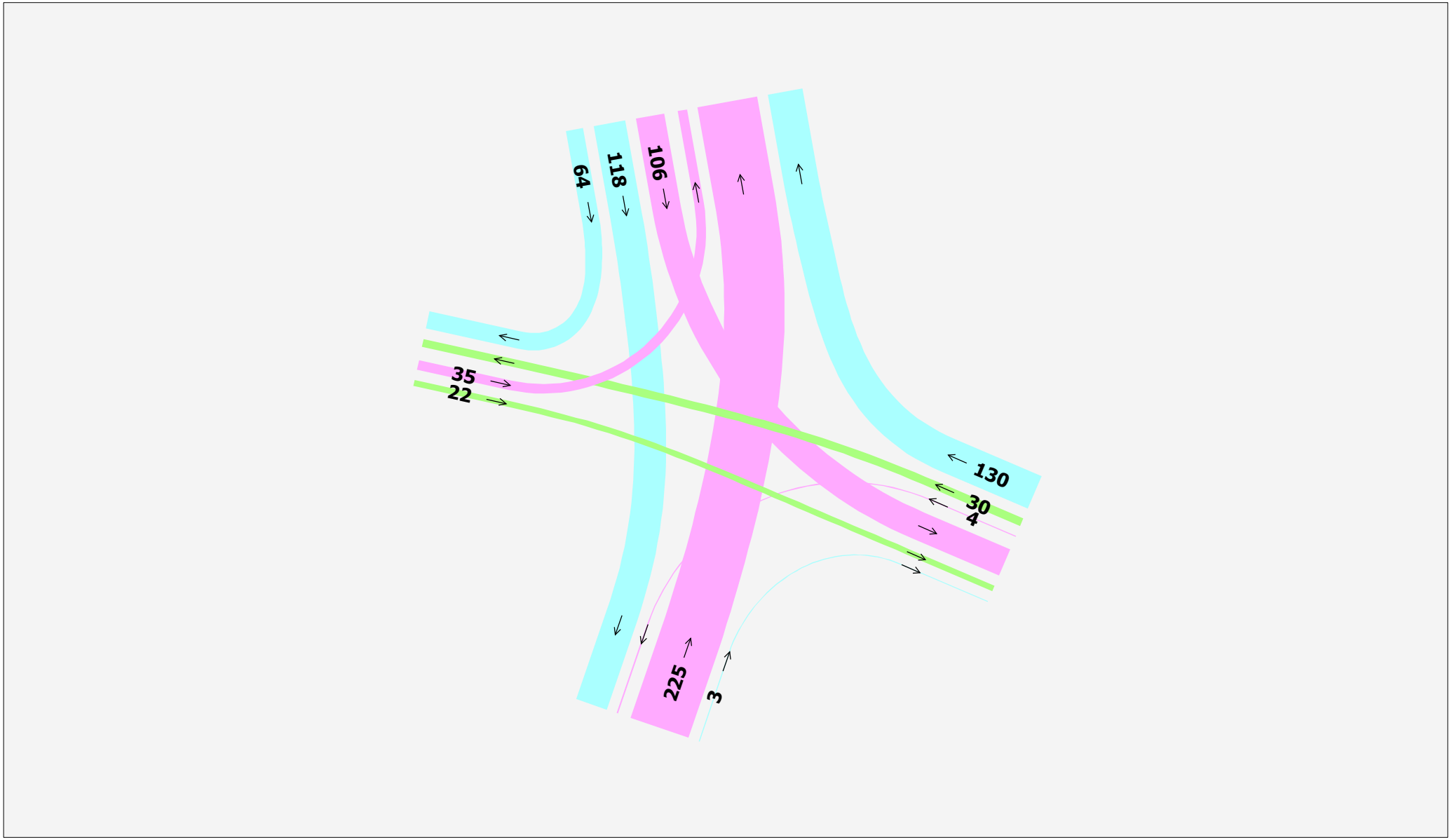
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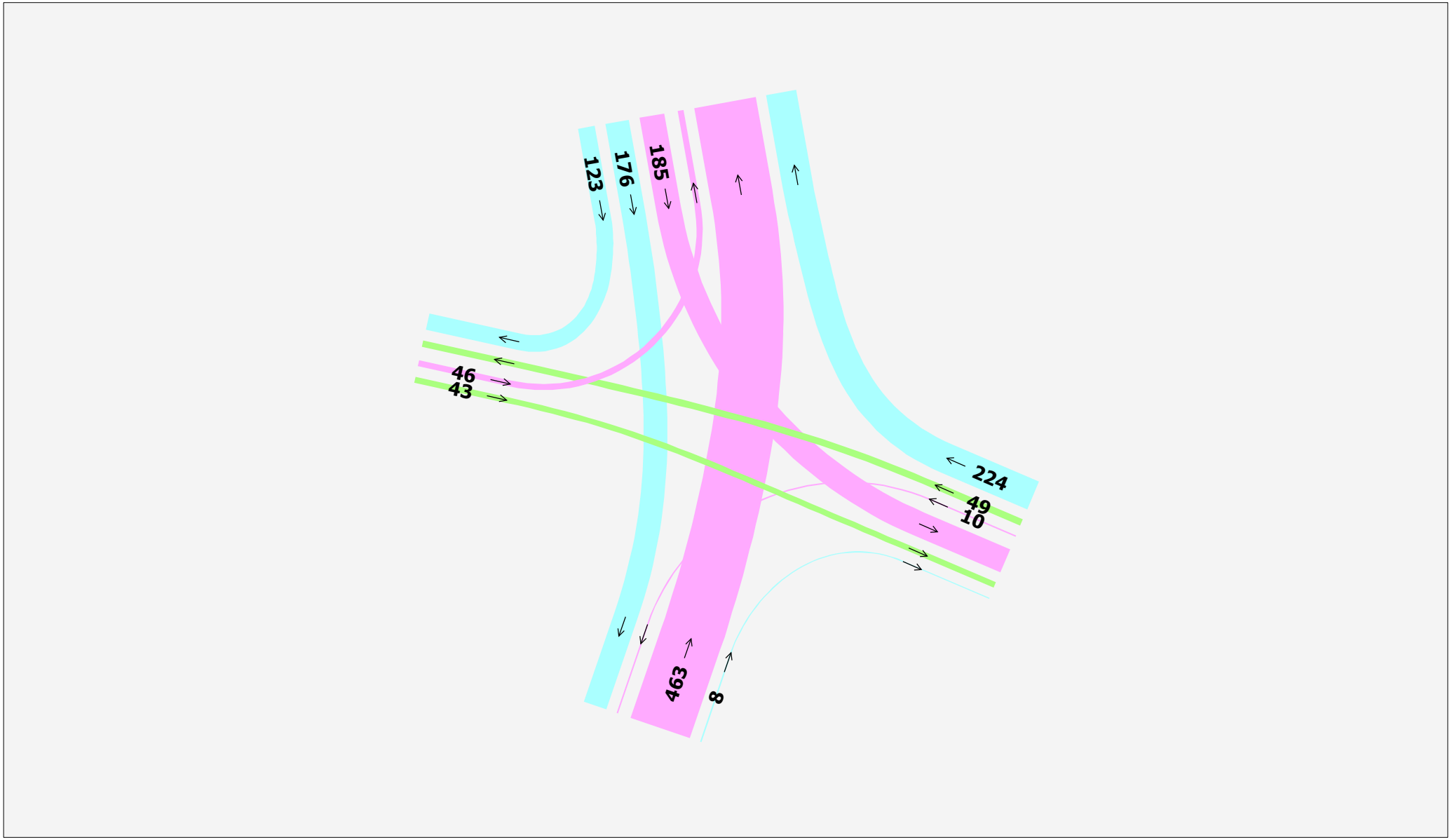
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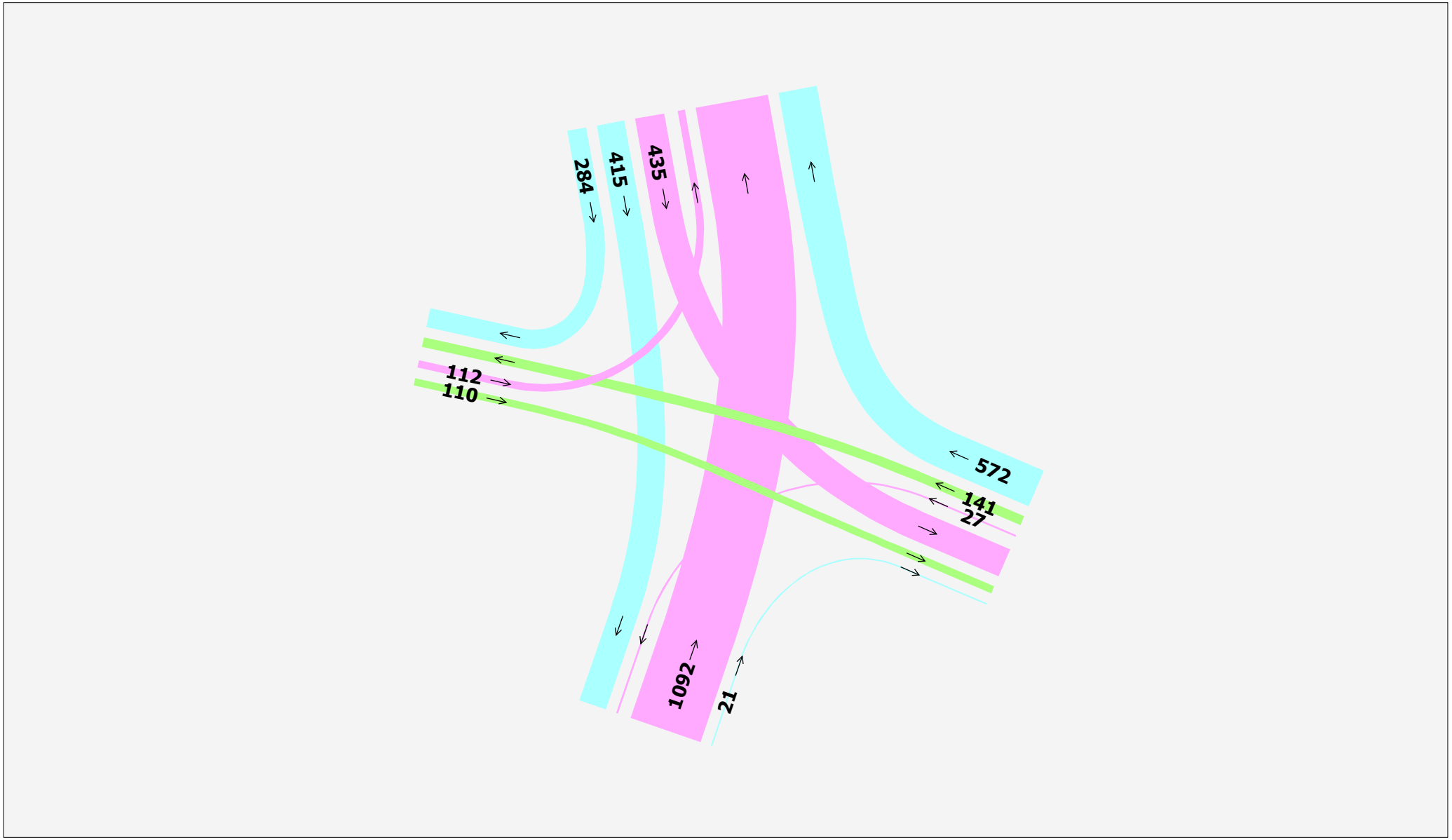
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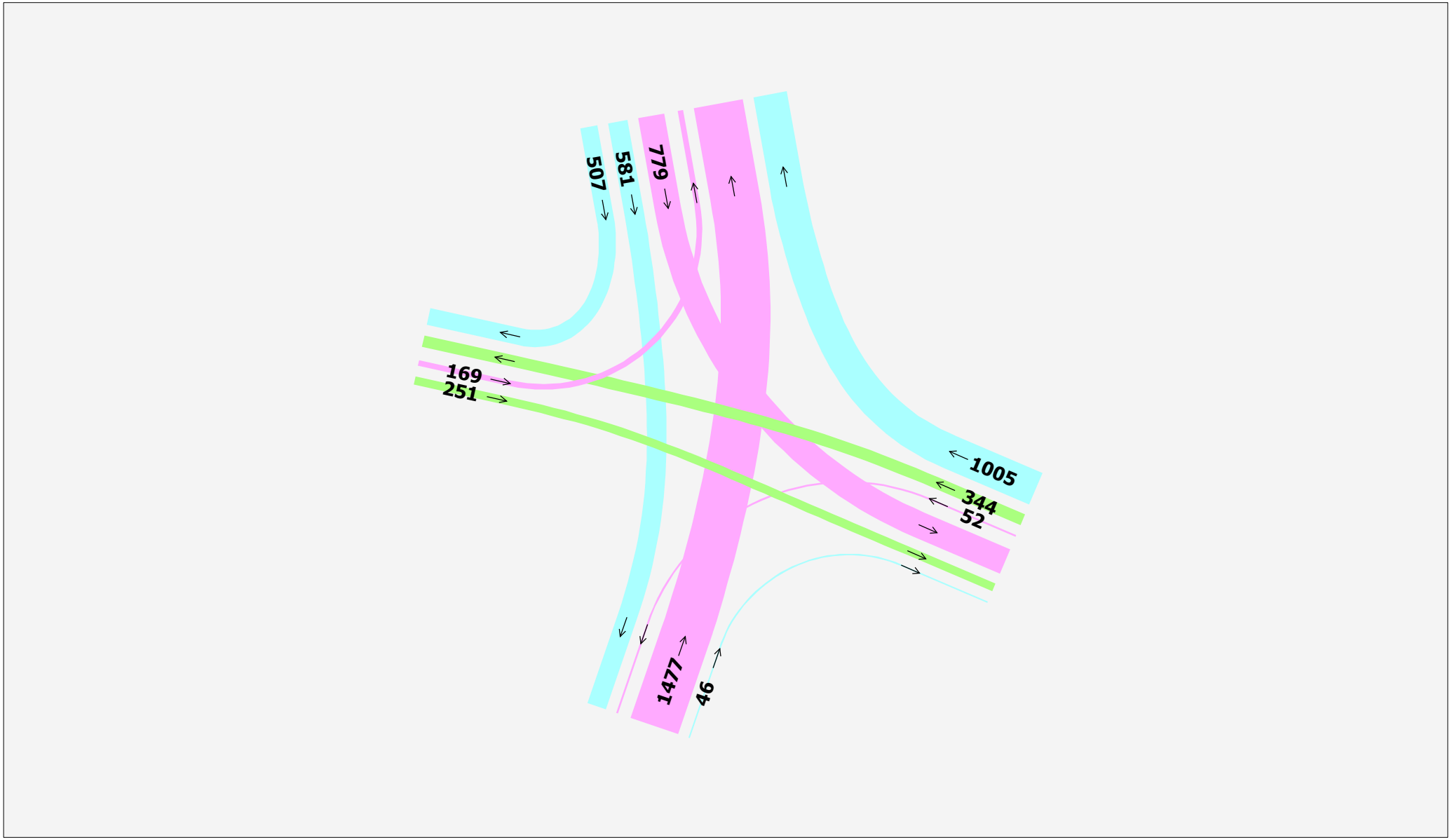
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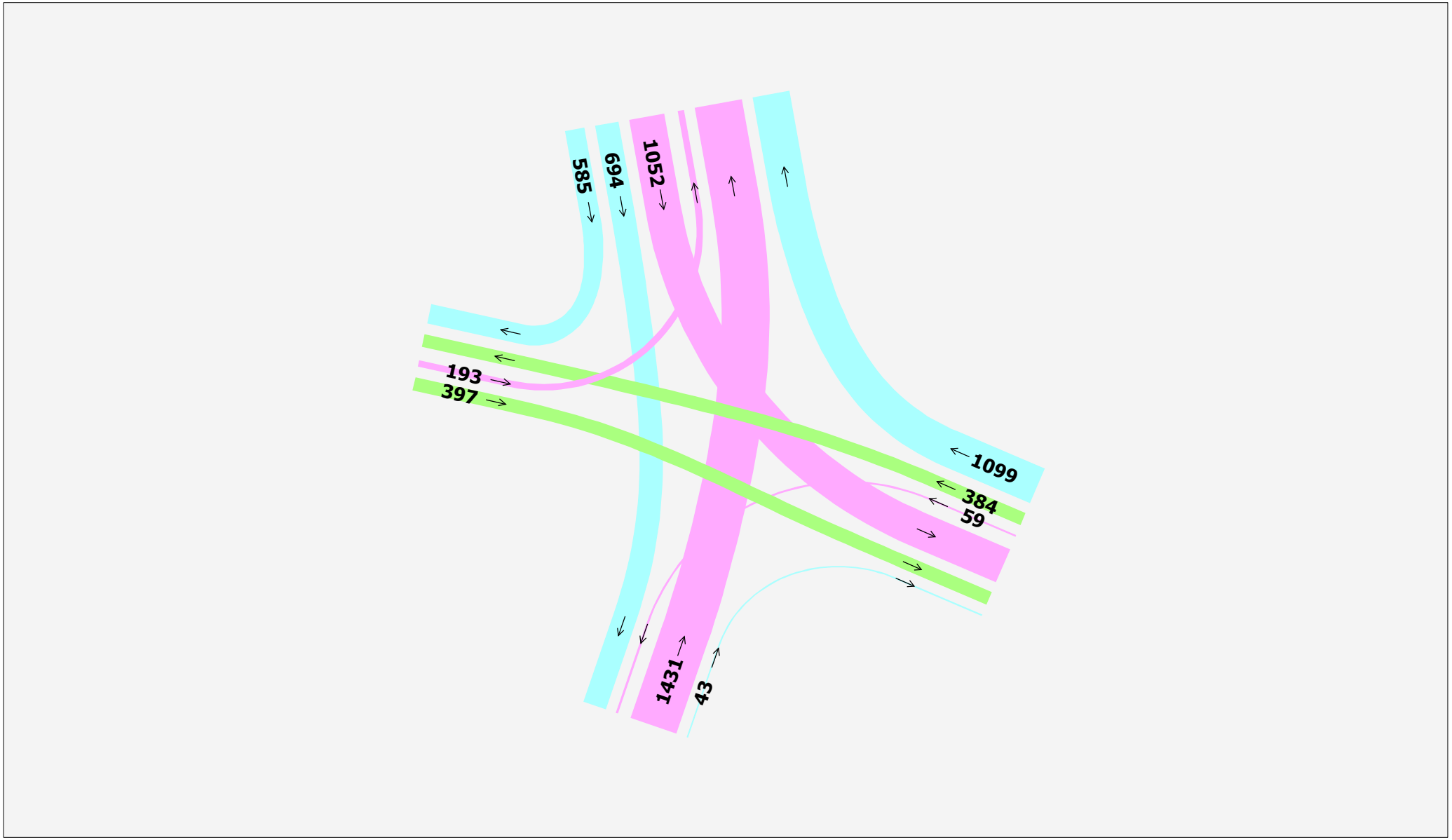
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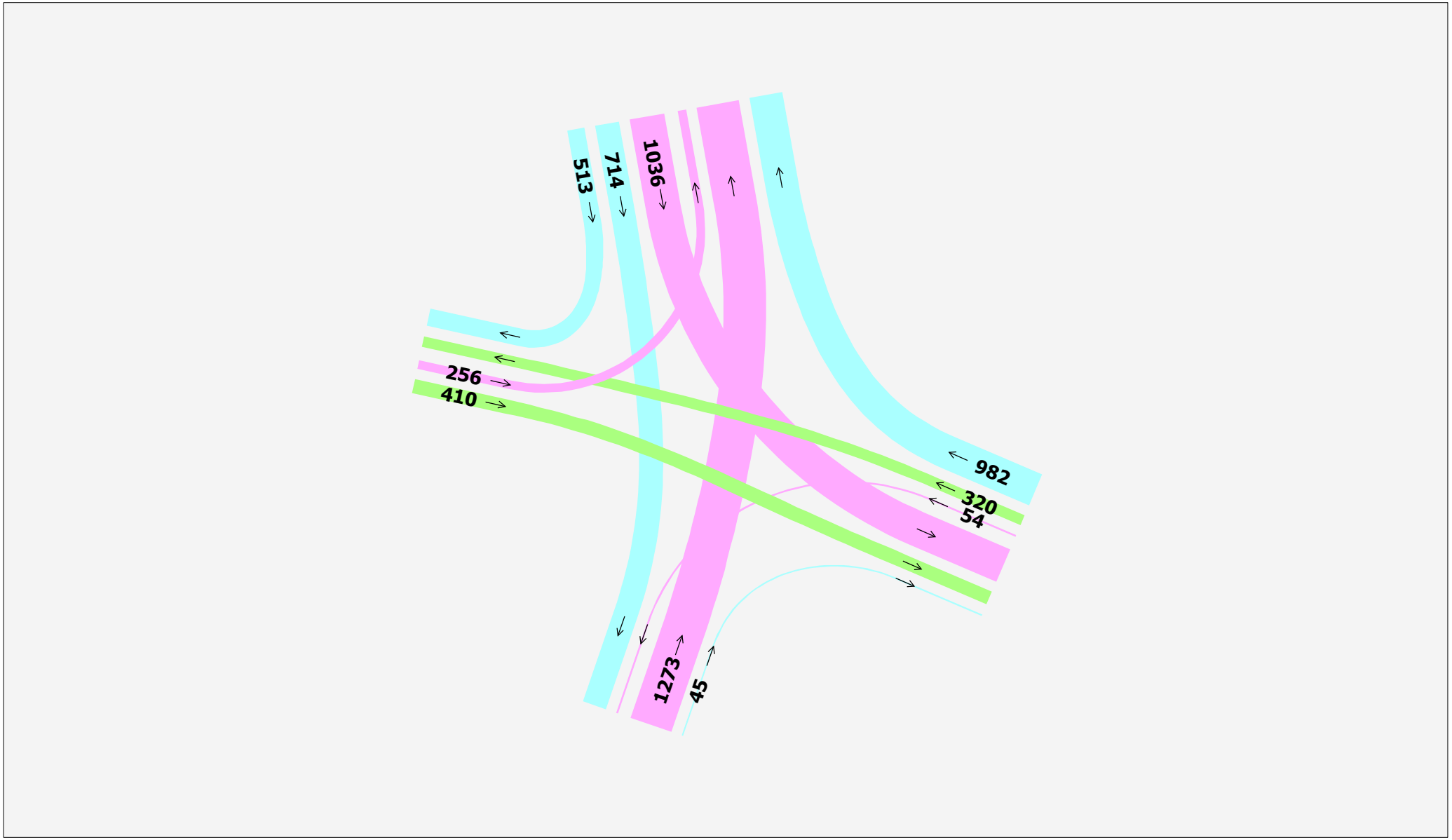
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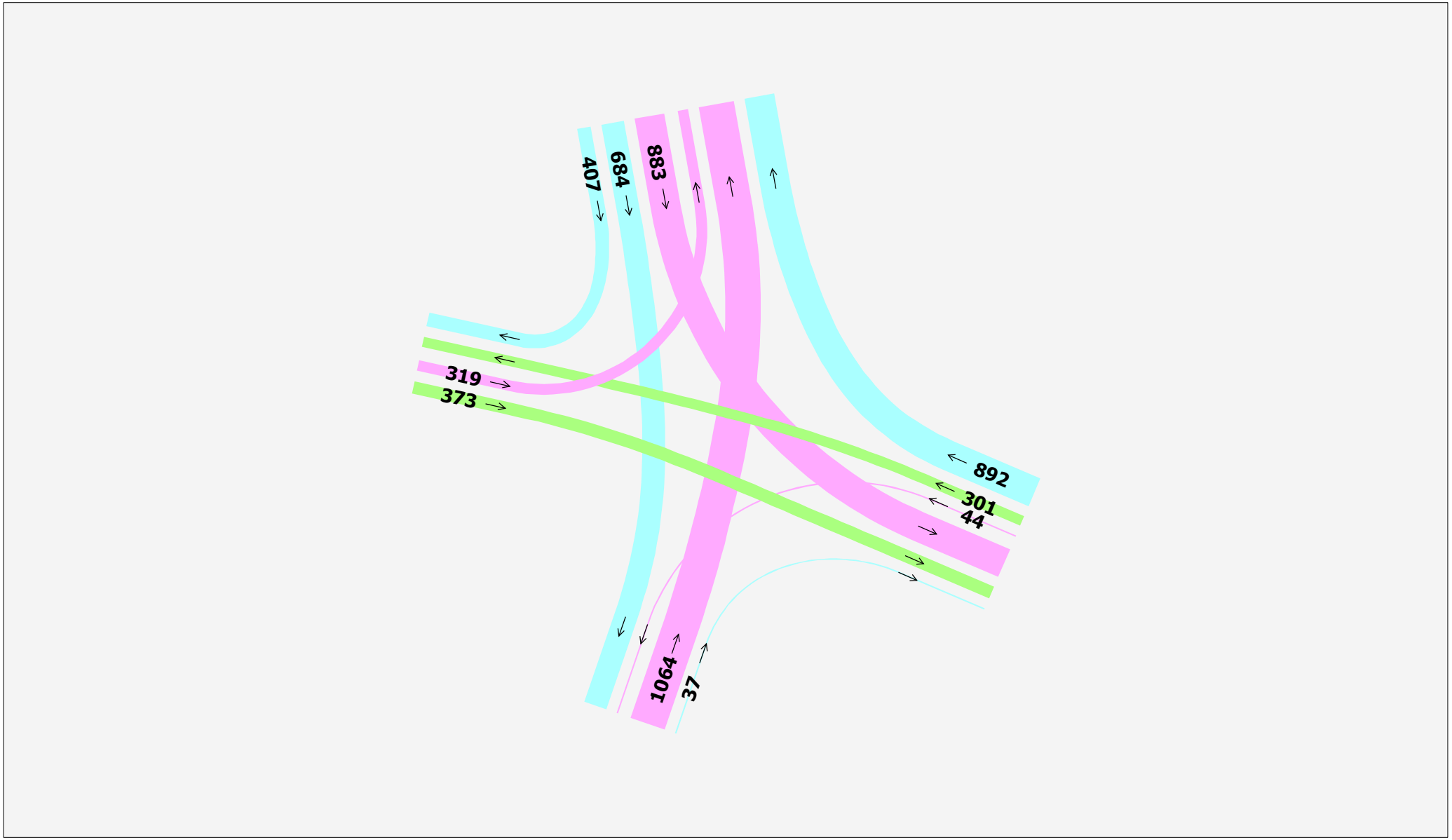
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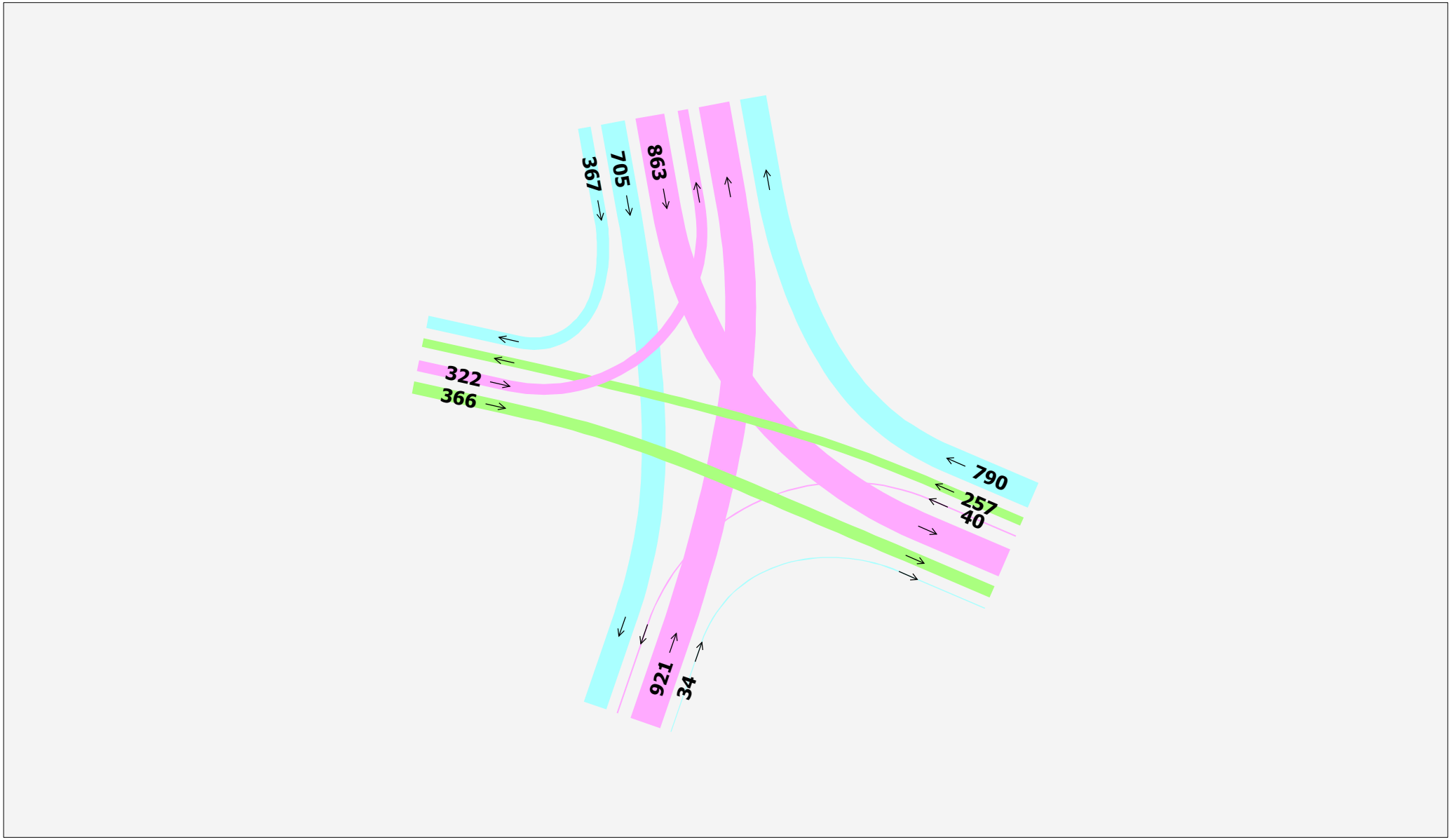
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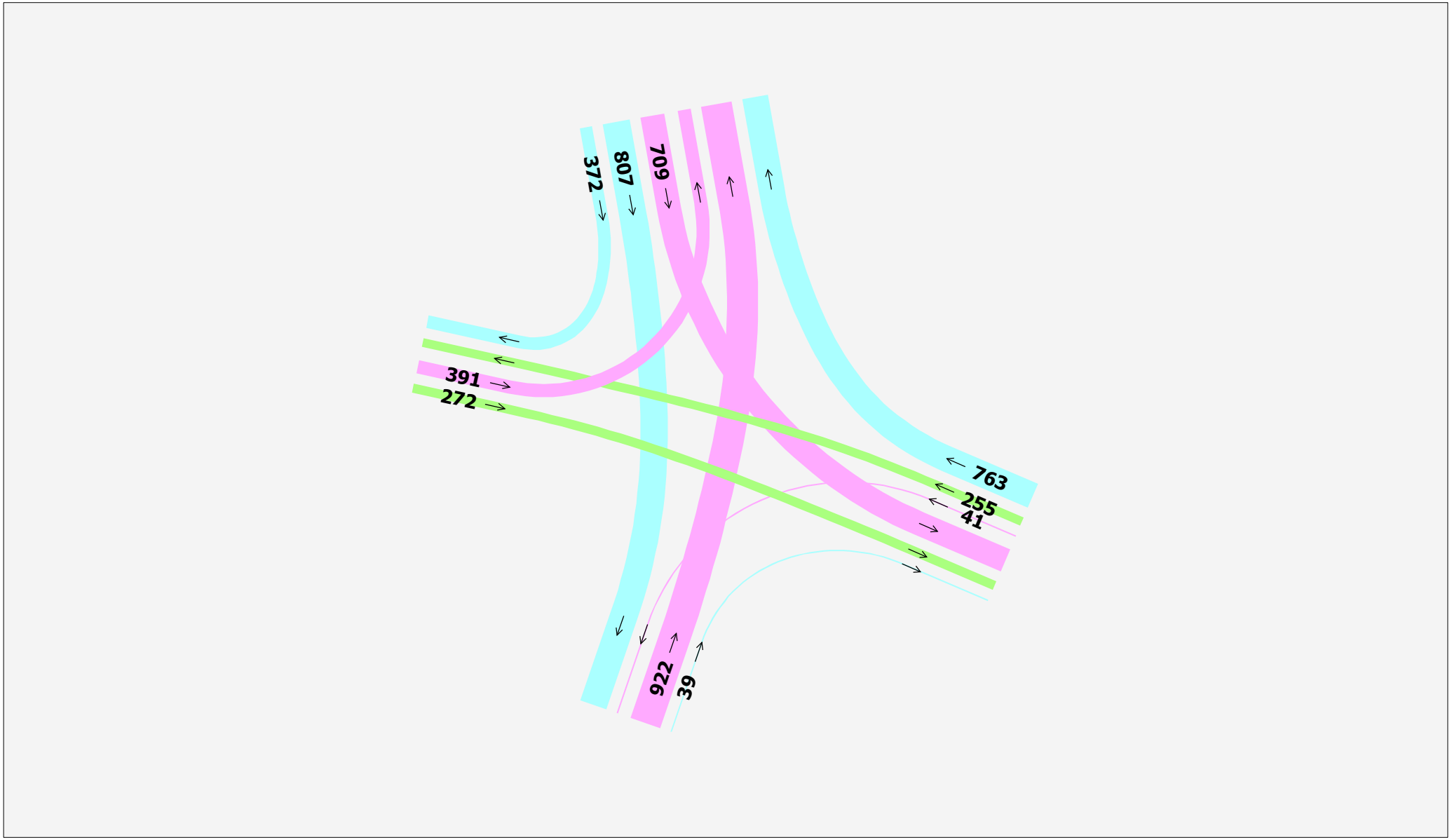
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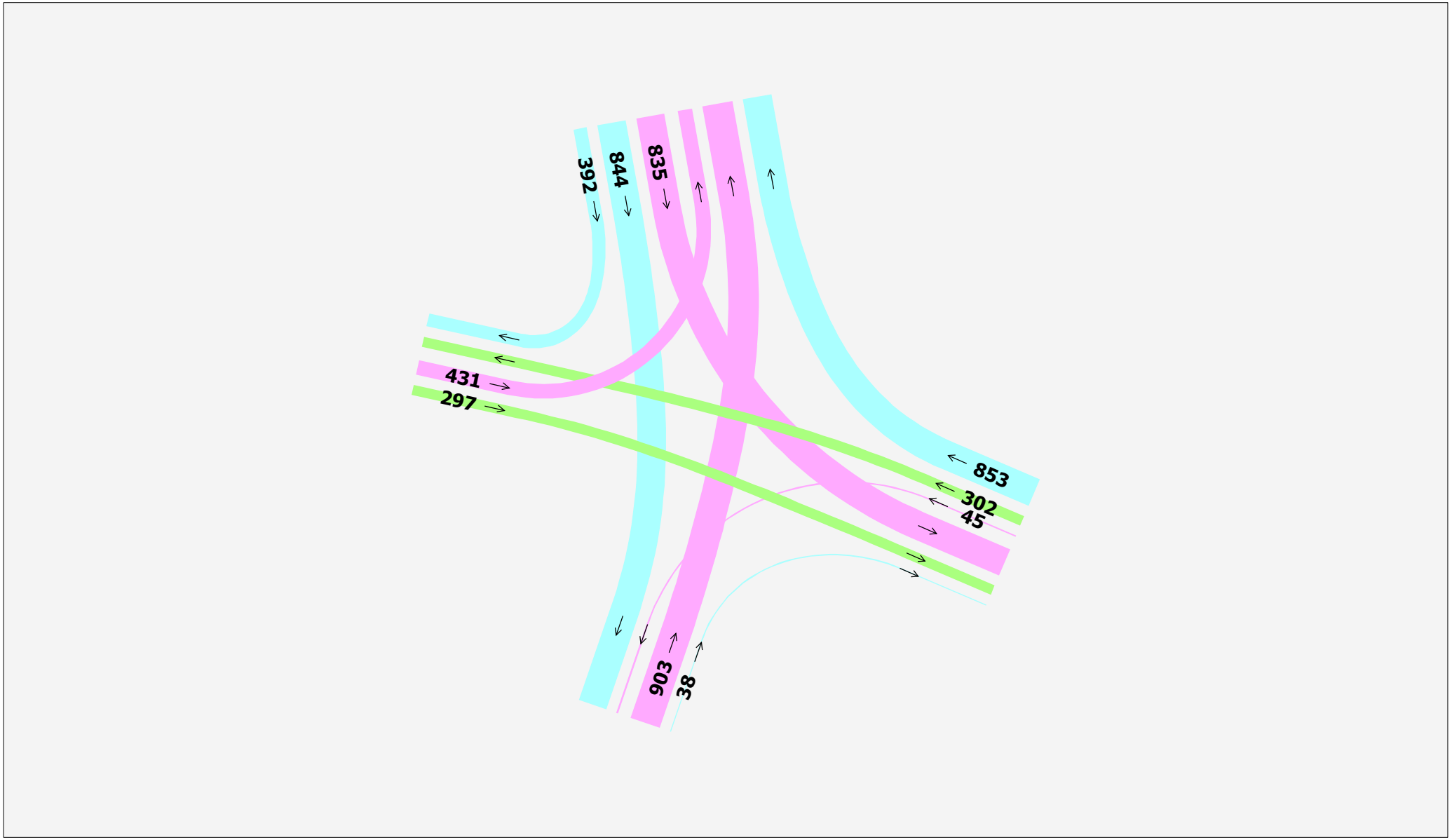
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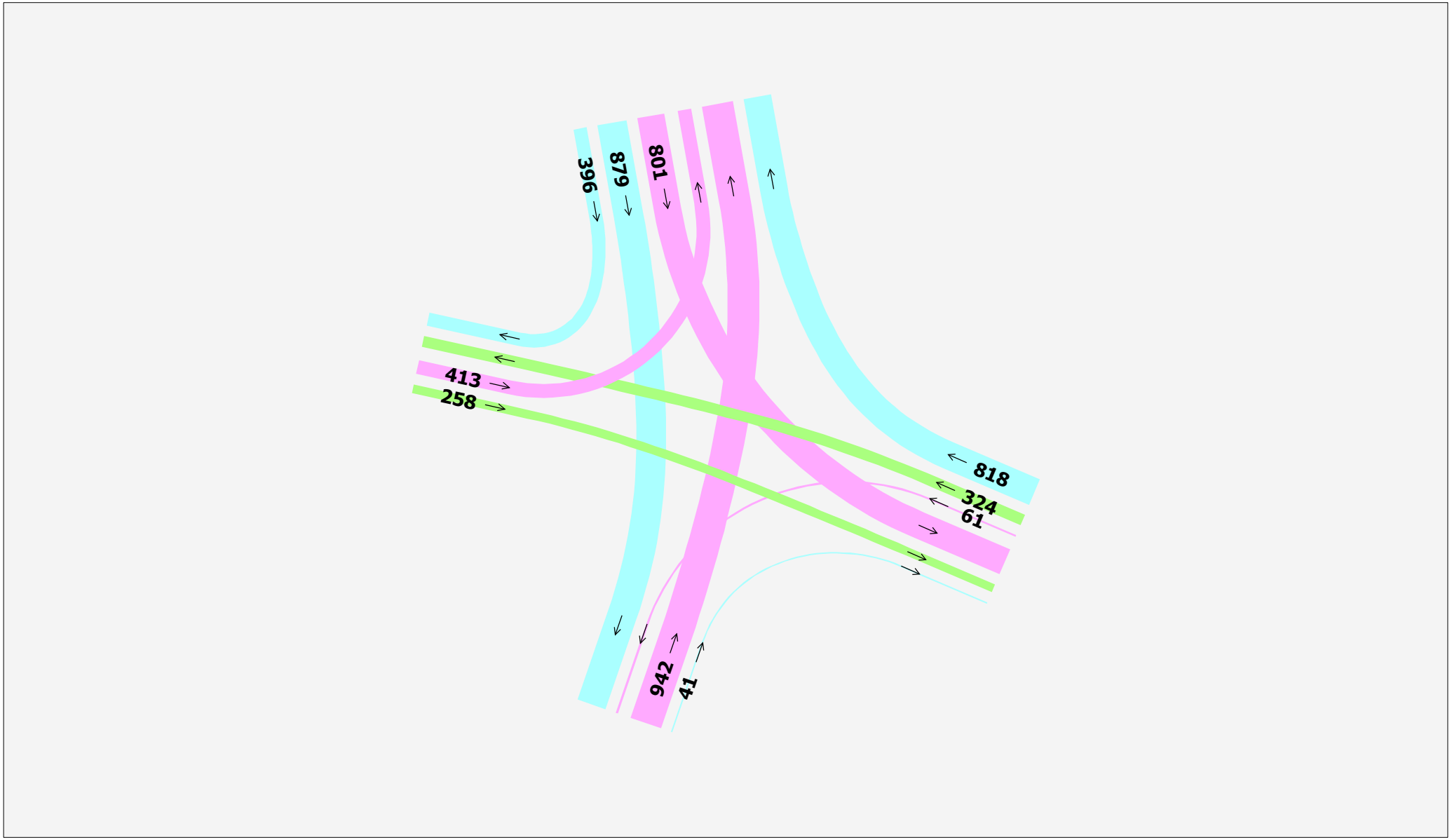
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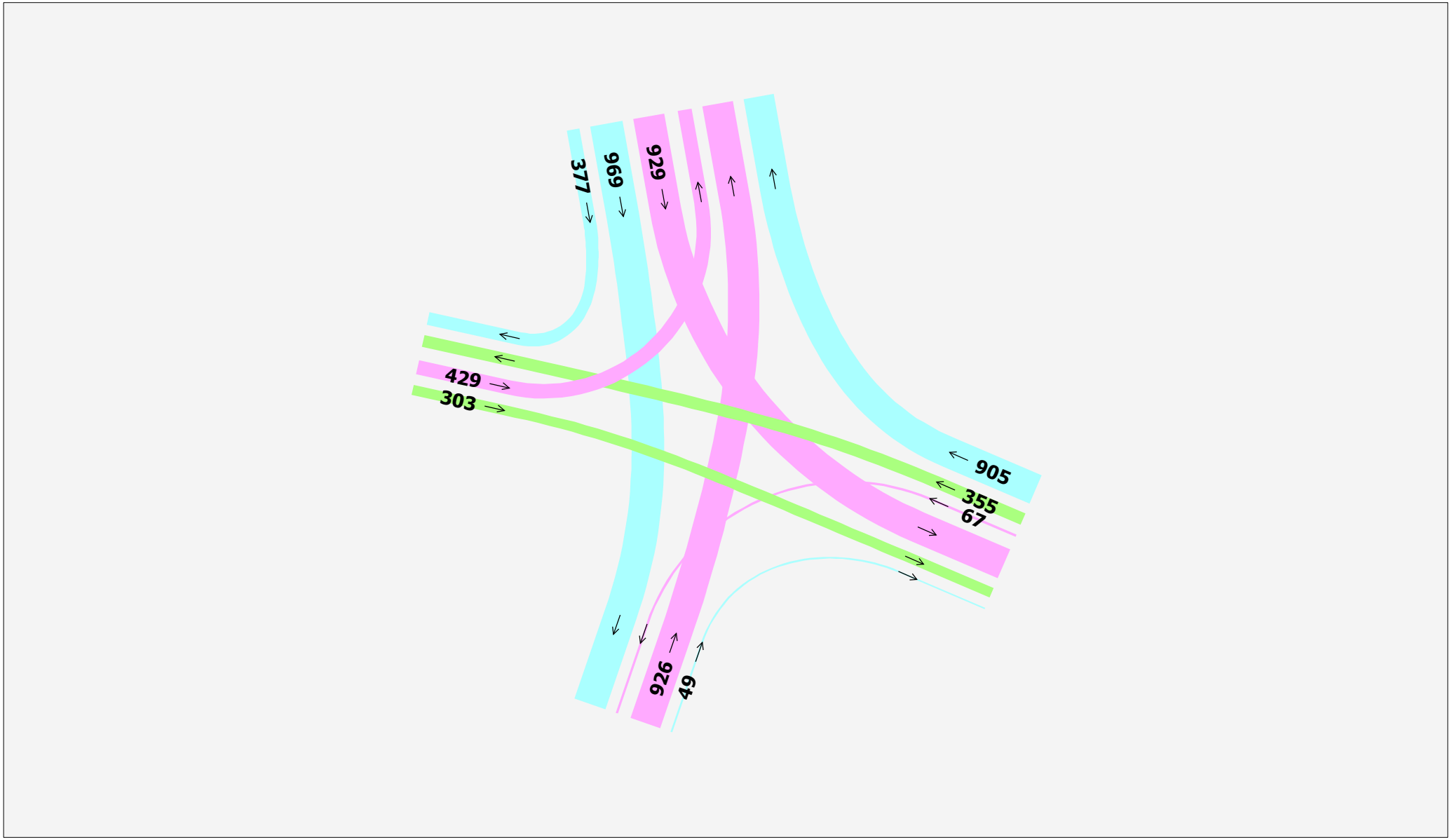
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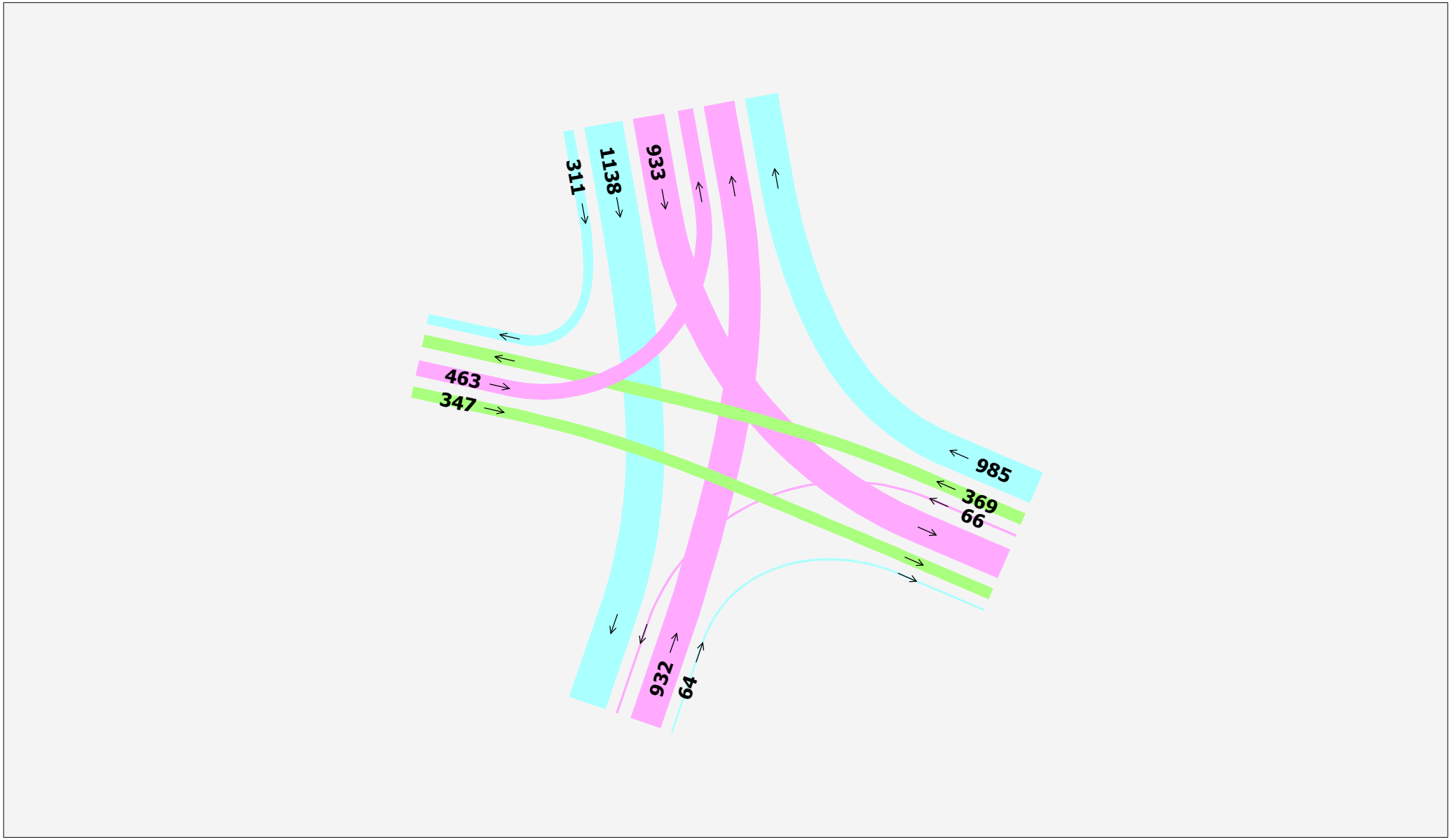
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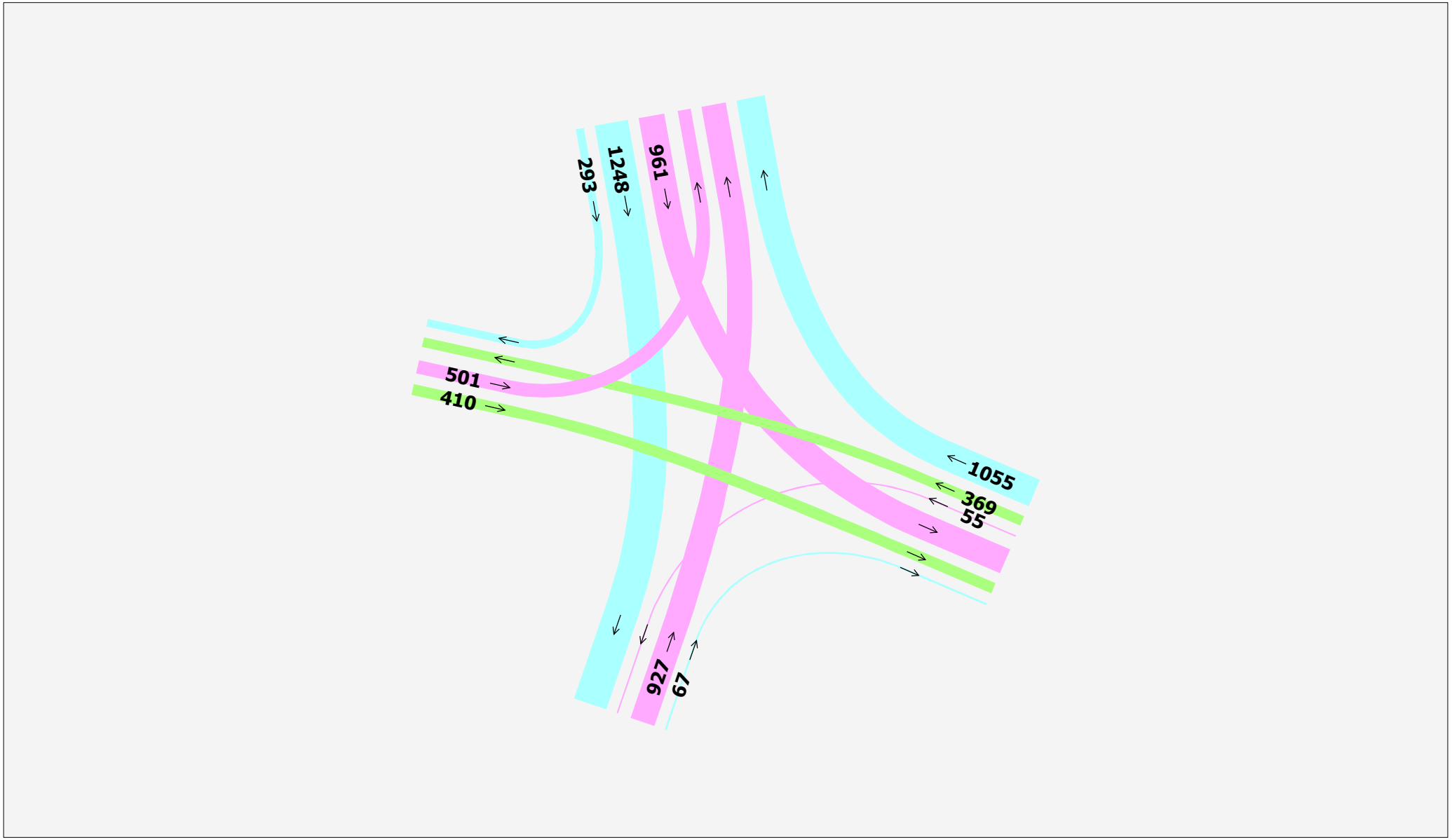
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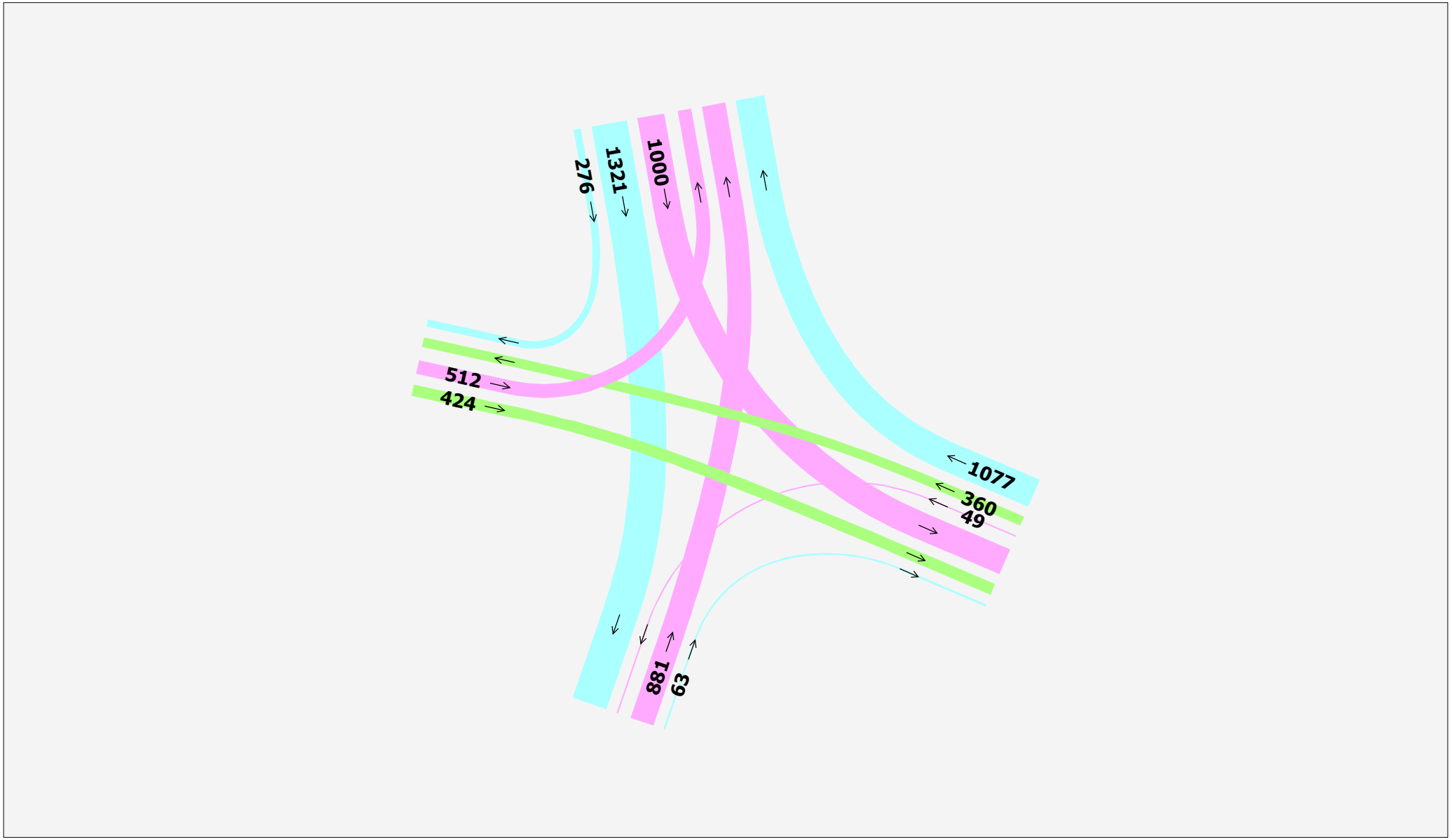
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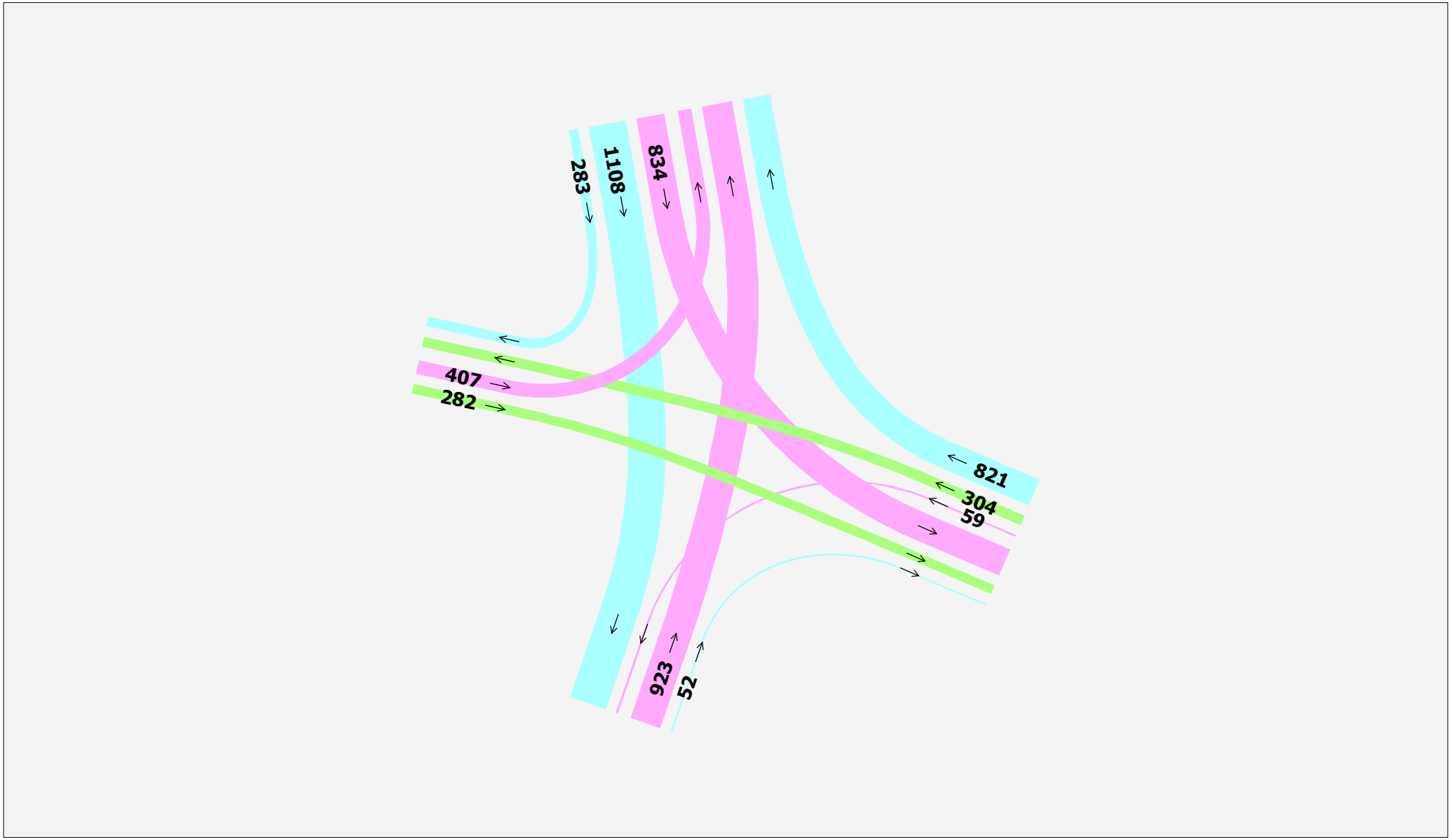
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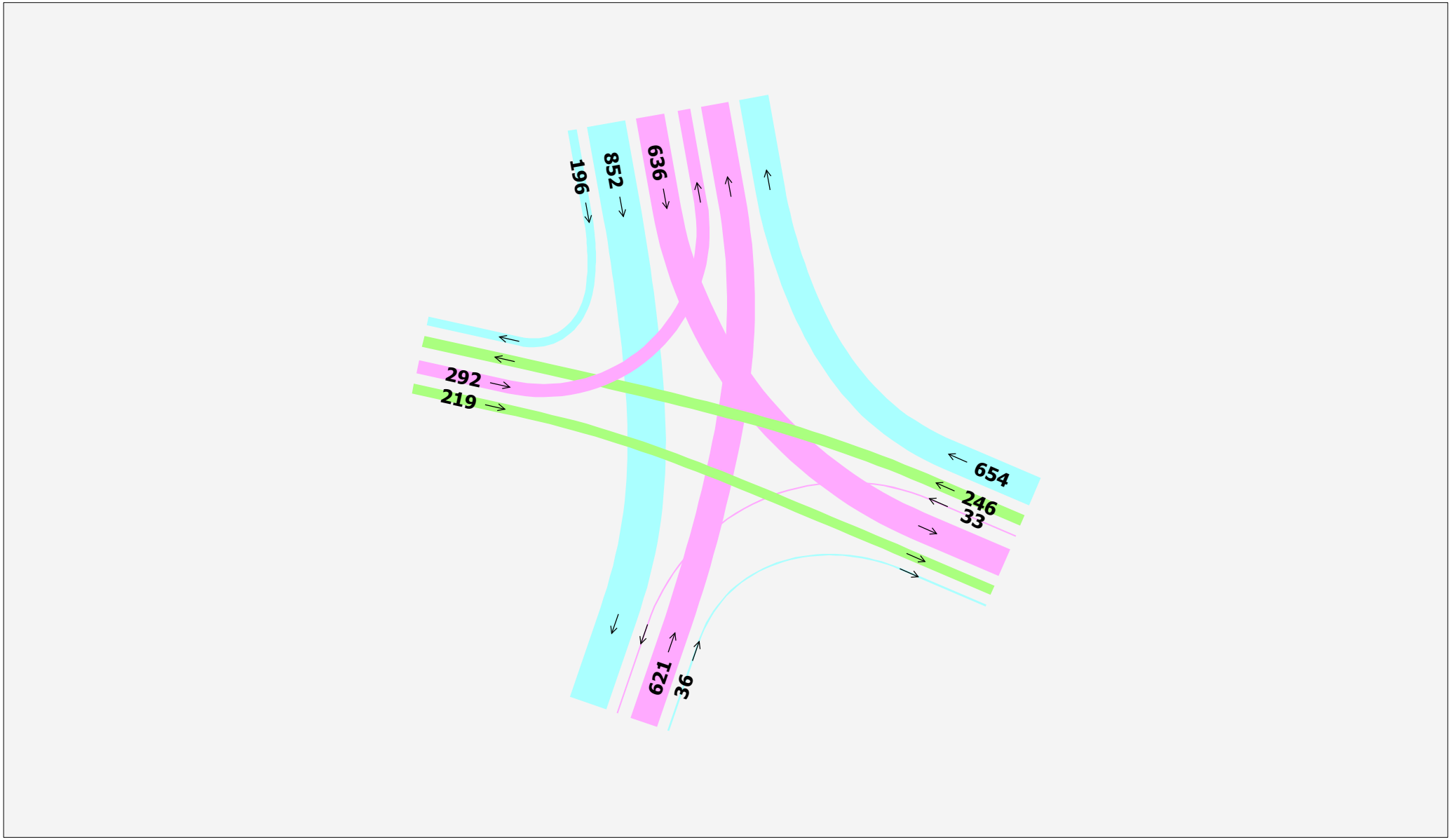
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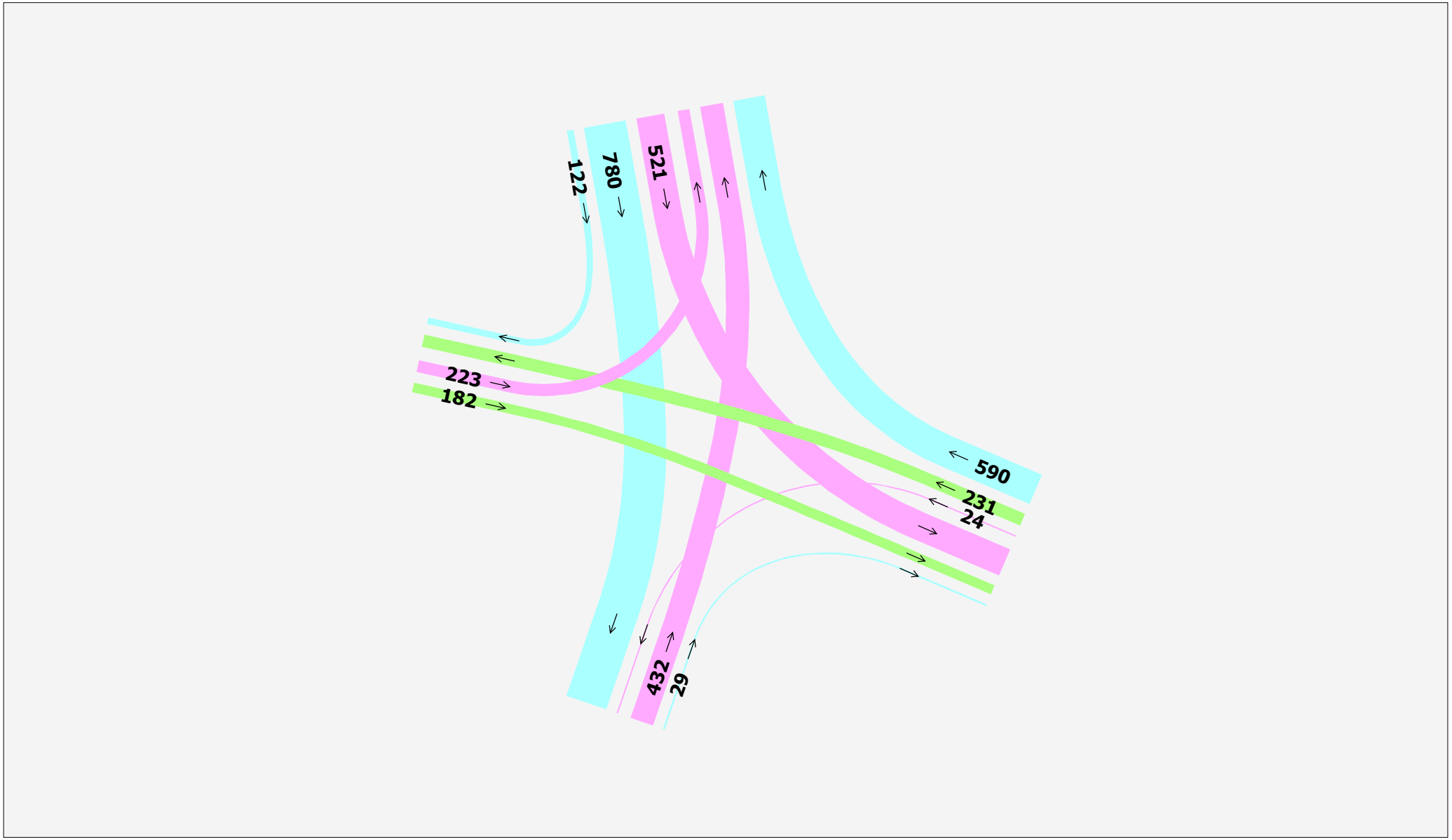
Beavercreek 18:00

2040



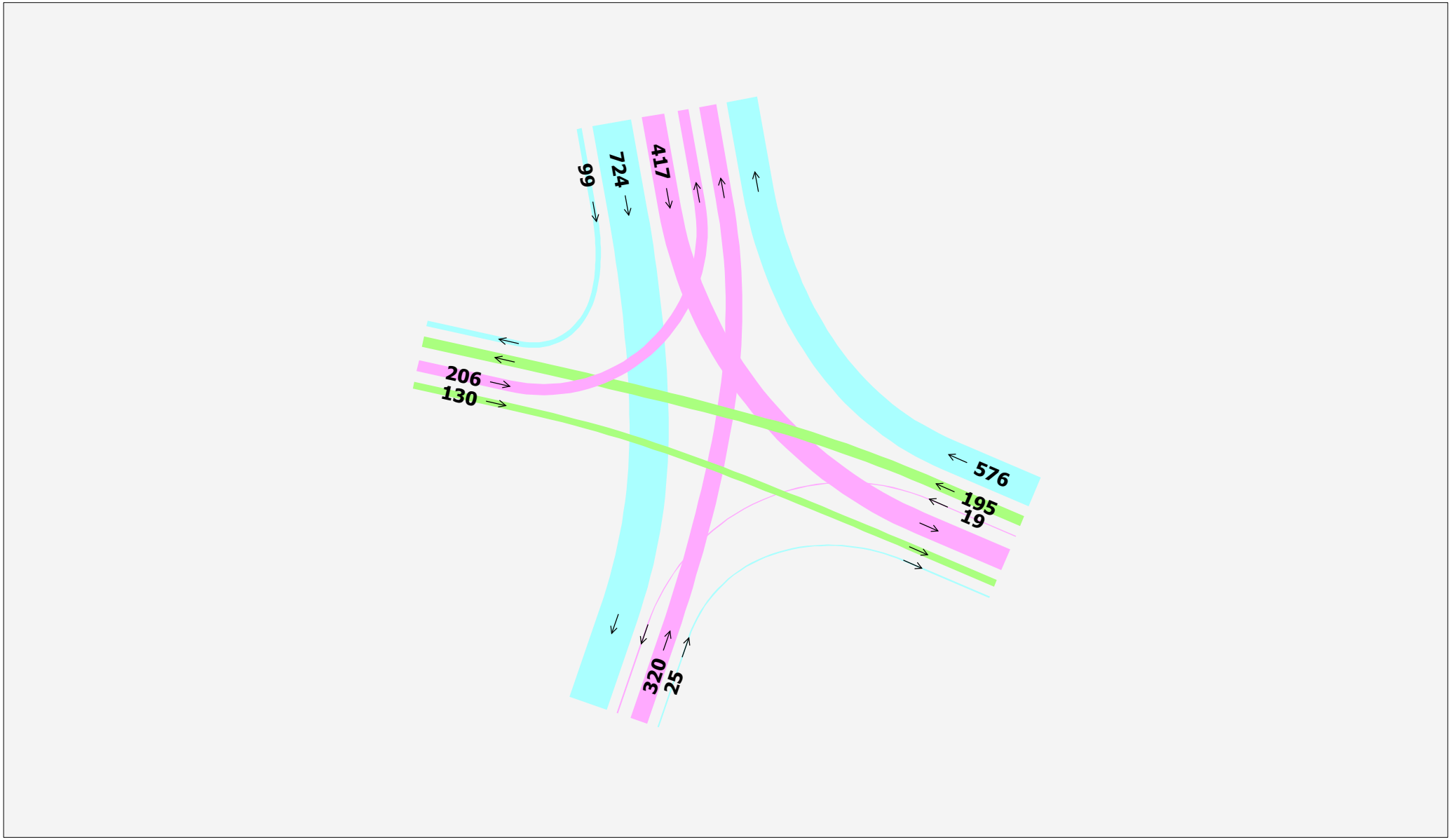
Beavercreek 19:00

2040



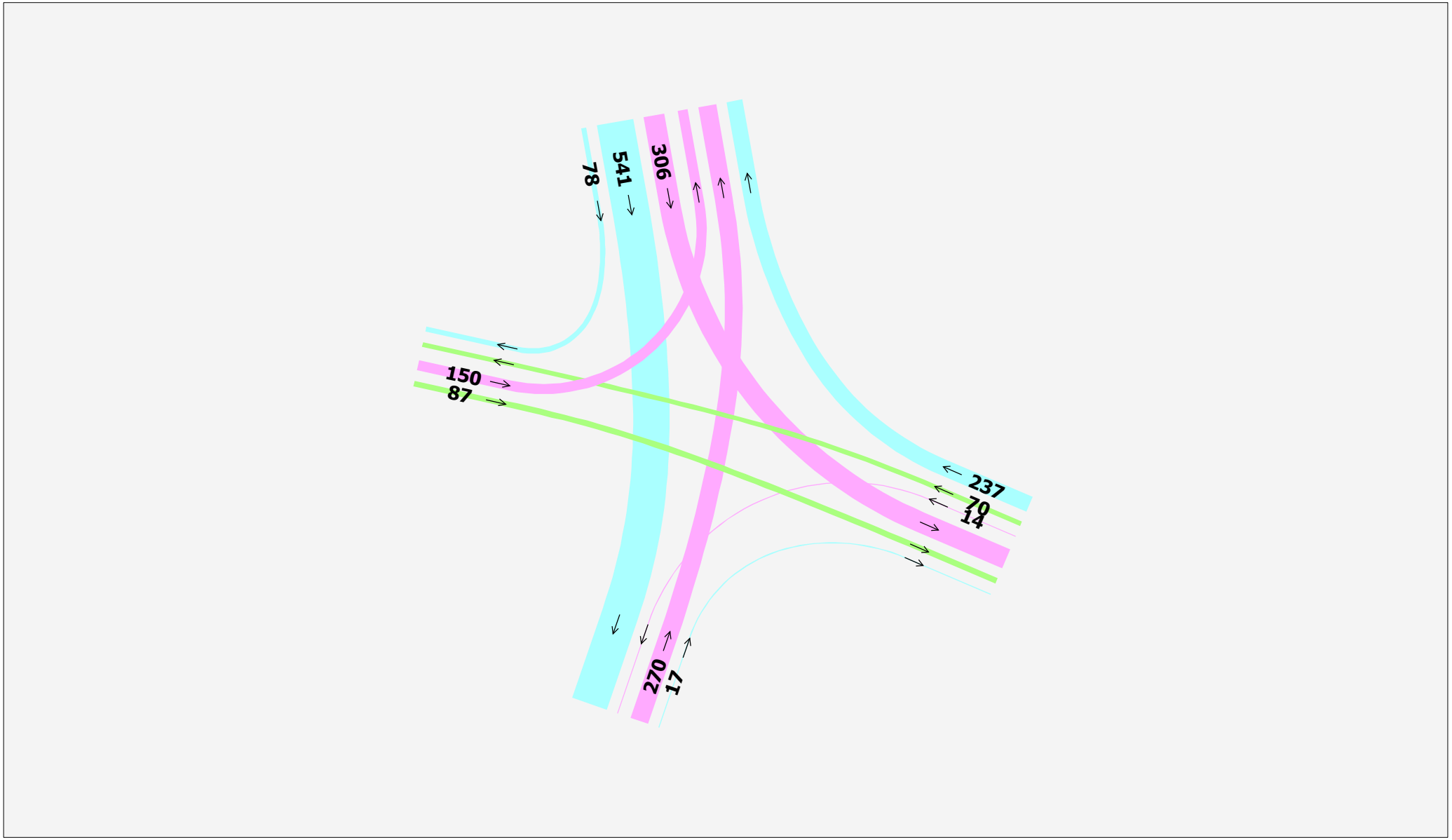
Beavercreek 20:00

2040



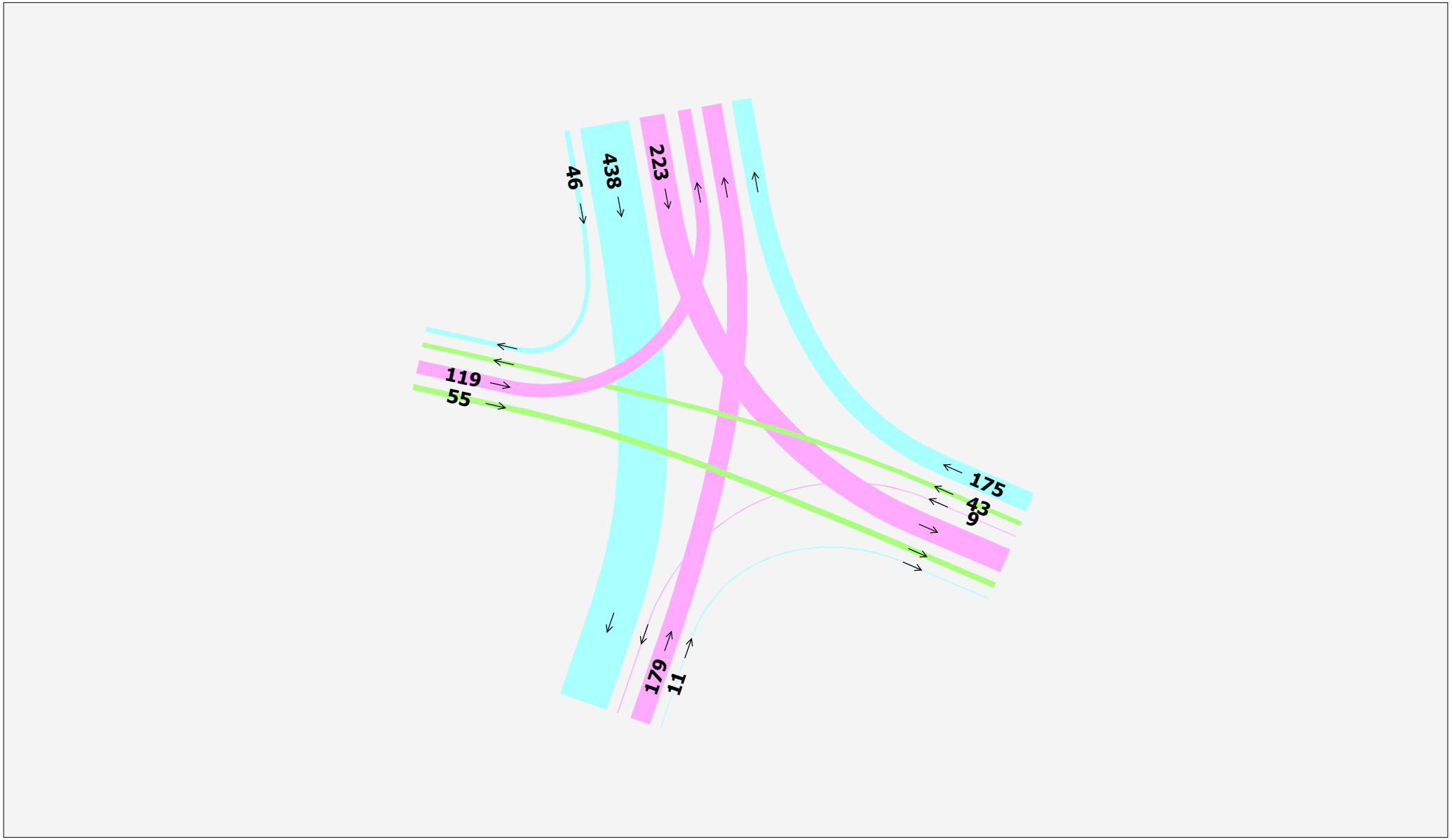
Beavercreek 21:00

2040



Beavercreek 22:00

2040



Beavercreek 23:00

2040



Redland 0:00

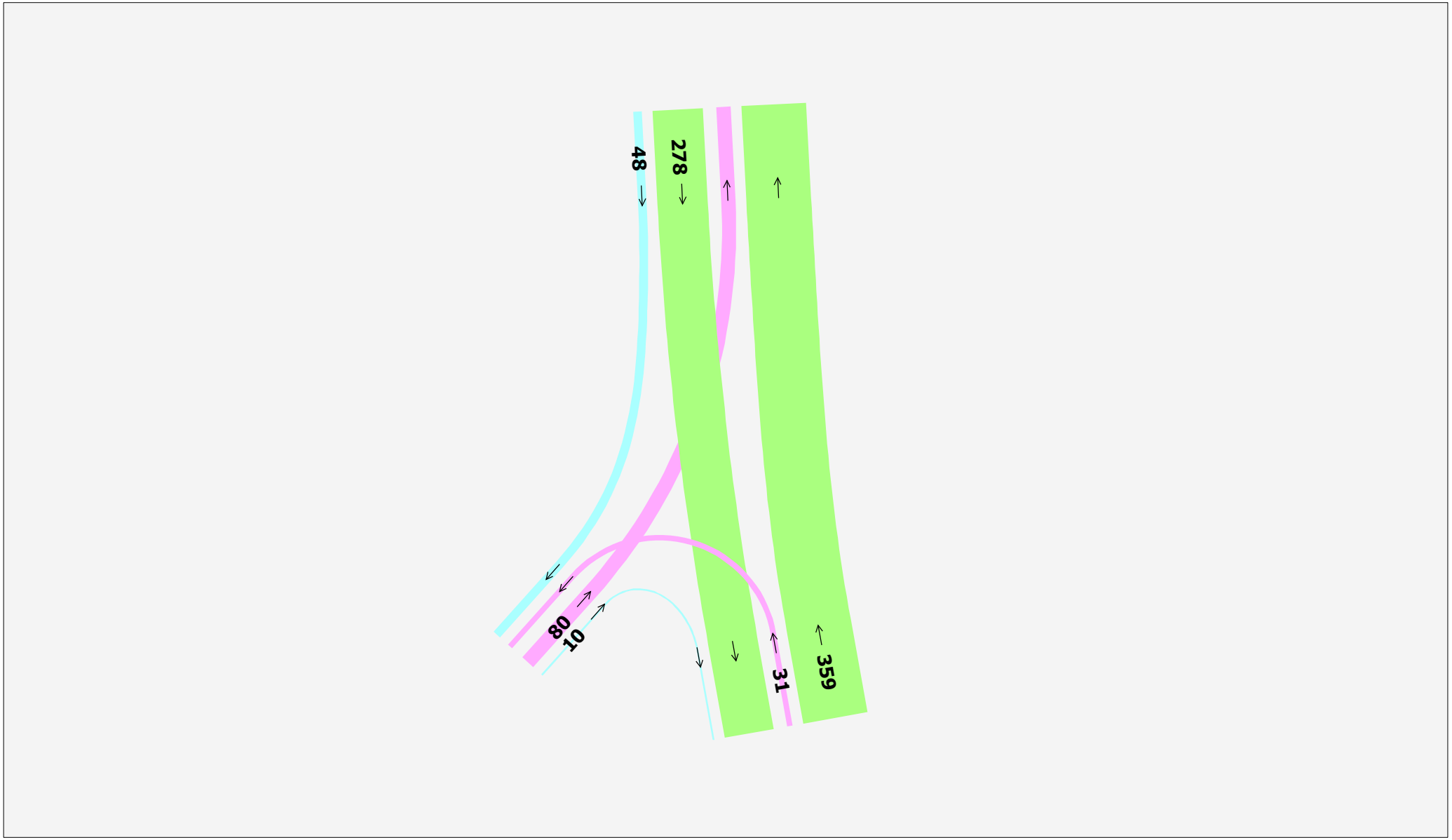
2040



Redland 1:00

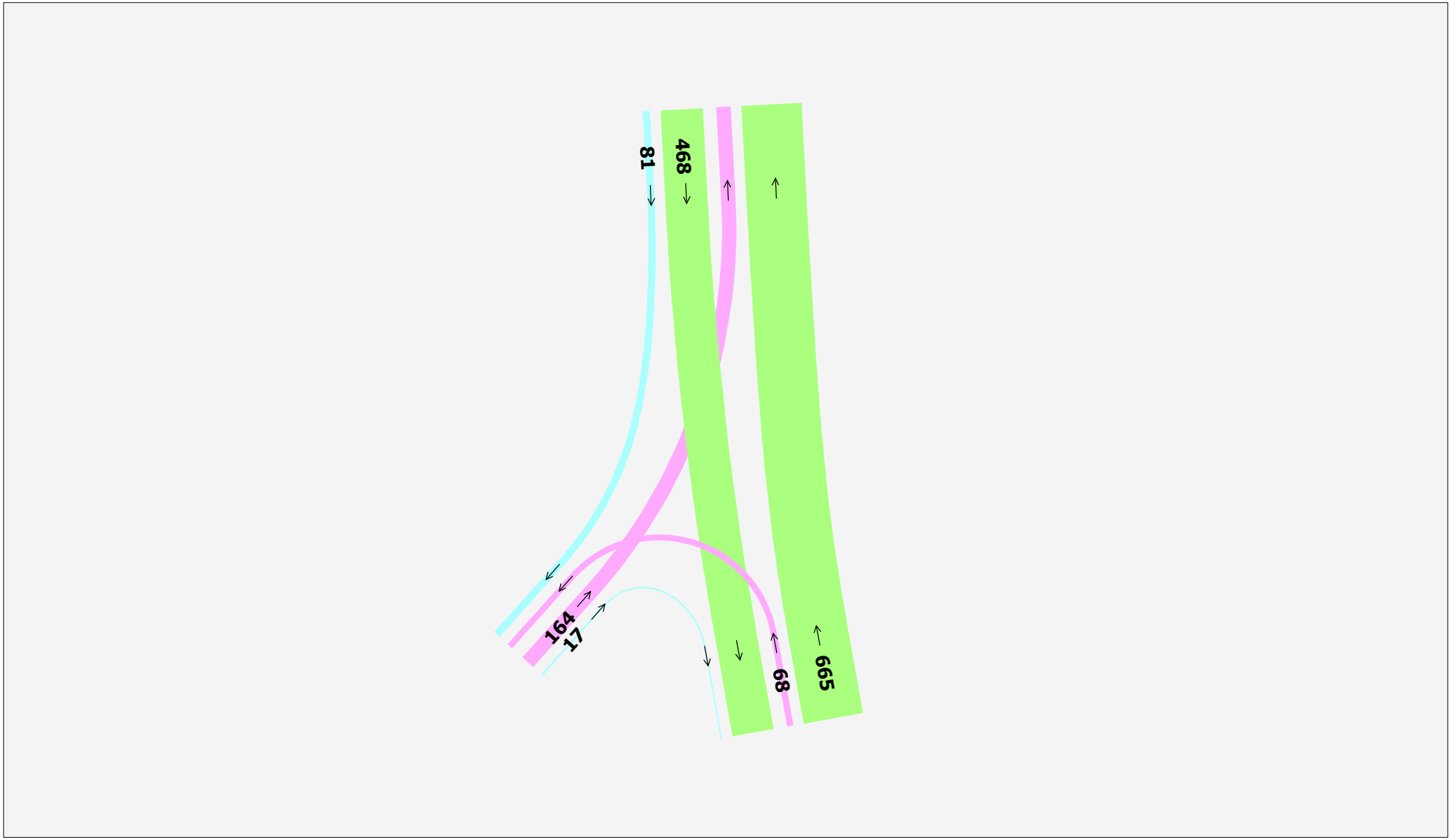

66
273
170
14
41
14
1

2040

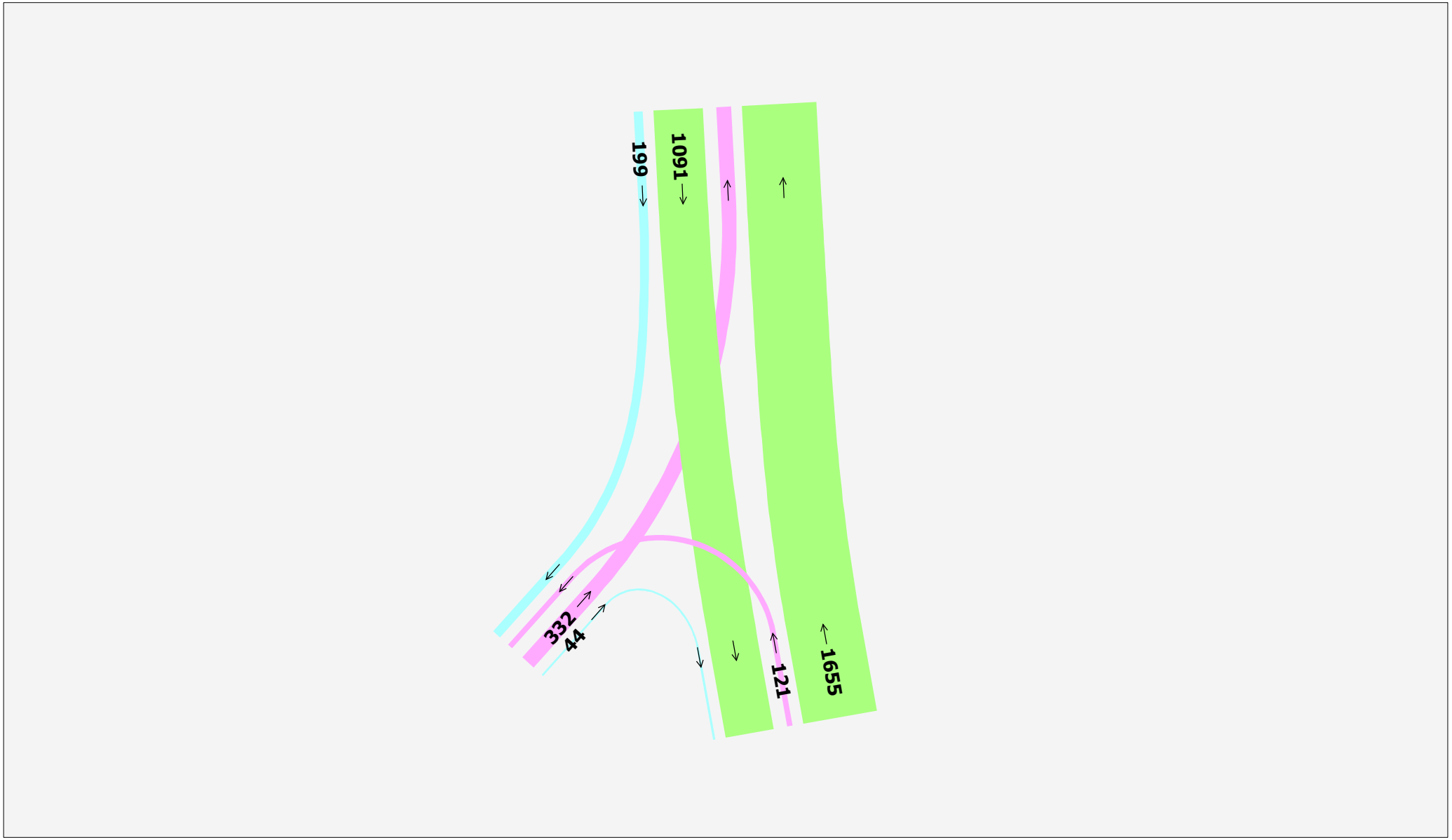


Redland 3:00

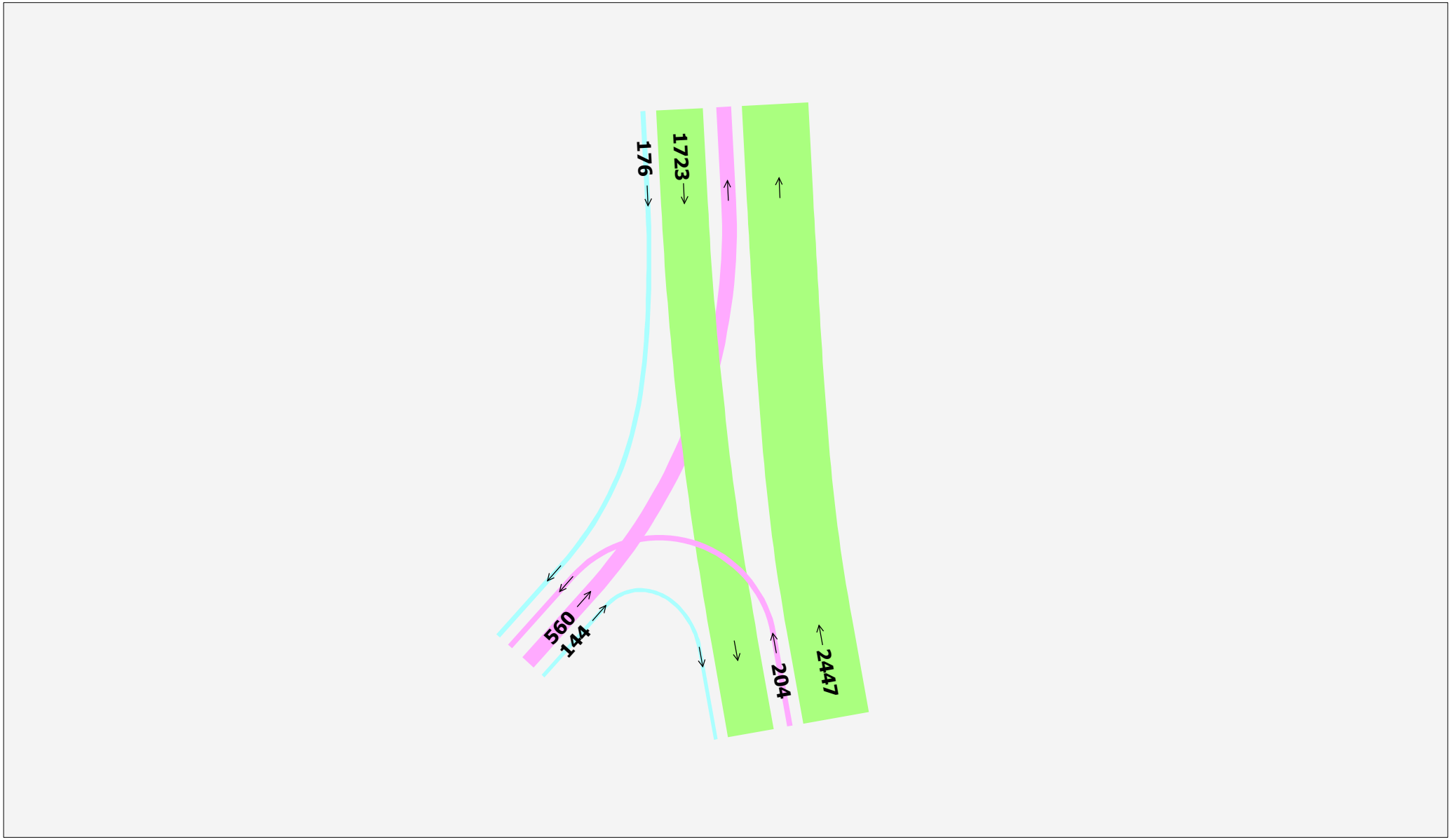
2040



Redland 4:00


199
1091
1655
121
332
44

2040



Redland 6:00

2040



Redland 7:00


211
2108
601
156
280
2232

2040

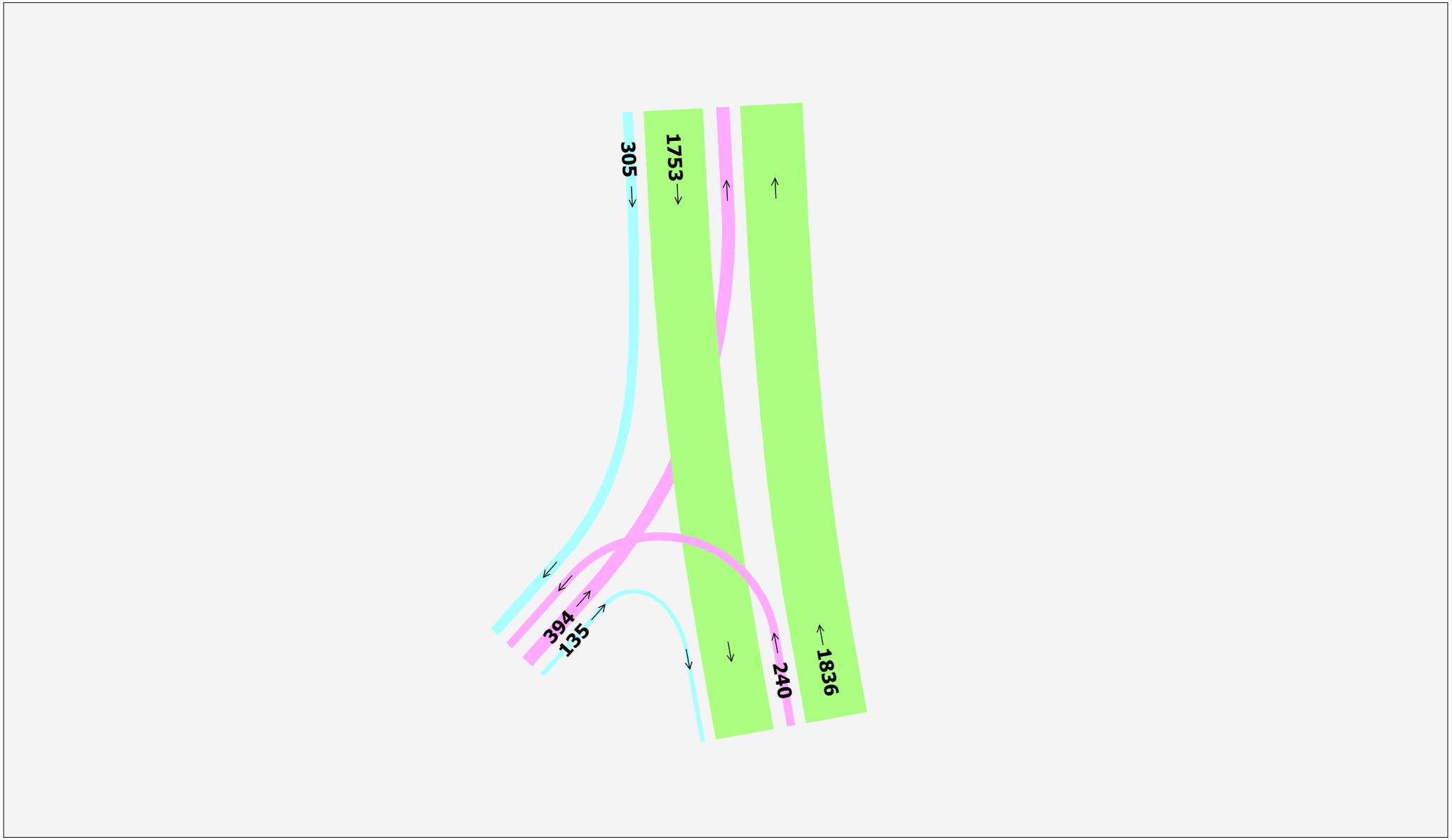


Redland 9:00

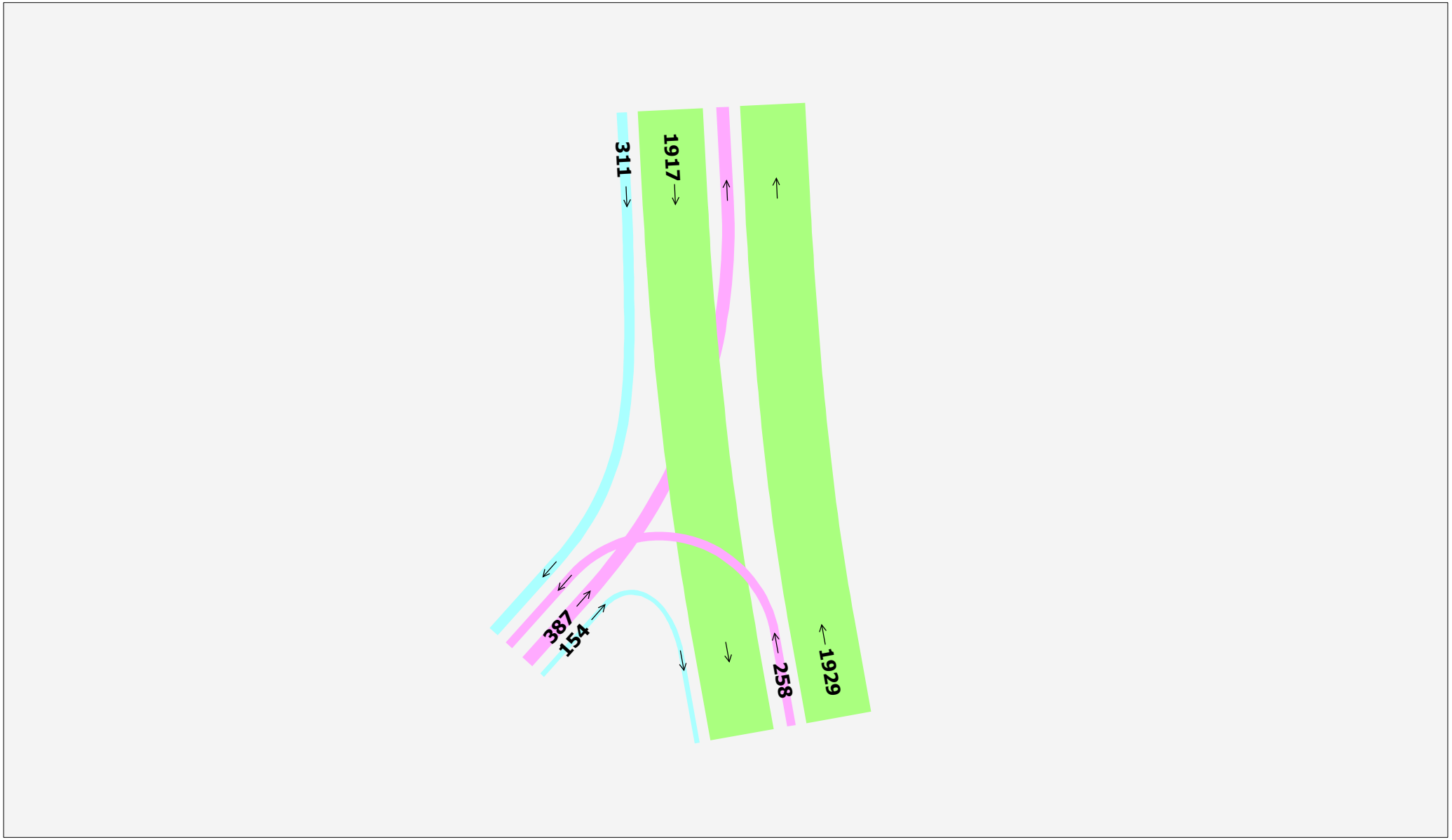
2040



Redland 10:00

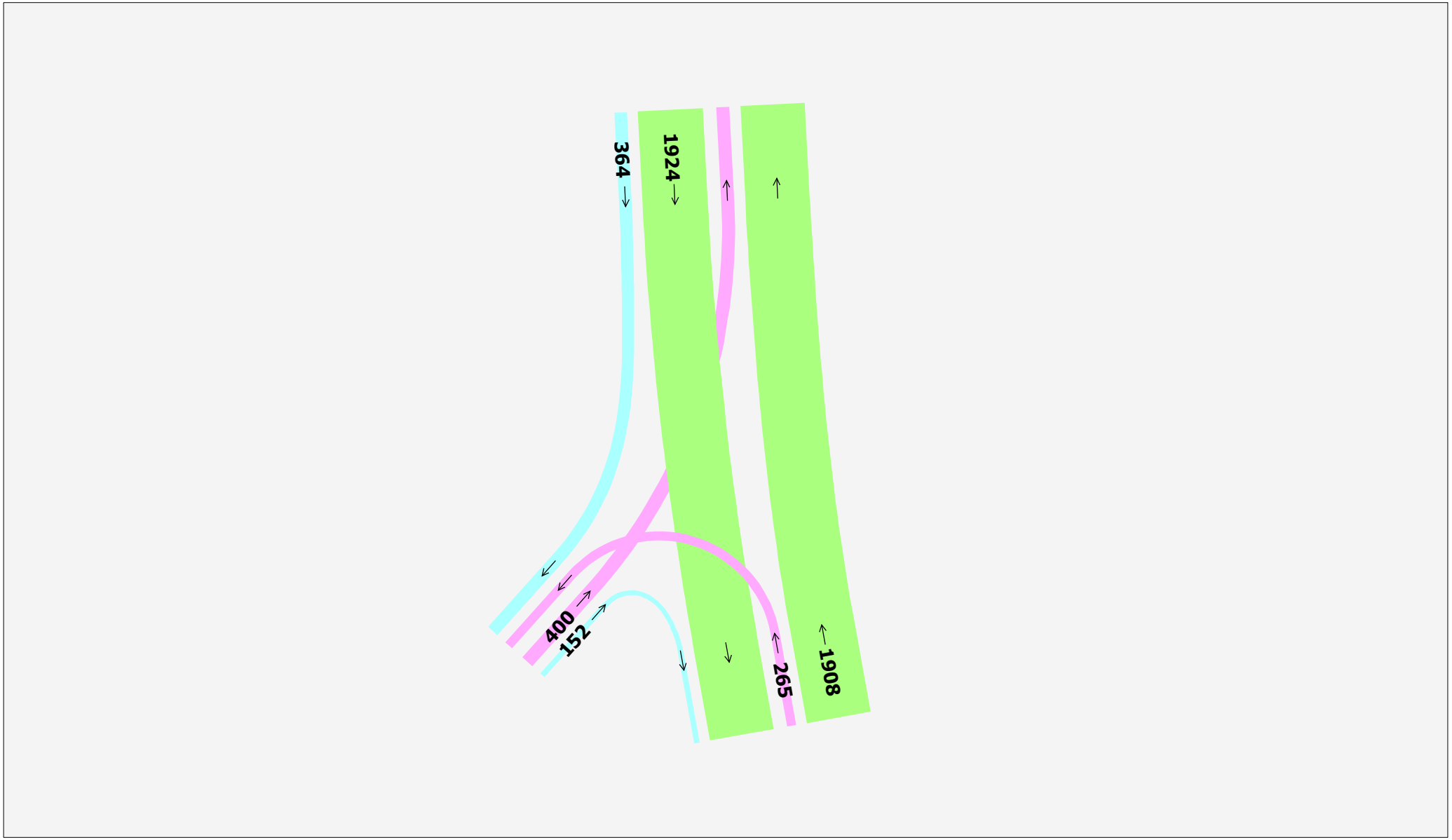

305
1753
394
135
240
1836

2040



Redland 12:00

2040



Redland 13:00

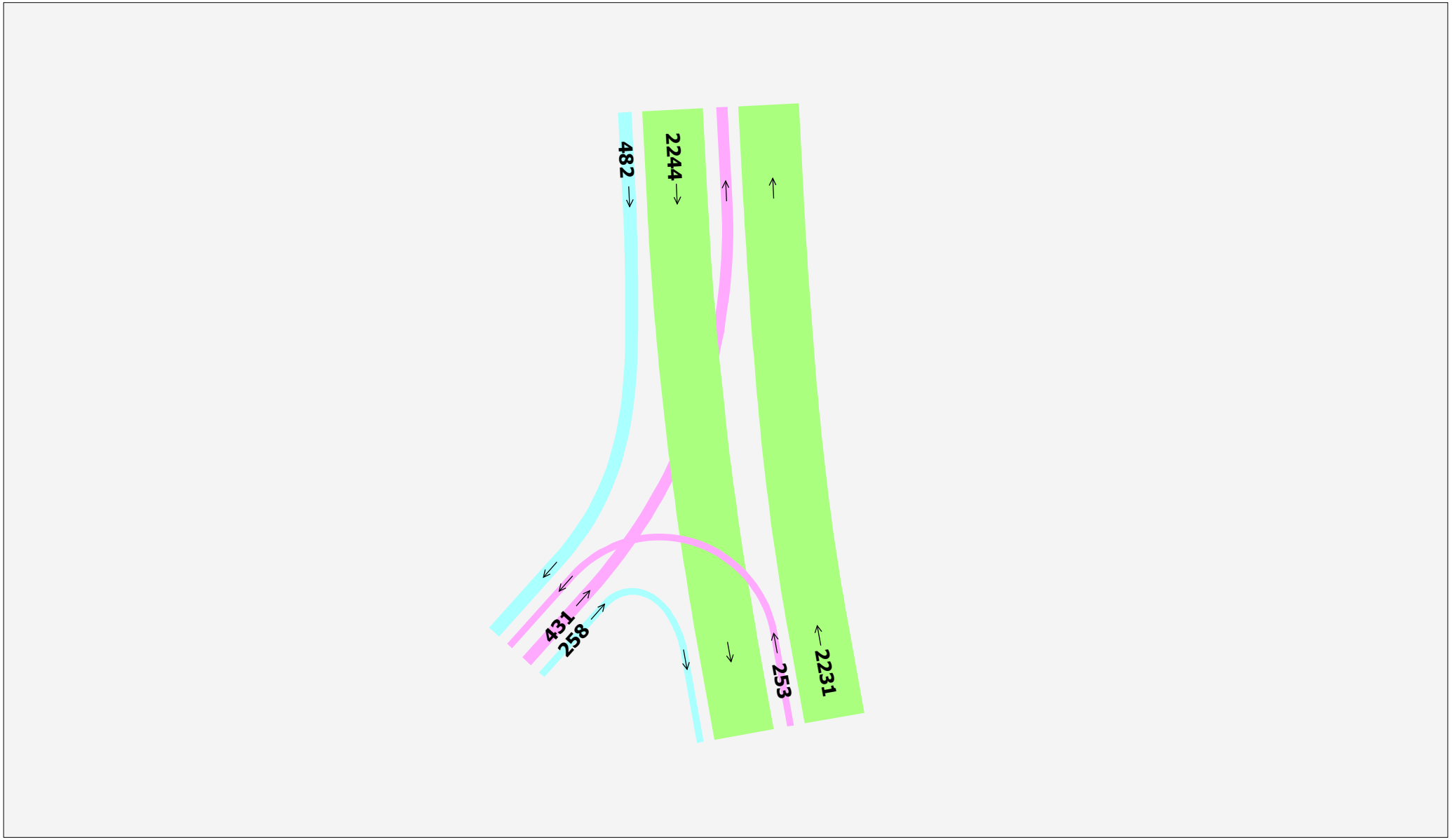
2040



Redland 14:00


455
2125
430
256
259
2121

2040

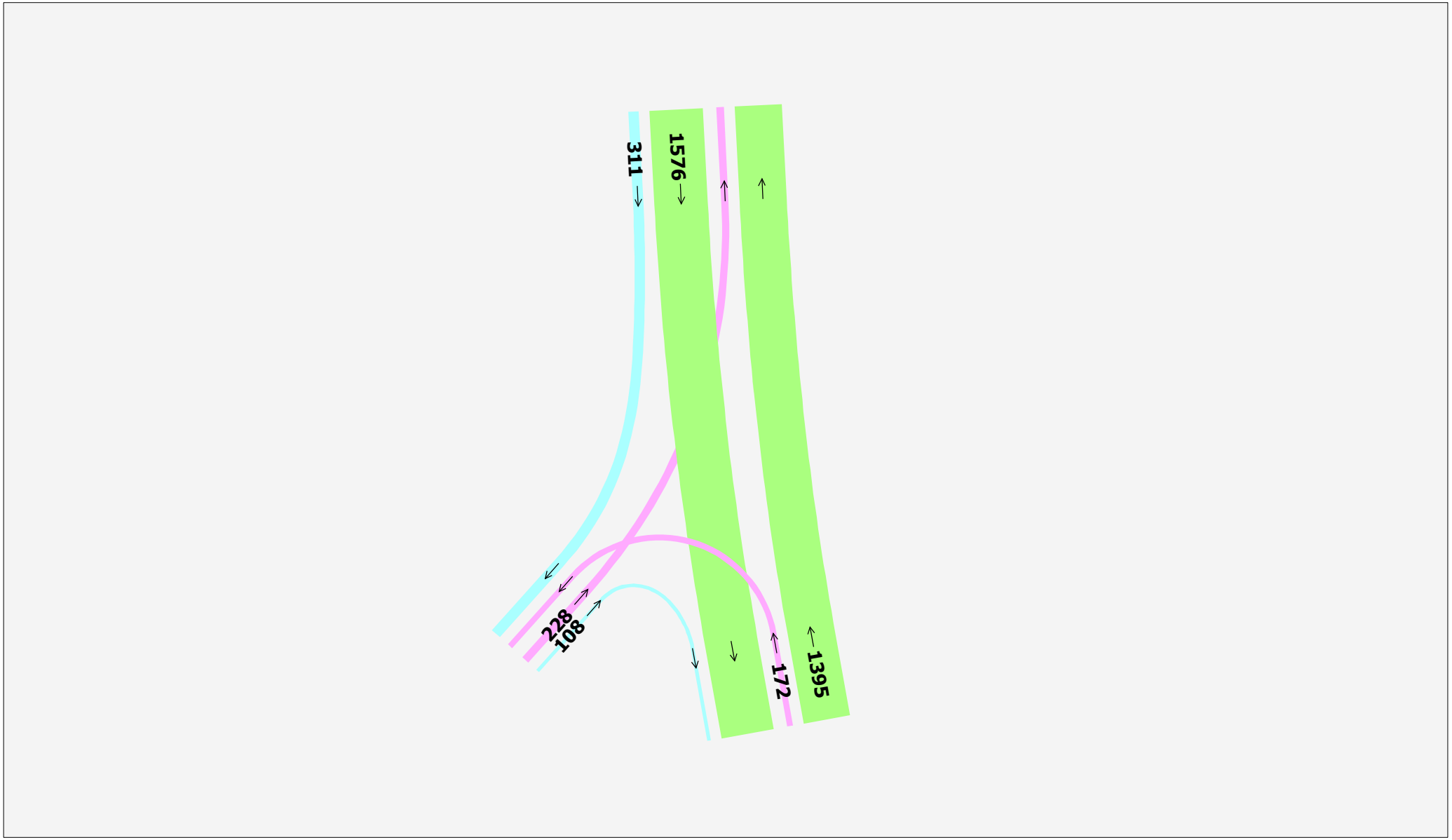


Redland 16:00


493
2374
421
223
255
2215


437
2054
421
172
257
1893

2040



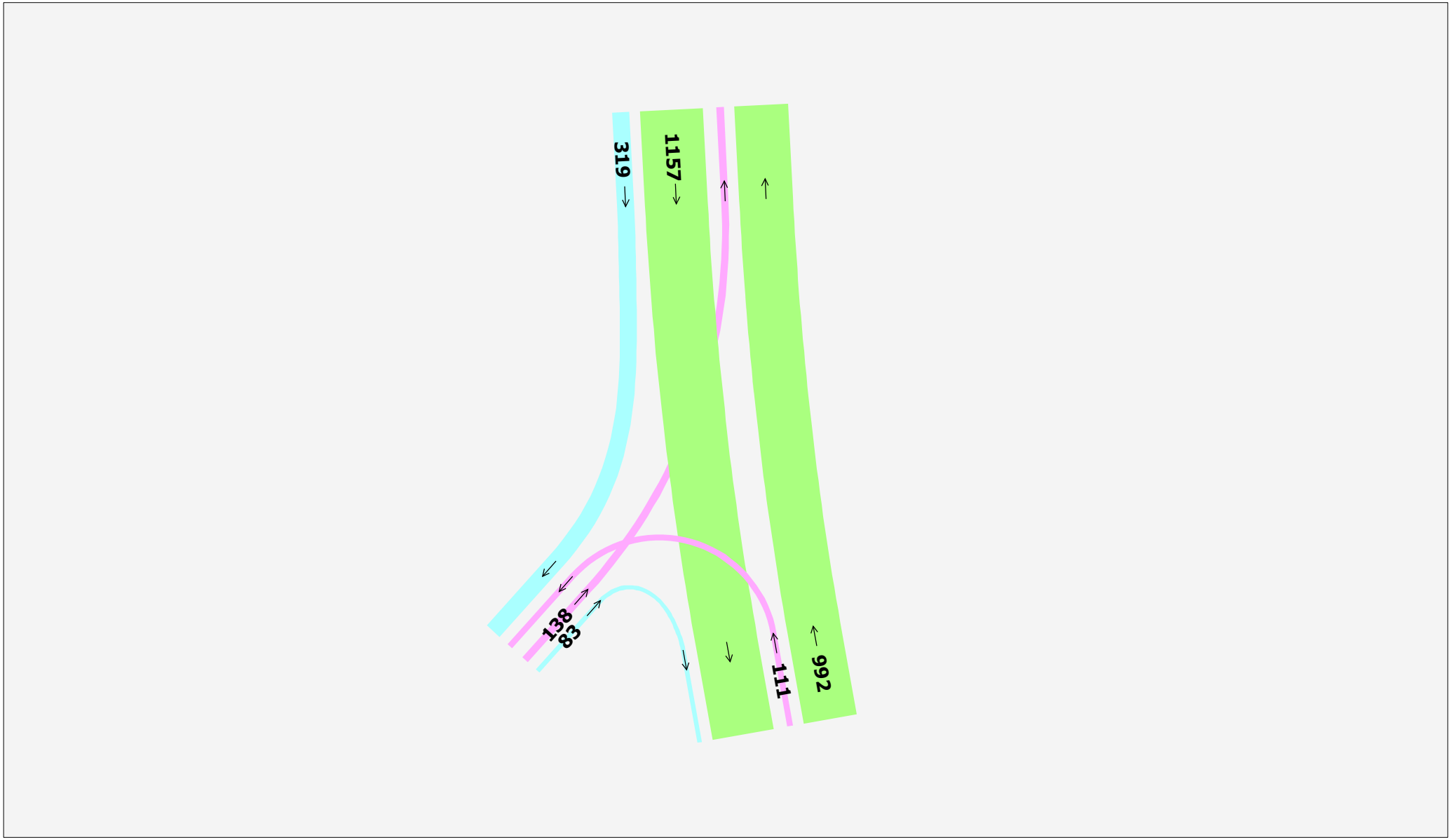
Redland 19:00

2040



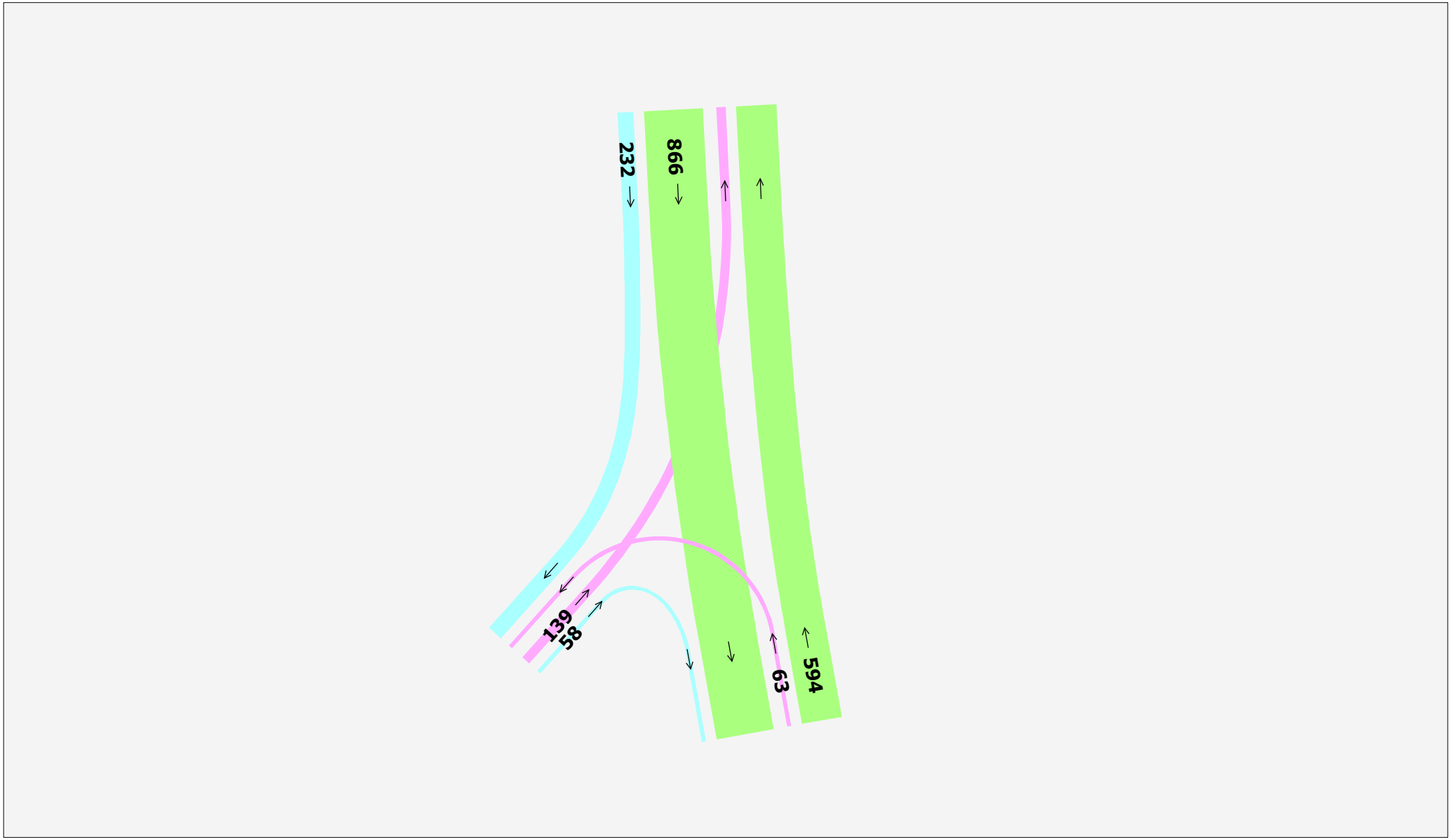
Redland 20:00

2040



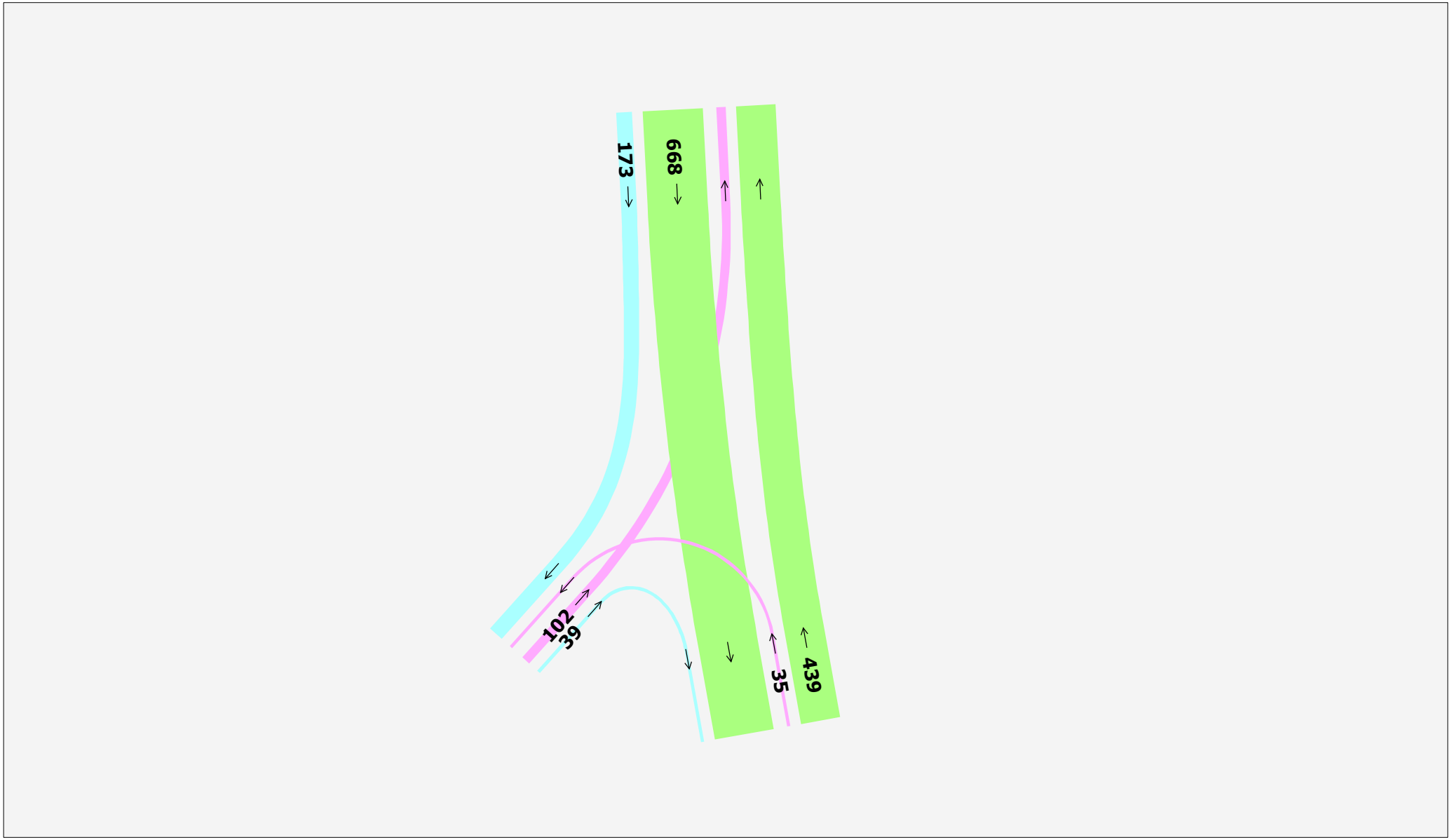
Redland 21:00

2040



Redland 22:00

2040



Redland 23:00

Type of peak hour being reported: Intersection Peak

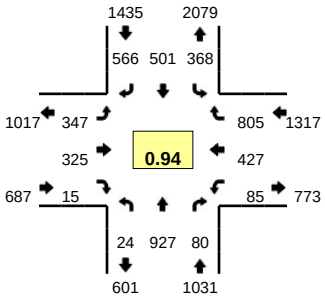
Method for determining peak hour: Total Entering Volume

LOCATION: Cascade Hwy -- S Beavercreek Rd

CITY/STATE: Oregon City, OR

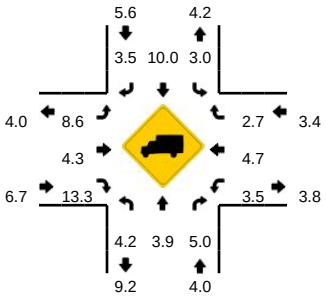
QC JOB #: 14414701

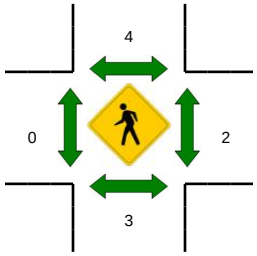
DATE: Tue, May 16 2017

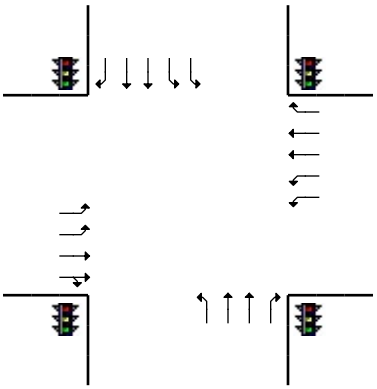


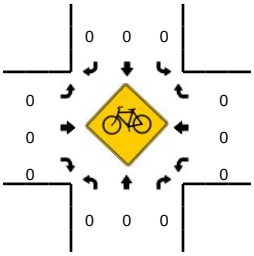
Peak-Hour: 7:00 AM -- 8:00 AM

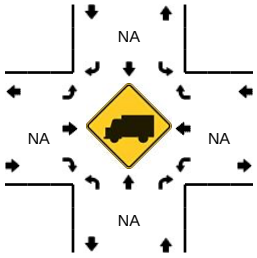
Peak 15-Min: 7:45 AM -- 8:00 AM

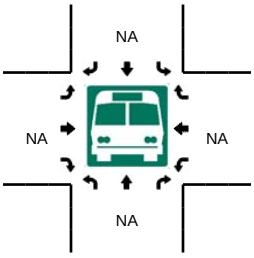












5-Min Count Period Beginning At	Cascade Hwy (Northbound)				Cascade Hwy (Southbound)				S Beavercreek Rd (Eastbound)				S Beavercreek Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	75	7	0	25	28	42	0	29	19	2	0	4	27	67	0	325	
7:05 AM	0	82	3	0	23	39	47	0	32	21	1	0	9	30	71	0	358	
7:10 AM	2	86	10	0	19	30	41	0	21	28	4	0	2	22	77	0	342	
7:15 AM	0	81	6	0	38	36	38	0	29	37	0	0	7	38	73	0	383	
7:20 AM	5	85	11	0	29	31	45	0	26	44	3	0	8	36	69	0	392	
7:25 AM	3	84	3	0	42	42	41	0	43	46	0	0	5	35	65	0	409	
7:30 AM	2	74	11	0	32	34	41	0	34	33	1	0	9	39	49	0	359	
7:35 AM	1	74	7	0	37	45	53	0	34	19	1	0	4	33	73	0	381	
7:40 AM	3	55	4	0	24	48	39	0	26	22	1	0	8	34	70	0	334	
7:45 AM	3	65	7	0	41	48	50	0	32	22	0	0	15	45	66	0	394	
7:50 AM	3	82	4	0	31	34	68	0	21	21	1	0	10	50	68	0	393	
7:55 AM	2	84	7	0	27	86	61	0	20	13	1	0	4	38	57	0	400	4470
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4145
8:05 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3787
8:10 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3445
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3062
8:20 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2670
8:25 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2261
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1902
8:35 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1521
8:40 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1187
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	793
8:50 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	400
8:55 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	32	924	72	0	396	672	716	0	292	224	8	0	116	532	764	0	4748
Heavy Trucks	0	20	4		8	56	8		12	4	0		0	16	16		144
Pedestrians		0				8				0				0			8
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/22/2017 3:28 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Cascade Hwy -- S Beavercreek Rd

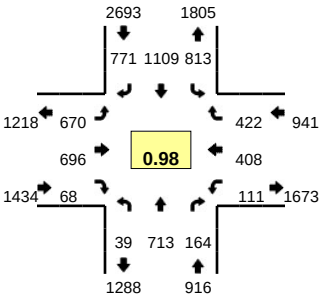
CITY/STATE: Oregon City, OR

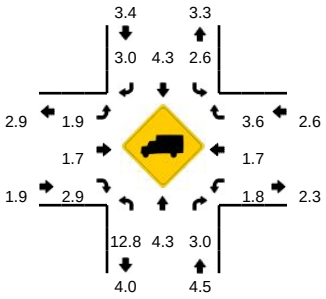
QC JOB #: 14414702

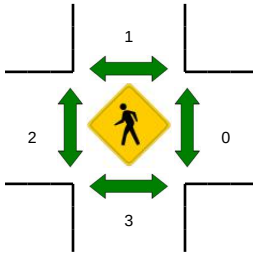
DATE: Tue, May 16 2017

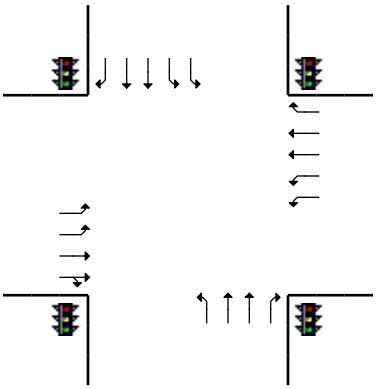
Peak-Hour: 4:30 PM -- 5:30 PM

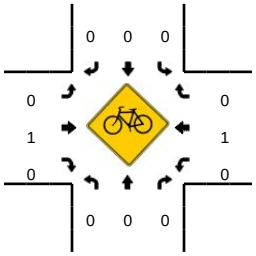
Peak 15-Min: 5:05 PM -- 5:20 PM

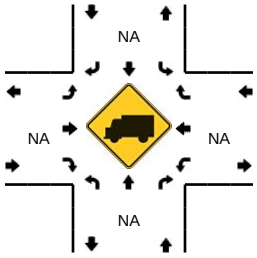


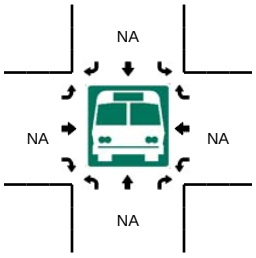












5-Min Count Period Beginning At	Cascade Hwy (Northbound)				Cascade Hwy (Southbound)				S Beavercreek Rd (Eastbound)				S Beavercreek Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	3	63	14	0	45	74	63	0	59	55	8	0	9	41	33	0	467	5599
4:05 PM	3	45	12	0	63	83	76	0	54	63	10	0	6	32	34	0	481	5635
4:10 PM	3	70	11	0	46	104	66	0	52	52	8	1	4	33	40	0	490	5692
4:15 PM	1	58	10	0	58	86	56	1	61	53	3	0	21	26	29	0	463	5702
4:20 PM	2	44	12	0	57	87	65	0	44	56	7	0	17	51	36	0	478	5719
4:25 PM	4	46	14	0	71	78	68	0	44	72	7	0	16	27	36	0	483	5724
4:30 PM	5	62	19	0	65	79	63	0	49	62	4	0	7	32	25	0	472	5735
4:35 PM	2	58	11	0	66	118	60	0	49	55	7	0	7	32	41	0	506	5801
4:40 PM	6	54	17	0	63	70	64	0	61	64	4	0	15	35	35	0	488	5761
4:45 PM	3	59	14	0	68	102	69	0	68	61	7	0	12	26	46	0	535	5842
4:50 PM	4	51	16	0	59	97	58	0	55	58	6	0	10	45	31	0	490	5856
4:55 PM	5	67	9	0	56	112	63	0	47	56	10	0	14	33	24	0	496	5849
5:00 PM	5	52	13	0	88	81	62	0	48	65	8	0	6	35	27	0	490	5872
5:05 PM	0	67	17	0	55	59	78	0	78	61	4	0	7	34	29	0	489	5880
5:10 PM	2	57	8	0	76	102	67	0	62	63	6	0	9	30	50	0	532	5922
5:15 PM	4	56	18	0	74	91	48	0	57	61	3	0	10	41	48	0	511	5970
5:20 PM	3	64	12	0	68	95	68	0	45	51	7	0	4	33	36	0	486	5978
5:25 PM	0	66	10	0	75	103	71	0	51	39	2	0	10	32	30	0	489	5984
5:30 PM	3	48	12	0	70	84	44	0	50	54	10	0	6	30	33	0	444	5956
5:35 PM	1	70	8	0	64	102	72	0	56	49	8	0	11	29	32	0	502	5952
5:40 PM	6	36	14	0	76	73	55	0	62	70	2	0	11	40	44	0	489	5953
5:45 PM	3	59	20	0	66	97	53	0	52	65	2	0	15	33	19	0	484	5902
5:50 PM	4	71	15	0	56	93	57	0	35	53	5	0	6	28	27	0	450	5862
5:55 PM	6	45	11	0	61	70	51	0	47	54	5	0	11	30	24	0	415	5781

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	24	720	172	0	820	1008	772	0	788	740	52	0	104	420	508	0	6128
Heavy Trucks	0	36	4		24	60	20		0	8	0		4	12	12		180
Pedestrians		8				0				4				0			12
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/22/2017 3:28 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

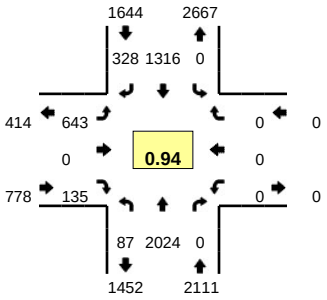
Method for determining peak hour: Total Entering Volume

LOCATION: Cascade Hwy -- Redland Rd

CITY/STATE: Oregon City, OR

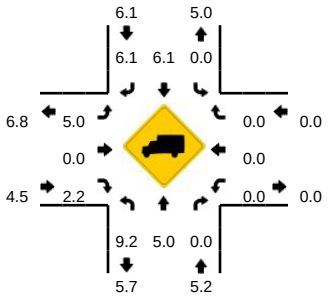
QC JOB #: 14414703

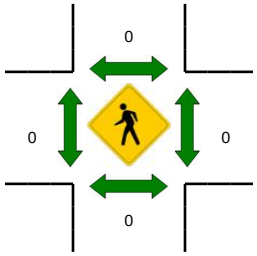
DATE: Tue, May 16 2017



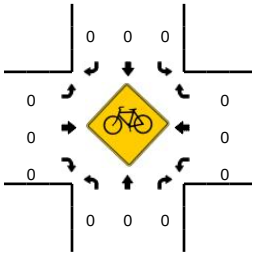
Peak-Hour: 7:00 AM -- 8:00 AM

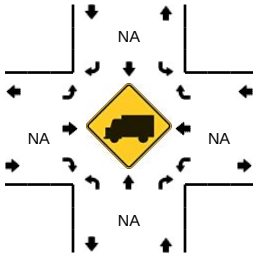
Peak 15-Min: 7:20 AM -- 7:35 AM

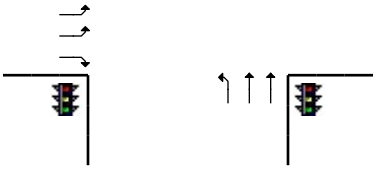


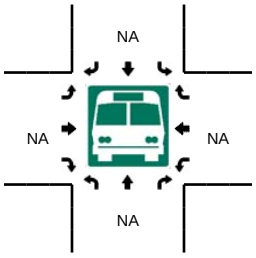












5-Min Count Period Beginning At	Cascade Hwy (Northbound)				Cascade Hwy (Southbound)				Redland Rd (Eastbound)				Redland Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	5	163	0	0	0	77	32	0	52	0	8	0	0	0	0	0	337	
7:05 AM	0	162	0	0	0	86	18	0	64	0	11	0	0	0	0	0	341	
7:10 AM	10	197	0	0	0	103	25	0	50	0	8	0	0	0	0	0	393	
7:15 AM	9	182	0	0	0	90	33	0	39	0	8	0	0	0	0	0	361	
7:20 AM	8	160	0	0	0	104	29	0	70	0	22	0	0	0	0	0	393	
7:25 AM	4	192	0	1	0	110	29	0	57	0	12	0	0	0	0	0	405	
7:30 AM	12	176	0	0	0	113	27	0	62	0	12	0	0	0	0	0	402	
7:35 AM	1	168	0	0	0	112	26	0	47	0	13	0	0	0	0	0	367	
7:40 AM	12	156	0	0	0	108	21	0	59	0	8	0	0	0	0	0	364	
7:45 AM	5	151	0	0	0	100	27	0	57	0	6	0	0	0	0	0	346	
7:50 AM	5	169	0	0	0	144	25	0	47	0	14	0	0	0	0	0	404	
7:55 AM	15	148	0	0	0	169	36	0	39	0	13	0	0	0	0	0	420	4533
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4196
8:05 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3855
8:10 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3462
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3101
8:20 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2708
8:25 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2303
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1901
8:35 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1534
8:40 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1170
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	824
8:50 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	420
8:55 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	96	2112	0	4	0	1308	340	0	756	0	184	0	0	0	0	0	4800
Heavy Trucks	0	104	0		0	80	16		56	0	0		0	0	0		256
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/22/2017 3:28 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

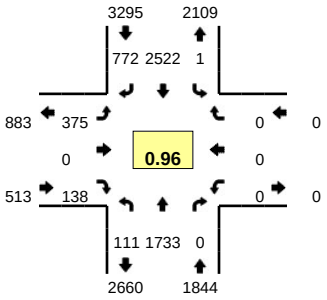
Method for determining peak hour: Total Entering Volume

LOCATION: Cascade Hwy -- Redland Rd

QC JOB #: 14414704

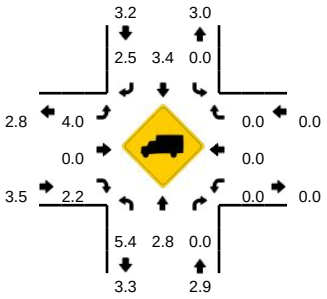
CITY/STATE: Oregon City, OR

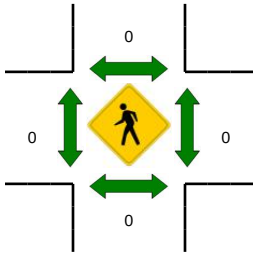
DATE: Tue, May 16 2017

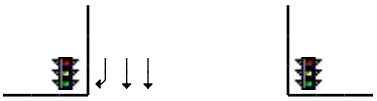


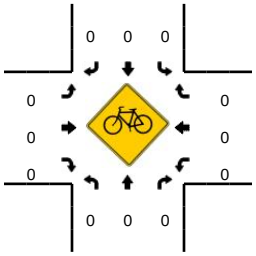
Peak-Hour: 4:35 PM -- 5:35 PM

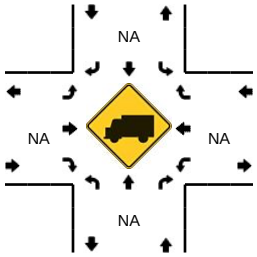
Peak 15-Min: 5:10 PM -- 5:25 PM

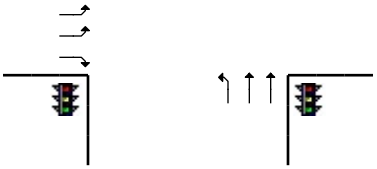


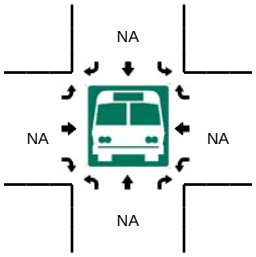












5-Min Count Period Beginning At	Cascade Hwy (Northbound)				Cascade Hwy (Southbound)				Redland Rd (Eastbound)				Redland Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	12	118	0	0	0	177	64	0	41	0	13	0	0	0	0	0	425	5212
4:05 PM	20	137	0	0	0	200	51	0	29	0	11	0	0	0	0	0	448	5260
4:10 PM	10	135	0	0	0	207	73	0	30	0	19	0	0	0	0	0	474	5307
4:15 PM	5	150	0	0	0	217	53	0	34	0	10	0	0	0	0	0	469	5378
4:20 PM	11	143	0	0	0	187	52	0	34	0	11	0	0	0	0	0	438	5412
4:25 PM	9	109	0	0	0	199	67	0	28	0	19	0	0	0	0	0	431	5377
4:30 PM	9	126	0	0	0	203	51	0	30	0	6	0	0	0	0	0	425	5415
4:35 PM	15	123	0	0	0	175	71	0	45	0	18	0	0	0	0	0	447	5360
4:40 PM	11	153	0	0	0	232	80	0	30	0	10	0	0	0	0	0	516	5431
4:45 PM	9	160	0	0	0	223	55	0	27	0	11	0	0	0	0	0	485	5444
4:50 PM	15	114	0	0	0	191	58	0	32	0	12	0	0	0	0	0	422	5406
4:55 PM	12	144	0	0	0	214	65	0	29	0	10	0	0	0	0	0	474	5454
5:00 PM	6	130	0	0	0	227	61	0	26	0	13	0	0	0	0	0	463	5492
5:05 PM	6	123	0	0	0	198	49	0	42	0	11	0	0	0	0	0	429	5473
5:10 PM	8	181	0	0	0	208	62	0	27	0	14	0	0	0	0	0	500	5499
5:15 PM	8	172	0	0	0	219	62	0	26	0	9	0	0	0	0	0	496	5526
5:20 PM	3	136	0	0	0	213	68	1	36	0	20	0	0	0	0	0	477	5565
5:25 PM	11	151	0	0	0	204	69	0	29	0	2	0	0	0	0	0	466	5600
5:30 PM	7	146	0	0	0	218	72	0	26	0	8	0	0	0	0	0	477	5652
5:35 PM	5	119	0	1	0	215	50	0	27	0	9	0	0	0	0	0	426	5631
5:40 PM	16	153	0	0	0	175	56	0	39	0	15	0	0	0	0	0	454	5569
5:45 PM	13	132	0	0	0	210	79	0	29	0	11	0	0	0	0	0	474	5558
5:50 PM	12	100	0	0	0	200	58	0	26	0	19	0	0	0	0	0	415	5551
5:55 PM	18	119	0	0	0	170	41	0	41	0	12	0	0	0	0	0	401	5478

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	76	1956	0	0	0	2560	768	4	356	0	172	0	0	0	0	0	5892
Heavy Trucks	0	52	0		0	84	20		8	0	0		0	0	0		164
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 5/22/2017 3:28 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

ATR CHARACTERISTIC TABLE (Printed: 9/30/2016)										
2015 SEASONAL TRAFFIC TREND	AREA TYPE	# OF LANES	WEEKLY TRAFFIC TREND	2016 AADT	OHP CLASSIFICATION	2015 ATR	COUNTY	HIGHWAY ROUTE, NAME, & LOCATION	MP	STATE HWY NUMBER
COM	URBANIZED	4	WEEKDAY	112800	STATEWIDE HWY	34-010	WASHINGTON	US26, 0.73 MILE EAST OF 185TH AVENUE OVERCROSSING	65.02	47
COM	URBANIZED	4	WEEKDAY	46200	STATEWIDE HWY	09-009	DESCHUTES	US97, THE DALLES-CALIFORNIA HIGHWAY, 0.23 MILE SOUTH OF REVERE AVENUE	137.36	4
COM	URBANIZED	4	WEEKDAY	35600	STATEWIDE HWY	03-018	CLACKAMAS	OR224, CLACKAMAS HIGHWAY, 0.13 MILE WEST OF JOHNSON ROAD	3.60	171
COM	URBANIZED	4	WEEKDAY	34200	STATEWIDE HWY	03-017	CLACKAMAS	OR212, CLACKAMAS HIGHWAY, 0.14 MILE WEST OF S.E.130TH AVENUE	6.80	171
COM	URBANIZED	4	WEEKDAY	33900	STATEWIDE HWY	34-009	WASHINGTON	OR8, TUALATIN VALLEY HIGHWAY, 0.28 MILE WEST OF N.W. 334TH AVENUE	14.84	29
COM	URBANIZED	4	WEEKDAY	32100	STATEWIDE HWY	26-003	MULTNOMAH	US26, MT. HOOD HIGHWAY, 0.18 MILE SOUTHEAST OF S.E. POWELL VALLEY ROAD	14.36	26
COM	URBANIZED	4	WEEKDAY	27000	STATEWIDE HWY	20-028	LANE	OR569, BELTLINE HIGHWAY, 0.42 MILE SOUTH OF BARGER DRIVE INTERCHANGE	5.20	69
SUM	URBANIZED	4	WEEKDAY	24300	STATEWIDE HWY	09-003	DESCHUTES	US97, THE DALLES-CALIFORNIA HIGHWAY, 0.17 MILE SOUTH OF CHINA HAT ROAD	142.41	4
COM	URBANIZED	4	WEEKDAY	24100	STATEWIDE HWY	30-008	UMATILLA	US395, PENDLETON-JOHN DAY HIGHWAY, 0.09 MILE SOUTH OF OLD OREGON TRAIL	1.77	28

03-017

	2015	2014	2013	2012	2011		
Jan	93	95	91	92	94	93	0.97
Feb	97	91	96	96	96	96	1.00
March	99	99	98	96	98	98	1.02
April	101	103	100	100	101	101	1.05
May	102	103	100	101	100	101	1.05
June	108	105	108	104	106	106	1.11
July	105	107	109	108	107	107	1.12
Aug	106	108	107	109	110	108	1.13
Sept	101	103	101	105	102	102	1.06
Oct	99	99	101	99	98	99	1.03
Nov	93	92	95	94	93	93	0.97
Dec	96	95	95	96	96	96	1.00

03-018

	2015	2014	2013	2012	2011			Avg	
Jan	97	94	96	95	96	96	0.95	94	0.96
Feb	103	91	102	100	99	100	1.00	98	1.00
March	103	100	102	98	102	101	1.01	100	1.02
April	104	104	105	103	103	104	1.03	102	1.04
May	102	102	103	102	101	102	1.02	102	1.03
June	105	105	105	103	103	104	1.04	105	1.07
July	99	101	99	100	99	99	0.99	103	1.05
Aug	101	103	101	102	102	102	1.01	105	1.07
Sept	99	103	98	102	99	100	1.00	101	1.03
Oct	101	104	100	101	101	101	1.01	100	1.02
Nov	93	96	95	96	96	96	0.95	95	0.96
Dec	93	98	94	96	98	96	0.96	96	0.98

2017 Count Data - Seasonally Adjusted - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00														
1:00														
2:00														
3:00														
4:00														
5:00														
6:00														
7:00	368	501	566	85	427	805	24	927	80	347	325	15	4,470	5
8:00														
9:00														
10:00														
11:00														
12:00														
13:00														
14:00	451	823	682	100	368	402	42	693	124	531	502	63	4,781	4
15:00	625	1,041	681	155	454	434	88	762	143	595	543	91	5,612	3
16:00	717	1,090	771	138	413	410	41	677	159	643	707	81	5,847	1
17:00	829	1,050	726	106	395	399	37	691	158	643	685	62	5,781	2
18:00														
19:00														
20:00														
21:00														
22:00														
23:00														
Total												AADT	65,693	
												Major	44,728	
												Minor	20,965	

2015 Base Model - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00	96	211	28	3	9	47		100	4	59	14		571	
1:00	70	159	15	2	6	23		50	3	40	11		379	
2:00	71	165	16	2	5	24		49	2	42	10		386	
3:00	45	95	54	3	16	99		203	2	31	7		555	
4:00	70	138	105	7	28	186		422	6	41	14		1,017	
5:00	180	346	245	18	79	454		941	15	100	39		2,417	16
6:00	344	502	435	43	171	757		1,325	38	132	96		3,843	8
7:00	551	599	491	46	196	781		1,305	46	178	216		4,409	3
8:00	607	624	466	41	187	674		1,134	38	217	214		4,202	5
9:00	607	596	354	32	176	625		977	25	244	190		3,826	9
10:00	619	621	314	27	118	504		859	24	277	188		3,551	12
11:00	475	715	328	28	112	473		814	27	345	119		3,436	13
12:00	555	778	349	29	137	524		790	26	375	141		3,704	10
13:00	475	800	356	32	136	516		827	28	362	105		3,637	11
14:00	583	918	311	35	166	568		823	34	392	175		4,005	6
15:00	635	997	299	40	185	583		834	42	429	215		4,259	4
16:00	709	1,072	271	45	184	578		833	45	465	250		4,452	2
17:00	783	1,119	229	47	203	625		780	46	448	239		4,519	1
18:00	610	1,008	255	38	142	504		815	37	366	173		3,948	7
19:00	483	779	171	23	116	418		520	25	252	111		2,898	14
20:00	412	703	109	17	121	392		358	20	194	103		2,429	15
21:00	335	661	87	14	123	380		259	17	178	73		2,127	
22:00	237	478	68	10	31	119		222	12	130	47		1,354	
23:00	182	398	41	6	16	72		142	7	102	31		997	
Total	9,734	14,482	5,397	588	2,663	9,926	0	15,382	569	5,399	2,781	0	66,921	
		29,613			13,177			15,951			8,180			
								68%			32%			

2040 Model - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00	123	234	32	4	24	107		125	5	69	28		751	
1:00	85	177	17	3	16	61		66	4	47	20		496	
2:00	86	183	19	3	16	67		66	4	50	18		512	
3:00	106	118	64	4	30	130		225	3	35	22		737	
4:00	185	176	123	10	49	224		463	8	46	43		1,327	
5:00	435	415	284	27	141	572		1,092	21	112	110		3,209	15
6:00	779	581	507	52	344	1,005		1,477	46	169	251		5,211	7
7:00	1,052	694	585	59	384	1,099		1,431	43	193	397		5,937	2
8:00	1,036	714	513	54	320	982		1,273	45	256	410		5,603	5
9:00	883	684	407	44	301	892		1,064	37	319	373		5,004	9
10:00	863	705	367	40	257	790		921	34	322	366		4,665	12
11:00	709	807	372	41	255	763		922	39	391	272		4,571	13
12:00	835	844	392	45	302	853		903	38	431	297		4,940	10
13:00	801	879	396	61	324	818		942	41	413	258		4,933	11
14:00	929	969	377	67	355	905		926	49	429	303		5,309	6
15:00	933	1,138	311	66	369	985		932	64	463	347		5,608	4
16:00	961	1,248	293	55	369	1,055		927	67	501	410		5,886	3
17:00	1,000	1,321	276	49	360	1,077		881	63	512	424		5,963	1
18:00	834	1,108	283	59	304	821		923	52	407	282		5,073	8
19:00	636	852	196	33	246	654		621	36	292	219		3,785	14
20:00	521	780	122	24	231	590		432	29	223	182		3,134	16
21:00	417	724	99	19	195	576		320	25	206	130		2,711	
22:00	306	541	78	14	70	237		270	17	150	87		1,770	
23:00	223	438	46	9	43	175		179	11	119	55		1,298	
Total	14,738	16,330	6,159	842	5,305	15,438	0	17,381	781	6,155	5,304	0	88,433	
		37,227			21,585			18,162			11,459			
								63%			37%			

2040 Post-Processed - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															Should this
5:00															
6:00															
7:00	742	581	658	102	688	1,097	32	1,026	76	367	526	20	5,916	5	80%
8:00															
9:00															
10:00															
11:00															
12:00															
13:00															
14:00	728	867	778	154	632	662	56	780	138	571	720	84	6,169	4	84%
15:00	892	1,173	699	179	731	749	116	848	163	632	750	120	7,053	3	96%
16:00	947	1,252	810	147	675	775	54	755	179	682	979	107	7,363	1	100%
17:00	1,032	1,229	769	109	600	732	49	778	174	714	1,000	82	7,268	2	99%
18:00															
19:00															
20:00															
21:00															
22:00															
23:00															
Total												AADT	82,592		
												Major	51,731		
												Minor	30,861		

2017 Count Data - Seasonally Adjusted - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	
0:00														
1:00														
2:00														
3:00														
4:00														
5:00														
6:00														
7:00		1,316	328				87	2,024		643		135	4,533	4
8:00														
9:00														
10:00														
11:00														
12:00														
13:00														
14:00		1,864	532				94	1,499		380		131	4,500	5
15:00		2,233	666				135	1,692		357		142	5,225	3
16:00		2,425	740				138	1,612		389		150	5,454	2
17:00		2,457	727				113	1,662		374		143	5,476	1
18:00														
19:00														
20:00														
21:00														
22:00														
23:00														
Total												AADT	61,977	
												Major	55,313	
												Minor	6,665	

2015 Base Model - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00		324	77				13	193		48		12	667	
1:00		234	56				8	105		27		9	439	
2:00		244	55				8	106		28		8	449	
3:00		190	39				20	313		62		5	629	
4:00		304	63				45	604		127		9	1,152	
5:00		748	162				97	1,399		222		22	2,650	15
6:00		1,199	259				125	2,088		618		82	4,371	6
7:00		1,579	212				154	2,110		674		62	4,791	3
8:00		1,651	195				150	1,875		623		46	4,540	5
9:00		1,499	210				102	1,745		356		58	3,970	10
10:00		1,494	207				103	1,536		299		60	3,699	13
11:00		1,465	271				114	1,519		312		54	3,735	12
12:00		1,612	265				122	1,567		308		70	3,944	11
13:00		1,568	313				120	1,585		329		64	3,979	9
14:00		1,746	356				97	1,687		332		65	4,283	7
15:00		1,850	462				152	1,694		415		81	4,654	4
16:00		1,972	472				171	1,704		443		81	4,843	2
17:00		2,050	493				168	1,685		411		80	4,887	1
18:00		1,798	371				108	1,576		352		74	4,279	8
19:00		1,382	307				119	1,072		221		51	3,152	14
20:00		1,180	309				93	851		157		44	2,634	16
21:00		1,034	279				81	736		131		49	2,310	
22:00		749	195				40	431		111		34	1,560	
23:00		598	146				22	294		77		23	1,160	
Total	0	28,470	5,774	0	0	0	2,232	28,475	0	6,683	0	1,143	72,777	
		34,244			0			30,707			7,826			
								89%			11%			

2040 Model - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00		369	91				22	279		66		20	847	
1:00		264	67				13	161		39		15	559	
2:00		273	66				14	170		41		14	578	
3:00		278	48				31	359		80		10	806	
4:00		468	81				68	665		164		17	1,463	
5:00		1,091	199				121	1,655		332		44	3,442	15
6:00		1,723	176				204	2,447		560		144	5,254	7
7:00		2,138	202				268	2,455		597		193	5,853	3
8:00		2,108	211				280	2,232		601		156	5,588	5
9:00		1,832	233				220	2,056		491		142	4,974	10
10:00		1,806	207				240	1,793		400		130	4,576	13
11:00		1,753	305				240	1,836		394		135	4,663	12
12:00		1,917	311				258	1,929		387		154	4,956	11
13:00		1,924	364				265	1,908		400		152	5,013	9
14:00		2,063	392				290	1,970		437		212	5,364	6
15:00		2,125	455				259	2,121		430		256	5,646	4
16:00		2,244	482				253	2,231		431		258	5,899	2
17:00		2,374	493				255	2,215		421		223	5,981	1
18:00		2,054	437				257	1,893		421		172	5,234	8
19:00		1,576	311				172	1,395		228		108	3,790	14
20:00		1,330	301				131	1,114		162		93	3,131	16
21:00		1,157	319				111	992		138		83	2,800	
22:00		866	232				63	594		139		58	1,952	
23:00		668	173				35	439		102		39	1,456	
Total	0	34,401	6,156	0	0	0	4,070	34,909	0	7,461	0	2,828	89,825	
		40,557			0			38,979			10,289			
								89%			11%			

2040 Post-Processed - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total		
0:00															
1:00															
2:00															
3:00															
4:00															From Beavercreek
5:00															
6:00															
7:00		1,782	316				167	2,333		573		307	5,479	5	80%
8:00															
9:00															
10:00															
11:00															
12:00															
13:00															
14:00		2,163	573				257	1,743		482		314	5,533	4	84%
15:00		2,510	658				226	2,081		370		343	6,188	3	96%
16:00		2,702	752				205	2,078		379		360	6,476	2	100%
17:00		2,782	727				179	2,140		383		312	6,523	1	99%
18:00															
19:00															
20:00															
21:00															
22:00															
23:00															
Total												AADT	73,588		
												Major	65,159		
												Minor	8,429		

2040 Balanced - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															
5:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
6:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
7:00	762	597	676	102	688	1,100	32	1,028	76	368	526	20	5,975	#DIV/0!	80%
8:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
9:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
10:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
11:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
12:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
13:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
14:00	744	886	795	154	632	660	56	778	138	569	720	84	6,216	#DIV/0!	84%
15:00	907	1,192	710	179	731	762	116	863	163	643	750	120	7,136	#DIV/0!	96%
16:00	955	1,263	817	147	675	788	54	767	179	693	979	107	7,424	#DIV/0!	100%
17:00	1,043	1,242	777	109	600	748	49	795	174	729	1,000	82	7,347	#DIV/0!	99%
18:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
19:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
20:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
21:00															
22:00															
23:00															
Total												AADT	84,363		
												Major	52,840		
												Minor	31,523		

2035 - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
7:00	664	564	639	98	634	1,036	30	1,005	77	363	484	19	5,614	5	81%
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
14:00	670	858	758	143	577	608	53	762	135	563	675	80	5,880	4	85%
15:00	836	1,145	695	174	673	684	110	830	159	624	707	114	6,752	3	97%
16:00	899	1,218	802	145	620	699	51	739	175	674	922	102	7,047	1	101%
17:00	990	1,192	760	108	557	663	47	760	170	699	934	78	6,958	2	100%
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
21:00															
22:00															
23:00															
Total												AADT	79,071		
												Major	49,526		
												Minor	29,546		

2035 Balanced - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															
5:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
6:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
7:00	679	577	653	98	634	1,039	30	1,008	77	364	484	19	5,662	#DIV/0!	80%
8:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
9:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
10:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
11:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
12:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
13:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
14:00	697	892	788	143	577	588	53	737	135	545	675	80	5,909	#DIV/0!	83%
15:00	861	1,179	715	174	673	674	110	818	159	615	707	114	6,799	#DIV/0!	96%
16:00	905	1,226	807	145	620	708	51	748	175	683	922	102	7,093	#DIV/0!	100%
17:00	997	1,201	766	108	557	675	47	774	170	712	934	78	7,019	#DIV/0!	99%
18:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
19:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
20:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
21:00															
22:00															
23:00															
Total												AADT	80,597		
												Major	50,481		
												Minor	30,116		

2040 Balanced - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															From Beavercreek
5:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
6:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
7:00		1,736	319				167	2,328		589		300	5,438	#DIV/0!	80%
8:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
9:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
10:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
11:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
12:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
13:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
14:00		2,118	628				258	1,749		319		307	5,379	#DIV/0!	84%
15:00		2,471	718				222	2,047		365		337	6,143	#DIV/0!	96%
16:00		2,679	749				202	2,045		381		357	6,413	#DIV/0!	100%
17:00		2,754	727				175	2,096		381		308	6,441	#DIV/0!	99%
18:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
19:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
20:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
21:00															
22:00															
23:00															
Total												AADT	73,192		
												Major	64,808		
												Minor	8,384		

2035 - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															From Beavercreek
5:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
6:00		0	0				0	0		0		0	0	#DIV/0!	0%
7:00		1,680	319				150	2,266		589		270	5,273	#DIV/0!	81%
8:00		0	0				0	0		0		0	0	#DIV/0!	0%
9:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
10:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
11:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
12:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
13:00		0	0				0	0		0		0	0	#DIV/0!	0%
14:00		2,205	625				159	1,650		318		262	5,218	#DIV/0!	85%
15:00		2,532	718				183	1,894		365		301	5,992	#DIV/0!	97%
16:00		2,642	749				190	1,977		381		314	6,254	#DIV/0!	101%
17:00		2,712	727				165	2,036		381		275	6,295	#DIV/0!	100%
18:00		0	0				0	0		0		0	0	#DIV/0!	0%
19:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
20:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
21:00															
22:00															
23:00															
Total												AADT	71,539		
												Major	63,345		
												Minor	8,194		

2035 Balanced - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															From Beavercreek
5:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
6:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
7:00		1,645	319				150	2,260		589		264	5,226	#DIV/0!	81%
8:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
9:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
10:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
11:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
12:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
13:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
14:00		2,124	625				164	1,707		318		253	5,191	#DIV/0!	85%
15:00		2,462	718				185	1,921		365		293	5,949	#DIV/0!	97%
16:00		2,625	749				188	1,953		381		312	6,208	#DIV/0!	101%
17:00		2,691	727				162	2,000		381		273	6,234	#DIV/0!	100%
18:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
19:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
20:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
21:00															
22:00															
23:00															
Total												AADT	70,839		
												Major	62,725		
												Minor	8,114		

2017 Count Data - Seasonally Adjusted - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00														
1:00														
2:00														
3:00														
4:00														
5:00														
6:00														
7:00	381	519	586	88	442	833	25	959	83	359	336	16	4,626	5
8:00														
9:00														
10:00														
11:00														
12:00														
13:00														
14:00	467	852	706	104	381	416	43	717	128	550	520	65	4,948	4
15:00	647	1,077	705	160	470	449	91	789	148	616	562	94	5,808	3
16:00	742	1,128	798	143	427	424	42	701	165	666	732	84	6,052	1
17:00	858	1,087	751	110	409	413	38	715	164	666	709	64	5,983	2
18:00														
19:00														
20:00														
21:00														
22:00														
23:00														
Total												AADT	67,992	
												Major	46,294	
												Minor	21,699	

2015 Base Model - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00	96	211	28	3	9	47		100	4	59	14		571	
1:00	70	159	15	2	6	23		50	3	40	11		379	
2:00	71	165	16	2	5	24		49	2	42	10		386	
3:00	45	95	54	3	16	99		203	2	31	7		555	
4:00	70	138	105	7	28	186		422	6	41	14		1,017	
5:00	180	346	245	18	79	454		941	15	100	39		2,417	16
6:00	344	502	435	43	171	757		1,325	38	132	96		3,843	8
7:00	551	599	491	46	196	781		1,305	46	178	216		4,409	3
8:00	607	624	466	41	187	674		1,134	38	217	214		4,202	5
9:00	607	596	354	32	176	625		977	25	244	190		3,826	9
10:00	619	621	314	27	118	504		859	24	277	188		3,551	12
11:00	475	715	328	28	112	473		814	27	345	119		3,436	13
12:00	555	778	349	29	137	524		790	26	375	141		3,704	10
13:00	475	800	356	32	136	516		827	28	362	105		3,637	11
14:00	583	918	311	35	166	568		823	34	392	175		4,005	6
15:00	635	997	299	40	185	583		834	42	429	215		4,259	4
16:00	709	1,072	271	45	184	578		833	45	465	250		4,452	2
17:00	783	1,119	229	47	203	625		780	46	448	239		4,519	1
18:00	610	1,008	255	38	142	504		815	37	366	173		3,948	7
19:00	483	779	171	23	116	418		520	25	252	111		2,898	14
20:00	412	703	109	17	121	392		358	20	194	103		2,429	15
21:00	335	661	87	14	123	380		259	17	178	73		2,127	
22:00	237	478	68	10	31	119		222	12	130	47		1,354	
23:00	182	398	41	6	16	72		142	7	102	31		997	
Total	9,734	14,482	5,397	588	2,663	9,926	0	15,382	569	5,399	2,781	0	66,921	
		29,613			13,177			15,951			8,180			
								68%			32%			

2040 Model - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00	123	234	32	4	24	107		125	5	69	28		751	
1:00	85	177	17	3	16	61		66	4	47	20		496	
2:00	86	183	19	3	16	67		66	4	50	18		512	
3:00	106	118	64	4	30	130		225	3	35	22		737	
4:00	185	176	123	10	49	224		463	8	46	43		1,327	
5:00	435	415	284	27	141	572		1,092	21	112	110		3,209	15
6:00	779	581	507	52	344	1,005		1,477	46	169	251		5,211	7
7:00	1,052	694	585	59	384	1,099		1,431	43	193	397		5,937	2
8:00	1,036	714	513	54	320	982		1,273	45	256	410		5,603	5
9:00	883	684	407	44	301	892		1,064	37	319	373		5,004	9
10:00	863	705	367	40	257	790		921	34	322	366		4,665	12
11:00	709	807	372	41	255	763		922	39	391	272		4,571	13
12:00	835	844	392	45	302	853		903	38	431	297		4,940	10
13:00	801	879	396	61	324	818		942	41	413	258		4,933	11
14:00	929	969	377	67	355	905		926	49	429	303		5,309	6
15:00	933	1,138	311	66	369	985		932	64	463	347		5,608	4
16:00	961	1,248	293	55	369	1,055		927	67	501	410		5,886	3
17:00	1,000	1,321	276	49	360	1,077		881	63	512	424		5,963	1
18:00	834	1,108	283	59	304	821		923	52	407	282		5,073	8
19:00	636	852	196	33	246	654		621	36	292	219		3,785	14
20:00	521	780	122	24	231	590		432	29	223	182		3,134	16
21:00	417	724	99	19	195	576		320	25	206	130		2,711	
22:00	306	541	78	14	70	237		270	17	150	87		1,770	
23:00	223	438	46	9	43	175		179	11	119	55		1,298	
Total	14,738	16,330	6,159	842	5,305	15,438	0	17,381	781	6,155	5,304	0	88,433	
		37,227			21,585			18,162			11,459			
								63%			37%			

2040 Post-Processed - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															
5:00															
6:00															
7:00	760	600	680	105	710	1,131	33	1,060	79	380	541	21	6,098	5	80%
8:00															
9:00															
10:00															
11:00															
12:00															
13:00															
14:00	748	897	804	159	651	679	58	806	142	590	744	86	6,363	4	84%
15:00	919	1,212	723	184	754	769	120	876	168	654	774	124	7,277	3	96%
16:00	976	1,293	838	152	696	795	56	780	185	706	1,010	111	7,597	1	100%
17:00	1,065	1,269	795	113	618	751	51	804	179	738	1,032	85	7,499	2	99%
18:00															
19:00															
20:00															
21:00															
22:00															
23:00															
Total												AADT	85,212		
												Major	53,371		
												Minor	31,840		

2017 Count Data - Seasonally Adjusted - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	
0:00														
1:00														
2:00														
3:00														
4:00														
5:00														
6:00														
7:00		1,362	339				90	2,095		666		140	4,692	4
8:00														
9:00														
10:00														
11:00														
12:00														
13:00														
14:00		1,929	551				97	1,551		393		136	4,658	5
15:00		2,311	689				140	1,751		369		147	5,408	3
16:00		2,510	766				143	1,668		403		155	5,645	2
17:00		2,543	752				117	1,720		387		148	5,668	1
18:00														
19:00														
20:00														
21:00														
22:00														
23:00														
Total												AADT	64,146	
												Major	57,249	
												Minor	6,898	

2015 Base Model - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00		324	77				13	193		48		12	667	
1:00		234	56				8	105		27		9	439	
2:00		244	55				8	106		28		8	449	
3:00		190	39				20	313		62		5	629	
4:00		304	63				45	604		127		9	1,152	
5:00		748	162				97	1,399		222		22	2,650	15
6:00		1,199	259				125	2,088		618		82	4,371	6
7:00		1,579	212				154	2,110		674		62	4,791	3
8:00		1,651	195				150	1,875		623		46	4,540	5
9:00		1,499	210				102	1,745		356		58	3,970	10
10:00		1,494	207				103	1,536		299		60	3,699	13
11:00		1,465	271				114	1,519		312		54	3,735	12
12:00		1,612	265				122	1,567		308		70	3,944	11
13:00		1,568	313				120	1,585		329		64	3,979	9
14:00		1,746	356				97	1,687		332		65	4,283	7
15:00		1,850	462				152	1,694		415		81	4,654	4
16:00		1,972	472				171	1,704		443		81	4,843	2
17:00		2,050	493				168	1,685		411		80	4,887	1
18:00		1,798	371				108	1,576		352		74	4,279	8
19:00		1,382	307				119	1,072		221		51	3,152	14
20:00		1,180	309				93	851		157		44	2,634	16
21:00		1,034	279				81	736		131		49	2,310	
22:00		749	195				40	431		111		34	1,560	
23:00		598	146				22	294		77		23	1,160	
Total	0	28,470	5,774	0	0	0	2,232	28,475	0	6,683	0	1,143	72,777	
		34,244			0			30,707			7,826			
								89%			11%			

2040 Model - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank
0:00		369	91				22	279		66		20	847	
1:00		264	67				13	161		39		15	559	
2:00		273	66				14	170		41		14	578	
3:00		278	48				31	359		80		10	806	
4:00		468	81				68	665		164		17	1,463	
5:00		1,091	199				121	1,655		332		44	3,442	15
6:00		1,723	176				204	2,447		560		144	5,254	7
7:00		2,138	202				268	2,455		597		193	5,853	3
8:00		2,108	211				280	2,232		601		156	5,588	5
9:00		1,832	233				220	2,056		491		142	4,974	10
10:00		1,806	207				240	1,793		400		130	4,576	13
11:00		1,753	305				240	1,836		394		135	4,663	12
12:00		1,917	311				258	1,929		387		154	4,956	11
13:00		1,924	364				265	1,908		400		152	5,013	9
14:00		2,063	392				290	1,970		437		212	5,364	6
15:00		2,125	455				259	2,121		430		256	5,646	4
16:00		2,244	482				253	2,231		431		258	5,899	2
17:00		2,374	493				255	2,215		421		223	5,981	1
18:00		2,054	437				257	1,893		421		172	5,234	8
19:00		1,576	311				172	1,395		228		108	3,790	14
20:00		1,330	301				131	1,114		162		93	3,131	16
21:00		1,157	319				111	992		138		83	2,800	
22:00		866	232				63	594		139		58	1,952	
23:00		668	173				35	439		102		39	1,456	
Total	0	34,401	6,156	0	0	0	4,070	34,909	0	7,461	0	2,828	89,825	
		40,557			0			38,979			10,289			
								89%			11%			

2040 Post-Processed - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total		
0:00															
1:00															
2:00															
3:00															
4:00															From Beavercreek
5:00															
6:00															
7:00		1,835	327				171	2,409		595		316	5,654	5	80%
8:00															
9:00															
10:00															
11:00															
12:00															
13:00															
14:00		2,234	593				263	1,800		497		323	5,709	4	84%
15:00		2,594	681				232	2,147		383		352	6,388	3	96%
16:00		2,793	778				211	2,142		392		370	6,685	2	100%
17:00		2,875	752				184	2,207		396		320	6,734	1	99%
18:00															
19:00															
20:00															
21:00															
22:00															
23:00															
Total												AADT	75,970		
												Major	67,268		
												Minor	8,702		

2040 Balanced - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															
5:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
6:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
7:00	781	616	698	105	710	1,133	33	1,062	79	381	541	21	6,160	#DIV/0!	80%
8:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
9:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
10:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
11:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
12:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
13:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
14:00	764	917	822	159	651	677	58	803	142	588	744	86	6,410	#DIV/0!	84%
15:00	933	1,231	735	184	754	782	120	891	168	665	774	124	7,361	#DIV/0!	96%
16:00	985	1,305	845	152	696	808	56	792	185	717	1,010	111	7,662	#DIV/0!	100%
17:00	1,076	1,282	803	113	618	767	51	821	179	754	1,032	85	7,581	#DIV/0!	99%
18:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
19:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
20:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
21:00															
22:00															
23:00															
Total												AADT	87,064		
												Major	54,532		
												Minor	32,533		

2035 - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
7:00	681	583	660	102	654	1,069	31	1,039	80	376	498	20	5,792	5	81%
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
14:00	689	888	784	147	594	625	55	787	139	582	697	82	6,068	4	84%
15:00	862	1,184	719	179	695	702	114	858	164	646	730	118	6,971	3	97%
16:00	927	1,259	829	150	640	718	53	763	181	697	952	105	7,275	1	101%
17:00	1,022	1,231	786	112	574	680	48	785	176	723	965	81	7,183	2	100%
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0%
21:00															
22:00															
23:00															
Total												AADT	81,624		
												Major	51,124		
												Minor	30,500		

2035 Balanced - OR213/Beavercreek Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															
5:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
6:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
7:00	696	596	675	102	654	1,071	31	1,041	80	376	498	20	5,840	#DIV/0!	80%
8:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
9:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
10:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
11:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
12:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
13:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
14:00	716	923	815	147	594	604	55	762	139	563	697	82	6,098	#DIV/0!	83%
15:00	887	1,218	740	179	695	692	114	845	164	636	730	118	7,018	#DIV/0!	96%
16:00	933	1,267	835	150	640	727	53	773	181	706	952	105	7,322	#DIV/0!	100%
17:00	1,030	1,240	792	112	574	693	48	800	176	736	965	81	7,247	#DIV/0!	99%
18:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
19:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
20:00	#DIV/0!	#DIV/0!	#DIV/0!	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	0	#DIV/0!	#DIV/0!	#DIV/0!
21:00															
22:00															
23:00															
Total												AADT	83,206		
												Major	52,115		
												Minor	31,091		

2040 Balanced - OR213/Redland Road

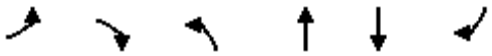
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0:00															
1:00															
2:00															
3:00															
4:00															From Beavercreek
5:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
6:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
7:00		1,787	330				171	2,404		610		308	5,610	#DIV/0!	80%
8:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
9:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
10:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
11:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
12:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
13:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
14:00		2,187	649				264	1,805		330		316	5,552	#DIV/0!	84%
15:00		2,553	743				228	2,112		378		346	6,341	#DIV/0!	96%
16:00		2,768	775				208	2,108		394		366	6,620	#DIV/0!	100%
17:00		2,845	752				180	2,161		394		317	6,650	#DIV/0!	99%
18:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
19:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
20:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
21:00															
22:00															
23:00															
Total												AADT	75,563		
												Major	66,907		
												Minor	8,655		

2035 - OR213/Redland Road

Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															From Beavercreek
5:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
6:00		0	0				0	0		0		0	0	#DIV/0!	0%
7:00		1,732	330				154	2,341		610		278	5,445	#DIV/0!	81%
8:00		0	0				0	0		0		0	0	#DIV/0!	0%
9:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
10:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
11:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
12:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
13:00		0	0				0	0		0		0	0	#DIV/0!	0%
14:00		2,278	647				164	1,701		329		269	5,388	#DIV/0!	84%
15:00		2,617	743				188	1,954		378		309	6,189	#DIV/0!	97%
16:00		2,731	775				196	2,039		394		323	6,459	#DIV/0!	101%
17:00		2,803	752				169	2,101		394		283	6,502	#DIV/0!	100%
18:00		0	0				0	0		0		0	0	#DIV/0!	0%
19:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
20:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
21:00															
22:00															
23:00															
Total												AADT	73,887		
												Major	65,423		
												Minor	8,463		

2035 Balanced - OR213/Redland Road

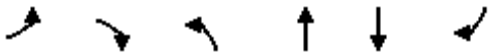
Time	SBL	SBT	SBR	WBL	WBT	WBR	NBL	NBT	NBR	EBL	EBT	EBR	Total	Rank	
0:00															
1:00															
2:00															
3:00															
4:00															From Beavercreek
5:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
6:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
7:00		1,695	330				153	2,334		610		272	5,394	#DIV/0!	81%
8:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
9:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
10:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
11:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
12:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
13:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
14:00		2,194	647				169	1,761		329		259	5,359	#DIV/0!	84%
15:00		2,545	743				191	1,982		378		301	6,144	#DIV/0!	97%
16:00		2,714	775				194	2,014		394		321	6,413	#DIV/0!	101%
17:00		2,781	752				166	2,063		394		281	6,438	#DIV/0!	100%
18:00		#DIV/0!	0				#DIV/0!	#DIV/0!		0		#DIV/0!	#DIV/0!	#DIV/0!	0%
19:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
20:00		#DIV/0!	#DIV/0!				#DIV/0!	#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!	0%
21:00															
22:00															
23:00															
Total												AADT	73,154		
												Major	64,774		
												Minor	8,379		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	595	316	171	2409	1835	327
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3400	1568	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3400	1568	1770	3539	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	595	316	171	2409	1835	327
RTOR Reduction (vph)	0	10	0	0	0	37
Lane Group Flow (vph)	595	306	171	2409	1835	290
Heavy Vehicles (%)	3%	3%	2%	2%	2%	2%
Turn Type	Prot	pm+ov	Prot	NA	NA	pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	29.1	46.4	17.3	110.5	88.7	117.8
Effective Green, g (s)	29.1	46.4	17.3	110.5	88.7	117.8
Actuated g/C Ratio	0.20	0.31	0.12	0.74	0.60	0.79
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	665	537	206	2631	2112	1302
v/s Ratio Prot	c0.18	0.07	0.10	c0.68	0.52	0.04
v/s Ratio Perm		0.13				0.14
v/c Ratio	0.89	0.57	0.83	0.92	0.87	0.22
Uniform Delay, d1	58.3	42.7	64.2	15.3	25.1	3.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.5	1.4	23.7	6.4	5.2	0.1
Delay (s)	72.8	44.1	87.9	21.7	30.3	4.0
Level of Service	E	D	F	C	C	A
Approach Delay (s)	62.8			26.1	26.3	
Approach LOS	E			C	C	

Intersection Summary			
HCM 2000 Control Delay	32.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	148.6	Sum of lost time (s)	13.5
Intersection Capacity Utilization	91.1%	ICU Level of Service	F
Analysis Period (min)	15		

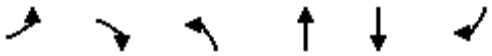
c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	573	307	167	2333	1782	316
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3400	1568	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3400	1568	1770	3539	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	573	307	167	2333	1782	316
RTOR Reduction (vph)	0	11	0	0	0	42
Lane Group Flow (vph)	573	296	167	2333	1782	274
Heavy Vehicles (%)	3%	3%	2%	2%	2%	2%
Turn Type	Prot	pm+ov	Prot	NA	NA	pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	28.6	46.1	17.5	110.5	88.5	117.1
Effective Green, g (s)	28.6	46.1	17.5	110.5	88.5	117.1
Actuated g/C Ratio	0.19	0.31	0.12	0.75	0.60	0.79
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	656	535	209	2640	2114	1299
v/s Ratio Prot	c0.17	0.07	0.09	c0.66	0.50	0.04
v/s Ratio Perm		0.12				0.13
v/c Ratio	0.87	0.55	0.80	0.88	0.84	0.21
Uniform Delay, d1	58.0	42.4	63.6	14.0	24.2	3.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.3	1.2	18.9	4.8	4.3	0.1
Delay (s)	70.3	43.7	82.5	18.8	28.5	4.0
Level of Service	E	D	F	B	C	A
Approach Delay (s)	61.0			23.0	24.8	
Approach LOS	E			C	C	

Intersection Summary			
HCM 2000 Control Delay	29.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	148.1	Sum of lost time (s)	13.5
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		

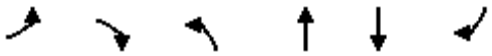
c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	497	323	263	1800	2234	593
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3400	1568	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3400	1568	1770	3539	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	497	323	263	1800	2234	593
RTOR Reduction (vph)	0	5	0	0	0	24
Lane Group Flow (vph)	497	318	263	1800	2234	569
Heavy Vehicles (%)	3%	3%	2%	2%	2%	2%
Turn Type	Prot	pm+ov	Prot	NA	NA	pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	22.1	44.2	22.1	118.9	92.3	114.4
Effective Green, g (s)	22.1	44.2	22.1	118.9	92.3	114.4
Actuated g/C Ratio	0.15	0.29	0.15	0.79	0.62	0.76
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	500	509	260	2805	2177	1254
v/s Ratio Prot	c0.15	0.09	c0.15	0.51	c0.63	0.07
v/s Ratio Perm		0.11				0.29
v/c Ratio	0.99	0.62	1.01	0.64	1.03	0.45
Uniform Delay, d1	63.9	45.7	63.9	6.6	28.9	6.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	38.5	2.4	58.8	1.1	26.3	0.3
Delay (s)	102.4	48.1	122.7	7.7	55.1	6.7
Level of Service	F	D	F	A	E	A
Approach Delay (s)	81.0			22.4	45.0	
Approach LOS	F			C	D	

Intersection Summary			
HCM 2000 Control Delay	42.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	101.8%	ICU Level of Service	G
Analysis Period (min)	15		

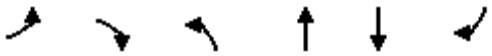
c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	482	314	257	1743	2163	573
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3400	1568	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3400	1568	1770	3539	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	482	314	257	1743	2163	573
RTOR Reduction (vph)	0	6	0	0	0	24
Lane Group Flow (vph)	482	308	257	1743	2163	549
Heavy Vehicles (%)	3%	3%	2%	2%	2%	2%
Turn Type	Prot	pm+ov	Prot	NA	NA	pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	21.5	43.2	21.7	119.5	93.3	114.8
Effective Green, g (s)	21.5	43.2	21.7	119.5	93.3	114.8
Actuated g/C Ratio	0.14	0.29	0.14	0.80	0.62	0.77
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	487	498	256	2819	2201	1259
v/s Ratio Prot	c0.14	0.09	c0.15	0.49	c0.61	0.06
v/s Ratio Perm		0.11				0.28
v/c Ratio	0.99	0.62	1.00	0.62	0.98	0.44
Uniform Delay, d1	64.1	46.2	64.2	6.1	27.6	6.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	37.7	2.3	57.2	1.0	15.5	0.2
Delay (s)	101.8	48.5	121.4	7.1	43.1	6.4
Level of Service	F	D	F	A	D	A
Approach Delay (s)	80.8			21.8	35.4	
Approach LOS	F			C	D	

Intersection Summary			
HCM 2000 Control Delay	37.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		

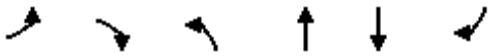
c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	383	352	232	2147	2594	681
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3400	1568	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3400	1568	1770	3539	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	383	352	232	2147	2594	681
RTOR Reduction (vph)	0	4	0	0	0	19
Lane Group Flow (vph)	383	348	232	2147	2594	662
Heavy Vehicles (%)	3%	3%	2%	2%	2%	2%
Turn Type	Prot	pm+ov	Prot	NA	NA	pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	16.9	35.5	18.6	124.1	101.0	117.9
Effective Green, g (s)	16.9	35.5	18.6	124.1	101.0	117.9
Actuated g/C Ratio	0.11	0.24	0.12	0.83	0.67	0.79
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	383	418	219	2927	2382	1291
v/s Ratio Prot	c0.11	0.10	c0.13	0.61	c0.73	0.06
v/s Ratio Perm		0.12				0.36
v/c Ratio	1.00	0.83	1.06	0.73	1.09	0.51
Uniform Delay, d1	66.5	54.4	65.7	5.7	24.5	5.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	46.0	13.3	77.4	1.7	47.8	0.3
Delay (s)	112.5	67.7	143.1	7.4	72.3	6.1
Level of Service	F	E	F	A	E	A
Approach Delay (s)	91.1			20.6	58.5	
Approach LOS	F			C	E	

Intersection Summary			
HCM 2000 Control Delay	48.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	106.7%	ICU Level of Service	G
Analysis Period (min)	15		

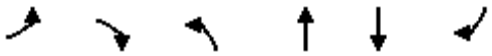
c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	370	343	226	2081	2510	658
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3400	1568	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3400	1568	1770	3539	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	370	343	226	2081	2510	658
RTOR Reduction (vph)	0	5	0	0	0	20
Lane Group Flow (vph)	370	338	226	2081	2510	638
Heavy Vehicles (%)	3%	3%	2%	2%	2%	2%
Turn Type	Prot	pm+ov	Prot	NA	NA	pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	16.6	35.1	18.5	124.4	101.4	118.0
Effective Green, g (s)	16.6	35.1	18.5	124.4	101.4	118.0
Actuated g/C Ratio	0.11	0.23	0.12	0.83	0.68	0.79
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	376	413	218	2935	2392	1292
v/s Ratio Prot	c0.11	0.10	c0.13	0.59	c0.71	0.05
v/s Ratio Perm		0.11				0.35
v/c Ratio	0.98	0.82	1.04	0.71	1.05	0.49
Uniform Delay, d1	66.6	54.4	65.8	5.3	24.3	5.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.9	12.0	70.9	1.5	33.0	0.3
Delay (s)	108.4	66.4	136.6	6.8	57.3	5.9
Level of Service	F	E	F	A	E	A
Approach Delay (s)	88.2			19.5	46.6	
Approach LOS	F			B	D	

Intersection Summary			
HCM 2000 Control Delay	41.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	103.7%	ICU Level of Service	G
Analysis Period (min)	15		

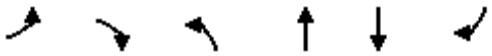
c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	392	370	211	2142	2793	778
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3400	1568	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3400	1568	1770	3539	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	392	370	211	2142	2793	778
RTOR Reduction (vph)	0	3	0	0	0	14
Lane Group Flow (vph)	392	367	211	2142	2793	764
Heavy Vehicles (%)	3%	3%	2%	2%	2%	2%
Turn Type	Prot	pm+ov	Prot	NA	NA	pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	15.5	31.0	15.5	125.5	105.5	121.0
Effective Green, g (s)	15.5	31.0	15.5	125.5	105.5	121.0
Actuated g/C Ratio	0.10	0.21	0.10	0.84	0.70	0.81
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	351	371	182	2960	2489	1324
v/s Ratio Prot	0.12	c0.10	c0.12	0.61	c0.79	0.06
v/s Ratio Perm		0.13				0.42
v/c Ratio	1.12	0.99	1.16	0.72	1.12	0.58
Uniform Delay, d1	67.2	59.3	67.2	5.1	22.2	5.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	83.4	43.3	116.1	1.6	61.0	0.6
Delay (s)	150.7	102.6	183.4	6.6	83.2	5.9
Level of Service	F	F	F	A	F	A
Approach Delay (s)	127.3			22.5	66.4	
Approach LOS	F			C	E	

Intersection Summary			
HCM 2000 Control Delay	57.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	111.3%	ICU Level of Service	H
Analysis Period (min)	15		

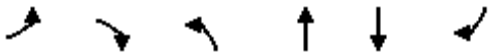
c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	379	360	205	2078	2702	752
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3400	1568	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3400	1568	1770	3539	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	379	360	205	2078	2702	752
RTOR Reduction (vph)	0	4	0	0	0	15
Lane Group Flow (vph)	379	356	205	2078	2702	737
Heavy Vehicles (%)	3%	3%	2%	2%	2%	2%
Turn Type	Prot	pm+ov	Prot	NA	NA	pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	15.5	31.0	15.5	125.5	105.5	121.0
Effective Green, g (s)	15.5	31.0	15.5	125.5	105.5	121.0
Actuated g/C Ratio	0.10	0.21	0.10	0.84	0.70	0.81
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	351	371	182	2960	2489	1324
v/s Ratio Prot	0.11	c0.10	c0.12	0.59	c0.76	0.06
v/s Ratio Perm		0.13				0.41
v/c Ratio	1.08	0.96	1.13	0.70	1.09	0.56
Uniform Delay, d1	67.2	58.9	67.2	4.8	22.2	5.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	71.0	35.8	104.7	1.4	46.2	0.5
Delay (s)	138.2	94.6	172.0	6.3	68.4	5.6
Level of Service	F	F	F	A	E	A
Approach Delay (s)	117.0			21.1	54.7	
Approach LOS	F			C	D	

Intersection Summary			
HCM 2000 Control Delay	50.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	108.1%	ICU Level of Service	G
Analysis Period (min)	15		

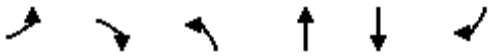
c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	396	320	184	2207	2875	752
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3400	1568	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3400	1568	1770	3539	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	396	320	184	2207	2875	752
RTOR Reduction (vph)	0	3	0	0	0	10
Lane Group Flow (vph)	396	317	184	2207	2875	742
Heavy Vehicles (%)	3%	3%	2%	2%	2%	2%
Turn Type	Prot	pm+ov	Prot	NA	NA	pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	16.5	29.0	12.5	124.5	107.5	124.0
Effective Green, g (s)	16.5	29.0	12.5	124.5	107.5	124.0
Actuated g/C Ratio	0.11	0.19	0.08	0.83	0.72	0.83
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	374	350	147	2937	2536	1356
v/s Ratio Prot	c0.12	0.08	c0.10	0.62	c0.81	0.06
v/s Ratio Perm		0.13				0.41
v/c Ratio	1.06	0.91	1.25	0.75	1.13	0.55
Uniform Delay, d1	66.8	59.2	68.8	5.8	21.2	4.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	62.9	25.7	157.2	1.8	65.7	0.5
Delay (s)	129.7	84.9	225.9	7.6	86.9	4.6
Level of Service	F	F	F	A	F	A
Approach Delay (s)	109.6			24.4	69.8	
Approach LOS	F			C	E	

Intersection Summary			
HCM 2000 Control Delay	57.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	112.2%	ICU Level of Service	H
Analysis Period (min)	15		

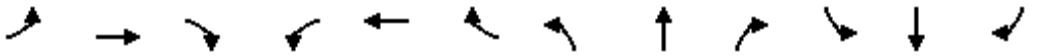
c Critical Lane Group



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	383	312	179	2140	2782	727
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lane Util. Factor	0.97	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3400	1568	1770	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3400	1568	1770	3539	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	383	312	179	2140	2782	727
RTOR Reduction (vph)	0	4	0	0	0	14
Lane Group Flow (vph)	383	308	179	2140	2782	713
Heavy Vehicles (%)	3%	3%	2%	2%	2%	2%
Turn Type	Prot	pm+ov	Prot	NA	NA	pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	15.5	29.0	13.5	125.5	107.5	123.0
Effective Green, g (s)	15.5	29.0	13.5	125.5	107.5	123.0
Actuated g/C Ratio	0.10	0.19	0.09	0.84	0.72	0.82
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	351	350	159	2960	2536	1345
v/s Ratio Prot	c0.11	0.08	c0.10	0.60	c0.79	0.05
v/s Ratio Perm		0.12				0.40
v/c Ratio	1.09	0.88	1.13	0.72	1.10	0.53
Uniform Delay, d1	67.2	58.8	68.2	5.1	21.2	4.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	74.7	21.4	109.1	1.6	50.6	0.4
Delay (s)	142.0	80.2	177.4	6.6	71.8	4.7
Level of Service	F	F	F	A	E	A
Approach Delay (s)	114.2			19.8	57.9	
Approach LOS	F			B	E	

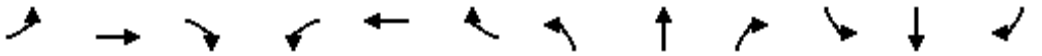
Intersection Summary			
HCM 2000 Control Delay	50.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	109.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



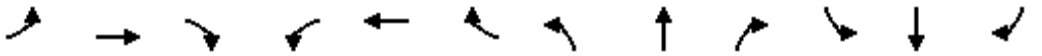
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	380	541	21	105	710	0	33	1060	79	760	600	680
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3544		3502	3610		1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3544		3502	3610		1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	380	541	21	105	710	0	33	1060	79	760	600	680
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	52	0	0	212
Lane Group Flow (vph)	380	560	0	105	710	0	33	1060	27	760	600	468
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	16.5	38.8		7.1	29.4		4.6	47.8	47.8	33.2	76.4	76.4
Effective Green, g (s)	18.0	40.3		8.6	30.9		6.1	50.8	50.8	34.7	79.4	79.4
Actuated g/C Ratio	0.12	0.27		0.06	0.21		0.04	0.34	0.34	0.23	0.53	0.53
Clearance Time (s)	5.5	5.5		5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	410	949		200	741		69	1183	531	792	1850	819
v/s Ratio Prot	c0.11	0.16		0.03	c0.20		0.02	c0.30		c0.22	0.17	
v/s Ratio Perm									0.02			0.30
v/c Ratio	0.93	0.59		0.53	0.96		0.48	0.90	0.05	0.96	0.32	0.57
Uniform Delay, d1	65.5	47.9		68.9	59.1		70.6	47.3	33.5	57.2	20.2	24.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	26.6	0.7		1.6	23.0		3.0	9.5	0.1	22.2	0.2	1.4
Delay (s)	92.2	48.6		70.5	82.1		73.6	56.8	33.6	79.4	20.4	25.4
Level of Service	F	D		E	F		E	E	C	E	C	C
Approach Delay (s)		66.2			80.6			55.7			44.1	
Approach LOS		E			F			E			D	

Intersection Summary			
HCM 2000 Control Delay	57.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	150.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	94.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



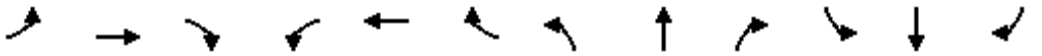
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	367	526	20	102	688	0	32	1026	76	742	581	658
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3545		3502	3610		1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3545		3502	3610		1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	367	526	20	102	688	0	32	1026	76	742	581	658
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	50	0	0	209
Lane Group Flow (vph)	367	545	0	102	688	0	32	1026	26	742	581	449
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	16.4	38.3		7.0	28.9		3.4	48.2	48.2	32.7	77.5	77.5
Effective Green, g (s)	17.9	39.8		8.5	30.4		4.9	51.2	51.2	34.2	80.5	80.5
Actuated g/C Ratio	0.12	0.27		0.06	0.20		0.03	0.34	0.34	0.23	0.54	0.54
Clearance Time (s)	5.5	5.5		5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	410	942		198	733		55	1198	537	784	1884	834
v/s Ratio Prot	c0.11	0.15		0.03	c0.19		0.02	c0.29		c0.22	0.17	
v/s Ratio Perm									0.02			0.29
v/c Ratio	0.90	0.58		0.52	0.94		0.58	0.86	0.05	0.95	0.31	0.54
Uniform Delay, d1	65.0	47.7		68.6	58.7		71.4	45.8	33.0	56.8	19.2	22.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	21.1	0.6		1.4	19.4		11.3	6.7	0.1	20.0	0.2	1.1
Delay (s)	86.1	48.3		70.0	78.2		82.7	52.6	33.0	76.8	19.3	23.6
Level of Service	F	D		E	E		F	D	C	E	B	C
Approach Delay (s)		63.5			77.1			52.1			42.3	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	54.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	149.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



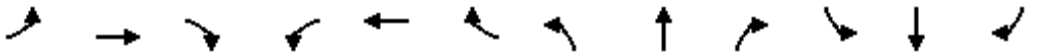
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	380	541	21	105	710	1131	33	1060	79	760	600	680
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3544		3502	3610	1553	1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3544		3502	3610	1553	1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	380	541	21	105	710	1131	33	1060	79	760	600	680
RTOR Reduction (vph)	0	2	0	0	0	190	0	0	59	0	0	173
Lane Group Flow (vph)	380	560	0	105	710	941	33	1060	20	760	600	507
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	11.5	61.9		7.1	57.5	57.5	3.3	35.1	35.1	23.5	55.3	55.3
Effective Green, g (s)	13.0	63.4		8.6	59.0	59.0	4.8	38.1	38.1	25.0	58.3	58.3
Actuated g/C Ratio	0.09	0.42		0.06	0.39	0.39	0.03	0.25	0.25	0.17	0.39	0.39
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	295	1487		199	1409	606	54	883	396	568	1352	598
v/s Ratio Prot	c0.11	0.16		0.03	0.20		0.02	c0.30		c0.22	0.17	
v/s Ratio Perm						c0.61			0.01			0.33
v/c Ratio	1.29	0.38		0.53	0.50	1.55	0.61	1.20	0.05	1.34	0.44	0.85
Uniform Delay, d1	69.0	30.2		69.3	34.9	46.0	72.2	56.5	42.8	63.0	34.4	42.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	152.8	0.1		1.6	0.2	257.2	15.1	101.1	0.1	163.8	0.4	11.7
Delay (s)	221.9	30.3		70.9	35.1	303.2	87.4	157.6	42.9	226.8	34.8	54.0
Level of Service	F	C		E	D	F	F	F	D	F	C	D
Approach Delay (s)		107.6			192.9			147.9			112.7	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM 2000 Control Delay	144.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.39		
Actuated Cycle Length (s)	151.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	120.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			



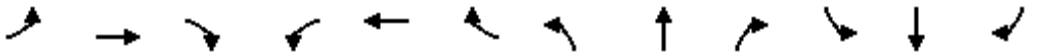
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	367	526	20	102	688	1097	32	1026	76	742	581	658
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3545		3502	3610	1553	1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3545		3502	3610	1553	1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	367	526	20	102	688	1097	32	1026	76	742	581	658
RTOR Reduction (vph)	0	2	0	0	0	190	0	0	57	0	0	177
Lane Group Flow (vph)	367	544	0	102	688	907	32	1026	19	742	581	481
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	11.5	62.0		7.0	57.5	57.5	3.3	35.1	35.1	23.5	55.3	55.3
Effective Green, g (s)	13.0	63.5		8.5	59.0	59.0	4.8	38.1	38.1	25.0	58.3	58.3
Actuated g/C Ratio	0.09	0.42		0.06	0.39	0.39	0.03	0.25	0.25	0.17	0.39	0.39
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	295	1489		197	1409	606	54	883	396	568	1352	598
v/s Ratio Prot	c0.11	0.15		0.03	0.19		0.02	c0.29		c0.22	0.17	
v/s Ratio Perm						c0.58			0.01			0.31
v/c Ratio	1.24	0.37		0.52	0.49	1.50	0.59	1.16	0.05	1.31	0.43	0.80
Uniform Delay, d1	69.0	30.0		69.3	34.7	46.0	72.2	56.5	42.8	63.0	34.2	41.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	135.1	0.1		1.4	0.2	232.4	12.7	85.4	0.1	150.3	0.4	8.6
Delay (s)	204.2	30.1		70.7	34.8	278.5	84.8	141.9	42.9	213.3	34.6	49.9
Level of Service	F	C		E	C	F	F	F	D	F	C	D
Approach Delay (s)		100.1			178.4			133.6			106.6	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM 2000 Control Delay	133.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	151.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	117.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			



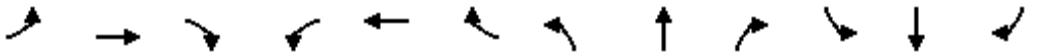
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	347	325	15	85	427	805	24	927	80	368	501	566
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539		3502	3610	1553	1703	3505	1573	3433	3505	1551
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539		3502	3610	1553	1703	3505	1573	3433	3505	1551
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	347	325	15	85	427	805	24	927	80	368	501	566
RTOR Reduction (vph)	0	2	0	0	0	107	0	0	58	0	0	291
Lane Group Flow (vph)	347	338	0	85	427	698	24	927	22	368	501	275
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	14.2	69.0		6.3	61.1	61.1	2.5	38.3	38.3	15.1	50.9	50.9
Effective Green, g (s)	15.7	70.5		7.8	62.6	62.6	4.0	41.3	41.3	16.6	53.9	53.9
Actuated g/C Ratio	0.10	0.46		0.05	0.41	0.41	0.03	0.27	0.27	0.11	0.35	0.35
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	354	1639		179	1484	638	44	951	426	374	1241	549
v/s Ratio Prot	c0.10	0.10		0.02	0.12		0.01	c0.26		c0.11	0.14	
v/s Ratio Perm						c0.45			0.01			0.18
v/c Ratio	0.98	0.21		0.47	0.29	1.09	0.55	0.97	0.05	0.98	0.40	0.50
Uniform Delay, d1	68.1	24.2		70.2	29.9	44.8	73.2	54.9	41.0	67.7	37.0	38.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	42.3	0.0		1.2	0.1	63.9	9.2	23.2	0.1	41.9	0.4	1.4
Delay (s)	110.4	24.3		71.4	30.0	108.7	82.4	78.1	41.1	109.6	37.4	40.0
Level of Service	F	C		E	C	F	F	E	D	F	D	D
Approach Delay (s)		67.8			80.8			75.4			56.9	
Approach LOS		E			F			E			E	

Intersection Summary			
HCM 2000 Control Delay	69.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	152.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	95.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



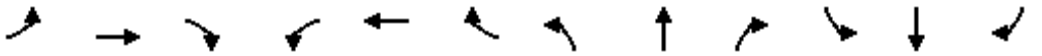
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	590	744	86	159	651	0	58	806	142	748	897	804
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3491		3502	3610		1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3491		3502	3610		1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	590	744	86	159	651	0	58	806	142	748	897	804
RTOR Reduction (vph)	0	6	0	0	0	0	0	0	104	0	0	303
Lane Group Flow (vph)	590	824	0	159	651	0	58	806	38	748	897	501
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	26.6	44.3		9.9	27.6		5.1	36.7	36.7	33.3	64.9	64.9
Effective Green, g (s)	28.1	45.8		11.4	29.1		6.6	39.7	39.7	34.8	67.9	67.9
Actuated g/C Ratio	0.19	0.31		0.08	0.20		0.04	0.27	0.27	0.24	0.46	0.46
Clearance Time (s)	5.5	5.5		5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	653	1082		270	711		76	942	422	808	1611	713
v/s Ratio Prot	c0.17	0.24		0.05	c0.18		0.03	c0.23		c0.22	0.26	
v/s Ratio Perm									0.02			0.32
v/c Ratio	0.90	0.76		0.59	0.92		0.76	0.86	0.09	0.93	0.56	0.70
Uniform Delay, d1	58.5	46.0		65.9	58.1		69.8	51.3	40.5	55.2	29.0	31.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	15.8	3.0		2.5	16.3		33.7	8.3	0.2	16.2	0.7	3.7
Delay (s)	74.2	49.0		68.4	74.4		103.5	59.6	40.6	71.4	29.6	35.6
Level of Service	E	D		E	E		F	E	D	E	C	D
Approach Delay (s)		59.5			73.2			59.4			44.3	
Approach LOS		E			E			E			D	

Intersection Summary			
HCM 2000 Control Delay	54.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	147.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	91.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



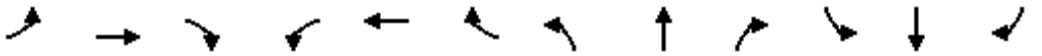
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	571	720	84	154	632	0	56	780	138	728	867	778
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3491		3502	3610		1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3491		3502	3610		1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	571	720	84	154	632	0	56	780	138	728	867	778
RTOR Reduction (vph)	0	6	0	0	0	0	0	0	101	0	0	305
Lane Group Flow (vph)	571	798	0	154	632	0	56	780	37	728	867	473
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	26.2	44.0		9.5	27.3		4.9	35.6	35.6	32.8	63.5	63.5
Effective Green, g (s)	27.7	45.5		11.0	28.8		6.4	38.6	38.6	34.3	66.5	66.5
Actuated g/C Ratio	0.19	0.31		0.08	0.20		0.04	0.27	0.27	0.24	0.46	0.46
Clearance Time (s)	5.5	5.5		5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	654	1092		264	715		74	930	417	809	1603	709
v/s Ratio Prot	c0.17	0.23		0.04	c0.18		0.03	c0.22		c0.21	0.25	
v/s Ratio Perm									0.02			0.30
v/c Ratio	0.87	0.73		0.58	0.88		0.76	0.84	0.09	0.90	0.54	0.67
Uniform Delay, d1	57.1	44.5		65.0	56.7		68.7	50.5	40.2	53.9	28.4	30.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	12.1	2.3		2.5	12.3		32.8	7.3	0.2	12.7	0.6	3.0
Delay (s)	69.3	46.8		67.5	69.0		101.6	57.8	40.3	66.6	29.0	33.8
Level of Service	E	D		E	E		F	E	D	E	C	C
Approach Delay (s)		56.1			68.7			57.8			42.1	
Approach LOS		E			E			E			D	

Intersection Summary			
HCM 2000 Control Delay	52.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	145.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



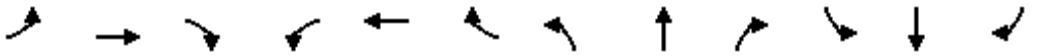
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	590	744	86	159	651	679	58	806	142	748	897	804
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3491		3502	3610	1553	1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3491		3502	3610	1553	1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	590	744	86	159	651	679	58	806	142	748	897	804
RTOR Reduction (vph)	0	6	0	0	0	257	0	0	108	0	0	275
Lane Group Flow (vph)	590	824	0	159	651	422	58	806	34	748	897	529
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	24.5	52.0		10.0	37.5	37.5	5.3	33.0	33.0	31.5	59.2	59.2
Effective Green, g (s)	26.0	53.5		11.5	39.0	39.0	6.8	36.0	36.0	33.0	62.2	62.2
Actuated g/C Ratio	0.17	0.36		0.08	0.26	0.26	0.05	0.24	0.24	0.22	0.41	0.41
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	595	1245		268	938	403	77	841	377	755	1453	643
v/s Ratio Prot	c0.17	0.24		0.05	0.18		0.03	c0.23		c0.22	0.26	
v/s Ratio Perm						c0.27			0.02			0.34
v/c Ratio	0.99	0.66		0.59	0.69	1.05	0.75	0.96	0.09	0.99	0.62	0.82
Uniform Delay, d1	61.9	40.6		67.0	50.1	55.5	70.8	56.3	44.3	58.3	34.5	39.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	34.6	1.1		2.7	2.0	57.9	31.4	21.6	0.2	30.3	1.1	9.3
Delay (s)	96.5	41.8		69.7	52.1	113.4	102.2	77.9	44.5	88.7	35.6	48.3
Level of Service	F	D		E	D	F	F	E	D	F	D	D
Approach Delay (s)		64.5			81.9			74.6			56.0	
Approach LOS		E			F			E			E	

Intersection Summary			
HCM 2000 Control Delay	66.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	91.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



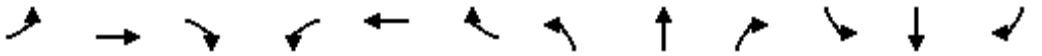
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	571	720	84	154	632	662	56	780	138	728	867	778
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3490		3502	3610	1553	1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3490		3502	3610	1553	1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	571	720	84	154	632	662	56	780	138	728	867	778
RTOR Reduction (vph)	0	6	0	0	0	258	0	0	105	0	0	275
Lane Group Flow (vph)	571	798	0	154	632	404	56	780	33	728	867	503
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	24.5	52.9		9.6	38.0	38.0	4.9	32.5	32.5	31.5	59.1	59.1
Effective Green, g (s)	26.0	54.4		11.1	39.5	39.5	6.4	35.5	35.5	33.0	62.1	62.1
Actuated g/C Ratio	0.17	0.36		0.07	0.26	0.26	0.04	0.24	0.24	0.22	0.41	0.41
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	595	1265		259	950	408	72	829	372	755	1451	642
v/s Ratio Prot	c0.17	0.23		0.04	0.18		0.03	c0.22		c0.21	0.25	
v/s Ratio Perm						c0.26			0.02			0.32
v/c Ratio	0.96	0.63		0.59	0.67	0.99	0.78	0.94	0.09	0.96	0.60	0.78
Uniform Delay, d1	61.5	39.5		67.3	49.3	55.1	71.1	56.2	44.6	57.9	34.2	38.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	26.7	0.8		2.8	1.5	41.9	38.0	18.9	0.2	24.0	0.9	7.0
Delay (s)	88.2	40.4		70.1	50.9	97.0	109.1	75.1	44.8	82.0	35.2	45.2
Level of Service	F	D		E	D	F	F	E	D	F	D	D
Approach Delay (s)		60.2			74.0			72.8			52.8	
Approach LOS		E			E			E			D	

Intersection Summary			
HCM 2000 Control Delay	62.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



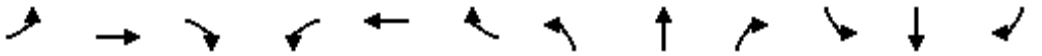
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	654	774	124	184	754	0	120	876	168	919	1212	723
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3464		3502	3610		1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3464		3502	3610		1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	654	774	124	184	754	0	120	876	168	919	1212	723
RTOR Reduction (vph)	0	9	0	0	0	0	0	0	128	0	0	298
Lane Group Flow (vph)	654	889	0	184	754	0	120	876	40	919	1212	425
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	26.6	46.6		9.3	29.3		12.3	33.0	33.0	37.6	58.3	58.3
Effective Green, g (s)	28.1	48.1		10.8	30.8		13.8	36.0	36.0	39.1	61.3	61.3
Actuated g/C Ratio	0.19	0.32		0.07	0.21		0.09	0.24	0.24	0.26	0.41	0.41
Clearance Time (s)	5.5	5.5		5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	643	1110		252	741		156	841	377	894	1432	634
v/s Ratio Prot	c0.19	0.26		0.05	c0.21		0.07	c0.25		c0.27	0.35	
v/s Ratio Perm									0.03			0.27
v/c Ratio	1.02	0.80		0.73	1.02		0.77	1.04	0.11	1.03	0.85	0.67
Uniform Delay, d1	61.0	46.6		68.2	59.6		66.5	57.0	44.5	55.4	40.1	36.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	39.9	4.1		9.5	37.5		18.9	42.4	0.2	37.5	5.3	3.4
Delay (s)	100.8	50.6		77.7	97.1		85.5	99.4	44.7	92.9	45.3	39.5
Level of Service	F	D		E	F		F	F	D	F	D	D
Approach Delay (s)		71.8			93.3			90.1			59.2	
Approach LOS		E			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	72.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



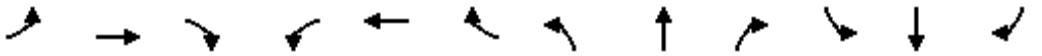
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	632	750	120	179	731	0	116	848	163	892	1173	699
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3464		3502	3610		1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3464		3502	3610		1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	632	750	120	179	731	0	116	848	163	892	1173	699
RTOR Reduction (vph)	0	8	0	0	0	0	0	0	122	0	0	291
Lane Group Flow (vph)	632	862	0	179	731	0	116	848	41	892	1173	408
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	25.7	45.3		8.9	28.5		11.9	34.8	34.8	37.5	60.4	60.4
Effective Green, g (s)	27.2	46.8		10.4	30.0		13.4	37.8	37.8	39.0	63.4	63.4
Actuated g/C Ratio	0.18	0.31		0.07	0.20		0.09	0.25	0.25	0.26	0.42	0.42
Clearance Time (s)	5.5	5.5		5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	622	1080		242	722		152	883	396	892	1481	655
v/s Ratio Prot	c0.18	0.25		0.05	c0.20		0.07	c0.24		c0.26	0.33	
v/s Ratio Perm									0.03			0.26
v/c Ratio	1.02	0.80		0.74	1.01		0.76	0.96	0.10	1.00	0.79	0.62
Uniform Delay, d1	61.4	47.3		68.5	60.0		66.7	55.4	43.1	55.5	37.6	33.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	40.2	4.0		10.3	36.6		18.9	21.4	0.2	30.1	3.4	2.5
Delay (s)	101.6	51.3		78.7	96.6		85.6	76.8	43.3	85.6	41.0	36.4
Level of Service	F	D		E	F		F	E	D	F	D	D
Approach Delay (s)		72.4			93.1			72.9			54.2	
Approach LOS		E			F			E			D	

Intersection Summary			
HCM 2000 Control Delay	67.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



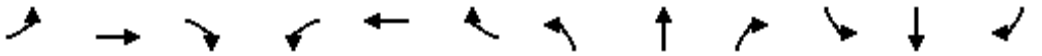
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	654	774	124	184	754	769	120	876	168	919	1212	723
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3464		3502	3610	1553	1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3464		3502	3610	1553	1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	654	774	124	184	754	769	120	876	168	919	1212	723
RTOR Reduction (vph)	0	9	0	0	0	282	0	0	129	0	0	268
Lane Group Flow (vph)	654	889	0	184	754	487	120	876	39	919	1212	455
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	24.5	50.2		9.8	35.5	35.5	10.1	32.0	32.0	34.5	56.4	56.4
Effective Green, g (s)	26.0	51.7		11.3	37.0	37.0	11.6	35.0	35.0	36.0	59.4	59.4
Actuated g/C Ratio	0.17	0.34		0.08	0.25	0.25	0.08	0.23	0.23	0.24	0.40	0.40
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	595	1193		263	890	383	131	817	367	823	1387	614
v/s Ratio Prot	c0.19	0.26		0.05	0.21		0.07	c0.25		c0.27	0.35	
v/s Ratio Perm						c0.31			0.02			0.29
v/c Ratio	1.10	0.75		0.70	0.85	1.27	0.92	1.07	0.11	1.12	0.87	0.74
Uniform Delay, d1	62.0	43.3		67.7	53.8	56.5	68.7	57.5	45.2	57.0	41.8	38.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	67.0	2.4		6.9	7.3	141.5	53.0	52.7	0.2	68.5	6.8	5.6
Delay (s)	129.0	45.7		74.6	61.1	198.0	121.7	110.2	45.5	125.5	48.7	44.3
Level of Service	F	D		E	E	F	F	F	D	F	D	D
Approach Delay (s)		80.8			124.3			102.0			72.3	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	91.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



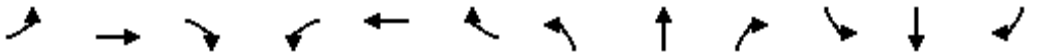
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	632	750	120	179	731	749	116	848	163	892	1173	699
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3464		3502	3610	1553	1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3464		3502	3610	1553	1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	632	750	120	179	731	749	116	848	163	892	1173	699
RTOR Reduction (vph)	0	9	0	0	0	284	0	0	126	0	0	273
Lane Group Flow (vph)	632	861	0	179	731	465	116	848	37	892	1173	426
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	24.5	50.0		10.8	36.3	36.3	11.2	31.0	31.0	34.7	54.5	54.5
Effective Green, g (s)	26.0	51.5		12.3	37.8	37.8	12.7	34.0	34.0	36.2	57.5	57.5
Actuated g/C Ratio	0.17	0.34		0.08	0.25	0.25	0.08	0.23	0.23	0.24	0.38	0.38
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	595	1189		287	909	391	144	794	356	828	1343	594
v/s Ratio Prot	c0.18	0.25		0.05	0.20		0.07	c0.24		c0.26	0.33	
v/s Ratio Perm						c0.30			0.02			0.27
v/c Ratio	1.06	0.72		0.62	0.80	1.19	0.81	1.07	0.10	1.08	0.87	0.72
Uniform Delay, d1	62.0	43.0		66.6	52.6	56.1	67.4	58.0	45.9	56.9	42.9	39.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	54.5	2.0		3.4	5.0	107.7	26.0	51.7	0.2	54.2	7.0	4.9
Delay (s)	116.5	45.1		70.0	57.6	163.8	93.5	109.7	46.2	111.1	49.9	44.2
Level of Service	F	D		E	E	F	F	F	D	F	D	D
Approach Delay (s)		75.1			106.9			98.8			68.2	
Approach LOS		E			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	83.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



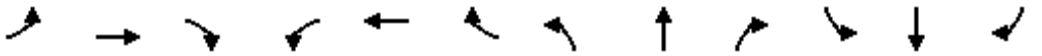
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	738	1032	85	113	618	0	51	804	179	1065	1269	795
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3513		3502	3610		1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3513		3502	3610		1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	738	1032	85	113	618	0	51	804	179	1065	1269	795
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	137	0	0	329
Lane Group Flow (vph)	738	1113	0	113	618	0	51	804	42	1065	1269	466
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	29.5	48.5		4.5	23.5		4.6	32.1	32.1	42.5	70.0	70.0
Effective Green, g (s)	31.0	50.0		6.0	25.0		6.1	35.1	35.1	44.0	73.0	73.0
Actuated g/C Ratio	0.21	0.33		0.04	0.17		0.04	0.23	0.23	0.29	0.48	0.48
Clearance Time (s)	5.5	5.5		5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	704	1162		139	597		68	814	365	999	1693	749
v/s Ratio Prot	c0.21	0.32		0.03	c0.17		0.03	c0.23		c0.31	0.36	
v/s Ratio Perm									0.03			0.30
v/c Ratio	1.05	0.96		0.81	1.04		0.75	0.99	0.12	1.07	0.75	0.62
Uniform Delay, d1	60.0	49.5		72.0	63.0		71.7	57.8	45.8	53.5	31.6	28.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	47.3	17.0		28.2	46.2		34.3	28.4	0.3	47.8	2.2	2.1
Delay (s)	107.3	66.5		100.2	109.3		106.1	86.1	46.0	101.4	33.8	31.0
Level of Service	F	E		F	F		F	F	D	F	C	C
Approach Delay (s)		82.7			107.9			80.2			56.1	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	72.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	151.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	104.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



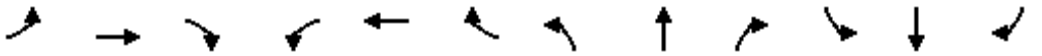
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	714	1000	82	109	600	0	49	778	174	1032	1229	769
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3513		3502	3610		1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3513		3502	3610		1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	714	1000	82	109	600	0	49	778	174	1032	1229	769
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	134	0	0	330
Lane Group Flow (vph)	714	1078	0	109	600	0	49	778	40	1032	1229	439
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	29.5	48.5		4.5	23.5		4.6	32.1	32.1	42.5	70.0	70.0
Effective Green, g (s)	31.0	50.0		6.0	25.0		6.1	35.1	35.1	44.0	73.0	73.0
Actuated g/C Ratio	0.21	0.33		0.04	0.17		0.04	0.23	0.23	0.29	0.48	0.48
Clearance Time (s)	5.5	5.5		5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	704	1162		139	597		68	814	365	999	1693	749
v/s Ratio Prot	c0.21	0.31		0.03	c0.17		0.03	c0.22		c0.30	0.35	
v/s Ratio Perm									0.03			0.28
v/c Ratio	1.01	0.93		0.78	1.01		0.72	0.96	0.11	1.03	0.73	0.59
Uniform Delay, d1	60.0	48.8		71.9	63.0		71.7	57.2	45.7	53.5	31.1	28.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	37.5	12.4		23.4	38.1		28.5	21.6	0.3	37.3	1.9	1.7
Delay (s)	97.6	61.2		95.3	101.1		100.1	78.9	46.0	90.9	32.9	29.9
Level of Service	F	E		F	F		F	E	D	F	C	C
Approach Delay (s)		75.7			100.2			74.2			51.9	
Approach LOS		E			F			E			D	

Intersection Summary			
HCM 2000 Control Delay	67.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	151.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	101.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



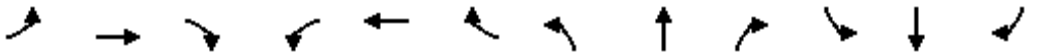
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	738	1032	85	113	618	751	51	804	179	1065	1269	795
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3513		3502	3610	1553	1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3513		3502	3610	1553	1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	738	1032	85	113	618	751	51	804	179	1065	1269	795
RTOR Reduction (vph)	0	4	0	0	0	326	0	0	138	0	0	294
Lane Group Flow (vph)	738	1113	0	113	618	425	51	804	41	1065	1269	501
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	26.5	51.1		5.9	30.5	30.5	4.6	31.1	31.1	39.5	66.0	66.0
Effective Green, g (s)	28.0	52.6		7.4	32.0	32.0	6.1	34.1	34.1	41.0	69.0	69.0
Actuated g/C Ratio	0.19	0.35		0.05	0.21	0.21	0.04	0.23	0.23	0.27	0.46	0.46
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	636	1222		171	764	328	68	791	354	931	1600	708
v/s Ratio Prot	c0.21	0.32		0.03	0.17		0.03	c0.23		c0.31	0.36	
v/s Ratio Perm						c0.27			0.03			0.32
v/c Ratio	1.16	0.91		0.66	0.81	1.30	0.75	1.02	0.12	1.14	0.79	0.71
Uniform Delay, d1	61.5	47.0		70.6	56.6	59.5	71.7	58.5	46.5	55.0	35.0	33.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	88.8	10.2		7.9	6.1	154.5	34.3	36.2	0.3	77.6	3.2	3.9
Delay (s)	150.4	57.2		78.5	62.7	214.0	106.1	94.7	46.8	132.6	38.1	36.8
Level of Service	F	E		E	E	F	F	F	D	F	D	D
Approach Delay (s)		94.3			140.6			86.9			70.0	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	92.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	151.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	104.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



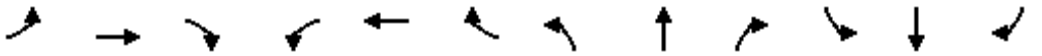
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	714	1000	82	109	600	732	49	778	174	1032	1229	769
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3513		3502	3610	1553	1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3513		3502	3610	1553	1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	714	1000	82	109	600	732	49	778	174	1032	1229	769
RTOR Reduction (vph)	0	4	0	0	0	326	0	0	135	0	0	295
Lane Group Flow (vph)	714	1078	0	109	600	406	49	778	39	1032	1229	474
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	26.5	51.3		5.7	30.5	30.5	4.5	31.1	31.1	39.5	66.1	66.1
Effective Green, g (s)	28.0	52.8		7.2	32.0	32.0	6.0	34.1	34.1	41.0	69.1	69.1
Actuated g/C Ratio	0.19	0.35		0.05	0.21	0.21	0.04	0.23	0.23	0.27	0.46	0.46
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	636	1227		166	764	328	67	791	354	931	1602	709
v/s Ratio Prot	c0.21	0.31		0.03	0.17		0.03	c0.22		c0.30	0.35	
v/s Ratio Perm						c0.26			0.02			0.31
v/c Ratio	1.12	0.88		0.66	0.79	1.24	0.73	0.98	0.11	1.11	0.77	0.67
Uniform Delay, d1	61.5	46.1		70.7	56.3	59.5	71.8	58.2	46.5	55.0	34.3	32.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	74.4	7.3		7.6	5.1	130.1	30.8	27.9	0.3	63.9	2.6	3.0
Delay (s)	136.0	53.4		78.4	61.4	189.6	102.6	86.1	46.7	119.0	36.9	35.0
Level of Service	F	D		E	E	F	F	F	D	F	D	D
Approach Delay (s)		86.2			127.8			80.1			64.4	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	84.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	151.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	101.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



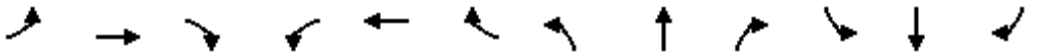
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	706	1010	111	152	696	0	56	780	185	976	1293	838
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3495		3502	3610		1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3495		3502	3610		1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	706	1010	111	152	696	0	56	780	185	976	1293	838
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	137	0	0	316
Lane Group Flow (vph)	706	1116	0	152	696	0	56	780	48	976	1293	522
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	28.8	49.5		6.3	27.0		5.0	31.7	31.7	40.1	66.8	66.8
Effective Green, g (s)	30.3	51.0		7.8	28.5		6.5	34.7	34.7	41.6	69.8	69.8
Actuated g/C Ratio	0.20	0.34		0.05	0.19		0.04	0.23	0.23	0.28	0.46	0.46
Clearance Time (s)	5.5	5.5		5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	688	1179		180	680		73	804	361	945	1619	716
v/s Ratio Prot	c0.21	0.32		0.04	c0.19		0.03	c0.22		c0.28	0.37	
v/s Ratio Perm									0.03			0.34
v/c Ratio	1.03	0.95		0.84	1.02		0.77	0.97	0.13	1.03	0.80	0.73
Uniform Delay, d1	60.4	48.7		71.0	61.3		71.6	57.7	46.2	54.8	34.7	33.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	41.1	14.9		28.1	40.6		35.3	24.7	0.3	38.0	3.2	4.4
Delay (s)	101.5	63.7		99.1	101.9		106.9	82.4	46.6	92.8	37.9	37.4
Level of Service	F	E		F	F		F	F	D	F	D	D
Approach Delay (s)		78.3			101.4			77.3			55.0	
Approach LOS		E			F			E			D	

Intersection Summary			
HCM 2000 Control Delay	70.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	151.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



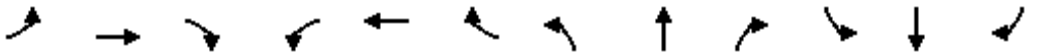
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	682	979	107	147	675	0	54	755	179	947	1252	810
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95		1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3495		3502	3610		1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3495		3502	3610		1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	682	979	107	147	675	0	54	755	179	947	1252	810
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	137	0	0	315
Lane Group Flow (vph)	682	1081	0	147	675	0	54	755	42	947	1252	495
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	28.5	48.9		6.1	26.5		4.8	32.1	32.1	40.5	67.8	67.8
Effective Green, g (s)	30.0	50.4		7.6	28.0		6.3	35.1	35.1	42.0	70.8	70.8
Actuated g/C Ratio	0.20	0.33		0.05	0.19		0.04	0.23	0.23	0.28	0.47	0.47
Clearance Time (s)	5.5	5.5		5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3		2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	681	1165		176	668		71	814	365	954	1642	727
v/s Ratio Prot	0.20	c0.31		0.04	c0.19		0.03	c0.22		c0.28	0.36	
v/s Ratio Perm									0.03			0.32
v/c Ratio	1.00	0.93		0.84	1.01		0.76	0.93	0.12	0.99	0.76	0.68
Uniform Delay, d1	60.5	48.6		71.1	61.5		71.7	56.8	45.8	54.4	33.2	31.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	34.8	12.4		26.9	37.4		35.3	17.0	0.3	27.2	2.5	3.2
Delay (s)	95.4	61.0		98.0	99.0		106.9	73.7	46.0	81.6	35.7	34.6
Level of Service	F	E		F	F		F	E	D	F	D	C
Approach Delay (s)		74.3			98.8			70.5			49.8	
Approach LOS		E			F			E			D	

Intersection Summary			
HCM 2000 Control Delay	65.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	151.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	99.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



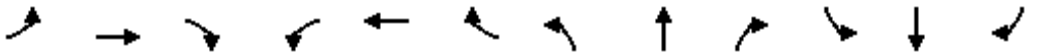
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	706	1010	111	152	696	795	56	780	185	976	1293	838
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3495		3502	3610	1553	1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3495		3502	3610	1553	1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	706	1010	111	152	696	795	56	780	185	976	1293	838
RTOR Reduction (vph)	0	6	0	0	0	301	0	0	140	0	0	280
Lane Group Flow (vph)	706	1115	0	152	696	494	56	780	45	976	1293	558
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	25.5	53.3		7.7	35.5	35.5	4.5	29.0	29.0	36.5	61.0	61.0
Effective Green, g (s)	27.0	54.8		9.2	37.0	37.0	6.0	32.0	32.0	38.0	64.0	64.0
Actuated g/C Ratio	0.18	0.37		0.06	0.25	0.25	0.04	0.21	0.21	0.25	0.43	0.43
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	617	1276		214	890	383	68	747	335	869	1495	662
v/s Ratio Prot	c0.21	0.32		0.04	0.19		0.03	c0.22		c0.28	0.37	
v/s Ratio Perm						c0.32			0.03			0.36
v/c Ratio	1.14	0.87		0.71	0.78	1.29	0.82	1.04	0.13	1.12	0.86	0.84
Uniform Delay, d1	61.5	44.4		69.1	52.7	56.5	71.5	59.0	47.8	56.0	39.1	38.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	83.0	6.8		9.5	4.3	149.2	51.5	45.0	0.3	70.3	5.9	10.4
Delay (s)	144.5	51.2		78.6	57.0	205.7	123.0	104.0	48.1	126.3	45.0	48.9
Level of Service	F	D		E	E	F	F	F	D	F	D	D
Approach Delay (s)		87.2			131.0			94.9			71.6	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	91.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	682	979	107	147	675	775	54	755	179	947	1252	810
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3495		3502	3610	1553	1703	3505	1573	3433	3505	1552
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3495		3502	3610	1553	1703	3505	1573	3433	3505	1552
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	682	979	107	147	675	775	54	755	179	947	1252	810
RTOR Reduction (vph)	0	6	0	0	0	302	0	0	141	0	0	281
Lane Group Flow (vph)	682	1080	0	147	675	473	54	755	38	947	1252	529
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	25.5	54.5		7.5	36.5	36.5	4.5	28.0	28.0	36.5	60.0	60.0
Effective Green, g (s)	27.0	56.0		9.0	38.0	38.0	6.0	31.0	31.0	38.0	63.0	63.0
Actuated g/C Ratio	0.18	0.37		0.06	0.25	0.25	0.04	0.21	0.21	0.25	0.42	0.42
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	617	1304		210	914	393	68	724	325	869	1472	651
v/s Ratio Prot	c0.20	0.31		0.04	0.19		0.03	c0.22		c0.28	0.36	
v/s Ratio Perm						c0.30			0.02			0.34
v/c Ratio	1.11	0.83		0.70	0.74	1.20	0.79	1.04	0.12	1.09	0.85	0.81
Uniform Delay, d1	61.5	42.6		69.2	51.4	56.0	71.4	59.5	48.4	56.0	39.3	38.3
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	68.6	4.3		8.6	2.9	113.8	43.9	45.1	0.3	57.9	5.3	8.5
Delay (s)	130.1	47.0		77.8	54.3	169.8	115.3	104.6	48.7	113.9	44.6	46.8
Level of Service	F	D		E	D	F	F	F	D	F	D	D
Approach Delay (s)		79.0			112.5			95.1			67.0	
Approach LOS		E			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	83.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	99.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	643	707	81	138	413	410	41	677	159	717	1090	771
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3493		3502	3610	1554	1703	3505	1573	3433	3505	1553
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3493		3502	3610	1554	1703	3505	1573	3433	3505	1553
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	643	707	81	138	413	410	41	677	159	717	1090	771
RTOR Reduction (vph)	0	6	0	0	0	300	0	0	117	0	0	360
Lane Group Flow (vph)	643	782	0	138	413	110	41	677	42	717	1090	411
Confl. Peds. (#/hr)	2		11	11		2	2		1	1		2
Heavy Vehicles (%)	2%	1%	3%	0%	0%	2%	6%	3%	1%	2%	3%	2%
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Actuated Green, G (s)	29.0	40.5		8.8	20.3	20.3	4.2	33.1	33.1	31.9	60.8	60.8
Effective Green, g (s)	30.5	42.0		10.3	21.8	21.8	5.7	36.1	36.1	33.4	63.8	63.8
Actuated g/C Ratio	0.22	0.30		0.07	0.16	0.16	0.04	0.26	0.26	0.24	0.46	0.46
Clearance Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	7.0
Vehicle Extension (s)	2.3	2.3		2.3	2.3	2.3	2.3	4.7	4.7	2.3	4.7	4.7
Lane Grp Cap (vph)	759	1064		261	571	245	70	918	412	832	1622	719
v/s Ratio Prot	c0.19	0.22		0.04	c0.11		0.02	c0.19		c0.21	0.31	
v/s Ratio Perm						0.07			0.03			0.26
v/c Ratio	0.85	0.73		0.53	0.72	0.45	0.59	0.74	0.10	0.86	0.67	0.57
Uniform Delay, d1	51.4	42.9		61.4	55.1	52.6	64.9	46.5	38.5	50.0	28.8	27.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.5	2.4		1.2	4.1	0.8	9.1	3.6	0.2	9.0	1.4	1.6
Delay (s)	59.9	45.3		62.7	59.2	53.3	74.0	50.2	38.8	59.0	30.2	28.7
Level of Service	E	D		E	E	D	E	D	D	E	C	C
Approach Delay (s)		51.9			57.2			49.2			37.7	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	46.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	137.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

OR213 & Beavercreek Road Improvements

Right Turn Acceleration Lane & Left Turn Queue

City of Oregon City

KITTELSON & ASSOCIATES

Engineer's Conceptual Estimate

Prepared By: Fred Wismer, PE		*Date: December 4, 2017*		
	This Estimate has a Rating of:	**3C**	*(See rating scale guide below.)*	
ITEM	**UNIT**	**TOTAL QUANTITY**	**UNIT PRICE**	**TOTAL COST**
Mobilization	LS	ALL	$131,000.00	$131,000.00
Traffic Control	LS	ALL	$107,000.00	$107,000.00
Erosion Control	LS	ALL	$114,000.00	$114,000.00
Removal of Structures and Obstructions	LS	ALL	$29,000.00	$29,000.00
Clearing and Grubbing	LS	ALL	$25,000.00	$25,000.00
General Earthworks	CY	30,150	$25.00	$753,750.00
Asphalt Roadway - Full Depth	SF	37,950	$6.70	$254,265.00
Pedestrian Ramp Rebuild	EA	4	$10,000.00	$40,000.00
Roadway - Shoulder	SF	7,640	$3.40	$25,976.00
Concrete Curbs - Traffic Separator	LF	285	$20.00	$5,700.00
Guardrail Barrier, Complete	LF	790	$40.00	$31,600.00
Guardrail Terminal, Complete	EA	2	$3,000.00	$6,000.00
Permanent Landscaping	SF	81,000	$1.10	$89,100.00
Pavement Markings, Complete	LS	ALL	$5,200.00	$5,200.00
Signage, Complete	LS	ALL	$12,350.00	$12,350.00
Traffic Signal Modifications, Complete	LS	ALL	$25,000.00	$25,000.00
TOTAL CONSTRUCTION COST				**$ 1,654,941**
ENGINEERING SUPPORT				
Engineering & Construction Management	LS	25%	$1,654,941.00	$413,800.00
ENGINEERING SUPPORT SUBTOTAL				**$ 413,800**
TOTAL PROJECT SUBTOTAL				**$ 2,068,741**
30% Contingency				**$ 620,630**
TOTAL ESTIMATED PROJECT COST				**$ 2,689,371**

Scope Accuracy:

Level 1: Project scope well understood and well defined.

Level 2: Project scope conceptual. Scope lacks detail due to potential permit requirements; Unknown project conditions; limited knowledge of external impacts.

Level 3: Project scope is a "vision" with limited detail.

Engineering Effort:

Level A: Preliminary engineering performed. Technical information is available, engineering calculations have been performed; clear understanding of the materials size and quantities needed to execute job. Schedule understood; staff and permitting is fairly clear, (however this element may still need refining). Project Development & Construction Contingencies ranges between 10%-20%.

Level B: Conceptual engineering performed. Technical information is available, rough engineering calculations may have been performed, or similar information from previous similar work is compared and used. Project Development Contingencies ranges between 15% to 25% and Construction Contingencies ranges between 20% to 30%.

Level C: No engineering performed. Educated guesstimating. Limited technical information available and/or analysis performed. Project Development and Construction Contingencies should be selected appropriately by Project Manager. Contingency may range up to 50%.

Spec. No.	Item No.	Item	Bid Unit	Est. Unit	Quantity	2016 Unit Price	2016 Price
		TEMPORARY FEATURES AND APPURTENANCES					
00210	10	Mobilization	Lump Sum	Lump Sum	1	$ 689,700.00	$ 689,700.00
00225	20	Temporary Protection and Direction of Traffic	Lump Sum	Lump Sum	1	$ 72,200.00	$ 72,200.00
00225	30	Temporary Signs	Sq Ft	Sq Ft	755	$ 16.00	$ 12,080.00
00225	40	Temporary Barricades, Type III	Each	Each	6	$ 120.00	$ 720.00
00225	50	Temporary Impact Attenuators, Truck Mounted	Each	Each	2	$ 11,400.00	$ 22,800.00
00225	60	Temporary Plastic Drums	Each	Each	194	$ 60.00	$ 11,640.00
00225	70	Portable Changeable Message Signs	Each	Each	3	$ 8,300.00	$ 24,900.00
00225	80	Flaggers	Hour	Hour	2000	$ 50.00	$ 100,000.00
00270	90	Temporary Fence	Ft	Ft	1,400.0	$ 3.00	$ 4,200.00
00280	100	Erosion Control	Lump Sum	Lump Sum	1	$ 58,700.00	$ 58,700.00
00280	110	Compost Erosion Blanket	Cu Yd	Cu Yd	400.0	$ 40.00	$ 16,000.00
00280	120	Check Dam	Each	Each	5	$ 140.00	$ 700.00
00280	130	Compost Filter Berm	Cu Yd	Cu Yd	240.0	$ 30.00	$ 7,200.00
00280	140	Construction Entrance	Each	Each	3	$ 1,100.00	$ 3,300.00
00280	150	Sediment Fence, Unsupported	Ft	Ft	280.0	$ 4.00	$ 1,120.00
00280	160	Inlet Protection	Each	Each	24	$ 90.00	$ 2,160.00
00290	170	Pollution Control Plan	Lump Sum	Lump Sum	1	$ 3,100.00	$ 3,100.00
		ROADWORK					
00310	180	Removal of Structures and Obstructions	Lump Sum	Lump Sum	1	$ 11,000.00	$ 11,000.00
00310	190	Removal of Pipes	Ft	Ft	591.0	$ 20.00	$ 11,820.00
00310	200	Removal of Inlets	Each	Each	3	$ 340.00	$ 1,020.00
00310	210	Removal of Guardrail	Ft	Ft	1,928.0	$ 3.70	$ 7,133.60
00310	220	Removal of Barrier	Ft	Ft	1,059.0	$ 9.00	$ 9,531.00
00320	230	Clearing and Grubbing	Lump Sum	Acre	4.0	$ 11,000.00	$ 44,000.00
00330	240	Ditch Excavation	Cu Yd	Cu Yd	664.0	$ 15.00	$ 9,960.00
00330	250	General Excavation	Cu Yd	Cu Yd	13,000	$ 12.00	$ 156,000.00
00350	260	Drainage Geotextile, Type 2	Sq Yd	Sq Yd	185	$ 7.00	$ 1,295.00
00350	270	Subgrade Geotextile	Sq Yd	Sq Yd	14,335	$ 2.00	$ 28,670.00
00350	280	Riprap Geotextile, Type 2	Sq Yd	Sq Yd	59.0	$ 7.00	$ 413.00
00350	290	Waterproofing Membrane	Sq Yd	Sq Yd	198.0	$ 42.00	$ 8,316.00
00390	300	Loose Riprap, Class 50	Cu Yd	Cu Yd	14.0	$ 57.00	$ 798.00
		DRAINAGE AND SEWERS					
00406	310	Tunneling, Boring, and Jacking	Lump Sum	Lump Sum	1	$ 11,000.00	$ 11,000.00
00430	320	8 Inch Drain Pipe	Ft	Ft	50.0	$ 21.00	$ 1,050.00
00445	330	12 Inch Storm Sewer Pipe, 5 Ft Depth	Ft	Ft	1,244.0	$ 47.00	$ 58,468.00
00445	340	12 Inch Storm Sewer Pipe, 10 Ft Depth	Ft	Ft	277.0	$ 73.00	$ 20,221.00
00445	350	18 Inch Storm Sewer Pipe, 5 Ft Depth	Ft	Ft	67.0	$ 62.00	$ 4,154.00
00445	360	18 Inch Storm Sewer Pipe, 10 Ft Depth	Ft	Ft	435.0	$ 73.00	$ 31,755.00
00445	370	12 Inch Slotted Drain Pipe, 5 Ft Depth	Ft	Ft	497.0	$ 140.00	$ 69,580.00
00445	380	18 Inch Slotted Drain Pipe, 5 Ft Depth	Ft	Ft	728.0	$ 150.00	$ 109,200.00
00445	390	Sloped End Sections, 12 Inch	Each	Each	2	$ 370.00	$ 740.00
00445	400	Sloped End Sections, 18 Inch	Each	Each	1	$ 420.00	$ 420.00
00445	410	Concrete In Blocks	Cu Yd	Cu Yd	101.0	$ 140.00	$ 14,140.00
00460	420	Paved Culvert End Slopes	Sq Ft	Sq Ft	84.0	$ 21.00	$ 1,764.00
00470	430	Concrete Storm Sewer Manholes	Ea	Ea	3	$ 6,700.00	$ 20,100.00
00470	440	Concrete Manholes, Split Flow	Ea	Ea	1	$ 7,300.00	$ 7,300.00
00470	450	Concrete Inlets, Type D	Ea	Ea	2	$ 1,600.00	$ 3,200.00
00470	460	Concrete Inlets, Type D Modified	Ea	Ea	2	$ 1,900.00	$ 3,800.00
00470	470	Concrete Inlets, Type G-2	Ea	Ea	14	$ 1,300.00	$ 18,200.00
00480	480	Drainage Curbs	Ft	Ft	128.0	$ 9.00	$ 1,152.00
00490	490	Adjusting Inlets	Each	Each	1	$ 670.00	$ 670.00
00490	500	Manholes Over Existing Sewers	Each	Each	1	$ 1,600.00	$ 1,600.00
00490	510	Connection to Existing Structures	Each	Each	5	$ 930.00	$ 4,650.00
00490	520	Cap Inlet	Each	Each	1	$ 900.00	$ 900.00
00490	530	Reconstruct Inlet	Each	Each	1	$ 1,100.00	$ 1,100.00
00495	540	Trench Resurfacing	Sq Yd	Sq Yd	66.0	$ 100.00	$ 6,600.00
00495	550	Trench Resurfacing - Grass/Misc. Landscaping	Sq Yd	Sq Yd	92.0	$ 110.00	$ 10,120.00
		RETAINING WALL No. 21424 "Holcomb"					
00596	560	Anchored Soldier Pile Wall	Sq Ft	Sq Ft	10,300.0	$ 250.00	$ 2,575,000.00
01050	570	Ornamental Protective Fence, 6 Ft	Ft	Ft	808.0	$ 170.00	$ 137,360.00
		BASES					
00620	580	Cold Plane Pavement Removal, 2 Inch Deep	Sq Yd	Sq Yd	26,952.0	$ 2.60	$ 70,075.20
00620	590	Cold Plane Pavement Removal, 4 Inch Deep	Sq Yd	Sq Yd	1,315.0	$ 4.70	$ 6,180.50
00641	600	Aggregate Base	Ton	Ton	10,300.0	$ 20.00	$ 206,000.00

00641	610	Free Draining Aggregate Base	Ton	Ton	29,730.0	$	20.00	$	594,600.00
		WEARING SURFACES							
00730	620	Emulsified Asphalt for Tack Coat	Ton	Ton	19.0	$	700.00	$	13,300.00
00745	630	Level 3, 1/2 Inch Dense HMAC	Ton	Ton	8,700.0	$	70.00	$	609,000.00
00745	640	PG 70-22 Asphalt in HMAC	Ton	Ton	500.0	$	619.00	$	309,500.00
		PERMANENT TRAFFIC SAFETY AND GUIDANCE DEVICES							
00810	650	Guardrail, Type 2A	Ft	Ft	1,050.0	$	20.00	$	21,000.00
00810	660	Guardrail, Type 3	Ft	Ft	25.0	$	30.00	$	750.00
00810	670	Guardrail Anchors, Type 1 Modified	Each	Each	2	$	570.00	$	1,140.00
00810	680	Guardrail End Pieces, Type C	Each	Each	2	$	130.00	$	260.00
00810	690	Guardrail Transitions	Each	Each	2	$	2,600.00	$	5,200.00
00810	700	Guardrail Connections	Each	Each	2	$	600.00	$	1,200.00
00810	710	Guardrail Terminals, Non-Flared, Test Level 3	Each	Each	1	$	2,100.00	$	2,100.00
00820	720	Concrete Barrier	Ft	Ft	4,116.0	$	60.00	$	246,960.00
00830	730	Impact Attenuator, Type L	Each	Each	1	$	28,900.00	$	28,900.00
00830	740	Remove and Reinstall Impact Attenuator	Each	Each	1	$	5,200.00	$	5,200.00
00865	750	Methyl Methacrylate, Profile, 120 Mils, Extruded	Ft	Ft	19,500.0	$	2.40	$	46,800.00
00867	760	Pavement Legend, Type B: Elongated Arrows	Each	Each	20	$	400.00	$	8,000.00
00867	770	Pavement Legend, Type B: Wrong Way Arrows	Each	Each	6	$	500.00	$	3,000.00
00867	780	Pavement Legend, Type B-HS: Bicycle Lane Stencil	Each	Each	3	$	300.00	$	900.00
00867	790	Pavement Bar, Type B	Sq Ft	Sq Ft	590.0	$	7.80	$	4,602.00
		PERMANENT TRAFFIC CONTROL AND ILLUMINATION SYSTEMS							
00902	800	Crosswalk Closure Barricades	Each	Each	2	$	600.00	$	1,200.00
00905	810	Remove Existing Signs	Lump Sum	Lump Sum	1	$	6,000.00	$	6,000.00
00905	820	Remove and Reinstall Existing Signs	Lump Sum	Lump Sum	1	$	6,000.00	$	6,000.00
00910	830	Wood Sign Posts	FBM	FBM	950	$	7.80	$	7,410.00
00920	840	Sign Support Footings	Lump Sum	Lump Sum	1	$	8,800.00	$	8,800.00
00930	850	Bridge Structure Mounts	Lump Sum	Lump Sum	1	$	1,600.00	$	1,600.00
00930	860	Multi-post Breakaway Sign Supports	Lump Sum	Lump Sum	1	$	13,000.00	$	13,000.00
00930	870	Triangular Base Breakaway Sign Supports	Lump Sum	Lump Sum	1	$	7,000.00	$	7,000.00
00930	880	Perforated Steel Square Tube Sign Supports	Lump Sum	Lump Sum	1	$	600.00	$	600.00
00940	890	Type "F1" Signs In Place	Sq Ft	Sq Ft	23.0	$	23.20	$	533.60
00940	900	Type "G" Signs In Place	Sq Ft	Sq Ft	170.0	$	23.20	$	3,944.00
00940	910	Type "R" Signs In Place	Sq Ft	Sq Ft	50.0	$	21.00	$	1,050.00
00940	920	Type "W1" Signs In Place	Sq Ft	Sq Ft	84.0	$	20.00	$	1,680.00
00940	930	Type "W7" Signs In Place	Sq Ft	Sq Ft	12.0	$	25.00	$	300.00
00940	940	Type "Y1" Signs In Place	Sq Ft	Sq Ft	32.0	$	21.00	$	672.00
00940	950	Type "Y2" Signs In Place	Sq Ft	Sq Ft	25.0	$	21.00	$	525.00
00963	960	42 Inch Diameter Signal Support Drilled Shaft	Ft	Ft	16.0	$	700.00	$	11,200.00
00990	970	Traffic Signal Installation, OR213/Redland Road	Lump Sum	Lump Sum	1	$	93,000.00	$	93,000.00
00990	980	Loop Detector Installation	Lump Sum	Lump Sum	1	$	52,000.00	$	52,000.00
		RIGHT OF WAY DEVELOPMENT AND CONTROL							
01030	990	Weed Control	Acre	Acre	1.25	$	11,000.00	$	13,750.00
01030	1000	Seeding Mobilization	Each	Each	1	$	500.00	$	500.00
01030	1010	Permanent Seeding, Mix No. 1	Acre	Acre	3.50	$	1,900.00	$	6,650.00
01030	1020	Restoration Seeding, Mix No. 1	Acre	Acre	0.10	$	4,700.00	$	470.00
01040	1030	Soil Testing	Each	Each	1	$	410.00	$	410.00
01030	1040	Topsoil	Cu Yd	Cu Yd	1,300.0	$	16.00	$	20,800.00
01092	1050	Water Quality Basin "SW12"	Lump Sum	Lump Sum	1	$	24,400.00	$	24,400.00

SUB-TOTAL OF ITEMS	$	6,902,890.00
Contingencies @ 15%	$	1,035,500.00
Preliminary Engineering @ 8%	$	635,100.00
Construction Engineering @ 15%	$	1,190,800.00
TOTAL CONSTRUCTION ESTIMATE (PHASE 2):	**$**	**9,764,290.00**

Oregon

Department of Transportation
Region 1 Headquarters
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Portland, Oregon 97209
(503) 731.8200
FAX (503) 731.8531

January 22, 2018

Planning Commission
City of Oregon City
PO Box 3040
Oregon City, OR 97045

The Oregon Department of Transportation (ODOT) is pleased to offer our support for the City of Oregon City's proposed alternative mobility targets in the vicinity of Highway 213 and Beavercreek Road. ODOT staff participated in the development of the City's Transportation System Plan which included direction to perform a refinement plan to develop alternative mobility targets. ODOT staff also participated in the Technical Advisory Group and Community Advisory Group for the Highway 213 Corridor Alternative Mobility Targets effort.

ODOT supports the proposed alternative mobility targets at OR 213 and Beavercreek Road based on inclusion of the westbound right turn merge lane project at OR213/Beavercreek Road in the City's TSP *and* in the Financially Constrained RTP project list, as well as the addition of the Beavercreek Road sidewalk infill and Hwy 213 and Beavercreek Road safety Improvement projects into the City's TSP. The length of the merge lane is to be determined during project development, must be approved by ODOT, and should not be specified in the project description. ODOT supports the proposed performance measurement methodology based on average annual weekday peak hour performance.

ODOT advises the City that alternative mobility targets are not needed at Redland Road based on inclusion of a proposed project (TSP project D79, RTP project 10119) in the Financially Constrained RTP project list. With this project in place, the intersection meets current Oregon Highway Plan mobility targets. The project may be assumed to be in place for purposes of future plan amendments based on the Transportation Planning Rule (TPR), OAR 660-0012-0060(4)(b)(C). Any one of the options under section -0060(4) are sufficient for projects to be considered planned improvements that jurisdictions and applicants are able to rely on for purposes of compliance with section -0060 of the TPR.

ODOT requests that the City state its intent to pursue actual funding of both the Beavercreek and Redland Road projects (as described in the City's TSP and Financially Constrained RTP) as opportunities arise, including the proposed regional transportation funding bond measure.

Upon local adoption of the proposed alternative mobility targets, ODOT staff will work with the City to take the proposed targets to the Oregon Transportation Commission for adoption. Let us know if we can be of any more assistance,

Jon Makler

Jon Makler
Planning Manager
ODOT Region 1

12.04.205 - Mobility standards.

Development shall demonstrate compliance with intersection mobility standards. When evaluating the performance of the transportation system, the City of Oregon City requires all intersections, except for the facilities identified in subsection ~~E~~F~~D~~ below, to be maintained at or below the following mobility standards during the two-hour peak operating conditions. The first hour has the highest weekday traffic volumes and the second hour is the next highest hour before or after the first hour. Except as provided otherwise below, this may require the installation of mobility improvements as set forth in the transportation system plan or as otherwise identified by the city transportation engineer.

A. For intersections within the regional center, the following mobility standards apply:

1. During the first hour, a maximum v/c ratio of 1.10 shall be maintained. For signalized intersections, this standard applies to the intersection as a whole. For unsignalized intersections, this standard applies to movements on the major street. There is no performance standard for the minor street approaches.

2. During the second hour, a maximum v/c ratio of 0.99 shall be maintained at signalized intersections. For signalized intersections, this standard applies to the intersection as a whole. For unsignalized intersections, this standard applies to movements on the major street. There is no performance standard for the minor street approaches.

3. Intersections located on the Regional Center boundary shall be considered within the Regional Center.

B. For intersections outside of the Regional Center but designated on the Arterial and Throughway Network, as defined in the Regional Transportation Plan, the following mobility standards apply:

1. During the first hour, a maximum v/c ratio of 0.99 shall be maintained. For signalized intersections, this standard applies to the intersection as a whole. For unsignalized intersections, this standard applies to movements on the major street. There is no performance standard for the minor street approaches.

2. During the second hour, a maximum v/c ratio of 0.99 shall be maintained at signalized intersections. For signalized intersections, this standard applies to the intersection as a whole. For unsignalized intersections, this standard applies to movements on the major street. There is no performance standard for the minor street approaches.

C. For intersections outside the boundaries of the Regional Center and not designated on the Arterial and Throughway Network, as defined in the Regional Transportation Plan, the following mobility standards apply:

1. For signalized intersections:

a. During the first hour, LOS "D" or better will be required for the intersection as a whole and no approach operating at worse than LOS "E" and a v/c ratio not higher than 1.0 for the sum of the critical movements.

b. During the second hour, LOS "D" or better will be required for the intersection as a whole and no approach operating at worse than LOS "E" and a v/c ratio not higher than 1.0 for the sum of the critical movements.

2. For unsignalized intersections outside of the boundaries of the Regional Center:

a. For unsignalized intersections, during the peak hour, all movements serving more than twenty vehicles shall be maintained at LOS "E" or better. LOS "F" will be tolerated at movements serving no more than twenty vehicles during the peak hour.

D. For the intersection of OR 213 & Beavercreek Road, the following mobility standards apply:

1. During the first, second & third hours, a maximum v/c ratio of 1.00 shall be maintained. Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.

~~E. For the intersection of OR 213 & Redland Road, the following mobility standards apply:~~

~~1. During the first & second hours, a maximum v/c ratio of 1.10 shall be maintained. Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.~~

~~2. During the third hour, a maximum v/c ratio of 1.05 shall be maintained. Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.~~

~~D~~F~~E~~. Until the city adopts new performance measures that identify alternative mobility targets, the city shall exempt proposed development that is permitted, either conditionally, outright, or through detailed development master plan approval, from compliance with the above-referenced mobility standards for the following state-owned facilities:

I-205/OR 99E Interchange

~~I-205/OR 213 Interchange~~

~~OR 213/Beavercreek Road~~

State intersections located within or on the Regional Center Boundaries

1. In the case of conceptual development approval for a master plan that impacts the above references intersections:
   a. The form of mitigation will be determined at the time of the detailed development plan review for subsequent phases utilizing the Code in place at the time the detailed development plan is submitted; and
   b. Only those trips approved by a detailed development plan review are vested.
2. Development which does not comply with the mobility standards for the intersections identified in [Section] 12.04.205.E~~F~~D shall provide for the improvements identified in the Transportation System Plan (TSP) in an effort to improve intersection mobility as necessary to offset the impact caused by development. Where required by other provisions of the Code, the applicant shall provide a traffic impact study that includes an assessment of the development's impact on the intersections identified in this exemption and shall construct the intersection improvements listed in the TSP or required by the Code.

(Ord. No. 10-1003, § 1(Exh. 1), 7-7-2010; Ord. No. 13-1003, § 1(Exh. 1), 7-17-2013)

Editor's note— Ord. No. 13-1003, § 1, Exhibit 1, adopted July 17, 2013, retitled § 12.04.205 from "Intersection level of service standards" to "Mobility standards."

Hwy 213 Corridor Alternative Mobility Targets

Transportation System Plan (TSP) Amendments

Add/revise the following projects to the TSP:

Project #	Project Description	Project Extent	Project Elements	Priority	Cost Estimate
D95	Hwy 213 & Beavercreek Road Westbound Right Turn Merge Lane	Hwy 213 & Beavercreek Road to the north	Addition of a free flow right turn lane from Beavercreek Road to Hwy 213 Northbound and associated merge lane on Hwy 213 northbound	Short-Term	$2,700,000
W83	Beavercreek Road Sidewalk Infill	South of the Coltrane Path to North of Marjorie Lane	Sidewalk Infill	Medium Term	$330,000
W84	Hwy 213 & Beavercreek Road Area Safety Improvements	Hwy 213 & Beavercreek Road Intersection to Beavercreek Road & Maple Lane Intersection	Implement feasible Safety Improvements as identified in the Hwy 213 Corridor Alternative Mobility Targets Final Report	Medium-Term	$275,000
S13	Newell Creek Canyon/ Holly Lane Shared Use Path	Donovan Road to ~~Maplelane Road~~Beavercreek Rd	Add a shared use path ~~on the east side of the street~~between Holly Lane and HWY 213 to Maplelane Ct and beyond, connecting to the Oregon City Loop Trail at Beavercreek Road. (RTP project 10147)	Long Term Phase 2	$1,515,000

Project: D95
Description: Hwy 213 & Beavercreek Rd
Westbound Right Turn Merge Lane

Project: W84
Description: Hwy 213 & Beavercreek Rd
Area Safety Improvements

Project: W83
Description: Beavercreek Road Sidewalk Infill

Transportation System Plan Amendments

The City of Oregon City makes no representations, express or implied, as to the accuracy, completeness and timeliness of the information displayed. This map is not suitable for legal, engineering, or surveying purposes. Notification of any errors is appreciated.

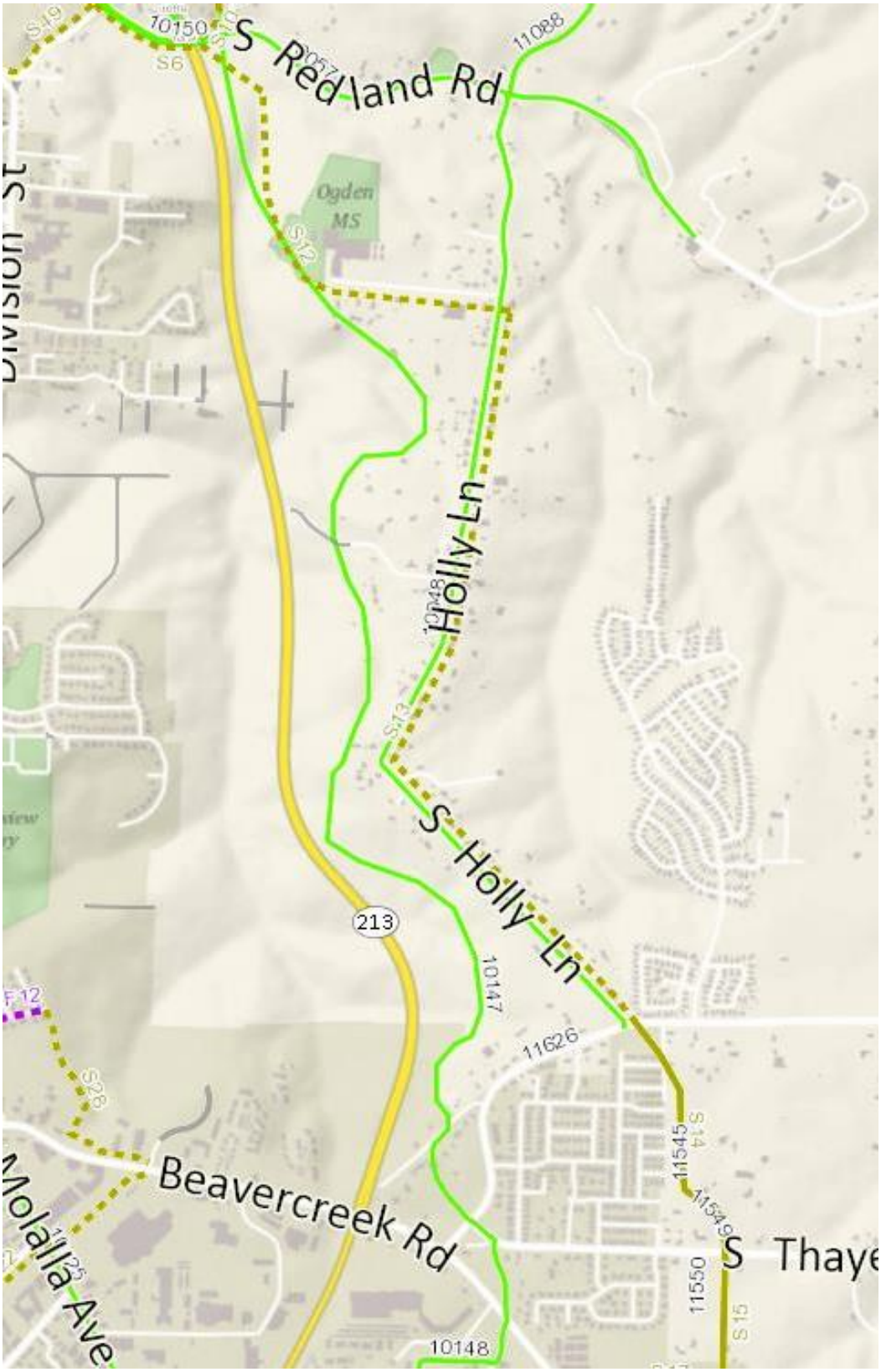
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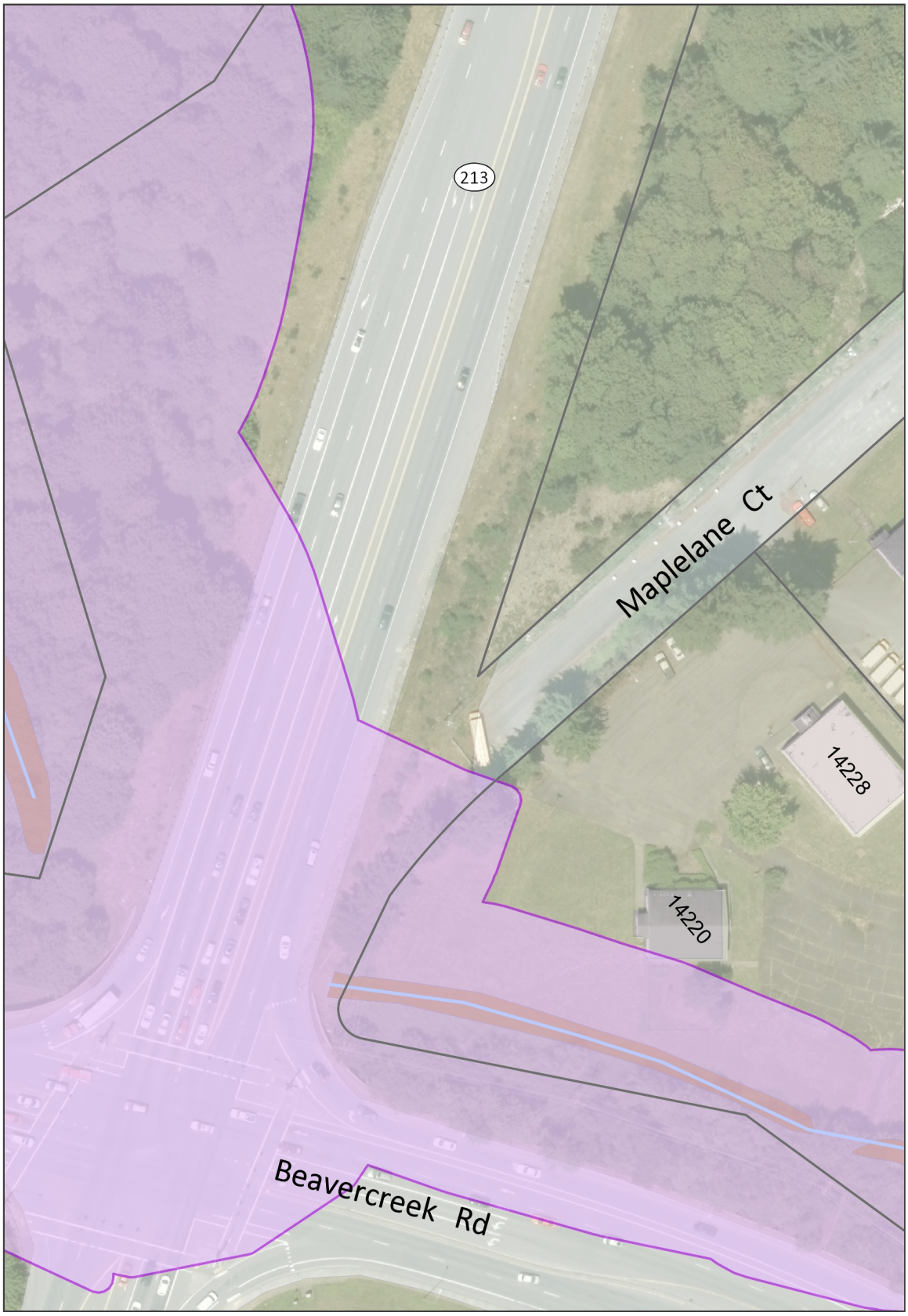
City of Oregon City
P.O. Box 3040
625 Center St
Oregon City, OR 97045
503-657-0891 phone
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www.orcity.org

Plot date: 12/15/2017; Map name: Alternative Mobility Projects D95 W83 W84 - 36x48P.mxd; Plot name: Alternative Mobility Projects D95 W83 W84 - 36x48P - 20171215.pdf

Existing TSP/RTP Map of Newell Creek/Holly Lane Shared Use Path



Oregon City GIS Map

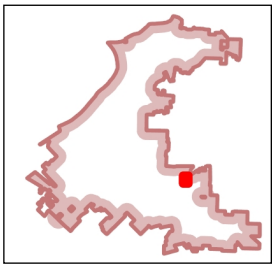


Legend

- Taxlots
- Taxlots (Outside UGB)
- NROD - Natural Resource Ove
- Title 3 - Streams
- Title 3 - Wetlands
- City Limits
- UGB
- Basemap

Notes

Overview Map



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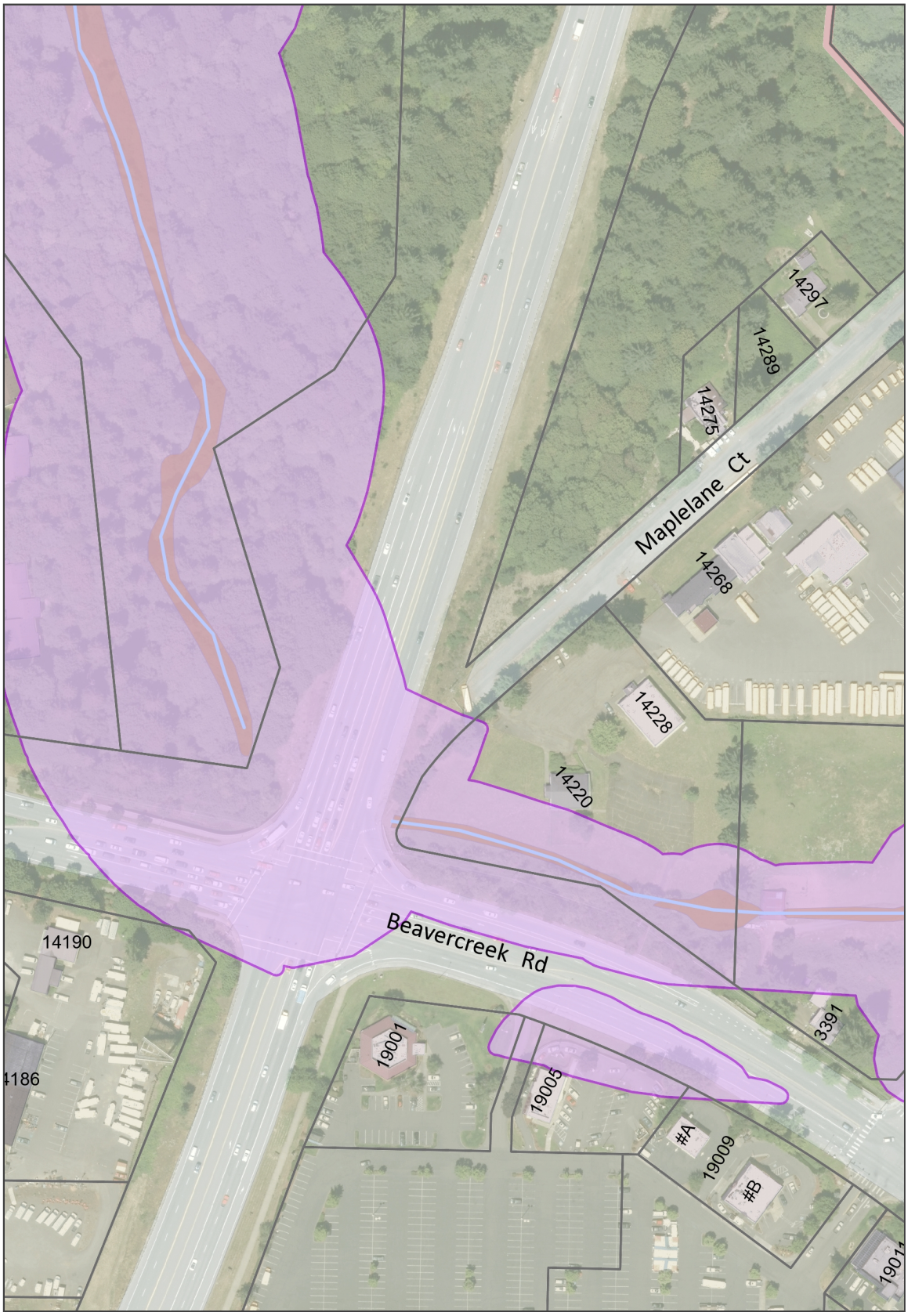
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1: 1,200

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Map created 3/1/2018

Oregon City GIS Map

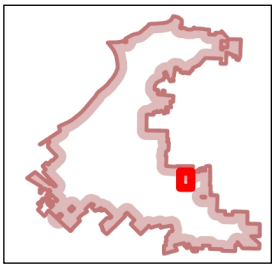


Legend

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Overview Map



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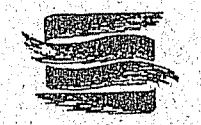
APPROVED WETLANDS INVENTORY
Oregon Division of State Lands
Meets Local Wetlands Inventory standards
Date 9/99 Approved by J. Morlan

Oregon City
Local Wetland Inventory and Riparian Assessment

Prepared for

The City of Oregon City

Prepared by



Shapiro and Associates, Inc.

June 24, 1999

Oregon City
Local Wetland Inventory and Riparian Assessment

Prepared for

The City of Oregon City
320 Warner Milne Road
Oregon City, Oregon 97045

Prepared by

Dan Cary
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June 24, 1999

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Appendices

Appendix A Wetland Data and Summary Sheets (organized by drainage basin and wetland code)
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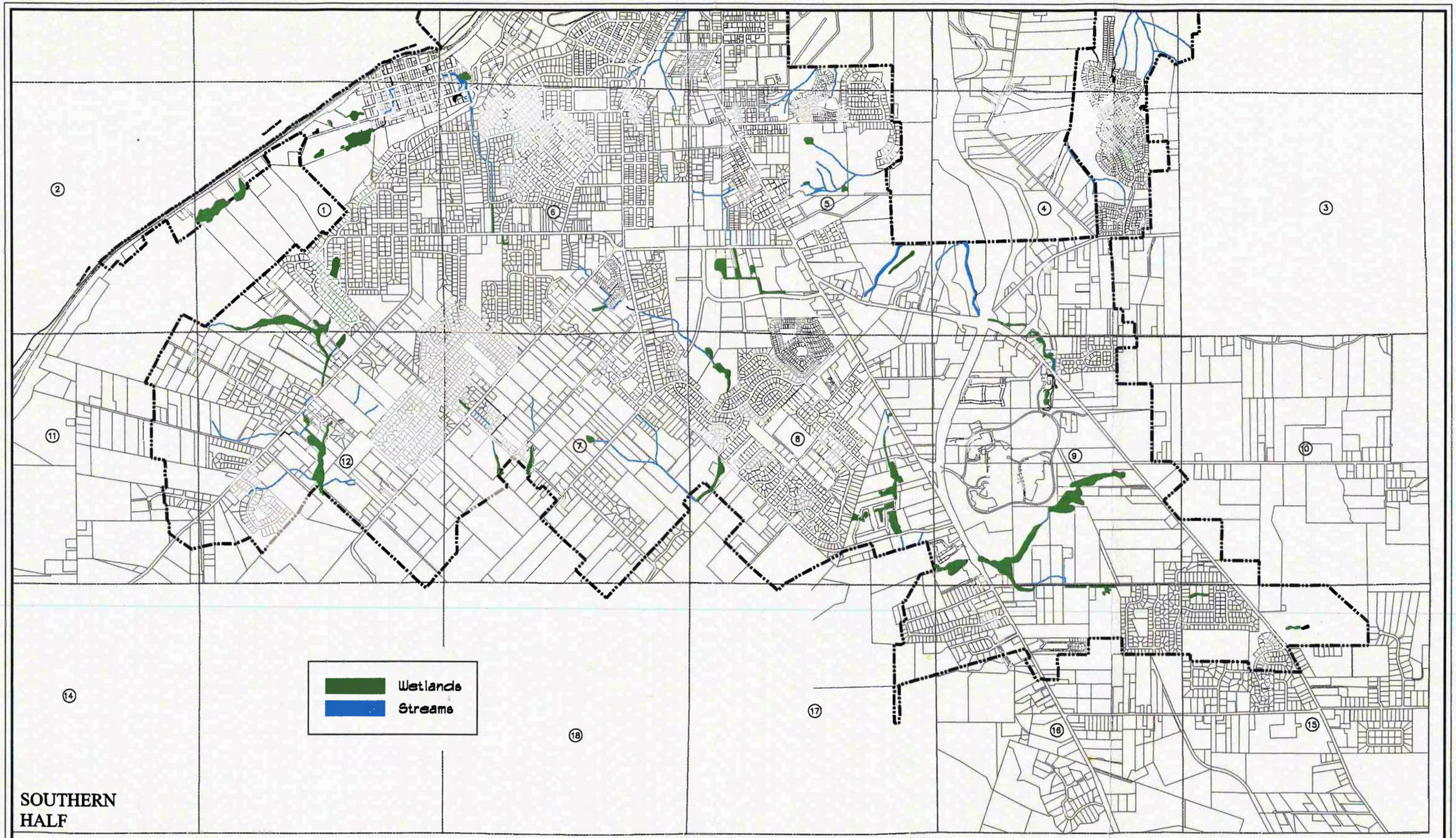
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Attachment

Wetland and Riparian Inventory Section Maps

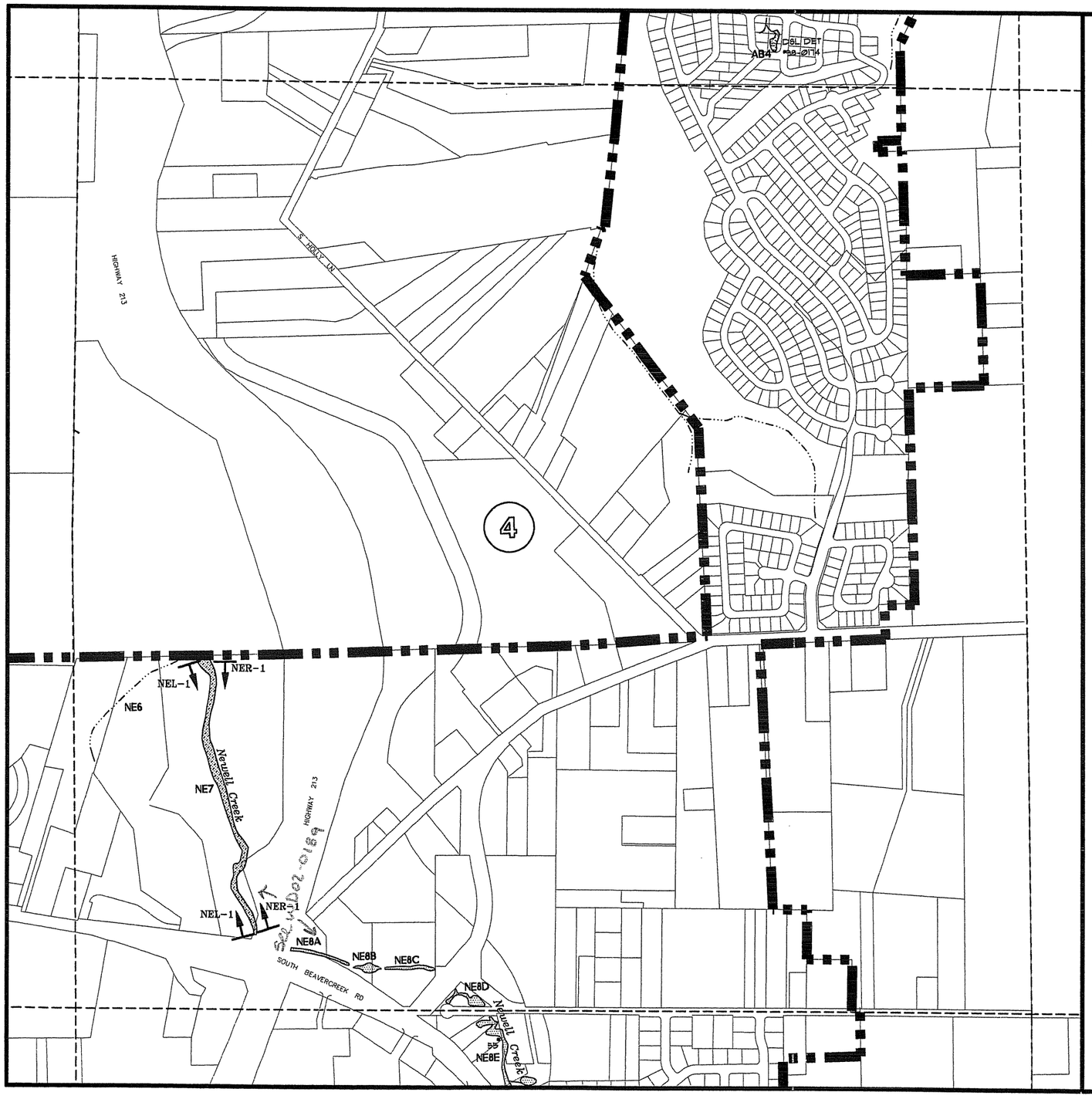


Wetlands, drainages, and riparian areas identified by the Local Wetlands Inventory of the area within Oregon City's Urban Growth Boundary.

FIGURE
6b

SHAPIRO & ASSOCIATES, INC.

APPROVED WETLANDS INVENTORY
Oregon Division of State Lands
Meets LWI standards
Date 9/22 Approved by J. Morlan

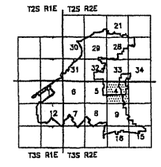


T 3S R 2E Section 04

CITY OF OREGON CITY LOCAL WETLAND INVENTORY

LEGEND

- Urban Growth Boundary
- Wetland
- AC2 Wetland label
- FCR1 Riparian label
- .46 Sample site
- DSL DET wetland
- DSL DET #97-0569 DSL label
- Mitigation wetland
- Site access not granted
- Stream



Wetland acreage

1 acre
1/2 acre
1/10th acre

NORTH

0 400 800
FEET

JUNE 1999

WETLAND INFORMATION IS SUBJECT TO CHANGE

This map is for planning purposes only. Mapped wetland and riparian boundaries were not flagged or surveyed (unless noted as a delineation study). Boundaries for on-site verified wetlands are accurate to within 25'. There may be exceptions or unmapped wetlands subject to regulation. In all cases, actual field conditions determine wetland boundaries. If site alteration work is proposed, you are advised to contact the Oregon Division of State Lands or the U.S. Army Corps of Engineers with regulatory questions. This study was funded by an Oregon Department of Land Conservation and Development periodic review planning grant.

City of Oregon City
320 Warner Milne Road
Oregon City, Oregon 97045

SHAPIRO INCORPORATED

Creek flows in a deep canyon. Three smaller drainage basins without USGS mapped streams form the headwaters of Livesay Creek. Minor intermittent, unnamed tributaries of Abernethy Creek also run in canyons south of the creek on the eastern edge of the UGB at the northern end of the Country Village development area.

Newell Creek is a major tributary on the southern side of Abernethy Creek. Most of Newell Creek flows in a deep canyon. The UGB includes only the upper parts of the Newell Creek basin and smaller drainage areas of intermittent tributaries that flow into it. Only about 0.1 mile of Newell Creek is actually mapped by the USGS within the study area, northwest of the intersection of Highway 213 and Beavercreek Road. That part of the stream is mapped as perennial.

The Newell Creek headwaters are above the mapped part of the stream, at the ponds of the John Innskeep Environmental Learning Center. These ponds currently receive most of their water from the heating and cooling system of a nearby public school. The water is periodically flushed from the system and drains into the ponds. Natural springs also contribute to the water flow. After leaving the ponds, water from Newell Creek flows in a gentle gradient through a series of channels and culverts, eventually daylighting in the northwestern corner of the intersection of Highway 213 and South Beavercreek Road. It plunges down a concrete flume for approximately 50 feet, then cascades down a steep decline of boulders and plunge pools to the edge of the study area.

Beaver Creek has four tributaries that drain the southern portion of the inventory area, including Caufield Creek, Mud Creek, and a small tributary known locally as Little Beaver Creek. **Caufield Creek** is the farthest upstream, and drains the southeastern end of the inventory area. At the time of the inventory, properties in the upper Caufield Creek basin, in the vicinity of Glen Oak Road, were undergoing residential development, and much of the eastern end of the stream was in culverts. The creek channel south of Glen Oak Road has been excavated, and part of it apparently has been realigned as road-side drainage ditches. These ditches collect runoff and groundwater that make up the initial flow for Caufield Creek, which is mapped by the USGS as a perennial stream.

An earthen dam south of Highway 213 has created a pond of approximately 2 acres on Caufield Creek. The northern side of the pond is a moderately steep canyon wall, while the eastern side is adjacent to fill for Highway 213. The southern side has more moderate topography, with low-density residential development. Upon exiting the pond, Caufield Creek flows through a shrub and forested wetland and riparian area to the southern edge of the inventory area.

Mud Creek is the next tributary downstream (west) of Caufield Creek. Mud Creek is the longest tributary of Beaver Creek and starts as an intermittent drainage east of the intersection of Linn Avenue and Pease Road. The USGS mapped Mud Creek as an intermittent stream within the inventory area. Most of Mud Creek flows in a modified channel or long culverts and is ponded in small ponds in a city park near the center of the drainage and a small pond at the southern edge of the UGB.

West of Mud Creek is a small, unnamed, intermittent tributary in the area of the intersection of McCord and Leland Roads. The USGS does not map the stream within the study area.

OREGON CITY LOCAL WETLANDS INVENTORY

- Stream Summary Sheet -

Date(s) of Field Verification: 7/16/98

Mapping Code: NE-7

Investigator(s): JG/PO

Size (acres): 1.3

Location

Legal: T3S R 2E S4

Other: NW of intersection of Hwy. 213 and Beavercreek Rd.

Basin: Newell Creek

Comments:

This stream is in a very steep, narrow canyon oriented generally north-south. Water flows into the wetland through a culvert in the northwestern corner of the intersection of Highway 213 and South Beavercreek Road. The water exits the culvert and flows down a concrete chute for an estimated 40 to 50 feet before entering a streambed that is composed predominantly of large boulders. The flow in this stream appears to be perennial, based on the quantity of water observed during the inventory field work. However, a major source of water for the stream is the Inskeep Environmental Learning Center wetland system, which receives much of its water intermittently from a pumping system. The stream contains a large quantity of woody debris, and is well shaded by the trees in the canyon. The steepness of the canyon and the rocky nature of the substrate prohibit the growth of emergent wetland vegetation at the water's edge.

Urban Riparian Inventory and Assessment

Project Number: 7971165
Project Name: City of Oregon City
Riparian Code: NEL-1

Riparian Width Determination

Date: 7/16/98 Investigators: JG/PO

Dominant tree species: Acer macrophyllum

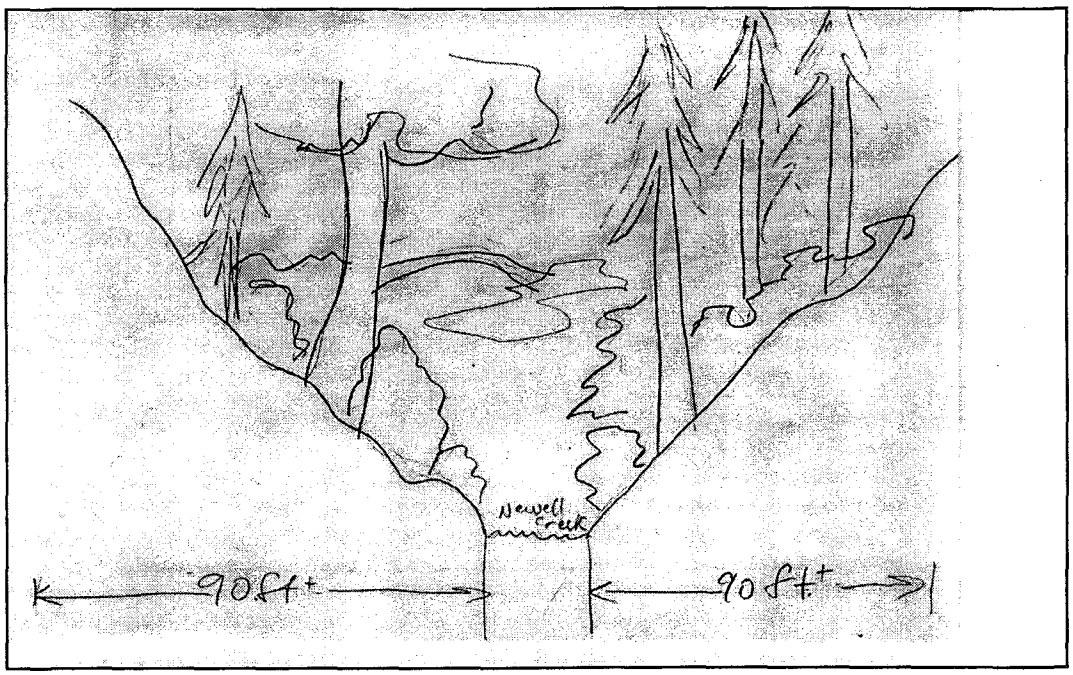
Potential tree height (PTH)/Width of Riparian Area: 90/90

(Width measured horizontally from edge of water resource)

PTH determined by: ☑ On-site vegetation ☐ Reference site Code:

Comments:

Typical Cross Section:



Urban Riparian Inventory and Assessment

Project Number: 7971165
Project Name: City of Oregon City
Riparian Code: NEL-1

Riparian Characterization Form — Part 1

General Information

Date: 7/16/98

On-site ☑ Office ☐ Reach Length: 1,600

Investigators: JG/PO Hydrologic Basin: Newell Creek

Water Resource Information

Water Resource: Stream/River ☑ Width: 8
Lake/Pond ☐ Width: 0
Wetland ☐ Width: 0

LWI Wetland Code: NE-7

Water present year-round: Yes

Are salmonids present in the adjacent water resource: Yes

Is the water resource listed for temperature on DEQ's 303(d) list: No

Within FEMA-mapped 100-year floodplain: No

Mapped soil series: 8B, 92F

Adjacent Land Uses?

Agriculture ☐ Residential ☑ Undeveloped ☐
Commercial ☐ Roads ☑ Forestry ☐

Woody Vegetation	Herbaceous Vegetation
Acer macrophyllum	Polystichum munitum
Thuja plicata	Hydrophyllum tenuipes
Alnus rubra	Urtica dioica
Acer circinatum	Geranium robertianum
Oemleria cerasiformis	Claytonia sibirica
Rubus ursinus	
Ilex aquifolium	
Vaccinium occidentale	

Urban Riparian Inventory and Assessment

Project Number: 7971165
Project Name: City of Oregon City
Riparian Code: NEL-1

Riparian Characterization Form — Part 2

Average slope in the riparian area: (Question 1)

☐ <10:1 (10%) ☐ Between 10:1 (10%) and 5:1 (20%) ☑ >5:1 (20%)

Extent of impervious surface within the riparian area: (Question 4)

☑ <10% ☐ 10% to 25% ☐ >25%

☐ **The reach is constricted by man-made features.**

☑ **The orientation allows for shading of the water resource at midday in summer.**

Dominant vegetation layer within the riparian area:

☐ Woody vegetation ☐ Herbaceous vegetation ☐ Bare ground

☑ **Woody vegetation hangs over the edge of the water.**

☑ **Large woody debris in riparian area.**

Percent of water resource bordered by vegetated riparian area at least 30 feet wide:

☑ >40% ☐ 10% to 40% ☐ <10%

Degree of development or human cause disturbance:

☑ <25% ☐ 25% to 75% ☐ >75%

Urban Riparian Inventory and Assessment

Project Number: 7971165
Project Name: City of Oregon City
Riparian Code: NEL-1

Riparian Function Assessment Answer Sheet

Water Quality

Question 1:	1
Question 2:	3
Question 3:	3
Question 4:	3
Question 5:	2
Total Points:	12

Function:
- [x] High
- [ ] Medium
- [ ] Low

Flood Management

Question 6:	3
Question 7:	3
Question 8:	3
Total Points:	9

Function:
- [x] High
- [ ] Medium
- [ ] Low

Thermal Regulation

Question 9:	3
Question 10:	3
Question 11:	2
Total Points:	8

Function:
- [x] High
- [ ] Medium
- [ ] Low

Wildlife Habitat

Question 12:	3
Question 13:	3
Question 14:	2
Question 15:	3
Question 16:	3
Question 17:	3
Question 18:	1
Question 19:	3
Total Points:	21

Function:
- [x] High
- [ ] Medium
- [ ] Low

Urban Riparian Inventory and Assessment

Project Number: 7971165
Project Name: City of Oregon City
Riparian Code: NER-1

Riparian Width Determination

Date: 7/16/98 Investigators: JG/PO

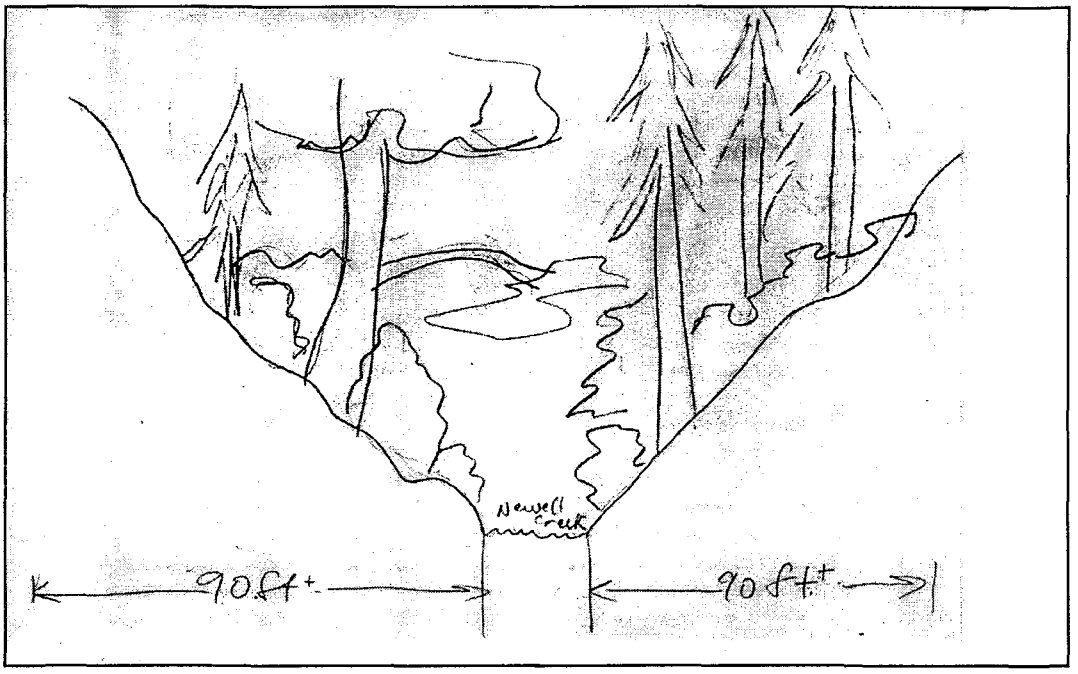
Dominant tree species: Acer macrophyllum

Potential tree height (PTH)/Width of Riparian Area: 90/90
(Width measured horizontally from edge of water resource)

PTH determined by: ☑ On-site vegetation ☐ Reference site Code:

Comments:

Typical Cross Section:



Urban Riparian Inventory and Assessment

Project Number: 7971165
Project Name: City of Oregon City
Riparian Code: NER-1

Riparian Characterization Form — Part 1

General Information

Date: 7/16/98

On-site ☑ Office ☐ Reach Length: 1,600

Investigators: JG/PO Hydrologic Basin: Newell Creek

Water Resource Information

Water Resource: Stream/River ☑ Width: 8
Lake/Pond ☐ Width: 0
Wetland ☐ Width: 0

LWI Wetland Code: NE-7

Water present year-round: Yes

Are salmonids present in the adjacent water resource: Yes

Is the water resource listed for temperature on DEQ's 303(d) list: No

Within FEMA-mapped 100-year floodplain: No

Mapped soil series: 8B, 92F

Adjacent Land Uses?

Agriculture ☐ Residential ☑ Undeveloped ☐
Commercial ☐ Roads ☑ Forestry ☐

Woody Vegetation	Herbaceous Vegetation
Acer macrophyllum	Polystichum munitum
Thuja plicata	Hydrophyllum tenuipes
Alnus rubra	Urtica dioica
Acer circinatum	Geranium robertianum
Oemleria cerasiformis	Claytonia sibirica
Rubus ursinus	
Ilex aquifolium	
Vaccinium occidentale	

Urban Riparian Inventory and Assessment

Project Number: 7971165
Project Name: City of Oregon City
Riparian Code: NER-1

Riparian Characterization Form — Part 2

Average slope in the riparian area: (Question 1)

☐ <10:1 (10%) ☐ Between 10:1 (10%) and 5:1 (20%) ☑ >5:1 (20%)

Extent of impervious surface within the riparian area: (Question 4)

☑ <10% ☐ 10% to 25% ☐ >25%

☐ **The reach is constricted by man-made features.**

☑ **The orientation allows for shading of the water resource at midday in summer.**

Dominant vegetation layer within the riparian area:

☑ Woody vegetation ☐ Herbaceous vegetation ☐ Bare ground

☑ **Woody vegetation hangs over the edge of the water.**

☑ **Large woody debris in riparian area.**

Percent of water resource bordered by vegetated riparian area at least 30 feet wide:

☑ >40% ☐ 10% to 40% ☐ <10%

Degree of development or human cause disturbance:

☑ <25% ☐ 25% to 75% ☐ >75%

Urban Riparian Inventory and Assessment

Project Number: 7971165
Project Name: City of Oregon City
Riparian Code: NER-1

Riparian Function Assessment Answer Sheet

Water Quality

Question 1:	1
Question 2:	3
Question 3:	3
Question 4:	3
Question 5:	2
Total Points:	12

Function:
- [x] High
- [ ] Medium
- [ ] Low

Flood Management

Question 6:	3
Question 7:	3
Question 8:	3
Total Points:	9

Function:
- [x] High
- [ ] Medium
- [ ] Low

Thermal Regulation

Question 9:	3
Question 10:	3
Question 11:	2
Total Points:	8

Function:
- [x] High
- [ ] Medium
- [ ] Low

Wildlife Habitat

Question 12:	3
Question 13:	3
Question 14:	2
Question 15:	3
Question 16:	3
Question 17:	3
Question 18:	1
Question 19:	3
Total Points:	21

Function:
- [x] High
- [ ] Medium
- [ ] Low

OREGON CITY LOCAL WETLANDS INVENTORY

- Wetland Summary Sheet -

Date(s) of Field Verification: 7/21/98

Wetland Mapping Code: NE-8

Investigator(s): KC/PO

Size (acres): 1

Location

Legal: T3S R2E S4

Other: NE of intersection of Hwy. 213 & Beavercreek Rd.

Basin: Newell Creek

Soils

Mapped Series: 8B

Hydrology

Hydrologic Source: Surface flow

Wetland Classification(s): PSS

Dominant Vegetation

Trees	Shrubs	Vines	Herbs
Fraxinus latifolia	*Cornus sericea*	*Rubus discolor*	*Phalaris arundinacea*
Populus balsamifera	*Rubus spectabilis*	*Rubus laciniatus*	*Carex obnupta*
Alnus rubra		*Rubus ursinus*	*Solanum dulcamara*
			Carex deweyana
			Convolvulus arvensis
			Geum macrophyllum
			Holcus lanatus
			Epilobium watsonii

Comments:

Newell Creek meanders through backyards and culverts under streets. The vegetation is highly disturbed. Some evidence of flooding was noted.

Wetland Classification Codes:

PFO = palustrine forested	PSS = palustrine scrub-shrub	RSB = riverine streambed (intermittent)
PEM = palustrine emergent	POW = palustrine open water	RUB = riverine unconsolidated bottom

WETLAND DETERMINATION DATA SHEET - 1987 MANUAL

Client/Applicant: City of Oregon City Site: NE-8 Plot: 55

T 3S R 2E S 4 City: Oregon City County: Clackamas State: OR

Plot Location; Topography Bank of stream N of Inskeep Environmental Learning Center

Project #: 7971165 Determined by: KC/PO Date: 7/21/98

DETERMINATION: IS THIS PLOT IN A WETLAND?: Yes

Do Normal Circumstances exist on the site? Yes

Are Soils ☐ Vegetation ☐ Hydrology ☐ significantly disturbed? No

VEGETATION Dominant Plant Species

Herb Stratum - % total cover:		Ind. %Cover: 70
Phalaris arundinacea	FACW	20
Carex obnupta	OBL	20
Solanum dulcamara	FAC+	10
Carex deweyana	FACU	10
Convolvulus arvensis	UPL	10
Geum macrophyllum	FACW	10
Holcus lanatus	FAC	10
Epilobium watsonii	FACW	5

Shrub/Sapling Stratum - % total cover:		Ind. %Cover: 15
Cornus Sericea	FACW	100

Woody Vine Stratum - % total cover:		30
Rubus spectabilis	FAC+	60
Rubus discolor	FACU	20
Rubus laciniatus	FACU	10
Rubus ursinus	FACU	10

Tree Stratum - % total cover:		50
Fraxinus latifolia	FACW	20
Populus balsamifera	FAC	15
Alnus rubra	FAC	15

Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-) 8 of 11 = 73 % (50/20 Rule)

Vegetation Criterion Met? Yes

SOILS Mapped Unit Name: Bornstead silt loam
Drainage Class: Moderately well drained
Taxonomy: Fine-silty, mixed, mesic Typic Haploxerults

Horizon	Depth	Matrix Color	Redox Abundance, Size, Color	Texture, Structure, Other
	0-10"	10 YR 3/2	mottles abundant, medium, 7.5 YR 5/8	Silty clay loam
	10-18"	7.5 YR 3/1	mottles abundant, coarse, 7.5 YR 4/6	Clay loam

☐ Histosol ☐ Prob. Aquic moisture regime ☐ Redox features ☐ Organic streaking
☐ Histic epipedon ☐ Reducing conditions ☐ Concretions ☐ Organic pan
☐ Sulfidic odor ☐ Gleyed ☐ Highly organic surface layer ☐ On hydric soils list

Soil Criterion Met? Yes

HYDROLOGY

Depth of inundation N/A Depth to water table: >18" Depth to saturation: 12"

Primary Indicators:
☐ Inundated
☑ Saturated in upper 12"
☐ Water marks
☐ Drift lines
☑ Sediment deposits
☑ Drainage patterns

Secondary Indicators (2 or more required):
☑ Oxidized rhizospheres
☐ Water-stained leaves
☐ Recorded data (aerials, groundwater data)
Explain:
☐ Other
Explain:
☐ Local soil survey data
☐ FAC-Neutral test

Hydrology Criterion Met? Yes

OREGON FRESHWATER WETLAND ASSESSMENT METHODOLGY

Date(s):	7/21/98	Investigator(s):	KC/PO
Project Name:	City of Oregon City		
WetlandCode:	NE-8	ProjectNumber:	7971165

Wildlife Habitat		Fish Habitat Streams		Fish Habitat Lakes/Ponds		Water Quality		Hydrologic Control		Sensitivity to Impact	
Q1:	A	Q1:	B	Q1:		Q1:	A	Q1:	B	Q1:	A
Q2:	A	Q2:	B	Q2:		Q2:	A	Q2:	A	Q2:	B
Q3:	B	Q3:	B	Q3:		Q3:	B	Q3:	C	Q3:	C
Q4:	C	Q4:	A	Q4:		Q4:	B	Q4:	B	Q4:	A
Q5:	A	Q5:	C	Q5:		Q5:	A	Q5:	A	Q5:	A
Q6:	A	Q6:	A	Q6:		Q6:	C	Q6:	A	Q6:	A
Q7:	A							Q7:	A		
Q8:	C										
Q9a:											
Q9b:	C										

Enhancement Potential		Education		Recreation		Aesthetic Quality	
Q1:	B	Q1:	C	Q1:	C	Q1:	B
Q2:	A	Q2:	A	Q2:	C	Q2:	B
Q3:	C	Q3:	B	Q3:	C	Q3:	C
Q4:	C	Q4:	C	Q4:	B	Q4:	B
Q5a:		Q5:	C	Q5:	B	Q5:	A
Q5b:	C	Q6:	B	Q6:	B	Q6:	B
Q6:	B						

Wildlife Habitat:	The wetland provides habitat for some wildlife species.
Fish Habitat - Streams:	The wetland's fish habitat function is impacted or degraded.
Fish Habitat - Lakes/Ponds:	N/A
Water Quality:	The wetland's water quality function is impacted or degraded.
Hydrologic Control:	The wetland's hydrologic control function is intact.
Sensitivity to Impact:	The wetland is potentially sensitive to future impacts.
Enhancement Potential:	The wetland has little enhancement potential.
Education:	The wetland site is not appropriate for educational use.
Recreation:	The wetland is not appropriate for or does not provide recreational opport
Aesthetic Quality:	The wetland is considered to be moderately pleasing.

OREGON FRESHWATER WETLAND ASSESSMENT METHODOLGY

Function and Condition Summary Sheet for the Oregon Method

WetlandCode:	NE-8	ProjectNumber:	7971165

Function	Evaluation Descriptor	Rationale
Wildlife Habitat	The wetland provides habitat for some wildlife species.	Two or more Cowardin wetland classes. Woody vegetation is dominant vegetation cover. Moderate degree of Cowardin class interspersion. Less than 0.5 acre of unvegetated open water present. Wetland connected to another body of water by surface water. Wetland connected to other wetlands within a 3 mile radius. Upstream not listed as water quality limited. Residential/Industrial land use within 500 feet of wetland edge.
Fish Habitat - Streams	The wetland's fish habitat function is impacted or degraded.	Between 50 and 75% of stream shaded by riparian vegetation. Portions of stream channel modified. Stream contains between 10 and 25% of instream structures. Upstream not listed as water quality limited. Residential/Industrial land use within 500 feet of wetland edge. Salmon, trout, or sensitive species present sometime during the year.
Fish Habitat - Lakes/Ponds	N/A	
Water Quality	The wetland's water quality function is impacted or degraded.	Surface flow (including streams and ditches) is wetland's primary source of water. Evidence of flooding or ponding during part of the growing season. Moderate (approx. 60%) degree of wetland vegetation cover. Between 0.5 and 5 acres of wetland connected to other wetlands within a 3 mile radius. Residential/Industrial land use within 500 feet of wetland edge. Upstream not listed as water quality limited in watershed or adjacent to the wetland.
Hydrologic Control	The wetland's hydrologic control function is intact.	No part of wetland located within 100-year floodplain or enclosed basin. Evidence of flooding or ponding during the growing season. Area is less than 0.5 acre. Minor restrictions slow down waterflow out of the wetland. Woody vegetation is dominant cover type. Residential/Industrial land use within 500 ft of wetland on downstream or down-slope edge of wetland. Urban or Urbanizing land use in watershed upstream from area.
Sensitivity to Impact	The wetland is potentially sensitive to future impacts.	Stream flow or bank has been modified by human activities within 1 mile above wetland. Water is not being taken out of streams through active diking, drainage, or irrigation districts upstream. Upstream not listed as water quality limited in watershed upstream of the or adjacent to the wetland. Residential/industrial (developed) land use within 500 feet of wetland's edge. Dominant

OREGON FRESHWATER WETLAND ASSESSMENT METHODOLGY

Function and Condition Summary Sheet for the Oregon Method

WetlandCode:	NE-8	ProjectNumber:	7971165

Function	Evaluation Descriptor	Rationale
		Residential/Industrial (developed) land use within 500 feet of wetland's edge. Woody vegetation is the dominant cover.
Enhancement Potential	The wetland has little enhancement potential.	Wetland has lost one or more functions or one or more functions is not present in assessment results for wildlife habitat, fish habitat, water quality and hydrologic control. Wetland's primary source of water is surface flow, including streams and ditches. Water flow into wetland is restricted and cannot be restored. Wetland's area is less than 0.5 acre. Less than 10% of wetland's edge is bordered by a vegetative buffer 25 or more feet wide. Wetland is potentially sensitive to future impacts.
Education	The wetland site is not appropriate for educational use.	Wetland site is not open to the public for direct access or observation. There are no visible hazards to the public at the wetland site. Provides wildlife habitat for some species, or fish habitat is impacted or degraded. There is no existing physical public access to other features, and observation of other features cannot be made. There is not an existing access point within 250 feet of the wetland's edge (if existing-hazardous). Access is not available for limited mobility.
Recreation	The wetland is not appropriate for or does not provide recreational opportunities.	There is not an existing access point within 250 feet of the wetland's edge (if existing-hazardous). Wetland not accessible by boat-no boat launch within 1 mile/ cannot develop. No existing trails and viewing areas to guide user or if created, would disrupt wildlife or plant habitat. Wetland provides habitat for some species. Fishing is not allowed at wetland or adjacent water body (or not applicable). Hunting is not allowed at the wetland.
Aesthetic Quality	The wetland is considered to be moderately pleasing.	Two Cowardin classes are visible from primary viewing area(s). Between 25 and 50% of wetland is visible from viewing area(s). General appearance of wetland has visual detractors which cannot be removed easily. Visual character with surrounding area is landscaped or manipulated by people. Natural, pleasant odors are present at primary viewing location. Continuous traffic and other intrusive noise and natural sounds are audible at primary viewing location.

GREATER OREGON CITY WATERSHED ASSESSMENT









PREPARED FOR:

Greater Oregon City Watershed Council
Oregon City, OR
Contact: Rita Baker

PREPARED BY:

ICF International
317 Alder Street, Suite 800
Portland, OR 97204
Contact: John Runyon
503/525-6153

&

Watershed Professionals Network
Corvallis, OR

April 2010

ICF INTERNATIONAL

ICF International. 2010. Greater Oregon City Watershed Assessment. (ICF Project 00223.09.) Portland, OR. Prepared for the Greater Oregon City Watershed Council, Oregon City, OR.

Acknowledgements

Primary funding for this project was provided by the Oregon Watershed Enhancement Board. We thank Wendy Hudson, Willamette Basin Program Representative, for her support and guidance.

Additional funding was provided by the Clackamas County Soil and Water Conservation District.

The group of dedicated volunteers, from the watershed council members, the technical advisory committee, and agency staff, attended meetings and provided thoughtful review comments on the draft assessment. The final product is much stronger due to their dedication and commitment to this project. We thank:

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Acronyms and Abbreviations

cfs	cubic feet per second
dbh	diameter at breast height
DPS	Distinct Population Segment
ESA	federal Endangered Species Act
ESU	Evolutionarily Significant Unit
GOCWC	Greater Oregon City Watershed Council
LiDAR	Light Detection and Ranging
NSPECT	Nonpoint-Source Pollution and Erosion Comparison Tool
NWI	National Wetland Inventory
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OWRD	Oregon Water Resources Department
PAHs	polyaromatic hydrocarbons
RUSLE	Revised Universal Soil Loss Equation
TDS	Total Dissolved Solids
TMDL	total maximum daily load
TSS	Total suspended solids
UGB	urban growth boundary
USGS	U.S. Geological Survey

Introduction and Purpose

Abernethy Green

Originally called Green Point, Indians gathered here for over 3,000 years to fish at Willamette Falls.

George Abernethy arrived here June 2, 1840, with the "Great Reinforcement" of Jason Lee's Willamette Mission. He took 640 acres just north of Oregon City, including a neck of land that extended to the Willamette River. This area became known as Abernethy green. George and Anna (Pope) Abernethy built their house at the mouth of Abernethy Creek next to the Methodist Mission where the first laws of Oregon were drafted.

Oregon Trail emigrants started arriving on rafts from Fort Vancouver in 1843. They put in at Abernethy's house and climbed up to Abernethy green. Arriving in late fall or early winter, most of them opted to winter over in encampments at Abernethy green. During their stay here they would scout out their piece of the Willamette Valley, file their claim at the Government Land Office and resupply in Oregon City at places like Pettygrove's Red Store or Governor Abernethy's Mercantile.

Beginning in 1846 two-thirds of Oregon Trail emigrants took Sam Barlow's Mount Hood Toll Road which ended right here at Abernethy Green. During peak years of the Oregon Trail migrations, Abernethy Green would be filled with covered wagons and neighbors Hiram Straight, Hugh Burns, Daniel Tompkins, and Jacob Hunsaker took the overflow. In 1851 Hunsaker's wife took in an emigrant family with mountain fever, and she lost a son and daughter to the disease. A rose from May John McLoughlin still grows on their grave.

A devastating flood in 1861 destroyed everything nearby. George Abernethy was financially ruined and left for Portland. By this time improvements along the Oregon Trail had cut travel time almost in half and emigrants no longer needed to winter over. Abernethy Green ceased being the encampment at the end of the Oregon Trail.

—Text of the marker at the end of the Oregon Trail, Oregon City, Oregon

The rich history of the Oregon City area has been influenced by its strategic location near Willamette Falls. Because of the economic importance of the Willamette River and its fish runs, there is extensive information on the river, its fish populations, and habitats. However, very little information is available on the status of fish species or habitats for the stream network that drains the area immediately below and above the falls: Abernethy and Beaver creeks and a group of small tributaries that begin in Oregon City and drain directly into the Willamette River. These streams are the focus of this watershed assessment.

The purpose of the watershed assessment is to provide the Greater Oregon City Watershed Council (GOCWC) with information on the natural processes, current management practices, and land uses that influence stream habitat, fish populations, and water quality in the watershed assessment area. The assessment provides the foundation for the *Greater Oregon City Watershed Council Restoration Action Plan*. This plan provides the GOCWC with a framework and a roadmap for implementing voluntary watershed restoration projects and landowner education.

The assessment's approach follows the general framework described in the Oregon Watershed Enhancement Board's *Watershed Assessment Manual* (Watershed Professionals Network 1999). The assessment is primarily based on existing information from watershed residents, stream habitat studies, field data collection efforts, government reports, aerial photography, and other data sources.

A unique feature of this assessment is the use of Light Detection and Ranging (LiDAR) data to characterize streamside riparian vegetation. LiDAR provides detailed and comprehensive information for assessing riparian vegetation characteristics and shade over stream channels.

Watershed Assessment Area

The watershed assessment area encompasses the stream network for three subwatersheds: Abernethy Creek, Beaver Creek, and Willamette River (Figure 1).

Abernethy Creek enters the Willamette River at river mile 25.3 and is tidally influenced at its confluence with the river. Lower Columbia River anadromous (i.e., residing in the ocean as adults and returning to rivers and streams to spawn) runs of coho salmon and steelhead trout are present in the Abernethy Creek subwatershed.

Beaver Creek, of which Parrot Creek is a large tributary, enters the river above Willamette Falls at river mile 31.4; this system is not tidally influenced. Because Beaver Creek is above the falls, which historically blocked some fish runs, this stream is part of the upper Willamette River system. The Beaver Creek subwatershed contains resident cutthroat trout and lamprey and may now be accessible to Upper Willamette River steelhead.

The Willamette River subwatershed consists of small tributaries that begin within Oregon City and flow over steep-sided bluffs directly into the river. These small streams are very high gradient and do not contain fish with the exception of lower channel habitats within the Willamette River floodplain. Fish occupy the lower floodplain portions of these small streams during high-flow periods.

The watershed assessment area is within the Willamette River Basin in western Oregon. Abernethy and Beaver creeks begin at elevations of about 1200 feet above mean sea level and flow generally in a northwesterly direction to join the Willamette River. Because the entire watershed assessment area is within the low elevation portions of the Willamette Valley, there are no mountainous areas to capture winter snowpack. Consequently, most precipitation comes from rainfall. The largest quantities of rainfall occur between October and November; very little precipitation occurs during the summer and early fall, when stream flows are at their lowest.

The watershed assessment area encompasses 44,353 acres (Table 1). The Abernethy Creek and Beaver Creek subwatersheds are similar in size (21,573 and 20,083 acres, respectively); the Willamette subwatershed is the smallest (2,697 acres). The headwaters of Abernethy and Beaver creeks are largely in unincorporated Clackamas County. Approximately 17% of the watershed assessment area is within the Oregon City urban growth boundary (UGB). A significant portion of the Abernethy subwatershed, primarily the lower stream channel, is within the UGB (16%). A somewhat smaller portion of the Beaver Creek subwatershed is within the UGB (13%), primarily small streams that originate in Oregon City and flow north into Beaver Creek. Most of the Willamette River subwatershed is within the UGB (59%).

Figure 1. Watershed Assessment Area Base Map

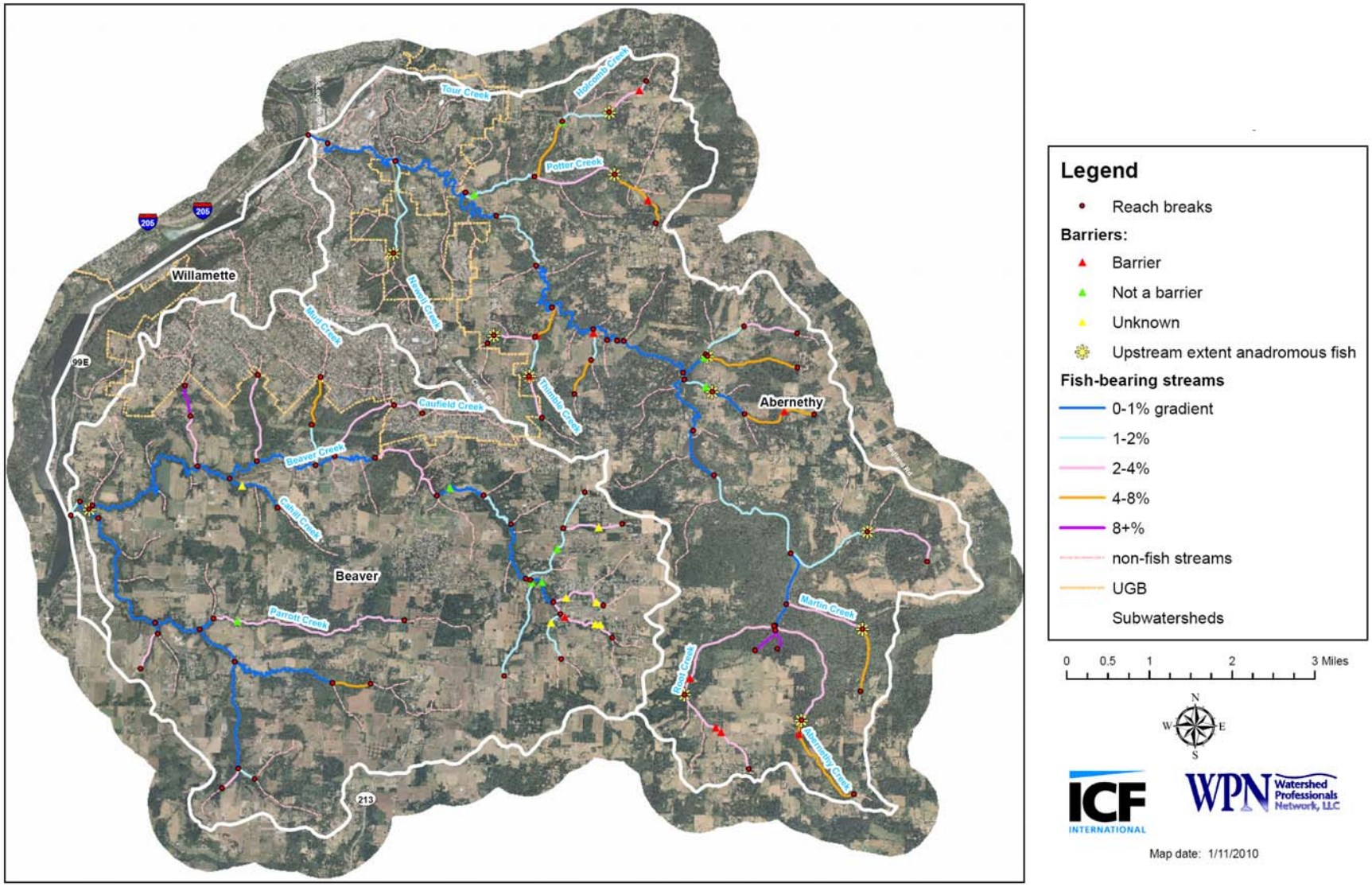


Table 1. Greater Oregon City Watershed Assessment Subwatershed Acreages and Proportions within the Oregon City Urban Growth Boundary

Subwatershed	Total Area Acres (Square Miles)	Oregon City UGB Acres (Square Miles)	Percentage within UGB
Abernethy	21,573 (33.71)	3,471 (5.42)	16%
Beaver	20,083 (31.38)	2,562 (4.00)	13%
Willamette	2,697 (4.21)	1,596 (2.49)	59%
Total	44,353 (69.30)	7,629 (11.92)	17%

UGB = urban growth boundary

The Abernethy Creek, Beaver Creek, and Willamette River subwatersheds have been dramatically altered over the years as a result of urbanization, agriculture, and other land uses. The presettlement historical vegetation of the watershed assessment area consisted of oak woodlands, prairie, and old-growth Douglas-fir forests in the uplands (Metro 2009a). The areas along the streams (i.e., riparian areas) were occupied by a mix of deciduous-coniferous forests and wetlands. The riparian area vegetation included red alder, big-leaf maple, western red cedar, and Douglas-fir, with an understory of fern, snowberry, and salmonberry. The area along the Willamette River between Abernethy and Beaver creeks consists of upland bluffs and steep cliffs, the historical (and current) habitat for many of the area's unique and culturally significant plant species, including Delphinium leucophaeum and camas. Historically, the upland bluffs contained abundant upland oak woodlands and prairie habitats (Metro 2009b).

The watershed assessment base map (Figure 1) serves as the foundation for the watershed assessment and for restoration action planning. The base map illustrates the following elements:

- land cover, vegetation types, and land uses displayed on high resolution aerial photography (2005);
- watershed assessment area and subwatershed boundaries;
- Oregon City UGB;
- stream channels with markers for the upper extent of anadromous, resident, and non-fish-bearing channels;
- location and type of fish passage barriers;
- stream reaches, including areas of uniform channel gradient (steepness) and habitat, or fish passage barriers; and
- stream gradient classifications.

Because the streams in the Willamette River subwatershed do not contain fish (with the exception of a small area in the river's floodplain), the stream channel network and reaches are not displayed on the base map.

This map is also a resource for GOCWC's planning and community outreach. Due to the limitations of print, the base map in this report (Figure 1) does not provide the detail of the digital version. The digital version is available from the GOCWC.

Land Use and Land Cover

The major land cover types and land uses in the watershed assessment area are shown in Figure 2. Agricultural and rural residential land uses account for 46% of the watershed assessment area; forest cover accounts for 33% (Table 2). The distribution of land cover types varies in the subwatersheds: the largest percentage of land in Abernethy Creek subwatershed is in forest cover (44%); the largest percentage in Beaver Creek subwatershed is under agricultural and rural residential land uses (55%); and the largest percentage in Willamette River subwatershed is urban land cover (28%).

A large portion of the watershed assessment area (9%) is covered with impervious surfaces (i.e., pavement, buildings, roofs, and other surfaces that do not absorb rainfall). The amount and distribution of impervious surfaces has significant implications for watershed health. Unless steps are taken to control runoff, rainfall on these areas does not infiltrate into the ground and rapidly runs off as stormwater into streams, negatively affecting stream flows, water quality, and fish populations, and stream habitat. The Willamette subwatershed, which has the highest proportion of area within Oregon City, has the most impervious surfaces (22%). In addition, individual streams (e.g., Newell Creek, which has headwaters within Oregon City) can have a much greater proportion of the drainage area in impervious surfaces.

Waite et al. (2008) assessed the impacts of urbanization on streams in the Willamette Valley. The authors found that increases in impervious surfaces resulting from urbanization affect the flow regime in ways that can reduce the quality of stream habitats, increase sedimentation rates, and increase fluctuation in frequency and magnitude of runoff from rain storms (i.e., storm flows). An impervious surface area of 5% of the watershed appears to be a threshold for negative effects on streams and fish populations (Waite et al. 2008).

U.S. Geological Survey (USGS) data (2004)on percent impervious surfaces for the Oregon City area were used to evaluate the percent impervious surface for the contributing watershed area upstream of the midpoint of each stream reach (Homer et al. 2004) (Figure 3). For the purposes of this assessment, reaches were classified as follows by percent impervious surface in contributing area:

- 5% or less—good
- 5–10%—fair
- greater than 10%—poor

Based on these classifications, reaches in the Abernethy Creek subwatershed were the least affected overall by impervious surfaces, with approximately 75% of the reach length classified as good, 20% as fair, and only 5% as poor (Figure 4). Approximately 45% of the reach length in Beaver Creek was classified as good, 20% as fair, and 35% as poor (Figure 4*)*.

Figure 2. Land Use and Land Cover in the Watershed Assessment Area

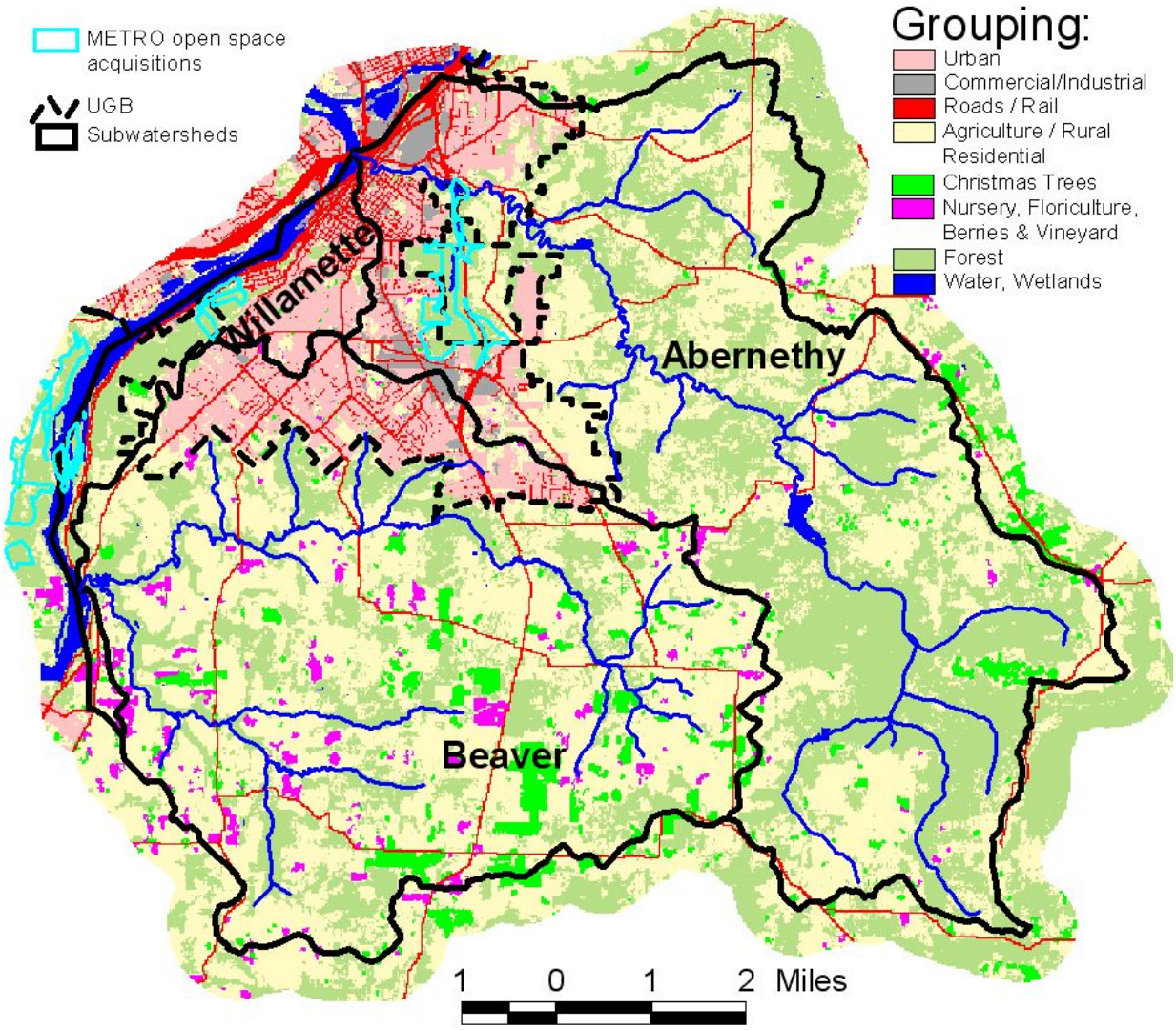
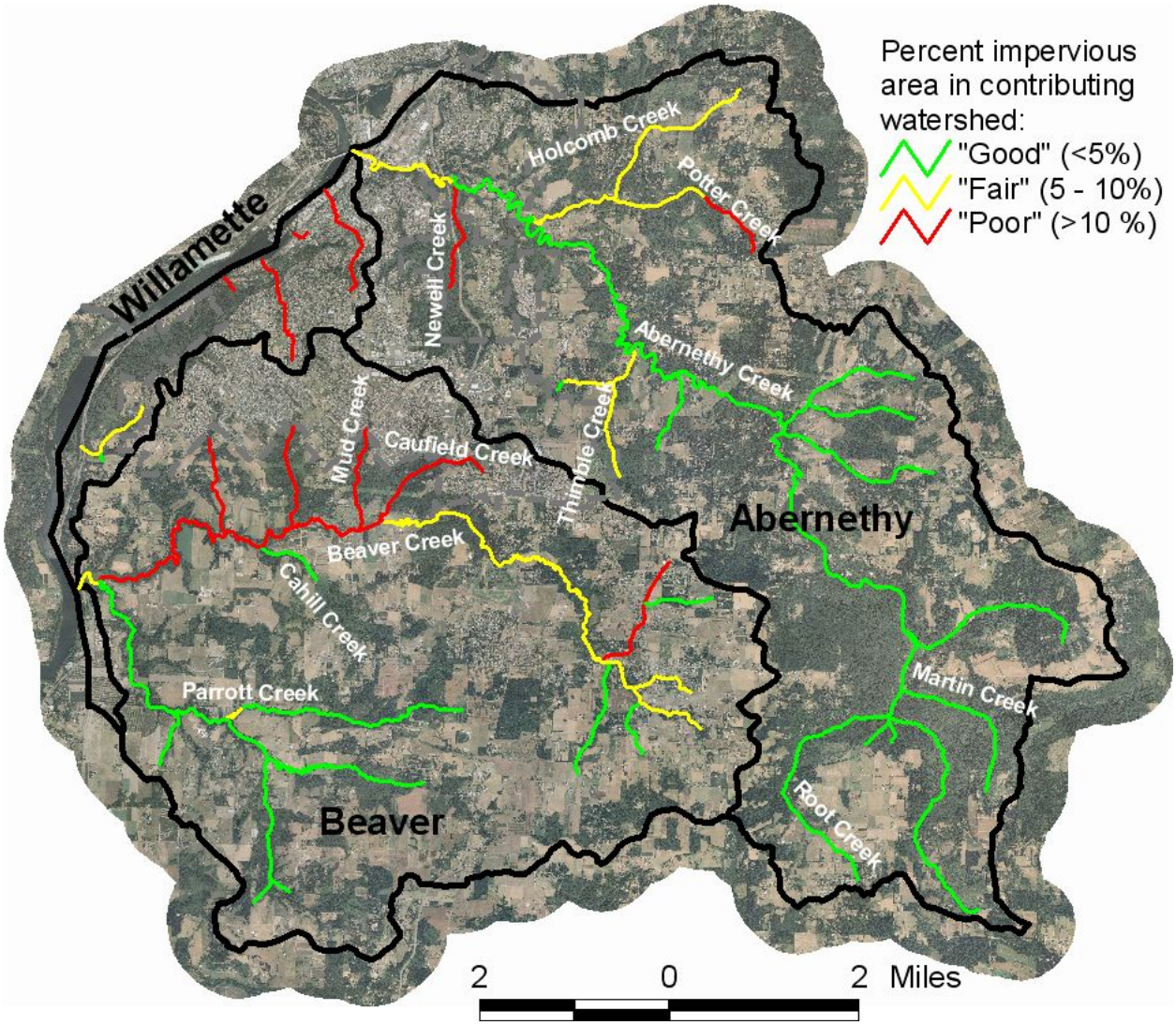


Table 2. Watershed Assessment Area Land Uses and Land Cover Types

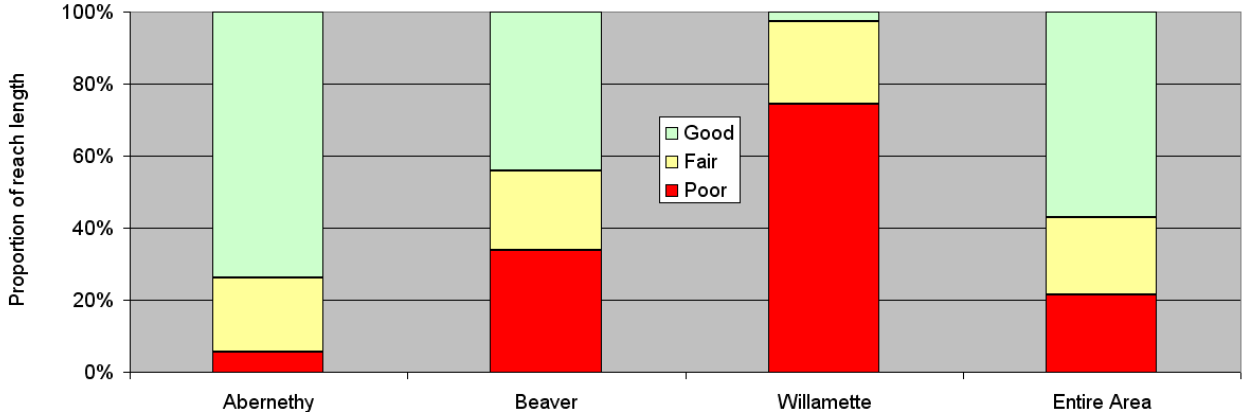
Land Use/Land Cover Group	Percent Cover by Subwatershed			Entire Assessment Area
	Willamette River	Abernethy Creek	Beaver Creek (includes Parrott)	
Urban	28%	6%	8%	8%
Commercial and industrial	2%	2%	0%	1%
Agriculture and rural residential	14%	42%	55%	46%
Roads and rail	15%	4%	3%	4%
Water and wetlands	12%	0%	0%	1%
Forest	26%	44%	23%	33%
Nursery, floriculture, berries, and vineyards	2%	0%	3%	2%
Christmas trees	1%	2%	6%	4%
Watershed Land Use Summary				
Subwatershed area (square miles)	4.21	33.71	31.38	69.30
Metro open space acquisitions (acres)	112	387	—	499
Mean percent impervious area	22%	7%	9%	9%

Figure 3. Percent Impervious Surface for the Contributing Watershed Area Upstream of the Midpoint of Each Stream Reach



Source: Homer et al. 2004

Figure 4. Percentage of Reach Length Classified as Good, Fair, or Poor for Impervious Surfaces



Natural Areas

The regional government, Metro, has made a large investment in protecting natural areas throughout the Portland area (Metro 2009a). Metro purchases land from willing landowners and sets it aside for watershed protection, wildlife, and recreation. The following three areas in the Abernethy Creek and Willamette River subwatersheds are now protected by Metro:

- **Newell Creek Canyon—300 acres in the Abernethy Creek subwatershed.** The presence of native fish and the relatively large size of the undeveloped land bordering the stream make the canyon biologically notable. The goal for this area is to protect undeveloped lands along lower Newell Creek for future restoration (especially threatened habitat for native steelhead and cutthroat populations) and wildlife connectivity. This acquisition is part of a larger strategy to protect natural corridors and uplands along the mainstem of Abernethy Creek and its major tributaries (particularly Holcomb and Potter Creeks) to protect water quality and wildlife habitat.
- **Upper Abernethy Creek headwaters stream—107 acres in the Abernethy Creek subwatershed.** This acquisition includes a relatively large, intact forested area adjacent to two small streams, which protects water quality and fish habitat. (This area is not shown on Figure 2 or other figures; it is adjacent to Tributary C, on the digital version of the base map).
- **Willamette Narrows and Canemah Bluff—112 acres in the Willamette River subwatershed.** This acquisition forms the Willamette River corridor in the vicinity of Oregon City and protects unique rock outcrops and rare plant communities (oak woodlands and prairies).

These areas have some of the highest quality habitat in the watershed assessment area, and offer opportunities for the GOCWC to coordinate restoration actions with Metro and adjoining landowners.

Geology

The watershed assessment area contains four hydrogeologic units. These units are shown in Figure 5 and described below in order of oldest to youngest (McFarland and Morgan 1996 as summarized by Snyder 2008).

Unconsolidated sedimentary aquifer. This unit consists primarily of Quaternary deposits from the Missoula Floods at the end of the last ice age (12,700–15,300 years ago), along with areas of alluvial deposits along channels and floodplains of the present-day (Holocene) drainage system (Gannett and Caldwell 1998). The Missoula Floods were caused by periodic failure of ice dams at the outlet of glacial Lake Missoula in western Montana. These glacier-outburst floods carried material that was deposited as layers of silt, sand, gravel, cobbles, and boulders in the Portland Basin as a result of loss in transport power as floodwaters emerged from the narrow Columbia River Gorge. This unit consists of highly permeable coarse deposits, and is the most permeable of the aquifers in the Portland Basin.

Soil textures in this unit are predominantly silt loams (Natural Resources Conservation Service 2009). The predominant hydrologic soils class for this area is type "C," indicating a slow infiltration rate, even when thoroughly wetted. In the Oregon City area the unconsolidated sedimentary aquifer is found along the Willamette River corridor and in the lower elevation areas of Beaver and Parrott Creeks. This unit is not present in the Abernethy Creek subwatershed.

Troutdale gravel aquifer. This unit is made up primarily (approximately 90%) of Boring Lavas, with additional areas (approximately 10%) of terrace deposits (i.e., deeply weathered sand, gravel, and silt of older alluvial surfaces, including fans), both from the Pleistocene and Pliocene (Gannett and Caldwell 1998). This unit has a relatively high permeability. Perched groundwater in this unit is associated with the Boring Lavas, although these perched groundwater bodies are discontinuous and irregularly distributed (McFarland and Morgan 1996).

The Troutdale gravel aquifer unit is the most common unit in the in watershed assessment area (60%) (Figure 5). The unit occurs at the highest elevations and is intersected by many of the tributary and headwater streams. It is one of the most important aquifers in the region; many public-supply, industrial, and domestic wells derive their water from this source.

Soil textures are predominantly silty clay loam and silt loam (Natural Resources Conservation Service 2009). Hydrologic Soil Group rating is predominantly "B," indicating moderate infiltration rates, moderately well-drained to well-drained soils.

Troutdale sandstone aquifer. This unit is comprised of continental sedimentary rocks from the Pliocene and upper Miocene (Gannett and Caldwell 1998). The rocks include sand, gravel, sandstone, conglomerate, siltstone, and mudstone that were transported from the Cascade Range and Columbia River basin. The unit is found primarily in the subsurface; in the watershed assessment area it occurs primarily where the principal tributaries have incised into the overlying Troutdale gravel aquifer (Figure 5). Overall it comprises approximately 30% of watershed assessment area. It is an important water-bearing unit north of the watershed assessment area to the west of the mouth of the Columbia River Gorge, but its importance diminishes moving south.

Soil textures in the unit are predominantly silt loams and silty clay loams (Natural Resources Conservation Service 2009). Hydrologic Soil Group rating is predominantly type "C," indicating slow infiltration rates and the impeded downward movement of water.

Older rocks. This unit is made up of Columbia River Basalts from the Miocene epoch (Gannett and Caldwell 1998). It occurs only along the Willamette River, and comprises only 2% of the watershed assessment area (Figure 5). The older rocks underlie the basin fill sediments described above. The Columbia River Basalt Group is used in the vicinity of the watershed assessment area as an aquifer where it is not overlain by thick sedimentary rock aquifers.

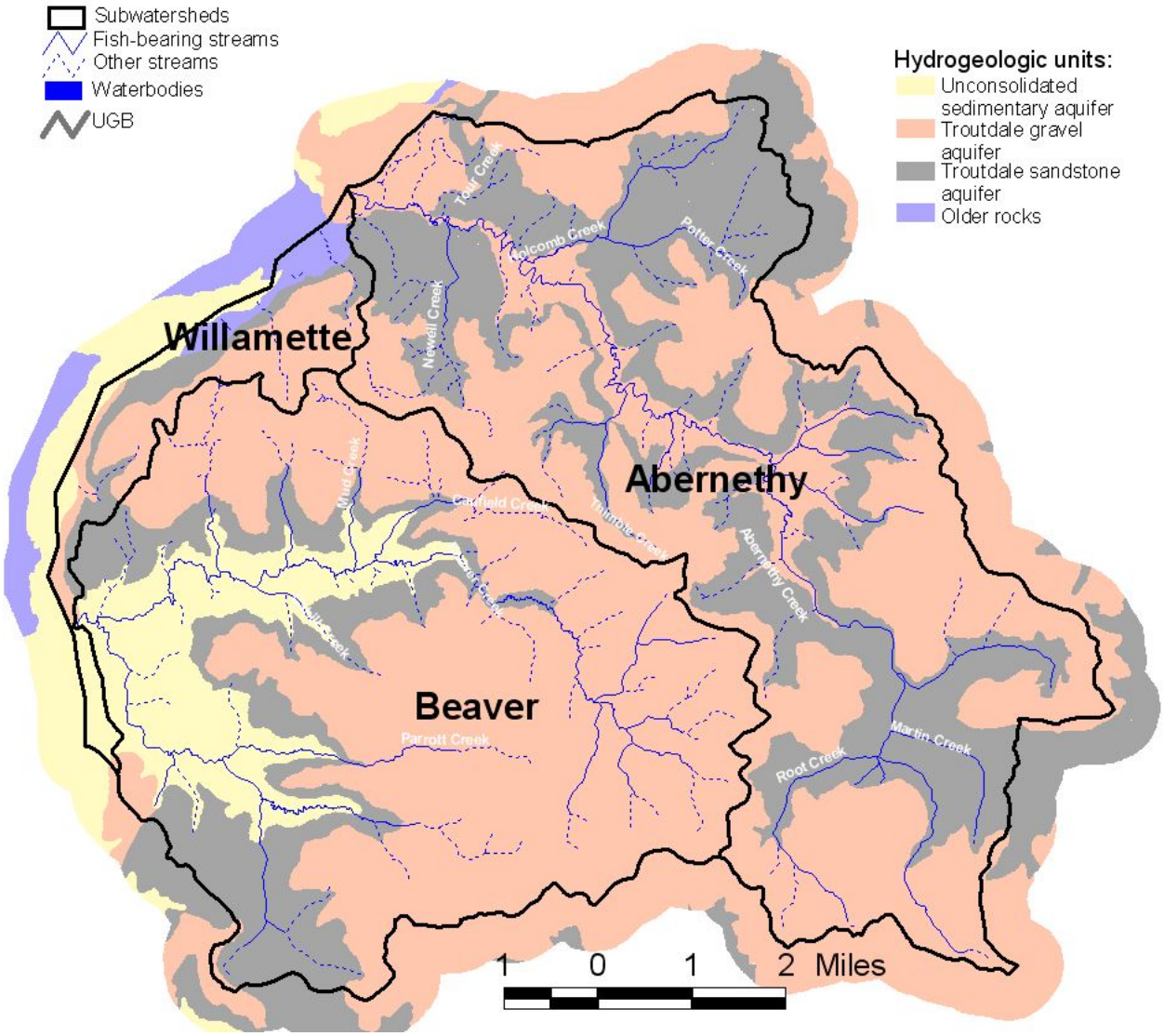
Soil textures in this unit are predominantly silt loam, very stony silt loam, and gravelly loam (Natural Resources Conservation Service 2009). Hydrologic Soil Group ratings are predominantly types "D" and "C," indicating very slow infiltration rates for these shallow soils over nearly impervious material.

The geologic setting has implications for water quality, fish habitat, and prioritizing steps to improve the health of the watershed, including the following:

- Soil textures throughout the watershed assessment area are very fine, contributing to the overall fine-grained nature of sediments in the area. Slow infiltration rates associated with these soils exacerbate the impacts of high-magnitude rainfall events by favoring rapid surface runoff over infiltration into ground and slower runoff into streams.
- The types of soils in the watershed assessment area result in a sediment-rich environment with high levels of background sedimentation in streams.

- Stream channel substrate throughout the watershed assessment area is expected to be relatively fine-grained (e.g., sands and silts), based on the types of soils in the watershed assessment area. The best spawning gravels are probably derived from the Boring Lavas (i.e., the Troutdale gravel aquifer unit; Figure 5). Areas underlain by older rocks (i.e., Columbia River Basalts) would be expected to have relatively good spawning-sized substrate; however, these areas make up only a tiny portion of the watershed analysis area.
- The depth to groundwater (measured in feet below land surface) in the vicinity of streams is generally low throughout the watershed analysis area, approximately 40 feet on average (Snyder 2008). In the unconsolidated sedimentary aquifer, the depth to groundwater is very low in the vicinity of streams (approximately 10 feet). Consequently, groundwater recharge should be relatively rapid, resulting in rapid stream response to storm events. Furthermore, wetlands and wet riparian areas would be expected to be prevalent in areas where depth to groundwater is very low.

Figure 5. Hydrogeologic Units in the Watershed Assessment Area



Introduction

This section describes and quantifies the riparian and wetland conditions in the watershed assessment area compared to historical conditions. The assessment focuses on riparian vegetation composition, stream shading levels, and invasive plant species.

Riparian areas are areas that lie between a stream, or other waterbody, and the adjacent upland and that contain distinctive vegetation. Riparian areas include wetlands and those portions of floodplains and valley bottoms that support riparian vegetation. Vegetation that is growing on or near the banks of water bodies is usually more dependent on water than vegetation that is found further upslope. Historically, riparian vegetation in the watershed assessment area included red alder, big-leaf maple, western red cedar, and Douglas-fir, with an understory of fern, snowberry, and salmonberry (Metro 2009a).

The key product of the riparian vegetation assessment is a detailed map of riparian vegetation for the stream reaches throughout the watershed assessment area. Riparian areas are shown for fish-bearing streams in the Abernethy Creek and Beaver Creek subwatersheds; riparian vegetation for the Willamette River subwatershed was not mapped, because its small streams do not contain fish.

Riparian Area Assessment

Riparian vegetation was assessed based on LiDAR (2006–2008) data, which provide fine-scale measures of bare earth and the heights of other objects (e.g., trees, shrubs, buildings). From these two elevation sources (ground and tree heights, for example), absolute vegetation heights were calculated relative to the ground surface. A "canopy height map" was created, based on these measurements, and use to classify the vegetation as shrubs or trees. Shading over the stream channel was calculated as "effective shade," which is a function of vegetation height, stream channel aspect (north or south), and local hill slopes and other topography. For mapping purposes, a riparian area is defined as a 200-foot-wide area (100 feet on each side of the stream's center). The detailed riparian area maps are available from the GOCWC.

The assessment identified riparian areas in 4% of both the Abernethy Creek and Beaver Creek subwatersheds (Table 3). Although the area covered by riparian vegetation is relatively small, it is disproportionately important because it fulfills several critical functions that promote healthy streams and fish populations—stream shade; food sources (i.e., leaves); and large wood in the stream channel that creates pools, cover, and other high quality fish habitat elements.

Table 3. Acres and Percentage of Subwatersheds in Riparian Areas (100 feet on each side of the stream channel)

Subwatershed[1]	Total acres in riparian area	% Subwatershed area within the riparian area
Abernethy	911	4%
Beaver	768	4%
Total	1,679	4%

[1] Riparian areas were not mapped for the Willamette River subwatershed.

The riparian areas were classified by vegetation types and land uses (Table 4). The classifications reflect the effects on the stream system or potential threats, such as invasive weeds, that could affect the quality of riparian vegetation. Forested areas, for example, play key roles in shading the stream, providing bank stability, and providing logs and large wood create pools and cover for fish. Figure 6 shows an example of the riparian area classification map for lower Abernethy Creek. The complete set of the riparian area classification maps for the watershed assessment area are available from the GOCWC.

Table 4. Riparian Area Classification Types

Riparian Area Classification	Plant Species/Functional Groups	Benefits to the Stream/Disturbance Mechanisms/Notes
Forested	Douglas-fir, western red cedar, black cottonwood, big leaf maple, landscape tree species (mostly >30 feet in height)	Stream shading, bank stability, input of leaves and other materials, wildlife habitat, large wood inputs
Small Trees/ Hardwoods	Species listed above, with dominance of hardwoods (e.g., cottonwood, red alder, willow, dogwood, ash) and young conifers (10–30 feet in height)	Factors listed above, with long-term large wood recruitment from young conifers
Tall Shrubs	Native hardwoods (i.e., very small trees and tall shrub forms), often with mature Himalayan blackberry (~5–10 feet in height)	Stream shading and areas for invasive species spread (e.g., blackberry)
Shrubs/Grass	Mostly blackberry and herbaceous weeds, with potentials for native meadow species; domestic irrigated fields also included	Invasive/nonnative plant species
Land Use	Fields, roads, impervious surfaces and other features of low heights and high reflectance	Areas with high erosion potential, invasive species colonization, low shade
Water bodies	Surface water observed that is larger than the stream channel (e.g., lakes, ponds, impoundments, wetlands)	Water storage sites, reservoirs; potential sites for water heating (impoundments) or cooling (wetlands)
Unclassified/ Transitional	Areas that did not have high confidence in classification; includes buildings, structures, and transitional zones between vegetation types	Data gaps

Figure 6. Riparian Area Classification Map for Lower Abernethy Creek (Reach 2)

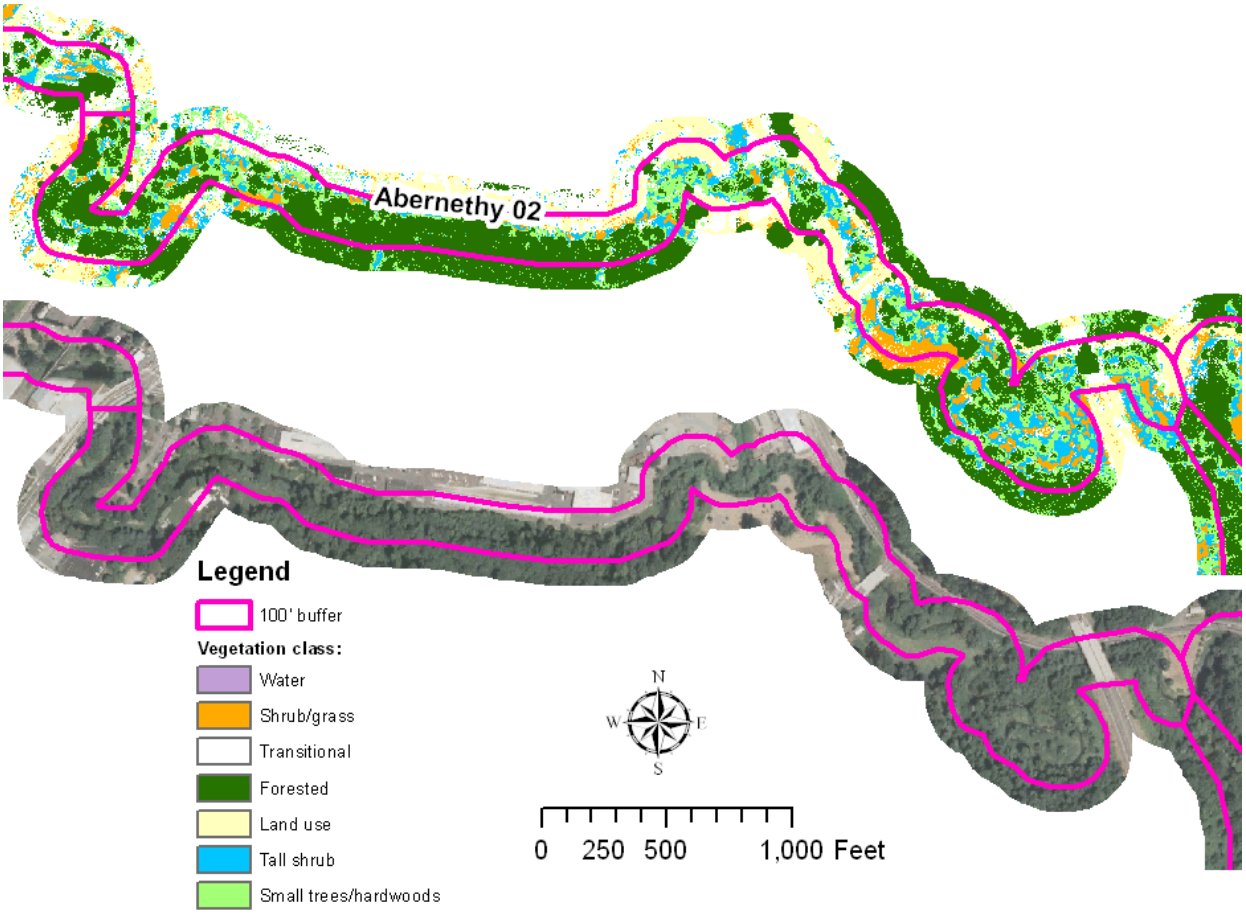
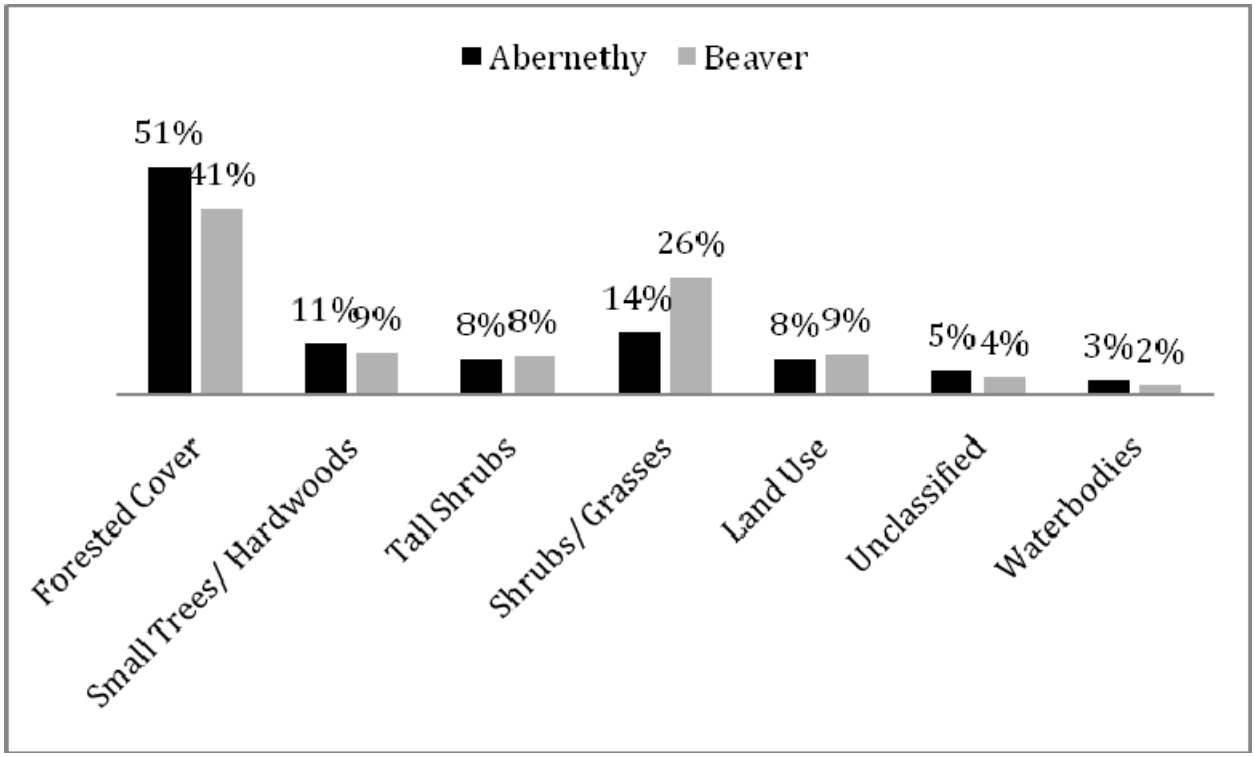


Figure 7 shows the percentage of the riparian area covered by each of the classification types. Forested vegetation is the most common riparian area classification: 51% of the Abernethy Creek subwatershed and 41% of the Beaver Creek subwatershed are in forested riparian areas. With the exception of shrubs and grass cover, the distribution of the other riparian area types is roughly equivalent for the two subwatersheds. The Beaver Creek subwatershed has a much larger proportion (26%) of the riparian area covered in shrubs and grasses. The larger proportion of riparian area shrubs and grasses is probably due to the dominance of agricultural land uses in the Beaver Creek subwatershed.

Figure 7. Percentage of Abernethy Creek and Beaver Creek Subwatershed Riparian Areas Covered by Each of the Classification Types



Invasive Plant Species

Invasive plants are nonnative species whose introduction does environmental harm to watershed health. The five most common invasive plants found in the Portland area include English ivy, Himalayan blackberry, Scot's broom, reed canarygrass, and Japanese knotweed. Invasive plants are most likely to enter areas that have been disturbed by human land uses such as homes, agricultural areas, or roads. Riparian areas can be colonized by all of the five most common invasive plants, but Himalayan blackberry, reed canarygrass, and Japanese knotweed are the most common species found along streams in the watershed assessment area. These invasive plants displace trees and other native vegetation that are important for stream habitat and water quality.

The riparian area maps show areas that may be colonized by invasive plants; however, ground surveys would be required to confirm their presence. Riparian areas classified as tall shrubs or shrubs and grasses have a high probability of being dominated by invasive weeds. The Beaver Creek subwatershed has the highest proportion of these types of riparian areas (Figure 7).

A comprehensive ground inventory of invasive plants has not been completed for the watershed assessment area, but there are scattered observations. All five of the most common invasive plant species were present in an inventory of the Newell Creek canyon, and were particularly prevalent along forest edge areas and highway corridors (John Inskeep Environmental Learning Center No Date). Based on field reconnaissance conducted as part of the watershed assessment, Japanese knotweed was observed in riparian areas along Abernethy Creek tributary streams, including Holcomb Creek. This very aggressive species propagates to downstream points through broken rhizomes or other plant tissue and the potential area of infestation includes all reaches downstream

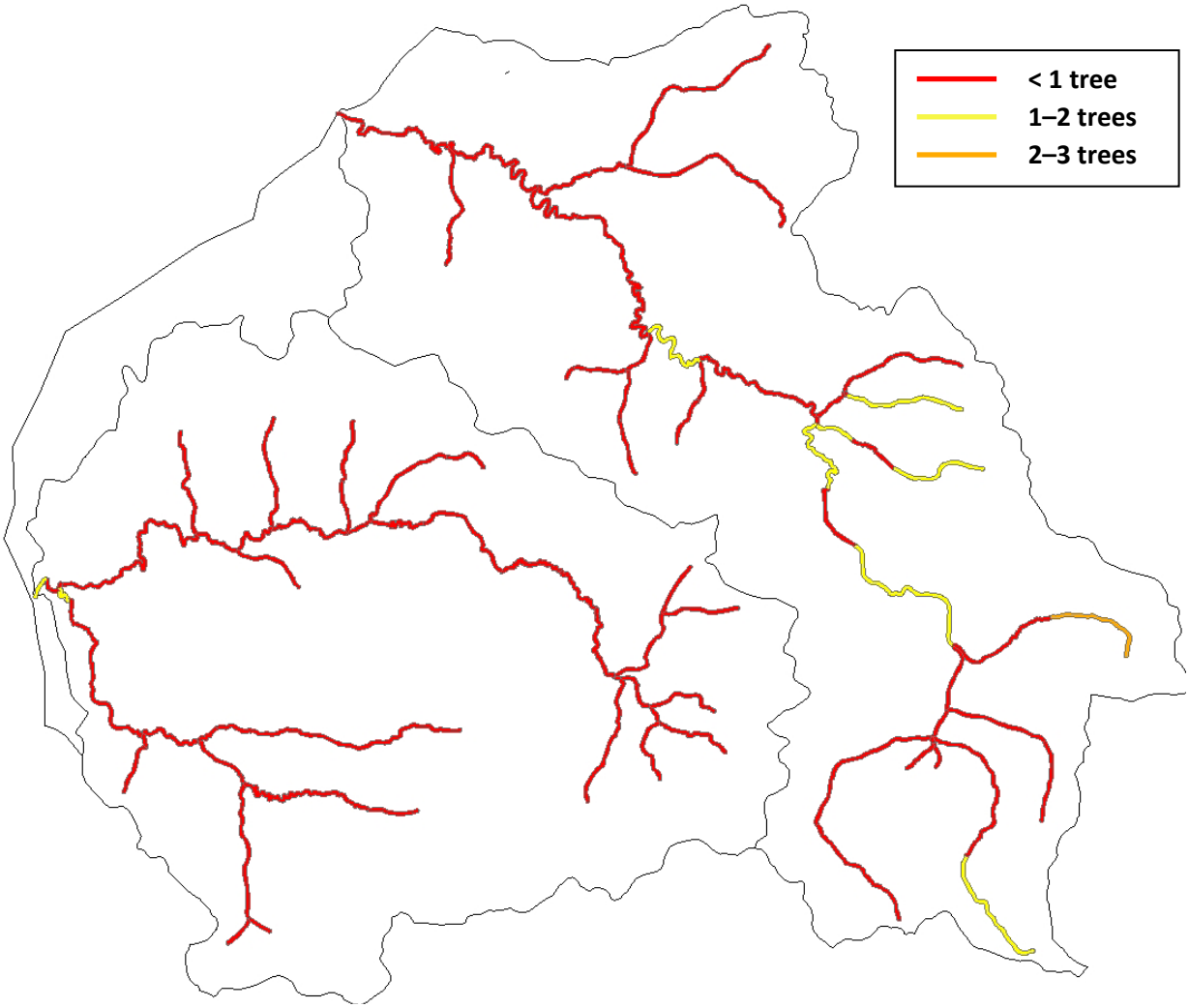
of an established patch. For this reason, the riparian areas throughout the assessment area are considered to have an "extreme" potential threat rating for the presence of Japanese knotweed.

Forested Riparian Areas and Contributions of Large Wood

Forested riparian areas with large trees are important for stream habitat because, over time, these areas can provide large wood to the stream channel, which creates pools and cover for fish. Large trees greater than 20 inches in diameter at breast height (dbh) provide stable large wood in streams. An estimate of riparian areas containing these large trees was made using the LiDAR tree height coverage and measurements of tree crowns. This estimate provides a general estimate of the potential large wood contributions of riparian areas. Field measurements of trees would increase the level of accuracy.

The riparian areas of Abernethy Creek and Beaver Creek subwatersheds contain very few large trees. Each of the riparian areas contains fewer than two trees greater than 20 inches dbh (Figure 8). Given the limited number of large trees in the riparian areas, few opportunities exist for large trees to fall and provide the amount of large wood to stream channels necessary for high quality fish habitat.

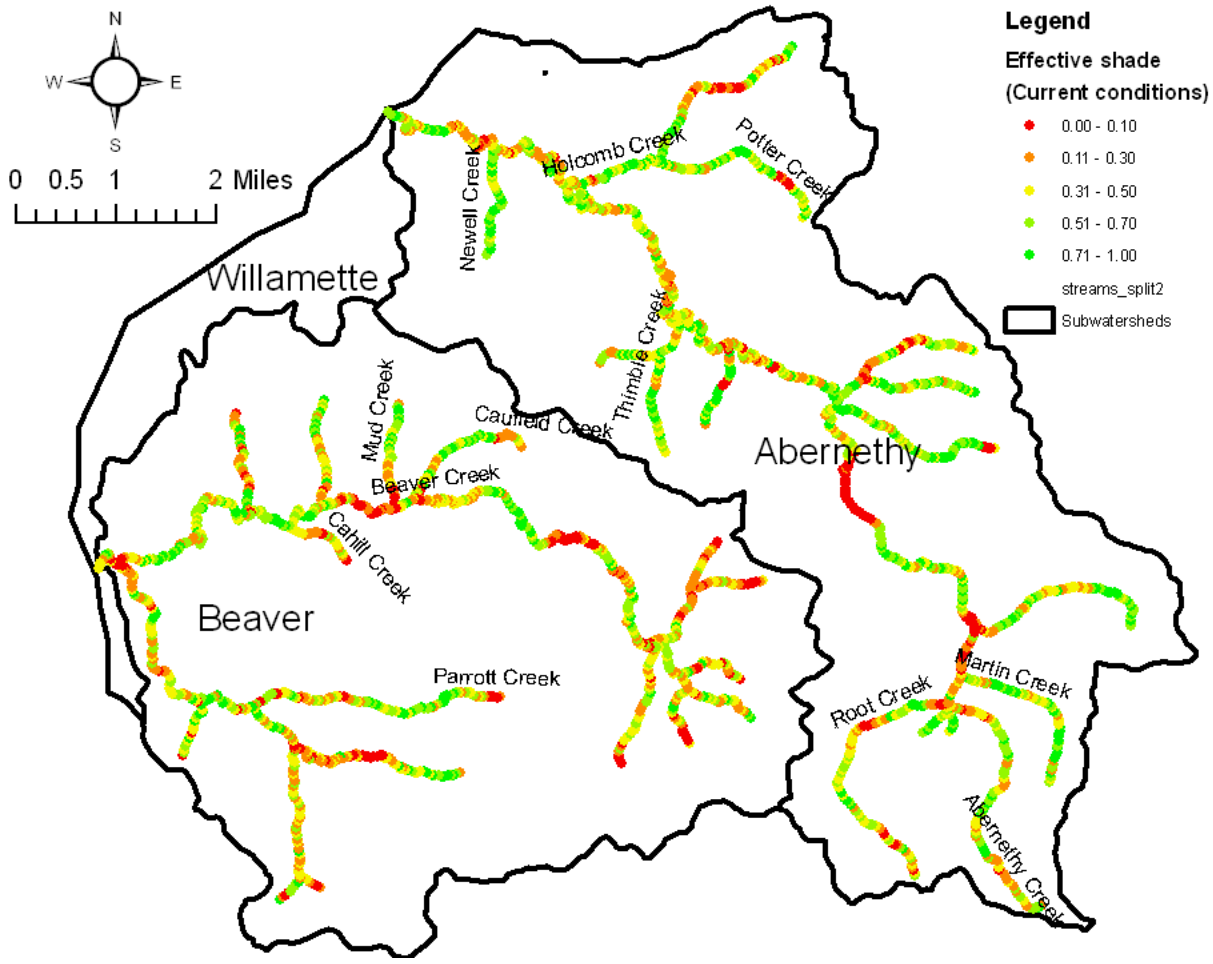
Figure 8. Number of Riparian Area Trees Greater Than 20 Inches dbh per 1,000 Feet of Riparian Area



Stream Shade

The riparian vegetation canopy provides shade over the stream, which maintains cool water for fish and other aquatic species. Effective shade in the Abernethy Creek and Beaver Creek subwatersheds was measured as a combination of three factors: vegetation height, stream aspect (north, south, east, or west flowing channels), and neighboring topography (e.g., hillslopes). For the most part, there is adequate shade over the watershed assessment area stream channels (Figure 9). Average effective shade is 47% for Abernethy Creek subwatershed and 41% for Beaver Creek subwatershed. The large area with no shade along upper Abernethy Creek is due to the open water created by Beaver Lake Estates reservoir.

Figure 9. Shade over Abernethy Creek and Beaver Creek Subwatershed Stream Channels. The large section with minimal shade on upper Abernethy Creek is Beaver Lake



Wetland Habitat Loss

Wetlands provide a number of important functions that contribute to watershed health, including habitat for wildlife species and areas along stream margins where fish can find cover during flood events. Wetlands can reduce the magnitude of flooding by absorbing water created by storms and slowly releasing it back into the stream system.

No information on the likely extent of wetland loss was available for the watershed assessment area. One approach to estimating possible wetland loss is by comparing present-day wetlands to the area classified as having hydric soils. Hydric soils are soils that are, or have been, saturated, flooded, or have had standing water long enough during the growing season to develop anaerobic (i.e., without oxygen) conditions in the upper part of the soil layer. Areas with hydric soils that do not currently support wetlands may have supported them in the past. The Natural Resources Conservation Service (2009) soil survey of the Clackamas area identifies hydric soils within several soil series. Not all of the area within these mapping units contains hydric soils, and not all of the hydric soils necessarily supported wetlands historically. However, this information provides us with an approximation of the extent that may have been occupied by wetlands historically.

Current wetland locations are available from the National Wetland Inventory (NWI) produced by the U.S. Fish and Wildlife Service (2009). The area currently occupied by wetlands and the area of hydric soils in the watershed assessment area are shown in Figure 10. The watershed assessment area has approximately 1,500 acres of hydric soils and 250 acres of wetlands (Figure 11), suggesting that wetlands may currently occupy only one-sixth of the area that they occupied historically. The proportion of estimated wetland loss appears to be similar among the subwatersheds (Figure 11).

Figure 10. Current Wetland Locations and Soil Mapping Units That Contain Hydric Soils in the Watershed Assessment Area

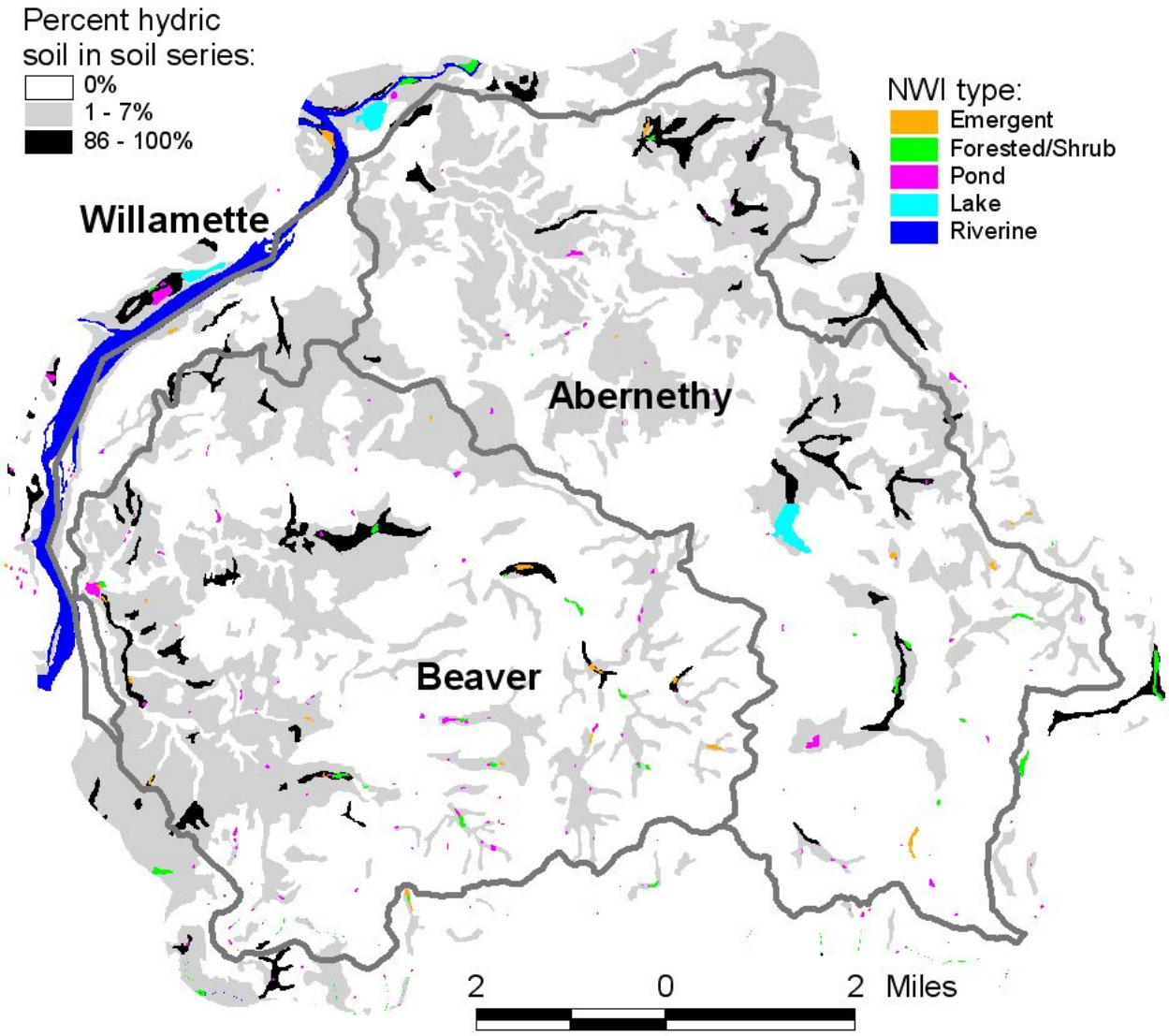
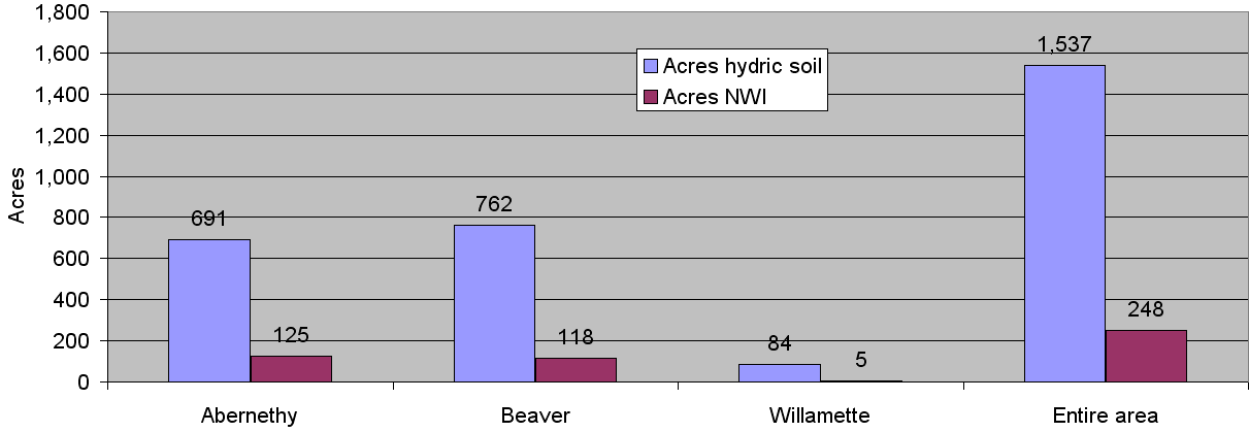


Figure 11. Current Wetland Locations and Soil Mapping Units That Contain Hydric Soils in the Watershed Assessment Area



Introduction

This section focuses on the causes and effects of streamflows at both extremes: low flows and high flows (floods). Human activities, such as agriculture, withdraw water from streams, which can reduce flows during the critical summer and early fall periods when flows are naturally low. Floods, depending on the perspective, can be beneficial or destructive. Floods benefit streams through the force of water and routing of materials through the system, including moving logs and gravels, scouring pools, and creating spawning areas. On the other hand, floods can destroy property and endanger human lives.

This section summarizes what is known about streamflow patterns and about human influences on these patterns in the watershed assessment area. Key issues examined are the flood history of the watershed, how land uses and storage affect high and low flows, and the nature of water withdrawal activities. Land use impacts on streamflows are addressed using techniques that USGS has applied in similar adjacent watersheds, and are based primarily on the percent impervious surface in the drainage areas of the primary streams as described under "Watershed Overview."

Streamflow Patterns

Few records exist on streamflow patterns for the watershed assessment area. The locations of available streamflow data from the five gages in the watershed assessment area are shown in Figure 12. These streamflow gages were operated for 1 year (1936) by the Oregon Water Resources Department (OWRD). The records from these gages are of too short in duration to be of much value in characterizing streamflow conditions; however, they provide a historic snapshot of how watershed response varies among the drainages. Mean daily streamflows, normalized for drainage area, are shown in Figure 13. In general, watershed response over this 1-year period of record is consistent across drainage area and watershed location. Flood recession in the Holcomb Creek watershed appears to be faster than in other areas, possibly due to the predominance of Troutdale Sandstone in the contributing area (Figure 5).

Figure 12. Stream Gages in the Watershed Assessment Area (Operated January–Mid-December 1936)

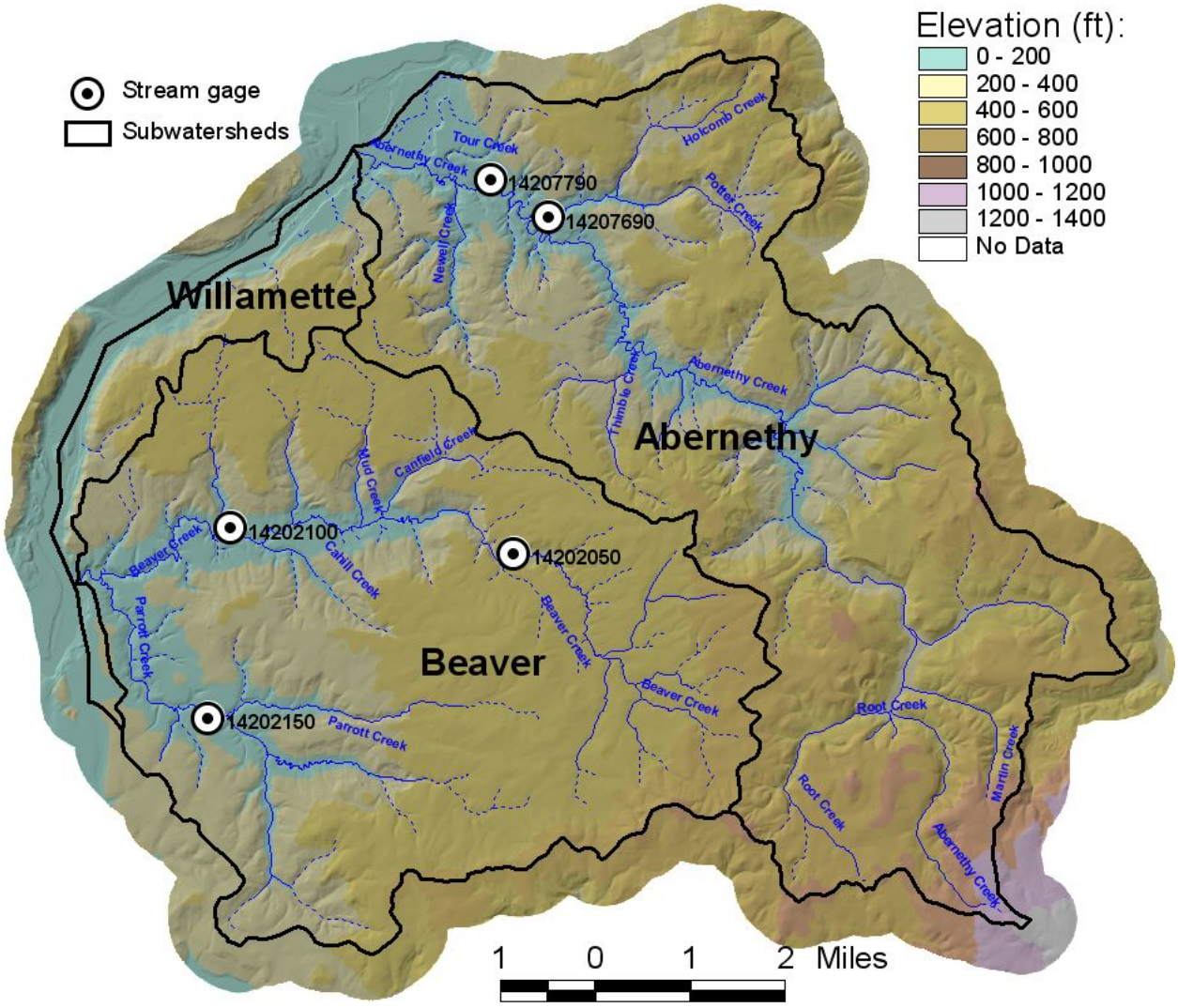
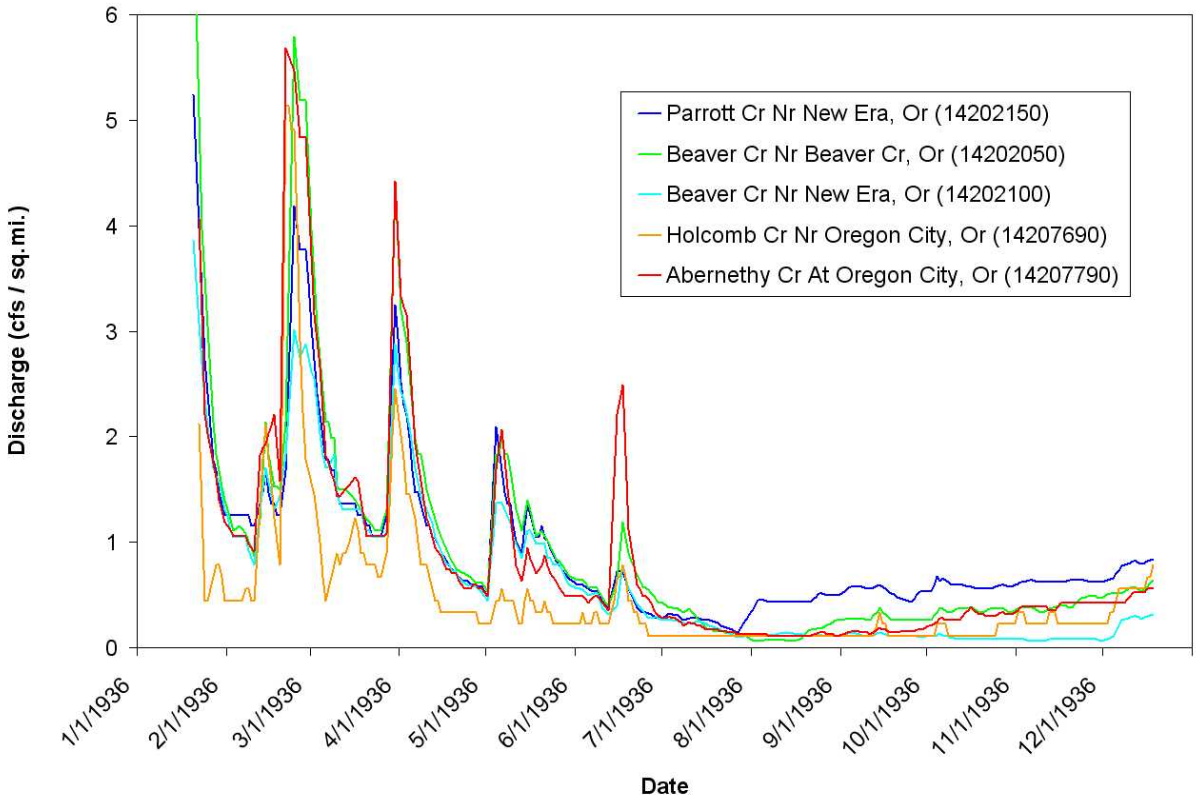


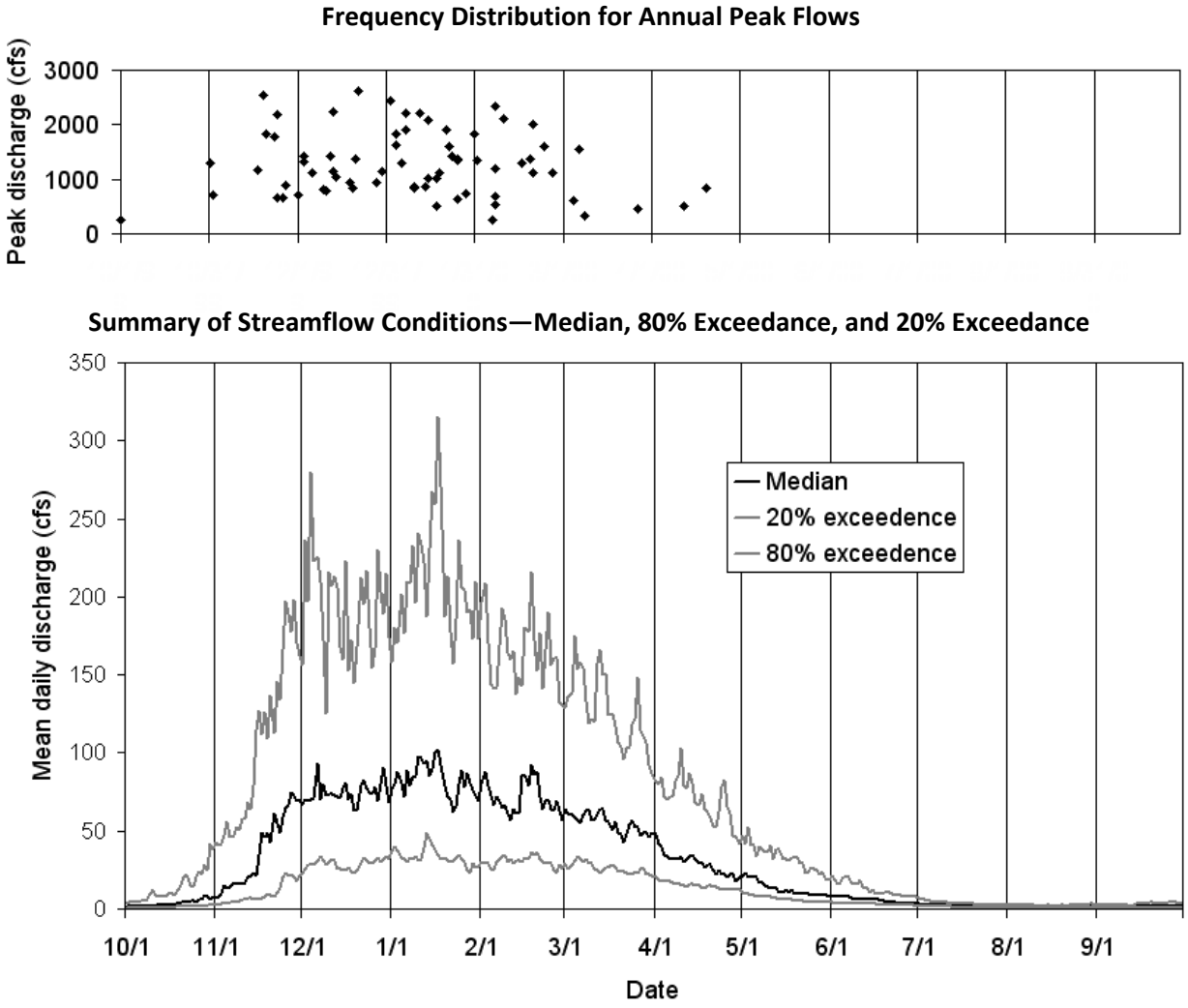
Figure 13. Mean Daily Discharge Normalized by Drainage Area



The longest-term active gage in the vicinity of the watershed assessment area is the Johnson Creek gage at Sycamore, which drains an area of similar size, precipitation, geology and relief. Figure 14 shows the median, 80%, and 20% exceedance[1] flows at the Johnson Creek gage. Mean daily streamflow is highest during the winter months, with the highest values generally occurring in January. Annual peak-flow events occur primarily from December through February, and are most prevalent during January. Summertime streamflows are generally quite low, and are at their lowest in August. Lower Abernethy and Beaver creeks should display the same streamflow patterns.

[1]The median (i.e., 50% exceedance) streamflow is the streamflow that occurs at least 50% of the time in a given month. The 80% exceedance streamflow is exceeded 80% of the time, and can be thought of as the streamflow that occurs in a particularly dry month. Conversely, the 20% exceedance streamflow is exceeded only 20% of the time, and can be thought of as the streamflow that occurs in a particularly wet month.

Figure 14. Flows at Johnson Creek Stream Gage



Flood History

The primary mechanisms for generating floods in the Willamette Basin are rainfall, snowmelt, and rain-on-snow events. Rain-on-snow events are wintertime conditions when relatively warm wind and rain combine to produce rapid snowmelt. These events typically occur at higher elevations. Because watershed assessment area is below 2,300 feet elevation (Watershed Professionals Network 1999), the dominant peak-flow generating processes are estimated as rainfall. Although rain-on-snow events are less likely at lower elevations such as those in the watershed assessment area, they can still occur.

No long-term data on annual floods are available for the watershed assessment area. Data on annual floods from the Johnson Creek at Sycamore gage were used to illustrate recent flood history in the area. The magnitudes of the annual flood events are presented as a time series in Figure 15. Recurrence intervals, also shown in Figure 15, were calculated for the period of record using techniques described by the Interagency Advisory Committee on Water Data (1982). The two

largest floods recorded at the Johnson Creek gage were on December 22, 1964 (2,620 cubic feet per second [cfs]), and November 19, 1996 (2,550 cfs). Significantly, the most recent event on January 2, 2009, was the third largest on record (2,430 cfs; Figure 16). All of these flood events were near or slightly below 25-year recurrence intervals; in other words, they have a one in four (25%) chance of occurring in any given year.

Figure 15. Magnitude and Recurrence Interval for Annual Flood Events at Gage #14211500, Johnson Creek at Sycamore. Dashed lines signify the recurrence interval for the flood event (e.g., a 10-year event has a one in ten chance of occurring in any one year)

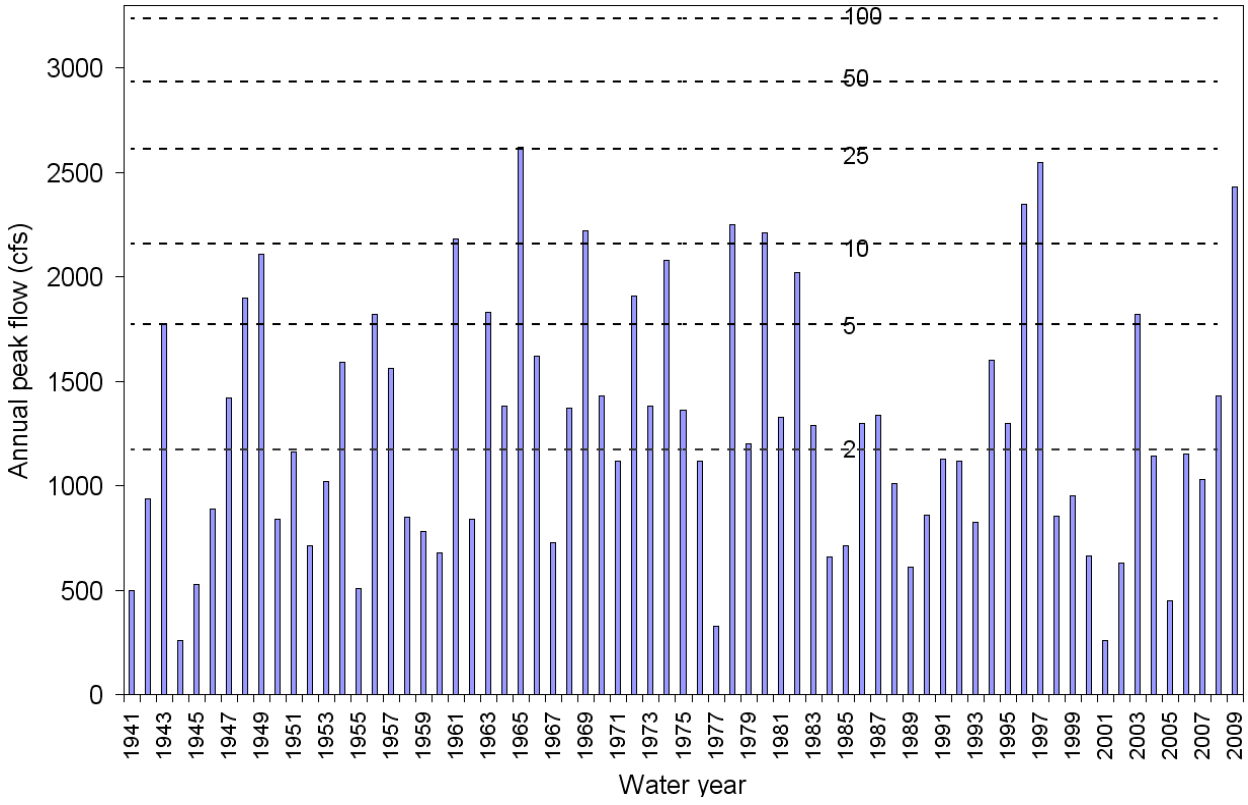


Figure 16. Beaver Creek during January 2, 2009, Flood



Photo courtesy of Ben Fritchie

Water Use

Data available from OWRD (Oregon Water Resources Department 2009a, 2009b) were used to identify locations and characteristics of water use for the watershed assessment area. Only those water rights whose current status is listed as "non-cancelled" were included in this assessment.

Water rights entitle a person or organization to use the public waters of the state in a beneficial way. Oregon's water laws are based on the principle of prior appropriation (Oregon Water Resources Department 2008). The first entity to obtain a water right on a stream is the last to be shut off in times of low streamflows. In times when water is in short supply, the water right holder with the oldest date of priority can demand the water specified in their water right regardless of the needs of junior users. The oldest water right in the watershed assessment area has a priority date of April 27, 1911, and the newest a priority date of June 4, 2008 (Oregon Water Resources Department 2009a).

Certain water uses do not require a water right (Oregon Water Resources Department 2008). Exempt uses of surface water include natural springs that do not flow off of the property from which they originate, stock watering, fire control, forest management, and the collection of rainwater. Exempt groundwater uses include stock watering, watering of less than 0.5 acre of lawn and garden, and domestic water uses of no more than 15,000 gallons per day.

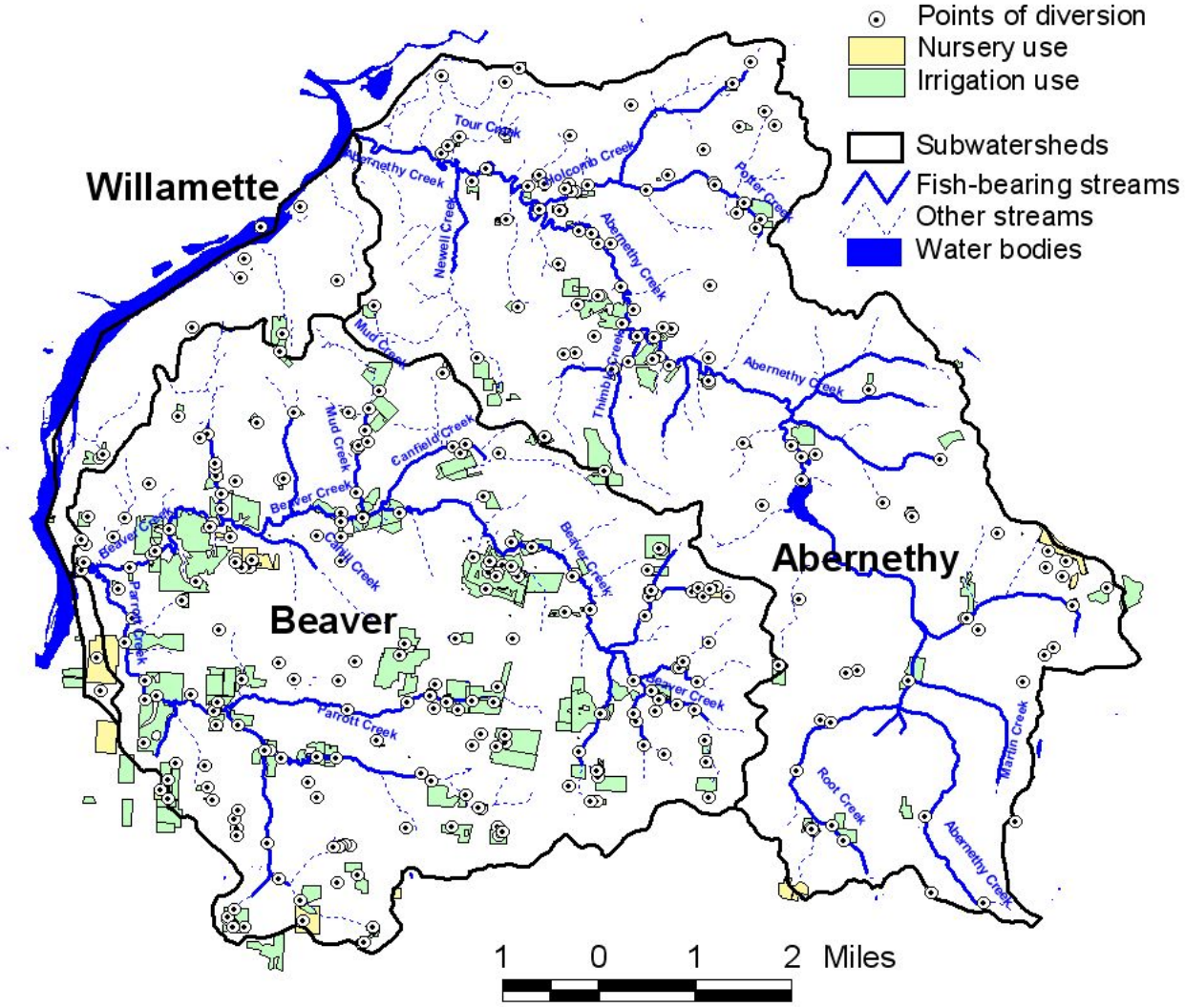
In Oregon, any entity wanting to use the waters of the state for a beneficial use has to go through an application and permit process administered by OWRD. Under this process an entity applies for a permit to use a certain amount of water, and then establishes that the water is being used for a beneficial use. Once the beneficial use is established, and a final proof survey is done to confirm the right, a certificate is issued.

OWRD also approves instream water rights for fish protection, minimizing the effects of pollution, or maintaining recreational uses (Oregon Water Resources Department 2008). Instream water rights set the flow levels that must be maintained in a stream reach on a monthly basis, have a priority date, and are regulated the same as other water rights. Instream water rights do not guarantee that a certain quantity of water will be present in the stream; under Oregon law, an instream water right cannot affect a use of water with a senior priority date (Oregon Water Resources Department 2008). No instream water rights were identified in the watershed assessment area (Oregon Water Resources Department 2009a).

Locations of Water Withdrawals

OWRD identifies approximately 700 points of diversion for water rights in the watershed assessment area (Oregon Water Resources Department 2009b). The approximate locations of these points of diversion are shown in Figure 17. Points of diversion for water rights are found in all three subwatersheds. Half (49%) of the points of diversion are from surface waters, one-quarter (25%) are from groundwater sources, and the remaining quarter (26%) are for storage.

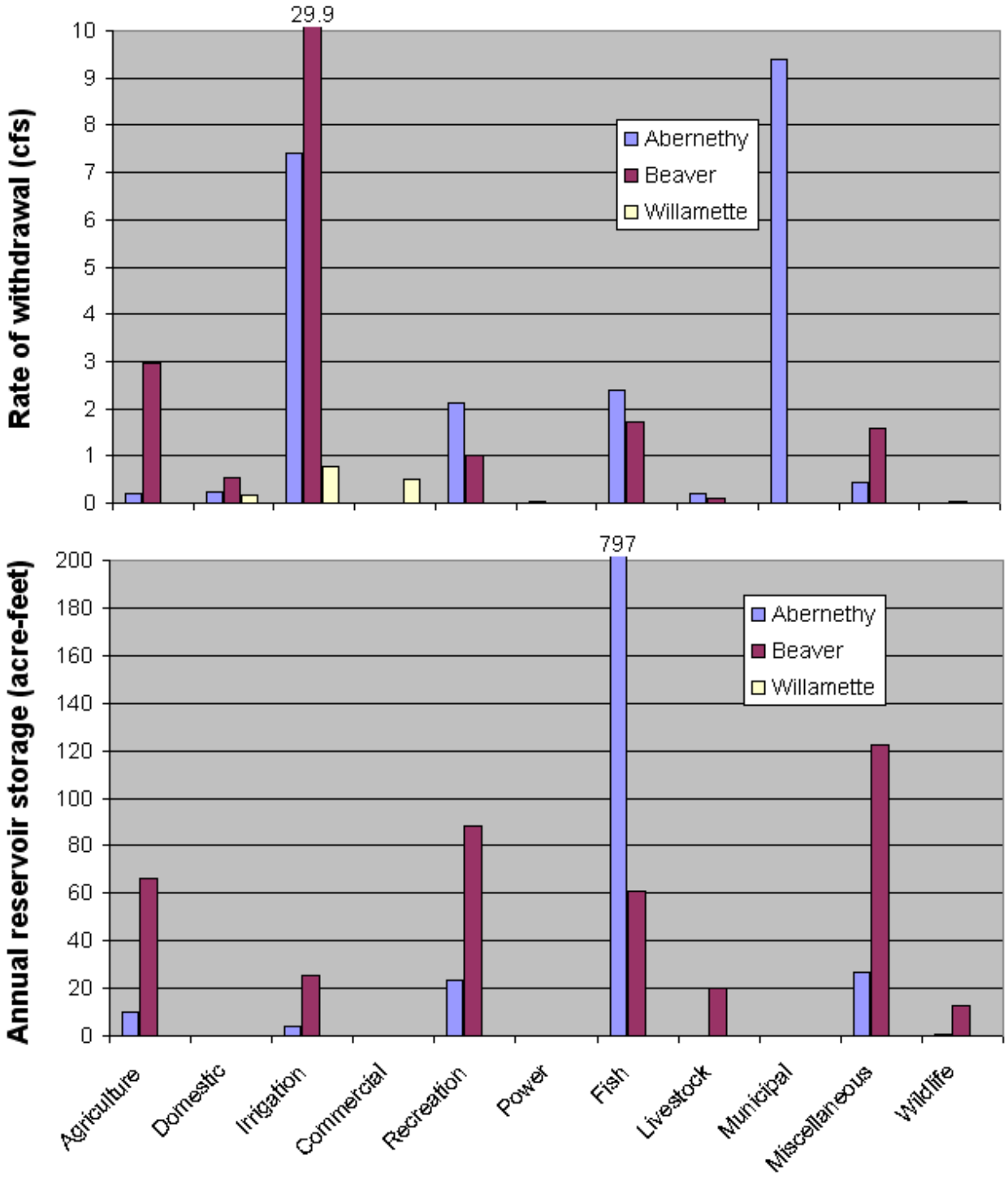
Figure 17. Points of Diversion for Water Rights and Irrigated Areas in the Watershed Assessment Area



Withdrawal Rates

Information on withdrawal rates associated with water rights in the watershed assessment area is available through OWRD (2009a). Rate of withdrawal given in the OWRD data is expressed as an instantaneous rate (i.e., cubic feet per second), except for reservoir storage, which is expressed as a total yearly volume (i.e., acre-feet). In addition, the withdrawal rate for many water rights changes by season (e.g., the allowable withdrawal rate may be lower in the summer months). Withdrawal rates are summarized in Figure 18. August 1 was chosen as the date of focus, because it falls within the period typical of the lowest flows in the watershed assessment area.

Figure 18. Withdrawal Rates and Annual Reservoir Storage in the Watershed Assessment Area for August 1 of Any Given Year



The total instantaneous rate of withdrawal on August 1 is 22.4 cfs in the Abernethy Creek watershed, 37.9 cfs in the Beaver Creek subwatershed, and 1.4 cfs in the Willamette River subwatershed (Figure 18; top graph). The largest instantaneous water use in the Abernethy Creek subwatershed is for Municipal purposes (Figure 18; top graph), primarily because of a municipal well owned by the Clackamas Water District, which is located north of Abernethy Creek,

downstream of Newell Creek (Figure 17). Irrigation and agriculture are primary uses of water withdrawals in the Abernethy Creek and Beaver Creek subwatersheds (Figure 18; top graph). Water withdrawal rates for irrigation are much higher in the Beaver Creek subwatershed than in the Abernethy Creek subwatershed, despite the subwatersheds' similar sizes.

The total annual volume of reservoir storage is 861 acre-feet in Abernethy Creek subwatershed, and 396 acre-feet in Beaver Creek subwatershed (Figure 18; bottom graph). There is no storage in the Willamette River subwatershed. The largest reservoir storage use in the Abernethy Creek subwatershed (Figure 18; bottom graph) is Terra Corporation's Beaver Lake, on upper Abernethy Creek, which is used for fish culture (Figure 17). In addition to fish culture, large users of water storage in the Abernethy Creek and Beaver Creek subwatersheds are for "miscellaneous," recreation, agriculture, and irrigation.

Effects of Water Withdrawals on Flow Regime

Two pieces of information are needed to estimate the net effects of water use on streamflows at any given location: an estimate of the natural streamflow volume and an estimate of the consumptive portion of all upstream water withdrawals. Unfortunately, no gage records are available for the watershed assessment area, so monthly streamflows cannot be estimated directly. OWRD estimates natural monthly streamflows at the outlets of "water availability basins" (WABs); however, the WAB that contains the watershed assessment area (the Lower Willamette River, from the Molalla River to the confluence with the Columbia River) is too large to allow for meaningful results. Similarly, the consumptive use values that have been calculated for the areas are too course in resolution to allow for a meaningful analysis of effects specific to Abernethy or Beaver creeks.

Assuming that the flows at the outlets of Abernethy and Beaver creeks are similar to what has been observed at the Johnson Creek gage and assuming that existing water rights are fully used, it is likely that water withdrawals in Abernethy and Beaver creeks would have a significant negative effect on streamflows during summer and early fall periods. However, further analysis is needed to understand the full effect of water withdrawals on streamflows and fish populations.

Introduction

Rainfall can erode soils, carrying fine particles of sediment into the stream system. Sediment is a natural part of stream habitat, forming part of the channel bottom, or substrate; however, increased sediment loads carried into stream channels can negatively affect fish habitat by filling channels and covering spawning gravels. Due to the underlying geology and soil types, the watershed assessment area has naturally high rates of soil erosion and associated sediment in streams. This assessment examines erosion above the natural background level.

The likely primary sources of sedimentation in the watershed assessment area are bank erosion and upland surface erosion. These sediment sources are evaluated using the impervious surface assessment described above, under "Watershed Overview," and through a modeling application of the Revised Universal Soil Loss Equation (RUSLE). Stormwater runoff from impervious surfaces affect bank erosion areas and magnitudes through increased peak flows that scour banks and create exposed areas of bare soils. Surface erosion associated with land uses (e.g., agriculture, forestry) is evaluated through the RUSLE.

Bank Erosion

Bank erosion is a natural process that occurs in all stream systems, largely in response to variable streamflow events and changes in the resistive strength of the bank material, often associated with streambank vegetation and associated root strength. Bank erosion rates in urban or urbanizing watersheds are likely to be elevated over background levels due to changes in the flood-flow regime. As discussed in the section above, the most likely mechanism for flow regime impacts in the watershed assessment area is the increase in impervious surfaces in the upstream contributing watershed. The area-weighted percent impervious value for the contributing watershed area upstream of the midpoint of each reach (Figure 3) represents the likely magnitude of bank erosion impacts. As discussed above, reaches having 5% or less impervious surface in the contributing area are classified as good, 5–10% as fair, and greater than 10% as poor. Based on these criteria, reaches in the Abernethy Creek subwatershed were the least affected overall, with approximately 75% of the reach length classified as good, 20% as fair, and only 5% as poor. Approximately 45% of the reach lengths in the Beaver Creek subwatershed were classified as good, 20% as fair, and 35% as poor. Areas with poor impervious surfaces likely have the highest levels of bank erosion.

Upland Surface Erosion

The Nonpoint-Source Pollution and Erosion Comparison Tool (NSPECT) was used to evaluate the potential impacts of upland land uses on surface erosion and sediment delivery (Eslinger et al. 2005). NSPECT uses the RUSLE to estimate average annual runoff and sediment load (Renard et al. 1997). The application of NSPECT requires map-based representations of 1) digital elevation model

data to calculate surface flow direction and flow accumulation throughout a watershed 2) land cover data 3) soils data and 4) annual precipitation data.

Values for two soil parameters are needed to run NSPECT: soil erodibility ("k factor") and the hydrologic soil type (i.e., A, B, C, or D, depending on the soil's infiltration rates). Both of these values were available for soil series in the NRCS (2009) soil layers available for Clackamas County. Annual precipitation values from the time period 1971–2000 (PRISM Climate Group 2006) were used to characterize mean annual precipitation in the watershed assessment area.

Average annual sediment yield was calculated for two modeling scenarios: current land cover and historic land cover. Soil, elevation, and precipitation values were held constant between the two modeling scenarios. Average annual sediment yield was calculated at the midpoint of each stream reach under both scenarios, and the increase over background was calculated by dividing current yield by historic yield. The resultsare illustrated in Figure 19, as sediment increase over natural background levels, and summarized in Figure 20.

All stream reaches showed a modeled increase over background conditions. Increases were lowest in areas of relatively undisturbed forest (e.g., Martin Creek) and highly urbanized areas (e.g., the headwaters of Mud Creek). The greatest modeled increases in sediment yield are for the areas with extensive agricultural uses. The Beaver Creek subwatershed, which has the highest percentage of area in agricultural land uses, displays the highest sediment rate above background.

Figure 19. Sediment Increase over Background for the Watershed Assessment Area (Calculated at the Midpoint of Each Reach)

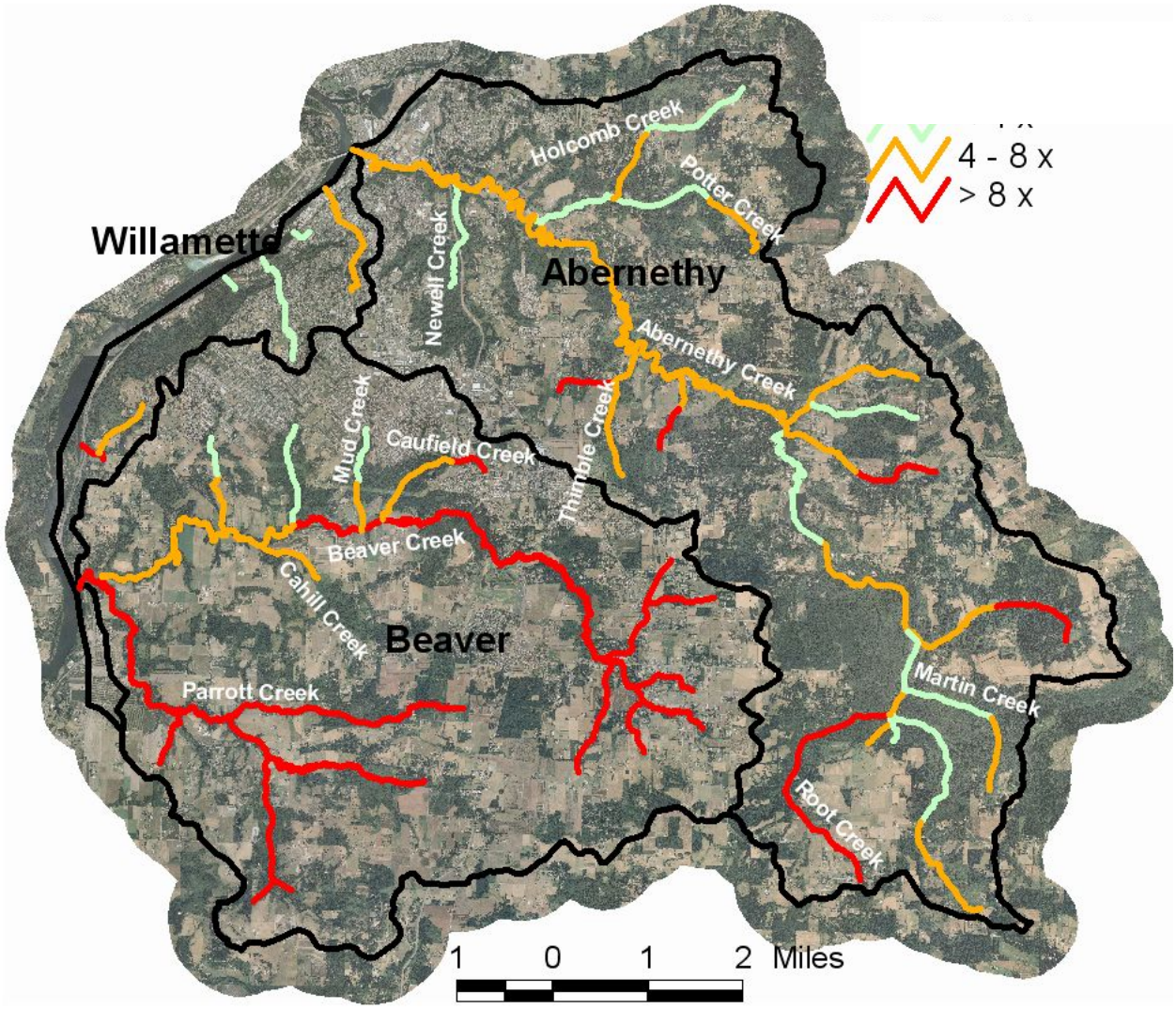
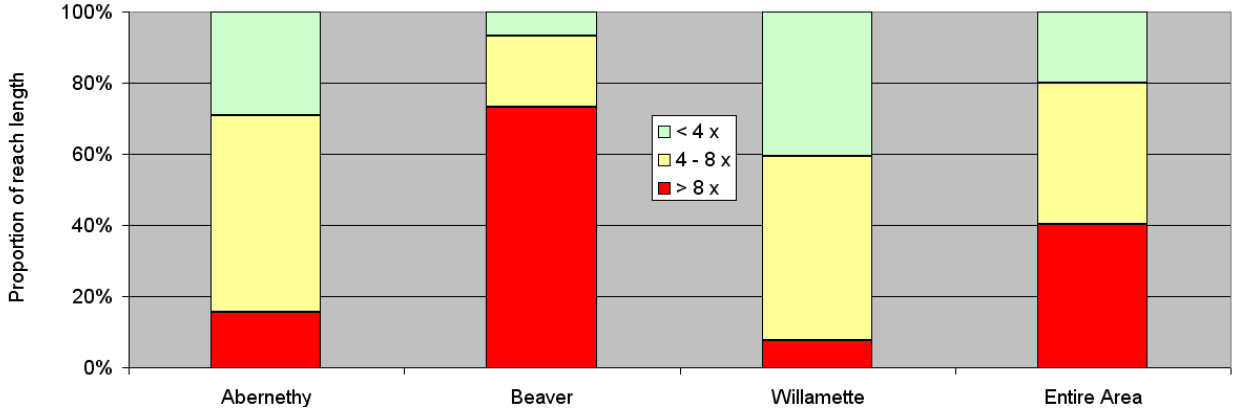


Figure 20. Proportion of Reach Length by Each of the Three Sediment Increase Ratings



Introduction

The Oregon Water Quality Standards (Oregon Administrative Rules [OAR] 340-041-0340, 2010) include the list of beneficial uses of the stream, the water quality criteria designated to protect those uses, and policies to implement the water quality standards. Since criteria applicable to streams are based on the protected beneficial uses it is important to identify the uses specific to each water body. Beneficial uses applicable to Willamette River Basin and Abernethy Creek and Beaver Creek subwatersheds are identified in the Oregon Water Quality Standards (Table 5). Water quality standards for temperature and other parameters applicable to salmon and trout rearing and migration are in effect for Abernethy Creek and Beaver Creek subwatersheds. Standards for salmon and steelhead spawning are applicable only to Abernethy Creek subwatershed.

Table 5. General Beneficial Uses Identified for All Willamette River Basin Tributaries and Specific to Abernethy Creek and Beaver Creek Subwatersheds (2010)

General Beneficial Use Designations	
Public Domestic Water Supply	Wildlife & Hunting
Private Domestic Water Supply	Fishing
Industrial Water Supply	Boating
Irrigation	Water Contact Recreation
Livestock Watering	Aesthetic Quality
Fish and Aquatic Life	
Beneficial Uses: Fish Use Designations for Abernethy Creek Subwatershed	
Salmon and trout rearing and migration	
Salmon and steelhead spawning use, October 15–June 15	
Beneficial Uses: Fish Use Designations for Beaver Creek Subwatershed	
Salmon and trout rearing and migration	
No spawning use	
Source: OAR 340-041-0340	

The federal Clean Water Act, Section 303(d), requires states to maintain a list of streams considered water quality limited, in other words, streams that do not meet particular water quality standards for the beneficial uses. If a 303(d) listing is warranted, a total maximum daily load (TMDL) plan is developed for the stream segment. The TMDL plan identifies the maximum pollutant load (e.g., water temperature) that can be supported and still meet water quality criteria. Pollutant loads, above the level that meet water quality criteria, must be reduced over time using pollution-control technology for point sources, such as wastewater treatment plants, and best management practices for non-point sources, such as agricultural land uses.

The approach to evaluating water quality issues in the watershed assessment area is based on an initial review of available water quality data, applicable studies, and any potential pollution sources that occur in the watershed. Very limited water quality data are available for Abernethy Creek

subwatershed and virtually no data are available for Beaver Creek subwatershed. Appendix A outlines the sources of water quality data, sample site locations, and criteria used for this assessment.

This section focuses on what is known about the water quality characteristics that are important for maintaining watershed health and restoring salmon and trout populations: temperature; toxics, which include pesticides, herbicides, and heavy metals; and stormwater, which includes a variety of parameters such as bacteria and sediment.

Relationship to Land Use

Because there is limited water quality data for streams in the watershed assessment area, the evaluation of water quality depends to a large extent on studies in the Clackamas River watershed and nearby lower Willamette Basin tributary streams. Fortunately, several comprehensive studies have been completed by USGS that provide a good idea of what water quality issues to expect in urbanizing watersheds similar to the watershed assessment area. The Clackamas River is a good case study, because its watershed characteristics, land uses, and crops are similar to those in the watershed assessment area. The lower Clackamas River basin transitions from forested land cover to agricultural and rural residential then to urban land uses similar to the Abernethy Creek and Beaver Creek subwatersheds. The general mix of pollutant sources for temperature, sediment, nutrients, pesticides, and herbicides are similar in composition to the lower Clackamas.

- The study of nutrients and algal conditions in the Clackamas River (Carpenter 2003) established the relationship between pollution sources, nutrients, and effect on water quality.
- The USGS study of pesticides (Carpenter et al. 2008) in the lower Clackamas Basin provides a useful analogy for what pesticides/herbicides to expect in these watersheds due to the similarity in land uses.
- Another USGS study shows the effects of urbanization in stream ecosystems in the Willamette River (Waite et al. 2008).

The issues identified in these studies are also highlighted in the Willamette Basin TMDLs, which list elevated stream temperatures, bacteria, mercury, and pesticides.

The percent impervious surface area plays a key role in determining water quality (see "Watershed Overview"). USGS correlated urbanization and impervious surfaces to water quality in the Willamette River Basin, including Portland area watersheds that are similar to the Oregon City watersheds such as Kellogg and Abernethy Creeks (Waite et al. 2008). The USGS study found strong correlations between the degree of urbanization and water quality measurements including the total pesticide concentration, toxic equivalents, and dissolved oxygen. There is also a high correlation between urbanization and altered biological communities. Fish and aquatic insect communities appear to be affected at an impervious surface threshold of 5%, which corresponds to a number of streams in the watershed assessment area (Figure 3).

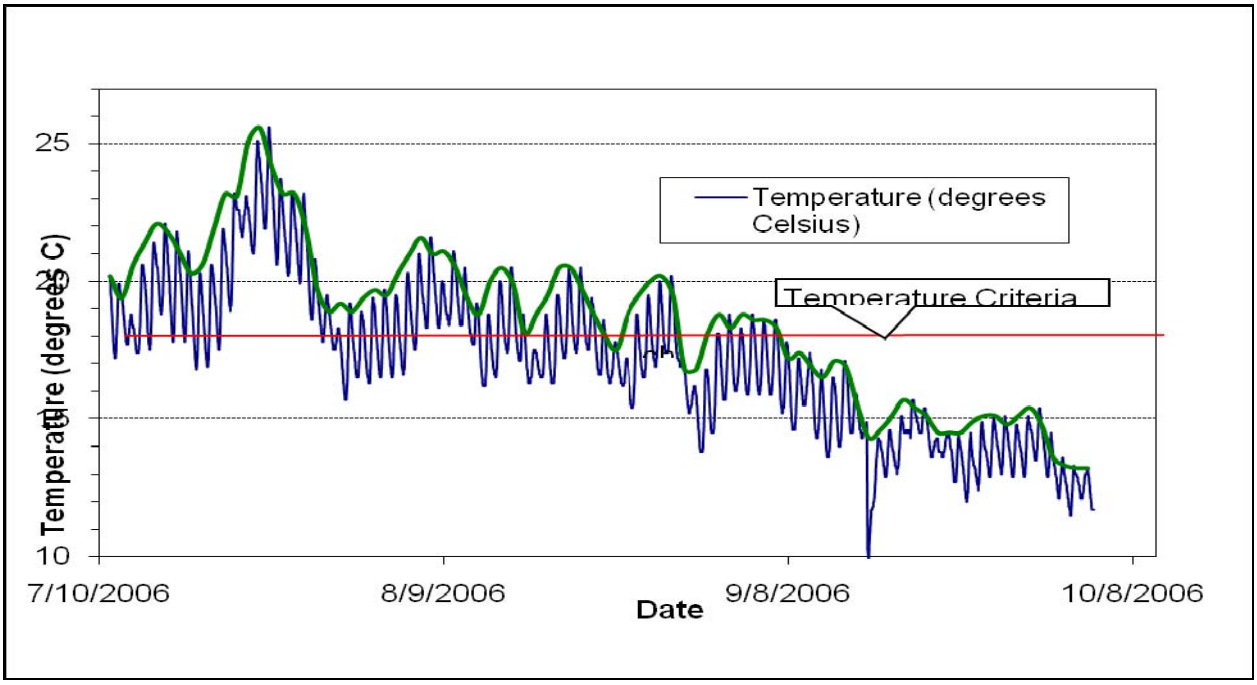
Water Temperature

Temperature is listed as water quality limited for one stream in the watershed assessment area, Abernethy Creek. One temperature station in Abernethy Creek provides a snapshot of temperature conditions; no other temperature records are available for the watershed assessment area.

Water temperature was measured continuously by the Oregon Department of Environmental Quality (ODEQ) in Abernethy Creek near Atkinson Park within Oregon City from July 11 to October 4, 2006 (Figure 21). The water quality criterion for this period of time is 18 degrees Celsius (64.4 degrees Fahrenheit), which has been established to protect salmon and trout rearing and migration.

Water temperature exceeded the temperature criteria 100% of the time during the months of July and August, indicating that the lower section of Abernethy Creek is not conducive to salmon or trout populations.

Figure 21. Water Temperature and 7-Day Average Water Temperature Recorded for Abernethy Creek



Source: Oregon Department of Environmental Quality 2006.

Toxics

Toxic pollutants of concern in the aquatic environment include heavy metals, organic pesticides, herbicides, polyaromatic hydrocarbons (PAHs), polychorinated biphenyls (PCBs), pharmaceuticals and other human-made chemicals. The best local information on potential toxic chemicals is contained in the detailed study completed by USGS between 2000 and 2005 on pesticide occurrence in the lower Clackamas Basin (Carpenter et al. 2008).

The USGS study reported the following:

In all, 63 pesticide compounds were detected, including 33 herbicides, 15 insecticides, 6 fungicides, and 9 pesticide degradation products. Atrazine and simazine were detected in about half of samples, and atrazine and one of its degradates (deethylatrazine) were detected together in 30 percent of samples. Other high-use herbicides such as glyphosate, triclopyr, 2,4-D, and metolachlor also were frequently detected, particularly in the lower-basin tributaries. Pesticides were detected in all eight of the lower-basin tributaries sampled, and were also frequently detected in the lower Clackamas River.

The highest pesticide loads were found in Deep and Rock Creeks. These medium-sized streams drain a mix of agricultural land (row crops and nurseries), pastureland, and rural residential areas. "Although most of the 51 current-use pesticides detected have multiple uses, 48 (or 94 percent) can be used on agricultural crops. Ninety-two percent can be used on nursery or floriculture crops; about one-half are commonly used on either lawns and landscaping in urban areas (57 percent), on golf courses (49 percent), along roads and right-of-ways (45 percent), and some can be used on forestland (7 percent).

Some concentrations of insecticides (diazinon, chlorpyrifos, azinphos-methyl, and *p,p'*-DDE) exceeded U.S. Environmental Protection Agency (USEPA) aquatic-life benchmarks in Carli, Sieben, Rock, Noyer, Doane, and North Fork Deep Creeks. One azinphos-methyl concentration in Doane Creek (0.21 microgram per liter [µg/L]) exceeded Federal and State of Oregon benchmarks for the protection of fish and benthic invertebrates. Concentrations of several other pesticide compounds exceeded non-USEPA benchmarks.

The study provides a useful analog for Abernethy Creek and Beaver Creek subwatersheds. Many of the land uses in these subwatersheds are similar to the areas in the lower Clackamas that have the highest pesticide loads. The watershed assessment area contains a large proportion of agricultural and residential land uses, indicating a very high probability that pesticides are an issue in the watershed. In addition, pesticides and herbicides are used on lawns and landscapes in the urban/commercial use areas, providing a further source of toxics to the stream system.

Although none of the USGS studies focused on metals, heavy metals are commonly found in urban stormwater. Copper, lead, and zinc were listed as parameters in a watershed in the Middle Willamette River Basin (Oregon Department of Environmental Quality 2006).

Stormwater Quality

Lower Abernethy Creek flows through Oregon City, and other small tributaries originate in the city and flow into Abernethy and Beaver creeks or into the Willamette River. Key headwater streams that begin in the city include Newell Creek, a tributary to Abernethy Creek, and a number of small tributaries that flow into Beaver Creek. Oregon City has a comprehensive approach to managing and monitoring stormwater. Data for the stormwater evaluation were collected by the city for three dates during the winter of 2007–2008. The November sample was reported as dry, and the December and January samples were reported as wet (City of Oregon City 2008).

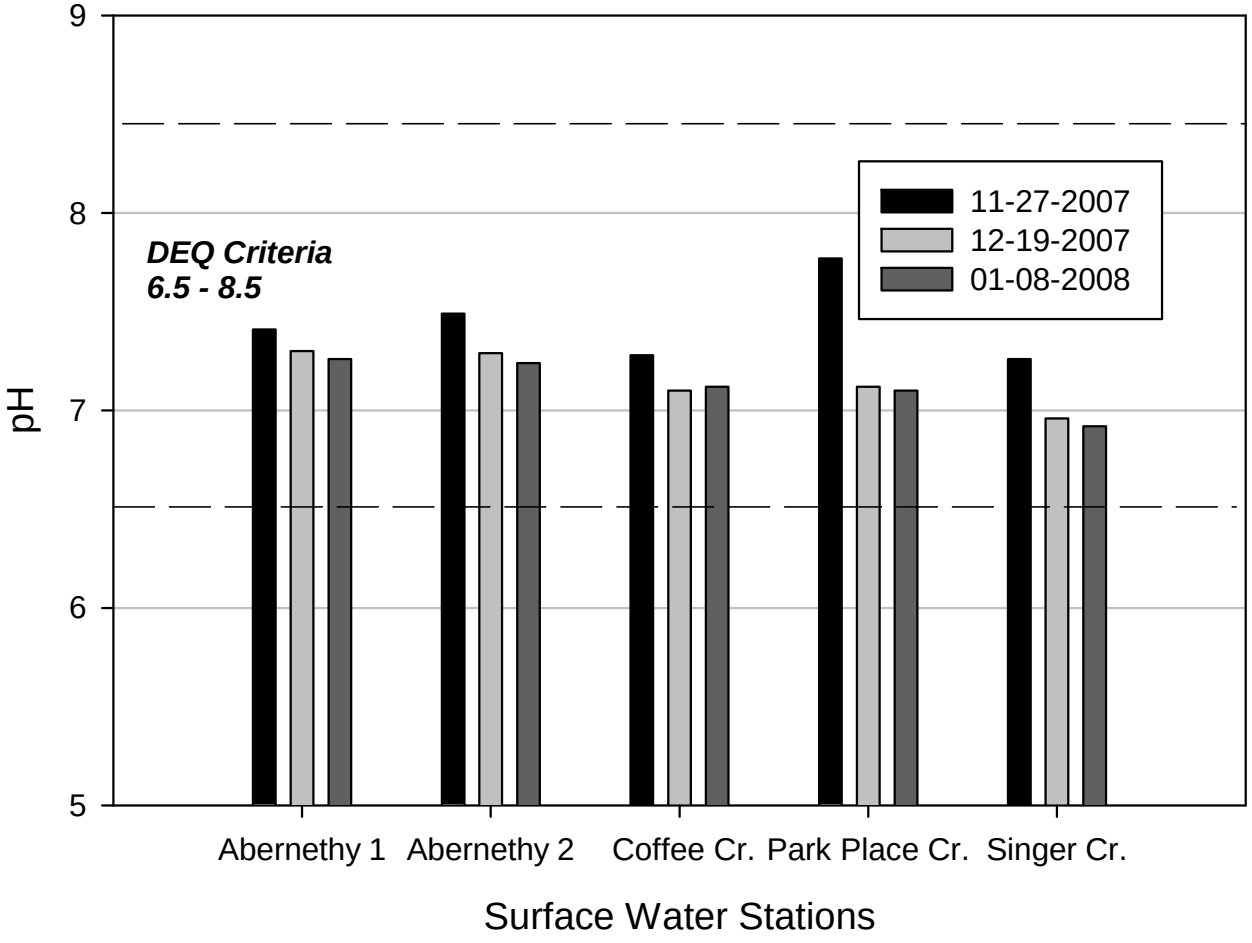
Antecedent rainfall conditions and a numeric summary of the water quality findings are contained in Appendix I. The stormwater quality findings for pH, total dissolved solids, total suspended solids, bacteria, and nutrients are summarized below. In addition to these parameters, the stormwater samples were tested for heavy metals. Dissolved copper, lead and zinc were generally below DEQ chronic criteria, with one exception. Dissolved zinc exceeded criteria in one stormwater sample at Park Place Creek.

pH

pH measures the hydrogen ion concentration and is influenced by the buffering capacity of the water. Daily fluctuation in pH is expected, because pH increases during the daytime hours as dissolved carbon dioxide is being drawn out of the water column for algal photosynthesis. Daily extremes in pH are, therefore, an indicator of eutrophication (high nitrogen and other nutrient loads leading to increased algae and other aquatic plants), but this effect can only be detected by using continuous sampling.

pH, as measured by the three discrete stormwater samples, is within the state water quality criteria (6.5–8.5) (Figure 22), and does not vary substantially between monitoring stations.

Figure 22. pH—Stormwater Monitoring (2007–2008). Monitoring site locations are described in Appendix A



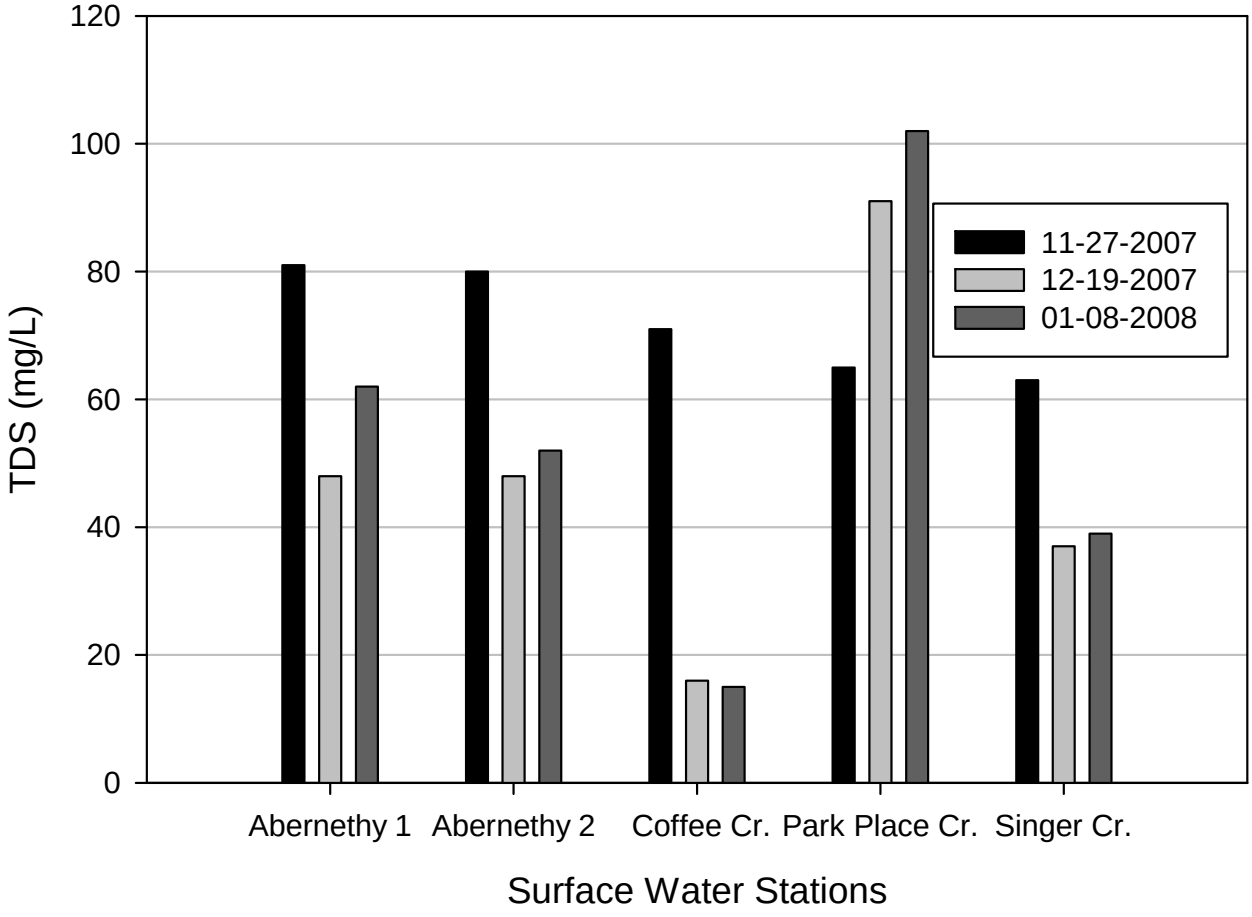
Total Dissolved Solids

Total Dissolved Solids (TDS) is a measure of the dissolved salts in the water column (e.g., sodium chloride, calcium, magnesium carbonates). In general, an increase in TDS is an indicator of pollution, because both rural and urban pollution often increase dissolved salts.

Generally, TDS decreases during storm flows as a result of dilution by rainwater. This pattern is reflected in the comparison in Figure 23, where most sites had higher TDS levels during the dry

sample period (November 2007) in comparison to lower levels during the wet sample periods (December 2007 and January 2008). The pattern is reversed for Park Place Creek indicating likely urban stormwater pollution sources. TDS at Park Place Creek, as measured in January 2008, slightly exceeds the water quality criteria of 100 milligrams per liter.

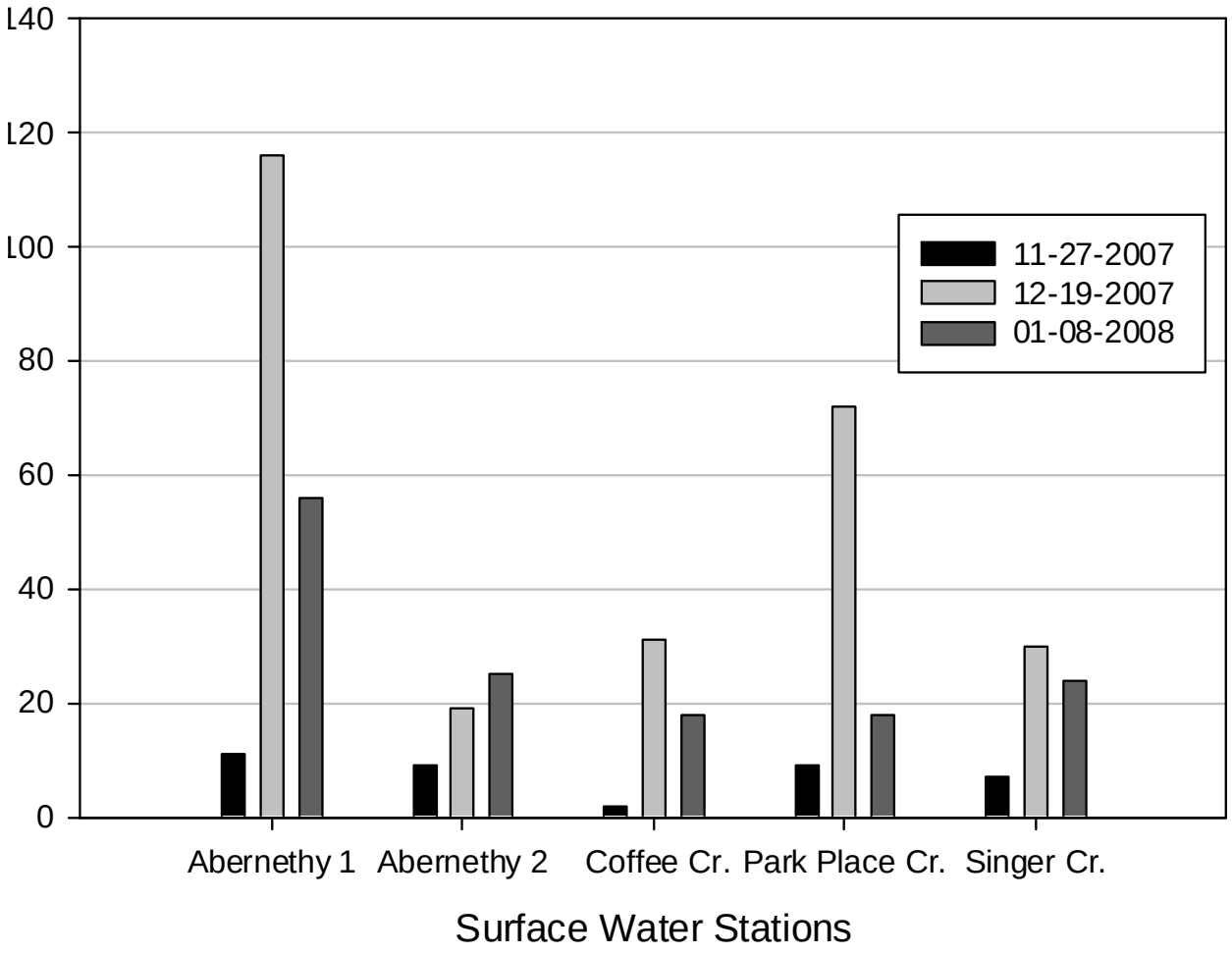
Figure 23. Total Dissolved Solids—Stormwater Monitoring (2007–2008). Monitoring site locations are described in Appendix A



Total Suspended Solids

Total suspended solids (TSS) measures the organic and inorganic solids that are retained on a filter, primarily soil and fine sediment particles. TSS increases during rainfall events as soil is eroded from fields, stream banks break down, and solids collected on road surfaces are washed into ditches and stream channels. TSS increased during the storm events in December and January (Figure 24) at all of the stormwater stations monitored. The upstream-downstream increase in Abernethy Creek, from Holly Lane to the railroad trestle, during the storm events, can be attributed to urban stormwater runoff. As with TDS, the higher magnitude increase at Park Place Creek (from 9 to 72 milligrams per liter) is indicative of an urban stormwater source.

Figure 24. Total Suspended Solids—Stormwater Monitoring (2007–2008). Monitoring site locations are described in Appendix A



Bacteria

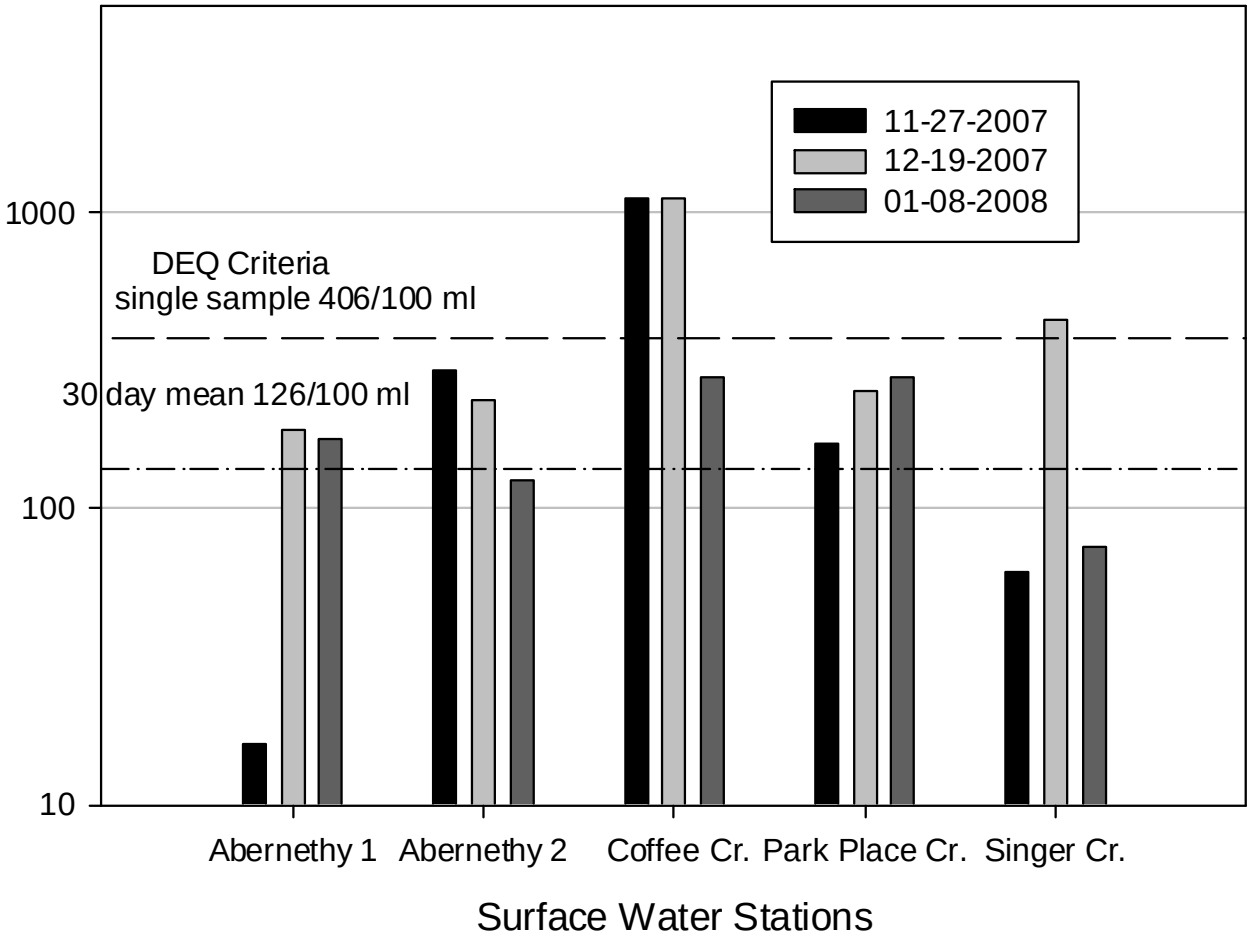
E. coli (*Escherichia coli*) is a type of fecal coliform bacteria commonly found in the intestines of warm-blooded animals and humans. The presence of E. coli in water is an indication of recent sewage or animal waste contamination, and a possible indication that other pathogens may also be present. Two of the water quality criteria are based on monitoring frequency. For water contact recreation, a single sample is not to exceed 406 per 100 milliliters, and the 30-day log mean is not exceed 126 per 100 milliliters.

Bacteria and other potential pathogens occur in water as a result of both natural and pollution sources. Background sources of E. coli are wild birds and mammals, and these bacteria may increase where animals are concentrated (e.g., flocks of ducks and geese). But generally, E. coli numbers are relatively low in unpolluted waters (less than 10 per 100 milliliters).

The monitoring stations indicate a fairly high bacterial load during both the dry and wet season samples (Figure 25). Surface water that is not subject to pollution sources will often have a very low background concentration, such as the values observed at the Clackamas River station with a mean value of 4 per 100 milliliters.

Water quality criteria are designed to recognize the variable nature of bacterial growth, allowing a higher value for a single sample (406 per 100 milliliters) versus an average taken over a longer period of time (126 per 100 milliliters). Single samples were generally below 406-per-100-milliliter criterion (Figure 25); however, if sample frequency had been sufficient to calculate mean values, it appears likely that bacteria numbers would exceed criteria during storm events. Bacteria are washed into streams during storms and get resuspended with bottom sediments in stream channels.

Figure 25. Bacteria—Stormwater Monitoring (2007–2008). Monitoring site locations are described in Appendix A



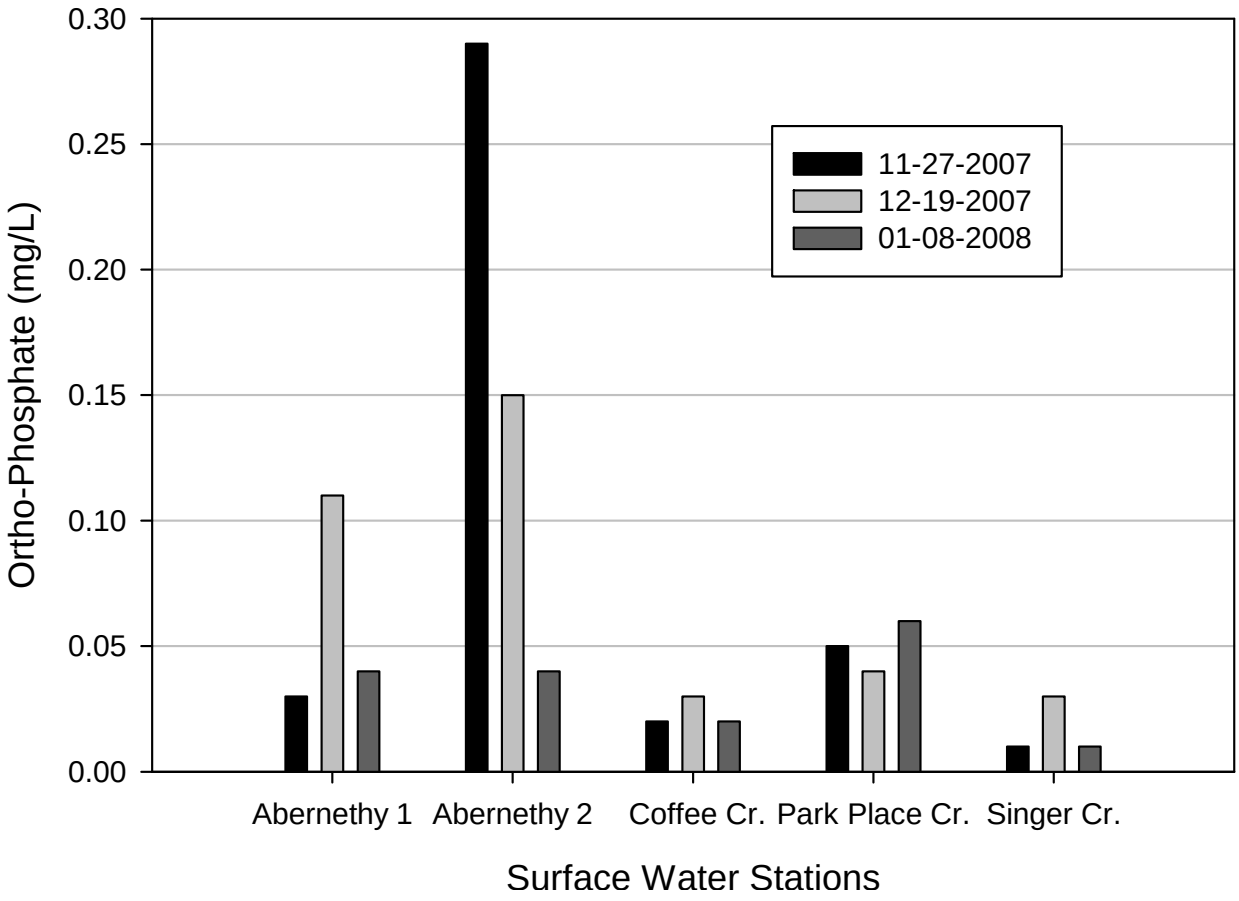
Nutrients and Eutrophication

Fairly low phosphorus and nitrogen concentrations can stimulate algal growth and lead to undesirable effects of eutrophication. Values recommended by the U.S. Environmental Protection Agency for preventing eutrophication in the Willamette Valley ecoregion are 0.04 milligram per liter for total phosphorus[2] and 0.15 milligram per liter for nitrogen. Figure 26 and Figure 27 provide the ortho-phosphorus and nitrogen levels, respectively, in the watershed assessment area.

[2] EPA-recommended values are expressed as milligram per liter for total phosphorus where total represents dissolved and suspended fractions. The variable used here is ortho-phosphate, which represents the dissolved fraction. Ortho-phosphate is readily bioavailable and is, therefore, more meaningful for understanding the likelihood of stimulating algal growth.

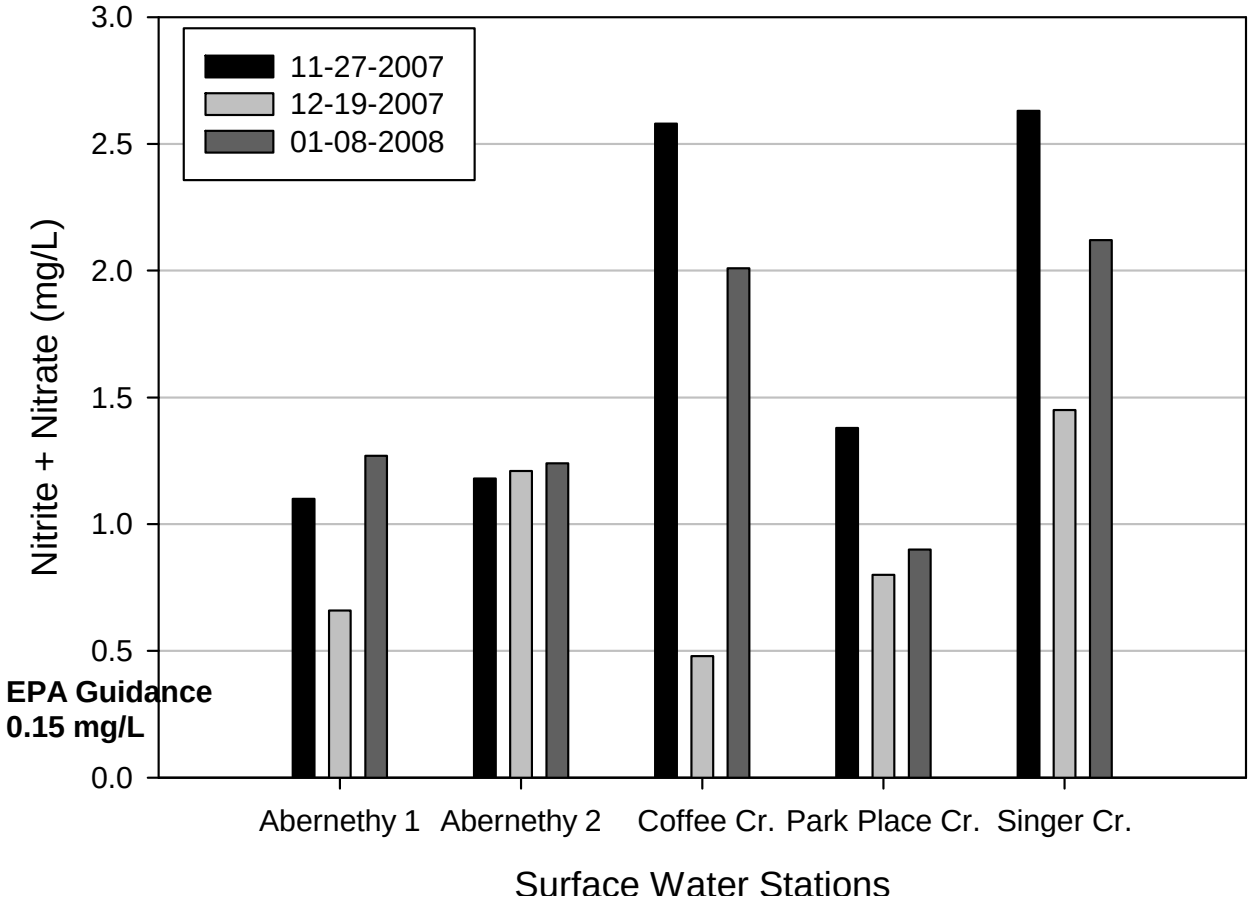
As shown in Figure 26, ortho-phosphate at stormwater stations in the watershed assessment area is generally below the EPA-recommended value; however, the value is exceeded in Abernethy Creek above the city limits. This pattern indicates that the phosphorus values are likely associated with sources in the agricultural/rural residential areas rather than in the urban zone. Likely sources of phosphorus are crop fertilizers and livestock waste. In comparison, the average ortho-phosphate concentration during the same period of time on the upper Clackamas River was 0.01 milligram per liter.

Figure 26. Ortho-Phosphate—Stormwater Monitoring (2007–2008). Monitoring site locations are described in Appendix A



Nitrate concentrations are elevated at all the stations both in the dry and wet sampling periods (Figure 27) indicating a high potential for contributing to eutrophication. For comparison, the average nitrate concentration in the upper Clackamas River was 0.02 milligram per liter, which indicates that EPA-recommended value is both appropriate and achievable for this ecoregion.

Figure 27. Nitrates—Stormwater Monitoring (2007–2008). Monitoring site locations are described in Appendix A



Introduction

This section summarizes what is known about fish populations and stream habitat in Abernethy Creek, Beaver Creek, and tributary streams. The natural and human management factors that influence the presence and abundance of fish, steam habitat quality, and fish movement through streams in the Abernethy Creek and Beaver Creek subwatersheds are described. Because the small streams of the Willamette River subwatershed fall off the steep hillsides of Oregon City and are very high gradient, these streams do not contain fish with the exception of lower channel habitats within the Willamette River floodplain; we do not describe the status of fish populations and habitat for this subwatershed.

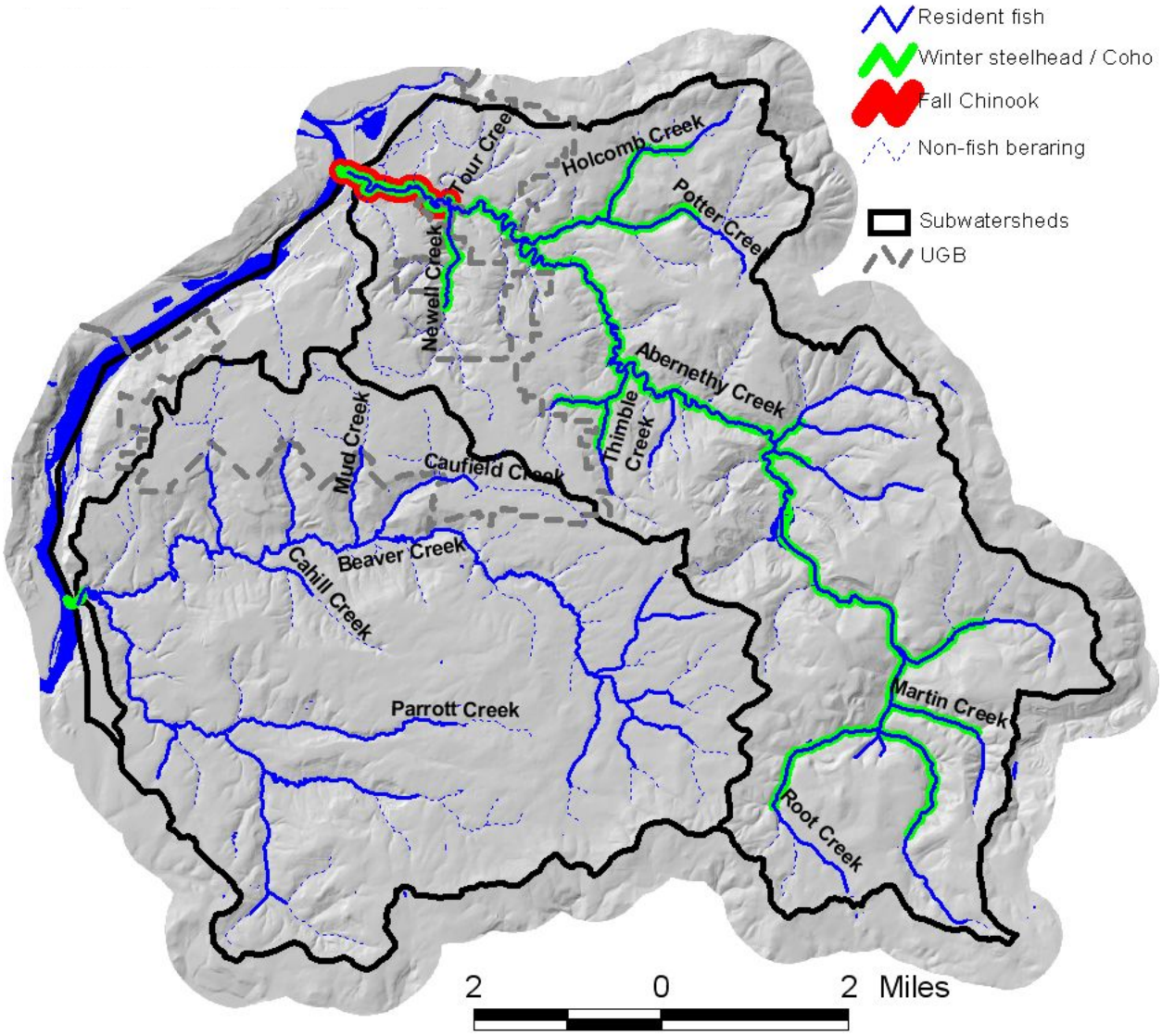
Studies, inventories, and other documents produced by the Oregon Department of Fish and Wildlife (ODFW), ODEQ, Clackamas County, and other sources provided information on fish habitat, spawning and rearing fish populations, and fish passage barriers. These studies were supplemented by field reconnaissance of selected stream areas. Very little information is available on fish presence and populations in the watershed assessment area; studies from similar Portland area tributary streams, such as Johnson and Kellogg Creek, inform the description of fish populations and habitat quality.

Overview of Fish Presence and Distribution

Four salmonid species (family *Salmonidae*), and a variety of native non-salmonid fish species inhabit streams in the watershed assessment area for at least a portion of their life cycle. The fish life cycle stages include migration (by adults and juveniles), spawning, juvenile rearing, and adult residence. Coho salmon (*Oncorhynchus kisutch*), fall Chinook salmon (*Oncorhynchus tshawytscha*), and steelhead trout (*Oncorhynchus mykiss*) were historically abundant in the lower Willamette River and its tributaries. These anadromous (i.e., residing in the ocean as adults and returning to rivers and streams to spawn) fish have experienced significant declines; some populations from Portland area urban streams, including streams within the watershed assessment area, have been virtually eliminated (Myers et al. 2006). Resident cutthroat trout (*Oncorhynchus clarki*) are also present in the watershed assessment area. Cutthroat trout populations are also likely lower in abundance due to habitat loss and other factors (Johnson et al. 1999). Figure 28 shows the historic distribution of anadromous salmon and steelhead and resident cutthroat trout in Abernethy Creek and Beaver Creek subwatersheds.

In addition to the salmon and trout populations noted above, chum salmon and a migratory form of cutthroat trout from the Willamette River may have been historically present in Abernethy Creek (Sanders pers. Comm.). Chum salmon are not present in the watershed at this time and the continued presence of migratory cutthroat trout is unknown.

Figure 28. Fish Distribution of fall Chinook, Steelhead, Coho, and Resident Cutthroat Trout in the Watershed Assessment Area



Abernethy Creek is thought to have once had a small run of fall Chinook salmon that was part of the larger population associated with the lower Clackamas River and Johnson Creek (Huntington 2007). Most of this population was eliminated when water pollution blocked adult migration in the early 1900s (McElhany et al. 2000). A small run of fall Chinook related to the historical population reestablished in the lower Clackamas River after the water quality issues were addressed, but the Abernethy Creek population has not returned (Huntington 2007). The focus of this section is on summarizing the status of coho, steelhead, resident trout, and other fish species in the watershed assessment area; fall Chinook salmon are not described because this population is not longer present in the system.

Native non-salmonid fish present in the watershed assessment area include two lamprey species, sculpins, and members of the minnow family (dace and shiners). Much less is known about the distribution and status of these non-salmonid fish species. Pacific lamprey are anadromous and brook lamprey are resident species. Because a serious decline in abundance has been noticed since the 1950s, both lampreys are listed as Oregon State sensitive species (Kostow 2002).

In addition to native fish, fish species that are not native to Abernethy Creek, Beaver Creek, or other Pacific Northwest streams are probably present in the watershed assessment area. There are no recorded observations of non-native fish in the watershed assessment area; however, recorded observations in nearby Portland area streams indicate that these introduced fish are likely present in the system. A variety of nonnative fish, including largemouth bass, bluegill, pumpkinseed, and mosquito fish, have been observed in nearby Kellogg Creek (StreamNet 2010). Nonnative fish are a concern because they occupy habitats inhabited by native species, can prey upon juvenile trout and salmon, and are an indication of degraded habitat conditions, including elevated water temperatures (Waite et al. 2008).

Beaver Creek is above Willamette Falls. Because the falls historically blocked some fish runs, the Beaver Creek subwatershed is part of the upper Willamette River fish populations, including distinct salmon and steelhead runs. The Beaver Creek subwatershed contains resident cutthroat trout and, as discussed in the "Fish Passage" section, below, may now be accessible to Upper Willamette River steelhead. Steelhead from the upper Willamette River are genetically distinct from those in the lower river. Reproductive isolation from lower river populations may have been facilitated by Willamette Falls, which is known to be a migration barrier to some anadromous fish. For example, winter steelhead and spring Chinook salmon occurred historically above the falls, but summer steelhead, fall Chinook salmon, and coho salmon did not.

The Abernethy Creek coho and steelhead are part of lower Willamette River and Columbia River populations, all of which are listed as threatened under the federal Endangered Species Act (ESA). Coho in the lower Willamette River are part of the lower Columbia River coho evolutionarily significant unit (ESU); steelhead are part of the lower Columbia River steelhead distinct population segment (DPS). Critical habitat for these fish has been designated and includes the Willamette River, but has not been designated for Abernethy Creek or Beaver Creek.

Sustainable populations of lower Columbia River coho, fall Chinook, and steelhead exist in the nearby Clackamas River. Coho and steelhead are still present in Abernethy Creek and its tributaries, but they are not considered to be self-sustaining and are probably supported to a large degree by the more productive populations in the Clackamas River.

Fish that spawn in Abernethy Creek contribute to the lower Willamette River coho and steelhead population complexes. It is the collective array of river and tributary stream habitats across the lower Willamette River that supports the health of the salmon and steelhead populations. The quantity, quality, diversity, and distribution of habitats in the river and tributary streams contribute to the overall abundance and productivity of the steelhead and salmon population complex. Some areas such as the upper Clackamas River may contribute more strongly to population abundance; whereas the urban tributary streams, including Abernethy, Kellogg, Tryon, and Johnson creeks, all contribute habitats that increase the spatial diversity of the population.

Coho Salmon

Coho salmon occupy about 26 miles of Abernethy Creek and tributary streams as migration corridors or juvenile rearing habitat (Figure 28). The Abernethy Creek coho population follows the standard lower Columbia River life history pattern. In Abernethy Creek, coho likely move upstream into spawning areas from mid-October through the end of January and die after spawning (Huntington 2007). Coho generally spawn in small, lower-gradient stream reaches (Lestelle 2007). No comprehensive data exist on where coho spawn in the Abernethy Creek subwatershed, but

spawning areas appear to include Abernethy Creek upstream of Holcomb Creek, and tributary streams that offer cool water temperatures and appropriate habitat—Newell, Holcomb, Potter, Thimble, Martin, and Root creeks (Sanders pers. Comm.).

Juvenile coho rear in Abernethy Creek in areas of better habitat quality and cooler water temperatures for about a year before migrating to the Pacific Ocean as smolts during late winter or spring of their second year of life (Lestelle 2007). Juvenile coho favor relatively slow-moving water such as pools downstream of riffles. High quality juvenile coho rearing habitat includes cover, large wood, water temperatures of less than 64°F, and high dissolved oxygen levels. There are no comprehensive inventories of juvenile coho rearing areas, but they appear to be occupying the tributary streams that have cooler water temperatures and higher quality habitat. Juvenile coho have been observed in Newell, Holcomb, and Potter creeks (Sanders pers. comm.; Adolfson Associates 2000).

Little information exists on Abernethy Creek coho abundance or trends, but it appears that they are below historical population levels (Huntington 2007). Willamette River and Columbia River coho populations have declined overall; factors contributing to population declines include spawning and rearing habitat loss, fish passage barriers, altered streamflow regimes, water quality, and negative impacts from hatchery fish (Weitkamp et al. 1996).

Winter Steelhead

Abernethy Creek supports a small run of winter steelhead trout (Huntington 2007). The extent of steelhead habitat in Abernethy Creek subwatershed roughly overlaps coho habitat; about 26 miles of Abernethy Creek and tributary streams are occupied as migration corridors or juvenile rearing habitat (Figure 28).

Adult winter steelhead enter Abernethy Creek from mid-November through May, with the heaviest entry occuring from mid-January through April (Huntington 2007). Steelhead spawn in upstream areas and tributaries from February through June, and emerge from the spawning areas as fry during spring and early summer.

Juvenile steelhead rear in Abernethy Creek in areas of better habitat quality and cooler water temperatures for 1 to 2 years before migrating to the Pacific Ocean as smolts in the late winter, spring, or early summer (Oregon Department of Fish and Wildlife 2003). No comprehensive inventories of juvenile steelhead rearing areas are available; however, rearing juveniles appear to be occupying the tributary streams that have cooler water temperatures and higher quality habitat. Juvenile steelhead have been observed in Newell, Holcomb, and Potter creeks (Sanders pers. comm.; Adolfson Associates 2000).

Very little information is available on the status of the Abernethy Creek steelhead population, but all lower Willamette River and Columbia River steelhead populations are known to be in serious decline. Factors contributing to steelhead population declines include habitat loss, fish passage barriers, altered streamflow regimes, water quality, and negative impacts from hatchery fish (Busby et al. 1996).

Cutthroat Trout

Cutthroat trout have the widest distribution of any fish in the watershed assessment area, and are found throughout the Abernethy Creek and Beaver Creek subwatersheds (Figure 28). Juvenile and

adult resident cutthroat trout can reside in tributary streams, with gradients of up to 12%, often in very small streams above the distribution of coho and steelhead (Figure 28). Two life history patterns are native to the watershed assessment area: a fluvial population that migrate Willamette River or Columbia River estuary into small streams to spawn and resident populations that occupy small streams throughout the watershed assessment area and are the dominant species in small headwater tributaries. A fluvial cutthroat trout population is known to exist in the lower Willamette River, but it is not known if this life history is present in Abernethy Creek (Johnson et al. 1999).

Resident cutthroat trout often grow, mature, and spawn very close to the location from which they hatched; these fish will move up and down the stream system for spawning and to escape warm water temperatures in the summer and into seasonal streams to escape high flows in the winter. Cutthroat trout spawn in the spring in small headwater streams with abundant gravels that are free from sediments. Cutthroat trout spawning habitat requires connected habitats that are free from fish passage barriers. Adult and juvenile cutthroat trout require cool water temperatures, usually less than 64°F, and high dissolved oxygen levels; habitat needs include abundant pools, complex cover from logs and undercut banks, and shade from riparian vegetation.

Very few systematic studies of cutthroat trout population trends have been conducted for lower Willamette tributary streams. Resident cutthroat trout are likely lower in abundance due to spawning and rearing habitat loss and fish passage barriers (Johnson et al. 1999). Cutthroat trout habitat loss is especially pronounced in the Portland area streams that have experienced urbanization and other development.

Lamprey and Other Fish Species

Non-salmonid fish species found in the watershed assessment area include Pacific and brook lamprey, sculpins, dace, and shiners. The status of Willamette River basin lamprey has been studied, but very little information is available on sculpins, dace, or shiner distribution or population status. All of these species have been observed in Newel Creek, a tributary to lower Abernethy Creek, but there are no other observations in this subwatershed (Adolfson Associates 2000). No information is available on the presence or distribution of lamprey, sculpins, shiners, or dace in the Beaver Creek subwatershed; however, given the general distribution of these species in the Willamette Basin, they are almost certainly present.

Two species of lamprey are distributed above and below Willamette Falls, and are present in the watershed assessment area. The Pacific lamprey is a large, anadromous species that has received the most research and management attention. The western brook lamprey is smaller and resides in small streams throughout all life stages (i.e., nonanadromous). No systematic inventories of lamprey distribution and abundance have been conducted for the watershed assessment area. Most observations of lamprey have been incidental observations during electrofishing surveys, stream habitat inventories, spawning surveys, or incidental catches in smolt traps. Both Pacific and brook lamprey were observed in Newell Creek (Adolfson Associates 2000). No observations have been recorded in Beaver Creek, but populations are likely present.

While lamprey abundance has been declining, the Willamette Basin is probably the most important production area for Pacific lamprey in the Columbia River system (Kostow 2002). Lamprey abundance can vary dramatically from one stream to the next and from one year to the next. This variability in abundance is reflected in juveniles collected in smolt traps in 2001 on tributaries to the lower Clackamas River. Because it is very difficult to distinguish between juvenile brook and Pacific

lamprey, they were not identified to species. In Kostow's Clackamas basin study, Clear Creek had extremely large numbers of juvenile lamprey (9,480), whereas far fewer were observed in Deep (173) and Eagle (101) creeks (Kostow 2002). Lamprey populations have been declining from as a result of the same factors affecting other fish species—habitat loss and restricted access to upstream areas. Instream barriers including road crossing culverts and other obstructions substantially restrict lamprey distribution. Evidence has shown that lamprey have difficulty passing above fish ladders (Kostow 2002).

Abernethy Creek: Fish Use and Habitat

Very little information is available on fish use and habitat in the Abernethy Creek subwatershed (Huntington 2007). Abernethy Creek is very similar to other urban streams in the Portland area, and information can be extrapolated from studies in other streams below Willamette Falls, including Kellogg, Tryon, and Johnson creeks. Some information exists on fish populations and habitat in the system, primarily from an inventory of Newel Creek and several other studies.

Limited field data on coho abundance for Abernethy Creek is consistent with the overall pattern of population declines noted above. Abernethy Creek coho spawning ground counts collected between 1949 and 2001 illustrates this declining trend, with peak counts during the 1950s. Spawning coho counts averaged 7 fish (range 0 to 30 fish), with the peak count in 1956, and no fish observed between 1973 and 2001 (ODFW 2010).

Based on a review of three ODEQ sampling sites (Mile 0.6 and Mile 7.8, and Tour Creek), Huntington (2007) noted that available data on stream channels suggest a general pattern in the lower Abernethy Creek watershed of habitat simplification, including limited deep pools with minimal large wood to create structure and cover, channel down-cutting, and localized bank instability (Table 6). Very few pieces of large wood are present in the channel, and accumulations of long, stable logs (key pieces), which help form pools and create hiding areas for fish, are almost nonexistent.

ODEQ data on the two sites confirm that the mainstem of Abernethy Creek is very low gradient, with few, relatively deep pools, averaging about 0.5 meter (approximately 1.5 feet) in depth. It appears that large sections of the channel are primarily glides (i.e., areas with generally uniform depth and flow with no surface turbulence, generally in reaches of less than 1% gradient) (Moore et al. 1997). Glides are distinguished from pools by their overall homogeneity, lack of logs and other structure, and low habitat complexity.

Fine sediments will accumulate in low-gradient, depositional channels like lower Abernethy Creek. It appears, however, that fine sediment deposition is higher than would be expected in an undisturbed stream. ODEQ documented at both sites that the channel substrate of Abernethy Creek is dominated by fine sediment deposition. For example, the substrate conditions documented at the upstream site (Mile 7.8) were characteristic of relatively poor habitat conditions for salmon and trout: 78% sand or finer substrates, and 52% of the substrate material finer than sand (e.g., silt and clay). Embeddedness, which is the extent (as an average percentage) that boulders, cobble, and gravel particles on the channel surface are buried by fine sediments, was very high—81% embedded in fine sediment.

In its current condition, it appears that lower Abernethy Creek does not provide high quality habitat for trout and salmon. Limitations on habitat include limited stable large wood, few complex pools,

and high levels of streambed sedimentation. The lower portions of the Abernethy Creek serve primarily as a migratory corridor for juvenile and adult fish moving to areas upstream and between the mainstem and tributaries. It appears to provide some rearing habitat for juvenile trout and salmon from fall through spring when water temperatures are lower. The incised channel, limited complex pools, and minimal large wood constrain the quality of seasonal rearing habitat. The channel incision has reduced stream access to the floodplain during flood events. The limited quantities of large wood in the channel, particularly long pieces in complex accumulations, and minimal stream connection to the floodplain have severely degraded fish habitat quality.

While this description focuses on the Abernethy Creek, conditions in the lower Willamette and other tributaries strongly influence the performance of coho and steelhead in the watershed. For instance, habitat in the Willamette River provides rearing and migration habitat (Friesen 2005) that potentially augments habitat in Portland area tributary streams (McConnaha 2003). Other Portland area tributaries with known populations of these fish include Johnson, Tryon, and creeks, and the Clackamas River. These populations form an integrated complex that is connected by the Willamette River and genetically linked, because coho, steelhead, and Chinook stray from one tributary to another and occupy available habitat (ICF Jones & Stokes 2008).

Table 6. Stream Habitat Characteristics in the Abernethy Creek Subwatershed Surveyed by ODEQCharacteristic	Abernethy Creek	Abernethy Creek	Tour Creek
Location	Mile 0.6	Mile 7.8	Mile 06
Year of summer survey	2006	2004	2006
Surveyed length (m)	240	198	150
Channel slope (%)	<1%	<1%	3%
Mean channel incision (m)	2.0	0.5	0.8
Bankfull width/depth ratio	7.5	16.8	5.1
Bankfull width (m)	8.3	6.0	1.9
Mean stream width (m)	7.4	5.2	1.2
Mean stream depth (cm)	48	42	5
Percent sand and finer substrate	69%	78%	45%
Percent finer than sand substrate	56%	52%	29%
Percent substrate embeddedness	85%	81%	80%
Percent pool	4%	11%	10%
Number of pools per 100 m	0.83	2.02	5.33
Number of pools with residual depths > 100 cm, per 100 m	0.00	0.00	0.00
Number of pools with residual depths > 75 cm, per 100 m	0.42	0.51	0.00
Mean maximum residual pool depth (cm)	75	88	20
Percent slow-water habitat	100%	93%	51%
Percent cover: wood pieces	7%	9%	4%
Percent cover: total	45%	36%	31%
Wood pieces, per 100 m: all (>10cm diam., >1.5 m long)	41.7	9.0	17.3
Wood pieces, per 100 m: large (>60cm diam., >1.5 m long)	2.1	2.5	0.7
Wood pieces, per 100 m: key (>60cm diam., >15 m or 2 BFW long)	0.0	ND	0.7
Mean canopy cover: mid-channel (%)	83%	82%	98%
Mean canopy cover: near-bank (%)	92%	93%	99%
Mean riparian canopy cover: large (>30 cm dbh) trees (%)	38%	16%	33%
Mean riparian canopy cover: total (%)	51%	25%	36%

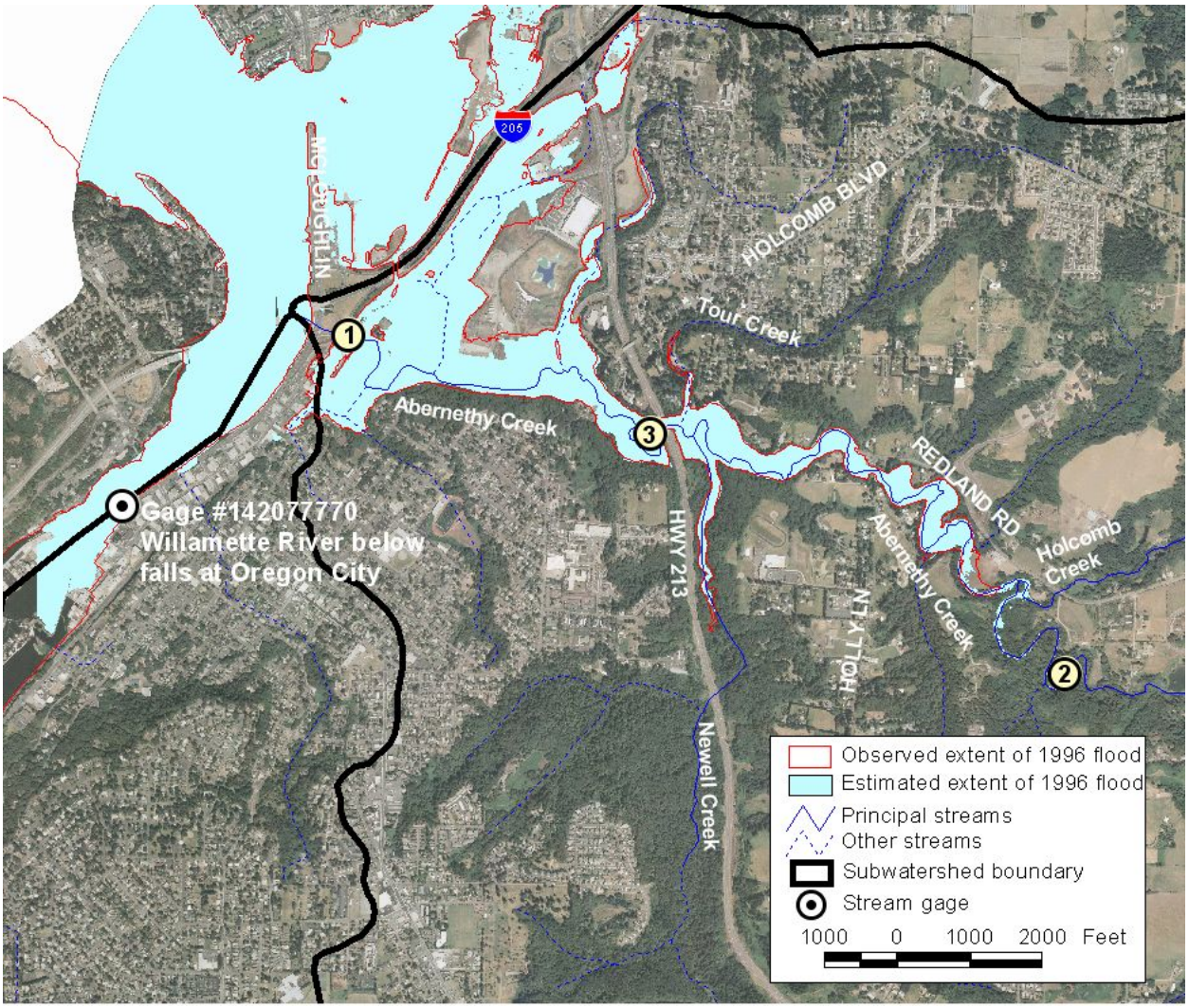
Source: Huntington 2007.
m = meter; cm = centimeter; BFW = bank full width; ND = no data reported;
dbh = diameter at breast height.

Backwatering in Abernethy Creek and Fish Use

The lower portions of Abernethy Creek are very low gradient (less than 1%), and stream levels are influenced by backwatering from the Willamette River during high river stages. This backwatering occurs during the late fall, winter, and spring, when the river's discharge is high and can be exaggerated by daily fluctuations in river levels associated with the tidal cycle.

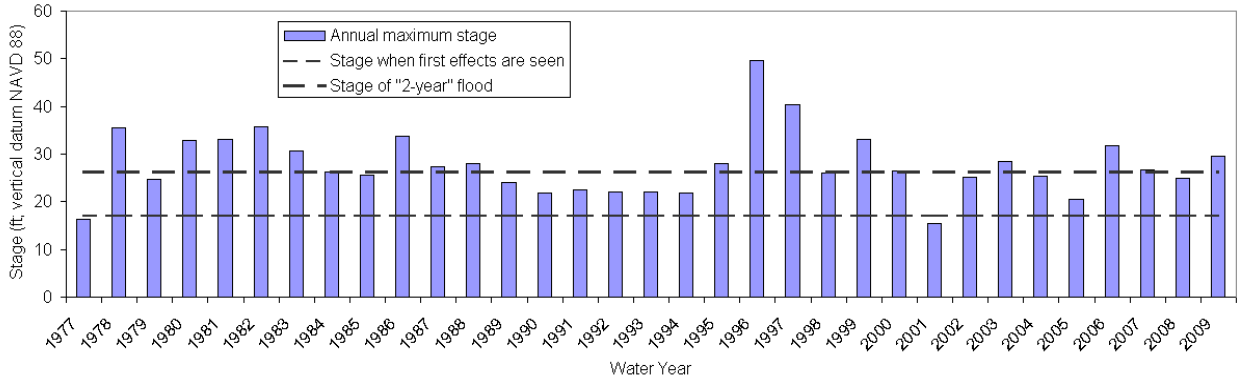
River flow gage data were used to evaluate how far the Willamette River backwaters up Abernethy Creek. The USGS gage (U.S. Geological Survey 2009) is located approximately 0.7 mile upstream of the confluence with Abernethy Creek (Figure 29). Annual maximum river stage values were extracted from the gage's data set (Figure 30).

Figure 29. Area of Inundation During February 9, 1996, Flood—Lower Abernethy Creek Area Showing Portions of Newell Creek and Holcomb Creek



Source: Metro 1996.

Figure 30. Annual Maximum Stage at USGS Gage #14207770, Willamette River Below Falls, Oregon City



The minimum flood stage that would produce a backwater effect in Abernethy Creek is estimated to be approximately 17 feet (Figure 30, lower dashed line). This corresponds with the upstream invert of the large culvert that conveys Abernethy Creek under Highway 99 (Figure 29, Point #1). Only two of the 32 annual maximum stage values in the period of record are lower than 17 feet in elevation (Figure 30), indicating that some backwatering occurs in lower Abernethy Creek almost every year.

The highest recorded stage value was on February 9, 1996. Metro acquired aerial photography during this flood event and created a GIS layer showing the maximum extent of flood inundation (Figure 29). The Metro data is aligned well with the calculated flood elevation at the USGS gage. Based on these data, it appears that the maximum extent of backwatering associated with the 1996 flood was slightly upstream of the Holcomb Creek confluence (Figure 29, Point #2).

The flood stage with an approximate recurrence interval of 2 years was estimated as the median value of the annual maximum stage values over the period of record. This is the elevation that, on average, is exceeded every other year. The estimated value for this 2-year recurrence flood stage is 26.25 feet (Figure 30, upper dashed line). The upstream extent associated with this flood stage is approximately the Highway 213 Bridge over Abernethy Creek (Figure 29, Point #3).

Off-channel areas include side channels and the lower portions of tributary streams. Juvenile steelhead and coho salmon spend relatively long periods of time in the lower Willamette River and use off-channel areas for feeding (Friesen 2005). Backwatering of Abernethy Creek during high flows adds to the limited availability of off-channel habitat in the lower Willamette River and contributes to the success of fish spawned in other areas of the Willamette River basin. While no sightings of juvenile coho or steelhead have been recorded from upstream populations in lower Abernethy creek, these fish have been observed in similar Portland area streams. For example, when fall and winter high-flow conditions permit movement through the Highway 43 culvert, juvenile coho and steelhead enter Tryon Creek from the Willamette River (ICF Jones & Stokes 2008).

The loss of shallow, complex, off-channel habitat is a major limiting factor for salmon in the lower Willamette River (McConnaha 2003). Restoration of urban streams, including Abernethy, Kellogg, Tryon, and Johnson creeks, is one of the few opportunities to improve this kind of habitat in the lower Willamette River (ICF Jones & Stokes 2008). Potential habitat improvements to the backwater areas in Abernethy Creek would contribute to the recovery of listed coho and steelhead by increasing the extent and diversity of productive stream habitats that flow into the lower Willamette River.

Abernethy Tributary Streams

Based on field reconnaissance, Huntington (2007) suggests that the tributaries to Abernethy Creek have better channel habitat conditions and water quality than the mainstem. Tour Creek, for example, has cooler summer temperatures than the mainstem and has cutthroat trout during the summer when they are absent from the sampled portions of Abernethy Creek (Huntington 2007). The following paragraphs describe the habitat and fish use in three important Abernethy Creek tributaries that contain coho salmon and steelhead—Newell, Holcomb, and Potter creeks.

Newell Creek begins on the Clackamas Community College campus and in headwater streams draining the eastern portions of Oregon City; it then flows over steep walls into the canyon area. Because much of Newell Creek is within a steep-sided, inaccessible canyon, the creek's habitats are in better condition than most urban streams. Metro has purchased nearly 300 acres of open space on both sides of the canyon, which provide some protection for the stream and riparian areas. With

the Metro property and lands owned and managed by Oregon City and the Oregon Department of Transportation, Newell Creek watershed includes the largest intact forested natural area in the southern Portland metropolitan area (Metro 2009a).

Newell Creek supports significant native populations of fish, including coho salmon, cutthroat trout, and steelhead. Adolfson Associates (2000) surveyed habitat and sampled fish population for 90% of Newell Creek's length. The survey yielded a greater number and diversity of fish than expected (Table 7). All of the observed fish were native, including three species of salmonids: some juvenile coho, significant numbers of juvenile steelhead, and resident cutthroat trout. Riffle sculpins were the most abundant fish present. Redshide shiners and other members of the minnow family (dace and shiners) were observed along the entire length of stream. Brook and Pacific Lamprey were also found, with Pacific lamprey the most abundant and widely distributed of the two.

Table 7. Fish Species Observed in Newel Creek

Species	Total observed
Coho salmon	6
Rainbow trout (steelhead)	43
Cutthroat trout	48
Long-nose dace	2
Speckled dace	3
Redside shiner	56
Riffle sculpin	198
Reticulate sculpin	2
Pacific lamprey	14
Brook lamprey	2
Crawfish	6

Source: Adolfson Associates 2000.

The Newell Creek habitat assessment assigned ranked scores (poor, marginal, suboptimal, optimal) for the following in-channel and riparian habitat elements: pool substrate, pool variability, sediment deposition, channel flow, channel alteration, channel sinuosity, bank stability, vegetation protection on the banks, and width of the riparian zone (Adolfson Associates 2000).

The habitat assessment found that Newell Creek habitat, particularly in the middle portions of the stream, is in very good condition, with minimal alteration of the channel or riparian area. Sections of the stream have deep pools and large wood providing complex habitat and cover for fish. A series of beaver dams in the central canyon add habitat complexity and capture sediments and moderate high flows during storm events (John Inskeep Environmental Learning Center n.d.).While the canyon has been subject to logging in the past, portions of the stream with wide areas of intact riparian vegetation and mature trees remain. Trees include Douglas-fir, cedars, maple, alder, and cottonwoods. A large number of springs provide cool, high quality water to the stream, which is especially important during summer (John Inskeep Environmental Learning Center n.d.).

The assessment identified habitat quality issues for the lower and upper sections of Newell Creek. Sediment deposition, channel sinuosity, and riparian area width were noted to be marginal quality for the lowest segment of Newell Creek from its confluence with Abernethy Creek to the Highway 213 culvert. The upper sections of the stream have variable habitat quality, but portions of the stream have marginal habitat ratings for pool substrate, pool variability, channel sinuosity, and bank

stability. The major issue for the upper portions of Newell Creek is sediment deposition, which was rated as "poor," based on the presence of heavy deposits of fine material covering more than 80% of the stream bottom. The *Newell Creek Watershed Restoration and Conservation Strategy* noted that 25% of the watershed is covered by impervious surface and concluded that stormwater flows from the headwaters within Oregon City contribute to the sediment deposition issue (John Inskeep Environmental Learning Center n.d.).

No detailed field inventories of fish habitat have been conducted for Abernethy Creek tributary streams. Based on limited field reconnaissance, portions of Holcomb Creek and Potter Creek contain high quality fish habitat. These observations are supported by fish presence information: coho and steelhead juveniles observed during snorkel surveys (Sanders pers. comm.). Sections of Holcomb and Potter creeks have abundant pools, logs in the channel, and wide riparian areas with trees and shade (Figure 31).

Limited field data on coho abundance for Holcomb Creek is consistent with high quality habitat but display the overall pattern of population declines, with peak coho counts in 1950 (27 fish) and no fish observed between 1973 and 2001(ODFW 2010). Surveys of juvenile coho in Holcomb Creek conducted between 1972 and 2002 demonstrated the same trend: some fish were observed in most years but in generally declining numbers, and no fish have been observed after 1991 (ODFW 2010).

Figure 31. An Example of High Quality Holcomb Creek Stream and Riparian Habitat



Beaver Creek: Fish Use and Habitat

The Beaver Creek subwatershed comprises more than 33 miles of fish-bearing streams. Currently, Beaver Creek's tributary streams are occupied by cutthroat trout and probably other native fish species (e.g., sculpins, dace, and shiners). The Beaver Creek subwatershed probably had historical runs of steelhead (Sanders pers. comm.). In about 1871, a grist mill and dam were constructed on lower Beaver Creek, approximately 1000 yards upstream from its confluence with the Willamette River (Dean pers. comm.). The dam created an impoundment, Sevick Pond, which backed up water in the area upstream and blocked fish access. Sevick Pond covered approximately 12 acres, and the area of standing water included the junction of Parrott and Beaver creeks.

In 1969, the grist mill dam washed out in a flood event and a new dam was constructed (Dean pers. comm.). The new dam did not provide fish passage. This dam remained in place until the January 2, 2009, flood. In this flood, Beaver Creek eroded the northern portion of dam, creating a channel that is passable to fish.

The Beaver Creek subwatershed is now accessible to steelhead and Pacific lamprey. Because steelhead will quickly move into new habitat, it is expected that that they will recolonize the system for spawning and juvenile rearing (Sanders pers. comm.). Unfortunately, because no information is available on fish habitat quality in the Beaver Creek subwatershed, it is not possible to predict the capability of the stream network to support steelhead or resident cutthroat trout populations.

Fish Passage Barriers

Fish passage barriers on Abernethy Creek, Beaver Creek, and tributary streams can pose a significant problem for fish populations. Dams and road crossing culverts are examples of fish passage barriers in the watershed assessment area. Fish move around the stream network through the different phases of their life cycle and in response to changing conditions. Fish passage barriers, prevent fish from accessing important areas for spawning or from moving into cool tributary streams when Abernethy Creek or Beaver Creek warm during the summer months.

Fish passage barriers can totally block fish movement during all times or they can partially block movement during periods of high or low flows. Partial fish passage barriers can significantly slow the migration of coho and steelhead through the system. Fish will often hold in pools at the base of a barrier waiting for conditions to change. This can delay migration and create problems such as stress on the fish, which provide opportunities for poaching and predation.

While fish passage is a concern, adult fish and juvenile fish are usually the most vulnerable to passage issues. In comparison to adults, small juvenile fish are the weaker swimmers and can be stopped by a stream channel drop of less than 6 inches. For this reason, most criteria for fish passage are designed to accommodate juveniles. For example, the guidelines for fish passage developed by ODFW specify that road-crossing culverts need to be installed at a gradient of less than 0.5% and have no more than a 6-inch drop at the outlet (Oregon Department of Fish and Wildlife 2010).

Dams

Dams, which are often constructed in streams to impound water for irrigation or recreation, can impede fish passage if fish ladders or other mechanisms are not in place. Several dams on Abernethy Creek may present obstacles to fish passage. The Hidden Lake water diversion dam just upstream from Holcomb Creek may be a fish passage barrier, but its status needs to be confirmed (Sanders pers. comm.). The Beaver Lake dam on upper Abernethy Creek has a fish ladder in place (Figure 32). Although fish passage at this ladder has not been studied, some evidence shows that it impedes adult coho and steelhead movement into spawning and rearing streams above the lake (Sanders pers. comm.).

Figure 32. Beaver Lake Fish Ladder on Upper Abernethy Creek



The Sevick Pond dam on lower Beaver Creek washed out in the January 2, 2009, flood event. Steelhead, lamprey, and other fish species can now move into the upper portions of the Beaver Creek subwatershed. Because Sevick Pond captured substantial sediments, the stream channel is now down-cutting through these sediments (Figure 33). As the stream erodes this large volume of sediment into the channel, a "headcut" in the deep sediments has developed. This headcut creates a steep fall over the sediments that could block upstream fish movement in the channel, but a field inventory would be necessary to confirm the ability of fish to pass through this area.

Figure 33. Sevick Pond Sediments in the Channel Beaver Creek after the Dam Washed out in the January 2, 2009, Flood



Road Crossings

Fish passage at many of the road crossings (primarily culverts) in the watershed assessment area have been evaluated using the ODFW criteria. Table 8 provides information on the fish passage status for 14 road crossings in the Abernethy Creek subwatershed and 13 road crossings in the Beaver Creek subwatershed. Most of the road crossings were inventoried by ODFW or Clackamas County, and their fish passage status is known. The road crossing inventory is comprehensive for Abernethy Creek subwatershed, but a number of crossings have not been assessed for fish passage (i.e., designated as unknown) in the Beaver Creek subwatershed; this is useful information for prioritizing future fish passage assessments.

In addition to the road crossings identified below in Table 8, ICF evaluated fish passage for the Abernethy Creek culvert under Highway 99. This culvert is important because it is the first obstacle that salmon and steelhead encounter upon entering Abernethy Creek. The culvert was examined on September 10, 2009. It is approximately 800 feet in length and 40 feet in diameter. The outlet, which is 150 feet upstream from the Willamette River, is tidally influenced. A series of six notched weirs in the culvert slow water velocities and create backwater areas behind the structures.

The evaluation of fish passage through the Highway 99 culvert is based on the culvert diameter, length, and gradient, the characteristics of the weirs, and flow conditions in Abernethy Creek. The

weirs appear to provide some fish passage at lower flows, though the jump height exceeds the 6-inch ODFW fish passage criterion and may impede juvenile fish. Adult salmon and steelhead do pass through the culvert (Sanders pers. comm.), though they may have difficulty during very high flow conditions when water velocities exceed fish swimming abilities. This does not appear to severely limit upstream access, however, because fish have been observed.

Figure 1, Watershed Assessment Area Base Map, shows the location and fish status of road crossings in the Abernethy Creek and Beaver Creek subwatersheds. This information will aid in prioritizing culvert replacement to address fish passage. Clackamas County, for example, has improved fish passage in Holcomb Creek by replacing culverts with new structures that meet the ODFW fish passage criteria.

Table 8. Fish Passage Status and Location for Road Crossings in the Watershed Assessment Area

Subwatershed	Stream and Reach Location	Responsible for Inventory and ID Number	Fish Passage Status/Notes[1]
Abernethy			
	Holcomb 01a Holcomb 01b	County 01	Not a barrier
	Potter 02a Potter 02b	County 04	Barrier
	Holcomb 02 Holcomb 03	County 02	Not a barrier
	Holcomb 04a Holcomb 04b	County 03	Barrier
	Thimble 01a Thimble 01b	County 05	Barrier
	Thimble 02 Thimble 03	County 06	Barrier
	Abernethy Trib A 01a Abernethy Trib A 01b	County 07	Barrier
	Abernethy Trib B 01a Abernethy Trib B 01b	County 08	Not a barrier
	Abernethy Trib C 01a Abernethy Trib C 01b	County 09	Not a barrier
	Abernethy Trib C 03a Abernethy Trib C 03b	County 10	Barrier
	Root 02a Root 02b	County 11	Barrier
	Root 03a Root 03b	County 12	Barrier
	Root 03b Root 03C	County 13	Barrier
	Abernethy 16a Abernethy 16b	County 14	Barrier

Subwatershed	Stream and Reach Location	Responsible for Inventory and ID Number	Fish Passage Status/Notes[1]
Beaver			
	Parrott 05a Parrott 05b	ODFW 01	Not a barrier
	Cahill 01a Cahill 01b	County 15	Unknown
	Beaver 11a Beaver 11b	ODFW 02	Not a barrier
	Beaver Trib C 01a Beaver Trib C 01b	ODFW 06	Not a barrier
	Beaver Trib C Trib A 01a Beaver Trib C Trib A 01b	County 16	Unknown
	Beaver Trib D 01a Beaver Trib D 01b	ODFW 03	Not a barrier
	Beaver 15a Beaver 15b	ODFW 04	Not a barrier
	Beaver Trib E 01a Beaver Trib E 01b	County 17	Unknown
	Beaver Trib E 01b Beaver Trib E 01c	County 18	Unknown
	Beaver Trib F 01a Beaver Trib F 01b	County 19	Unknown
	Beaver 17a Beaver 17b	ODFW 05	Barrier
	Beaver 17b Beaver 17c	County 20	Unknown
	Beaver 17c Beaver 17d	County 21	Unknown

[1] The fish passage condition is known for road crossings that were inventoried by Clackamas County and ODFW. Figure 1 shows the locations and status.

Summary and Recommendations

Urbanization, roads, and other land uses have modified stream habitat, riparian vegetation, fish populations, and water quality in the watershed assessment area. Table 9 summarizes the watershed conditions and outlines restoration and other actions that can be taken to improve watershed health. The information in from this table and the watershed assessment provides the foundation for the *Greater Oregon City Watershed Council Restoration Action Plan*. This plan provides the GOCWC with a framework and a roadmap for implementing voluntary watershed restoration projects and landowner education.

Table 9. A Summary of Watershed Conditions and Actions That Will Improve Water Quality and Fish Habitat in the Watershed Assessment Area

Location	Condition Summary	Examples of Actions
Abernethy Creek Subwatershed	• Abernethy Creek and tributaries are important habitat for lower Willamette River populations of coho and steelhead and other native fish species • Water quality issues: temperature and sedimentation • Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions in many areas • Fish passage barriers are present • Stream habitat is simplified with limited wood	• Remove riparian weeds, plant native vegetation, and expand width of corridor • Address fish passage barriers • Educate landowners on riparian area management and sediment-reduction actions
Lower Abernethy Creek	• Most of lower Abernethy Creek is within Oregon City • During flood events the Willamette River creates a backwater area in Abernethy Creek as far upstream as Holcomb Creek • Important migration corridor for coho, steelhead and lamprey • Winter rearing area for Willamette Basin salmon and steelhead populations during floods • Water quality issues: temperature, sedimentation, and stormwater • Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions in many areas • The stream channel is incised and disconnected from the floodplain • Stream habitat is simplified with limited wood	• Remove riparian weeds, plant native vegetation, and expand width of corridor • Reconnect floodplain areas and add wood to the channel • Address stormwater issues in collaboration with Oregon City

Location	Condition Summary	Examples of Actions
Newel Creek	• The headwaters of Newel Creek are within Oregon City • Metro property in the watershed and focus area for protection and restoration • Important stream for coho, steelhead, and lamprey spawning and rearing • Water quality issues: sedimentation and storm water • The stream has cool water temperatures • Some riparian areas have riparian vegetation and weeds • Large portions of the stream have high quality fish and riparian habitat	• Work in collaboration with Metro on restoration actions • Field inventory riparian weeds, particularly knotweed • Remove riparian weeds, plant native vegetation, and expand width of corridor • In selected areas, improve channel complexity by adding wood • Address stormwater issues in collaboration with Oregon City • Monitor water temperature and other water quality conditions
Holcomb/Potter Creek	• Metro focus area for protection and restoration • Important stream for coho, steelhead, and lamprey spawning and rearing • Water quality conditions are unknown, but the stream may have cool water conditions • Some areas of degraded riparian vegetation and weeds • Large portions of the stream have high quality fish and riparian habitat, but some areas are degraded • Fish passage barriers at road crossings	• Remove riparian weeds, plant native vegetation, and expand the width of the corridor • Field inventory riparian weeds, particularly knotweed • In selected areas, improve channel complexity by adding wood • Monitor water temperatures • Address fish passage barriers
Upper Abernethy Creek	• Important stream for coho, steelhead, and lamprey spawning and rearing • Flooding is affecting floodplain landowner • Water quality issues: sedimentation and temperature are unknown • Some areas of degraded riparian vegetation and weeds • Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions in many areas • Fish passage barriers are present • Unknown fish passage conditions at water diversion and Beaver Lake fish ladder • Stream habitat is simplified with limited wood	• Remove riparian weeds, plant native vegetation, and expand width of corridor • Field inventory riparian weeds, particularly knotweed • Address floodplain landowners and flooding through education and other actions • In selected areas, improve channel complexity by adding wood • Address fish passage barriers and study unknown barriers at dams

Location	Condition Summary	Examples of Actions
Oregon City Headwater Streams	• Headwater streams originate in Oregon City and flow into all three subwatersheds • Large area in impervious surfaces • Water quality issues: sedimentation and stormwater	• Remove riparian weeds, plant native vegetation, and expand width of corridor • Address stormwater issues in collaboration with Oregon City through education and actions that retain stormwater • Collaborate with Oregon City to monitor water quality conditions
Beaver Creek Subwatershed	• Beaver Creek, Parrot Creek, and tributaries are now accessible to steelhead and lamprey • Water quality issues: sedimentation; other conditions are unknown • Water withdrawals are probably reducing water flow during the late summer and early fall • Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions in many areas • Fish passage barriers are present • Unknown fish passage conditions at many road crossings • Stream habitat conditions are unknown	• Remove riparian weeds, plant native vegetation, and expand width of corridor • Field inventory riparian weeds, particularly knotweed • Address fish passage barriers and study unknown barriers at road crossings • Educate landowners on riparian area management and sediment-reduction actions • Explore opportunities to increase water flows through voluntary actions
Beaver/Parrott Creek Confluence Area	• Sevick Dam washed out in the January 2, 2009, flood; upstream areas are now accessible to fish • A large quantity of sediment is exposed in the drained Sevick Pond area, which will become a weedy area • The channel is down-cutting through the sediments and may create fish passage issues	• In collaboration with the landowner, develop a plan to restore the drained Sevick pond area with native vegetation • Field inventory riparian weeds, particularly knotweed • Study the Sevick Pond sediment accumulation and develop a plan to control sedimentation and maintain fish passage

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Appendix A. Water Quality Data Sources, Criteria, and Stormwater Quality Summary

Table 1. Availability of Water Quality Data for the Assessment Watersheds

Sources	Application to the Watershed Assessment
Data	
DEQ LASER database: water chemistry	There is a variety of scattered single samples, mostly outdated. Only one station, #10873, is sampled consistently. **Station**: Abernathy Creek @ Highway 213, #10873, 3/2006 – 12/2006. (Oregon City)
DEQ LASER database: temperature data	One-half hour temperature data **Station**: Abernathy Creek near Atkinson Park, #33523, 7/10/2006 – 10/4/2006. (Oregon City). Limited field parameters: DO, pH, conductivity, turbidity
Oregon City Stormwater Monitoring Data (2007-2008)	Three monitoring events at 4 surface water sites. Monitored for 1 dry period and 2 rain events. **Stations**: 1. Abernathy Creek, 17082 Holly Ln., Site # OC019 2. Coffee Creek behind 415 McLoughlin Blvd., Site # OC021 3. Park Place Creek behind 13530 Redland Rd., Site # OC022 4. Singer Creek @ Singer Cr. Park, Site # OC023
Reports	
Oregon City, 2008. NPDES Municipal Stormwater Permit Annual Report.	The City of Oregon City Annual Stormwater Report summarizes stormwater plans, facilities, maintenance, erosion control plan and monitoring program.
DEQ 2006. Middle Willamette TMDL	The lower 15.5 river miles of Abernathy Creek is listed as water quality limited for Temperature during the summer. The TMDL addresses fecal coliform bacteria, DO, dieldrin, and copper/lead/zinc as pollutants in other Willamette basin watersheds, which flags these constituents as parameters of interest.
Carpenter, K.D. 2003. Water quality and algal conditions in the Clackamas River.	This report evaluated nutrient enrichment and water quality effects in the adjacent Clackamas River. This detailed study provides a good corollary for the assessment watersheds in regards to nutrient enrichment, algal conditions and land uses.
Carpenter and others, 2008. Pesticide occurrence and distribution in the lower Clackamas River basin.	The pesticide study identified the occurrence of pesticides and herbicides in the lower Clackamas River. The similarity in land use to Abernathy and Parrot Creeks provide a good indication of what pesticides to expect in these watersheds.
Waite and others, 2008. Effects of urbanization on stream ecosystems in the Willamette River basin and surrounding area.	This study evaluated effects of increasing urbanization on aquatic habitats and water quality throughout the Willamette River Basin. The study used a combination of land use, land cover, infrastructure and socioeconomic variables to measure urbanization. The study provides a good indication of what water quality conditions to expect in similar urban/rural streams.

Table 2. Water Quality Monitoring Stations

Source	Number	Description	Purpose
Abernathy Creek Watershed			
Agency	**Station Id.**	**Station Name and Location**	**Monitoring Purpose**
DEQ	33523	Abernathy Creek within Oregon City (45.362061,-122.592403)	temperature
Oregon City	OC019	Abernathy Creek at Holly Lane Bridge (45.359573,-122.571208)	above Oregon City limits
Oregon City	OC020	Abernathy Creek at Railroad Trestle (45.364088,-122.598437)	below Oregon City limits
Oregon City	OC022	Park Place Creek (at Abernathy Cr.) (45.362953,-122.587542)	high density residential
Oregon City	OC023	Singer Creek (in Singer Creek Park) (45.34751,-122.602108)	mixed use residential & commercial
Willamette Watershed			
Oregon City	OC021	Coffee Creek (outfall at Willamette R.) (45.347721,-122.623093)	mixed use residential & light industrial
Clackamas River Basin—for Reference			
DEQ	13070	Clackamas River at McIver Park	primarily forested

Table 3. Summary of Applicable Water Quality Criteria

Parameter (Beneficial Use)	Criteria
Dissolved Oxygen (Fish and aquatic life, salmonid spawning and rearing)	Salmonid Spawning: greater than 11.0 mg/L Cold Water Aquatic Life: greater than 8.0 mg/L.
pH and TDS (Fish and aquatic life, water contact recreation)	pH: 6.5 – 8.5 TDS: 100 mg/L
Nutrients (Aesthetics)	No State numeric criteria. Recommended EPA target (EPA 2001) Total Phosphorus: 0.04 mg/L Nitrates: 0.15 mg/L
Temperature (Fish and aquatic life, salmonid spawning and rearing)	Seven-day-average maximum temperature Salmonid and trout rearing and migration: 64.4°F (18°C) Salmon and steelhead spawning: 55.4°F (13° C)
Bacteria (Water contact recreation)	30-day log mean—126 colonies/100 ml Single sample—406/100 ml
Toxics (Fish and aquatic life)	Numeric criteria are identified for organic and inorganic toxic substances in Table 20 in the Oregon Water Quality Standards.
Metals (Fish and aquatic life)	Copper Acute Criteria: 4.6 µg/L Chronic Criteria: 3.5 µg/L Lead Acute Criteria: 13.9 µg/L Chronic Criteria: 3.2 µg/L Zinc Acute Criteria: 35.4 µg/L Chronic Criteria: 32.3 µg/L Note: Hardness dependent metals. 25 mg/L hardness used in calculation.

Table 4. Antecedent Rainfall Conditions for Oregon City Stormwater Monitoring as Measured at the Portland Weather Station

November 2007	Precipitation (inches)	December 2007	Precipitation (inches)	January 2008	Precipitation (inches)
21	0	13	0	2	0.61
22	0	14	0.01	3	0.21
23	0	15	0.02	4	0.21
24	0	16	0.10	5	0.22
25	0	17	0.10	6	0.14
26	0.24	18	0.17	7	0.05
27	**0.1**	**19**	**0.46**	**8**	**0.60**
7-Day Average	0.05		0.12		0.29

Table 5. Oregon City Stormwater Water Quality Descriptive Statistics Summary

	Abernathy Creek 1	Abernathy Creek 2	Coffee Creek	Park Place Creek	Singer Creek	Clackamas River McIver Park
Number	3	3	3	3	3	5
pH						
Min	7.26	7.24	7.1	7.1	6.92	7.2
Max	7.41	7.49	7.28	7.77	7.26	7.8
Mean	**7.32**	**7.34**	**7.17**	**7.33**	**7.05**	**7.6**
Total Dissolved Solids (mg/L)						
Min	48	48	15	65	37	33
Max	81	80	71	102	63	58
Mean	**63.67**	**60.00**	**34.00**	**86.00**	**46.33**	**46.20**
Total Suspended Solids (mg/L)						
Min	11	9	2	9	7	1
Max	116	25	31	72	30	11
Mean	**61.00**	**17.67**	**17.00**	**33.00**	**20.33**	**4.0**
E. Coliform Bacteria (count/100 ml)						
Min	16	124	276	166	61	1
Max	186	291	1120	276	435	8
Mean	**124.67**	**216.00**	**838.67**	**230.67**	**190.33**	**3.00**
Ortho Phosphorus (mg/L)						
Min	0.03	0.04	0.02	0.04	0.01	0.01
Max	0.11	0.29	0.03	0.06	0.03	0.01
Mean	**0.06**	**0.16**	**0.02**	**0.05**	**0.02**	**0.01**
Nitrates (mg/L)						
Min	0.66	1.18	0.48	0.80	1.45	0.01
Max	1.27	1.24	2.58	1.38	2.63	0.04
Mean	**1.01**	**1.21**	**1.69**	**1.03**	**2.07**	**0.02**

Greater Oregon City Watershed Council **Watershed Action Plan** | May 2010









ICF INTERNATIONAL

GREATER OREGON CITY WATERSHED COUNCIL WATERSHED RESTORATION ACTION PLAN

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ICF International. 2010. Greater Oregon City Watershed Council Watershed Restoration Action Plan. (ICF 00223.08.) Portland, OR. Prepared for Greater Oregon City Watershed Council, Oregon City, OR.

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Acronyms and Abbreviations

BMPs	best management practices
GOCWC	Greater Oregon City Watershed Council
NRCS	Natural Resources Conservation Service
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
OWEB	Oregon Watershed Enhancement Board
OWRD	Oregon Water Resources Department
ROTC	Reserve Officers' Training Corps
SM	stream mile
SWCD	Soil and Water Conservation District
UGB	Urban Growth Boundary
USFWS	U.S. Fish and Wildlife Service

Introduction and Purpose

This action plan will serve as a guide for the Greater Oregon City Watershed Council (GOCWC) in its selection, implementation, and monitoring of projects in the Greater Oregon City Watershed over a 10-year period. The action plan describes:

- How GOCWC will engage in a long-term, science-based program to advance adaptive and accountable restoration within the Greater Oregon City subwatersheds: Abernethy Creek, Beaver Creek, and Willamette Tributaries.
- The GOCWC restoration priorities and strategies to reduce historical and current threats to watershed health and to restore streams, fish populations, and water quality.
- The range of activities that the GOCWC will engage in, including public outreach and education, restoration, and monitoring.
- A framework and roadmap for increasing the pace and improving the effectiveness of watershed restoration by implementing voluntary watershed restoration projects and landowner education.

The action plan builds on background information and restoration rationale outlined in the *Greater Oregon City Watershed Assessment* (ICF International 2010). The assessment described the characteristics of the three subwatersheds; provided detailed information on the watershed's physical characteristics, fish populations, streamside vegetation, and water quality; and delineated the threats that impair the viability of the watershed.

Watershed and Subwatershed Overview

This section summarizes information from the *Greater Oregon City Watershed Assessment* (ICF International 2010).

The watershed assessment area encompasses the stream network for three subwatersheds: Abernethy Creek, Beaver Creek, and Willamette River (Figure 1).

- Abernethy Creek enters the Willamette River at river mile 25.3 and is tidally influenced at its confluence with the river. Lower Columbia River anadromous (i.e., residing in the ocean as adults and returning to rivers and streams to spawn) runs of coho salmon and steelhead trout are present in this subwatershed.
- Beaver Creek, of which Parrott Creek is a large tributary, enters the river above Willamette Falls at river mile 31.4; this system is not tidally influenced. Because Beaver Creek is above the falls, which historically blocked some fish runs, this stream is part of the Upper Willamette River system. The Beaver Creek subwatershed contains resident cutthroat trout and Pacific lamprey and may now be accessible to Upper Willamette River steelhead.
- The Willamette River subwatershed consists of small tributaries that begin within the Oregon City Urban Growth Boundary (UGB) and flow over steep-sided bluffs directly into the river. These small streams are very high gradient and do not contain fish with the exception of lower channel habitats within the Willamette River floodplain. Fish occupy the lower floodplain portions of these small streams during high-flow periods.

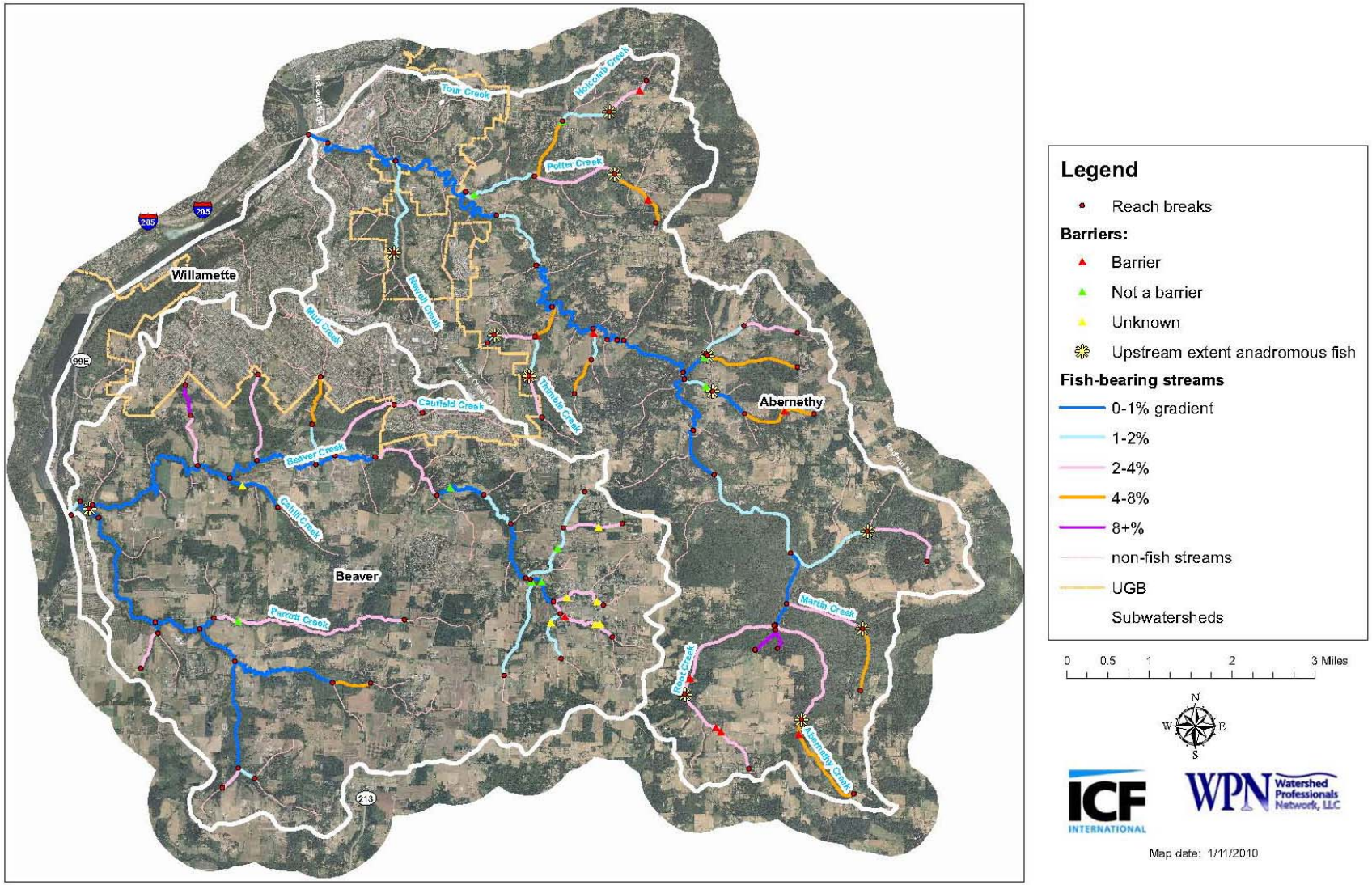
The watershed assessment area is within the Willamette River Basin in western Oregon. Abernethy and Beaver creeks begin at elevations of about 1200 feet above mean sea level and flow generally in a northwesterly direction to join the Willamette River. Because the entire watershed assessment area is within the low elevation portions of the Willamette Valley, there are no mountainous areas to capture winter snowpack. Consequently, most precipitation comes from rainfall. The largest quantities of rainfall occur between October and November; very little precipitation occurs during the summer and early fall, when stream flows are at their lowest.

The watershed assessment area encompasses 44,353 acres (Table 1). The Abernethy Creek and Beaver Creek subwatersheds are similar in size (21,573 and 20,083 acres, respectively); the Willamette subwatershed is the smallest (2,697 acres). The headwaters of Abernethy and Beaver creeks are largely in unincorporated Clackamas County. Approximately 17% of the watershed assessment area is within the Oregon City UGB). A significant portion of the Abernethy subwatershed, primarily the lower stream channel, is within the UGB (16%). A somewhat smaller portion of the Beaver Creek subwatershed is within the UGB (13%), primarily small streams that originate in Oregon City and flow north into Beaver Creek. Most of the Willamette River subwatershed is within the UGB (59%).

Table 1. Greater Oregon City Watershed Assessment Subwatershed Acreages and Proportions within the Oregon City Urban Growth Boundary

Subwatershed	Total Area Acres (Square Miles)	Oregon City UGB Acres (Square Miles)	Percentage within Urban Growth Boundary
Abernethy	21,573 (33.71)	3,471 (5.42)	16%
Beaver	20,083 (31.38)	2,562 (4.00)	13%
Willamette	2,697 (4.21)	1,596 (2.49)	59%
Total	44,353 (69.30)	7,629 (11.92)	17%

Figure 1. Watershed Assessment Area Base Map



Watershed Conditions, Limitations, and Opportunities

This section summarizes information from the *Greater Oregon City Watershed Assessment* that describes watershed conditions, factors limiting fish populations and water quality, and opportunities for restoration.

Conditions and Limitations

Urbanization, roads, and other land uses have modified stream habitat, riparian vegetation, fish populations, and water quality within the watershed assessment area. Table 2 summarizes the watershed conditions for the subwatersheds based on the watershed assessment.

The Abernethy Creek, Beaver Creek, and Willamette River subwatersheds have been dramatically altered over the years as a result of urbanization, agriculture, and other land uses. The greatest limitations to watershed health and fish populations within the three subwatersheds include:

- Water quality issues: temperature and sedimentation
- Stormwater from Oregon City headwater streams: modifications in water quality and flow patterns
- Stream habitat quality: channels incised and disconnected from floodplain; scarcity of wood in the channel limiting complex habitats
- Fish passage barriers on Abernethy Creek and Beaver Creek and tributaries
- Riparian areas: modified vegetation composition and narrowed corridor; weedy conditions prevail in many areas
- Water flow: water withdrawals probably reducing water flow during the late summer and early fall

Information is available on the general health of streams and riparian areas in the watershed assessment area; however, detailed, site-specific information for key watershed characteristics is limited, particularly for fish habitat and water quality. For example, no comprehensive inventory of fish habitat throughout the channel network exists; such an inventory would delineate the presence of pools and the quantity of large wood in the channel. Similarly, almost no water quality data exists for key parameters such as water temperature. Because of these data limitations, it is difficult to develop restoration actions that focus on the issues limiting fish populations and water quality for sections of the stream network or a specific landownership.

Collecting baseline information on stream habitat and water quality should be the GOCWC's first priority. Data collection efforts should use existing protocols, such as the Oregon Department of Fish and Wildlife (ODFW) Aquatic Habitat Inventory and the Oregon Department of Environmental Quality (ODEQ) stream temperature collection methods.

Opportunities

The GOCWC, in collaboration with landowners and other partners, should focus actions to improve watershed conditions on the following strategic areas and opportunities.

- During flood events the Willamette River creates a backwater area in Abernethy Creek as far upstream as Holcomb Creek, which creates a winter rearing area for Willamette Basin salmon and steelhead populations during floods.
- Abernethy Creek and key tributaries are important for coho, steelhead, and lamprey migration, rearing, and spawning.
- With the elimination of the fish passage issue at Sevick Pond, Beaver Creek is now accessible to Upper Willamette steelhead and lamprey.
- Habitat in the lower watershed within Oregon City and the surrounding areas, particularly in Newell Creek and Holcomb Creek, represents some of the highest quality salmon and steelhead habitat in the Portland area.
- The Metro property in the Newell Creek watershed and the Holcomb Creek area is a focus area for Metro's protection and restoration efforts.
- Oregon City is strategically located, with headwater streams within the city limits draining into all three subwatersheds and thus influencing water quality and fish habitat in downstream areas.

Table 2. A Summary of Watershed Conditions in the Watershed Assessment Area

Location	Condition Summary
Abernethy Creek Subwatershed	• Abernethy Creek and tributaries are important habitat for lower Willamette River populations of coho and steelhead and other native fish species • Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions prevail in many areas • Fish passage barriers are present, with several on the mainstem • Stream habitat is simplified with limited wood • Most of lower Abernethy Creek is within Oregon City • During flood events, the Willamette River creates a backwater area in Abernethy Creek as far upstream as Holcomb Creek • Important migration corridor for coho, steelhead, and lamprey • Winter rearing area for Willamette Basin salmon and steelhead populations during floods • Water quality issues: temperature, sedimentation, and stormwater • The stream channel is incised and disconnected from the floodplain • The headwaters of Newell Creek are within Oregon City • Metro property in the Newell Creek watershed and Holcomb Creek is a focus area for protection and restoration • Newell and Holcomb creeks are important for coho, steelhead, and lamprey spawning and rearing and contain areas with high quality habitat
Oregon City Headwater Streams encompassing all subwatersheds	• Headwater streams originate in Oregon City and flow into all three subwatersheds • Large area of impervious surfaces • Water quality issues: sedimentation and stormwater • Streams within the Willamette Subwatershed do not have fish use, with the exception of the lower portions within the Willamette River Floodplain
Beaver Creek Subwatershed	• Beaver Creek, Parrott Creek, and tributaries are now accessible to steelhead and lamprey • Water quality issues: sedimentation (other conditions are unknown) • Water withdrawals are probably reducing water flow during the late summer and early fall • Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions prevail in many areas • Fish passage barriers are present • Fish passage conditions are unknown at many road crossings • Stream habitat conditions are unknown • Sevick Dam washed out in the January 2, 2009, flood; upstream areas are now accessible to fish • A large quantity of sediment is exposed in the drained Sevick Pond area, which will become a weedy area • The channel is down-cutting through the sediments and may create fish passage issues

Watershed Restoration Strategy and Priorities

Roni et al. (2002) outlines an approach for prioritizing restoration projects. The strategy builds on key principles of watershed function and conservation biology. The first component is to focus efforts on protecting existing areas with high quality habitat. The second component is to indentify, based on the watershed assessment, the factors that are limiting water quality and fish populations. Combing these components creates an integrated watershed improvement strategy for the GOCWC, which focuses on activities that will protect and restore watershed processes that are essential for the creation and maintenance of fish habitat and water quality.

Based on this prioritization approach (Roni et al. 2002), the GOCWC watershed restoration strategy focuses on the following types of projects.

- **Protecting high quality habitats.** High quality habitats for salmon, trout and other species "anchor" the restoration effort and provide core areas that can be enhanced and then reconnected to the whole watershed through restoration actions. This strategy is centered on a key principal of conservation biology, which emphasizes the importance of protecting habitats that are better functioning while restoring degraded habitats.
- **Restoring fish passage.** Restoring fish passage is a high priority because it has a very high probability of success and it provides immediate access to historic habitat.
- **Restoring hydrologic and water quality processes because these actions help maintain and restore aquatic habitat.** Hydrologic processes include sediment delivery to stream channels, water flow regimes (low and high flows), and can be affected by stormwater management and water withdrawals. Riparian areas also affect hydrologic and water quality processes by providing floodplain connections, shading streams, and providing large wood that contributes to complex stream habitat.
- **Restoring instream flows.** Engaging in instream restoration projects, such as placement of instream large wood, which are best implemented in conjunction with reconnection of isolated high quality habitats and projects to restore watershed processes.
- **Educating landowners and other watershed stakeholders** on actions they can take to protect and restore the watershed.

The GOCWC will pursue this strategy through the following methods:

- Engaging in assessment and monitoring projects to better understand stream habitat quality, key areas for restoration (e.g., areas with riparian weeds), and water quality (e.g., water temperature patterns);
- Working with local jurisdictions, including Oregon City and Metro, to protect and restore key high quality habitat areas;
- Engaging landowners and jurisdictions in voluntary restoration projects;
- Educating landowners on best management practices and approaches for restoring habitat on their property; and
- Tracking trends in habitat, water quality, and stream flow as restoration proceeds.

GOCWC Restoration Project Accomplishments

The action plan will build on the GOCWC's restoration project accomplishments, described below, and expand efforts into new geographic areas and project types.

Abernethy Phase I

The GOCWC was awarded a $6,650 grant from the Oregon City/Metro Enhancement Fund for the Abernethy Phase I project. The project enhanced the riparian corridor along Abernethy Creek from Main Street to just east of the Washington Street Bridge. The project area covers four tax lots, which are owned by the Oregon Department of Transportation (ODOT), Oregon City, and Historic Properties LLC.

Two volunteer events were held (one in 2006 and one in 2007) to remove garbage, including debris remaining from the residence that was demolished on the Oregon City parcel, and nonnative invasive vegetation, including Himalayan blackberry, Clematis spp., English ivy, nightshade, laurel, English hawthorn, and holly.

Two planting events were held (one in 2006 and one in 2007) to revegetate the area with native riparian species. The long-term goal of the planting was to develop a structurally complex corridor that would provide habitat for wildlife and shade for Abernethy Creek. Subsequent volunteer events have been held to remove nonnative, invasive plants.

Abernethy Phase II

The GOCWC was awarded a $14,285 grant from the Oregon City/Metro Enhancement Fund for the Abernethy Phase II project. The project is located west of Washington Street on Oregon City park land. The GOCWC coordinated efforts to remove invasive species, plant natives, and mulch the ground along Abernethy Creek at Abernethy Park in Oregon City. This project supports the long-term goal of plant survival and successful establishment of a structurally complex corridor that will provide habitat for wildlife and shade for Abernethy Creek.

The bulk of the project was completed in 2008. Clackamas County Corrections' crews removed much of the invasive plants in the spring/summer. Students from Springwater Elementary Environmental Charter School and Oregon City High School Junior Reserve Officers' Training Corps (ROTC) planted 300 plants along the banks and slopes of the creek. The Junior ROTC volunteers also removed 40 cubic yards of invasive plants and 5 cubic yard of roofing material from the park. Echo Valley Natives nursery donated plants, Oregon City provided tools, and the National Guard provided a warming tent. The students had a lot of fun and learned about the value of riparian areas.

Tooze Pond

The GOCWC was awarded a $3,500 grant from the Oregon City/Metro Enhancement Fund for the Tooze Pond project. The project area includes two parcels. The northern perimeter of the pond is owned by Oregon City and the southeastern parcel is privately owned by City Councilmember Dan Tooze and contains a permitted dammed lake in Cauflield Creek just west of Highway 213. The majority of the project area lies beneath BPA power lines.

In 2008, 1 ton of garbage and nonnative, invasive vegetation, including Himalayan blackberry and Japanese knotweed, was removed from the site. Because of past harassment issues (e.g., garbage, rock throwing, BB guns directed at glass bottles and wildlife) associated with the residents of the apartment complex to the north, a strip of blackberries was left along the northern perimeter of the project area to limit human access from the north.

The site, which lies within an environmentally sensitive area, zoned by Oregon City as a Water Quality Resource Overlay, was degraded. Restoration of the riparian vegetation will support its ability to improve water quality and protect slope stability. Trees and shrubs improve water quality by reducing rapid stormwater runoff, increasing water infiltration, allowing groundwater recharge, and shading streams. Fish, such as cutthroat trout, and macroinvertebrates inhabiting Caufield Creek will benefit from any improvements to water quality. Waterfowl, wading birds, osprey, and wetland songbirds that frequent the pond will benefit from additional structure, cover, and prey base as the plants mature. In addition to providing wildlife habitat, the trees and tall shrubs will improve air quality and provide noise attenuation.

Coniferous trees and native dogwoods were planted along the northern perimeter of the project area, wherever possible, to buffer the pond from the adjacent development and to provide cover and shade for a remnant population of cutthroat trout. The property owner actively managed this project.

Younger Project

The Younger project was conducted by ODFW, the Younger family, and the GOCWC, with a $51,615 grant from Oregon Watershed Enhancement Board (OWEB). The project is on Potter Creek less that 0.33 mile upstream of the confluence of Holcomb and Potter creeks at 15822 Neibur Road near Oregon City. Potter Creek is a perennial tributary of Abernethy Creek that supports winter steelhead, Coho salmon, Pacific lamprey and cutthroat trout populations. Twin 48-inch culverts under the Younger's driveway were creating a barrier to upstream juvenile fish passage and hindering passage of adult salmon in the stream.

The grant application was submitted to OWEB, in 2008. In January 2009, rains washed out the culverts and the driveway, which provided the sole access to property owner's home.

The project, completed in 2009, replaced the twin culverts with a 13-foot-wide, 5-foot, 1-inch-tall, 46-foot-long bottomless arch pipe. Native plants and trees were planted on the slopes adjacent to the area of work. The OWEB grant covered engineering design, removal of the existing structure, purchase and installation of the crossing structure.

SOVL's Lower Abernethy Creek Project

The GOCWC is partnering with a local non-profit, SOLV, on a restoration project along lower Abernethy Creek. The project is currently in the planning stages. The project objectives center on floodplain modifications, weed control, and riparian restoration along a 0.13-mile length of Abernethy Creek and adjoining Park Place Creek. The project will reduce streambank erosion, improve the stream's access to the floodplain, and increase native vegetation and the riparian tree canopy.

Yodis Property: Potter Creek Fish Passage Project

The project replaced two culverts that were blocking fish passage, removed a small diversion dam, and created a wetland and side channel on the Potter Creek between stream miles (SM) 1.26 and 1.45. The project, completed in 2006, opened up 0.52 mile of fish spawning and rearing habitat; created riffles and pools in the area adjacent to where the diversion dam was removed; created 250 feet of stream-side channel area; and restored 0.5 acre wetland habitat. The following project partners provided funding or other support: the Yodis family, U.S. Fish and Wildlife Service (USFWS), Natural Resources Conservation Service (NRCS), OWEB, ODFW, and Clackamas Soil and Water Conservation District (SWCD). Total project cost was $131,500.

Saling Property: Potter Creek Fish Passage

The project replaced two side-by-side culverts that were blocking fish passage with a bridge on the Potter Creek at SM 0.85. The project, completed in 2006, opened up 0.4 mile of fish spawning and rearing habitat. The following project partners provided funding or other support: the Saling family, USFWS, NRCS, OWEB, ODFW, and Clackamas SWCD. Total project cost was $146,000.

Clackamas Soil and Water Conservation District's Holcomb Creek Fish Passage Project: Schmitz Property

The project replaced three side-by-side culverts that were blocking fish passage with a bridge on the Holcomb Creek at SM 0.82. The project, completed in 2009, opened up 1.9 miles of fish spawning and rearing habitat. Clackamas County SWCD wrote and administered the grant. The following project partners provided funding or other support: NRCS, OWEB, and ODFW. Total project cost was $75,600.

City of Oregon City's Redland Road Project

The City replaced a 6-by6-foot, concrete box culvert that was blocking fish passage with a 15-foot span metal arch pipe on Holcomb Creek at SM 0.22. The project, completed in 2003, opened up 0.6 mile of fish spawning and rearing habitat. The following project partners provided funding or other support: ODFW, USFWS, U.S. Forest Service, U.S. National Marine Fisheries Service, OWEB, Clackamas County, For the Sake of the Salmon, Portland General Electric Salmon Friendly Power Program, Northwest Resource Conservation and Development Board.

The following action plan priorities were determined based on the watershed assessment findings and the restoration strategy.

- Assess baseline conditions
- Protect and restore key tributary anchor habitats
- Enhance Oregon City stormwater quality and quantity
- Enhance habitat in the Beaver Creek–Parrott Creek confluence area
- Improve fish passage
- Improve habitat in the lower portions of Abernethy Creek
- Address water flows during the summer and early fall
- Educate watershed residents and stakeholders and conduct outreach to landowners
- Evaluate project success

These priorities provide a framework for selecting projects and the development of the GOCWC's annual work plan. The GOCWC should implement actions as much as possible within the geographic focus areas depicted in Figure 2 and described within each action plan priority. That said, the GOCWC should to continue to work with landowners who propose restoration projects, regardless of the location of the project, if the project is designed to address issues that are constraining fish habitat and water quality. The restoration strategy provides a framework for evaluating the merits of all projects, including those initiated for locations outside of the geographic focus areas.

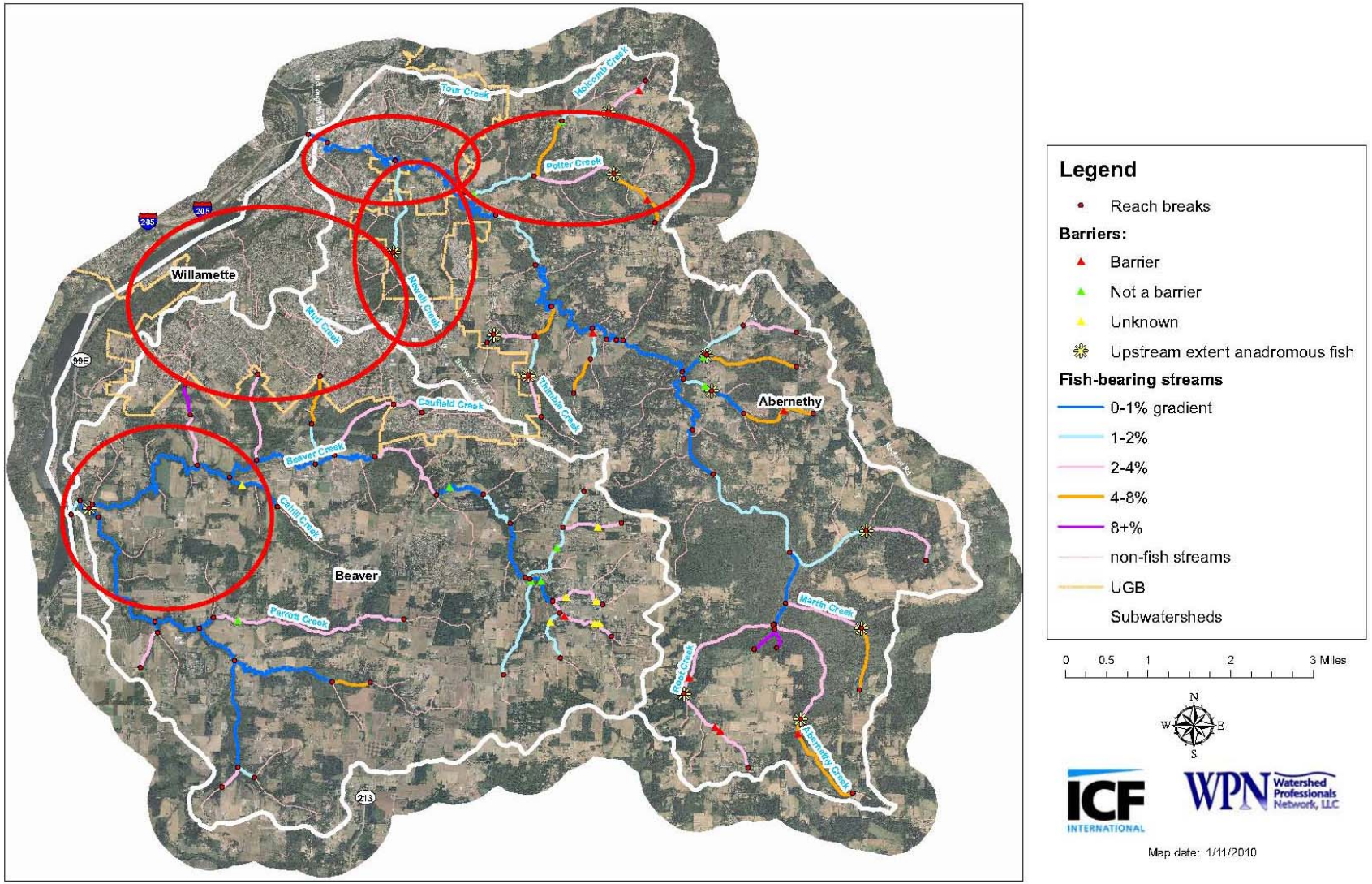
The following section describes the rationale, project categories, and geographic focus areas for each action plan priority.

Assess Baseline Conditions

Rationale

The *Greater Oregon City Watershed Assessment* provides information on the natural processes, current management practices, and land uses that influence stream habitat, fish populations, and water quality in the watershed assessment area. The assessment was based on limited information; key data were unavailable, particularly for stream habitat, water quality, and water quantity. Additional information on baseline conditions is necessary to identify specific locations and actions for restoration projects. Establishing this baseline data is the essential first step for the action plan. It will guide future project planning and provide the foundation for tracking changes in watershed conditions over time.

Figure 2. Geographic Focus Areas (circled) for Action Plan Implementation



Focus Areas

- Fish-bearing streams in the Abernethy and Beaver Creek subwatersheds.
- High quality habitat areas in lower Abernethy Creek that have not been inventoried, particularly the Holcomb Creek and Potter Creek systems.
- Fish passage barriers within the Beaver Creek subwatershed and on the mainstem of Abernethy Creek.
- Inventorying habitat conditions in the area within and below Sevick Pond (see section below for description).

Actions

- Conduct aquatic habitat inventories with according to ODFW protocols.
- After obtaining landowner cooperation, work with volunteers to monitor water temperatures according to ODEQ protocols.
- Work with the Oregon Water Resources Department (OWRD) to establish methods to assess streamflows during the late summer and early fall and to identify ways to restore them in key problem areas.
- With volunteers and landowner cooperation, work with Oregon City to monitor stormwater quality.

Partnerships

- ODFW
- ODEQ: 319 program grant funding
- OWRD
- OWEB: grant Funding
- Oregon City

Protect and Restore Key Tributary Anchor Habitats: Newell Creek and the Holcomb Potter Creek systems

Rationale

Newell Creek and the Holcomb Creek and Potter Creek systems, in the lower portions of the Abernethy Creek subwatershed (Figures 3 and 4), contain some of the highest quality stream and riparian habitat in the Abernethy Creek subwatershed. Historically, these tributary streams were important to the health of Abernethy Creek fish populations; the current presence, though at reduced population levels, of steelhead, coho, Pacific lamprey, and cutthroat trout in these stream means the streams could still support health populations. Opportunities exist in these systems to protect existing high quality aquatic and riparian habitat and to restore areas with poor habitat. It is also important to address issues in this area that are contributing to degraded habitat and water

quality, including stormwater runoff from Oregon City into Newell Creek and invasive weeds that are present and spreading throughout the system.

The reasons for focusing habitat protection and restoration on the Newell Creek and Holcomb/Potter Creek systems include:

- Within the context of the Portland metropolitan area and the lower Willamette river fish runs, Newell Creek and the Holcomb Creek/Potter Creek system provide important habitat for coho and steelhead spawning and rearing.
- Large portions of Newell Creek, particularly the middle portions, have high quality fish and riparian habitat.
- Metro manages over 300 acres in Newell Creek Canyon as open space, which offers opportunities for expanded protection and restoration. This acquisition is part of a larger strategy to protect natural corridors and uplands along the mainstem of Abernethy Creek and its major tributaries (particularly Holcomb and Potter creeks) to protect water quality and wildlife habitat.
- The presence of native fish and the relatively large size of the undeveloped land bordering the Newell Creek make the canyon area and Metro property biologically notable.
- Some sections of the Newell Creek aquatic and riparian habitat are degraded, particularly the lower and upper portions, providing opportunities to restore habitat and expand high quality habitat out from the middle sections.
- Water quality conditions in Newell Creek and the Holcomb Creek/Potter Creek system are unknown, but these streams appear to contribute cooler water to the system and provide areas of cold water were native fish can reside when water temperatures are elevated in Abernethy Creek.
- Stormwater from Oregon City appears to be contributing sediment to Newell Creek.
- Areas of Newell Creek and the Holcomb/Potter system contain degraded riparian vegetation and invasive weeds.

Focus Areas

- Newell Creek and tributaries (Figure 3): stream habitat restoration in the lower and upper fish-bearing sections and rectification of stormwater runoff issues in the headwater streams within Oregon City that affects downstream fish-bearing areas.
- Holcomb Creek, Potter Creek, and fish-bearing tributaries (Figure 4).

Actions

Newell Creek:

- Field inventory riparian weeds, particularly knotweed throughout system.
- Remove riparian weeds, plant native vegetation, and expand width of corridor.
- In the lower and upper sections of the creek, improve channel complexity by adding wood.
- Address stormwater issues through projects and outreach in headwater areas in collaboration with Oregon City.

- Monitor water temperature, sediment, and other water quality conditions.

Holcomb and Potter creeks (Figure 4):

- Remove riparian weeds, plant native vegetation, and expand the width of the corridor.
- Field inventory riparian weeds, particularly knotweed.
- In selected areas, improve channel complexity by adding wood.
- Monitor water temperatures.
- Address fish passage barriers.

Partnerships

- Metro: collaboration to restore habitat in the Newell Creek canyon area and to expand protection efforts into the Holcomb Creek/Potter Creek systems.
- Metro: grant funding
- Oregon City: coordinate stormwater management projects and public outreach activities.
- OWEB: grant funding

Figure 3. Newell Creek Action Area

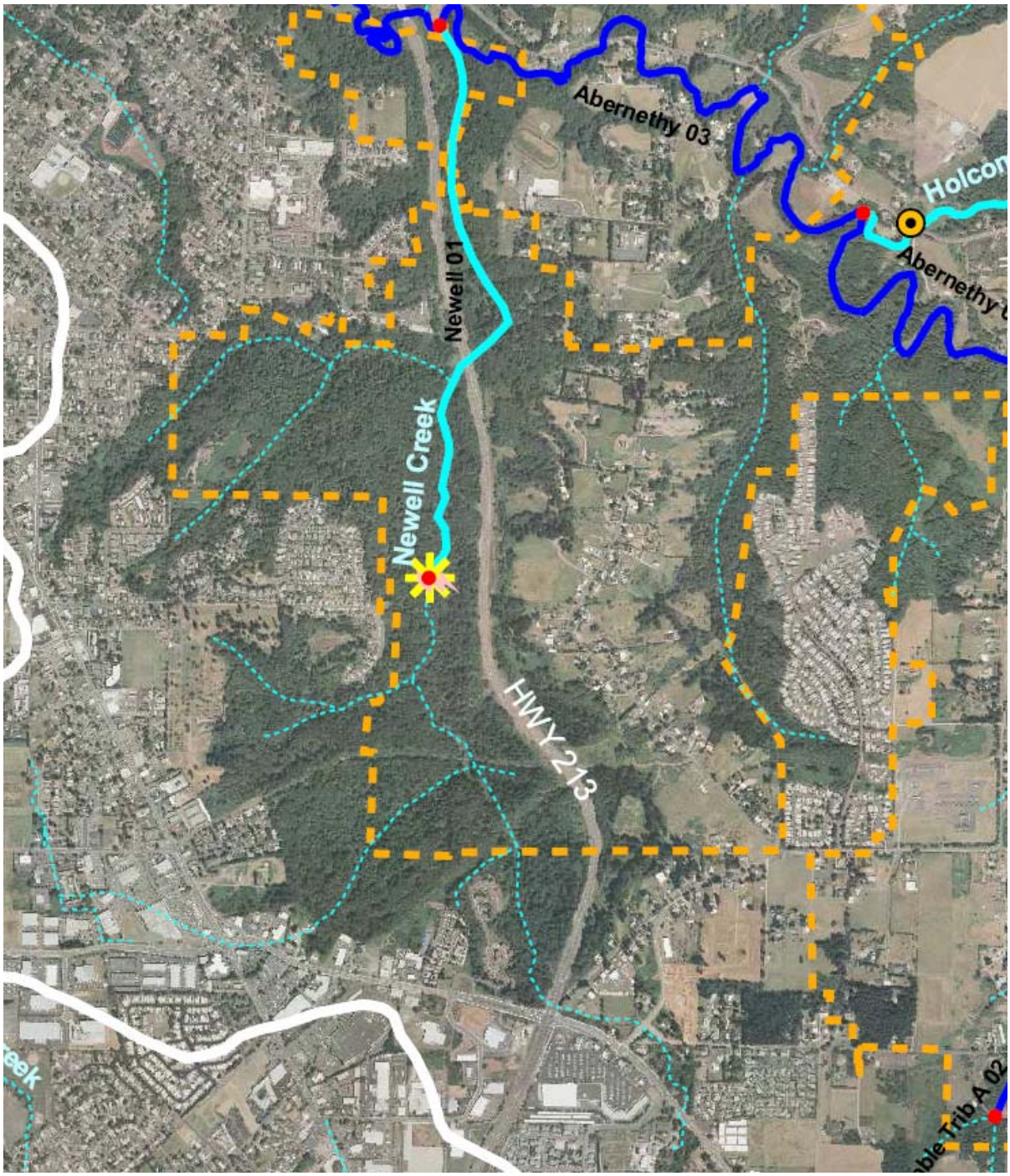
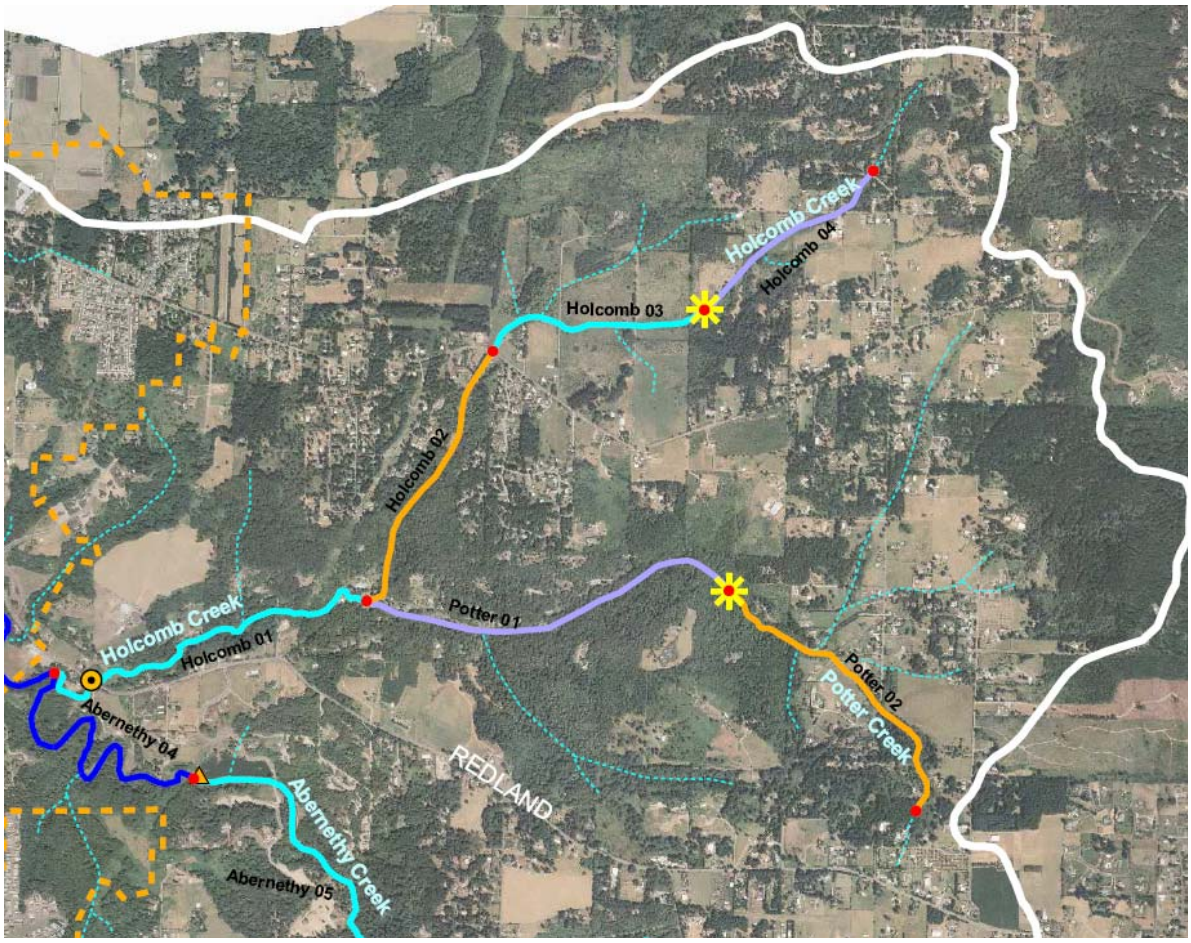


Figure 4. Holcomb and Potter Creek Action Area



Enhance Oregon City Stormwater Quality and Quantity

Rationale

Oregon City is strategically located, with headwater streams within its city limits that drain into all three subwatersheds: Abernethy, Beaver, and Willamette Tributaries (Figure 5). As a result, land use practices within the city strongly influence water quality and fish habitat in downstream areas.

A large area of the city is covered in impervious surfaces (roofs, pavement, and other areas that do not absorb rainfall). The amount and distribution of impervious surfaces has significant implications for watershed health. Unless steps are taken to control runoff, rainfall on in areas with impervious surfaces does not infiltrate into the ground. Instead, it rapidly runs off as stormwater into streams, negatively affecting streamflows, water quality, fish populations, and stream habitat. The Willamette subwatershed, which has the highest proportion of area within Oregon City, has the most impervious surfaces (22%). In addition, individual streams (e.g., Newell Creek, which has headwaters within Oregon City) can have a much greater proportion of the drainage area in impervious surfaces.

An impervious surface area of 5% of the watershed appears to be a threshold for negative effects on streams and fish populations. Negative effects can include increased flows during flood events, sedimentation, and other water quality concerns. The *Greater Oregon City Watershed Assessment* (ICF International 2010) classified reaches as follows by percent impervious surface in contributing area (Figure 6):

- 5% or less—good
- 5–10%—fair
- greater than 10%—poor

Based on these classifications, reaches that drain Oregon City are the most affected overall by impervious surfaces. This includes Newell Creek, a key tributary to Abernethy Creek that contains high quality habitat and significant steelhead and coho salmon populations.

Oregon City is taking active steps to control and monitor stormwater conditions. The City directs new developments to employ best management practices (BMPs) such as bioswales, wetland areas, and other facilities that retain stormwater and minimize water quality problems. In addition, the City has an ongoing monitoring program that assesses, evaluates, and reports on stormwater quality status and trends.

Focus Areas

- All areas within the Oregon City UGB (Figure 5).

Actions

- Work with Oregon City staff on public outreach efforts that educate landowners and other residents on actions they can take to minimize stormwater issues, including maintaining functioning riparian areas and taking steps to reduce erosion.
- Collaborate with Oregon City staff to identify and work with landowners on voluntary projects to improve stormwater conditions, including planting native riparian vegetation and efforts to reduce erosion.
- Work with Oregon City staff to identify, fund, and implement stormwater retention areas, including installing bioswales and creating wetland areas.
- Collaborate with Oregon City to monitor stormwater water quality conditions.

Partnerships

- Oregon City
- ODEQ: grant funding through the 319 program

Figure 5. Oregon City Headwater Streams Action Area

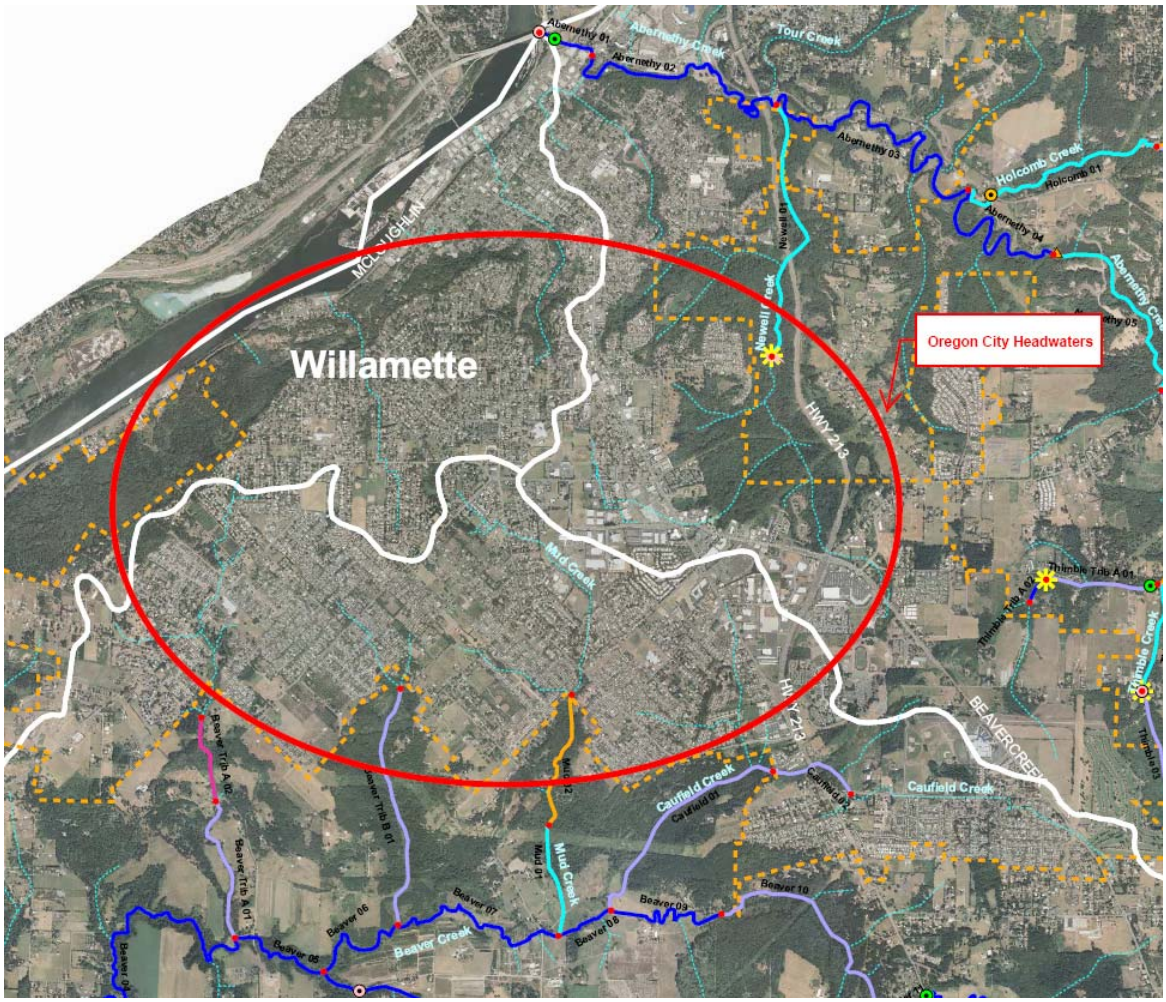
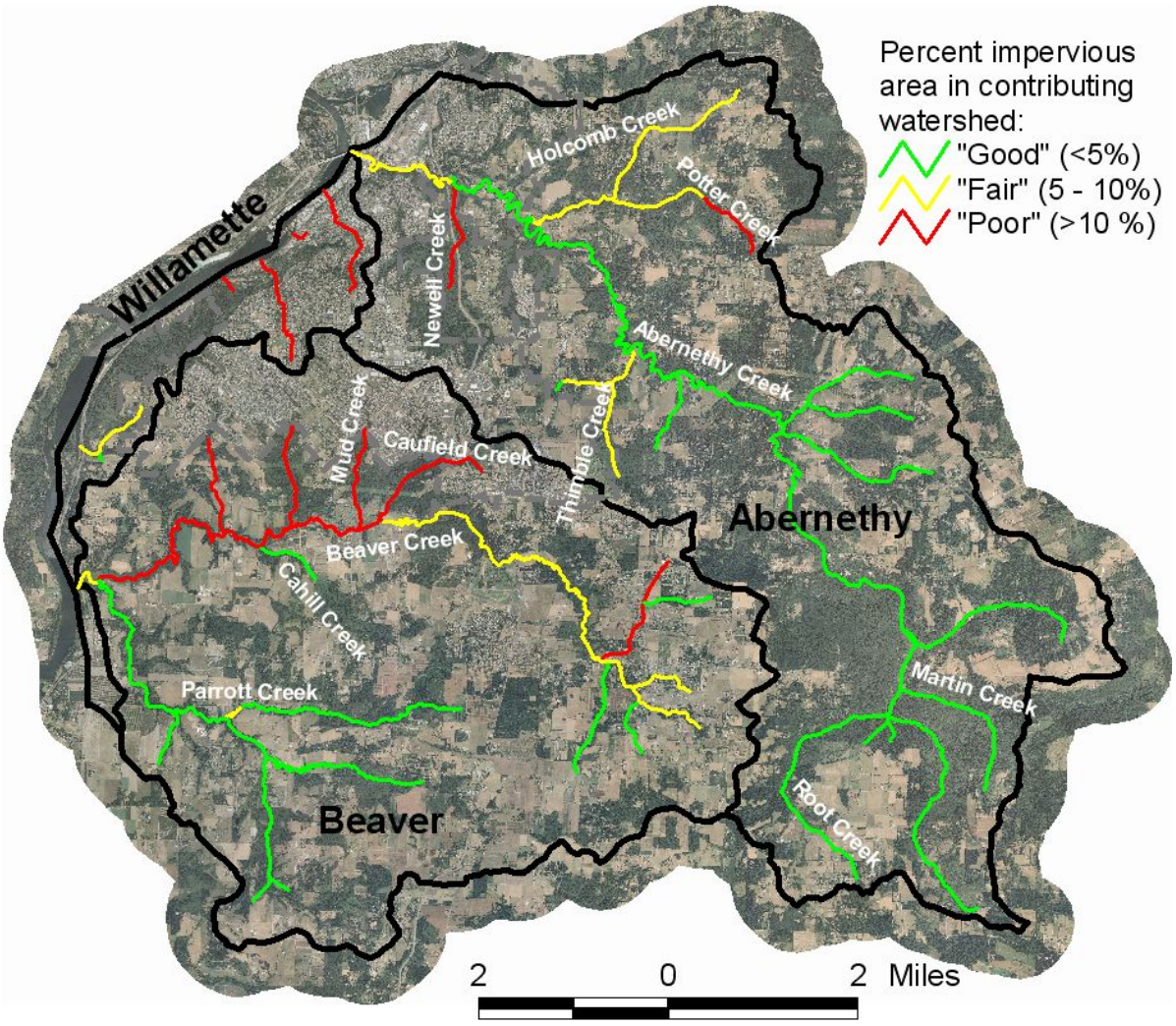


Figure 6. Percent Impervious Surface for the Contributing Watershed Area Upstream of the Midpoint of Each Stream Reach



Enhance Habitat in the Beaver Creek–Parrott Creek Confluence

Rationale

A dam near the confluence of Beaver and Parrott creeks created an impoundment, Sevick Pond, which backed up water in the area upstream and blocked fish access. Sevick Pond covered approximately 12 acres including the junction of Parrott and Beaver creeks. This dam remained in place until the January 2, 2009, flood. In this flood, Beaver Creek eroded the northern portion of dam, creating a channel that is passable to fish.

The Beaver Creek subwatershed is now accessible to steelhead and Pacific lamprey. Because steelhead will quickly move into new habitat, it is expected that that they will recolonize the system for spawning and juvenile rearing. Unfortunately, because no information is available on fish habitat

quality in the Beaver Creek subwatershed, it is not possible to predict the capability of the stream network to support steelhead or resident cutthroat trout populations.

Because Sevick Pond captured substantial sediments, the stream channel is now down-cutting through these sediments. As the stream erodes this large volume of sediment into the channel, a "headcut" in the deep sediments has developed. This headcut creates a steep fall over the sediments that could block upstream fish movement in the channel, but a field inventory would be necessary to confirm the ability of fish to pass through this area. In addition to the possible fish passage issue, the large quantity of sediment exposed in the drained Sevick Pond will evolve into a weed-infested area in the absence of efforts to control weeds and plant native vegetation.

The draining of Sevick pond and the new accessibility of the Beaver Creek subwatershed to anadromous fish presents an area for focused restoration actions in the Beaver Creek–Parrott Creek confluence area. Opportunities in this area to work with landowners to assess conditions and identify and pursue restoration projects include the following:

- Sedimentation is a water quality issue in the Sevick Pond area, but other water quality conditions (e.g., water temperature) are unknown.
- Water withdrawals are probably reducing water flow during the late summer and early fall; it is important to assess streamflow conditions during this period and work with landowners on voluntary mechanisms to reduce water withdrawals.
- Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions prevail in many areas.
- Fish passage conditions are unknown at many road crossings.
- Stream habitat conditions are unknown.

Focus Areas

- The area surrounding the Beaver Creek–Parrott Creek confluence (Figure 7).
- Sevick pond area (Figure 8).

Actions

- Remove riparian weeds, plant native vegetation, and expand width of corridor.
- Field inventory riparian weeds, particularly knotweed.
- Address fish passage barriers and assess unknown barriers at road crossings.
- Educate landowners on riparian area management and sediment-reduction actions.
- Explore opportunities to increase streamflows through voluntary actions.
- Collaboration with the landowner to develop a plan to restore the drained Sevick pond area with native vegetation.
- Study the Sevick Pond sediment accumulation and develop a plan to control sedimentation, reduce weeds, plant native vegetation, and maintain fish passage.

Partnerships

- Clackamas County SWCD
- OWEB: grant funding

Figure 7. The Beaver and Parrott Creek Confluence Action Area

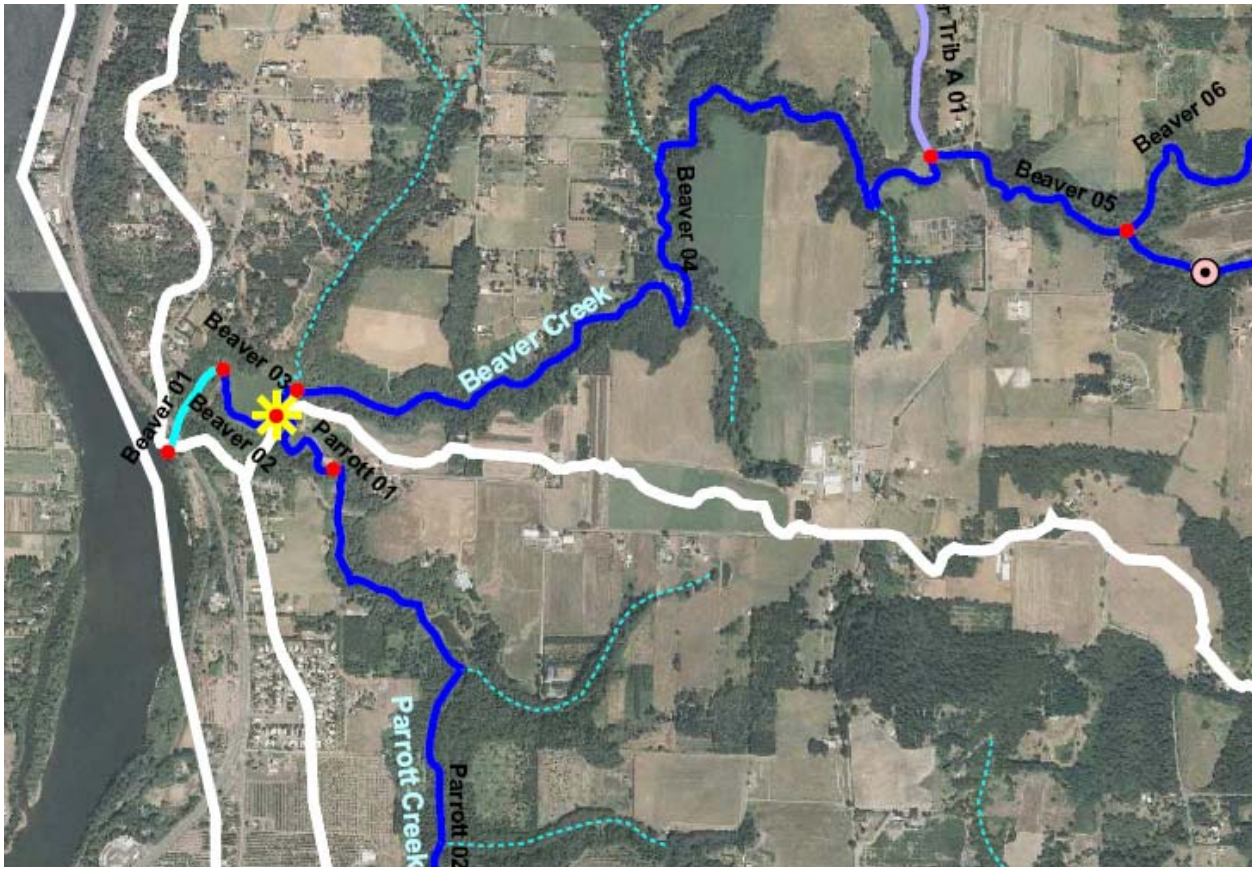
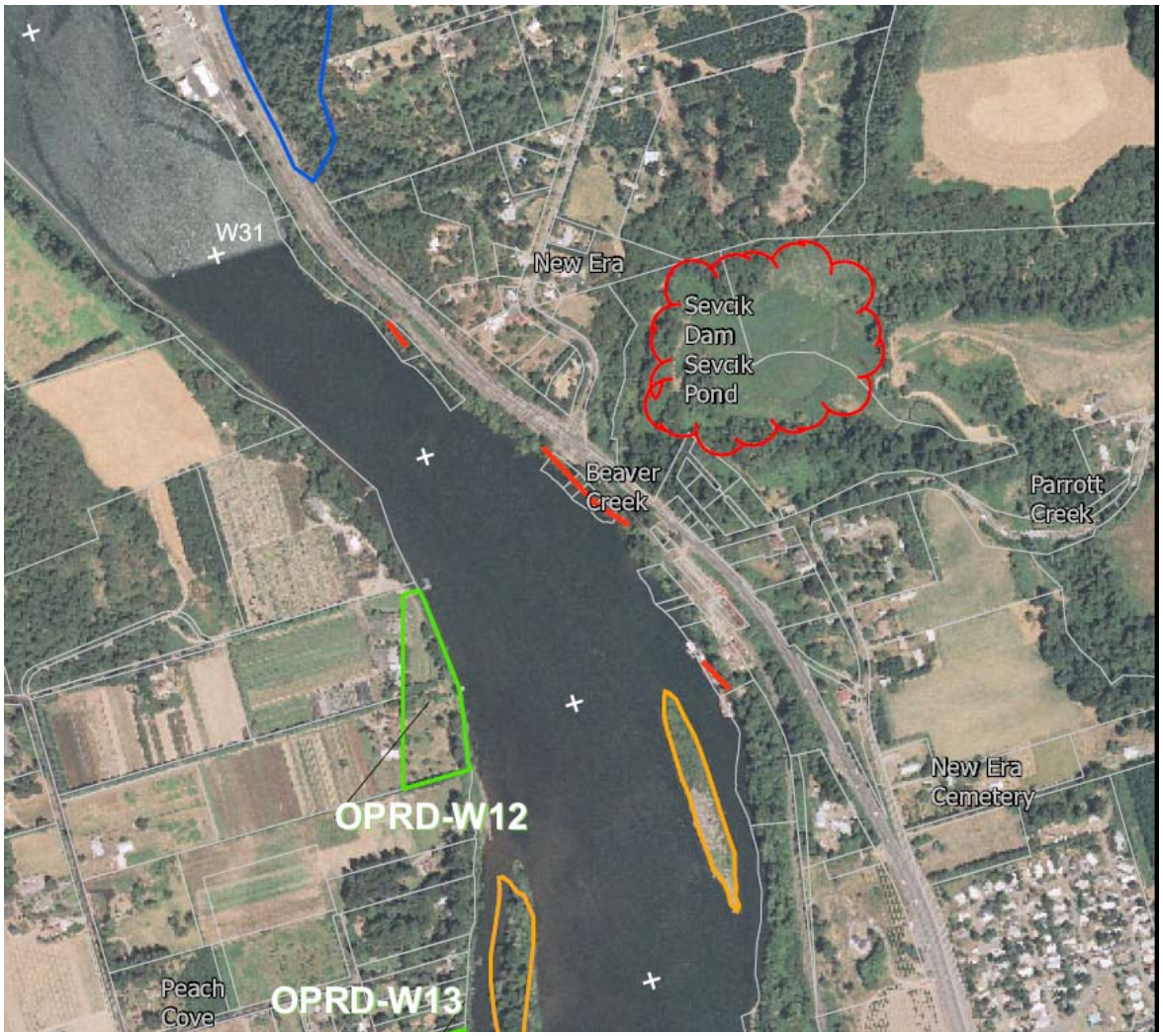


Figure 8. The Sevick Pond Site, Lower Beaver Creek Subwatershed



Source: Oregon State Parks and Oregon Watershed Enhancement Board 2008 (aerial photo), note that Sevick pond is spelled incorrectly in source map.

Improve Fish Passage

Rationale

Fish passage barriers on Abernethy Creek, Beaver Creek, and tributary streams can pose a significant problem for fish populations. Dams and road crossing culverts are examples of fish passage barriers in the watershed assessment area. Fish move around the stream network through the different phases of their life cycle and in response to changing conditions. Fish passage barriers, prevent fish from accessing important areas for spawning or from moving into cool tributary streams when Abernethy Creek or Beaver Creek warm during the summer months.

Fish passage barriers can totally block fish movement during all times or they can partially block movement during periods of high or low flows. Partial fish passage barriers can significantly slow the migration of coho and steelhead through the system. Fish will often hold in pools at the base of a

barrier waiting for conditions to change. This can delay migration and create problems such as stress on the fish, which provide opportunities for poaching and predation.

Dams, which are often constructed in streams to impound water for irrigation or recreation, can impede fish passage if fish ladders or other mechanisms are not in place. Several dams on Abernethy Creek may present obstacles to fish passage. The Hidden Lake water diversion dam just upstream from Holcomb Creek may be a fish passage barrier, but its status needs to be confirmed. The Beaver Lake dam on upper Abernethy Creek has a fish ladder in place. Although fish passage at this ladder has not been studied, some evidence shows that it impedes adult coho and steelhead movement into spawning and rearing streams above the lake.

The Sevick Pond dam on lower Beaver Creek washed out in the January 2, 2009, flood event. Because Sevick Pond captured substantial sediments, the stream channel is now down-cutting through these sediments. As the stream erodes this large volume of sediment into the channel, a "headcut" in the deep sediments has developed. This headcut creates a steep fall over the sediments that could block upstream fish movement in the channel, but a field inventory would be necessary to confirm the ability of fish to pass through this area.

Fish passage at many of the road crossings (primarily culverts) in the watershed assessment area has been evaluated using the ODFW criteria. Table 2 provides the fish passage status for 14 road crossings in the Abernethy Creek subwatershed and 13 road crossings in the Beaver Creek subwatershed. Most of the road crossings were inventoried by ODFW or Clackamas County, and their fish passage status is known. The road crossing inventory is comprehensive for Abernethy Creek subwatershed, but a number of crossings have not been assessed for fish passage (i.e., designated as unknown) in the Beaver Creek subwatershed.

With the absence of the Sevick Pond dam and its barrier to fish passage, upper Willamette steelhead and Pacific lamprey can now access the Beaver Creek subwatershed. Little is known about the status of fish passage in Beaver and Parrott creeks. Because it is now accessible to anadromous fish, this subwatershed should be the focus of fish passage assessments.

In addition to the road crossings identified below in Table 3, ICF evaluated fish passage for the Abernethy Creek culvert under Highway 99. This culvert is important because it is the first obstacle that salmon and steelhead encounter upon entering Abernethy Creek. The evaluation of fish passage through the Highway 99 culvert is based on the culvert diameter, length, and gradient, the characteristics of the weirs, and flow conditions in Abernethy Creek. The weirs appear to provide some fish passage at lower flows, though the jump height exceeds the 6-inch ODFW fish passage criterion and may impede juvenile fish. Adult salmon and steelhead do pass through the culvert, though they may have difficulty during very high-flow conditions when water velocities exceed fish swimming abilities. Upstream access does not appear to be severely limited, because fish have been observed.

Table 3. Fish Passage Status and Location for Road Crossings in the Watershed Assessment Area

Subwatershed	Stream and Reach Location	Responsible for Inventory and ID Number	Fish Passage Status/Notes
Abernethy			
	Holcomb 01a Holcomb 01b	County 01	Not a barrier
	Potter 02a Potter 02b	County 04	Barrier
	Holcomb 02 Holcomb 03	County 02	Not a barrier
	Holcomb 04a Holcomb 04b	County 03	Barrier
	Thimble 01a Thimble 01b	County 05	Barrier
	Thimble 02 Thimble 03	County 06	Barrier
	Abernethy Trib A 01a Abernethy Trib A 01b	County 07	Barrier
	Abernethy Trib B 01a Abernethy Trib B 01b	County 08	Not a barrier
	Abernethy Trib C 01a Abernethy Trib C 01b	County 09	Not a barrier
	Abernethy Trib C 03a Abernethy Trib C 03b	County 10	Barrier
	Root 02a Root 02b	County 11	Barrier
	Root 03a Root 03b	County 12	Barrier
	Root 03b Root 03C	County 13	Barrier
	Abernethy 16a Abernethy 16b	County 14	Barrier

Subwatershed	Stream and Reach Location	Responsible for Inventory and ID Number	Fish Passage Status/Notes
Beaver			
	Parrott 05a Parrott 05b	ODFW 01	Not a barrier
	Cahill 01a Cahill 01b	County 15	Unknown
	Beaver 11a Beaver 11b	ODFW 02	Not a barrier
	Beaver Trib C 01a Beaver Trib C 01b	ODFW 06	Not a barrier
	Beaver Trib C Trib A 01a Beaver Trib C Trib A 01b	County 16	Unknown
	Beaver Trib D 01a Beaver Trib D 01b	ODFW 03	Not a barrier
	Beaver 15a Beaver 15b	ODFW 04	Not a barrier
	Beaver Trib E 01a Beaver Trib E 01b	County 17	Unknown
	Beaver Trib E 01b Beaver Trib E 01c	County 18	Unknown
	Beaver Trib F 01a Beaver Trib F 01b	County 19	Unknown
	Beaver 17a Beaver 17b	ODFW 05	Barrier
	Beaver 17b Beaver 17c	County 20	Unknown
	Beaver 17c Beaver 17d	County 21	Unknown

Focus Areas

- Hidden Lake water diversion dam on Abernethy Creek.
- Sevick Pond, lower Beaver Creek.
- Beaver Creek subwatershed.

Actions

- Assess fish passage at the Hidden Lake water diversion dam and identify options for addressing any issues.
- Assess fish passage, in combination with a comprehensive habitat assessment, in the Sevick Pond area and upstream; identify options for addressing any fish passage issues.
- Assess fish passage throughout the Beaver Creek subwatershed and identify options for addressing any fish passage issues. The fish passage assessment could be combined with the aquatic habitat inventory.

Partnerships

- ODFW
- Clackamas County

Improve Habitat in the Lower Portions of Abernethy Creek

Rationale

Backwatering of Abernethy Creek during high flows adds to the limited availability of off-channel habitat in the lower Willamette River and contributes to the success of fish spawned in other areas of the Willamette River basin. The loss of shallow, complex, off-channel habitat is a major limiting factor for salmon in the lower Willamette River. Restoration of urban streams, including Abernethy, Kellogg, Tryon, and Johnson creeks, is one of the few opportunities to improve this kind of habitat in the lower Willamette River. Potential habitat improvements to the backwater areas in Abernethy Creek would contribute to the recovery of listed coho and steelhead by increasing the extent and diversity of productive stream habitats that flow into the lower Willamette River.

The incised channel, limited complex pools, and minimal large wood in lower Abernethy Creek constrain the quality of seasonal rearing habitat. The channel incision has reduced stream access to the floodplain during flood events. The limited quantities of large wood in the channel, particularly long pieces in complex accumulations, and minimal stream connection to the floodplain have severely degraded fish habitat quality. Key reasons why it is important to pursue restoration actions in the lower Abernethy Creek area include the following:

- Most of lower Abernethy Creek is within Oregon City.
- During flood events, the Willamette River creates a backwater area in Abernethy Creek as far upstream as Holcomb Creek.
- Provides an important migration corridor for coho, steelhead and Pacific lamprey.
- Provides winter rearing for Willamette Basin salmon and steelhead populations during floods.
- Water quality issues include temperature, sedimentation, and stormwater runoff.
- Riparian vegetation composition is modified and the corridor is narrowed; weedy conditions prevail in many areas.
- The stream channel is incised and disconnected from the floodplain.
- Stream habitat is simplified with limited wood.

Focus Areas

- Lower Abernethy Creek (Figure 9).

Actions

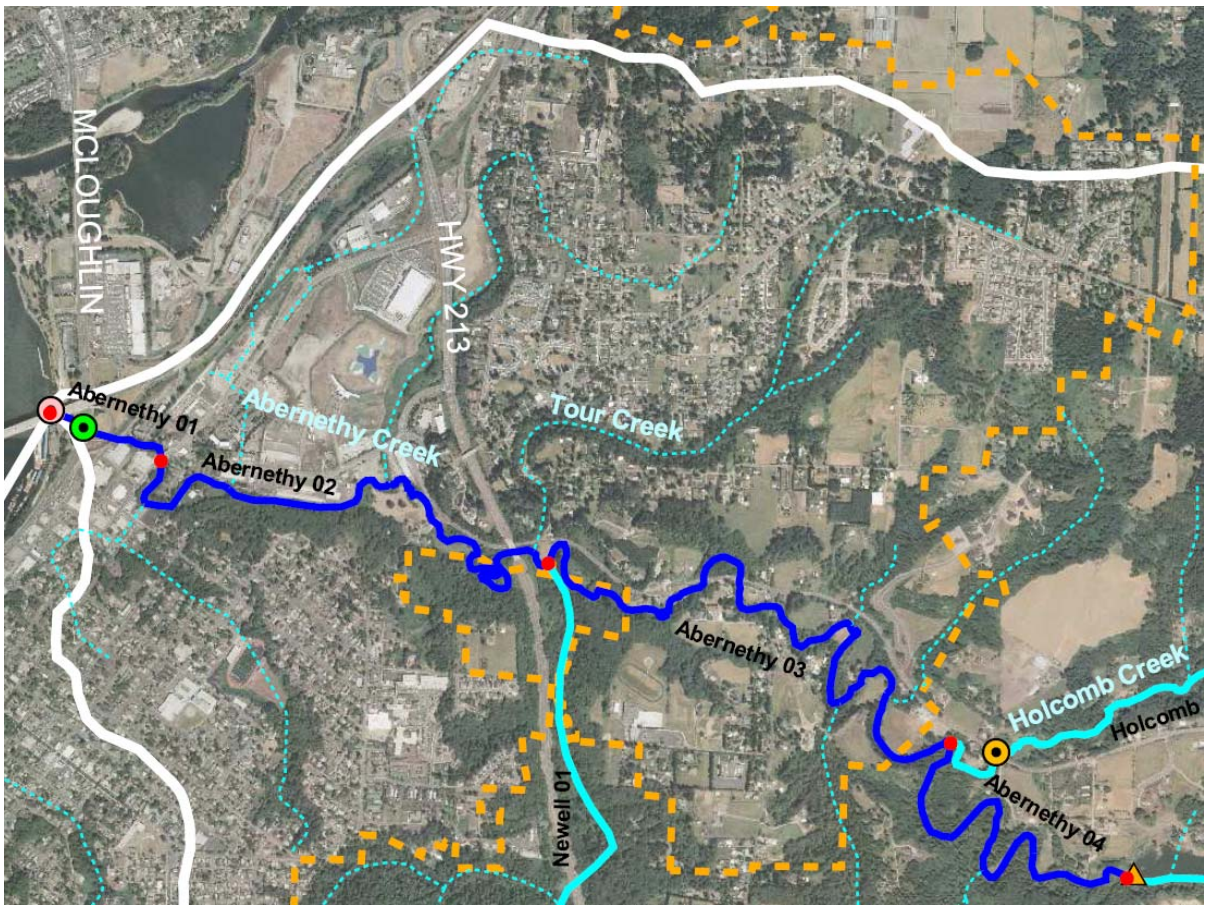
- Reconnect floodplain areas and add wood to the channel.
- Address stormwater issues in collaboration with Oregon City.

- Remove riparian weeds, plant native vegetation, and expand width of corridor.

Partnerships

- Oregon City

Figure 9. Lower Abernethy Creek Action Area.



Address Streamflows

Rationale

Withdrawing water from streams for agriculture, livestock, and other purposes can reduce streamflows and, in turn, affect the health of the aquatic environment. Reduced streamflows, particularly in the late summer and early fall when flows are naturally low, can increase water temperatures, reduce pool areas, and limit connectivity between stream habitats, all of which can adversely affect salmon, trout, and other aquatic organisms. The *Greater Oregon City Watershed Assessment* (ICF International 2010) found that water withdrawal activities were reducing low flows in Abernethy and Beaver creeks during the critical late summer and early fall period. It appears that the flow reductions are the greatest in Beaver Creek subwatershed, which includes Parrott Creek, although there is some uncertainty about the finding and it will need to be substantiated through

further assessment. With the recolonization of steelhead and Pacific lamprey in Beaver Creek, it is very important to understand and address the low flows in this system.

Voluntary incentives are in place to address water withdrawal issues, including temporary leasing of water rights. Water withdrawals, affected streamflows, and water rights are complex issues; the GOCWC should collaborate with OWRD to assess the water quantity issues in Beaver Creek subwatershed and develop a strategy for improving conditions during low-flow periods.

Focus Areas

- Beaver Creek subwatershed, including the Parrott Creek system (Figure 10).

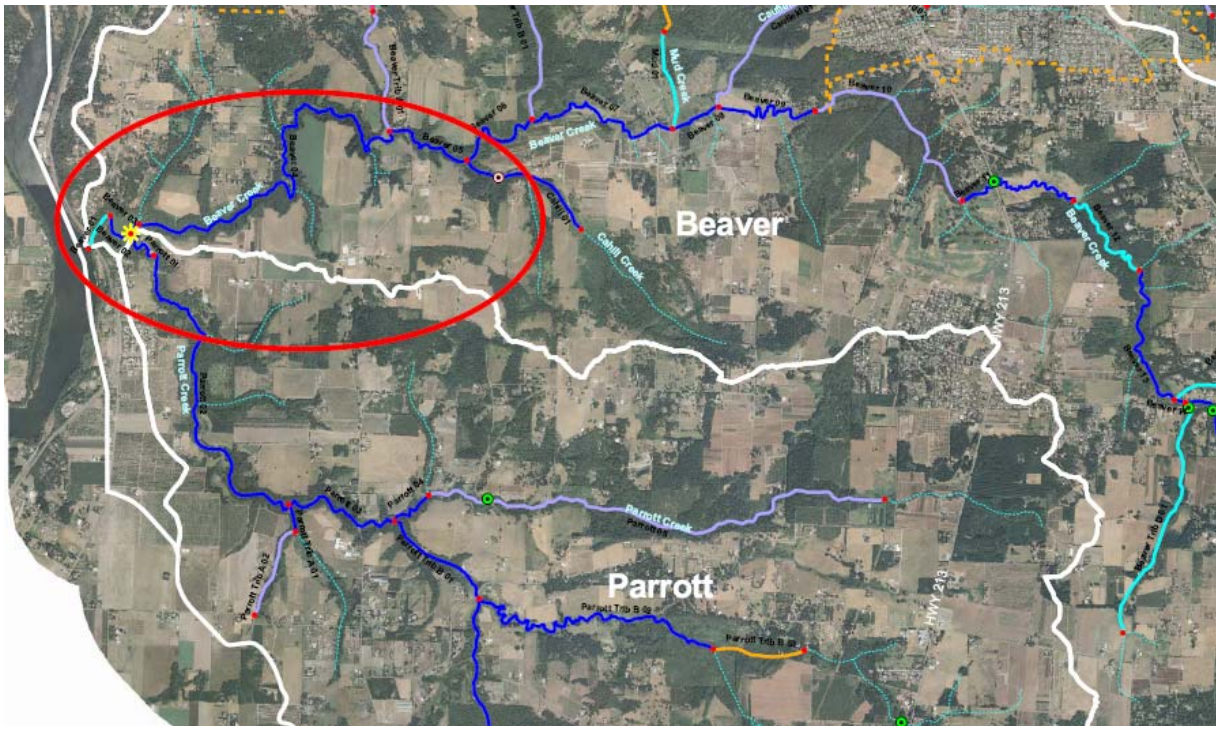
Actions

- Assess streamflow conditions and water right issues in collaboration with OWRD and ODFW.
- Develop a strategy, in collaboration with OWRD and ODFW, for addressing water withdrawals and maintaining adequate streamflows in.

Partnerships

- OWRD
- ODEQ
- Clackamas County Soil and Water Conservation District

Figure 10. The Beaver Creek Subwatershed and the Beaver and Parrott Creek Confluence Area



Education and Outreach to All Watershed Residents

Rationale

Successful restoration of the greater Oregon City watersheds depends on the goodwill, stewardship values, and participation of landowners and residents. Education and outreach builds community support and engages landowners and other residents in restoration projects. The watershed education and outreach effort complements all of the action plan strategies and actions, and serves as a tool for recruiting landowners and volunteers to participate in restoration projects.

The GOCWC can reach out to watershed residents through a variety of approaches including the following:

- Field tours of restoration activities
- Workshops and training on restoration activities and needs
- Speaking engagements with neighborhood groups and in other forums
- Printed and online informational materials to increase awareness on watershed issues and what individuals can do to improve the health of the watershed

Effective public education and outreach is a complex task. For that reason, it is recommended that the GOCWC develop a watershed education and outreach plan to guide its efforts. A number of Willamette Basin watershed councils have developed and implemented successful plans that can serve as examples. Development of the plan will take some time and in the interim, the GOCWC should continue to engage in outreach and education activities.

Focus areas

- Abernethy, Beaver, and Willamette Tributary subwatersheds.

Actions

- Engage in watershed outreach and education efforts in collaboration with partners.
- Develop an education and outreach plan and implement activities identified in the plan.

Partnerships

- Clackamas Soil and Water Conservation District
- Oregon City
- OWEB: grant funding
- SOLV

Project Phasing and Budgets

A number of factors control the GOCWC's capacity to plan and implement projects. It is anticipated that council staffing, project funding, and the ability to engage partner organizations and landowners will all increase over time. Figure 11 illustrates the proposed 10-year phasing of the action plan restoration strategies. Assessing baseline conditions and engaging landowners will help lay the foundation for future restoration actions.

Table 4 outlines year 1 action plan activities. The proposed activities will, by necessity, be modified based on grant funding levels, staffing, volunteer engagement, and landowner participation.

Figure 11. Restoration Action Plan Implementation Phasing

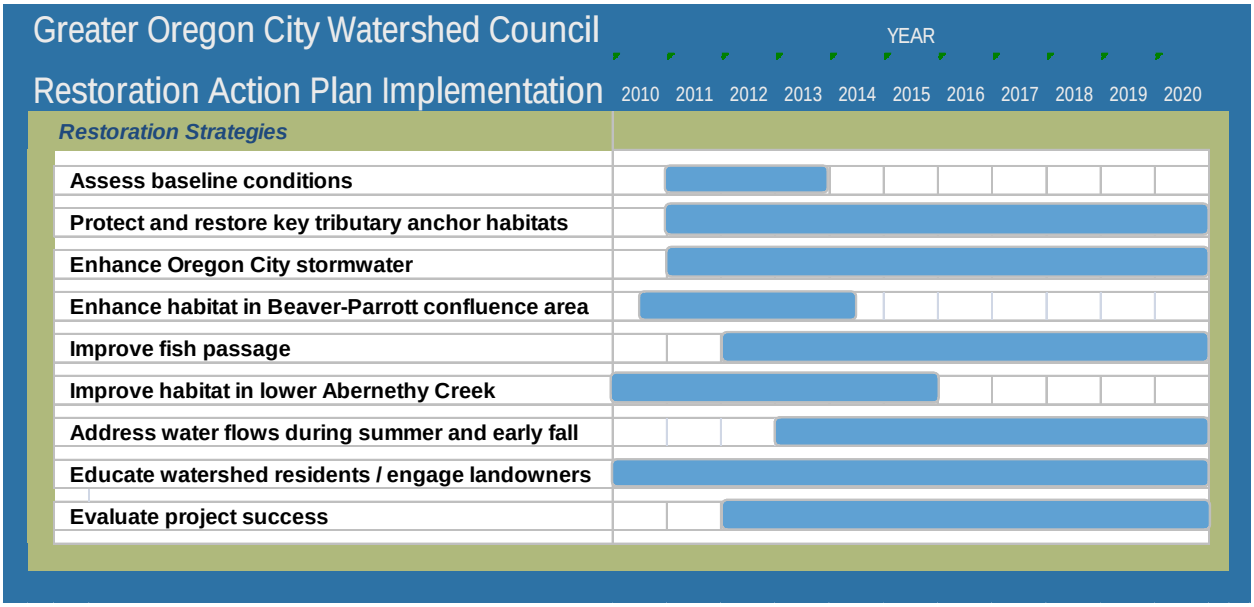


Table 4. Year 1 Restoration Action Plan Activities

Action Plan Component	Action	Estimated Cost	Notes
Protect and restore key tributary anchor habitats	Focus on Newell Creek and Holcomb Potter Creek systems		Work in partnership with Oregon City and Metro to identify restoration actions, volunteer activities, and public outreach approaches.
Assess baseline conditions	Aquatic habitat inventory (ODFW protocol)	$75,000	The Abernethy Creek subwatershed contains 38 miles of fish-bearing streams, 26 miles of which contain coho. The Beaver Creek subwatershed contains 32 miles of fish-bearing streams, though the extent of steelhead distribution is not known. The inventory will include assessing stream habitat, riparian conditions, and fish passage issues. ODFW aquatic habitat inventories cost approximately $1,500 per mile (Sanders pers. comm.). Estimated cost is for 50 miles of surveyed streams. Funding sources: OWEB; NOAA-Fisheries.
	Assess condition in the Sevick Pond Area	$50,000	Assess riparian conditions, sediment accumulation, and any potential fish passage barriers. Develop a channel, riparian and wetland restoration plan. Funding: DEQ EPA 319 program; OWEB; NOAA-Fisheries
	Assess fish passage at the Hidden Lake water diversion	$5,000	This dam should be examined by a fish passage specialist. If there is an issue, conceptual approaches to remedying the situation should be outlined. If a problem is identified, this assessment will lay the foundation for a grant to improve fish passage. Funding: OWEB; NOAA-Fisheries
Enhance habitat in Beaver-Parrott Confluence Area	Enhance habitat in the Sevick Pond Area	$60,000	Restore wetland, riparian, and channel habitats. Funding: OWEB
Improve habitat in lower Abernethy Creek	Cooperate with SOLV restoration project		Cooperate with SOLV on project implementation and public outreach. Plan landowner tours of the site.

Action Plan Component	Action	Estimated Cost	Notes
Watershed outreach & Education	Continue with ongoing outreach activities		Continue with current outreach activities, with an emphasis on geographic focus areas.
	Develop watershed outreach and education plan	$25,000	Develop a detailed public outreach and education plan in cooperation with Oregon City, Clackamas County SWCD and other partners. The plan should specify how outreach activities will help secure additional landowners to participate in restoration projects. Funding: DEQ EPA 319 program; OWEB.

References

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Oregon State Parks and Oregon Watershed Enhancement Board. 2008. 2005 Willamette River Aerial Photography with Public Lands, Land Trusts and Revetments. Available: <http://www.oweb.state.or.us/OWEB/publications.shtml>. Accessed: April 10, 2010.

Roni, P., T.J. Beechie, R.E. Bilby, F.E. Leonetti, M.M. Pollock, and G.R. Pess. 2002. A review of stream restoration techniques and a hierarchical strategy for prioritizing restoration in Pacific Northwest streams. *North American Journal of Fisheries Management* 22:1–20.

Sanders, Isaac. Fisheries Biologist. Oregon Department of Fish and Wildlife, Clackamas, OR. March 31, 2009—email.

Appendix A: Grant Funding Sources

Table A-1. Grant Funding Sources

Grant	Agency	Amount		Deadline	Website and Contact	Type of Projects Funded							
		Funds Available	Grant Range			Fish Passage	Water Quantity	Water Quality	Stormwater	Fish & Wildlife Habitat	Stream Restoration	Outreach & Education	Wetland Restoration
2010 Open Rivers Initiative	U.S. Department Commerce/NOAA	$6 Million	$100,000 – 3 Million	Nov 16	Steve Drescher; steve.j.drescher@noaa.gov http://www.nmfs.noaa.gov/habitat/restoration/projects_programs/crp/partners_funding/callforprojects3.html Also via grants.gov	X							
Oregon Watershed Enhancement Board (OWEB): Technical Assistance, Outreach, Education grants	Oregon Watershed Enhancement Board	$20 Million	$10,000–500,000		http://www.oregon.gov/OWEB/GRANTS/index.shtml Willamette Bain: Wendy Hudson 503-986-0061 wendy.hudson@state.or.us	X				X	X	X	X
North American Wetlands Conservation Act	U.S. Department of the Interior/ U.S. Fish and Wildlife Service		$1 Million	Mar, Jul & Oct	703-358-1784 or dbhc@fws.gov								X
Clean Water Act Section 319 Nonpoint Source Grant Program	Oregon Department of Environmental Quality		Varies	Varies	Lower Willamette Area: Doug Drake 503-229-5350 http://www.deq.state.or.us/wq/nonpoint/grants.htm			X	X		X	X	
Partners for Fish and Wildlife Program	U.S. Department of the Interior/ U.S. Fish and Wildlife Service	$9 Million	Up to $25,000	Sep 30	David Gordon: 703-358-2025 http://www07.grants.gov/search/search.do?&mode=VIEW&flag2006=false&oppId=47672					X	X		X
Whole Watershed Restoration Initiative	U.S. Department Commerce/NOAA		$20,000–100,000	Nov 20	Polly Hicks, 206-526-4861; polly.hicks@noaa.gov	X				X	X	X	
NOAA/American Rivers Partnership Funding	U.S. Department Commerce/NOAA		Up to $100,000	Apr & Nov	Jason Lehto, 206-526-4670; Jason.a.lehto@noaa.gov	X				X	X	X	



2017 Compliance Report

March 1, 2018

Public service
We are here to serve the public with the highest level of integrity.

Excellence
We aspire to achieve exceptional results

Teamwork
We engage others in ways that foster respect and trust.

Respect
We encourage and appreciate diversity in people and ideas.

Innovation
We take pride in coming up with innovative solutions.

Sustainability
We are leaders in demonstrating resource use and protection.

Metro's values and purpose

We inspire, engage, teach and invite people to preserve and enhance the quality of life and the environment for current and future generations.

If you picnic at Blue Lake or take your kids to the Oregon Zoo, enjoy symphonies at the Schnitz or auto shows at the convention center, put out your trash or drive your car – we've already crossed paths.

So, hello. We're Metro – nice to meet you.

In a metropolitan area as big as Portland, we can do a lot of things better together. Join us to help the region prepare for a happy, healthy future.

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Executive Summary

Metro's Urban Growth Management Functional Plan provides tools and guidance for local jurisdictions to implement regional policies and achieve the goals set out in the region's 2040 Growth Concept. The 2017 Compliance Report summarizes the status of compliance for each city and county in the region with the Metro Code requirements included in the Urban Growth Management Functional Plan and the Regional Transportation Functional Plan. Every city and county in the region is required if necessary to change their comprehensive plans or land use regulations to come into compliance with Metro Code requirements within two years of acknowledgement by the Oregon Land Conservation and Development Commission and to remain in compliance. The information in this report confirms the strong partnerships at work in this region to implement regional and local plans.

In 2017, there were no requests for extensions of existing compliance dates for the Urban Growth Management Functional Plan.

Previously, eleven jurisdictions had a deadline of December 31, 2014 to meet the requirements of the Regional Transportation Functional Plan. As described below and in Appendix D, two of these jurisdictions have requested extensions until 2015. Two have requested an extension to 2016. Two have requested an extension to 2017. All six of these jurisdictions were found to meet one of the two criteria: 1) the city or county is making progress towards compliance; or 2) there is good cause for failure to meet the deadline for compliance. Therefore, all of these extensions were granted by the Chief Operating Officer.

Metro Code Chapter 3.07 Urban Growth Management Functional Plan and Metro Code Chapter 3.08 Regional Transportation Functional Plan – March 2018

Introduction

Metro Code 3.07.870 requires the Chief Operating Officer to submit the status of compliance by cities and counties with the requirements of the Metro Code Chapter 3.07 (Urban Growth Management Functional Plan) annually to the Metro Council. In an effort to better integrate land use and transportation requirements, this compliance report includes information on local government compliance with the Regional Transportation Functional Plan (Metro Code Chapter 3.08) as well as the Urban Growth Management Functional Plan (UGMFP).

Overview

Per the Metro Code, the Chief Operating Officer (COO) may grant an extension request if a local government meets one of two criteria: 1) the city or county is making progress towards compliance; or 2) there is good cause for failure to meet the deadline for compliance.

By statute, cities and counties had two years following the date of acknowledgement of Metro's Regional Transportation Plan (RTP) in Summer 2014 to bring their Transportation System Plans (TSPs) into compliance with any new or changed regional requirements. However, Metro exercised its authority under the state's Transportation Planning Rule to extend city and county deadlines beyond the two-year statutory deadline. Metro consulted

with each city and county to determine a reasonable timeline for this work and adopted a schedule that is available on Metro's website at www.oregonmetro.gov/tsp. The deadlines are phased to take advantage of funding opportunities and the availability of local and Metro staff resources.

Appendix A summarizes the compliance status for all local governments with the requirements of the Urban Growth Management Functional Plan (UGMFP) by the end of 2017.

Appendix B shows the status of Title 11 new urban area planning for areas added to the Urban Growth Boundary (UGB) since 1998.

Appendix C summarizes the compliance dates for each UGMFP title.

Appendix D summarizes the compliance dates for the Regional Transportation Functional Plan (RTFP) in effect as of December 31, 2017.

Appendix E is the Annual Report on Amendments to the Title 4 Employment and Industrial Areas Map dated January 8, 2018.

Urban Growth Management Functional Plan Compliance Status

All jurisdictions are in compliance with the Urban Growth Management Functional Plan.

Portland: After a four-year update process, the new 2035 Comprehensive Plan was adopted on June 15, 2016. Portland's Comprehensive Plan is a long-range plan that helps the City prepare for and manage expected population and employment growth, as well as plan for and coordinate major public investments. The package of Early Implementation projects includes changes to the Zoning Map, the Zoning Code, and other documents to implement the new Comprehensive Plan which was adopted on December 21, 2016. With adoption, all phases of the Comprehensive Plan Update project are completed, and the entire plan is now with the state Department of Land Conservation and Development (DLCD). Pending DLCD review and acknowledgment, the new plan will take effect May 24, 2018 at 1:00 p.m., replacing Portland's first comprehensive plan adopted in 1980 and updated many times since.

Metro's jurisdiction dropped from three counties and 25 cities to 24 cities after the dissolution of the City of Damascus. Residents of the City of Damascus voted for disincorporation on May 17, 2016. Formal disincorporation occurred on July 18, 2016. Damascus's lands, businesses and former city residents have reverted to Clackamas County's jurisdiction, as was the case prior to the city's incorporation in 2004. Metro staff continue to work with Clackamas County and Happy Valley to ensure that the former Damascus area is planned in compliance with regional requirements.

Regional Transportation Functional Plan Compliance Status

Previously, five jurisdictions had the deadline of December 31, 2015 to meet the requirements of the Regional Transportation Functional Plan. As described below and in Appendix D, two of those jurisdictions requested an extension to 2017 – Gladstone and

Hillsboro. Both of these jurisdictions were found to meet one of the following two criteria; 1) The city or county is making progress towards compliance; or 2) There is good cause for failure to meet the deadline for compliance. Therefore, these extensions were granted by the Chief Operating Officer.

Two jurisdictions, Fairview and Portland, completed their Transportation System Plan and development code updates in 2016 and are now in compliance with the RTFP. Metro sent the City of Portland a letter telling them they were in compliance on December 20, 2016. Portland will finalize performance measures and the packaging of the final TSP by April 2018. This stage of TSP completion was delayed due to the delay of the city's Comprehensive Plan.

Jurisdictions with 2015 deadlines that requested extensions until 2017/18

Cornelius: In 2016, the City was awarded a grant from the TGM program. They are scheduled to complete their TSP update by May 2018.

Gladstone: The City was awarded a grant through the TGM program to complete a TSP update. The City Council adopted their TSP on November 28, 2017.

Hillsboro: The City expects to adopt their TSP by Summer 2018.

Wood Village: The City was awarded a grant from the TGM program to complete a town center concept plan and complete their TSP. Wood Village finalized their town center concept and adopted their TSP on June 27, 2017.

APPENDIX A

Summary of Compliance Status as of December 31, 2017
(Functional Plan effective 1/18/12)

City/ County	Title 1 Housing Capacity	Title 3 Water Quality & Flood Management	Title 4 Industrial and other Employment Land	Title 6[1] Centers, Corridors, Station Communities & Main Streets	Title 7 Housing Choice	Title 11 Planning for New Urban Areas (see Appendix B for detailed information)	Title 13 Nature in Neighborhoods
Beaverton	In compliance	In compliance	In compliance	See footnote	In compliance	In compliance	In compliance
Cornelius	In compliance	In compliance	In compliance	See footnote	In compliance	In compliance	In compliance
Durham	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Fairview	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Forest Grove	In compliance	In compliance	In compliance	See footnote	In compliance	In compliance	In compliance
Gladstone	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Gresham	In compliance	In compliance	In compliance	See footnote	In compliance	In compliance	In compliance
Happy Valley	In compliance	In compliance	In compliance	See footnote	In compliance	In compliance	In compliance
Hillsboro	In compliance	In compliance	In compliance	See footnote	In compliance	In compliance	In compliance
Johnson City	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
King City	In compliance	In compliance	In compliance	See footnote	In compliance	In compliance	In compliance
Lake Oswego	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Maywood Park	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Milwaukie	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Oregon City	In compliance	In compliance	In compliance	See footnote	In compliance	In compliance	In compliance

[1] Title 6 is an incentive approach and only those local governments wanting a regional investment (currently defined as a new high-capacity transit line) will need to comply.

City/ County	Title 1 Housing Capacity	Title 3 Water Quality & Flood Management	Title 4 Industrial and other Employment Land	Title 6[1] Centers, Corridors, Station Communities & Main Streets	Title 7 Housing Choice	Title 11 Planning for New Urban Areas (see Appendix B for detailed information)	Title 13 Nature in Neighborhoods
Portland	In compliance	In compliance	In compliance	See footnote	In compliance	In compliance	In compliance
Rivergrove	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Sherwood	In compliance	In compliance	In compliance	See footnote	In compliance	Area 61 extended to 12/31/21*	In compliance
Tigard	In compliance	In compliance	In compliance	See footnote	In compliance	In compliance.	In compliance
Troutdale	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Tualatin	In compliance	In compliance	In compliance	See footnote	In compliance	Basalt Creek extended to 9/1/2019	In compliance
West Linn	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Wilsonville	In compliance	In compliance	In compliance	See footnote	In compliance	Basalt Creek extended to 9/1/2019	In compliance
Wood Village	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Clackamas County	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Multnomah County	In compliance	In compliance	In compliance	See footnote	In compliance	Not applicable	In compliance
Washington County	In compliance	In compliance	In compliance	See footnote	In compliance	North Cooper Mountain not in compliance	In compliance

*The City of Tualatin requested that the City of Sherwood take over concept planning for Area 61 Title 11 planning in 2012.

[1] Title 6 is an incentive approach and only those local governments wanting a regional investment (currently defined as a new high-capacity transit line) will need to comply.

APPENDIX B
TITLE 11 NEW AREA PLANNING COMPLIANCE
(As of December 31, 2017)

Project	Lead Government(s)	Compliance	Status
1998 UGB Expansion			
Rock Creek Concept Plan	Happy Valley	Yes	Concept plan and implementation measures completed; development on-going.
Pleasant Valley Concept Plan	Gresham and Portland	Yes	Concept plan and implementation measures completed; city annexed 524 acres and development to begin in eastern section.
1999 UGB Expansion			
Witch Hazel Community Plan	Hillsboro	Yes	Concept plan and implementation measures completed; development on-going.
2000 UGB Expansion			
Villebois Village	Wilsonville	Yes	Concept plan and implementation measures completed; development on-going.
2002 UGB Expansion			
Springwater Community Plan	Gresham	Yes	Concept plan and implementation measures completed for this mostly industrial area; waiting annexation & development.
Damascus/Boring Concept Plan	Happy Valley	Yes	HV portion: Concept plan and implementation measures completed; waiting annexation and development.
	Happy Valley/ Clackamas County	No	The former City of Damascus land area.
	Gresham	Yes	Gresham portion, called Kelley Creek Headwaters Plan, was adopted by city in 2009.
Park Place Master Plan	Oregon City	Yes	Concept plan and implementation measures completed; waiting annexation & development.
Beavercreek Road	Oregon City	Yes	Concept plan completed and accepted by Metro.
South End Road	Oregon City	Yes	Concept plan and implementation measures completed.
East Wilsonville (Frog Pond area)	Wilsonville	Yes	CPDG grant awarded in 2013. Concept plan completed in December 2015 as part of Phase I of the grant. Phase II of the grant will focus on the creation of a Master Plan along with Comprehensive Map designation.
NW Tualatin Concept Plan (Cipole Rd & 99W)	Tualatin	Yes	Concept plan and implementation measures completed for this small industrial area.
SW Tualatin Concept Plan	Tualatin	Yes	Concept plan and implementation measures completed for this industrial area.
Brookman Concept Plan	Sherwood	Yes	Concept Plan and implementation measures completed; waiting development.
West Bull Mountain (River Terrace)	Tigard	Yes	Combined with Roy Rogers West (2011); development ongoing.
Study Area 59	Sherwood	Yes	Concept plan and implementation measures completed; school constructed.
Study Area 61 (Cipole Rd	Sherwood	Extension to 12/31/2021	Extension agreement – planning shall be completed when Urban Reserve 5A is completed, or by 12/31/2021, whichever is sooner.
99W Area (near Tualatin-Sherwood Rd)	Sherwood	Yes	Concept plan and implementation measures completed.

Project	Lead Government(s)	Compliance	Status
Cooper Mountain area	Washington County	No	Preliminary planning completed by City of Beaverton. Community plan pending Washington County work program.
Study Area 64 (14 acres north of Scholls Ferry Rd)	Beaverton	Yes	Concept plan and implementation measures completed; annexed to City.
Study Area 69 & 71	Hillsboro	Yes	Areas are included in South Hillsboro Area Plan. City has adopted these areas into its comprehensive plan; upon annexation, they will be zoned to comply with comp plan.
Study Area 77	Cornelius	Yes	Concept plan and implementation measures completed; annexed to City.
Forest Grove Swap	Forest Grove	Yes	Concept plan and implementation measures completed; annexed to City.
Shute Road Concept Plan	Hillsboro	Yes	Concept plan and implementation measures completed; annexed to City and portion developed with Genentech.
North Bethany Subarea Plan	Washington County	Yes	Concept plan and implementation measures completed; annexations underway with development occurring.
Bonny Slope West Concept Plan (Area 93)	Multnomah County	Yes	Planning completed.
2004/2005 UGB Expansion			
Damascus area	Damascus	See under 2002 above	Included with Damascus comprehensive plan (see notes above).
Tonquin Employment Area	Sherwood	Yes	Concept plan and implementation measures completed.
Basalt Creek/West RR Area Concept Plan	Tualatin and Wilsonville	IGA extension to 10/2019; CET extension to 6/30/18	Work continues on concept planning. Cities to agree to the concept plan by 12/31/17. Comprehensive plan and/or zoning map amendments to be complete 6/30/18.
N. Holladay Concept Plan	Cornelius	Yes	Concept plan completed; implementation to be finalized after annexation to City.
Evergreen Concept Plan	Hillsboro	Yes	Concept plan and implementation measures completed.
Helvetia Concept Plan	Hillsboro	Yes	Concept plan and implementation measures completed.
2011 UGB Expansion			
North Hillsboro	Hillsboro	Yes	Concept planning completed. Awaits annexation to city.
South Hillsboro	Hillsboro	Yes	Concept planning completed. Awaits annexation to city.
South Cooper Mountain	Beaverton	Yes	Concept planning completed.
Roy Rogers West (River Terrace)	Tigard	Yes	See West Bull Mountain.

2014 UGB Expansion (HB 4078)	Lead Government(s)	Compliance	Status
Cornelius North	Cornelius	Yes	Comprehensive planning completed. Awaits annexation to city.
Cornelius South	Cornelius	Yes	Comprehensive planning completed. Partially annexed to city.
Forest Grove (Purdin Road)	Forest Grove	Yes	Comprehensive plan work in progress. CPDG Cycle 3.
Forest Grove (Elm Street)	Forest Grove	Yes	Comprehensive plan work in progress. CPDG Cycle 3.
Hillsboro (Jackson School)	Hillsboro	No	Comprehensive plan work scheduled. CPDG Cycle 4.

APPENDIX C
COMPLIANCE DATES FOR THE
URBAN GROWTH MANAGEMENT FUNCTIONAL PLAN

Functional Plan Requirement	When Local Decisions Must Comply		
	Plan/Code Amendment 3.07.810(C)[1]	**Land Use Decision** 3.07.810(D)[2]	**Adoption** 3.07.810(B)[3]
Title 1: Adopt minimum dwelling unit density (3.07.120.B)	12/21/2013	12/21/2013	12/21/2014
Title 1: Allow accessory dwelling unit in SFD zones (3.07.120.G) *(provision included in previous version of Metro Code as 3.07.140.C)*	12/8/2000		12/8/2002
Title 3: Adopt model ordinance or equivalent and map or equivalent (3.07.330.A)	12/8/2000		12/8/2002
Title 3: Floodplain management performance standards (3.07.340.A)	12/8/2000	12/8/2001	12/8/2002
Title 3: Water quality performance standards (3.07.340.B)	12/8/2000	12/8/2001	12/8/2002
Title 3: Erosion control performance standards (3.07.340.C)	12/8/2000	12/8/2001	12/8/2002

[1] After one year following acknowledgment of a UGMFP requirement, cities and counties that amend their plans and land use regulations shall make such amendments in compliance with the new functional plan requirement.
[2] A city or county that has not yet amended its plan to comply with a UGMFP requirement must, following one year after acknowledgement of the requirement (the date noted), apply the requirement directly to land use decisions
[3] Cities and counties must amend their plans to comply with a new UGMFP requirement within two years after acknowledgement of the requirement (the date noted)

Functional Plan Requirement	When Local Decisions Must Comply		
	Plan/Code Amendment 3.07.810(C)[1]	**Land Use Decision** 3.07.810(D)[2]	**Adoption** 3.07.810(B)[3]
Title 4: Limit uses in Regionally Significant Industrial Areas (3.07.420)	7/22/2005	7/22/2006	7/22/2007
Title 4: Prohibit schools, places of assembly larger than 20,000 square feet, or parks intended to serve people other than those working or residing in the area in Regional Significant Industrial Areas (3.07.420D)	12/21/2013	12/21/2013	12/21/2014
Title 4: Limit uses in Industrial Areas (3.07.430)	7/22/2005	7/22/2006	7/22/2007
Title 4: Limit uses in Employment Areas (3.07.440)	7/22/2005	7/22/2006	7/22/2007
Title 6: (Title 6 applies only to those local governments seeking a regional investment or seeking eligibility for lower mobility standards and trip generation rates)	12/21/12	12/2113	12/21/14
Title 7: Adopt strategies and measures to increase housing opportunities (3.07.730)			6/30/2004
Title 8: Compliance Procedures (45-day notice to Metro for amendments to a comprehensive plan or land use regulation) (3.07.820)	2/14/2003		
Title 11: Develop a concept plan for urban reserve prior to its addition to the UGB (3.07.1110)	N/A	N/A	N/A

Functional Plan Requirement	When Local Decisions Must Comply		
	Plan/Code Amendment 3.07.810(C)[1]	**Land Use Decision** 3.07.810(D)[2]	**Adoption** 3.07.810(B)[3]
Title 11: Prepare a comprehensive plan and zoning provisions for territory added to the UGB (3.07.1120)	12/8/2000	12/8/2001	2 years after the effective date of the ordinance adding land to the UGB unless the ordinance provides a later date
Title 11: Interim protection for areas added to the UGB (3.07.1130) *(provision included in previous version of Metro Code as 3.07.1110)*	12/8/2000	12/8/2001	12/8/2002
Title 12: Provide access to parks by walking, bicycling, and transit (3.07.1240.B)			7/7/2005
Title 13: Adopt local maps of Habitat Conservation Areas consistent with Metro-identified HCAs (3.07.1330.B)	12/28/2005	1/5/2008	1/5/2009
Title 13: Develop a two-step review process (Clear & Objective and Discretionary) for development proposals in protected HCAs (3.07.1330.C & D)	12/28/2005	1/5/2008	1/5/2009
Title 13: Adopt provisions to remove barriers to, and encourage the use of, habitat-friendly development practices (3.07.1330.E)	12/28/2005	1/5/2008	1/5/2009

APPENDIX D

Summary of Compliance Status for 2017
(Regional Transportation Functional Plan in effect as of 12/31/2014)

Jurisdiction	Title 1 Transportation System Design	Title 2 Development and Update of Transportation System Plans	Title 3 Transportation Project Development	Title 4 Regional Parking Management	Title 5 Amendment of Comprehensive Plans
Beaverton	In compliance	In compliance	In compliance	In compliance	In compliance
Cornelius	12/31/16*	12/31/16*	12/31/16*	12/31/16*	12/31/16*
Durham	Exempt	Exempt	Exempt	Exempt	Exempt
Fairview	In compliance	In compliance	In compliance	In compliance	In compliance
Forest Grove	In compliance	In compliance	In compliance	In compliance	In compliance
Gladstone	In compliance	In compliance	In compliance	In compliance	In compliance
Gresham	In compliance	In compliance	In compliance	In compliance	In compliance
Happy Valley	In compliance	In compliance	In compliance	In compliance	In compliance
Hillsboro	12/31/17*	12/31/17*	12/31/17*	12/31/17*	12/31/17*
Johnson City	Exempt	Exempt	Exempt	Exempt	Exempt
King City	Exempt	Exempt	Exempt	Exempt	Exempt
Lake Oswego	In compliance	In compliance	In compliance	In compliance	In compliance
Maywood Park	Recommending exemption	Recommending exemption	Recommending exemption	Recommending exemption	Recommending exemption
Milwaukie	In compliance	In compliance	In compliance	In compliance	In compliance
Oregon City	In compliance	In compliance	In compliance	In compliance	In compliance
Portland	In compliance	In compliance	In compliance	In compliance	In compliance
Rivergrove	Exempt	Exempt	Exempt	Exempt	Exempt
Sherwood	In compliance	In compliance	In compliance	In compliance	In compliance
Tigard	In compliance	In compliance	In compliance	In compliance	In compliance
Troutdale	In compliance	In compliance	In compliance	Exception	In compliance
Tualatin	In compliance	In compliance	In compliance	In compliance	In compliance
West Linn	In compliance	In compliance	In compliance	In compliance	In compliance
Wilsonville	In compliance	In compliance	In compliance	In compliance	In compliance
Wood Village	In compliance	In compliance	In compliance	In compliance	In compliance
Clackamas County	In compliance	In compliance	In compliance	In compliance	In compliance
Multnomah County	12/31/17	12/31/17	12/31/17	12/31/17	12/31/17
Washington County	In compliance	In compliance	In compliance	In compliance	In compliance

Date shown in table is the deadline for compliance with the Regional Transportation Functional Plan (RTFP). Note – a city or county that has not yet amended its plan to comply with the RTFP must, following one year after RTFP acknowledgement, apply the RTFP directly to land use decisions.

**Expected completion date Summer 2018.*

Metro
600 NE Grand Ave.
Portland, OR 97232-2736

Memo

Date: January 8, 2018
To: Metro Council and the Metro Policy Advisory Committee
From: Martha Bennett, Chief Operating Officer
Subject: Annual report on amendments to the Title 4 Employment and Industrial Areas Map

Background
Title 4 (Industrial and Other Employment Areas) of the Urban Growth Management Functional Plan seeks to improve the region's economy by protecting a supply of sites for employment by limiting the types and scale of non-industrial uses in Regionally Significant Industrial Areas, Industrial Areas, and Employment Areas. Those areas are depicted on the Employment and Industrial Areas Map.

Title 4 sets forth several avenues for amending the map, either through a Metro Council ordinance or through an executive order, depending on the circumstances. Title 4 requires that, by January 31 of each year, Metro's Chief Operating Officer submit a written report to the Council and MPAC on the cumulative effects on employment land in the region of amendments to the Employment and Industrial Areas Map during the preceding year. This memo constitutes the report for 2017.

Title 4 map amendments in 2017
There were no amendments made to the Title 4 Map in 2017 either by the Council or through executive order.

Chief Operating Officer recommendations
I do not, at this time, recommend changes to Title 4 policies.

Highway 213/Beavercreek Road Improvements Project
Stormwater Fact Sheet

The Highway 213 and Beavercreek Road intersection improvements include additional traffic lanes, bike lanes, sidewalks, street lighting, landscaping and utility replacement. The project is located in the Newell Creek watershed with headwaters near Clackamas Community College that flow down Newell Canyon. Newell Creek drains into Abernethy Creek, a tributary to the Willamette River.

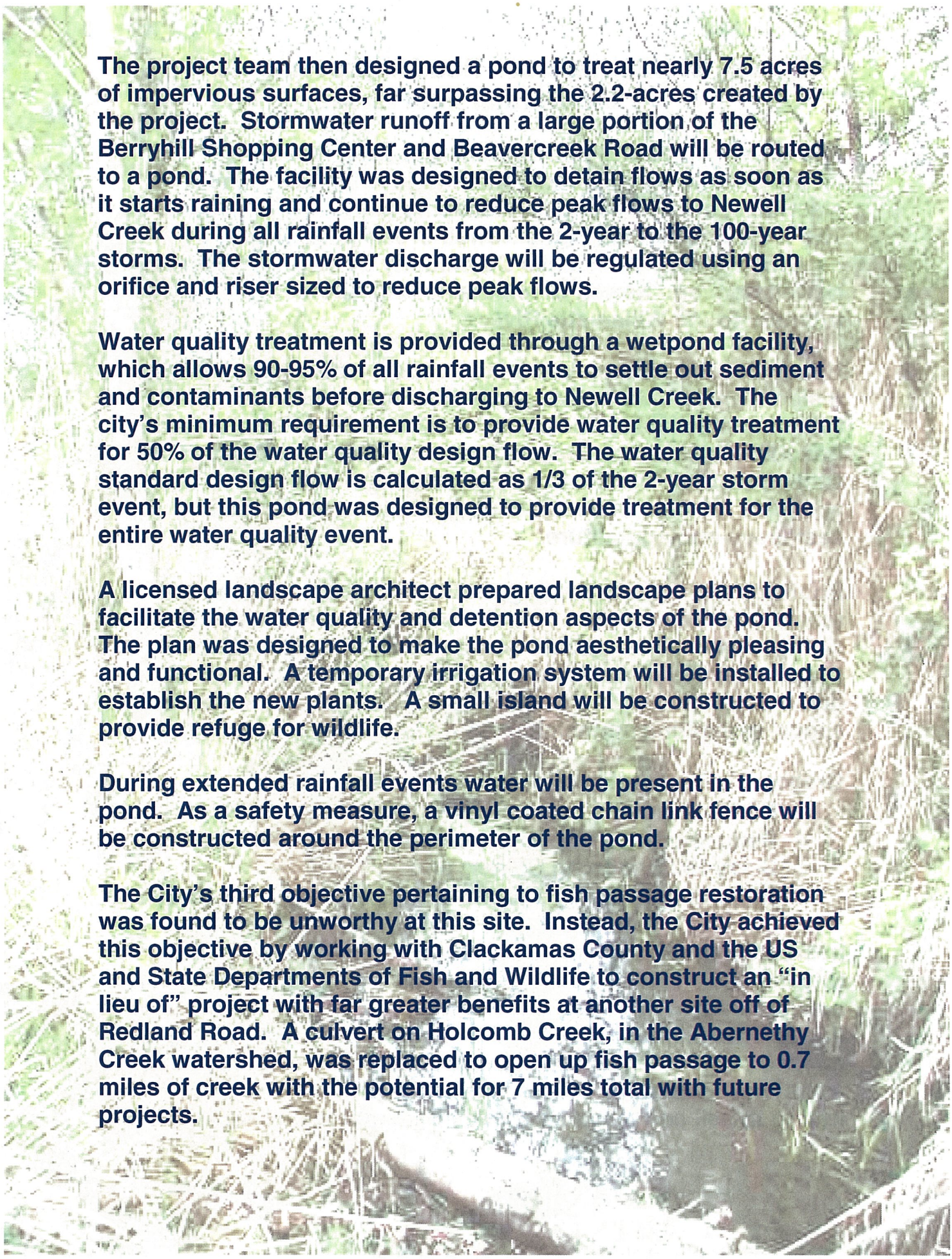
Newell Creek has been known to support native populations of resident and anadromous fish, including coho salmon, cutthroat trout and steelhead. The creek is a Goal 5 Significant Natural Resource Area under Oregon Statewide Planning Goals. As such, the stream needs to be protected and managed at a level adequate for fish, wildlife, pollution abatement, recreation, aesthetics and agriculture.

Rooftops and asphalt in Oregon City's Hilltop and Berry Hill areas speed up how fast rainfall flows to Newell Creek. This changes the natural stream flow and can adversely affect all stages of fish life, particularly juveniles which can be swept downstream during high flows. In addition, stream banks can be scoured resulting in unstable slopes.

Oregon City's objectives for the project included:

- Protect Newell Canyon from the project stormwater runoff;
- Reduce adverse stormwater impacts from the existing Berry Hill Shopping Center; and
- Restore fish passage to the area upstream of Highway 213.

In order to provide stormwater treatment and detention Oregon City needed a stormwater management facility within the project area that would be capable of managing the target stormwater flows. This included slowing the runoff and treating the water to remove pollutants found in stormwater. The project team found a site that consisted of three properties where the owners were willing to sell and move from busy Beavercreek Road.



The project team then designed a pond to treat nearly 7.5 acres of impervious surfaces, far surpassing the 2.2-acres created by the project. Stormwater runoff from a large portion of the Berryhill Shopping Center and Beavercreek Road will be routed to a pond. The facility was designed to detain flows as soon as it starts raining and continue to reduce peak flows to Newell Creek during all rainfall events from the 2-year to the 100-year storms. The stormwater discharge will be regulated using an orifice and riser sized to reduce peak flows.

Water quality treatment is provided through a wetpond facility, which allows 90-95% of all rainfall events to settle out sediment and contaminants before discharging to Newell Creek. The city's minimum requirement is to provide water quality treatment for 50% of the water quality design flow. The water quality standard design flow is calculated as 1/3 of the 2-year storm event, but this pond was designed to provide treatment for the entire water quality event.

A licensed landscape architect prepared landscape plans to facilitate the water quality and detention aspects of the pond. The plan was designed to make the pond aesthetically pleasing and functional. A temporary irrigation system will be installed to establish the new plants. A small island will be constructed to provide refuge for wildlife.

During extended rainfall events water will be present in the pond. As a safety measure, a vinyl coated chain link fence will be constructed around the perimeter of the pond.

The City's third objective pertaining to fish passage restoration was found to be unworthy at this site. Instead, the City achieved this objective by working with Clackamas County and the US and State Departments of Fish and Wildlife to construct an "in lieu of" project with far greater benefits at another site off of Redland Road. A culvert on Holcomb Creek, in the Abernethy Creek watershed, was replaced to open up fish passage to 0.7 miles of creek with the potential for 7 miles total with future projects.

PRIOR TO CONSTRUCTION

Holcomb Creek Culvert Replacement Project

2002—2003



From culvert inlet opening, looking downstream through the 6'x 6' concrete box culvert

Looking downstream through 6'x 6' concrete box culvert Outlet perched over 1.5', creating fish passage barrier. Downstream weirs in background.





Looking upstream (culvert at right edge of photo) series of downstream weirs

POST CONSTRUCTION

Holcomb Creek Culvert Replacement Project

FALL 2003



From culvert inlet opening, looking downstream through the multi-plate arched culvert.
Culvert is embedded 2 feet below thalweg with native material and fish habitat rocks.



From culvert outlet, looking upstream through the multi-plate arched culvert. Downstream weirs are removed and channel re-graded.



Culvert outlet view from road surface

DURING CONSTRUCTION

Holcomb Creek Culvert Replacement Project

SUMMER 2003





Fish Salvage Results: July 31 to August 1, 2003

Species	Upstream of Culvert	Downstream of Culvert
Coho salmon – juvenile	0	47
Cutthroat trout	5	8
Salmonid (unidentified) – juvenile[1]	1	
Pacific lamprey – adult	0	3
Pacific lamprey – juvenile	0	12
Western brook lamprey – juvenile	3	9
Redside shiner	0	1
Sculpin (Cottus sp.)	20	127
Crayfish	1	39
Pacific giant salamander	1	0
Frog - unidentified (not red legged)	0	1

[1] Unable to accurately identify due to small size (approx. 1 inch).



Assembling Multi-plate Arch culvert while stream is being diverted following fish salvaging operation.

METRO'S PHASE I ESEE ANALYSIS
April 2005

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METRO
People places • open spaces
Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy, and good transportation choices for people and businesses in our region. Voters have asked Metro to help with the challenges that cross those lines and affect the 24 cities and three counties in the Portland metropolitan area.

A regional approach simply makes sense when it comes to protecting open space, caring for parks, planning for the best use of land, managing garbage disposal, and increasing recycling. Metro oversees world-class facilities such as the Oregon Zoo, which contributes to conservation and education, and the Oregon Convention Center, which benefits the region's economy.

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CHAPTER 1: INTRODUCTION

Purpose and Objectives

Metro's authority to plan for fish and wildlife habitat protection in the region derives from State Land Use Planning Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces. The Goal 5 administrative rule (OAR 660-023) recognizes Metro's unique planning role and gives Metro the option to develop a functional plan to protect regionally significant fish and wildlife habitat[1] (OAR 660-023-080(3)). In 1996 the Metro Council voted to recognize the regional significance of fish and wildlife habitat and include protection in the functional plan.

In October 2000, the Metropolitan Policy Advisory Committee (MPAC) approved a vision for fish and wildlife habitat protection for the region, which was adopted by the Metro Council.

> The overall goal is to conserve, protect and restore a continuous ecologically viable streamside corridor system, from the streams' headwaters to their confluence with others streams and rivers, and with their floodplains in a manner that is integrated with the surrounding urban landscape. This system will be achieved through conservation, protection and appropriate restoration of streamside corridors through time. (Metro 2000)

In achieving the overall goal, the vision statement emphasizes the importance of balancing several goals, including livable communities and a strong economy with protection and enhancement of fish and wildlife habitat. Integrating the needs of people with the needs of fish and wildlife in an urban environment is not an easy task. There is debate on the value of protecting habitat in urban and developing areas, considering the difficulty many species have cohabiting with humans and the economic value of developable land in urban areas. Metro's policies have consistently placed a high level of importance on the protection of the natural environment as a means of maintaining the high quality of life citizens of this region expect.

The general economic, social, environmental, and energy (ESEE) tradeoffs of allowing, limiting, and prohibiting conflicting uses in fish and wildlife habitat areas are described in this report. The next step of Metro's planning process is to identify the specific ESEE tradeoffs of several program options, after which the Metro Council will make a decision to allow, limit, or prohibit conflicting uses in fish and wildlife habitat areas.

Description of the Goal 5 ESEE process

The Goal 5 process follows three steps. The first step is to identify regionally significant fish and wildlife habitat, which Metro completed in 2002. The economic, social, environment and energy (ESEE) analysis is the second step. Metro is now completing the first phase of a regional ESEE analysis. Metro will next apply the tradeoffs identified in the first phase of the analysis to several options for protection to evaluate where and how to protect fish and wildlife habitat. This will provide the Metro Council the information they need to make a decision about where development should be allowed, limited, or prohibited. The third step is to develop a program to

[1] In this report, when we use the term "fish and wildlife habitat" we are referring to "regionally significant fish and wildlife habitat" as identified in Metro's Goal 5 Inventory.

protect significant fish and wildlife habitat. After Metro adoption, local cities and counties will have 2-4 years to comply with the regional fish and wildlife habitat protection program.

Oregon State Planning Goal 5 requires an analysis of the economic, social, environmental, and energy (ESEE) consequences that could result from a decision to allow, limit, or prohibit conflicting uses in fish and wildlife habitat. The rule requires that this analysis be completed before actions are taken to protect or not protect any regionally identified fish and wildlife habitat. Specifically, the rule requires the following steps:

1. Identify conflicting uses;
2. Determine the impact area;
3. Analyze the ESEE consequences; and
4. Develop a program to achieve Goal 5.

First, governments must identify conflicting uses that exist, or could occur, with regard to significant Goal 5 resource sites (fish and wildlife habitat). A conflicting use is a land use or activity that may negatively impact fish and wildlife habitat. Second, the rule requires a determination of the impact area, representing the extent to which land uses or activities in areas adjacent to habitat could negatively impact the habitat. The impact area identifies the geographic limits within which to conduct the ESEE analysis for significant fish and wildlife habitat. Third, the ESEE consequences analysis considers the impact of a decision to either fully protect fish and wildlife habitat, fully allow conflicting uses, or limit the conflicting uses. Jurisdictions that choose to limit conflicting uses must do so in a way that "protects the resource to the desired extent." The standards identified by the state for completing the ESEE analysis are procedural rather than substantive. Findings must show that the steps of the ESEE analysis are met, but OAR 660-23-040 states that: "[t]he ESEE analysis need not be lengthy or complex, but should enable reviewers to gain a clear understanding of the conflicts and consequences to be expected."

Regional policies guide Metro's ESEE analysis

Metro's role in identifying fish and wildlife habitat protection measures and incentives within its boundary has been established with adoption of the *Regional Urban Growth Goals and Objectives (RUGGOs), Region 2040 Growth Concept* and the *Urban Growth Management Functional Plan*. Fish and wildlife habitat, by their very nature, cross jurisdictional boundaries and require management through regional, watershed-wide protection strategies. Metro has a role in working with local jurisdictions to determine the protection of these important habitats, just as it determines parking standards, transportation networks and land use densities for the region. Through extensive public involvement, the Metro Council has identified the need to balance natural resource protection with urban development while the region grows.

The Metro Council has adopted several policies following the direction of citizens that influence the ESEE consequences analysis. These policies provide the framework for protecting natural resources while managing urban growth in the region. Fish and wildlife habitat play a key role in maintaining the livability of the Metro region. Table 1-1 below summarizes key regional policies guiding Metro's work.[2]

[2] More extensive descriptions of these policies may be found in *Appendix A*.

Table 1-1. Regional policies guiding habitat protection efforts.

Policy	Description and relevance to habitat protection
Metro Charter *1992*	Required Metro to address issues of regional significance, such as land use and transportation planning as well as regional parks and open spaces. Identified the protection of natural systems – floodplains, rivers, streams, and wetlands – as a cornerstone for regional policies.
Greenspaces Master Plan *1992*	Articulated the vision for a cooperative, interconnected system of parks, natural areas, trails, and green ways for fish, wildlife and people. Recommended tools to protect greenspaces, such as acquisition, education and restoration. In 1995, voters passed a bond measure directing Metro to purchase regionally significant natural areas. Since then, more than 8,000 acres of natural areas have been acquired for permanent protection.
Future Vision Report *1995*	A key document in guiding land use management for the protection of fish and wildlife habitat. While not a regulatory document, it has greatly influenced the content of Metro's regional plans. States that the region should manage watersheds to protect, restore and maintain the integrity of streams, wetlands and floodplains, and their multiple biological, physical and social values. Identifies the need for restored ecosystems protected from future degradation.
Metro 2040 Growth Concept *1994*	Describes the preferred form of growth and development for the region, including how much the UGB should ultimately be expanded, ranges of density within the boundary, and which areas should be protected as open space. Basic philosophy is to preserve access to nature and build better communities.
Regional Urban Growth Goals and Objectives (RUGGO's) *1995*	Identifies goals and planning activities for the Metro region. Two objectives relate to water resources, and a third relates to wildlife habitat: Objective 12, Watershed Management and Regional Water Quality and Objective 13, Urban Water Supply; Objective 15, Natural Areas, Parks, Fish and Wildlife Habitat calls for an open space system capable of sustaining or enhancing native wildlife and plants.
Regional Framework Plan *1998*	Sets out the land-use, transportation, parks, water resources, natural hazards and related policy directives for the region's future. Three chapters address fish and wildlife habitat: Chapter 3: protection of lands outside the UGB for natural resource, future urban or other uses; Chapter 6: parks, open spaces and recreational facilities; and Chapter 7: water sources and storage.
Stream and Floodplain Protection Plan (Title 3) *1998*	Adopted by Metro as part of the Urban Growth Management Functional Plan, it establishes regional performance standards to address water quality and floodplain management. Recommends actions for the protection of fish and wildlife habitat. The completed sections of Title 3 meet the requirements for Statewide Planning Goal 6 (water quality) and Goal 7 (flood management).

As shown in the table above, Title 3 of Metro's Urban Growth Management Functional Plan addresses water quality, flood management, and fish and wildlife habitat conservation. Section 5(C) of Title 3 describes the steps that Metro must follow in order to establish a program to protect fish and wildlife habitat. These steps, shown below, relate to the process outlined in the state's Goal 5 administrative rule.

1) Establish criteria to define and identify regionally significant fish and wildlife habitat areas.
2) Adopt a map of regionally significant fish and wildlife areas after (a) examining existing Goal 5 data, reports and regulations from cities and counties, and (b) holding public hearings.
3) Identify inadequate or inconsistent data and protection in existing Goal 5 data, reports, and regulations on fish and wildlife habitat.
4) Complete Goal 5 economic, social, environmental, and energy (ESEE) analyses for mapped regionally significant fish and wildlife habitat areas only for those areas where inadequate or inconsistent data or protection has been identified.

5) Establish performance standards for protection of regionally significant fish and wildlife habitat that must be met by the plans' implementing ordinances of cities and counties.

Steps 1 and 2, establishing an inventory of regionally significant fish and wildlife habitat, have been completed and were adopted by the Metro Council in 2002.[3] Step 3 requires Metro to conduct an analysis of local jurisdictions' existing Goal 5 programs to determine inadequacy or inconsistency of these programs across the region. Metro's *Local Plan Analysis* satisfies the requirement (step 3) by providing a thorough analysis of local Goal 5 city and county programs (Metro 2002a). The analysis concludes that there are many inconsistencies and inadequacies in fish and wildlife habitat protection in the Metro region. Step 4 is the economic, social, environmental, and energy (ESEE) analysis. A region-wide analysis must be conducted that considers the economic, social, environmental, and energy consequences of allowing, limiting, or prohibiting conflicting uses before a program can be developed (Step 5).

Metro's approach to the analysis

Goal 5 has previously been completed by city or county governments, focusing on the natural resources (or other Goal 5 resources) that fall within their specific jurisdictions. However, Metro was given the ability to choose to protect Goal 5 resources at a regional level in the state administrative rule. Streams and rivers, forests and meadows, and the fish and wildlife that inhabit them do not acknowledge jurisdictional boundaries. The economy of the region also functions at a larger scale than just one city or county. Just as it makes sense to plan for transportation needs across the Portland metropolitan region (Metro region), consideration of the protection of fish and wildlife habitat at a larger scale allows for greater understanding of the connections between habitats and the functions of the ecosystem as a whole. Now the task at hand is to weigh the economic, social, environmental, and energy (ESEE) consequences of protecting fish and wildlife habitat within the Metro region. Many issues are similar to those encountered at a city or county; however, some are different such as Metro's ability to add land to the urban growth boundary (UGB) to prevent a net loss of buildable land due to fish and wildlife protection.[4]

Metro's approach for conducting a region-wide ESEE consequences analysis focuses on achieving the goals of the 2040 Growth Concept. The goals in the Growth Concept, the Future Vision, the Regional Framework Plan (implemented through the Urban Growth Management Functional Plan) and Metro's Vision Statement for Protecting Fish and Wildlife Habitat all specify that the region should manage growth while protecting the natural environment, maintaining a high quality of life, and providing affordable housing options.

Development of the 2040 Growth Concept included the balancing of goals in some ways similar to an ESEE analysis. Citizens and policymakers chose to increase density in centers and along major transportation routes (e.g., light rail, main streets) to minimize sprawl and avoid the addition of more land to the urban growth boundary. Green corridors and protection along streams and rivers was identified as a critical component of maintaining a high quality of life in a densely populated region. Transportation plays a critical role in the overall concept: without

[3] See Metro's *Riparian corridor and wildlife habitat inventories* (Metro 2002d) and *Technical Report for Goal 5* (Metro 2002c).
[4] This topic is discussed in more detail at the end of this chapter.

efficient public transit as well as opportunities to walk, bike or drive from home to shops, jobs, and recreation the compact communities envisioned would not function. Metro's current efforts to protect fish and wildlife habitat help further the goals in the 2040 Growth Concept.

Metro has taken a regional approach to the ESEE analysis, considering the overall tradeoffs of protecting or not protecting fish and wildlife habitat. The analysis is general and contains qualitative and, where possible, quantitative, descriptions of tradeoffs. The conflicting use and economic analyses contain specific acreage figures but at a regional scale. Additional analysis will be conducted in the next step of the planning process in the evaluation of the tradeoffs of several program options. Frequently, a consequence could fall in more than one ESEE category. For example, flooding has negative economic consequences (cost to repair damaged structures), social consequences (families lose irreplaceable items like photos), environmental consequences (changes to the stream system), and energy consequences (energy used to repair buildings). Many consequences cross categories and Metro staff used professional judgement to determine which category was most effective for describing the consequences.

This ESEE analysis does not result in a final decision to allow, limit, or prohibit conflicting uses in fish and wildlife habitat. The analysis describes the tradeoffs in a general fashion to help the Metro Council evaluate program options during the next step of the planning process. The Metro Council will complete the ESEE by making allow, limit, or prohibit decisions for fish and wildlife habitat.

Local Goal 5 programs

Most of the local jurisdictions in the Metro region have adopted Goal 5 programs that have been acknowledged by Oregon's Department of Land Conservation and Development as being in compliance with the state rule. Some of these programs were developed prior to Goal 5 rule revisions in 1996, while a few have been done more recently. The rule requires local jurisdictions to balance the need to protect natural resources against other state goals such as housing (Goal 10) and transportation (Goal 12) while providing ample opportunity for citizen involvement (Goal 1). Thus, the state rule allows local jurisdictions' Goal 5 programs to be in compliance with state law while being inconsistent with each other. However, Metro's code required an analysis of the consistency of local fish and wildlife protection prior to conducting a regional ESEE analysis and a regional protection program.

Metro staff conducted an analysis of local Goal 5 programs beginning in 1999 and culminating in a report to the Metro Council (Metro 2002a). The analysis demonstrated that there are many inconsistencies and inadequacies in fish and wildlife protection in the Metro region. An important reason for the inconsistency in local protection is that the Goal 5 rule does not set a specific standard, rather it lays out a process for jurisdictions to follow. The process described by state law allows jurisdictions to choose which resources to protect and the level of protection received after balancing the consequences of protection with the economic, social, and energy needs within the jurisdiction. Most jurisdictions choose to "limit" conflicting uses in fish and wildlife habitat areas, the Goal 5 rule defines this choice as "conflicting uses should be allowed in a limited way that protects the resource to the desired extent." This language gives local governments wide discretion in designing protection programs.

Metro's Regional Urban Growth Goals and Objectives (RUGGOs) and the Vision Statement emphasize the importance of protecting fish and wildlife habitat and recognize the need to provide a more consistent level of protection throughout the region. Metro's ESEE analysis identifies the tradeoffs of allowing, limiting, or prohibiting development consistently across the region.

Federal and state habitat protection policies

There are many policies that focus attention on the protection of fish and wildlife habitat. This section provides a brief overview of the key federal and state policies that set requirements for jurisdictions and agencies for fish and wildlife habitat protection.[5] While Metro is not required by law to address most of the policies described in Table 1-2 on the following page, a regional fish and wildlife habitat protection plan will help to meet the goals described by many of the federal and state policies.[6]

The federal Endangered Species Act and the Clean Water Act most specifically relate to Metro's current efforts to protect fish and wildlife habitat. NOAA Fisheries is currently developing recovery plans for listed salmon species. Metro's inventory of regionally significant fish and wildlife habitat has identified habitat upon which listed salmon depend for some part of their life histories. Coordinating Metro's program with NOAA Fisheries recovery plan as it is developed will not only assist in long-term recovery of the species, but also with local compliance with the ESA.

The Oregon Department of Environmental Quality (DEQ) is required by the federal Clean Water Act to maintain a list of steam segments that do not meet water quality standards, called the 303(d) list (DEQ 2003a). Many of the region's streams are 303(d) listed as water-quality impaired due to elevated temperatures.[7] Once a stream or river segment is 303(d) listed, the DEQ is responsible for developing water quality standards that protect beneficial uses of rivers, streams and lakes. These standards, called Total Maximum Daily Load (TMDL) determinations, are specific to 303(d) listed segments of rivers and streams and the problems identified in those segments, but are developed using a comprehensive approach that considers a larger geographic area, such as a watershed (DEQ 2003).

TMDLs outline how much pollution a water body can receive and still not violate water quality standards. Once TMDL standards are established, the state monitors water quality and reviews available data and information to determine if these standards are being met and water is protected. A stream or river segment can be "de-listed," or removed from the 303(d) water quality limited list, when TMDL determinations are made, or when new data indicates the

[5] Additional descriptions of these policies may be found in *Appendix A.*

[6] Metro must address activities on land owned by Metro, such as the take provisions of the ESA, local standards adopted to comply with the CWA, and state wetland laws.

[7] Appendix B includes two tables showing the DEQ's 1998 and 2002 303(d) listings of water quality limited water bodies in the Metro region (courtesy Don Yon, Oregon DEQ, 2003). Note that the 1998 list is substantially longer than the 2002 list. This does not mean that the water quality has improved; stream reaches that were on the 1998 list, but not on the 2002 list, typically indicate that a TMDL was developed, not that the particular pollution problem was solved.

waterbody meets water quality standards. The 303(d) listing identifies the problem(s); TMDLs provide a plan to improve water quality and meet federal clean water standards.

Metro's Stream and Floodplain Protection Plan (Title 3), described earlier, addresses water quality. However, many streams in the region still suffer from degraded water quality, and more recent science calls for greater protections than were in place when Title 3 was developed. Current efforts to improve water quality for fish habitat will also help to meet the federal standards in the Clean Water Act.

Table 1-2. Federal and state policies guiding fish and wildlife habitat protection.

Policy	Description
Federal policies	
Endangered Species Act (ESA)	The purpose of the ESA is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." Requires federal agencies to identify critical habitat for endangered and threatened species, create a recovery plan for those species and in some circumstances issue regulations that provide for the conservation of such species. Above all, the act prohibits any individual, group of individuals, states, cities and counties from "taking" a listed species.[1] Twelve species of salmon and steelhead are listed as either threatened or endangered in the Columbia River and Willamette River Basins.
Clean Water Act (CWA)	Sets a national goal to "restore and maintain the chemical, physical and biological integrity of the Nation's waters." In Oregon, the CWA is implemented by the DEQ with review and approval by the U.S. EPA. The DEQ has the responsibility for protecting the beneficial uses of rivers, streams and lakes of the state. Beneficial uses include drinking water, cold water fisheries, industrial water supply, recreation and agricultural uses.
Northwest Power Act	Requires the Bonneville Power Administration to implement a Fish and Wildlife Program that mitigates for the degradation to both fish and wildlife habitat caused by the Columbia Hydropower System. Complying with the Fish and Wildlife Program is achieved primarily through subbasin plans developed with oversight from the Northwest Power Planning Council.
Magnuson-Stevens Fishery Conservation and Management Act	Requires federal agencies to consult with NOAA Fisheries on activities that may adversely affect essential fish habitat (EFH). Defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." The Pacific Fishery Management Council identified EFH for pacific coast salmon. Those areas generally include "waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and … a healthy ecosystem."
State policies	
Oregon Plan for Salmon and Watersheds	The mission of the Oregon Plan is "to restore our native fish populations – and the aquatic systems that support them – to productive and sustainable levels that will provide substantial environmental, cultural and economic benefits." Initiated to address restoration of coastal coho salmon, the Oregon Legislature later incorporated other related efforts into one overarching framework. Designed to restore the healthy function of Oregon's natural aquatic systems.
Native Fish Conservation Policy	The purpose of the policy is: "to ensure the conservation and recovery of native fish in Oregon." Focuses on "naturally produced native fish" which are those fish species that "reproduce and complete their full life cycle in natural habitats." The reason for this focus on naturally produced fish is that those "native fish are the primary basis for Endangered Species Act de-listing decisions and the foundation for long-term sustainability of native species and hatchery programs."
Oregon Endangered Species Act	Intended to manage the listed "species and their habitats so that the status of the species improves to a point where listing is no longer necessary." Species are listed when they are: (1) native, and (2) in danger of extinction throughout any significant portion of its range (endangered) or (3) likely to become an endangered species within the foreseeable future throughout any significant portion of its range (threatened).
Oregon Wetland Regulatory Program	The Oregon Division of State Lands (DSL) administers Oregon's removal/fill law. Using similar definitions as the federal government, DSL determines wetland boundaries and water bodies that meet the definition of "waters of the state." A permit is required for fill or removal equal to or exceeding 50 cubic yards or more of material in any waters of the state at one location.
Essential Indigenous Anadromous Salmonid Habitat	In an effort to identify and protect essential habitat for salmon and trout, the Oregon Legislature in 1993 required DSL to identify essential indigenous anadromous salmon habitat. DSL has defined such habitat as: "habitat that is necessary to prevent the depletion of indigenous anadromous salmonid species during their life history stages of spawning and rearing."

[1]The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.
Acronyms: DEQ: Department of Environmental Quality; EPA: Environmental Protection Agency; NOAA: National Oceanic and Atmospheric Administration.

Public opinion on habitat protection

In a national survey on biodiversity, respondents strongly agreed (69 percent) with the statement "[w]e have a personal responsibility to the earth to protect all plant and animal life"; and strongly agreed (71 percent) with the statement "[n]ature provides me with inspiration and peace of mind." (Belden, Russonello & Stewart, 2002). Residents of the Metro region are known for placing a high value on the natural environment, which some believe adds to a high quality of life. Many people move to the region to take advantage of the close proximity to hiking, biking, boating and other outdoor activities. Residents also enjoy access to nature in the city: hiking in Forest Park, boating on the Willamette, birding at Smith and Bybee Lakes. Residents of the region have emphasized the protection and restoration of parks and open spaces through public surveys over the last several years. Metro has been particularly interested in public opinion regarding the protection of fish and wildlife habitat in recent years.

Several opinion surveys were conducted in 2001, including a May 2001 Davis and Hibbits phone survey commissioned by Metro, an October 2001 Moore Information survey sponsored by KGW-TV and the Portland Tribune, and an informal "SurveyPoint" poll available by phone and on Metro's website. Results from all three studies demonstrated that Metro residents place great value on protecting natural resources and maintaining the region's quality of life. In 2002 Davis, Hibbitts, & McCaig conducted a survey for Clean Water Services in Washington County that showed a mix of values related to healthy streams. The general public and streamside property owners rated clean drinking water, clean rivers and streams, and open space for fish and wildlife habitat as being "most important"; but rated healthy fish populations in local streams and adequate water in streams for fish and wildlife as being "least important". This contradiction is especially interesting since clean rivers and streams locally are a requirement for healthy fish populations regionally.

Metro held "Coffee Talks" from September 2001 through January 2002, a series of 93 small group dialogues in various locales throughout the urban region. Discussions focused on the urban growth boundary, fish and wildlife habitat protection, and transportation. The Coffee Talks were advertised via local radio, television, and newspapers. In addition, approximately 90,000 citizens received an October 2001 "Let's Talk" about fish and wildlife newsletter, including some 45,000 property owners with land in the inventory. An important component of these talks involved whether the public thought it was important to protect fish and wildlife habitat in the urban region and if so, how this should be accomplished. This public feedback was distributed to Metro staff and Councilors for consideration in the planning process. One important outcome of this process was indication of strong public support for Metro's efforts to maintain and enhance natural habitat areas.

In March 2002, Metro held a regional conference and five localized workshops to garner public opinion and participation entitled "Let's Talk" (Metro 2002b). Metro undertook a major notification process to encourage attendance to these activities, including the fall 2001 Natural Resource Protection mailing of nearly 90,000 to property owners and interested parties; press releases to major and local newspapers; partnership with KGW, a major local television station; and follow-up calls to neighborhood associations, business interests and other parties to encourage participation. About 1,000 people attended the conference and workshops. The

results confirm the importance of natural resource protection to the area's citizens, and interest in several strategies for natural resource protection emerged – perhaps most notably, financial incentives for protection as well as disincentives for failing to protect these resources.

Overview of Metro's fish and wildlife habitat inventory

Metro has the authority pursuant to Oregon Administrative Rule chapter 660, division 23, to identify "regional resources." A regional resource is defined by the Goal 5 rule as "a site containing a significant Goal 5 resource, including but not limited to a riparian corridor, wetland, or open space, which is identified as a regional resource on a map adopted by Metro ordinance." Metro's Goal 5 work addresses the following Goal 5 resources: riparian corridors, associated wetlands, and wildlife habitat. This report uses the term "regional resource" or "resource" interchangeably with "riparian corridors and upland wildlife habitat," or simply "fish and wildlife habitat." A regional approach to inventorying fish and wildlife habitat requires a consistent level of data and analysis across the entire Metro region. Metro's fish and wildlife habitat inventory is based on the best available information that can be applied consistently at a regional scale.

Metro completed its inventory of fish and wildlife habitat in 2002. Metro took an ecological functions approach to define the riparian corridor and identify upland wildlife habitat, based on its extensive scientific literature review (Metro 2002c). This approach combines geographic information system (GIS) mapping technology, scientific recommendations, and fieldwork for an inventory that encompasses the entire Metro region. The methodology assigns values to fish and wildlife habitat features that allows comparison of their cumulative importance. Below is a short overview of the current state of fish and wildlife habitat in the region, followed by a description of the inventory methodology.

State of the region's fish and wildlife habitat

Habitat loss, alteration, and significant increases in the amount of impervious land cover characterize the Metro region. More than one-fourth of all surface streams (about 400 miles) have been removed or piped underground, and many of the remaining stream miles suffer from degraded water quality, fragmentation, and simplification (loss of structural and functional diversity) of riparian corridors for fish and wildlife. Ninety-six percent of the land in the Willamette basin under 500 feet in elevation is privately owned and has been converted to agricultural or urban use (Willamette Urban Watershed Network 2000). A recent study of tree cover in the Willamette/Lower Columbia Region found a reduction in tree canopy cover from 46 percent in 1972 to 24 percent at present (American Forests 2001). Average tree cover in the region's urban areas is only 12 percent, down from nearly 21 percent in 1972. Eleven percent of the Metro region's natural areas[8] were lost between 1989-1999, with accompanying adverse effects on watershed hydrology and wildlife habitat.

Below are some examples of changes in our region's fish and wildlife habitat over time. The Metro region has experienced substantial vegetation loss, harming wildlife and habitat. For example:

[8] Identified by Metro's Parks and Greenspaces Department, includes undeveloped areas providing fish and wildlife habitat value.

- There has been a ***43 percent decline in forest cover*** from levels prior to substantial urbanization (i.e., 1850's), with very serious repercussions for wildlife and hydrology. Forest composition has also changed due to loss of old growth forests and white oak woodlands. The species depending on these habitats are disappearing (Metro 2002c).
- ***Current riparian/wetland forest is only 17 percent of historic levels***. Riparian wildlife habitat has more closely associated species (64, excluding fish) than any other terrestrial habitat type, including 11 species at risk in Oregon and/or nationally, with at least two more species now lost from this region (Metro 2002c).
- Of all habitat types in the Metro region, the greatest change in vegetation type has been the ***near-complete loss of grassland and oak savanna***; current estimates are that less than one percent of the historic extent still exists in small, scattered patches. ***Grassland bird species are declining precipitously*** in the Metro area, with several species lost and more that will disappear from the region if trends continue.[9]
- ***Agriculture and urban land uses comprise 55 percent*** of the land area in the region. Urban land cover is overtaking agricultural lands in the Metro region, with important hydrologic and wildlife repercussions.[10]

The riparian corridors and wildlife habitat that remain in our region, especially those providing a high ecological functional value, are scarce and diminishing as more land is urbanized.

Riparian corridors

As described in Metro's Technical Report for Goal 5 (science review; Metro 2002c), the riparian corridor refers to the land and vegetation adjacent to waterbodies such as streams, rivers, wetlands and lakes that are influenced by perennial or intermittent water. According to the scientific literature reviewed, riparian corridors provide important ecological benefits for fish and wildlife including:

1. Microclimate and shade
2. Streamflow moderation and water storage
3. Bank stabilization, sediment and pollution control
4. Large wood and channel dynamics
5. Organic matter input

The ecological functions listed above provide the basis for Metro's delineation of riparian corridors. In the spring of 2001, Metro launched an effort to map the ecological functions of riparian corridors and the specific landscape features that are associated with these functions. Features include stands of trees, woody vegetation, meadows, wetlands, steep slopes, and flood areas that are located along the region's streams and rivers. Based on the scientific literature, Metro identified areas where landscape features make a substantial, or "primary," contribution to providing an ecological function to the stream. Areas identified as "primary" receive a score of

[9] See Table 8 in Metro's *Riparian Corridor and Wildlife Habitat Inventories*, Metro 2002d.
[10] Agricultural lands are more water-permeable than urban lands, and are used by grassland species as "surrogate" grassland habitat.

six points. Landscape features that fall within the outer part of the range described in the scientific literature provide riparian function to a lesser degree and are said to serve a "secondary function" and receive one point. All areas that provide function to the stream are thus mapped and receive a score.

The scores are additive for any given landscape feature and reflect relative ecological function at any given point on the map. For example, a location on the map could contribute significantly to all five functions listed above and receive a score of 30 (five primary functions times six points each). Another location may receive primary scores for three functions (three primary functions times six points) plus secondary functions for up to two other functions (18 points for primary functions, plus two points for secondary functions). Still another location may receive only a single point for one secondary function (for example, developed floodplains). ***The Metro Council determined that all areas receiving a score for providing riparian ecological function are regionally significant.***

Wildlife habitat

The Goal 5 rule defines wildlife habitat as

> …[A]n area upon which wildlife depend in order to meet their requirements for food, water, shelter, and reproduction. Examples include wildlife migration corridors, big game winter range, and nesting and roosting sites. (OAR 660-023-0110(1)(b)).

The rule does not provide specific guidance on how to identify significant wildlife habitats other than referring to the standard inventory process (OAR 660-23-030) and minimum consultation requirements outlined in OAR 660-23-110. The Goal 5 rule allows a jurisdiction flexibility in defining the area for which a significance determination must be made.

Metro's approach to identifying the region's important wildlife habitats was based on a combination of: (1) best available scientific literature; (2) GIS modeling; (3) field studies to address the Goal 5 rule to determine the location, quantity and quality of potential wildlife habitat, as well as the adequacy of that information; and (4) local expertise to identify locations of sensitive species and habitats (Habitats of Concern). The model assigns values to wildlife habitat features that allow comparison of their cumulative importance to the regional wildlife habitat network. In early 2001, Metro mapped wildlife habitat based on specific features associated with these characteristics. Features include stands of trees, woody vegetation, meadows, and wetlands located within the region. The wildlife model is based on four criteria:

1. habitat patch size (minimum patch size of 2 acres unless a Habitat of Concern),
2. proximity to water sources,
3. proximity to other natural areas, and
4. forest interior habitat.

In brief, larger habitat patches are more valuable to native wildlife than smaller patches because more species are retained over time, and species sensitive to human disturbance still have a place to live. Rounder patches are better than long, narrow patches to reduce negative edge effects. Water within or near habitat patches is important so animals can drink. Connectivity to other

natural area patches is key to maintaining biodiversity; sometimes local populations become extinct and connectivity provides the means for reintroducing that species, as well as maintaining the genetic diversity important to the long-term health of a population.

Metro's model accounts for edge effects and habitat quality, as verified by scientific fieldwork conducted in 2001. The habitat attributes positively associated with increasing scores[11] in Metro's GIS model include:

- More downed wood and logs
- More food resources
- A wider variety of food resources
- Food availability over longer periods
- Fewer non-native trees
- Fewer non-native shrubs
- Fewer non-native herbs
- Increased structural diversity
- More wildlife cover available throughout the year
- More nesting and den sites (snags, root wads, rocky crevices, etc.)
- Less human disturbance onsite or nearby
- Better wildlife diversity onsite
- More year-round availability of water
- Healthier stream channel morphology
- More vegetative cover near water sources
- More types of water resources (streams, wetlands, etc.)

Each habitat patch was ranked and assigned a score for each of the model criteria, relative to other habitat patches. Sites were subsequently separated into three classes, of up to three possible points, for each criterion. The scores are additive for any given habitat patch and reflect relative wildlife habitat value for each of the habitat patches identified on the map. In addition to the wildlife habitat model, Metro worked with local experts and agency staff to identify "Habitats of Concern." Habitats of Concern are those sites known to be critical for sensitive species or to be scarce and declining in the Metro region. ***The Metro Council determined that all areas receiving a score of two or greater are regionally significant, plus sites identified as a Habitat of Concern.***

Fish and habitat classification

Metro's inventories of fish and wildlife habitat provide a wealth of information on the relative ecological value of specific sites across the region. The inventory methodology distinguished between habitat function with as much precision as possible to make an informed decision on regional significance. The upland wildlife habitat was evaluated separately from the riparian wildlife habitat areas. However, a method of classifying the fish and wildlife habitat together becomes useful in the ESEE to facilitate distinguishing the tradeoffs of protecting or not

[11] Statistically significant results of simple linear regression. For more detailed statistical findings, see Metro's *Riparian corridors and wildlife habitat inventory* (Metro 2002c).

protecting the habitat areas and, later, in the protection program. For the ESEE analysis, Metro classified fish and wildlife habitat based on the ecological function scores into six classes, under two main categories: riparian/wildlife and upland wildlife. Each class covers a geographically discrete portion of the inventory, and may include riparian and/or wildlife functions and also may be a Habitat of Concern. Class I riparian/wildlife and Class A upland wildlife are the highest value. More description of the classification system may be found in the *Conflicting Uses* chapter.

Definition of allow, limit, prohibit

In Metro's ESEE analysis the consequences of allowing, limiting, or prohibiting identified conflicting uses on fish and wildlife habitat are described. The Goal 5 rule requires that a program be developed that is based on and supported by the ESEE analysis, and that describes the degree of protection intended for the fish and wildlife habitat. Although the ESEE consequences analysis is described in terms of "allow, limit, or prohibit," the Goal 5 program may be some combination of the three scenarios, such as "strictly limit" (between prohibit and limit), "limit," or "moderately limit" (between limit and allow).

Allow a conflicting use

According to the Goal 5 rule, "a local government may decide that the conflicting use should be allowed fully, notwithstanding the possible impacts on the resource site." The Goal 5 rule also requires that the ESEE analysis "demonstrate that the conflicting use is of sufficient importance relative to the resource site, and must indicate why measures to protect the resource to some extent should not be provided." [660-23-040 (5)(a)] For example, the economic and social benefits of allowing an industrial use may outweigh the environmental and energy benefits of protecting the fish and wildlife habitat because of the additional jobs and increased tax base the development may create.

A decision to allow the conflicting use does not necessarily preclude habitat protection. All development in a fish and wildlife habitat area would be subject to existing local, state, and federal government regulations. For example, Title 3 (water quality) setbacks are required for new development along streams. In addition, incentives and/or educational materials could be developed to encourage stewardship and other voluntary protection measures.

Limit conflicting use

According to the Goal 5 rule, "a local government may decide that both the resource site and the conflicting uses are important compared to each other, and, based on the ESEE analysis, the conflicting uses should be allowed in a limited way that protects the resource site to a desired extent." [660-23-404(5)(b)]

A program to limit a conflicting use can be designed to allow some level of development with certain restrictions to protect the fish and wildlife habitat to the maximum extent possible. For example, the disturbance area may be limited in size ("x" number of square feet) and location (as far from the water feature as possible). Design standards may also be required to lessen the impact on the habitat (e.g., tree retention, cluster development, impervious surface reduction, etc.). In addition, mitigation standards may be required to replace lost habitat functions (e.g., plant native vegetation).

Prohibit a conflicting use

A Goal 5 resource (i.e., fish and wildlife habitat) would receive the highest level of protection with a decision to prohibit conflicting uses. According to the Goal 5 rule, "a local government may decide that a significant resource site is of such importance compared to the conflicting uses, and the ESEE consequences of allowing the conflicting uses are so detrimental to the resource, that the conflicting uses should be prohibited." [660-23-404(5)(c)] For example, development may be prohibited within a highly valuable riparian corridor with intact vegetation. Some development, however, may be allowed if all economic use of a property is lost through full protection. This could occur when a parcel of otherwise developable land is located fully within a riparian corridor.

Impact of ESEE decision on the UGB

A decision to limit or prohibit conflicting uses in fish and wildlife habitat areas could impact the amount of buildable land available to meet the jobs and housing needs of the Metro region within the UGB. If land for employment and housing were protected, then the Metro Council is required to consider either increasing densities or changing design type designations in other parts of the region. If the 20-year demand for growth still cannot be met, the Metro Council has the authority to expand the UGB to meet regional needs. At the regional level, expanding the UGB has the potential to mitigate the negative consequences on jobs and housing of limiting or prohibiting development. However, not all uses are "substitutable" or able to be relocated from one part of the region to another. For example, it is easier to relocate housing than water-dependent industrial uses. Expanding the UGB to allow for protection of fish and wildlife habitat may be one method to minimize clashes with conflicting uses. However, such a decision may increase expenditures associated with extending infrastructure, vehicle miles traveled, and other development related expenses.

Organization of this report

This ESEE analysis describes the tradeoffs associated with allowing, limiting, or prohibiting conflicting uses in fish and wildlife habitat areas. The goals are to follow the steps outlined in the Goal 5 rule and to provide sufficient information for the Metro Council to evaluate program options for the protection of fish and wildlife habitat.

The second chapter, *Impact Areas*, identifies the area within which conflicting uses adversely affect the fish and wildlife habitat. Chapter three, *Conflicting Uses*, describes the land uses and activities that negatively impact fish and wildlife habitat, including a substantial amount of data related to the inventory, fish and wildlife habitat classification, and acreage figures for types of conflicting uses.

Chapters four through seven *(Economic Consequences*, *Social Consequences*, *Environmental Consequences*, and *Energy Consequences)* contain Metro's analysis of the ESEE consequences for the region.

Chapter eight, *Summary and Conclusions*, highlights the main ESEE tradeoffs and the implications for the next step of Metro's planning process in the development of a fish and wildlife habitat protection plan.

CHAPTER 2: IMPACT AREAS

Introduction

One step of the economic, social, environmental, and energy (ESEE) analysis is to identify "impact areas." The ESEE analysis is conducted for both the resource area (in this case, regionally significant riparian corridors and wildlife habitat) and the impact area. Under the Goal 5 rule, Metro may develop a program that applies to both the regionally significant fish and wildlife habitat and the impact area.

Definition of the impact area

Under the Goal 5 rule, Metro must identify an impact area for all regionally significant fish and wildlife habitat:

> *Local governments shall determine an impact area for each significant resource site. The impact area shall be drawn to include only the area in which allowed uses could adversely affect the identified resource. The impact area defines the geographic limits within which to conduct an ESEE analysis for the identified significant resource. (OAR 660-23-040(3))*

Simply put, the impact area defines an area where allowed land uses or activities could harm the fish and wildlife habitat. The impact area may be larger than the identified significant fish and wildlife habitat or it may be as small as the fish and wildlife habitat itself. For example, impact areas for riparian corridors could encompass lands outside the corridor that contribute to riparian function. Development near streams and wetlands removes vegetation that would otherwise contribute to riparian function by providing shade, sedimentation control, and water storage. Developed areas near streams and wetlands can be included within impact areas because they are sources of run-off from impervious surfaces, human disturbance, noise, lighting, toxins, fertilizers and pesticides. Each of these influences may adversely affect riparian areas and wildlife habitat.

The Goal 5 rule allows substantial discretion in determining the impact area for fish and wildlife habitats. Recent court decisions dictate that the size and extent of the impact area can be quite large, so long as there are reasons to support the impact area decision.[12] For example, the extent of an impact area could include the entire watershed.

As documented in Metro's science paper, the effects of urbanization on the functions and values of fish and wildlife habitat are pervasive.[13] A compelling case can be made for identifying the entire watershed as an impact area based on the cumulative effects of urbanization, such as road density, impervious surfaces and altered hydrology, vegetation loss and alteration, and species depletion. However, doing so may necessitate an ESEE analysis for the entire watershed, which significantly encumbers the Goal 5 planning process. Stormwater management through watershed planning may be more realistic for addressing these larger, more pervasive effects of

[12] Sanders v. Yamhill County, 34 Or LUBA 782 (1998).
[13] Metro's Technical Report for Goal 5, August, 2002, pages 33-50.

urbanization on the function of fish and wildlife habitats.[14] Metro's current work plan calls for addressing regional stormwater issues following completion of the fish and wildlife program.

Local examples[15]

Local jurisdictions complying with the Goal 5 rule have used a variety of means to determine impact areas, with approaches ranging from simple to complex. In the simplest approach the impact area and the fish and wildlife habitat area can be the same, and some local jurisdictions have selected that option. For example, the city of Fairview, city of St. Helens, and Deschutes County consider the impact area to be the same as the habitat area. Note that Fairview, under the old Goal 5 rule, stated, "the Fairview impact area could reasonably be the entire City." However, Fairview did not identify a specific impact area outside of the habitat area, as it would serve "no useful purpose."

Some jurisdictions utilize setbacks to define impact areas. For example, the city of Wilsonville chose to implement a 25-foot impact area in addition to the habitat area "because it was protective of the resource, provided a reasonable review of development, and allowed a buffer area for the storm sewer system."

Other jurisdictions assign impact areas that vary based on fish and wildlife habitat. For example, Lake Oswego uses the impact area to refer to "the area where development siting standards are recommended to mitigate identified adverse impacts." The City's definition of the impact area varies based on the habitat type (e.g., 30-foot impact area on each side of a Class 1 stream, with different impact areas for other types of stream). The impact area width ranges from 25-30 feet (in which no new structures may be built), but there is an additional 10-foot construction setback. However, upon development and drawing of the final plat, the 30-foot setback outer line then becomes the hard-and-fast line and everything within becomes the protection area. For upland tree groves there are no impact areas.

In Tualatin, the impact area also varies based on the habitat type. The impact area for wetlands includes the wetland plus a 25-foot setback surrounding the wetland. Some upland wildlife habitat within 50 feet of certain wetlands plus any adjacent steeply sloped areas are also included in the impact area. Open space areas do not include any additional land as an impact area, and for forested habitat sites the impact area extends to the edge of the canopy. These examples are a sampling of the broad range of choices available for designating impact areas.

Metro's approach

Metro's riparian corridor inventory covers a substantial portion of the landscape and describes the features that provide function to the riparian corridor. Areas that received a score of one to 30 are identified as regionally significant habitat. The wildlife habitat inventory excludes substantial low-structure vegetation, most forested habitat patches less than two acres, and habitat patches scoring less than two in the model (approximately 2,070 acres in the 2-20 acre size range). The potential impacts of adjacent land use on wildlife habitat are important.

[14] Stormwater management and watershed planning are identified in Metro's Regional Growth Goals and Objectives, the Regional Framework Plan, and Title 3 as issues of regional concern.
[15] See Metro's *Local Plan Analysis* (Metro 2002) for more information.

However, the advantages of additional impact areas may be higher for vulnerable riparian areas (within 150 feet of a water feature) than for upland wildlife habitat. Therefore, a larger impact area for riparian areas close to water features has been identified than for wildlife habitat and riparian resources further than 150 feet from water.

Riparian impact areas beyond the existing inventory include the areas adjacent to the most vulnerable resources such as streams, wetlands and lakes with little or no riparian vegetation. All land uses in a watershed impact the streams within it, but Metro's scientific literature review indicates that the area providing the most important ecological functions to the stream generally falls within 150 feet. Therefore the ***riparian impact area*** has been defined as the area within 150 feet of a stream, wetland or lake that otherwise is not included in the inventory. Developed floodplains that are included in the inventory do not have an additional impact area. The ***vegetation impact area*** is defined as 25 feet around all remaining resources to protect the tree root zone area and low-structure vegetation. Using this method to identify the impact area adds 16,323 acres to the inventory of regionally significant fish and wildlife habitat to be analyzed for ESEE consequences.

There are many ways to determine impact areas under the Goal 5 rule. Metro's impact area focuses primarily on two aspects of the Goal 5 fish and wildlife habitat inventories: primary functional criteria for streams and waterbodies, and tree root-zone protection. This impact area protects the vulnerability of the fish and wildlife habitat. An ecologically appropriate impact area designation also helps Metro and its partners identify key restoration areas.

Riparian corridor impact area

Aquatic resources such as streams, wetlands and lakes may be strongly influenced by adjacent land use, and their degradation may cause cascading negative effects downstream. For example, an eroding streambank has negative consequences for instream habitat both onsite and downstream. This is particularly true when there is little or no existing vegetation nearby. When these conditions exist, streams, rivers, and wetlands are unlikely to receive the benefits of any Goal 5 program without additional impact areas. These water resources are likely to be in close proximity to developed areas where runoff, sediments, excess nutrients and pollutants can make their way directly to the water without the moderating influences provided by vegetation. These resources may be the areas most adversely impacted by adjacent land uses and practices.

While all land uses in a watershed impact the water bodies within it, the scientific literature review shows that the area providing primary function to the stream generally falls within 150 feet[16]. Adjacent land use has the strongest influence on waterways within the 150-foot zone, where the majority of primary ecological functions are either being provided, or would be if the area were not developed. Areas with secondary ecological functions may extend substantially further than 150 feet from the stream. These resources likely play lesser, but cumulatively important, roles in regional stream health and an argument can be made for impact areas on existing secondary resources. However, basing impact areas on secondary functions *that should*

[16] To review the literature on recommended widths, see Table 7 in *Metro's Technical Report for Goal 5*, July 2002; for GIS mapping descriptions for the two inventories, see Tables 4 and 5 in *Metro's Riparian Corridor and Wildlife Habitat Inventories*, August 2002.

exist but don't would be difficult to model and would necessitate inclusion of the entire watershed as the impact area. These data support Metro's impact area for riparian areas of 150 feet from the water body.

Tree root zone protection

In the case of wildlife habitat, adverse edge effects are an important driver of ecological value and are incorporated into Metro's wildlife habitat model via habitat patch size and habitat interior. Edge effects are a function of human influences occurring at or near a forest or wetland edge; therefore it could be argued that impact areas are already accounted for in wildlife habitat patches. For example, a habitat patch narrower than 400 feet contains virtually no interior habitat. Therefore, human influences such as disturbance and nonnative species may be relatively pervasive; impact areas may serve no purpose in such cases. However, tree root zone compaction could theoretically result in a gradual shrinking of forested habitat over time due to tree damage around the edges of the habitat.

Tree root protection is important because root damage affects the entire tree. Soil compaction above the roots is a key culprit. The drip-line is the full area beneath the tree canopy. Certified arborists state that the root zone of a tree typically extends at least one-and-a-half to two times the distance of the drip-line; some experts indicate root spread may extend as far as two to three times the distance of the drip-line (Appleton et al. 2000; Ryan et al. 2002). A Metro GIS survey of trees in our region indicates that the drip-line for relatively mature trees is about 65 feet. Therefore, Metro's impact area for root zone protection is 25 feet.[17]

A 25-foot impact area is also appropriate for addressing non-forested habitat areas. Low structure vegetation can be quite fragile and vulnerable to disturbances such as trampling, motorized and non-motorized traffic, grazing, etc. Physical disturbance in herbaceous habitats often leads to nonnative or invasive species proliferation (Alberta Riparian Habitat Management Program). This is an issue in for both native herbaceous habitats and agricultural lands, where noxious weeds may rapidly spread and can cause severe crop losses resulting in economic hardship.

Summary

A 150-foot riparian impact area and 25-foot vegetation impact area will:

- Provide all fish and wildlife habitat with an impact area (except developed floodplains).
- Provide the most sensitive fish and wildlife habitat with wider impact areas.
- Provide impact areas to address tree root zones.
- Allow the potential to address areas that are already degraded, but where negative inputs may strongly influence onsite and downstream water quality and key wildlife habitat (such as wetlands).
- Meet the requirements of the Goal 5 rule.

[17] Take the drip line times the recommended distance: 65 x 1.75 = 113.75. Subtract out the drip line: 113.75 – 65 ft = 48.75. Divide by two to get the radius for a 1-sided impact area: 48.75 / 2 = 24.4 ft.

CHAPTER 3: CONFLICTING USES

Introduction

A key step in the economic, social, environmental, and energy (ESEE) analysis is to identify conflicting uses that "exist, or could occur" within regionally significant fish and wildlife habitat and identified impact areas. A conflicting use is a "land use, or other activity reasonably and customarily subject to land use regulations, that could adversely affect a significant Goal 5 resource" (OAR 660-23-010(1)). Identifying conflicting uses is important in order to focus the ESEE consequences analysis on various land uses and related disturbance activities that may negatively impact fish and wildlife habitat.

The following sections describe:

- Metro's method for identifying conflicting uses from a regional perspective,
- the relationship of generalized regional zones to Metro's fish and wildlife habitat inventory,
- the relationship of the 2040 design type hierarchy to Metro's fish and wildlife habitat inventory,
- the relationship of impact areas to generalized regional zones, and
- conflicting uses by Metro's generalized regional zones.

The consequences of allowing, limiting or prohibiting the conflicting use are covered in each of the ESEE analyses, discussed in the following chapters.

Identifying Conflicting Uses

The Goal 5 rule directs local governments to identify conflicting uses in their ESEE analysis by examining "land uses allowed outright or conditionally within the zones applied to the resource site and impact area" (OAR 660-23-040(2)). The Goal 5 rule does not, however, address how conflicting uses should be identified for a regional ESEE analysis.

Metro has taken a regional approach in identifying conflicting uses. Metro is responsible for developing regional policies for managing growth, protecting natural resources, directing regional investment in a mix of transportation options, as well as other policies. Metro does not, however, have zoning authority. Instead, local governments are responsible for implementing regional policy using their comprehensive planning and zoning authority. Consequently, Metro is relying on its compilation of local jurisdictions' zoning codes to provide the framework for identifying conflicting uses (Metro's regional zones and generalized regional zones), as described in the next section. In addition, Metro's 2040 Growth Concept is also described to address conflicting uses that "could occur" over time.

Regional zones and generalized regional zones

Metro's Data Resource Center (DRC) developed "regional zones" and "generalized regional zones" as a GIS data layer to perform regionwide analyses. These regional zones are based on a compilation of local government zoning designations. Each local jurisdiction has a unique array of zoning categories, with literally hundreds of zoning codes that regulate land use in the 24 cities and three counties within Metro's jurisdiction. Although zoning categories are similar among jurisdictions, the actual permitted uses and density requirements often vary. Metro compiled local city and county zoning codes and assigned them to one of 26 regional zones as shown in Table 3-1 below. Table 3-1 also shows the generalized regional zones into which the 26 regional zones are further aggregated. Local jurisdictions had an opportunity to review the compilation and assignments, and corrections were made based on their comments.

Table 3-1. Regional zones & generalized regional zones.

Regional zones	Generalized regional zones
SFR1 Single Family 1 – detached housing with minimum lot sizes from 20,000 square feet and over.	***SFR Single-family Residential***
SFR2 Single Family 2 – detached housing with minimum lot sizes ranging from 12,000 to 20,000 square feet.	
SFR3 Single Family 3 – detached housing with minimum lot sizes ranging from 8,500 to 12,000 square feet.	
SFR4 Single Family 4 – detached housing with minimum lot sizes from 6,500 to 8,500 square feet.	
SFR5 Single Family 5 – detached housing with minimum lot sizes ranging from 5,500 to 6,500 square feet.	
SFR6 Single Family 6 – detached housing with minimum lot sizes from 4,000 to 5,500 square feet.	
SFR7 Single Family 7 – detached housing with minimum lot sizes up to 4,000 square feet.	
MFR1 Multi-family 1 – housing and/or duplex, townhouse and attached single-family structures allowed outright. Maximum net allowable densities range from 2 to 25 units per acre, with height limits usually set at 2 1/2 to 3 stories.	***MFR Multi-family Residential***
MFR2 Multi-family 2 – housing accommodating densities ranging from 25 to 50 units per acre. Buildings may exceed three stories in height.	
MFR3 Multi-family 3 – housing accommodating densities ranging from 50 to 100 units per acre.	
MFR4 Multi-family 4 – housing accommodating densities greater than 100 units per acre. This is the densest of the multi-family zones and would require greater use of vertical space and buildings with multiple stories.	

Note: Local jurisdictions are the ultimate source for actual zoning of any given property.

Table 3-1 (cont.). Regional Zones & Generalized Regional Zones

Regional Zones (cont.)	Generalized Regional Zones (cont.)
MUC1 Mixed Used Center 1 – combines residential and employment uses in town centers, main streets and corridors.	***MUC Mixed Use Centers***
MUC2 Mixed Use Center 2 – combines residential and employment uses in light rail station areas and regional centers.	
MUC3 Mixed Use Center 3 – combines residential and employment uses in central city locations. Mixed use is weighted toward residential development.	
CN Neighborhood Commercial – small scale commercial districts permitting retail and service activities such as grocery stores and laundromats supporting the local residential community. Floor space and/or lot size is usually limited from 5,000 to 10,000 square feet.	***COM Commercial***
CG General Commercial – larger scale commercial districts, often with a more regional orientation for providing services. Businesses offering a wide variety of goods and services are permitted and include highway and strip commercial zones.	
CC Central Commercial – allows a full range of commercial activities typically associated with central business districts. More restrictive than general commercial in the case of large lot and highway oriented uses, but usually allows multi-story development.	
CO Office Commercial – districts accommodating a range of business, professional and medical office facilities, typically as a buffer between residential areas and more intensive uses.	
PF Public Facilities – generally provides for community services such as schools, churches, government offices, hospitals, libraries, correctional facilities, public parks, public recreation facilities and public utilities.	
IL Light Industrial – districts permitting warehousing and light processing and fabrication activities. May allow some commercial activities.	***IND Industrial***
IH Heavy Industrial – districts permitting light industrial and more intensive industrial activities such as bottling, limited chemical processing, heavy manufacturing and similar uses.	
IMU Mixed Use Industrial – districts accommodating a mix of light manufacturing, office and retail uses.	
IA Industrial Area – districts designated exclusively for manufacturing, industrial, warehouse and distribution related operations.	
FF Agriculture or Forestry – activities suited to commercial scale agricultural production, typically with lot sizes of 30 acres or more.	***RUR Rural***
RRFU Rural or Future Urban – residential uses permitted on rural lands or areas designated for future urban development with minimum lot sizes of one acre or more.	
POS Parks and Open Space – preservation of public and private open and natural areas.	***POS Parks and Open Space***

Note: Local jurisdictions are the ultimate source for actual zoning of any given property.

Metro's 26 regional zones provide a clear representation of general land uses allowed outright over the regional landscape. The general zones do not, however, represent land uses allowed conditionally within zones because these vary among local jurisdictions and are not explicitly captured in the regional zones. Disturbance activities associated with conditional uses will be considered in the *Conflicting Uses by Generalized Regional Zones* section.

According to the Goal 5 rule, the ESEE analysis "may address each of the identified conflicting uses, or it may address a group of similar conflicting uses" (OAR 660-23-040(5)). The 26 regional zones are further aggregated into seven major land use categories (generalized regional zones, see Table 3-1): single-family residential, multi-family residential, mixed use, commercial, industrial, rural, and parks and open space. These seven generalized regional zones represent a group of similar conflicting uses and are used in the ESEE analysis for identifying the consequences of allowing, limiting, or prohibiting conflicting uses within fish and wildlife habitat.

Metro's 2040 Growth Concept

Metro's 2040 Growth Concept helps to identify where conflicting uses are likely to occur over time. The 2040 Growth Concept map[18] shows the general location of the 2040 design types inside the urban growth boundary (UGB), as well as several outside the UGB, but inside Metro's jurisdiction. Areas outside the UGB are primarily designated as rural reserves. In December 2002, the Metro Council approved a major expansion of the UGB. The decision brings approximately 18,880 acres into the boundary. These areas have been held at a rural level of development and do not yet have urban zoning. These areas will be the focus of detailed concept planning based on the 2040 Growth Concept principles and land uses will intensify in these areas over time.

Metro's 2040 Growth Concept (adopted in 1995) defines the form of regional growth and development for the Metro region. The concept encourages land use and transportation policies that will allow the Metro area cities and counties to manage growth, protect natural resources, and make improvements to facilities and infrastructure while maintaining the region's quality of life. The concept reflects important values identified by the people who live in this region: access to nature, protection of farmland and natural areas, safe and stable neighborhoods, a diversity of housing types, transportation choices, and a healthy economy.

The concept provides an expression of the region's goals through land use and identifies various design types as the "building blocks" of the regional strategy for managing growth. The centerpiece of the 2040 Growth Concept is the development of centers – compact, mixed-used areas inside the UGB with employment, housing, retail, and cultural and recreational activities, and a pedestrian-friendly environment with access to a variety of transportation choices.

The success of the 2040 Growth Concept depends in large part on the implementation of regional transportation priorities. The Regional Transportation Plan (RTP) groups the 2040 design types into a hierarchy based on transportation investment priority. This hierarchical scheme also helps

[18] To view the 2040 Growth Concept map online: http://www.metro-region.org/library_docs/land_use/concept.pdf

to focus economic development priorities (see *Economic Consequences* chapter) in areas that are most important to achieving the goals of the 2040 Growth Concept. For the purposes of Metro's Goal 5 ESEE analysis, a modified grouping of the 2040 design types is proposed as follows:

Primary land use components

The central city, regional centers, industrial areas, and intermodal facilities are centerpieces of the 2040 Growth Concept. Implementation of the Growth Concept is largely dependent on the success of these primary components:

- *Central City.* Downtown Portland serves as the region's major regional center and also functions as a hub for cultural activities and employment for the entire metropolitan area.

- *Regional Centers.* Regional centers are located throughout the region and serve large market areas outside the central city (e.g., Hillsboro, Gresham). They are intended to become the focus of compact development, redevelopment, and high-quality transit service.

- *Industrial Areas (non-water dependent).* The region's economy depends on a strong base of industry. The Growth Concept identifies areas to be devoted to this use. For purposes of Goal 5, industrial areas have been further divided into non-water dependent and water dependent. Industrial areas that are not water dependent typically demand proximity to high quality transportation and access to an employee base.

- *Industrial Areas (water dependent).* The metropolitan area developed as a city based on a prime location at the confluence of the Columbia and Willamette Rivers. The Portland Harbor consists of several marine terminals that provide access to cities throughout the Pacific Rim, as well as access to the rest of the United States with rail and highway service. Several industrial properties are located on the harbor adjacent to this transportation network.

- *Intermodal transportation facilities.* The region's continued strength as a national and international distribution center is dependent on the provision of adequate intermodal facilities. These facilities include marine terminals, freight facilities for trucking, airports and railroads.

Secondary land use components

- *Town Centers.* Town centers include compact development and a relatively high level of transit service, but they are meant to be smaller and less dense than regional centers. Town centers provide local shopping, employment, and cultural and recreational opportunities within a local market area (e.g., Forest Grove, Milwaukie).

- *Main Streets.* Main streets are similar to town centers but on a smaller scale. Main streets typically serve the immediate neighborhood and sometimes have a traditional commercial identity that may draw visitors from other parts of the region.

- *Station Communities.* Station communities are areas of development centered around light rail or high-capacity transit stations. These areas include mixed-use, compact development and provide a mix of transportation options such as light rail, bus, bicycling, walking and auto.

Tertiary design type components

- *Inner Neighborhoods.* These areas include primarily residential development and are accessible to employment. Inner neighborhoods generally have better access to jobs and shopping than outer neighborhoods and lot sizes are typically smaller.

- *Outer Neighborhoods.* These areas are farther away from large employment centers and have larger lot sizes and thus lower densities than inner neighborhoods.

- *Employment centers.* Employment centers are designated to receive various types of employment and may include residential development that serves the needs of employees.

- *Corridors.* Corridors are major streets that serve as key transportation routes for people and goods. Corridors are not intended to be as dense as centers, but provide a mix of uses such as higher density residential, office, commercial, and retail.

Other

- *Parks and Open Spaces.* Parks and open space include recreational parks, streams and trail corridors, wetlands, floodplains and other natural areas. These areas play a key role in maintaining the quality of life citizens of the region enjoy. Access to both recreational parks and natural areas has been identified as a high priority by residents. These areas are unlikely to provide opportunities for residential, commercial, or industrial development.

- *Rural.* Rural lands outside the urban growth boundary.

The 26 regional zones and seven generalized regional zones, together with the 2040 Growth Concept described in this section, allow for a regional picture of both existing and potential future conflicting uses. The next section describes the relationship of the seven generalized regional zones with Metro's Goal 5 fish and wildlife habitat inventory.

Relationship of generalized regional zones and 2040 design types to Metro's Goal 5 inventory of regionally significant fish and wildlife habitat

This section takes a closer look at where conflicting uses and Goal 5 fish and wildlife habitat overlap. Metro's Goal 5 inventory of regionally significant fish and wildlife habitat is analyzed in the following ways: geographical boundaries (i.e., UGB, Metro's jurisdiction); development status (i.e., developed and vacant); generalized regional zones and development status; generalized regional zones, fish and wildlife habitat classification and development status; and 2040 design types hierarchy and fish and wildlife classification. In addition, impact areas are summarized by generalized regional zones and development status. This information provides context in the ESEE analysis by quantifying the extent (i.e., acreage) to which fish and wildlife habitat may be impacted by allowing, limiting, or prohibiting the conflicting uses.

Distribution of land within the UGB and Metro's jurisdictional boundary

Figure 3-1 below shows the urban growth boundary and Metro's jurisdictional boundary (before December 2002). The land area within Metro's jurisdiction is comprised of approximately 227,540 acres within the UGB and 53,120 outside the UGB for a total of over 280,660 acres (not including water features), or about 438 square miles. The 2002 UGB expansion areas (hatched areas on map) include approximately 18,800 acres, most of which are inside Metro's jurisdiction (over 3,100 acres are currently outside Metro's jurisdiction). The gray area on the map represents regionally significant fish and wildlife habitat.

Figure 3-1. Metro's fish and wildlife habitat inventory, UGB, jurisdictional boundary & expansion areas.

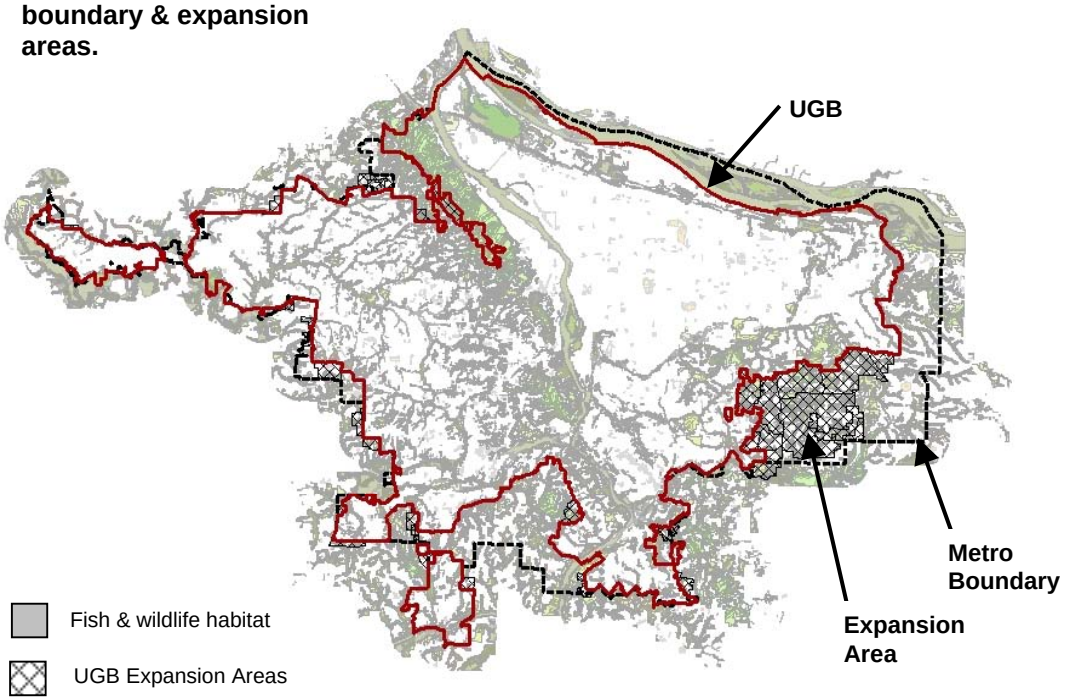


Table 3-2 disaggregates non-habitat and habitat lands into three geographical areas: inside the UGB, UGB expansion areas, and the remaining areas in Metro's jurisdiction outside of the UGB. The total acreage shown in the table includes approximately 3,100 acres in the expansion areas that are currently outside Metro's jurisdiction. Approximately 81,700 acres of fish and wildlife habitat are within, or will be within, Metro's jurisdictional boundary (almost 29 percent of the total land area). Within the UGB, 24 percent of the total land area is fish and wildlife habitat (53,671 acres). UGB expansion areas include over 8,200 acres of fish and wildlife habitat (44 percent of the expansion area). Fifty-three percent of the remaining areas in Metro's jurisdiction outside the UGB (19,794 acres) are fish and wildlife habitat.

Two-thirds (66 percent) of the total fish and wildlife acres are within the UGB. The other third (28,026 acres) is located in the expansion areas and the remaining areas in Metro's jurisdiction outside the UGB.

Table 3-2. Fish and wildlife habitat by Metro's jurisdictional status.

Geographical Area	**Total Acres*** (Non-habitat and habitat)	**Fish and wildlife habitat**		
		Habitat Acres	*% of Geog. Area*	*% of Total Habitat*
Inside UGB (before Dec. 2002)	227,539	53,671	24%	66%
UGB Expansion Areas (Dec. 2002)**	18,799	8,232	44%	10%
Remaining areas in Metro's jurisdiction outside UGB	37,404	19,794	53%	24%
Total Acreage	283,742	81,697	29%	100%

Source: Metro's Regional Land Information System (RLIS) data base
*Water areas removed (~8,000 acres of habitat)
**UGB expansion areas include approximately 3,100 acres that are currently outside Metro's jurisdiction

Distribution of land by development status

In this section, both non-habitat and habitat lands are broken out by development status (developed and vacant) within the three geographical areas (see Table 3-3). A description of each development status follows to provide a better understanding of Table 3-3.

Developed refers to land that has improvements and specific land uses. There are two subsets within the developed category: urban and parks. *Urban*, as used in this report, refers to land developed in accordance with the specific zoning (e.g., single-family residential, commercial, industrial, etc.).

Parks refer to Metro's inventory of public and private parks and open space, golf courses, cemeteries, trails, and other uses. Parks are categorized as developed land because they are generally not available for urban development in Metro's analysis of buildable lands within the UGB.

Vacant refers to land that has no buildings, improvements or identifiable land use. Metro's vacant lands inventory also includes vacant portions of developed tax lots that are 1/2 acre

(20,000 square feet) or greater. The vacant category also has two subsets: constrained and buildable.

Constrained land consists of environmentally sensitive land – Title 3 Water Quality and Flood Management Areas (i.e., river and stream corridors, wetlands, floodplains, steep slopes 25 percent or greater adjacent to water features); land in public ownership (that otherwise would be buildable); already platted single-family lots; and buffers on major utility lines (50-75 feet). Title 3 areas alone are used to calculate constrained land outside the UGB. Constrained land is not necessarily unbuildable. For example, from 1998 to 2000, 363 acres (seven percent) of undeveloped Title 3 vegetated corridors were developed and 568 acres (9 percent) of floodplains were developed (Metro 2003).

Buildable land is what remains after subtracting out vacant constrained land from total vacant acres. Vacant, buildable land provides the basis for estimating the region's 20-year land supply for dwelling units and employment inside the UGB.

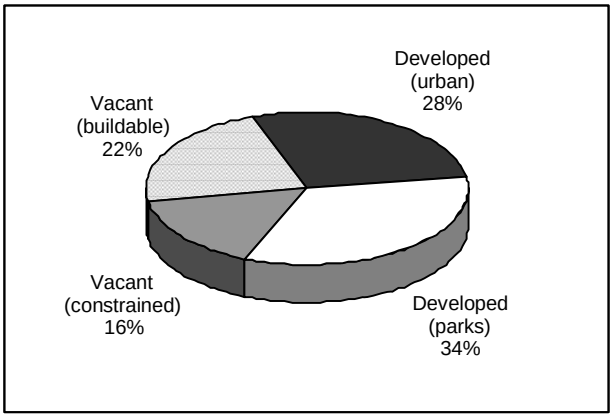
Forty-four percent of the total vacant, buildable acres (both non-habitat and habitat land) in Table 3-3 are classified as fish and wildlife habitat (28,355 acres/64,178 acres). Approximately 41 percent of the total vacant buildable acres within the UGB is fish and wildlife habitat (11,923 acres/29,146 acres). Outside the UGB, 47 percent of the total vacant buildable acres (16,431 acres/35,031 acres) is fish and wildlife habitat.

Table 3-3. Non-habitat and habitat lands by development status.

Geographical Area	Non-habitat acres				Fish and wildlife habitat acres				Total Acres
	Developed		Vacant		Developed		Vacant		
	Urban	*Parks*	*Constr.*	*Buildable*	*Urban*	*Parks*	*Constr.*	*Buildable*	
Inside UGB (before 12/02)	143,263	9,216	4,166	17,223	15,041	18,258	8,449	11,923	227,539
UGB Expansion Areas (12/02)	3,791	377	0	6,399	1,262	716	552	5,703	18,799
Remaining areas in Metro's jurisdiction	4,701	708	0	12,201	2,161	5,028	1,877	10,728	37,404
Total Acreage	151,754	10,301	4,166	35,823	18,464	24,001	10,878	28,355	283,742

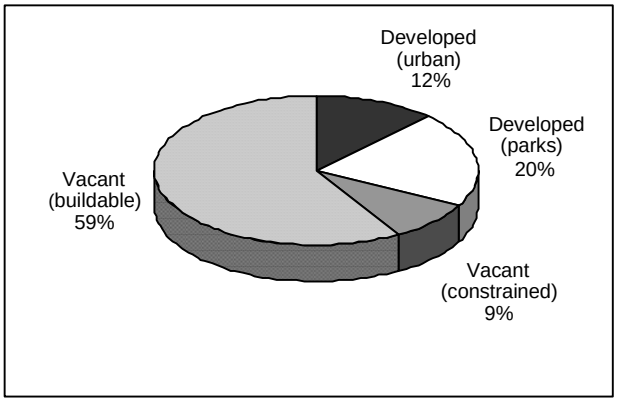
Figures 3-2 and 3-3 show the proportion of fish and wildlife habitat by development status inside the UGB and outside the UGB in expansion areas and Metro's jurisdiction (based on Table 3-3). Thirty-eight percent of the fish and wildlife habitat inside the UGB is vacant (buildable plus constrained); 62 percent is considered developed (urban plus parks). Within the expansion areas and remaining areas in Metro's jurisdiction, 32 percent of the land is developed and 68 percent is vacant.

Figure 3-2. Fish and wildlife habitat by development status inside UGB.



Developed land is included in the Goal 5 fish and wildlife habitat inventory for several reasons. First, developed areas along streams that lack significant vegetation are mapped with a 50-foot default area to recognize essential riparian function. Second, vegetated portions of developed lots are included in the Goal 5 inventory where they contribute riparian function and/or wildlife habitat value. For example, dense forest canopies over developed subdivisions are included in the inventory where the canopy meets the applicable mapping criteria (Metro 2002d).

Figure 3-3. Fish and wildlife habitat by development status in expansion areas & remaining areas in Metro's jurisdiction.



The development status of fish and wildlife habitat provides some insight into the vulnerability of the habitat to potential adverse impacts from conflicting uses. The least vulnerable fish and wildlife habitat is that in park status; however, protection is not guaranteed. For example, a park may be developed for recreational uses (e.g., ball fields) rather than left in a natural state. Fish and wildlife habitat classified as developed (urban) is less vulnerable than those that are vacant. Changes often occur, however, on developed land. For example, a lot may be subdivided, expansion of existing facilities may occur, or management practices may change (e.g., tree cutting). Vacant, constrained fish and wildlife habitat, as pointed out above, may also be developed but less intensively in many cases. Vacant, buildable fish and wildlife habitat is the most vulnerable to adverse impacts.

Distribution of fish and wildlife habitat by generalized regional zones and development status

This section presents regionally significant fish and wildlife habitat by generalized regional zones and development status (Tables 3-4 and 3-5) within the UGB (before December 2002), and in UGB expansion areas and the remaining areas in Metro's jurisdiction.

The largest proportion of fish and wildlife habitat is zoned for single-family residential development (46 percent). Nearly 27 percent of single-family zoned habitat land (6,687 acres) is considered buildable, which also represents the largest proportion of total buildable habitat land (56 percent).

The parks and open spaces (POS) category contains the next highest proportion of fish and wildlife habitat (20 percent). However, the POS category significantly under-represents the amount of land actually used as parks in the region because many local jurisdictions do not have a separate zone for parks and open space. Instead, parks are allowed outright or conditionally in all or most zones. In such cases, parks and open space generally retain the underlying zoning. To address this issue, parks are identified separately under the "developed" land category in the tables below. For example, there are over 5,500 acres of parks (based on Metro's parks and open space inventory) that are zoned single-family residential.

Fourteen percent of fish and wildlife habitat is zoned for industrial use (7,721 acres); of that, 23 percent is considered buildable (1,761 acres). Although only seven percent of fish and wildlife habitat is zoned for rural uses inside the UGB, over half of it is buildable and represents the second highest proportion (17 percent) of total buildable habitat land.

Table 3-4. Total fish and wildlife habitat by generalized regional zones inside UGB.*

Generalized Regional Zones	Fish and wildlife habitat acres					
	Developed		Vacant		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	9,300	5,557	3,277	6,687	24,821	46%
MFR	975	704	462	470	2,610	5%
MUC	406	100	266	512	1,284	2%
COMM	649	1,144	451	429	2,672	5%
IND	2,620	972	2,368	1,761	7,721	14%
RUR	380	193	1,261	2,015	3,923	7%
POS	483	9,577	359	48	10,468	20%
NO ZONE**	155	11	5	1	172	0%
TOTAL	*14,968*	*18,258*	*8,449*	*11,923*	*53,671*	*100%*

***Before December 2002**

****Some habitat areas within the UGB (0.3%) have no zoning designation.

Most of the fish and wildlife habitat in UGB expansion areas and the remaining areas in Metro's jurisdiction has rural zoning (89 percent; Table 3-5). Sixty-three percent of rural habitat land is considered buildable (15,772 acres).

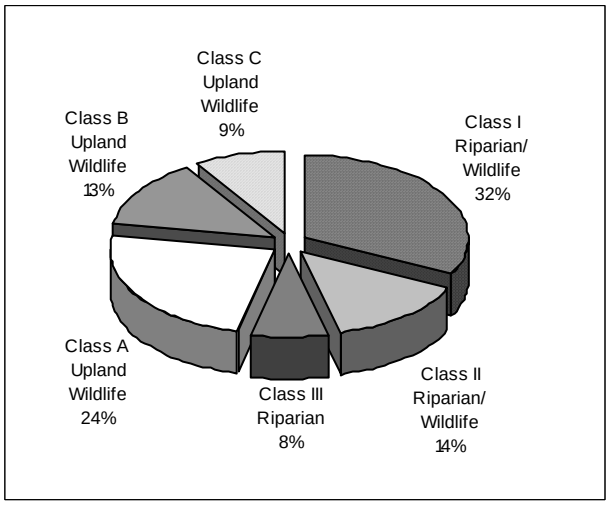
Table 3-5. Total fish and wildlife habitat acres by generalized regional zones in expansion areas and remaining areas in Metro's jurisdiction.

Generalized Regional Zones	Fish and wildlife habitat acres					
	Developed		Vacant		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	163	231	16	460	871	3%
RUR	2,860	3,982	2,356	15,772	24,969	89%
POS	324	1,521	43	109	1,997	7%
MFR, MUC, COM, IND	77	9	13	90	189	1%
TOTAL	*3,423*	*5,743*	*2,429*	*16,431*	*28,026*	*100%*

Distribution of fish and wildlife habitat by classification and generalized regional zones

In this section, Metro's fish and wildlife habitat inventory is divided into six classifications, each representing discreet areas on the landscape: Class I, II and III riparian/wildlife corridors, and Class A, B, and C upland wildlife habitat. Metro has created these classifications as a tool to distinguish higher value habitat from lower value habitat. This information can then be used for analyzing conflicting uses and ESEE consequences, and for developing a Goal 5 program. Figures 3-4 and 3-5 show the breakdown of regionally significant fish and wildlife habitat by classification (53,671 habitat acres in UGB; 28,026 habitat acres outside UGB). The following sections describe these classifications and present tables that show each fish and wildlife habitat classification by generalized regional zone.

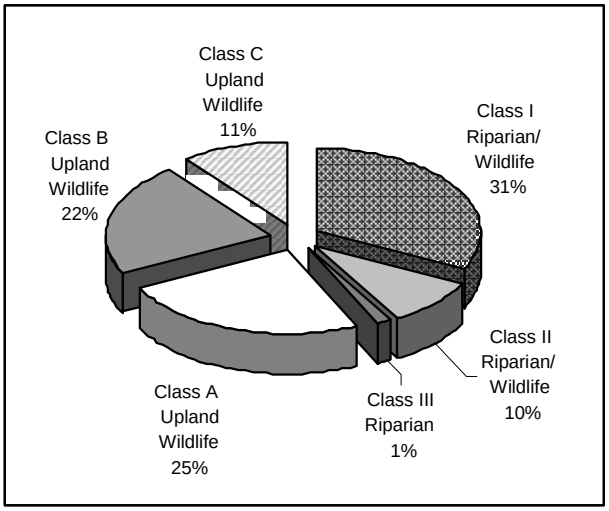
Figure 3-4. Fish and wildlife habitat by classification within the UGB.



Class I riparian/wildlife corridors

Class I riparian/wildlife corridors is the largest classification, representing 32 percent of total fish and wildlife habitat inside the UGB and 31 percent outside the UGB. These areas are predominantly high value riparian corridors that provide three to five primary functions (scoring 18-30 points in the riparian model). The primary functions include: 1) microclimate and shade; 2) streamflow moderation and water storage; 3) bank stabilization, sediment and pollution control; 4) large wood and channel dynamics; and 5) organic material sources. Class I riparian corridors include rivers, streams, stream-associated wetlands, undeveloped floodplains,

Figure 3-5. Fish and wildlife habitat by classification in UGB expansion areas & remaining areas in Metro's jurisdiction.



forest canopy within 100 feet of a stream, and forest canopy within 200 feet of streams with adjacent steep slopes.

Wildlife habitat is also included in high value riparian/wildlife corridors. For example, an area providing riparian function may also have habitat value in the wildlife model. Habitats of Concern are unique or unusually important wildlife habitat areas and are considered high value habitat. Where Habitats of Concern coincide with any riparian/wildlife corridor, the area of overlap is elevated to a Class I riparian/wildlife corridor.

Table 3-6 shows that single-family residential, rural, and industrial development contain the largest concentration of Class I riparian/wildlife corridors (40 percent, 18 percent, and 17 percent, respectively) and the largest portion of buildable land (42 percent, 33 percent, and 14 percent, respectively) inside the UGB. Outside the UGB (Table 3-7), 80 percent of Class I riparian/wildlife corridors is zoned rural and 18 percent is in parks and open space. Forty percent of rural zoned Class I riparian/wildlife corridors inside the UGB is considered buildable. Overall (i.e., inside and outside the UGB), only seven percent of all buildable land (non-habitat and habitat) is Class I riparian/wildlife corridors.[19]

Table 3-6. Class I riparian/wildlife corridors by generalized regional zones inside UGB.

Generalized Regional Zones	Class I Riparian/Wildlife Corridors					
	Developed		Vacant		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	1,661	2,414	1,868	942	6,886	40%
MFR	206	377	296	71	949	6%
MUC	74	57	194	97	423	2%
COMM	104	607	242	84	1,036	6%
IND	427	713	1,441	326	2,907	17%
RUR	113	85	922	739	1,858	18%
POS	111	2,812	246	9	3,176	11%
NO ZONE*	38	8	3	0	50	0%
TOTAL	*2,734*	*7,073*	*5,212*	*2,267*	*17,285*	*100%*

*****Some habitat areas within the UGB (0.3%) have no zoning designation.

Table 3-7. Class I riparian/wildlife corridors by generalized regional zones in expansion areas and remaining areas in Metro's jurisdiction.

Generalized Regional Zones	Class I Riparian/Wildlife Corridors					
	Developed Acres		Vacant Acres		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	24	41	16	74	155	2%
RUR	571	2,635	1,867	2,098	7,172	80%
POS	288	1,288	37	18	1,631	18%
MFR, MUC, COM, IND	15	7	11	17	50	1%
TOTAL	*898*	*3,971*	*1,931*	*2,207*	*9,008*	*100%*

Class II riparian/wildlife corridors

Class II riparian/wildlife corridors comprise 14 percent of total fish and wildlife habitat inside the UGB and ten percent outside the UGB (see Figures 3-4 and 3-5). These areas are medium value riparian/wildlife corridors that provide one to two primary functional values (scoring six to

[19] (2,267 acres + 2,207 acres)/64,178 total buildable acres = 6.97%

17 points in the riparian model) or a combination of one primary function and one or more secondary functions. Wildlife habitat is included in these areas where it coincides with the medium value riparian habitat. Class II riparian/wildlife corridors include rivers, streams, 50-foot area along developed stream segments, forest canopy or low structure vegetation within 200 feet of streams, and portions of undeveloped floodplains extending beyond 300 feet of streams. Class II riparian/wildlife corridors are elevated to Class I when they contain Habitats of Concern.

Forty-four percent of fish and wildlife habitat inside the UGB is zoned single-family residential; 22 percent is industrial (Table 3-8). Outside the UGB (Table 3-9), 95 percent of the habitat is zoned rural. Only about five percent[20] of the total vacant buildable land (non-habitat and habitat land) is classified as Class II riparian/wildlife corridors.

Table 3-8. Class II riparian/wildlife corridors by generalized regional zones inside UGB.

Generalized Regional Zones	Class II Riparian/Wildlife Corridor					
	Developed Acres		Vacant Acres		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	1,385	666	527	708	3,285	44%
MFR	207	78	75	62	422	6%
MUC	64	17	45	100	226	3%
COMM	134	250	137	75	596	8%
IND	448	114	684	378	1,623	22%
RUR	88	23	269	186	566	8%
POS	64	571	41	13	689	9%
NO ZONE*	42	2	2	0	47	1%
TOTAL	*2,432*	*1,721*	*1,780*	*1,521*	*7,454*	*100%*

*****Some habitat areas within the UGB (0.3%) have no zoning designation.

Table 3-9. Class II riparian/wildlife corridors by generalized regional zones in expansion areas and remaining areas in Metro's jurisdiction.

Generalized Regional Zones	Class II Riparian/Wildlife Corridors					
	Developed Acres		Vacant Acres		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	15	14	1	42	71	3%
RUR	348	214	438	1,568	2,569	95%
POS	14	8	1	6	29	1%
MFR, MUC, COM, IND	21	1	1	9	32	1%
TOTAL	*398*	*237*	*442*	*1,625*	*2,702*	*100%*

Class III riparian/wildlife corridors

Class III riparian corridors comprise eight percent of total fish and wildlife habitat inside the UGB and one percent outside the UGB (see Figures 3-4 and 3-5). These are low value areas that have riparian value only (located outside of wildlife habitat areas) such as developed floodplains and smaller forest canopies that are disassociated from streams (less than 20 acres). Thirty-seven percent of Class III riparian/wildlife corridors inside the UGB are single-family residential; another 37 percent is industrial (Table 3-10). Overall, most of Class III areas are developed (84 percent), typically in floodplains. Class III riparian corridors outside the UGB are predominantly rural land (90 percent) and mostly buildable (58 percent; Table 3-11). These are probably undeveloped forest canopies of less than 20 acres.

[20] (1,521 acres + 1,625 acres)/64,178 acres = 4.9%

Table 3-10. Class III riparian/wildlife corridors by generalized regional zones inside UGB.

Generalized Regional Zones	Class III Riparian Corridors					
	Developed Acres		Vacant Acres		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	1,186	84	55	174	1,499	37%
MFR	245	5	7	35	293	7%
MUC	183	0	2	23	209	5%
COMM	272	16	4	25	318	8%
IND	1,389	16	31	59	1,496	37%
RUR	45	5	2	46	98	2%
POS	115	33	3	2	153	4%
NO ZONE *	29	0	0	0	29	0%
TOTAL	*3,464*	*161*	*104*	*364*	*4,094*	*100%*

*****Some habitat areas within the UGB (0.3%) have no zoning designation.

Table 3-11. Class III riparian/wildlife corridors by generalized regional zones in expansion areas and remaining areas in Metro's jurisdiction.

Generalized Regional Zones	Class III Riparian Corridors					
	Developed		Vacant		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	13	1	0	7	21	6%
RUR	116	10	1	203	330	90%
POS	8	0	0	0	8	2%
MFR, MUC, COM, IND	6	0	1	2	9	2%
TOTAL	*142*	*11*	*2*	*212*	*368*	*100%*

Class A upland wildlife habitat

Class A upland wildlife habitat comprises 24 percent of the fish and wildlife habitat inside the UGB and 25 percent outside the UGB (see Figures 3-4 and 3-5). These are high value wildlife habitat areas scoring seven to nine points in the wildlife model. Examples include upland portions of large forest patches and large contiguous patches such as Forest Park. This category may also contain areas providing secondary functions for riparian corridors and Habitats of Concern located outside of riparian/wildlife corridors.

Within the UGB, forty-five percent of Class A upland wildlife habitat is zoned as single-family residential and 44 percent is parks and open space (Table 3-12). Seventy-seven percent of buildable land located within Class A upland wildlife habitat is zoned single-family zoning. Ninety percent of Class A wildlife habitat in UGB expansion areas and the remaining areas in Metro's jurisdiction is zoned for rural uses (Table 3-13), and most of this acreage is buildable (72 percent).

Table 3-12. Class A upland wildlife habitat by generalized regional zones inside UGB.

Generalized Regional Zones	Class A Upland Wildlife Habitat					
	Developed Acres		Vacant Acres		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	1,677	1,285	286	2,486	5,734	45%
MFR	85	129	42	94	350	3%
MUC	17	23	9	112	161	1%
COMM	29	53	21	49	152	1%
IND	80	98	47	238	462	4%
RUR	45	27	10	234	316	2%
POS	94	5,557	43	7	5,700	44%
NO ZONE*	4	0	0	0	4	0%
TOTAL	*2,031*	*7,171*	*457*	*3,219*	*12,879*	*100%*

*****Some habitat areas within the UGB (0.3%) have no zoning designation.

Table 3-13. Class A upland wildlife habitat by generalized regional zones in expansion areas and remaining areas in Metro's jurisdiction.

Generalized Regional Zones	Class A Upland Wildlife Habitat					
	Developed Acres		Vacant Acres		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	34	175	0	191	400	6%
RUR	615	862	34	4,682	6,193	90%
POS	10	209	2	35	256	4%
MFR, MUC, COM, IND	7	0	0	23	30	0%
TOTAL	*666*	*1,246*	*36*	*4,931*	*6,879*	*100%*

Class B upland wildlife habitat

Class B upland wildlife habitat makes up 13 percent of the fish and wildlife habitat inside the UGB and 22 percent outside the UGB (see Figures 3-4 and 3-5). These are medium value upland wildlife habitat areas scoring four to six points in the wildlife model. These areas include upland portions of medium sized forest patches with low structure connector patches along streams and rivers. This habitat category may also contain areas providing secondary functions for riparian corridors. Within the UGB, seventy-two percent of Class B upland wildlife habitat is zoned single-family residential; a large portion (68 percent) is developed, parks, and constrained land (Table 3-14). Outside the UGB, 96 percent of the habitat is zoned for rural uses. Eighty-three percent of these rural zoned lands are buildable (Table 3-15).

Table 3-14. Class B upland wildlife habitat by generalized regional zones inside UGB.

Generalized Regional Zones	Class B Upland Wildlife Habitat					
	Developed		Vacant		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	2,339	794	409	1,657	5,199	72%
MFR	119	47	23	95	284	4%
MUC	23	0	9	111	143	2%
COMM	50	128	15	76	269	4%
IND	58	5	25	262	350	5%
RUR	89	28	29	419	565	8%
POS	52	298	27	2	378	5%
NO ZONE*	17	0	0	0	17	0%
TOTAL	*2,747*	*1,299*	*537*	*2,622*	*7,205*	*100%*

*****Some habitat areas within the UGB (0.3%) have no zoning designation.

Table 3-15. Class B upland wildlife habitat by generalized regional zones in expansion areas and remaining areas in Metro's jurisdiction.

Generalized Regional Zones	Class B Upland Wildlife Habitat					
	Developed		Vacant		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	54	0	0	93	147	2%
RUR	805	171	12	4,869	5,856	96%
POS	5	16	3	47	71	1%
MFR, MUC, COM, IND	12	0	0	28	41	1%
TOTAL	*876*	*187*	*15*	*5,037*	*6,115*	*100%*

Class C upland wildlife habitat

Class C upland wildlife habitat represents nine percent of the fish and wildlife habitat inside the UGB and 11 percent outside the UGB (see Figures 3-4 and 3-5). These are less valuable upland wildlife habitat areas scoring two to three points in the wildlife habitat model. They include forest patches and smaller connector patches along streams and rivers. This category may also contain areas providing secondary functions for riparian corridors.

Within the UGB, single-family zoning is applied to 47 percent of Class C wildlife habitat. Industrial and rural zoning are applied to 19 percent and 11 percent, respectively (Table 3-16). Over 40 percent of the total land in this habitat category is buildable inside the UGB. Almost all of the land outside the UGB (96 percent; Table 3-17) is zoned rural, 82 percent of which is buildable.

Table 3-16. Class C upland wildlife habitat by generalized regional zones inside UGB.

Generalized Regional Zones	Class C Upland Wildlife Habitat					
	Developed		Vacant		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	1,052	314	132	721	2,219	47%
MFR	113	69	18	113	313	7%
MUC	44	2	6	70	122	3%
COMM	59	90	32	120	301	6%
IND	218	26	142	498	884	19%
RUR	73	25	29	393	520	11%
POS	48	308	1	16	372	8%
NO ZONE*	26	0	0	0	26	
TOTAL	*1,633*	*834*	*360*	*1,929*	*4,756*	*100%*

*****Some habitat areas within the UGB (0.3%) have no zoning designation.

Table 3-17. Class C upland wildlife habitat by generalized regional zones in expansion areas and remaining areas in Metro's jurisdiction.

Generalized Regional Zones	Class C Upland Wildlife Habitat					
	Developed		Vacant		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	21	1	0	54	76	3%
RUR	406	89	4	2,350	2,849	96%
POS	0	0	0	2	2	0%
MFR, MUC, COM, IND	15	1	0	12	28	1%
TOTAL	442	91	4	2,418	2,955	*100%*

Relationship of Metro's fish and wildlife habitat inventory to the 2040 Design Type Hierarchy

This section examines the relationship of Metro's fish and wildlife habitat inventory to the 2040 design type hierarchy described in the first section. Table 3-18 shows that over half of the fish and wildlife habitat (55 percent) falls into the tertiary design type category (i.e., inner and outer neighborhoods, employment centers, corridors); 28 percent is other design types (i.e., parks and open space, rural); and 11 percent is primary design types (city center, regional centers, industrial centers, intermodal transportation facilities). Only 14 percent of buildable fish and wildlife habitat coincides with primary design types, whereas 79 percent is in the tertiary design

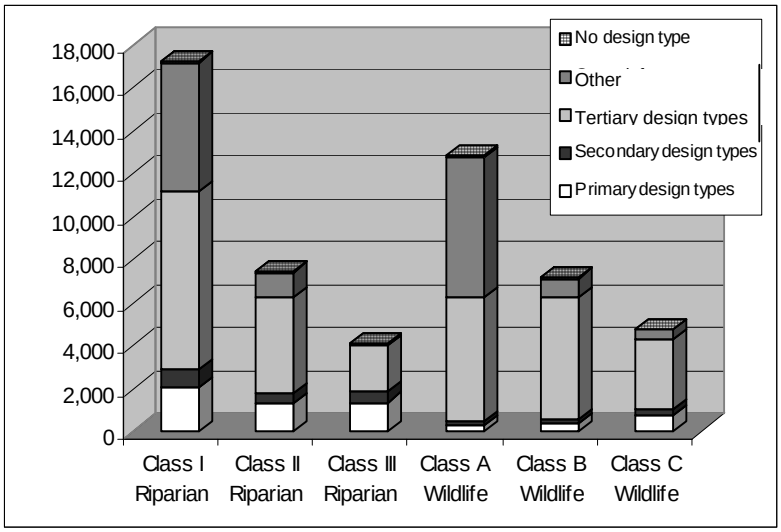
type category. This information is not included for the area outside the UGB because design types are not applied for the most part. Where they are applied, the location of the design types is very general.

Table 3-18. Fish and wildlife habitat acreage by 2040 design type hierarchy and development status inside the UGB.

2040 Design Type Hierarchy	Development Status					
	Developed		Vacant		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
Primary design types	2,205	66	2,082	1,712	6,064	11%
Secondary design types	1,070	212	525	762	2,570	5%
Tertiary design types	11,460	3,038	5,685	9,384	29,568	55%
Other design types	271	14,818	92	6	15,187	28%
No design types	34	123	65	59	282	1%
Total	*15,041*	*18,258*	*8,449*	*11,923*	*53,671*	*100%*

Figure 3-6 shows the distribution of fish and wildlife habitat classes by 2040 design type hierarchy.[21] For example, most of Class I riparian/ wildlife corridors (14,350 acres; 83 percent) falls within the tertiary design type and other design type categories; almost all of Class A upland wildlife (12,305 acres; 96 percent) coincides with these two categories.

Figure 3-6. Distribution of fish and wildlife habitat classes by 2040 design type priority inside UGB.



Impact Areas

Impact areas, as described in the previous section, define an area where allowed land uses or activities could harm the fish and wildlife habitat. Development activities near streams and wetlands often remove vegetation that would otherwise contribute to riparian function by providing shade, sedimentation control, and water storage. Developed areas also contribute runoff from impervious surfaces, human disturbance, noise, lighting, toxins, fertilizers and pesticides; each of these influences may adversely affect riparian areas and wildlife habitat. Tables 3-19 and 3-20 break out impact area acreage by generalized regional zones and development status. Over 13,300 acres are included as impact areas inside the UGB and 82 percent are developed. Over half of the impact area inside the UGB is zoned for single-family use; 19 percent is industrial zoned land. Impact areas outside the UGB (3,000 acres) are primarily zoned for rural uses (92 percent). Fifty-nine percent of the impact area outside the UGB is considered buildable.

[21] Figure 3-6 does not reflect design types adopted through the Pleasant Valley Concept Plan.

Table 3-19. Impact areas by generalized regional zones inside UGB.

Generalized Regional Zones	Impact Areas					
	Developed		Vacant		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	5,833	400	254	634	7,121	53%
MFR	903	67	39	92	1,101	8%
MUC	309	15	32	103	459	3%
COMM	645	159	33	89	926	7%
IND	1,625	86	251	585	2,547	19%
RUR	205	20	53	263	541	4%
POS	139	397	8	8	552	4%
NO ZONE*	70	0	0	0	70	1%
TOTAL	*9,729*	*1,144*	*670*	*1,774*	*13,317*	*100%*

*****Some habitat areas within the UGB (.3%) have no zoning designation.

Table 3-20. Impact areas by generalized regional zones in expansion areas and remaining areas in Metro's jurisdiction.

Generalized Regional Zones	Impact Areas					
	Developed		Vacant		Total	
	Urban	*Park*	*Constrained*	*Buildable*	*Dev. & Vac*	*% of Total*
SFR	59	1	0	43	103	3%
RUR	932	105	0	1,722	2,759	92%
POS	53	4	0	4	61	2%
MFR, MUC, COM, IND	65	0	0	18	83	3%
TOTAL	1,109	110	0	1,787	3,006	100%

The next section describes the activities that occur within each zone that may conflict with regionally significant fish and wildlife habitat.

Conflicting Uses by Metro's Generalized Regional Zones

The seven generalized regional zones provide the framework for identifying conflicting uses at a regional scale and the potential consequences, or impacts, to regionally significant fish and wildlife habitat. These generalized regional zones, by themselves, are not conflicting uses. It is the development activities and other disturbances (e.g., clearing land, adding impervious surfaces, replacing natural vegetation with non-native vegetation, etc.) permitted by the local zoning that potentially conflict with fish and wildlife habitat. These activities can generate negative impacts on natural vegetation and soil, the hydrologic and erosional processes in a watershed, and the physical characteristics of fish and wildlife habitat.

This section describes some of the common disturbance activities associated with land uses that are allowed outright or conditionally within Metro's generalized regional zones and that conflict with fish and wildlife habitat. The consequences, or impacts, to regionally significant fish and wildlife habitat are described in each of the ESEE analyses that follow this section.

According to the Goal 5 rule, a local government, following the standard ESEE process, complies with the rule if it identifies "at least the following activities as conflicting uses in riparian corridors:

(a) The permanent alteration of the riparian corridor by placement of structures or impervious surfaces, except for:
  (A) Water-dependent or water-related uses; and
  (B) Replacement of existing structures with structures in the same location that do not disturb additional riparian surface area; and

(b) Removal of vegetation in the riparian area, except:
  (A) As necessary for restoration activities, such as replacement of vegetation with native riparian species;
  (B) As necessary for the development of water-related or water-dependent uses; and
  (C) On lands designated for agricultural or forest use outside UGBs." (OAR 660-23-090(7))

Past land use practices, and perhaps to a lesser degree current land use practices, can negatively impact fish and wildlife habitat. Some of the common disturbance activities are listed in Table 3-21. Among the most obvious disturbances are the removal of vegetation and the placement of structures and impervious surfaces. Removal of vegetation from streambanks, floodplains, and upland wildlife areas fundamentally alters the stream hydrology resulting in many adverse effects (e.g., increased erosion, sedimentation, increased flooding, loss of habitat, etc.). Increased levels of impervious surfaces reduce groundwater infiltration, increase stormwater runoff, and degrade water quality (see *Environmental Consequences* chapter).

Disturbance activities occur in all regional zones; however, the degree to which these disturbances occur depends on the intensity of the land use (e.g., single-family residential vs. mixed use center), and the form and layout of the development (cluster development vs. evenly distributed development). The remainder of this section describes the disturbance activities in each of following generalized regional zones.

- Single family residential
- Multi-family residential
- Mixed Use Centers
- Commercial
- Industrial
- Rural
- Parks and Open Space

Table 3-21. Common disturbance activities.

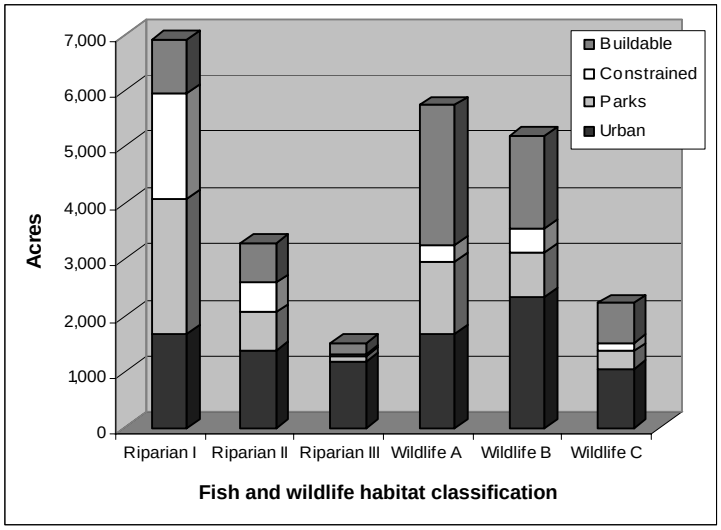
- Clearing vegetation and removing native soils
- Grading, excavation, filling, hauling, and soil compaction
- Adding impervious surfaces by constructing buildings, sidewalks, driveways, parking areas and roads
- Modifying streams such as channelizing, piping, widening, deepening, straightening and armoring streambanks to confine flows, increase capacity for flood control, and stabilize streambanks
- Installing utility connections such as sewers and stormwater pipes; septic tanks (in rural areas); building sewer pump stations and water towers
- Building stormwater control structures
- Constructing roads, stream crossings (e.g., bridges), installing culverts
- Landscaping with non-native vegetation (e.g., establishment of lawns, addition of non-native landscape features – trees, shrubs, groundcover, etc.)
- Introducing non-native fish and wildlife species
- Using fertilizers, pesticides and herbicides
- Building fences and other wildlife barriers
- Using toxins in households and businesses
- Generating runoff from household and business activities
- Other (pets, lights, noise, litter, garbage, etc.)

Single family residential (SFR 1-7)

Single-family residential (SFR 1-7) generally allows detached and attached housing on lot sizes up to 20,000 square feet. Conditional uses that often occur in single-family residential zones include: residential recreational centers, churches, schools, daycare facilities, nursing homes, retail sales and service, basic utilities, parks and open areas, etc.

The largest portion of Metro's Goal 5 fish and wildlife habitat inventory– 46 percent – is zoned for single-family residential uses (24,821 acres; see Table 3). Figure 3-7 shows the distribution of SFR fish and wildlife habitat by classification and development status. Over 50 percent of SFR habitat land is classified as high value riparian/wildlife corridors and upland wildlife habitat (12,620 acres); 44 percent of it is vacant (17 percent constrained; 27 percent buildable). Twenty-one percent of SFR habitat land is classified as Class B upland wildlife habitat; 13 percent is

Figure 3-7. Distribution of SFR zoned habitat land by classification and development status in UGB.



riparian/wildlife II. Overall, the developed/vacant status of SFR habitat land is 60/40 percent (respectively). Twenty-seven percent of the vacant land is buildable. Outside the UGB in expansion areas and remaining areas in Metro's jurisdiction, only three percent of fish and wildlife habitat is currently zoned for single-family residential. UGB expansion areas, which are predominantly zoned for rural uses, will eventually be upzoned to accommodate single-family residential development as well as a mix of other uses (e.g., multi-family, commercial, industrial, etc.).

Common development activities that occur in areas zoned for single-family residential include: preparing the site by clearing vegetation and grading; installing utility connections (e.g., stormwater pipes; sewer pipes); building roads and sidewalks; creating stormwater detention facilities; and constructing dwelling units, garages, accessory buildings, driveways, and parking areas. Past development practices included piping or modifying streams (e.g., channelizing, deepening, widening) and filling wetlands. These activities are now widely regulated and are less likely to occur.

Other disturbance activities occurring in SFR land that potentially impact fish and wildlife habitat include: landscaping with non-native vegetation (e.g., lawn, ornamental plants, etc.); applying pesticides, herbicides, and fungicides; building fences and other wildlife barriers; generating runoff; using household toxins; allowing pets to roam freely; generating noise, and using outdoor lighting.

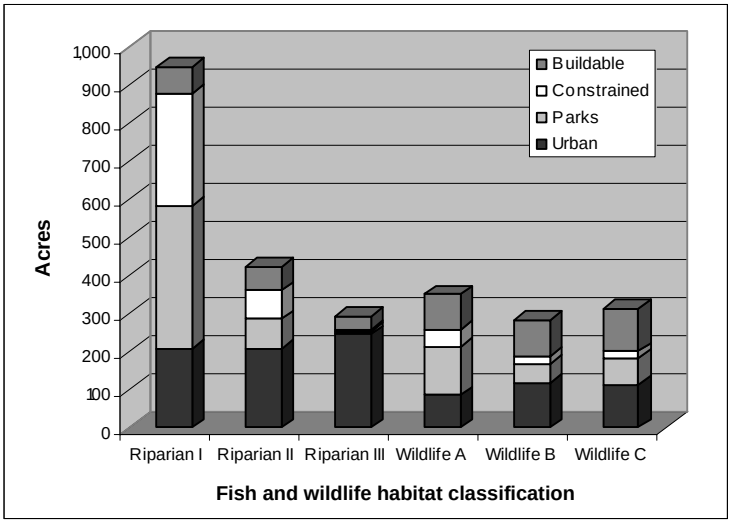
As described earlier, the removal of natural vegetation and the placement of structures and impervious surfaces are the most prevalent disturbances in nearly all zones. Some land uses may require more site preparation (e.g., vegetation removal, grading, etc.) and more impervious surface coverage (e.g., buildings, parking, etc.) than others. For example, a two-acre parcel developed as a single-family subdivision may add less impervious surfaces than an industrial development that requires a large percentage of total land area to accommodate manufacturing, warehousing and transportation facilities. Within SFR zones, however, vegetation removal and impervious surface coverage are highly variable, depending on development practices. For example, some communities may not require that trees and native vegetation be conserved during the development process. Residential streets may be designed to be wider than necessary for serving small volumes of traffic. Development practices that incorporate natural resources into the design (e.g., cluster design) and reduce overall imperviousness (e.g., narrow street design, shared parking) are likely to have less impact on fish and wildlife habitat.

Multi-family residential (MFR 1-4)

Multi-family residential (MFR1-4) includes land for apartment complexes, duplexes, garden apartments, rowhouses, townhouses, condominiums, and other attached single-family structures. These range in densities from two to 25 units per acre with height limits usually set at 2-1/2 to 3 stories (MFR1) to densities greater than 100 units and multiple stories (MFR4). Some mixed-use and neighborhood-scale commercial uses may be allowed under certain circumstances. Conditional uses may include churches, governmental facilities, utility structures, schools, residential recreational centers, group living facilities, etc.

Five percent of the Goal 5 fish and wildlife habitat inventory is zoned as MFR (2,610 acres; see Table 3-4). Figure 3-8 shows the distribution of MFR land by habitat classification and development status. Half of the MFR zoned habitat is classified as high value riparian/wildlife corridors and upland wildlife habitat (1,299 acres). Overall, the total developed/vacant status of MFR habitat is 64/36 percent respectively. Most of the buildable land is found in the three upland wildlife categories.

Figure 3-8. Distribution of MFR zoned habitat land by classification and development status in UGB.

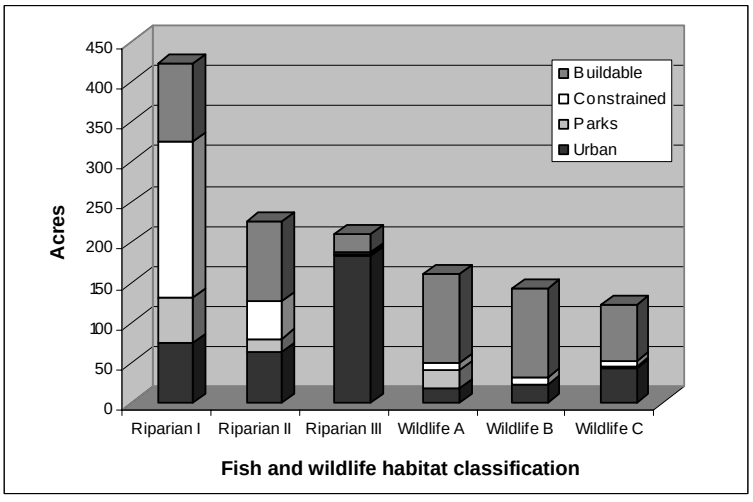


Development activities that occur in areas zoned for multi-family residential are similar to those found in single-family residential areas. Vegetation is removed, impervious surfaces are added, household activities are similar. Multi-family development may add more impervious surface than single-family residential to accommodate for parking. However, in many cases multi-family residential construction can clear less land area to construct the dwelling units than a typical single-family subdivision. Certain disturbance activities may be more common in single-family than in multi-family residential uses. For example, pesticide, herbicide and fertilizer use may be greater in single-family developments with landscaped yards.

Mixed use centers (MUC)

Mixed use centers (MUC) include residential along with commercial uses in town centers, main streets, corridors, light rail station areas, regional centers and the central city. Development types generally permitted include moderate-density to high-density multi-family residential uses, attached single-family dwellings, locally-oriented commercial, retail, services, office uses, community service, and daycare. Mixed-use centers have a strong pedestrian and transit orientation.

Figure 3-9. Distribution of MUC zoned habitat land by classification and development status in UGB.



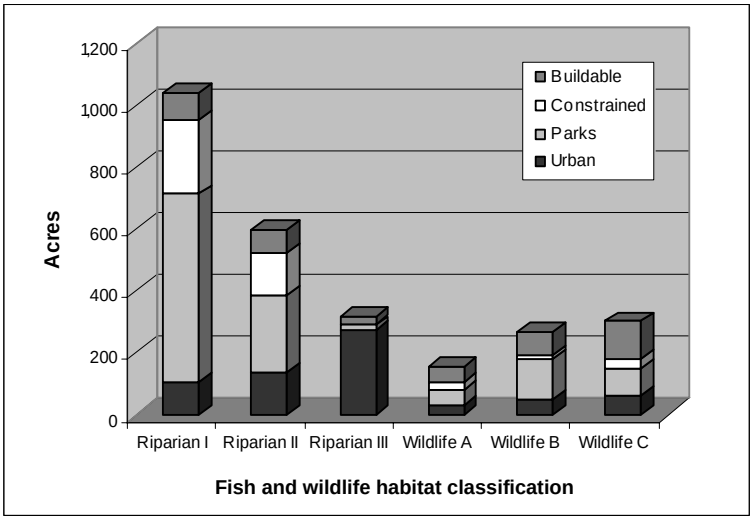
Only two percent of fish and wildlife habitat is zoned for mixed use (1,284 acres; see Table 3-4). Figure 3-9 shows the distribution of MUC land by habitat classification and development status. Fifty-one percent of habitat zoned for mixed use is Class I and II

riparian/wildlife corridors (649 acres); 33 percent is upland wildlife habitat (426 acres); and 16 percent is Class III riparian (210 acres). About 40 percent of MUC zoned habitat is buildable.

Similar development activities to those described in the SFR and MFR sections occur in mixed-use centers: vegetation is cleared, impervious surfaces are added. A higher level of imperviousness may occur in these areas as a result of parking requirements and road networks. Other disturbance activities may be different from residential uses. For example, the use of pesticides and herbicides is likely to be less significant in mixed-use centers. The design of mixed-use centers determines the severity of impacts on the fish and wildlife habitat.

Commercial (COM)

Figure 3-10. Distribution of COM zoned habitat land by classification and development status in UGB.



Commercial (COM) districts are similar to mixed use zoning in that they tend to be closer to central urban areas or related corridors of commercial activity. Commercial uses include a wide range and scale of retail and service businesses, office, and civic uses in a concentrated area. Public facilities (PF) such as schools, churches, government offices, hospitals, libraries, correctional facilities, public recreation facilities, and public utilities are also included in this category. Conditional uses typically allowed in commercial areas include group living facilities (e.g., nursing homes, boarding houses), churches, schools, jails and related facilities, basic utilities, radio transmission facilities, transit park and rides, rail lines and utility corridors, etc.

Five percent of fish and wildlife habitat is zoned for commercial development (2,672 acres; see Table 3-4). Figure 3-10 shows the distribution of commercial land by habitat classification and development status. Thirty-nine percent of the land is classified as high value riparian/wildlife corridors; only eight percent of that is buildable. Upland wildlife habitat comprises only a small potion (nine percent) of commercial land. The developed/vacant status of COM habitat land is 67/33 percent (respectively).

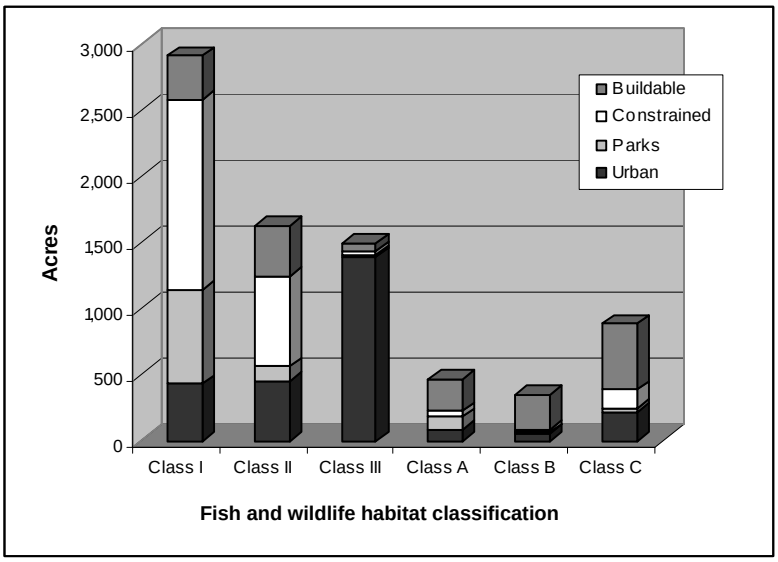
The disturbance activities related to commercial uses are similar to those described for SFR and MFR uses; however, in many cases these activities are more intense. Clearing and grading are usually more extensive for commercial development. Roads and parking lots are important features of commercial development to allow for customer access and visitation. Additional traffic around commercial areas creates more pollutants on roadways, which are eventually washed into streams and rivers. In addition, increased traffic creates hazards to wildlife when moving from one habitat area to another. Large parking lots result in more impervious surfaces than are typically required for residential uses and mixed use areas.

Some of the disturbance activities are less of an issue in commercial development than in residential areas. For example, application of fertilizers, pesticides and herbicides may be reduced, unless the commercial development incorporates extensive landscaping. Impacts to the fish and wildlife habitat from domestic pets are also less relevant in commercial development.

Industrial (IND)

Industrial zones allow a variety of industrial uses from light manufacturing (e.g., fabrication) to heavy manufacturing (e.g., chemical processing) to mixed use industrial (e.g., a mix of light manufacturing, office and retail uses). Supporting commercial services such as restaurants and banks may be allowed outright, depending on the zone, or permitted with limitations. Conditional uses may include junkyards and wrecking yards, basic utilities, commercial recreation facilities, and waste related services.

Figure 3-11. Distribution of IND zoned habitat land by classification and development status in UGB.



Industrial zoned land represents a fairly significant portion of the Goal 5 fish and wildlife habitat inventory – 14 percent (7,721 acres; see Table 3-4). Industrial land tends to be large, flat parcels that may intersect with fish and wildlife habitat in lower density areas of the region, often bordering rivers, streams or wetlands. This fact is apparent from Figure 3-11; over 2,900 acres, or 38 percent of industrially zoned habitat, is high value riparian/wildlife corridors. Over sixty percent of Class I is considered vacant, most of which is constrained land. The developed/vacant status of total IND habitat land is 47/53 percent (respectively).

Disturbance activities in industrial development are similar to those found in residential and commercial areas, but to a greater degree depending on the intensity of the industrial activity (e.g., light industrial vs. heavy industrial). Industrial development is typically land intensive, meaning it requires a large percentage of total land area to accommodate manufacturing, warehousing, transportation facilities, etc. Site preparation for industrial development frequently requires complete site clearing and grading. Past development practices retained few, if any, natural resources on the site and the entire site was covered with impervious surfaces. Current regulations require that impervious surfaces be set back from water features, and that riparian areas be planted with native vegetation.

Some industrial uses require a substantial amount of water for use in manufacturing processes (e.g., cooling equipment) that is later released to the rivers at an increased temperature. This process impacts instream habitat for fish and other aquatic species. Industrial areas may

contribute high quantities of heavy metals and other toxic materials. In addition, the use, storage, and transport of hazardous materials often occurs in industrial uses.

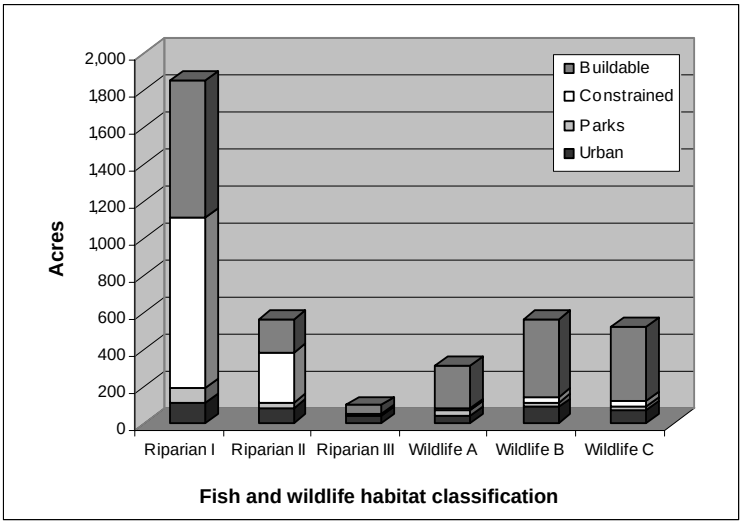
Mining typically occurs on industrially-zoned land. In the Metro region, mining is focused on aggregate resources (naturally occurring concentrations of stone, rock, sand and other materials used for urban development and road building). Aggregate resources are regulated as Goal 5 resources. Instream and off-channel mining of aggregate resources has direct and significant negative impacts on the aquatic ecosystem. Extraction of sand and gravel from within a stream channel may change the way in which water and sediment move through a stream system and altering stream characteristics (e.g., channel morphology and substrate, channel stability, etc.). Off-channel mining practices often include construction of berms and dikes to prevent flood flows from spilling into excavation areas. These structures can prevent the natural lateral migration of the stream.

Marine terminals, freight facilities for trucking, airports and railroad mostly occur in industrial zoned areas. These land uses have similar disturbance activities as land intensive industrial uses. Airports have the additional impact of noise and light. The Goal 5 rule exempts water-dependent or water-related uses, which are generally located in industrially zoned areas, from being identified as conflicting uses. (OAR 660-23-090(7)) However, activities related to these uses have detrimental impacts on instream aquatic habitat.

Rural (RUR)

The rural generalized zoning category includes RRFU (Rural Residential and Future Urban) and FF (Agricultural and Forestry). Rural residential lands provide the opportunity for single-family housing on lots of one acre or more in a rural or semi-rural environment. This designation also includes areas set aside for future urban development. Some of the local zones that fall into the RRFU category also allow agriculture, horticulture, greenhouses, nurseries, timber growing, and raising of livestock and animals.

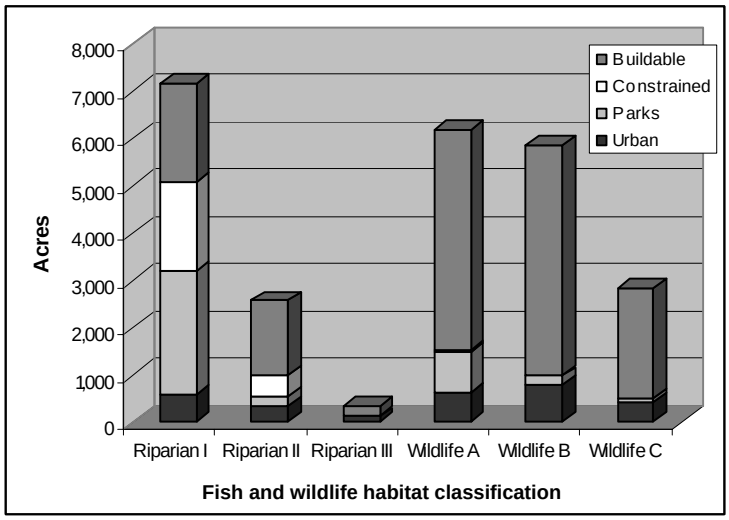
Figure 3-12. Distribution of RUR habitat land by classification and development status in UGB.



Fourteen percent of the fish and wildlife habitat inside the UGB (before December 2002) is zoned for rural use (7,721 acres; see Table 3-4). Not surprisingly, fish and wildlife habitat zoned for rural uses is a much higher proportion (89 percent) in UGB expansion areas and the remaining areas within Metro's jurisdiction (24,969 acres; see Table 3-5). Figure 3-12 shows that most of the rural zoned habitat land within the UGB is Class I and Class II riparian/wildlife corridors (62 percent). Over half (51 percent) the total habitat land zoned for rural uses inside the UGB is considered buildable.

Figure 3-13 shows the distribution of rural fish and wildlife habitat in UGB expansion areas and the remaining areas in Metro's jurisdiction. Fifty-four percent of habitat zoned for rural uses is high value Class I riparian/wildlife corridors and Class A upland wildlife habitat; more than half of that is buildable. Over 8,200 acres of the 18,800 acres in UGB expansion areas (44 percent) are significant fish and wildlife habitat. These areas will eventually be upzoned from rural zoning to accommodate urban development.

Figure 3-13. Distribution of RUR habitat land by classification and development status outside UGB.



Rural disturbance activities are similar to single-family and multi-family residential, except that there is typically less impervious surface. The larger lots generally spread out the impact of development and produce less stormwater runoff. However, the use of pesticides, herbicides and fertilizers may be greater in rural developments where agricultural uses are allowed. In addition, grazing of livestock can cause soil erosion, soil compaction, deterioration of water quality, and simplification of native vegetation diversity.

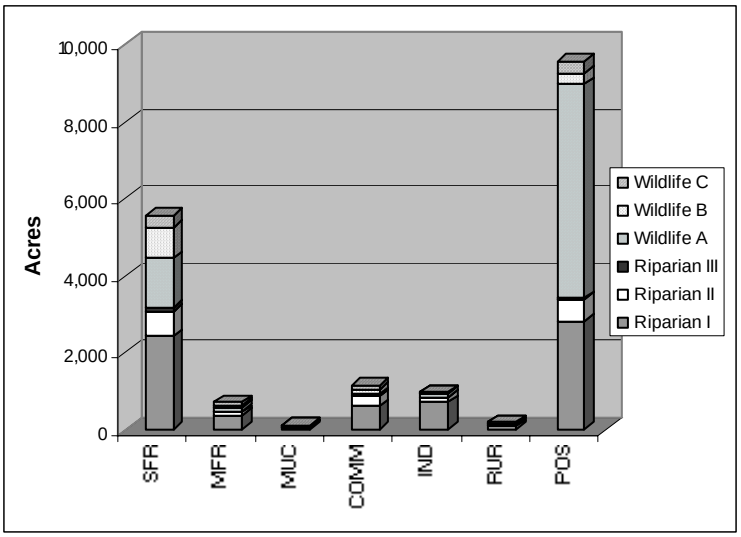
Agricultural uses and forestry, suitable to commercial scale production (typically with lot sizes of 30 acres or more), are allowed in the FF (Agriculture or Forestry) regional zone. Commercial farm and forest uses can involve extensive removal of native vegetation and habitat and are considered a conflicting use within the UGB. However, the Goal 5 rule exempts identifying agricultural and forest use outside the UGB as conflicting uses. (OAR 660-23-090(7)) Clearing vegetation, plowing fields, exposing bare soils and other farming and forestry practices (e.g., use of harvesting equipment) can heavily impact fish and wildlife habitat (e.g., soil erosion, soil compaction, etc.).

Parks and open space (POS)

Twenty percent of the Goal 5 fish and wildlife habitat inventory (10,470 acres; see Table 3-4) is actually zoned as parks and open space. An additional 8,680 acres are included in Metro's parks and open spaces inventory, but are zoned something other than POS. Parks and open space are allowed outright or conditionally in all of the generalized regional zones, although to varying degrees, and often retain the underlying zoning. Metro excludes parks and open space from the buildable land supply for estimating the region's 20-year land supply for dwelling units and employment inside the UGB.

Figure 3-14 shows park acreage by generalized zones and habitat classification. The largest number of park acres occurs in POS and SFR zoning.

Figure 3-14. Parks and open space by generalized regional zones and habitat classification.



The disturbance activities associated with parks and open space vary depending on the intensity of use. Many developed parks provide ball fields, tennis courts, picnic areas, recreational trails, maintenance facilities, parking lots, and other amenities. Disturbance activities in parks create impacts that are similar to those described for residential uses; however, generally a smaller percentage of land is covered by impervious surfaces. Maintenance practices used in many parks are similar to residential landscaping practices and can negatively impact habitat. Off-leash dog use in some of these parks impacts water quality.

Undeveloped open space, on the other hand, has the least amount of disturbance activities. These areas provide important wildlife habitat. Publicly owned open space provides recreational opportunities for people and a connection to nature and exposure to wildlife. Human activities such as hiking and biking, however, can negatively impact the fish and wildlife habitat.

Summary

Metro identified conflicting uses from a regional perspective by examining generalized regional zones (Metro's compilation of local jurisdictions' zones) and by considering Metro's 2040 Growth Concept. The conflicting use chapter analyzed Metro's Goal 5 fish and wildlife habitat inventory (e.g., habitat class, development status) and its distribution among generalized regional zones, 2040 design type priorities, and impact areas. Disturbance activities that are likely to occur within the generalized regional zones are also described. Some key points from this chapter include:

- Metro's jurisdiction is comprised of approximately 280,660 acres, or about 438 square miles (not including water features). Figure 3-15 shows a comparison of non-habitat land with habitat land in three geographical areas: the UGB (pre-December 2002), UGB expansion areas (December 2002), and the remaining areas in Metro's jurisdiction outside the UGB (see Figure 3-1 map).
- About 29 percent of the total acreage in the three geographical areas represented in Figure 3-15 is regionally significant fish and wildlife habitat (81,700 acres).
- Approximately two-thirds of fish and wildlife habitat are within the UGB.
- Twenty-three percent of the total land area (both non-habitat and habitat) is vacant buildable land (64,175 acres). Almost half of the vacant buildable land in Metro's jurisdiction is fish and wildlife habitat (see Figure 3-16).
- Twenty-eight percent of vacant fish and wildlife habitat is already constrained by existing environmental regulations.
- The highest quality riparian/wildlife corridors (Class I) comprise about seven percent of the total supply of buildable land, while the highest quality upland wildlife (Class A) is 13 percent of the total supply of buildable land.

Figure 3-15. Total acreage in Metro's jurisdiction.

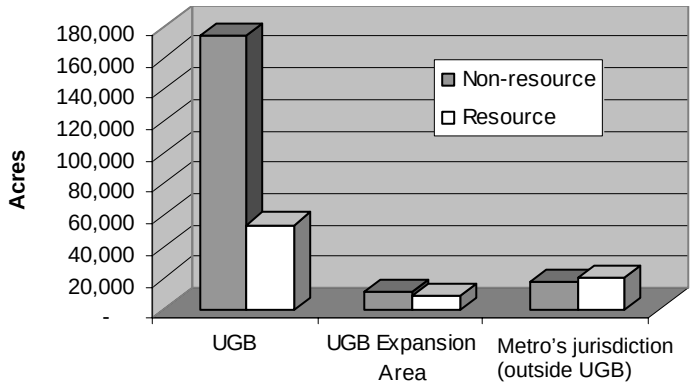
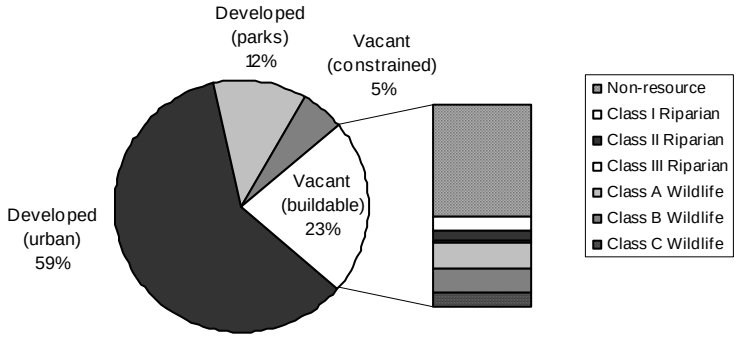


Figure 3-16. Percentage of total acreage in Metro's jurisdiction by development status.



- The generalized regional zones, by themselves, are not conflicting uses. It is the development activities and other disturbances (e.g., clearing vegetation; adding impervious surfaces such roads, sidewalks, buildings and parking lots; landscaping with non-native vegetation; use of chemicals and contaminants) that generate negative impacts to fish and wildlife habitat.
- Forty-seven percent of fish and wildlife habitat is zoned single-family residential; over half is classified as high value riparian/wildlife and upland wildlife.
- Twenty percent of the fish and wildlife habitat is zoned for parks and open space. However, 34 percent of the fish and wildlife habitat is used as a park or open space.
- Fourteen percent of fish and wildlife habitat is zoned for industrial use. Of this amount, 44 percent overlaps with high value habitat, and over half is vacant.
- Metro has identified approximately 16, 300 acres as impact areas; over half are zoned single-family residential; 19 percent are zoned industrial; 82 percent is developed.
- 2040 design types are prioritized into four categories: primary land use components, secondary land use components, tertiary land use components, and other. Over half of the fish and wildlife habitat overlap with tertiary land use components (i.e., inner and outer neighborhoods, employment centers, corridors); 28 percent of the habitat is other design types (i.e., parks and open space, rural), 11 percent is in a primary category (i.e., central city, regional centers, industrial areas, intermodal transportation facilities); and five percent is secondary land uses (i.e., town centers, main streets, and station communities).

Figure 3-17. Distribution of habitat classification by generalized regional zones inside the UGB.

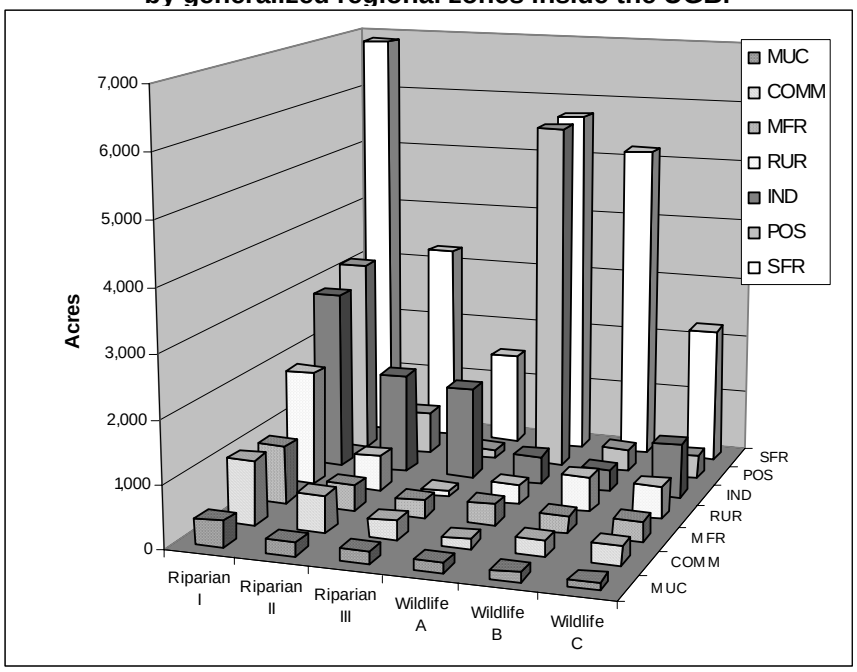
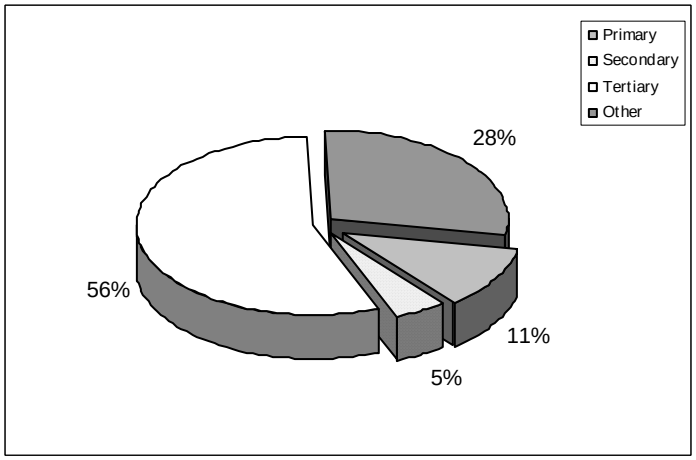


Figure 3-18. Percentage of fish and wildlife habitat by 2040 design type hierarchy.



The next four chapters consider the ESEE consequences of allowing, limiting, or prohibiting conflicting uses in fish and wildlife habitat areas.

CHAPTER 4: ECONOMIC CONSEQUENCES

Introduction

This chapter focuses on the economic consequences of protecting or not protecting fish and wildlife habitat. The competition between developing fish and wildlife habitat and protecting the ecosystem services provided by these areas lies at the heart of economic analysis. Metro contracted with ECONorthwest, a well-respected economic consulting firm, to provide insights into this competition and identify supporting information for the economic analysis. ECONorthwest conducted a review of the relevant literature[22] that focused on the factors that influence the market value for developable land and the economic value of ecosystem services provided by fish and wildlife habitat.

This chapter begins by providing an overview of the region's economy and the economic principles guiding the analysis. It then briefly outlines the major analytical tasks involved. The remainder of the chapter summarizes ECONorthwest's analysis[23] and describes the tradeoffs of protecting or not protecting fish and wildlife habitat by addressing the following questions:

- How is land ranked based on the economic importance for development?
- How is land ranked based on the economic importance for ecosystem services?
- What are the interactions between development value and ecosystem services value of fish and wildlife habitat?
- What are the potential economic consequences of allowing, limiting or prohibiting conflicting uses?

Background and context

Metro region's economy

The economic structure of the region's economy has shifted over time from one driven by resource industries (timber, agriculture, and metals) to more knowledge-based and service-oriented industries. This restructuring has occurred as productivity, labor trends and capital investments have re-shaped the national economy over the last half century and forced regional economies like the Portland area to adapt in order to prosper. And indeed the Portland area has prospered – witnessed by its above-average population and job growth over the last several decades.

Early on, cities on the West Coast emerged because of proximity to trade routes and abundant natural resources of which residents could take advantage. This region was blessed with plentiful rainfall and rich soil for agriculture in the Willamette Valley and plentiful trees for harvesting logs for homes and industry. Portland's proximity at the confluence of two great rivers provided cheap and convenient access/connections for farm goods and supplies to and

[22] See Appendix C: *Final Draft Literature Review for the Economic Portion of Metro's Goal 5 ESEE Analysis* (ECONorthwest 2003)
[23] See Appendix C: *Final Report for the Economic Portion of Metro's Goal 5 ESEE Analysis* (ECONorthwest 2004).

from various sea and inland trade routes. Portland became a major seaport and transportation hub for West Coast trade.

Agriculture in the northern Willamette Valley has changed over time as farm production has become more competitive nationwide. Farms that once produced foodstuffs for the Portland area no longer are the dominant agricultural industry. Today instead, the major agricultural producers are nursery growers and grass seed farming.

With the onset of World War II, the region's economy shifted to producing goods for the war effort. Ship building and ancillary manufacturing arose to briefly become a key industry during the 1940's. Since then, ship building has declined. However, the transportation equipment industry remains a significant industry in the region, but the components of this industry have shifted away from ship building to the production of rail cars (Gunderson), aircraft parts manufacturing (Boeing) and heavy diesel truck production (Freightliner).

After construction of the Bonneville Dam and other dams along the Columbia River, metals manufacturing and fabrication (particularly aluminum) became an important component of the regional economy. The dams provided an opportunity to create jobs and generate cheap and plentiful electricity for residents in the region. The enormous surplus of electricity attracted Reynolds Aluminum and others to locate aluminum smelting plants in and around the region. As the aluminum industry matured, the Northwest aluminum industry's competitive advantage steadily waned. A combination of higher electricity prices, diminished electrical supplies, and global competition has forced most of the region's aluminum smelters out of business. The metal industry in the region has evolved into a secondary industry that mostly handles recycling of scrap metals.

Before the 1980's regional recession, timber products (logging and paper) were engines of growth for the State and metropolitan area economies. This is no longer the situation. Continued concerns over logging of old growth forests and associated decline of species have led to restricted harvest levels on federal forest lands. In addition, competition from Canadian sources and southeast U.S. producers has increased over time. Continued productivity enhancements in the industry also add to the long-term employment declines in this industry. As a result, the forest products industry is a smaller part of the regional economy.

As the region's traditional resource industries came under increased competitive pressures, the metropolitan area experienced the emergence of a new industry – the so-called high-tech industry. High-tech had its nascent beginning in 1946 with Techtronix and 30 years later with Intel. The high-tech industry really came into prominence in the 1990's as Intel and other multi-national firms from Asia invested over $10 billion in the area alone. The high-tech sector, popularly known as Silicon Forest, which is largely concentrated in Hillsboro, with smaller "clusters" in Tualatin and Gresham, is not monolithic but is comprised of different companies specializing in various fields of expertise. The region's specialties in the high-tech field include semi-conductors, electro-scientific instruments, printer and parts manufacturing, and visual projection devices.

The transport of goods and services has always been an important component of the metropolitan economy. The Port of Portland continues to be a key economic component to this region's economic health. The factors that made Portland a key location for commerce are still here today and may be even stronger today than before. International travel and the trading of goods and services overseas is much greater today. The regional economy is much more globally bound, so the infrastructure and technology to move goods and people overseas and around the country are very important to the growth and prosperity of the region.

As the region's basic or traded sectors grow and attract new businesses and the people who work for these companies, the region has experienced a multi-fold increase in services and retail. Every city has needs and these needs are provided by the numerous entrepreneurs who everyday provide the goods and services residents living in the city demand. As the region's population grows, so have the number of shopkeepers. Like all metropolitan areas in the U.S., there has been an evolution in how goods and services are supplied to consumers. One example is the rapid growth of Mega-stores and regional malls that did not exist half a century ago.

As described above, the region's economy has shifted over time from resource-based industries to more knowledge-based and service-oriented industries. This transition has added complexity to the region's economy and competition for natural resources. The following section briefly describes the economic principles upon which this analysis is based.

Economic principles

The following six economic principles help define the approach to the analysis of economic tradeoffs of developing lands that contain significant riparian and/or wildlife habitat or protecting this habitat and the associated ecosystem services that benefit society.

1. *Market prices for land can be used as a measure of development value.* Property markets for developable land meet most of the criteria for a well-functioning market. Many sellers and buyers participate in the market, there is free entry to and exit from the market, and buyers and sellers have access to information on the attributes of land that provide development value. For these reasons, market prices for land provide a good measure of development value. Participants in a market can measure or rank the development potential or importance of properties based on property value.
2. *Ecosystem services have economic value.* Ecosystem services are the benefits to society of well-functioning ecosystems such as riparian areas that mitigate flooding, help filter toxins and sediment from surface runoff and provide recreational and other amenity values. Society also benefits from wildlife habitat that helps support populations of species with commercial, recreational, and cultural value.
3. *Property markets may capture some, but not all, of the values of ecosystem services.* Property markets can provide information on the value of some ecosystem services, such as the value associated with proximity or access to recreational resources or scenic vistas. Property values typically do not reflect the value of other ecosystem services, such as water quality or wildlife habitat services.
4. *Property markets may not capture public policy or planning goals.* Just as property markets fail to reflect the full value to society of ecosystem services, these markets may also fail to capture the value of public policy or planning goals that affect land use. For example, properties with the highest market value may not necessarily be the most

important lands from a public policy perspective. Specific to this project, the hierarchy of design types as described by the 2040 Growth Concept emphasizes certain land use types in certain locations. Public policy consideration drives the design of the hierarchy, not market prices. As a result, the 2040 Growth Concept may emphasize the importance of a relatively low valued land use, such as industrial development, in an area that, if left to property markets, would develop into a higher valued use, such as a residential development.

5. *There is competition for the fish and wildlife habitat resources at issue in this study.* In the past, discussions of the competition for natural resources focused on the tradeoffs of developing or using a resource and the associated jobs created or supported versus protecting the resource for its intrinsic or non-use value. This is the 'jobs vs. the environment' argument. Such an approach assumed two competing demands for a resource: 1) that protecting the environment would not generate or support jobs, and 2) that development use would not generate negative impacts beyond affecting non-use values.

   Today, the competition for resources is more complex with more demands on a finite amount of natural resources. The dynamics of the competition extend far beyond a choice of jobs or the environment. A distinction can be made between demands on the resource that have use and non-use values. The range of demands with use values include commercial use of the resource, the ecosystem services provided by the resources, the impacts of the resources and development values on location decisions of retirees, workers and businesses and other quality-of-life impacts and options to use the resources in the future.[24] Demands with non-use values include the intrinsic value of the resources.
6. *A static analysis likely will fail to inform stakeholders or decision makers adequately of the economic tradeoffs*. A static analysis is similar to taking a snapshot of analytical conditions. This approach assumes no changes in factors that could influence the outcome of a decision to develop or to protect resources. An alternative approach that considers how changes or adjustments affect the economic analysis will likely provide a more complete description of the economic tradeoffs than ignoring these adjustments. In this case, dynamic adjustments may include expanding the urban growth boundary (UGB) and the substitutability of land within the UGB. Such a dynamic approach also considers the likely restoration efforts that can help mitigate the negative impacts of development on regionally significant fish and wildlife habitat. A dynamic approach that considers likely changes, adjustments, or possible mitigation efforts will provide decision makers with a more complete view of the likely economic impacts than will a static approach.

Framework for the economic analysis

The framework for the economic analysis consists of four major analytical tasks, briefly described below.

[24] See Appendix C, *Final Draft Literature Review for the Economic Portion of Metro's Goal 5 ESEE Analysis* (ECONorthwest, 2003), for more information on the competing demands for natural resources.

- *Rank fish and wildlife habitat based on the economic importance for development (development value).* In this analytical task, a method was developed to rank the relative importance of land for development using three criteria: land value, employment and 2040 design types.

- *Describe economic value of ecosystem services provided by fish and wildlife habitat.* In this task, the economic value of ecosystem services is described based on ECONorthwest's economic literature review. Metro's ranking of fish and wildlife habitat for ecological function serves as a proxy for the economic value of ecosystem services.

- *Compare the ranking of economic importance for development (development value) with Metro's ranking of ecological value for fish and wildlife habitat.* This comparison provides information on the amount and distribution of significant interactions between development use and habitat protection.

- *Describe the economic consequences of allowing, limiting, or prohibiting development of regionally significant fish and wildlife habitat.* In this task, reference is made back to the previous tasks that describe the context for the analysis of economic tradeoffs. Economic factors (e.g., land value, employment, 2040 design types and value of ecosystem services) are described that may be affected by a Goal 5 decision.

How is land ranked based on the economic importance for development?

Not all land has the same economic importance for development, just as not all fish and wildlife habitat have the same ecological value. For example, land zoned for parks has less economic importance compared to land zoned for industrial uses. This analysis ranks land based on economic importance for development, or "development value." This approach helps weigh the economic consequences of protecting or not protecting fish and wildlife habitat.

Development value of land can be ranked in many ways. Methods include ranking land based on property value, distance from city center, the amount of vehicle and pedestrian traffic that passes by, or local economic development priorities that target specific economic sectors or land uses. Developing an exhaustive list of methods and applying them to the lands that contain fish and wildlife habitat goes beyond the scope of this analysis. Instead, this analysis focuses on a three measures that provide a general understanding of the development values: land value, employment potential associated with development (employment density) and 2040 Growth Concept planning goals.

Property markets provide a good measure of a property's development value because factors that affect a parcel's development potential (i.e., location and use) are typically widely known and easily measured.[25] The location factors that influence property values include availability of

[25] See Appendix C, *Final Draft Literature Review for the Economic Portion of Metro's Goal 5 ESEE Analysis* (ECONorthwest, 2003), for more information.

urban infrastructure services, transportation access, and zoning and other regulations. Use factors include a property's amenities, physical terrain and lot size and shape.

The second measure for describing the importance of land for development is the employment potential associated with development. Land values and employment potential describe current conditions. For insights into relative importance for development in the future, a third measure is used that ranks land using Metro's 2040 Growth Concept planning goals described by the 2040 design types.[26] The following sections describe these three measures.

Rank lands based on land value

Market prices reflect a parcel's location and use factors. Distribution of land value was modeled based on local tax assessor data and mapped using GIS. County assessors' data on value (compiled by Metro) is a reasonable proxy for market value for purposes of identifying a range of property values from high to low. "Reasonable proxy" means that there is a relatively high correlation between values in the assessor's data and market values. That is, a high value in the assessor's database will also have a high market value. Given the limitations on assessed value from Measures 5 and 50, it is expected that assessed values will be less than market values. However, this data is used to describe a range of property values from high to low, not as a measure of market value for any one property.

The data on land value was used for ranking lands, not the value of land plus improvements. Land value reflects the expected value of land in the best uses supported by the market and allowed by public policy. Including the value of improvements would bias the analysis against undeveloped land. Property without improvements would likely be constrained to the lower end of the range of values if the range included the value of improvements.

The database of assessed values excludes land uses that do not pay property taxes, such as public schools and some hospitals, and underestimates the value of other land uses that pay limited property taxes, such as low-income housing. Land value reflects the amenity values associated with fish and wildlife habitat, but likely does not capture the value of other ecosystem services such as those associated with water quality and flood management.

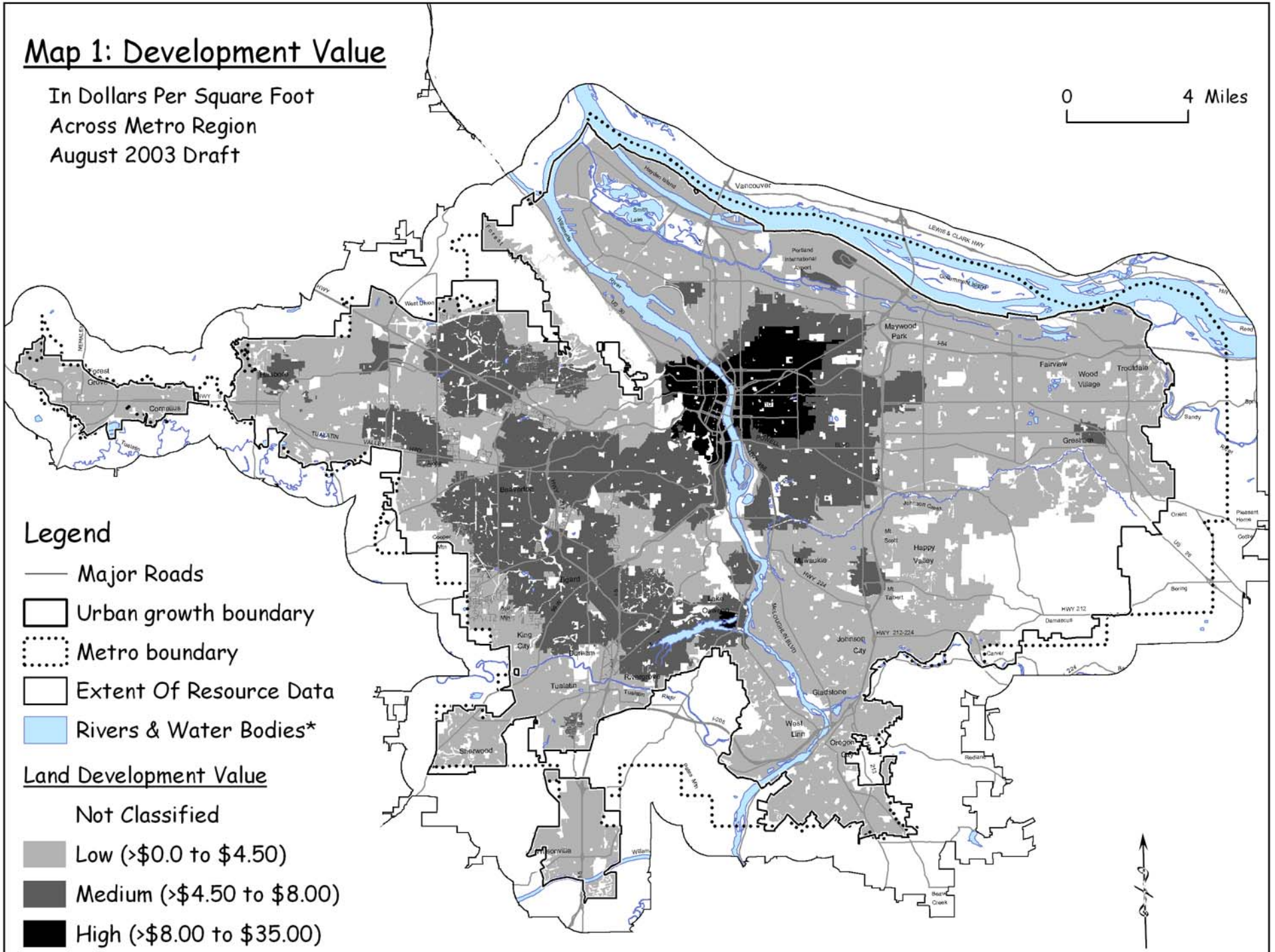
Map 1 shows the distribution of land value across the Metro region. Land value is divided into "low," "medium" and "high" values. Habitat lands with assessed values equal to or greater than $8.00 per square foot have high development value. Habitat lands with assessed values greater than $4.50 and less than $8.00 have medium development value. Habitat lands with assessed value below $4.50 per square foot have low development value.[27] Values are expressed as mean dollars per square foot. Map 1 shows that the highest values are centered on the city of Portland and surrounding concentrations of population and commercial activity. Areas of medium value surround the high valued areas and include areas of suburban population and commercial concentrations. Low values are found in the remaining outlying areas.

[26] See Conflicting Use chapter for description of 2040 design types.
[27] See Appendix C, *Final Report for the Economic Portion of Metro's Goal 5 ESEE Analysis* (ECONorthwest 2004), for more information

Map 1a depicts the distribution of land values for the subset of lands in Metro's jurisdiction that contain fish and wildlife habitat. The large majority of these acres fall in the outlying or low category. Map 1b shows only those habitat lands that are ranked high for the quality of fish and wildlife habitat characteristics. Another way of describing the lands shown in Map 1b is that they represent the development value of lands that contain the most significant fish and wildlife habitat

Map 1: Development Value

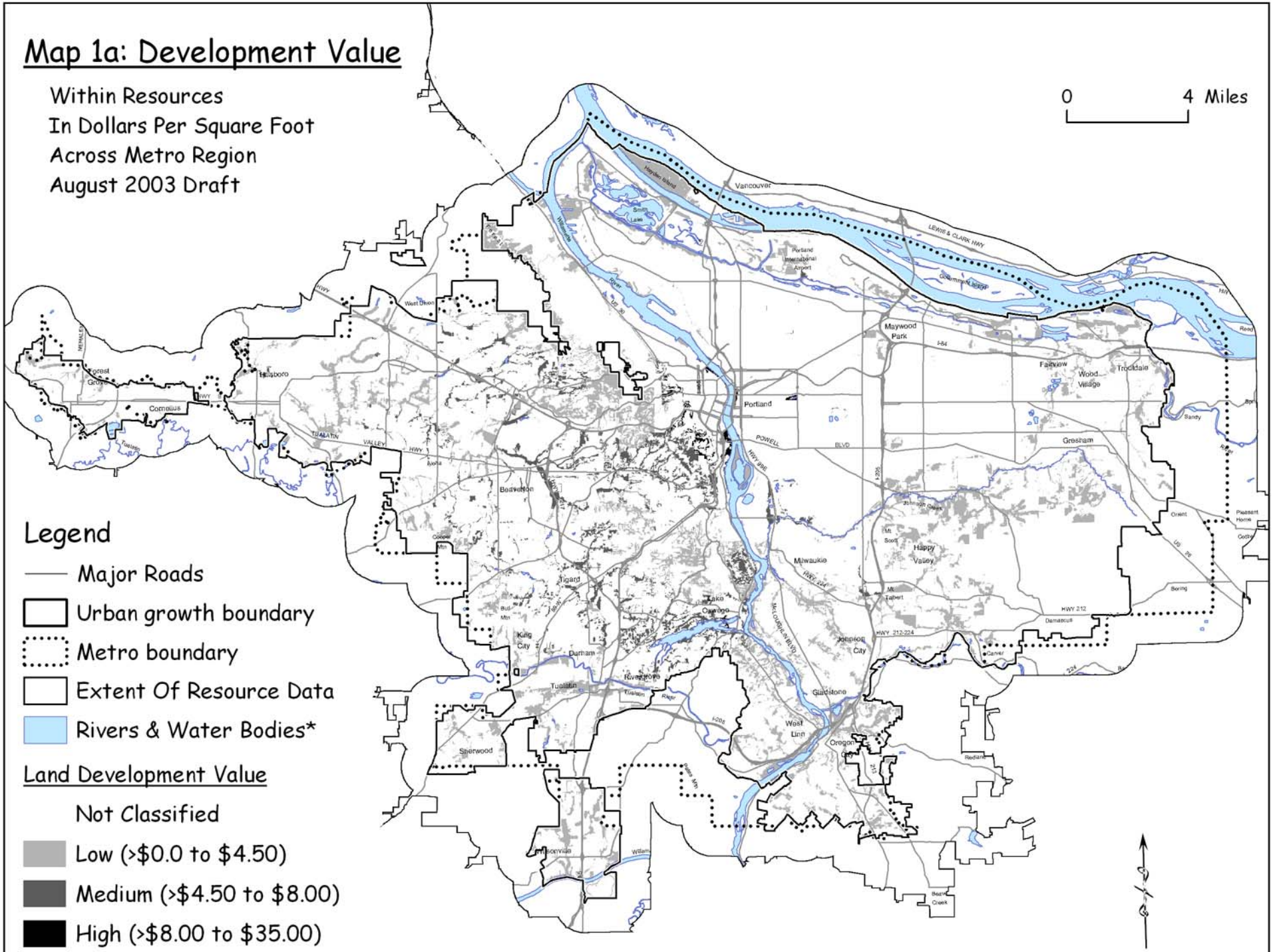
In Dollars Per Square Foot
Across Metro Region
August 2003 Draft



*rivers & water bodies greater than 2 acres in size - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps091103\Map 1 Development Value.mxd

Map 1a: Development Value

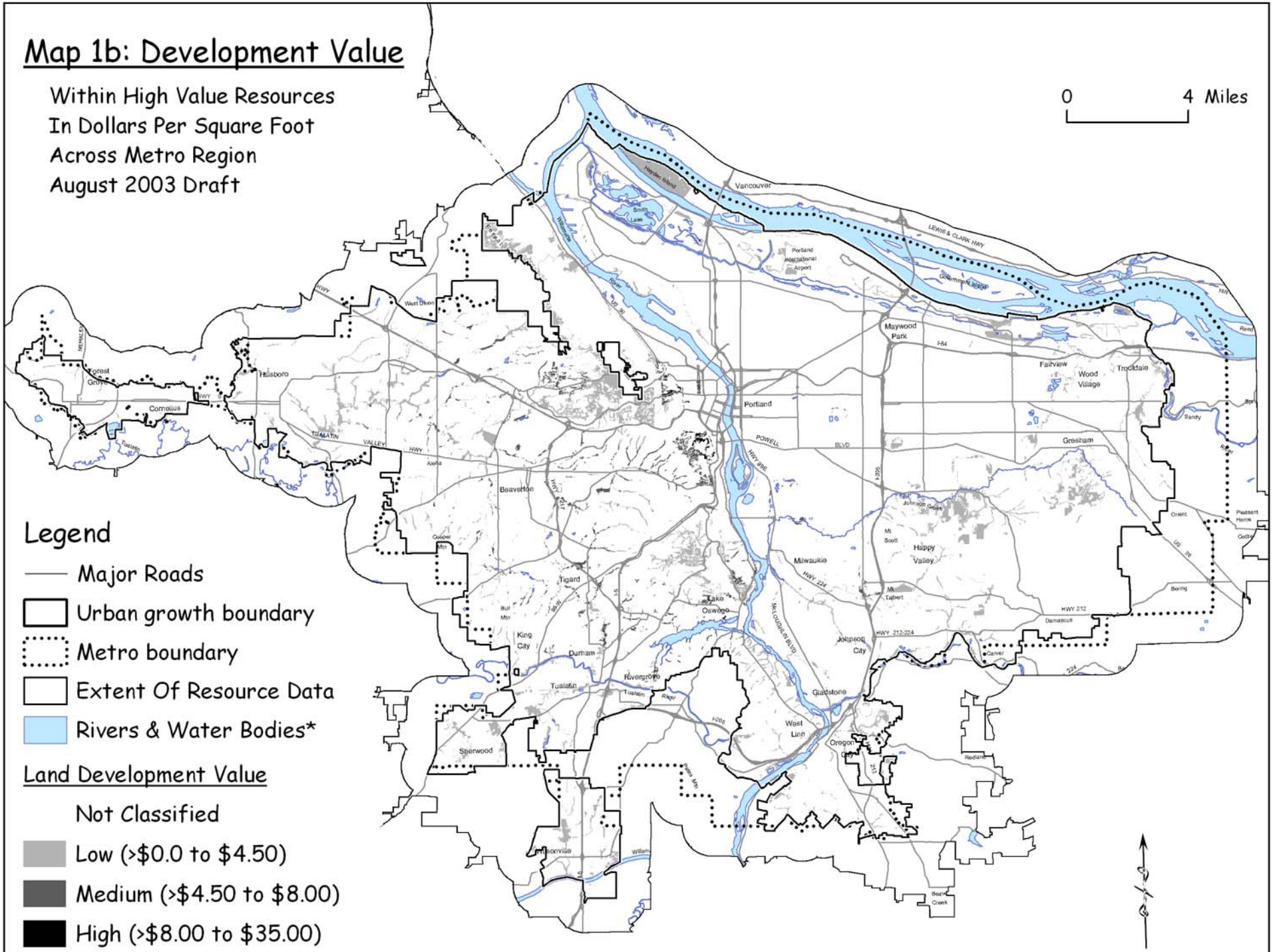
Within Resources
In Dollars Per Square Foot
Across Metro Region
August 2003 Draft



*rivers & water bodies greater than 2 acres in size - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps091103\Map 1 Development Value.mxd

Map 1b: Development Value

Within High Value Resources
In Dollars Per Square Foot
Across Metro Region
August 2003 Draft



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Rank lands based on employment potential

Employment potential associated with development is a way of ranking economic importance of land. The more employees that land can support, the more valuable it is for development. Employment density was modeled as employees per gross acre across the Metro region (using State 202 employment data[28]) and mapped using GIS. Jobs were assigned to vacant or undeveloped land based on jobs in surrounding areas with similar zoning.

Employment density was divided into "low," "medium" and "high" employment. Habitat lands with employment density equal to or greater than 16 jobs per acre have high development value. Habitat lands with employment density greater than four and less than 16 jobs per acre have medium development value. Habitat lands with employment density of four jobs per acre or less have low development value.[29]

The methodology for assigning jobs to vacant land and for defining three categories of employment density assumes that jobs are tied to a specific location and cannot move to other locations in the Metro region. This assumption is certainly not strictly correct; in some instances it may not be even approximately correct. To the extent that land uses that support these jobs can move elsewhere in the UGB, or be directed elsewhere in the future, these alternatives will help mitigate potential negative employment impacts of limit and prohibit decisions.

The measure of employment density does not capture the relative importance of residential development; however, ranking land based on land value, as described in the previous section, provides a measure of the relative development value of residential areas. Another limitation of this analysis is that it does not distinguish among jobs that are more "important" and those that are less "important" to the region's economy.

Map 2 shows the distribution of lands ranked by employment density. The low, medium and high categories in Map 2 correspond to the break points described above. Compared with the distribution of development values as described by land value (see Map 1), lands that support employment occupy a smaller subset of Metro's jurisdiction. That is because Map 2 excludes lands that do not support employment, primarily residential and park lands. Map 2 shows that lands that support employment predominate in the Portland city center and along transportation routes.

Map 2a depicts the distribution of employment density for the subset of lands in Metro's jurisdiction that contains significant fish and wildlife habitat. The large majority of these lands fall in the outlying or low category.

Map 2b shows the subset of lands from Map 2a that are ranked high for the quality of fish and upland wildlife habitat characteristics. Map 2b shows the employment density for lands that contain the most significant fish and wildlife habitat. Policy decisions that protect the most significant habitat would have the greatest impact on these lands.

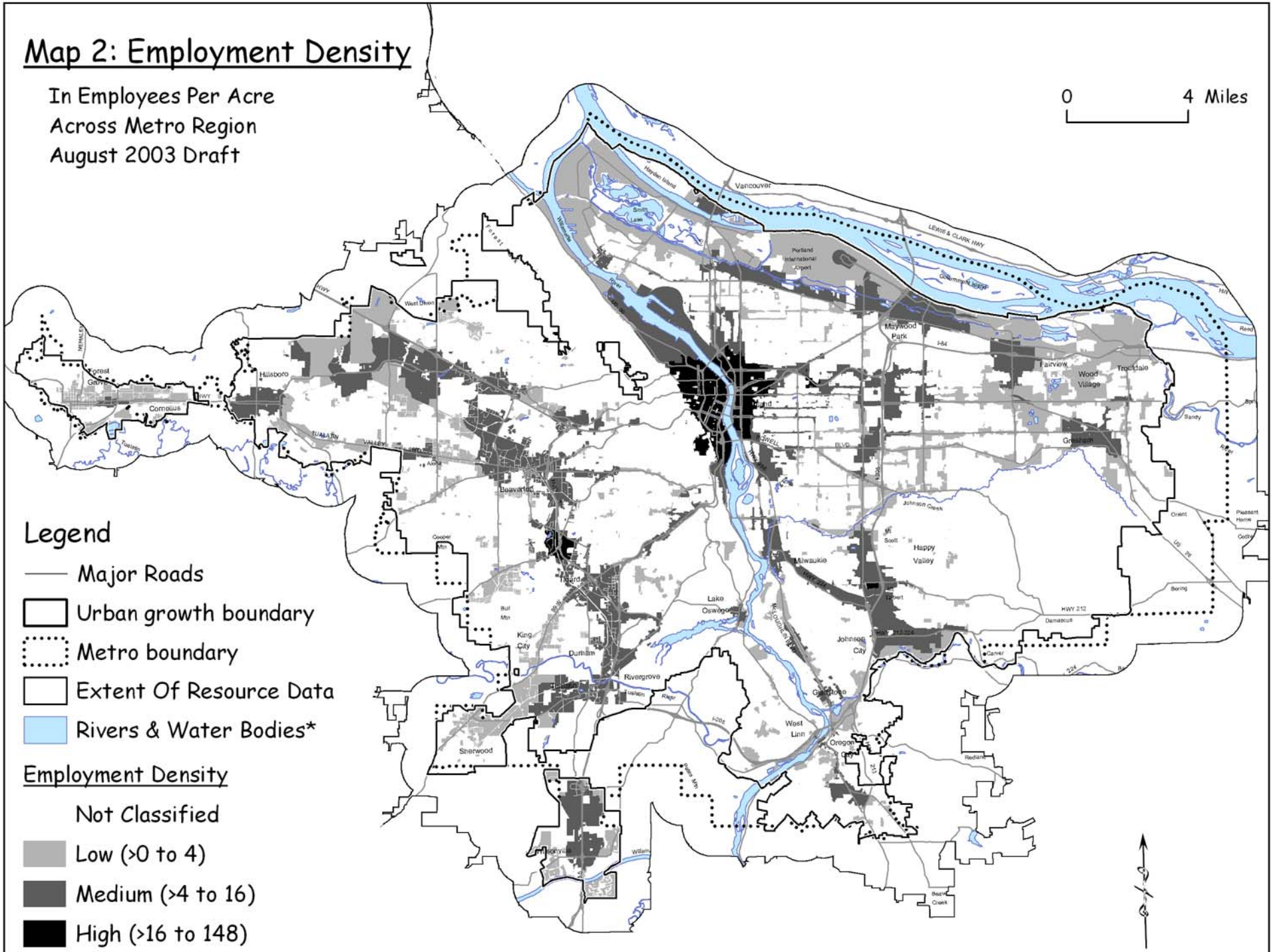
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[28] 2002 employment data for the metropolitan region are from the Oregon Department of Revenue (referred to as the Employment Security, 202 tapes).

[29] See Appendix C: *Final Report for the Economic Portion of Metro's Goal 5 ESEE Analysis* (ECONorthwest 2004).

Map 2: Employment Density

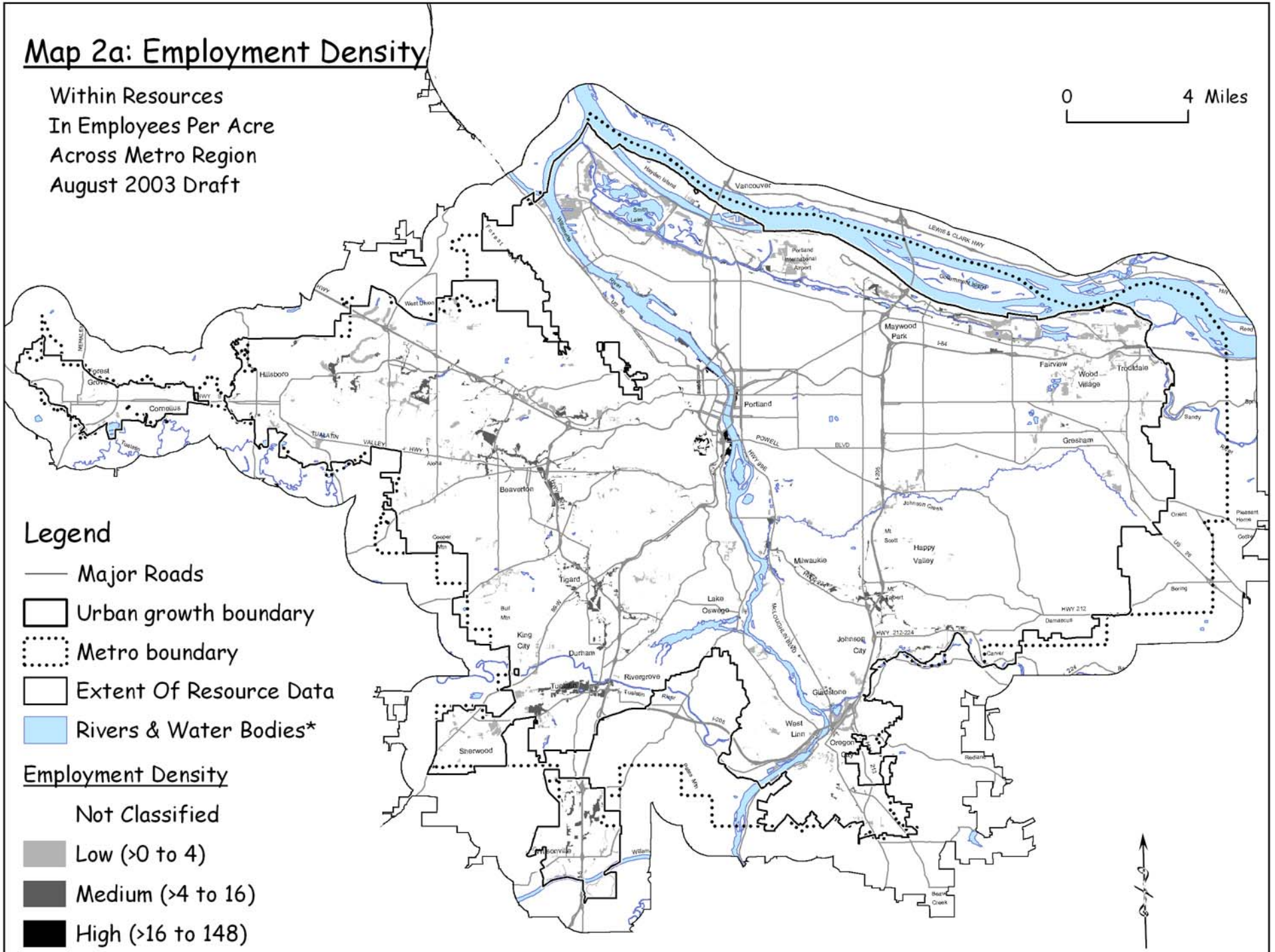
In Employees Per Acre
Across Metro Region
August 2003 Draft



*rivers & water bodies greater than 2 acres in size - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps091103\Map 2 Employment Density.mxd

Map 2a: Employment Density

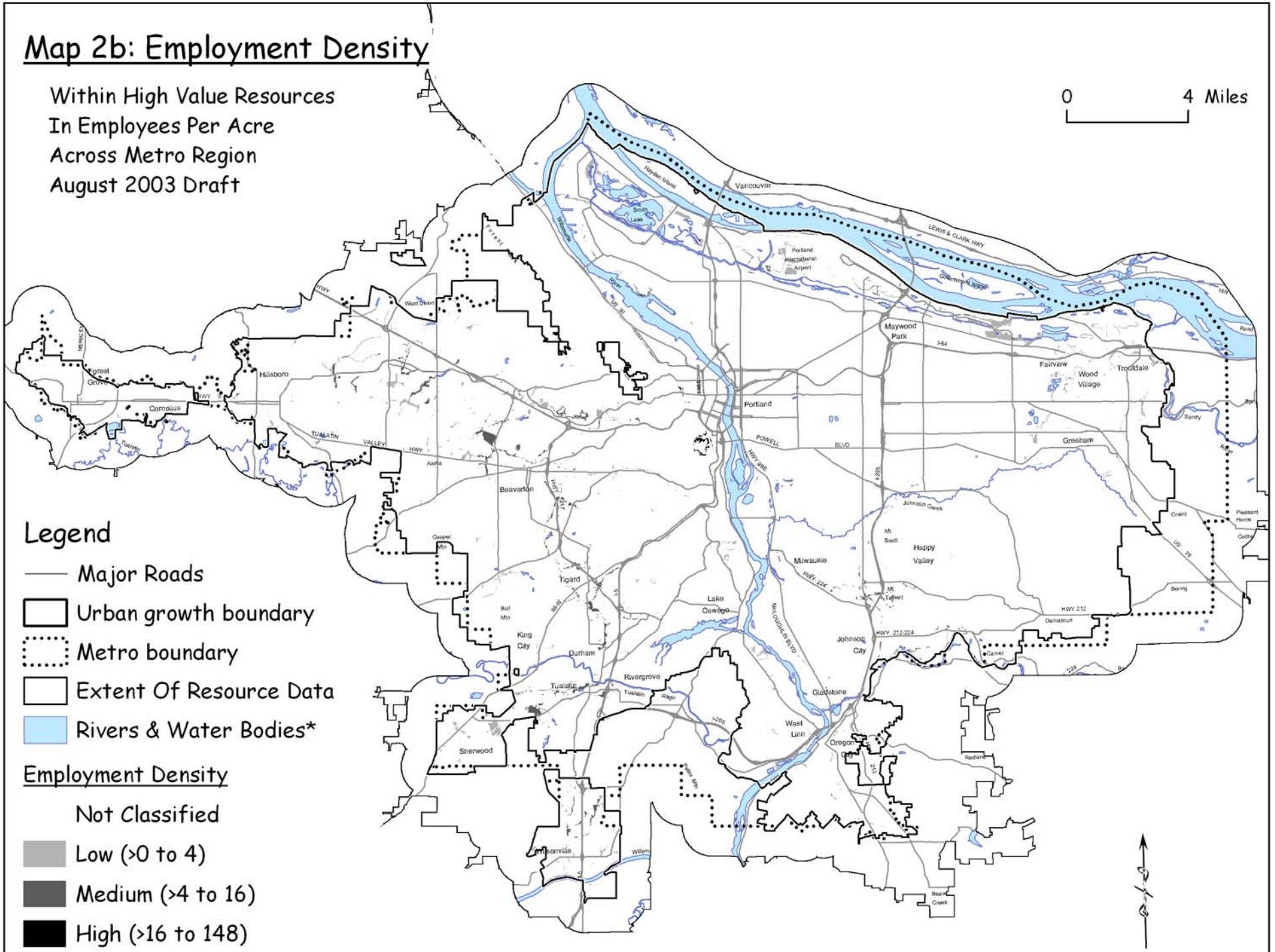
Within Resources
In Employees Per Acre
Across Metro Region
August 2003 Draft



*rivers & water bodies greater than 2 acres in size - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps091103\Map 2a Employment Density.mxd

Map 2b: Employment Density

Within High Value Resources
In Employees Per Acre
Across Metro Region
August 2003 Draft



*rivers & water bodies greater than 2 acres in size - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps091103\Map 2b Employment Density.mxd

Rank lands based on 2040 design types

Land value and employment density provide snapshot views of current conditions. For insights into future development patterns and associated economic importance of land, the 2040 design type hierarchy was used. As described in the *Conflicting Use* chapter, the success of the 2040 Growth Concept depends in large part on the implementation of regional transportation priorities. The Regional Transportation Plan (RTP) groups the 2040 design types into a hierarchy based on transportation investment priority. This hierarchy also helps to focus economic development priorities in areas that are most important to achieving the goals of the 2040 Growth Concept. For the purposes of this economic analysis, a modified grouping of the 2040 design types was used as follows:

- *Primary land use components* – central city, regional centers, industrial areas, and intermodal facilities
- *Secondary land use components* – town centers, main streets, station communities
- *Tertiary land use components* – inner and outer neighborhoods, employment centers, corridors, future urban lands
- *Other land use components* – parks and open space, rural lands

In general, land values and employment densities are expected to be higher for primary components and decrease moving from primary to secondary to tertiary and finally to other land use components.

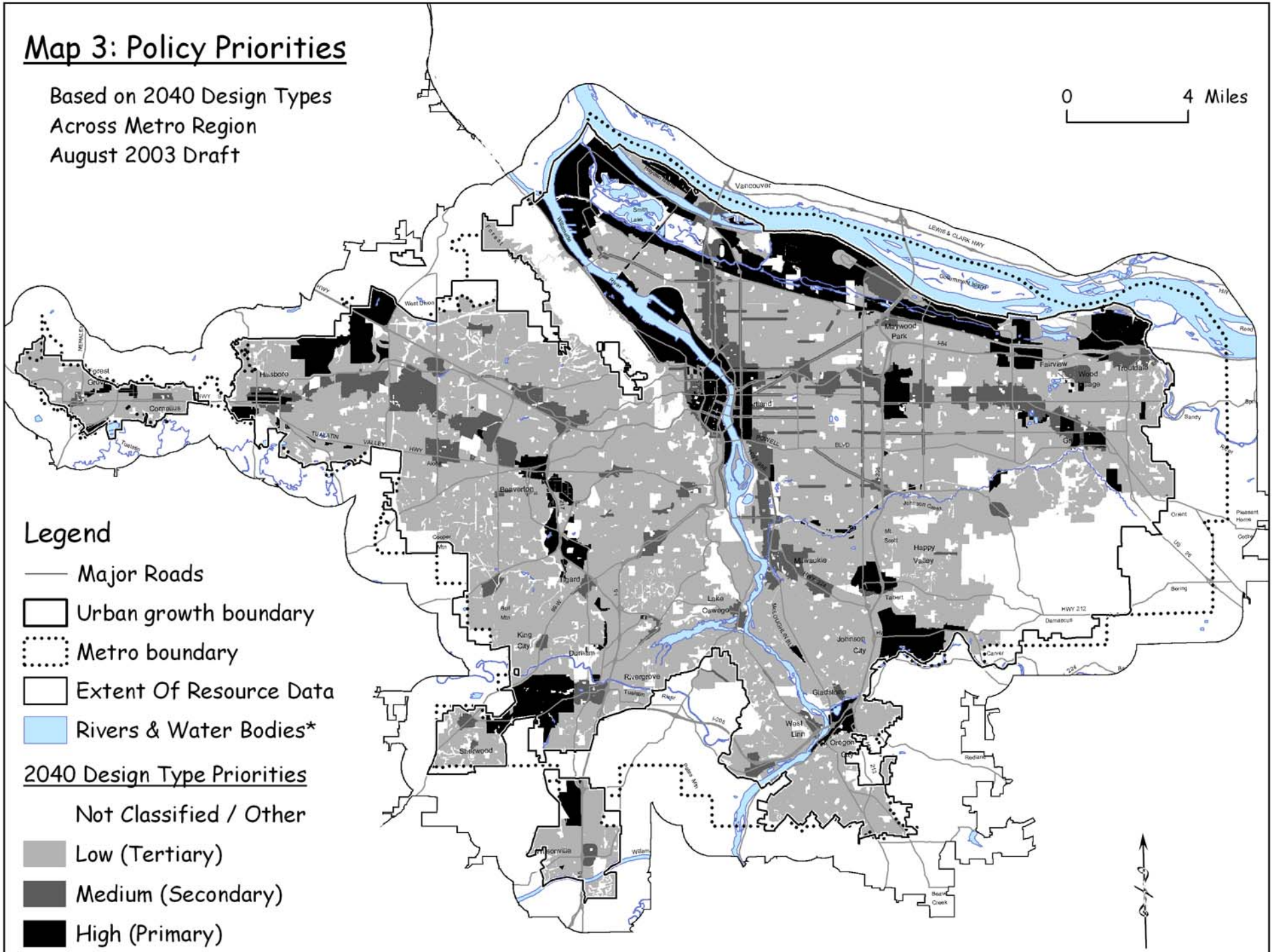
Maps 3, 3a, and 3b show the distribution of the four categories of 2040 design types. Map 3a shows the subset of lands in Map 3 that contain significant Goal 5 fish and wildlife habitat. Metro's Goal 5 decision will affect these lands. Map 3b shows the subset of lands in Map 3a that support the most significant Goal 5 fish and wildlife habitat.

Comparing Maps 1, 2, and 3 show that primary design types are distributed across more of Metro's jurisdiction than are areas of high land value or employment density, which are concentrated mostly in the downtown Portland area. This is especially true along the Columbia River and the Willamette River outside of downtown Portland. These industrial areas have low land values and employment densities for the most part, but have a primary design type designation. One interpretation of this difference is that the design types reflect public policies to support or enhance the industrial areas along the rivers for future development. Even though these areas have low land values and employment densities relative to the Portland city center, public policy considerations dictate that these industrial lands should be emphasized or enhanced for reasons other than land value or employment density.

The preceding paragraph describes differences in distribution among the three measures of development value. There are also similarities. For example, just as most lands in Metro's jurisdiction rank low for land value and employment density, most lands also rank in the tertiary or other design type. Another similarity is that, with the exception of lands along the rivers, the distribution of lands with high and medium employment density has a pattern similar to the distribution of lands ranked primary and secondary design types.

Map 3: Policy Priorities

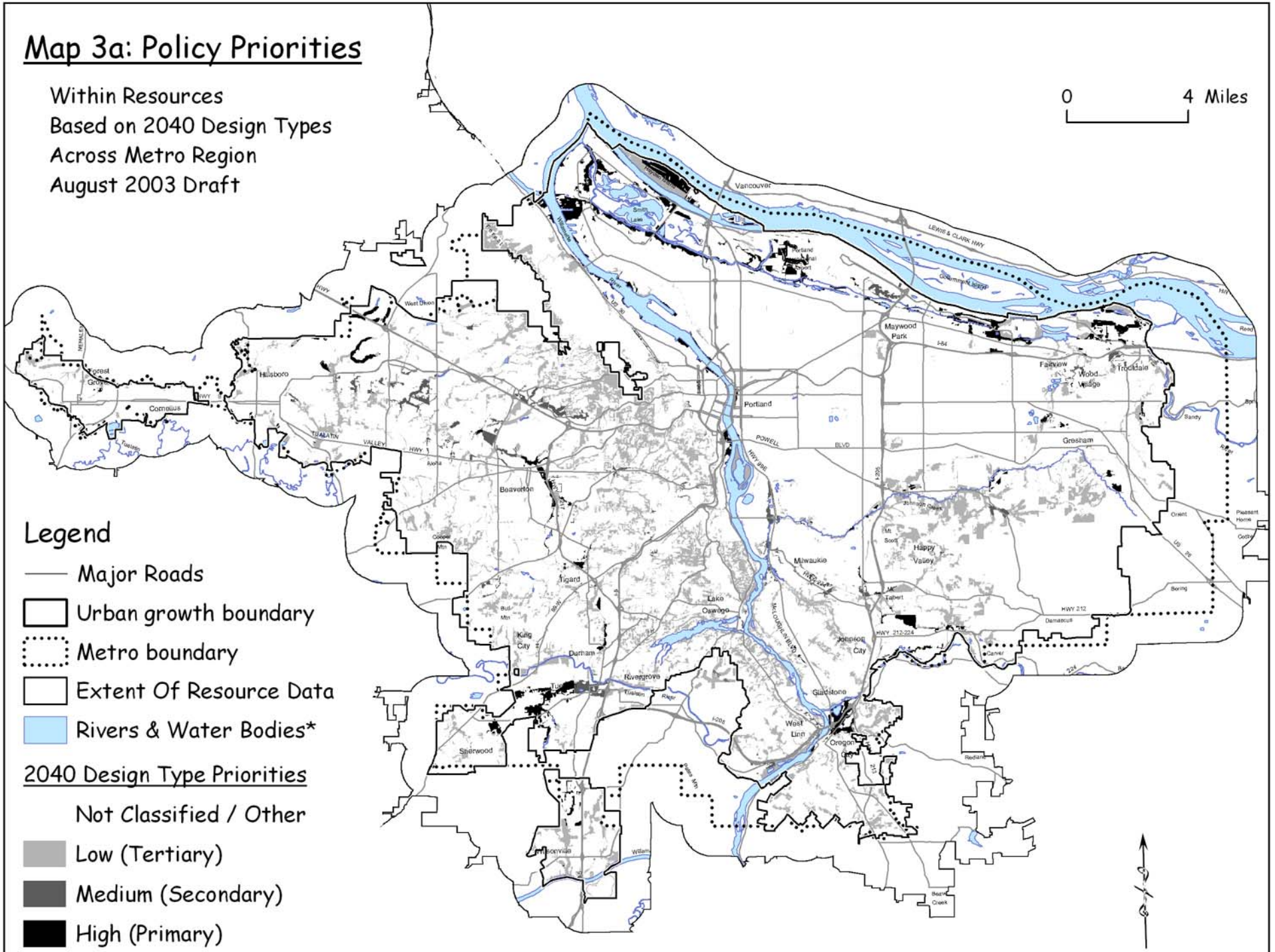
Based on 2040 Design Types
Across Metro Region
August 2003 Draft



*rivers & water bodies greater than 2 acres in size - **These names could change in the future - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps\Map 3 Policy Priorities.mxd

Map 3a: Policy Priorities

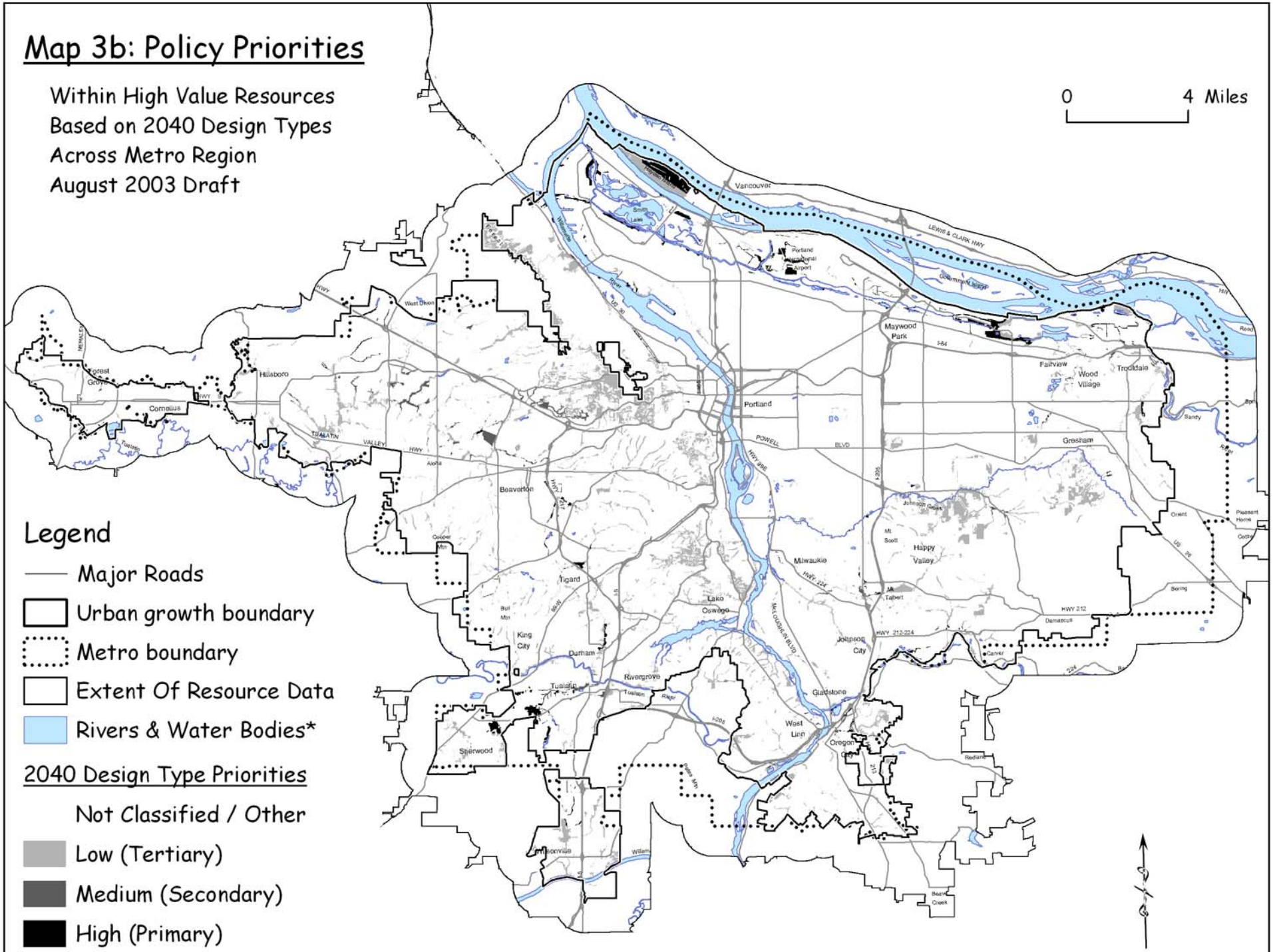
Within Resources
Based on 2040 Design Types
Across Metro Region
August 2003 Draft



*rivers & water bodies greater than 2 acres in size - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps091103\Map 3a Employment Density.mxd

Map 3b: Policy Priorities

Within High Value Resources
Based on 2040 Design Types
Across Metro Region
August 2003 Draft



*rivers & water bodies greater than 2 acres in size - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps091103\Map 3b Policy Priorities.mxd

Limitations of the ranking methods

Land value

This method excludes land uses exempt from property taxes or underestimates the economic importance of lands that pay taxes at a diminished rate. Lands exempt from tax assessments—for example, schools, universities, and some hospitals—do not appear in the data base or analysis for this measure of economic importance. This method also underestimates the economic importance of lands with restricted or diminished tax assessments—for example, low-income housing, urban-renewal areas, and other land uses that benefit from public policies that subsidize tax payments. The analysis includes these lands in the ranking, but the rankings may not reflect these parcels' full value.

Employment density

This analysis calculates the average employment density across all land uses in a given GIS map unit. This method may underestimate or overestimate the employment density for some individual parcels. For example, the employment density for a GIS map unit that includes residential areas surrounding a university or hospital may underestimate the employment ranking for these facilities because of the relatively low employment densities found in the residential areas. The opposite is also true. Because the method calculates the average employment density per map unit, properties with lower-than-average densities will be represented by an average measure for the entire map unit that overestimates the employment density for these parcels.

Employment density does not distinguish between "more" important or "less" important jobs as described by employment income or employment multipliers. Employment density provides stakeholders and decisionmakers with employment information that exceeds the requirements for a Goal 5 ESEE analysis. Also, Metro uses employment density when addressing other land use issues that have employment consequences.[30] Finally, the 2040 design types capture to some degree the economic importance of land as described by employment multipliers.

2040 design types

The 2040 design types exclude certain land uses or underestimate the relative importance of a given land use. For example, several educational institutions are not located in designated design type areas. In other cases, what some consider a regionally significant land use, such as a regional medical center, is included in a lower level design type.

The land uses of concern—those for which the three methods used in the economic analysis either exclude or underestimate their economic importance—fall predominantly into four general categories: 1) transportation, 2) utilities, 3) education, and 4) health care. The following subsection briefly describes the relative economic importance of these land uses.

Transportation facilities and utilities: To stay competitive, cities must have modern and efficient physical infrastructure, including roads, bridges, water and sewer systems, airport and cargo facilities, energy systems and telecommunications. The economic literature shows a correlation between economic growth and transportation facilities and utility services. Well-functioning and efficient physical infrastructure helps promote improvements in productivity.

[30] See the Metro report, *Technical Report: 1999 Employment Density Study*, April 6, 1999, revised May 5, 1999.

The quality of, and access to, transportation facilities and utilities can also directly influence production costs.

Education: The economic literature distinguishes between the economic importance of primary and secondary education, from college, university and post-graduate studies. Many high-skilled or knowledge-based workers can choose where they want to live, they can apply their skills to a variety of industries or have the ability to telecommute. Because they can pick and choose their locations, they choose those with quality amenities, including good elementary and secondary schools.

Given the current high demand for skilled labor, economic growth and development depends in part on access to a critical mass of employable persons with the necessary training and education. An educated workforce has become the primary location factor for growing companies. The most competitive cities recognize that businesses must locate near or have access to knowledge centers. Among the most important knowledge-based organizations are colleges and universities that provide trained personnel and research capacities. Companies also depend on training and continuing education facilities that help them become and remain learning organizations.

Increasing evidence suggests that promoting innovation, creativity, flexibility and adaptability will be essential to keeping U.S. cities economically vital and internationally competitive. Innovation is particularly important in industries that require an educated workforce. High-tech companies need to have access to new ideas typically associated with a university or research institute.

Medical services: Medical services contribute to a region's economic growth and development in a number of ways. In many municipalities, hospitals and medical clinics are among the largest employers. For example, in the Portland area, OHSU is the region's top employer. Medical schools and research facilities provide important education related services that help support the growth and development of knowledge-based businesses. The availability of high quality and diverse medical services also contributes to a region's quality of life, which helps attract and retain high skilled, and highly educated workers.

How is land ranked based on the economic importance for ecosystem services?

Ecosystem services are the beneficial outcomes, for the natural environment or people, that result from ecosystem functions. Overlap exists between the ecological functions of riparian corridors and upland wildlife habitat and the ecosystem services that benefit society and have economic value (see Table 4-1). For example, the ecosystem function of tree canopy and foliage shading streams helps reduce air and water temperatures, which may benefit society by reducing cooling demands in summer and by protecting species such as salmon that have recreational, commercial and intrinsic value. The ecosystem functions of streamflow moderation and water storage help moderate flooding, which benefits society by reducing flood damage and flood management costs. The ecosystem functions of bank stabilization and sediment and pollution control may help reduce landslides and maintain water quality, which benefits society through avoided

costs to filter and treat water. Wildlife habitat may benefit society by supporting species with commercial and recreational value. Riparian corridors and wildlife habitat provide amenity benefits such as scenic views and open space.

Table 4-1: Ecological functions, wildlife characteristics and related ecosystem services that benefit society.

Ecological Functions (Riparian)	**Ecosystem Services**
Microclimate shade and cooling	Moderating summer temperatures, which reduces energy demand for cooling.
Stream flow moderation and improved water storage	Reduced flood damage and flood-management costs.
Bank stabilization and sediment and pollution control	Improved water quality. Reduced demand for water filtration and treatment. Reduced landslides and related damage and clean-up costs.
Large woody debris and channel dynamics	Reduced flood damage and flood-management costs.
Well-functioning riparian areas in general	Amenity and intrinsic values associated with riparian areas.
Ecological Functions (Wildlife Characteristics)	
Habitats of concern and habitats for unique and sensitive species	Increased population of salmon and associated increase in commercial, recreational, spiritual and intrinsic value.
Well-functioning wildlife habitats in general	Amenity and intrinsic values associated with wildlife habitat.

Source: ECONorthwest 2003.

Describing the value of ecosystem services is more challenging than describing the value of development related attributes. No single measure of the economic value of ecosystem services captures the complete value of all services provided by riparian corridors and upland wildlife habitat. ECONorthwest's literature review[31] describes various studies (e.g., hedonic analysis, replacement cost, avoided cost, travel cost, contingent valuation, benefit-transfer) that provide information and perspectives on the value of ecosystem services. The review also reports values for a range of ecosystem services (e.g., flood management, water quality, habitat that supports salmon, amenity and intrinsic values) as described in academic literature and other sources.

During the inventory process, regionally significant riparian corridors and upland wildlife habitat were determined based primary and/or secondary ecological services they provide. ECONorthwest concluded in their literature review that Metro's inventory and ranking of riparian corridors and upland wildlife habitat provide a basis from which to identify the ecosystem services provided by this habitat that have value to society. Even though the inventory ranking did not focus on the economic value of these habitats, it provides insights into the relative economic importance. That is, resources that ranked high (for ecological functions) provide more of the type of ecosystem services that society values than do areas that ranked low.

For the ESEE analysis, riparian corridors and upland wildlife habitat were divided into six classifications (three riparian, three wildlife), each representing discreet areas on the landscape

[31] Appendix C: *Final Draft Literature Review for the Economic Portion of Metro's Goal 5 ESEE Analysis* (October 2004).

(see description in the *Conflicting Use* chapter). This was done to distinguish higher value habitat from lower value habitat for consideration of allow, limit and prohibit consequences. This analysis assumes that areas that provide more of the ecological functions and wildlife characteristics provide more ecosystem services and value to society than do areas that provide fewer functions and characteristics. It also assumes that actions that enhance or protect ecosystem services will have positive economic consequences, and actions that degrade these services will have negative economic consequences, specific to these services. For purposes of this analysis, the six classifications have been grouped into three categories: high value, medium value and low value (see Table 4-2).

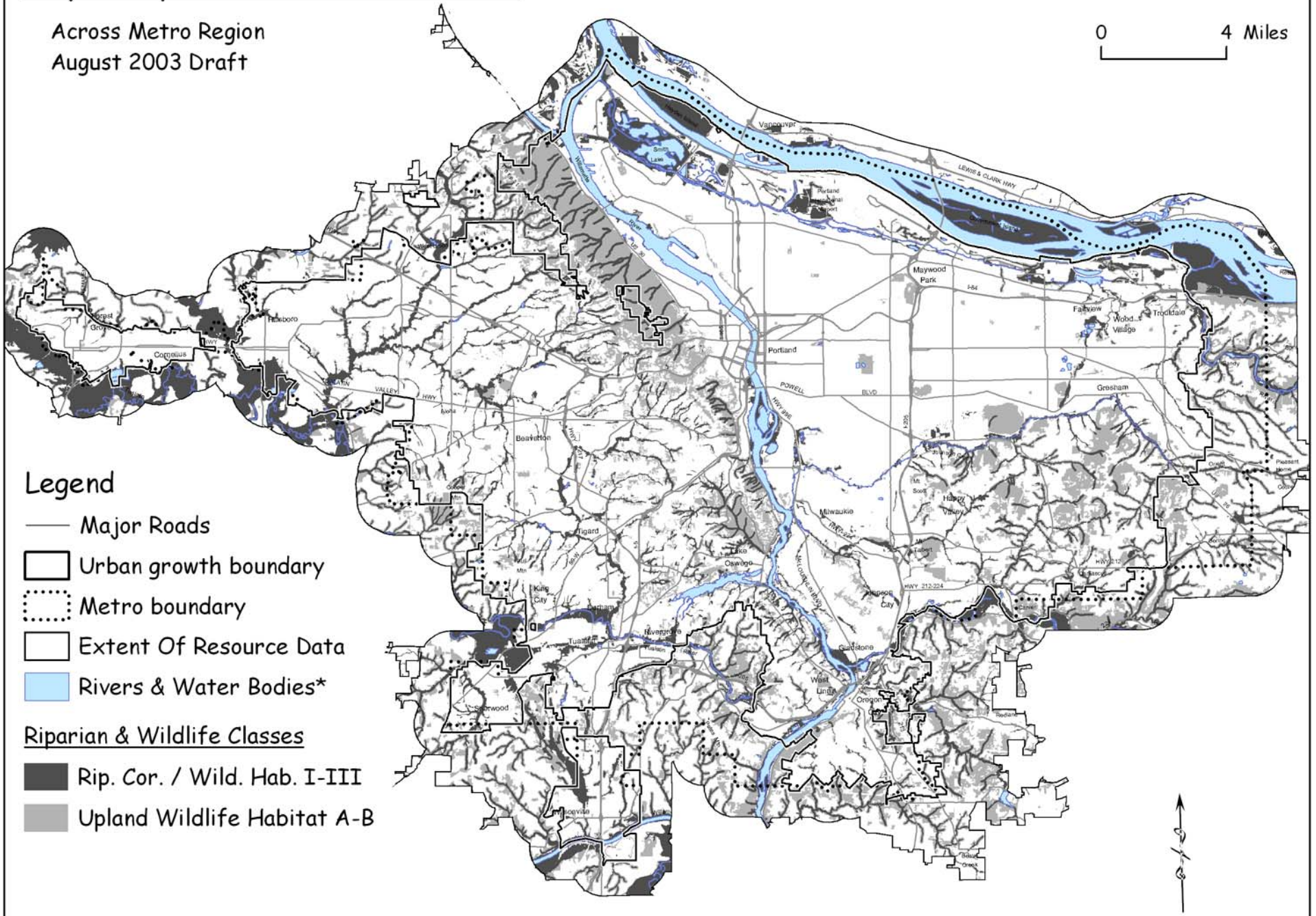
Table 4-2. Ranking for economic importance for ecosystem services.

High Value Habitat	Medium Value Habitat	Low Value Habitat
Class I riparian/wildlife corridors	Class II riparian/wildlife corridors	Class III riparian corridors
Class A upland wildlife habitat	Class B upland wildlife habitat	Class C upland wildlife

Map 4 shows the distribution of the riparian and wildlife habitat classes across Metro's jurisdiction. The map shows that with one notable exception, the area between the Willamette and Columbia rivers, fish and wildlife areas cover much of Metro's jurisdiction. The areas with little or no fish or wildlife habitat are historically the most intensely developed areas. Map 4a shows the distribution of the highest valued habitat lands: Class I riparian/wildlife corridors and Class A upland wildlife habitat.

Map 4: Riparian & Wildlife Classes

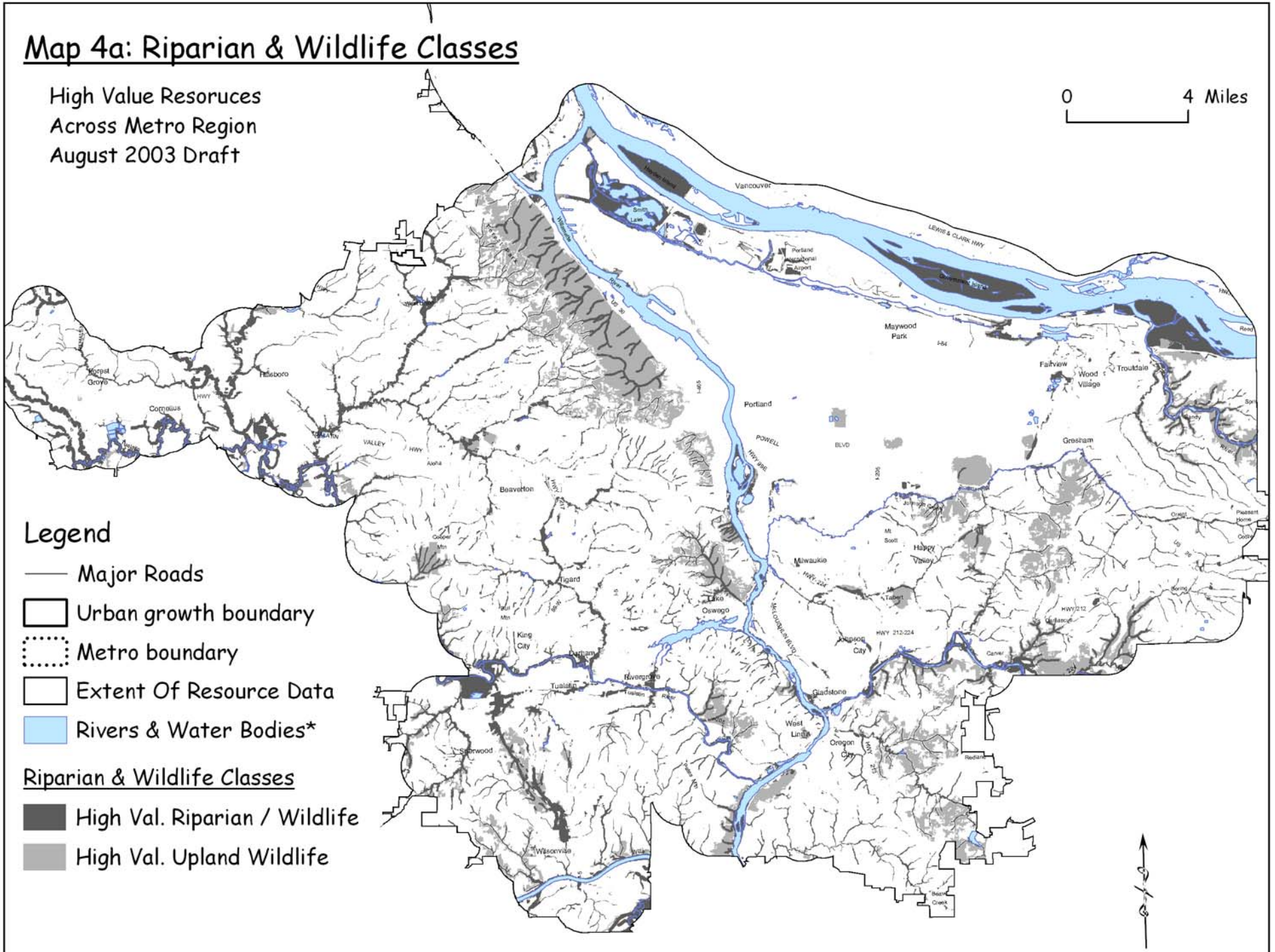
Across Metro Region
August 2003 Draft



*rivers & water bodies greater than 2 acres in size - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps091103\Map 4 Riparian & Wildlife Classes.mxd

Map 4a: Riparian & Wildlife Classes

High Value Resoruces
Across Metro Region
August 2003 Draft



Legend

- Major Roads
- Urban growth boundary
- Metro boundary
- Extent Of Resource Data
- Rivers & Water Bodies*

Riparian & Wildlife Classes

- High Val. Riparian / Wildlife
- High Val. Upland Wildlife

*rivers & water bodies greater than 2 acres in size - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps091103\Map 4a Riparian and Wildlife.mxd

What are the interactions between development value and ecosystem services value of fish and wildlife habitat?

The *Conflicting Use* chapter described lands within the UGB, in UGB expansion areas and the remaining areas within Metro's jurisdiction (outside the UGB) in various ways. This section relies on that data and other data generated from this economic analysis to provide insight on the amount and distribution of significant interactions between development use and habitat protection. This information is relevant because the economic consequences of allowing, limiting, or prohibiting development differs by development value and ecosystem services value.

To provide background for this analysis, this section begins by recapping information from the *Conflicting Use* chapter on the development status of fish and wildlife habitat, and the potential conflicts based on generalized regional zones. It then presents data and analysis on the economic interactions between development value (land value, employment density, 2040 design types) and habitat type (Class I-III riparian corridors, Class A-C upland wildlife).

Development status of fish and wildlife habitat and impact areas

The development status is relevant to the economic analysis because it can influence the type, amount and timing of the economic consequences of allow, limit and prohibit decisions. Of the four development categories shown in Table 4-3 below, lands in the developed/park status would be least affected by Metro's Goal 5 decisions. To the extent that lands in this development status includes private lands such as golf courses, these uses may be affected in some way by Goal 5 decisions, but any impact will be more limited compared with potential impacts to land in developed urban uses.

Table 4-3: Fish and wildlife habitat by development status and as a percentage of total lands in the development status in the UGB (2002).

Development Status	% of Fish & Wildlife Habitat	% of Total in Development Status
Developed (parks)	34%	66%
Developed (urban)	28%	10%
Vacant (constrained)	16%	67%
Vacant (buildable)	22%	41%
Total	100%	(not applicable)

Development on lands in the vacant constrained status is already affected more by Title 3 (Water Quality and Flood Management) and other regulations. Goal 5 decisions may have impacts on these lands; however, it will be to a lesser degree than on vacant land unconstrained by Title 3 or other regulations. Goal 5 decisions may affect lands in the developed/urban status in the future if the properties are redeveloped or existing uses expand to cover more of the property. Lands in the vacant buildable status may be most immediately affected by Goal 5 decisions.

Table 4-3 also shows habitat lands as a percentage of total lands (both fish and wildlife habitat and non-fish and wildlife habitat) in development categories in the UGB. For example, 34 percent of fish and wildlife habitat are in the developed/parks category and they account for approximately 66 percent of the total developed/parks in the UGB. Developed/urban lands account for 28 percent of fish and wildlife habitat, but these lands represent just 10 percent of total developed/urban acres in the UGB. Vacant constrained lands contain 16 percent of the fish and wildlife habitat, representing 67 percent of total vacant constrained acres in the UGB. Twenty-two percent of fish and wildlife habitat is vacant buildable, and these lands account for a significant percentage (41 percent) of the total vacant buildable acres in the UGB.

Figure 4-1: Development status of impact areas.

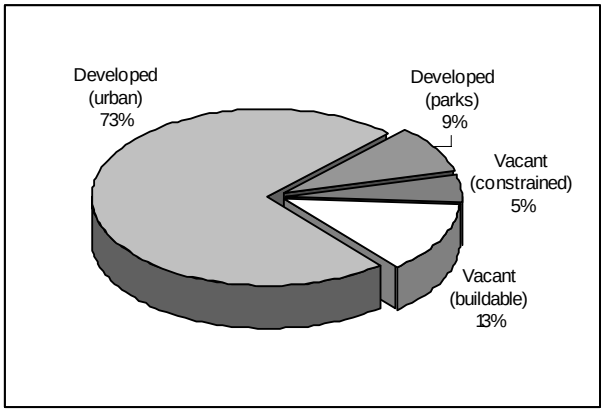
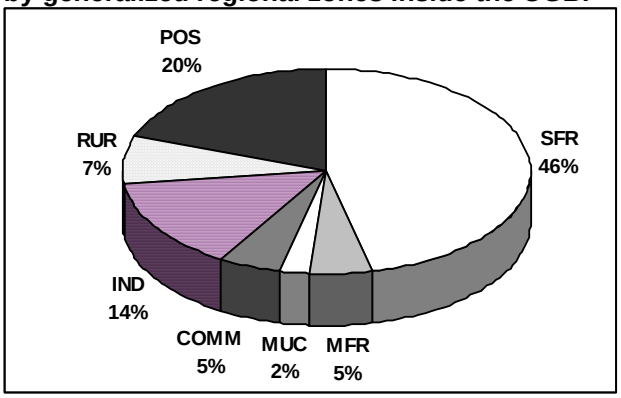


Figure 4-1 shows that most impact areas (see Chapter 2: *Impact Areas* for definition) are developed as urban. The distribution of development values for impact areas follow the distributions of land value, employment density and 2040 design types described earlier for lands containing fish and wildlife habitat. Most impact areas are characterized by low land value or employment density, or design types that have low land value and employment.

Fish and wildlife habitat by generalized regional zones

As Figure 4-2 shows, approximately 46 percent of the fish and wildlife habitat occur on lands zoned as single-family residential. Other zones with a significant percentage of fish and wildlife habitat are parks and open space (20 percent) and industrial (14 percent). Together, these three zones account for 80 percent of the fish and wildlife habitat.

Figure 4-2: Percentage of fish & wildlife habitat by generalized regional zones inside the UGB.



Lands outside the UGB and within Metro's jurisdiction are primarily zoned rural residential, and agricultural and forestry lands. Relative to the Portland City center, these lands have low land value and employment density. These lands have not yet been categorized by 2040 design types.

Fish and wildlife habitat classifications

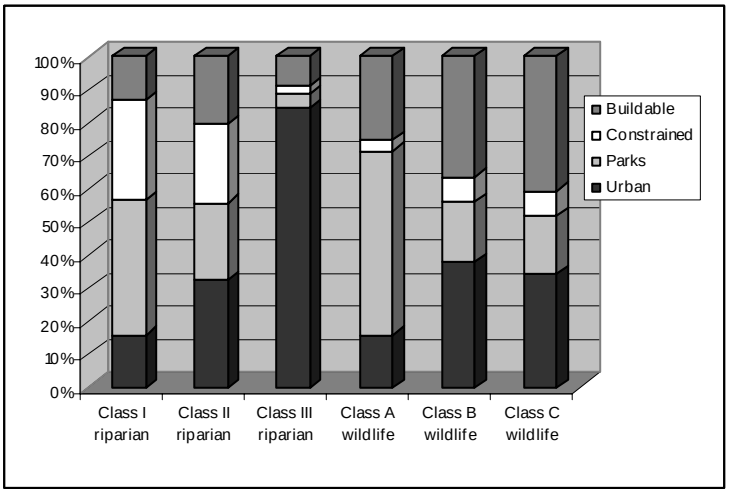
Fish and wildlife habitat classifications are defined in the *Conflicting Use* chapter. Table 4-4 shows the percentage of fish and wildlife habitat in each classification. Notice that the percentage declines from Class I to Class III and from Class A to Class C. Fifty-six percent of the inventory lands is in high value riparian/wildlife corridors (Class I) and upland wildlife habitat (Class A). Twenty-seven percent of the inventory land is medium value (Class II/B) and the remainder (17 percent) is low value fish and wildlife habitat.

Table 4-4: Percentage of fish and wildlife habitat by habitat classifications.

Fish and wildlife habitat classification	Percent of total fish & wildlife habitat
Riparian/wildlife Class I	32%
Riparian/wildlife Class II	14%
Riparian Class III	8%
Upland Wildlife Class A	24%
Upland Wildlife Class B	13%
Upland Wildlife Class C	9%
Total	100%

Figure 4-3 shows that, in general, the percentage of land in a given habitat type (i.e., riparian/wildlife corridors, upland wildlife habitat) that is developed as urban increases moving from high value (Class I/A) habitat to low value habitat (Class III/C). For example, 16 percent of Class I riparian/ wildlife corridors is developed as urban, whereas 85 percent of Class III is developed as urban. These results are consistent with the map of significant fish and wildlife habitat (Map 4), which shows very few significant resources in areas with the longest history of more intensive urban development.

Figure 4-3: Fish and wildlife habitat classification by development status.



Much of the Class I/A land is in parks and opens space: 41 percent of Class I lands and 56 percent of Class A lands. This percentage drops significantly when moving to Class II/B, 23 percent and 18 percent, respectively.

The greatest percentage of vacant constrained land falls in Class I and II riparian/wildlife corridors (30 percent and 24 percent, respectively). This makes sense because many of these areas are located in floodplains. In the vacant buildable status, a higher percentage of habitat lands is upland wildlife habitat compared to riparian/wildlife corridors.

Development value

Development value, or the economic importance of land for development, is measured by land value, employment value, and 2040 design type hierarchy. The following analysis describes the interaction between individual measures of development value and fish and wildlife habitat.

Land value

Table 4-5 below demonstrates that the percentage of fish and wildlife habitat classifications with no land value (as determined by tax assessors)[32] declines from Class I riparian/wildlife and Class A upland wildlife habitat to Class III riparian and Class C upland wildlife. The percentage of lands with low and medium land value increases across these same classes of riparian and upland wildlife habitat. None of the lands in Class I and only three percent of lands in Class III have high land value. One percent of land in the remaining classes are categorized as having high land value.

Map 1a shows the overlap of the three classes of land value on fish and wildlife habitat. Map 1b shows the overlap on high valued habitat lands (Class I/A) only. These maps illustrate the distribution of land value described in Table 4-5. Comparing Map 1a with Map 4 (Riparian and Wildlife Classes) shows that a significant portion of the lands that contains fish and wildlife habitat does not support development value as measured using land value. Map 1b shows that a relatively small percentage of the fish and wildlife habitat that support land value are ranked high valued habitat (Class I/A).

Table 4-5: Percentage of fish and wildlife habitat by land value.

Land Value	Riparian/ Wildlife I	Riparian/ Wildlife II	Riparian III	Upland Wildlife A	Upland Wildlife B	Upland Wildlife C
% of habitat with no land value (as determined by tax assessor)	43%	25%	7%	57%	19%	19%
% of habitat with **low** land value	48%	61%	69%	38%	59%	62%
% of habitat with **medium** land value	9%	14%	22%	4%	22%	18%
% of habitat with **high** land value	0%	1%	3%	1%	1%	1%
Total	100%	100%	100%	100%	100%	100%

Employment Value

Table 4-6 lists the percentage of fish and wildlife habitat classifications that does not support employment and, the percentage categorized as having low, medium, and high employment density, relative to the Portland city center.[33] The table shows that much of the fish and wildlife habitat is zoned for uses that does not support significant amounts of employment. For example,

[32] Excludes a measure of the land value of public institutions, such as parks and schools, and public infrastructure such as roads, sewer and water services.

[33] See the full table of interactions in the Appendix for the number of acres by zoning type ranked low, medium and high employment density.

83 percent of Class I riparian/wildlife corridors and 95 percent of Class A upland wildlife habitat are zoned for single-family residential, multi-family residential, rural, and parks and open space. Of the acres in zonings that support employment, such as industrial, commercial and mixed use, 11 percent of Class I lands and three percent of Class A lands are categorized as having low employment density relative to the Portland city center.

In general, the percentage of lands that does not support employment declines from Class I/A to Class III/C. However, the percentage of lands with low employment value increases from Class I/A to Class III/C. Two out of the six classes of significant fish and wildlife habitat, Class II and III, have lands designated as high employment value. However, these lands represent a very small percentage, one and two percent respectively, of the total lands in these classes.

Table 4-6: Percentage of fish and wildlife habitat by employment density value.

Employment Density	Riparian/ Wildlife I	Riparian/ Wildlife II	Riparian III	Upland Wildlife A	Upland Wildlife B	Upland Wildlife C
% of habitat that does not support employment	83%	72%	51%	95%	91%	75%
% of habitat supporting **low** employment	11%	18%	30%	3%	5%	18%
% of habitat supporting **medium** employment	6%	9%	17%	2%	4%	7%
% of habitat supporting **high** employment	0%	1%	2%	0%	0%	0%
Total	100%	100%	100%	100%	100%	100%

Map 2a shows the overlap of the three classes of employment density on all classes of fish and wildlife habitat. Map 2b shows the overlap of the three classes of employment density on high valued habitat (Class I/A) only. These maps illustrate the distributions shown in Table 4-6. Maps 2a, employment density, and Map 4, fish and wildlife habitat inventory, illustrate that much of the inventory is zoned parks and open space or residential, which are not considered employment generating uses. Also, of the habitat lands that do support employment, very little of these lands support high employment densities. Map 2b shows the same trends but for high valued habitat lands (Class I/A) only. Comparing Map 1a with Map 2a shows that more of the fish and wildlife habitat lands support development value as measured by land value compared with development value measured by employment density.

2040 design types

Table 4-7 shows the distribution of fish and wildlife habitat classifications by the 2040 design type hierarchy. This distribution differs from the trends described for land value and employment density. In general, more of the fish and wildlife habitat have high economic value from a policy perspective than from a land value or employment generation perspective. Map 3a shows the overlap of the three design type priorities on all classes of fish and wildlife habitat. Map 3b shows the same overlap but for high valued habitat lands (Class I/A) only. As with land

value and employment, much of the fish and wildlife habitat does not support development values as measured by 2040 design types (see Map 3a compared with Map 4). Map 3b and Map 4 show that, relative to the total distribution of fish and wildlife habitat, the overlap of high valued habitat with primary 2040 design types covers a small area.

Table 4-7: Percentage of fish and wildlife habitat by 2040 design type hierarchy.

2040 Design Type Hierarchy	Riparian/ Wildlife I	Riparian/ Wildlife II	Riparian III	Upland Wildlife A	Upland Wildlife B	Upland Wildlife C
% Other design types that do not support development value	35%	15%	2%	52%	13%	10%
% Tertiary **(low)**	48%	60%	52%	44%	79%	68%
% Secondary **(medium)**	5%	6%	13%	2%	3%	7%
% Primary **(high)**	12%	18%	33%	2%	5%	15%
Total	100%	100%	100%	100%	100%	100%

Comparing Table 4-7 with Tables 4-5 and 4-6 illustrates that more fish and wildlife habitat have development value when ranking these lands using design types than rankings based on land value or employment. However, a significant percentage of lands still falls in the low valued development category (tertiary). Except for Classes A and B (upland wildlife habitat), which have a relatively small percentage of land in the high category (primary), the other classes have a significantly larger percentage of land in the high category, relative to land value and employment measures. As illustrated in the next table (Table 4-8), much of this high valued land is zoned for industrial use.

Single-family residential, parks and open space, and industrial generalized regional zones account for 80 percent of significant fish and wildlife acres (see Figure 4-4). Cross referencing the number of habitat acres for these zoning types with primary, secondary, tertiary and other 2040 design types illustrates interactions between habitat land and future land use as described by the design types. Table 4-8 shows the major interactions.

Table 4-8: Interactions between fish and wildlife habitat by zoning and 2040 design types hierarchy in the UGB (2002).

Generalized Regional Zones	% of Fish & Wildlife Habitat Classified as Tertiary & Other	% of Fish & Wildlife Habitat Classified as Primary
Single-family residential	98%	1%
Parks and open space	98%	0.3%
Industrial	33%	60%

Source: Data analysis by Metro staff and ECONorthwest.

Ninety-eight percent of fish and wildlife habitat acres zoned as single-family residential and parks and open space is classified as tertiary or other design types, but only 33 percent of industrial acres is classified by these design types. In contrast, sixty percent of fish and wildlife habitat acres in industrial zoning is classified as a primary 2040 design type, with one percent or less of single-family and parks and open space acres in the primary design type.

As illustrated in Tables 4-5 and 4-6, estimating development value using land value or employment found that the large majority of fish and wildlife habitat acres either do not support development value or have a low value, relative to acres in the Portland city center. Estimating development value using 2040 design types has similar results for land in single-family or parks and open space zoning but not for acres in industrial zoning, as noted above. To the extent that 2040 design types describe future development patterns in the UGB, it appears that the future interactions between high development values and significant fish and wildlife habitat will occur mostly on land zoned for industrial use.

Combined measures

The analysis above describes the interaction between *individual* measures of development value, for example, land value, employment, 2040 design types, and fish and wildlife habitat. The following analysis describes the interactions between the *combined* measures of development values and significant fish and wildlife habitat.

As described above, the development value of acres containing significant habitat was ranked based on high, medium, and low land values and employment density. For these same acres development value is also described using primary, secondary, tertiary and other 2040 design types. The "other" design type includes parks, open space, and rural lands, which are expected to have a low development value.

Table 4-9 describes the interactions between the combined measures of development value and fish and wildlife habitat for the three zoning types, single-family residential, parks and open space and industrial, which account for 80 percent of the acres of significant habitat. The second column in Table 4-9 lists the percentage of habitat acres that fall into the "other" design type. The percent of habitat acres that score low on all three measures of development value is listed in the third column. The fourth column lists the percentage of habitat acres that score at least one medium value and no high values. The percentage of habitat acres that scored high on at least one measure of development value is shown in the fifth column.

Table 4-9: Interactions fish and wildlife habitat by zoning and combined measures of development value in the UGB (2002).

Generalized Regional Zones	% of Habitat Acres Classified as "Other" Design Type	% of Habitat Acres with All Low Measures	% Habitat Acres with at Least One Medium Measure, No High Measures	% of Habitat Acres with at Least One High Measure
Single-family Residential	17%	61%	21%	2%
Parks and Open Space	81%	17%	2%	0.3%
Industrial	10%	14%	15%	61%

Source: Data analysis by Metro staff and ECONorthwest.

Similar to the results illustrated in Table 4-8, Table 4-9 shows how interactions for industrial lands differ from interactions for single-family or parks and open space. For example, approximately 17 percent of fish and wildlife habitat in single-family zoning is in the "other"

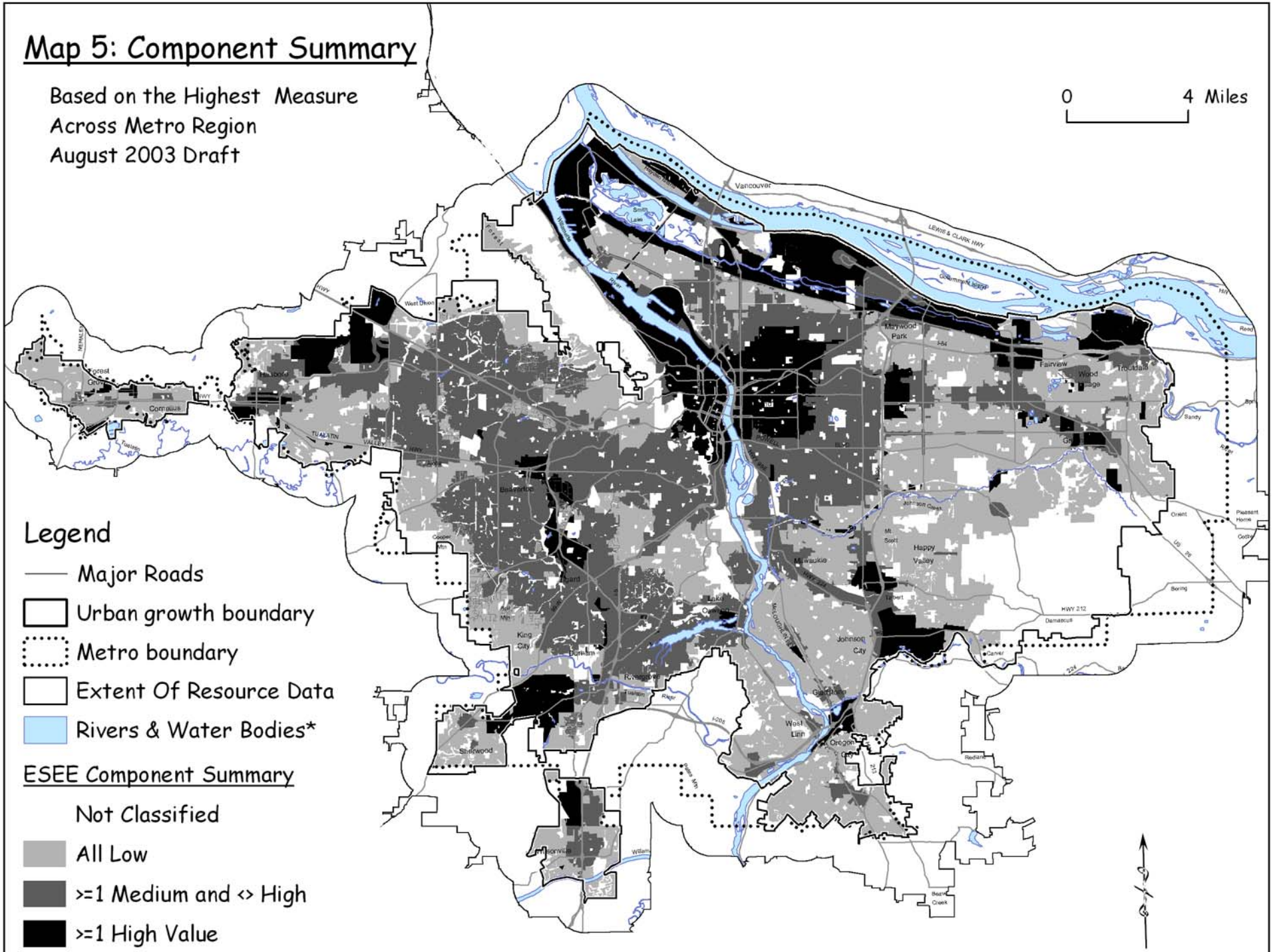
design type; 61 percent scored low on all three measures of development value. For parks and open space the percentage of habitat acres in these two categories is even higher, approximately 98 percent. In contrast, for habitat acres in industrial zoning, approximately 24 percent is in these two low categories, with approximately 61 percent of the industrial acres scoring high on at least one measure of development value. As noted in Table 4-7, most of these acres scored high on the 2040 design type measure of development value. A very small percentage of habitat acres in single-family or parks and open space scored high on any of the measures of development value.

Maps 5, 5a and 5b show the distribution of the three combined measures: areas that scored low on all three measures of development value, areas that scored medium on at least one measure without scoring high on any measures, and areas that scored high on at least one measure. Map 5a shows the overlap of the combined measures on all habitat lands and Map 5b shows the overlap of combined measures on high valued habitat lands (Class I/A) only.

Comparing Map 5 with Maps 1 (Land Value), 2 (Employment Density) and 3 (2040 Design Type Hierarchy) illustrates that areas outside the Portland city center that ranked high on at least one measure ranked high on the 2040 design types. Map 5a shows this same distribution for lands that overlap with significant fish and wildlife habitat. As shown on Map 5b much of the high value fish and wildlife habitat lands overlap with lands that scored low on all three measures of development value. However, for a significant portion of this map there is an overlap of high valued habitat with areas that scored high on at least one measure of development value. In most cases these lands scored high on 2040 design types and are zoned industrial.

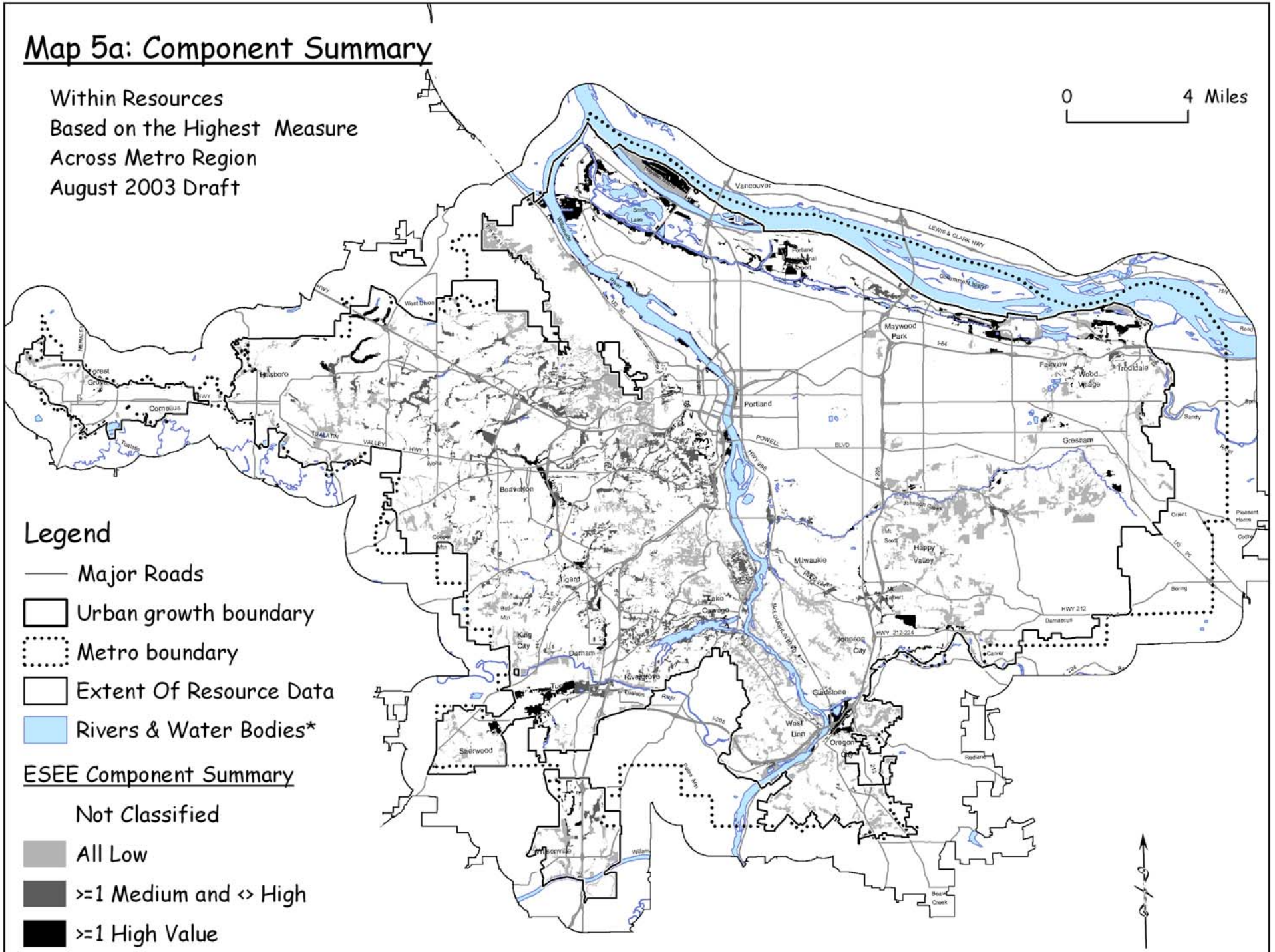
Map 5: Component Summary

Based on the Highest Measure
Across Metro Region
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0
4 Miles
Legend
Major Roads
Urban growth boundary
Metro boundary
Extent Of Resource Data
Rivers & Water Bodies*
ESEE Component Summary
Not Classified
All Low
>=1 Medium and <> High
>=1 High Value
Vancouver
Portland
Gresham
Beaverton
Hillsboro
Tigard
Tualatin
Lake Oswego
Milwaukie
Oregon City
West Linn
Wilsonville
Sherwood
Tualatin River
Willamette River
Columbia River
Sandy River
Clackamas River
Johnson Creek
Fairview
Troutdale
Wood Village
Maywood Park
Happy Valley
Damascus
Johnson City
Gladstone
King City
Durham
Rivergrove
Forest Grove
Cornelius
Orient
Pleasant Home
Boring
Carver
Canby
Barlow
Scholls
Aloha
Cooper Mtn
Mt Scott
Bull Mtn
Parrett Mtn
Chehalem Mtns
Newberg
Dundee
Yamhill
McMinnville
Sherwood
Tualatin
Wilsonville
Molalla
Estacada
Sandy
Gresham
Troutdale
Fairview
Wood Village
Maywood Park
Milwaukie
Oregon City
West Linn
Gladstone
Johnson City
Happy Valley
Damascus
Boring
Orient
Pleasant Home
Carver
Canby
Barlow
Scholls
Aloha
Beaverton
Hillsboro
Tigard
Tualatin
Lake Oswego
Forest Grove
Cornelius
King City
Durham
Rivergrove
Sherwood
Wilsonville
Newberg
Dundee
Yamhill
McMinnville
Molalla
Estacada
Sandy
Clackamas River
Willamette River
Columbia River
Tualatin River
Johnson Creek
Sandy River
Columbia Slough
Multnomah Channel
Scappoose Bay
Sauvie Island
Government Island
Smith Lake
Bybee Lake
Vancouver Lake
Lewis River
Lewis & Clark Hwy
I-5
I-84
I-205
I-405
Hwy 26
Hwy 212
Hwy 224
Hwy 213
Hwy 99W
Hwy 43
Hwy 47
Hwy 219
Hwy 240
Hwy 18
Hwy 22
Hwy 30
Hwy 99E
Hwy 211
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Map 5a: Component Summary

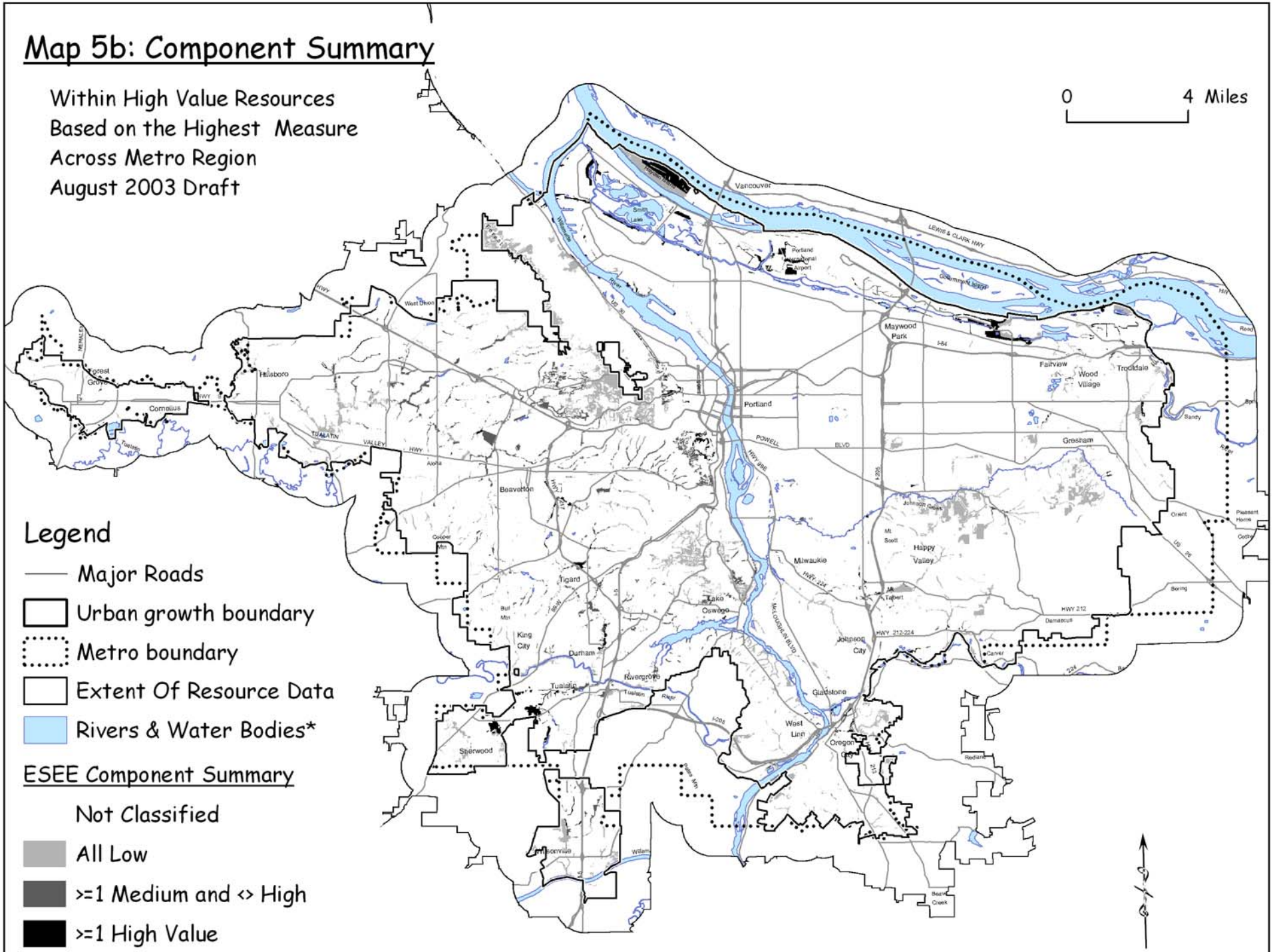
Within Resources
Based on the Highest Measure
Across Metro Region
August 2003 Draft



*rivers & water bodies greater than 2 acres in size - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps091103\Map 5a Employment Density.mxd

Map 5b: Component Summary

Within High Value Resources
Based on the Highest Measure
Across Metro Region
August 2003 Draft



*rivers & water bodies greater than 2 acres in size - J:\houk\Goal5\ESEE\EconomicAnalysis\ECONorthwest\maps\Map 5b Component Summary.mxd

Summary of interactions

- *Land value, zoning and habitat:* The zoning for a majority of fish and wildlife habitat lands, approximately 64 percent, support development value. The remainder fall into POS zoning or contain water bodies. Of the lands with development value, most fall into the low land value category.
- *Employment, zoning and habitat:* Approximately 78 percent of the fish and wildlife lands do not support employment. These lands are zoned SFR, MFR, RUR and POS. Of the lands that do support employment, most fall into the low employment category.
- *2040 design type and habitat:* The distribution of fish and wildlife habitat lands by 2040 design types differs from the distributions described above for land value and employment. In general, categorizing lands using 2040 design types yields a distribution with a greater percentage of the lands having development value, and for the lands that have development value, more of the lands rank in the higher-valued design types.
- *2040 design type, zoning, and habitat:* Three generalized regional zones, SFR, POS and IND, account for 80 percent of the habitat acres. Ninety-eight percent of the fish and wildlife habitat lands zoned SFR and POS fall into the lowest design type[34]. In contrast, 33 percent of the lands zoned IND fall in the lowest design type and 60 percent is ranked in the primary, or highest, design type.
- *Land value, employment, 2040 design type, zoning and habitat:* Focusing on fish and wildlife habitat lands zoned SFR, POS and IND, approximately 98 percent of POS lands, and approximately 78 percent of SFR lands ranked in the lowest category for all three measures of development value (land value, employment and 2040 design type). In contrast, 25 percent of lands zoned IND ranked in the lowest categories for all three measures of development value. Over 60 percent of IND lands ranked in the highest category for at least one measure.
- *Goal 5 allow, limit, prohibit impacts:* The large majority of Goal 5 allow, limit and prohibit decisions will impact lands zoned SFR, POS and IND. Impacts on lands zoned SFR and POS will have little or no employment impacts and will affect lands ranked low on the land-value scale. The majority of impacts on lands zoned IND will affect lands ranked high on at least one measure of development value.

The fact that Goal 5 decisions would primarily affect acres with lower land values and employment densities does not mean that limit or prohibit decisions on these acres would generate trivial economic consequences. The low category for these development values are relative to land values and employment densities found in the Portland city center and do not represent an absolute measure of land value or employment. The actual impacts of limit or prohibit decisions on property values or employment will depend on the specifics of the decision, the details of the Goal 5 program that implements the decision, actions that may mitigate any negative impacts, and specifics of the individual parcels affected.

[34] This includes lands in the tertiary design type, and lands in the "other" design type that includes parks, open space and rural reserves.

What are the potential economic consequences of allowing, limiting or prohibiting conflicting uses?

This section describes the economic consequences of decisions to allow, limit, or prohibit land uses that conflict with significant fish and wildlife habitat. Four categories of economic consequences of Goal 5 decisions are considered in this analysis:

- The changes in the values of the goods and services citizens receive are referred to as *economic values*. The economic values at issue in this analysis include the impact of Goal 5 decisions on property values (location and site factors) and the values of ecosystem goods and services provided by riparian and wildlife areas (e.g., flood management, water quality, habitat that supports salmon, amenity and intrinsic values).
- The changes in the level of economic activities within the local economy such as the impact on the level of local employment and income, changes in tax payments and transportation impacts are referred to as *economic impacts*.
- The changes in the development patterns over the coming decades are outlined by the *2040 design types.*
- The changes in the distributions of costs and benefits within the economy, especially changes affecting groups of special concern, such as property owners that shoulder a disproportionate amount of the negative consequences of a policy decision, are referred to as *economic equity.* Equity tradeoffs in this analysis include tradeoffs by type of land use, as described by zoning type, and the geographic distribution of economic tradeoffs.

The sections that follow describe: 1) the baseline for the analysis of economic tradeoffs, 2) the potential economic consequences based on the four categories listed above, 3) the summary of economic consequences of allow, limit or prohibit decisions and 4) the factors that influence economic consequences.

Baseline for the analysis of economic tradeoffs

The existing, non-Goal 5, regulatory protection of fish and wildlife habitat provides the baseline for the analysis of economic tradeoffs of Goal 5 allow, limit and prohibit decisions. An allow decision will permit developing significant habitat to the limits allowed by existing, non-Goal 5 protection measures. Goal 5 limit or prohibit decisions provide a marginal *increase* in protection above and beyond existing protection measures.

For lands in Metro's jurisdiction, Title 3 of the Urban Growth Management Function Plan (Title 3) describes existing protection measures and is the baseline against which the Goal 5 management decisions will be measured. Title 3 regulates development that affects water quality, flood management and fish and wildlife conservation.

Because Title 3 implements statewide land-use goals, it affects lands in all the local jurisdictions within Metro's jurisdiction. Local jurisdictions, however, may adopt protection measures that exceed Title 3 regulations. The economic tradeoffs of Goal 5 allow, limit and prohibit decisions in these jurisdictions will differ from the tradeoffs in jurisdictions where Title 3 represents the baseline protection in the following ways:

- Allow decisions will overestimate the negative impacts of development on Goal 5 fish and wildlife habitat and associated ecosystem services. An allow decision will also overestimate the benefits on development values.
- Limit and prohibit decisions will overestimate the benefits of habitat protection and will overestimate the negative impacts on development values.

Potential economic consequences

This section describes potential economic consequences by the four economic factors – economic values, economic impacts, 2040 design types and economic equity – and how Goal 5 decisions may impact these factors.

Economic Values

Property values in development – the factors that affect the development value for land fall into two general categories: location factors and use factors.

Location factors include:

- Availability and quality of public infrastructure, for example, roads, sewer, water and electric. Land-use decisions that hinder or make more difficult the provision of infrastructure services may negatively impact the values of the affected properties.
- Access to the site. Actions that limit or impede access to a site may negatively impact the site's property value.
- Agglomerative economies associated with the location. Decisions that promote or allow the development of agglomerative economies, such as clustering of commercial or industrial developments, will help maintain or enhance development values of these activities. Decisions that inhibit the development of such agglomerative economies may have the opposite effect.
- Existing zoning or other land-use regulations. Zoning and other regulations can have positive and negative impacts on a property's value. For example, waterfront properties zoned for industrial use might have higher property values if they were zoned residential. In another example, a residential zoning may protect property values by excluding incompatible land uses (e.g., a gas station).

Use factors include:

- Amenities of the site, for example, views, access to parks, water and other open spaces. Actions that protect or enhance a location's amenities, may also protect or enhance the impact that amenities have on property values.
- Physical terrain, for example, hilly or flat. Grading hills and other changes to a parcel's physical terrain may increase the parcel's usability and development value. Actions that limit grading hills or other changes to a parcel's physical terrain may negatively impact the parcel's property value.
- Lot size, shape and buildable area. Actions that limit a parcel's usable area may negatively impact the parcel's development value. Impacts from limiting a parcel's usable area will likely be the most common way that limit or prohibit decisions could influence development values.

Values of ecosystem services – Chapter 6 of the report describes the environmental consequences of allow, limit and prohibit decisions on fish and wildlife habitat and on the associated ecological functions and wildlife characteristics. As described in literature review (see Appendix C), the

ecological functions of fish and wildlife provide ecosystem services that benefit society. Actions that protect or enhance these services will also protect and enhance their value. Actions that degrade ecosystem services will have the opposite effect. As services degrade, society either does without the service, restores the degraded habitat or replaces some lost or degraded services by building engineered projects (e.g., upgrading a water-treatment plant that provides clean water).

Ecosystem services include:

- Flood management. Fish and wildlife habitat help mitigate flooding by moderating flow intensities and absorbing runoff. Actions that reduce flood management services may increase flooding of area homes and businesses, and increase flood related damages and government expenditures for flood clean up and mitigation.
- Water quality. Fish and wildlife habitat help control soil erosion and landslides that cause sedimentation. Habitat areas also help filter toxins and sediment from surface runoff before they enter streams and other water bodies. Degrading these services may increase the flow of sediment and contaminants into area waters. Degraded water quality may increase filtration costs for businesses and municipalities. Increased concentrations of toxins and sedimentation may also increase the costs of projects mandated by regulatory agencies to bring water quality into compliance with federal and state water-quality laws (e.g., the Clean Water Act).
- Moderating water and air temperatures. Vegetation in fish and wildlife habitats provides shade that helps reduce air temperatures and the "heat island effect" in summer. Moderating air temperatures in summer helps reduce electricity costs associated with air conditioning. Actions that remove this vegetation may increase summer air temperatures and cooling costs.
- Stormwater services. Fish and wildlife habitats absorb rainfall that otherwise would flow into stormwater systems. Replacing these habitats with impervious surfaces will increase stormwater flows and management costs. These costs can be substantial.
- Salmon habitat. Fish and wildlife habitat support salmon populations and related commercial, recreational and cultural values. Actions that protect salmon habitats also help protect these values. Actions that degrade habitats may have the opposite effect.
- Amenities. Fish and wildlife habitat provide view, open space, and water-related amenities and associated amenity values for properties in proximity to habitat. Actions that protect these amenities also protect the contribution this habitat make toward property values. Actions that degrade the habitat have the opposite effect.
- Recreation. Fish and wildlife habitat support recreation activities including wildlife viewing, fishing and activities associated with parks and open space. Degrading these habitats may also degrade recreation related ecosystem services.
- Intrinsic and option values. Intrinsic values are the values people find inherent in a habitat or species for itself, rather from the use or consumption of the habitat. These values represent the amounts residents or society would pay to protect a habitat, or expect in payment to degrade the habitat. Option values represent the value of protecting a habitat or species for future use or enjoyment. Actions that degrade fish and wildlife habitat also degrade the intrinsic and option values associated with the habitat. Such decisions also increase the risks of an irreversible outcome, for example, extinction of a salmon species, which may have negative economic consequences in the future.

- Carbon sequestration. Chapter 7 describes the energy consequences of allow, limit and prohibit decisions on fish and wildlife habitat, including the carbon-sequestration benefits of trees and other vegetation. Removing the vegetation negatively impacts the sequestration benefits and associated economic value.

To the extent that fish and wildlife habitat provide multiple ecosystem service, the true or full values of services at risk from actions that degrade habitat are the cumulative values of the affected services.

Economic Impacts

Employment – for lands that support employment, e.g., commercial, industrial and mixed use, the factors that influence land value also influence employment. For example, actions that affect access to a site or a property's developable area will also likely affect the employment potential of the site. In general, however, Goal 5 decisions will impact land values more than employment (or income) for the following reasons:

- A large percentage of the fish and wildlife habitat are zoned for land uses that do not support employment. Of the remaining lands, many have low employment densities relative to densities in the Portland city center.
- A portion of the lands containing habitat zoned commercial or industrial have previously been developed and currently support employment. Goal 5 decisions will not affect this employment. A Goal 5 decision on these lands may affect future employment through redevelopment of properties.

Actions that protect or degrade fish and wildlife habitat may impact jobs that depend on these habitats. For example, protecting salmon habitat may help support jobs that depend on commercial and recreational salmon harvests. In this example, many of the jobs associated with salmon harvests may be located outside Metro's service area.

Income – income tradeoffs of protecting or degrading fish and wildlife habitat will follow employment tradeoffs

Property taxes **–** impacts of protecting or degrading fish and wildlife habitat will follow impacts on property values. This is especially true for lands zoned commercial and industrial that have not yet been developed. Limiting development on these lands may negatively impact property values and associated property taxes. Limiting development may have the opposite effect on property values and associated tax payments for residential property surrounding or adjacent to properties currently undeveloped. Protecting fish and wildlife habitat on these lands may have a beneficial impact in property taxes, especially over the long term.

Payroll taxes – the payroll tax tradeoffs of protecting or degrading fish and wildlife habitat will follow employment and income tradeoffs.

Business taxes – the business tax tradeoffs of protecting or degrading fish and wildlife habitat will follow the tradeoffs for property value, employment and income for lands zoned commercial, industrial and mixed use.

Transportation costs – transportation costs increase with the number of vehicle miles traveled (VMT). Planning guidelines that address transportation costs, such as the 2040 design types, promote more compact development that limits VMT and transportation costs. Actions that push development out towards the UGB or beyond will increase VMT and transportation costs relative to actions that promote more compact development.

2040 Design Types

The 2040 Growth Concept outlines the Portland metropolitan region's plan to accommodate expected population growth over the coming decades, while addressing housing, transportation, open space and employment needs. The 2040 design types represent land-use categories (e.g., central city, main streets, neighborhoods, rural reserves/open space) that embody the Growth Concept's transportation, housing and other land-use goals. The 2040 Growth Concept anticipates expected population growth while:

- Maintaining access to nature.
- Protecting wildlife habitat.
- Promoting efficient use of land.
- Supporting a vibrant economy.
- Providing transportation options.
- Promoting development along transportation corridors.
- Minimizing sprawl and VMT.

Activities that protect or degrade fish and wildlife habitat may have mixed impacts on the 2040 Growth Concept's goals and associated design types. Protecting and maintaining access to these habitats supports the growth concept and design types' emphasis on habitat protection. However, if protecting habitat displaces development to the extent that it promotes sprawl, expanding the UGB and the number of VMT, protection actions may inhibit or limit the design types. Alternatively, developing habitat may limit UGB expansion and associated consequences, but may also conflict with the growth concept's goals that address habitat protection and access to natural areas.

The growth concept's goals regarding development density and transportation considerations may mitigate the impacts of habitat protection on sprawl. Increasing the efficiency of land use by promoting higher development densities along transportation corridors complements the habitat protection goals by accommodating, to some extent, land uses that might otherwise be displaced to outside the UGB.

Economic Equity

Geographic distribution of impacts – in general, locations within Metro's jurisdiction that have been developed more intensely over longer periods of time have the least amount of fish and wildlife habitat. As a result, Goal 5 protection measures will have limited or no negative impacts on development in these locations.

Distribution of impacts by land use – approximately 80 percent of the lands containing fish and wildlife habitat fall into three generalized regional zones: single-family residential (SFR), parks and open space (POS), and industrial (IND). Potential economic tradeoffs associated with Goal 5 protection will fall primarily on lands in these zoning categories. As a group, lands in other zoning categories will experience limited Goal 5 economic tradeoffs.

Distribution of impacts by Goal 5 treatment **–** Goal 5 treatments will affect the distribution of positive and negative economic tradeoffs. Allow treatments do not increase habitat protection beyond Title 3 or local regulatory measures and place no additional restrictions on land use and development. Developers and property owners will enjoy most, if not all, of the benefits. Habitat-associated ecosystem services and those that benefit from the habitat and services will suffer most, if not all, of the negative economic tradeoffs. Results for prohibit treatments will have the opposite effect. Development interests will suffer most, if not all, of the restrictions. Habitat, ecosystem services, and those who benefits from the habitat and services will experience most, if not all, of the benefits. Limit treatments offer the most equitable distribution of tradeoffs because they generate positive and negative tradeoffs for development and resource interests.

Summary of economic consequences

Summarized below are some of the economic consequences of allowing, limiting or prohibiting conflicting uses.

Allow conflicting uses

Allowing conflicting uses means no additional protection of Goal 5 fish and wildlife beyond the baseline protection provided by Title 3, or by local protection measures that exceed Title 3 guidelines.

- No impediments to development or negative impacts on the development value of land.
- Development-related employment, income and taxes will be unaffected by Goal 5.
- No Goal-5 related increase in VMT, transportation costs or UGB expansion.
- Amenity-related property values and associated property taxes for undeveloped lands zoned SFR and RUR that are adjacent to Goal 5 habitat lands may be less for this scenario relative to limit and prohibit scenarios.
- Flood mitigation services will decline, flood damage and clean-up costs may increase.
- Erosion and sedimentation will increase, as will concentration of toxins in streams and other water bodies. Water-quality expenditures (e.g., for filtration and treatment) by businesses and municipalities may increase. Municipal expenditures that address water-quality regulations (e.g., the federal Clean Water Act) may increase.
- Summer temperatures and the urban "heat island effect" may increase with an associated increase in cooling costs.
- Developing fish and wildlife habitat will increase the amount of impervious surfaces, which will increase stormwater flows and treatment costs.
- Development that negatively impacts salmon habitat may affect commercial, recreational and cultural harvests. Municipal expenditures that address habitat regulations (e.g., Endangered Species Act) may increase.

- Degrading fish and wildlife habitat may negatively affect recreational opportunities and values that depend on these habitats.
- Negative impacts on intrinsic values for fish and wildlife habitat.
- Developing fish and wildlife habitat now or in the near-term precludes developing them in the future or protecting them for future generations. This reduces the option values associated with the habitats.
- Carbon sequestration and air-pollution removal will decline with an associated decline in air quality and related values of air-quality services.
- Businesses that rely on fish and wildlife habitat and associated ecosystem services may experience a decline in sales, employment and income relative to the limit or prohibit scenarios. Employment and business-related tax payments may also decline.
- Allowing conflicting uses will negatively affect the 2040 Growth Concept and design types that emphasize protecting habitat and maintaining access to habitat.
- The large majority, if not all, of the negative economic tradeoffs of this option affect fish and wildlife habitat, associated ecosystem services and economic factors (e.g., jobs, incomes and values, that depend on these habitats). Development interests suffer little or no negative economic tradeoffs.

Limit conflicting uses

Limiting conflicting uses strikes a balance between completely developing the Goal 5 fish and wildlife habitat and protecting them. This alternative provides opportunities including: developing lands in ways that minimize negative environmental and economic tradeoffs; supporting the development goals embodied by the 2040 design types; and protecting the most important habitats.

- Will generate a mix of positive and negative economic tradeoffs for development interests and for the habitats and associated ecosystem services. Developing habitat will generate positive impacts on development values, employment, income and tax payments. However, these impacts will be less than for the allow scenario. The habitat will likely suffer some degradation, but not to the extent generated under the allow scenario.
- The consequences for the 2040 design types will be mixed. Protecting fish and wildlife habitat to a greater extent, compared with the allow scenario, may increase VMT if protecting habitat displaces development and pushes it out toward the UGB or beyond. This may also increase the next UGB expansion and transportation costs. However, protecting habitat is consistent with the planning goals reflected in the design types.
- Will generate a more equitable distribution of positive and negative economic tradeoffs, compared with either the allow or prohibit scenarios. Development interests and habitat will both experience positive and negative economic tradeoffs.

Prohibit conflicting uses

Prohibiting conflicting uses will prevent development actions that conflict with, or degrade, fish and wildlife habitat. This scenario emphasizes habitat protection. Protection measures will exceed the baseline protection provided by Title 3, or by local protection measures that exceed Title 3 guidelines.

- Amenity-related property values and associated property taxes for lands zoned SFR and RUR that are adjacent to fish and wildlife habitat may be greater for this scenario relative to limit and allow scenarios.
- This alternative will provide the greatest amount of flood mitigation services and value.
- Erosion and sedimentation will be less than limit or allow alternatives, as will concentration of toxins in streams and other water bodies. Water quality expenditures (e.g., for filtration and treatment) by businesses and municipalities may be the least under this alternative. Municipal expenditures that address water quality regulations (e.g., the federal Clean Water Act) may decline, especially over the long term.
- This alternative will have the greatest mitigating effect on summer temperatures, the urban "heat island effect," and associated cooling costs.
- Prohibiting development in fish and wildlife habitat will generate the least amount of impervious surfaces, and will generate the least amount of stormwater flows and treatment costs.
- This scenario will protect the greatest amount of salmon habitat and may positively affect commercial, recreational and cultural harvests. Municipal expenditures that address habitat regulations (e.g., Endangered Species Act) may decline, especially over the long term.
- This alternative will preserve the greatest amount of recreational opportunities and the associated recreational values.
- The intrinsic and options values for the fish and wildlife habitat will be preserved.
- Maintaining the greatest amount of vegetation will maximize carbon sequestration, air pollutant removal and the related values of air quality services.
- This alternative will provide the greatest support to businesses that rely on fish and wildlife habitat and associated ecosystem services.
- Prohibiting conflicting uses will support the aspects of the 2040 Growth Concept and design types that emphasize protecting habitat and maintaining access to habitat.
- This alternative will have the greatest negative impact on the development value of land.
- Development related employment, income and tax payments will also suffer the greatest under this alternative.
- Aspects of the 2040 design types that minimize VMT and sprawl will be negatively impacted if protection measures displace development within the UGB.
- The large majority, if not all, of the negative economic tradeoffs of this alternative affect development interests. The economic values and activities supported by fish and wildlife habitat suffer little or no negative economic tradeoffs, relative to allow and limit alternatives.

Factors that influence economic consequences

The description of economic tradeoffs in the previous section assumes no reaction by stakeholders and decision makers that would impact the economic tradeoffs. This static approach ignores, for example, the possibility that restoring fish and wildlife habitat may mitigate some of the negative economic tradeoffs of development on these habitats. A more dynamic view of economic tradeoffs considers alternatives that could help mitigate negative tradeoffs and enhance positive tradeoffs. This section describes a number of these dynamic factors.

Substitutability of land uses
Moving proposed land uses that conflict with fish and wildlife habitat to alternative locations may mitigate negative economic tradeoffs for both the land use and habitat. The previously conflicting land use can take place without impacting habitat. Substituting a non-conflicting or less conflicting land use in the habitat area will protect, to some extent, the property's development value. Such a move will also protect, to some extent, the quality and quantity of the property's fish and wildlife habitat.

The feasibility of substituting land uses depends on the types of land uses at issue and the availability of suitable sites outside habitat areas. The more specific or unique the development requirements, the less likely the development can take place elsewhere. For example, water-dependent industrial development must take place in specific locations—relatively large lots with water access. This limits the extent to which the land use can avoid conflicting with habitat by moving elsewhere. By comparison, residential land uses have relatively few development specific requirements and take place throughout Metro's jurisdiction.

Expanding the Urban Growth Boundary
Protecting fish and wildlife habitat may reduce the amount of developable land within the UGB. If this is the case, expanding the UGB could mitigate this loss while protecting fish and wildlife habitat within the existing UGB. However, expanding the UGB may promote sprawl and negative sprawl-related impacts including increased VMT and transportation costs, and possibly minimizing the effectiveness of the 2040 design types.

Encourage development practices that minimize conflicts with fish and wildlife habitat
Encouraging development practices that minimize conflicts with resources may help mitigate negative economic tradeoffs for both development and the resources. These practices include low-impact development projects that minimize impervious surfaces and manage stormwater in ways that more closely mimic natural systems. Cluster developments for residential lands is another example. This type of development localizes housing sites and associated land-use activities (e.g., roads) while avoiding developing fish and wildlife habitat. In another example property owners may sell future development rights while retaining ownership without restrictions on existing land uses.

Restoring degraded fish and wildlife habitat
Restoring already-degraded fish and wildlife habitat could offset a portion of the negative impact of new development on habitat elsewhere. In some cases, restoration opportunities may lie outside the existing UGB or Metro's jurisdiction.

Economic consequences by generalized regional zone

Below is a brief description of the economic consequences by the seven generalized regional zones (matrices describing the consequences may be found in (See Appendix D):

- **Single-family residential (SFR):** Lands zoned SFR account for almost half, 46 percent, of Goal 5 fish and wildlife habitat. Protection actions on these lands will primarily affect property values and related tax payments with little or no direct impacts on employment and income. Since SFR developments typically retain more vegetation and tree cover than other

types of development, this land use will conflict less with habitat and retain more ecosystem services and associated economic values than other development uses. Encouraging low impact developments and cluster development patterns may help mitigate negative economic tradeoffs for development and resources.

- **Multi-family residential (MFR):** MFR lands account for approximately five percent of Goal 5 fish and wildlife habitat. Economic tradeoffs will be similar to SFR lands except that MFR development typically retains less vegetation cover and fewer ecosystem services and associated values.
- **Commercial (COM):** Approximately five percent of Goal 5 fish and wildlife habitat are on lands zoned COM. Habitat protection actions may negatively affect property values, employment, income and related tax payments. COM developments involve extensive landscape modifications that negatively affect ecosystem services and the economic values of services. These negative impacts are comparable to, or greater than, the degradation of ecosystem services and values associated with MFR developments.
- **Industrial (IND):** IND lands account for approximately 15 percent of lands containing Goal 5 fish and wildlife. Economic tradeoffs will be similar in type and extent to tradeoffs for COM lands.
- **Mixed-use centers (MUC):** Approximately three percent of Goal 5 fish and wildlife habitat are on lands zoned MUC. Economic tradeoffs will be similar to developments on lands zoned MFR and COM. Limiting MUC developments will have mixed impacts on 2040 design types and the underlying 2040 Growth Concept. Protecting fish and wildlife habitat supports the Growth Concept's goals of maintaining access to nature and protecting habitat. Limiting MUC developments, however, may negatively impact the design type's emphasis on promoting more efficient land use and minimizing sprawl and VMT.
- **Rural residential (RUR):** RUR lands account for approximately seven percent of Goal 5 fish and wildlife habitat. Economic tradeoffs of developing RUR lands will be similar to SFR except less intensive given the more dispersed nature of RUR developments.
- **Parks and Open Space (POS):** Approximately 20 percent of the Goal 5 fish and wildlife habitat are on lands zoned POS. Protection measures may limit recreation activities that require facilities (e.g., ball fields and golf courses, and related infrastructure such as parking lots). This limitation may negatively impact property values for private parklands more than parks on public lands. Park and open space land uses may be the least intrusive on habitats and associated ecosystem services and economic values.

Summary Points

This section lists the summary points from the analysis of economic consequences.

- Fish and wildlife habitat lands were ranked for their economic importance for development or development value using three measures: land value, employment density and 2040 design type hierarchy.
- Fish and wildlife habitat lands provide ecological functions (e.g., bank stabilization, streamflow moderation, shade, etc.) that also provide ecosystem services (e.g., reduce flood damage, improve water quality). Ecosystem services have economic value. The analysis assumes that habitat that ranked high (for ecological functions) provide more of the type of ecosystem services that society values than do areas that ranked low.
- The Goal 5 programs may protect services such as flood management, water quality, amenity, and salmon-habitat values across a broad area that may affect residents throughout

the UGB and downstream from the UGB. Protecting these ecosystem services may also reduce municipal expenditures to provide these same services, especially over the long term.

- Prohibiting development protects habitat and associated values, but will limit development related economic benefits.
- Limiting development preserves some level of development and habitat values.
- Protecting fish and wildlife habitat within the existing UGB preserves habitat in close proximity to current population distributions but increases the probability of expanding the UGB sooner or to a greater extent than otherwise would be the case if protection measures displace developable land.
- Protecting habitat on the urban fringe protects development interests close in, but reduces access to habitat and associated ecosystem services for the majority of the population within the existing UGB.
- The details of the program options applied at the parcel level will dictate the type and extent of positive and negative economic tradeoffs for Goal 5 habitat protection measures.
- The fact that Goal 5 decisions would primarily affect land with lower property values and employment density does not mean economic consequences of limit or prohibit decisions would be trivial. The low category of land value and employment is relative to values and employment in the Portland city center. The cumulative property value or number of employees affected may be significant depending on the type of decision, the details of the Goal 5 program that implements the decision, actions that may mitigate the negative impact (e.g., expanding the UGB), and specifics of the individual parcels affected.
- Goal 5 programs that include fish and wildlife habitat restoration activities may mitigate the need to implement more severe limit decisions. That is, a program that includes habitat restoration may result in more allow or limit decisions, compared with a program that excludes habitat restoration. However, restoration plans should be developed in the context that restoring degraded habitat may be more expensive, and in the end provide fewer or lower quality ecosystem services, compared with protecting high quality habitat.

CHAPTER 5: SOCIAL CONSEQUENCES

Introduction

This chapter focuses on the social consequences of protecting or not protecting fish and wildlife habitat. Areas providing fish and wildlife habitat provide many important social benefits. However, protecting these areas places a burden on property owners. In this chapter the social benefits and burdens of protecting or not protecting fish and wildlife habitat are described by addressing the following questions:

- What do fish and wildlife habitat contribute to our cultural heritage and sense of place?
- How does protecting fish and wildlife habitat affect our health?
- What educational values are provided by fish and wildlife habitat?
- How does protecting fish and wildlife habitat affect public safety?
- What are the social impacts of protecting fish and wildlife habitat on the land supply?
- How does protecting fish and wildlife habitat affect property rights (private and public)?
- What fish and wildlife habitat will we leave for future generations to enjoy?
- What are the potential social consequences of allowing, limiting, or prohibiting conflicting uses as they relate to Metro's generalized zones?

Metro's fish and wildlife habitat protection efforts are being conducted under State Land Use Planning Goal 5. Land use planning is largely a negotiated social and political process that involves people, their communities, and their governments in decision making. Thus, the social issues include not only those related to land use plans specifically but also those of democracy, participation, and community process. Planning is a public social process representing multiple needs and values. The overall planning context and the importance of social participation are discussed in the section below.

Framework for the social analysis

Citizens have indicated the importance of protecting the air and water, endangered species and natural areas. Federal,[35] state, regional, and local policies reflect these choices. Publicly supported programs (e.g., Metro's Parks and Greenspaces program) exemplify the value placed on natural resources. Over 40 local groups (largely volunteers) focus their work on preserving and restoring streams and rivers, including watershed councils and conservation groups, land trusts, friends groups, specific stream groups, and the Willamette restoration initiative.[36] The public interest and outreach programs sponsored by parks and recreation programs and non-profit organizations provide opportunities for social gatherings, education, recreation, and conservation activities.

The value placed on ecosystem health by citizens in the region highlights the importance of conserving fish and wildlife habitat. The long-term, less tangible benefit of ecosystem health (intrinsic value of habitat) exists along with short-term amenity benefits to property owners and

[35] Endangered Species Act, Clean Water Act, etc. See *Introduction* chapter and *Appendix A* of ESEE report for more detail on policies that protect fish and wildlife habitat.
[36] See Metro's *Riparian Corridor and Wildlife Habitat Inventories* (Metro 2002d) for more information.

others. Some of the social benefits that arise from a healthy ecosystem are clean water, improved salmon and other wildlife habitat, biodiversity of plant and animal species, relief from urban stress, flood mitigation, educational and recreational opportunities, and neighborhood amenities.

In this analysis we consider the possible impacts of protecting or not protecting fish and wildlife habitat on human needs and social values. This analysis does not undertake a survey of people's values; however, it does point to a range of relevant and acknowledged values that bear on the protection of fish and wildlife habitat. Some of the relevant values considered in the analysis are ecological, economic, health, educational, aesthetic, and sense of place or regional identity. A range of values is associated with these issues, and sometimes they conflict with each other.

Linking human needs and comprehensive planning

The existing and planned functions[37] of the Metro region serve the needs of individuals, organizations and communities. These functions cover a range of security and welfare needs as well as the need for freedom and identity. Oregon's comprehensive planning goals parallel the diversity of social organization that supports human development. The planning goals address an array of concerns such as farms, industry, water quality, historic preservation, citizen involvement and urbanization. Land use policies specifically address such social functions as land for housing and employment, location of public facilities, and provision of recreation and natural areas.

Metro's 2040 Growth Concept was designed to help the Metro region continue to grow in a way that maintains a high quality of life. This includes livable neighborhoods, good transportation options, a strong economy, a vibrant culture, and access to nature while retaining aspects of the local character that provide continuity with the past and make this region unique.

Natural resources are one touchstone of this region's uniqueness. Without the proximity of forests, rivers, scenic mountain views, and farmland valleys, the region's natural and cultural identity would be diminished. Oregon's planning goals recognize that the land use planning program needs to preserve significant fish and wildlife habitat. This recognition of natural resource protection is a form of valuation that society places on nature to meet a variety of general needs and desires related to resource dependency, urbanization, and enjoyment of life.

Social participation and public legitimacy

This analysis focuses on the tradeoffs of protecting or not protecting fish and wildlife habitat from a social point of view. However, a key social consideration of any protection program is a well-designed and transparent public outreach and involvement process. Without plentiful opportunities for meaningful public comment, a program (regulatory or voluntary) is unlikely to succeed, and with good public involvement the success of implementation is more likely. It is important to identify the range of opinions of those who have a stake in the development of potential policies to protect fish and wildlife habitat.

Natural resource protection engenders strong stakeholder claims. The value placed on natural resources differs among individuals and stakeholder groups, and the natural resources in question

[37] For example, housing, schools, roads and transportation, industrial zones, and parks.

are not always equally distributed. Some people view natural resources as public or common goods, while others view them as private property. Citizens have given the government the responsibility for overseeing the management and allocation of public resources while also protecting private property rights.

Regulations to protect natural resources require a degree of social agreement for acceptance and cooperation to be effective. According to Uphoff and Langholz (1998), three key elements must be in place for natural resource protection to be effective: (1) a legal/coercive element, (2) an economic/profit motive element, and (3) a cultural/social acceptance element. Without social approval it may be impossible to prevent motivations of monetary self-interest or to counter illegal activity intended to circumvent laws protecting common goods. Social processes that uphold legitimacy and participation in decision making are thus essential for long-term public policy support and successful implementation.

It is important to respect the right of citizens to participate in identifying key issues of interest and concern. Without an adequate level of citizen involvement and direction, a program may be less likely to be accepted and runs the risk of being viewed as too technical or bureaucratic (Lane 2001, Brechin et al. 2002). The disproportionate influence of "powerful interests" can be ameliorated with open planning processes. Public resource management and allocation is political and involves the values of a broad range of people. Broad citizen involvement allows for a transparent process, develops trust, and leads to negotiated agreements that build locally acceptable commitments (Creighton 1983).

Citizen involvement is formalized in Oregon's land use planning system as Statewide Planning Goal 1. When stakeholders are provided with an opportunity to participate, programs are more likely to be successful. People and communities may see their interests in protecting the region's fish and wildlife habitats differently and may thus express different priorities in terms of their immediate needs and values. But, from a social perspective, this process of participation and opportunity for citizen involvement in the planning process is central. It is important that citizen involvement be a key aspect of program development and that the issues raised in the analysis below be considered.

What do fish and wildlife habitat contribute to our cultural heritage and sense of place?

Fish and wildlife habitat once covered the entire Metro region. "Historical evidence indicates that at the time of the Oregon Trail migration, the majority of the Portland region was in a continuous canopy" (Poracsky 2000). People have been drawn to the Willamette Valley and the confluence with the Columbia River for centuries because of the abundant natural resources available to provide a good quality of life. Lewis and Clark missed the mouth of the Willamette River twice as they explored the Columbia River, due to the forested islands screening it from view. After they were told by Native Americans of the river's existence they went back to explore and were duly impressed (Riddle 2000). Wildlife were abundant: "[Lewis and Clark] camped across the river from the island and in their journals bemoaned being kept awake by the 'horid' noise of the geese, ducks, and swans" (Matrazzo 2000). Just a few decades later the rivers were completely changed:

> River traffic was crowded with ferries carrying passengers back and forth to the east and west banks, and river steamers taking sightseers on excursions up the Willamette to the "Niagara of the West," up the Columbia to the Gorge, or downriver to the ocean. (Riddle 2000)

Today the remnants of habitat provide residents with a sense of regional identity and preserve some of the fish and wildlife species that have so shaped the development of this region.

Cultural heritage

Nature and wildlife are part of our region's unique identity. Residents of this region consistently say that contact with nature is important, and they value the natural biological diversity that is part of the Willamette Valley.[38] Robin Cody (2000), co-author of the book *Wild in the City: A guide to Portland's natural areas* (Houck and Cody 2000), states: "Although Portlanders are now a fully urbanized people, the rivers still make us who we are. Never too deeply buried in the urban ethos is an imaginative truth, that not so long ago we emerged to a riverside clearing, the sons and daughters of pioneers, self-selected for rugged individuality."

As Oregonians, state symbols are part of the cultural identity of residents in the Portland metropolitan region. The Western Meadowlark was selected as Oregon's state bird by schoolchildren in 1927 (Marshall et al. 2003). It is currently a state-listed Species of Concern, and has been nearly extirpated from the Portland metropolitan region due to loss of native grasslands (a Habitat of Concern here) and development encroachment. However, some birds still winter over in the region, and bird-watchers often seek them out in areas such as the agricultural lands around the Tualatin River. The state fish, Chinook salmon, has five runs in or near this region, and all five are federally listed as Threatened or Endangered. Loss of these species and their habitats implies an irreplaceable cultural loss.

Fish and wildlife play key roles, currently and historically, in Native American religion and culture. Levi Holt, former commissioner of the Columbia River Inter-Tribal Fish Commission (CRITFC), comments:

> The tribes always treated water as a medicine because it nourished the life of the earth, flushing poisons out of humans, other creatures and the land. We knew that to be productive, water must be kept pure. When water is kept cold and clean, it takes care of salmon. (Hollenbach and Ory 1999)

The CRITFC (2002) states that "without salmon returning to our rivers and streams, we would cease to be Indian people." CRITFC holds fundraisers each year, and so far the Spirit of the Salmon Fund has raised over $1.5 million for the commission and its member tribes to spend on salmon recovery activities. The federal government also has treaty obligations that ensure the availability of Chinook salmon and steelhead trout for tribal fishing (*U.S. v. Washington* 1974).

This identification with nature and wildlife by the majority of the region's residents is reflected in many ways. For example, the 100-year-old Audubon Society of Portland is older than the

[38] May 2001 Davis and Hibbits phone survey commissioned by Metro, an October 2001 Moore Information survey sponsored by KGW-TV and the Portland Tribune, and an informal "SurveyPoint" poll available by phone and on Metro's website in 2001.

national Audubon Society and is the largest chapter in the country, with over 10,000 members and 1,000 volunteers. Each year thousands of residents flock to the Wild Arts Festival to buy wildlife art and meet the authors of wildlife-related books; salmon and birds are probably the most common art themes in this area. Metro's annual Salmon Festival takes place at Oxbow Regional Park, located in the scenic Sandy River Gorge eight miles east of Gresham. Native Chinook salmon have migrated for thousands of years from the Pacific Ocean to the Sandy River and may be viewed spawning at the park during the festival and throughout October. Nature and wildlife are prominent subjects in the Portland Art Museum and in art galleries throughout the region.

Residents of the region also care specifically about at-risk wildlife and habitats. For example, in a 1997 poll conducted by the *Oregonian*, the decline of the region's salmon topped the list of residents' environmental worries (Brinckman 1997). The underlying reason was that salmon represent the Northwest's heritage and serve as a gauge of water quality and environmental health. Residents frequent rare habitats such as the oak woodland/wetlands complex in Oaks Bottom and river islands such as Sauvie Island. Such places harbor unique plant and wildlife communities and represent native habitats that were once common here, which makes them especially valuable to the region.

In 1999, Metro surveyed a diverse group of stakeholders, whose consensus on the most appropriate criteria for defining regionally significant fish and wildlife habitat included the presence of threatened, endangered, state sensitive, or state-listed species (Metro 1999a). Declining species most often depend on sensitive or declining habitats, such as riparian, Oregon white oak, undeveloped hilltops and river islands, or native grasslands. Loss of these species and the habitats they depend on is irreversible. In 2002, Metro conducted a public outreach effort in which over 2,400 residents participated (Metro 2002b). Environmental protection was identified as one of the three key issues deserving greater emphasis.

Contact with nature and the rich diversity of species and habitats native to this region are important parts of the region's cultural heritage; to the extent that these habitats are lost, so is a part of our culture, heritage, and natural history.

Sense of place and neighborhood character

The relation of people to place and land is an essential experience. Humans have been sensitized over millions of years by their co-evolution with the landscapes and species on the planet. The experience people have growing up is influenced by the climate, seasons, terrain, vegetation, and local animals. Home or neighborhood terrain, playgrounds, backyards, local parks, and scenic views, as well as the urban experiences of work, leisure, and travel in the region all influence the sense of place people feel, including their level of attachment to particular places.

The Metro region is well defined by its landscape: major rivers, hills, trees, the rainy season and summer heat. It includes views of Mt. Hood and Mt. St. Helens. The region is defined by the many streams and rivers, including the Willamette River running through the urban core, the Tualatin in the west and the Clackamas in the east, and the Columbia River leading to the Pacific Ocean. Forest Park provides opportunities for hiking in the city as well as defining our views of downtown Portland – skyscrapers framed against the forest and hills. This region is unique:

"Few cities in the nation can boast putting oceans, mountains, fresh strawberries, spawning salmon, and spectacular waterfalls in the same sentence, much less in the same day" (Seltzer 2000).

Bioregionalism is a landscape term expressing a reciprocal interaction of people and place, nature and society. Respect for place becomes a key feedback response for promoting the quality of life that people seek (Bethold-Bond 2000). Our regional identity includes the urban landscape that spans the river harbors, downtown Portland, and the cities and towns with a mix of new and old structures, known neighborhood features, gathering places, workplaces, city parks, museums, restaurants and stores. People are socially connected to the entirety of the built and natural environment, through street trees, gardens, walks, bicycle rides, and automobile trips. People have a regional identity in addition to other place-based identities (e.g., a neighborhood or watershed).

Historical perspectives on the changing Oregon landscape, the people who settled here, and the treatment of the environment, explain some of the region's uniqueness as well as common responses to life and development issues. In Terence O'Donnell's (1988) history of the 10,000 years of settlement since the "land came to rest and humans arrived to live from it," the people that chose to come to Oregon are described as being of modest ambition, respectable folks, self-sufficient and independent, seeking some measure of retreat and quiet.

> To delineate with any exactitude the character of either a person or a place is a futile exercise. Nonetheless, and perhaps as this and impressionistic history of Portland suggests, certain traits have appeared again and again in the town's expression of itself. There is the value placed on nature, a rather curious value for a city to embrace. One observer has commented that Portlanders are 'reluctant to face the facts of urban life, only its amenities'." (O'Donnell & Vaughn 1984)

A counter-perspective to immigrant sensibilities or attachment to place is reflected in an account of the utility of the land and the realities of capital and markets. Many people moved to Oregon to profit from the abundant natural resources. For many years it seemed there was no end to the board feet to be logged from the forests and the number of salmon caught from the rivers.

> Nearly a century and a half of American settlement has produced a regional landscape which has grown increasingly less distinctive and progressively less stable…. Northwesterners have frequently acted as if the natural world exists largely as something to buy and sell and as if the regional ecology were infinitely malleable. (White 1983)

These perspectives on the value of natural resources represent the conflicting values placed on natural resources and the changing views over time.

Scenic values

Trees, open space, and streams define the visual appeal of the Portland metropolitan region. Tree-covered hills blanket the cities and towns; removal of large sections of the canopy would change the visual appeal residents of the region enjoy. Fish and wildlife habitat can provide scenic value regardless of the degree of physical accessibility. People can enjoy a view of a stream, open space, or forest even if they are not able to explore it. However, people's perceptions of what makes up a "scenic" view may differ. Some consider densely vegetated

hillsides to be attractive, while others are attracted to open, park-like land. Most fish and wildlife habitat value is derived from the more densely vegetated areas. There are also economic values placed on scenic views, as described in the *Economic Consequences* chapter of this report.

Natural resources buffer land uses from each other

Fish and wildlife habitat can help to buffer incompatible land uses from each other. Open space, tree canopy, and streams provide physical, noise, and visual buffering that can separate land uses and reduce off-site impacts. Trees not only help to control noise pollution but add the soothing sounds of wind rustling through leaves and branches. A U.S. Department of Agriculture publication reports that a 100-foot wide and 45-foot tall patch of trees can reduce noise levels by 50 percent (U.S. Department of Agriculture 1998). For example, a residential area buffered from industrial uses by a forest or stream will be more desirable than a residential area without the buffer.

How does protecting fish and wildlife habitat affect our health?

Health is a social issue. It encompasses both physical and mental well being. Fish and wildlife habitat provide benefits that affect both our physical and mental health. According to the Academy of Leisure Sciences (2002), recreation and leisure activities may be one of the best methods of curbing rising medical costs. Recreation contributes to healthy living, and healthy people need less medical care. People have long recognized the value of nature in contributing to our mental and physical well being. In fact, the ancient Egyptians created gardens to restore the spirit.

Recreational opportunities

Land use planning is tied to environmental quality and to recreational and leisure activity, both of which have a direct effect on people's health. Air and water quality is one aspect of this, along with opportunities for physical exercise through recreation and mental health benefits derived from proximity to nature. Recreation helps to fuel the human spirit, strengthen the physical self, and create a series of connections to others, community, and the environment that are as necessary to life as air and water.

Psychologists Sachs and Segal (1994) found that activities such as a walk in the woods gives a boost to the immune system that lasts two or three days. Exercise helps people live longer. Several studies have shown that middle-aged adults who exercise live on average about two years longer (Nieman 1998). Aside from improved cardiopulmonary benefits and quality of life, researchers have found that exercise had a beneficial effect on the happiness of cancer survivors: those exercising reported 19 additional hours of happiness per week than those not exercising (Courneya et al. 2003).

Natural areas provide tangible value in urban environments for people and communities. Natural resources, open space, parks, greenways, and trail systems are described generally as amenities in an urban area. The region's natural resource amenities include a mix of local parks and natural scenery, plus access to wilderness destinations within a two-hour drive. Hiking in Portland's Washington Park, driving to the scenic Columbia Gorge, weekend camping visits to

the Cascades or the Oregon Coast, and boating on the Willamette River are some examples of recreation opportunities in the region. People enjoy walking and spending time in their neighborhoods and backyards in livable communities. Many people move to the Metro region specifically for the abundance of recreational opportunities located in and near the urban area.

The Metropolitan Greenspaces Master Plan, adopted by the Metro Council in 1992, describes a vision for a unique regional system of parks, natural areas, greenways, and trails for fish, wildlife and people. The plan identifies 57 urban natural areas and 34 trail and greenway corridors that define green infrastructure for the Metro region. In 1995 voters approved a bond measure ($135 million) to purchase sites identified in the plan. Local park providers, schools, businesses, and citizen groups are implementing the plan through a combination of open space acquisition, land-use standards, incentives, and stewardship.

Residents and local governments are working with Metro to ensure that people have access to nature close to home as well as efficient ways to get to work, school, or shopping. When originally conceived 100 years ago, the regional trail system was going to be 40 miles long, circling the city of Portland. The Metro area has grown substantially since then. The Metropolitan Greenspaces Master Plan expanded the concept to 25 cities and four counties within the Portland/Vancouver metropolitan region. Today, plans call for an 800-mile network of land trails, water trails, and greenways. Nearly 30 percent of the land-based trails are complete. Recreation and access to nature are important values to citizens of this region.

Recreational activities help to keep people well. While protecting fish and wildlife habitat on private land does not provide most residents of the region with direct recreational opportunities, it does contribute to overall ecosystem health. A healthy ecosystem means continued presence of fish in streams and birds and other wildlife in natural areas. Many citizens have moved to this region for the opportunity to engage in fishing, canoeing, sea kayaking, and other activities on the region's streams and rivers. Birdwatching is a popular pastime, especially visits to Smith and Bybee Lakes and Sauvie Island.

Impact of sprawl

A healthy urban environment is typified by neighborhood amenities such as access to nature (in the form of parks or openspace views) and pedestrian-scale development that provides both aesthetic and functional value. The modern predominance of door-to-door automobile trips, congestion, stresses, and pollution detracts from our health and enjoyment of city living. An article on integrative medicine identifies the "biopsychosocial interface" of the built environment, implicating urban planning and public policy in the process:

> While the trend toward increasing urban sprawl has impacts on land use, transportation, and economic and social development, less attention has been paid, until recently, to the fact that the way that our communities are designed can also have serious health consequences. (Horowitz 2002)

Horowitz describes the common health threats of auto-dependent urban sprawl as respiratory problems from air pollution, toxicity in air and water supplies, various stress factors, lack of physical exercise or activity, obesity, and impaired access to nature. Urban and suburban sprawl can isolate people socially. Urban stress also arises from noise, crime, litter, or blight in

neighborhood settings. However, increased density does not always have a positive impact on health. For instance, densely settled areas may allow for faster transmittal of communicable diseases. Not all neighborhoods face these issues, and social inequities between income groups and neighborhoods are well known and linked to health and environmental justice issues.

Environmental quality

Having intact natural systems helps keep the air and water clean in urban areas. Urbanization contributes to poor air quality and higher levels of industrial pollutants and results in other adverse effects such as high summer "heat island" temperatures.[39] Polluted air and water can cause many physical ailments such as asthma and bronchitis, allergies, and gastrointestinal problems. Poor air quality can prevent children from playing outside on summer days and can prevent adults from exercising outdoors or commuting by foot or bicycle. Retaining natural areas in the region helps to mitigate the negative impacts of development on human health.

Fish and wildlife depend on clean air and water to thrive. Fish are especially sensitive to poor water quality, such as that caused by the presence of toxins and other chemicals. Some people depend on fishing as a supplementary food source, and eating contaminated fish can negatively affect their health. Negative impacts include increased cancer risk and other health effects such as immunological, reproductive, developmental or nervous system disorders (U.S. Environmental Protection Agency 2002). Native Americans in the Columbia Basin eat fish at rates six to 11 times the national average and thus may be at a higher risk for negative impacts (U.S. Environmental Protection Agency 2002). Toxic fish are of particular concern for pregnant women and young children. Therefore, protecting fish and wildlife habitat may help keep those who eat fish from the region's rivers healthy.

Mental health and stress

The sight of natural areas enhances our mental health. Edward O. Wilson (1986) described this in his "biophilia hypothesis," which posits that human beings are attracted to nature because they are inextricably linked to the natural world and emotionally dependent on it. In discussing related research, the Trust for Public Lands (1994) points to information in over 100 studies describing the benefits of stress reduction from "experiences in wilderness and urban nature areas." Dr. Roger Ulrich of Texas A&M's Center for Health Systems and Design supports this research. He is cited in popular health literature regarding his studies on the positive response patients exhibit when exposed to natural environments:

> "…[J]ust looking at certain types of everyday nature is quickly effective in producing a mild, open-eyed relaxation response… Anger and fear also both diminish to the point of measurable improvement." (Ulrich quoted in British United Provident Association [BUPA] 2002)

Ulrich has found that passive scenic values reduce stress, lower blood pressure, and enhance medical recovery (Ulrich et al. 1991). Anytime people have a chance to look out a window at greenspace, or to be outdoors, they experience some benefit associated with a connection to nature, all other factors being equal (BUPA 2002, Baker 2002). Even pictures of nature can positively affect hospital patients. A study in a Swedish hospital found that heart surgery

[39] See *Energy Consequences* chapter for more discussion on Urban Heat Island effects.

patients viewing a landscape with trees and water "experienced less anxiety, and required fewer strong pain doses, than control groups assigned no pictures" (Ulrich et al. 1993).

Nature and spiritual values

Spiritual values are associated with a deeper reverence for nature and the outdoors. Beyond the benefits of exercise or stress relief, spirituality binds human beings and nature in a larger whole. Some people feel their closest connection with religion or the spiritual world when in the woods or by a river. Over the past few centuries the rise of science and rationalism provided humankind the opportunity to exert more control over nature and distanced people from their spiritual connections to nature (Rockefeller 1992). Most people today live in urban environments, with many children growing up not learning how the natural environment functions and supports our well being.

Many religions reflect beliefs of a larger mutual arising of knowing, meaning, and sense between people, nature and cosmos. Respect for the land, a morality of caring that extends to the type of utility we place on nature, is evident in Western spiritual traditions. On the other hand, another school of thought focuses on the "man over nature" model that focuses on the utilitarian value of animals and ecosystems (Rockefeller 1992). Lately many of the major religious organizations, such as the World Council of Churches, the U.S. Conference of Catholic Bishops, and the National Religious Partnership for the Environment have actively supported environmental protection policies and describe the connection between faith and the ecological health of the planet (Schueller 2001). For example, the Catholic Bishops of the Northwest issued a letter on caring for the Columbia River watershed, spurred by the economic and ecological conflicts evident in the region (Columbia River Pastoral Letter Project 2000). The letter described "…a vision that promotes justice for people and stewardship of creation."

Native American culture and spirituality is based on an appreciation of the natural world, as described by Margaret Saluskin of the Yakama Tribe below.

> Salmon was presented to me and my family through our religion as our brother. The same with the deer. And our sisters are the roots and berries. And you would treat them as such. Their life to you is just as valuable as another person would be. (Hollenbach and Ory 1999).

Spiritual awareness of the importance of nature has led to the philosophy and teaching of ethics, as expressed by such inspirational leaders as John Muir, Aldo Leopold, and Henry David Thoreau (Rockefeller 1992). It has also given rise to new philosophies, such as deep ecology, and to religions that view nature as sacred, such as paganism and Gaia (goddess)-based religions. Deep ecology is a philosophy based on the sacred relationship with Earth and all beings, an international movement for a viable future, a path for self-realization, and a compass for daily action (Drengson 1999). Nature provides inspiration and the chance for people from many religions and viewpoints to explore and enjoy their spirituality.

What educational values are provided by fish and wildlife habitat?

The existence of healthy ecosystems and fish and wildlife species enhances educational values and promotes recreation opportunities such as wildlife viewing, nature painting, and

photography. Healthy ecosystems also provide "living laboratories" for active educational programs from volunteer monitoring to formal scientific research. While these values and opportunities are realized mostly on public lands, private open space and natural resources also contribute substantially to maintaining healthy ecosystems and habitat for fish and wildlife species. These activities are not limited to public lands, as some private lands are dedicated to wildlife sanctuaries and environmental education facilities. In addition, roads and adjacent public parks afford viewing opportunities on adjacent private lands.

Nearby natural areas provide important educational opportunities

The importance of a variety of accessible natural areas for educational programs is evidenced by the wide array of non-formal education providers[40] and formal education providers[41] in the region. These entities provide programs for children and adults to learn about the environment, natural and cultural history, fish and wildlife species and their habitats, social studies, and civics.

Natural areas can provide a focal point for teaching people about how government works and how they can be involved in improving their neighborhood, city, or region. This public participation improves community understanding of environmental, social, and political issues.

Park districts such as Metro Parks and Greenspaces, Portland Public Parks, Tualatin Hills Parks and Recreation District, and North Clackamas County Parks District host hundreds of outdoor activities and environmental education programs, involving thousands of youth and adults on an annual basis. Metro's Parks and Greenspaces department developed a map depicting the locations of all the nature centers and environmental learning centers in the region. Non-profit groups such as the Audubon Society of Portland, Friends of Trees, and SOLV have extensive education and volunteer programs aimed at restoring fish and wildlife habitats and increasing people's awareness of the habitats and species within the region.

Natural areas provide opportunities for interdisciplinary education

More and more schools are recognizing the value of natural areas and the environment as an effective focus for integrated, interdisciplinary studies in all areas – social studies, arts, science, and mathematics. This model, *using the environment as an integrated context for learning* (EIC), has been shown to improve critical thinking skills, achievement in standardized tests and improved student attitudes about learning and civility toward others (Leiberman and Hoody 1998).

Public school districts, such as Portland Public Schools and North Clackamas School District, provide magnet schools focused on environmental learning. These schools fully incorporate public open spaces in their curriculum, providing an integrated context for all subject areas. Public and private schools also have "adopted" natural areas adjacent to or near the school grounds as a project-based approach to the overall curriculum. Happy Valley Environmental School, for example, uses the city-owned wetlands in this way and has helped build walkways

[40] For example, Tualatin Hills Nature Park, Jackson Bottom Wetlands Preserve, Tryon Creek State Park.
[41] For example, public and private schools, community colleges, universities, professional training institutes.

and restore native vegetation. Three Rivers Charter School in the Wilsonville-West Linn School District uses its grounds and adjacent lands to integrate all subjects.

Publicly owned open space and natural areas provide the bulk of recreation and educational opportunities within the region. However, private lands and wildlife sanctuaries, such as the 112-acre Audubon Society of Portland campus and the OES March/Montclair wetlands complex, also make a substantial contribution to the region's environmental education and recreation opportunities. Corporate parks, with associated natural areas, provide passive and active recreational opportunities for workers while enhancing the overall workplace environment.

How does protecting fish and wildlife habitat affect public safety?

Land that provides functional fish and wildlife habitat is often located on steep slopes and on floodplains in the urban area, since those lands pose more difficulties to develop. Protecting vegetative cover in these areas may reduce public safety hazards like landslides and floods. However, negative impacts of protecting or increasing trees and vegetative cover include possible increased risk of wildfires and increased numbers of undesirable species. Fish and wildlife habitat may also have an impact on reducing crime and violence.

Flooding and landslides

Trees and vegetative cover provide slope stability, prevent stream bank erosion, and allow for permeable soils to absorb and hold floodwaters, while conserving fish and wildlife habitat. Any conservation and restoration of habitat lands would likewise help with the prevention of natural and environmental hazards such as landslides, flooding, stormwater runoff, and erosion. The costs to property owners and insurance companies from landslides, flooding, and erosion can be significant if development is not carefully engineered; even then downstream properties may be affected by vegetative clearance or surface runoff. Thus, habitat conservation provides social benefits to property owners and communities that are located in higher risk locations.

Goal 7 of the Statewide Planning Goals requires local governments to reduce risk from natural hazards. The rule states that "local governments shall adopt comprehensive plans (inventories, policies and implementing measures) to reduce risk to people and property from natural hazards." Approximately 28 percent of the vacant, buildable land in Metro's inventory is environmentally constrained. The fish and wildlife inventory represents ecosystem functions and biodiversity in the region, and environmental constraints represent hazards and safety protection (e.g., floods, landslides, and water quality). This convergence of functions illustrates multiple benefits from habitat protection – preventing natural hazards and protecting fish and wildlife habitat. It also demonstrates that much of the remaining fish and wildlife habitat is located in the more difficult to develop areas.

Wildfires and windstorms

Besides flooding and landslides, wildfires are another type of natural hazard. Urban wildfires are risks for property owners associated with dry trees, brush, and vegetation in close proximity to built structures that in drought conditions or hot summer weather. Managing fish and wildlife habitat to encourage native vegetative cover while also managing for any fire hazard is a

balancing act. The risks would be less in cool, moist riparian areas than the drier upland habitats. Spatial buffering could minimize risks to people and structures. Trees intermingled with houses, businesses, roads, and utility lines can pose hazards in windstorms as well.

Nuisance species

Preserving fish and wildlife habitat could allow nuisance species to continue to live in proximity to people. However, several species have adapted to live in the most urban environments and are likely to stay, such as raccoons and opossums. Wetlands and areas of standing water allow mosquitoes to breed and may contribute to diseases such as the West Nile virus. However, if wetlands are healthy the natural ecosystem controls mosquito populations (Scheirer 1994, Ladd and Frankenberger 2003).

Crime and violent behavior

The presence of trees and grass can lower the incidence of aggression and violent behavior, as was found by Bill Sullivan and Francis Kuo in a study of residents of public housing in Chicago (Kuo and Sullivan 2001a). Greenery reduces mental fatigue, which allows for more positive interactions between people. Neighborhood green areas can also increase community ties and support networks (Kuo et al. 1998). Additionally, tree canopy (as opposed to dense shrubs) in urban areas may actually reduce crime (Kuo and Sullivan 2001b). The study found that, compared with apartment buildings that had little or no vegetation, buildings with high levels of greenery had 52 percent fewer total crimes, including 48 percent fewer property crimes and 56 percent fewer violent crimes.

What are the social impacts of protecting fish and wildlife habitat on the land supply?

The urban land supply is a representative social issue because it relates to people's basic needs for housing, jobs and urban services. A constriction of the existing land supply could negatively affect the social needs these lands serve (e.g., housing and employment). An urban growth boundary (UGB) expansion could offset the impacts, but the urbanizing rural land spreads the development pattern further towards the periphery of the region. This could increase travel times[42] and congestion and could encroach further on fish and wildlife habitat in rural areas.

Metro's fish and wildlife habitat inventory covers developed, vacant, and buildable land. (See *Conflicting Use* chapter for more information.) If there are changes to the regional land supply, the Goal 5 rule allows governments to meet competing needs by compensating for reductions in the buildable land inventory. The rule states that a government shall:

> (a) Amend its urban growth boundary to provide additional buildable lands sufficient to compensate for the loss of buildable lands caused by application of Goal 5;
> (b) Redesignate other land [inside the UGB] to replace identified land needs… (OAR 660-23-070(1)).

[42] Please see this report's *Energy Consequences Analysis* chapter for more description of the impacts of urbanizing rural land.

One of Metro's key tasks is the identification of buildable land, which defines where new development can occur. The buildable land supply influences housing availability and affordability, employment, and manufacturing locations. It also influences transportation system planning and general accessibility, along with public facility siting (e.g., cultural centers, schools, utility, and maintenance facilities). Land supply also affects public capital expenditures as urban services are spread out over larger areas.

Vacant land, redevelopable land, and infill sites provide the basis for housing and employment growth in the region. All vacant land is not considered *buildable*. Some of it is environmentally constrained (Title 3 lands in floodplains and adjacent steep slopes), and some is in public ownership and serves other needs (e.g., schools, parks, utility easements). The buildable land inventory is reviewed periodically to ensure that there is an adequate 20-year supply to meet forecasted housing and employment demand.[43]

Whether protection of fish and wildlife habitat will constrain buildable lands will not be determined until a program option is chosen. The Goal 5 rule allows for a range of approaches to conflicting uses: development may continue, be limited in some manner, or be prohibited in certain areas. Consistent with Metro's existing policies to protect water quality and floodplains, the assumption is that habitat protection may restrict design and management on some lands but will not prevent all development in order to prevent regulatory takings. Potential social impacts of constraining the land supply are described below.

Housing opportunities and affordability

Residential zones make up the largest component of buildable land in the fish and wildlife habitat inventory. Approximately 60 percent of the vacant, buildable habitat within the urban growth boundary is zoned residential,[44] and of that 66 percent is not environmentally constrained. Thus, the residential buildable land supply appears to be the most sensitive to possible impacts of fish and wildlife habitat protection.

The types of housing opportunities available may change depending on habitat protection. Rather than reduce the number of housing units allowed on a lot, regulations may allow for the same units in a denser configuration, such as rowhouses, condominiums, or apartments. Clustering units on smaller lots in a subdivision may allow fish and wildlife habitat to be preserved. These potential changes have social impacts. Many people who might choose to purchase or rent a single-family home with a large yard will not view these other housing options as equivalent. The location of the housing is important as well. Housing opportunities closer to existing employment, shopping, and entertainment will not be replaced by residentially zoned land in areas on the urban fringe.

Housing affordability may be affected if protecting fish and wildlife habitat results in changes to the land supply. Some studies have shown that maintaining an urban growth boundary and limiting the supply of buildable land increase the cost of housing (Staley and Mildner 1999). Further limits to the land supply may cause a commensurate increase in housing costs. However,

[43] Buildable lands are described in December 1999 Update to the Technical Appendix to the Urban Growth Report.
[44] SFR: 56%, MFR: 4%

another recent study found that market demand, not land constraints or growth management policies, is the primary determinant of housing prices (Nelson et. al 2002). In some instances denser housing is more affordable than large-lot single-family homes, so that policies supporting increased density may result in lower housing costs. Housing developed on the periphery of the region may or may not be affordable, depending on the costs involved in bringing urban services to new areas. Limiting or prohibiting conflicting uses could have a negative impact on housing affordability but may not, depending on the type of development allowed and other market forces.

Impacts on quantity and nature of employment opportunities

Employment opportunities typically occur on land that is zoned for commercial, industrial, or institutional uses. Vacant land zoned for commercial, industrial, or mixed-use development makes up 28 percent of the land within the fish and wildlife habitat inventory, and almost half is not environmentally constrained. Development of these uses on land containing fish and wildlife habitat can sometimes occur in such a way that some or most of the habitat functional value is retained.

The location of these lands is an important factor in determining the social impact of allowing, limiting, or prohibiting use in these areas. Metro is able to add land to the UGB if employment capacities are reduced due to habitat protection. However, it is important to consider the social impacts of adding employment land on the urban fringe. Will job opportunities located in newly developed areas be equivalent to lost opportunities located near existing concentrations of housing? Residents choosing to work in locations further from their homes will incur additional travel expenses as well as a reduction in quality of life due to more time spent commuting and away from home. Additionally, the types of jobs may be different, as a company that might choose to locate in an existing commercial or industrial area may not choose to move to a new location.

How does protecting fish and wildlife habitat affect property rights (private and public)?

Metro's Goal 5 fish and wildlife habitat inventory covers both public and private land. Habitat coincides with residential, commercial, and industrial property as well as with public land such as parks, greenspaces, schools, and public facilities. Property ownership and land use regulations are sensitive issues that are central to habitat protection. Property is subject to law and review by people and social institutions concerned with the use of land. Changes to property use are negotiated in this public-private dynamic.

Natural resource stewardship exacerbates the question of government oversight because ecosystems cross property lines and jurisdictional boundaries. Ecosystem continuity is one criterion for successful environmental stewardship, and this larger view tends to reside with public sector planning and oversight. Government has a responsibility to uphold the public trust, including the protection of valued public resources, once identified and agreed upon.

Property owners have many concerns about regulations limiting development on their land. People purchase a property with the expectation of a certain use; thus regulatory certainty is an important factor. A change in regulations affecting land development and use could have an economic impact, but there is also a social aspect relating to individuals' perceptions of their rights and roles in our society. Restrictions on the use of property can also contribute to feelings of political alienation and may cause people to invest in property or businesses elsewhere.

Americans have a history of strong individual property rights

Property is considered by many to be one of the basic institutions of human society, similar to family and religion. In America the rights that come along with owning a piece of property have been especially revered. Many people believe that individual property owners should determine the most appropriate and beneficial use of their property. These beliefs date back to frontier times in America, when land was conquered and tamed.

The legal concept of property consists of a number of rights that are guaranteed by the government (Sargent et. al 1991). A common idiomatic description of property rights is the reference to a "bundle of sticks," where each stick represents rights the owner has in regard to the land. Some sticks are reserved by the government, such as the right to tax and the right to control the type of private use on the land (Meyer 2001). Conferred rights depend on public oversight and responsibilities associated with land ownership. The benefits, agreements, and responsibilities tied to property are varied and are negotiated over time by law and public policy. There are also informal cultural aspects of property such as status conferred by property, how property is kept, and related social conduct by property owners.

Land ownership issues are complex because individuals have expectations of what they can do with their land while society at large has expectations of how land should be managed.[45] Environmental conservation and natural resource scarcity are two examples of how common issues affect both public and private property interests. Natural resource protection, for the sake of the public good, has become a factor in the debate about land use and resource management, which involves multiple types of property and uses. However, many residents of the region consider unregulated ownership of property (or as few regulations as possible) to be important. Thus, if Metro were to implement regulations to limit or prohibit conflicting uses in identified fish and wildlife habitat, such limitations on the activities of a private property owner would have a social impact on those property owners and other citizens who feel strongly about the rights of private property owners to use their property as they see fit, unfettered by government regulation.

Takings

The "Takings Clause" of the Fifth Amendment to the U.S. Constitution provides that private property shall not be taken for public use without just compensation. This clause was part of the U.S. Constitution as initially ratified, and it represents a bedrock principle of American law. Article I, section 18 of the Oregon Constitution contains a similar requirement. Not many people

[45] Property rights are a function of what others are willing to acknowledge. A property owner's actions are limited by the expectations and rights of other people, as formally sanctioned and sustained in law (Meyer 2001).

would disagree that if the government physically takes private property and puts it to public use, to build a road, for example, the landowner should be justly compensated for the value of the property that was taken. This is normally done through a condemnation procedure. A more difficult question arises, however, when the government does not physically confiscate property but rather regulates how private citizens may use their property. The U.S. Supreme Court has issued numerous decisions interpreting and refining the meaning of the federal Takings Clause in the context of such alleged "regulatory takings."[46] Such jurisprudence makes it clear that the meaning of the Takings Clause in the context of regulatory takings is still vigorously and passionately debated.

In 2000, this issue was put before the people of Oregon in the form of Ballot Measure 7. Measure 7 asked if property owners should be compensated for any decrease in the market value of their property caused by the imposition of new governmental regulations. The measure passed, but the Oregon Supreme Court later overturned the measure on procedural grounds (it had not been adopted as required by the Oregon Constitution). A recent report by the City Club of Portland on ballot Measure 7 (from the 2000 election) addressed regulatory takings. The report suggests that compensation to property owners is reasonable at a certain agreed-upon threshold of regulatory appropriation, as it relates to existing allowed uses (not anticipated or speculative uses). The report suggests government is accountable for its regulatory impacts and should estimate these impacts and make exceptions when unfair burdens exist (City Club of Portland 2002).

Thus, in summary, it is clear that people have strong feelings about the takings issue; feelings that go beyond concern about a loss in the economic value of property. There are people who believe, for example, that the *Dolan v. City of Tigard* decision should be interpreted to require the government to compensate any landowner whose ability to develop their property is at all limited by a government regulation. Others legally dispute that interpretation, and a legal recitation of the interpretation of Supreme Court cases is inappropriate in this analysis. The point of raising this issue is that it goes to the question of individual rights in our society and the relationship between individuals and government. Some who believe that more compensation should be provided when the government regulates the use of private property might feel alienated from government when courts have ruled that certain regulations do not constitute compensable takings. Put another way, if regulations are imposed that may decrease property owners' freedom to use their property as they wish, some will believe that the government has "taken" their property, regardless of whether a court would find that such an action was a constitutional "taking" for which they should be compensated.

If the Metro Council chooses to limit or prohibit conflicting uses on some fish and wildlife habitat, a program to protect these areas will be developed in such a way that a legal taking does not occur, similar to current regulations to protect water quality and prevent flooding (Title 3). However, many landowners believe that additional regulations require compensation, and that a regulatory program should also include incentives.

[46] See, e.g., *Agins v. Tiburon*, *Nollan v. California Coastal Commission*, *Dolan v. City of Tigard*, *Penn Central Transp. Co. v. New York City*, *Lucas v. South Carolina Coastal Council*, and *Palazzolo v. Rhode Island*; see also *Dodd v. Hood River County* (9th Circuit decision).

Personal financial security

Real property is one of the largest economic investments many people make and is an important and sensitive social issue. Property represents issues of security, income, housing, and employment opportunity. The ability to use land as it is zoned implies a social and economic purpose or right – perhaps described as certainty or security. Private investment in property is tied to a potential income stream or return on investment, which usually results from a combination of local plans and development conditions, general market conditions, upkeep, and improvements. Investors in property seek clarity about the regulatory framework. Regulations that result in reductions to property value may affect people's ability to draw on the equity in their homes to fund retirement, education, and other activities. Thus, limiting or prohibiting conflicting uses, if it results in reduced property values, can have a negative social impact.

At the same time, because property overlaps with and can affect natural resource systems – land, water, air, ecosystems – property is also tied to common goods which are needed and valued by society at large as well as by individuals. The impact of natural areas on quality of life, property values, and regional attractiveness is an economic consideration as well. For example, local studies (Lutzenhiser and Netusil 2001, Bolitzer and Netusil 2000) have shown that proximity to some types of natural areas actually increase property values, thus preservation of these habitats could positively impact nearby property owners. Private individuals and firms can capture the value of location, such as nearby parks, open space or schools, or good accessibility to services or transportation infrastructure. This results in higher demand and higher dollar valuation of these properties. On the other hand, public parks, schools, highways, and other perceived amenities capture individual or commercial value by the usage, time, and willingness of people to pay for them. Negative impacts such as congestion, noise, nuisance, crime, pollution, or diminished natural features can affect adjacent property values as well as the community.

Distribution of benefits and burdens

When a community makes habitat allocation decisions, social equity issues and questions of policy fairness may arise. There are several social equity considerations. Who may be affected if fish and wildlife habitat identified in the inventory is protected? Who benefits, and who is burdened by a habitat protection program? If some property owners are burdened, is the benefit gained commensurate with the burdens on property owners? The affected parties could include individual property owners, families, and businesses as well as other entities such as public agencies, non-profits, and community organizations.

Fish and wildlife habitat is fixed in location at a given point in time; therefore, the distribution of the assets and liabilities resulting from the habitat is inherently uneven. Uneven distribution of the habitat is not in itself an inequity, since these natural assets were not publicly allocated in the past and cannot be reallocated at present. The habitat exists in nature, is partially attributable to historic development trends, and is a feature of the landscape today. If Metro were to develop a plan to restore or acquire fish and wildlife habitat and thus invest publicly in conserving these areas, then social equity concerns might arise. Currently, distributive concerns are minimized because of the fixed character of the habitat and the lack of funds to develop restoration or acquisition programs targeted to the fish and wildlife habitat inventory.

Public access to many of the fish and wildlife habitat inventory sites identified by Metro is limited, and public benefits are more indirect than direct. Indirect public benefits are derived from the value of maintaining biodiversity in the region and from general environmental health and water quality improvements. The more direct benefits of being located near fish and wildlife habitat accrue to those nearby. While streams and rivers are a public resource, streamside property owners benefit more from actions taken to protect and enhance stream health. Those same property owners may "pay" for their location with the increased risk of flooding and sometimes additional regulations to maintain the public values of the habitat. Amenity values[47] that benefit property owners may be considered as offsets against burdens these same owners may face in shouldering the responsibility of conserving these resources.

Fish and wildlife habitat can add value to property (Bolitzer and Netusil 2000) and is related to the demand for these locations. On the other hand, if the fish and wildlife habitat substantially hinders development of the property or acts as a nuisance, then there are inequities to consider. If the benefits and burdens are relatively equal, then some of the equity issues may be neutral.

The property owners most affected by a decision to limit or prohibit conflicting uses are single-family residential (46 percent), followed by industrial land (14 percent). However, developed land is likely to be less affected than vacant land.[48] All residents of the region will benefit from the retention of fish and wildlife habitat, even though public access may be unavailable on all but publicly owned land. The benefits arising from protecting fish and wildlife habitat have been described throughout this social analysis. Thus, the burden may fall disproportionately on one group of property owners to provide the benefit for the common good. A protection program that includes incentives and carefully considers the impact of regulations may reduce the burden on the selected property owners.

Public property rights

Ownership of property is defined as an aggregate of rights that are guaranteed and protected by the government. However, the government retains some rights in trust for the people. For example, environmental quality and fish and wildlife habitat are not owned by anyone. They are public resources that the government can act to preserve, which is the concept of the public trust doctrine.

For example, the public has a right to clean air and water. Landowner actions on private land affect the quality of both air and water. Therefore, government regulations at the federal level have been developed to protect public rights through the Clean Air Act and the Clean Water Act. Similarly, fish and wildlife are important natural resources that typically cross legal boundaries, moving from one property to another. An individual does not own the wildlife that inhabits or crosses his or her land (*Geer v. Connecticut* 1896). If society has identified specific species of fish or wildlife as important to protect, through the Endangered Species Act or other means, then a government has the responsibility to act to maintain the species in trust for the people.

[47] See *Economic Consequences Analysis* for more description of amenity values.
[48] Developed land: single family, 37 percent; industrial, 34 percent. See *Conflicting Uses* chapter for more data.

In law, the public trust doctrine serves as a foundation of the public's right for common use and access of public resources (although this doctrine has traditionally been restricted to the interpretation of navigable waterways and tidelands). The public trust doctrine can theoretically be applied to all public trust resources. Private individuals do not own public trust resources. The Oregon beaches are one example of a public trust resource. The Oregon legislature affirmed the public's right to access or use of a common area (the beach) on Oregon's coast (between low tide and the line of vegetation defined in ORS 390.770) even if privately owned. This is not so much about a right of public access as about the responsibility to preserve the associated public value (availability of that experience) inherent to this unique coastal environment (Oregon Department of Land Conservation and Development 2003a, "Beach Bill"). Access is not required to protect a public trust resource. Protecting air and water quality or wildlife, while affecting private property rights, does not require providing public access to private land.

Controversy and legal conflicts are likely regarding the differences in public trust assertions and private right claims when these concepts overlap in policy making, such as with developing a program to protect regionally significant fish and wildlife habitat. Establishing the value of these habitats from both a public and private perspective is important in identifying the social concerns of protecting fish and wildlife habitat.

What fish and wildlife habitat will we leave for future generations to enjoy in the Metro region?

Sustainable development and other social movements by local, national and international groups have fostered a new urgency in planning and development. Interdisciplinary thinking seeks to reconcile natural resources, human needs, social responsibility, and ethics. Preserving biodiversity has an intrinsic value as well as a potential future value with regard to science, health, cultural heritage, and the economy. The overarching message of social-environmental policy is human interdependence with the natural world. Resource scarcity and environmental degradation temper production and consumption patterns around the world. This new social awareness leads to shifts in how growth and development occur, from the workplace to people's backyards.

Social values that support society's interdependence with nature, as opposed to control over nature, indicate an awareness of the biophysical limits of the environment. While everyone does not adhere to sustainable development's goal of a moral obligation to preserve the natural world, some see this as recognition of deeper social values that extend to future generations. The U.S. Conference of Catholic Bishops (USCCB) states that

> …[W]e simply cannot leave this problem for the children of tomorrow. As stewards of their heritage, we have an obligation to respect their dignity and to pass on their natural inheritance, so that their lives are protected and, if possible, made better than our own. (USCCB 2001)

Resource dependency is a defining characteristic of living systems. An essential challenge for modern development is how to design and manage for humanity's interdependence with nature. This is not just an ecological, engineering, or market question; it is also increasingly a social and policy issue. Attention to human-induced environmental problems has emerged as a result of our

increased population, resource scarcity, waste generation and the combined effects on health and long-term survival. In urban metropolitan areas these effects can be seen with growth: more people, more pollution, and a scarcity of open space (Donnelley 1998, Lange 2003, Lazaroff 2003, McClure 2003).

Intergenerational equity

How do people manage for environmental stability, health, and the integrity of the planet's ecosystem for future generations? The interdependency of people and nature is a reciprocal relationship. Feedback or awareness is key to the stability of the ecosystem. Sustainable development embraces this idea. It has captured the common sense notion of moderation, of realizing that biophysical limits exist and exercising caution with resources that may not be easily replenished. This current awareness extends to monitoring the most basic ecosystem attributes, such as climate conditions, air, water and soil quality, and species diversity.

Originally written 30 years ago, the Oregon Statewide Planning goals repeatedly cite "carrying capacity"[49] when assessing development and impacts on the environment. The following two phrases are repeated as considerations in nine planning guidelines (for natural resources, air and water quality, natural hazards, recreation, economic development, housing, public facilities, transportation, and urbanization):

> Plans … should consider as a major determinant the carrying capacity of the air, land and water resources of the planning area. The land conservation and development actions provided by such plans should not exceed the carrying capacity of such resources. (Oregon Department of Land Conservation and Development 2003b)

These are general parameters of evaluation and specific application of this principle is often hard to estimate. As more attention is paid to sustainability, renewed attention to what carrying capacity means becomes relevant. A decision to limit or prohibit conflicting uses in fish and wildlife habitat areas meets the social goal of retaining natural resources for future generations to enjoy.

What are the potential social consequences of allowing, limiting, or prohibiting conflicting uses?

The Goal 5 process requires local governments to make a decision to allow, limit, or prohibit conflicting uses to protect fish and wildlife habitat based on balancing the consequences of the four ESEE factors. A description of what it might mean to allow, limit, or prohibit conflicting uses is described in the Chapter 3, *Conflicting Uses*. The social consequences analysis is limited by the hypothetical context of policy changes. In general, the social considerations as they relate to specific property development are focused on people's rights and interests in effecting policy and on the value people place on the long-term existence of fish and wildlife habitat. Below is a general description of the social impacts of allowing, limiting or prohibiting conflicting uses, a

[49] *Carrying capacity* as defined by DLCD: Level of use which can be accommodated and continued without irreversible impairment of natural resources productivity, the ecosystem and the quality of air, land and water resources.

summary of the differences of the consequences by regional zone, and the key points learned from the social analysis. Several matrices relating the social impacts to Metro's generalized regional zones may be found in Appendix D.

Potential social consequences

Allow conflicting uses

A decision to allow conflicting uses in fish and wildlife habitat areas would have positive and negative social consequences. Property owners would not be concerned about impacts to property rights, there would be no takings issues, and the burden of protecting fish and wildlife habitat would be equally distributed. For residential land in particular, there might not be a change in personal financial security or the right to maintain and develop land within the existing regulatory framework. There would be no change in the number or type of housing options, and housing affordability might not be affected. Industrial landowners could continue to develop using land intensive practices. Employment opportunities under current zoning might not change. Additionally, less fish and wildlife habitat might mean a decreased risk of urban wildfires and nuisance species.

However, a decision to allow conflicting uses would have several negative impacts. The fish and wildlife habitat that forms a major portion of our cultural heritage, sense of place, and regional identity might be eroded and possibly lost. The salmon that are so important to Native American culture and the heritage of the Pacific Northwest would stand less of a chance of surviving. Some property owners might be concerned that property values would diminish due to potential loss of nearby natural areas. Public health could suffer due to poor air and water quality, fewer recreational opportunities, reduction in opportunities for mentally restorative nature visits, and possibly higher levels of aggression and violence. Opportunities for children and adults to learn about the environment specifically and to integrate environmental learning with traditional subjects to form a cohesive approach would be lost. Loss of tree canopy and vegetation could increase the risk of floods and landslides. Fewer companies might locate to this region if the quality of life and outdoor recreation are negatively affected. An allow decision would not provide for intergenerational equity, since people today would not be saving fish and wildlife habitat for future generations to enjoy.

Limit conflicting uses

A decision to limit conflicting uses in fish and wildlife habitat areas would be a compromise, attempting to minimize the negative social impacts of either allowing or prohibiting conflicting uses. If development occurred with minimal impact to the fish and wildlife habitat, social values could be maintained while reducing the effect on property owners. This type of approach could maintain housing and employment options while preserving as much habitat as possible. Some or most of our cultural heritage, neighborhood character, sense of place, and scenic values would be preserved. Negative impacts on public health could be reduced, and most educational opportunities could be retained. Benefits such as stress reduction, decrease in aggression and violent behavior, and positive impacts on mental health might not be lost. Salmon would be provided with more of a chance to recover and impacts on Native American culture and regional identity would be lessened. Risk of floods and landslides would be reduced, and there would be more intergenerational equity. However, an increase in habitat could result in more urban wildfires and nuisance species. Regulations limiting conflicting uses might not be equitably

distributed among property owners, and there may be impacts on property rights as well as takings concerns.

Prohibit conflicting uses

A decision to prohibit conflicting uses in fish and wildlife habitat areas would preserve all of the important social values and public benefits provided by habitat described above. However, such regulations would result in an unequal distribution of burden among property owners, with a negative impact on property rights. Takings concerns would likely become an issue. While property owners with existing homes might not be affected, vacant land might not be allowed to develop in the same way as currently allowed. Housing and employment options might be reduced, with a resulting need to increase densities or expand the urban growth boundary. More land would be needed to meet housing and employment demand if conflicting uses were prohibited on additional land within the urban growth boundary.

Social consequences by generalized regional zone

Most of the social consequences are similar across zones (matrices describing the consequences may be found in Appendix D); the differences are identified below.

- **Single-family residential (SFR):** For single-family uses, a decision to allow could maintain personal financial security (equity) if property values are not affected. A limit or prohibit decision might reduce options for large lot homes if they are allowed under current zoning. However, in some instances larger lots could reduce the impact on fish and wildlife habitat and could be allowed under a limit decision, depending on the type of program.
- **Multi-family residential (MFR):** A limit or prohibit decision may reduce opportunities to develop at high densities in fish and wildlife habitat areas. This could affect property owners by reducing the number of units that could be built on a specific property, reducing development potential. However, a program could be designed to minimize the impact by allowing clustered development or transferring density.
- **Mixed-use centers (MUC):** An allow decision would have no impact on current 2040 densities or development in centers, supporting the achievement of the 2040 Growth Concept. A limit or prohibit decision may impact achievement of the 2040 Growth Concept by curtailing growth in centers, depending on the type of program implemented.
- **Commercial (COM) & Industrial (IND):** For commercial and industrial land the most important social consequence of a limit or prohibit decision is the potential to impact job creation and the location of future jobs.
- **Rural (RUR):** In rural areas the focus is on the future opportunities for housing and employment that could be minimized when the land is urbanized.
- **Parks and open space (POS):** An allow decision would maintain or increase opportunities for active recreation, while a decision to limit or prohibit could reduce opportunities for active recreation, depending on the program.

Summary points

- Protection of fish and wildlife habitat preserves many important social values. These include our cultural heritage, regional identity, sense of place, and neighborhood character. Property owners may also benefit from the retention of fish and wildlife habitat through increased

property values. Opportunities for education abound in areas with healthy fish and wildlife habitat.

- The distribution of the regulatory burden on property owners to protect fish and wildlife habitat for the general public benefit is a critical social concern. Private property rights are a fundamental cornerstone of American life, and additional regulations reducing development rights may be seen as an attack on personal financial security as well as a possible taking. However, there are public rights to clean air and water, as well as healthy fish and wildlife, which serve as a counterbalance to this view.
- Fish and wildlife habitat provide positive benefits to public health and safety, but there are some negative effects. There are many obvious benefits of recreation, as well as the mental health and stress relief found in nature. Additionally, minimizing the incidence of flooding and erosion contributes to public safety. However, increased forest canopy and vegetation could lead to wildfire risks and potential damage from windstorms.
- People today have a responsibility to provide future generations with some of the same benefits that current residents enjoy. Sustainable development practices allow for development to occur today while maintaining a certain amount of intergenerational equity.

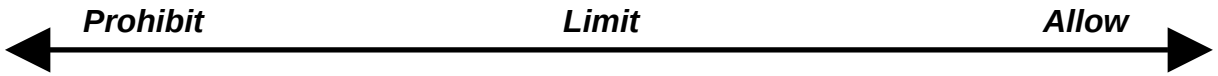
CHAPTER 6: ENVIRONMENTAL CONSEQUENCES

Introduction

Urban areas are, by their nature, heavily impacted by human activities. In turn, humans are part of the ecosystem in which they live, and human welfare ultimately depends in part on the vital services, such as shade, fresh air and clean water, provided by natural resources. The urban growth boundary (UGB) designates a limit to physical expansion of the urban area; to contain the negative ecological effects associated with urban sprawl and to protect valuable forest and agricultural lands. The UGB is effective at this: current aerial photographs clearly show that more natural resources and farmland remain outside the UGB than within it.

What are the consequences to regionally significant fish and wildlife habitat of allowing, limiting, or prohibiting land uses that conflict with habitat functions? Full protection of remaining fish and wildlife habitat will preserve existing habitat functions. Fully allowing conflicting uses in fish and wildlife habitat will reduce or remove existing ecological functions, with associated negative impacts on fish, wildlife and people. However, consequences for the broadest category – limiting conflicting uses within fish and wildlife habitat – depend on the definition of limit. Limiting conflicting uses implies that some limited amount of development or other conflicting use(s) will occur in conflict with fish and wildlife habitat areas. The consequences depend on the extent and type of land use and the habitat's ecological importance in the regional system, influenced by the program selected in the next phase of the Goal 5 process. Figure 6-1 provides a general illustration of the potential environmental consequences of this decision process; actual consequences depend on the program selected and its implementation effectiveness.

Figure 6-1. Range of potential consequences of prohibiting, limiting, and allowing conflicting uses within fish and wildlife habitat.



Prohibit	Limit	Allow
• Preserve existing ecological functions	• Existing ecological functions impaired	• Existing ecological functions greatly impaired
• More native plants and animals	• Some increase in non-native species invasions	• Greatly increased non-native species invasions
• More biodiversity	• Some biodiversity loss	• Substantial biodiversity loss
• Retain existing stream network	• Some streams will be lost, but less than allow	• Substantial stream loss continues
• Good restoration potential	• Good restoration potential	• Poor restoration potential
• Flood frequency, magnitude maintained as is possible	• Flooding increased compared to prohibit	• Flooding substantially increased
• Soil loss continues at current level	• Increased soil loss, sedimentation	• Very damaging soil loss, sedimentation
• Possibly retain salmon	• Salmon decline further	• Probable salmon loss
• Possible environmental threat due to greater UGB expansions	• Possible environmental threat due to greater UGB expansions, but to a lesser degree than Prohibit	• Decreased need for future UGB expansions, reducing environmental threats to areas outside the UGB

This chapter addresses the following questions:

- What are the functions and values of the region's fish and wildlife habitat?
- What impacts do conflicting uses have on the region's fish, wildlife, and their habitats?
- What are the potential environmental consequences to fish and wildlife habitat of allowing, limiting, or prohibiting uses that conflict with habitat function?

What are the functions and values of the region's fish and wildlife habitat?

To assess the consequences of allowing, limiting or prohibiting conflicting uses on fish and wildlife habitat, it is important to first identify the ecological characteristics of healthy ecosystems. Metro's science paper characterized the attributes of healthy watersheds and functional values of fish and wildlife habitat (Metro 2002c), as summarized below:

Key ecological attributes that characterize a healthy watershed

- Vegetated uplands dominated by native plant cover.
- Continuous stream corridors, including headwater areas, with healthy, fully functioning riparian corridors. The fewer the disruptions within the riparian corridor, the better.
- Floodplains connected with stream and river channels.
- Relatively unaltered hydrologic regimes.[50]
- Intact hyporheic zones.[51]
- Clean water at temperatures suitable to support native wildlife.
- Natural (or ecologically sustainable) input rates of solar radiation, sediments, organic matter, and nutrients that support healthy, productive and diverse fish and wildlife populations.
- Lateral, longitudinal and vertical connections between ecosystem components.
- Natural (or ecologically sustainable) rates of landscape disturbances.
- Good air quality.[52]
- Healthy, uncompacted soils.
- Diverse biological communities.

Key functions and values of fish and wildlife habitat

- Key habitat functions in riparian corridors can be assigned to five main categories: microclimate and shade; streamflow moderation and water storage; bank stabilization and pollution control; large wood and channel dynamics; and organic material sources.
- Native vegetation plays a critical role in the longitudinal and lateral connectivity of the riparian corridor for fish and wildlife.
- Native vegetation supports more species of native wildlife than non-native vegetation.
- Downed wood and snags (or large woody debris), frequently found in natural ecosystems but often lacking in disturbed environments, are crucial to providing high quality habitat in both

[50] That is, natural drainage systems that route and deliver water in quantities and at rates similar to natural conditions.
[51] Retention of the natural intermixing of ground- and stream water.
[52] See Chapter 7, *Energy Consequences* for further discussion of air quality.

aquatic and terrestrial ecosystems. Large wood also influences natural channel dynamics.
- Conservation of the majority of water areas – wetlands, streams, groundwater, and near surface water areas (hyporheic zone) – is essential to ecosystem health.
- Appropriate buffers to retain key riparian corridor functions should be based on site-specific conditions.
- Upland habitat is important for many wildlife species. The guidelines in developing a conservation plan for upland habitat are: large habitat patches are better than small patches; small patches of unique habitat are worth saving; connectivity to other patches is important; and connectivity or proximity to water resources is valuable.
- Declining and unique habitats are vital to regional biodiversity, and should receive high conservation priority status.
- Habitat fragmentation is detrimental to both wildlife and habitat; buffers and surrounding land use play an important role in maintaining the functions of remaining habitat.
- Tree canopy provides important wildlife habitat and helps maintain air and water quality.

Metro's science paper (Metro 2002c) identifies the fish and wildlife species regularly supported by the region's existing wildlife habitat.

What impacts do conflicting uses have on the region's fish, wildlife, and their habitats?

In water and on land, urban environments share similar ecological problems worldwide, including habitat loss, habitat damage and alteration, modified hydrology, non-native species, and human disturbance. Impacts with negative consequences to fish and wildlife habitat are both site-specific and ultimately, cumulative. For example, stream problems due to pollution may come from either point-source[53] or non-point source polluters.[54] Cumulative impacts provide a way to consider the combined influence of one type of action by many individuals.

Metro's role is to assess and address the cumulative impacts of development and other uses that conflict with fish and wildlife habitat at the regional level. The scientific literature and Metro's fieldwork (Frady et al. 2003) state that certain types of site-specific impacts tend to be associated with certain development types.[55]

In urban areas, cumulative impacts are pervasive and cause great environmental harm. It is often difficult to separate one cumulative impact category from another because they overlap and combine for harmful effects. For example, vegetation loss and increased impervious surfaces combine to alter natural hydrologic regimes. During rainstorms, these impacts cause too much water to enter the streams, too quickly. The result is damaged streambanks and streambeds with increased erosion; erosion adds sediments to the stream, and so forth. Problems such as these quickly become widespread in all urban areas. For the purposes of this analysis it is useful to cluster the primary consequences into eight general categories. Table 6-1 below lists each environmental consequence category and cross-references it with the conflicting uses identified

[53] Industrial or municipal wastewater discharge into a stream or river.
[54] All landowners using pesticides or all non-natural stormwater discharges within a watershed.
[55] This is discussed in more detail in the *Conflicting Use* chapter.

in the *Conflicting Uses* chapter. Following Table 6-1, each environmental consequence category is described more fully and the types of impacts associated with that category identified.[56]

Table 6-1. Cross-reference of the major environmental consequences categories and the conflicting uses associated with each category.

Potential consequences to fish and wildlife habitat	Disturbance Activities (conflicting uses)																
	Vegetative clearing	Grading, filling, soil compaction	Installation of impervious surfaces; runoff	Stream modification	Installation and maintenance of utilities	Stormwater piping, water control structures	Road construction, bridges, culverts	Landscaping, introduction of exotic plant species	Introduction of non-native fish and wildlife species	Herbicides, pesticides, fertilizer use	Installation of fences and other wildlife barriers	Introduction of toxics, heavy metals, pollutants	Water useage	Livestock grazing	Trail construction, maintenance and use	Allowing pets, livestock in natural resource areas	Human disturbance (e.g. light, noise)
Altered hydrology, physical stream damage, increased flooding	■	■	■	■	■	■	■	□	□	□		□	■	■	□	□	
Degraded water quality	■	■	■	■	■	■	■	■	□	■		■	■	■	■	■	
Loss/degradation of riparian or upland habitat	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Habitat fragmentation	■	■	■	■	■	■	■	■	□	□	■		□	■	□	□	■
Altered microclimate	■	■	■	■	■	■	■	□		□			■	■	□		■
Reduced woody debris and organic materials	■	□	■	■	■	■	■	■		□			□	■	□		
Erosion, sedimentation and soil loss	■	■	■	■	■	■	■	□		□			□	■	■	□	
Reduced biodiversity; non-native species invasions	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

■ Conflicting use has potential for direct impact.
□ Conflicting use has potential for impacts, but at a reduced level or through indirect means.

Altered hydrology, physical stream damage, increased flooding

This category is listed first because it is an overarching issue in urban ecology. Activities typically associated with urbanization, especially vegetation removal, installation of impervious surfaces, and stormwater control (Table 6-1), fundamentally alter the patterns of rainwater delivery to streams and other waterbodies: too much water hits the stream too quickly. The result is physical damage to streams and an increase in flooding. Many adverse effects are documented due to hydrologic alterations, and some of these are listed in Table 6-2. Impaired

[56] For more in-depth discussions of these issues and relevant literature citations, see *Metro's Technical Report for Goal 5* (Metro 2002c).

water quality, addressed as a separate environmental consequence category, is also associated with altered hydrology, as are many other urban effects (see Table 6-1 above).

In the Metro region, much of the rainfall naturally seeps into the soil and makes its way to the stream only after much slowing and interception by soils, rocks, plants, and roots. Streams and the animals living there are adapted to these patterns; when the patterns change substantially, streams can no longer support some of these species, such as salmon and certain insects critical to instream food webs (McCarron et al. 1997; May and Horner 2000).

Development activities remove vegetation, add impervious surfaces, and often include intentional widening, deepening, straightening, and sometimes armoring streambanks to confine flows and increase a stream's capacity for localized flood control (although in fact, this practice increases flooding by altering the hydrology). These activities result in moving water more quickly downstream, disconnecting the stream from its floodplain and groundwater sources, degrading riparian habitat, and creating bigger floods and more problems downstream. To illustrate this concept, Figure 6-2 compares two hydrographs, a type of graph that charts the timing of runoff and peak flood stage. The "Q after" line shows a taller flood peak that occurs sooner, with more water being discharged via the stream than under natural conditions (Q before).

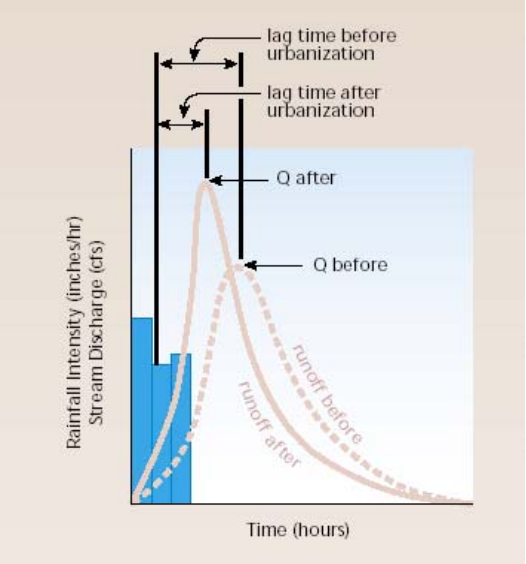


Figure 6-2. A comparison of hydrographs before and after urbanization.
(Source: FIRSWG 1988)

Altered hydrology damages stream channels and streambanks. Fast-moving, high-volume water quickly erodes away streambanks, incises (downcuts) stream channels, and increases sediment loads in the water and streambed. Stream channels widen and straighten, and are often intentionally modified in these ways, to accommodate increased stormwater velocity and volume due to altered hydrology. Large woody debris, ponds, pools, riffles, streambanks, and sandbars are simplified or washed away. The stream's substrate – that is, the particles making up the bottom of the streambed – tend to change from larger rocks to finer particles such as clay and silt; fine substrates are tightly packed, with little room for oxygen pockets or macroinvertebrates. Salmon need larger substrates for spawning, and they also need macroinvertebrates for food. These changes result in a loss of stream complexity and fish and wildlife habitat and degraded water quality downstream due to increased fine sediments in the channel and in the water column.

Altered hydrology causes increased flooding by affecting the frequency, duration and magnitude of flood events, and reducing water infiltration and storage (Booth and Jackson 1997). The frequency is altered in that more floods occur per year. Flood duration and severity tend to be increased. These flood characteristics are typically measured using a hydrograph; Figure 6-2 shows an example of the changes in flood patterns that occur with urbanization. The hydrograph's peak is taller and occurs sooner (a bigger flood that quickly overwhelms water

storage) and the shape of the peak is narrower (the water is not retained on the land to replenish groundwater and keep summer streams running).

Altered hydrology complicates restoration efforts in an urban setting. Restoration has some limited ability to counteract these negative effects, but may be rendered ineffective if larger-scale issues such as stormwater, canopy cover, and imperviousness are not addressed. For example, placing large wood in a stream usually helps under more natural conditions, but if the stream is too flashy from altered hydrology it may wash away the wood and continue to widen, deepen, and damage the stream.

Table 6-2. Environmental consequences of altered hydrology, physical stream damage and increased flooding.

- Degraded riparian habitat, ecological function loss
- Decreased channel sinuosity (results in higher water velocity, increased discharge, increased flooding)
- Stream channel scouring, armoring, and changes in channel width and depth
- Streambank erosion and destabilization
- Downstream sedimentation and erosion
- Loss of riparian vegetation due to erosion, downcutting, disconnection with groundwater
- Loss of stream shading; higher water temperatures
- Altered microclimate
- Loss of riparian buffer filtration capacity
- Loss of hyporheic zone, groundwater
- Loss of large woody debris, instream complexity
- Loss of pool/riffle complexes and decreased streambed substrate size harms native fish and invertebrates
- Loss of ecosystem services provided by healthy watersheds: clean water, nutrient cycling, human food (salmon), water storage, flood abatement, summertime inflow/recharge of cool, clean water to streams, etc.
- Loss of critical food web components (macroinvertebrates, salmon, organic materials)
- Loss of sand bars, shorebird, and waterfowl habitat
- Loss of habitat heterogeneity; reduced instream and riparian structural and functional diversity
- Loss of native soil and native soil invertebrates
- Native aquatic and land-dwelling wildlife decline due to cumulative instream and terrestrial habitat degradation
- Reduced biodiversity

Degraded water quality

Urban areas are where human population densities are highest. Humans are the primary source of pollutants and excess nutrients, thus urbanized watersheds typically have elevated pollution levels and impaired water quality. However, many factors contribute to pollution, and some of these factors can be controlled or mitigated. Table 6-3 highlights some of the environmental consequences of degraded water quality.

Excess pollutants, increased temperatures, or excess sediments may degrade water quality. Sediments are addressed in a separate consequences category below (Erosion, sedimentation and soil loss). Pollution can destroy food webs within stream systems. Pollution includes excess fertilizers, pesticides and herbicides, heavy metals, and other toxins. Impervious surfaces collect and concentrate pollutants from different land use activities and deliver these materials to streams during storms, preventing percolation and natural filtering by soil and vegetation. Data collected in the Pacific Northwest suggest that pollution from urban areas is harming salmon, birds and some mammals such as river otters (Lower Columbia River Estuary Program [LCREP] 1999; McCarthy and Gale 1999). Human health is also an issue; eating fish and crayfish from polluted waters can cause serious illness.[57] For example, fish in the Columbia Slough contain PCBs and pesticides; these chemicals may effect human development, reproduction, and immune systems, and may increase the probability of contracting cancer (City of Portland 2003).

[57] See *Social Consequences* chapter for further discussion of public health issues.

Development type influences the pollutants entering stream systems. For example, *E. coli* derives primarily from residential areas (pets, leaking septic tanks, etc.), entering through runoff, stormwater and groundwater; this bacterium is an indicator of fecal pollution from warm-blooded animals (Oregon Department of Environmental Quality 1998). Sediments derive most frequently from industrial and residential streets; construction and agriculture are other major sediment sources.

Phosphorus derives from fertilizer applied to residential lawns, industrial streets, and residential streets, in that order, but also sometimes from natural geological sources and from air deposition (Don Yon, Oregon DEQ, personal communication 2003); elevated phosphorus levels are a common problem in our area. Excess nitrogen is typically associated with agricultural lands, but residential fertilizers are another source. Some of these nutrients are needed in waterways, but excess amounts cause unnaturally increased nutrients, leading to low-oxygen water conditions and other water quality problems.

Heavy metals in excess amounts are toxic to humans, fish and other wildlife. Heavy metals are often contributed by cars and trucks; brake pads, oil and tire wear are major sources (Engberg 1995; Baldwin et al. 2003). Copper is emerging as a major problem for salmon, and in urban areas derives primarily from brake pads (Baldwin et al. 2003). Industrial lands are also a source of heavy metals through both point- and nonpoint-sources, but residential roofs also contribute substantial amounts of copper and zinc.

Pesticides, from both the present and the past (e.g., DDT), are present in many of the region's streams. More pounds of pesticides per acre are applied in urban areas than agricultural areas (Stinson and Bromley 1991). Recent research suggests that pesticides at low levels have an additive harmful effect on stream-dwelling wildlife (Munn and Gilliom 2001). Pesticides harm fish and wildlife through a variety of means, including direct mortality, decreased reproductive capacity, loss of salmon navigation and defense abilities, and loss of macroinvertebrates, a key salmon food source.

Table 6-3. Environmental consequences of degraded water quality.

- Hazardous materials, toxics in waterways and on land
- Groundwater and well water contamination
- Toxic pesticide residuals may remain in soils, plants, groundwater, and surface water for decades
- Human toxicity, direct and indirect (drinking contaminated water, eating contaminated fish)
- Heavy metal contamination harms salmon
- Pesticides entering waterways kill or harm aquatic organisms; unintended kills to non-target organisms
- Loss of pollution-intolerant species; increase in tolerant generalist species, which out-compete sensitive species
- Toxin bioaccumulation; decrease in reproductive success (e.g., Bald Eagles, Osprey, salmon, otters)
- Pollution-associated chemical changes, growth impediments
- Decreased stream and wetland water quality; feeds into larger streams, rivers and degrades downstream quality
- Increased nutrients in streams and wetlands; excess algal growth, low oxygen conditions harm aquatic organisms
- Decrease in life-sustaining capacity of air, water, and land
- Impaired salmon olfactory responses and homing behavior
- E. coli, other bacterial contamination; human health risk
- Water temperature increases result in lower dissolved oxygen; harms temperature-sensitive aquatic organisms (e.g., salmon, macroinvertebrates)
- Reduced biodiversity

Other chemicals found in streams, soil and groundwater create a variety of health problems for humans, fish and wildlife. Oil and other hydrocarbons, PAHs (polycyclic aromatic hydrocarbons), PCBs, dioxins and furans, pesticides, and metals are the most toxic to fish and wildlife, based on both Lower Columbia River and Willamette River studies by DEQ, and these are also most prevalent in the region's waterways (Don Yon, personal communication 2003). These chemicals typically derive from vehicular use and industrial and residential uses, through both point- and nonpoint-sources.

Physical and chemical pollution is not the only important water quality issue; temperature is a key water quality issue in the Metro region (see *Appendix B*). Water temperature is an important indicator of a watershed's vitality because of its controlling influence on the metabolism, development and activity of aquatic organisms (Naiman et al. 1992). Cold water holds more oxygen; cold, well-oxygenated water is needed by many aquatic species. Increased water temperatures may have profound effects on aquatic species, such as salmon, that can tolerate only a limited temperature range natural to Pacific Northwest streams. Air temperature and riparian vegetation play key roles in maintaining lower water temperatures.[58]

Riparian vegetation helps keep stream and river water cool (Budd et al. 1987). Riparian vegetation is more effective in providing shade and moderating stream temperature in smaller streams. Shade also cools shallow groundwater that feeds the stream during dry summer periods. Although shading on larger rivers may have little influence on water temperature, overhanging riparian vegetation along the banks creates cooler microhabitat for fish and aquatic organisms, and shade from smaller tributaries supply cooler water to large rivers (Palone and Todd 1997). Removing vegetation, especially trees and shrubs, results in warmer stream and river water.

As described in Chapter 1, the Oregon DEQ is required by the federal Clean Water Act to maintain a list of steam segments that do not meet water quality standards, called the 303(d) list. Many of the region's stream reaches are 303(d) listed as water-quality impaired due to elevated temperatures (Appendix B). Elevated temperatures are typically due to a combination of riparian forest removal and an increase in pavement and other impervious surfaces, where water flowing across these heat-gathering surfaces is warmed. Fish and other aquatic wildlife are adapted to the naturally cool water conditions in the Metro region, and warmer water harms these animals.

Loss/degradation of fish and wildlife habitat

Vegetation loss through a variety of means harms fish and wildlife and their habitats. Habitat loss has been identified a key factor in the decline of biodiversity worldwide (Kerr and Currie 1995). Within this category, many actions contribute to cumulative impacts. The Metro region, once composed of vast forested expanses, now has only about 12 percent forest canopy cover remaining according to one recent report (American Forests 2001). Substantial losses (25 percent or more) of surface streams reduces riparian habitat, a vitally important habitat type to the region's wildlife (Metro 1999b). Table 6-4 highlights some of the environmental consequences of habitat loss and degradation.

However, substantially more forest canopy cover exists outside the UGB than within it, attesting

[58] See Chapter 7 *Energy Consequences* for more information.

to the success of the UGB in controlling some negative impacts due to urbanization at the macro scale. In addition, many areas within the Metro region are currently undergoing restoration and tree-planting activities that provide widespread benefits to fish, wildlife, and people through improvements to the environment. If this environmentally promising trend continues and accelerates, the region could potentially see ecological improvement over time, perhaps even with increased human population and development.

Wildlife habitat is directly lost through development and other land use activities that remove trees and other vegetation. Habitat is degraded through a variety of activities, from site-specific to regional spatial scales. For example, at the site level, construction of a single-family residential home typically involves clearing vegetation, resulting in habitat loss. Lawns and other non-native vegetation replace native forests, resulting in a shift in plant species, leading to a shift in wildlife species. This is often to the detriment of native species and those species that rely on specific native habitat types such as grasslands, coniferous forests, or Oregon white oak habitat. During site preparation, soils are moved and compacted, altering soil profiles, fungus and microorganisms important to the success of native plant communities.

Table 6-4. Environmental consequences of fish and wildlife habitat loss and degradation.

- Altered watershed hydrology
- Increased flooding
- Erosion and soil loss throughout the watershed
- Increased downstream sedimentation and erosion
- Increased water velocity: stream incision, bank damage, loss of pool/riffle complexes, decreased substrate size
- Soil compaction; reduced water infiltration and storage
- Loss of fish and wildlife habitat
- Loss of habitat connectivity; fragmentation
- Reduction of structural and functional habitat diversity
- Shift in vegetation types or dominant plant species
- Shift to deciduous tree cover, with changes in wildlife, nutrient cycles, and reduced water storage capacity
- Increased adverse edge effects such as predation
- Increased edge-associated non-native species
- Loss of native vegetation in herbaceous, shrub, tree layers
- Loss of large woody debris and its sources
- Loss of native soil and native invertebrates
- Native aquatic wildlife declines due to cumulative instream and terrestrial habitat degradation
- Loss of stream shading
- Increased air temperatures (see Energy section, Urban Heat Island effect)
- Increased water temperatures
- Altered microclimate (warmer, drier air and soils)
- Loss of ecosystem services provided by plants (toxin and CO_2 uptake; O_2 release; water and carbon storage)
- Loss of riparian buffer pollution, sediment filtration capacity
- Loss of at-risk habitats
- Reduced biodiversity

At a larger spatial scale, the effects of changes in vegetative cover can be observed through long-term species trends. For example, at-risk habitats in this region include riparian forests and grasslands, with substantial regional losses documented. Trends over the past three decades for many bird species that specialize in these habitats show precipitous declines.[59]

All other consequence categories interact with this consequence category. For example, altered hydrology results in the loss and degradation of aquatic/riparian areas; so do degraded water quality, habitat fragmentation, altered microclimate, loss of large wood, and erosion and soil

[59] For some examples of species declining in the Metro region, see Table 6 in *Metro's Technical Report for Goal 5* (Metro 2002c).

loss. This is because wildlife depends on natural resources to live, and natural resources rely to some degree on wildlife as well. For example, plants need insects for fertilization; plants provide insects with food and a place to live, hide, and reproduce. Nearly all bird species feed their young insects. Birds disperse the plant seeds pollinated by the insects, and also do some pollinating themselves (for example, hummingbirds).

Habitat fragmentation

As discussed above, large-scale vegetation loss impacts wildlife. What habitat remains typically becomes fragmented, with increased consequences to wildlife and habitat due to negative edge effects and loss of connectivity between habitats. Habitat fragmentation has been identified as a key factor in the decline of biodiversity worldwide (Kerr and Currie 1995). Table 6-5 highlights some of the environmental consequences of habitat fragmentation.

Fragmentation reduces or eliminates the structural and functional diversity of fish and wildlife habitat; it also alters microclimate, discussed below. The predominance of non-native species is a key problem accompanying habitat fragmentation, primarily due to adverse edge effects.[60]

Edge effects are the negative consequences to plant and wildlife communities due to positioning near the edge of a habitat patch. Edge effects include increased predation of birds and bird nests by native and non-native predators; increased non-native plant and animal species; simplified forest structure; and increased human disturbances (physical, light and noise) associated with activities near the edge of the patch (Soulé 1991; Lidicker and Koenig 1996; Bolger et al. 1997; Hennings and Edge 2003). Habitat fragmentation increases edge habitat, and edge effects.

Table 6-5. Environmental consequences of wildlife habitat fragmentation.

- Small remnant patches of habitat not connected to other natural vegetation
- Adverse edge effects due to non-native or invasive plants and animals
- Increased wildlife disturbance and mortality due to pets, humans and predators moving along patch edges
- Increased nest predation
- Degraded habitat quality due to reduction in invertebrate abundance and quality
- Loss of connectivity between habitat patches
- Gradual loss of species richness over time in disconnected habitat patches
- Loss of population gene flow and genetic diversity
- "Edge" species benefit, while forest-interior or area-sensitive species decline or are lost
- Impassable barriers and mortality to wildlife (e.g., roads)
- Increases in roads and pathways (major disturbance and invasive species vectors)
- Vegetation trampling, soil compaction and tree root zone disturbance; increased tree wind-throw and death
- Loss of/harm to those species relying on a specific habitat type to meet their life-history needs
- Loss of/harm to disturbance-sensitive wildlife species (e.g., Neotropical migratory songbirds, bats, shorebirds)
- Noise/light pollution require fish and wildlife habitat quality
- Reduced biodiversity

Fragmentation and habitat isolation is also a problem because some wildlife species, such as amphibians, have small home ranges and cannot travel as freely as birds and mammals (Corn and Bury 1989; Richter and Azous 1995). Once a species disappears from a habitat patch, there may

[60] Non-native species are discussed further under the section below entitled "Reduced biodiversity and non-native species invasions."

be no way for more individuals of that species to move back in and repopulate the patch, causing regional species losses over time. All types of development can cause habitat loss and fragmentation, and fragmentation occurs in all types of habitat – streams, wetlands, riparian, and upland wildlife habitats. When large-scale habitat loss occurs, an ecosystem can no longer support as much wildlife as it once did (Wilcox and Murphy 1985; Bolger et al. 1997).

It is possible to reduce the adverse effects of fragmentation by planning the size, shape, and connectivity of remaining natural areas (Soulé 1991) and Metro built these important characteristics into the wildlife habitat model.[61]

In areas with extensive habitat loss typical of urban areas, it is important to plan for larger habitat patches and connectivity among patches wherever possible. Narrow habitat patches such as those along developed streams are critical to migratory wildlife such as Neotropical migratory birds, known to be at risk in the Metro area (Hennings and Edge 2003). Neotropical migrants are bird species that breed in the Metro region, but migrate south of the U.S./Mexico border to overwinter.[62] A system that contains large and medium sized habitat patches, connected by narrower corridors and nearby smaller patches is desirable.

The amount of human disturbance to wildlife is related to habitat fragmentation. Human disturbance can occur anywhere in urban areas, but within wildlife habitat patches these disturbances are typically concentrated in or near edge habitats. Road, noise, lights, and human activity[63] can all have detrimental effects on fish and wildlife and their habitats.

Noise can disrupt wildlife movement by distracting animals or by causing them to move away from the noise source, which can affect migration, breeding and nesting habits, as well as effectively reducing available habitat. Road noise is an emerging issue for birds, who rely on song to communicate and defend their breeding territories (Reijnen et al. 1995). Road noise may be a key to Neotropical migratory songbird loss in our urban area, where the number of species and individuals is reduced with increasing road density (Hennings and Edge 2003).

Night lighting, which frequently occurs near habitat edges, can alter the life cycles of plants and animals. For example, Moore et al. (2000) found that night lighting caused some wetland algae-grazing invertebrate species to forage deeper in the water; this could cause algal blooms at the water's surface, which can degrade water quality through low dissolved oxygen levels and toxicity. While lighting effects on fish of our area have not been studied, river-dwelling seatrout in Scotland are exposed to greater predation under night lighting (Contor and Griffith 1995). Terrestrial invertebrates (Frank 1988), amphibians (Buchanan 1993), birds (Frey 1993) and mammals (Rydell and Baagoe 1996) are also affected by night lighting.

Large buildings that remain lit overnight are known to attract migrating birds, which are injured or killed when they hit the buildings (Trapp 1998; Manville 2000). The magnitude of kills may

[61] See *Introduction* chapter for a brief description of Metro's wildlife habitat model. Metro's *Riparian corridor and Wildlife Habitat Inventories* contain a complete description (Metro 2002c).
[62] Typical examples include some of the more colorful species such as most warblers, Rufous Hummingbirds and Western Tanagers.
[63] For example, hiking on trails, children playing in streams.

depend on siting, height, lighting, and cross-sectional area of the obstacle, as well as weather conditions (Weir 1976). Night lighting also affects wildlife habitat itself. Many plant species depend on light and dark cycle lengths to direct their growth and reproduction, thus changing light duration may interfere with germination, flowering, and growth (Campbell 1990; Edwards and El-Kassaby 1996; Environmental Building News 1998).

The mere presence of humans has been shown to be detrimental to some wildlife species. Repeated human disturbance such as approaching large mammals can cause loss of unborn young (Phillips and Alldredge 2000). Bird biologists recognize that repeatedly approaching a bird's nest may cause the parents to abandon eggs or young (Bowman and Stehn 2003). Human disturbance causes energetically costly defensive behavior in animals; for example, bats are particularly sensitive to human disturbance, especially during breeding or hibernation (LaRoe et al. 1995; Tuttle 1997; Montana Chapter, The Wildlife Society 1999). Other negative effects from humans disturbing natural environments include vegetation trampling, tree root zone disturbance, and soil compaction, which reduces water infiltration and capacity for soil to support plants and invertebrates) (Cole and Trull 1992; Cole 1995; Whitecotton et al. 2000).

Altered microclimate

Riparian areas have a unique microclimate differentiated from upland habitat by a diversity of vegetation, leading to complex structure in the forest canopy, which impacts the amount of light, heat, and wind that penetrates the area. Moist soils help to keep temperatures lower than in surrounding areas as well. Stream channel width and riparian area topography influence microclimate extent (Brosofske et al. 1997; Pollock and Kennard 1998). Table 6-6 highlights some of the environmental consequences of altered microclimate.

Table 6-6. Environmental consequences of altered microclimate.

- Decrease in soil and air moisture
- Increase in soil, air, and water temperatures, with particularly harmful effects to amphibians
- Wider temperature variability in soils and air
- Decrease in soil's carrying capacity for microorganisms (macroinvertebrates, beneficial bacteria and fungi)
- Decrease in soil's ability to support plants, with corresponding habitat loss/degradation and reduction in ecosystem's ability to support wildlife
- Reduction in organic materials and large wood; altered food web, degraded fish and wildlife habitat (especially invertebrates, fish, amphibians, small mammals and snag-dependent species)
- Decrease in terrestrial food sources: leaves and other organic matter, macroinvertebrates
- Decreased stream shading, increased water temperatures
- Shallow groundwater temperature increases due to shading loss and soil warming
- Increased wind causes wind-throw, damaging or killing trees, especially near edges
- Wind-throw causes reduction in patch size and increased edge effects and fragmentation
- Wind-throw exposes soils to erosion
- Altered plant, fish and wildlife communities
- Reduced biodiversity

The microclimate of riparian areas is generally more moist and mild (cooler in summer and warmer in winter) than the surrounding area (Knutson and Naef 1997). This creates diverse habitat characteristics that are desirable to many species, particularly for amphibians year-round and for large mammals during hot, dry summers and severe winters (Knutson and Naef 1997). Widespread microclimate alterations change plant and animal communities, due in part to the edge effects engendered by habitat fragmentation (Saunders et al. 1999; Gehlhausen et al. 2000; Laurance et al. 2000). Forest edges tend to have

elevated air temperatures, reduced humidity, and are exposed to more wind than forest interior habitats (Saunders et al. 1999; Gehlhausen et al. 2000; Laurance et al. 2000). In urban areas, this effect is compounded by the urban heat island effect.[64]

Amphibians may be the group most sensitive to microclimate changes and have suffered worldwide declines over the past 20 years, with particularly significant declines in the Pacific Northwest (LaRoe et al. 1995; Richter and Ostergaard 1999; Semlitsch 2000). Unlike other species groups, amphibian skin and eggs are not wind- or waterproof, and exposure to temperature and wind increases may be lethal.

Microclimate includes wind effects. An important consideration with forested riparian buffers is the ability of the forest to withstand the force of high winds (Broderson 1973; Steimblums et al. 1984). For example, in northwest Washington, windthrow (uprooting of trees or tree trunk breakage from wind) averaged 33 percent in riparian forest buffers within one to three years after clearcut harvest of adjacent timber (Grizzel and Wolff 1998). In a review of several studies, Pollock and Kennard (1998) determined that wider forest buffers protected trees from windthrow much more effectively than narrow forests. Thus, microclimate effects also relate to habitat loss and degradation, as well as several other consequence categories.

Shade is an important microclimatic function of riparian vegetation that influences water temperature (discussed in the Degraded Water Quality section above). Riparian vegetation creates an instream microclimate that maintains relatively constant water temperatures; when a riparian forest is removed, the monthly mean maximum temperature along smaller streams may increase 7-8° C (Budd et al. 1987). Water temperature is one of the most crucial environmental factors influencing salmon and other aquatic species.

Reduced woody debris and organic materials

Large woody debris (LWD), such as branches, logs, snags, uprooted trees, and root wads, is an important component of aquatic habitats in the Pacific Northwest, both as a structural element and as cover from predators or protection from high streamflows (Adams 1994; Prichard et al. 1998). Organic matter, such as leaves, twigs, and pine needles, help form the foundation of food webs both in aquatic habitats and on land. When riparian vegetation is removed, the source of large wood and organic matter is removed, with resulting harm to fish and wildlife habitat. Table 6-7

Table 6-7. Environmental consequences of reduced woody debris and organic material.

- Loss of stream and channel complexity (pool-riffle sequences, river island formation)
- Changes in channel bottom topography and substrate
- Increased water velocity in streams and rivers
- Changes in sediment and nutrient storage, transport, and cycling; decreased nutrient retention time
- Increased erosion rates and sedimentation
- Loss of important base components of food web
- Reduced carrying capacity of environment (fewer individuals can be supported when food is reduced)
- Loss of important macroinvertebrate, fish, amphibian, bat and small mammal, and bird refugia and habitat
- Potential loss of wildlife species depending on large wood and snags
- Decreased carbon storage (see Energy section)
- Loss of organic components that make up healthy soil; decreased beneficial bacteria, fungi and soil invertebrates
- Decreased rate of new soil production
- Decreased ability for soil to support plants and animals
- Reduced biodiversity

[64] See *Energy Consequences* chapter.

highlights some of the environmental consequences of reduced woody debris and organic materials.

Large woody debris is a key aquatic habitat structure. As sediment, large woody debris and other organic materials are transported and deposited throughout a watershed, channel characteristics and aquatic and terrestrial habitats are formed. Large woody debris is important because it influences the routing and storage of water and sediments, as well as the development of channel bottom topography, including the formation and distribution of pools (Beschta 1979; Booth et al. 1997).

In addition, LWD helps dissipate energy generated from streamflow, slowing erosion and sediment transport rate and retaining organic debris, making it available to organisms living there (Naiman et al. 1992). Large woody debris is also an important source of aquatic cover and acts as a surface for biological activity by aquatic organisms (Gregory et al. 1991; Naiman et al. 1992).

Large woody debris is often intentionally removed from waterways; for example, between 1867 and 1912, 55 miles of the Willamette River above Albany, Oregon were improved for navigation by removing an average 61 snags per kilometer (Sedell et al. 1990). Large wood may also be removed from streams in an attempt to reduce flooding. In urban streams of the Pacific Northwest, large wood is significantly depleted through washout, downcutting, and direct removal (Booth et al. 1997). In the Puget Sound region, the amount of large woody debris in the channel decreases with increased development (May et al. 1997).

The removal of riparian vegetation also results in loss of terrestrial LWD critical to soil health and wildlife habitat (Maser and Trappe 1984). Large woody debris, both standing (snags) and fallen, is an important source of foraging, cover and nest sites for birds, mammals, reptiles, and amphibians. LWD provides nesting habitat for cavity-nesting birds such as woodpeckers, chickadees, nuthatches and wrens. Woody debris has also been shown to be a key habitat element for amphibians (Bury et al. 1991; Welsh and Lind 1991; Butts and McComb 2000) and small mammals (McComb et al. 1993; Butts and McComb 2000; Wilson and Carey 2000).

Beyond the structural importance of LWD, other, smaller organic debris provides carbon, the basic fuel for aquatic and terrestrial food webs (Allan 1995). Smaller pieces of organic litter (e.g., leaves, needles and twigs) and terrestrial insects, important food sources for aquatic species, enter the stream primarily by direct leaf or debris fall (Spence et al. 1996). Benthic, or stream-bottom, invertebrates rely on a supply of organic litter to maintain healthy communities. Removing riparian vegetation also removes the primary source of these materials, reducing the stream's habitat value to fish and wildlife (Brown and Krygier 1970). In addition, when flow rates increase and channels are simplified, the retention time of organic debris in the system is decreased because it quickly washes downstream (Webster and Meyer 1997). Thus urbanized streams tend to contain less food than undisturbed watersheds.

Erosion, sedimentation and soil loss

Increased erosion and sedimentation results from:

- vegetation removal,
- hydrologic alterations (increased water velocity increases erosion),
- roads and other impervious surfaces, and
- construction.

Upon delivery to streams, these sediments are either suspended in water (creating increased turbidity) or deposited on the streambed (creating sediment build-up and embeddedness), where they can alter sediment transport processes, initiate channel instability and lead to in- and near-stream habitat degradation. Erosion removes topsoil; it takes many years for nature to build only a few inches of good topsoil. Healthy soils are vital in the establishment and nourishment of plants and provide habitat for countless organisms. Construction activities also compact soil, reducing the overall watershed infiltration rate and storage capacity. Table 6-8 highlights some of the environmental consequences of erosion, sedimentation and soil loss.

Table 6-8. Environmental consequences of erosion, sedimentation and soil loss.

- Soil loss; it takes centuries to build a few inches of good soil. Hydric (water-retaining) soil is especially detrimental.
- Stream banks damaged
- Stream bed substrates altered, size reduced (salmon and many macroinvertebrates need larger substrate; fish, amphibians, birds, other animals need macroinvertebrates)
- Sediment buildup in stream channels and subsequent loss of channel topography (infilling of pools and loss of biodiversity in aquatic habitats)
- Water quality impairments; increased sedimentation in downstream streams and wetlands
- Increased sedimentation in estaries due to feeder stream sediment loads
- Loss of soil's ability to support vegetation, with accompanying habitat loss and degradation
- Vegetation is damaged or washed away when soils are eroded; fish and wildlife habitat loss and degradation
- Vegetation loss leads to increased runoff, leading to further erosion
- Loss of organic matter critical to fish and wildlife food webs and habitat
- Toxics bind to sediments, enter streams and wetlands
- Salmon reduction and loss
- Large amounts of land with recently disturbed soils suitable for weedy, invasive species
- Increased water turbidity and/or changes in water chemistry, with negative fish and wildlife consequences
- Reduced biodiversity

Vegetation holds soils in place and captures excess sediments as they wash through during rainstorms (Gregory et al. 1991; Knutson and Naef 1997; Naiman and Decamps 1997). Riparian vegetation removal is especially harmful because it disturbs existing soils, allows sediments from the disturbed area to wash into stream, and removes the last remaining filter between the stream and the land. However, removal of vegetation in upland areas, especially in steeply sloped terrain, also contributes to a higher rate of soil erosion and can result in significant consequences such as landslides, flooding, channel erosion and destruction of aquatic habitat.

Landslides are downslope movement, under gravity, of masses of soil and rock material.[65] In an urban setting, improper drainage most often induces disastrous sliding (Oregon DOGAMI 2003). Landslides and debris flows (rapidly moving landslides that typically move long distances) are natural processes, triggered or accelerated by these factors:

- Intense or prolonged rainfall, or rapid snow melt, causing sharp changes in groundwater levels
- Undercutting of a slope or cliff by erosion or evacuation
- Shocks or vibrations from earthquakes or construction.
- Vegetation removal by fires, timber harvesting, or land clearing.
- Placing fill (weight) on steep slopes
- A combination of these factors

Salmon and other aquatic species need clear water with low concentrations of suspended sediments in the water column (turbidity) and cool water. High turbidity clogs fish gills and can hamper migration. However, deposited sediments generally have a greater impact on aquatic species than suspended sediments because they alter macroinvertebrate communities (salmon food supply) and ruins spawning habitat. Salmon, salamanders and many aquatic insects need relatively sediment-free gravel beds with suitable gravel in which to reproduce.

Roads and other impervious surfaces contribute substantially to erosion and soil loss. Road networks contribute more sediments to streams than any other land management activity, from both surface erosion and landslides (Jones et al. 2000; Gucinski et al. 2001). Not only do these features substantially increase sedimentation in their own right, but they also reduce the capacity of soil to support vegetation and store water. In addition, many toxic substances bind to soil particles and enter waterways via eroded soil; for example, DDT, banned decades ago but still present in soils, washes into streams and wetlands in this manner.

Activities such as grading, filling, hauling and agriculture cause significant erosion and transport of fine sediments to the stream (Trimble 1997; Wood and Armitage 1997). Each year in the U.S. an estimated 80 million tons of sediment are washed from construction sites into water bodies (Goldman et al. 1986). Soil quality is typically degraded along urban stream corridors where development activities include removal of natural riparian vegetation, grading, compaction of soil, and placement of fill that is dissimilar from native topsoil.

Reduced biodiversity, non-native species introductions, and landscaping

As described in the *Introduction* chapter, our area's natural resources have changed dramatically in terms of quantity and quality with human encroachment. Altered plant and animal communities are a hallmark of urban ecosystems. Non-native plant and animal invasions, proliferation of generalist species and loss of specialists (those relying on a specific habitat type or feature) are prevalent. Non-native species are associated with the majority of at-risk species declines worldwide due to competition for resources and outright predation (Wilcove et al. 1998;

[65] As defined by the Oregon Department of Geology and Mineral Industries (DOGAMI; Oregon DOGAMI 2003). Landslide hazard areas have been mapped by DOGAMI and are available on their website www.oregongeology.com/landslide/landslidehome.htm.

Pimentel et al. 2000). Table 6-9 highlights some of the environmental consequences of reduced biodiversity and non-native species invasions.

Manicured lawns and landscaping often replace natural vegetation along stream corridors in developed areas throughout watersheds, and this impacts wildlife communities. By replacing the naturally complex mix of vegetation with lawns, structural complexity is reduced. Structurally complex vegetation supports more native species than simple vegetation (Hennings and Edge 2003). In addition, simplified, non-native habitats favor non-native wildlife species because the non-native species that have established populations are habitat generalists, or species that can survive in a wide variety of circumstances. Native generalists also benefit from habitat simplification, to the detriment of native species with more specific habitat requirements.

Table 6-9. Environmental consequences of reduced biodiversity, non-native species introductions, and landscaping.

- Restricted pool of pollinators and seed dispersers
- Reduced native wildlife gene pools can lead to decreased survival rates
- Human-enhanced dispersal of some species (weeds, rodent pests, starlings, English Sparrows, pigeons)
- Potential reduction, loss of species that control pest species (e.g., woodpeckers control carpenter ants)
- Increased competition for food and habitat resources
- Non-native species invasions; reductions in native fish and wildlife populations; extirpations; species extinctions
- Urbanization often benefits species with small home ranges and high reproductive rates
- Generalists that can thrive in a variety of habitats and situations displace more sensitive habitat specialists
- Loss of balance between predator-prey populations
- Increase in small mammal abundance for certain species; small mammals eat bird eggs
- Simplification and large-scale alteration of plant and animal communities
- Non-native plant invasions reduce functional and structural diversity of wildlife habitat
- Loss of food resources for native wildlife species (native insects and birds prefer native plants)
- Local native species extinctions due to increased competition and predation
- Numerous sources for continuous non-native re-invasions
- Introduction of diseases and parasites to which native organisms are not adapted
- Financial harm to crops and agriculture due to pests
- Wildlife predation by cats, dogs, and other human-introduced predators
- Reduced biodiversity

In the Metro region, non-native birds such as European Starlings, non-native amphibians such as bullfrogs, and non-native fish tend to out-compete or directly kill native species.[66] Non-native plants are an issue because they favor non-native wildlife species. In the Metro region, non-native birds and plants are linked to edge effects.[67]

Domestic animals can have strong impacts on wildlife communities. Domestic animals include livestock, but in urban areas the primary species impacting wildlife are domestic cats and dogs, which kill wildlife and disrupt native wildlife behavior. For example, barking dogs scare wildlife, increasing stress levels and reducing

[66] For example, starlings made up 17 percent of riparian birds surveyed along 54 riparian study sites in the greater Metro region (Hennings 2001); the narrower the forest, the more starlings – sometimes more than half of all breeding birds present.

[67] Discussed in the Fragmentation section above; non-native plants, shrubs, and birds decline with distance to the edge of a forest patch.

their ability to forage and nest.[68] As most pet owners realize, cats kill animals even when they have ample food provided. In addition, dogs and cats can contribute to stream degradation by contributing fecal coliform and disturbing streambanks and vegetation.

Wildlife barriers (including habitat fragmentation) also reduce biological diversity. Development practices such as installing stream crossings[69] and piping and culverting streams destroy habitat and create impassable fish barriers that block entire stream reaches to migratory fish species and isolate remaining species, putting these populations at risk of reduced genetic diversity and/or extinction. Habitat fragmentation creates wildlife barriers by creating space between habitat patches across which some species cannot travel.

What are the potential environmental consequences to fish and wildlife habitat of allowing, limiting, or prohibiting uses that conflict with natural resource function?

All major consequences occur in each zoning type, but the severity depends on prevalent conflicting uses. For example, more imperviousness results in more severe hydrologic alterations; more pesticide use results in increased water quality impairment. More traffic translates to increased human disturbance to wildlife. The consequences also depend on the percent of fish and wildlife habitat falling within each zoning type. For example, single-family residential contains about half of all habitat; consequences may be strong due to amount of land cover. On the other hand, commercial contains only five percent of all habitat; thus potential consequences are reduced because commercial uses do not cover much land. This section includes a summary of the potential environmental tradeoffs of allowing, limiting, or prohibiting conflicting uses. Most of the environmental consequences are similar in all regional zones, the differences are described below. Appendix D contains several matrices that summarize the environmental consequences of a decision to allow, limit, or prohibit by generalized regional zones. Finally, the key points learned from the environmental consequences analysis are highlighted at the end of the chapter.

Summary of potential environmental tradeoffs

The analysis of environmental consequences is general in nature to account for variability within zoning types, and also because consequences depend on the program selected. Environmental consequences can also vary depending on the scale through which they are viewed; for example, at the site level, high-density housing is associated with fairly high levels of imperviousness, but on a larger scale this zoning type reduces the amount of roads and land needed to accommodate housing. Below are some general consequences associated with allow, limit, and prohibit decisions.

Allow conflicting uses

- Extensive loss of ecological functions in riparian areas, especially for Class I riparian corridors

[68] About a third of U.S. households have cats; each year in the U.S. cats kill an unknown, but undeniably large number of wild animals (The Wildlife Society 2002).
[69] For example, roads, sewers, and pipelines.

- Likely to harm salmon
- Degraded water quality
- Extensive loss of valuable wildlife habitat and functional values (size, interior habitat, connectivity, proximity to water)
- Loss of Habitats of Concern
- Continued loss of native species and at-risk species; reduction in migratory songbirds
- Education opportunities
- Reduced need for UGB expansion; protects habitat outside UGB from urban encroachment

Limit conflicting uses

- Depends on type of program: results may range from minimal protection to near-full protection of ecological functions
- Strong potential for restoration, mitigation, and education activities to offset negative impacts
- Implementation of BMPs (best management practices) and low impact development standards could reduce negative impacts
- Less harm to native species and fewer nonnative species invasions than Allow
- Intrusion in some habitat areas will reduce the quality of other habitats, especially if connector habitat is fragmented and interior habitat reduced
- May require UGB expansion, depending on program

Prohibit conflicting uses

- Retention of some of the region's most critical ecological functions and best remaining wildlife habitats
- Most likely to support salmon conservation, retains important aquatic habitat
- Prevents further habitat fragmentation; preserves restoration opportunities
- Minimizes hydrologic alterations, reduces flooding, and preserves water quality
- Provides key breeding habitat for migratory songbirds, aquatic species, habitat interior species, and other native species
- Preserves Habitats of Concern
- May require substantial expansion of the UGB

Environmental consequences by generalized regional zone

The disturbance activities, or conflicting uses, associated with each of Metro's generalized regional zones were described in Chapter 3, *Conflicting Uses.* Disturbance activities (conflicting uses) were cross-referenced with potential consequences to regionally significant fish and wildlife habitat in Table 6-1 at the beginning of this chapter. Many of the negative environmental impacts due to conflicting uses relate to the levels of imperviousness and the amounts of natural land cover associated with those conflicting uses. There are trends in imperviousness and natural land cover associated with Metro's generalized regional zones. These trends are useful in fostering discussion about land use impacts. Table 6-10 lists these general trends, providing a foundation for the consequences discussion.

Table 6-10. Relative levels of imperviousness and natural landcover typically associated with generalized zoning land-use types.*

Generalized regional zone	Typical onsite imperviousness[1]	Typical infrastructure requirements[2]	Typical natural landcover[1]
Commercial	High	Moderate to high	Low
Industrial	High	Variable	Low
Mixed use	Moderate to high	Lower per person	Low
High-density multi-family	Moderate to high	Lower per person	Low to moderate
Medium/low density multi-family	Moderate onsite	Moderate per person	Low to moderate
High density single family	Moderate onsite	Moderate per person	Low to moderate
Medium/low density single family	Low to moderate	Higher per person	Moderate to high
Rural	Low	Higher per person	High
Agricultural	Low	Variable	High
Open space	Low	Low	High

*These general estimates are provided to facilitate discussion.
[1]Relative to other land use types; per unit area.
[2]Infrastructure refers to roads and parking, sewers and stormwater piping, power transmission, etc. needed to support the land use.

Most of the environmental consequences are similar across zones (matrices describing the consequences may be found in Appendix D); the differences are identified below.

- **Single-family residential (SFR):** tends to retain more trees and vegetation, reducing negative impacts. Stormwater piping and imperviousness is a strong factor due to the extent of single family zoning; altered hydrology is a primary consequence. Landscaping, pesticide and fertilizer use, and pets tend to degrade habitat and water quality. Potential to retain existing vegetation and add new vegetation, as well as stormwater solutions such as Low Impact Development, could have positive implications for stormwater runoff and hydrology.
- **Multi-family residential (MFR):** density decreases overall infrastructure and road requirements, but increases onsite imperviousness and vegetation loss. Multi-family residential tends to create more human disturbance because human densities are higher. In general, negative environmental consequences are stronger at the site level compared to less dense forms of housing, but reduced at a larger scale due to compactness and efficiency of form.
- **Commercial (COM):** high onsite imperviousness; increased traffic and human disturbance. Consequences similar to industrial development, but commercial development is more consistently associated with certain disturbances, including installation and maintenance of utilities, stormwater-related modifications, and road construction. Not as strongly associated with toxics, heavy metals and other pollutants as industrial development, although transportation-related toxics are an issue due to heavy traffic and parking requirements.
- **Industrial (IND):** high onsite imperviousness; tends to have low amounts of vegetation; use of toxic chemicals may increase negative impacts to fish and wildlife. Consequences weighted toward altered hydrology, degraded water quality, habitat loss, and alterations to biological communities, including reduced biodiversity. Institutional uses are similar to industrial, except that they are not strongly associated with toxics and can sometimes have more natural land cover.
- **Mixed-use centers (MUC):** may decrease VMT which reduces water quality impacts at the regional scale, but onsite imperviousness and noise and light disturbances may be high. May

include a variety of land uses, therefore conflicting uses and consequences vary. Can offer efficient land use and reduce the amount of land needed, because development types can meet specific local needs. Can provide shared parking and greater efficiency in parking lot layout, thereby reducing imperviousness and the stormwater runoff associated with paved areas.

- **Rural residential (RUR):** Less severe hydrologic alterations compared to areas with more pavement and less vegetation. More roads and other infrastructure required per dwelling unit. Agriculture (not regulated by Metro) may increase pesticides, nutrient inputs, and seasonal disturbances, but also can provide grassland and connector habitat. Leaky septic systems can degrade water quality. Livestock grazing harms riparian areas, compacts soil, and degrades water quality. Human disturbance reduced compared to higher density housing types.
- **Parks and open space (POS):** active parks increase human disturbance and tend to remove natural landcover; landscaping in such parks may degrade water quality and wildlife habitat. In more natural areas parks provide important habitat, connectivity, and improved water qualityIn some jurisdictions (e.g., Portland), other uses such as rail lines, utility corridors, broadcast facilities, mining, agriculture, and institutional uses are allowed, with corresponding consequences.

Summary points

- Tree canopy is invaluable to the functionality of both fish and wildlife habitat habitat. It is important both near streams and throughout the watershed, as affirmed by local studies (Frady et al. 2003). Tree canopy provides habitat, absorbs pollution and excess nutrients, and slows and retains stormwater, reducing hydrologic alterations.
- Hydrologic changes have far-reaching negative consequences. Reducing or mitigating imperviousness and stormwater impacts will be important to address these consequences.
- Consequences to fish habitat depend on habitat value. For example, loss of high-value (Class I) riparian corridors, which retain three to five primary functions, would have a stronger ecological impact than Class II or Class III riparian corridors, which contain two or no primary ecological functions, respectively. Loss of high-value riparian corridors would also result in loss of high-value wildlife habitat, because Class I riparian corridors include some high-value wildlife habitat (including Habitats of Concern) where high value inventory areas overlap. For example, many Class I riparian corridors include bottomland hardwood forest and wetlands in a floodplain setting; this type of area is critical to riparian function and also provides a unique and declining habitat type.
- Consequences to wildlife habitat also depend on habitat value, but with different implications than fish habitat. Because connectivity is important to wildlife, the loss of any component in the system may reduce the value of nearby wildlife habitat patches. For example, preserving two Class A wildlife habitat patches – the largest patches with good water resources and connectivity to other patches, or Habitats of Concern – will be most valuable to wildlife if between-patch connectivity is retained; the connecting patches are typically Class B or C wildlife habitat. If only Class A wildlife habitat is preserved, its value will be reduced due to loss of nearby Class B and C patches. On the other hand, smaller habitat patches tend to have lower quality habitat due to edge effects and reduced interior habitat.
- Homes surrounded by trees can provide very important wildlife habitat. For example, local

studies indicate that resident native birds are most diverse in developed areas with plenty of forest canopy (Hennings and Edge 2003). Single-family residential accounts for a large proportion of fish and wildlife lands, therefore retaining tree canopy within this zoning type is desirable. This would allow some conflicting uses to occur while retaining important natural resources, with important implications for limiting future UGB expansions. Clustered housing is one way to reduce forest canopy loss.

CHAPTER 7: ENERGY CONSEQUENCES

Introduction

Urbanization leads to concentrated areas of energy use, with important implications for fish and wildlife habitat. In turn, fish and wildlife habitat influence energy use. Within the UGB the issue is not whether, but *how* to urbanize, and the extent to which fish and wildlife habitat should be protected. The nature of these relationships can affect energy use and efficiency within the UGB, as well as the boundary's size and shape.

The energy consequences analysis of allowing, limiting or prohibiting conflicting uses in fish and wildlife habitat areas addresses the following questions, from a regional perspective:

- What is energy, and how is it used?
- What are the environmental consequences of energy use?
- How does regional planning relate to energy use?
- What are the energy consequences of allowing, limiting, or prohibiting conflicting uses in or near fish and wildlife habitat?

What is energy, and how is it used?

Energy can be broadly defined as the capability of a system to do work. In the electric power industry, energy is more narrowly defined as the mathematical product of real power and time (Public Power Council 2003). For the purposes of this document, energy is the fossil fuel, hydroelectric, or other resource providing the energy to do work, such as driving, creating roads and buildings, and heating and cooling.

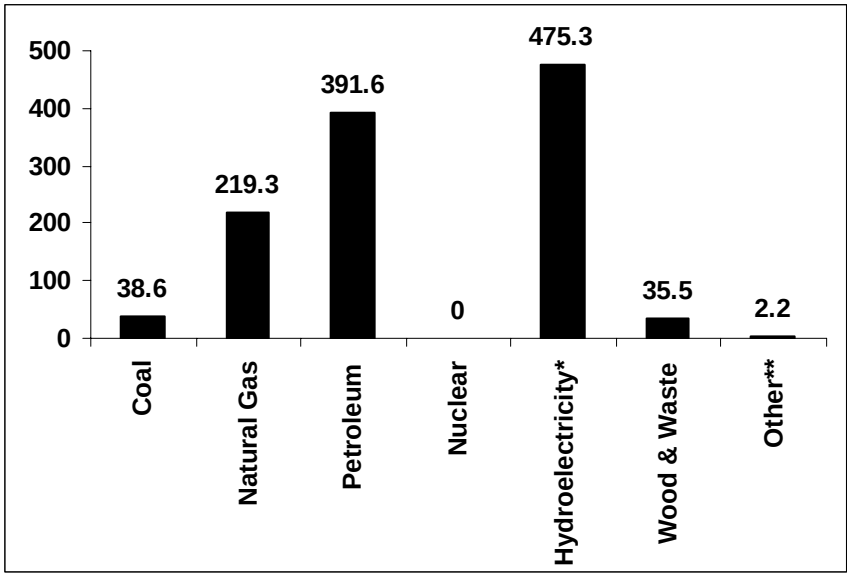
According to the U.S. Department of Energy, Oregonians' primary energy sources are fossil fuels (petroleum products and natural gas) and electricity (Figure 7-1). The proportion of Oregon's energy derived from fossil fuels has risen substantially, whereas the proportion of electricity has held steady since 1980, at about 20 percent (Oregon Office of Energy 2002). Regional planning influences fossil fuel use more than electricity use, because the spatial arrangement of urban infrastructure systems strongly influence fossil fuel use. The factors influencing electricity use tend to be more site-specific.

Fossil fuels

Oregon's fossil fuel use has nearly tripled in the past 40 years. This is due primarily to motor vehicle use, which relies chiefly on petroleum products although interest in alternative fuels is growing. By 1999, petroleum products accounted for nearly half of the energy used in the state (Oregon Office of Energy 2002).

Natural gas is another important fossil fuel resource for industry, electricity generation, residential, and commercial uses, in that order. Natural gas use per capita increased 63 percent between 1990 and 1999, rising to 24 percent of total energy use in the state.

Figure 7-1. Types of energy consumed by Oregonians, 1999 (in trillions of BTUs).



* May include pumped storage and net imports of electricity generated from this resource.
** Geothermal, wind, photovoltaic, and solar.
Source: U.S. Department of Energy, http://www.eia.doe.gov/emeu/sep/or/frame.html

Electricity

Electricity is another important energy source in the region. Portland General Electric (PGE) is the state's largest utility, providing electricity to more than 730,000 customers in Portland, Salem and nearby communities (Hemmingway et al. 2002). The energy sources for PGE's electricity include PGE's hydropower (10 percent), coal (25 percent), gas/oil (26 percent) and purchases on the market which include Mid-Columbia hydropower, wind and other renewable energy sources (39 percent) (PGE 2002). Pacific Power serves another 68,000 customers in the Metro region. Eighty percent of Pacific Power's generation is from thermal plants (Pacificorp 2003).

It takes energy to produce and deliver energy to gas stations, homes, businesses and industry. Of the major energy sources, electricity takes the most energy, on average, for production and delivery to the site (U.S. Department of Energy 1999). However, that depends on how electricity is produced (e.g., via hydropower or fossil fuels). For example, for every unit of fossil fuel-generated electricity produced, it costs three fossil fuel energy units to produce and deliver it to the site, whereas hydropower takes substantially less production and delivery energy (U.S. Department of Energy 1999). Coal is the most energy-intensive source of electricity. Hydropower is a renewable resource, as discussed next, but the region's capacity for generating hydropower is limited.

Renewable energy sources

The Oregon Office of Energy defines renewable energy as energy from any source that can be maintained in a constant supply over time (Oregon Office of Energy 2003). Renewable energy

sources represent the most promising future energy supplies because they may be sustainable over the long term; the supply of fossil fuels is limited and therefore non-renewable and non-sustainable. Hydropower (flowing water) is the prevalent renewable energy source used in the Metro region, but alternative sources such as wind and sun power could be further developed. Table 7-1 shows the five predominant renewable energy sources: hydropower, biomass, wind, the sun (solar), and heat from inside the earth (geothermal).

Table 7-1. Types of and uses for renewable sources of energy.

Source of energy	Description	Used for heat?	Used for Electricity?	Used for Vehicle fuel?
Water (hydro-electric)	Like the wind, flowing water is a product of the earth's climate and geography. Snowmelt and runoff from precipitation at higher elevations flow toward sea level in streams and rivers. In an earlier era, water wheels used the power of flowing water to turn grinding stones and to run mechanical equipment. Modern hydro-turbines use water power to generate electricity.		Yes	(electric cars are used, but not on a widespread basis)
Biomass	"Biomass" describes all plants, trees and organic matter on the earth. Biomass is a source of renewable energy because the natural process of photosynthesis constantly produces new organic matter in the growth of trees and plants. Photosynthesis stores the sun's energy in organic matter. That energy is released when biomass is used to make heat, electricity or liquid fuels.	Yes	Yes	Yes
Wind	The wind blows because of natural conditions of climate and geography. Historically, wind power was used to supply mechanical energy, for example to pump water, grind grain or sail a boat. Today, wind power is primarily a source of electricity.		Yes	
Solar	The sun is a constant natural source of heat and light. Sunlight can be converted to electricity. Solar energy is energy that comes directly from the sun.	Yes	Yes	
Geothermal	Heat from deep within the earth is called "geothermal energy." In some locations, geothermal energy is close enough to the surface that, by drilling a well to reach the heat source, the energy can be extracted and used for heating buildings and other purposes. Where the temperatures are hot enough, geothermal energy can be used to generate electricity.	Yes	Yes	

Source: Oregon Department of Energy 2003.

All renewable energy sources can be used to produce electricity. Solar energy and geothermal energy can supply both electricity and heat. Biomass can supply all three forms of useful energy.

Energy cost and availability

Energy cost and availability are important factors influencing the prevailing types of energy used. The Oregon Office of Energy calculated source-specific potential electricity generation and estimated wholesale costs for a variety of renewable energy types (Table 7-2, in order of least to most expensive).

Table 7-2. Potential generation and estimated wholesale costs for renewable energy resources available in the Pacific Northwest.

Renewable energy resource	Cost (cents per kilowatt-hour)	Region-Wide Potential for Generation (average megawatts)
Hydroelectric	1.1 to 7.0	170
Chemical recovery boilers (used to recycle chemicals, reduce wastewater discharges, and recover energy from pulp wood industry)	2.6	195
Natural gas (can be manufactured rather than extracted; for example, methane from livestock manure)	2.7	7,400
Industrial cogeneration (consumes fuel, usually natural gas, to produce both heat and electricity; captures and uses energy that otherwise would be wasted)	2.7 to 6.4	4,600
Landfill gas	3.1	94
Wood residue	4.3 to 5.4	300
Geothermal	5.2 to 6.5	390 to 1,070
Wind	5.3 to 8.1	700+
Forest biomass	5.5 to 6.6	300 to 1,000
Solar thermal	8.6	------
Solar photovoltaic (large-scale)	19.4	------
Solar photovoltaic (small-scale)	21.5 to 23.6	------

Source: Oregon Office of Energy 2003.

As Table 7-2 shows, hydroelectric power is the cheapest renewable source of electricity in the region, but not necessarily the source with the most energy potential nor the most environmentally sound option. As with any source of energy, there are environmental costs associated with hydroelectric power, including harm to salmon habitat. Some sources such as wind and solar power may be less environmentally harmful, and prices may drop as the technology develops. The environmental consequences of energy use are discussed next.

What are the environmental consequences of energy use?

Energy use can impact the environment in some major and specific ways, and natural resources mitigate these consequences and influence energy use. Therefore, energy consequences are often environmental, but environmental consequences lead to changes in energy use. Some environmental consequences relating directly to energy use include:

- Increased air temperatures
- Increased water temperatures
- Reduced air quality
- Habitat loss and degradation due to infrastructure (transportation and energy)
- Negative effects from hydropower and dams

Increased air temperatures

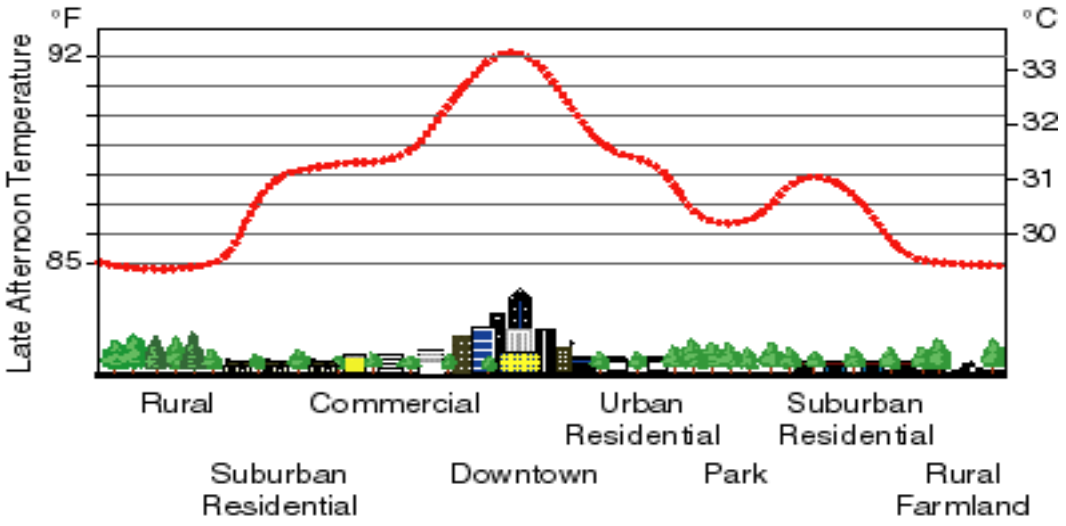
Vegetation helps cool the air, whereas pavement, buildings, and combustion processes such as motor vehicle engines tend to warm the air. This warming may occur both locally (the urban heat island effect) and globally (global warming). Air temperature also influences water temperature and quality, as discussed in the next category.

Air temperature influences energy use; for example, in cities with populations of more than 100,000, peak utility cooling demand increases 1.5 percent to 2 percent for every degree Fahrenheit the temperature rises (U.S. Department of Energy 1999). This increases energy demand and alters forest microclimates by increasing water, soil and air temperature and reducing soil and air humidity.[70]

Urban heat island effect

Cities are warmer than other areas, a phenomenon called the "Urban Heat Island effect" (Figure 7-2; U.S. Department of Energy 1993). The urban heat island effect is not limited to downtown areas, but is also influenced by suburban developments; it is a temperature gradient, increasingly warm from rural to urban areas. The average temperature difference along this gradient varies regionally, with differences in temperature from rural to urban areas ranging from 2º to 8º F (U.S. Department of Energy 1993).

Figure 7-2. Sketch of a typical Urban Heat Island profile (reproduced with permission from Morris 2003).



Plants help reduce the urban heat island effect by cooling the air through several mechanisms. In well-vegetated areas, a substantial portion of solar energy that hits plants is used for plant metabolism (U.S. Department of Energy 1993). Plants provide shade, which keeps other surfaces from storing the sun's heat energy. Plants also use moisture for temperature control; as temperatures rise, excess water is released from leaves it cools the surrounding air.

[70] See *Environmental Consequences* chapter for further discussion on microclimate.

Impervious surfaces, especially dark surfaces with low reflectivity, collect and efficiently store the sun's energy as heat, as well as displacing vegetation. The heat energy is released at night, creating areas of warm air. Several hot days in a row can compound this effect, because as the urban or suburban area fails to cool at night, temperatures rise on each successive hot day; ambient air temperature can differ between an urban heat island and a vegetated area by 2-10° F. On a hot day, the air above a paved area may be 25° F hotter than the air in a nearby forest. The U.S. Department of Energy (1993) states that one of the simplest and cheapest strategies for countering the urban heat island effect is to increase the number of trees and other plants.

Global warming

Carbon dioxide in the air is a key contributor to global warming, or the "greenhouse effect" (Rubin et al. 1992). Carbon is stored in trees and other plants, but is released through combustion processes and vegetation removal (Northwest Environment Watch 2003). Although debate continues, most scientists now agree that increasing greenhouse gas emissions from human activities are altering the world's atmosphere, primarily due to the burning of fossil fuels and land use changes such as deforestation (Oregon Progress Board 2000; Price and Root 2001).

In Oregon, electricity production generates 44 percent of the carbon dioxide (CO_2) emissions, and transportation fuels contribute another 35 percent; natural gas contributes 14 percent (Oregon Progress Board 2000). Trees absorb and trap atmospheric CO_2, storing the carbon in solid form for long periods of time (Krieger 2001; Price and Glick 2002). Trees also reduce atmospheric CO_2 by reducing demand for heating and air conditioning (McPherson et al. 2002).

Global warming is expected to change the planet's climate by altering the exchange of water among the oceans, atmosphere, and land; this is expected to shift regional temperatures and patterns of rainfall (Price and Glick 2002). To illustrate, the annual average global temperature has increased by one degree Fahrenheit over the past century; increases have been slightly higher in the Pacific Northwest, at 1.5º F (Price and Root 2001; Northwest Environment Watch 2003). Scientists anticipate that the Pacific Northwest will experience warmer, wetter winters and warmer, drier summers, with an average increase of 4.5˚F by 2050 (Snover et al. 1998).

Global climate change is also likely to influence terrestrial wildlife, such as bird communities (Price 2000; Price and Root 2001). Species' distribution ranges are likely to move northward, and for many species that are already vulnerable, the risk of extinction will increase with global warming (Gitay et al. 2002). For example, Neotropical migratory birds, known to be at-risk in the urban Metro area (Hennings and Edge 2003), are predicted to change in species composition by 32 percent, with a 16 percent net decrease in species richness over the next 75-100 years (Price and Root 2001).

Increased water temperatures

Air temperature strongly influences water temperature. Water temperature is an important indicator of a watershed's vitality because of its controlling influence on the metabolism, development and activity of aquatic organisms (Naiman et al. 1992). Temperature and precipitation are the primary variables that determine the annual water cycle in the Pacific Northwest (Climate Impacts Group, University of Washington 2003). Increased water

temperature is a common reason for Metro-area streams appearing on DEQ's 303(d) list of water quality impaired streams, as discussed in the *Environmental Consequences* chapter.

Increased water temperatures reduce the amount of oxygen the water can hold and change the water's chemistry (Pauley et al. 1989). As a result, energy impacts that cause an upward shift in air temperatures result in impaired water quality. This has negative impacts on wildlife living in and near the stream, such as macroinvertebrates, fish and amphibians (Tevis 1966; Pearson and Kramer 1972; Merritt et al. 1982).

Eaton and Scheller (1996) estimated that temperature increases from a doubling of atmospheric carbon dioxide is likely to reduce habitat for cold and cool water fish by approximately 50 percent. Rathert et al. (1999) identified annual air temperature range as a key environmental variable predicting the number of native fish species present in Oregon streams. According to Tyedmers and Ward (2001), the direct impacts to fisheries of water temperature increases due to predicted global warming include the following:

- Rising water temperatures (streams fed by deep groundwater or with riparian shading will be less affected)
- Altered hydrologic regimes (more winter flooding; dryer summers; decreased water supply due to loss of snow pack; shift in some streams from perennial to ephemeral)
- Changes in aquatic productivity (loss of cold-water fish and the macroinvertebrates on which they depend for food; increase in nonnative warm-water species)

Reduced air quality

Although an environmental issue, air pollution is directly related to urban energy use. Vehicular traffic, industry, and heating and cooling are energy-consuming activities that produce air pollutants as products of combustion. Air pollution is also directly related to vegetation; trees and plants clean the air (McPherson et al. 2002).

Air quality is measured and reported in a variety of ways, but Oregon DEQ collects and houses most state and local air quality data. Oregon DEQ uses an Air Pollution Index (API) to integrate carbon monoxide, particulates, ozone, nitrogen oxides, sulfur dioxide, and other pollutants into a single air quality index value (Oregon Department of Environmental Quality 2003b).[71] Figure 7-3 (on page XX) shows the Metro region's major sources of air pollution.

Air temperature is a major factor relating to air pollution. Higher air temperatures accelerate the chemical reactions leading to high ozone concentrations and other pollutants. While ozone high in the earth's atmosphere protects humans from the harmful effect of ultraviolet radiation, it is a pollutant near the earth's surface. Unacceptable levels of smog-forming ozone and other pollutants are frequently reached at 94° F and above, compounding the heat island problem by creating a heat-trapping cloud of pollution over urban areas (McPherson et al. 2002).

Most air pollution is caused by individual actions such as driving cars; using woodstoves, gas-powered lawn mowers and motorboats, paints and aerosol products like hairspray and air

[71] Air quality indices are reported daily via DEQ's website (http://www.deq.state.or.us).

fresheners; and outdoor burning. The Oregon DEQ estimates that industry contributes less than 10 percent of air pollution problems in the state; by far, the largest single source of air pollution is gas-powered vehicles (Oregon Department of Environmental Quality 2001), and this is what can be influenced most at the regional scale.

Habitat loss and degradation due to infrastructure (transportation and energy)

Motor vehicle transportation is the single biggest outlay of energy in the region, and also creates the largest proportion of infrastructure needed to support urban areas. Transportation infrastructure such as road networks requires substantial energy outlays, removes habitat, and negatively impacts wildlife and the environment.[72] Wildlife mortality due to roads is well known. Infrastructure relating directly to the transmission of energy, such as power line corridors and pipelines, may also remove or fragment fish and wildlife habitat, as well as providing corridors for the transmission of undesirable seed sources.[73]

Negative effects from hydropower and dams

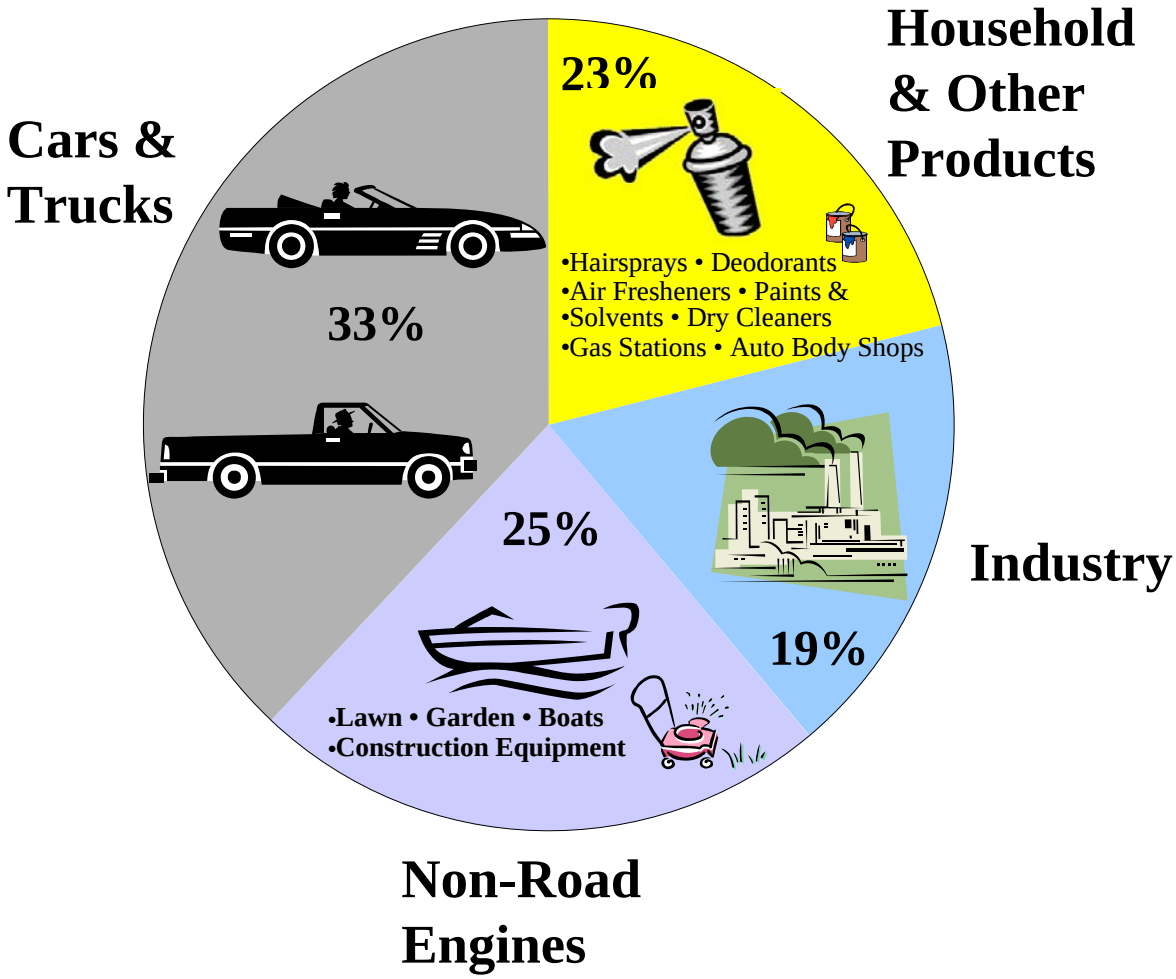
Hydropower is associated with both positive and negative environmental impacts: on the one hand, hydropower is one of the cleanest sources of electricity available on a large scale because it harnesses the movement of water for energy rather than burning fossil fuels. On the other hand, dams affect fish and wildlife and their habitats. Although dams provide many societal benefits including power generation, water storage, flood control, agricultural irrigation, and recreation, they influence watershed functions in fundamental ways (FISRWG 1998). Ecological problems associated with dams include erratic water volume and velocity (altered hydrology), increased streambank erosion, loss and fragmentation of riparian habitat, altered water chemistry, altered instream habitat, and blocked fish and instream wildlife passage.

All salmon and steelhead in the Columbia Basin are affected to some degree by damming activities (Federal Caucus 2000). Fish bypass systems and mitigation strategies are now required as part of Federal Energy Regulatory Commission licensing (Portland General Electric 2003).[74] Recognizing the impacts of energy production on wildlife, regional energy providers such as PGE now offer voluntary "salmon power" or "green power" energy sources, designed to provide more wildlife- and environment-friendly energy at slightly higher short-term costs.

More than 85 percent of the inland waterways within the continental United States are now artificially controlled through dams (National Research Council [NRC] 1992), including all major Metro area rivers. The Columbia and Snake River systems are protected areas, closed to further hydropower development (Oregon Office of Energy 2003). Some of the Metro region's electricity derives from these sources. Reducing the risk to salmon populations in these river systems may require changes in the management of existing hydroelectric plants. These measures may reduce overall generating capacity, although further development of alternative renewable energy sources could help offset the capacity loss.

[72] See *Environmental Consequences* chapter for further discussion.
[73] Infrastructure is discussed further in the Regional Planning section of this chapter.
[74] The Idaho National Engineering Laboratory administers a federally funded program to develop hydroelectric turbines that will cause less harm to fish (Oregon Office of Energy 2003).

Figure 7-3. Portland/Vancouver metropolitan area airshed ozone* sources, 2001.



* Volatile Organic Compounds and Nitrogen Oxides

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How does regional planning relate to energy use?

At the regional scale, energy use is most strongly influenced by the extent and physical arrangement of transportation networks, the built environment, and green infrastructure. These factors are related, and changes in one affect the others and overall energy use patterns. All three factors influence air and water temperature and quality, thus influencing fish and wildlife habitat.

The 2040 Growth Concept and the UGB are important tools for reducing energy use because they define the extent of the urban region and guide the physical arrangement of the built environment and corresponding transportation network. Keeping development inside the UGB protects farm and forest lands from sprawl and reduces vehicle miles traveled (VMT). The 2040 Growth Concept sets forth and implements policies that encourage efficient land use and a balanced transportation system, and guides the physical arrangement of urban centers and the transportation network.

The region's 2040 Growth Concept calls for:

- A compact urban form, including efficient land use that can accommodate a variety of needed zoning types;
- A well-planned transportation system that includes vehicular travel, mass transit, and alternative transportation modes such as bicycling and walking; and
- Protection of natural areas.

The importance of these factors to the region's energy use is discussed below.

Importance of a compact urban form and zoning types

A compact urban form conserves energy by reducing transportation-related energy output and infrastructure needs, and also reduces the spatial extent of vegetation loss and the urban heat island effect.

As the population of an area increases transportation needs increase, and sometimes the number of miles a citizen needs to travel (VMT) also increases. At present, most vehicles are powered by fossil fuels; therefore increased VMT results in increased fossil fuel use. The amount of VMT increase depends on where and how far citizens must drive to meet their daily needs, as well as whether alternative modes of transportation are available.

In the Metro region from 1989 through 1999, about 46 square miles of land were developed, with most construction resulting from development within existing urban and suburban areas in keeping with the region's goals to contain urban sprawl (Northwest Environment Watch 2002a, 2002b). The Metro region's rate of high-density growth (more than 12 people per acre) nearly doubled that of Seattle over the past decade; the region's population increased by about 470,000 during that period.

These statistics indicate two things about the Metro region: first, with more people moving into the area, more city or suburban areas and related infrastructure must be built or expanded, which

takes energy and materials.[75] Second, because population density is increasing within the UGB, the infrastructure requirements are reduced compared to the much larger infrastructure investments needed to support development in rural areas. Compact urban forms are more energy and resource efficient than "sprawled" cities.

Transportation and other infrastructure relates to energy because it:

- requires energy to install and maintain;
- can cause loss of trees and natural areas, with resulting energy implications including air temperature and quality and the need to repair damaged stream systems; and
- creates impervious surfaces, with resulting transportation, energy-related air and water quality, and maintenance and repair issues.

Compact urban forms reduce infrastructure requirements. During the 2040 Growth Concept development process Metro modeled water, sewer and stormwater infrastructure requirements under three regional development scenarios (Metro 1994a, b). The option with the most compact urban form incurred the lowest costs for water and sanitary sewer service, although stormwater costs were indistinguishable among the concepts.

There are hidden energy and ecological expenses involved with installing and maintaining infrastructure systems. Stream equilibrium is disturbed when roads, sewer or stormwater pipes are located in stream corridors and under streams, resulting in disturbances that require energy and materials to restore. For example, energy is required to address sediments generated through construction that clog wetlands and stormwater systems; exotic plant invasions; stream channel damage; flood protection and repair, etc.

Substantial dollars in the region are already being invested in restoration. For example, the Metropolitan Greenspaces Program, funded by the U.S. Fish and Wildlife Service and administered in partnership with Metro Regional Parks and Greenspaces, funded 279 restoration and environmental education products totaling more nearly $2.4 million from 1991-2002. With total local matching funds of nearly $7.4 million, the Portland/Vancouver region has spent nearly $9.8 million on restoration through this program alone.

Zoning type influences energy use. Table 7-3 shows the results of a survey Metro conducted to examine the VMT issue. The results indicate that areas combining good transit options (trains and buses) and mixed-use zoning tend to have the lowest VMT, as well as the fewest cars or trucks per household. Mixed-use urban centers are higher density centers of employment and housing that are well served by transit to form compact areas of retail, cultural, and recreational activities in a pedestrian-friendly environment. Mixed-use centers are energy-efficient because they provide efficient access to goods and services and enhance multi-modal transportation. Higher density residential housing is more energy-efficient than low densities due to increased VMT and infrastructure requirements. All zoning types are needed, but a compact urban form can help reduce energy requirements for each.

[75] Materials also require energy for manufacture and transport.

Table 7-3. Metro Travel Behavior Survey Results for Multnomah County (all trip purposes, all income groups).

Mode Share						Vehicle Miles per Capita	Auto Ownership per Household
Land Use Type	% Auto	% Walk	% Transit	% Bike	% Other		
Good Transit/Mixed Use	58.1%	27.0%	11.5%	1.9%	1.5%	9.8	0.9
Good Transit Only	74.4%	15.2%	7.9%	1.4%	1.1%	13.3	1.5
Remainder of Multnomah County	81.5%	9.7%	3.5%	1.6%	3.7%	17.3	1.7
Remainder of Region	87.3%	6.1%	1.2%	0.8%	4.6%	21.8	1.9

Source: Metro 1994 Travel Behavior Survey

Importance of a balanced transportation system

Fossil fuel use is second only to hydroelectric power in regional energy consumption. A large proportion of the region's infrastructure, including roads, parking areas and driveways, supports transportation. Transportation infrastructure creation and maintenance require energy, and so do the vehicles using that infrastructure. However, mass transit and the availability of alternative transportation modes reduce energy consumption and related environmental consequences by reducing VMT, fossil fuel use, and infrastructure needs.

Gasoline use is the principal cause of urban air pollution in the Pacific Northwest, creates the region's largest source of greenhouse gas emissions, and is one of the region's most expensive imports (Northwest Environment Watch 2002a). Overall gas consumption in the Pacific Northwest grew 21 percent from 1993-2002, about in step with the rate of population growth. Oregon consumes 17 percent more gas than it did a decade ago.

Although overall gas consumption also grew in Oregon recent decades, per capita gas consumption in the state actually dropped by about one percent over the last decade; the average Oregonian used 8.5 gallons of gas per week in 2002 (Northwest Environment Watch 2002b). Per capita consumption was expected to drop more substantially with the significant trends in fuel efficiency seen during the 1980s, but Oregonians bought more trucks and sport utility vehicles (SUVs) in the 1990s. SUVs and minivans typically consume about one-fourth more gasoline per mile than cars. Therefore, the expected improvements in per capita fuel use and air quality failed to materialize (Northwest Environment Watch 2002a).

VMT, the number of trips made, driving speed, and driving patterns impact fossil fuel use (Girling et al. 2000). These variables are influenced by the accessibility of uses, and the attractiveness of routes to pedestrian, bicycle, and transit modes of travel. In general, research agrees that higher densities, appropriate mixes of land uses, well designed circulation networks, transit options, and attractive pedestrian and bicycle routes can be associated with less motor vehicle travel.

Importance of "green infrastructure"

As discussed above, trees and other vegetation reduce energy demand and help moderate the air temperature increases and air pollution associated with energy use. Fish and wildlife habitat that provides ecosystem services and that are considered important or necessary to support cities and suburbs, can be considered a type of infrastructure: "green infrastructure." Recognition and protection of green infrastructure, both inside and outside the urban growth boundary, are reflected in Metro's 2040 Growth Concept.

Aside from positive environmental and aesthetic effects, green infrastructure can provide access to alternative transportation modes such as walking and bicycling – for example, the Fanno Creek Greenway and Springwater Corridor trail systems provide non-motorized transportation access to many of the region's citizens.

However, protection of fish and wildlife habitat can also increase energy use by increasing VMT. For example, too many avoided stream crossings may result in the need to drive further around fish and wildlife habitat, increasing VMT. Similarly, utilities such as sewer and water lines may need to be rerouted, requiring energy and materials. Extensive natural areas protection could result in larger UGB expansions.

Those policies that allow the region to maintain a compact urban form and reduce VMT, while at the same time interspersing green infrastructure into and around the built environment, will reduce regional energy demands and the environmental impacts associated with energy use.

What are the energy consequences of allowing, limiting, or prohibiting conflicting uses in or near fish and wildlife habitat?

The analysis of energy consequences is general in nature and deals primarily with the implications of tree and vegetation loss and extent of the urban area. Metro avoided focusing on site-specific energy issues such as household appliance use, because other issues are more relevant to energy use at the regional scale. Below is a general description of the energy impacts of allowing, limiting or prohibiting conflicting uses, a summary of the differences of the consequences by regional zone, and the key points learned from the energy analysis. Several matrices relating the energy impacts to Metro's generalized regional zones may be found in Appendix D.

Potential energy consequences

Below are some general consequences associated with allow, limit, and prohibit decisions:

Allow conflicting uses

- Compact urban form reduces transportation energy use
- Less vegetation available to conserve energy and mitigate air quality, air and water temperatures

Limit conflicting uses

- Potential to find middle ground, maximizing vegetation and compact urban form
- Most likely to support Region 2040 Growth Concept***Prohibit conflicting uses***

- Potential need for UGB expansions, increased transportation infrastructure, more energy used
- Maximizes retention of forest canopy and vegetation, maximizing vegetation energy benefits

Energy consequences by generalized regional zone

Most of the energy consequences are similar across zones (matrices describing the consequences may be found in Appendix D); the differences are identified below.

- **Single-family residential (SFR):** tends to retain more trees and vegetation than other zoning types, reducing negative air quality and temperature impacts. However, tends to require more infrastructure and creates the need for greater travel distances. In this regard, low-density housing is the most energy inefficient use of all housing types. Clustered housing can reduce this negative consequence.
- **Multi-family residential (MFR):** density decreases overall infrastructure and road requirements, reducing energy use due to reduced transportation and infrastructure needs.
- **Commercial (COM):** high onsite imperviousness, including parking needs, and relatively low tree and vegetation cover can increase temperatures and air pollution consequences.
- **Industrial (IND):** high onsite imperviousness and relatively low amounts of vegetation can increase temperatures and air pollution. Tends to have fewer parking needs than COM.
- **Mixed-use centers (MUC):** this land use is energy efficient because it decreases VMT and overall infrastructure requirements. Can offer efficient land use and reduce the amount of land needed, because development types can meet specific local needs. Can provide shared parking and greater efficiency in parking lot layout, thereby reducing imperviousness and negative energy consequences associated with temperature regulation.
- **Rural residential (RUR):** more roads and other infrastructure required per dwelling unit. Higher VMT due to distances residents need to travel to meet their daily needs. However, tends to retain forest canopy and other vegetation, helping to regulate air and water temperatures and improve air quality.
- **Parks and open space (POS):** varies by the intensity of development within the park. Some parks are very natural, contributing to positive temperature regulation and air quality effects. Other parks, such as those with buildings, parking areas and paved boat landings, may increase negative energy effects related to temperature regulation and air quality.

Summary points

- A compact urban form conserves energy by reducing infrastructure and Vehicle Miles Traveled (VMT), and also conserves fish and wildlife habitat outside UGB.
- Trees and other vegetation are a key variable mitigating negative energy impacts. Plants clean and cool air and water, and also reduce air conditioning demand.
- Transportation infrastructure creation and maintenance require energy, whereas transit and alternative transportation modes reduce energy consumption. Program solutions that reduce infrastructure needs and support alternative modes of transportation are likely to reduce overall energy use.
- At the regional scale, fossil fuel use for transportation constitutes a key use of energy and contributes to warming of air and water, as well as air pollution. Reducing vehicle miles traveled, and the infrastructure required to support such travel, is an important variable in reducing energy use. Clustered housing and MUC and MFR zoning types provide three potential ways to reduce VMT and infrastructure needs.

- Protection of fish and wildlife habitat can increase energy use by increasing VMT, because drivers must travel around the protected areas. However, trees and other vegetation also help mitigate negative energy effects. A strong energy solution would include a balance between compact urban form and retention of green infrastructure within the urban area.

CHAPTER 8: SUMMARY AND CONCLUSIONS

Introduction

Integrating the needs of people with the needs of fish and wildlife in an urban environment is not an easy task. There is debate on the value of protecting habitat in urban and developing areas, considering the difficulty many species have cohabiting with humans and the economic value of developable land in urban areas. However, a large body of evidence, both local and nationwide, indicates that people living in urban areas value fish and wildlife habitat. In addition, properties located adjacent to fish and wildlife habitat can have higher economic and social value.

In keeping with these values, Metro's policies have consistently placed a high level of importance on the protection of the natural environment as a means of maintaining the high quality of life citizens of this region expect. The general economic, social, environmental, and energy tradeoffs of allowing, limiting, and prohibiting conflicting uses are summarized in this chapter. The next step of Metro's planning process is to identify the specific ESEE tradeoffs of several program options, after which the Metro Council will make a decision to allow, limit, or prohibit conflicting uses in fish and wildlife habitat areas.

Tradeoffs of allowing, limiting or prohibiting conflicting uses

The Goal 5 rule describes a process in which the economic, social, environmental, and energy consequences of allowing, limiting, and prohibiting conflicting uses are balanced with the need to preserve fish and wildlife habitat. These tradeoffs are described below by fish and wildlife habitat classification and then the differences by general regional zone are highlighted. Metro considers the tradeoffs from a regional perspective. Some of the tradeoffs are different when considering local priorities and concerns, for example from a regional perspective conflicting uses could be relocated or intensified in one area to account for fish and wildlife habitat protection in another. This solution may not address the needs of a city to provide jobs or housing within its jurisdiction, or to protect locally significant fish and wildlife habitat.

Fish and wildlife habitat class

The consequences of allowing conflicting uses vary by habitat class, with negative impacts greater when conflicting uses are allowed in high value fish and wildlife habitat areas. Impacts on undeveloped land would likely be greater than on developed land, depending on the type of program implemented. However, developed land may be impacted when redevelopment activities occur. Here we focus on the impacts to undeveloped land.

Class I riparian/wildlife corridors and Class A upland wildlife

Allow

The tradeoffs of an allow decision would be substantially greater in Class I riparian/wildlife corridors and Class A upland wildlife habitats than in habitat areas with less functional value. There would not be many positive consequences of allowing conflicting uses in these high quality habitat areas. Only seven percent of the unconstrained, buildable land[76] within the

[76] Unconstrained land has no current environmental regulations; buildable land includes vacant lots and portions of developed lots over a certain size. See *Conflicting Uses* chapter for more detailed definitions.

UGB[77] falls within Class I riparian/wildlife, if more vacant land fell within these areas the tradeoffs would be higher. Less than one-fifth of Class I land is zoned for uses which support employment[78] and none is of high employment value,[79] limiting economic benefits of an allow decision. The largest portion (42 percent) of buildable land in Class I riparian/wildlife is zoned for single family use, so a decision to allow would minimize additional property owner concerns about further regulations on their land. Class A wildlife contains about eight percent of unconstrained, buildable land within the UGB, and of that land 77 percent is zoned for single family use. Single family is likely to retain more natural land cover than other zoning types, providing some wildlife habitat and connectivity within the UGB. Only five percent of Class A wildlife is zoned for uses which support employment, and none is ranked as high employment value.

The negative impacts of an allow decision are particularly striking when considering the environmental consequences. Many primary ecological functions and habitat characteristics would be lost, key habitat for sensitive and endangered species would be fragmented and degraded, and nonnative species would likely be introduced. The loss of trees and vegetation would also lead to higher air temperatures and increased energy demand for temperature regulation. The negative economic impacts of an allow decision in these healthy habitat areas would include the loss of ecosystem services, potential increase in municipal expenditures on water quality and flood control, and a high risk of foregoing future ecosystem benefits. The social impact of losing these high value habitat would be greater than lower value areas, since these places are critical to preserving cultural heritage and protecting public health. A decision to allow would negatively impact the salmon that are so important to Native American culture; and the heritage and economy of the Pacific Northwest may face an irreversible loss through habitat loss and degradation.

Prohibit

A decision to prohibit conflicting uses in Class I riparian/wildlife corridors and Class A upland wildlife would result in the most positive environmental consequences. The amount of buildable land impacted would be fifteen percent of the total buildable land in the UGB, which would reduce competition between habitat conservation and development of these high value habitats (Class I and Class A habitat). Preserving the high value habitats would minimize negative environmental consequences but would focus protection efforts on owners of buildable single family land, especially in upland habitat areas. A decision to prohibit would reduce air temperatures but may increase infrastructure needs and commute distances by preventing road development in high value habitats. Some of the negative economic development impacts of a prohibit decision may be mitigated by the value of ecosystem services provided by high quality habitat. The key social tradeoff is between preserving the public social values of habitat while impacting private property rights. A decision to prohibit conflicting uses in these areas would likely require additional density elsewhere in the UGB or an expansion of the UGB to provide sufficient buildable land.

[77] The UGB prior to December 2002.
[78] Land zoned for employment includes mixed-use, commercial, and industrial zones, and does not include parks.
[79] Employment density is based on employees per acre. See Appendix C.

Limit

A decision to limit conflicting uses in Class I riparian/wildlife corridors and Class A upland wildlife habitat would allow some habitat preservation while mitigating the negative economic, social and energy consequences. The impact of limiting development would depend on the type of program implemented, and the results may range from minimal to almost complete protection of ecological functions. Using best management practices and low impact development standards to mitigate the impacts of development could reduce negative environmental, social, energy and economic consequences. Retention of existing habitat would be much cheaper than restoring it later, and also would require less energy.

Class II riparian/wildlife corridors and Class B upland wildlife

Allow

The tradeoffs of allowing conflicting uses in Class II riparian/wildlife would not be as great as in Class I riparian/wildlife corridors but still have a substantial negative impact on ecological function. However, the potential for losing existing ecological functions is reduced because fewer functions are present. A decision to allow may also result in the loss of restoration opportunities to regain ecological functions. The loss of Class II riparian/wildlife corridors would remove existing water quality filtration capacity and other ecological functions, with resulting negative impacts on ecosystem services, social values, and energy use. It also would have a negative environmental impact on Class I riparian/wildlife corridors by removing areas that contribute both primary and secondary function to the streams and water bodies. Class II riparian/wildlife corridors contains about four percent of the unconstrained buildable land within the UGB; thus allowing development in these areas does not have a significant economic benefit. Most of that buildable land is zoned for single family (47 percent), followed by industrial land (25 percent). The positive social and economic benefits of development would accrue to private landowners with an allow decision, while the public benefits would be diminished. Approximately 28 percent of land in Class II riparian/wildlife corridors supports employment, but only one percent is classified as high employment value.

A decision to allow development in Class B upland wildlife would result in the loss of connectivity between habitat patches as well as extensive loss of migratory stopover habitats and movement corridors. This would impact the value of the Class A upland wildlife areas by reducing connectivity among them, with consequent negative social and economic impacts. Class B upland wildlife contains a little over six percent of the buildable land in the UGB. Over 63 percent of that land is zoned for single family use, followed by rural (16 percent) and industrial (10 percent). Single family uses often retain more habitat value if trees and vegetation are preserved, which would reduce the negative environmental, social and energy consequences of a decision to allow development. Only nine percent of Class B upland wildlife land supports employment, and none is classified as of high employment value.

Prohibit

Prohibiting conflicting uses in Class II riparian/wildlife corridors and Class B upland wildlife would result in a number of positive environmental consequences but at the expense of affecting a large number of residential property owners. Preservation of Class II riparian/wildlife corridors and Class B upland wildlife would increase the quality of Class I riparian/wildlife corridors and Class A upland wildlife, maintaining riparian ecological functions and habitat connectivity. A decision to prohibit may result in the need to increase density within the UGB or

to expand the boundary. It also would retain restoration opportunities where ecological functions could be regained by increasing tree canopy or removing nonnative plants.

Limit

The tradeoffs of preserving Class II riparian/wildlife corridors and Class B upland wildlife may be addressed by mitigating the negative consequences with a limit decision. The impact of limiting development would depend on the type of program implemented. Using best management practices and low impact development standards to mitigate the impacts of development could reduce negative environmental, social, energy and economic consequences. Retention of existing habitat would be much cheaper than restoring it later, and also would require less energy. These habitat types that are not currently high quality may benefit from limited development if tied to restoration and mitigation.

Class III riparian/wildlife corridors; Class C upland wildlife

Allow

The tradeoffs of allowing conflicting uses in Class III riparian/wildlife corridors and Class C upland wildlife would not be as great as in the higher value habitat areas. Class III riparian/wildlife corridors include smaller forest patches and developed floodplains. The developed floodplains currently provide little ecological value but may provide opportunities for restoration in the future. Isolated smaller forest patches provide some environmental and energy benefits. These areas make up less than one percent of the buildable land in the UGB. Forty-eight percent of that land is zoned for single family, development of which could retain some of the forest canopy. Forty-nine percent of Class III riparian/wildlife corridors is zoned for uses which support employment, but only two percent is classified as high employment value.

Class C upland wildlife patches are of reduced quality compared to A and B upland wildlife and these isolated patches may be associated with increased wildlife mortality on roads. However, Class C upland wildlife patches may provide important habitat for specific wildlife species as well as connectivity along riparian corridors. Class C upland wildlife comprises only about five percent of the buildable land within the UGB, most of which is zoned for single family (37 percent) and industrial (26 percent). Only 25 percent of Class C upland wildlife land is zoned for uses which support employment, and none is classified as high employment value.

Prohibit

The ecological benefits of prohibiting development in Class III riparian/wildlife corridors and Class C upland wildlife would not be commensurate with the negative economic, social and energy consequences for the property owners in these areas. However, the impact on buildable land would be minimal, reducing the regional impact of preserving these areas.

Limit

A decision to limit conflicting uses in Class III riparian/wildlife corridors and Class C upland wildlife could preserve some habitat value while mitigating the negative consequences of protection. Class III riparian/wildlife corridors and Class C upland wildlife could provide important sites for restoration, improving the overall habitat quality for all habitat classes.

Impact areas

Allow, Limit, Prohibit

The negative consequences of allowing conflicting uses in impact areas would be substantially less for all four ESEE factors than in higher value fish and wildlife habitat categories. Impact areas provide little existing ecological function, so the environmental benefit of limiting or prohibiting conflicting uses is low. However, these areas provide important opportunities for landowner education, stewardship and restoration. With redevelopment a limit decision that directs the use of low impact development standards and best management practices could help the overall ecosystem to regain ecological function over time.

Regional zones

Most of the impacts of allowing conflicting uses would be the same across regional zones and are described in Table 8-1; the differences are described below.

Single family residential (SFR)

For single-family uses, the tradeoffs include many of the most sensitive social issues. Single-family zoning comprises the largest portion (46 percent) of the fish and wildlife habitat inventory, and includes 23 percent of the total unconstrained buildable land within the UGB. A decision to allow conflicting uses minimizes additional restrictions on the development potential of land, reducing possible impacts on personal financial security and regulatory or perceptual takings. Allowing conflicting uses on vacant land may impact established neighborhoods, changing neighborhood character and impacting property owners. With a limit decision, single family uses provide opportunities to balance the competing needs of habitat protection and property development rights. These lands often retain trees and vegetation and also provide opportunities for stewardship and landowner education. However, residential uses may increase offsite roads and infrastructure. Prohibiting conflicting uses completely would adversely affect a large number of residential property owners, but would retain habitat and neighborhood character.

Multi-family residential (MFR)

The most important tradeoff to consider in a decision to allow, limit, or prohibit development on land zoned for multi-family is the impact on capacity within the UGB. However, land zoned for multi-family accounts for only five percent of the total fish and wildlife habitat inventory and only one and a half percent of the total unconstrained buildable land within the UGB. Thus, limiting or prohibiting conflicting uses on multi-family land would have a minimal impact on housing capacity. Multi-family development tends to have fewer infrastructure requirements per dwelling unit as compared to single family, reducing the cost of development (economic and energy) but increasing vegetation loss and impervious surfaces. With a limit decision, this zoning type allows for substantial preservation of the habitat along with development if low impact development standards are applied in conjunction with best management practices.

Mixed-use centers (MUC)

A key tradeoff to consider for mixed-use centers is their importance in supporting the 2040 Growth Concept and providing housing and employment capacity within the UGB. Mixed-use centers comprise only two percent of the fish and wildlife habitat inventory, and almost two percent of the total unconstrained buildable land in the UGB. Mixed-use centers allow residents

the opportunity to live near their work, which tends to reduce vehicle miles traveled and the related negative water quality impacts and energy use. Less time spent commuting also allows people time to spend with family, on hobbies or recreational activities. However, the increased levels of impervious surfaces and tree loss add to the urban heat island effect and contribute to global warming. Mixed-use centers may provide some opportunity for habitat preservation along with development, depending on the type of program implemented.

Commercial (COM)

For commercial uses the most important tradeoff to consider is the impact on employment and shopping opportunities. Commercially zoned land accounts for five percent of the fish and wildlife habitat inventory, and only one and a half percent of the total unconstrained buildable land in the UGB. Allowing conflicting uses in commercially zoned areas reduces employment impacts specific to development use and does not affect related income and income tax revenue to municipalities. However, similar to mixed-use centers, the increased levels of on-site impervious surfaces have negative environmental and energy impacts. Commercial land uses tend to be more land extensive than single family or multi-family uses, thus reducing the ability to preserve ecological function while allowing development. However, some ecological functions could be retained with a limit decision by requiring low impact development and best management practices.

Industrial (IND)

Industrial uses provide employment and an income base for the region, a critical tradeoff to consider when protecting fish and wildlife habitat. Land zoned for industrial use comprises 14 percent of the fish and wildlife habitat inventory, but only six percent of the total unconstrained buildable land in the UGB. Additionally, most of the habitat land zoned for industrial use is classified as having a low employment density, minimizing the economic development impacts of a limit or prohibit decision. Industrial development tends to be very land extensive, maximizing vegetation loss; increased toxins may be present. Instituting low impact development standards and best management practices with a limit decision may preserve some of the ecological functions while reducing negative economic impacts.

Rural (RUR)

An important tradeoff to consider in rural areas is the impact of allowing conflicting uses on the regional identity and preservation of land for development in the future. Rural areas serve as visual greenbelts and also maintain land in agricultural uses near the UGB. Rural zoning comprises seven percent of the fish and wildlife habitat inventory and seven percent of the total unconstrained buildable land in the UGB. Outside of the UGB but within Metro's jurisdiction, rural residential is the predominate use. Rural uses provide important connector habitat, but allowing conflicting uses in rural areas can have negative environmental effects such as livestock degradation of riparian areas and water quality impacts of leaky septic tanks. A limit decision would provide opportunities to preserve habitat while allowing some development to occur.

Parks and open space (POS)

A key consideration for parks and open space uses is the need for active recreation facilities versus using public land to preserve habitat for the public benefit. Land in use as parks and open space makes up 20 percent of the fish and wildlife habitat inventory, but provides a negligible

amount of unconstrained buildable land. Publicly owned lands offer the main opportunity to preserve habitat for the public benefit without negatively impacting private property owners.

Key points

Following completion of the ESEE analysis, Metro staff will develop alternatives for implementing programs to protect regionally significant fish and wildlife habitat. These alternatives will be analyzed based on the ESEE tradeoffs identified above, and will be evaluated using criteria developed from the key points described below. This section identifies some of the implications from the analysis that may be relevant to developing and evaluating Goal 5 alternatives.

Economic

1. **Fish and wildlife habitat and the ecosystem services they provide have economic value.** Decisions that protect or enhance ecosystem services have a positive effect on the economy. In some cases it is more cost effective to protect fish and wildlife habitat than it is to undertake restoration or build engineered structures to provide for flood control, water quality, and other ecosystem services.
2. **Development status of fish and wildlife habitat moderates the types, intensity, and distribution of economic consequences.**
   - Most fish and wildlife habitat is in park status, developed with existing uses, or constrained by existing regulatory programs protecting streams, wetlands, floodplains, and steep slopes near streams (34 percent of the habitat is in park status, 22 percent is developed, and 16 percent is vacant constrained). The majority of high value fish and wildlife habitat (71 percent of Class I riparian/wildlife and 59 percent of Class A upland wildlife areas) is already in parks/open space or constrained.
   - While fish and wildlife habitat comprises 41 percent of the unconstrained buildable land supply within the 2002 UGB, the highest value habitat comprises 20 percent of the region's buildable land supply. This reduces the competition between conservation and development of high value fish and wildlife habitat.
   - The degree to which development is limited within fish and wildlife habitat, especially vacant buildable lands, will directly affect the need for compensatory actions such as increasing densities within the UGB and expanding the UGB.
   - Single-family lands deserve special attention given that they account for a large proportion of fish and wildlife habitat (46 percent). How these lands are treated in protection programs will influence the development value and habitat value of these lands.
   - Conflicts are highest on the 14 percent of fish and wildlife habitat lands in industrial zoning. About 61 percent of these lands scored high for at least one measure of development value. How conflicts are resolved in these areas have implications on employment and potentially the need to expand the UGB.
3. **A majority of fish and wildlife habitat occurs outside areas of intensive urban development.** Economic consequences of decisions to limit or prohibit conflicting uses on these lands will affect economic activities with low land value and employment density, relative to the Portland city center. However, these decisions will have a more significant impact on land values than on employment.

- A majority of high value fish and wildlife habitat (83 percent of Class I riparian/wildlife and 95 percent of Class A upland wildlife) is not zoned to support employment, and land that does support employment is mostly of low employment value (no land in these categories is of high employment value).
- Moderate and low value fish and wildlife habitat supports more employment compared to high value habitat, but most employment values remain low.
- A significant proportion of fish and wildlife habitat occurs in areas that have some development value, but compared to the Portland city center, the development values are low.

4. **Limit and prohibit decisions would affect primarily 2040 design types with lower expected levels of urbanization (i.e., inner and outer neighborhoods)**. However, these areas cover a majority of the urban landscape, so the decisions would impact a large number of property owners.
5. **The fact that limit or prohibit decisions would affect land with lower property values and employment density does not mean that the regional consequences of such decisions would be trivial.** The cumulative property value or employment affected could be significant depending on the details of the regional program and the nature of mitigating actions (such as increasing densities within centers or expanding the UGB)
6. **Decisions that result in protection of fish and wildlife habitat may reduce the future costs to municipalities of complying with environmental regulations such as the federal Endangered Species Act and the federal Clean Water Act.** Likewise, degrading fish and wildlife habitat increases the likelihood that future municipal expenditure to comply with environmental laws will increase.
7. **Relocation of conflicting uses within the current UGB, or expanding the UGB, has the potential to mitigate the adverse effects of limit and prohibit decisions on land value and employment.** However, expanding the UGB may increase expenditures associated with vehicle miles traveled, extending or expanding infrastructure, and other urban growth expenditures. At the local scale, relocating conflicting uses to another jurisdiction or expansion of the UGB may not mitigate adverse effects unless the expansion occurs nearby.

Social

1. **Protection of fish and wildlife habitat preserves many important social values.** These include our cultural heritage, regional identity, sense of place, and neighborhood character. Property owners may also benefit from the retention of fish and wildlife habitat through increased property values. Opportunities for education abound in areas with healthy fish and wildlife habitat.
2. **The distribution of the regulatory burden on property owners to protect fish and wildlife habitat for the general public benefit is a critical social concern.** Private property rights are a fundamental cornerstone of American life, and additional regulations reducing development rights may be seen as an attack on personal financial security as well as a possible taking. However, there are public rights to clean air and water, as well as healthy fish and wildlife, which serve as a counterbalance to this view.
3. **Fish and wildlife habitat provide positive benefits to public health and safety, but there are some negative effects.** There are many obvious benefits of recreation, as well as the mental health and stress relief found in nature. Additionally, minimizing the incidence of

flooding and erosion contributes to public safety. However, increased forest canopy and vegetation could lead to wildfire risks and potential damage from windstorms.

4. **People today have a responsibility to provide future generations with some of the same benefits that current residents enjoy.** Sustainable development practices allow for development to occur today while maintaining a certain amount of intergenerational equity.

Environmental

1. **Trees are invaluable to the health of fish and wildlife habitat.** It is important both near streams and throughout the watershed, as affirmed by local studies. Trees provide habitat, absorb pollution and excess nutrients, and slow and retain stormwater, reducing hydrologic alterations.
2. **Hydrologic changes have far-reaching negative consequences.** Reducing or mitigating impervious surfaces and stormwater impacts is necessary to mimic natural water flow patterns.
3. **Consequences to fish habitat depend on habitat value.** For example, loss of high-value Class I riparian/wildlife habitat would have a stronger ecological impact than Class II or Class III habitat. Loss of high-value riparian habitat would also result in loss of high-value wildlife habitat, because Class I riparian/wildlife habitat include some high-value wildlife habitat (including Habitats of Concern).
4. **Consequences to wildlife habitat also depend on habitat value, but with different implications than fish habitat.** Because connectivity is important to wildlife, the loss of any component in the system may reduce the value of nearby wildlife habitat patches. For example, preserving two Class A upland wildlife habitat patches will be most valuable to wildlife if connectivity is retained, and the connecting patches are typically Class B or C upland wildlife. If only Class A upland wildlife is preserved, its value will be reduced due to the loss of nearby Class B and C upland wildlife.
5. **Homes surrounded by trees can provide important wildlife habitat.** Resident native birds are most diverse in developed areas with plenty of forest canopy. A limit decision provides opportunities to preserve important fish and wildlife habitat while allowing for some conflicting uses, especially in residential zones.

Energy

1. **Trees and other vegetation are a key variable mitigating negative energy impacts.** Plants clean and cool air and water, and also reduce air conditioning demand.
2. **Transportation infrastructure creation and maintenance require energy, whereas transit and alternative transportation modes reduce energy consumption.** Program solutions that reduce infrastructure needs and support alternative modes of transportation can reduce overall energy use.
3. **At the regional scale, fossil fuel use for transportation constitutes a key use of energy and contributes to warming of air and water, as well as air pollution.** Reducing vehicle miles traveled, and the infrastructure required to support such travel, is an important variable in reducing energy use. Clustered housing in single family zones, as well as mixed-use centers and multi-family zoning types provide three potential ways to reduce VMT and infrastructure needs.

4. **Protection of fish and wildlife habitat can increase energy use by increasing VMT, because drivers must travel around the protected areas.** However, trees and other vegetation also help mitigate negative energy effects. A limit decision could provide a balance between compact urban form and retention of green infrastructure within the urban area.

Next steps

The right balance between preserving and developing fish and wildlife habitat is not obvious. Allowing 100 percent of the desired development activities or protecting 100 percent of the habitat areas from development will not satisfy the many competing interests, as described above. The ESEE tradeoffs and key points identified in this report create a base of facts as a foundation for the public debate and decision making process. Metro's ESEE analysis shows the difficulty inherent in balancing the goals of protecting fish and wildlife habitat and providing for the development needs of the region.

The next step in Metro's planning process involves defining several program options for protecting fish and wildlife habitat. The tradeoffs associated with each option will be evaluated and compared, providing valuable information to the Metro Council as it considers a final decision to allow, limit, or prohibit conflicting uses in regionally significant fish and wildlife habitat areas.

Table 8-1. ESEE consequences of allowing, limiting and prohibiting conflicting uses by habitat class

ESEE Consequences of ***ALLOWING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
CLASS I RIPARIAN *Score: 18-30* *3-5 primary functions, plus secondary functions*	+ Property owners realize full development potential + Supports intrinsic value of built environment + No affect on employment and income related to development activities + Buildable land with habitat accounts for almost half of the total buildable land in UGB, reduces need to expand UGB by allowing development + SFR: No impact on development value on large portion of habitat land + IF a restoration component is included impacts on ecosystem services could be mitigated but at higher cost - Negative impacts on employment and income that depend on quality of riparian and wildlife habitat - Increased municipal spending on flood and water quality management - Cumulative negative impacts on all ecosystem services (e.g., flood management, water-quality) - Increases risk of foregoing future uses and benefits associated with habitat - Increases risk of irreversible outcome (e.g., extinction of salmon) that may have future negative economic consequences - May increase cost of municipal compliance with federal regulations (ESA) - Majority of habitat occurs on land with low development value and employment density, protection of ecosystem values could occur with less economic impact	+ Maintain housing and employment options + No change in property rights + No takings concerns + Equitable impact on property owners + SFR: Maintain personal financial security (equity) + MUC: Does not impact 2040 densities and development in centers + MUC: Allows residents opportunity to live near where they work + POS: Maintain or increase opportunities for active recreation - May lose cultural heritage - May not protect salmon and thus impact Native American culture and regional identity - May change neighborhood character and sense of place - Scenic values may be lost - Incompatible land uses may lose buffers - May degrade environmental quality and impact health - May lose recreational and educational opportunities - Loss of tree canopy and vegetation may increase stress levels and impact mental health - Aggression and violent behavior could increase - May increase risk of landslides and floods if tree canopy and vegetation is removed - Loss of intergenerational equity	+ **Functional consequences:** no positive consequences beyond that provided by existing protection + Reduced need for UGB expansion + SFR: may retain more trees/ vegetation + MFR: Increased density within UGB reduces need for UGB expansions + MFR: Decreased infrastructure requirements per dwelling unit decreases overall infrastructure/roads + MUC: tends to reduce VMT, reducing water quality impacts - **Functional consequences:** loss of 3-5 primary ecological functions - Likely harm to salmon and wildlife through habitat loss and degradation - Increased pesticide and fertilizer use degrades water quality - Landscaping uses water - Continued development in flood areas - Continued wetland conversion - Nonnative species introductions - MFR: tends to retain less vegetation and add more imperviousness - IND: Increased imperviousness and decreased canopy cover increase negative ecological effects - IND: Increased toxins may be associated with this land use - IND: Can be particularly detrimental to water quality - RUR: Livestock degrade riparian area - RUR: Septic tanks are common and may leak, reducing water quality	+ Contributes to efficiencies in provision of services + More compact development may reduce VMT (Vehicle Miles Traveled per person) and fossil fuel use + Reducing VMT and fossil fuel use reduces air pollutants and heat + MUC: High density centers reduce VMT, infrastructure, energy use + RUR: Imperviousness is typically lower and vegetation cover higher, reducing Urban Heat Island effect - Loss of trees and increased imperviousness lead to Urban Heat Island effect and global warming; higher air conditioning (AC) demand - Warmer air warms water; harms salmon - Increased energy consumption to provide engineered solutions to manage stormwater flow, reduce soil erosion, keep water cool, etc. - SFR: associated with increased offsite roads and infrastructure - MFR, COM, IND: Increased onsite imperviousness and tree loss add to Urban Heat Island effect and global warming on a per-acre basis - IND: Placement within the floodplain is common, increasing energy-requiring flood mitigation

ESEE Consequences of ***ALLOWING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
CLASS II RIPARIAN *Score: 6-17* *1-2 primary functions and some secondary functions*	+ *Same as Class I riparian* - *Same as Class I Riparian, except less risk*	+ *Same as Class I riparian* - *Same as Class I Riparian, except less risk*	+ *Similar to Class I riparian habitat* - *Similar to Class I riparian habitat, except:* - Loss of restoration opportunities to regain ecological functions - Loss of functionality would be less because fewer ecological functions are present; however, loss of Class 2 Riparian removes existing water quality filtration capacity and other ecological services	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*
CLASS III RIPARIAN *Score: 1-5* *No primary functions, no wildlife value: includes small forest patches and developed floodplain*	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*	+ *Similar to Class I riparian habitat, except:* + Class 3 Riparian ecological functions are already reduced, thus allowing conflicting uses does not have a significant impact on overall ecological function - *Similar to Class II riparian habitat, except:* - The potential for losing existing ecological functions is reduced	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*

ESEE Consequences of ***ALLOWING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
CLASS A WILDLIFE *Score 7-9 no primary riparian function but may contain secondary riparian functions*	+ *Same as Class I riparian* - *Same as Class I riparian*	+ *Same as Class I riparian* + Less vegetation may reduce risk of wildfires + Less habitat may reduce number of undesirable species - *Same as Class I Riparian*	+ *Similar to Class I riparian habitat* + **Functional consequences:** no positive consequences noted + SFR: may retain more natural land cover than other zoning, providing wildlife habitat and connectivity + MFR, MUC: Increased density in UGB may limit expansion to new areas + RUR: Less habitat fragmentation; tends to retain more connectivity + RUR: agricultural areas can provide important grassland habitat - **Functional consequences:** Loss of key habitat characteristics - Extensive loss of valuable wildlife habitat - Nonnative plant and animal species invasions - Increased adverse edge effects - Pesticides may harm wildlife - Noise and light disturbances - Continued native species loss over time, reduction in migratory songbirds - Decline of at-risk wildlife species; more species imperiled - Continued loss of Habitats of Concern and associated species - Mortality from roadway crossings - MFR: higher onsite imperviousness, increased negative effects on wildlife and migratory songbirds - COM, IND: Increased imperviousness and decreased canopy cover - COM, MUC: Increased human disturbance	+ *Same as Class I Riparian* - *Same as Class I Riparian*

ESEE Consequences of ***ALLOWING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
CLASS B WILDLIFE *Score 4-6* *no primary riparian function but may contain secondary riparian functions*	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*	+ *Same as Class A Wildlife* - *Same as Class A Wildlife, except less risk*	+ *Similar to Class I Riparian* + *Similar to Class A Wildlife* - *Similar to Class A Wildlife, except:* - Habitat interior loss less extensive than Class A - Loss of connectivity especially pronounced; extensive loss of migratory stopover habitat and movement corridors. Reduces value of Class A patches. - Loss of grassland and low-structure vegetation within 300 ft of streams - Loss of locally rare migratory stopover habitat and locally rare habitat patches with water resources	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*
CLASS C WILDLIFE *Score 2-3* *no primary riparian function but may contain secondary riparian functions*	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*	+ *Same as Class A Wildlife* - *Same as Class A Wildlife, except less risk*	+ *Similar to Class I Riparian and Class A Wildlife* + These patches tend to be relatively small, isolated, and lacking substantial water resources, and are therefore reduced in quality compared to Class A and B + Isolated patches may be associated with increased wildlife mortality on roadways - *Similar to Class B, except:* - Only limited loss of habitat interior - Some loss of connectivity between patches - Important loss of migratory stopover habitat, these patches tend to occur in areas lacking substantial wildlife habitat - Loss of upland patches lacking water resources but providing important habitat to specific wildlife species	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*

ESEE Consequences of ***ALLOWING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
Riparian impact area	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone	+ Opportunities for landowner education may reduce effects of existing and future environmentally harmful practices near waterways - Potential for increased adverse impacts (e.g., pollution, altered hydrology, pesticide use, bacterial contamination, human disturbance…) to waterways due to existing and new conflicting uses in areas adjacent to waterways - These impacts are greater than in other areas because they are near water and because non-habitat areas tend to lack natural filtration provided by riparian vegetation	
Vegetation impact area	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone	+ Opportunities for landowner education may reduce effects of existing and future environmentally harmful practices - Potential for increased adverse effects adjacent to habitat areas, primarily forested but also low-structure vegetation	

ESEE Consequences of ***LIMITING*** conflicting uses

Habitat type	Economic	Social	Environment	Energy
CLASS I RIPARIAN *Score: 18-30* *3-5 primary functions, plus secondary functions*	+ *Extent of impact depends on program:* + IF a restoration component is included impacts on ecosystem services could be mitigated but at higher cost + Intrinsic value of built environment can be retained if balanced with habitat needs + Positive to neutral impact on employment and income that depend on quality of riparian and wildlife habitat + Reduces municipal spending on flood and water quality management + Reduces risk of foregoing future uses and benefits associated with habitat + Reduces risk of irreversible outcome (e.g., extinction of salmon) that may have future negative economic consequences + May decrease cost of municipal compliance with federal regulations (ESA) + Majority of habitat occurs on land with low development value and employment density, protection of ecosystem values could occur with less economic impact + Primarily affects 2040 design types with lower expected levels of urbanization + Reduces cumulative negative impacts on all ecosystem services (e.g., flood management, water-quality) + SFR: Large portion of habitat, decisions on access/layout influences development and habitat value - Development potential of property is limited - Some effect on employment and income related to development activities - Buildable land with habitat accounts for almost half of the total buildable land in UGB, may impact need to expand UGB by limiting development - SFR: May substantially impact development value	+ Preserve some buffers between uses + Retain some or most cultural heritage + Provide salmon chance for recovery, lessen impacts on Native American culture and regional identity + Retain most neighborhood character and sense of place + Preserve most scenic values + Maintain environmental quality and reduce negative health impacts + Retain most educational and recreational opportunities + Retention of tree canopy/vegetation may reduce stress levels and positively impact mental health + Reduce risk of landslides and floods + Provide some intergenerational equity + SFR, MFR, MUC: Maintain housing options/affordability if development minimally impacts the habitat + COM, MUC, IND: Maintain employment opportunities + POS: Increase active recreation opportunities if habitat minimally impacted - Property rights: owners may not be able to develop land to same extent - Takings concerns - Inequitable to property owners - SFR: May reduce option for large lot single family homes - SFR: May impact property values, decreasing personal financial security - SFR, MFR, MUC: May reduce housing options/affordability if development minimally impacts the habitat - COM, MUC, IND: May reduce employment opportunities - POS: May reduce opportunities for active recreation	+ **Functional consequences:** May conserve some of 3-5 existing primary ecological functions, depending on program, as well as Class A or B wildlife habitat falling within Class I riparian; extent depends on program + Reduced need for UGB expansion + Strong potential for BMP implementation and low impact development and innovative design standards + Hydrology less altered than "allow" + MFR: Increased density within UGB reduces need for expansions + MFR: Decreased infrastructure requirements per dwelling unit reduces negative ecological effects + MUC: reduced VMT, fewer water quality impacts from transportation runoff - **Functional consequences:** Potential for substantial loss of 3-5 primary ecological functions, as described in ALLOW. Class A or B wildlife habitat falling within Class I riparian would also be compromised. Extent of loss depends on program. *See comments under "allow," except:* - Hydrology less altered, less stream damage - Greater flood area/wetland protection - Greater protection of steep slopes - Fish and other aquatic wildlife habitat impaired, but extent of loss reduced - Water quality impacts likely, but degree depends on program - MFR, MUC, COM, IND: Loss of ecological functions greater than SFR due to increased imperviousness and tree loss - IND: Increased toxins may be associated with this land use type - RUR: Septic tanks may leak bacteria into waterways, reducing water quality	+ **May reduce new infrastructure requirements** + **Reducing VMT and fossil fuel use reduces air pollutants and heat** + **Increased forest cover helps remove air pollutants and reduce smog** + **Increased forest cover cools air by shade, evapotranspiration, carbon storage; reduced Urban Heat Island effect, global warming, and AC demand** + **May result in decreased energy consumption to manage stormwater runoff, reduce sedimentation and erosion and keep water cool** + **Tree retention is cheaper, easier, and less energy-consumptive than planting new** + **MFR: Requires less land per unit than SFR, reducing extent of tree loss, infrastructure, UGB expansions** + **MUC: Higher density centers create compact urban form, reducing VMT, infrastructure**, energy use **Negative consequences similar to "ALLOW", but to a lesser degree** - Avoiding sensitive natural areas may increase infrastructure requirements - May lead to increased VMT - May result in need for UGB expansion - Loss of trees increases Urban Heat Island effect, global warming, AC demand - Warmer air warms water; harms salmon and other species - MFR, COM, IND: Increased onsite tree loss and imperviousness add to Urban Heat Island effect and global warming - COM, IND: May increase energy consumption to replace natural systems - IND: Placement within the floodplain is common, increasing energy-requiring flood mitigation

ESEE Consequences of ***LIMITING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
CLASS II RIPARIAN *Score: 6-17* *1-2 primary functions and some secondary functions*	+ *Same as Class I riparian* - *Same as Class I riparian, except less risk*	+ *Same as Class I riparian* - *Same as Class I riparian, except less risk*	+ *Similar to Class I riparian habitat* + Retains restoration opportunities where ecological functions could be regained through tree canopy increases or other measures - *Similar to Class I riparian resources, except:* - Some loss of features providing ecological functions (scores 6-17), unless offset by mitigation and restoration activities	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*
CLASS III RIPARIAN *Score: 1-5* *No primary functions, no wildlife value: includes small forest patches and developed floodplain*	+ *Same as Class I riparian* - *Same as Class I riparian, except less risk*	+ *Same as Class I riparian* - *Same as Class I riparian, except less risk*	+ *Similar to Class II riparian habitat* - *Similar to Class II riparian habitat, except:* - Loss of opportunities to add forest canopy along streams where low structure currently exists	: *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*

ESEE Consequences of ***LIMITING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
CLASS A WILDLIFE *Score 7-9 no primary riparian function but may contain secondary riparian functions*	+ *Same as Class I riparian* - *Same as Class I riparian*	+ *Same as Class I riparian* - *Same as Class I riparian* - More vegetation could increase risk of wildfires - Less habitat could increase nuisance species	+ **Functional consequences:** Some retention of key habitat attributes (patch size, habitat interior, connectivity and water resources) for habitat outside Class I riparian + More habitat retained than Allow + Reduced edge effects + Fewer nonnative species invasions + More connectivity retained + Less harm to native species + Reduced need for UGB expansion + Landscaping can provide diverse habitats + Low to moderate levels of development provide good habitat for some species + MFR: Increased density in UGB may limit expansion to new areas, protecting important outlying habitats + RUR: Less habitat fragmentation; tends to retain more connectivity + RUR: agricultural areas can provide important grassland habitat *Similar to "allow," but to a lesser degree depending on program options* - **Functional consequences:** Potential for *reduction* in habitat patch size, connectivity, and amount of interior habitat, reducing ecological function - Wildlife crossings across roadways cause mortality - MFR, COM, MUC, IND: More onsite imperviousness and less forest/vegetation increase negative effects on wildlife and migratory songbirds - MFR, COM, MUC, IND: Higher level of development is less valuable to wildlife - MFR, COM, MUC, IND: Increased human disturbance may negatively impact wildlife, but to a lesser degree than allow - RUR: Increased toxins may be associated with agriculture	+ *Same as Class I riparian* - *Same as Class I riparian, except less risk*

ESEE Consequences of ***LIMITING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
CLASS B WILDLIFE *Score 4-6* *no primary riparian function but may contain secondary riparian functions*	+ *Same as Class I Riparian* − *Same as Class I Riparian, except less risk*	+ *Same as Class A Wildlife* − *Same as Class A Wildlife, except less risk*	*Similar to Class A, except:* + More habitat connectivity between large habitat patches retained + Grassland and low structure habitat within 300 ft of stream may be retained + Low to moderate levels of development provide good habitat for some species, most pronounced in Class A patches *Similar to "ALLOW," but to a lesser degree depending on program options* − To the extent the resource removed, habitat and connectivity will be lost − MFR: More onsite imperviousness and less forest and vegetation increases negative effects on wildlife and migratory songbirds − MFR, COM, IND, MUC: Higher density development less valuable to wildlife − MFR, COM, IND, MUC: Increased human disturbance may negatively impact wildlife	+ *Same as Class I Riparian* − *Same as Class I Riparian, except less risk*
CLASS C WILDLIFE *Score 2-3* *no primary riparian function but may contain secondary riparian functions*	+ *Same as Class I Riparian* − *Same as Class I Riparian, except less risk*	+ *Same as Class A Wildlife* − *Same as Class A Wildlife, except less risk*	*Similar to Class B, except:* + Most are small forested patches + Less likely to provide good habitat for some species, because these patches tend to be narrow, disconnected, and surrounded by development + Isolated patches may be associated with increased wildlife crossing mortality on roadways *Similar to "allow," but to a lesser degree depending on program options* − To the extent that conflicting uses remove the resource, habitat and connectivity will be lost	+ *Same as Class I Riparian* − *Same as Class I Riparian, except less risk*

ESEE Consequences of ***LIMITING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
Riparian impact area	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone	+ Retains restoration opportunities where riparian functions could be regained through planting tree canopy or other measures + May help protect existing water resources from current or future adverse effects due to conflicting uses + Provides mitigation opportunities + Incentives and landowner education could enhance ecological health over time - Similar to "allow," but to a lesser degree	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone
Vegetation impact area	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone	+ Retains restoration opportunities where habitat patch functions could be regained through planting tree canopy or other measures; for example, potential for decreased edge effects, increased interior habitat and increased connectivity to other patches and to water resources + Provides mitigation opportunities + Incentives and landowner education could enhance ecological health over time - *Similar to "allow," but to a lesser degree*	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone

ESEE Consequences of ***PROHIBITING*** conflicting uses

Habitat type	Economic	Social	Environment	Energy
CLASS I RIPARIAN *Score: 18-30* *3-5 primary functions, plus secondary functions*	+ Positive impact on employment and income that depend on quality of riparian and wildlife habitat + Minimizes municipal spending on flood and water quality management (as long as takings issues are avoided) + Minimizes risk of foregoing future uses and benefits associated with habitat + Minimizes risk of irreversible outcome (e.g., extinction of salmon) that may have future negative economic consequences + May decrease cost of municipal compliance with federal regulations (ESA) + Majority of habitat occurs on land with low development value and employment density, protection of ecosystem values could occur with less economic impact + Most habitat is on land with 2040 design types with lower expected levels of urbanization + Minimizes cumulative negative impacts on all ecosystem services (e.g., flood management, water-quality) - Does not support intrinsic value of built environment - Development potential of property is impacted substantially - Major affect on employment and income related to development activities if buildable land decreased - Buildable land with habitat accounts for almost half of the total buildable land in UGB, likely to impact need to expand UGB by prohibiting development - SFR: Likely to have substantial impact on development value on large portion of habitat	+ Preserve cultural heritage + Provide salmon a chance to recover and lessen impacts on Native American culture and regional identity + Preserve or increase buffers between incompatible land uses + Retain neighborhood character/sense of place + Preserve scenic values + Maintain and possibly improve environmental quality and reduce negative health impacts + Retain educational and recreational opportunities + Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health + Reduce risk of landslides and floods + Provide intergenerational equity - Inequitable impact on property owners - Property rights: owners may not be able to develop land to same extent - Likely to result in takings concerns - SFR: Possible negative impact on property values, decrease in equity - SFR, MFR, MUC: Reduce housing options and opportunities - SFR, MFR, MUC: May impact housing affordability - MUC: Negative impact to 2040 if development in centers is curtailed - COM, IND, MUC: Reduce employment options and opportunities - POS: Reduce opportunities for active recreation	+ Functional consequences: Preservation of the most ecologically functional riparian areas, as well as some of the most important wildlife habitat remaining in the region, including Habitats of Concern + Helps maintain hydrologic connectivity + Minimizes hydrologic alterations, reduces flooding + Retention of important salmon habitat + IND: Minimize water quality degradation + RUR: Fewer water quality problems associated with leaky septic tanks, livestock + POS: Could help prevent human/pet disturbance to wildlife - **Functional consequences**: no adverse consequences for Class I habitat - Increased need for UGB expansion - Potential for increased infrastructure intrusion into other habitat areas if Class I riparian areas are avoided - MFR, MUC: Opportunity for increased density reduced, thereby increasing need for UGB expansion - RUR: Rural lands are low density and therefore tend to require more infrastructure per dwelling unit, increasing VMT and decreasing water quality	+ **Retention of tree canopy and other vegetation may provide strong protection from warmer air and water from Urban Heat Island effect and global warming** + **Opportunity for pleasant, accessible alternative means of transportation such as walking and bicycling through natural areas, if permitted under program** + **Likely to result in decreased need for future** restoration and flood mitigation - Limits transportation planning options - Limits infrastructure placement options - Increases extent of urban area and VMT - Potential for increased total imperviousness due to increased roads; energy is required to build and maintain roadways and other infrastructure - If utilities are prohibited from being installed along streams, may require pumping or other activities to take non-gravity driven pathways - Increased VMT, fossil fuel use, air pollution, related warming of air and water - Extent of Urban Heat Island effect may increase, potentially increasing AC demand - MUC: Most energy-efficient land use; prohibit decision would reduce energy saving opportunities

ESEE Consequences of ***PROHIBITING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
CLASS II RIPARIAN *Score: 6-17* *1-2 primary functions and some secondary functions*	+ *Same as Class I riparian* - *Same as Class I riparian, except less risk*	+ *Same as Class I riparian* - *Same as Class I riparian, except less risk*	+ Similar to Class I riparian habitat + Retention of some critical ecological functions and ecosystem services provided by existing natural resources + Retains restoration opportunities where ecological functions could be regained through tree canopy increases or other measures + Provides mitigation opportunities - *Similar to Class I riparian habitat, except:* - Increased need for UGB expansion, but less so than prohibit decision in Class I (scores of 6-18 – at least 1 primary function) -	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*
CLASS III RIPARIAN *Score: 1-5* *No primary functions, no wildlife value: includes small forest patches and developed floodplain*	+ *Same as Class I riparian* - *Same as Class I riparian, except less risk*	+ *Same as Class I riparian* - *Same as Class I riparian, except less risk*	+ Similar to Class I riparian habita, except: + Retention of some ecological functions and ecosystem services provided by existing natural resources + Retains restoration opportunities where ecological functions could be regained through tree canopy increases or other measures + Provides mitigation opportunities - *Similar to Class I riparian habitat, except:* - Increased need for UGB expansion, but less so than Class II	+ **Same** *as Class I Riparian* - *Same as Class I Riparian, except less risk*

ESEE Consequences of ***PROHIBITING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
CLASS A WILDLIFE *Score 7-9 no primary riparian function but may contain secondary riparian functions*	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*	+ *Same as Class I Riparian* - *Same as Class I Riparian* - More vegetation increase risk of wildfires - More habitat may increase nuisance species	+ Functional consequences: Retention of key attributes for habitat outside Class I riparian + Retention of some of the best remaining wildlife habitats in the region + Provides key breeding habitat for migratory songbirds, aquatic species and habitat interior specialists + Retains Habitats of Concern + Provides important source habitats for native wildlife and plant species + Reduced wildlife road crossing mortality + RUR: Decrease in agricultural toxins + RUR: Reduced livestock damage - **Functional consequences:** Continuing functionality of Class A habitat patches may depend on connectivity with other, less valuable habitat patches - If conflicting uses are prohibited in all Class A wildlife other habitat may be disproportionately removed or altered, reducing the quality of Class A habitat - Class A patches are typically very large, may result in need for UGB expansions - RUR: Agricultural areas can provide important habitat for grassland and low structure-associated species	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*

ESEE Consequences of ***PROHIBITING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
CLASS B WILDLIFE *Score 4-6* *no primary riparian function but may contain secondary riparian functions*	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*	+ *Same as Class A Wildlife* - *Same as Class A Wildlife, except less risk*	+ Similar to Class A, except: + Retention of some of the most important connectivity elements in the region + Retention of large upland habitat patches important to specific wildlife species + Important for migratory songbirds + May provide important source habitats for native wildlife and plant species + Grassland and low-structure vegetation within 300 ft of streams would be retained - *Similar to Class A Wildlife, except:* - If conflicting uses are prohibited in all Class B wildlife habitat, Class A and C may be disproportionately removed or altered, thereby reducing the quality of Class B habitat through connectivity loss and increasing isolation	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*
CLASS C WILDLIFE *Score 2-3* *no primary riparian function but may contain secondary riparian functions*	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*	+ *Same as Class A Wildlife* - *Same as Class A Wildlife, except less risk*	+ Similar to Class B, except: + Not as important to regional connectivity, may provide important local connectivity + Small, isolated patches provide important and locally rare stopover habitat to migratory birds + RUR: Prohibiting conflicting uses may decrease agricultural toxins + RUR: Reduced livestock damage - *Similar to Class B, except:* - Small isolated habitat patches may limit reproductive success due to edge effects and reduced habitat quality - Isolated patches may be associated with increased roadway mortality - RUR: Agricultural areas can provide important habitat for grassland and low structure-associated species	+ *Same as Class I Riparian* - *Same as Class I Riparian, except less risk*
Riparian impact area	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone	+ *Similar to "limit," but to a greater degree* - Primary negative consequences relate to social, economic and energy	+ Positive consequences depend on the general zone - Negative consequences depend on the general zone

ESEE Consequences of ***PROHIBITING*** conflicting uses				
Habitat type	**Economic**	**Social**	**Environment**	**Energy**
Vegetation impact area	**+** Positive consequences depend on the general zone **-** Negative consequences depend on the general zone	**+** Positive consequences depend on the general zone **-** Negative consequences depend on the general zone	**+** *Similar to "limit," but to a greater degree* **-** Primary negative consequences relate to social, economic and energy	**+** Positive consequences depend on the general zone **-** Negative consequences depend on the general zone

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APPENDICES

Copies of Appendices A, B, C and D are available for review in the Metro Council's files. In addition, copies may be requested from the Metro Planning Department, 600 N.E. Grand Ave., Portland, OR 97232, or by calling 503-797-1555. Copies may also be available via the Metro website: www.metro-region.org/nature.

APPENDIX A

Federal, State, Regional, and Local Policies

APPENDIX A
FEDERAL, STATE, REGIONAL, AND LOCAL POLICIES

Federal, State, Regional, and Local Policies

When the Metro Council adopted the Urban Growth Management Functional Plan in 1996, one of the purposes was to address regional fish and wildlife habitat as a matter that has a "significant impact upon the orderly and responsible development of the metropolitan area." ORS 268.390(1). Regional conservation of identified fish and wildlife habitat is consistent with many other state and federal policies and laws. The Metro Policy Advisory Committee recognized this connection in October 2000, when it adopted the "Purpose, Vision, Goal, Principles and Context" (Vision Statement) for the development of Metro's fish and wildlife program.

The Vision Statement recommended that the Metro Council address these state and federal policies, in particular the Endangered Species Act (ESA). MPAC recommended that Metro develop a program that could satisfy federal agency standards, and comply with the ESA "so that local governments could use it if they choose." Metro's fish and wildlife program will have important connections with many other state and federal programs, and will aid in local compliance with those programs. The discussion below describes relevant federal and state requirements and how Metro's program may be coordinated with those requirements.

Federal Policy

Endangered Species Act (ESA)

The purpose of the ESA is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." 16 USC 1531(b). The act requires federal agencies to identify critical habitat for endangered and threatened species, create a recovery plan for those species and in some circumstances issue regulations that provide for the conservation of such species. Above all, the act prohibits any individual, group of individuals, states, cities and counties from "taking" a listed species.[1]

Twelve species of salmon and steelhead are listed as either threatened or endangered in the Columbia River and Willamette River Basins. (See Table A-1). The federal agency responsible for these species is the National Oceanic and Atmospheric Administration Fisheries unit (NOAA Fisheries). All of these species are present in the Portland metropolitan area at some point in their life cycle. They either migrate through the metropolitan area as adults or juveniles, or may spawn and rear in metropolitan area streams. Most of these salmonids were listed in 1997, 1998 and 1999. NOAA Fisheries is currently undertaking a review of those listed species to determine whether their status should be revised. This review could result in species being reclassified from endangered to threatened or visa versa, or candidate species (those proposed for listing in the past) being listed as endangered or threatened. One such species that exists in the metropolitan area is the lower Columbia River Coho Salmon.

[1] The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. 16 USC 1532(19).

Numerous other fish and wildlife species and species of concern may also be found in the Metro region. These include as listed species: Aleutian Canada goose and Peregrine falcon; species of concern: Pacific western big-eared bat, Northwestern pond turtle, Tricolored blackbird, Olive-sided flycatcher, Little willow flycatcher, Northern red-legged frog, Long-eared myotis (bat), Fringed myotis (bat), Long-legged myotis (bat), Yuma myotis (bat), Green sturgeon and Pacific lamprey.

Table A-1: Endangered Species Act status of West Coast salmon & steelhead

Species	ESU (Date)	Status
Coho Salmon	Lower Columbia River/Southwest WA ESU (7/95)	Proposed
Chinook Salmon	Snake River Fall-run (4/92)	Threatened
	Snake River Spring/Summer-run (4/92)	Threatened
	Lower Columbia River (3/99)	Threatened
	Upper Willamette River (3/99)	Threatened
	Upper Columbia River Spring-run (3/99)	Endangered
Chum Salmon	Columbia River (3/99)	Threatened
Sockeye	Snake River (11/91)	Endangered
Steelhead	Upper Columbia River (8/97)	Endangered
	Snake River Basin (8/97)	Threatened
	Lower Columbia River (3/98)	Threatened
	Upper Willamette (3/99)	Threatened
	Middle Columbia River (3/99)	Threatened

The listing of species as threatened or endangered triggers a requirement for the responsible federal agency to create a recovery plan for that species or their habitat. NOAA Fisheries lists threatened and endangered species by Evolutionarily Significant Units (ESU) which encompass geographic areas that may include multiple river basins. For recovery planning purposes, NOAA Fisheries has combined five ESUs into the Columbia Basin "recovery domain" for listed salmonids. The Willamette River Basin is part of that recovery domain. Recovery planning must address problems at both the ESU scale and the smaller scale of independent populations of fish. For example, NOAA Fisheries has identified independent populations of threatened steelhead in the McKenzie, Calapooia, Santiam and Clackamas river basins.

NOAA Fisheries is currently developing recovery plans for listed salmonid species. As explained in more detail below, much of that work will be accomplished through the Northwest Power Planning Council's subbasin planning process. While it is anticipated that the recovery plans will be detailed and comprehensive, the measures identified by the plans will apply only to federal actions, or actions that have a federal nexus (i.e., federally funded). Strictly speaking, individuals and state and local governments are not bound by these recovery plans. However, the recovery plans are likely to represent the best guidance for conducting local actions that may have an adverse impact on the listed species. It may also be several years before the recovery plans are fully implemented. Until that time, local governments must implement their own measures to avoid taking listed species. These measures can take the form

of a section 4(d) limit, a section 10 habitat conservation plan, or modifying regulation of local land development to minimize the risk of take.

Metro's inventory of regionally significant fish and wildlife habitat has identified habitat upon which listed salmonids depend for some part of their life histories. Coordinating Metro's program with NOAA Fisheries recovery plan as it is developed will not only assist in long-term recovery of the species, but also with local compliance with the ESA.

Clean Water Act (CWA)

The Clean Water Act (CWA) sets a national goal to "restore and maintain the chemical, physical and biological integrity of the Nations waters." 33 U.S.C.A. 1251. In Oregon, the CWA is implemented by the Department of Environmental Quality (DEQ) with review and approval by the U.S. Environmental Protection Agency (EPA). The DEQ has the responsibility for protecting the beneficial uses of rivers, streams and lakes of the state. Beneficial uses include drinking water, cold water fisheries, industrial water supply, recreation and agricultural uses. The DEQ carries out this responsibility in part by identifying those water bodies which are not meeting current water quality standards. This inventory is commonly referred to as the section 303(d) list. The 1998 303(d) list included over two hundred miles of rivers and streams in the Metro region which did not meet water quality parameters for one or more pollutants. For the entire state, about 5,000 miles of water quality limited rivers and streams have been added to the 303(d) list since 1998.

For waters identified on the 303(d) list, DEQ must develop total maximum daily loads (TMDL) for those pollutants that exceed water quality standards. These TMDLs apply to both point sources (end of pipe) and nonpoint sources (no specific origin). The daily load allocations become part of plans at the watershed scale intended to meet water quality standards. Depending upon where the watershed is located, different state agencies, local governments and land owners will be responsible for developing the water quality plans. In urban areas, local governments, watershed councils, landowners and stakeholders will likely be the parties responsible for such plans.

In addition to developing water quality plans in connection with TMDLs, some cities and counties are also responsible for stormwater management. Generally, large cities, smaller cities within urbanized areas, and cities outside urbanized areas with populations over 10,000 are required to have permits to operate municipal separate storm sewer systems that discharge into surface waters of the state. These permits require cities to implement water quality protections for their municipal operations and for construction and post construction run-off control from urban development.

Beginning in December 2002, individual projects that disturb one or more acres of land need National Pollutant Discharge Elimination System (NPDES) 1200-C general permit coverage. These permits govern stormwater discharges. One of the requirements of these permits is an erosion and sediment control plan that applies before during and after construction. The plan must demonstrate how erosion will be controlled and limited so that sediment does not have an adverse impact on receiving water bodies.

While Metro does not have responsibility or authority to regulate water quality, the Title 3 water quality land use requirements are already consistent with many DEQ rules. Metro's fish and wildlife program will further assist the region with improving water quality for the beneficial use of supporting cold water fisheries.

Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act)

The 1980 Northwest Power Act requires the Bonneville Power Administration ("BPA") to implement a Fish and Wildlife Program that mitigates for the degradation to both fish and wildlife habitat caused by the Columbia Hydropower System. Complying with the Fish and Wildlife Program is achieved primarily through subbasin plans developed with oversight from the Northwest Power Planning Council. The subbasin plans consist of three parts: (1) a subbasin assessment describing existing and historic resource conditions, (2) an inventory if existing activities, and (3) a management plan that addresses the key limiting factors in the subbasin. A "lead entity" is contracted to coordinate the subbasin planning. The BPA provides funding for producing the subbasin plan, technical assistance related to the plan, and ultimately for on-the-ground projects that implement the plan.

The connection between NPPC subbasin planning and NOAA Fisheries recovery planning for listed salmonids has recently been strengthened. The Regional Administrator for NOAA Fisheries envisions that subbasin plans will become components of federal recovery plans. NOAA Fisheries and NPPC collaborated on developing a Technical Guide for Subbasin Planners with the intent of enabling those planners to produce a subbasin plan that would satisfy local recovery plan requirements under the ESA.

The NPPC has contracted with the Willamette Restoration Initiative (WRI) to coordinate the creation of the Willamette Subbasin Plan. The subbasin planning process accommodates and encourages participation by watershed councils, stakeholders, and local governments. The information generated by Metro's Fish and Wildlife Habitat Conservation program will be valuable to that planning process and contribute as a building block of NOAA Fisheries recovery plan. Coordination between Metro and WRI on the subbasin planning will be extremely important because the subbasin plan will prioritize needs and projects in the Lower Willamette and Clackamas River basins that will potentially qualify for federal funding support, and will constitute local components of NOAA Fisheries recovery plan for listed salmonids.

The Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act was originally passed in 1976 and amended by the Sustainable Fisheries Act of 1996. These statutes require federal agencies to consult with NOAA Fisheries on activities that may adversely affect "essential fish habitat" ("EFH"). The Magnuson – Stevens Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity."

The Pacific Fishery Management Council has identified EFH for the pacific coast salmon fishery. Those areas generally include "those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to

a healthy ecosystem."[2] To meet that goal, EFH must include all streams, lakes, ponds, wetlands and the habitat historically accessible to salmon in Washington, Oregon, Idaho and California. The Sandy River, Clackamas River, Tualatin River, and Lower Willamette River basins have all been identified as EFH for chinook and coho salmon. These basins include streams and habitat in urban areas.

The Magnuson – Stevens Act does not contain requirements for state, local or private entities. NOAA Fisheries typically considers EFH at the same time it conducts ESA Section 7 consultations. However, the Pacific Fishery Management Council considers EFH to be a common interest among all parties, and a tool to promote healthy and sustainable coastal fisheries.

State Policy

Oregon Plan for Salmon and Watersheds

The mission of the Oregon Plan for Salmon and Watersheds is "to restore our native fish populations – and the aquatic systems that support them – to productive and sustainable levels that will provide substantial environmental, cultural and economic benefits." It was initiated in 1995 to address restoration of coastal coho salmon. In April 1997, the Oregon Legislature incorporated other related efforts into one overarching framework: "The Oregon Plan for Salmon and Watersheds." It is designed to restore the healthy function of Oregon's natural aquatic systems. It represents commitments on behalf of government, interest groups and private citizens from all sectors of the State.

The local watershed councils are the bedrock of the Oregon Plan. The councils are composed of citizens who are concerned about their rivers and watersheds. They are formed and operate according to two principles adopted by the Legislature: 1) that the watershed council be a voluntary, local group, and 2) the council represents a balance of interested and affected persons within the watershed. The primary tasks of a watershed council are to conduct an assessment of the watershed and create an action plan for improving the watershed.

Six watershed councils are currently operating in the Metro region: Columbia Slough Watershed Council, Sandy River Basin Watershed Council, Clackamas Basin Watershed Council, Tualatin River Watershed Council, Tryon Creek Watershed Council, and Johnson Creek Watershed Council. Each of these groups is funded to some degree by the Oregon Watershed Enhancement Board (OWEB). In addition to doing their assessment and action plans, these watershed councils do a heroic amount of community outreach and education. Close cooperation between Metro and the watershed councils will fulfill the purpose of the Oregon Plan and help identify key restoration opportunities that are important to those communities in the region.

There is a Willamette Chapter to the Oregon Plan for Salmon and Watersheds. In 1998 former Governor John Kitzhaber founded Willamette Restoration Initiative (WRI) by appointing a diverse group of business, government, farming, conservation and community representatives to serve on a board. The group was charged with identifying the means to address the Willamette River's many problems from water quality to lost habitat. In February 2001, the Willamette

[2] Identification and Description of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon, Pacific Fishery Management Council, 1999.

Restoration Initiative published its "Willamette Restoration Strategy" which is the Willamette Chapter of the Oregon Plan. The Strategy identifies 27 critical actions that are necessary in the Willamette River Basin to improve the river and its ecosystems. The recommendations from the Strategy will strongly influence local plans that seek to protect natural resources in and along the Willamette River.

Native Fish Conservation Policy

In November 2002, the Oregon Fish and Wildlife Commission adopted the Native Fish Conservation Policy. The purpose of the policy is: "to ensure the conservation and recovery of native fish in Oregon." OAR 635-007-0502. The policy focuses on "naturally produced native fish" which are those fish species that "reproduce and complete their full life cycle in natural habitats." OAR 635-007-0501(33). The reason for this focus on naturally produced fish is that those "native fish are the primary basis for Endangered Species Act delisting decisions and the foundation for long-term sustainability of native species and hatchery programs."

The Oregon Department of Fish and Wildlife is responsible for developing conservation plans for native fish species with priority on those species listed under the state ESA or as state "sensitive species." OAR 635-007-0505(3). The conservation plans will use the Oregon Plan for Salmon and Watersheds and input from "local and regional forums" as the context for the development, implementation, and coordination of the plans. Although Metro's fish and wildlife program is not restricted to protecting native fish species, the program will offer some protection to the habitats upon which native fish depend and provide an opportunity to coordinate with ODFW on applicable conservation plans.

Oregon Endangered Species Rules

The Oregon Endangered Species Act is intended to manage the listed "species and their habitats so that the status of the species improves to a point where listing is no longer necessary." Species are listed under the state act when: (1) they are native, and (2) they are in danger of extinction throughout any significant portion of its range within this state (endangered) or (3) likely to become an endangered species within the foreseeable future throughout any significant portion of its range within this state (threatened). OAR 635-100-0105(3). The state act also lists a species as "sensitive" when the "wildlife species, subspecies, or populations that are subject to a decline in number of sufficient magnitude to qualify their listing as Threatened due to loss in quantity or quality of habitat or other factors." OAR 635-100-0001(4).

The Oregon Department of Fish and Wildlife (ODFW) is required to develop survival guidelines for certain threatened or endangered species. The survival guidelines include water quality, water quantity and habitat requirements that apply on state property. The state act requires any agency in charge of state owned property to consult with ODFW to ensure that all actions on such property are consistent with the survival guidelines developed for affected species. OAR 635-100-1030. Lower Columbia River Coho salmon are listed as endangered under the state act and ODFW has adopted survival guidelines for the coho. At the time of listing, the species was only found in the Clackamas and Sandy River basins. Lower Columbia River Coho are candidate species for listing under the federal ESA.

Oregon Wetland Regulatory Program

The Oregon Division of State Lands (DSL) administers Oregon's removal/fill law (ORS 196.800-196.990). Using similar definitions as the federal government, DSL determines wetland boundaries and water bodies that meet the definition of "waters of the state." A permit is required for fill equal to or exceeding 50 cubic yards or more of material in any waters of the State at one location. Likewise, a permit is required for removal of more than 50 cubic yards of material in any waters of the state in any calendar year. Waters of the state means natural waterways including all tidal and nontidal bays, intermittent and constantly flowing streams, lakes, wetlands, and other bodies of navigable and non-navigable water.

Oregon Division of State Lands Essential Indigenous Anadromous Salmonid Habitat

In an effort to identify and protect essential habitat for salmon and trout, the Oregon Legislature in 1993 required the DSL to identify essential indigenous anadromous salmon habitat. DSL has defined such habitat as: "habitat that is necessary to prevent the depletion of indigenous anadromous salmonid species during their life history stages of spawning and rearing." OAR 141-102-0020(1). The agency has mapped essential habitat throughout the state. The essential habitat designation carries with it a requirement for a "permit for activities involving the fill or removal of any amount of material in essential habitat, unless the activity is exempt" by state law. OAR 141-102-0000(3).

Regional Policy

Several policies adopted by the Metro Council with the direction of citizens in the region influence the ESEE consequences analysis. These policies provide the framework for protecting natural resources while managing urban growth in the region. Natural resources, including riparian corridors and water quality, play a key role in the livability of the Metro region. Key policies are described below.

Metro Charter

Metro's 1992 Charter requires Metro to address issues of regional significance such as land use and transportation planning as well as regional parks and open spaces. Through its Charter-mandated responsibilities, the Metro Council has provided leadership in addressing growth management issues by working with citizens, elected officials and diverse interest groups to craft a vision of how the region will grow and to adopt policies to achieve that vision. In the course of debating how growth will be managed, the Metro Council identified the protection of natural systems – floodplains, rivers, streams and wetlands – as a cornerstone for these regional policies. Metro has determined in the *Region 2040 Growth Concept* that protecting these systems is essential to maintaining the region's livability and economic well being as well as providing habitat, water quality and flood management benefits.

Metro's role in identifying natural resource protection measures and incentives within its boundary has been established with adoption of the *Regional Urban Growth Goals and Objectives (RUGGOs), Region 2040 Growth Concept* and the *Urban Growth Management Functional Plan*. Natural resources by their very nature cross jurisdictional boundaries and are best managed with regional, watershed-wide protection strategies. Metro has a role in working with local jurisdictions to determine the protection of these important resources, just as it determines parking standards, transportation networks and land use densities for the region. Through extensive public involvement, the Metro Council has identified the need to balance

natural resource protection with urban development while the region grows. If coordination with citizens and elected officials outside of the Metro area can be achieved, natural resource protection can be ensured for entire watershed systems.

Future Vision Report

The 1992 Metro Charter required Metro to develop and consider a vision for the region's future development. Metro's 1995 *Future Vision Report* recognizes the region's unique ecosystem and the value of improved air and water quality. It states that the region should manage watersheds to protect, restore and maintain the integrity of streams, wetlands and floodplains, and their multiple biological, physical and social values. It also states that "…We value natural systems for their intrinsic value, and recognize our responsibility to be stewards of the region's natural resources." It identifies the need for "…restored ecosystems protected from future degradation and decline." While not a regulatory document, the *Future Vision Report* has greatly influenced the content of Metro's regional plans.

Regional Urban Growth Goals and Objectives

Metro's Regional Urban Growth Goals and Objectives (RUGGO), amended in 1995, identify goals and planning activities for the Metro region. Several RUGGO chapters relate to watersheds and riparian corridors. Two chapters relate to water resources: Objective 12: Watershed Management and Regional Water Quality and Objective 13: Urban Water Supply. Objective 12.1 states: "Metro will develop a long-term regional strategy for comprehensive water resources management, created in partnership with the jurisdictions and agencies charged with planning and managing water resources and aquatic habitats. The regional strategy shall meet federal and state water quality standards and complement, but not duplicate, local integrated watershed plans."

Objective 15: Natural Areas, Parks, Fish and Wildlife Habitat calls for an open space system capable of sustaining or enhancing native wildlife and plant populations. It recognizes the need for a regionwide system of linked significant wildlife habitats and states that this system should be preserved, restored where appropriate, and managed to maintain the region's biodiversity. The *Region 2040 Growth Concept* included a 200-foot environmental greenway along all streams in the region to ensure connectivity throughout the natural landscape. The Land Conservation and Development Commission (LCDC) acknowledged the RUGGOs for compliance with the statewide planning goals in 1996.

The Stream and Floodplain Protection Plan (Title 3)

Title 3, the *Stream and Floodplain Protection Plan*, (1996 *Urban Growth Management Functional Plan*) establishes regional performance standards to address water quality and floodplain management and recommends actions for the protection of fish and wildlife habitat. In June 1998, the Metro Council adopted revisions to Title 3, including water quality and floodplain maps that show where Title 3 applies. Section 5 of Title 3 (which was essentially unchanged by the 1998 amendments) directed Metro staff to address fish and wildlife habitat. The purpose of Section 5 is to: "conserve, protect and enhance fish and wildlife habitat within the fish and wildlife habitat conservation areas to be identified on the water quality and flood management area map by establishing performance standards and promoting coordination by Metro of regional urban watersheds." The completed sections of Title 3 meet the requirements for Statewide Planning Goal 6 (water quality) and Goal 7 (flood management), while Section 5

relates to Goal 5. LCDC acknowledged the water quality and floodplain protection components of Title 3 for compliance with Goals 5, 6 and 7 in 2000.

Greenspaces Master Plan

The Metro Greenspaces Master Plan, adopted by Metro Council in 1992, articulated the vision for a cooperative, interconnected system of parks, natural areas, trails and greenways for fish, wildlife and people. The Master Plan recommended tools to protect greenspaces such as acquisition, education and restoration. In 1995, voters passed Bond Measure 26-26 directing Metro to purchase regionally significant natural areas. Since then over 9,000 acres of natural areas have been acquired for permanent protection. Metro's Parks and Greenspaces Department also provides education programs and works to restore its properties.

Local Goal 5 programs

Most of the local jurisdictions in the Metro region have adopted Goal 5 programs that have been acknowledged by the Department of Land Conservation and Development as being in compliance with the state rule. Some of these programs were developed prior to Goal 5 rule revisions in 1996, while a few have been done more recently. The rule requires local jurisdictions to balance the need to protect natural resources against other state goals such as housing (Goal 10) and transportation (Goal 12) while providing ample opportunity for citizen involvement (Goal 1). Thus, the state rule allows local jurisdictions' Goal 5 programs to be in compliance with state law while being inconsistent with each other. However, Metro's code required an analysis of the consistency of local natural resource protection prior to conducting a regional ESEE analysis and a regional protection program.

Metro staff conducted an analysis of local Goal 5 programs beginning in 1999 and culminating in a report (*Local Plan Analysis: A Review of Goal 5 Protection in the Metro Region)* to the Metro Council in August 2002. The local plan analysis demonstrated that there are many inconsistencies and inadequacies in natural resource protection in the Metro region. An important reason for the inconsistency in local protection is that the Goal 5 rule does not set a specific standard, rather it lays out a process for jurisdictions to follow. The process described by state law allows jurisdictions to choose which resources to protect and the level of protection received after balancing the consequences of protection with the economic, social, and energy needs within the jurisdiction. Most jurisdictions choose to "limit" conflicting uses in resource areas, the Goal 5 Rule defines this choice as "conflicting uses should be allowed in a limited way that protects the resource to the desired extent." This language gives local governments wide discretion in designing protection programs.

If protecting natural resources is an important piece of maintaining livability within the region, as stated in Metro's Regional Urban Growth Goals and Objectives (RUGGOs), then it is critical to provide a more consistent level of protection throughout the region. This ESEE analysis identifies the tradeoffs of allowing, limiting, or prohibiting development consistently across the region.

Appendix B

Portland Metro Area – DEQ's 303 (d) Listed Pollutants of TMDLs

APPENDIX B
Portland Metro Area – DEQ's 303 (d) Listed Pollutants of TMDLs as per the 1998 Listing of Water Quality Limited Waterbodies.

TMDL	303 (D) LISTED POLLUTANTS
Lower Columbia River – Tenasillahe Island to Willamette River	Bacteria, Dissolved Oxygen, pH, Temperature, Total Dissolved Gas (from Dams), Arsenic, PCB, DDE, DDT
Lower Columbia River –Willamette River to Bonneville Dam	pH, Temperature, Total Dissolved Gas (from Dams), Arsenic, PCB, DDE, DDT
Lower Columbia – Sandy River	Temperature
Clackamas River -- Mainstem	Temperature
Clackamas River – Fish Creek	Habitat Modification
Lower Willamette -- Blue Lake	Aquatic Weeds or Algae, pH
Lower Willamette -- Bybee Lake	Aquatic Weeds or Algae, Biological Criteria, Flow Modification, Habitat Modification, pH
Lower Willamette -- Columbia Slough	Bacteria, Chlorophyll a, Dissolved Oxygen, Nutrients, pH, Temperature, DDE, DDT, PCBs, 2,3,7,8 TCDD (Dioxin), Lead
Lower Willamette -- Fairview Creek	Bacteria, Nutrients, pH
Lower Willamette -- Fairview Lake	Nutrients
Lower Willamette -- Johnson Creek	Bacteria, Temperature, DDT, Dieldrin
Lower Willamette -- Smith Lake	Aquatic Weeds or Algae, Biological Criteria, Flow Modification, Habitat Modification, pH
Lower Willamette -- Spring Brook Creek	Bacteria
Lower Willamette -- Tryon Creek	Temperature
Willamette River Mainstem – Mouth to Willamette Falls	Bacteria, Biological Criteria, Temperature, Mercury, Pentachlorophenol, Arsenic
Tualatin Basin – Ash Creek	Bacteria, Biological Criteria, Dissolved Oxygen, Temperature
Tualatin Basin – Beaverton Creek	Bacteria, Biological Criteria, Dissolved Oxygen, Temperature
Tualatin Basin – Bronson Creek	Bacteria, Biological Criteria, Chlorophyll a, Dissolved Oxygen, Temperature
Tualatin Basin – Burris Creek	Bacteria, Chlorophyll a, Dissolved Oxygen
Tualatin Basin – Butternut Creek	Bacteria, Biological Criteria, Dissolved Oxygen, Temperature
Tualatin Basin – Carpenter Creek	Bacteria, Dissolved Oxygen
Tualatin Basin – Cedar Creek	Bacteria, Chlorophyll a, Dissolved Oxygen
Tualatin Basin – Cedar Mill Creek	Bacteria, Biological Criteria, Temperature
Tualatin Basin – Chicken Creek	Bacteria, Dissolved Oxygen
Tualatin Basin – Christenson Creek	Bacteria, Dissolved Oxygen
Tualatin Basin – Council Creek	Dissolved Oxygen
Tualatin Basin – Dairy Creek	Bacteria, Dissolved Oxygen, Temperature, pH
Tualatin Basin – Fanno Creek	Bacteria, Chlorophyll a, Dissolved Oxygen, Temperature, Arsenic, Manganese, Iron
Tualatin Basin – Gales Creek	Bacteria, Dissolved Oxygen, Temperature, pH
Tualatin Basin – Hall Creek	Bacteria, Dissolved Oxygen
Tualatin Basin – Heaton Creek	Bacteria
Tualatin Basin – Hedges Creek	Bacteria, Biological Criteria, Dissolved Oxygen, Temperature
Tualatin Basin – Johnson Creek	Bacteria, Biological Criteria, Dissolved Oxygen, Temperature
Tualatin Basin – McFee Creek	Bacteria, Dissolved Oxygen
Tualatin Basin – McKay Creek	Bacteria, Temperature
Tualatin Basin – Nyberg Creek	Bacteria, Chlorophyll a, Dissolved Oxygen, Temperature
Tualatin Basin – Rock Creek	Bacteria, Biological Criteria, Chlorophyll a, Dissolved Oxygen, Temperature
Tualatin Basin – Scoggins Creek	Dissolved Oxygen
Tualatin Basin – Summer Creek	Bacteria, Biological Criteria, Dissolved Oxygen, Temperature
Tualatin Basin – Willow Creek	Bacteria, Dissolved Oxygen, Temperature
Tualatin River – Mainstem	Bacteria, Temperature

Courtesy Don Yon, Oregon DEQ, 2003.

APPENDIX B
Portland Metro Area – DEQ's 303 (d) Listed Pollutants of TMDLs as per the 2002 Listing of Water Quality Limited Waterbodies.

TMDL	303 (D) LISTED POLLUTANTS
Clackamas River -- Mainstem	*E. coli*, Temperature
Willamette River -- Mainstem	Aldrin, Biological Criteria, DDT, DDE, Dieldrin, Fecal Coliform, Iron, Manganese, Mercury, PCB, Pentachlorophenol, Polynuclear Aromatic Hydrocarbons (PAHs), Temperature
Lower Columbia – Sandy River	Dissolved Oxygen, *E. coli*, Temperature
Willamette River -- Smith Lake	Aquatic Weeds or Algae, pH
Willamette River -- Blue Lake/Arata Creek and Bybee Lake	Aquatic Weeds or Algae, pH
Willamette River -- Columbia Slough	Iron, Manganese, Temperature
Willamette River -- Fairview Lake/ Osburn Creek	PH
Willamette River -- Johnson Creek	DDT, Dieldrin, Fecal Coliform, PCB, Polynuclear Aromatic Hydrocarbons (PAHs), Temperature
Willamette River -- Spring Brook Creek	Temperature
Willamette River – Kellogg, Mt. Scott, and Phillips Creeks	*E. coli*
Willamette River – Tryon Creek	Temperature
Tualatin Basin – Knoll Wetland	Chromium, Copper, Lead, Silver, Zinc

Courtesy Don Yon, Oregon DEQ, 2003.

Note: This list is shorter than the 1998 list not because water quality has improved, but because TMDLs were developed for many 303(d)-listed reaches.

APPENDIX C

Economic Report and Literature Review

Final Report for the Economic Portion of Metro's Goal 5 ESEE Analysis

October 2004

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SUMMARY

This report is part of Metro's Goal 5 analysis of the economic, social, environmental and energy (ESEE) consequences of developing or protecting riparian and upland-wildlife resources. This final report describes the economic tradeoffs of allowing, limiting or prohibiting development of resources in Metro's service area. Following the conclusion of the ESEE analysis Metro will develop and evaluate the details of Goal 5 program options to protect resources. The appropriate context for considering this report, therefore, is as an interim report about possible methods, *not* as a final report that evaluates proposed policy options. This is not a report on the costs and benefits of protection measures at the local or parcel level. The report describes the economic tradeoffs of allow, limit and prohibit decisions qualitatively and on a regional scale.

Our analysis included the following analytical tasks:

- Rank the lands that contain riparian and upland-wildlife resource using the land's development value. In consultation with Metro staff and Metro's Economic Technical Advisory Council ("ETAC") we develop three methods of ranking the relative importance of land for development: land value, employment, and the 2040 Design Types.
- Compare development importance with Metro's rankings based on the amount and types of ecological functions or wildlife characteristics the lands provide. Comparing the rankings of development importance with rankings for riparian and wildlife importance provides information on the amount and distribution of significant conflicts between development use and resource protection.
- Describe the current land-use status of lands that contain riparian and upland-wildlife resources. Some of these lands have already been developed. Other lands are vacant, but development will be constrained by existing protection measures (e.g., Title 3) or characteristics of the land (e.g., steep slopes). Development status affects the economic analysis because it can influence the type, amount and timing of economic tradeoffs of protection decisions.
- Describe the economic tradeoffs of allow, limit, and prohibit decisions as they relate to the development use of lands and protecting the riparian and wildlife resources.
- Our analysis includes a review of the professional literature on the economic value of land in development and preservation.

The economic principles most relevant to our analysis:

- Market prices for land reflect potential development values. Participants in a market can measure or rank the development importance of land using property values.
- Ecosystem services benefit society and have economic value. Actions that enhance or protect these services also enhance or protect the associated societal benefits and values. Actions that degrade ecosystem services will have the opposite effect.
- Property markets capture some but not all of the value of ecosystem services. Markets typically do not reflect the value of ecosystem services provided by natural resource, such as flood-mitigation or filtering sediment from stormwater runoff.
- Property markets may not capture public-policy or planning goals. For example, public policy may proscribe specific land uses in a specific area (e.g., water-dependent industrial use), that, if left to property markets, would develop into higher-valued land uses (e.g., water-front, large-lot residential developments).
- There's competition for the riparian and upland-wildlife resources at issue in this study. Resources, especially in urban areas, cannot satisfy the complex and competing demands that society places on them. Allocating resources to one use means that competing uses go without, with the associated economic benefits and costs of the allocation decision.
- A static analysis likely will fail to inform decisionmakers adequately of the economic tradeoffs. This approach assumes no changes in factors that could mitigate negative outcomes and encourage positive outcomes. An alternative approach that considers how changes or adjustments—examples in this case include expanding the Urban Growth Boundary (UGB) or restoring degraded riparian areas—affect the economic outcomes will likely provide a more complete descriptions of tradeoffs.

Comparing the different methods of ranking lands and current land uses yields the following interactions:

- Less than 25 percent of the lands that contain Goal 5 resources are vacant and available for development. Goal 5 decisions will have the most immediate impacts on these lands because development is unconstrained by other factors.
- Over 60 percent of resource acres are on lands already maintained as parks or already developed with urban uses. Goal 5 decisions may affect these lands in the future through redevelopment, though impacts on parks lands are expected to be minimal compared to impacts on land in urban development.
- In the short-term, Goal 5 decisions will have the greatest impact on the 22 percent of resource lands that are undeveloped and

unconstrained by Title 3 or other rules. These lands also contain a significant amount, 41 percent, of the total vacant-buildable lands in the UGB.

- Over 80 percent of the land uses that potentially conflict with Goal 5 riparian and upland-wildlife resources occur in three regional zones: single-family residential (SFR), parks and open space (POS), and industrial (IND).

- SFR contains the largest percentage of Goal 5-resource lands, over 46 percent. Goal 5 allow, limit and prohibit decisions likely will fall most heavily on lands in this zoning.

- Lands zoned POS account for approximately 20 percent of Goal 5 natural resources.

- Over 14 percent of the lands with Goal 5 natural resources are zoned IND.

- The majority of lands with Goal 5 resources do not support employment. Less than 22 percent of the lands are zoned for commercial, industrial or mixed-use.

- The zoning for a majority of resource lands, approximately 64 percent, supports development value. The remainder fall into POS zoning or contain water bodies. Of the lands with development value, most fall into the "low" land-value category.

- Approximately 78 percent of the resources lands do not support employment. These lands are zoned SFR, MFR, RUR, and POS. Of the lands that do support employment, most fall into the "low" employment category.

- The distribution of resource lands by 2040 Design Type differs from the distributions described above for land value and employment. In general, categorizing lands using 2040 Design Types yields a distribution with a greater percentage of the lands having development value, and for the lands that have development value, more of the lands rank in the higher-valued design types.

- The large majority of Goal 5 allow, limit and prohibit decisions will impact lands zoned SFR, POS and IND. Impacts on lands zoned SFR and POS will have little or no employment impacts and will affect lands ranked "low" on the land-value scale. The majority of impacts on lands zoned IND will affect lands ranked "high" on at least one measure of development value.

- The fact that Goal 5 decisions would primarily affect acres with lower land values and employment densities does not mean that economic

consequences of limit or prohibit decisions would be trivial. The "low" category of land value and employment is relative to values and employment in the Portland city center. The cumulative property value or number of employees affected may be significant depending on the type of decision, the details of the Goal 5 plan that implements the decision, actions that may mitigate the negative impact (e.g., expanding the UGB), and specifics of the individual parcels affected.

- Given the volume or amount of riparian and upland-wildlife resources at issue, and the quality of the resources, the Goal 5 programs that protect these resources may have significantly positive impacts on the values of ecosystem services provided by these resources. These programs may protect services such as flood management, water quality, amenity, and salmon-habitat values across a broad area that may affect residents through out the UGB and downstream from the UGB. Protecting these ecosystem services may also reduce municipal expenditures to provide these same services, especially over the long term.

We describe three categories of economic consequences of Goal 5 decisions:

1. The changes in the values of the goods and services citizens receive. We label these consequences *economic values*. The economic values at issue in this analysis include the impact of Goal 5 decisions on property values and the values of ecosystem goods and services provided by riparian and wildlife areas.

2. The changes in the levels of economic activities within the local economy, in particular, the impact on the level of local employment and income. We label these consequences *economic impacts*.

3. The changes in the distributions of costs and benefits within the economy, especially changes affecting groups of special concern such as property owners that shoulder a disproportionate amount of the negative consequences of a policy decision. We label these consequences *economic equity.*

Allowing conflicting uses means no additional protection of Goal 5 riparian or upland-wildlife resources beyond the baseline protection provided by Title 3, or by local protection measures that exceed Title 3 guidelines. This alternative emphasizes developing lands containing Goal 5 resources. Positive economic tradeoffs of this alternative include:

- No impediments to development or impacts on the development value of land.
- Development-related employment, income and taxes will be unaffected by Goal 5.

- No Goal-5 related increase in Vehicle Miles Traveled (VMT), transportation costs or UGB expansion because Goal 5 protection does not displace development within the UGB.

Negative economic tradeoffs include:

- Amenity-related property values and associated property taxes for undeveloped lands zoned SFR and RUR that are adjacent to Goal 5 resource lands may be less for this scenario relative to limit and prohibit scenarios.
- Flood-mitigation services will decline, flood damage and clean-up costs may increase.
- Erosion and sedimentation will increase, as will concentration of toxins in streams and other water bodies. Water-quality expenditures (e.g., for filtration and treatment) by businesses and municipalities may increase. Municipal expenditures that address water-quality regulations (e.g., the federal Clean Water Act) may increase.
- Summer temperatures and the urban "heat island effect" may increase with an associated increase in cooling costs.
- Developing riparian and upland-wildlife resources will increase the amount of impervious surfaces, which will increase stormwater flows and treatment costs.
- Development that negatively impacts salmon habitat may affect commercial, recreational and cultural harvests. Municipal expenditures that address habitat regulations (e.g., Endangered Species Act) may increase.
- Degrading riparian and upland-wildlife resources may negatively affect recreational opportunities and values that depend on these resources.
- Developing the resources may negatively impact their intrinsic values.
- Developing Goal 5 resources now or in the near-term precludes developing them in the future or protecting them for future generations. This reduces the option values associated with the resources.
- Carbon sequestration and air pollutant removal will decline with an associated decline in air quality and the related values of air-quality services.
- Businesses that rely on riparian and upland-wildlife resources and associated ecosystem services may experience a decline in employment and income. Employment and business-related tax payments may also decline.
- Allowing conflicting uses will negatively affect the 2040 Growth Concept and Design Types that emphasize protecting resources and maintain access to resources.

- The large majority, if not all, of the negative economic tradeoffs of this option affect riparian and upland-wildlife areas, associated ecosystem services and economic factors, e.g., jobs, incomes and values, that depend on these resources. Development interests suffer little or no negative economic tradeoffs.

Limiting conflicting uses strikes a balance between completely developing the Goal 5 riparian and upland-wildlife resources and protecting them. This alternative provides opportunities including: developing lands in ways that minimize negative environmental and economic tradeoffs; supporting the development goals embodied by the 2040 Design Types; and protecting the most important habitats.

The economic tradeoffs for this alternative depend on the degree of limitation on development actions: lightly limit, moderately limit, or strictly limit. Lightly-limit treatments will have more in common with allow treatments than with prohibit treatments. The opposite will be the case for strictly-limit treatments. As the name implies, tradeoffs for the moderately-limit treatment will fall somewhere in between.

This scenario will generate a mix of positive and negative economic tradeoffs for development interests and for the resources and associated ecosystem services. Development will occur, with the associated positive impacts on property values, employment, income, and tax payments. However, these impacts will be less than for the allow scenario. The resources will likely suffer some degradation, but not to the extent generated under the allow scenario. The resource-related economic values and impacts will also increase.

The consequences for the 2040 Design Types will be mixed. Protecting resources to a greater extent, compared with the allow scenario, may increase VMT if protecting resources displaces development and pushes it out toward the UGB or beyond. This may also increase the next UGB expansion and transportation costs. However, protecting riparian and upland-wildlife resources is consistent with the planning goals reflected in the Design Types.

The limit scenario will generate a more equitable distribution of positive and negative economic tradeoffs, compared with either the allow or prohibit scenarios. Development interests and the resources will both experience positive and negative economic tradeoffs.

Prohibiting conflicting uses will prevent development actions that conflict with, or degrade, Goal 5 riparian and upland-wildlife resources. This scenario emphasizes resource protection. Protection measures will exceed the baseline protection provided by Title 3, or by local protection measures that exceed Title 3 guidelines.

Positive economic tradeoffs of this alternative include:

- Amenity-related property values and associated property taxes for lands zoned SFR and RUR that are adjacent to Goal 5 resource lands may be greater for this scenario relative to limit and allow scenarios.
- This alternative will provide the greatest amount of flood-mitigation services and value.
- Erosion and sedimentation will be less than limit or allow alternatives, as will concentration of toxins in streams and other water bodies. Water-quality expenditures (e.g., for filtration and treatment) by businesses and municipalities may be the least under this alternative. Municipal expenditures that address water-quality regulations (e.g., the federal Clean Water Act) may decline, especially over the long term.
- This alternative will have the greatest mitigating effect on summer temperatures, the urban "heat island effect," and associated cooling costs.
- Prohibiting development in Goal 5 riparian and upland-wildlife resources will generate the least amount of impervious surfaces, and will generate the least amount of stormwater flows and treatment costs.
- This scenario will protect the greatest amount of salmon habitat and may positively affect commercial, recreational and cultural harvests. Municipal expenditures that address habitat regulations (e.g., Endangered Species Act) may decline, especially over the long term.
- This alternative will preserve the greatest amount of recreational opportunities, and the associated recreational values.
- The intrinsic and options values for the riparian and upland-wildlife resources will be preserved.
- Maintaining the greatest amount of vegetation will maximize carbon sequestration, air pollutant removal and the related values of air-quality services.
- This alternative will provide the greatest support to businesses that rely on riparian and upland-wildlife resources and associated ecosystem services.
- Prohibiting conflicting uses will support the aspects of the 2040 Growth Concept and Design Types that emphasize protecting resources and maintain access to resources.

Negative economic tradeoffs include:

- This alternative will have the greatest negative impact on the development value of land.
- Development-related employment, income and tax payments will also suffer the greatest under this alternative.

- The large majority, if not all, of the negative economic tradeoffs of this alternative affect development interests. The economic values and activities supported by riparian and upland-wildlife resources suffer little or no negative economic tradeoffs, relative to allow and limit alternatives.

A static description of economic consequences assumes, for the most part, that the consequences are fixed without possibility of mitigating negative impacts or enhancing positive impacts. This view ignores alternatives that may influence the economic tradeoffs of Goal 5 decisions. A more dynamic view of likely consequences accounts for these factors.

These dynamic factors include:

- The substitutability of land use within the UGB. Moving proposed land uses that conflict with riparian and upland-wildlife resources to alternative locations may mitigate negative economic tradeoffs for both the land use and resources.
- Expanding the UGB. Protecting riparian and upland-wildlife resources may reduce the amount of developable land within the UGB. If this is the case, expanding the UGB could mitigate this loss while protecting riparian and upland-resources within the existing UGB.
- Encouraging development practices that minimize conflicts with resources may help mitigate negative economic tradeoffs for both development and resources. These practices include low-impact development projects that minimize impervious surfaces and manage stormwater in ways that more closely mimic natural systems.
- The extent of restoration efforts. Restoring already-degraded riparian and upland-wildlife habitat could offset a portion of the negative impact of new development on habitat elsewhere.

Implications of the economic analysis for developing Goal 5 program options include:

- The economic analysis identifies the major factors and impacts that decisionmakers can use to screen lands at a regional level to get a subset of lands to consider for some level of protection.

- The extreme ends of likely program options include: (1) Adopt no new policy to preserve riparian or upland-wildlife resources inside the UGB, and perhaps even eliminate some existing policies that restrict economic development in specific areas, e.g., water-dependent industrial development; and (2) Allow no new development on any identified resource lands. For political and economic reasons, neither of those options is likely to be the preferred option. Final program options will likely fall somewhere between the extremes.

- A program option that would generate the minimum negative economic impacts on local businesses would continue with and enforce existing regulations. No new Goal 5-related regulations or incentives for preservation would be implemented, but none of the existing ones would be eliminated. With this option, may of the riparian and upland-wildlife resources would eventually get some level of development, though the amount or configuration of the development may be restricted to the benefit of ecosystem services by existing policies, e.g., Title 3.

- A program option that provides some additional protection of significant resources beyond existing regulations would target restrictions on some types development on some types of properties. There's a large number of possible variations of these program options. One option starts with slightly limiting development on lands that ranked low on all three measures of development value that contain the highest quality riparian or wildlife resources. Or, slightly limiting development on these lands in combination with restoring degraded riparian and wildlife resources elsewhere.

- Another example is developing a program option that combines resource protection, as described above, with options that protect specific development values. For example, program options that protect development on lands that ranked high on all three measures of development value, or that protect development that can't be relocated in the UGB to avoid conflicts with significant resources, e.g., water-dependent industrial use.

1. INTRODUCTION

1.1 PURPOSE OF THIS REPORT

State land-use policies, as described by Goal 5: Open Spaces, Scenic and Historic Areas, and Natural Resources, requires that local governments protect important natural resources. Elements of the Goal 5 program include identifying resources, describing their biophysical significance, and evaluating the positive and negative tradeoffs of protecting the resources. Goal 5 lists four categories of potential tradeoffs: economic, social, environmental, and energy (ESEE).

In the Portland region, Metro's responsibilities include identifying significant natural resources and evaluating ESEE consequences of allowing, limiting, or prohibiting development on lands that contain resources. Metro hired ECO to help evaluate the economic consequences. This final report is ECO's product responding to this charge.

1.2 SCOPE OF THIS REPORT

The findings in this report must be interpreted in context. Most importantly, this report is *an interim report about possible methods, <u>not</u> a final report that evaluates proposed policy options.* The rest of this section explains that point.

The analysis described in this report addresses the economic tradeoffs of allowing, limiting, or prohibiting lands uses and other actions that conflict with riparian areas and upland-wildlife habitat[1]. The analysis of tradeoffs addressed how protection actions may impact values and other economic measures including:

- The development value of land.
- The values of ecosystem services provided by riparian and upland-wildlife resources.
- Related economic measures including employment and economic equity.

The format of the Goal 5 process dictates that the ESEE analyses be conducted without the benefit of detailed information on the policies that will protect significant resource. Thus Metro must conduct the analyses:

- Without knowing the *extent* of allow, limit or prohibit decisions. Neither Metro, nor the local jurisdictions with Goal 5-responsibilities have identified the lands on which conflicting uses

[1] See Metro's report on its inventory of significant Goal 5 resources for more information.

will be *allowed*, and the lands on which development activity will be *limited* or *prohibited*.

- Without knowing *how* these decisions will be implemented. Metro's responsibility includes developing management decisions at the *regional* level. As we understand it, *local* jurisdictions have the responsibility of implementing the protection measures at the local level. Local decisions will influence the economic consequences.

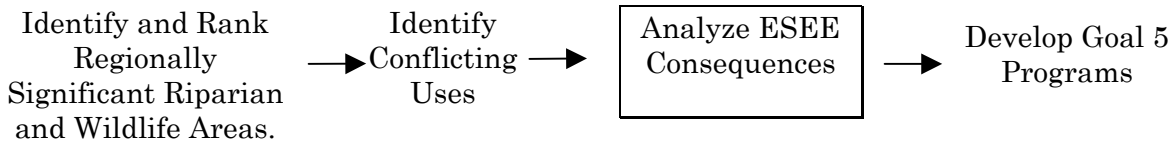
- Without a precise *definition* of what limit means for both development value and value of ecosystem services.

Given these constraints and uncertainties, this economic analysis describes the consequences or tradeoffs of allow, limit, and prohibit decisions *qualitatively* and on a *regional scale*. This is *not* a cost-benefit study that:

- Quantifies or measures the complete range of economic costs and benefits of allow, limit and prohibit decisions.
- Describes the economic consequences, tradeoffs or costs and benefits of Goal 5 decisions at the local or parcel level.
- Evaluates the range of management options and identifies, from an economic perspective, the "best" Goal 5 protection policy.

A description of the past and future tasks in Metro's ESEE evaluation helps show where and how this report fits in. Figure 1 summarizes the main parts of Metro's Goal 5 process.[2]

Figure 1: Summary of Metro's Goal 5 Process



The process began in 2001 with Metro identifying significant riparian and upland wildlife areas and creating an inventory of these natural resources. Based on this information, Metro ranked riparian areas and upland-wildlife habitats. Metro Council adopted these areas as regionally-significant resources in August 2002.

Next Metro identified land uses that conflict with or would adversely affect riparian and upland-wildlife resources. Any development potentially conflicts at some level with the preservation of land in its natural state, but some development types may conflict less than others. Metro described conflicting uses based on the following land-use zonings: single-family

[2] See Metro's Goal 5 report for more information.

residential, multi-family residential, commercial, mixed-use, industrial, rural, and parks-and-open-space.

ECO and Metro completed a preliminary scope of work in March of 2003. In May of 2003, ECO and Metro finalized the scope and ECO completed a preliminary review of the relevant literature. In late May 2003, ECO began work on the economic analysis, while Metro staff evaluated the social, energy, and environmental tradeoffs. ECO completed a draft report in September 2003. ECO reviewed comments on the draft report submitted by Metro's Economic Technical Advisory Committee ("ETAC"), the Independent Economic Analysis Board ("IEAB"), Dr. Art O'Sullivan, stakeholders, and Metro staff and Council. This is ECO's final report.

Based on the results of the analyses of ESEE tradeoffs and on other information, Metro staff will develop and evaluate program options that protect riparian areas and upland-wildlife habitats. Metro Council will make the final determination on protection measures.

1.3 OVERVIEW OF THE ANALYSIS

We started by reviewing Oregon State Land Use Goal 5 and previous Metro work regarding the Goal 5 ESEE analysis. We then searched the professional literature on the economic value of land in development and preservation. In consultation with Metro staff and ETAC we examined the available data that describes the development value of land at issue in the study. We also studied reports on Metro's inventory and ranking of significant riparian and wildlife resources. Working with Metro staff we ranked the relative importance of land in development and preservation and generated maps that depict development value and ecological importance across Metro's jurisdiction. Based on these maps and on the underlying data we examined the interactions between development value and ecological importance of Goal 5 resources. We then described the economic tradeoffs of decisions to allow, limit, or prohibit development of the resource lands.

The analytical constraints and focus of the Goal 5 process require that we depict economic consequences qualitatively rather than quantitatively. We describe the economic factors that can be influenced by an allow, limit, or prohibit decision and the likely direction of change. We do not, however, calculate a quantitative change in development or resource values associated with a Goal 5 decision for the region or for a specific property.

We reviewed the draft reports by Metro staff that describe the energy, social and environmental tradeoffs of allow, limit, and prohibit decisions. To the extent that these studies described energy, social or environmental changes that have economic tradeoffs, we considered this information in our analysis.

1.4 ORGANIZATION OF THIS REPORT

The remainder of this report is divided into two sections:

Economic Principles provides the underlying economic concepts that guide our analysis.

Analysis applies the economic principles to come to conclusions about the economic tradeoffs of allow, limit and prohibit protection measures.

2. ECONOMIC PRINCIPLES

We begin by introducing the economic principles that guide this study. These principles help define our approach to the analysis of economic tradeoffs of developing lands that contain significant riparian or wildlife resources or protecting these resources and the associated ecosystem services that benefit society.

The following are the six economic principles most relevant to our analysis:

1. *Market prices for land can be used as a measure of development value.* Property markets for developable land meet most of the criteria for a well functioning market. Many sellers and buyers participate in the market, there's free entry to and exit from the market, and buyers and sellers have access to information on the attributes of land that provide development value. For these reasons, market prices for land provide a good measure of development value. Participants in a market can measure or rank the development potential or importance of properties based on property value.

2. *Ecosystem services have economic value.* By ecosystem services we mean the benefits to society of well-functioning ecosystems such as riparian areas that mitigate flooding, help filter toxins and sediment from surface runoff and provide recreational and other amenity values. Society also benefits from wildlife habitat that helps support populations of species with commercial, recreational, and cultural value.

3. *Property markets may capture some, but not all, of the values of ecosystem services.* Property markets can provide information on the value of some ecosystem services, such as the value associated with proximity or access to recreational resources or scenic vistas. Property values typically do not reflect the value of other ecosystem services, such as water-quality or wildlife-habitat services.

4. *Property markets may not capture public-policy or planning goals*. Just as property markets fail to reflect the full value to society of ecosystem services, these markets may also fail to capture the value of public-policy or planning goals that affect land use. For example, properties with the highest market value may not necessarily be the most important lands from a public-policy perspective. Specific to this project, the hierarchy of design types as described by the 2040 Growth Concept emphasizes certain development types in certain locations. Public policy consideration drive the design of the hierarchy, not market prices. As a result, a 2040 Growth Concept may emphasize the importance of a relatively low valued land use, such as industrial development, in an area that, if left to property markets, would develop into a higher-valued use, such as a residential development.

5. *There's competition for the riparian and wildlife resources at issue in this study*. In the past, discussions of the competition for natural resources focused on the tradeoffs of developing or using a resource and the associated jobs created or supported versus protecting the resource for its intrinsic or non-use value. This is the 'jobs vs. the environment' argument. Such an approach assumed two competing demands for a resource, that protecting the environment would not generate or support jobs and that development use would not generate negative impacts beyond affecting non-use values.

   Today, the competition for resources is more complex with more demands on a finite amount of natural resources. The dynamics of the competition extend far beyond a choice of jobs or the environment. We distinguish between demands on the resource that have use and non-use values. The range of demands with use values include commercial use of the resource, the ecosystem services provided by the resources, the impacts of the resources and development values on location decisions of retirees, workers and businesses and other quality-of-life impacts and options to use the resources in the future.[3] Demands with non-use values include the intrinsic value of the resources.

6. *A static analysis likely will fail to inform stakeholders or decisionmakers adequately of the economic tradeoffs.* A static analysis is similar to taking a snapshot of analytical conditions. This approach assumes no changes in factors that could influence the outcome of a decision to develop or protect resources. An alternative approach that considers how changes or adjustments affect the economic analysis will likely provide a more complete

[3] See the literature review in the appendix of this report for more information on the competing demands for natural resources.

description of the economic tradeoffs than ignoring these adjustments. In this case, dynamic adjustments may include expanding the Urban Growth Boundary ("UGB") and the substitutability of land within the UGB. Such a dynamic approach also considers the likely restoration efforts that can help mitigate the negative impacts of development on significant resources. A dynamic approach that considers likely changes, adjustments, or possible mitigation efforts will provide decisionmakers with a more complete view of the likely economic impacts than will a static approach.

3. ANALYSIS

The major analytical tasks for our study include:

- *Rank the relative importance of lands that contain significant riparian and wildlife resource for development.* The tradeoffs of protecting riparian and wildlife areas or developing these lands for residential, commercial, industrial, etc. use lies at the heart of Metro's Goal 5 decisions. In this task we worked with Metro staff and ETAC to develop three methods of ranking the relative importance of land for development use: land value, employment, and the 2040 Design Types.

- *Overlay or compare the ranking of development importance with Metro's ranking of significant riparian and wildlife resources.* Metro ranked lands that contain riparian and wildlife resources into six categories depending on the amount and type of ecological functions or wildlife characteristics.[4] In this task we compare the rankings of development importance with rankings for riparian and wildlife importance. This comparison provides decisionmakers with information on the amount and distribution of significant interactions between development use and resource protection.

- *Describe the current land-use status of lands that contain significant riparian and wildlife resources.* We can describe the lands at issue in Metro's Goal 5 process many ways. Metro described and ranked the lands according to the ecological functions they provide. We worked with Metro staff to rank these same lands based on their development value. Current land-use status provides additional information relevant to Goal 5 deliberations. Some of these lands have already been developed. Other lands are vacant, but developing some of these lands will be constrained by existing rules or regulations or characteristics of the land, e.g., too steep. The development status of property relates to the economic analysis because it can influence the

[4] See Metro's report on Riparian Corridor and Wildlife Habitat Inventories and Metro's Conflicting Use report for more information on Metro's ranking of lands.

type, amount and timing of economic tradeoffs of allow, limit and prohibit decisions.

- *Describe the economic tradeoffs of allow, limit, and prohibit decisions as they relate to the development use of lands and protecting the riparian and upland-wildlife resources.* In this task we'll refer back to the previous tasks that describe the context for the analysis of economic tradeoffs. We describe the economic factors, e.g., development value, employment and value of ecosystem services, that may be affected by a Goal 5 decision and the factors that may influence the economic tradeoffs, e.g., expanding the UGB. We summarize our description of economic tradeoffs in a matrix.

3.1. RANK LAND BASED ON THE ECONOMIC IMPORTANCE FOR DEVELOPMENT

We can rank the economic-development importance of land many ways. Methods include ranking land based on property value, distance from city center, the amount of vehicle and pedestrian traffic that passes by, or local economic-development priorities that target specific economic sectors or land uses. Developing an exhaustive list of methods and applying them to the lands that contain Goal 5 riparian and upland-wildlife resources goes beyond the scope of this analysis. We focused instead on a few measures that give stakeholders and decisionmakers a general understanding of the development values at issue in the Goal 5 process and apply to a broad rang of zonings and land uses. In consultation with Metro staff and Metro's ETAC, we selected three measures that describe the current and future development importance of land from different perspectives.

The first measure is property value. Real-estate markets provide a good measure of a property's development value because factors that affect a parcel's development potential are typically widely known and easily measured. The professional literature describes these factors as location and use factors.[5] The location factors that influence property values include availability of urban-infrastructure services, transportation access, and zoning and other regulations. Use factors include a property's amenities, physical terrain and lot size and shape.

Another way of describing the importance of land for development is the employment potential associated with development, which is our second method. We ranked the lands in Metro's inventory of significant riparian and upland-wildlife areas based on the employment associated with zoning and land uses.

[5] See the literature review in the Appendix for more information on these factors.

Property values and employment numbers describe current conditions. For insights into the relative importance of land for development in the future we ranked lands using the planning goals described by the 2040 Design Types[6].

These three measures provide information on development values for the large majority of lands in Metro's Goal 5 analysis. However, these methods have limitations for certain land uses. In subsection 3.1.4 we describe these limitations and provide additional information on the economic importance of the development value for these land uses.

3.1.1. RANK LANDS BASED ON MARKET PRICES FOR LAND

Method and Data

To define categories of development value based on market prices for land we took the following steps:[7]

- Choose the data base. The best (most consistent, broad, and available) data on land price for the Portland metropolitan region are from the county assessors (data compiled by Metro). The reported assessed values probably systematically underestimate at a consistent rate the market value, but the errors should be less than 10%. Also, our ranking of lands among categories of value depends more on the *distribution* of values, and less on a precise measure of value for any one property. This is especially true in our case where we've ranked land value into three categories. The fewer the categories, the less likely that the assessor's data misrepresents a given property's value and that we have assigned the property to the wrong category. Our analysis uses tax-assessor data for year 2003 for lands inside the UGB as of 2002.

- Choose the units of measurement. The two obvious choices for reporting measures of land value that are standardized by land area are dollars per acre and dollars per square foot. The latter is more common in real estate evaluations so we used that.[8]

- Consider natural breaks in the data, market conditions, and study objectives to define categories of land value.

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[6] See Metro's Conflicting Use report for more information on the 2040 Design Types.

[7] See the methodology in the Appendix that describes the details of Metro's ranking of lands that contain significant riparian and wildlife resources.

[8] Conder, S and K. Larson. 1998. *Residential Lot Values and the Capital-Land Substitution Parameter: Some Recent Results from the Portland Metro Area*. Metro. May.

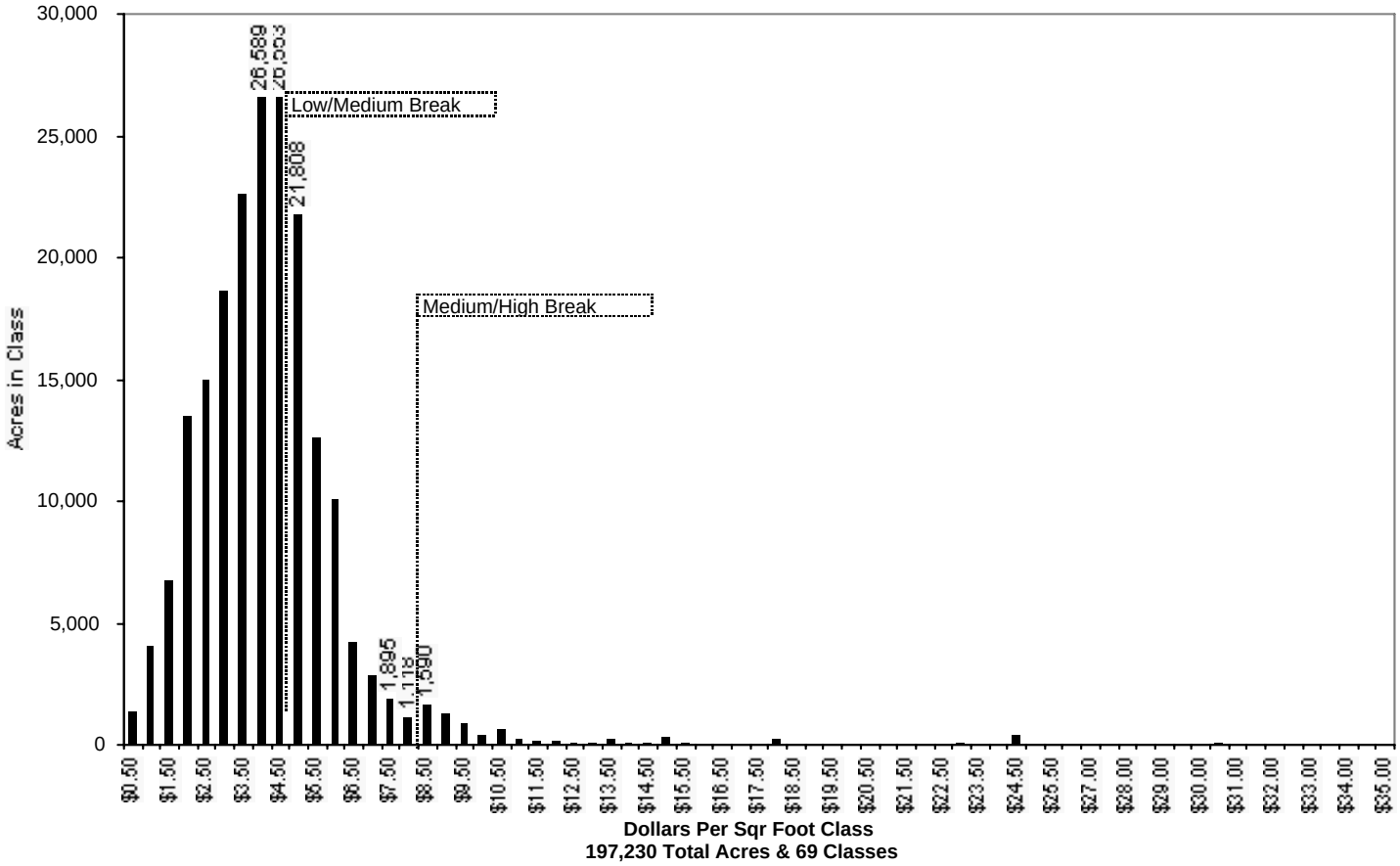
- Regarding market conditions, most unplatted but developable single-family residential parcels in the metropolitan area will be at $4 or $5 a square foot or more. Industrial land is, at the low end, around $5/sqft. Commercial and residential land is higher. Multi-family land, at the lower end (suburban) may be as low as $5/sqft. Land in downtowns outside of Portland will be in the range of $10 to $20 sq. ft. (higher in a few specific locations). Land close-in in Portland can be very much higher than $20/sqft., and can exceed $100/sqft. in the downtown.

- Regarding study objectives, it is more important to discriminate more at the low end of the scale than at the high end. Above $10/sqft., land is clearly "high" value and there is not much of it: showing land in $10- or $20-increments would not provide much value for decisionmaking. At the lower end, below $10/sqft., however, there is a lot of land, and where the line gets drawn between "low" and "medium" value could affect a large number of properties.

Given these considerations we divided "low," "medium," and "high" land values as shown in Figure 2. The acres in Figure 2 represent only those lands in Metro's jurisdiction that contain Goal 5 significant riparian and wildlife resources. Resource lands with assessed values equal to or greater than $8.00 per square foot have "high" development value. Resource lands with values greater than $4.50 and less than $8.00 have "medium" development value. Lands with value below $4.50 per square foot have "low" development value.

Near the breaks between low-medium and medium-high values we list the number of acres for each unit of land value. This information shows how the number of acres in each category increases or decreases by changing the breaks between the categories of land value. For example, *reducing the lower bound of the medium category* by $0.50 per square foot of land value, increases the number of acres with "medium" value and adds 26,553 acres to this category. *Increasing the lower bound of the medium category* by $0.50 per square foot, reduces the number of acres in that category by 21,808 acres.

Figure 2: Distribution of Land Value and Class Breaks



Source: Data analysis by Metro staff and ECONorthwest.

Assumptions and Limitations

Ranking the development value of resource lands as measured by assessed value per square foot reflects the following assumptions and limitations.

- Market prices reflect a parcel's location and use factors.

- The assessor's data on value is a reasonable proxy for market value for purposes of identifying a range of property values from "high" to "low." By reasonable proxy we mean that there's a relatively high correlation between values in the assessor's data and market values. That is, a "high" value in the assessor's database will also have a "high" market value. Given the limitations on assessed value from Measures 5 and 50, we expect assessed values will be less than market values. However, we're using this data to describe a range of property values

from "high" to "low," not as an absolute measure of market value for any one property.

- We used data on land value, not the value of land plus improvements. Land value reflects the expected value of land in the best uses supported by the market and allowed by public policy. Including the value of improvements would bias the analysis against undeveloped land. Property without improvements would likely be constrained to the lower end of the range of values if the range included the value of improvements.

- The database of assessed values excludes land uses that do not pay property taxes, such as public schools and some hospitals, and underestimates the value of other land uses that pay limited property taxes, such as low-income housing. We discuss this issue in subsection 3.1.4 below.

- Land values may reflect the amenity values associated with riparian areas and upland-wildlife habitat, but likely do not capture the value of other ecosystem services such as those associated with water quality and flood management.

Maps

Map 1[9] shows the distribution of land values for all lands in Metro's service area, including lands that do not support riparian and upland-wildlife resources. The "low," "medium," and "high" categories in Map 1 correspond to the break points illustrated in Figure 2. The distribution of land values from "low" to "high" follows the pattern of land-use intensity across Metro's jurisdiction. The highest values occur in the central parts of the city of Portland. Areas of medium value surround the high-valued areas and include urban and suburban population and commercial concentrations. Land with "low" values cover the remaining outlying areas.

Map 1a depicts the distribution of land values for the subset of lands in Metro's jurisdiction that contain riparian and upland-wildlife resources. This map shows the acres at issue in Metro's Goal 5 deliberations. The large majority of these acres fall in the outlying or "low" category.

Map 1b shows only those resource lands that are ranked "high" for the quality of riparian and upland-wildlife habitat characteristics. Another way of describing the lands shown in Map 1b is that they represent the development value of lands that contain the most significant Goal 5 resources.

[9] See the Appendix for the maps discussed throughout the report.

3.1.2. RANK LANDS BASED ON JOBS

Method and Data

To define categories of employment density, we took the following steps:[10]

- Choose the data base. The best data on employment (most consistent, broad, and available, current, disaggregated, and location-specific) for the Portland metropolitan region are from the Oregon Department of Revenue (refereed to as the Employment Security, 202 tapes). These data are available to Metro. Our analysis is based on employment data for year 2002.

- Choose the units of measurement. The two obvious choices for reporting measures of employment that are standardized by land area are employees per acre or per square feet of lot size. The former is more common in Oregon planning practice, and what we chose.[11] Yee and Bradford, 1999. These data represent employees per *gross* acre, which includes land dedicated to roads, sidewalks, and other areas that do not directly support employment.

- Estimate employment density for vacant lands based on the density in surrounding lands with similar zonings.

- Consider natural breaks in the data, market conditions, and study objectives to define categories of the employment value (measured in employees per acre—i.e., the more employees that the land can support, the more valuable it is for development).

- Regarding market conditions, typical density for industrial employment is 5 to 10 employees per acre. Commercial (office and retail) activities typically employ approximately 20 to 25 employees per acre in suburban city centers, shopping centers, and business parks. To get over 25 employees per acre for a large area would probably require a concentration of multi-story buildings.

- Regarding study objectives, it is more important to discriminate more at the low end of the scale than at the high end. Above 20 employees, land is clearly "high value" for employment and there is not much of it. At the lower end, below 20 employees per acre, however, there is a lot of land, and where the line gets drawn between low and medium value may affect many properties.

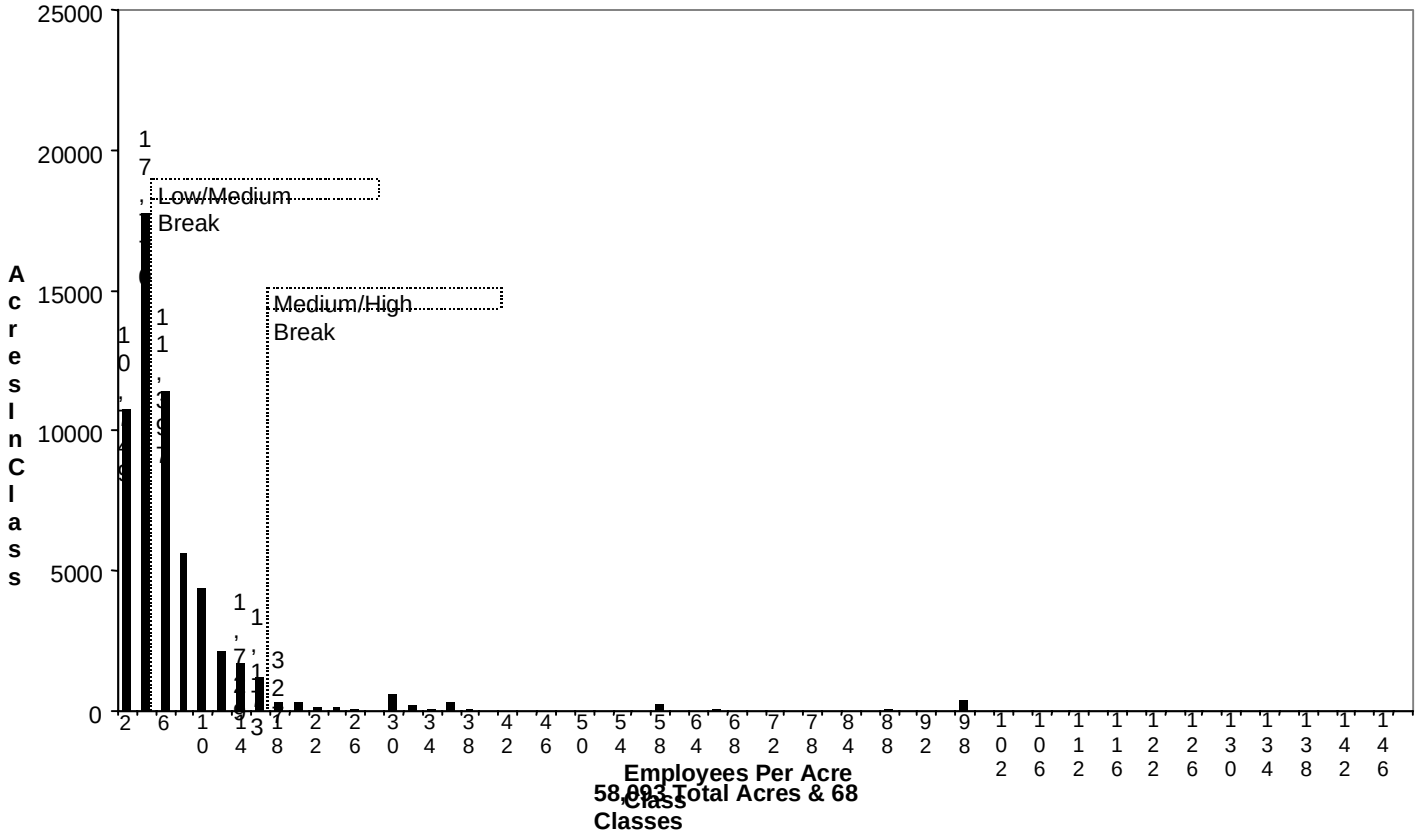
[10] See the methodology in the Appendix that describes the details of Metro's ranking of lands that contain significant riparian and wildlife resources.

[11] Yee, D. and J. Bradford, 1999. *1999 Employment Density Study: Technical Report*. Metro's Growth Management Services Department. Revised May 5.

Given these considerations, we divided "low," "medium," and "high" employment as shown in Figure 3. This figure shows the distribution of employment density for lands that contain significant riparian and wildlife resources. Resource lands with employment density equal to or greater than 16 jobs per acre have "high" development value. Resource lands with values greater than 4 and less than 16 jobs per acre have "medium" development value. Lands with employment density of 4 jobs per acre or less have "low" development value.

Near the breaks between low-medium and medium-high values we list the number of acres in each degree of employment density. For example, if we reduce the lower bound of the medium category by one degree of employment density, or 2 jobs per acre, we would add 17,770 acres into the medium category. If we were to increase the lower bound of the medium category by one degree we would reduce the number of total acres in that category by 11,397. This information will help decisionmakers and others conduct sensitivity analyses of the impacts of changing the break points on the number of acres per category.

Figure 3: Distribution of Employment Density and Class Breaks



Source: Data analysis by Metro staff and ECONorthwest.

Assumptions and Limitations

The ranking method described above reflects the following assumptions and limitations:

- This method assumes that jobs are tied to a specific location and cannot move to other locations in the Metro area. This assumption is certainly not strictly correct; in some instances it may not be even approximately correct.

- The measures of employment density do not capture the relative importance of residential developments. However, we expect that ranking land based on land value (as described above) provides a measure of the relative development value of residential areas.

- Employment density for vacant land will be equivalent to employment densities of surrounding lands with similar zonings and land use.

- One of the limitations of our analysis is that we have not distinguished among jobs that are more "important" and those that are less "important," as described by employment income or employment multipliers. The analysis assumes all jobs are equally important. The ranking for an individual parcel using employment income or employment multipliers may differ from the ranking based on employment density. The land uses most affected are smaller parcels that employ large numbers of works at low wages and large parcels that employ few workers at high wages. The former would rank higher on the employment-density scale and lower on the employment-income scale. The latter would rank lower on employment density and higher on employment income. It's not clear from a regional perspective the net effect of this limitation on the overall results. We note also that the 2040 Design Types described in the next subsection account, to some extent, for differences in employment types.

Maps

Map 2 shows the distribution of lands ranked by employment density. The "low," "medium," and "high" categories in Map 2 correspond to the break points illustrated in Figure 3. Compared with the distribution of development values as described by land value (see Map 1), lands that support employment occupy a smaller subset of Metro's service area. That's because Map 2 excludes lands that do not support employment, primarily residential and park lands. Map 2 shows that lands that support employment predominate in the Portland city-center and along transportation routes.

Map 2a depicts the distribution of employment density for the subset of lands in Metro's jurisdiction that contain significant riparian and upland-wildlife resources. This map shows the employment density for the lands at

issue in Metro's Goal 5 deliberations. The large majority of these lands fall in the outlying or "low" category.

Map 2b shows the subset of lands from Map 2a that are ranked "high" for the quality of riparian and upland-wildlife habitat characteristics. Map 2b shows the employment density for lands that contain the most significant Goal 5 riparian and wildlife resources. Policy decisions that protect the most significant Goal 5 resources would have the greatest impact on these lands.

3.1.3. RANK LANDS ACCORDING TO 2040 DESIGN TYPES

Method and Data

Land value and employment density measure development importance today under current conditions. For insights into future development patterns and the associated importance of land uses we look to the planning goals as described by the 2040 Design Types. As we understand it, the 2040 Design Types represent a blueprint that helps guide future development and reflect deliberations on what stakeholders and decisionmakers want future development to look like.[12]

For the purposes of Metro's Goal 5 ESEE analysis, Metro developed a hierarchical scheme for the design types as follows.

1. Primary Land Use Components

- *Central City*. Downtown Portland.
- *Regional Centers*. Areas outside the central city that are the focus of compact development, redevelopment, and high-quality transit service, e.g., Hillsboro and Gresham.
- *Industrial Areas, non-water dependent*.
- *Industrial Areas, water dependent*.
- *Intermodal Transportation Facilities*. These facilities include marine terminals, freight facilities for trucking, airports and railroads.

2. Secondary Land Use Components

- *Town Centers*. These areas are smaller and less dense than regional centers, e.g., Forest Grove and Milwaukie.
- *Main Streets*. Main streets are similar to town centers but on a smaller scale.
- *Station Communities*. These developments are centered around light rail or high-capacity transit stations.

[12] For more information on the 2040 Design Types see the Conflicting Uses section of Metro's ESEE report.

3. Tertiary Land Use Components

- *Inner Neighborhoods*. Primarily residential developments with access to employment and shopping.

- *Outer Neighborhoods*. Farther away from employment centers than inner neighborhoods with smaller lot sizes.

- *Employment Centers*. Areas designated to receive various types of employment and may include residential developments that serve the needs of employees.

- *Corridors*. Major streets that serve as key transportation routes for people and goods. Corridors provide a mix of land uses such as higher density residential, office, commercial, and retail.

- *Future Urban Lands*. Areas that have recently been brought into the urban growth boundary ("UGB") and lands that may be brought into the UGB.

4. Other

- *Parks and Open Space*. Not included in other design types.
- *Rural Reserves*. Lands outside the UGB that provide a visual and physical separation between urban areas and farm and forest lands.

Assumptions and Limitations

The ranking method described above reflects the following assumptions and limitations:

- The 2040 Design Types describe future development patterns in Metro's service area.

- The 2040 Design Types consider regional land-use goals and policies in addition to economic factors. For example, non-water dependent industrial areas rank as a primary component, even though some secondary components, e.g., Town Centers, may have higher land values or employment. Industrial areas, however, are more important or valuable from a policy perspective regarding the content and pattern of future development and so rank ahead of Town Centers.

Maps

Metro staff categorized lands in the UGB based on the 2040 Design Types and mapped lands using GIS.[13] Map 3 shows the distribution of the four

[13] See the methodology in the Appendix that describes the details of Metro's ranking of lands that contain significant riparian and wildlife resources.

categories of 2040 Design Types described above for all lands in Metro's service area. Map 3a shows the subset of lands in Map 3 that contain significant Goal 5 riparian or wildlife resources. Metro's Goal 5 decision will affect these lands. Map 3b shows the subset of lands in Map 3a that support the most significant Goal 5 riparian or wildlife resources.

Comparing Maps 1, 2 and 3 we see that the Primary Design Types cover more of Metro's jurisdiction than are areas of "high" land value or employment density, which are concentrated mostly in the downtown Portland area. This is especially true along the Columbia River and the Willamette River outside of downtown Portland. This area has "low" land values and employment densities for the most part, but has a Primary Design-Type designation. For these lands the Design Types reflect public policies that support or enhance the industrial areas along the rivers for future development. Even though these areas have "low" land values and employment densities relative to the Portland city center, public-policy considerations dictate that these industrial lands should be emphasized or enhanced for reasons other than the value of land or employment density.

The preceding paragraph describes differences in distribution among the three measures of development value. There are also similarities. For example, just as most lands in Metro's service area rank "low" for land value and employment density, most lands also rank in the "tertiary" or "other" design type. Another similarity is that, with the exception of lands along the rivers, the distribution of lands with "high" and "medium" employment density has a pattern similar to the distribution of lands ranked "primary" and "secondary" design types.

3.1.4. LIMITATIONS OF THE THREE MEASURES OF THE ECONOMIC IMPORTANCE OF LAND FOR DEVELOPMENT

Some reviewers of the draft economic report felt that the three methods of ranking lands using economic-development values—land value, employment density, and 2040 Design Types—create special concerns for certain land uses. These concerns arise because the three methods either exclude some land uses from the analysis or underestimate their economic importance.

In response to these comments we've added this subsection that describes the limitations of the ranking methods, the affected land uses and their regional significance, and factors to consider regarding the potential impacts of allow, limit, and prohibit decisions for these land uses.

We note that the economic portion of the ESEE analysis describes the relative economic importance of lands that contain significant natural resources from a *regional* perspective. The analysis does not focus on the relative economic importance of *individual parcels*. Such an analysis is beyond the scope of a Goal 5 ESEE analysis. The reviewers' concerns, however, apply to the economic importance of individual parcels. These comments highlight the importance of implementing a Goal 5 program that

considers unique or important characteristics at the parcel level when implementing protection guidelines developed at the regional level.

Limitations of the Ranking Methods

Land Value

This method excludes land uses exempt from property taxes or underestimates the economic importance of lands that pay taxes at a diminished rate. Lands exempt from tax assessments—e.g., schools, universities, and some hospitals—do not appear in the data base or analysis for this measure of economic importance.

This method underestimates the economic importance of lands with restricted or diminished tax assessments—e.g., low-income housing, urban-renewal areas, and other land uses that benefit from public policies that subsidize tax payments. The analysis includes these lands in the ranking, but the rankings may not reflect these parcels' full value.

Employment Density

Our analysis calculates the average employment density across all land uses in a given GIS map unit. This method may underestimate or overestimate the employment density for some individual parcels. For example, the employment density for a GIS map unit that includes residential areas surrounding a university or hospital may underestimate the employment ranking for these facilities because of the relatively low employment densities found in the residential areas. We note that the opposite is also true. Because the method calculates the average employment density per map unit, properties with lower-than-average densities will be represented by an average measure for the entire map unit that overestimates the employment density for these parcels.

Employment density does not distinguish between "more" important or "less" important jobs as described by employment income or employment multipliers. In consultation with Metro's ETAC we discussed this issue and considered adding these measures to the analysis or substituting them for employment density. Ultimately we concluded that employment density provides stakeholders and decisionmakers with employment information that exceeds the requirements for a Goal 5 ESEE analysis. Also, we note that Metro uses employment density when addressing other land use issues that have employment consequences[14]. Finally, the 2040 Design Types capture to some degree the economic importance of land as described by employment multipliers.

[14] See the Metro report, *Technical Report: 1999 Employment Density Study*, April 6, 1999, revised May 5, 1999.

2040 Design Type

Some reviewers commented that the 2040 Design Types exclude certain land uses or underestimate the relative importance of a given land use. For example, several educational institutions are not located in designated design-type areas. In other cases, what some consider a regionally-significant land use, such as a regional medical center, are included in a lower-level design type.

Relative Economic Importance of Land Uses

The lands uses of concern—those for which the three methods used in the economic analysis either exclude or underestimate their economic importance—fall predominantly into four general categories: 1) transportation; 2) utilities; 3) education; and, 4) health care. In this subsection we describe the relative economic importance of these land uses.

Transportation Facilities and Utilities: To stay competitive, cities must have modern and efficient physical infrastructure, including roads, bridges, water and sewer systems, airport and cargo facilities, energy systems and telecommunications. The economic literature shows a correlation between economic growth and transportation facilities and utility services. Well-functioning and efficient physical infrastructure helps promote improvements in productivity. The quality of, and access to, transportation facilities and utilities can also directly influence production costs.[15]

Education: The economic literature distinguishes between the economic importance of primary and secondary education, from college, university and post-graduate studies.

Primary and Secondary Education

Many high-skilled or knowledge-based workers can choose where they want to live, they can apply their skills to a variety of industries or have the

[15]Atkinson, Robert D. and Paul D. Gottlieb. 2001. *The Metropolitan New Economy Index: Benchmarking Economic Transformation in the Nation's Metropolitan Areas*. Progressive Policy Institute and the Center for Regional Economic Issues, Case Western Reserve University. April.

Cohen, Natalie. 2000. *Business Location Decision-Making and the Cities: Bringing Companies Back*. Washington, D.C.: The Brookings Institution. April.

Rondinelli, Dennis A. 1998. "The Changing Forces of Urban Economic Development: Globalization and City Competitiveness in the 21st Century." *Cityscape*, 3 (3).

Fisher, R.C. 1997. "The Effects of State and Local Public Services on Economic Development." *New England Economic Review*. March/April, p. 53-82.

Collaborative Economics. 1999. *Innovative Regions: The Importance of Place and Networks in the Innovative Economy*. The Heinz Endowments, Innovation Works, Inc., and The Pittsburg Regional Alliance. October. Collaborative Economics 1999.

ability to telecommute. Because they can pick and choose their locations, they choose those with quality amenities, including good elementary and secondary schools.[16]

College, University, and Post-Graduate Studies

Given the current high demand for skilled labor, economic growth and development depends in part on access to a critical mass of employable persons with the necessary training and education. An educated workforce has become the primary location factor for growing companies.[17]

The most competitive cities recognize that businesses must locate near or have access to knowledge centers. Among the most important knowledge-based organizations are colleges and universities that provide trained personnel and research capacities. Companies also depend on training and continuing education facilities that help them become and remain learning organizations.[18]

Increasing evidence suggests that promoting innovation, creativity, flexibility, and adaptability will be essential to keeping US cities economically vital and internationally competitive. Innovation is particularly important in industries that require an educated workforce. High-tech companies need to have access to new ideas typically associated with a university or research institute.[19]

Medical Services: Medical services contribute to a region's economic growth and development in a number of ways. In many municipalities, hospitals and medical clinics are among the largest employers. For example, in the Portland area, OHSU is the region's top employer. Medical schools and research facilities provided important education-related services that help

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[16] Cohen 2000

Florida, R. 2000. *Competing in the Age of Talent: Environment, Amenities, and the New Economy*. Prepared for the R.K. Mellon Foundation, Heinz Endowments, and Sustainable Pittsburgh.

[17] Cohen 2000

Ady, Robert M. 1997. "Discussion." *New England Economic Review*. March/April, p. 77-82.

Glaeser, E. and J.M. Shapiro. 2001. *Job Sprawl: Employment Location in the U.S. Metropolitan Areas*. The Brookings Institution. May.

[18] Rondinelli 1998

Audretsch, D.B. and M.P. Feldman. 1996. "R&D Spillovers and the Geography of Innovation and Production." *The American Economic Review*. 86 (3), p. 630-640.

Collaborative Economics 1999.

[19]Fulton, William and Paul Shigley. 2001. "Little Chips, Big Dreams." *Governing* (no information on volume number).

support the growth and development of knowledge-based businesses. The availability of high-quality and diverse medical services also contributes to a region's quality of life, which helps attract and retain high skilled, and highly-educated workers.

Factors To Consider Regarding Allow, Limit and Prohibit Decisions

The reviewers' comments highlight the importance of considering unique or important characteristics at the *parcel* level when implementing protection guidelines developed at the *regional* level. The economic factors that may affect deliberations of these issues at the local level include:

Land Value. The fact that municipalities or regional governments grant certain land uses a waiver or reduction of property taxes offers insights into the relative importance of the services provided by these land uses to local or regional residents and businesses. Using this approach for lands excluded from or undervalued in the land-value database, facilities with complete and permanent exemption from property taxes would rank higher than facilities with limited or temporary exemptions.

Employment Density. Some regionally-significant facilities rank low on the employment scale because they're surrounded by land uses with low employment densities. Others because they occupy relatively large parcels, which diminishes the number of employees per gross acre. This condition is analogous to industrial lands, which occupy relatively large parcels and have relatively low employment densities. Metro recognized that employment density and the other measures of economic importance did not adequately reflect the economic contribution of some industrial lands to the regional economy. As a result of this limitation, it made a policy decision to identify these lands as "regionally-significant" industrial lands and to rank these lands higher on the scale of economic importance than other industrial lands. Metro or local decisionmakers could apply this same policy consideration and decision to the lands that rank lower on the employment measure of development value.

Flexibility of Land Use. The potential economic consequences of Goal 5 protection for the land uses at issue in this part of our analysis depends in part on the details of a given land use including the physical space the use occupies. For example, the economic impacts of limiting the development of a runway extension at Portland airport will be different from the potential impacts of reconfiguring an access road on the airport grounds so that it avoids significant riparian areas.

In another example, a utility right-of-way that extends for miles along a narrow strip of land may pass through riparian or wildlife habitats that vary in importance and value. This land use has limited flexibility in that it would be difficult and expensive to move or reconfigure the right-of-way. The utility services provided via the right-of-way may have regional significance if they affect residences and businesses through out Metro's service area. In a

contrasting example, a college or university with ample vacant land on its campus may have multiple options for the site of a new dormitory if the proposed location conflicts with important and valuable riparian or upland-wildlife habitat.

3.2. RANK LAND BASED ON THE ECONOMIC IMPORTANCE FOR ECOSYSTEM SERVICES

Method and Data

Metro conducted an inventory of the significant riparian-wildlife and upland-wildlife resources in its service area and ranked these resources based on the amount and type of ecological functions and wildlife characteristics.[20]

The ecological functions specific to riparian wildlife areas that Metro considered include:

- Microclimate and shade provided by forest or woody vegetation in and along riparian areas.
- Stream flow moderation and water storage capabilities.
- Bank stabilization and sediment and pollution control.
- Channel dynamics.
- Organic inputs.

Metro ranked riparian-wildlife areas into three categories, Class I, II, and III. As we understand it, areas with more ecological functions and/or areas with functions near a stream, wetland or floodplain received a higher ranking than areas with fewer functions or with functions that were further away from water features.

The characteristics that Metro considered for upland-wildlife areas included:

- Habitats of concern and habitats for unique and sensitive species.
- Habitat patch size and interior habitat.
- Connectivity and proximity to water resources and other habitat areas.

Similar to the ranking of riparian areas, Metro staff ranked land with upland-wildlife habitat into three categories, Class A, B, and C, depending on the type and amount of wildlife characteristics.

[20] See Metro's report, *Metro's Riparian Corridor and Wildlife Habitat Inventories* for more information on Metro's inventory and ranking of riparian and wildlife resources.

In Table 1 below, we list the riparian and wildlife classes and the percent of total resources by class.

Table 1: Resource Categories, as a Percentage of Total Resource Lands.

Resource Category	Percent of Total Resource Lands
Riparian & Wildlife Class I	32%
Riparian & Wildlife Class II	14%
Riparian Class III	8%
Upland Wildlife Class A	24%
Upland Wildlife Class B	13%
Upland Wildlife Class C	9%
Total	100%

Source: Conflicting Uses section of Metro's Goal 5 report.

Fifty-six percent of the resource lands are in Riparian & Wildlife Class I and Upland Wildlife Class A, categories with the most important ecological functions and wildlife characteristics. The percentage of total resource lands in a resource category declines from Class I to Class III and from Class A to Class C.

Metro's inventory and ranking focused on the ecological functions and wildlife characteristics that affect the biophysical health and wellbeing of these areas, without concern for how these attributes benefit society. Hueting, et al. (1998), King and Mazzotta (2003) and others,[21] describe the relationship between the biophysical attributes of natural areas and the related benefits to society. These researchers and others use the term "ecosystem services" to describe the services provided by natural areas that benefit society.

Table 2 below lists the ecological functions and wildlife characteristics that Metro considered in its ranking of riparian and wildlife areas and the related ecosystem services that benefit society.[22]

[21] Balmford, A., et al. 2002. "Economic Reasons for Conserving Wild Nature." *Science* 297: 950-953.

Costanza, R., et al. 1997. "The Value of the World's Ecosystem Services and Natural Capital." *Nature* 387 (May 15): 253-260.

Daily, G. and K. Ellison. 2002. *The New Economy of Nature*. Washington, D.C.: Island Press.

[22] See also Metro's analysis of environmental consequences for information on the relationship between ecological functions, wildlife characteristics and benefits to society.

Table 2: Ecological Functions, Wildlife Characteristics and Related Ecosystem Services that Benefit Society

Ecological Function	Ecosystem Service
Microclimate shade and cooling	Moderating summer temperatures, which helps reduces energy demand for cooling.
Stream flow moderation and improved water storage	Reduced flood damage and flood-management costs.
Bank stabilization and sediment and pollution control	Improved water quality. Reduced demand for water filtration and treatment. Reduced landslides and related damage and clean-up costs.
Large woody debris and channel dynamics	Reduced flood damage and flood-management costs.
Well-functioning riparian areas in general	Recreation, amenity and intrinsic values associated with riparian areas.
Wildlife Characteristic	
Habitats of concern and habitats for unique and sensitive species	Increased populations of salmon and other species and associated increases in commercial, recreational, cultural and intrinsic values.
Well-functioning wildlife habitats in general	Recreation, amenity and intrinsic values associated with wildlife habitat.

Source: ECONorthwest and Metro's inventory and ranking of riparian and wildlife resources.

As described in the references noted above, and in the literature review that accompanies this report, the ecological functions and wildlife characteristics in Table 2 provide ecosystem services that benefit society. For example, riparian areas that mitigate flooding help reduce flood-related damages to homes and businesses. In another example, protecting or improving habitat that benefits salmon helps protect the fish's commercial, recreational, and cultural values. See the literature review for more information on ecosystem services and their economic values.

Assumptions and Limitations

The ranking of riparian-wildlife and upland-wildlife resources depends on the following assumptions and characteristics:

- Areas that provide more of the ecological functions and wildlife characteristics illustrated in Table 1 provide more ecosystem services and value to society than do areas that provide fewer functions and characteristics.

- Actions that enhance or protect ecosystem services also enhance or protect the economic values associated with those services. Actions that degrade these services will have the opposite effect.

Maps

Map 4 shows the distribution of the classes of riparian-wildlife and upland-wildlife resources across Metro's service area. With one notable exception—the area between the Willamette and Columbia Rivers—Goal 5 significant natural resources cover much of Metro's service area. The map shows that the most intensively-developed areas of the Portland city center and extending east from the Willamette River retain little or no riparian or wildlife resources.

Map 4a shows the distribution of the highest-valued resource lands, Riparian & Wildlife Class I and Upland Wildlife Class A.

3.3. CURRENT LAND-USE STATUS OF RESOURCE LANDS

The previous subsections describe the lands at issue in Metro's Goal 5 analysis based on their economic importance for development and on the quality of riparian and wildlife habitat. This section describes the current land-use characteristics of the land. These characteristics include development status (vacant or developed, and the type of development) and zoning type (e.g., single-family residential, commercial, etc).

Development status and zoning type influence the type, amount, and timing of the economic consequences of Goal 5 allow, limit and prohibit decisions. For example, the employment impacts of limiting future activities in an already-developed residential area will differ from the impacts of limiting development of vacant area zoned for commercial or industrial use.

3.3.1. DEVELOPMENT STATUS

Metro classified the lands containing significant riparian and wildlife resources using four development categories:

- *Developed Parks*[23]: Park and openspace lands that Metro considers already developed and generally not available for urban development.
- *Developed Urban:* Lands that have been developed in accordance with specific zoning, such as single-family residential or commercial use.
- *Vacant Constrained:* Lands that have not yet been developed but development is constrained by Title 3[24].

[23] This category includes all areas covered by parks or open space and includes park land zoned as single-family residential, commercial, or other zoning.

[24] For information on Title 3, see, "Title 3: Water Quality, Flood Management, and Fish and Wildlife Conservation" described in the Metro Urban Growth Management Functional Plan. Title 3 describes development guidelines that protect water quality, floodplain areas, and fish and wildlife habitat.

- *Vacant Buildable*: Vacant, buildable land that's unconstrained by non-Goal 5 regulations.

Table 3 describes the development status of the Goal 5 resources lands and describes these lands as a percentage of the *total* lands by development category in the UGB. For example, 34 percent of Goal 5 resources lands are in parks and these parklands account for approximately 66 percent of the total parklands in the Portland Metro UGB.

Table 3: Goal 5 Resource Lands by Development Status and As A Percentage of Total Lands in the Development Status in the UGB in 2002

Development Status	% of Total Goal 5 Resource Lands	Goal 5 Resources as a % of Total Lands in the Development Status in the UGB
Developed Parks	34%	66%
Developed Urban	28%	10%
Vacant Constrained	16%	67%
Vacant Buildable	22%	41%
Total	100%	(not applicable)

Source: Data analysis by Metro staff.

Table 3 illustrates that:

- Less than 25 percent of the lands that contain Goal 5 resources are vacant and available for development. Goal 5 decisions will have the most immediate impacts here because development is unconstrained by other factors. Limit and prohibit decisions will affect vacant-buildable lands throughout the Portland metro area because these lands account for over 40 percent of the total inventory of vacant-buildable lands within the UGB.

- Seventy-eight percent of the lands with Goal 5 resources have already been developed or development is constrained on these lands by non-Goal 5 regulations.

- Over 60 percent of Goal 5-resource lands have already been developed as parks/open space or as urban residential, commercial, industrial, etc. developments.

- We expect that future developments on park and open-space lands will have limited negative impacts on the significant riparian and wildlife resources on these lands. As a result, it's unlikely that Goal 5 limit or prohibit decisions will significantly affect future developments on these lands.

- Goal 5 decisions may impact lands in the developed-urban category in the future as these lands are redeveloped.

- Title 3 restricts development on 16 percent of the lands with Goal 5 resources. This percentage underestimates the total amount of land on which development is restricted because Title 3 is a state-wide regulation and does not reflect lands on which development is restricted by local regulations that exceed Title 3 guidelines.

Metro must conduct the Goal 5 ESEE analysis for lands that contain significant natural resources *and* impact areas[25]. Impact areas lie outside, but adjacent to, the lands that contain significant resources. Land-use activities that occur on lands within the impact areas may negatively impact significant resources. Metro identified two types of impact areas. Riparian-impact areas occur within 150 feet of a stream, wetland, or lake that otherwise receives no resource protection. Supplementary impact areas occur in a band 25-feet wide around all resources to protect the tree root-zone areas.

Table 4 describes the development status of impact areas.

Table 4: The Development Status of Impact Areas

	Developed Parks	Developed Urban	Vacant Constrained	Vacant Buildable
Percentage of Impact Areas	9%	73%	5%	13%

Source: Data analysis by Metro staff.

As Table 4 indicates, most impact areas have already been developed.

An analysis of the development value of impact areas, as described by land value, employment density and 2040 Design Types, found that the distribution of development values follows the distributions of land value, employment density and 2040 Design Types described above for the lands containing significant riparian and wildlife resources. That is, most impact areas have "low" land value, employment density, and design types, relative to the values measured for lands in the Portland city center.

3.3.2. GENERALIZED REGIONAL ZONES

As described in the Conflicting Uses section of Metro's Goal 5 report, Metro identified land uses that could potential conflicting with significant riparian-wildlife and upland-wildlife habitat. Metro described these land uses using "generalized regional zones." The generalized regional zones reflect a compilation of zoning designations as implemented by local governments

[25] See the Impact Areas section of Metro's Goal 5 report for more information on impact areas.

within Metro's service area.[26] In this subsection we describe the lands containing significant Goal 5 natural resource by generalized regional zones.

Table 5 below lists the lands with Goal 5 natural resources by the generalized regional zones[27].

Table 5: Significant Riparian Areas and Wildlife Habitat by Generalized Regional Zone, in Acres and Percentage, in the UGB in 2002

Generalized Regional Zone	Acres	Percentage of Total Acres of Significant Resources
Single-Family Residential	24,821	46.2%
Multi-Family Residential	2,610	4.9%
Commercial	2,672	5.0%
Industrial	7,721	14.4%
Mixed Use Centers	1,284	2.4%
Rural	3,923	7.3%
Parks and Open Space	10,468	19.5%
No Zoning	172	0.3%
Total	53,671	100%

Source: Conflicting Uses section of Metro's Goal 5 report.

Table 5 illustrates that:

- Over 80 percent of the land uses that potentially conflict with Goal 5 riparian-wildlife and upland-wildlife resources occur in three regional zones: single-family residential (SFR), parks and open space (POS), and industrial (IND).
- SFR contains the largest percentage of Goal 5-resource lands, over 46 percent. Goal 5 allow, limit and prohibit decisions likely will fall most heavily on lands in this zoning.
- Lands zoned POS account for approximately 20 percent of Goal 5 natural resources.
- Over 14 percent of the lands with Goal 5 natural resource are zoned IND.

[26] See Metro's Goal 5 report for more information on designating conflicting uses.

[27] Table 3 describes the potential conflicting lands uses *within the UGB* in 2000. Lands *outside the UGB* but within Metro's service area are primarily zoned rural residential, agricultural, and forestry lands. Relative to the Portland city center we expect these lands have low employment density and land value. These lands have not yet been categorized by 2040 Design Type.

- The majority of lands with Goal 5 resource do not support employment. Less than 22 percent of the lands are zoned for commercial, industrial or mixed-use.

3.4. INTERACTIONS AMONG MEASURES

Previous subsections describe the lands containing Goal 5 natural resources using measures of development value[28], resource categories[29], and generalized regional zones[30]. In this subsection we describe the overlap and interactions among the measures. Given the number of measures and the large size of the table of interactions, we've appended the table in the Appendix to this report. The Appendix also contains tables that describe interactions between various subsets of measures.

Summary points illustrated in the tables of interactions include:

- *Land Value, Zoning and Resources:* The zoning for a majority of resource lands, approximately 64 percent, support development value. The remainder fall into POS zoning or contain water bodies. Of the lands with development value, most fall into the "low" land-value category. See Table 4 in the Appendix

- *Employment, Zoning and Resources:* Approximately 78 percent of the resources lands do not support employment. These lands are zoned SFR, MFR, RUR, and POS. Of the lands that do support employment, most fall into the "low" employment category. See Table 5 in the Appendix.

- *2040 Design Type and Resources:* The distribution of resource lands by 2040 Design Type differs from the distributions described above for land value and employment. In general, categorizing lands using 2040 Design Types yields a distribution with a greater percentage of the lands having development value, and for the lands that have development value, more of the lands rank in the higher-valued design types. See Table 6 in the Appendix.

- *2040 Design Type, Zoning, and Resources:* Three generalized regional zones, SFR, POS, and IND, account for 80 percent of the resource acres. Ninety-eight percent of the resource lands zoned SFR and POS fall into the lowest design type[31]. In contrast, 33 percent of the lands

[28] Land value, employment density, and 2040 Design Type.

[29] Riparian-wildlife classes I, II, and III, upland-wildlife classes A, B, and C.

[30] Single-family residential, multi-family residential, commercial, industrial, mixed use centers, rural, parks and open space, and no zoning.

[31] This includes lands in the tertiary design type, and lands in the "other" design type that includes parks, open space and rural reserves.

zoned IND fall in the lowest design type and 60 percent is ranked in the primary, or highest, design type. See Table 7 in the Appendix.

- *Land Value, Employment, 2040 Design Type, Zoning and Resources*: Focusing on resource lands zoned SFR, POS, and IND, approximately 98 percent of POS lands, and approximately 78 percent of SFR lands ranked in the lowest category for all three measures of development value (land value, employment and 2040 Design Type). In contrast, 25 percent of lands zoned IND ranked in the lowest categories for all three measures of development value. Over 60 percent of IND lands ranked in the highest category for at least one measure. See Table 8 in the Appendix.

- *Goal 5 Allow, Limit, Prohibit Impacts*: The large majority of Goal 5 allow, limit and prohibit decisions will impact lands zoned SFR, POS and IND. Impacts on lands zoned SFR and POS will have little or no employment impacts and will affect lands ranked "low" on the land-value scale. The majority of impacts on lands zoned IND will affect lands ranked "high" on at least one measure of development value.

The fact that Goal 5 decisions would primarily affect acres with lower land values and employment densities does not mean that limit or prohibit decisions on these acres would generate trivial economic consequences. The "low" category for these development values are relative to land values and employment densities found in the Portland city center and do not represent an absolute measure of land value or employment. The actual impacts of limit or prohibit decisions on property values or employment will depend on the specifics of the decision (e.g., lightly limit, moderately limit, etc.), the details of the Goal 5 plan that implements the decision, actions that may mitigate any negative impacts, and specifics of the individual parcels affected.

Maps

For mapping purposes, Metro summarized the interaction among the measures of development value into three categories, which they refer to as Component Summaries. The lowest category shows lands that ranked "low" on all three measures of development value: property value, employment density and 2040 Design Types. The next category shows lands that ranked "medium" on at least one category, with no "high" rankings. The final category shows lands that ranked "high" on at least one category.

Map 5 shows the Component Summaries for *all* lands in Metro's service area, including lands that do not contain Goal 5 natural resources. Map 5a shows the Component Summaries for the subset of lands within Metro's service area that contain significant Goal 5 natural resources. Goal 5 decisions will affect these lands. Map 5b is similar to Map 5a except that it illustrates the Component Summaries for the subset of resource lands that

ranked highest for type and amount of ecological functions and wildlife characteristics (Class I and Class A lands).

Focusing on Maps 5a and b that depict resource lands, the maps show that the majority of resource lands ranked "low" on all three measures of development value.

3.5. POTENTIAL ECONOMIC TRADEOFFS OF GOAL 5 ALLOW, LIMIT, AND PROHIBIT DECISIONS

3.5.1. INTRODUCTION

The economic portion of the Goal 5 ESEE analysis addresses the tradeoffs of developing lands that contain Goal 5 riparian and wildlife resources, or maintaining the resources and their associated ecosystem services that benefit society. Any development potentially conflicts at some level with preserving land in its natural state. Developing the lands with Goal 5 resources will generate a set of economic tradeoffs distinct from the tradeoffs of protecting the resources. We describe these tradeoffs in this subsection.

It's not clear at this time the details of Metro's Goal 5 programs or how they'll be implemented. Both will influence the economic tradeoffs. Economic tradeoffs will also depend on the specifics of the significant resources affected, the conflicting land uses, and parcel size, configuration, and location. As a result of these analytical uncertainties, we depict economic tradeoffs qualitatively rather than quantitatively. We describe—at the regional level—the economic factors that allow, limit, or prohibit decision can influence and the likely directions of change. We do not, however, calculate a quantitative change in the development or resource values associated with a Goal 5 decision on a specific property.

We considered the results from the analyses of energy, social, and environmental tradeoffs in our analysis of economic tradeoffs.

We describe the following categories of economic tradeoffs:

Economic Values. The changes in the values of goods and services.

- Property values.
- The values of ecosystem goods and services provided by riparian and wildlife areas.

Economic Impacts. The changes in the levels of economic activities within the local economy.

- Employment and income tradeoffs.
- Changes in tax payments.
- Transportation impacts.

2040 Design Types. The 2040 Design Types outline development patterns over the coming decades. The analysis considered the economic tradeoffs of how allow, limit and prohibit decisions may impact future development.

Economic Equity. The changes in the distributions of costs and benefits within the economy, especially changes affecting groups of special concern such as property owners that shoulder a disproportionate amount of the negative consequences of a policy decision. Equity tradeoffs in this analysis include:

- Tradeoffs by type of land use, as described by zoning type.
- The geographic distribution of economic tradeoffs.

As an introduction to our discussion of economic tradeoffs we describe the baseline conditions against which the economic tradeoffs of Goal 5 decisions will be compared. We then describe the static economic tradeoffs or the tradeoffs as if the economy or policy makers cannot react to mitigate or avoid negative economic outcomes, or to enhance or promote positive economic outcomes. Following our description of economic tradeoffs we list the major factors that can influence the distribution and magnitude of tradeoffs. These factors provide a somewhat dynamic view of the tradeoffs. In matrices that follow our narrative description we summarize the economic tradeoffs of allow, limit, and prohibit decisions by generalized regional zones.

3.5.2. BASELINE FOR THE ANALYSIS OF ECONOMIC TRADEOFFS

The existing, non-Goal 5, regulatory protection of riparian and wildlife resources provides the baseline for the analysis of economic tradeoffs of Goal 5 allow, limit and prohibit decisions. An allow decision will permit developing significant natural resource to the limits allowed by existing, non-Goal 5 protection measures. Goal 5 limit or prohibit decisions provide a marginal *increase* in protection above and beyond existing protection measures.

For lands in Metro's service area, Title 3 of the Urban Growth Management Function Plan (Title 3) describes existing protection measures and is the baseline against which the Goal 5 management decisions will be measured. Title 3 regulates development that affects water quality, flood management and fish and wildlife conservation. As described by Metro, the goal of Title 3 is to

> "[P]rotect the region's health and public safety by reducing flood and landslide hazards, controlling soil erosion and reducing pollution of the region's waterways. Title 3 specifically implements the Oregon Statewide Land Use Goals 6 and 7 by protecting streams, rivers, wetlands and floodplains by avoiding,

limiting or mitigating the impact on these areas from development." [32]

Because Title 3 implements statewide land-use goals it affects lands in all the local jurisdictions within Metro's service area. Local jurisdictions, however, may adopt protection measures that *exceed* Title 3 regulations. The economic tradeoffs of Goal 5 allow, limit and prohibit decisions in these jurisdictions will differ from the tradeoffs in jurisdictions where Title 3 represents the baseline protection in the following ways.

- Allow decisions will overestimate the negative impacts of development on Goal 5 riparian and wildlife resource and associated ecosystem services. An allow decision will also overestimate the benefits on development values.

- Limit and prohibit decisions will overestimate the benefits of habitat protection and will overestimate the negative impacts on development values.

3.5.3. POTENTIAL ECONOMIC TRADEOFFS OF GOAL 5 ALLOW, LIMIT, AND PROHIBIT DECISIONS

We begin by describing economic values, economic impacts, 2040 Design Types and equity issues and how Goal 5 decisions may impact these factors. Next we summarize the economic tradeoffs for allow, limit and prohibit decisions. Finally, we describe economic tradeoffs by generalized regional zones.

Economic Values

Property Values in Development

The factors that affect the development value for land fall into two general categories: location factors and use factors[33].

Location factors include:

- Availability and quality of public infrastructure, e.g., roads, sewer, water, electric. Land-use decisions that hinder or make more difficult the provision of infrastructure services may negatively impact the values of the affected properties.

- Access to the site. Actions that limit or impede access to a site may negatively impact the site's property value.

[32] www.metro-region.org/article.cfm?ArticleID=274 accessed August 5, 2004.

[33] See the accompanying literature review for more information on location and use factors.

- Agglomerative economies associated with the location. Decisions that promote or allow the development of agglomerative economies, e.g., clustering of commercial or industrial developments, will help maintain or enhance development values of these activities. Decisions that inhibit the development of such agglomerative economies may have the opposite effect.

- Existing zoning or other land-use regulations. Zoning and other regulations can have positive and negative impacts on a property's value. For example, water-front properties zoned for industrial use might have higher property values if they were zoned residential. In another example, a residential zoning may protect property values by excluding incompatible land uses, e.g., a gas station.

Use factors include:

- Amenities of the site, e.g., views, access to parks, water, and other open spaces. Actions that protect or enhance a location's amenities, may also protect or enhance the impact that amenities have on property values.

- Physical terrain, e.g., hilly or flat. Grading hills and other changes to a parcel's physical terrain may increase the parcel's usability and development value. Actions that limit grading hills or other changes to a parcel's physical terrain may negatively impact the parcel's property value.

- Lot size, shape and buildable area. Actions that limit a parcel's usable area may negatively impact the parcel's development value. We expect that the impacts from limiting a parcel's usable area will likely be the most common way that limit or prohibit decisions could influence development values.

Values of Ecosystem Services

Metro's report on Goal 5 environmental tradeoffs describes the consequences of allow, limit and prohibit decisions on riparian and wildlife resources and on the associated ecological functions and wildlife characteristics. As described in Metro's environmental report, and above in Section 3.2 and in the literature review that accompanies this report, the ecological functions and wildlife characteristics at issue in Metro's study provide ecosystem services that benefit society. Actions that protect or enhance these services will also protect and enhance their value. Actions that degrade ecosystem services will have the opposite effect. As services degrade, society either does without the service, restores the degraded habitat, or replaces some lost or degraded services by building engineered projects, e.g., upgrading a water-treatment plant that provide clean water.

Metro's Goal 5 decisions will impact the following ecosystem services:

- *Flood Management*. Riparian and upland-wildlife habitat help mitigate flooding by moderating flow intensities and absorbing runoff. Actions that reduce flood-management services may increase flooding of area homes and businesses, and increase flood-related damages and government expenditures for flood clean up and mitigation.

- *Water Quality*. The habitats at issue in this study help control soil erosion and landslides that cause sedimentation. Riparian and wildlife areas also help filter toxins and sediment from surface runoff before they enter streams and other water bodies. Degrading these services may increase the flow of sediment and contaminants into areas waters. Degraded water quality may increase filtration costs for businesses and municipalities. Increased concentrations of toxins and sedimentation may also increase the costs of projects mandated by regulatory agencies to bring water quality into compliance with federal and state water-quality laws, e.g., the Clean Water Act.

- *Moderating Water and Air Temperatures*. Vegetation in riparian and wildlife habitats provides shade that helps reduce air temperatures and the "heat island effect" in summer. Moderating air temperatures in summer helps reduce electricity costs associated with air conditioning. Actions that remove this vegetation may increase summer air temperatures and cooling costs.

- *Stormwater Services*. Riparian and upland wildlife habitats absorb rainfall that otherwise would flow into stormwater systems. Replacing these habitats with impervious surfaces will increase stormwater flows and management costs. These costs can be substantial. For example, Portland is currently spending approximately $1.4 billion retrofitting its stormwater system[34].

- *Salmon Habitat*. The habitats at issue in this study help support salmon populations and related commercial, recreational and cultural values. Actions that protect salmon habitats also help protect these values. Actions that degrade habitats may have the opposite effect.

- *Amenities*. Riparian and upland-wildlife habitats provide view, open-space, and water-related amenities and associated amenity values for properties in proximity to the resources. Actions that protect these amenities also protect the contribution these resources make toward property values. Actions that degrade the resources have the opposite effect.

- *Recreation*. Riparian and upland-wildlife habitats support recreation activities including wildlife viewing, fishing, and activities associated

[34] Portland Utility Review Board, Issue Paper Recommendation, August 25, 2004. <www.portlandonline.com>

with parks and open space. Degrading these resources may also degrade recreation-related ecosystem services.

- *Intrinsic and Option Values*. Intrinsic values are the values people find inherent in a resource or species for itself, rather from the use or consumption of the resource. These values represent the amounts residents or society would pay to protect a resources, or expect in payment to degrade the resource. Option values represent the value of protecting a resource or species for future use or enjoyment[35]. Actions that degrade riparian and upland-wildlife resources also degrade the intrinsic and option values associated with the resources. Such decisions also increase the risks of an irreversible outcome, e.g., extinction of a salmon species, which may have negative economic consequences in the future.

- *Carbon Sequestration*. Metro's Goal 5 report on energy tradeoffs describes the carbon-sequestration benefits of trees and other vegetation. Removing the vegetation negatively impacts the sequestration benefits and associated economic value[36].

To the extent that riparian and upland-wildlife resources provide multiple ecosystem service, the true or full values of services at risk from actions that degrade resources are the cumulative values of the affected services.

Economic Impacts

Employment

We expect that for lands that support employment, e.g., commercial, industrial and mixed use, the factors that influence land value also influence employment. For example, actions that affect access to a site or a property's developable area will also likely affect the employment potential of the site. In general, however, we expect that Goal 5 decisions will impact land values more than employment (or income) for the following reasons.

- A large percentage of Goal 5 riparian and upland-wildlife resources are zoned for land uses that do not support employment. Of the remaining lands, many have "low" employment densities, relative to densities in the Portland city center.

- A portion of the lands containing resources zoned commercial or industrial have previously been developed and currently support employment. Goal 5 decisions will not affect this employment. A Goal

[35] See the literature review that accompanies this report for more information on intrinsic and option values.

[36] See the literature review for more information on the value of carbon sequestration.

5 decision on these lands may affect future employment through re-development of properties.

Actions that protect or degrade riparian and upland-wildlife resources may impact jobs that depend on these resources. For example, protecting salmon habitat may help support jobs that depend on commercial and recreational salmon harvests. In this example, many of the jobs associated with salmon harvests may be located outside Metro's service area.

Income

We expect the income tradeoffs of protecting or degrading riparian and upland-wildlife resources will follow employment tradeoffs.

Taxes

Property Taxes

We expect impacts of protecting or degrading riparian and upland-wildlife resources will follow impacts on property values. This is especially true for lands zoned commercial and industrial that have not yet been developed. Limiting development on these lands may negatively impact property values and associated property taxes. Limiting development may have the opposite effect on property values and associated tax payments for residential property surrounding or adjacent to properties currently undeveloped. Protecting riparian and upland-wildlife resources on these lands may have a beneficial impact in property taxes, especially over the long term.

Payroll Taxes

We expect that the payroll-tax tradeoffs of protecting or degrading riparian and upland-wildlife resources will follow employment and income tradeoffs.

Business Taxes

We expect that the business-tax tradeoffs of protecting or degrading riparian and upland-wildlife resources will follow the tradeoffs for property value, employment and income for lands zoned commercial, industrial and mixed-use.

Transportation Costs

Transportation costs increase with the number of vehicle miles traveled (VMT). Planning guidelines that address transportation costs, such as the 2040 Design Types, promote more compact development that limits VMT and transportation costs. Actions that push development out towards the UGB boundary or beyond will increase VMT and transportation costs relative to actions that promote more compact development.

2040 Design Types

The 2040 Growth Concept outlines the Portland metropolitan region's plan to accommodate expected population growth over the coming decades, while addressing housing, transportation, open space and employment needs. The 2040 Design Types represent the land-use categories, e.g., central city, main streets, neighborhoods, rural reserves/open space, that embody the Growth Concept's transportation, housing and other land-use goals[37]. The 2040 Growth Concept anticipates expected population growth while:

- Maintaining access to nature.
- Protecting wildlife habitat.
- Promoting efficient use of land.
- Supporting a vibrant economy.
- Providing transportation options.
- Promoting development along transportation corridors.
- Minimizing sprawl and VMT.

Activities that protect or degrade riparian and upland-wildlife resources may have mixed impacts on the 2040 Growth Concept's goals and associated Design Types. Protecting and maintaining access to these resources supports the Growth Concepts and Design Types' emphasis on resource protection. However, if protecting resources displaces development to the extent that it promotes sprawl, expanding the UGB and the number of VMT, protection actions may inhibit or limit the Design Types. Alternatively, developing resource lands may limit UGB expansion and associated consequences, but may also conflict with the Growth Concept's goals that address resource protection and access to natural areas.

The Growth Concept's goals regarding development density and transportation considerations may mitigate the impacts of resource protection on sprawl. Increasing the efficiency of land use by promoting higher development densities along transportation corridors complements the resource-protection goals by accommodating, to some extent, land uses that might otherwise be displaced to outside the UGB.

Economic Equity

Geographic Distribution of Impacts

In general, locations within Metro's service area that have been developed more intensely over longer periods of time have the least amount of riparian

[37] For more information on the 2040 Growth Concept and Design Types see Metro's publication, "The Nature of 2040: The Region's 50-Year Plan for Managing Growth," "2040 Growth Concept and the RTP," and other information on Metro's web site, www.metro-region.org.

and upland-wildlife resources. As a result, Goal 5 protection measures will have limited or no negative impacts on development in these locations. Map 4 shows the distribution of riparian and upland-wildlife resources at issue in Metro's Goal 5 analysis.

As illustrated in Map 4, a triangularly-shaped area that extends southwest from the confluence of the Willamette and Columbia Rivers down to Gladstone, then northeast up to Troutdale, and northwest along the Columbia River to the confluence with the Willamette River has little riparian or upland-wildlife resources, excluding river-front areas. We expect that negative tradeoffs of Goal 5 protection measures on development will predominantly affect properties outside this area.

To the extent that Goal 5 decisions limit development outside this triangular area, properties within the triangle may become more desirable to developers and increase in value relative to conditions that would exist without Goal 5 protection.

Distribution of Impacts by Land Use

Approximately 80 percent of the lands containing riparian and upland-wildlife resources fall into three generalized regional zones: single-family residential (SFR), parks and open space (POS), and industrial (IND). See Table 5. We expect the economic tradeoffs associated with Goal 5 protection will fall primarily on lands in these zoning categories. As a group, lands in other zoning categories will experience limited Goal 5 economic tradeoffs.

SFR lands accounts for approximately 46 percent of Goal 5-resource lands and will experience the large majority of economic tradeoffs. This percentage is disproportionately large, relative to other zonings, and means Goal 5 tradeoffs will impact these lands the most and to a greater extent than lands in other zonings. POS lands account for approximately 20 percent of resource lands, and IND lands 14 percent. Lands in the remaining four zoning categories, multi-family residential, commercial, mixed use centers, and rural, combined account for approximately 20 percent of Goal 5 riparian and upland-wildlife lands. Tradeoffs associated with Goal 5 protection measures will be disproportionately less for these lands.

The current development status of lands that contain Goal 5 riparian and upland wildlife resources shows another aspect of the distribution of Goal 5 economic tradeoffs. As described above in section 3.3, vacant-buildable lands that contain Goal 5 riparian and upland-wildlife resources will likely experience the most immediate effects of Goal 5 protection measures. These lands account for approximately 22 percent of Goal 5 resource lands. See Table 3. However, these lands also represent over 40 percent of the available vacant-buildable land in the UGB. The economic tradeoffs of Goal 5 protection measures will affect a significant portion of vacant-buildable land throughout the UGB.

Distribution of Impacts By Goal 5 Treatment

Of course, the Goal 5 treatments will affect the distribution of positive and negative economic tradeoffs. Allow treatments do not increase resource protection beyond Title 3 or local regulatory measures and place no additional restrictions on land use and development. Developers and property owners will enjoy most, if not all, of the benefits. Riparian and upland-wildlife resources, associated ecosystem services and those that benefit from the resources and services will suffer most, if not all, of the negative economic tradeoffs. Results for prohibit treatments will have the opposite effect. Development interests will suffer most, if not all, of the restrictions. The natural resources, ecosystem services, and those who benefits from the resources and services will experience most, if not all, of the benefits. Limit treatments offer the most equitable distribution of tradeoffs because they generate positive and negative tradeoffs for development and resource interests.

SUMMARY OF ECONOMIC TRADEOFFS

Allow Conflicting Uses

Allowing conflicting uses means no additional protection of Goal 5 riparian or upland-wildlife resources beyond the baseline protection provided by Title 3, or by local protection measures that exceed Title 3 guidelines. This alternative emphasizes developing lands containing Goal 5 resources. Positive economic tradeoffs of this alternative include:

- No impediments to development or negative impacts on the development value of land.
- Development-related employment, income and taxes will be unaffected by Goal 5.
- No Goal-5 related increase in VMT, transportation costs or UGB expansion.

Negative economic tradeoffs include:

- Amenity-related property values and associated property taxes for undeveloped lands zoned SFR and RUR that are adjacent to Goal 5 resource lands may be less for this scenario relative to limit and prohibit scenarios.
- Flood-mitigation services will decline, flood damage and clean-up costs may increase.
- Erosion and sedimentation will increase, as will concentration of toxins in streams and other water bodies. Water-quality expenditures (e.g., for filtration and treatment) by businesses and municipalities may increase. Municipal expenditures that address water-quality regulations (e.g., the federal Clean Water Act) may increase.

- Summer temperatures and the urban "heat island effect" may increase with an associated increase in cooling costs.
- Developing riparian and upland-wildlife resources will increase the amount of impervious surfaces, which will increase stormwater flows and treatment costs.
- Development that negatively impacts salmon habitat may affect commercial, recreational and cultural harvests. Municipal expenditures that address habitat regulations (e.g., Endangered Species Act) may increase.
- Degrading riparian and upland-wildlife resources may negatively affect recreational opportunities and values that depend on these resources.
- Negative impacts on intrinsic values for riparian and upland-wildlife resources.
- Developing Goal 5 resources now or in the near-term precludes developing them in the future or protecting them for future generations. This reduces the option values associated with the resources.
- Carbon sequestration and air-pollution removal will decline with an associated decline in air quality and related values of air-quality services.
- Businesses that rely on riparian and upland-wildlife resources and associated ecosystem services may experience a decline in sales, employment and income relative to the limit or prohibit scenarios. Employment and business-related tax payments may also decline.
- Allowing conflicting uses will negatively affect the 2040 Growth Concept and Design Types that emphasize protecting resources and maintain access to resources.
- The large majority, if not all, of the negative economic tradeoffs of this option affect riparian and upland-wildlife areas, associated ecosystem services and economic factors, e.g., jobs, incomes and values, that depend on these resources. Development interests suffer little or no negative economic tradeoffs.

Limit Conflicting Uses

Limiting conflicting uses strikes a balance between completely developing the Goal 5 riparian and upland-wildlife resources and protecting them. This alternative provides opportunities including: developing lands in ways that minimize negative environmental and economic tradeoffs; supporting the development goals embodied by the 2040 Design Types; and protecting the most important habitats.

The economic tradeoffs for this alternative depend on the degree of limitation on development actions: lightly limit, moderately limit, or strictly

limit. Lightly-limit treatments will have more in common with allow treatments than with prohibit treatments. The opposite will be the case for strictly-limit treatments. As the name implies, tradeoffs for the moderately-limit treatment will fall somewhere in between.

This scenario will generate a mix of positive and negative economic tradeoffs for development interests and for the resources and associated ecosystem services. Developing resources will generate positive impacts on development values, employment, income, and tax payments. However, these impacts will be less than for the allow scenario. The resources will likely suffer some degradation, but not to the extent generated under the allow scenario.

The consequences for the 2040 Design Types will be mixed. Protecting resources to a greater extent, compared with the allow scenario, may increase VMT if protecting resources displaces development and pushes it out toward the UGB or beyond. This may also increase the next UGB expansion and transportation costs. However, protecting riparian and upland-wildlife resources is consistent with the planning goals reflected in the Design Types.

The limit scenario will generate a more equitable distribution of positive and negative economic tradeoffs, compared with either the allow or prohibit scenarios. Development interests and the resources will both experience positive and negative economic tradeoffs.

Prohibit Conflicting Uses

Prohibiting conflicting uses will prevent development actions that conflict with, or degrade, Goal 5 riparian and upland-wildlife resources. This scenario emphasizes resource protection. Protection measures will exceed the baseline protection provided by Title 3, or by local protection measures that exceed Title 3 guidelines.

Positive economic tradeoffs of this alternative include:

- Amenity-related property values and associated property taxes for lands zoned SFR and RUR that are adjacent to Goal 5 resource lands may be greater for this scenario relative to limit and allow scenarios.
- This alternative will provide the greatest amount of flood-mitigation services and value.
- Erosion and sedimentation will be less than limit or allow alternatives, as will concentration of toxins in streams and other water bodies. Water-quality expenditures (e.g., for filtration and treatment) by businesses and municipalities may be the least under this alternative. Municipal expenditures that address water-quality regulations (e.g., the federal Clean Water Act) may decline, especially over the long term.

- This alternative will have the greatest mitigating effect on summer temperatures, the urban "heat island effect," and associated cooling costs.
- Prohibiting development in Goal 5 riparian and upland-wildlife resources will generate the least amount of impervious surfaces, and will generate the least amount of stormwater flows and treatment costs.
- This scenario will protect the greatest amount of salmon habitat and may positively affect commercial, recreational and cultural harvests. Municipal expenditures that address habitat regulations (e.g., Endangered Species Act) may decline, especially over the long term.
- This alternative will preserve the greatest amount of recreational opportunities, and the associated recreational values.
- The intrinsic and options values for the riparian and upland-wildlife resources will be preserved.
- Maintaining the greatest amount of vegetation will maximize carbon sequestration, air pollutant removal and the related values of air-quality services.
- This alternative will provide the greatest support to businesses that rely on riparian and upland-wildlife resources and associated ecosystem services.
- Prohibiting conflicting uses will support the aspects of the 2040 Growth Concept and Design Types that emphasize protecting resources and maintain access to resources.

Negative economic tradeoffs include:

- This alternative will have the greatest negative impact on the development value of land.
- Development-related employment, income and tax payments will also suffer the greatest under this alternative.
- Aspects of the 2040 Design Types that minimize VMT and sprawl will be negatively impacted if protection measures displace development within the UGB.
- The large majority, if not all, of the negative economic tradeoffs of this alternative affect development interests. The economic values and activities supported by riparian and upland-wildlife resources suffer little or no negative economic tradeoffs, relative to allow and limit alternatives.

3.5.4. THE DYNAMIC ASPECTS OF ECONOMIC TRADEOFFS

The description of economic tradeoffs in the previous section assumes no reaction by stakeholders and decisionmakers that would impact the economic

tradeoffs. This static approach ignores, for example, the possibility that restoring riparian and upland-wildlife habitats may mitigate some of the negative economic tradeoffs of development on these resources. A more dynamic view of economic tradeoffs considers alternatives that could help mitigate negative tradeoffs and enhance positive tradeoffs. In this section we describe a number of these dynamic factors.

Substitutability of Land Uses

Moving proposed land uses that conflict with riparian and upland-wildlife resources to alternative locations may mitigate negative economic tradeoffs for both the land use and resources. The previously-conflicting land use can take place without impacting Goal 5 resources. Substituting a non-conflicting or less-conflicting land use in the resource area will protect, to some extent, the property's development value. Such a move will also protect, to some extent, the quality and quantity of the property's riparian and upland-wildlife resources.

The feasibility of substituting land uses depends on the types of land uses at issue and the availability of suitable sites outside the resource areas. The more specific or unique the development requirements, the less likely the development can take place elsewhere. For example, water-dependent industrial development must take place in specific locations—relatively large lots with water access. This limits the extent to which the land use can avoid conflicting with riparian resources by moving elsewhere. By comparison, residential land uses have relatively few development-specific requirements and take place throughout Metro's service area.

Expanding the Urban Growth Boundary

Protecting riparian and upland-wildlife resources may reduce the amount of developable land within the UGB. If this is the case, expanding the UGB could mitigate this loss while protecting riparian and upland-resources within the existing UGB. However, expanding the UGB may promote sprawl and negative sprawl-related impacts including increased VMT and transportation costs, and possibly minimizing the effectiveness of the 2040 Design Types.

As we understand it, Metro Council and staff consider expanding the UGB as an option of last resort. Goal 5 protection options will be developed in ways that emphasize other mitigation options.

Encourage Development Practices That Minimize Conflicts With Resources

Encouraging development practices that minimize conflicts with resources may help mitigate negative economic tradeoffs for both development and the resources. These practices include low-impact development projects that minimize impervious surfaces and manage

stormwater in ways that more closely mimic natural systems. Cluster developments for residential lands is another example. This type of development localizes housing sites and associated land-use activities, e.g., roads, while avoiding developing riparian and upland-forest resources. In another example property owners may sell future development rights while retaining ownership without restrictions on existing land uses.

Restoring Degraded Riparian and Upland-Wildlife Resources

Restoring already-degraded riparian and upland-wildlife habitat could offset a portion of the negative impact of new development on habitat elsewhere. In some cases, restoration opportunities may lie outside the existing UGB or Metro's service area.

3.5.5. ECONOMIC TRADEOFFS BY GENERALIZED REGIONAL ZONE

Single Family Residential (SFR)

Lands zoned SFR account for almost half, 46 percent, of Goal 5 riparian and upland-wildlife resources. Protection actions on these lands will primarily affect property values and related tax payments with little or no direct impacts on employment and income. Since SFR developments typically retain more vegetation and tree cover than other types of development, this land use will conflict less with resources and retain more ecosystem services and associated economic values than other development uses. Encouraging low-impact developments and cluster development patterns may help mitigate negative economic tradeoffs for development and resources.

Multi-family Residential (MFR)

MFR lands account for approximately 5 percent of Goal 5 riparian and upland-wildlife resources. Economic tradeoffs will be similar to SFR lands except that MFR development typically retains less vegetation cover and fewer ecosystem services and associated values.

Commercial (COM)

Approximately 5 percent of Goal 5 riparian and upland-wildlife resources are on lands zoned COM. Resource-protection actions may negative affect property values, employment, income and related tax payments. COM developments involve extensive landscape modifications that negatively affect ecosystem services and the economic values of services. These negative impacts are comparable to, or greater than, the degradation of ecosystem services and values associated with MFR developments.

Industrial (IND)

IND lands account for approximately 15 percent of lands containing Goal 5 riparian and upland-wildlife resources. Economic tradeoffs will be similar in type and extent to tradeoffs for COM lands.

Mixed-Use Centers (MUC)

Approximately three percent of Goal 5 riparian and upland-wildlife resources are on lands zoned MUC. Economic tradeoffs will be similar to developments on lands zoned MFR and COM. Limiting MUC developments will have mixed impacts on 2040 Design Types and the underlying 2040 Growth Concept. Protecting riparian and upland-wildlife resources supports the Growth Concept's goals of maintaining access to nature and protecting habitat. Limiting MUC developments, however, may negatively impact the Design Type's emphasis on promoting more efficient use of land and minimizing sprawl and VMT.

Rural Residential (RUR)

RUR lands account for approximately 7 percent of Goal 5 riparian and upland-wildlife resources. Economic tradeoffs of developing RUR lands will be similar to SFR except less intensive given the more dispersed nature of RUR developments.

Parks and Open Space (POS)

Approximately 20 percent of the Goal 5 riparian and upland-wildlife resources are on lands zoned POS. Protection measures may limit recreation activities that require facilities, e.g., ball fields and golf courses, and related infrastructure, e.g., parking lots. This limitation may negatively impact property values for private parklands more than parks on public lands. Park and open-space land uses may be the least intrusive on habitats and associated ecosystem services and economic values.

The matrices at the end of this report depict the proceeding descriptions of economic tradeoffs by generalized regional zone in table format.

3.5.6. SUMMARY POINTS

- Allowing development of Goal 5 riparian and upland-wildlife resources protects development values but will degrade riparian and upland wildlife resources and the associated ecosystem services that society values.

- Prohibiting development protects resources and associated values, but will limit development-related economic benefits.

- Limiting development preserves some level of development and resource values.

- Protecting resources within the existing UGB preserves resources in close proximity to current population distributions but increases the probability of expanding the UGB sooner or to a greater extent than otherwise would be the case if protection measures displace developable land.

- Protecting resources on the urban fringe protects development interests close in, but reduces access to resources and associated ecosystem services for the majority of the population within the existing UGB.

- The details of the program options applied at the parcel level will dictate the type and extent of positive and negative economic tradeoffs for Goal 5 resource-protection measures.

- Avoid double-counting environmental consequences when developing Goal 5 programs. For example, environmental consequences were estimated by Metro staff as part of their ESEE analysis. ECONorthwest's analysis of economic consequences considered the impacts on ecosystem services, which are based in large part on Metro's analysis of environmental consequences.

4. MATRICIES OF ECONOMIC CONSEQUENCES

Single Family Residential

	Riparian & Wildlife Classes I, II, III		Upland Wildlife Classes A, B, C	
	Positive	**Negative**	**Positive**	**Negative**
Allow	• Property owners realize full development potential. • Protection of amenity/quality of life values associated with the build environment in urban areas. • Expanding UGB to offset development land lost to resource protection not required.	• Degradation of ecosystem services and values. • Higher loss of ecosystem services and values for resources in Class I compared with Classes II and III. • Municipal expenditures may increase in the future re environmental laws, flood management and water-quality control. • Damages and costs associated with flooding and landslides may increase. • Cooling costs in summer may increase. • Increased risk of foregoing future uses of resources. • Increased risk of irreversible outcome with possible negative economic results. • May increase restoration costs. • May negatively impact jobs and income that depend on quality of ecosystem services.	Similar to Riparian.	Similar to Riparian except: • Degradation of ecosystem services associated with habitat that supports salmon. Negative consequences on related commercial, recreational, spiritual and intrinsic values. • Higher loss of ecosystem services and values for resources in Class A compared with Classes B and C. • Negative impacts on employment that depends on quality of salmon habitat.

Single Family Residential

	Riparian & Wildlife Classes I, II, III		Upland Wildlife Classes A, B, C	
	Positive	**Negative**	**Positive**	**Negative**
Limit	• The economic tradeoffs associated with a limit decision will fall between the tradeoffs of allow and prohibit. Limit tradeoffs will depend on the specifics of the limit decision (severely limit, moderately limit, or slightly limit), the land use and property in question, and the mitigation possibilities. The limit option offers the most equitable distribution of positive and negative economic tradeoffs of Goal 5 protection.			
Prohibit	• Protection of riparian resource and associated ecosystem services and values. • Greater protection of services and values for Class I resource compared with Class II and III. • May reduce future costs re environmental regulations, flood management and water quality controls. • May reduce future damage and costs re flooding and landslides. • May reduce "heat-island" effect and cooling costs in summer. • Lower restoration costs compared with allow or limit. • Reduced risk of foregoing future uses of resources. • Reduced risk of irreversible outcome with possible negative economic results. • May protect jobs and income that depend on quality of ecosystem services.	• Negative consequences on development value of property and associated taxes. • Expanding the UGB to mitigate negative impacts on amount of developable land may increase costs associated with expanding or extending infrastructure and other sprawl-related costs. • SFR accounts for 46% of total resource lands and will experience more negative impacts than other land uses.	Similar to Riparian except: • Protecting wildlife habitat that supports salmon and related commercial, recreational, spiritual, and intrinsic values. • May protect jobs and income that depend on quality of salmon habitat.	Similar to Riparian.

Multi Family Residential

	Riparian & Wildlife Classes I, II, III		Upland Wildlife Classes A, B, C	
	Positive	**Negative**	**Positive**	**Negative**
Allow	Similar to SFR.	Similar to SFR except: • More habitat disturbance will generate greater negative impacts on resources, ecosystem services and associated economic values.	Similar to SFR.	Similar to SFR.
Limit	Similar to SFR.			
Prohibit	Similar to SFR.	Similar to SFR. except: • Pressure to expand UGB will be less than for SFR because of the increased density of MFR developments.	Similar to SFR.	Similar to SFR.

Commercial

	Riparian & Wildlife Classes I, II, III		Upland Wildlife Classes A, B, C	
	Positive	**Negative**	**Positive**	**Negative**
Allow	Similar to MFR except: • No employment impacts specific to development use. • No impacts on related income and income-tax revenue to municipalities.	Similar to MFR.	Similar to MFR.	Similar to MFR.
Limit	Similar to MFR.			
Prohibit	Similar to MFR.	Similar to MFR except: • COM contains 5% of significant resources. • Negative impacts on employment specific to development use. Substitutability or reconfiguration of land use may mitigate this impact. • Negative impacts on related income and income-tax revenue.	Similar to MFR.	Similar to MFR.

Industrial

	Riparian & Wildlife Classes I, II, III		Upland Wildlife Classes A, B, C	
	Positive	**Negative**	**Positive**	**Negative**
Allow	Similar to COM except: • More intensive positive development-related impacts.	Similar to COM except: • Greater negative impacts on ecosystem services.	Similar to COM.	• Similar to COM.
Limit	Similar to COM.			
Prohibit	Similar to COM except: • Greater beneficial impacts on ecosystem services.	Similar to COM except: • More intensive negative development-related impacts.	Similar to COM.	Similar to COM.

Mixed Use Centers

	Riparian & Wildlife Classes I, II, III		Upland Wildlife Classes A, B, C	
	Positive	**Negative**	**Positive**	**Negative**
Allow	Similar to MFR and COM, depending on land use.	Similar to MFR and COM, depending on land use.	Similar to MFR and COM, depending on land use.	Similar to MFR and COM, depending on land use.
Limit	Similar to MFR and COM, depending on land use.			
Prohibit	Similar to MFR and COM, depending on land use.	Similar to MFR and COM, depending on land use.	Similar to MFR and COM, depending on land use.	Similar to MFR and COM, depending on land use.

Rural

	Riparian & Wildlife Classes I, II, III		Upland Wildlife Classes A, B, C	
	Positive	**Negative**	**Positive**	**Negative**
Allow	Similar to SFR except: • Impacts will be more dispersed.	Similar to SFR except: • Impacts will be more dispersed.	Similar to SFR except: • Impacts will be more dispersed.	Similar to SFR except: • Impacts will be more dispersed.
Limit	Similar to SFR except: • Impacts will be more dispersed.			
Prohibit	Similar to SFR except: • Impacts will be more dispersed.	Similar to SFR except: • Impacts will be more dispersed.	Similar to SFR except: • Impacts will be more dispersed.	Similar to SFR except: • Impacts will be more dispersed.

Parks and Open Space

	Riparian & Wildlife Classes I, II, III		Upland Wildlife Classes A, B, C	
	Positive	**Negative**	**Positive**	**Negative**
Allow	Similar to RUR except: • Employment, income and related taxes specific to public and private parklands, e.g., golf courses, will be unaffected.	Similar to RUR.	Similar to RUR.	Similar to RUR.
Limit	Similar to RUR.			
Prohibit	Similar to RUR.	Similar to RUR except: • Negative impacts on development values specific to public and private park lands.	Similar to RUR.	Similar to RUR.

Impact Areas

	Riparian & Wildlife Classes I, II, III		Upland Wildlife Classes A, B, C	
	Positive	**Negative**	**Positive**	**Negative**
Allow	Similar to SFR, COM, IND, POS, depending on land use.	Similar to SFR, COM, IND, POS, depending on land use.	Similar to SFR, COM, IND, POS, depending on land use.	Similar to SFR, COM, IND, POS, depending on land use.
Limit	Similar to SFR, COM, IND, POS, depending on land use.			
Prohibit	Similar to SFR, COM, IND, POS, depending on land use.	Similar to SFR, COM, IND, POS, depending on land use.	Similar to SFR, COM, IND, POS, depending on land use.	Similar to SFR, COM, IND, POS, depending on land use.

5. APPENDIX TABLES

Table 1: Percentage of Goal 5 Resource Lands in Urban Development, in the UGB in 2002

	Riparian & Wildlife Resources			Upland Wildlife Resources		
	Class I	**Class II**	**Class III**	**Class A**	**Class B**	**Class C**
% of Goal 5 Lands in Urban Development	16%	33%	85%	16%	38%	34%

Source: Data analysis by Metro staff and ECONorthwest.

Table 2: Percentage of Goal 5 Resource Lands in Parks and Open Space, in the UGB in 2002

	Riparian & Wildlife Resources			Upland Wildlife Resources		
	Class I	**Class II**	**Class III**	**Class A**	**Class B**	**Class C**
% of Goal 5 Lands in Parks	41%	23%	4%	56%	18%	18%

Source: Data analysis by Metro staff and ECONorthwest.

Table 3: Percentage of Goal 5 Resource Lands Categorized as Vacant Buildable, in the UGB in 2002

	Riparian & Wildlife Resources			Upland Wildlife Resources		
	Class I	**Class II**	**Class III**	**Class A**	**Class B**	**Class C**
% of Goal 5 Lands Vacant Buildable	13%	20%	9%	25%	36%	41%

Source: Data analysis by Metro staff and ECONorthwest.

Table 4: Percentage of Goal 5 Lands In Zonings That Do Not Support Development Values, and for Zonings That Do Support Development Value, the Percentage of Lands Categorized As Low, Medium, and High Land Value, in the UGB in 2002

	Riparian Resources			Wildlife Resources		
	Class I	**Class II**	**Class III**	**Class A**	**Class B**	**Class C**
% of Goal 5 Lands in Zonings that Do Not Support Development Value	43%	25%	7%	57%	19%	19%
% Low Land Value	48%	60%	68%	38%	58%	62%
% Medium Land Value	9%	14%	22%	4%	22%	18%
% High Land Value	0%	1%	3%	1%	1%	1%
Total	100%	100%	100%	100%	100%	100%

Source: Data analysis by Metro staff and ECONorthwest.

Table 5: Percentage of Goal 5 Lands In Zonings That Do Not Support Employment, and for Zonings That Do Support Employment, the Percentage of Lands Categorized Low, Medium, and High Employment Density, in the UGB in 2002

	Riparian & Wildlife Resources			Upland Wildlife Resources		
	Class I	**Class II**	**Class III**	**Class A**	**Class B**	**Class C**
% of Goal 5 Lands in Zonings that Do Not Support Employment	83%	72%	51%	95%	91%	75%
% Low Employment Value	11%	18%	30%	3%	5%	18%
% Medium Employment Value	6%	9%	17%	2%	4%	7%
% High Employment Value	0%	1%	2%	0%	0%	0%
Total	100%	100%	100%	100%	100%	100%

Source: Data analysis by Metro staff and ECONorthwest.

Table 6: Percentage of Goal 5 Lands by 2040 Design Type That Do Not Support Development Values, and for Lands That Do Support Development Value, the Percentage of Lands Categorized as Tertiary, Secondary, and Primary Design Types, in the UGB in 2002

	Riparian Resources			Wildlife Resources		
	Class I	**Class II**	**Class III**	**Class A**	**Class B**	**Class C**
% of Goal 5 Lands By Design Types that Do Not Support Development Value	35%	15%	2%	52%	12%	10%
% Tertiary Design Type	48%	61%	52%	44%	80%	68%
% Secondary Design Type	5%	6%	13%	2%	3%	7%
% Primary Design Type	12%	18%	33%	2%	5%	15%
Total:	100%	100%	100%	100%	100%	100%

Source: Data analysis by Metro staff and ECONorthwest.

Table 7: Interactions Between Resource Acres By Zoning and 2040 Design Types, in the UGB in 2002

Zoning Type Containing Acres of Significant Riparian and Wildlife Resources	Percentage of Acres in Zoning Type Classified as Tertiary + Other 2040 Design Types	Percentage of Acres in Zoning Type Classified as Primary 2040 Design Type
Single Family Residential	98%	1%
Parks and Open Space	98%	0.3%
Industrial	33%	60%

Source: Data analysis by Metro staff and ECONorthwest.

Table 8: Interactions Between Resource Acres By Zoning and Combined Measures of Development Value, in the UGB in 2002

Zoning Type Containing Acres of Significant Riparian and Wildlife Resources	% of Acres In Zoning Type Classified as "Other" Design Type	% of Acres in Zoning Type with All Low Measures	% of Acres in Zoning Type with At Least One Medium Measure, No High Measures	% of Acres in Zoning Type with At Least One High Measure
Single Family Residential	16.7%	60.9%	20.7%	1.7%
Parks and Open Space	81.0%	16.9%	1.7%	0.3%
Industrial	10.3%	14.1%	15.1%	60.5%

Source: Data analysis by Metro staff and ECONorthwest.

APPENDIX D

ESEE Consequences by Generalized Regional Zones

Development scenario	Economic consequences: SINGLE FAMILY RESIDENTIAL (SFR)			
	Class I, II and III Riparian/wildlife		Class A, B, and C Upland wildlife habitat	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	• Property owners realize full development potential. • Protection of amenity/quality of life values associated with the build environment in urban areas. • Expanding UGB not required.	• Degradation of ecosystem services and values. • Higher loss of ecosystem services and values for resources in Class I compared with Classes II and III. • See full table of interactions for tradeoffs of low-, medium, and high-valued SFR with Class I, II, III resources. • Municipal expenditures in the future re environmental laws may increase. • Municipal expenditures in the future re flood management and water quality may increase. • Damages and costs associated with flooding and landslides may increase. • Cooling costs in summer may increase. • Increased risk of foregoing future uses of resources. • Increased risk of irreversible outcome with possible negative economic results. • May include restoration costs. • May negatively impact jobs and income that depend on quality of ecosystem services.	*Similar to Riparian*	*Similar to Riparian except:* • Degradation of ecosystem services associated with habitat that supports salmon. Negative consequences on related commercial, recreational, spiritual and intrinsic values. • Higher loss of ecosystem services and values for resources in Class A compared with Classes B and C. • See full table of interactions for tradeoffs of low-, medium, and high-valued SFR with Class A, B, and C resources. • Negative impacts on employment that depends on quality of salmon habitat.
LIMIT	The economic tradeoffs associated with a limit decision will fall between the tradeoffs of allow and prohibit. Limit tradeoffs will depend on the specifics of the limit decision (severely limit, moderately limit, or slightly limit), the land use and property in question, and the mitigation possibilities.			

Development scenario	Economic consequences: SINGLE FAMILY RESIDENTIAL (SFR)			
	Class I, II and III Riparian/wildlife		Class A, B, and C Upland wildlife habitat	
	Positive	***Negative***	***Positive***	***Negative***
PROHIBIT	• Protection of riparian resource and associated ecosystem services and values. • Greater protection of services and values for Class I resource compared with Class II and III. • May reduce future costs re environmental regulations. • May reduce future costs re flood management and water quality. • May reduce future damage and costs re flooding and landslides. • May reduce "heat-island" effect and cooling costs in summer. • No restoration costs. • Reduced risk of foregoing future uses of resources. • Reduced risk of irreversible outcome with possible negative economic results. • May protect jobs and income that depend on quality of ecosystem services.	• Negative consequences on development value of property. Substitutability or reconfiguration of land use may mitigate this consequence. • 1% of SFR has "High" land value. • 98% of SFR ranked "Low" on 2040 Design Types. • 78% of SFR ranked "Low" on all measures of development value. • See full table of interactions for tradeoffs of low-, medium, and high-valued SFR with Class I, II, III resources. • Expanding the UGB to mitigate negative impacts on amount of developable land may increase costs associated with expanding or extending infrastructure and other sprawl-related costs. • SFR accounts for 46% of total resource lands and will experience more negative impacts than other land uses.	*Similar to Riparian except:* • Protection of wildlife habitat that supports salmon and related commercial, recreational, spiritual, and intrinsic values. • May protect jobs and income that depend on quality of salmon habitat. • See full table of interactions for tradeoffs of low-, medium, and high-valued SFR with Class A, B, and C resources.	*Similar to Riparian*

Development scenario	Economic consequences: MULTI-FAMILY RESIDENTIAL (MFR)			
	Class I, II and III Riparian/wildlife		Class A, B, and C Upland wildlife habitat	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to SFR except:* • Reduced need for UGB expansion and associated costs.	*Similar to SFR. except:* • Increased negative impacts on economic costs and damage associated with stormwater (flooding) and water quality. • See full table of interactions for tradeoffs of low-, medium, and high-valued MFR with Class I, II, III resources.	*Similar to SFR.*	*Similar to SFR except:* • See full table of interactions for tradeoffs of low-, medium, and high-valued MFR with Class A, B, C resources.
LIMIT	*Similar to SFR.*	*Similar to SFR.*	*Similar to SFR.*	*Similar to SFR.*
PROHIBIT	*Similar to SFR.*	*Similar to SFR. except:* • MFR accounts for 5% of significant resources. • 66% of MFR lands ranked low on land value and 4% ranked high. • 86% of MFR ranked "Low" on 2040 Design Types. • 68% ranked "Low" on all measures of development value. • See full table of interactions for tradeoffs of low-, medium, and high-valued MFR with Class I, II, III resources. • Increased concentration of development means that the marginal demand to expand UGB will be less than for SFR.	*Similar to SFR.*	*Similar to SFR except:* • See full table of interactions for tradeoffs of low-, medium, and high-valued MFR with Class A, B, C resources.

Development scenario	Economic consequences: COMMERCIAL (COM)			
	Class I, II and III Riparian/wildlife		Class A, B, and C Upland wildlife habitat	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to MFR except:* • No employment impacts specific to development use. • No impacts on related income and income-tax revenue to municipalities.	*Similar to MFR except:* • Increased costs and damage associated with stormwater (flooding) and water quality. • See full table of interactions for tradeoffs of low-, medium, and high-valued COM with Class I, II, III resources.	*Similar to MFR.*	*Similar to MFR except:* • See full table of interactions for tradeoffs of low-, medium, and high-valued COM with Class A, B, C resources.
LIMIT	*Similar to MFR.*	*Similar to MFR.*	*Similar to MFR.*	*Similar to MFR.*
PROHIBIT	*Similar to MFR.*	*Similar to MFR except:* • COM contains 5% of significant resources. • Negative impacts on employment specific to development use. Substitutability or reconfiguration of land use may mitigate this impact. • Negative impacts on related income and income-tax revenue to municipalities. • 81% COM ranked “Low” land value. • 57% COM ranked “Low” employment and 0.2% ranked “High” employment. • 77% COM ranked “Low” on 2040 Design Type • 63% COM ranked “Low” on all measures of development value. 9% COM ranked high on one measure. • See full table of interactions for tradeoffs of low-, medium, and high-valued COM with Class I, II, III resources.	*Similar to MFR.*	*Similar to MFR except:* • See full table of interactions for tradeoffs of low-, medium, and high-valued COM with Class A, B, and C resources.

Development scenario	Economic consequences: INDUSTRIAL (IND)			
	Class I, II and III Riparian/wildlife		Class A, B, and C Upland wildlife habitat	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to MFR except:* • No employment impacts specific to development use. • No impacts on related income and income-tax revenue to municipalities.	*Similar to MFR except:* • Increased costs and damage associated with negative impacts on ecosystem services. • IND accounts for 14% of significant resources. • See full table of interactions for tradeoffs of low-, medium, and high-valued IND with Class I, II, III resources.	*Similar to MFR.*	*Similar to MFR except:* • See full table of interactions for tradeoffs of low-, medium, and high-valued IND with Class A, B, and C resources.
LIMIT	*Similar to MFR.*	*Similar to MFR.*	*Similar to MFR.*	*Similar to MFR.*
PROHIBIT	*Similar to MFR.*	*Similar to MFR except:* • Negative impacts on employment specific to development use. Substitutability or reconfiguration of land use may mitigate this impact. • Negative impacts on related income and income-tax revenue to municipalities. • 93% ranked "Low" land value. • 70% ranked "Low" employment. • 32% ranked "Low" 2040 Design Type and 60% ranked "High." • 24% ranked "Low" on all measures of development value. 61% ranked "High" on at least one measure.	*Similar to MFR.*	*Similar to MFR.*

Development scenario	Economic consequences: MIXED-USE CENTERS (MUC)			
	Class I, II and III Riparian/wildlife		Class A, B, and C Upland wildlife habitat	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to MFR and COM, depending on land use.*	*Similar to MFR and COM, depending on land use except:* • MUC accounts for 2% of significant resources. • See full table of interactions for tradeoffs of low-, medium, and high-valued MUC with Class I, II, III resources.	*Similar to MFR and COM, depending on land use.*	*Similar to MFR and COM, depending on land use except:* • See full table of interactions for tradeoffs of low-, medium, and high-valued MUC with Class A, B, and C resources.
LIMIT	*Similar to MFR and COM, depending on land use.*	*Similar to MFR and COM, depending on land use.*	*Similar to MFR and COM, depending on land use.*	*Similar to MFR and COM, depending on land use.*
PROHIBIT	*Similar to MFR and COM, depending on land use.*	*Similar to MFR except:* • Negative impacts on employment specific to development use. Substitutability or reconfiguration of land use may mitigate this impact. • Negative impacts on related income and income-tax revenue to municipalities. • 74% ranked "Low" land value. • 41% ranked "Low", 49% ranked "Medium," and 10% ranked "High" employment. • 24% ranked "Low," and 19% ranked "High" on 2040 Design Types. • 17% ranked "Low" on all measures of development value, 64% ranked "Medium" on at least one measure, and 19% ranked "High" on at least one measure.	*Similar to MFR and COM, depending on land use.*	*Similar to MFR and COM, depending on land use.*

Development scenario	Economic consequences: RURAL (RUR)			
	Class I, II and III Riparian/wildlife		Class A, B, and C Upland wildlife habitat	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to SFR.*	*Similar to SFR except:* • RUR accounts for 7% of significant resources. • See full table of interactions for tradeoffs of low-, medium, and high-valued RUR with Class I, II, III resources.	*Similar to SFR.*	*Similar to SFR except:* • See full table of interactions for tradeoffs of low-, medium, and high-valued RUR with Class A, B, and C resources.
LIMIT	*Similar to SFR.*	*Similar to SFR.*	*Similar to SFR.*	*Similar to SFR.*
PROHIBIT	*Similar to SFR.*	*Similar to SFR except:* • 100% of RUR ranked "Low" on land value. • 84% ranked "Low" and 15% ranked "High" on 2040 Design Types. • 83% ranked "Low" on all measures of development value, 15% ranked "High" on at least one measure.	*Similar to SFR.*	*Similar to SFR.*

Development scenario	Economic consequences: PARKS AND OPEN SPACE (POS)			
	Class I, II and III Riparian/wildlife		Class A, B, and C Upland wildlife habitat	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to RUR.*	*Similar to RUR except:* • POS contain approximately 20% of the Goal 5 significant resources. • See full table of interactions for tradeoffs of low-, medium, and high-valued POS with Class I, II, III resources.	*Similar to RUR.*	*Similar to RUR except:* • See full table of interactions for tradeoffs of low-, medium, and high-valued POS with Class A, B, and C resources.
LIMIT	*Similar to RUR.*	*Similar to RUR.*	*Similar to RUR.*	*Similar to RUR.*
PROHIBIT	*Similar to RUR.*	*Similar to RUR except:* • In general, this category has no development value.	*Similar to RUR.*	*Similar to RUR.*

Development scenario	Economic consequences: IMPACT AREAS			
	Class I, II and III Riparian/wildlife		Class A, B, and C Upland wildlife habitat	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Depends on land use. May be similar to SFR, COM, IND, POS.*	*Depends on land use. May be similar to SFR, COM, IND, POS.* • See full table of interactions for tradeoffs of low-, medium, and high-valued Impact Areas with Class I, II, III resources.	*Depends on land use. May be similar to SFR, COM, IND, POS.*	*Depends on land use. May be similar to SFR, COM, IND, POS.* • See full table of interactions for tradeoffs of low-, medium, and high-valued Impact Areas with Class A, B, C resources.
LIMIT	*Depends on land use. May be similar to SFR, COM, IND, POS.*	*Depends on land use. May be similar to SFR, COM, IND, POS.*	*Depends on land use. May be similar to SFR, COM, IND, POS.*	*Depends on land use. May be similar to SFR, COM, IND, POS.*
PROHIBIT	*Depends on land use. May be similar to SFR, COM, IND, POS.*	*Depends on land use. May be similar to SFR, COM, IND, POS.*	*Depends on land use. May be similar to SFR, COM, IND, POS.*	*Depends on land use. May be similar to SFR, COM, IND, POS.*

Development scenario	Social consequences: SINGLE-FAMILY RESIDENTIAL Riparian and wildlife habitat resources	
	Positive	***Negative***
ALLOW	• Maintain housing options • No change in property rights • No takings concern • Maintain personal financial security (equity) • Equitable impact on property owners *Wildlife habitat same as riparian, except:* • Less vegetation may reduce risk of wildfires • Less habitat may reduce number of undesirable species	• May lose cultural heritage • May not protect salmon and may impact Native American culture and regional identity • May change neighborhood character and sense of place • Scenic values may be lost • Incompatible land uses may lose buffers • May degrade environmental quality and affect health • May lose recreational and educational opportunities • Loss of tree canopy and vegetation may increase stress levels and impact mental health • May increase risk of landslides and floods if tree canopy and vegetation are removed • Loss of intergenerational equity
LIMIT	• Maintain housing options when development can occur with minimal impact to the resource • Preserve some buffering of incompatible uses • Retain some or most of our cultural heritage • Provide salmon more of a chance to recover and lessen impacts on Native American culture and regional identity • Retain most neighborhood character and sense of place • Preserve most scenic values • Maintain environmental quality and reduce negative health impacts • Retain most educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide some amount of intergenerational equity	• May reduce option for large-lot single-family homes • Regulations may affect property rights – owners may not be able to develop land to same extent • May result in takings concerns • Could have a negative impact on property values and thus decrease personal financial security • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species
PROHIBIT •	• Preserve cultural heritage • Provide salmon a chance to recover and lessen impacts on Native American culture and regional identity • Preserve or increase buffers between incompatible land uses • Retain neighborhood character and sense of place • Preserve scenic values • Maintain and possibly improve environmental quality and reduce negative health impacts • Retain educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide intergenerational equity	• Reduce housing options and opportunities (Even if residential land is provided outside the UGB it is not equivalent to land in existing neighborhoods) • May impact housing affordability • Regulations would impact property rights – owners may not be able to develop land to same extent • Likely to result in takings concerns • Could have a negative impact on property values and thus decrease personal financial security • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species

Development scenario	Social consequences: MULTI-FAMILY RESIDENTIAL Riparian and wildlife habitat resources	
	Positive	***Negative***
ALLOW	• Maintain housing options • No change in property rights • No takings concern • Equitable impact on property owners *Wildlife habitat same as riparian, except:* • Less vegetation may reduce risk of wildfires • Less habitat may reduce number of undesirable species	• May lose cultural heritage • May not protect salmon and thus impact Native American culture and regional identity • May change neighborhood character and sense of place • Scenic values may be lost • Incompatible land uses may lose buffers • May degrade environmental quality and impact health • May lose recreational and educational opportunities • Loss of tree canopy and vegetation may increase stress levels and impact mental health • May increase risk of landslides and floods if tree canopy and vegetation are removed • Loss of intergenerational equity
LIMIT	• Maintain housing options when development can occur with minimal impact to the resource • Preserve some buffering of incompatible uses • Retain some or most of our cultural heritage • Provide salmon more of a chance to recover and lessen impacts on Native American culture and regional identity • Retain most neighborhood character and sense of place • Preserve most scenic values • Maintain environmental quality and reduce negative health impacts • Retain most educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide some amount of intergenerational equity	• May reduce opportunities to develop at high density • May impact housing affordability • Regulations may impact property rights – owners may not be able to develop land to same extent • Limit decision may result in takings concerns • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species
PROHIBIT	• Preserve cultural heritage • Provide salmon a chance to recover and lessen impacts on Native American culture and regional identity • Preserve or increase buffers between incompatible land uses • Retain neighborhood character and sense of place • Preserve scenic values • Maintain and possibly improve environmental quality and reduce negative health impacts • Retain educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide intergenerational equity	• Reduce housing options and opportunities (even if residential land is provided outside the UGB, it is not equivalent to land in existing neighborhoods) • May impact housing affordability • Regulations would impact property rights – owners may not be able to develop land to same extent • Likely to result in takings concerns • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species

Development scenario	Social consequences: MIXED-USE CENTERS Riparian and wildlife habitat resources	
	Positive	***Negative***
ALLOW	• Maintain housing options • Maintain employment opportunities • Does not impact 2040 densities and development in centers • Allows residents opportunity to live near where they work • No change in property rights • No takings concern • Equitable impact on property owners *Wildlife habitat same as riparian, except:* • Less vegetation may reduce risk of wildfires • Less habitat may reduce number of undesirable species	• 2040 growth concept emphasizes importance of green corridors, a healthy ecosystem • May lose cultural heritage • May not protect salmon and thus impact Native American culture and regional identity • May change neighborhood character and sense of place • Scenic values may be lost • Incompatible land uses may lose buffers • May degrade environmental quality and impact health • May lose recreational and educational opportunities • Loss of tree canopy and vegetation may increase stress levels and impact mental health • May increase risk of landslides and floods if tree canopy and vegetation are removed • Loss of intergenerational equity
LIMIT	• Maintain housing options when development can occur with minimal impact to the resource • Maintain employment opportunities if development can occur with minimal impact to the resource • Preserve some buffering of incompatible uses • Retain some or most of our cultural heritage • Provide salmon more of a chance to recover and lessen impacts on Native American culture and regional identity • Retain most neighborhood character and sense of place • Preserve most scenic values • Maintain environmental quality and reduce negative health impacts • Retain most educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide some amount of intergenerational equity	• May impact 2040 growth concept if development in centers is curtailed • May reduce opportunities to develop at high density • May reduce employment and housing opportunities • May impact housing affordability • Regulations may impact property rights – owners may not be able to develop land to same extent • Limit decision may result in takings concerns • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species

Development scenario	Social consequences: MIXED-USE CENTERS	
	Riparian and wildlife habitat resources	
	Positive	***Negative***
PROHIBIT	• Preserve cultural heritage • Provide salmon a chance to recover and lessen impacts on Native American culture and regional identity • Preserve or increase buffers between incompatible land uses • Retain neighborhood character and sense of place • Preserve scenic values • Maintain and possibly improve environmental quality and reduce negative health impacts • Retain educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide intergenerational equity	• Negative impact to 2040 growth concept if development in centers is curtailed • Reduce housing and employment options and opportunities. Even if residential and employment land is provided outside the UGB, it is not equivalent to land in existing neighborhoods and centers. • May impact housing affordability • Regulations would impact property rights – owners may not be able to develop land to same extent • Likely to result in takings concerns • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species

Development scenario	Social consequences: COMMERCIAL Riparian and wildlife habitat resources	
	Positive	***Negative***
ALLOW	• Maintain employment opportunities • No change in property rights • No takings concern • Equitable impact on property owners *Wildlife habitat same as riparian, except:* • Less vegetation may reduce risk of wildfires • Less habitat may reduce number of undesirable species	• 2040 growth concept emphasizes the importance of green corridors and a healthy ecosystem • May lose cultural heritage • May not protect salmon and thus impact Native American culture and regional identity • Scenic values may be lost • Incompatible land uses may lose buffers • May degrade environmental quality and impact health • May lose recreational and educational opportunities • Loss of tree canopy and vegetation may increase stress levels and impact mental health • May increase risk of landslides and floods if tree canopy and vegetation are removed • Loss of intergenerational equity
LIMIT	• Maintain employment opportunities if development can occur with minimal impact to the resource • Preserve some buffering of incompatible uses • Retain some or most of our cultural heritage • Provide salmon more of a chance to recover and lessen impacts on Native American culture and regional identity • Preserve most scenic values • Maintain environmental quality and reduce negative health impacts • Retain most educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide some amount of intergenerational equity	• May reduce employment opportunities • Regulations may impact property rights – owners may not be able to develop land to same extent • Limit decision may result in takings concerns • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species
PROHIBIT	• Preserve cultural heritage • Provide salmon a chance to recover and lessen impacts on Native American culture and regional identity • Preserve or increase buffers between incompatible land uses • Preserve scenic values • Maintain and possibly improve environmental quality and reduce negative health impacts • Retain educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide intergenerational equity	• Reduce employment options and opportunities. Even if employment land is provided outside the UGB, it is not equivalent to land in existing neighborhoods and centers. • Regulations would impact property rights – owners may not be able to develop land to same extent • Likely to result in takings concerns • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species

Development scenario	Social consequences: INDUSTRIAL	
	Riparian and wildlife habitat resources	
	Positive	***Negative***
ALLOW	• Maintain employment opportunities • No change in property rights • No takings concern • Equitable impact on property owners *Wildlife habitat same as riparian, except:* • Less vegetation may reduce risk of wildfires • Less habitat may reduce number of undesirable species	• May lose cultural heritage • May not protect salmon and thus impact Native American culture and regional identity • Scenic values may be lost • Incompatible land uses may lose buffers • May degrade environmental quality and impact health • May lose recreational and educational opportunities • Loss of tree canopy and vegetation may increase stress levels and impact mental health • May increase risk of landslides and floods if tree canopy and vegetation are removed • Loss of intergenerational equity
LIMIT	• Maintain employment opportunities if development can occur with minimal impact to the resource • Preserve some buffering of incompatible uses • Retain some or most of our cultural heritage • Provide salmon more of a chance to recover and lessen impacts on Native American culture and regional identity • Preserve most scenic values • Maintain environmental quality and reduce negative health impacts • Retain most educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide some amount of intergenerational equity	• May reduce employment opportunities • Regulations may impact property rights – owners may not be able to develop land to same extent • Limit decision may result in takings concerns • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species
PROHIBIT	• Preserve cultural heritage • Provide salmon a chance to recover and lessen impacts on Native American culture and regional identity • Preserve or increase buffers between incompatible land uses • Preserve scenic values • Maintain and possibly improve environmental quality and reduce negative health impacts • Retain educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide intergenerational equity	• Reduce employment options and opportunities. Even if employment land is provided outside the UGB, it is not equivalent to land in existing neighborhoods and centers. • Regulations would impact property rights – owners may not be able to develop land to same extent • Likely to result in takings concerns • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species

Development scenario	Social consequences: RURAL Riparian and wildlife habitat resources	
	Positive	***Negative***
ALLOW	• *Metro does not regulate agricultural activities, thus the impacts of allowing, limiting or prohibiting agricultural disturbances to the resource are not described here* • Maintain housing and employment opportunities in the future if land is to be urbanized • No change in property rights • No takings concern • Equitable impact on property owners *Wildlife habitat same as riparian, except:* • Less vegetation may reduce risk of wildfires • Less habitat may reduce number of undesirable species	• May lose cultural heritage • May not protect salmon and thus impact Native American culture and regional identity • Scenic values may be lost • Incompatible land uses may lose buffers • May degrade environmental quality and impact health • May lose recreational and educational opportunities • Loss of tree canopy and vegetation may increase stress levels and impact mental health • May increase risk of landslides and floods if tree canopy and vegetation are removed • Loss of intergenerational equity
LIMIT	• Maintain housing and employment opportunities in future if urbanized and development occurs with minimal impact to the resource • Preserve some buffering of incompatible uses • Retain some or most of our cultural heritage • Provide salmon more of a chance to recover and lessen impacts on Native American culture and regional identity • Preserve most scenic values • Maintain environmental quality and reduce negative health impacts • Retain most educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide some amount of intergenerational equity	• May reduce housing and employment opportunities in future if land is to be urbanized • Regulations may impact property rights – owners may not be able to develop land to same extent • Limit decision may result in takings concerns • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species
PROHIBIT	• Preserve cultural heritage • Provide salmon a chance to recover and lessen impacts on Native American culture and regional identity • Preserve or increase buffers between incompatible land uses • Preserve scenic values • Maintain and possibly improve environmental quality and reduce negative health impacts • Retain educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide intergenerational equity	• Reduce housing and employment options and opportunities – if area is to be urbanized in the future will impact land available for housing and employment • Regulations would impact property rights – owners may not be able to develop land to same extent • Likely to result in takings concerns • Impact on property owners is not equitable – only those with significant resources are impacted *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species

Development scenario	Social consequences: PARKS AND OPENSPACE	
	Riparian and wildlife habitat resources	
	Positive	***Negative***
ALLOW	• Maintain or increase opportunities for active recreation if parks are converted to ball fields, boat ramps, or other community structures *Wildlife habitat same as riparian, except:* • Less vegetation may reduce risk of wildfires • Less habitat may reduce number of undesirable species	• May lose cultural heritage • May not protect salmon and thus impact Native American culture and regional identity • Scenic values may be lost • May degrade environmental quality and impact health • May lose recreational and educational opportunities • Loss of tree canopy and vegetation may increase stress levels and impact mental health • May increase risk of landslides and floods if tree canopy and vegetation are removed • Loss of intergenerational equity
LIMIT	• Maintain existing active park use and provide new opportunities if development occurs with minimal impact to the resource • Retain some or most of our cultural heritage • Provide salmon more of a chance to recover and lessen impacts on Native American culture and regional identity • Preserve most scenic values • Maintain environmental quality and reduce negative health impacts • Retain most educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide some amount of intergenerational equity	• May reduce opportunities for active recreation *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species
PROHIBIT	• Preserve cultural heritage • Provide salmon a chance to recover and lessen impacts on Native American culture and regional identity • Preserve scenic values • Maintain and possibly improve environmental quality and reduce negative health impacts • Retain educational and recreational opportunities • Retention of tree canopy and vegetation may reduce stress levels and positively impact mental health • Reduce risk of landslides and floods • Provide intergenerational equity	• Reduce opportunities for active recreation *Wildlife habitat same as riparian, except:* • More vegetation could increase risk of wildfires • More habitat could increase number of undesirable species

Development scenario	Social consequences: IMPACT AREA	
	Riparian and wildlife habitat resources	
	Positive	***Negative***
ALLOW	Same as described above depending on the regional zoning category	Same as described above depending on the regional zoning category
LIMIT	Same as described above depending on the regional zoning category	Same as described above depending on the regional zoning category
PROHIBIT	Same as described above depending on the regional zoning category	Same as described above depending on the regional zoning category

Development scenario	Environmental consequences: SINGLE FAMILY RESIDENTIAL			
	Class I Riparian resources		**Class A Wildlife Habitat resources**	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	• **Functional consequences**: no positive consequences noted beyond that provided by existing protection (e.g., Title 3) • Reduced need for UGB expansion (protects land outside UGB) • Low to medium density SFR may retain more trees/vegetation than most other zoning types; local studies show that increased forest canopy near streams and throughout the watershed is associated with healthier streams • This zoning type contains the largest amount of Class I Riparian Resources, therefore incentives and education could improve land stewardship, but would require substantial financial investment	• **Functional consequences**: Widespread loss of 3-5 primary ecological functions, including: microclimate and shade; streamflow moderation/water storage; bank stabilization, sediment and pollution control; large wood and channel dynamics; and organic material sources. Class I Riparian resources also contain a substantial portion of high-value wildlife habitat (not included in Class A or B wildlife habitat if falls in Class I riparian), which would also be compromised or removed • Medium to high density housing tends to retain less vegetation and add more imperviousness; these factors are known to harm streams and wetlands • Likely harm to salmon and wildlife through habitat loss and degradation • Increased pesticide and fertilizer use degrades water quality • Landscaping uses water • Continued development in flood areas • Continued wetland conversion • Non-native species introductions • Severity of consequences relates to: o housing density o proximity to water resources o amount of vegetation retained onsite o amount of effective imperviousness o stormwater management practices o landowner/land user outreach and education	*Similar to Class I Riparian Resources* • **Functional consequences**: no positive consequences noted • Low to medium density SFR may retain more natural land cover than most other zoning types, providing wildlife habitat and connectivity	• **Functional consequences**: Loss of key habitat characteristics including large patch size, shape (habitat interior), water resources, connectivity • High density housing may not retain trees and other vegetation; partial or complete loss of largest, most well-connected and water-rich patches • Extensive loss of valuable wildlife habitat • Non-native plant and animal species invasions • Increased adverse edge effects • Reduced wildlife food and cover • Reduced woody debris and snags • Pesticides may harm wildlife • Noise and light disturbances • Continued native species loss over time • Reduction in Neotropical migratory songbirds • Most extensive loss of habitat interior and associated species outside Class I riparian • Further decline of at-risk wildlife species; more species likely to become imperiled • Continued loss of Habitats of Concern and associated species • Wildlife crossings across roadways cause mortality

Development scenario	Environmental consequences: SINGLE FAMILY RESIDENTIAL			
	Class I Riparian resources		**Class A Wildlife Habitat resources**	
	Positive	***Negative***	***Positive***	***Negative***
LIMIT	• **Functional consequences:** May conserve some level of 3-5 existing primary ecological functions, depending on program, as well as Class A or B wildlife habitat falling within Class I riparian; extent depends on program • Reduced need for UGB expansion compared to "prohibit" • Strong potential for restoration and mitigation activities to offset negative ecological effects • Strong potential for BMP implementation and low impact development and innovative design standards • Hydrology less altered than "allow" • The large extent of Class I Riparian Resources in SFR represents substantial mitigation, restoration and land stewardship opportunities, but would require investment	• **Functional consequences:** Potential for substantial loss of 3-5 primary ecological functions, as described in Allow. Class A or B wildlife habitat falling within Class I riparian would also be compromised. Extent of loss depends on program. • See comments under "allow," except: • Hydrology less altered, less stream damage • Greater protection of flood areas and wetlands • Greater protection of steep slope areas • Fish and other aquatic wildlife habitat impaired, but extent of loss reduced • Water quality impacts likely, but degree depends on program effectiveness	• **Functional consequences:** Some retention of key habitat attributes (patch size, habitat interior, connectivity and water resources) for habitat outside Class I riparian • More habitat retained than Allow • Reduced edge effects • Fewer non-native species invasions • More connectivity retained • Less harm to native species • Reduced need for UGB expansion • Landscaping can provide diverse habitats • Low to moderate levels of development provide good habitat for some species • This zoning type contains the largest amount of Class A Wildlife Habitat resources outside of Riparian Class I, therefore represents mitigation, restoration and land stewardship opportunities	*Similar to "allow," but to a lesser degree depending on program options* • **Functional consequences:** Potential for reduction in habitat patch size, connectivity, and amount of interior habitat, reducing ecological function of habitat
PROHIBIT	• **Functional consequences**: Preservation of the most ecologically functional riparian areas, as well as some of the most important wildlife habitat remaining in the region, including Habitats of Concern (especially wetlands, bottomland hardwood) • Helps maintain hydrologic connectivity • Minimizes hydrologic alterations, reduces flooding • Retention of important salmon habitat	• **Functional consequences:** no adverse consequences noted to Class I resources • Increased need for UGB expansion • Potential for increased infrastructure intrusion into other resource areas due to avoiding Class I riparian areas	• **Functional consequences**: Retention of key habitat attributes (patch size, habitat interior, connectivity and water resources) for habitat outside Class I riparian • Retention of some of the best remaining wildlife habitats in the region • This option will provide key breeding habitat for Neotropical migrants, aquatic species and habitat interior specialists (but see next column) • Retains Habitats of Concern • Provides important source habitats for native wildlife and plant species • Reduced wildlife road crossing mortality	• **Functional consequences:** Continuing functionality of Class A habitat patches may depend on connectivity with other, less valuable habitat patches • If conflicting uses are prohibited in all Class A wildlife habitat patches, other habitat patches may be disproportionately removed or altered, thereby reducing the functionality of Class A habitat patches through connectivity loss • Class A patches are typically very large, therefore may result in a need for UGB expansions

Environmental consequences: SINGLE FAMILY RESIDENTIAL (SFR)

Development scenario	Class II Riparian resources		Class B Wildlife Habitat resources	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to Class I riparian resources* • This zoning type contains the largest amount of Class II Riparian Resources, therefore represents substantial mitigation, restoration and land stewardship opportunities	*Similar to Class I riparian resources, except:* • Loss of restoration opportunities where ecological functions could be regained through tree canopy increases or other measures • Loss of functionality would be less because less ecological function exists; however, loss of this resource type would remove existing water quality filtration capacity or other ecological services, leaving waterways with little or no protection from conflicting uses	*Similar to Class I Riparian Resources* • SFR contains majority of Class B Wildlife Habitat Resources, therefore represents substantial mitigation, restoration and land stewardship opportunities	*Similar to Class A, except:* • Habitat interior loss less extensive than Class A • Loss of connectivity especially pronounced; extensive loss of migratory stopover habitat and movement corridors. Reduces value of Class A patches. • Loss of grassland and low-structure vegetation within 300 ft of streams; important to specific wildlife groups (e.g., grassland birds) • Loss of locally rare migratory stopover habitat and locally rare habitat patches with water resources
LIMIT	*Similar to Class I riparian resources, except:* • Retains restoration opportunities where ecological functions could be regained through tree canopy increases or other measures • Provides mitigation opportunities	*Similar to Class I riparian resources, except:* • Some loss of the features providing important ecological functions (scores 6-17), unless offset by mitigation and restoration activities	*Similar to Class A, except:* • More habitat connectivity between large habitat patches retained • Grassland and low structure habitat within 300 ft of stream may be retained • Low to moderate levels of development provide good habitat for some species, but this is most pronounced in Class A patches due to forest width	*Similar to "allow," but to a lesser degree depending on program options* • To the extent that conflicting uses remove the resource, habitat and connectivity will be lost
PROHIBIT	*Similar to Class I riparian resources, except:* • Retention of some critical ecological functions and ecosystem services provided by existing natural resources • Retains restoration opportunities where ecological functions could be regained through tree canopy increases or other measures • Provides mitigation opportunities	*Similar to Class I riparian resources, except:* • Increased need for UGB expansion, but less so than prohibit decision in Class I (scores of 6-18 – at least 1 primary function)	*Similar to Class A, except:* • Retention of some of the most important connectivity elements in the region • Retention of large upland habitat patches important to specific wildlife species • This option important for Neotropical migratory birds during migration • May provide important source habitats for native wildlife and plant species • Grassland and low-structure vegetation within 300 ft of streams would be retained	*Similar to Class A*

Environmental consequences: SINGLE FAMILY RESIDENTIAL (SFR)

Development scenario	Class III Riparian		Class C Wildlife Habitat resources	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to Class I riparian resources, except:* • Low Value Riparian tends to have less forest or other vegetation than other classes, and includes developed floodplains, where functionality is already reduced • SFR and IND contain the majority of Low Value Riparian Resources, therefore SFR represents opportunities for improved ecological function through mitigation or restoration	*Similar to Class II riparian resources, except:* • The potential for losing existing ecological functions is reduced	*Similar to Class I, except:* • These patches tend to be relatively small, isolated, and lacking substantial water resources, and are therefore reduced in quality and functionality compared to Class A and B • Isolated patches may be associated with increased wildlife crossing mortality on roadways	*Similar to Class B, except:* • Only limited loss of habitat interior • Some loss of connectivity between patches • Important loss of migratory stopover habitat, because these patches tend to occur in areas lacking substantial wildlife habitat • Loss of upland patches lacking water resources but providing important habitat to specific wildlife species
LIMIT	*Similar to Class I riparian resources, except:* • Retains restoration opportunities where ecological functions could be regained through tree canopy increases or other measures • Provides mitigation opportunities	*Similar to Class I riparian resources, except:* • Loss of opportunities to add forest canopy along streams where low structure currently exists	*Similar to Class B, except:* • Most are small forested patches • Less likely to provide good habitat for some species, because these patches tend to be narrow, disconnected, and surrounded by development • Isolated patches may be associated with increased wildlife crossing mortality on roadways	*Similar to "allow," but to a lesser degree depending on program options* • To the extent that conflicting uses remove the resource, habitat and connectivity will be lost
PROHIBIT	*Similar to Class I riparian resources, except:* • Retention of some ecological functions and ecosystem services provided by existing natural resources (scores 1-5) • Retains restoration opportunities where ecological functions could be regained through tree canopy increases or other measures • Provides mitigation opportunities	*Similar to Class I riparian resources, except:* • Increased need for UGB expansion, but less so than Class II	*Similar to Class B, except:* • Not as important to regional connectivity, but may provide important local connectivity • Small, isolated patches provide important and locally rare stopover habitat to migratory birds	*Similar to Class B, except:* • Small isolated habitat patches may limit reproductive success due to edge effects and reduced habitat quality • Isolated patches may be associated with increased wildlife crossing mortality on roadways

Development scenario	Environmental consequences: SINGLE FAMILY RESIDENTIAL (SFR)			
	Impact areas around waterways (50-150 feet from resource)		**Impact areas around habitat (25 feet)**	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	• Opportunities for landowner education may reduce effects of existing and future environmentally harmful practices near waterways	• Potential for increased adverse impacts (e.g., pollution, altered hydrology, pesticide use, bacterial contamination, human disturbance…) to waterways due to existing and new conflicting uses in areas adjacent to waterways • These impacts are greater than in other areas because they are near water and because non-resource areas tend to lack natural filtration provided by riparian vegetation	• Opportunities for landowner education may reduce effects of existing and future environmentally harmful practices	• Potential for increased adverse effects adjacent to habitat areas, primarily forested but also low-structure vegetation, including: o Soil compaction, causing tree and other vegetation damage and increasing risk of tree falls o Increased vegetation trampling at edges of habitat patches o Introduction of trash and pollutants to wildlife habitat o Increased adverse edge effects o Increased light and noise disturbance o Increased potential for non-native plant and animal species invasions
LIMIT	• Retains restoration opportunities where riparian functions could be regained through planting tree canopy or other measures • May help protect existing water resources from current or future adverse effects due to conflicting uses • Provides mitigation opportunities • Incentives and landowner education could enhance ecological health over time	*Similar to "allow," but to a lesser degree*	• Retains restoration opportunities where habitat patch functions could be regained through planting tree canopy or other measures; for example, potential for decreased edge effects, increased interior habitat and increased connectivity to other patches and to water resources • Provides mitigation opportunities • Incentives and landowner education could enhance ecological health over time	• Similar to "allow," but to a lesser degree
PROHIBIT	*Similar to "limit," but to a greater degree*	• Primary negative consequences relate to social, economic and energy	*Similar to "limit," but to a greater degree*	• Primary negative consequences relate to social, economic and energy

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Development scenario	Environmental consequences: MULTIFAMILY RESIDENTIAL (MFR)			
	Class I Riparian resources		**Class A Wildlife Habitat resources**	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to Single Family Residential, except:* • Increased density within UGB reduces need for UGB expansions • Decreased infrastructure requirements per dwelling unit decreases overall infrastructure and roads needed, thereby reducing negative ecological effects	*Similar to Single Family Residential, except:* • Associated with higher levels of onsite imperviousness and lower levels of forest and vegetation, with increased negative stormwater and water quality impacts	*Similar to Single Family Residential, except:* • Increased density within UGB may limit expansion to new areas, protecting important outlying habitats	*Similar to Single Family Residential, except:* • Associated with higher levels of onsite imperviousness and lower levels of forest and vegetation, with increased negative effects on riparian wildlife and Neotropical migrants
LIMIT	*Similar to Single Family Residential, except:* • Increased density within UGB reduces need for UGB expansions • Decreased infrastructure requirements per dwelling unit decreases overall infrastructure and roads needed, thereby reducing negative ecological effects	*Similar to Single Family Residential, except:* • Onsite loss of ecological functions and ecosystem services likely to be more severe due to increased imperviousness and tree canopy loss, unless offset by mitigation and restoration activities	*Similar to Single Family Residential, except:* • Increased density within UGB may limit expansion to new areas, protecting important outlying habitats	*Similar to Single Family Residential, except:* • Associated with higher levels of onsite imperviousness and lower levels of forest and vegetation, with increased negative effects on riparian wildlife and Neotropical migrants • Higher level of development less valuable to wildlife
PROHIBIT	*Similar to Single Family Residential*	*Similar to Single Family Residential, except:* • Opportunity for increased density reduced, thereby increasing need for UGB expansion	*Similar to Single Family Residential*	*Similar to Single Family Residential*

Environmental consequences: MULTIFAMILY RESIDENTIAL (MFR)

Development scenario	Class II Riparian resources		Class B Wildlife Habitat resources	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to Class I riparian resources*	*Similar to Class I riparian resources, except:* • Loss of restoration opportunities where ecological functions could be regained through tree canopy increases or other measures • Loss of functionality would be less because less ecological function exists; however, loss of this resource type would remove any remaining water quality filtration capacity or other ecological services, leaving waterways with little protection or buffering from conflicting uses	*Similar to Class I Riparian Resources*	*Similar to Class A, except:* • Habitat interior loss, but less extensive than Class A • Loss of connectivity especially pronounced; extensive loss of migratory stopover habitat and movement corridors. Reduces value of Class A patches. • In Type 2 habitat patches, loss of grassland and low-structure vegetation important to specific wildlife groups (e.g., grassland birds, meadow voles) • Loss of locally rare migratory stopover habitat and locally rare habitat patches with water resources • Associated with higher levels of onsite imperviousness and lower levels of forest and vegetation, with increased negative effects on riparian wildlife and Neotropical migrants • Higher density development less valuable to wildlife
LIMIT	*Similar to Class I riparian resources, except:* • Retains restoration opportunities where ecological functions could be regained through tree canopy increases or other measures • Provides mitigation opportunities	*Similar to Class I riparian resources, except:* • Loss of opportunities to add forest canopy along streams where low structure currently exists	*Similar to Class A, except:* • More habitat connectivity between large habitat patches retained • More grassland and low structure habitat retained (larger, better connected low structure patches fall in Class B)	*Similar to "allow," but to a lesser degree depending on program options* • To the extent that conflicting uses remove the resource, habitat and connectivity will be lost • Associated with higher levels of onsite imperviousness and lower levels of forest and vegetation, with increased negative effects on riparian wildlife and Neotropical migrants • Higher density development less valuable to wildlife
PROHIBIT	*Similar to Class I riparian resources, except:* • Retention of some critical ecological functions and ecosystem services provided by existing natural resources • Retains restoration opportunities where ecological functions could be regained through tree canopy increases or other measures • Provides mitigation opportunities	*Similar to Class I riparian resources, except:* • Increased need for UGB expansion, but less so than Class II	*Similar to Class A, except:* • Retention of some of the most important connectivity elements in the region • Retention of large upland habitat patches important to specific wildlife species • Preserves areas important for Neotropical migratory birds during migration • May provide important source habitats for native wildlife and plant	*Similar to Class A, except:* • If conflicting uses are prohibited in all Class B wildlife habitat patches, Class A and C may be disproportionately removed or altered, thereby reducing the functionality of Class B habitat patches through connectivity loss and increasing isolation

			species	

Development scenario	Environmental consequences: MULTIFAMILY RESIDENTIAL (MFR)			
	Low Value Riparian		**Class C Wildlife Habitat resources**	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to Class I riparian resources, except:* • This class tends to have less forest or other vegetation than other classes, and includes developed floodplains; functionality already reduced here	*Similar to Class II riparian resources, except:* • The potential for losing existing ecological functions is reduced	*Similar to Class B, except:* • These patches tend to be relatively small, isolated, and lacking substantial water resources, and are therefore reduced in quality and functionality compared to Class A and B	*Similar to Class B, except:* • Only limited loss of habitat interior • Some loss of connectivity between patches • Important loss of migratory stopover habitat, because these patches tend to occur in areas lacking substantial wildlife habitat • Loss of upland patches lacking water resources but providing important habitat to specific wildlife species
LIMIT	*Similar to Class I riparian resources, except:* • Retains restoration opportunities where ecological functions could be regained through tree canopy increases or other measures • Provides mitigation opportunities	*Similar to Class I riparian resources, except:* • Loss of opportunities to add forest canopy along streams where low structure currently exists	*Similar to Class B, except:* • Most are small forested patches • Less likely to provide good habitat for some species, because these patches tend to be narrow, disconnected, and surrounded by development	*Similar to "allow," but to a lesser degree depending on program options* • To the extent that conflicting uses remove the resource, habitat and connectivity will be lost
PROHIBIT	*Similar to Class I riparian resources, except:* • Retention of some ecological functions and ecosystem services provided by existing natural resources • Retains restoration opportunities where ecological functions could be regained through tree canopy increases or other measures • Provides mitigation opportunities	*Similar to Class I riparian resources, except:* • Increased need for UGB expansion, but less so than Class II	*Similar to Class B, except:* • Not as important to regional connectivity, but may provide important local connectivity • Small, isolated patches provide important and locally rare stopover habitat to migratory birds	*Similar to Class B, except:* • Small isolated habitat patches may limit reproductive success due to edge effects and reduced habitat quality

Development scenario	Environmental consequences: COMMERCIAL (COM)			
	Class I, II and III Riparian resources		Class A, B, and C Wildlife Habitat resources	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to MFR*	*Similar to MFR, except:* • Increased imperviousness and decreased canopy cover increase negative ecological effects	*Similar to MFR*	*Similar to MFR, except:* • Increased imperviousness and decreased canopy cover increase negative ecological effects • Increased human disturbance may negatively impact wildlife
LIMIT	*Similar to MFR*	*Similar to MFR, except:* • Increased imperviousness and decreased canopy cover increase negative ecological effects, to a lesser extent than allow	*Similar to MFR*	*Similar to MFR, except:* • Increased imperviousness and decreased canopy cover increase negative ecological effects to a lesser degree than allow • Increased human disturbance may negatively impact wildlife, but to a lesser degree than allow
PROHIBIT	*Similar to MFR*	• *Similar to MFR*	*Similar to MFR*	*Similar to MFR*

Development scenario	Environmental consequences: INDUSTRIAL (IND)			
	Class I, II and III Riparian resources		Class A, B, and C Wildlife Habitat resources	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to MFR, except:* • SFR and IND contain the majority of Low Value Riparian Resources, therefore SFR represents opportunities for improved ecological function through mitigation or restoration	*Similar to MFR, except:* • Increased imperviousness and decreased canopy cover increase negative ecological effects • Increased toxics may be associated with this land use type • IND contains a substantial portion of Class I Riparian Resources and can be particularly detrimental to water quality	*Similar to MFR*	*Similar to MFR, except:* • Increased imperviousness and decreased canopy cover increase negative ecological effects
LIMIT	*Similar to MFR, except:* • IND contains a substantial portion of Class I Riparian Resources, representing opportunities for improved ecological function through mitigation, restoration, or programmatic protection • SFR and IND contain the majority of Low Value Riparian Resources, therefore SFR represents opportunities for improved ecological function through mitigation or restoration	*Similar to MFR, except:* • Increased imperviousness and decreased canopy cover increase negative ecological effects • Increased toxins may be associated with this land use type	*Similar to MFR*	*Similar to MFR, except:* • Increased imperviousness and decreased canopy cover increase negative ecological effects, but to a lesser extent than allow
PROHIBIT	*Similar to MFR* • Prohibiting conflicting uses would minimize water quality degradation • IND contains a substantial portion of Class I Riparian Resources, representing opportunities for improved ecological function through preservation and restoration	*Similar to MFR*	*Similar to MFR*	*Similar to MFR*

Development scenario	Environmental consequences: MIXED USE CENTERS (MUC)			
	Class I, II and III Riparian resources		**Class A, B, and C Wildlife Habitat resources**	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	• Because MUC zoning allows for a variety of land uses in the same area, it has potential for reducing the amount of land needed; UGB expansions less necessary • MUC tends to reduce VMT, thereby reducing water quality impacts due to transportation runoff • Less use of fertilizers, pesticides and herbicides than residential because less landscaping and vegetation present	• Mixed use development generates similar disturbance activities and consequences as residential and commercial, but to varying degrees depending on uses • MUC typically have high imperviousness and little tree canopy cover • Extensive loss of ecological functions and ecosystem services, with particular concerns regarding altered hydrology, stormwater and water quality • More parking areas and roads add pollutants to water resources	• Because mixed use zoning allows for a variety of land uses, it has potential for reducing the amount of land needed; UGB expansions less necessary • Incentives and education could improve land stewardship, but requires financial investment	*Similar to MFR and COM, depending on mix of land uses, except:* • Noise and light disturbances may be higher • Extent of vegetation loss may be higher
LIMIT	*Similar to MFR and COM, depending on mix of land uses, except:* • MUC tends to reduce VMT, thereby reducing water quality impacts due to transportation runoff	*Similar to MFR and COM, depending on mix of land uses*	*Similar to MFR and COM, depending on mix of land uses*	*Similar to MFR and COM, depending on mix of land uses*
PROHIBIT	*Similar to MFR and COM, depending on mix of land uses*	*Similar to MFR and COM, depending on mix of land uses*	*Similar to MFR and COM, depending on mix of land uses*	*Similar to MFR and COM, depending on mix of land uses*

Development scenario	Environmental consequences: RURAL (RUR)			
	Class I, II and III Riparian resources		**Class A, B, and C Wildlife Habitat resources**	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to SFR, except:* • Lower imperviousness; more tree canopy and vegetation reduce harm to streams	*Similar to SFR, except:* • Increased pesticide use may be associated with this land use due to agriculture • Livestock degrade riparian area and water quality • Septic tanks are common and sometimes leak bacteria into waterways, reducing water quality	*Similar to SFR, except:* • Lower imperviousness; often more tree canopy and vegetation reduce extent of habitat loss and adverse edge effects • Less habitat fragmentation; tends to retain more connectivity between patches and to water • RUR lands with agricultural areas can provide important habitat for grassland and low structure-associated species	*Similar to SFR, except:* • Increased toxics may be associated with this land use type due to agriculture • Livestock degrade riparian area and reduce habitat quality • Wildlife crossings across roadways cause mortality
LIMIT	*See comments under "allow," except:* • Programmatic options may reduce loss of ecological functions • Impervious surface mitigation opportunities • Hydrology often less altered than other zoning types • Strong potential for BMPs, restoration and mitigation activities to offset negative ecological effects, but requires financial investment	*Similar to SFR, except:* • Increased pesticide use may be associated with this land use due to agriculture • Septic tanks are common and sometimes leak bacteria into waterways, reducing water quality	*Similar to SFR, except:* • Lower imperviousness; often more tree canopy and vegetation reduce extent of habitat loss and adverse edge effects • Less habitat fragmentation; tends to retain more connectivity between patches and to water • RUR lands with agricultural areas can provide important habitat for grassland and low structure-associated species	*Similar to SFR, except:* • Increased toxics may be associated with this land use type due to agriculture • Livestock grazing can damage riparian areas and reduce habitat quality • Wildlife crossings across roadways cause mortality
PROHIBIT	*Similar to SFR, except:* • Fewer water quality problems associated with leaky septic tanks, livestock • Less need to expand UGB	*Similar to SFR, except:* • Rural lands are low density and therefore tend to require more infrastructure per dwelling unit, increasing VMT and decreasing water quality	• Similar to SFR, except: • Prohibiting conflicting uses may decrease toxics associated with agriculture • Reduced livestock damage to habitat • Reduced wildlife road kill mortality •	*Similar to SFR, except:* • RUR lands with agricultural areas can provide important habitat for grassland and low structure-associated species

Development scenario	Environmental consequences: PARKS AND OPEN SPACE (POS)			
	Class I, II and III Riparian resources		**Class A, B, and C Wildlife Habitat resources**	
	Positive	***Negative***	***Positive***	***Negative***
ALLOW	*Similar to RUR, except:* • May be highly variable in natural land cover and management	*Similar to RUR, except:* • May be highly variable in natural land cover and management • Human disturbance may be higher	*Similar to SFR, except:* • May be highly variable in natural land cover and management	*Similar to RUR, except:* • May be highly variable in natural land cover and management
LIMIT	*Similar to RUR, except:* • May be highly variable in natural land cover and management	*Similar to SFR, except:* • May be highly variable in natural land cover and management • Human disturbance may be higher	*Similar to SFR, except:* • May be highly variable in natural land cover and management	*Similar to RUR, except:* • May be highly variable in natural land cover and management
PROHIBIT	*Similar to RUR, except:* • May be highly variable in natural land cover and management • Could help prevent human / pet disturbance to wildlife	*Similar to RUR, except:* • May be highly variable in natural land cover and management	*Similar to RUR, except:* • May be highly variable in natural land cover and management	*Similar to RUR, except:* • May be highly variable in natural land cover and management

Development scenario	Energy consequences: SINGLE FAMILY RESIDENTIAL *Fish and wildlife habitat*	
	Positive	***Negative***
ALLOW	• More compact form contributes to efficiencies in provision of services and reduction of travel distances • More compact development form may reduce VMT (Vehicle Miles Traveled per person) and fossil fuel use • Reducing VMT and fossil fuel use reduces air pollutants and heat • Represents the majority of buildable resource lands; opportunities for education and incentives	• Loss of trees and increased imperviousness lead to increased Urban Heat Island effect and global warming; increased air conditioning (AC) demand • Extensive loss of ecosystem services related to trees, plants; reduced air quality • Warmer air warms water; harms salmonids and other temperature-sensitive animals • Increased energy consumption to provide engineered solutions to replace natural systems to manage stormwater flow, reduce soil erosion, keep water cool, etc. • This land use type associated with increased offsite roads and infrastructure; large amount of buildable resource acres suggests high energy output for infrastructure creation, maintenance, and increased AC demand due to additional imperviousness • Decreased energy efficiency if housing is not required to use cluster design • Education and incentives, if implemented, would require substantial financial investment
LIMIT	• May reduce infrastructure requirements and enable use of existing infrastructure, thereby saving energy needed to create, install, and maintain all types of infrastructure • May allow energy-saving infrastructure development (e.g., gravity flow sewer or water lines) • Reducing VMT and fossil fuel use reduces air pollutants and heat • Increased forest cover can help remove energy-related air pollutants and reduce smog • Increased forest cover can cool air by shade, evapotranspiration, carbon storage; reduced Urban Heat Island effect, reduced global warming, reduced AC demand • May result in decreased energy consumption to manage stormwater runoff, reduce sedimentation and erosion and keep water cool • Tree retention is cheaper, easier, and less energy-consumptive than planting new trees • Limiting conflicting uses has the greatest potential for mitigation and restoration activities; may result in increased ecological function over time • Represents the majority of buildable resource lands; opportunities for education and incentives	*Negative consequences similar to "allow" option, but to a lesser degree* • Avoiding sensitive natural areas may increase energy-using infrastructure requirements • Increased miles of infrastructure and increased transportation systems lead to increased VMT • Avoiding sensitive natural areas may result in future need for UGB expansion • Loss of trees increases Urban Heat Island effect and global warming; increased air conditioning demand, impacts air quality • Allows greater transportation planning options compared to prohibit, while still retaining green infrastructure • Warmer air warms water; harms salmonids and other temperature-sensitive animals • Possible reduction in access to transportation modes such as bicycling, walking because extensive pathways often run along natural areas (program-dependent) • Education and incentives, if implemented, would require substantial financial investment
PROHIBIT	• Retention of substantial tree canopy and other vegetation may provide the strongest protection against warmer air and water due to Urban Heat Island effect and global warming (CO2 storage) (although physical extent of Urban Heat Island effect likely to be expanded) • Opportunity for pleasant, accessible alternative means of transportation such as walking and bicycling through natural areas, if permitted under programmatic options • Likely to result in decreased need for future energy-requiring restoration and flood mitigation activities due to retention of tree and vegetation cover	• Limits transportation planning options • Limits infrastructure placement options • Increases extent of urban area and VMT • Potential for increased total imperviousness due to increased roads; energy is required to build and maintain roadways and other infrastructure • If utilities are prohibited from being installed along streams, may require pumping or other energy-requiring activities to take non-gravity driven pathways • Increased travel distance, fossil fuel use, air pollution, related warming of air and water • Extent of Urban Heat Island effect may increase, potentially increasing AC demand

Development scenario	Energy consequences: MULTIFAMILY RESIDENTIAL	
	Fish and wildlife habitat	
	Positive	***Negative***
ALLOW	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive • Can clear less land per unit to construct dwelling units than SFR, reducing overall extent of tree loss, infrastructure requirements, and need for UGB expansion	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive • Increased onsite imperviousness and tree loss add to Urban Heat Island effect and global warming on a per-acre basis
LIMIT	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive • Can clear less land per unit to construct dwelling units than SFR, reducing overall extent of tree loss, infrastructure requirements, and need for UGB expansion	*Similar to Single Family Residential, except*: • Buildable resource lands are less extensive • Increased onsite imperviousness and tree loss add to Urban Heat Island effect and global warming on a per-acre basis
PROHIBIT	*Similar to Single Family Residential*	*Similar to Single Family Residential*

Development scenario	Energy consequences: COMMERCIAL	
	Fish and wildlife habitat	
	Positive	***Negative***
ALLOW	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive • High onsite imperviousness and tree loss add to Urban Heat Island effect and global warming on a per-acre basis • Further increases in energy consumption to provide engineered solutions to replace natural systems to manage stormwater flow, reduce soil erosion, keep water cool, etc.
LIMIT	*Similar to Single Family Residential* • Buildable resource lands are less extensive	*Similar to Single Family Residential, except*: • Buildable resource lands are less extensive • High onsite imperviousness and tree loss add to Urban Heat Island effect and global warming on a per-acre basis • Further increases in energy consumption to provide engineered solutions to replace natural systems to manage stormwater flow, reduce soil erosion, keep water cool, etc.
PROHIBIT	*Similar to Single Family Residential*	*Similar to Single Family Residential*

Development scenario	Energy consequences: INDUSTRIAL	
	Fish and wildlife habitat	
	Positive	***Negative***
ALLOW	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive, although still substantial	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive, although still substantial • High onsite imperviousness and tree loss add to Urban Heat Island effect and global warming • Further increases in energy consumption to provide engineered solutions to replace natural systems to manage stormwater flow, reduce soil erosion, keep water cool, etc. • Placement within the floodplain is common, increasing energy-requiring flood mitigation
LIMIT	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive, although still substantial	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive, although still substantial • High onsite imperviousness and tree loss add to Urban Heat Island effect and global warming • Further increases in energy consumption to provide engineered solutions to replace natural systems to manage stormwater flow, reduce soil erosion, keep water cool, etc. • Placement within the floodplain is common, increasing energy-requiring flood mitigation
PROHIBIT	*Similar to Single Family Residential, except:*	*Similar to Single Family Residential*

Development scenario	Energy consequences: MIXED USE CENTERS	
	Fish and wildlife habitat	
	Positive	***Negative***
ALLOW	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive • Higher density centers of employment and housing create compact urban form, reducing VMT, infrastructure, energy use • Provide efficient access to goods and services, enhance multi-modal transportation	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive
LIMIT	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive • Higher density centers of employment and housing create compact urban form, reducing VMT, infrastructure, energy use • Provide efficient access to goods and services, enhance multi-modal transportation	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive
PROHIBIT	*Similar to Single Family Residential* •	*Similar to Single Family Residential, except:* • This zoning type is the most energy-efficient land use; prohibit decision would reduce energy saving opportunities provided by land use and transportation efficiencies

Development scenario	Energy consequences: RURAL	
	Fish and wildlife habitat	
	Positive	***Negative***
ALLOW	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive • Imperviousness is typically lower and vegetation cover higher, reducing Urban Heat Island effect	*Similar to Single Family Residential, except:* • More infrastructure required per dwelling unit
LIMIT	*Similar toSingle Family Residential, except:* • Buildable resource lands are less extensive • Imperviousness is typically lower and vegetation cover higher, reducing Urban Heat Island effect	*Similar to Single Family Residential* • More infrastructure required per dwelling unit
PROHIBIT	*Similar to Single Family Residential*	*Similar to Single Family Residential* • More infrastructure required per dwelling unit

Development scenario	Energy consequences: PARKS AND OPEN SPACE	
	Fish and wildlife habitat	
	Positive	***Negative***
ALLOW	*Similar to Single Family Residential, except:* • Buildable resource lands are less extensive • Imperviousness is typically lower and vegetation cover higher, reducing Urban Heat Island effect • Less infrastructure required compared to other zoning types	*Similar to Single Family Residential*
LIMIT	*Similar toSingle Family Residential, except:* • Buildable resource lands are less extensive • Imperviousness is typically lower and vegetation cover higher, reducing Urban Heat Island effect • Less infrastructure required compared to other zoning types	*Similar to Single Family Residential*
PROHIBIT	*Similar toSingle Family Residential, except:* • Buildable resource lands are less extensive	*Similar to Single Family Residential*

Assumptions:

- At the regional scale, energy use is most strongly influenced by the extent and physical arrangement of transportation networks, the built environment, and green infrastructure. Options consistent with Region 2040 Growth Concept support energy conservation, especially fossil fuel use.
- Because options consistent with Region 2040 are a primary consideration, energy consequences differ little between:
    - riparian and wildlife habitat resources - tree retention and stream crossing considerations are most important
    - low-value and high value resources
    - types of land use (based on residential because that is most extensive land use; comments on differences among land uses included at end of table)

EXHIBIT F—ORDINANCE NO. 05-1077C

ATTACHMENT 4.

METRO'S PHASE II ECONOMIC, SOCIAL, ENVIRONMENTAL, AND ENERGY (ESEE) ANALYSIS

This report is available for review in the Metro Council's files or on Metro's website: **http://www.metro-region.org/nature**. In addition, copies may be requested from the Metro Planning Department, 600 N.E. Grand Ave., Portland, OR 97232, or by calling 503-797-1555.

Metro's Phase II ESEE Analysis

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METRO
People places • open spaces
Clean air and clean water do not stop at city limits or county lines. Neither does the need for jobs, a thriving economy, and good transportation choices for people and businesses in our region. Voters have asked Metro to help with the challenges that cross those lines and affect the 24 cities and three counties in the Portland metropolitan area.

A regional approach simply makes sense when it comes to protecting open space, caring for parks, planning for the best use of land, managing garbage disposal, and increasing recycling. Metro oversees world-class facilities such as the Oregon Zoo, which contributes to conservation and education, and the Oregon Convention Center, which benefits the region's economy.

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CHAPTER ONE: INTRODUCTION

The natural environment is an important aspect of the uniqueness of the Metro region. Metro's policies have consistently placed a high level of importance on the protection of the natural environment as a means of maintaining the high quality of life citizens of this region expect. Healthy streams and upland areas provide habitat for many animals, fish such as salmon, and clean water for people, fish, and wildlife.

Residents of this region consistently say that contact with nature is important, and they value the natural biological diversity that is part of the Willamette Valley.[1] As Oregonians, state symbols are part of the cultural identity of residents in the Metro region. The Western Meadowlark was selected as Oregon's state bird by schoolchildren in 1927 (Marshall et al. 2003). It is currently a state-listed Species of Concern, and has been nearly lost from the Metro region due to loss of native grasslands and urban development. However, some birds still winter over in the region, and bird-watchers often seek them out in areas such as the agricultural lands around the Tualatin River. The state fish, Chinook salmon, has five evolutionary significant units (ESUs) in or near this region, and all five are listed as Threatened or Endangered under the federal Endangered Species Act. Contact with nature and the rich diversity of species and habitats native to this region are important parts of the region's cultural heritage. To the extent that these habitat is lost, so is a part of our culture, heritage, and natural history.

Much work has already been accomplished to protect and restore fish and wildlife habitat in the region. Metro and other organizations have purchased close to 11,000 habitat acres, thousands of volunteers work to restore habitat and remove invasive species, and most cities and counties have existing habitat protection programs. Metro's efforts are not isolated and build on the tremendous work that is going on in the region. However, Metro's habitat inventories and science review, as well as compliance with federal regulations such as the Endangered Species Act and Clean Water Act, demonstrate that additional habitat protection is needed. Metro's goal is to provide more consistent, effective protection to fish and wildlife habitat across the region.

Metro's approach to fish and wildlife habitat protection

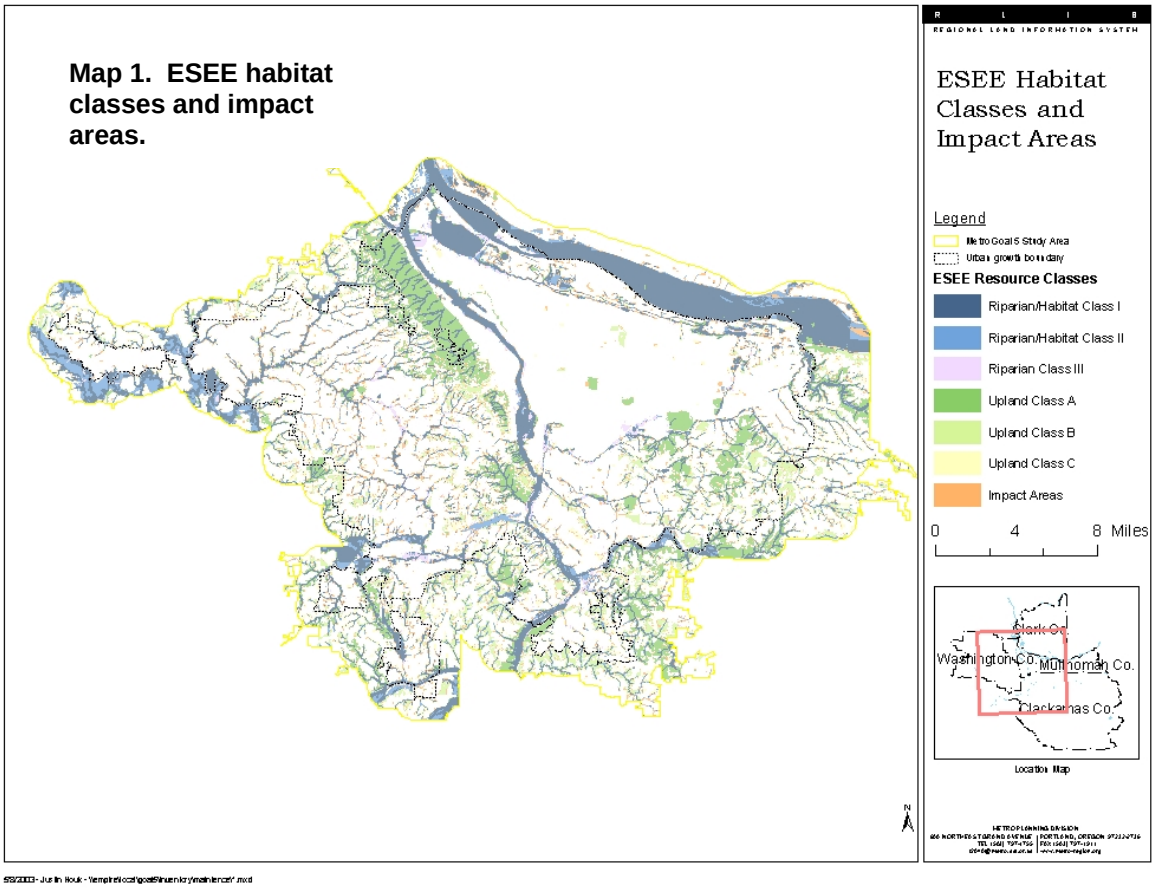
The Metro Council and its local partners are conducting a three-step planning process to conserve, protect, and restore urban streams, waterways, and upland areas that provide important fish and wildlife habitat. State land-use planning laws and broad citizen concern about the need to protect and restore habitat guide this work.

The Metro Council identified regionally significant fish and wildlife habitat in August 2002, based on a scientific assessment of functional habitat values, completing the first step of the planning process. Metro is currently completing the second step of the planning process: assessing the Economic, Environmental, Social, and Energy (ESEE) tradeoffs of protecting or not protecting regionally significant fish and wildlife habitat.

[1] May 2001 Davis and Hibbits phone survey commissioned by Metro, an October 2001 Moore Information survey sponsored by KGW-TV and the Portland Tribune, and an informal "SurveyPoint" poll available by phone and on Metro's website in 2001.

Metro's ESEE analysis is divided into two phases. The first phase was completed in fall 2003 with the release of the discussion draft ESEE Phase I report, which describes the general regional tradeoffs of allowing, limiting, or prohibiting conflicting uses in fish and wildlife habitat areas.[2] Map 1 shows the habitat and impact areas under consideration in the ESEE analysis.

Map 1. ESEE habitat classes and impact areas.



Key points from ESEE Phase I

Metro's approach for conducting a region-wide ESEE consequences analysis focused on achieving the goals of the 2040 Growth Concept. The goals in the Growth Concept, the Future Vision, the Regional Framework Plan (implemented through the Urban Growth Management Functional Plan), and Metro's Vision Statement for Protecting Fish and Wildlife Habitat all specify that the region should manage growth while protecting the natural environment, maintaining a high quality of life, and providing affordable housing options.

A key step in the ESEE analysis is to identify conflicting uses that "exist, or could occur" within regionally significant fish and wildlife habitat sites and identified impact areas. According to the Goal 5 rule, a conflicting use is a "land use, or other activity reasonably and customarily subject to land use regulations that could adversely affect a significant Goal 5 resource." Identifying conflicting uses is important to focus the ESEE analysis on various land uses and related

[2] Metro's Phase I Economic, Social, Environmental, and Energy Analysis (ESEE) April 2005.

disturbance activities that may negatively impact fish and wildlife habitat. In Metro's Phase I ESEE analysis, conflicting uses were identified from a regional perspective by examining generalized regional zones and by considering Metro's 2040 Growth Concept. Metro analyzed the distribution of its fish and wildlife habitat inventory among generalized regional zones, 2040 design type priorities, and impact areas.

The Goal 5 rule describes a process in which the ESEE consequences of allowing, limiting, and prohibiting conflicting uses are weighed with the need to preserve natural resources. These tradeoffs are described below. Metro considered the tradeoffs from a regional perspective. Some of the tradeoffs are different when considering local priorities and concerns; for example, from a regional perspective conflicting uses could be relocated or intensified in one area to account for habitat protection in another. This solution may not address the needs of a city to provide jobs or housing within its jurisdiction, to collect tax revenue, or to protect locally significant resources.

Economic tradeoffs

The key economic tradeoffs identified in the ESEE analysis include:

- Habitat lands have economic value for their urban development potential, which is measured using land value, employment density and 2040 design type designation. Generally, habitat land that is located in a primary 2040 design type designation (i.e., city center, regional center, industrial areas) has the highest value for urban development. Residential, lower density retail, and employment areas have lower value for urban development. Urban development value is not assigned to rural areas and parks.
- Habitat lands also have economic value for the ecosystem services they provide, such as flood control and water quality protection. Lands with the highest fish and wildlife values provide the highest level of ecosystem services.
- Competition between the use of habitat land for ecosystem services and urban development is minimal because the overlap between the highest value habitat and the highest value urban development land is relatively small.
- Much of the vacant, buildable land throughout the region is not part of the highest class of regionally significant fish and wildlife habitat.
- The majority of the highly valued habitat land is outside intensely developed urban areas and, thus, has lower urban development value.
- Lower-value habitat and urban development value areas are important for their cumulative contribution to the region's economy and habitat health.
- Habitat identified as having a low urban development value at the regional level may have high urban development value from a local perspective.
- By concentrating development in defined urban centers, some of the region's development needs can be met. However, accommodating demand for industrial land and single-family residential property will need special attention because these needs cannot be met fully in centers.
- Restricting the development of vacant habitat lands increases the likelihood of expanding the urban growth boundary (UGB).

Social tradeoffs

The key social tradeoffs identified in the ESEE analysis include:

- The social benefits of preserving fish and wildlife habitat areas are diverse and cross-cultural. Habitat areas are an integral part of the area's cultural heritage, regional identity, education, recreation, and public health.
- Public values must be balanced with personal and financial private property interests.
- The needs of future generations must be considered when determining how the land is used today.
- Consideration must be given to the additional time and resources needed for compliance and enforcement of new requirements.
- Preservation of land for habitat use within the urban area may result in the shifting of jobs and housing away from locations where people prefer to live and work.

Environmental tradeoffs

The key environmental tradeoffs identified in the ESEE analysis include:

- Development on highly valued fish and wildlife habitat land has a greater ecological impact than development on less valuable habitat land.
- Protection of both streamside and upland habitat is important to watershed health. Lower-valued upland wildlife areas can play a critical role in connecting habitat areas and supporting biodiversity.
- Trees are very important because they provide habitat, absorb pollution, and reduce water-related impacts by slowing and holding runoff.
- When development activity disturbs streams, the environmental impacts affect the immediate property and also are felt downstream.
- Protection of higher and lower-valued habitat supports healthy watersheds and creates restoration opportunities that, over time, can further improve the watershed.
- Some of the highest value habitat areas are located outside the UGB. If development needs cannot be accommodated within the existing UGB, conflict between habitat protection and urban development will increase as the UGB expands.

Energy tradeoffs

The key energy tradeoffs identified in the ESEE analysis include:

- Trees and other vegetation can reduce energy use because they cool and clean the air and water naturally.
- If protection results in additional expansion of the urban growth boundary to accommodate development needs, increased auto use could result in increased fuel (energy) use.
- Building in urban centers can reduce auto and energy use.

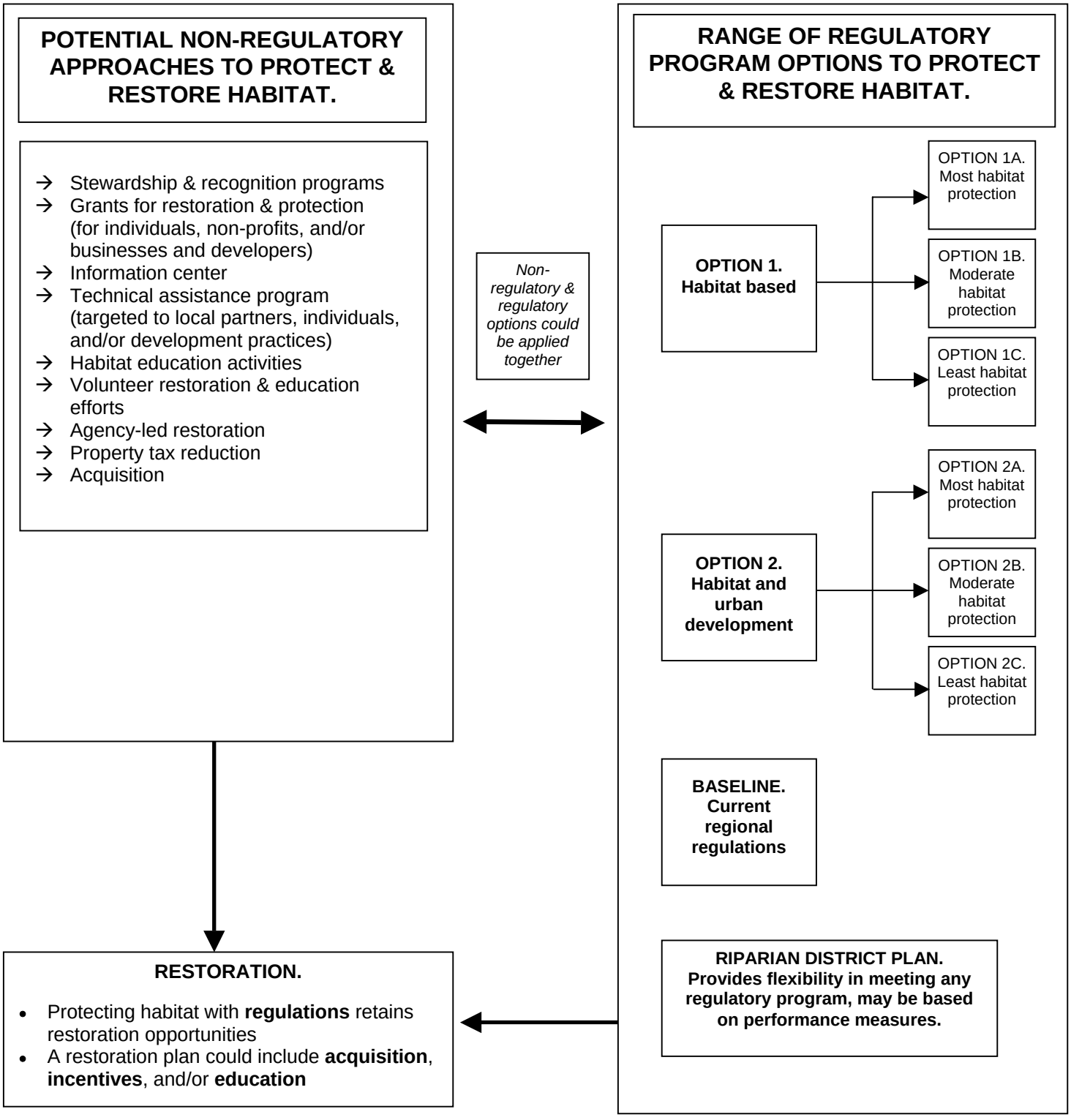
The results of the Phase I analysis showed that neither allowing all habitat land to be developed nor prohibiting development on all habitat land will satisfy the competing land use interests. Metro Council accepted the findings of the Phase I report and directed staff to evaluate six regulatory options that varied habitat protection levels.

Phase II ESEE analysis

This ESEE Phase II report describes several potential non-regulatory approaches to habitat protection and includes Metro's evaluation of the performance of the six program options

identified by the Metro Council in October 2003. The Program Option Chart (Figure 1-1) illustrates the six regulatory and various non-regulatory program approaches studied in the Phase II ESEE analysis. Program options are defined by applying a range of hypothetical allow, limit, and prohibit regulatory treatments to regionally significant fish and wildlife habitat and impact areas within Metro's jurisdiction. Non-regulatory approaches are described as possible components to program options. The results identified in this report will provide information to the Metro Council, local partners, and citizens in the region as the Council chooses a direction for program development in May 2004. The Metro Council is scheduled to consider a fish and wildlife program by December 2004 designed to protect the nature of the region for generations to come.

FIGURE 1-1: PROGRAM OPTION CHART



Format of report

This Phase II ESEE analysis includes four major chapters.

Chapter 2 focuses on non-regulatory approaches for protecting and restoring fish and wildlife habitat. A brief summary of existing efforts in the Metro region is included, followed by several potential approaches, most of which could build on existing programs. A cursory estimate of cost and effectiveness of the non-regulatory approaches is included.

Chapter 3 focuses on existing and potential regulations to protect fish and wildlife habitat. A summary of Metro's *Local Plan Analysis* (August 2002) describes the existing local Goal 5 protection plans. Due to inconsistencies of local plans, Metro uses Title 3 Stream and Floodplain Protection as a baseline for comparing the six regulatory program options. The baseline regulations are described, followed by a description of the regulatory options.

Chapter 4 includes the analysis of tradeoffs for the ESEE factors as well as other criteria including meeting federal guidelines and the increment of additional protection.

Chapter 5 summarizes Metro's analysis of the six regulatory program options, describes how the non-regulatory and regulatory tools could complement each other, and identifies the next steps in program development.

CHAPTER TWO: NON-REGULATORY TOOL OPTIONS

Introduction

A program to protect and restore fish and wildlife habitat can protect more habitat if it includes both regulatory and non-regulatory components. These approaches complement each other, as shown in the table below: non-regulatory tools can address habitat issues that are not covered under land use regulations (e.g., pesticide use) as well as decrease the social/economic impact of regulations (e.g., funds for restoration activities, technical assistance for habitat friendly development). An effective regional protection program could use regulations to establish baseline levels of protection and non-regulatory tools to support and in some cases exceed the baseline. Further, regulations could provide jurisdictions flexibility to meet protection standards under a variety of different circumstances. Regulatory and non-regulatory habitat protection tools can offer varying levels of protection, and can be applied to different habitat in the urban area. Choosing the right tool for the right habitat, location and situation is important, and will require additional analysis and the input and recommendations of the public and the Metro Council.

Table 2-1. Comparison of regulatory and non-regulatory approaches to protect and restore habitat.

Non-regulatory approaches	Regulatory approaches
1. Uncertain protection (acquisition provides certainty but requires funding and depends on willing sellers)	1. Certainty of protection (with adequate enforcement capability)
2. Restoration can be achieved with a variety of approaches (incentives are necessary)	2. Preserves restoration opportunities but does not achieve restoration (mitigation may be required but unlikely to increase overall ecological function)
3. Depends on willing landowners and good stewardship	3. Property rights concerns (takings, real or perceived)
4. Can apply to non-land use activities (e.g., gardening, landscaping, remodeling, etc.)	4. Triggered by development (e.g., building permit application)
5. Application is limited by dollars and the number of willing landowners	5. Consistent treatment of similar situations

Metro's Parks and Greenspaces Department, along with other local partners, commissioned a study of incentives for natural area protection in 2002 (*Incentives Report*).[3] The Metro Council has considered the *Incentives Report*, and the information that relates to fish and wildlife habitat protection has been incorporated into the Phase II ESEE analysis. The study included three parts: a study of 18 candidate incentives, landowner interviews, and implementation strategies for three promising programs. Potential non-regulatory approaches for protection and tools for restoration are described and evaluated based on cost and effectiveness. A summary of non-regulatory tools currently being used in the Metro region is also included. Any new or expanded non-regulatory tool would require funding at some level; potential funding sources will be considered when Metro develops a program to protect fish and wildlife habitat.

[3] Local partners include: City of Portland, City of Oregon City, and the Tualatin Hills Parks and Recreation District. *Tools for natural area protection*, February 2002.

Existing non-regulatory tools for habitat protection and restoration

Numerous non-regulatory programs focused on protecting fish and wildlife habitat exist in the Metro region. In 2003, Metro compiled and summarized the efforts of 31 groups[4] that focus habitat protection and restoration efforts within the UGB, providing a snapshot of current efforts.[5] Funding levels fluctuate and organizations come and go, but Metro's survey provides a picture of how much has been accomplished in the current environment with non-regulatory tools. Table 2-2, below, describes a few of the non-regulatory programs in the region.

Since there are so many different types of programs in the region, Metro's study of non-regulatory tools categorized habitat protection and restoration programs in the following ways:

- **Restoration and enhancement.** The watershed councils operating in the Metro area have identified many restoration and enhancement priorities, which have been implemented and funded by several types of government agencies and private organizations. Much of the grant money that flows into the region is used for restoration and enhancement, but the grants are highly competitive and are inadequate to meet the demand. For example, Metro's grant program with the US Fish and Wildlife Service funded only about 35 percent of the grant proposals over the past three years, leaving about $1.7 million of unfunded requests. These grant sources are also volatile and may change due to economic and political forces.
- **Education and outreach.** Some programs are focused on assisting private citizens and businesses in "green" consumer choices.[6] Other education efforts focus on living with wildlife, acquiring skills in watershed protection, and monitoring of fish and wildlife habitat. Outreach tools include articles in newsletters and on websites as well as brochures and books that inform the public and landowners about stewardship issues. In addition to informing the public about fish and wildlife habitat issues, education and outreach are often used to promote restoration and other habitat protection programs.
- **Land acquisition programs.** These programs are very effective in habitat protection and restoration and are usually applied to privately owned lands. Land may be purchased outright or with a conservation easement from willing landowners.

A summary of the known accomplishments from the organizations surveyed is described below.

[4] The 31 groups investigated included: city governments, environmental services districts, park districts, soil and water conservation districts, watershed councils, federal programs, Metro, and non-profit organizations.
[5] *Accomplishment Report: Non-regulatory fish and wildlife stewardship in the Metro region* (Metro 2003).
[6] Including programs such as: alternatives methods of pest control, "Naturescaping," and "Green Building" construction methods.

Table 2-2. Examples of existing non-regulatory programs in the Metro region.

Focus	Programs
Restoration and enhancement	• *Oregon Watershed Enhancement Board (OWEB) General Grant Program.* Grants to carry out on the ground watershed restoration projects to restore aquatic habitat, improve water quality, and improve biodiversity. Projects include planting, culvert replacement, habitat improvements, wetland restoration, and others. (2002 total of $3,028,000 for Clackamas, Multnomah, and Washington counties; 31 projects). • *Metro/USFWS Greenspaces Grant Program.* Provides funding for urban projects that emphasize environmental education, habitat enhancement and watershed health. • *East Multnomah Soil & Water Conservation District grants*. Provides awards for conservation and restoration projects, ranging from $200-2,500, mostly on rural lands (funding is sponsored by the Fish and Wildlife Foundation). • *Wildlife Habitat Incentives Program (WHIP)*. Implemented through Natural Resources Conservation Service (NRCS) to help landowners develop and improve wildlife habitat on their land. In Oregon approximately $350,000 (for the entire state) is targeted for salmon habitat, riparian habitat, and promotion of biodiversity. • *Environmental Quality Incentives Program (EQIP).* Provides payments through the NRCS to farmers and ranchers for assistance implementing conservation practices on their lands (including filter strips, manure management practices and others). Authorized by the 2002 Farm Bill, pays up to 74% of the costs of the implemented practice.
Education and outreach	• *Metro's Natural Gardening and Landscaping Program.* Metro offers free natural gardening seminars and workshops in spring and fall. Also includes a demonstration garden, summer garden tour, and educational materials. • *Downspout Disconnect Program.* City of Portland program that provides property owners with funds and technical expertise to disconnect downspouts to reduce flow into the stormsewer system. • *Eco Biz Program.* City of Portland program, started to recognize auto repair and service facilities that minimize their environmental impacts. Currently being extended to landscaping business. • *Metro's Green Streets Handbook.* A resource for designing environmentally sound streets that can help protect streams and wildlife habitat. • *Eco-roof Program.* Portland provides sewer rate discounts to developers that build greenroofs minimizing stormwater runoff. Also provides an eco-roof floor area bonus, in which each square foot of eco-roof equals an additional three square feet of building area in the downtown. • *G-Rated Incentive Program.* Portland program that encourages innovations in residential and commercial development and redevelopment for green building design practices. Provides up to $20,000 for commercial projects and $3,000 for residential projects.
Land acquisition programs	• *Metro Openspaces Acquisition Program.* Funded through $135 million bond measure approved by voters in 1995. Focuses on targeted natural areas and regional trails. • *Three Rivers Land Conservancy Acquisition Program.* Works to encourage donation of conservation easements to protect targeted open space in the Metro region. • *Johnson Creek Willing Seller Program.* Portland program allows landowners in Johnson Creek floodplain to sell their property to the City at fair market value. After acquisition, properties are restored to natural floodplain function. Funded largely with dollars from FEMA after the 1996 flood. • *Sherwood program.* Requires system development charge (SDC) for development in floodplains, fee waived if flood area is donated to the city.

Restoration and enhancement

On the ground restoration and enhancement programs and projects were conducted by all of the organizations surveyed, with the exception of the Federal programs that fund many of the efforts. The Americorps program provides much needed labor; the U.S. Fish and Wildlife Service (USFWS) provides $300,000 per year to fund environmental education, conservation and restoration grant projects; and the Natural Resources Conservation Service (NRCS) cost-share program implements restoration projects on rural lands in the region. Environmental service districts[7] conduct much of the revegetation efforts, planting a substantial portion of the trees and plants in the year surveyed. Much of this work is accomplished through Portland's Bureau of Environmental Services (BES) "Watershed Revegetation Program." BES provides their services as a contractor outside of the city projects, contracting with organizations like Metro.

Watershed Councils and Park Districts also carry out projects in restoration and enhancement. Watershed councils frequently work in partnership with environmental service districts and other organizations. City governments and non-profits make extensive use of volunteers to conduct habitat restoration. Over 15,000 volunteers worked on restoration and enhancement efforts in the Metro region in 2002, contributing 49,150 hours of labor to remove 76 tons, 30 truckloads, and 382 cubic yards of debris and restoring 162 acres of land.[8] The Soil and Water Conservation Districts in the Metro region support restoration and enhancement efforts by helping landowners to revise land management practices to reduce erosion and non-point pollution of streams and rivers.

Education and outreach

Education and outreach programs are an important component of fish and wildlife habitat protection. Most of the organizations surveyed by Metro include some type of education and outreach in their work programs. Hands-on education is very popular, and significant amounts of volunteer time and resources are spent on this aspect of fish and wildlife habitat protection and restoration. A majority of habitat education programs included in Metro's study were conducted by non-profits. The Audubon Society of Portland surpassed all other organizations in attendance and number of classes due to the popularity of their bird and animal oriented classes. Also significant was the contribution by the environmental service districts, providing classes for school children and adults.

Park districts also provide educational programs. The Tualatin Hills Nature Park provides many adults and children with a hands-on experience in one of Washington County's oak savannahs. Portland Parks takes many school children to Hoyt Arboretum, Powell Butte, and Forest Park. Metro provides classes at regional parks[9], natural gardening, and recycling programs. Watershed Councils often work to educate residents as well; one example is the Slough School education program conducted by the Columbia Slough Watershed Council (funded by grants from OWEB and the Metropolitan Greenspaces Program).

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[7] Washington County's Clean Water Services (CWS), Clackamas County's Water Environmental Services (WES), and Portland's Bureau of Environmental Services (BES).

[8] *Accomplishment Report: Non-regulatory fish and wildlife stewardship in the Metro region* (Metro 2003).

[9] 10,000 people annually, including 7,000 children.

The organizations reviewed for this study used a number of tools to reach out to the public. More than 406,000 newsletters, 106,000 brochures and other promotional materials were distributed throughout the region in one year about environmental health in the Metro region. As is the case almost everywhere, the Internet is a fast growing outreach tool. A partial sample[10] of web-based outreach organizations reported 120,500 website hits and 15,000 electronically mailed newsletters during the sample year. Technical support to landowners interested in revising management practices on their properties was limited, and is mostly provided by the soil and water conservation districts which focus efforts on rural and agricultural areas.

Land acquisition

Land acquisition programs are used by a select set of organizations. The high cost of land limits the ability of many smaller organizations to purchase land. Primarily city governments, Metro, federal programs, and a few non-profit organizations utilize acquisition programs. Since 1995, all of the programs combined have succeeded in protecting 10,925 acres of land in the Metro region that is explicitly managed for fish and wildlife habitat protection (Table 2-3 below).[11] Close to 80 percent of the land that Metro has purchased is located outside of the urban growth boundary. Much of the restoration and enhancement work, as well as education and outreach activities, occur on these lands.

Table 2-3. Acres of land purchased for fish and wildlife habitat (as of August 2003).

Organization	Outright purchase or donation	Conservation easements	Total
Metro	7,872	81	7,953
Cities/Environmental Service Districts/Parks	2,035	4	2,039
Non-profits	769	164	933
Total	10,757	168	**10,925**

Metro's 1995 Open Spaces Bond Measure provided an impetus for acquisition to other organizations. The Open Spaces land acquisition program has acquired 7,953 acres, of those acres a little over 80 acres are conservation easements. In addition, through their own programs (bond measures or system development charge funds) the cities of Gresham, Portland, and Lake Oswego have acquired 1,254 acres of parks and open spaces. Since 1995 Portland Parks and Tualatin Hills Park and Recreation Districts have acquired 621.3 acres of habitat land, some through land donations and the rest funded by system development charges.

The city of Portland currently operates a willing seller floodplain acquisition program targeted to the Johnson Creek floodplain. The program was established after the floods of 1996, and used funds from the Federal Emergency Management Agency (FEMA) and the Department of Housing and Urban Development (HUD). More than 106 acres of floodplain have been acquired, although the major sources of funding have been used up. The City of Portland Bureau

[10] Not including Metro's website.
[11] As of August 2003.

of Environmental Services (BES) contributes $300,000 of Capital Improvement Project money to the program each year.

The Three Rivers Land Conservancy (TRLC) and the Wetlands Conservancy have acquired 769 acres inside the urban area to protect wetlands, riparian areas, and uplands that meet strict criteria in their value added to fish and wildlife habitat restoration and enhancement. TRLC also has a conservation easement program that has grown to 164 acres in the past decade. These lands are still privately owned but are strictly managed for their natural resource values in perpetuity.

Summary

While there is substantial evidence of non-regulatory approaches accomplishing habitat protection, restoration, and education in the Metro region, these efforts have not been successful in preventing a decline in overall ecosystem health. As described and catalogued in Metro's *Technical Report for Goal 5* and *Riparian Corridor and Wildlife Habitat Inventories*, the amount and quality of fish and wildlife habitat has been in steady decline over time. Most non-regulatory programs are dependent on unsteady sources of grant funding, volunteerism, and good stewardship, often without recognition or reward. Each program conducts important work, but even taken as a whole over the past decade only a small portion of the habitat in the region received the attention needed. There is a much greater need for restoration dollars; technical assistance for landowners, developers, and local jurisdictions; and permanent protection for critical habitats than is currently available.

Potential non-regulatory tools for protection and restoration

Non-regulatory tools are a key component of a strategy to protect fish and wildlife habitat. Incentives, education, and acquisition strategies are popular among landowners and can be used in conjunction with regulations and where regulations do not apply. For example, local land use regulations are generally triggered by a proposal for new development or redevelopment. Non-regulatory strategies can apply to other activities such as landscaping and reducing pesticide and herbicide use. Non-regulatory tools for habitat protection include acquisition (outright purchase and conservation easements), property tax relief, and good stewardship agreements.

Restoration is a critical component of an effective fish and wildlife habitat protection program. Without active restoration efforts, ecological conditions will likely deteriorate further, even if most habitat lands are protected through regulations. Mitigation for the negative environmental impacts of development may be included as part of a regulatory program. However, actions to restore habitat to a condition better than exists today cannot be required as part of a regulatory program; restoration could be included as a major part of a non-regulatory approach. Regulations can protect land that can then be restored through non-regulatory approaches to provide better functioning habitat.

Based on the results of the *Incentives Report* and Metro's analysis of existing non-regulatory tools for habitat protection and restoration, the following potential non-regulatory tools are examined:

- Stewardship and recognition programs
- Financial incentives (grants, incentives for green streets, property tax reduction)
- Education (information center, technical assistance, other education activities)
- Volunteer activities
- Agency-led restoration
- Acquisition (outright purchase, conservation easements, revolving acquisition fund)

A brief examination of potential costs and effectiveness of potential non-regulatory programs is included in Table 2-5 at the end of this chapter.

Stewardship and recognition programs

These programs publicly acknowledge landowners, businesses and other entities for conserving open space, protecting or restoring habitat areas, making financial contributions or carrying out good stewardship practices in general. Public agencies and nonprofit organizations can administer the programs, and the recognition could take the form of media publicity, awards ceremonies, or plaques and certificates. These programs, while not widely applied in the Metro region, have much potential for encouraging conservation behavior when combined with other programs.

A good stewardship agreement between a landowner and an organization interested in protecting or restoring habitat and monitoring success over time can be used to achieve some level of habitat protection. Such a program would recruit landowners to agree to voluntary stewardship agreements that allow residents to make a commitment to care for the land in a manner that promotes habitat value. A stewardship agreement program would be most effective when combined with other incentives such as education, technical assistance, and grants.

Landowner recognition programs on their own generally provide no permanent protection of resources because participation is voluntary. However, administrative costs may be relatively low compared to funding for programs such as acquisition that provide definitive permanent protection. This tool is most likely to be effective when integrated with other tools (e.g., grants and education) as part of an overall conservation strategy.

Potential programs

1. ***Yearly report.*** Develop a report (printed and/or on website) to publicize innovative examples of restoration, protection and habitat friendly development in the Metro region.
2. ***Stewardship recognition program.*** Develop a regional fish and wildlife habitat stewardship program that recognizes landowners for restoring and protecting habitat on their land and habitat friendly development practices. Sponsor a yearly award ceremony, provide certificates, and encourage media coverage.
3. ***Stewardship agreements.*** Develop signed voluntary stewardship agreements between a property owner and Metro or another sponsor for habitat protection. Most likely to be effective when used in conjunction with small grants and long-term monitoring.

Financial incentives

Achieving restoration on private and public lands typically requires some type of financial incentive to induce property owners to conduct activities such as planting of native vegetation, removal of invasive species, and other habitat improvements.

Grants

Grants for restoration can provide the incentive for supportive landowners and other organizations to restore habitat on private and public lands. A small grant program, targeted to watershed councils, non-profit organizations, or local governments, could be created similar to Metro's recent grants for regional and town center planning efforts. Applicants could submit projects one or two times per year, and they could be reviewed and ranked based on established criteria. Small grants given in strategic places could build on existing work and encourage more efforts in targeted areas.

Funding can leverage additional benefits such as education and volunteerism. Private landowners may be interested in the concept of improving the habitat value on a portion of their land, and the availability of dollars can provide the impetus to conduct restoration activities. Many grants are provided with a required match of either dollars or in-kind materials or labor. These incentives provide landowners who contribute a portion of the proposed cost for conservation or restoration activities with additional funding opportunities. There are several programs in place for rural land in agriculture or forestry use, and some for urban lands. A grant program could target specific activities along stream reaches or within watersheds in coordination with watershed action plans to accomplish the most effective restoration. A monitoring component of a restoration plan would be essential to assess effectiveness over time at restoring habitat function.

As part of a regional habitat friendly development program, Metro could develop a *Habitat-oriented Development Program* similar to Metro's Transit-oriented Development (TOD) Program to encourage construction of new developments or redevelopment that protects and restores fish and wildlife habitat. This would require funds to provide the incentives for developers to practice habitat friendly development. For example, 1000 feet of a stream in the Tryon Creek watershed will be daylighted (removed from pipes) through incentives provided to a housing redevelopment project.[12]

Potential programs

A small grant program could be targeted to residential or individual landowners, or targeted towards development and business practices. Grants could also be aimed at watershed councils or other non-profit groups.

1. ***Small grant program for restoration.*** Develop a small grant program to accomplish restoration on private or public property within the identified regionally significant fish and wildlife habitat areas. With larger grants require long-term monitoring.
2. ***Habitat friendly development grants.*** Provide grants to encourage habitat friendly development, similar to Metro's grant programs to encourage and support Transit-Oriented Development (TOD) and regional and town center planning.

[12] *Oregonian*, "Developer keeps at creek crusade" 10/3/2003.

3. ***Wildlife crossing/culvert replacement grants.*** Provide grants to encourage culvert replacement and wildlife crossings around the region.

Incentives for green streets

The Metro Council could establish a priority for funding transportation projects based on their impacts to regionally significant fish and wildlife habitat. This could help to prevent additional damage to habitat in the region and also provide incentives to restore habitat that has been impacted by development. A criterion could be added to the MTIP funding priorities that focuses on habitat issues, such as culvert replacement or removal, wildlife crossing improvements, or implementation of Green Streets design standards. Alternatively, a separate category or bonus points could be assigned to projects that meet habitat criteria to allow for the funding of projects that improve transportation and habitat in the region.

Property tax reduction

Providing landowners with a reduction in property taxes in exchange for habitat protection or restoration is not a new idea. There are many federal programs that encourage landowners to do just that; however, most of these programs are applicable to farm or forest land. There are two state programs that could be applicable within the urban area: the *Riparian Lands Tax Incentive Program* and the *Wildlife Habitat Conservation and Management Program*. Both of these programs would require county or city action to be implemented. The riparian tax incentive program allows for a tax exemption for property within 100 feet of a stream provided the land is protected and managed for habitat value. The program is limited to 200 stream miles per county. The wildlife habitat program allows designated habitat land to be taxed at a special, reduced rate as long as it is protected and managed for habitat value. This program is not limited by acres and can be applied to riparian or upland habitat.

Property tax reduction is a useful tool to provide motivated landowners with an incentive to manage their land for habitat values, and can also serve as a mechanism to achieve some restoration if a habitat management plan includes requirements for enhancement of existing habitat. However, property tax reductions would reduce jurisdictional revenues. Once enrolled in the program, these properties could also be targeted by agencies that conduct restoration activities such as Metro, Portland's Bureau of Environmental Services, or Clean Water Services in Washington County for greater public benefit. Habitat protection and restoration may be most effective ecologically if this tool is applied strategically, for example, in a specific stream reach or headwater area. This tool could serve as an important incentive to encourage landowners to work in a coordinated fashion to leverage ecological improvements in a specific area. If used on a "first-come, first-served" basis, there may be a scattered approach and less ecological benefit overall. A downside to using property tax relief as a tool for habitat protection is that a landowner can leave the program at any time, the only penalty being payment of back taxes, similar to opting out of a farm or forest tax deferral program.

Education

Information center for fish and wildlife habitat protection

One of the biggest challenges with any incentive/non-regulatory program is getting information into the hands of people who can use it. An "information center" that includes technical assistance, recognition programs, and potentially small grant funds could serve as a "one-stop

shop" providing landowners and others with information and referrals needed to protect and restore fish and wildlife habitat. A center could also include assistance to landowners and others on regulatory compliance and provide coordination between multiple agencies. Metro has some experience providing information to the public – the Recycling Information Center has assisted people with recycling questions since 1981. Other Metro information programs that benefit the environment include Natural Gardening, Soils for Salmon, and Greenspaces education programs and grants. A similar system could be developed to provide landowners and others the information they need to protect fish and wildlife habitat. An alternative to a fully-fledged information center is a permanent hotline residents could call for information on habitat protection and restoration.

Potential programs

1. ***Hotline.*** Provide a permanent hotline for fish and wildlife habitat protection and restoration, include number on all brochures, handbooks, and other educational materials. The hotline could serve as a referral service to other experts in the region.
2. ***Information center.*** Develop an information center, similar to the Recycling Information Center but on a much smaller scale. Citizens could call and talk to a person about habitat protection and restoration or development questions.

Habitat education

Many landowners would like to manage their land in a way that benefits fish and wildlife habitat. However, frequently people do not know if certain activities are detrimental (using herbicides and pesticides), if there are alternatives (natural gardening), what to do to improve habitat (plant native plants, remove invasive species like ivy), and how to connect to agencies and organizations that provide grants and/or volunteers to help improve habitat. A program could be developed to focus efforts to increase people's awareness of the connections between their activities and the health of streams and rivers, similar to fish stencil programs. Landowners in regionally significant habitat areas could be targeted to raise awareness of how individual activities impact fish and wildlife habitat. Education activities would be most effective when used in conjunction with a stewardship certification program, grant programs, and regulatory programs.

Metro currently has several education programs that help fish and wildlife habitat in the Parks and Greenspaces Department and the Solid Waste and Recycling Department. Many other organizations in the region also provide classes about the environment. Several possible programs are described below.

Potential programs

1. ***Brochure.*** Provide an educational brochure about protecting and restoring habitat to be mailed once per year to landowners with significant habitat (also include on website).
2. ***Coordinate with other organizations.*** Distribute information about regionally significant fish and wildlife habitat through education programs provided by other organizations.
3. ***Expand existing education programs.*** Add to existing workshops and classes. Develop a program similar to "Naturescapeing" or "Natural Gardening" on habitat protection and restoration.
4. ***Curriculum for schools.*** Develop a curriculum for schools; work with teachers to implement.

Technical assistance

Technical assistance programs are noted for being responsive to landowner needs, providing practical information, and having knowledgeable resource staff. Such a program would not provide direct protection to habitat, but would offer a means of improving stewardship and enhancement by private landowners. Technical assistance could help supplement cost-sharing programs, such as grants, to further protection and restoration efforts. Technical assistance could be focused on landowners, development practices, and/or local partners. Metro has provided technical assistance to local partners throughout the implementation of the Regional Framework Plan and the Regional Urban Growth Management Functional Plan. This has proved especially important in the implementation of Title 3 (stream and floodplain protection) and planning for 2040 centers.

Metro could work with local partners to develop technical assistance, incentives, recognition programs, and awards for development that helps protect fish and wildlife habitat. Metro, in conjunction with local partners, could develop regional low impact development standards and designs to reduce development impacts on fish and wildlife habitat. The Green Streets Handbook serves as a successful model of technical assistance for transportation infrastructure.

Potential programs

1. ***Local partners.*** Provide assistance to staff from local jurisdictions and other organizations to enable them to assist property owners. If a regulatory program is chosen, provide assistance to local jurisdiction staff to aid in implementation.
2. ***Individual property owners.*** a) Develop and distribute materials focused on habitat protection, restoration and enhancement. b) Dedicate staff to assist property owners in habitat protection and restoration activities on a demand basis. c) Dedicate staff for a one-on-one outreach effort to property owners with high quality habitat, include workshops one to two times per year.
3. ***Development and business practices.*** a) Develop and distribute a manual on habitat-friendly development and green business practices. b) Dedicate staff to assist developers/businesses in habitat protection/restoration on a demand basis. c) Dedicate staff to proactively seek out developers/business owners to achieve habitat friendly development and restoration, include workshops one to two times per year.

Volunteer activities

Much habitat restoration has already been accomplished in the region through the efforts of volunteers. There are many groups that coordinate activities, including SOLV (the statewide Oregon non-profit organization founded in 1969 by Governor Tom McCall), Watershed Councils, Riverkeepers, and Friends' organizations. For example, the Friends of Forest Park organizes major efforts throughout the year to remove English ivy from the park and Friends of Trees organizes more than a dozen native planting events in natural areas each year. Metro currently works with volunteers to both educate (volunteer naturalists) and restore habitat. Involving volunteers in habitat restoration projects both helps to accomplish work and provides a forum for education and awareness of the fish and wildlife in the region. Metro could expand current efforts and partner with non-profit groups and public agencies to coordinate restoration activities to encourage restoration in areas that are designated as regionally significant fish and wildlife habitat.

Potential programs

1. ***Focus existing programs.*** Encourage existing volunteer organizations to focus restoration efforts in regionally significant fish and wildlife habitat areas.
2. ***Provide funding.*** Provide funds to existing volunteer organizations to conduct restoration on public lands with regionally significant fish and wildlife habitat.

Agency-led restoration

Several government agencies currently sponsor and conduct restoration. For example, Metro carries out restoration activities on its own properties to enhance existing habitat value. Metro is currently working with public landowners in the Clackamas River basin on a program to halt the spread of and hopefully eradicate Japanese knotweed – a tenacious non-native plant that overtakes riparian areas. Some agencies, such as the City of Portland's Bureau of Environmental Services, conduct restoration on private lands if they are invited to do so. Agency sponsored restoration could be used in conjunction with other incentive and regulatory programs to accomplish regional restoration goals.

Potential programs

1. ***Provide funding for public lands.*** Provide funds to agencies that conduct restoration to focus efforts in regionally significant habitat areas.
2. ***Provide funding for private lands.*** Provide funds to agencies to conduct restoration for private property owners with regionally significant habitat in exchange for habitat protection.

Acquisition

The most certain way to protect habitat is to acquire it. There are various ways to acquire land such as outright purchase, development rights, and property transfers. These programs address social concerns of fairness as well as real and perceived takings, since they conform to a market-based approach for habitat conservation.

Metro began focusing attention on fish and wildlife habitat protection in the early 1990's, identifying natural areas of regional significance and eventually developing the Greenspaces Master Plan to protect a system of regionally significant natural areas. Metro's $135 million bond measure passed in 1995 to primarily purchase open space and develop regional trails. The bond measure identified 14 target areas and six trail and greenway projects. These came from the Greenspaces Master Plan that identified "regionally significant" natural areas following an exhaustive inventory. Sites were selected based on the following criteria:

- Immediacy or threat of development
- Accessibility to residents of the region
- Protection of large contiguous blocks (patch size)
- Expanding on existing regionally significant areas that are protected

If additional funding to purchase habitat land was secured, an acquisition program could focus on regionally significant fish and wildlife habitat, targeted to achieve specific goals. The goals

could include protection of Habitats of Concern, floodplains, regional connector habitat, strategically located, high-value habitat, and key restoration opportunities. Table 2-4 below shows the acres of undeveloped land in Metro's fish and wildlife habitat inventory. This helps to describe the magnitude of land that falls within the habitat inventory. For example, Riparian Class I contains over 11,000 acres of undeveloped habitat land. Based on the cost of land purchased through Metro's 1995 Open Spaces Bond Measure, land costs inside the UGB average about $45,000/acre and outside the UGB average about $8,600/acre. Due to the expense, acquisition clearly is not a tool that could be used alone to protect even this most ecologically valuable habitat.

Table 2-4. Acres of undeveloped habitat land.

Habitat classification	Total undeveloped habitat land
Riparian Class I	11,614
Riparian Class II	5,365
Riparian Class III	682
Wildlife Class A	8,643
Wildlife Class B	8,211
Wildlife Class C	4,711
Total	**39,226**

Outright purchase

A fee simple purchase of habitat land provides permanent protection but depends on willing sellers. Property is purchased for market prices and thus an acquisition program must be well funded to be effective on a large scale. For example, Metro's Open Spaces acquisition program was funded through a $135 million bond measure approved by voters in May 1995. As of July 15, 2003, Metro had acquired more than 7,935 acres of land for regional natural areas and regional trails and greenways, in 251 separate property transactions at a cost of $1.2 million.[13] These properties protect 70 miles of stream and river frontage.

Regional Revolving Land Purchase Fund

Sometimes valuable fish and wildlife habitat is located on only a portion of a property, and the rest of the parcel is either already developed (e.g., a house) or could be developed in the future. If these parcels are purchased through an acquisition program two concerns arise. First, if the property has a house or other existing use, Metro or another purchasing agency would then be in the position of either renting the useable portion of the property or retiring it from the marketplace and shouldering high maintenance costs. Second, the overall purchase cost of such a parcel would be high, and would effectively reduce available funds for other targeted habitat acquisitions. A program could be developed to purchase habitat land, place development restrictions or conservation easements to protect the habitat areas, and then sell or exchange (via land swaps) the remainder of the land for development or continued use. Funds from the sale could then be used to protect additional land. Such a program could maximize the use of conservation dollars by protecting only the habitat areas on a parcel of land, rather than the entire parcel.

[13] Part of the $135 million bond measure went to local jurisdictions for local parks and greenspaces purchases.

Conservation easement

A conservation easement is a legal agreement between a landowner and a land trust or government agency that permanently limits use of the land in order to protect its habitat values. It allows landowners to continue to own and use their land and to sell it or pass it on to heirs. Conservation easements offer great flexibility. An easement on a property containing rare wildlife habitat might prohibit any development, for example, while one on a farm might allow continued farming. An easement may apply to a portion of the property and need not require public access.

Conservation easements can be donated or purchased. If the donation benefits the public by permanently protecting important conservation resources and meets other federal tax code requirements, it can qualify as a tax-deductible charitable donation. The amount of the donation is the difference between the land's value with the easement and its value without the easement. Conservation easements could be used effectively to target dollars for protecting critical habitat areas. A few organizations currently use conservation easements in the region. A strategy could be developed to collaborate with groups that currently use this tool to protect portions of the regionally significant fish and wildlife habitat identified in Metro's inventory. In addition, agency-sponsored revegetation could be offered to landowners as an incentive to establish conservation easements.

Metro currently has eight easements acquired through the open spaces program (81.1 acres total). One is a flood easement, the other seven are conservation easements. The flood easement is not included in acreage numbers, but the other seven are included. Three easements were donated (59.11 acres), three were purchased (15.89 acres), and one was acquired through an exchange of a 25-year agricultural lease on one acre of property - easement is on 6.1 acres.

Conservation easements have some drawbacks. The legal agreements are complex and time-consuming, and the level of effort (both time and dollars) is often comparable to an outright purchase. Additionally, some property owners would prefer to sell their land outright rather than be encumbered with a conservation easement. Finally, after a conservation easement is in place, it requires resources and staff time to monitor it to ensure it is being followed, and to enforce in instances where its requirements have been disregarded.

Summary

There are many types of non-regulatory tools that could be used to protect and restore fish and wildlife habitat in the region. All of these tools require some type of funding, whether to pay for staff or provide direct dollars to purchase or restore land. Moreover, the success of non-regulatory tools also relies on the willingness of property owners and businesses to invest time and resources, and often to change historic practices. Many of the non-regulatory tools could be implemented at either the local or regional level. Table 2-5 on the following pages describes some of the implementation issues and costs associated with the non-regulatory tools identified in this analysis.

Acquisition is the most effective non-regulatory tool to achieve definitive habitat protection. Acquisition achieves permanent protection and also preserves land to be restored at a later date. However, the high cost of purchasing land, especially within the urban growth boundary, the

dependence of an acquisition program on willing sellers, and the fact that much of the habitat is on partially developed land limits the effectiveness of such a program.

Many of the other non-regulatory habitat protection and restoration tools considered here are most effective when used in combination with each other and/or along with a regulatory program. A regulatory program can provide the incentive and motivation to develop innovative solutions to land development while protecting habitat. Grants and technical assistance are the tools that could be most effective in protecting and restoring habitat, in the absence of an acquisition program. A stewardship recognition program could help promote grants and serve to educate others about innovative practices. Coordinating with existing agencies and volunteer groups that conduct restoration as well as providing funds to focus efforts could be effective in enhancing regionally significant habitat.

Table 2-5. Potential non-regulatory programs for fish and wildlife habitat protection.

What	Effectiveness	Partnerships	Cost*
Stewardship & recognition programs 1. *Accomplishments report* to publicize innovative examples of restoration, protection, and habitat friendly development in region. 2. *Stewardship program* to recognize landowners for restoring and protecting habitat on their land and habitat friendly-development/business practices, include a yearly award ceremony. 3. *Voluntary stewardship agreements* between a property owner and either Metro or another sponsor for habitat protection.	• Limited acreage of total habitat covered • Long-term protection uncertain • Monitoring may increase effectiveness • Relies on willing participants • More effective when used with cost-sharing, grants and technical assistance to encourage more successful projects	Could be implemented by Metro, a local partner, or Watershed Councils.	Low to Medium
Grants for restoration & protection 1. *Residential owner.* Small grant program to accomplish restoration on private or public properties within resource area. 2. *Development activities and business practices.* Provide grants to: • businesses for habitat restoration • developers to encourage habitat friendly development or redevelopment • cities and counties for wildlife crossing and culvert replacement projects	• Effectiveness depends on funding, technical assistance and education, and long-term monitoring • Provides on-the-ground protection and restoration accomplishments • Grants to developers could effectively encourage innovative practices • Limited acreage of total habitat covered • Could increase effectiveness of regulations	A grant program could be implemented at the local or regional level. Partner with Watershed Councils and other groups.	Medium to High
Information center 1. *Hotline* for fish and wildlife habitat protection and restoration. (Calls would be returned periodically). 2. *Call center* for fish and wildlife habitat protection and restoration, referral to other agencies. (Immediate response).	• Effectiveness depends on publicity, technical expertise, and longevity • Depends on extensive marketing campaign and longevity	Could be implemented at the regional level and/or through partnerships.	Low to Medium
Habitat education activities 1. *Educational brochure* on maintaining and enhancing fish and wildlife habitat to be mailed once per year to landowners with significant habitat (also include on website). 2. *Coordinate* with existing organizations that provide habitat-oriented classes, distribute information on regionally significant resources. 3. *Add to Metro's existing workshops and classes* (e.g., Parks Dept. nature classes, tours, and birdwatching events; Solid Waste Dept. "Naturescaping" and "Natural Gardening" classes). 4. *Curriculum* for schools, work with teachers to implement.	• A long-term commitment is required to change behaviors and practices • Over time an education program can reach a large number of people • Could provide consistent message and economy of scale across the region	Could be implemented by Metro, local partners, Watershed Councils, or other non-profits.	Low to Medium
Technical assistance program *Focused on local partners* 1. Assistance to local jurisdiction staff and other organizations to enable them to assist property owners in their jurisdictions 2. Provide assistance to local jurisdiction staff to aid in implementation of a regulatory program (if one is chosen)	• Level of commitment and longevity of program would be key to effectiveness • Technical assistance supports stewardship programs and grants • Technical assistance could increase the effectiveness of a regulatory program	Could be implemented at the regional level and/or through a partnership with other jurisdictions and agencies (e.g.,	Low to Medium

What	Effectiveness	Partnerships	Cost*
Focused on residential, individual owners 3. Develop and distribute materials focused on habitat protection, restoration & enhancement 4. Dedicate staff to assist property owners in habitat protection/ restoration activities on a demand basis 5. Dedicate staff for a one-on-one outreach effort to property owners with high quality habitat, include workshops 1-2 times/year *Focused on development and business activities* 6. Develop and distribute a manual on habitat-friendly development and green business practices 7. Dedicate staff to assist developers/businesses in habitat protection/restoration activities on a demand basis 8. Dedicate staff to proactively seek out developers/business owners to achieve habitat friendly development, restoration; include workshops	• Most effective with high staff to client ratio; no single agency could address needs of so many properties without adequate staff • Knowledgeable staff is critical to providing effective technical assistance	Portland's Office of Sustainable Development).	
Volunteer activities 1. *Partner* with existing volunteer organizations to focus restoration efforts in regionally significant habitat areas. 2. *Provide funds* to existing volunteer organizations (e.g., SOLV) to conduct restoration on public lands with regionally significant habitat.	• Substantial restoration work currently conducted with volunteer efforts • Supports education efforts by training volunteers • Easier access on public lands	Coordinate with existing programs, such as Watershed Councils, friends' groups, SOLV.	Low to High
Agency-led restoration activities 1. *Restoration on public lands.* Provide funds to agencies (e.g., Metro, Portland Bureau of Environmental Services, Clean Water Services) that conduct restoration to focus on regionally significant habitat. 2. *Restoration on private lands.* Provide funds to agencies for restoration on private lands in exchange for habitat protection.	• A trained and experienced staff with monitoring capability could lead to effective restoration work • Maintenance and monitoring of the restoration site over time is necessary to accomplish effective long-term restoration	Implemented at regional and local partner level.	Medium to High
Property tax relief (Programs exist under Oregon state law) 1. Riparian Lands Tax Incentive Program 2. Wildlife Habitat Conservation and Management Program	• Limited landowner enrollment • Requires ongoing management plan with Oregon Department Fish & Wildlife • Landowners can opt out of program with payment of back taxes	Counties implement, Metro could facilitate implementation; encourage application in urban area.	Medium
Acquisition 1. Outright purchase 2. Conservation easement 3. Revolving acquisition fund 4. Donation/bequest program	• Most effective in long-term preservation • Properties may require maintenance • Conservation easements complex to negotiate • Revolving acquisition fund could make effective use of limited dollars	Could be implemented at federal, regional, or local level or by a non-profit.	High

*__About cost:__ High (grants, restoration, acquisition); Medium (dedicated staff); Low (materials only, some staff)

CHAPTER THREE: EXISTING REGULATORY ENVIRONMENT AND REGULATORY PROGRAM OPTIONS

Existing regional and local environmental regulations already cover a portion of the region's habitat land. Since 1998, cities and counties have implemented Metro's protection standards for flood management and water quality (Title 3) along streams and floodplains. Approximately 30 percent of regionally significant fish and wildlife habitat currently covered by Title 3 regulations achieves some, but not all, of the habitat protection needed in these areas. Very few of the wildlife areas in Metro's habitat inventory are covered by consistent regional standards.

In addition to implementing Title 3, some cities and counties have adopted local regulations to protect habitat. Regulations vary in the amount of habitat area they cover and in the level of protection they provide. None of them regulate all regionally significant fish and wildlife habitat within their jurisdiction. This chapter includes:

- a description of the baseline regulations (Title 3) for purposes of analysis
- a summary of Metro's analysis of local Goal 5 programs, and
- a description of the six regional regulatory program options to protect fish and wildlife habitat.

Baseline for analysis (Title 3)

This section describes the starting point for this Phase II ESEE analysis – a baseline from which to measure ESEE tradeoffs of the increment of additional protection posed by each option.

Metro's Title 3 (Water Quality and Flood Management Plan) provides a level of fish and wildlife habitat protection that is consistent across the region. For this reason, Title 3 serves as a proxy for measuring existing levels of protection and is the baseline for this analysis. Habitat outside of Title 3 management areas receives no additional regionally consistent protection. Although many local jurisdictions do provide protection beyond Title 3, none of them regulate all regionally significant habitat lands within their jurisdictions. A comparison of several local Goal 5 programs is made in the next section.

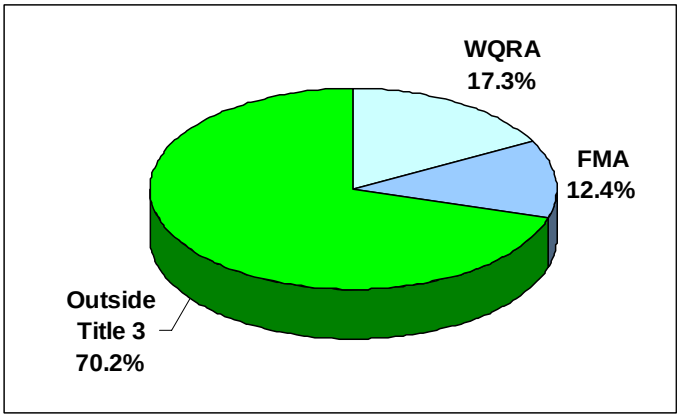
The water quality resource areas (WQRA) and flood management areas (FMA) established in Title 3 protect some of the regionally significant Goal 5 fish and wildlife habitat. Table 3-1 shows Title 3 coverage of fish and wildlife habitat and impact areas. Figures 3-5 and 3-6 graphically illustrate this information.

Table 3-1: Title 3 coverage of fish and wildlife habitat and impact areas (within Metro's jurisdiction)

Fish and wildlife habitat class	Acres within WQRA	Acres within FMA	Total WQRA/ FMA	Acres Outside Title 3	Total Acres	% WQRA/ FMA of Total Acres
Class I RC/WH	13,144	6,803	19,947	7,929	27,876	21%
Class II RC/WH	1,893	1,948	3,841	4,051	7,893	4%
Class III RC/WH	177	2,543	2,720	1,711	4,432	3%
Class A WH	214	108	322	19,359	19,682	0%
Class B WH	69	18	87	12,802	12,889	0%
Class C WH	42	92	134	7,328	7,463	0%
Impact Areas	1,067	419	1,486	14,235	15,721	2%
Total	***16,606***	***11,931***	***28,537***	***67,415***	***95,956***	***30%***

Habitat location (i.e., within WQRAs, within FMAs, outside Title 3), development status (vacant vs. developed), and conflicting land use (e.g., industrial development vs. single-family residential) are important factors for assessing the ESEE tradeoffs of additional protection proposed by the six program options.

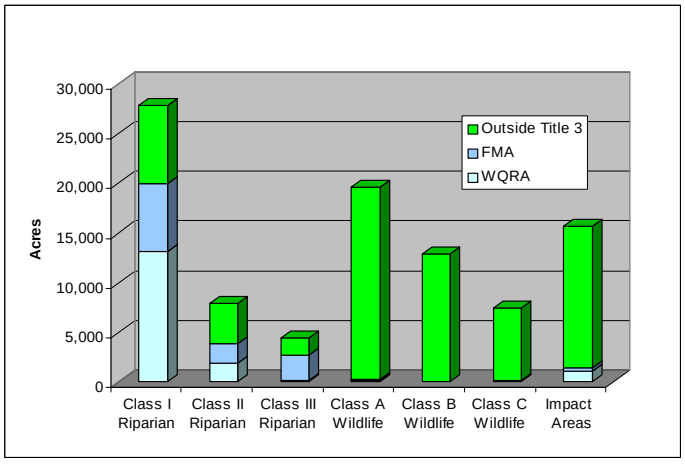
Figure 3-5. Proportion of habitat and impact areas covered by Title 3 (within Metro's jurisdiction).



Habitat location

Figure 3-5 shows that approximately 30 percent of habitat and impact areas are currently covered by Title 3 (28,537 acres). Title 3 achieves some, but not all, of the habitat protection needed in these areas. Most of the protection occurs in Class I-III riparian/wildlife corridors (see Figure 3-6); almost none of the upland wildlife habitat is covered by Title 3.

Figure 3-6. Title 3 coverage of habitat classes and impact areas (within Metro's jurisdiction).



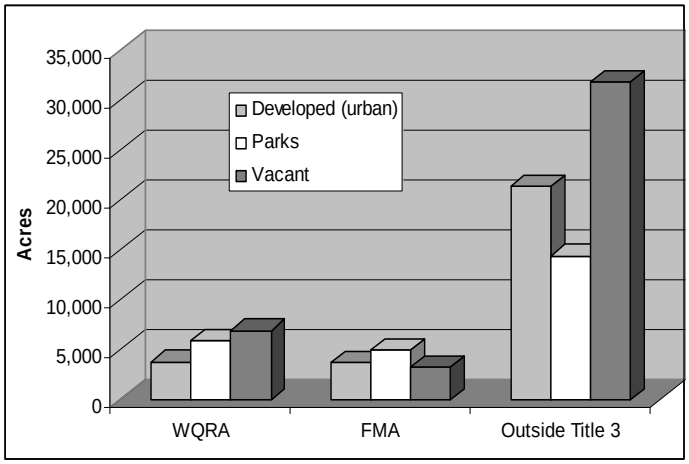
Title 3 performance standards differ in WQRAs and FMAs. Water quality resource areas vary in width from 15 feet to 50 feet from the water feature, and up to 200 feet in steeply sloped areas. New development is ***not allowed*** in these areas unless there is no practical alternative for locating it. In flood management areas, however, new development is ***allowed*** subject to the base zone or existing flood hazard overlay zones and Title 3 development standards (e.g., balance cut

and fill). FMAs include the 100-year floodplain, flood area and floodway, and the 1996 flood inundation area.

The increment of additional protection would be greater in the FMAs than in the WQRAs if disturbance areas are limited by a Goal 5 program because Title 3 does not currently limit disturbance area size in FMAs. The increment of additional protection would be greatest in habitat and impact areas outside Title 3, where it is assumed for this analysis that habitat is not currently protected.

Development status

Figure 3-7. Development status of habitat and impact areas (within Metro's jurisdiction).



Development status also plays a part in assessing the increment of additional protection. As described in the Phase I ESEE analysis, development status refers to whether habitat land is developed or vacant. Figure 3-7 shows development status of habitat land and impact areas inside Metro's jurisdiction.

Developed habitat is land with improvements (e.g., buildings, roads) and specific land uses (e.g., residential, industrial). Two subsets are included in this category: developed urban and parks. An example of habitat categorized as developed urban is dense forest canopy over a developed residential subdivision. Thirty percent of habitat and impact areas (28,734 acres) is developed with urban uses. Parks are categorized as developed land because they generally are not available for urban development. Approximately 28 percent (26,841 acres) of the habitat and impact areas are in park status or zoned parks and open spaces (POS). Generally, the impact of additional protection would be less in developed habitat land than in vacant habitat land, at least in the short term because the regulations would apply to new land use development and would not affect existing development. Over time as redevelopment occurs, however, new Goal 5 regulations would apply.

Vacant land is defined as land without buildings, improvements or identifiable land use. Metro's vacant lands inventory includes vacant portions of developed tax lots that are one-half acre or larger. Vacant land also has two subsets: constrained (by Title 3 WQRA and FMA) and buildable (vacant land outside Title 3). Forty-four percent of habitat and impact areas is vacant (41,965 acres). The impact of additional protection will be greatest on vacant habitat land outside Title 3 areas. Factors other than Title 3 can affect the ability to develop vacant land, such as utility corridors.

Conflicting land uses

Phase I of the ESEE analysis examined conflicting uses; that is, a land use that could adversely affect regionally significant fish and wildlife habitat. Conflicting uses were identified using

Metro's seven regional zones – a compilation of local jurisdictions' zones (see Chapter 3 of the Phase I ESEE Analysis for a full discussion of conflicting uses). Zoning plays a part in assessing ESEE tradeoffs. For example, the increment of additional protection on land zoned for parks would likely be less than habitat land zoned for urban uses (e.g., industrial). Some uses that would conflict with habitat protection may occur in a variety zones such as roads, public utilities, and regionally significant public facilities (major medical facilities and educational institutions). These special uses will be considered in the program development phase.

In summary, the ESEE analysis considers current regulations, development status and regional zoning in assessing the consequences of limiting, allowing or prohibiting development in fish and wildlife habitat areas. Thirty percent of the fish and wildlife habitat inventory overlaps with Title 3 water quality and flood management areas; 70 percent is outside Title 3. The increment of additional protection is influenced by where the habitat is located (in WQRA/FMA vs. outside Title 3), development status of the habitat (developed vs. vacant), and conflicting land uses (regional zones). Title 3 standards focus on streams, floodplains and wetlands; upland wildlife habitat is not covered for the most part. Developed land will experience the impacts of program options through the eventual redevelopment and expansion of existing land uses. Vacant land not covered by Title 3 will experience the most immediate impact of regulatory program options. The extent of the effects varies further by the nature of the land use. The next section describes local Goal 5 programs.

Local Goal 5 programs

Metro conducted a review of local jurisdiction's plans for habitat protection from 1999 to 2002, resulting in the *Local Plan Analysis: A review of Goal 5 protection in the Metro region (August 2002).* Most of the local jurisdictions in the Metro region have adopted Goal 5 programs that have been acknowledged by the Department of Land Conservation and Development as being in compliance with the state rule. Some of these programs were developed prior to the Goal 5 rule revisions in 1996, while a few have been completed more recently.

The Goal 5 rule requires a three-step process, as described in the introduction to this report. However, local governments may also choose to utilize the State "safe harbor" approach rather than conduct an inventory using the standard methodology described above (OAR 660-23-020). A safe harbor approach may be used for riparian corridors and wildlife habitat. Using the safe harbor approach, a local government may determine the boundaries of significant riparian corridors within its jurisdiction using a standard setback distance from all fish-bearing lakes and streams (OAR 660-23-090(5)). This setback distance is determined as follows:

(a) for streams with average annual stream flow greater than 1,000 cubic feet per second (cfs), the riparian corridor boundary is 75 feet upland from the top of each bank
(b) for lakes and fish-bearing streams with average annual stream flow less than 1,000 cfs, the riparian corridor boundary is 50 feet upland from the top of each bank

Goal 5 is a process goal – the state does not prescribe a specific outcome as it does in other land use planning goals. The rule requires local jurisdictions to balance the need to protect natural resources against other state goals such as housing (Goal 10) and transportation (Goal 12) while providing ample opportunity for citizen involvement (Goal 1). Thus, the state rule allows local

jurisdictions' Goal 5 programs to be in compliance with state law while being inconsistent with each other. However, Metro's code required an analysis of the consistency and/or adequacy of local natural resource protection prior to conducting a regional ESEE analysis and a regional protection program. The key findings from the *Local Plan Analysis* are reviewed below.

The Goal 5 process begins with the inventory of Goal 5 resource sites, providing information to locate and evaluate resources and to develop programs to protect such resources (OAR 660-023-0030(1)). The standard inventory process involves four steps. However, depending on the type of Goal 5 resource, not every step must be applied in the inventory stage.

Inconsistencies

Fish and wildlife habitat in the Metro region receive inconsistent treatment and protection across jurisdictions, considering the pervasive inconsistencies in Goal 5 inventory methodologies, data layer formats, ESEE analyses, and program decisions of local jurisdictions. Outside of the State safe harbor for riparian areas and wetlands, the Goal 5 rule provides little guidance to local governments on methods of protection, except the requirement that a protection program include clear and objective standards. The Goal 5 protection programs of local jurisdictions within the Metro region are inconsistent with each other on a number of levels. Some programs offer exclusive protection for riparian and wetland areas, prohibiting development unless exceptional circumstances apply, whereas other jurisdictions offer limited development within their most significant resource areas. Furthermore, protection levels for limited development range anywhere from five percent development to at least fifty percent development on significant natural resource land. Finally, there is no consistency between local jurisdictions' review processes, mitigation and enhancement procedures, or their monitoring and enforcement mechanisms.

Inadequacies

It is often difficult to determine what specific protection will be applied to resources by local governments when implementing Goal 5 programs. This not only leads to inconsistent protection around the region, but also may result in inadequate protection of natural resources. The most consistent protection is Metro's Title 3 regulations for protecting water quality and floodplain function.[14] In addition, several jurisdictions in the region have adopted the State's Safe Harbor provisions under Goal 5, which provide protection specific to fish-bearing streams based on stream size. Local jurisdictions' riparian corridor protection programs that do vary from either Title 3 or the State Safe Harbor range from 30 feet on a class I stream (Lake Oswego) to as much as 150 feet on a principal river (Clackamas County).[15]

Figure 1 compares the minimum widths recommended in the scientific literature[16] to the riparian corridor protection provided by Metro's Title 3 regulations and the State Safe Harbor. As the figure illustrates, even the maximum protection provided by Title 3 on steep slopes (200 ft.)

[14] This is why Metro is using Title 3 protection as a baseline for analysis purposes in the evaluation of the six program options, described later in this report.
[15] *(See Local Plan Analysis* section on inconsistencies – program decisions for more detail on local jurisdictions' programs.*)*
[16] See Metro's *Technical Report for Goal 5* (2002).

meets the average recommended width for only seven of the twelve functions included on the chart. However, the 200-foot vegetated corridor provides some protection for all twelve functions.[17] Furthermore, the State Safe Harbor, when applied to larger fish-bearing streams (75 ft), only meets the average recommended minimum width for one function, pollutant removal. The 75-foot buffer does not even meet the minimum recommendations for four functions, including one of the most important for listed salmon – large woody debris[18]. The 50-foot buffer provided by the State Safe Harbor on smaller fish-bearing streams and by Metro's Title 3 on primary streams only provides minimal protection for five functions. For smaller streams, those draining less than 50 acres, Title 3 provides for a 15-foot buffer that barely meets the most minimal scientific recommendations for two functions.

In effect, there is not a regulatory program in the region that provides sufficient protection for riparian corridors based on consideration of all the functions necessary for fish and wildlife habitat. While it is unlikely that any regulatory program could be implemented that would fully protect all of the functions depicted in Figure 3-1, habitat protection in the Metro region does not comport with the scientific knowledge of what is needed for full fish and wildlife habitat protection.

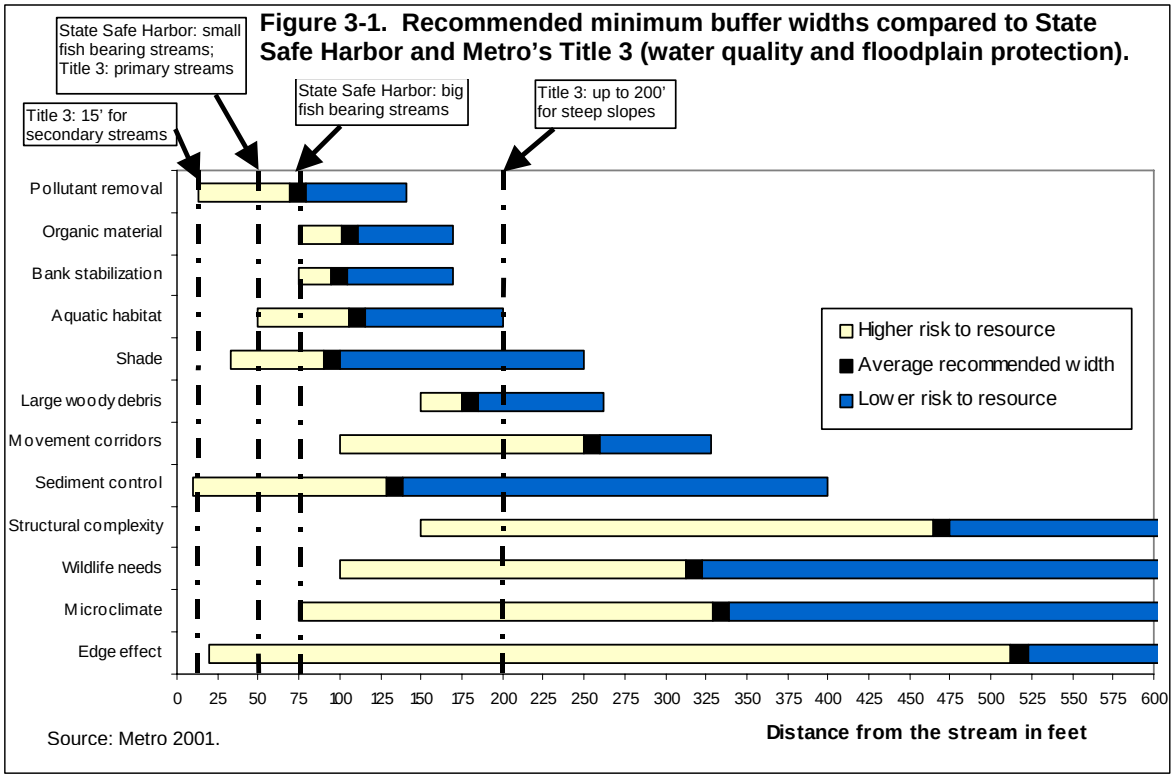


Figure 3-1. Recommended minimum buffer widths compared to State Safe Harbor and Metro's Title 3 (water quality and floodplain protection).

[17] These 12 functions were identified in Metro's *Technical Report for Goal 5* that included a review of the scientific literature related to fish and wildlife habitat.

[18] Obviously, large woody debris does reach the stream at distances of less than 75 feet, providing some level of function to instream habitat. However, several studies have shown that larger buffer widths are necessary to provide adequate levels of large woody debris to both instream and riparian (terrestrial) habitats. Thus, any distance that is less than one site potential tree height (average in Metro region determined to be 150 ft) allows for a very high risk to the resource.

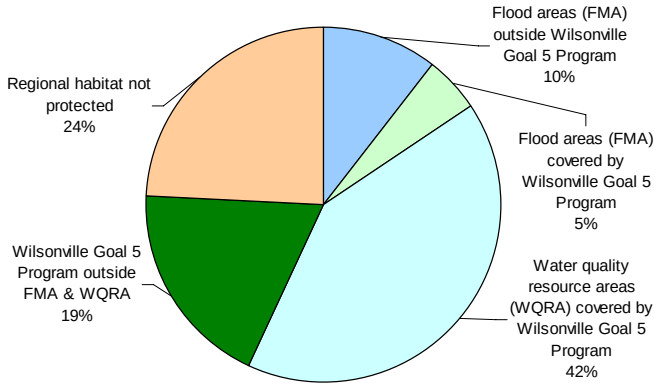
As described in the *Local Plan Analysis*, local protection of upland wildlife habitat is limited throughout the region. Only eight jurisdictions[19] have identified upland areas not associated with streams or wetlands for regulatory protection. By default, some steeply sloped areas are regulated due to natural hazards, such as earthquakes and landslides. The planning guidelines for upland habitats[20] recommend protection of large areas and retention of native vegetation. However, based on Metro's review of local regulations, protection of these areas in the region does not meet the scientific recommendations. Tree protection ordinances occur most frequently. However, ordinances that specifically protect upland habitat by limiting development are more effective but less common. For example, Lake Oswego requires protection of significant tree groves, but allows for up to 50 percent of the trees on a site to be removed for development purposes. Other jurisdictions such as Sherwood and Tigard require a tree inventory and provide incentives for retention of trees through the permit process. The city of Portland limits disturbance in upland areas and has established an ordinance for land divisions that requires preservation of existing tree canopy.

Comparison of three local programs with Metro's baseline regulations

For purposes of the Phase II ESEE Analysis, Metro chose three local Goal 5 programs as examples to compare the extent of the regional fish and wildlife habitat inventory covered by local environmental zones. These local zones also overlap, in many cases, with Title 3 water quality resource areas and flood management areas (see Figure 3-1 above). The extent of this overlap, as well as additional habitat areas covered by local environmental zones, is shown in Figures 3-2 to 3-4 for the cities of Wilsonville, Lake Oswego, and Portland.

The City of Wilsonville's Significant Resource Overlay Zone (SROZ) Ordinance as well as other ordinance requirements[21] exceed Metro's Title 3 baseline for water quality resource areas and flood management areas. Wilsonville's SROZ ordinance, combined with additional lands covered by Title 3 flood management restrictions, applies to 76 percent (927 acres) of regionally significant habitat. Twenty-four percent (296 acres) of regionally significant habitat is not covered by the SROZ ordinance or the Title 3 baseline (Figure 3-2). Wilsonville's SROZ ordinance

Figure 3-2. How existing habitat protection in Wilsonville addresses 1,222 acres of regionally significant habitat



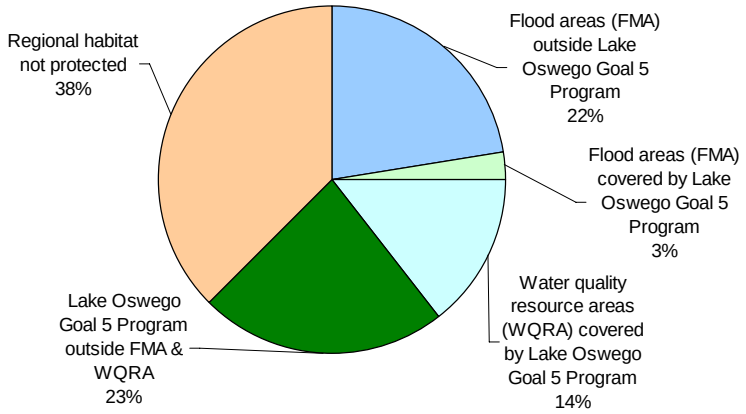
[19] Beaverton, Hillsboro, Lake Oswego, Milwaukie, Portland, Wilsonville, Clackamas County, Multnomah County, and Washington County have specifically mentioned wildlife habitat not associated with riparian corridors in local code.

[20] See Metro's *Technical Report for Goal 5* (2002).

[21] Significant Resource Overlay Zone Section 4.139 of the Zoning Ordinance; see also Planning and Development Ordinance Section 4.172 (Floodplain Regulations), Section 4.171.06 (Protection of Natural Features and other resources); Section 4.6 (Tree Preservation and Protection).

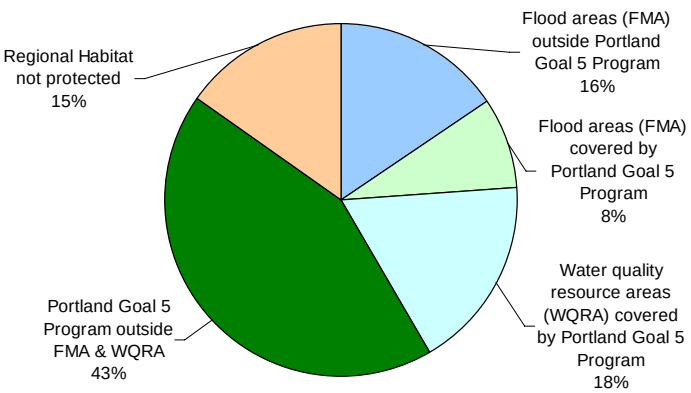
prohibits development within the overlay zone and impact area unless an applicant submits a significant resource impact report and mitigates for habitat loss.

Figure 3-3. How existing habitat protection in Lake Oswego addresses 2,603 acres of regionally significant habitat



The City of Lake Oswego's Sensitive Lands Overlay District as well as other ordinance requirements exceed Metro's Title 3 baseline for water quality resource areas and flood management areas.[22] Lake Oswego's Sensitive Lands Overlay District, combined with additional lands covered by Title 3 flood management areas, applies to 1,627 acres (62 percent) of regionally significant habitat. There are 976 acres comprising 38 percent of regionally significant habitat that are not covered by the Sensitive Lands Overlay District or Title 3 flood management restrictions. (Figure 3-3). The Sensitive Lands Overlay District includes resource protection and conservation overlay zones to protect stream corridors, wetlands, and tree groves, and establishes mitigation requirements for habitat loss. Significant isolated tree groves and tree groves associated with wetlands or streams receive additional protection.

Figure 3-4. How existing habitat protection in Portland addresses 28,659 acres of regionally significant habitat



The City of Portland's Environmental Overlay Zone Regulations as well as other ordinance requirements exceed Metro's Title 3 baseline for water quality resource areas and flood management areas.[23] Portland's Environmental Overlay zones, combined with additional lands covered by Title 3 water quality and flood management restrictions, applies to 24,296 acres (85 percent) of regionally significant habitat. There are 4,374 acres comprising 15 percent of regionally significant habitat that are not covered by Portland's environmental overlay zones or Title 3 flood management restrictions (Figure 3-4). Portland's environmental overlay zones include the protection zone and the conservation zone. The protection zone applies to the most significant habitat, and strictly limits development in

[22] Sensitive Lands Overlay District (Section 48.17 of the Development Code); see also Section 17 (Floodplain Standards), Section 55 (Tree Ordinance), Section 48.17.600 (Mitigation)

[23] Environmental Zones (Section 33.430 of the Zoning Code); see also Greenway Zone (Section 33.440 of the Zoning Code), Open Space Zone (Section 33.100 of the Zoning Code), Flood Hazard Areas (Section 24.50 of the Building Code).

these areas; the conservation zone applies to significant habitat and allows development as long as adverse impacts are avoided, minimized, and mitigated.

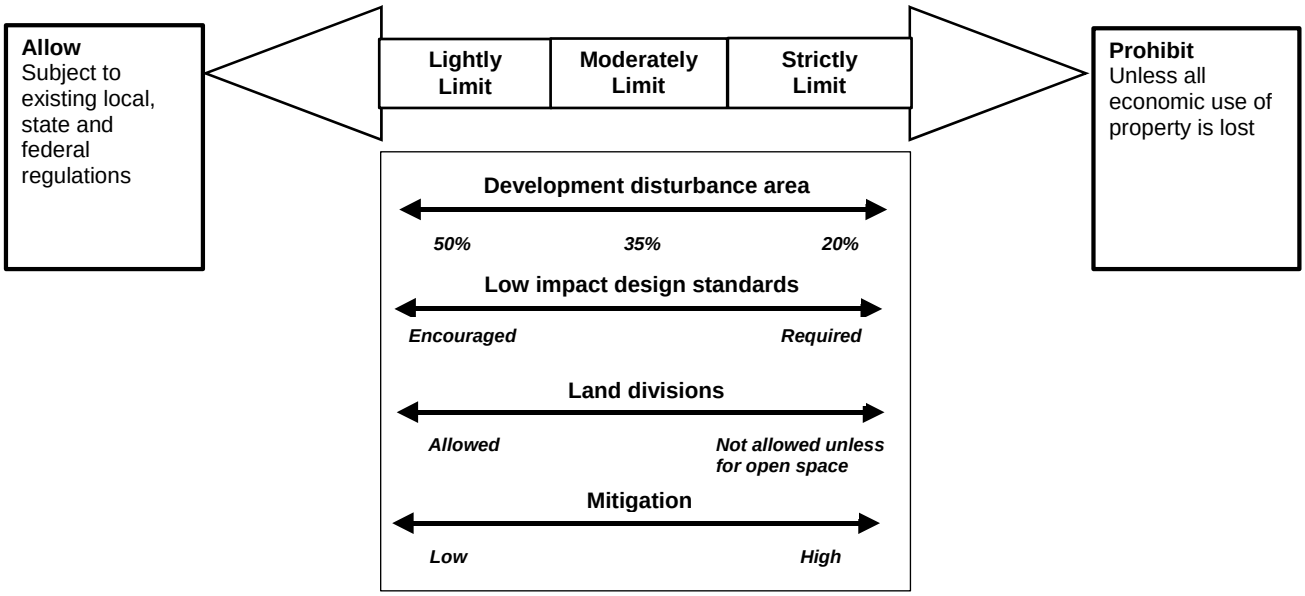
In summary, this comparison shows that at least some local programs currently exceed the minimum standards of Title 3 water quality resource areas and flood management areas. As a result, a portion of regionally significant habitat not covered by the Title 3 baseline receives protection by local programs. While it would be helpful to know the increment of local protection beyond the Title 3 baseline, the difficulties of measuring the extent of this coverage and the level of protection provided under all local government plans is well established in Metro's *Local Plan Analysis*.

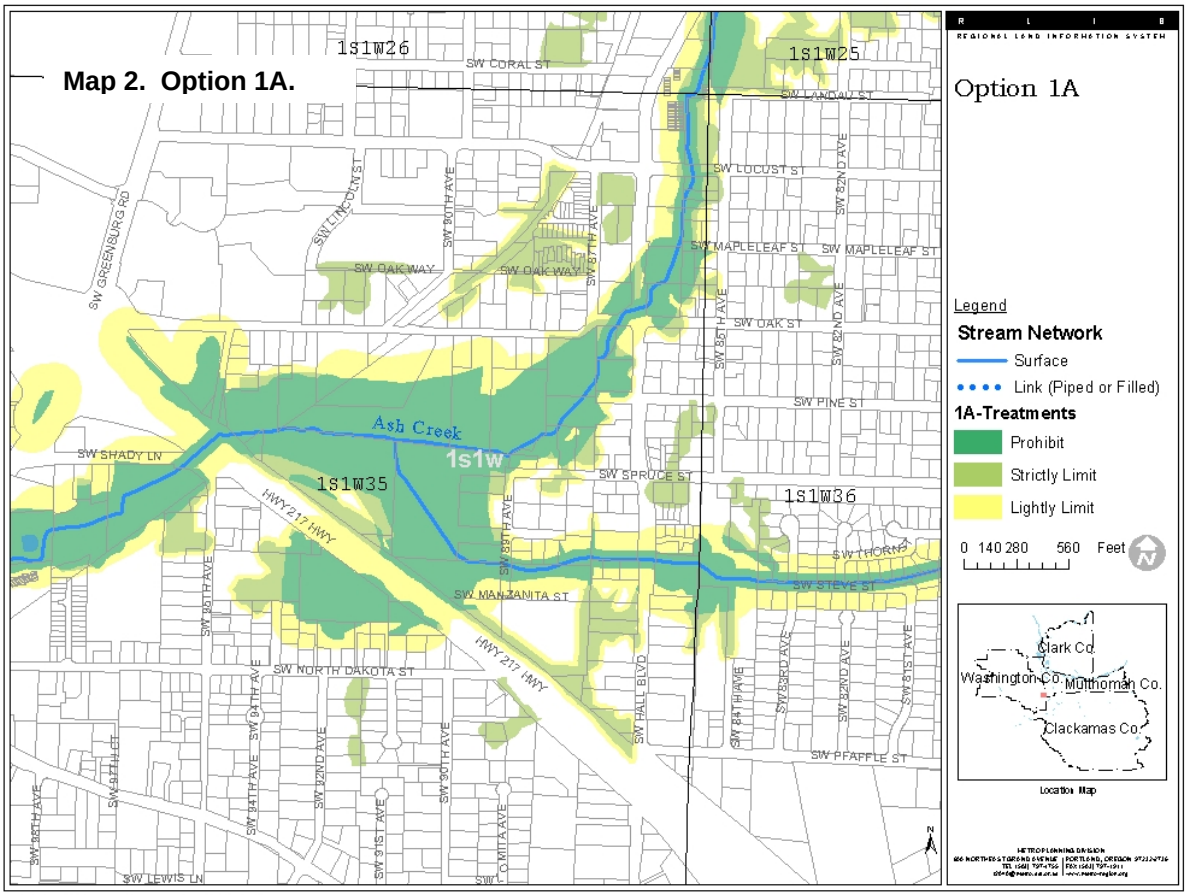
Regulatory program options

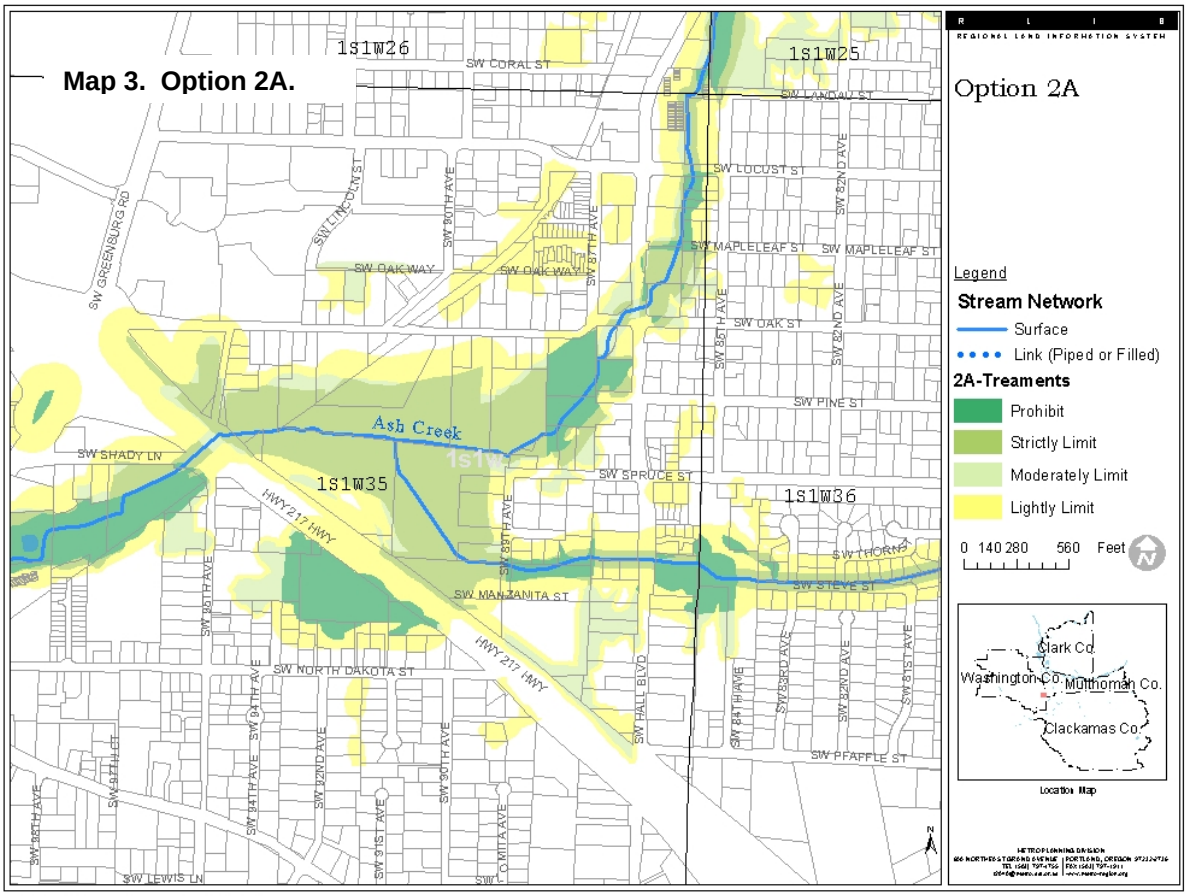
The Goal 5 rule requires Metro and local governments to develop a program to protect regionally significant fish and wildlife habitat based on ESEE decisions to allow, limit, or prohibit conflicting uses in significant resource sites. The six regulatory program options described in this section were developed to support Metro Council's decision. Maps 2-7 on the following pages depict the regulatory options for a specific geographic area that includes a regional center and several habitat types. These maps profile the differences among the options due to habitat types and urban development values.

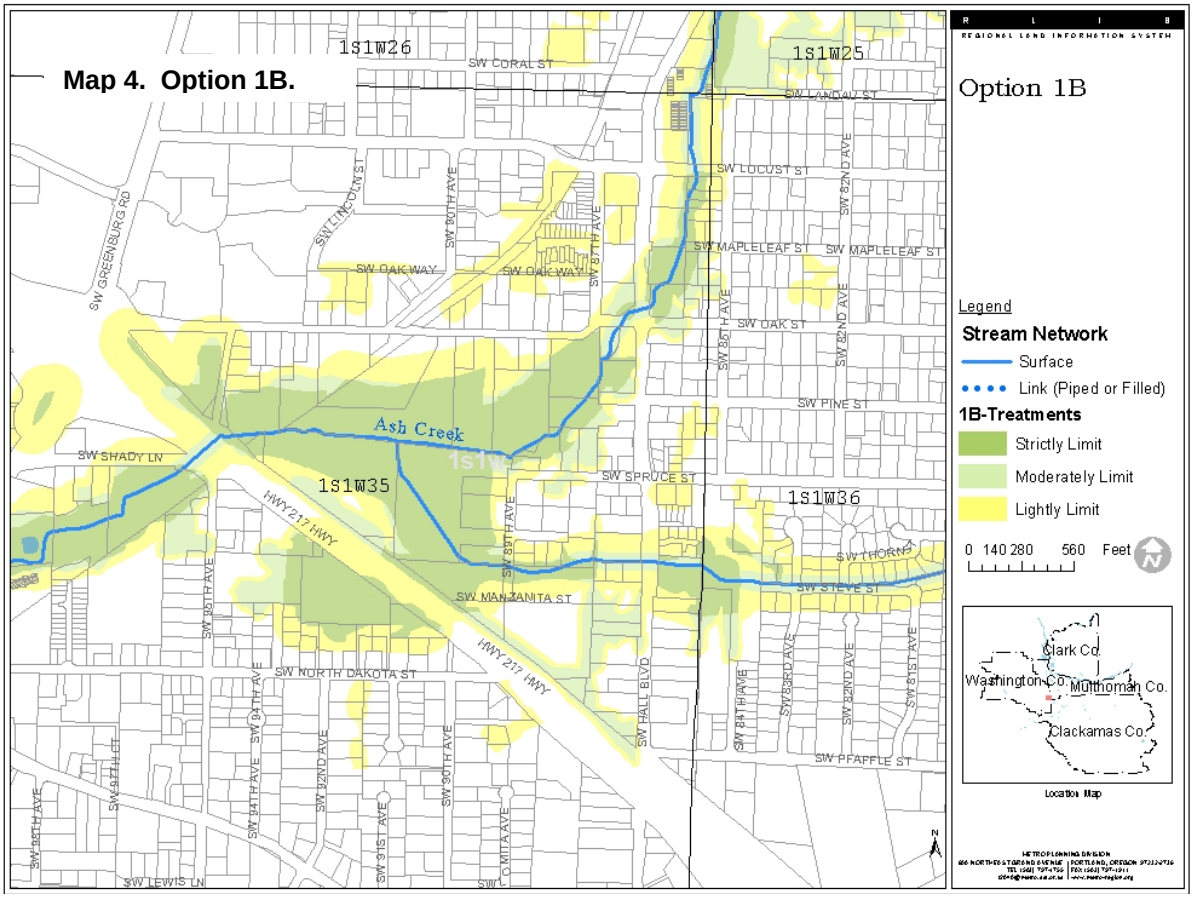
In each of the six options, allow, limit or prohibit "treatments" are assigned to each of the fish and wildlife habitat classes and impact areas. This results in a range of scenarios that provide varying levels of habitat protection. Figure 3-8 below shows the range of treatments (from least to most). In this analysis, the limit category has been expanded to three levels (lightly limit, moderately limit, strictly limit) to provide a continuum of protection approaches. The information in Figure 3-8 represents ***potential targets*** for protecting fish and wildlife habitat while allowing some level of development to occur. These potential targets are preliminary and are subject to revision during the third step of the Goal 5 process – the program development phase.

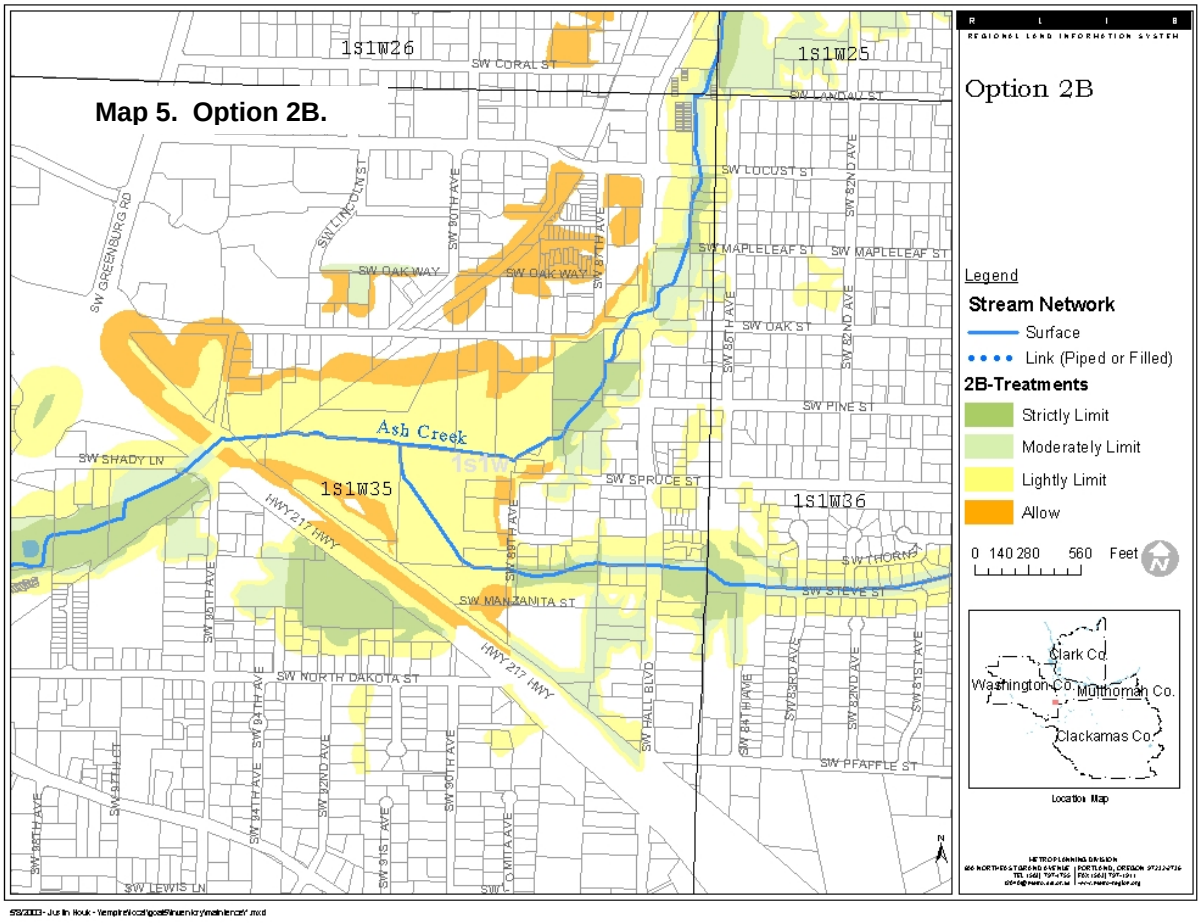
Figure 3-8. Allow, limit and prohibit treatments.
Range of Limit Treatments

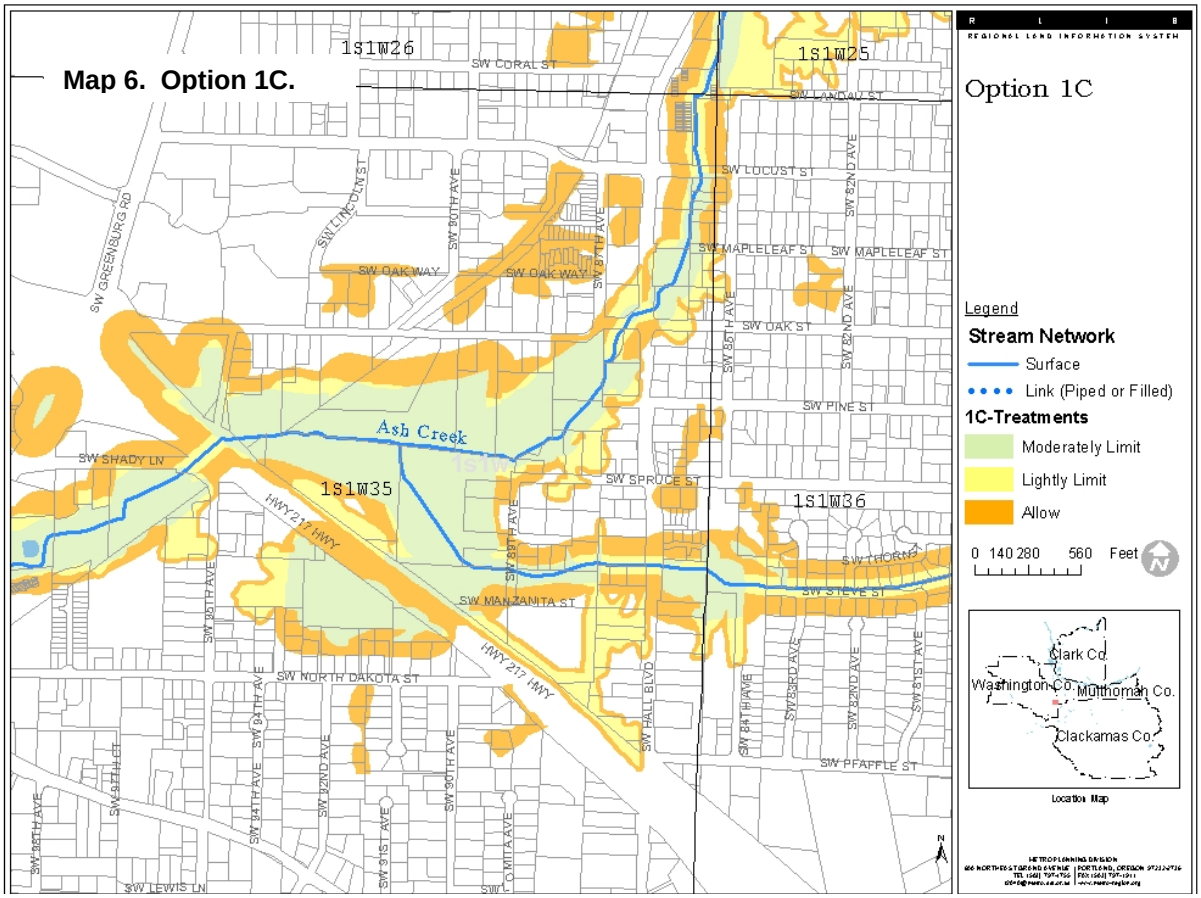


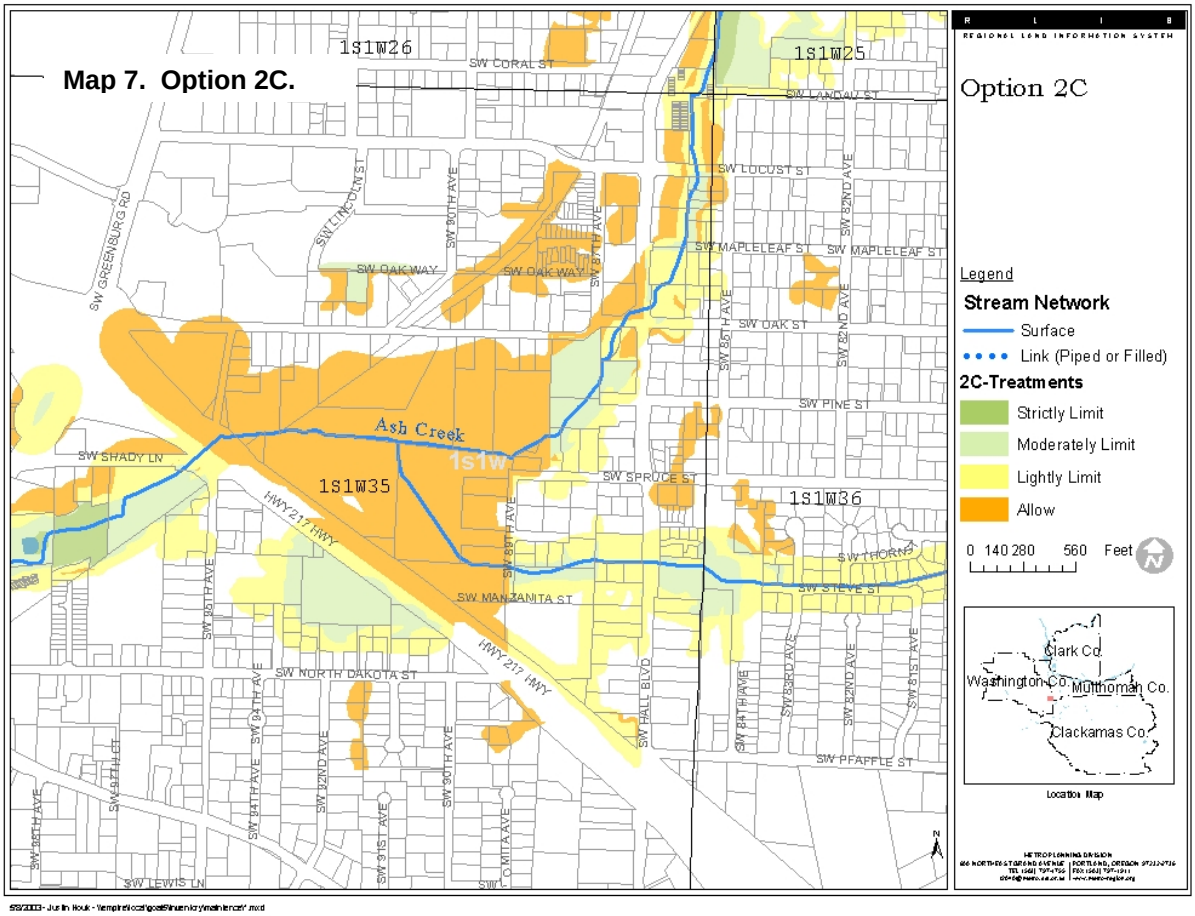

Map 2. Option 1A.
1S1W26
1S1W25
1S1W35
1S1W36
Ash Creek
1s1w
SW CORAL ST
SW LANDAU ST
SW LOCUST ST
SW MAPLELEAF ST
SW OAK WAY
SW OAK ST
SW PINE ST
SW SPRUCE ST
SW SHADY LN
SW THORN ST
SW STEVE ST
SW MANZANITA ST
SW NORTH DAKOTA ST
SW PFAFFLE ST
SW LEWIS LN
SW GREENSBURG RD
SW LINCOLN ST
SW 80TH AVE
SW 85TH AVE
SW 87TH AVE
SW 89TH AVE
SW 82ND AVE
SW 81ST AVE
SW 84TH AVE
SW 92ND AVE
SW 90TH AVE
SW 91ST AVE
SW 93RD AVE
SW 94TH AVE
SW 97TH CT
SW HALL BLVD
HWY 217 HWY
COMMERCIAL AVE
Option 1A
Legend
Stream Network
Surface
Link (Piped or Filled)
1A-Treatments
Prohibit
Strictly Limit
Lightly Limit
0 140 280 560 Feet
Clark Co.
Washington Co.
Multnomah Co.
Clackamas Co.
Location Map


Map 3. Option 2A.
1S1W26
1S1W25
1S1W35
1S1W36
Ash Creek
1s1w
SW CORAL ST
SW LANDAU ST
SW LOCUST ST
SW MAPLELEAF ST
SW OAK WAY
SW OAK ST
SW PINE ST
SW SPRUCE ST
SW SHADY LN
SW THORN ST
SW STEVE ST
SW MANZANITA ST
SW NORTH DAKOTA ST
SW PFAFFLE ST
SW LEWIS LN
SW GREENSBURG RD
SW LINCOLN ST
SW 80TH AVE
SW 85TH AVE
SW 87TH AVE
SW 89TH AVE
SW 82ND AVE
SW 81ST AVE
SW 84TH AVE
SW 92ND AVE
SW 90TH AVE
SW 91ST AVE
SW 93RD AVE
SW 94TH AVE
SW 97TH CT
SW HALL BLVD
HWY 217 HWY
COMMERCIAL AVE
Option 2A
Legend
Stream Network
Surface
Link (Piped or Filled)
2A-Treaments
Prohibit
Strictly Limit
Moderately Limit
Lightly Limit
0 140 280 560 Feet
Clark Co.
Washington Co.
Multnomah Co.
Clackamas Co.
Location Map


Map 4. Option 1B.
1S1W26
1S1W25
1S1W35
1S1W36
SW CORAL ST
SW LANDAU ST
SW LOCUST ST
SW MAPLELEAF ST
SW OAK WAY
SW OAK ST
SW PINE ST
SW SPRUCE ST
SW THORN ST
SW STEVE ST
SW SHADY LN
SW MANZANITA ST
SW NORTH DAKOTA ST
SW PFAFFLE ST
SW LEWIS LN
SW GREENBURG RD
SW LINCOLN ST
SW 80TH AVE
SW 82ND AVE
SW 83RD AVE
SW 84TH AVE
SW 85TH AVE
SW 87TH AVE
SW 91ST AVE
SW HALL BLVD
HWY 217 HWY
Ash Creek
Option 1B
Legend
Stream Network
Surface
Link (Piped or Filled)
1B-Treatments
Strictly Limit
Moderately Limit
Lightly Limit
0 140 280 560 Feet
Clark Co.
Washington Co.
Multnomah Co.
Clackamas Co.
Location Map


Map 5. Option 2B.
1S1W26
1S1W25
1S1W35
1S1W36
SW CORAL ST
SW LANDAU ST
SW LOCUST ST
SW MAPLELEAF ST
SW OAK WAY
SW OAK ST
SW PINE ST
SW SPRUCE ST
SW THORN ST
SW STEVE ST
SW SHADY LN
SW MANZANITA ST
SW NORTH DAKOTA ST
SW PFAFFLE ST
SW LEWIS LN
SW GREENBURG RD
SW LINCOLN ST
SW 80TH AVE
SW 82ND AVE
SW 83RD AVE
SW 84TH AVE
SW 85TH AVE
SW 87TH AVE
SW 91ST AVE
SW HALL BLVD
HWY 217 HWY
Ash Creek
Option 2B
Legend
Stream Network
Surface
Link (Piped or Filled)
2B-Treatments
Strictly Limit
Moderately Limit
Lightly Limit
Allow
0 140 280 560 Feet
Clark Co.
Washington Co.
Multnomah Co.
Clackamas Co.
Location Map


Map 6. Option 1C.
1S1W26
1S1W25
1S1W35
1S1W36
Ash Creek
SW CORAL ST
SW LANDAU ST
SW LOCUST ST
SW MAPLELEAF ST
SW OAK ST
SW OAKWAY
SW PINE ST
SW SPRUCE ST
SW SHADY LN
SW MANZANITA ST
SW NORTH DAKOTA ST
SW PFAFFLE ST
SW LEWIS LN
SW GREENBURG RD
HWY 217 HWY
Option 1C
Legend
Stream Network
Surface
Link (Piped or Filled)
1C-Treatments
Moderately Limit
Lightly Limit
Allow
0 140 280 560 Feet
Clark Co.
Washington Co.
Multnomah Co.
Clackamas Co.
Location Map


Map 7. Option 2C.
1S1W26
1S1W25
1S1W35
1S1W36
Ash Creek
SW CORAL ST
SW LANDAU ST
SW LOCUST ST
SW MAPLELEAF ST
SW OAK ST
SW OAKWAY
SW PINE ST
SW SPRUCE ST
SW SHADY LN
SW MANZANITA ST
SW NORTH DAKOTA ST
SW PFAFFLE ST
SW LEWIS LN
SW GREENBURG RD
HWY 217 HWY
Option 2C
Legend
Stream Network
Surface
Link (Piped or Filled)
2C-Treatments
Strictly Limit
Moderately Limit
Lightly Limit
Allow
0 140 280 560 Feet
Clark Co.
Washington Co.
Multnomah Co.
Clackamas Co.
Location Map

Habitat-based options (1A, 1B, 1C)

The three habitat-based options (Options 1A, 1B, and 1C) use habitat quality as the basis for varying protection regardless of land uses or urban development values. This approach recognizes fish and wildlife habitat as fixed assets in the urban landscape and orients urban development patterns around habitat areas based on the ecological values present.

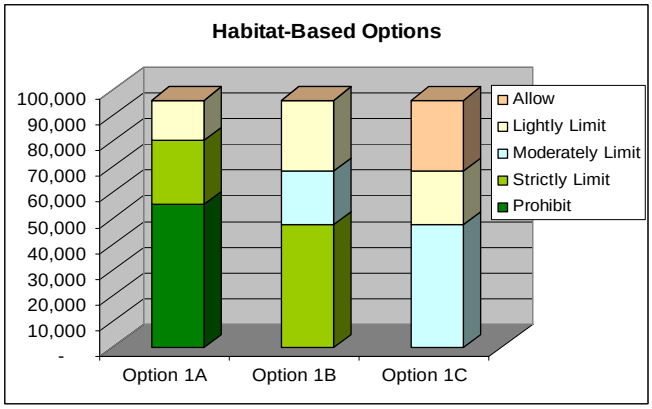
Ecological values were measured during Metro's Goal 5 inventory process and were based on landscape features (e.g., trees, woody vegetation, wetlands, etc.) and the ecological functions they provide (e.g., shade, streamflow moderation, wildlife migration, nesting and roosting sites, etc.). The inventory was then classified into six categories for the ESEE analysis (Class I-III riparian/wildlife corridors and Class A-C upland wildlife habitat) to distinguish higher value habitat from lower value habitat. Class I riparian/wildlife corridors and Class A upland wildlife habitat are the highest valued habitats.

Table 3-2: Habitat-based options (1A, 1B, 1C)

Fish & Wildlife Habitat Classification	Option 1A *Treatment*	Option 1B *Treatment*	Option 1C *Treatment*
Class I Riparian/Wildlife	P	SL	ML
Class II Riparian/Wildlife	P	ML	LL
Class III Riparian/Wildlife	SL	LL	A
Class A Upland Wildlife	P	SL	ML
Class B Upland Wildlife	SL	ML	LL
Class C Upland Wildlife	SL	LL	A
Impact Areas	LL	LL	A

Note: P = Prohibit; SL = Strictly Limit; ML = Moderately Limit; LL = Lightly Limit; A = Allow

Figure 3-9: Habitat-based program options



This approach assumes that all habitat lands have development value. As the ecological value decreases, the recommended treatment becomes less restrictive of development. In these options, the two high value habitat types (Class I riparian and Class A wildlife) would receive the same level of regulatory protection in industrial areas as they would in residential areas. In other words, these options establish a more equal shared responsibility for habitat protection across land uses.

Table 3-2 shows allow, limit and prohibit (ALP) treatments for each option. Figure 3-9 shows habitat and impact area acreage affected by ALP treatments under the three options. In Option 1A, the highest value habitat (Class I and II riparian and Class A wildlife) receives the highest level of protection, while lower valued habitat (Class III riparian and Class B and C wildlife) receives lower levels of protection. In Options 1B and 1C, habitats receive decreasingly lower levels of protection. In Option 1C, the lowest value habitat areas do not receive any protection other than existing local, state and federal regulations. Impact areas would face little or no regulatory requirements.

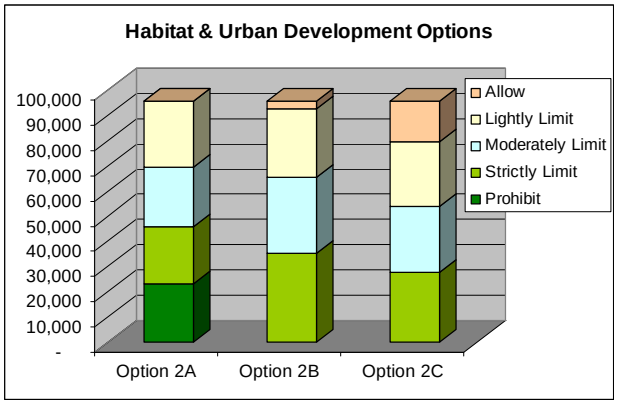
Habitat and urban development-based options (2A, 2B, 2C)

The three habitat and urban development-based options (2A, 2B, and 2C) use habitat values and urban development values as the basis for varying protection. Urban development values were categorized as high, medium or low in the Phase I ESEE analysis based on three measures: land value, employment density and 2040 design type hierarchy (based on Metro's 2040 Growth Concept). Areas receiving a high score in any of the three measures are called "high urban development value"; areas receiving no high scores but at least one medium score are called "medium urban development value"; and areas receiving all low scores are called "low urban development value." Areas without urban development value – parks and open space (both inside and outside the UGB) and rural areas outside the UGB – were not assigned development value.

High priority 2040 Growth Concept design types include the central city, regional centers and regionally significant industrial areas. Medium priority 2040 Growth Concept design types include town centers, main streets, station communities, other industrial areas and employment centers. Inner and outer neighborhoods and corridors are considered low priority 2040 Growth Concept design types. In the recent expansion areas, interim design types were used to determine urban development value.

Tables 3-3, 3-4 and 3-5 show the allow, limit and prohibit (ALP) treatments for each option. Habitat protection levels are adjusted based on urban development value in these options. For example, a Class I riparian corridor located within a regional center or industrial area (high urban development value) would receive less protection than one that passes through an inner or outer neighborhood (low urban development value) in all three tables. Figure 3-10 shows habitat and impact area acreage affected by ALP treatments under the three options.

Figure 3-10: Habitat and urban development-based program options



Option 2A provides the highest level of protection for high valued riparian habitat and less protection for wildlife and other habitat areas. Commercial and industrial areas, which are important to the region, have less protection than other areas in Option 2A. In Options 2B and 2C, the level of protection on the most highly valued habitat decreases, while the levels of protection in the high value urban development areas decrease even more. In Option 2C,the most highly valued urban development areas have no habitat protection, regardless of habitat quality. In all three habitat and urban development-based options, rural areas and parks and open spaces receive more protection than other areas due to their relatively low urban development value. Impact areas would face little or no regulatory requirements in these options.

Table 3-3. Habitat and urban development-based program option (2A) and ALP treatments.

Fish & Wildlife Habitat Classification	HIGH Urban Development Value	MEDIUM Urban Development Value	LOW Urban Development Value	Other Areas*
	Treatment	*Treatment*	*Treatment*	*Treatment*
Class I Riparian/Wildlife	SL	SL	P	P
Class II Riparian/Wildlife	ML	ML	SL	SL
Class III Riparian/Wildlife	LL	LL	LL	ML
Class A Upland Wildlife	LL	ML	ML	SL
Class B Upland Wildlife	LL	LL	ML	ML
Class C Upland Wildlife	LL	LL	LL	ML
Impact Areas	LL	LL	LL	LL

*Other areas include parks and open space within Metro's jurisdiction and areas outside the UGB with no design type.

Table 3-4: Habitat and urban development-based program option (2B) and ALP treatments.

Fish & Wildlife Habitat Classification	HIGH Urban Development Value	MEDIUM Urban Development Value	LOW Urban Development Value	Other Areas*
	Treatment	*Treatment*	*Treatment*	*Treatment*
Class I Riparian/Wildlife	LL	ML	SL	SL
Class II Riparian/Wildlife	LL	LL	ML	ML
Class III Riparian/Wildlife	A	LL	LL	ML
Class A Upland Wildlife	LL	ML	ML	SL
Class B Upland Wildlife	LL	LL	ML	ML
Class C Upland Wildlife	A	LL	LL	ML
Impact Areas	A	LL	LL	LL

*Other areas include parks and open space within Metro's jurisdiction and areas outside the UGB with no design type.

Table 3-5: Habitat and urban development-based program option (2C) and ALP treatments

Fish & Wildlife Habitat Classification	HIGH Urban Development Value	MEDIUM Urban Development Value	LOW Urban Development Value	Other Areas*
	Treatment	*Treatment*	*Treatment*	*Treatment*
Class I Riparian/Wildlife	A	LL	ML	SL
Class II Riparian/Wildlife	A	LL	LL	ML
Class III Riparian/Wildlife	A	A	A	ML
Class A Upland Wildlife	A	LL	ML	SL
Class B Upland Wildlife	A	LL	LL	ML
Class C Upland Wildlife	A	A	A	ML
Impact Areas	A	A	LL	LL

*Other areas include parks and open space within Metro's jurisdiction and areas outside the UGB with no design type.

Habitat acreage by allow, limit and prohibit treatments in program options

Table 3-6 below compares all six options and shows the number of acres that would be covered by each option and treatment type. For example, in Option 1A, 55,450 habitat acres would receive a prohibit treatment (almost 70 percent of habitat acres), whereas 23,084 acres in Option 2A (27 percent of habitat acres) would receive a prohibit treatment. The acreage in this table is for habitat areas and impact areas within Metro's jurisdictional boundary. Approximately 80,200 acres are fish and wildlife habitat; impact areas cover approximately 15,720 acres.

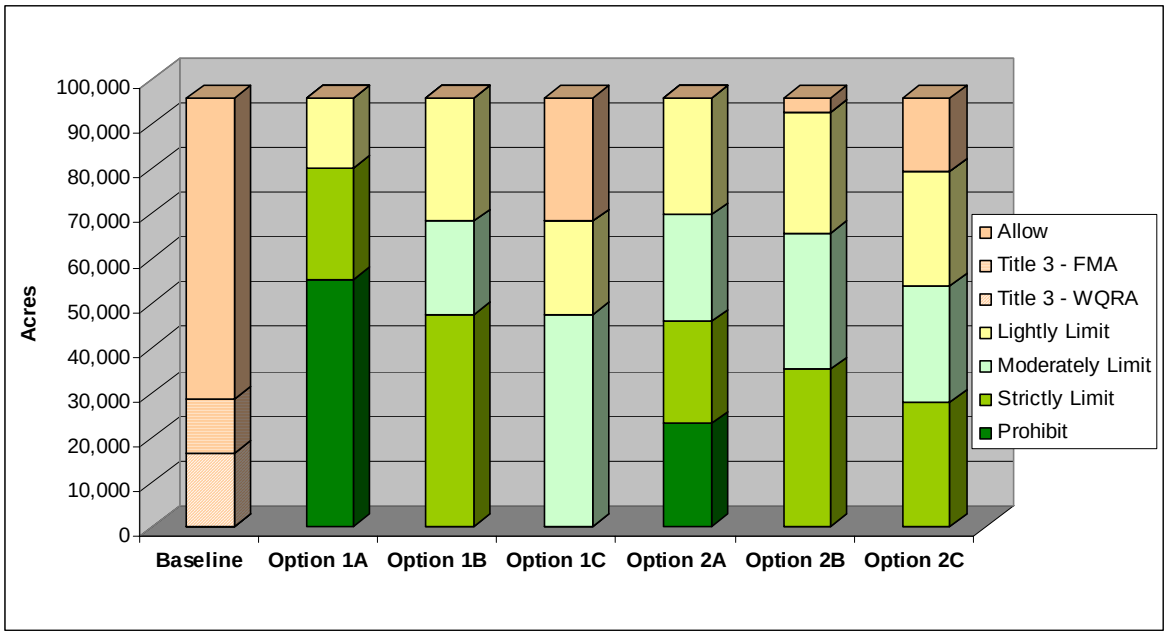
Table 3-6: Habitat and impact area acreage within Metro's jurisdictional boundary by allow, limit and prohibit treatments

Treatment	Option1A	Option 1B	Option 1C	Option 2A	Option 2B	Option 2C
Prohibit	55,450	0	0	23,084	0	0
Strictly Limit	24,784	47,557	0	22,775	35,212	27,872
Moderately Limit	0	20,782	47,557	23,965	30,352	25,983
Lightly Limit	15,721	27,616	20,782	26,131	27,323	25,727
Allow	0	0	27,616	0	3,069	16,374
Total	*95,956*	*95,956*	*95,956*	*95,956*	*95,956*	*95,956*

Figure 3-11 graphically illustrates the information in Table 3-6. The bar on the far left represents Title 3 protection of fish and wildlife habitat. Title 3 acreage is distributed within each of the bars representing the six options. However, these bars do not show in which treatment category this acreage occurs. For example, the 28,540 acres of Title 3 management areas may fall into any one of the treatment categories depending on the program option.

A comparison of the option bars shows that Option 1A provides the greatest habitat protection among the options with a total of 55,450 acres (Class I and II riparian/wildlife, Class A wildlife) covered by a prohibit treatment, and 15,721 acres (Class III riparian/wildlife, Class A and B wildlife) covered by a strictly limit treatment. The bars representing Option 2A-C show more variation in treatment than the habitat-based options, which is a result of considering urban development values. Option 1C provides the least habitat protection among these three options, considering the larger acreage in allow and lightly limit and lack of any habitat in strictly limit.

Figure 3-11: Comparison of options by allow, limit and prohibit treatments



These six program options are evaluated based on their economic, social, environmental and energy consequences in Chapter 4. Most of the data used in this analysis is shown in Table 3-7 (on the following two pages).

Table 3-7: Fish and wildlife habitat classes and impact areas by development status and development value (inside Metro's jurisdiction)

Fish & Wildlife Habitat Class & Urban Development Value	Option 1A	Option 1B	Option 1C	Option 2A	Option 2B	Option 2C	Developed (urban)			Developed (parks)			Total Devel. Habitat Acres	Vacant			Total Vacant Habitat Acres	Total Devel. & Vacant Habitat Acres
							Inside Title 3 WQRA	*Inside Title 3 FMA*	*Outside WQRA/ FMA*	*Inside Title 3 WQRA*	*Inside Title 3 FMA*	*Outside WQRA/ FMA*		*Inside Title 3 WQRA*	*Inside Title 3 FMA*	*Outside WQRA/ FMA*		
Class I Riparian/Wildlife Corridors																		
High	P	SL	ML	SL	LL	A	175	71	36	0	0	0	282	592	516	833	1,942	2,224
Medium	P	SL	ML	SL	ML	LL	254	66	140	0	0	0	460	1,274	288	545	2,107	2,567
Low	P	SL	ML	P	SL	ML	968	272	1,003	0	0	0	2,243	2,281	796	2,020	5,097	7,340
Other Areas	P	SL	ML	P	SL	SL	432	239	179	5,449	3,999	2,045	12,342	1,718	556	1,128	3,402	15,744
Total Acres							***1,829***	***648***	***1,357***	***5,449***	***3,999***	***2,045***	***15,327***	***5,866***	***2,156***	***4,527***	***12,549***	***27,876***
Class II Riparian/Wildlife Corridors																		
High	P	ML	LL	ML	LL	A	104	99	70	0	0	0	273	42	310	316	668	941
Medium	P	ML	LL	ML	LL	LL	184	39	186	0	0	0	409	123	128	434	686	1,095
Low	P	ML	LL	SL	ML	LL	607	102	793	0	0	0	1,502	227	262	875	1,364	2,866
Other Areas	P	ML	LL	SL	ML	ML	126	46	140	266	708	515	1,801	213	254	721	1,188	2,990
Total Acres							***1,021***	***286***	***1,189***	***266***	***708***	***515***	***3,986***	***606***	***954***	***2,347***	***3,907***	***7,893***
Class III Riparian/Wildlife Corridors																		
High	SL	LL	A	LL	A	A	22	918	127	0	0	0	1,066	0	6	41	48	1,114
Medium	SL	LL	A	LL	LL	A	42	487	321	0	0	0	851	2	4	125	131	982
Low	SL	LL	A	LL	LL	A	78	914	452	0	0	0	1,444	4	14	333	351	1,795
Other Areas	SL	LL	A	ML	ML	ML	25	152	57	3	45	123	405	1	3	133	137	541
Total Acres							***167***	***2,471***	***956***	***3***	***45***	***123***	***3,766***	***7***	***27***	***632***	***666***	***4,432***
Class A Wildlife Habitat																		
High	P	SL	ML	LL	LL	A	11	7	50	0	0	0	67	5	17	185	207	275
Medium	P	SL	ML	ML	ML	LL	12	0	88	0	0	0	101	6	0	365	372	473
Low	P	SL	ML	ML	ML	ML	20	2	2,031	0	0	0	2,054	25	2	4,726	4,753	6,807
Other Areas	P	SL	ML	SL	SL	SL	17	36	468	80	42	8,307	8,952	38	1	3,138	3,176	12,127
Total Acres							***60***	***45***	***2,637***	***80***	***42***	***8,308***	***11,173***	***74***	***21***	***8,414***	***8,508***	***19,682***
Class B Wildlife Habitat																		
High	SL	ML	LL	LL	LL	A	1	2	56	0	0	0	58	1	1	357	359	417
Medium	SL	ML	LL	LL	LL	LL	1	0	206	0	0	0	208	7	1	801	809	1,016
Low	SL	ML	LL	ML	ML	LL	15	2	2,674	0	0	0	2,690	15	3	3,094	3,112	5,802
Other Areas	SL	ML	LL	ML	ML	ML	2	1	640	16	4	1,481	2,144	11	4	3,494	3,509	5,653
Total Acres							***19***	***4***	***3,576***	***16***	***4***	***1,481***	***5,100***	***34***	***10***	***7,746***	***7,789***	***12,889***
Class C Wildlife Habitat																		
High	SL	LL	A	LL	A	A	3	6	109	0	0	0	118	4	38	421	462	580
Medium	SL	LL	A	LL	LL	A	2	1	313	0	0	0	317	10	4	809	822	1,139
Low	SL	LL	A	LL	LL	A	4	2	1,348	0	0	0	1,354	7	15	1,715	1,737	3,091
Other Areas	SL	LL	A	ML	ML	ML	1	5	256	9	21	892	1,184	3	0	1,465	1,468	2,653
Total Acres							***10***	***15***	***2,026***	***9***	***21***	***892***	***2,973***	***23***	***56***	***4,410***	***4,489***	***7,463***

Note: WQRA/FMA = Water Quality Resource Area/Flood Management Areas
P = Prohibit; SL = Strictly Limit; ML = Moderately Limit; LL = Lightly Limit; A = allow
Source: Metro 2003

Table 3-7 (cont.): Fish and wildlife habitat classes and impact areas by development status and development value (inside Metro's jurisdiction)

Fish & Wildlife Habitat Class & Development Value	Option 1A	Option 1B	Option 1C	Option 2A	Option 2B	Option 2C	Developed (urban)			Developed (parks)			Total Devel. Habitat Acres	Vacant			Total Vacant Habitat Acres	Total Devel. & Vacant Habitat Acres
							Inside Title 3 WQRA	*Inside Title FMA*	*Outside WQRA/ FMA*	*Inside Title 3 WQRA*	*Inside Title 3 FMA*	*Outside WQRA/ FMA*		*Inside Title 3 WQRA*	*Inside Title 3 FMA*	*Outside WQRA/ FMA*		
Impact Areas																		
High	LL	LL	A	LL	A	A	76	123	698	0	0	0	897	39	48	391	478	1,375
Medium	LL	LL	A	LL	LL	A	154	34	1,429	0	0	0	1,617	109	5	709	824	2,440
Low	LL	LL	A	LL	LL	LL	402	45	6,596	0	0	0	7,043	96	12	1,524	1,631	8,674
Other Areas	LL	LL	A	LL	LL	LL	52	6	801	103	143	1,005	2,109	37	2	1,084	1,123	3,232
Total Acres							***684***	***208***	***9,523***	***103***	***143***	***1,005***	***11,665***	***280***	***68***	***3,708***	***4,056***	***15,721***
Grand Total							***3,792***	***3,678***	***21,265***	***5,926***	***4,962***	***14,368***	***53,990***	***6,890***	***3,293***	***31,783***	***41,965***	***95,956***

Note: WQRA/FMA = Water Quality Resource Area/Flood Management Areas
RC/WH = riparian corridor, wildlife habitat; WH = upland wildlife habitat
P = Prohibit; SL = Strictly Limit; ML = Moderately Limit; LL = Lightly Limit; A = allow
Source: Metro 2002

CHAPTER FOUR: ANALYSIS OF REGULATORY PROGRAM OPTIONS

Six regulatory options are under consideration for land classified as regionally significant fish and wildlife habitat, as described in Chapter Three. Five potential regulatory treatments are applied in each of the options, ranging from allowing conflicting uses to prohibiting conflicting uses in habitat areas. The potential consequences of applying these treatments to fish and wildlife habitat are considered and evaluated with 19 criteria identified by the Metro Council in October 2003; 17 criteria are derived from the economic, social, environmental, and energy tradeoffs and two additional criteria consider how well the six regulatory options would assist in meeting the requirements of the federal Endangered Species Act and the Clean Water Act.

The criteria are based on the tradeoffs identified in the Phase I ESEE analysis of protecting or not protecting regionally significant fish and wildlife habitat. For example, the economic analysis identified the tradeoffs related to development opportunities and the regional economy. The economic analysis also identified the economic values associated with ecosystem services provided by fish and wildlife habitat. The criteria are assumed to have equal weight in the evaluation of program options. Table 4-1 below describes the evaluation criteria.

Table 4-1. Evaluation criteria.

Economic factors	**Description**
1. Supports the regional economy by providing development opportunities (such as residential, commercial, industrial)	The regional economy depends on urban development. Metro identified priorities for urban development based on land value, employment potential and regional growth management priorities (2040 Growth Concept).
2. Supports economic values associated with ecosystem services (such as flood control, clean water, recreation and amenity values).	Stream corridors and upland wildlife habitat provide economic value (e.g.,habitat provides services that can significantly reduce public and private costs over the long term). Higher value habitat provides more ecosystem services.
3. Promotes recreational use and amenities	Focuses on the recreational benefits – both active and passive – of retaining habitat. Options that protect more high quality habitat will help protect the recreational amenity values.
4. Distribution of economic tradeoffs	Highlights land uses (regional zoning) and ownership classes (public vs. private) that would bear a disproportional share of impacts.
5. Minimizes need to expand the urban growth boundary (UGB) and increase development costs.	Describes the effects of program options on the need to expand the urban growth boundary (UGB).
Social factors	
6. Minimizes impact on property owners	Potential regulations have different impacts on residential, business and rural property owners. Options that provide more habitat protection have more impact on property owners.
7. Minimizes impact on location and choices for housing and jobs	Applying regulations to protect habitat may affect the urban land supply and relates to people's basic needs for housing and jobs.
8. Preserves habitat for future generations	Species diversity, environmental quality and the potential economic benefits derived from fish and wildlife habitat are important for people today as well as future generations.
9. Maintains cultural heritage and sense of place	Fish and wildlife habitat provides important values such as cultural heritage (salmon) and regional identity (people move here to enjoy the proximity to the natural environment).

10. Preserves amenity value of resources (quality of life, property values, views)	Fish and wildlife habitat provides amenity values such as quality of life, increased property values and regional attractiveness.
Environmental factors	
11. Conserves existing watershed health and restoration opportunities	Preserving habitat protects existing ecosystem functions (such as clean, cold, reliable water sources) that promote a healthy watershed and retains lower quality habitat for future restoration opportunities.
12. Retains multiple habitat functions provided by forest areas	Forest cover is important to maintain healthy fish and wildlife habitat and a diversity of species in the region. Forested areas may be found in developed areas (such as neighborhoods) and on vacant land. Trees are more likely to be lost in vacant areas than in existing neighborhoods.
13. Promotes riparian corridor connectivity and overall habitat connectivity	Habitat connectivity is important to fish and wildlife. Stream corridor connectivity allows fish to travel safely to upstream areas. Many fish and wildlife species must make seasonal journeys to meet basic needs for food, shelter and breeding.
14. Conserves habitat quality and biodiversity provided by large habitat areas	Large habitats are more valuable to native wildlife than smaller ones because more wildlife species are retained over time. Animals sensitive to human disturbance still have a place to live.
15. Supports biodiversity through conservation of sensitive habitats and species	Some habitats once common are now scarce (such as wetlands, native meadows, white oaks, healthy urban streams). Sensitive species depend on these rare habitats; their loss could significantly impact biodiversity.
Energy Factors	
16. Promotes compact urban form	A compact urban form conserves energy by reducing auto travel times and need for roads.
17. Promotes green infrastructure	Trees and other vegetation reduce energy demand by decreasing water and air temperature, flooding, and air pollution associated with energy use.
Other criteria	
18. Assists in protecting fish and wildlife protected by the federal Endangered Species Act	The Endangered Species Act's ultimate goal is to recover species and conserve the ecosystems upon which they depend so they no longer need regulatory protection. Protecting slopes, wetlands, riparian functions, hydrologic conditions and areas of high habitat value may help species recover and prevent future listings.
19. Assists in meeting water quality standards required by the federal Clean Water Act	Protecting slopes and wetlands, habitat near streams, hydrologic conditions, and forested areas can assist local jurisdictions in meeting the standards of the federal Clean Water Act.

This chapter includes detailed analysis of the performance of the six regulatory program options against the criteria. It includes a ranking of the options for each criterion.

Evaluation of economic criteria

This section of the Phase II ESEE analysis compares the potential economic tradeoffs of the six regulatory programs. Based on the analysis of economic consequences in Phase I, Metro developed five criteria to measure the performance of program options in addressing the potential economic impacts. These criteria are:

1. Supports urban development priorities.
2. Supports economic values of ecosystem services.
3. Supports recreational access and amenities.
4. Distributes economic tradeoffs.
5. Minimizes need to expand the urban growth boundary (UGB).

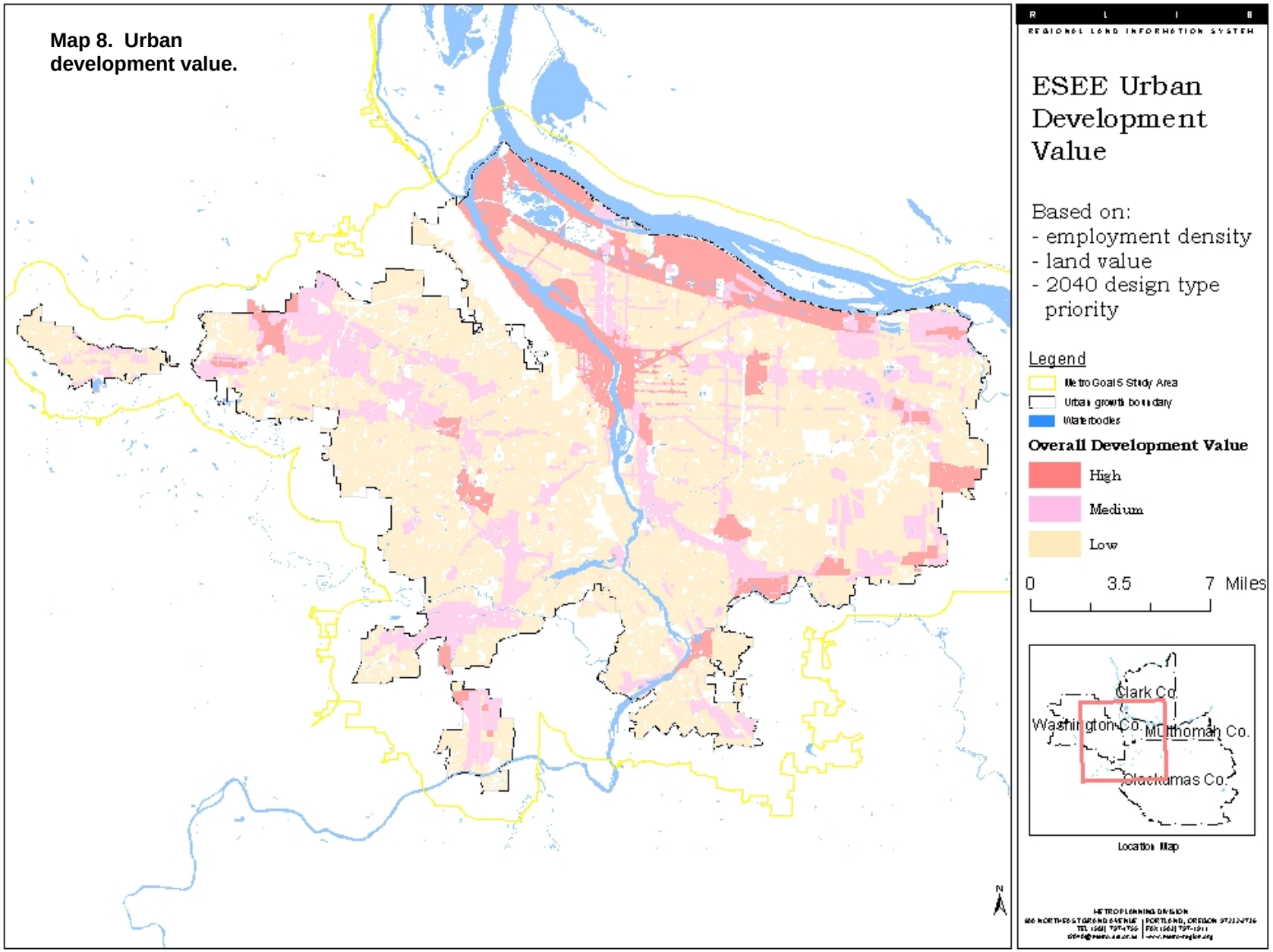
1. Supports urban development priorities.

This criterion uses the land rankings developed in Phase I of the ESEE analysis as a tool to identify where lands with high, medium or low development value are affected by allow, limit, or prohibit treatments under the six regulatory program options.

Not all land has the same economic importance for development. For example, land zoned for parks is assumed to have less economic importance than land zoned for industrial uses. In Phase I of the ESEE analysis, a method was developed to rank the relative economic importance of land for development, or "development value." Urban lands were ranked into three categories – "high," "medium" and "low" – using three measures: land value, employment density and 2040 design types (based on Metro's 2040 Growth Concept). Land value and employment density describe relative economic importance based on the current land use and labor demands. The 2040 design type hierarchy ranks land using development priorities as described by Metro's regional goals for future land use and development.

Lands that ranked high scored high on at least one of the three measures. Lands that ranked medium scored medium on at least one of the three measures, and lands that ranked low scored low on each of the three measures. A fourth category of lands, "other lands," describes primarily non-urban lands that are not ranked for development value. Approximately half of these lands are inside the UGB, half are outside. These lands include parks and open space and agricultural and forestry land. Describing the economic consequences of program options using these measures provides information on current and future economic tradeoffs of protecting fish and wildlife habitat. Map 8 shows the urban development values.

Map 8. Urban development value.

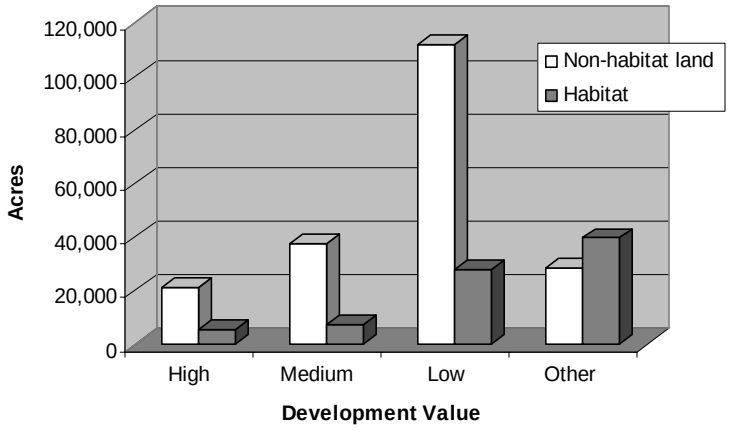


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Potential impacts on urban development priorities

The economic analysis for this criterion evaluates urban development values on land containing fish and wildlife habitat. Comparing the acres of land that contain habitat with the total acres of land in Metro's jurisdiction provides insight into the relative magnitude of land affected by the six regulatory program options. Figure 4-1 illustrates the distribution of lands in Metro's jurisdiction (approximately 280,000 acres) by habitat status (non-habitat vs. habitat) and development value (high, medium, low).

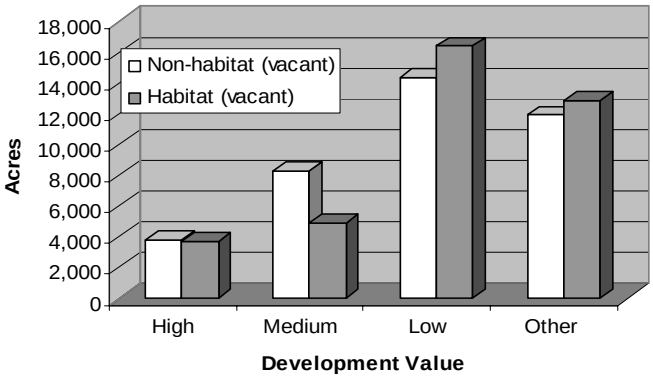
Figure 4-1: Non-habitat and habitat land by urban development value in Metro's jurisdiction.



This analysis assumes that Goal 5 treatments that protect habitat (i.e., prohibit or limit) could restrict urban use and development of these lands and/or increase development costs. About a quarter of the lands in Metro's jurisdiction with high, medium and low development values could potentially be affected by Goal 5 treatments and may have considerable negative consequences for the regional economy. Sixty-three percent of "other" lands in Metro's jurisdiction also contain fish and wildlife habitat. To the extent that program options protect habitat on these lands rather than on urban lands, negative impacts on urban development priorities may be limited.

Goal 5 treatments could impact half of all vacant land in Metro's jurisdiction. Figure 4-2 shows the breakdown of vacant lands in Metro's jurisdiction with and without fish and wildlife habitat. It describes a significant impact because in general, developing vacant land costs less and takes less time than redeveloping land, which makes this land more desirable for expanding urban development priorities. Also, because these lands are currently vacant and more easily developed, the negative impacts of reduced property value, increased development costs, and reduced employment associated with limit and prohibit treatments may begin in the short term.

Figure 4-2: Vacant non-habitat and habitat land by urban development value in Metro's jurisdiction.



Comparing Figure 4-1 with Figure 4-2 shows that a larger proportion of vacant land ranked high and low contain habitat compared with the average for all lands in Metro's jurisdiction.

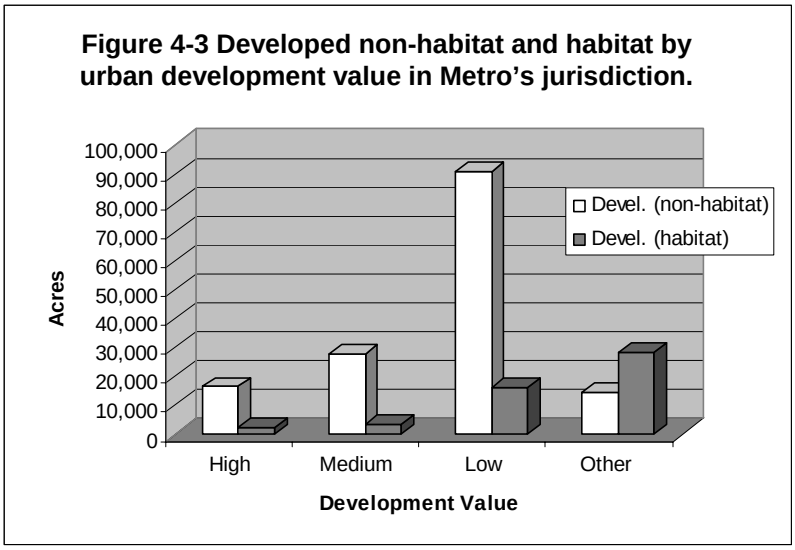


Figure 4-3 illustrates that most developed land in Metro's jurisdiction does not contain fish and wildlife habitat. Limit and prohibit treatments would affect development values on approximately 15 percent of the developed land in Metro's jurisdiction. Negative impacts on property value, development costs, and employment would accrue over the long term as redevelopment takes place on these lands.

Protecting habitat acres that otherwise could be developed under current regulations may reduce the developable area of a parcel, which could also reduce the parcel's market value. This result is more likely with strictly limit and prohibit treatments and less likely with lightly limit and moderately limit treatments.

Protection may also require modifying development plans, such as changing access routes or altering a development's configuration. Such changes may increase development costs, which may also negatively impact property values. Limiting developable area or increasing development costs for commercial or industrial sites may also negatively impact the site's employment potential. To the extent that protection limits or prevents developing land uses consistent with the 2040 Growth Concept, these actions may negatively impact the region's long-term planning goals.

Program options with the greatest support for use and development of land would rank highest for this criterion. These options have the greatest number of acres affected by allow, lightly limit and moderately limit treatments. Program options that least support use and development of land would rank lowest. These options have the greatest number of acres affected by strictly limit and prohibit treatments.

Measuring the criterion

Table 4-2 shows the number of acres of habitat land and impact areas in the four urban development categories (high, medium, low, and other) affected by allow, limit, and prohibit treatments for the six program options. Habitat acres considered developed, but in park status, are excluded from this table because they generally are not available for urban development.

Table 4-2: Acres of fish and wildlife habitat & impact areas by urban development priorities affected by program options (parks not included).

Treat-ment	Program Options	*HIGH* Urban Development Value			MEDIUM Urban Development Value			LOW Urban Development Value			Other Areas		
		Dev. urban	*Vacant inside Title 3*	*Vacant outside Title 3*	*Dev. urban*	*Vacant inside Title 3*	*Vacant outside Title 3*	*Dev. urban*	*Vacant inside Title 3*	*Vacant outside Title 3*	*Dev. urban*	*Vacant inside Title 3*	*Vacant outside Title 3*
Allow	Option 1A	0	0	0	0	0	0	0	0	0	0	0	0
	Option 1B	0	0	0	0	0	0	0	0	0	0	0	0
	Option 1C	2,081	135	853	2,785	134	1,643	9,841	148	3,572	1,354	45	2,683
	Option 2A	0	0	0	0	0	0	0	0	0	0	0	0
	Option 2B	2,081	135	853	0	0	0	0	0	0	0	0	0
	Option 2C	2,762	1,621	2,544	2,785	134	1,643	2,798	40	2,048	0	0	0
Lightly limit	Option 1A	897	87	391	1,617	114	709	7,043	108	1,524	859	39	1,084
	Option 1B	2,081	135	853	2,785	134	1,643	9,841	148	3,572	1,354	45	2,683
	Option 1C	331	355	673	617	260	1,235	4,192	507	3,970	955	483	4,215
	Option 2A	2,207	160	1,394	2,992	142	2,444	9,841	148	3,572	859	39	1,084
	Option 2B	681	1,486	1,691	3,402	394	2,878	9,841	148	3,572	859	39	1,084
	Option 2C	0	0	0	1,178	1,828	2,146	11,235	614	5,493	859	39	1,084
Moderately limit	Option 1A	0	0	0	0	0	0	0	0	0	0	0	0
	Option 1B	331	355	673	617	260	1,235	4,192	507	3,970	955	483	4,215
	Option 1C	349	1,132	1,018	561	1,568	911	4,296	3,104	6,746	1,372	2,312	4,266
	Option 2A	273	352	316	510	258	799	4,744	45	7,821	1,138	22	5,092
	Option 2B	0	0	0	561	1,568	911	6,246	534	8,696	1,450	489	5,814
	Option 2C	0	0	0	0	0	0	4,296	3,104	6,746	1,450	489	5,814
Strictly limit	Option 1A	1,243	50	819	1,375	28	1,734	5,488	58	5,143	1,138	22	5,092
	Option 1B	349	1,132	1,018	561	1,568	911	4,296	3,104	6,746	1,372	2,312	4,266
	Option 1C	0	0	0	0	0	0	0	0	0	0	0	0
	Option 2A	282	1,109	833	460	1,562	545	1,502	489	875	834	505	3,859
	Option 2B	0	0	0	0	0	0	2,243	3,077	2,020	1,372	2,312	4,266
	Option 2C	0	0	0	0	0	0	0	0	0	1,372	2,312	4,266
Prohibit	Option 1A	622	1,484	1,334	970	1,820	1,345	5,798	3,593	7,621	1,684	2,779	4,987
	Option 1B	0	0	0	0	0	0	0	0	0	0	0	0
	Option 1C	0	0	0	0	0	0	0	0	0	0	0	0
	Option 2A	0	0	0	0	0	0	2,243	3,077	2,020	850	2,274	1,128
	Option 2B	0	0	0	0	0	0	0	0	0	0	0	0
	Option 2C	0	0	0	0	0	0	0	0	0	0	0	0

Results

Figures 4-5 through 4-8 (at the end of this section) illustrate the findings in Table 4-2 for the four categories of urban development value: high, medium, low, and other lands. Program options that emphasize allow, lightly limit and moderately limit treatments rank higher for this criterion because, for the range of Goal 5 treatments, these would likely have the least negative impact on property values, employment and 2040 design types. Program options that rank higher for high and medium lands are not the same program options that rank higher for low and other lands. Low and other lands, however, account for more acres of land than high and medium lands.

Basic statistics

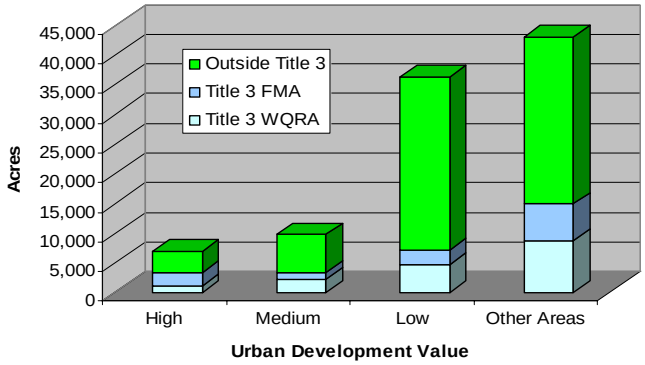
In total the analysis includes 95,956 acres of urban and non-urban fish and wildlife habitat and impact areas. This criterion would affect 53,015 acres of urban lands (ranked for development priority).

- 6,925 acres of land ranked high (habitat land – 5,550 acres; impact areas – 1,375 acres)
- 9,713 acres of land ranked medium (habitat land – 7,273 acres; impact areas – 2,440 acres)
- 36,376 acres of land ranked low (habitat land – 27,702 acres; impact areas – 8,674 acres)
- 42,940 acres of other areas, the non-urban lands that have not been ranked by high, medium, or low development value (habitat land – 39,708; impact areas – 3,232 acres)

Baseline protection (Title 3)

- Title 3 Water Quality and Flood Management Plan currently limits development in Water Quality Resource Areas, and requires specific design standards for development in Flood Management Areas. Any negative impacts of Goal 5 treatments on these lands represent marginal changes in development conditions rather than absolute changes compared with development conditions on the lands without Title 3 regulations. Some local regulations exceed Title 3 protection levels; therefore, the actual marginal changes in development conditions are less than if only Title 3 regulations were considered. However, for reasons stated in Chapter 3, it is not possible to measure the additional increment of land protection beyond the Title 3 baseline for all jurisdictions within the region.

Figure 4-4: Title 3 coverage of habitat & impact areas by urban development value.



- Figure 4-4 shows that Title 3 currently covers almost half of habitat lands with high development values.
- Approximately one-third of habitat lands with medium development values and one-fifth of lands with low urban development values currently receive Title 3 protection.

Potential economic tradeoffs vary by Goal 5 treatments

The extent to which the six program options support urban development priorities depends in part on the mix of allow, limit, and prohibit (ALP) treatments that comprise each program

option. The ALP treatments will affect the amount of land protected, prescribe mitigating habitat damage, and identify guidelines on development design and land division. To the extent that land outside Title 3 WQRAs are covered by local programs, they would not necessarily be affected by regional program options.

- *Protecting habitat*. The proposed definition of Goal 5 treatments for protecting habitat range from no additional protection under allow treatments, to limiting conflicting uses to varying degrees (lightly limit, moderately limit, strictly limit), to prohibiting conflicting uses in habitat areas.

- *Mitigation.* In addition to protecting significant amounts of habitat from development the potential ALP treatments also call for mitigating negative ecological impact of developing habitat lands. Mitigation requirements may increase with increasing protection.

  Mitigation requirements may increase the cost of developing lands that contain habitat, which could negatively impact the urban development priorities. The actual impacts on development costs would depend on the percentage of habitat cover, the negative impacts of development on habitat, and the specifics of the mitigation requirements.

- *Design guidelines and land divisions*. The potential ALP treatments may include locating development as far away as possible from water features and minimizing fragmentation of wildlife habitat. Lightly limit and moderately limit treatments may encourage using low impact development techniques. These treatments may also encourage land divisions that designate habitat as open space. Planned densities will most likely not be affected under lightly and moderately limit treatments. Strictly limit treatments may require low impact development practices and require land divisions for dedicated open space. Prohibit treatments may not allow development.

  Potential ALP treatments that include design standards and land division restrictions may increase development costs. The actual impacts on development costs would depend on the details specific to the parcel and land use.

- *Allow Treatment*. The allow treatment would have no impact on development priorities beyond existing federal, state, or local regulations. Goal 5 would have no incremental or additional impact on lands affected by an allow treatment.
- *Impact Areas*. A majority lands categorized as impact areas are already developed (66 percent). (See Phase I ESEE report for information on impact areas.) These lands would receive allow or lightly limit treatments upon redevelopment.

Potential economic tradeoffs of treatments vary by the development status of lands

The development status of lands would influence the timing of the economic impacts of program options on urban development priorities.

- *Vacant lands outside Title 3*. These lands are currently vacant and are unconstrained by Title 3 (water quality and flood management). However, these lands could be constrained by federal, state, and local regulations, which apply beyond Title 3 boundaries. These lands would likely be developed first and experience the most immediate impacts of program options.

- *Vacant lands inside Title 3*. Development on these lands is constrained by current regulations aimed at protecting water quality and flood areas. Similar to vacant lands outside Title 3, vacant lands inside Title 3 would likely experience economic impacts of program options in the short run. The magnitude of Goal 5 impacts on these lands, however, would likely be less (depending on the strictness of Goal 5 treatments applied) because existing regulations limit development on these lands.
- *Developed urban lands*. Lands classified as developed urban would experience economic impacts of program options through redevelopment or expanding existing land uses. Current Title 3 regulations apply to redevelopment actions, so Goal 5 treatments could result in a marginal increase in development constraints depending on the treatment applied. These impacts would likely occur farther into the future compared with impacts on vacant lands inside and outside Title 3.

Comparison of program options

Lands with high urban development value (See Figure 4-5)

- Option 2C provides the greatest support for lands with high urban development value among the six program options. This result holds for developed lands, vacant lands outside Title 3 and vacant lands inside Title 3.
- In descending order of support for urban development priorities the remaining options rank: 2B, 1C, 2A, 1B, and 1A. Option 1C, which emphasizes habitat protection, performs better under this criterion than does Option 2A, which emphasizes urban development values.
- The ranking of the program options described above applies to developed urban lands and vacant lands outside Title 3. This ranking also reflects the outcome for vacant lands inside Title 3 except that Options 2A and 1B perform similarly rather than 2A dominating 1B.

Lands with medium urban development value (See Figure 4-6)

- Option 2C also performs best for lands with medium urban development value. This result also holds for the three development categories of land.
- The order of the remaining program options for medium value lands under this criterion reflects the order for high value lands except that Option 1C performs better than remaining options in the following order: 1C, 2B, 2A, 1B, 1A.
- The above ranking holds for developed urban and vacant lands outside Title 3. For vacant land inside Title 3 Options 2A and 1B perform comparably rather than 2A performing better than 1B as indicated above.

Lands with low urban development value (See Figure 4-7)

- Option 1C, which was designed to emphasize habitat protection, performs better than the other options under this criterion for lands with low urban development value. This result holds for the three development categories.
- In descending order of support for urban development priorities the remaining options rank: 2C, 2B, 1B, 2A, 1A.
- This ranking holds for developed urban and vacant lands outside Title 3. For vacant land inside Title 3, Options 2B and 1B perform comparably rather than Option 2B performing better 1B as indicated above.

Other lands (See Figure 4-8)

- As with lands ranked low, Option 1C also provides the greatest support for urban development values for other lands. This result holds for the three development categories.
- In descending order of support for urban development priorities, the remaining options rank: 1B, 2C and 2B are comparable, 2A and 1A.
- This ranking holds for developed urban and vacant lands outside Title 3. For vacant land inside Title 3, Option 1B performs similarly to Options 2C and 2B rather than Option 1B performing better than the other two.

Figure 4-5: Comparison of allow, limit, prohibit treatments for HIGH urban development value.

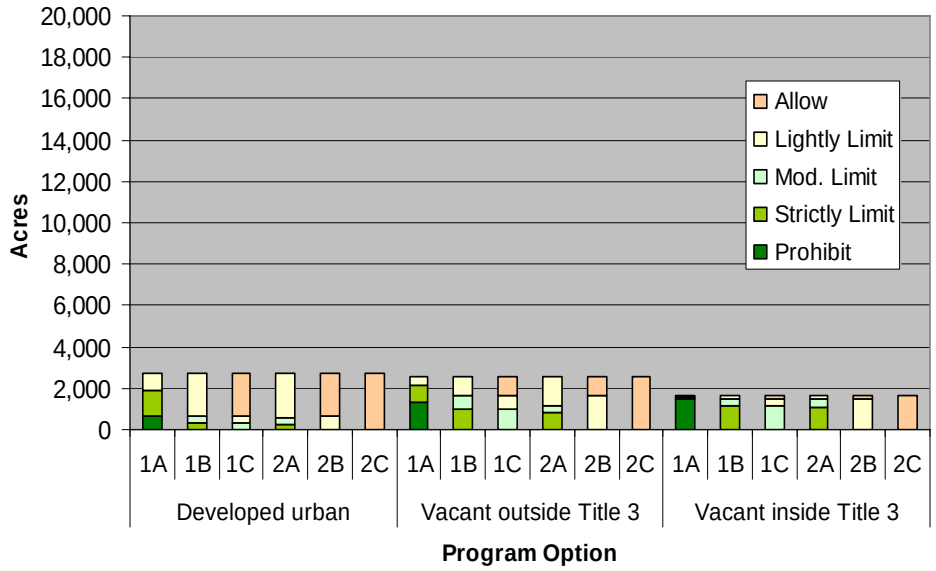


Figure 4-6: Comparison of allow, limit, prohibit treatments for MEDIUM urban development value.

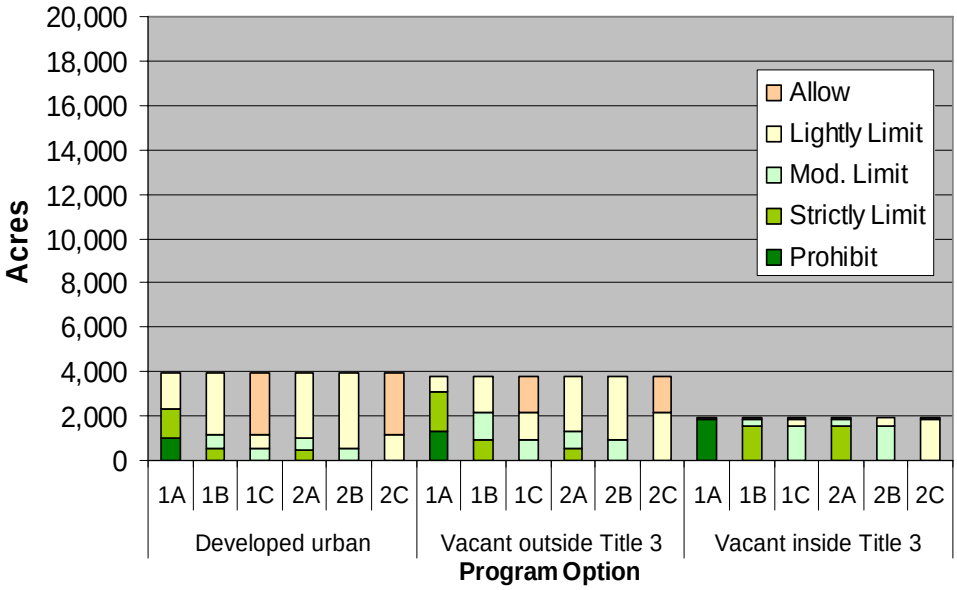


Figure 4-7: Comparison of allow, limit, prohibit treatments for LOW urban development value.

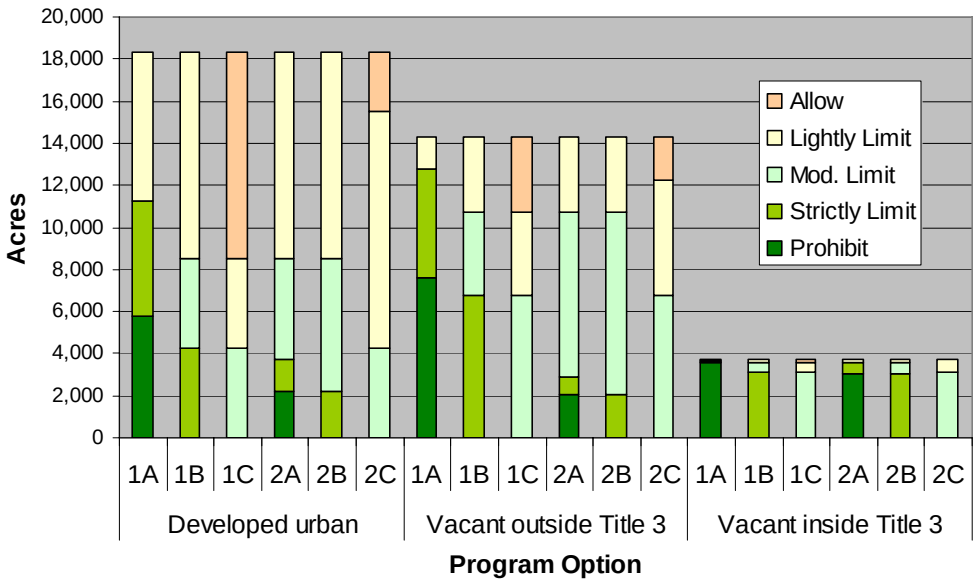
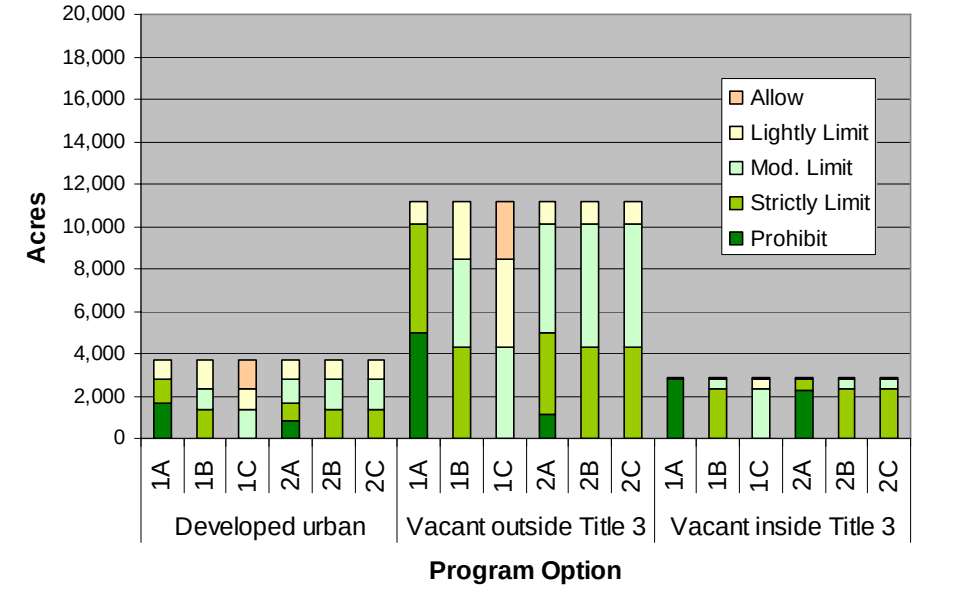


Figure 4-8: Comparison of allow, limit, prohibit treatments for OTHER areas (parks and open space, rural lands).



Summary

Table 4-3 summarizes the ranking of program options based on the outcome for lands with high urban development value. These lands contain the greatest concentration of high valued lands and lands with the highest employment density.

Table 4-3: Performance of options in meeting Economic Criterion 1: supports urban development priorities.

Rank	Option	Performance
1	2C	Option 2C provides the greatest support for urban development priorities among the six options, as described by the impacts on lands ranked "high." It has the greatest number of acres affected by allow treatments, which have no negative impacts on development, and no acres affected by strictly limit or prohibit treatments.
2	2B	Options 2B and 1C are second to Option 2C in the number of allow acres. 2B has more acres affected by lightly limit than 1C. 2B has zero acres affected by moderately limit, 1C has the most acres affected by moderately limit of any option. For these reasons 2B dominates 1C.
3	1C	Option 1C dominates option 2A because 1C has acres affected by allow treatments. 2A has no allow acres.
4	2A	Option 2A has more lightly limit acres than 1B or 1A. Option 1B has more acres affected by moderately limit and strictly limit than 2A. Option 1A is the only option with acres affected by prohibit treatments.
5	1B	Option 1B dominates 1A because it has more acres affected by lightly limit treatments and no acres affected by prohibit treatments.
6	1A	Option 1A has the greatest negative impact from prohibit treatments and the greatest negative impact overall on urban-development priorities of the six options.

Note that the ranking of program options based on the *average* outcome for the *total acres* in the analysis differs from the ranking in Table 4-3. A summary based on the average for all acres weighs more heavily the impacts on lands ranked low and other lands, because these rankings contain more acres than do lands with high or medium rankings. The ranking of program options based on the average for all acres is: 1C, 2C, 2B, 1B, 2A, 1A.

2. Supports economic values of ecosystem service

The acres of habitat protected by program options help determine the extent to which the options retain ecosystem services and related economic values. Regionally significant fish and wildlife habitat is ranked into six classes based on the amounts and types of ecological functions and wildlife characteristics: Class I-III riparian/wildlife corridors and Class A-C upland wildlife habitat. Areas with more ecological functions and/or areas with functions closer to streams, wetlands, or floodplains rank higher than areas with fewer functions or with functions further away from water features (see Chapter 4 of Metro's Phase I ESEE analysis for full discussion of ecosystem services).

Potential impacts on the value of ecosystem services

Metro's inventory and ranking focused on the ecological functions and wildlife characteristics that affect a habitat's biophysical health and wellbeing. Well-functioning habitats also produce ecosystem services that benefit society. Table 4-4 below lists the ecological functions and wildlife characteristics that were considered in ranking of fish and wildlife habitat, the related ecosystem services that benefit society, and where these ecosystem services occur in the inventory classes.

Table 4-4: Ecological functions, wildlife characteristics and related ecosystem services that benefit society.

Ecological function	Ecosystem service	Where ecosystem services occur in Metro's habitat classes
Microclimate, shade, and cooling of water temperature	Decreased summer temperatures, which helps reduce energy demand for cooling.	All habitat classes
Moderated stream flow and improved water storage	Reduced flood damage and flood management costs.	All habitat classes
Bank stabilization and sediment and pollution control	Improved water quality. Reduced demand for water filtration and treatment. Reduced landslides and related damage and clean-up costs.	All habitat classes
Large woody debris and channel dynamics	Reduced flood damage and flood-management costs.	Class I or II riparian/wildlife corridors
Well-functioning riparian areas in general	Increased amenity and intrinsic values associated with riparian areas.	All habitat classes
Habitats of concern and habitats for unique and sensitive species	Increased populations of salmon and other species and associated increases in commercial, recreational, spiritual and intrinsic values.	Class I riparian/wildlife corridors, Class A upland wildlife habitat
Well-functioning wildlife habitats in general	Increased amenity and intrinsic values associated with wildlife habitat.	All upland wildlife classes and Class I-II riparian/wildlife corridors

Source: ECONorthwest and Metro's inventory and ranking of riparian and wildlife resources.

The analysis of program options and their associated impacts on ecosystem services and related economic values assumes:

- Areas that provide more of the ecological functions and wildlife characteristics illustrated in Table 4-4 provide more ecosystem services and value to society than do areas that provide fewer functions and characteristics.
- Actions that enhance or protect ecosystem services also enhance or protect the economic values associated with those services. Actions that degrade these services will have the opposite effect.

This criterion emphasizes protecting habitats and associated ecosystem services. Criterion 1 emphasizes just the opposite, developing habitat in support of urban development priorities. In general, options that performed well under the Criterion 1, emphasizing urban development priorities, perform poorly under Criterion 2, because they degrade ecosystem functions, wildlife habitat, and the associated ecosystem services listed in Table 4-4. The resulting negative economic consequences over the long term may include:

- Higher summer temperatures with associated increased cooling costs in summer.
- Increased air pollution and associated impacts and costs.
- Increased flooding with related property damage, and disruption of commercial, business, and industrial activity, and increased transportation disruptions and costs.
- Increased landslides that may threaten residential, commercial and industrial properties, transportation routes and water quality.
- Decreased water quality and associated increased treatment costs.
- Reduced amenity and intrinsic values associated with habitat and species.

Degrading habitat on a regional scale, such as the lands in Metro's jurisdiction, may generate significant negative economic consequences, especially over the long term. Protecting these resources over the long term may yield economic benefits throughout the region. (See Metro's Phase 1 ESEE Report for information on methods of estimating the value of the affected ecosystem services and the magnitudes of the values.)

Environmental Criterion 1 (conserves existing watershed health and restoration opportunities) describes the impact of program options on the amount and quality of ecosystem functions for fish and wildlife habitat. It is assumed that program options that promote or protect these functions also promote or protect the related ecosystem services and values to society. It is also assumed that options that rank high on this environmental criterion will also rank high for related ecosystem services and economic values.

The analysis of program options and their impacts on the value of ecosystem services builds upon the biophysical analysis of ecosystem functions. The ecosystem functions provide the ecosystem services that society values. This criterion describes the impacts of program options on related ecosystem services and values to society. Not incidentally, to assign values to the ecosystem services derived from the biophysical analysis of ecosystem functions does not double count the economic importance of ecosystem functions or ecosystem services. The two

analyses— biophysical and economic—are separate, with the economic analysis converting the findings of the biophysical analysis to different units of measurement.

Measuring the criterion

Table 4-5 shows the number of acres of habitat, by habitat class, affected by allow, limit, and prohibit treatments for the six program options. The habitat classes are subdivided for developed and vacant acres. As described in Economic Criterion 1, vacant acres will experience the most immediate impacts of program options. Developed lands will experience impacts of program options through the eventual redevelopment and expansion of existing land uses.

Table 4-5: Retention of ecosystem services by program option (in number of acres of habitat).

Program treatment		Option 1A		Option 1B		Option 1C		Option 2A		Option 2B		Option 2C	
		Developed	Vacant	Developed	Vacant	Developed	Vacant	Developed	Vacant	Developed	Vacant	Developed	Vacant
Class I	A	0	0	0	0	0	0	0	0	0	0	282	1,942
	LL	0	0	0	0	0	0	0	0	282	1,942	460	2,107
	ML	0	0	0	0	15,327	12,549	0	0	460	2,107	2,243	5,097
	SL	0	0	15,327	12,549	0	0	742	4,050	14,585	8,499	12,342	3,402
	P	15,327	12,549	0	0	0	0	14,585	8,499	0	0	0	0
Class A	A	0	0	0	0	0	0	0	0	0	0	67	207
	LL	0	0	0	0	0	0	67	207	67	207	101	372
	ML	0	0	0	0	11,173	8,508	2,154	5,125	2,154	5,125	2,054	4,753
	SL	0	0	11,173	8,508	0	0	8,952	3,176	8,952	3,176	8,952	3,176
	P	11,173	8,508	0	0	0	0	0	0	0	0	0	0
Class II	A	0	0	0	0	0	0	0	0	0	0	273	668
	LL	0	0	0	0	3,986	3,907	0	0	682	1,354	1,911	2,050
	ML	0	0	3,986	3,907	0	0	682	1,354	3,303	2,553	1,801	1,188
	SL	0	0	0	0	0	0	3,303	2,553	0	0	0	0
	P	3,986	3,907	0	0	0	0	0	0	0	0	0	0
Class B	A	0	0	0	0	0	0	0	0	0	0	58	359
	LL	0	0	0	0	5,100	7,789	266	1,168	266	1,168	2,898	3,921
	ML	0	0	5,100	7,789			4,834	6,622	4,834	6,622	2,144	3,509
	SL	5,100	7,789					0	0	0	0	0	0
	P	0	0	0	0	0	0	0	0	0	0	0	0
Class III	A	0	0	0	0	3,766	666	0	0	1,066	48	3,361	530
	LL	0	0	3,766	666	0	0	3,361	530	2,295	482	0	0
	ML	0	0	0	0	0	0	405	137	405	137	405	137
	SL	3,766	666	0	0	0	0	0	0	0	0	0	0
	P	0	0	0	0	0	0	0	0	0	0	0	0
Class C	A	0	0	0	0	2,973	4,489	0	0	118	462	1,789	3,021
	LL	0	0	2,973	4,489	0	0	1,789	3,021	1,671	2,559	0	0
	ML	0	0	0	0	0	0	1,184	1,468	1,184	1,468	1,184	1,468
	SL	2,973	4,489	0	0	0	0	0	0	0	0	0	0
	P	0	0	0	0	0	0	0	0	0	0	0	0

Notes for table 4-5:

Developed: sums parks and urban acres because the focus of this criterion is the retention of habitat irrespective of development status

Vacant: sums constrained and unconstrained acres (by Title 3 baseline regulations) for the same reason above.

Results

Figures 4-9 through 4-11 illustrate the findings in Table 4-5. Program options that protect more fish and wildlife habitat overall, as well as more of the most valuable habitat, rank higher for this criterion.

Figure 4-9: Performance of program options for Class I and Class A habitat.

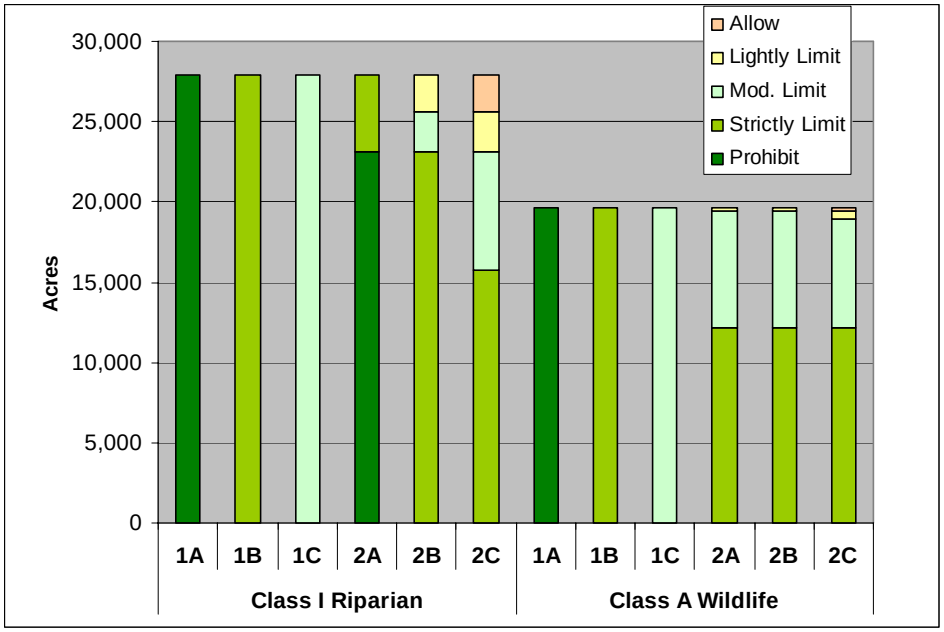


Figure 4-10: Performance of program options for Class II and Class B habitat.

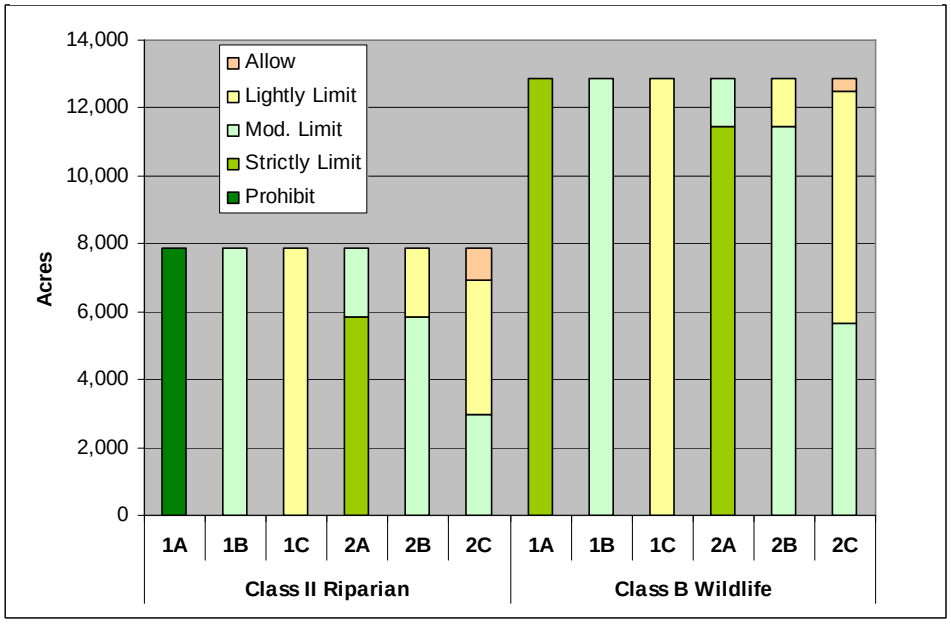
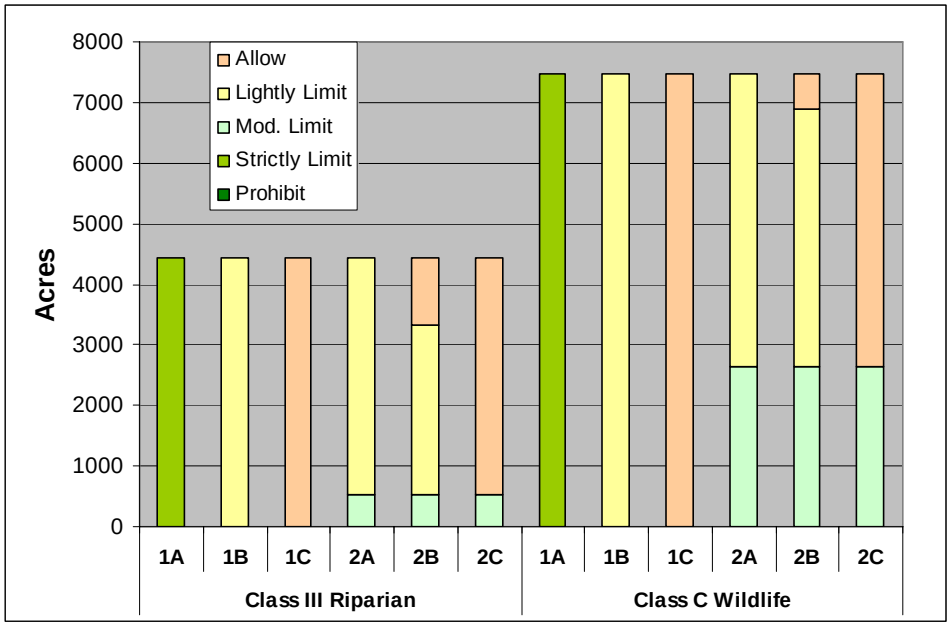


Figure 4-11: Performance of program options for Class III and Class C habitat.



Basic statistics

- This analysis includes 40,201 acres of Class I, II, and III riparian/wildlife corridors and 40,032 acres of Class A, B, and C wildlife habitat.
- The highest quality riparian/wildlife corridors (Class I) account for 69 percent of the total number of acres of riparian habitat.
- The highest quality wildlife habitat (Class A) account for 49 percent of the total number of acres of wildlife habitat.

Baseline protection (Title 3)

- Program options that provide the least protection to habitat lands will, in general, have more negative impacts on Class A, B, and C lands over the long term compared to the impacts on Class I, II, and III lands, because the lands in the latter group receive more baseline protection from Title 3. For example, nearly half of Class I and a quarter of Class II riparian/wildlife corridors are included in Title 3 Water Quality Resource Areas.
- Title 3 Water Quality Resource Areas (WQRA) and Flood Management Areas (FMA) protect 72, 49, and 61 percent of Class I, II, and III lands, respectively (See Chapter 3, *Baseline for Analysis*).
- To the extent that the WQRAs and FMAs also protect the ecosystem services specific to Class I through III habitat lands, they also protect the associated economic values.
- Title 3 provides almost no protection for Class A, B, and C lands or the associated ecosystem services and values. Inside Title 3 protection, Class A lands account for two percent, Class B lands for one percent, and Class C lands for two percent.

Comparison of program options

Class I, II, and III riparian/wildlife corridors

- Option 1A promotes the greatest retention of ecosystem services and associated economic values among the six options for Class I, II, and III lands. This result holds for developed and vacant land in Metro's jurisdiction.
- In descending order of retaining ecosystem services and associated values, the remaining options rank: 2A, 1B, 2B, 2C, 1C.

Class A, B, and C upland wildlife

- The six program options perform similarly for Class A and B lands but not for Class C lands.
- Similar to Class I, II, and III lands, Option 1A promotes the greatest retention of ecosystem services and associated economic values among the six options for Class A and B lands.
- In descending order for lands in Class A and B, the remaining options rank: 1B, 2A = 2B, 2C, and 1C. This ranking applies to developed and vacant land.
- Option 1A also promotes the greatest retention of ecosystem services and associated economic values among the six options for Class C lands.
- In descending order for lands in Class C, the remaining options rank: 2A, 2B, 2C, 1B, 1C. This ranking applies to developed and vacant land.

Summary

Table 4-6 summarizes the performance ranking of the program options based on the average outcome for the total acres in the analysis. As a group, Class I, II and III lands cover approximately the same number of acres as the lands in Class A, B and C. Thus, the outcomes for these two groups receive approximately the same weight. The outcomes for the individual classes, however, do not receive equal weights because the number of acres in each class differs. The classes rank in the following descending order based on the acres of lands in the class expressed as a percentage of the total acres in the analysis: Class I (35 percent of total acres), Class A (25 percent), Class B (16 percent), Class II (9 percent), Class C (9 percent), and Class III (6 percent). The results in Table 4-6 reflect the weighting of the results for the individual classes based on these percentages.

Table 4-6: Performance of options in meeting Economic Criterion 2: promotes retention of ecosystem services

Rank	Option	Performance
1	1A	This option provides the greatest retention of ecosystem services and related economic values among the six options. This is true for all classes of habitat and for developed and vacant lands.
2	2A	Comparable to Option 1B in overall retention of ecosystem services and related values. Option 2A retains more higher quality riparian services, while Option 1B retains more higher quality wildlife habitat services.
3	1B	See the description for Option 2A.
4	2B	Performs comparable to Option 2A for Class A and B lands. For all other lands, Option 1B performs better.
5	2C	Performs consistently behind Options 2B, and consistently dominates Option 1C.
6	1C	This option provides the least retention of ecosystem services and related economic values of the six options. This ranking applies for all classes of habitat and for developed and vacant lands.

The proposed Goal 5 guidelines include mitigating adverse impacts of development on habitat. Detailed mitigation guidelines have not yet been developed. The site-specific nature of habitat and the impacts of development on the habitat will also influence the type and amount of Goal 5 mitigation that may be required. Given these uncertainties, and the conclusions from Metro's Technical Report for Goal 5 that mitigating habitat damage in urban areas faces considerable challenges, the ranking of program options in Table 4-6 does not reflect the outcome of potential Goal 5 mitigation.

3. Promotes recreational access and amenities.

This criterion ranks program options based on the extent to which they promote recreational access and amenities. The analysis of this criterion uses data similar to that for the analysis of Environmental Criterion 1 and Economic Criterion 2 – acres of habitat protected. The criterion, however, focuses on the subset of total habitat acres that support recreational opportunities. Metro classifies these lands as parks and open space.

The analysis of this criterion distinguishes between public and private recreational lands because ownership may influence the impacts of program options on recreational access. For example, public ownership implies more open access to recreational opportunities. Private ownership implies that access requires membership or has other restrictions. Public park and open space lands include parks, schools and rights-of-way. Private park and open space lands includes golf courses and cemeteries.

Potential impacts on recreational opportunities

In general, the program options would have a limited impact on the number of acres of recreational and open space lands. This is true for two reasons. First, existing land uses either support recreational use and open space directly (e.g., public parks or golf courses) or support recreation related uses indirectly (e.g., schools). The options would have more limited impacts on the number of acres of these types of land uses compared with the more intensive urban development uses described in Criterion 1. The second reason is that the large majority of the lands in this analysis are publicly owned. Public ownership makes it unlikely (though not impossible) that recreational and open space uses will change significantly in the future.

The options may impact the *quality* of recreational and open space experiences on the lands at issue in this analysis. Options that protect more habitat, and more higher quality habitat, will help protect the recreational related amenity values associated with the habitat. The analysis of program options and their associated impacts on recreational access and amenities assumes:

- Fish and wildlife habitat provide recreation and open space related ecosystem services and values to society. Higher quality habitat provides higher quality ecosystem services and values compared with lower quality habitat.
- Actions that enhance or protect habitat also enhance or protect the recreation and open space related amenities that influence the quality of recreational experiences. Actions that degrade these services will have the opposite effect.
- Program options that protect habitat lands with more restrictive treatments will also promote greater access to recreational opportunities and higher quality recreational experiences. Options that provide less protection will have the opposite effect.

Other lands outside park and open space can contribute to recreational experiences and amenities. For example, bird and fish habitat on non-parklands contribute to the amenity value of bird watching and fishing on parklands. The analysis of Criterion 3 focuses only on parks and open spaces; thus, it likely underestimates the true scope and values of recreational amenities affected by Goal 5 program options.

Measuring the criterion

Table 4-7 below shows the habitat acres that support recreation (25,265 acres) by ownership (public vs. private) and by allow, limit, and prohibit treatments for the six program options.

Table 4-7: Acres in parks and open space lands by ownership and by program treatment

Program Options	Program treatments	Publicly owned	Privately owned	Total acres	Public: % of total	Private: % of total
Option 1A	Prohibit	19,046	2,372	21,418	89%	11%
	Strictly limit	2,076	521	2,596	80%	20%
	Moderately limit	0	0	0	0%	0%
	Lightly limit	950	302	1,252	76%	24%
	Allow	0	0	0	0%	0%
Option 1B	Prohibit	0	0	0	0%	0%
	Strictly limit	17,967	1,959	19,926	90%	10%
	Moderately limit	2,301	692	2,993	77%	23%
	Lightly limit	1,804	542	2,346	77%	23%
	Allow	0	0	0	0%	0%
Option 1C	Prohibit	0	0	0	0%	0%
	Strictly limit	0	0	0	0%	0%
	Moderately limit	17,967	1,959	19,926	90%	10%
	Lightly limit	2,301	692	2,993	77%	23%
	Allow	1,804	542	2,346	77%	23%
Option 2A	Prohibit	10,311	1,185	11,495	90%	10%
	Strictly limit	8,736	1,187	9,923	88%	12%
	Moderately limit	2,076	521	2,596	80%	20%
	Lightly limit	950	302	1,252	76%	24%
	Allow	0	0	0	0%	0%
Option 2B	Prohibit	0	0	0	0%	0%
	Strictly limit	17,967	1,959	19,926	90%	10%
	Moderately limit	3,155	933	4,088	77%	23%
	Lightly limit	950	302	1,252	76%	24%
	Allow	0	0	0	0%	0%
Option 2C	Prohibit	0	0	0	0%	0%
	Strictly limit	17,967	1,959	19,926	90%	10%
	Moderately limit	3,155	933	4,088	77%	23%
	Lightly limit	0	0	0	0%	0%
	Allow	950	302	1,252	76%	24%

Results

Figure 4-12 displays the information from Table 4-7. It shows that the large majority of land at issue in this case is in public ownership. Figure 4-13 shows park lands by quality of habitat and by ownership. The large majority of park lands in this analysis also contains the highest quality fish and wildlife habitat.

Figure 4-12: Performance of program options for parks and open space lands, by ownership.

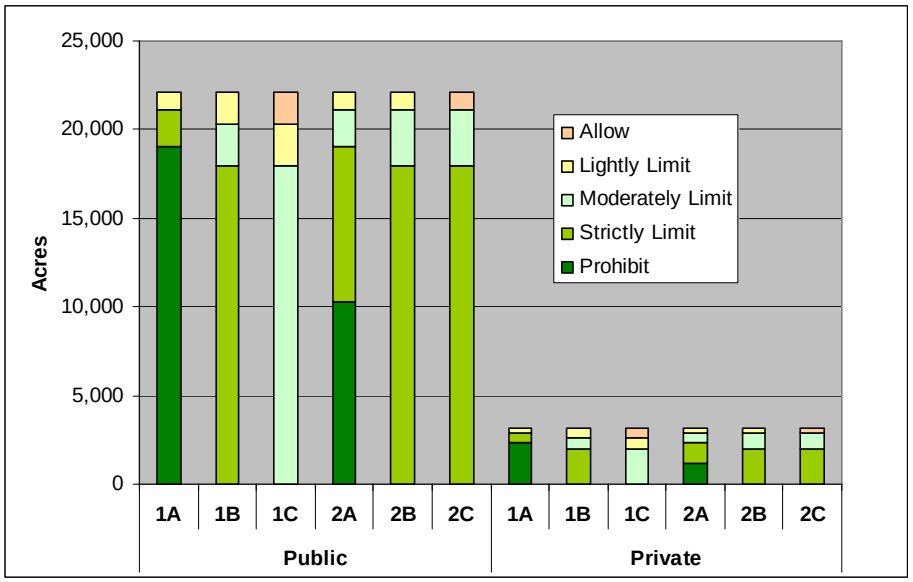
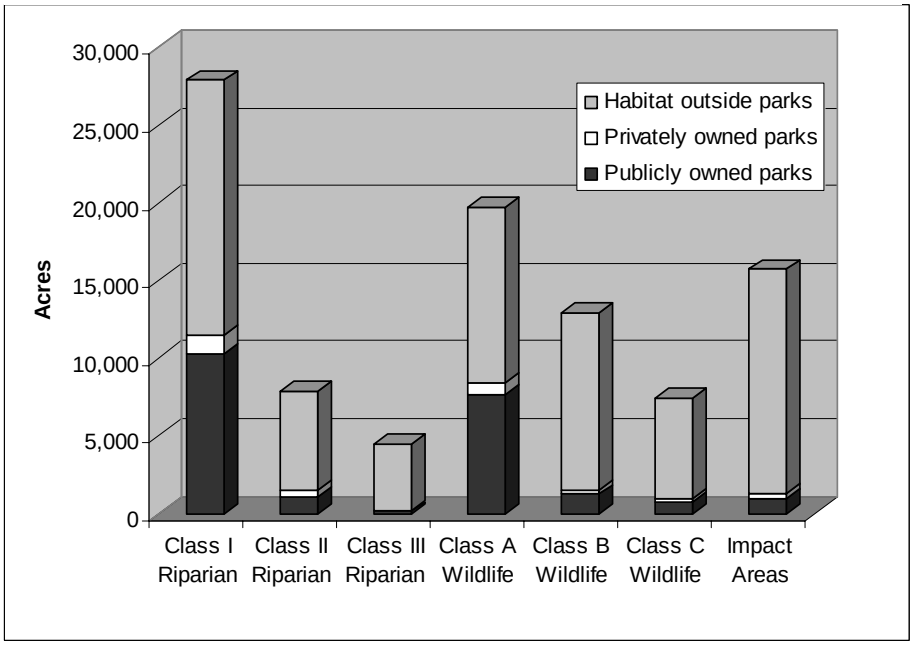


Figure 4-13: Park lands by habitat class and ownership.



Program options that protect more park and open space lands overall will more likely promote recreational access, higher quality recreational experiences and score higher for this criterion. Program options that protect more *public* park and open space lands will more likely promote recreational access with fewer restrictions compared with protecting *private* park and open space lands. The quality of remaining habitat land will also affect the quality of recreational experiences.

Basic statistics

- The analysis for this criterion includes 25,265 acres of park and open space lands.
- 22,071 acres, or 87 percent, are publicly owned; 3,194 acres, or 13 percent, are privately owned.

Comparison of Program Options

Park and open space lands in public ownership

- Option 1A promotes recreational access to the greatest extent of the six program options by protecting over 21,000 acres of public and private park and open space lands with prohibit treatments. Given that the large majority of these lands also contains Class I and Class A habitat, this option also protects habitat lands that provide the highest quality recreational and open space amenities.
- In descending order of promoting recreational access and the quality of recreational amenities, the options rank: 2A, 2B, 1B, 2C, 1C.
- Two of the options that take into account urban development values rather than quality of habitat, 2A and 2B, perform better under this criterion than do options 1B and 1C, which were designed with greater habitat protection in mind.

Park and open space lands in private ownership

- The program options rank the same for privately owned park lands as they do for lands in public ownership.
- Ownership does influence the performance of the less protective treatments of the program options. In general, private lands account for a higher proportion of the less protective treatments compared with their portion of the total park and open space acres. For example, under option 1B, private park land accounts for 23 percent of the lands with moderately and lightly limit treatments. But these lands account for 13 percent of the total park lands. In general, private lands receive a larger percentage of the less protective treatments and a smaller percentage of the more protective treatments relative to public lands.

Summary

Table 4-8 summarizes the ranking of the performance of the program options based on the average outcome for the total acres in the analysis.

Table 4-8. Performance of options in meeting Economic Criterion 3: promotes recreational access and amenities.

Rank	Option	Performance
1	1A	This option promotes the greatest access to recreational opportunities, and highest quality recreational experiences among the six options. This holds for both public and private park lands. This option protects over 21,000 acres with prohibit treatments, the most of any option.
2	2A	This option relies on a mix of prohibit and strictly limit treatments. It performs better than options 1B and 1C, which take habitat protection into account.
3	2B	This option relies on a mix of limit treatments, without allow or prohibit treatments. This option also performs better than options 1B and 1C.
4	1B	This option relies on a mix of limit treatments, without allow or prohibit treatments. Option 2B dominates this option even though both rely on a mix of limit treatments.
5	2C	This option relies on a mix of limit and allow treatments.
6	1C	This option provides the least support for recreational opportunities and quality of recreational experiences among the six options. This holds for both public and private park lands.

4. Distributes economic tradeoffs

This discussion of Criterion 4 has two parts. The first part considers the distributional impacts of program options on property owners as described by public and private land. The second considers the distributional impacts on land use as described by regional zoning types.

The other economic criteria (1, 2, 3 and 5) in this analysis rank program options on a scale, for example, from least to most supportive of urban development priorities. The analysis for this criterion does not emphasize ranking program options because they do not vary significantly by land ownership or regional zone. It focuses instead on describing the extent to which the strictness of program options (e.g., allow vs. lightly limit, or lightly limit vs. moderately limit, etc.) varies by ownership or by regional zone. This criterion highlights property owners or regional zones that would bear a greater burden of the land use impacts that may stem from the more restrictive Goal 5 treatments.

Distribution of impacts by property ownership

This portion of the analysis describes the impact of program options on land ownership as measured by acres of public and private land. Economic Criterion 1 describes the impacts of program options on urban development values. In this criterion, the *distribution* of the impacts of program options on public and private lands that support the urban development values (described in Criterion 1) are examined. Similar to the analysis of Economic Criterion 1, the analysis for this criterion also assumes that the Goal 5 program options that protect habitat would restrict use and development of public and private land. Restrictions are assumed to be more likely with prohibit and strictly limit treatments and less likely with lightly limit or allow treatments.

Measuring the criterion

Table 4-9 shows the breakdown of Goal 5 allow, limit, and prohibit treatments by public and private lands for each program option.

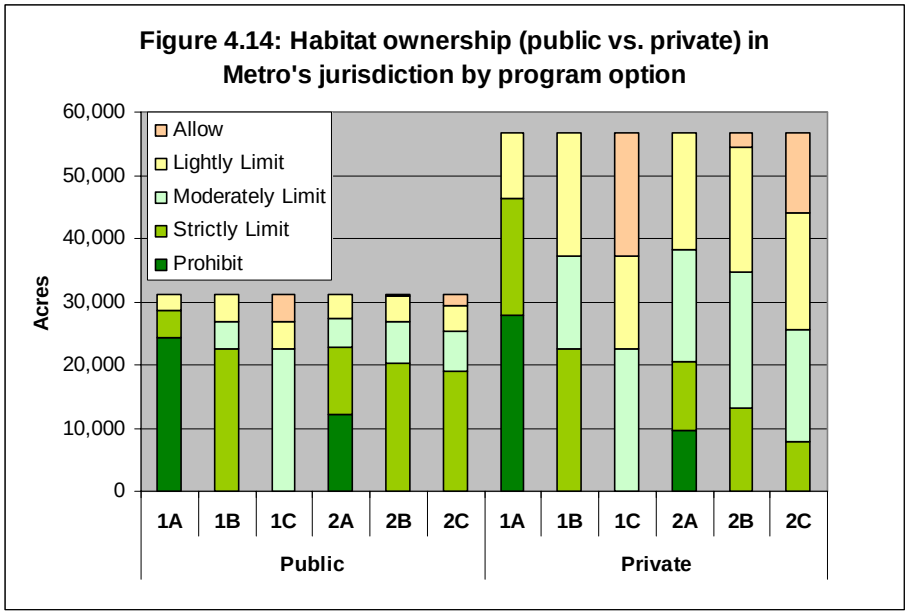
Table 4-9: Habitat and impact area acres by land ownership and program options.

Program	Program	Acres of Resource in Taxlots			% of Resource in Taxlots			% of Treament in Taxlots			% of Ownership in Taxlots		
Option	Treatment	Private	Public	Total*	Private	Public	Total*	Private	Public	Total*	Private	Public	Total*
	P	27,840	24,341	52,182	32%	28%	59%	53%	47%	100%	49%	78%	59%
	SL	18,423	4,156	22,579	21%	5%	26%	82%	18%	100%	32%	13%	26%
	ML	0	0	0	0%	0%	0%	0%	0%	0%	0%	0%	0%
	LL	10,491	2,534	13,025	12%	3%	15%	81%	19%	100%	18%	8%	15%
	AL	0	0	0	0%	0%	0%	0%	0%	0%	0%	0%	0%
Option 1A	Total*	56,754	31,032	87,786	65%	35%	100%	65%	35%	100%	100%	100%	100%
	P	0	0	0	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SL	22,527	22,507	45,034	26%	26%	51%	50%	50%	100%	40%	73%	51%
	ML	14,797	4,245	19,042	17%	5%	22%	78%	22%	100%	26%	14%	22%
	LL	19,431	4,280	23,710	22%	5%	27%	82%	18%	100%	34%	14%	27%
	AL	0	0	0	0%	0%	0%	0%	0%	0%	0%	0%	0%
Option 1B	Total*	56,754	31,032	87,786	65%	35%	100%	65%	35%	100%	100%	100%	100%
	P	0	0	0	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SL	0	0	0	0%	0%	0%	0%	0%	0%	0%	0%	0%
	ML	22,527	22,507	45,034	26%	26%	51%	50%	50%	100%	40%	73%	51%
	LL	14,797	4,245	19,042	17%	5%	22%	78%	22%	100%	26%	14%	22%
	AL	19,431	4,280	23,710	22%	5%	27%	82%	18%	100%	34%	14%	27%
Option 1C	Total*	56,754	31,032	87,786	65%	35%	100%	65%	35%	100%	100%	100%	100%
	P	9,658	12,197	21,855	11%	14%	25%	44%	56%	100%	17%	39%	25%
	SL	10,972	10,525	21,497	12%	12%	24%	51%	49%	100%	19%	34%	24%
	ML	17,495	4,629	22,124	20%	5%	25%	79%	21%	100%	31%	15%	25%
	LL	18,630	3,680	22,310	21%	4%	25%	84%	16%	100%	33%	12%	25%
	AL	0	0	0	0%	0%	0%	0%	0%	0%	0%	0%	0%
Option 2A	Total*	56,754	31,032	87,786	65%	35%	100%	65%	35%	100%	100%	100%	100%
	P	0	0	0	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SL	13,230	20,256	33,486	15%	23%	38%	40%	60%	100%	23%	65%	38%
	ML	21,456	6,550	28,006	24%	7%	32%	77%	23%	100%	38%	21%	32%
	LL	19,639	3,974	23,613	22%	5%	27%	83%	17%	100%	35%	13%	27%
	AL	2,430	251	2,681	3%	0%	3%	91%	9%	100%	4%	1%	3%
Option 2B	Total*	56,754	31,032	87,786	65%	35%	100%	65%	35%	100%	100%	100%	100%
	P	0	0	0	0%	0%	0%	0%	0%	0%	0%	0%	0%
	SL	7,740	18,953	26,693	9%	22%	30%	29%	71%	100%	14%	61%	30%
	ML	17,923	6,319	24,241	20%	7%	28%	74%	26%	100%	32%	20%	28%
	LL	18,291	3,997	22,288	21%	5%	25%	82%	18%	100%	32%	13%	25%
	AL	12,801	1,763	14,564	15%	2%	17%	88%	12%	100%	23%	6%	17%
Option 2C	Total*	56,754	31,032	87,786	65%	35%	100%	65%	35%	100%	100%	100%	100%

* Total habitat acres differ from original number (95,955 acres) because some areas do not have tax lots (e.g., roads).

Results

Figure 4-14 illustrates the findings from Table 4-9.



Basic Statistics

- Privately owned land accounts for 56,745 acres, or 65 percent of the total acres in this analysis.
- Publicly owned land accounts for 31,031 acres, or 35 percent of the total acres in this analysis.

Comparison of program options

- The ranking of program options from least to most restrictive does not vary by property ownership. The program options rank, from least to most restrictive: 1C, 2C, 2B, 1B, 2A, and 1A.
- Even though the rank of program options does not vary by ownership, the degree of restriction does vary by public or private ownership. In general, publicly owned lands bear a higher proportion of the most restrictive Goal 5 treatments than do privately owned lands, relative to the distribution of public and private acres in the analysis. For example, Option 1C, which is the least restrictive option, splits the number of acres affected by the most restrictive treatment (moderately limit) evenly between public and private land (see Table 4.11 below). However, private land accounts for 65 percent, and public land accounts for 35 percent of total acres. If the impacts of the most restrictive treatment were distributed proportionally based on the number of acres of private and public lands in the analysis, private lands would receive approximately 65 percent of the most restrictive treatment and public lands 35 percent.

Table 4-10: Distribution of Allow, Limit and Prohibit Treatments between Private and Public Land for Option 1C.

Treatment	Private Lands (65% of total acres)	Public Lands (35% of total acres)	Total
Prohibit	0%	0%	
Strictly Limit	0%	0%	
Moderately Limit	50%	50%	100%
Lightly Limit	78%	22%	100%
Allow	82%	18%	100%

- The reverse is true for the less restrictive treatments. The less restrictive Goal 5 treatments affect private lands in a proportion greater than their percentage of total acres in the analysis. Public lands receive less-than-proportional impacts from the less restrictive treatments.
- For example, private lands account for 65 percent of the acres in the analysis but account for 78 percent of the acres affected by lightly limit treatments and 82 percent of the acres affected by allow treatments. Public lands, in contrast, account for 35 percent of the acres but 22 percent of the lightly limit treatments and 18 percent of allow treatments.

Distribution of impacts by regional zoning type

In this portion of the analysis, the impacts of program options on land uses in Metro's jurisdiction are described. There are seven regional zones (see Metro's Phase I ESEE report for a description of regional zoning types).

- Single-family residential (SFR)
- Multi-family residential (MFR)
- Mixed-use centers (MUC)
- Commercial (COM)
- Industrial (IND)
- Parks and open space (POS)
- Rural (RUR)

Potential impacts on zoning types

In this part of the analysis, it is assumed that program options that protect habitat would restrict land uses as described by regional zoning types. Land use restrictions are assumed to be more likely with prohibit and strictly limit treatments and less likely with moderately or lightly limit treatments.

The extent to which any one zoning type bears a disproportional share of acres affected by program options, relative to the zoning type's share of total acres in Metro's jurisdiction, are considered. Also described for a given program option are the land uses that receive less restrictive treatments (e.g., moderately limit and lightly limit) and those that receive more (e.g., strictly limit and prohibit).

Measuring the criterion

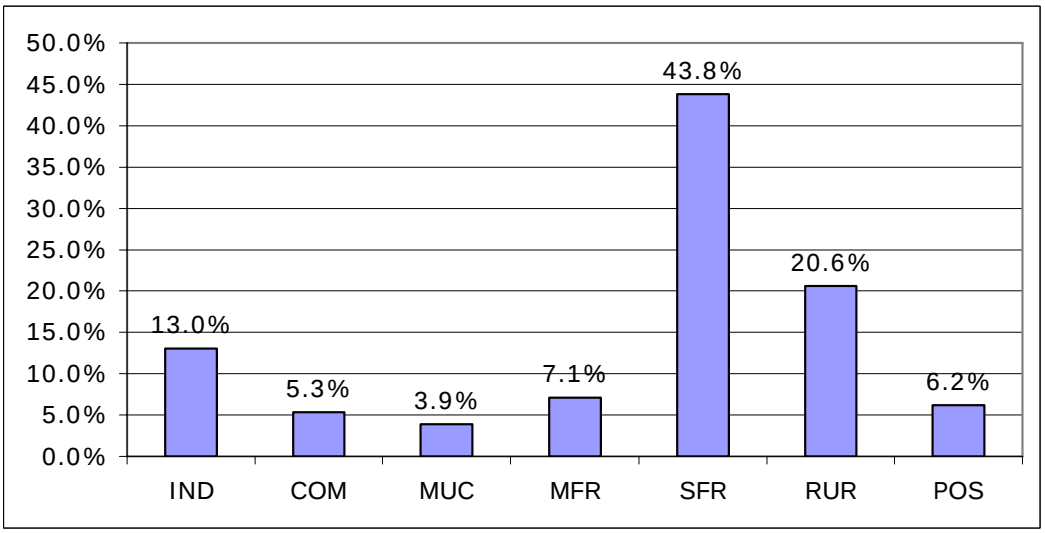
This criterion is measured by evaluating the number of acres in each zoning type affected by allow, limit and prohibit treatments.

Results

As background to the analysis of the distributional impacts of program options on land uses, Metro considered the extent to which any one zoning type bears a disproportional share of impacts from Goal 5 treatments relative to the zoning type's share of total acres in Metro's jurisdiction. Such an outcome would occur if a zoning type accounts for a larger proportion of the acres affected by a program option relative to the zoning type's proportion of total acres in Metro's jurisdiction.

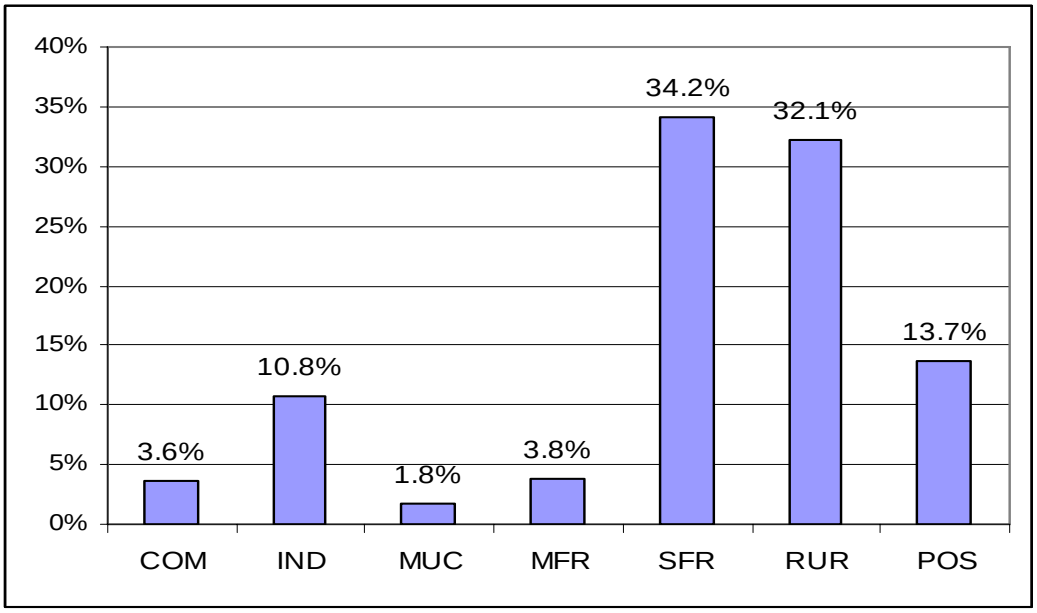
Figures 4-15 and 4-16 illustrate the relevant distributions. Figure 4-15 shows the percentage of total acres in Metro's jurisdiction by zoning type. For example, industrial lands (IND) account for 13 percent of the total acres in Metro's jurisdiction. Figure 4-16 shows the distribution of acres affected by program options, by zoning type. Industrial lands, for example, account for approximately 11 percent of the total acres affected by program options.

Figure 4-15: Percentage of total acres in Metro's jurisdiction by zoning type.



Source: ECONorthwest with data provided by Metro.

Figure 4-16: Percentage of total acres of habitat, by zoning type.



Source: ECONorthwest with data provided by Metro.

Comparing Figures 4-15 and 4-16:

- RUR and POS land uses would carry a disproportional share of the burden of Goal 5 treatments, relative to their share of total acres in Metro's jurisdiction. RUR lands account for approximately 21 percent of land but 32 percent of Goal 5 treatments. POS account for approximately 6 percent of land but 16 percent of Goal 5 treatments.
- Land uses with urban residential and business applications would shoulder a smaller share of the burden of Goal 5 treatments, relative to their proportion of total acres in Metro's jurisdiction. For example, SFR lands account for approximately 44 percent of land but only 32 percent of Goal 5 treatments. IND lands account for 13 percent of land but 11 percent of Goal 5 treatments.
- These results illustrate the interaction between the existing distributions of land uses and riparian and wildlife habitat and describe the *amount* and *type* of acres that would be affected by Goal 5 treatments. The *degree* to which any one program option would restrict land uses depends on the mix of allow, limit and prohibit treatments for that option. The following figures illustrate these impacts.

Figures 4-17, 4-18 and 4-19 illustrate the findings from Metro's analysis of social criteria based on the number of acres affected by allow, limit, and prohibit treatments for residential, business-related and rural land uses. Figure 4-17 illustrates the impacts of program options on SFR lands. Figure 4-18 shows the impacts on lands with business uses (MFR, MUC, COM, and IND). Figure 4-19 shows the impacts on RUR lands. Figure 4-20, which comes from the analysis of Economic Criterion 3, shows the impacts of Goal 5 treatments on park lands.

Figure 4-17.

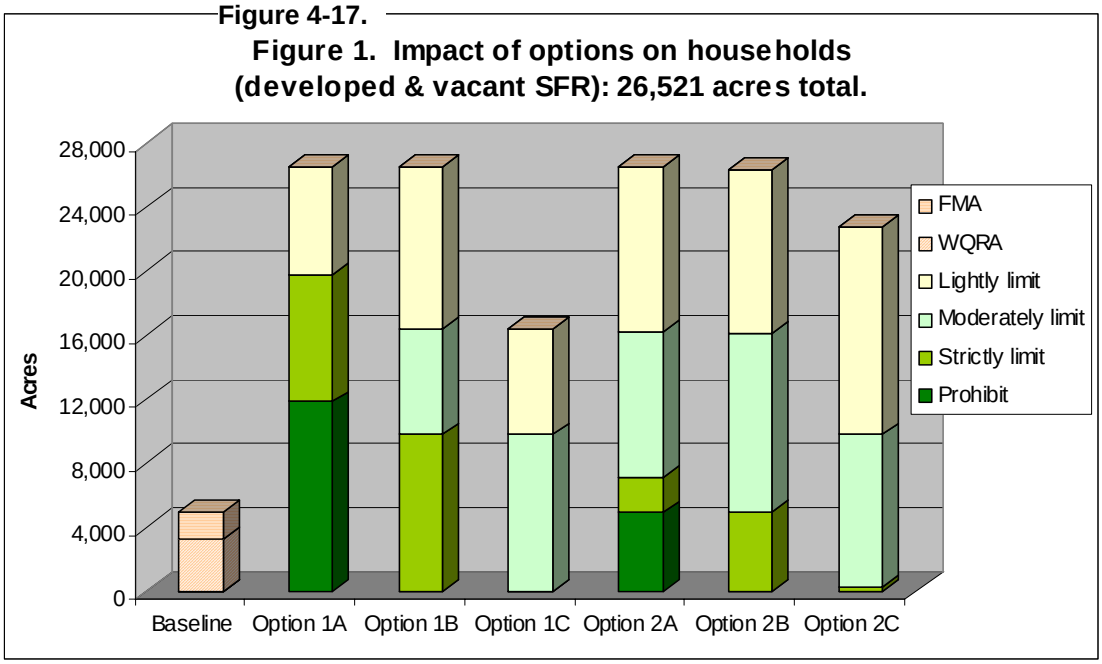


Figure 4-18. Impact of options on businesses (developed & vacant MFR, MUC, COM & IND): 15,857 acres total.

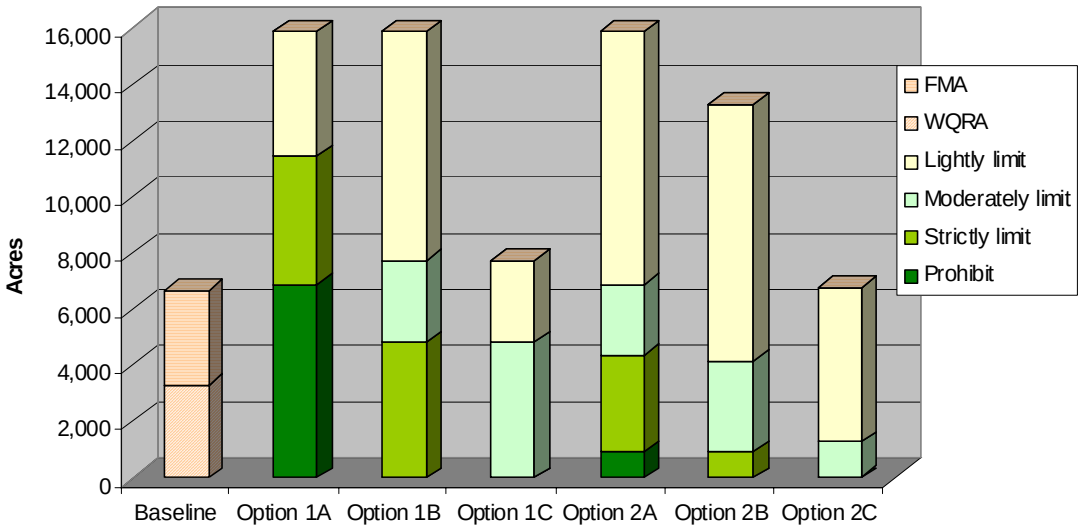


Figure 4-19. Impact of options on rural areas (developed & vacant): 26,459 acres total.

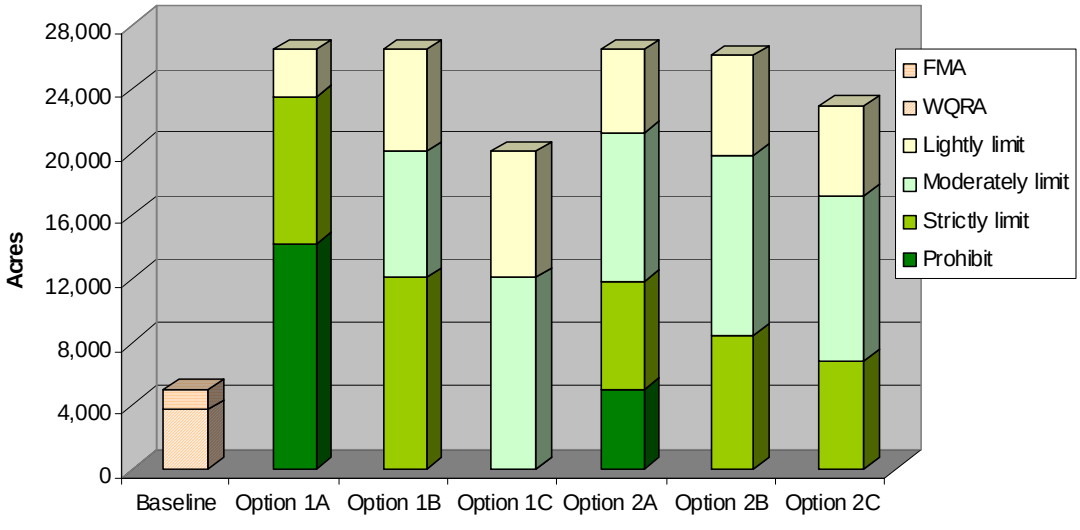
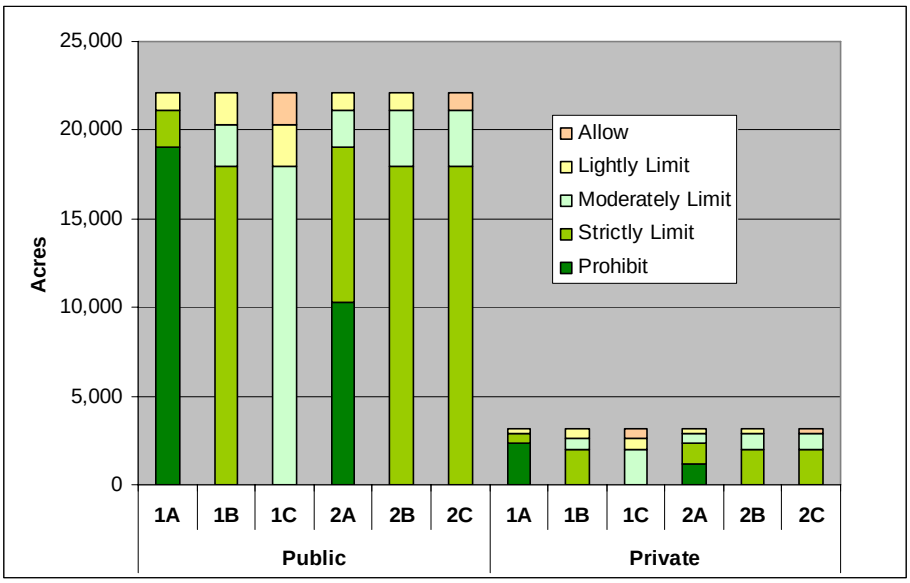


Figure 4-20: Performance of program options for parks and open space lands, by ownership



Basic Statistics

The number of acres that Goal 5 treatments would affect, by regional zone:

- SFR 26,521 acres
- MFR 2,886 acres
- MUC 1,625 acres
- COM 2,124 acres
- IND 9221 acres
- POS 13,118 acres
- RUR 26,460 acres.

Comparison of program options

- The ranking of program options, from least to most restrictive, varies little for residential, business-related, or rural land uses. In general, the program options that would restrict SFR lands the most would also restrict business-related (MFR, MUC, COM, IND) and rural (RUR) land uses the most.
- The ranking of program options for residential, business-related and rural land uses, from least to most restrictive, is 1C, 2C, 2B, 1B, 2A, and 1A. The only exception to this ranking is that for MUC and IND, 2C dominates 1C as the least restrictive option.
- The ranking of program options varies slightly for parks (POS) relative to the other regional zones. The ranking for POS, from least to most restrictive, is 1C, 1B, 2B, 2C, 2A, and 1A.
- Even though the rankings of program options would vary little among the regional zones, the limitations the program options would place on land uses would vary by regional zone. In general, the Goal 5 treatments under Criterion 4 would favor business-related land uses over POS, RUR, and SFR land uses. The non-business related land uses (POS, RUR, and SFR) would typically receive more restrictive Goal 5 treatments than would business-related land uses (MFR, MUC, COM, IND), for a given program option. For example, for option 1C,

approximately 38 percent of SFR lands would receive an allow treatment. For COM lands, 52 percent would receive an allow treatment. Option 1C ranks as the least restrictive option for both SFR and COM. See Table 4-11.

Table 4-11: Distribution of allow, limit and prohibit treatments for Option 1C by regional zone.

Treatment	SFR	MFR	MUC	COM	IND	POS	RUR
Allow	38%	52%	47%	52%	52%	9%	24%
Lightly Limit	25%	18%	19%	21%	17%	8%	30%
Moderately Limit	37%	29%	33%	27%	31%	83%	45%
Strictly Limit	0%	0%	0%	0%	0%	0%	0%
Prohibit	0%	0%	0%	0%	0%	0%	0%
Total	100%	100%[1]	100%[1]	100%	100%	100%	100%[1]

1: Total reflects rounding for the percentage by treatment.

- Among the non-business-related land uses, the ranking of regional zones from most restricted to least restricted is POS, RUR, and SFR. This ranking applies for all options.
- IND lands receive the least restrictive Goal 5 treatments of any of the regional zones.
- Among the business-related land uses, the ranking from most to least restricted is (in general) MFR, MUC, COM, and IND. This ranking applies primarily for options 2A, 2B and 2C. For example, for option 2C, approximately 71 percent of IND lands would receive an allow treatment. The comparable figures for the other business-related land uses are 25 percent for MFR, 49 percent for MUC, and 46 percent for COM. See Table 4-12.

Table 4-12: Distribution of allow, limit and prohibit treatments for Option 2C, by Regional Zone.

	SFR	MFR	MUC	COM	IND	POS	RUR
Allow	14%	25%	49%	46%	71%	0%	13%
Lightly Limit	49%	50%	47%	42%	26%	5%	21%
Moderately Limit	36%	25%	4%	12%	2%	12%	40%
Strictly Limit	1%	0%	0%	0%	0%	83%	26%
Prohibit	0%	0%	0%	0%	0%	0%	0%
Total	100%	100%	100%	100%	100%[1]	100%	100%

1: Total reflects rounding for the percentage by treatmen

t.

5. Minimizes need to expand the urban growth boundary (UGB).

In this discussion of Criterion 5, the effects of the program options on the need to expand Metro's urban growth boundary (UGB) are described. The program options that would have the least impact on the need to expand the UGB rank higher for this criterion.

Potential impacts on the need to expand the UGB

State land use laws require that Metro's UGB accommodate anticipated population and employment growth over the next twenty years. As the area's population grows and urban development intensifies, pressure to expand the UGB increases. By how much and where to expand the UGB depends on a variety of factors including population distribution, the suitability of land on the urban fringe, and the intensity of in-fill development within the existing UGB. The program options that protect fish and wildlife habitat to a greater extent may also decrease the amount of developable land available inside the UGB. As the amount of developable land inside the UGB decreases, the likelihood that the UGB will expand in response to population and development growth increases.

Previous expansions of the UGB and related developments provide a context for the analysis of the impacts of program options on the need to expand the UGB. Metro's UGB expansions and related developments include:

- In 1995, the Metro Council adopted the 2040 Growth Concept, which anticipated adding 15,000 to 19,000 acres to the UGB over 50 years.
- In 1998-99, Metro added 4,000 acres to the UGB.
- In May of 2002, voters approved ballot measure 26-29, which prohibits higher densities in existing neighborhoods. Increasing urban densities as a means of avoiding or minimizing UGB expansions cannot target existing neighborhoods and will focus instead on downtown city centers and transportation corridors.

- In December of 2002, Metro Council added 18,638 acres to the UGB, with 2,851 of these acres dedicated to employment needs.
- Metro's current deliberations on UGB expansion include a proposal to add 2,000 acres targeting industrial use.

The assumption is made in this criterion that the program options which would restrict to a greater extent the development of vacant lands would increase the likelihood of expanding the UGB. Impacts on vacant land would have the most immediate impact on vacant land because these lands provide the greatest development opportunities.

Program options that increase the likelihood of expanding the UGB may also contribute to sprawl related economic consequences, such as increased travel times, increased vehicle miles traveled with associated increased concentrations of air pollutants, and increased costs of extending or expanding roads, water and sewer infrastructure. Program options that minimize UGB expansions by promoting development within the existing UGB may minimize sprawl related costs but may generate other economic consequences. For example, developing lands within the existing UGB, at the expense of riparian and wildlife habitat, would reduce the concentrations or availability of habitat related ecosystem services near population centers. In effect, development would push these resources and associated ecosystem services further out to the urban fringe away from employment and population concentrations.

Measuring the criterion

Table 4-2 in Criterion 1 (supports urban development priorities) shows the number of acres of lands in the four urban development categories (high, medium, low, and other) affected by allow, limit, and prohibit treatments for the six program options. It also shows impacts by development status including vacant lands inside and outside Title 3 protection. The analysis for this criterion uses the data in Table 4-2.

Results

Comparison of program options

Lands with high urban development value

- Option 2C provides the least restrictive impact on vacant lands inside and outside Title 3 and would have the least likelihood of promoting UGB expansions of the six program options.
- In ascending order of increasing restrictions on vacant lands outside Title 3 and increasing the likelihood of UGB expansions—the remaining options rank: 2B, 1C, 2A, 1B, and 1A. This ranking also reflects the outcome for lands inside Title 3 except that Options 2A and 1B perform comparably rather than 2A performing better 1B.

Lands with medium urban development value

- The results for lands with medium urban development value reflect the outcome for lands with high value.

Lands with low urban development value

- Option 1C performs better than the other options under this criterion in that it would have the least restrictive impact on vacant lands inside and outside Title 3, and would be the least likely to promote UGB expansions of the six program options.

- In ascending order of increasing restrictions on vacant lands outside Title 3, and increasing likelihood of promoting UGB expansions, the remaining options rank: 2C, 2B, 1B, 2A, and 1A. This ranking also reflects the outcome for lands inside Title 3 except that Options 2B and 1B have about the same effect rather than 2B dominating 1B.

Other lands

- Option 1C also performs better under this criterion for park land and rural inside and outside Title 3.
- In ascending order of increasing restrictions on vacant lands outside Title 3, and increasing likelihood of promoting UGB expansions, the remaining options rank: 1B, 2C and 2B are comparable, 2A, and 1A. This ranking also reflects the outcome for lands inside Title 3 except that Option 1B performs similarly to Options 2C and 2B rather than dominating these options.

Summary

Table 4-13 summarizes the ranking of the performance of the program options based on the average outcomes for the total acres in the analysis. This summary weighs more heavily the impacts on vacant lands ranked low and other lands because these rankings contain more acres of land than do vacant lands with high or medium rankings.

Table 4-13: Performance of options in meeting Economic Criterion 5: minimizes the need to expand the UGB.

Rank	Option	Performance
1	1C	Option 1C provides the greatest support for developing vacant land among the six options and will least likely promote UGB expansions. It has the greatest number of acres affected by allow treatments, which have no negative impacts on development, and no acres affected by strictly limit or prohibit treatments.
2	2C	Option 2C is second only to Option 1C in supporting the development of vacant lands and in the number of acres affected by allow treatments. No acres affected by prohibit treatments.
3	2B	Option 2B supports developing vacant land to a greater extent than does Option 1B because the allow treatments in this option generate no negative development impacts and there are no negative impacts from prohibit treatments.
4	1B	All Goal 5 treatments for Option 1B would have some negative impact on developing vacant land. Option 2B dominates 1B because it has allow treatments for high-valued vacant land. 1B has no allow treatments. This option supports developing vacant land to a greater extent than do Options 2A and 1A primarily because it has no negative impacts from prohibit treatments.
5	2A	Option 2A would have a slightly more negative impact on developing vacant lands, and thus promote UGB expansions to a greater extent, than Option 1B because of the negative impacts associated with prohibit treatments.
6	1A	Option 1A has the greatest negative impact from prohibit and strictly limit treatments and the greatest negative impact overall on developing vacant land of the six options. This option would likely promote UGB expansions to a greater extent than the other options.

Evaluation of social criteria

The Goal 5 process requires local governments to make a decision to allow, limit, or prohibit conflicting uses to protect fish and wildlife habitat based on balancing the consequences of the four ESEE factors. Based on the analysis of social consequences in Phase I, Metro developed five criteria to measure the performance of the six regulatory program options in addressing the potential social impacts. These criteria are:

1. Minimizes impact on property owners,
2. Minimizes impact on location and choices for housing and jobs,
3. Preserves habitat for future generations,
4. Maintains cultural heritage and sense of place, and
5. Preserves amenity value of habitat.

Some of the key questions considered in the analysis were:

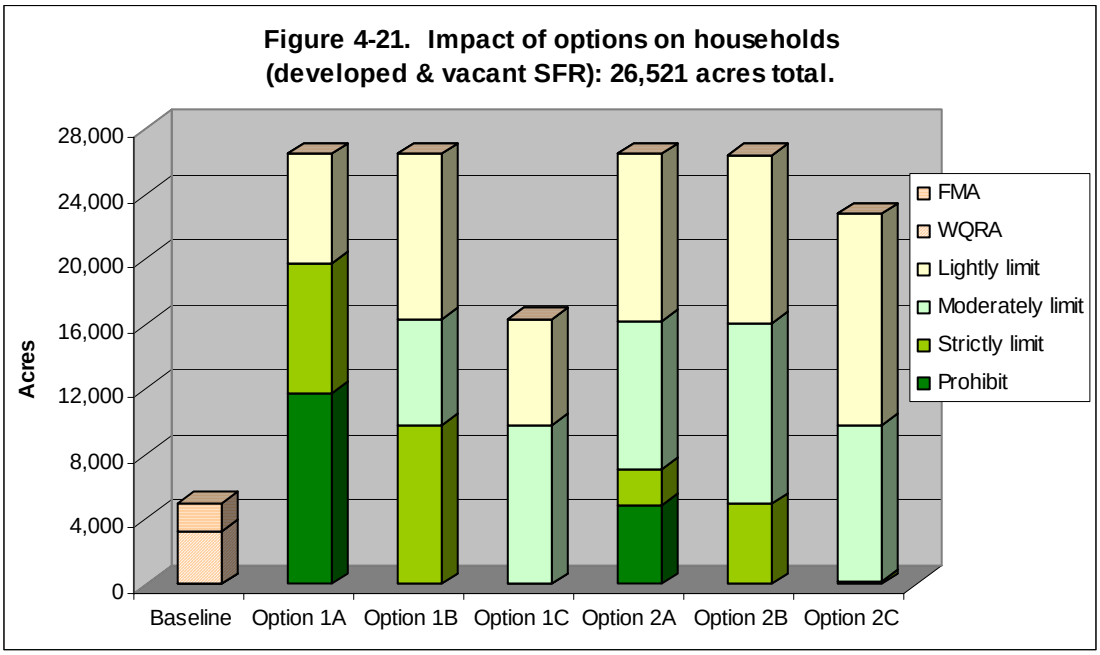
- How much of the habitat and impact areas are affected?
- How much of the habitat land is already protected to some extent by the baseline?
- Do the effects differ by habitat class?
- Do the effects differ by urban development values?
- What would be affected by a decision to "allow" or 'lightly limit" the impact areas?

1. Minimizes impact on property owners

Property ownership and land use regulations are sensitive issues central to habitat protection. Landowners may be concerned about impacts to property rights, takings issues, and the distribution of the burden of protecting habitat. Other landowners may be supportive of protection programs despite being personally affected for several reasons including an appreciation of habitat and the wish to see it remain in addition to the increased property values that can result from trees and proximity to water. For this criterion the data is analyzed by three main groups: households, businesses, and rural areas. It should be noted that, because treatments may be applied to only a portion of a lot, and several treatments could apply to the same lot, considering the acres affected by each treatment might produce statistics that tend to magnify potential impacts greater than they likely would be felt. Metro has already stated that potential regulations will not be imposed on particular, buildable lots if the result would be to render such lots unbuildable.

Potential impact on households

For residential land in particular, personal financial security or the expectation to maintain, develop or redevelop land within the existing regulatory framework could be impacted by a program option. A decision to allow, limit, or prohibit conflicting uses in fish and wildlife habitat has an impact on individual landowners. Thirty-four percent of the habitat lands are located in areas zoned for single-family residential uses, a third of which is in impact areas. Many residential properties are on small lots, thus options impacting more residential land could affect a large number of property owners, when compared to business and rural properties that have large lots. Figure 4-21 shows the distribution of the treatments on residential land (developed and undeveloped) for each option.



Results

The following observations are made from Figure 4-21 above.

Basic statistics & baseline protection

- 34 percent (26,521 acres) of habitat and impact areas are SFR.
- A third of the 26,521 acres of SFR land in Figure 4-21 is in impact areas, two-thirds has habitat value.
- SFR lands are distributed across all habitat classes.
- Most SFR lands fall in the low urban development value category.
- Baseline protection only covers a small portion of single-family land, with WQRA restrictions applied to about 10 percent and an additional five percent covered by FMA design guidelines.

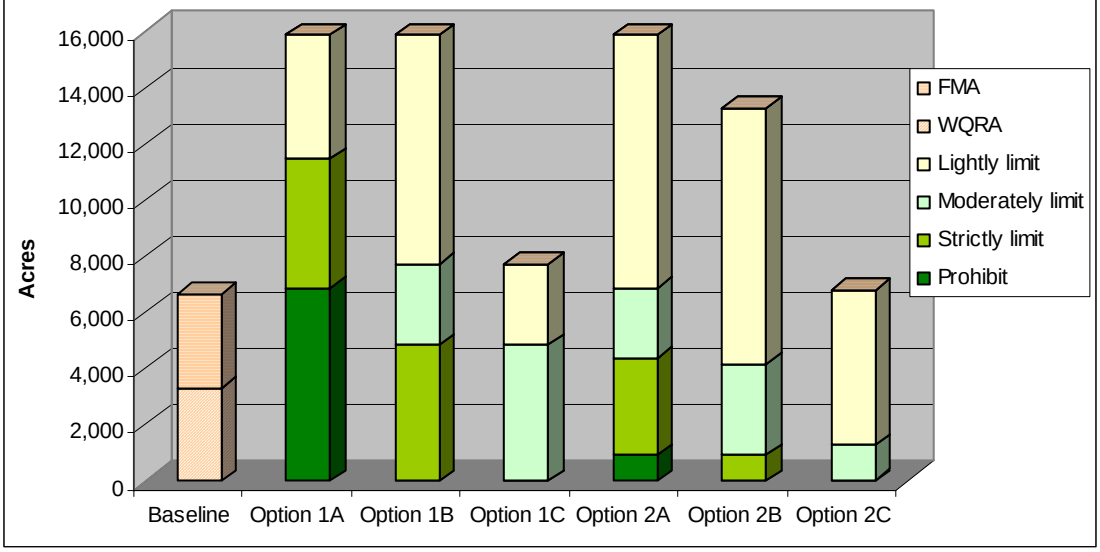
Comparison of options

- The urban development value options (2A-C) apply more stringent treatments to SFR lands than most other zoning types; while the habitat based options (1A-C) apply treatments to zoning types depending on habitat value.
- Option 1C, followed closely by 2C, has the least stringent treatments applied to the largest acreage of land zoned for single-family uses.
- Options 1A, 1B, 2A, and 2B each would apply some type of limit or prohibit decision to ***all*** land zoned for single-family with significant habitat.
- Option 1A would have the most impact on households, applying a prohibit treatment to 40 percent of the land, a strictly limit treatment to about 30 percent, and lightly limit to the remaining 30 percent (the impact areas).

Potential impact on businesses

Land used for business purposes, whether developed or vacant, would also be impacted by any of the regulatory program options. For developed land, the impact would be in the future if a property owner chose to redevelop and was required to follow new Goal 5 regulations. Reducing development opportunities and/or requiring specific habitat friendly development practices could impact vacant land. Restrictions on development could have an overall impact on the regional economy, (see economic criteria). Most business land includes commercial and industrial properties and apartment complexes located on large lots. This reduces the number of property owners potentially impacted. Figure 4-22 below shows the distribution of the treatments on land used for businesses (developed and undeveloped) for each option. Land used for businesses includes multi-family (MFR), mixed-use centers (MUC), commercial (COM), and industrial (IND).

Figure 4-22. Impact of options on businesses (developed & vacant MFR, MUC, COM & IND): 15,857 acres total.



Observations

The following observations are made from Figure 4-22 above.

Basic statistics & baseline protection

- Seventeen percent (15,857 acres) of total habitat and impact areas are zoned for business purposes.
- A third of the 15,857 acres of business land is in impact areas, two-thirds have habitat value.
- Baseline protection covers almost 40 percent of land used for business purposes, with WQRA restrictions applied to close to 20 percent and an additional 20 percent covered by FMA design guidelines.
- About 25 percent of business land contains the highest value riparian and wildlife habitat.

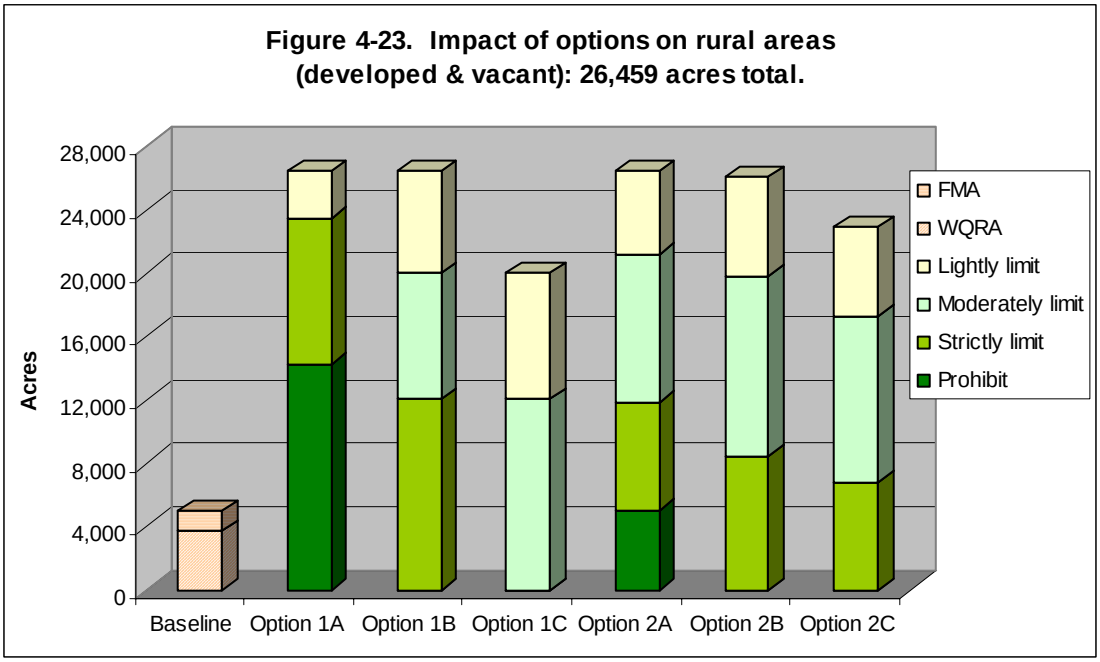
Comparison of options

- The urban development value options (2A-C) apply less stringent treatment to most business land; while the habitat based options (1A-C) apply treatments to zoning types depending on the habitat value.
- Option 2C, followed by 1C, has the least stringent treatments applied to the largest acreage of land zoned for businesses. Over 50 percent of business land receives an allow treatment in 2C.
- Option 2B provides substantially more protection than 1C and 2C, but less than 1A, 1B and 2A since about 20 percent of the land would receive an allow treatment.
- Options 1A, 1B and 2A each would apply some type of limit or prohibit decision to ***all*** land zoned for businesses with significant habitat.
- Option 1A would have the most impact on businesses with significant habitat, applying a prohibit treatment to over 40 percent of the land, strictly limit to about 30 percent, and lightly limit to the remaining 30 percent (impact areas).

Potential impact on rural areas

Much of the regionally significant fish and wildlife habitat falls on rural land, over 26,000 acres. Rural properties tend to be larger than those in other zones, impacting a smaller number of property owners but a large number of acres. Land uses include some residential and a substantial amount of farming and timber production. Farm and forestry practices have special regulations under Senate Bill 1010 and are not regulated by Metro. However, if these properties were urbanized in the future they would be subject to a regional fish and wildlife habitat protection program if those areas were to eventually become urbanized. Figure 4-23 shows how rural areas might be impacted by the six regulatory program options and how much of the rural landscape is covered by the baseline regulations.

Figure 4-23. Impact of options on rural areas (developed & vacant): 26,459 acres total.



Results

The following observations are made from Figure 4-23 above.

Basic statistics & baseline protection

- Twenty-eight percent (26,459 acres) of total habitat and impact areas are in rural areas.
- About 15 percent of the 26,459 acres of rural land is in the impact area, 85 percent has habitat value.
- Baseline protection only covers about 15 percent of rural land, with WQRA restrictions applied to about 10 percent and close to five percent covered by FMA design guidelines.
- Over 40 percent of rural land contains the highest value riparian and wildlife habitat.
- Urban development values apply to rural zoning with design types that fall inside Metro's urban growth boundary.

Comparison of options

- The urban development value options (2A-C) apply the most stringent treatments to rural areas that do not have a design type; while the habitat based options (1A-C) apply treatments to zoning types depending on the habitat value.
- Option 1C, followed by 2C, has the least stringent treatments applied to the largest acreage of rural land.
- Option 2B would apply an allow treatment to about two percent of rural lands, otherwise it is similar to 1B in the treatments applied.
- Options 1A, 1B and 2A each would apply some type of limit or prohibit decision to ***all*** rural land with significant habitat.
- Option 1A would have the most impact on rural land with significant habitat, applying a prohibit treatment to about 50 percent of the land, strictly limit to about 35 percent, and lightly limit to the remaining 15 percent.

Performance of options

All six regulatory options have some impact on landowners. The options that apply more stringent treatments to a larger part of the landscape have more of an impact than the options that apply lightly limit or allow treatments. The affect of applying the urban development values in Options 2A-C benefits business land substantially more than single-family residential and rural areas. In addition, the Metro Council's commitment not to adopt a program that would render currently buildable lots as unbuildable also moderates, to some degree, the impact that any option would have on property owners.

Table 4-14. Performance of options in meeting Social Criterion 1: minimizes impact on property owners.

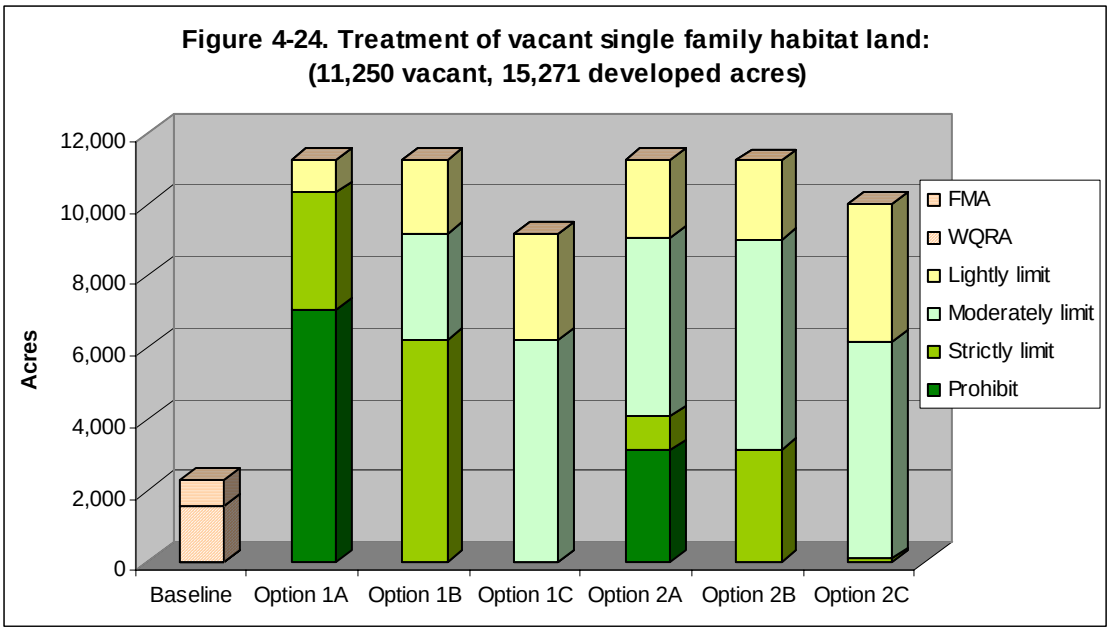
Rank	Option	Performance
1	Option 1C	This option affects the fewest property owners with stringent treatments.
2	Option 2C	Most business land receives an allow treatment under this option but a substantial number of residential and rural property owners are affected.
3	Option 2B	Urban development values reduce amount of business land receiving strict treatments but residential and rural areas receive strictly and moderately limit treatments.
4	Option 1B	This option affects the same number of property owners as Options 1A and 2A, but none would receive a prohibit treatment and a larger number would receive lightly limit.
5	Option 2A	Despite applying urban development values, this option affects a large number of property owners with stringent treatments, especially in residential and rural areas.
6	Option 1A	This option affects the most property owners with the highest level of restrictions.

2. Reduces impact on types/locations of jobs and housing

The urban land supply is a social issue because it relates to people's basic needs for housing, jobs and urban services. A constriction of the existing land supply could negatively affect the social needs these lands serve (e.g., housing and employment). An urban growth boundary (UGB) expansion could offset the impacts, but urbanizing rural land spreads the development pattern towards the periphery of the region. This could increase travel times and congestion and could encroach further on fish and wildlife habitat in rural areas.

Potential impact on housing location and choices

Residential zones (SFR and MFR) make up the largest component of buildable land in the fish and wildlife habitat inventory. The types of housing opportunities available may change depending on habitat protection. Rather than reduce the number of housing units allowed on a lot, regulations may allow for the same units in a denser configuration, such as rowhouses, condominiums, or apartments. Clustering units on smaller lots in a subdivision may allow fish and wildlife habitat to be preserved. However, these potential changes have social impacts. Many people who might choose to purchase or rent a single-family home with a yard may not view these other housing options as equivalent. The location of the housing is important as well. Housing opportunities closer to existing employment, shopping, and entertainment will not be replaced by residentially zoned land in areas on the urban fringe. Housing affordability may also be affected if protecting fish and wildlife habitat results in changes to the land supply. Figures 4-24 and 4-25 show how the options treat vacant single and multi-family land as compared to the baseline.


Figure 4-24. Treatment of vacant single family habitat land:
(11,250 vacant, 15,271 developed acres)
Acres
12,000
10,000
8,000
6,000
4,000
2,000
0
Baseline
Option 1A
Option 1B
Option 1C
Option 2A
Option 2B
Option 2C
FMA
WQRA
Lightly limit
Moderately limit
Strictly limit
Prohibit

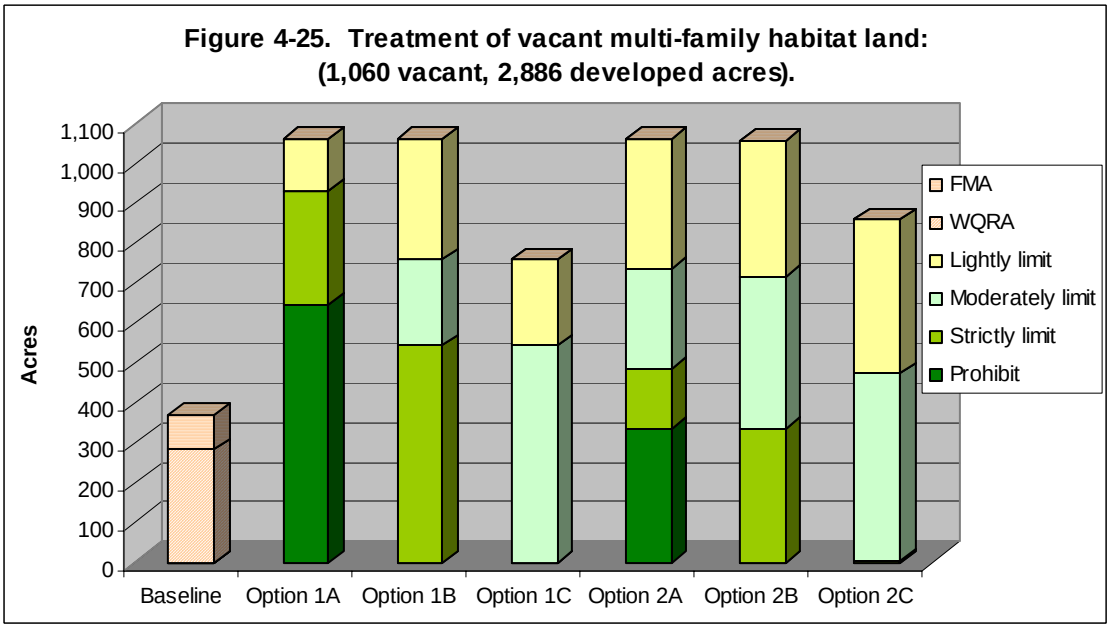

Figure 4-25. Treatment of vacant multi-family habitat land:
(1,060 vacant, 2,886 developed acres).
Acres
1,100
1,000
900
800
700
600
500
400
300
200
100
0
Baseline
Option 1A
Option 1B
Option 1C
Option 2A
Option 2B
Option 2C
FMA
WQRA
Lightly limit
Moderately limit
Strictly limit
Prohibit

Table 4-15. Vacant residential land: acres potentially affected.

	Status of vacant land	Allow		Lightly limit		Moderately limit		Strictly limit		Prohibit	
		SFR	MFR	SFR	MFR	SFR	MFR	SFR	MFR	SFR	MFR
Option 1A	**Inside Title 3**	0	0	63	16	0	0	33	7	2,214	348
	Outside Title 3	0	0	851	114	0	0	3,256	278	4,833	297
	% covered by baseline	*0.0%*	*0.0%*	*6.9%*	*12.3%*	*0.0%*	*0.0%*	*1.0%*	*2.5%*	*31.4%*	*54.0%*
Option 1B	**Inside Title 3**	0	0	85	19	297	47	1,927	304	0	0
	Outside Title 3	0	0	1,960	282	2,676	168	4,304	238	0	0
	% covered by baseline	*0.0%*	*0.0%*	*4.2%*	*6.3%*	*10.0%*	*21.9%*	*30.9%*	*56.1%*	*0.0%*	*0.0%*
Option 1C	**Inside Title 3**	85	19	297	47	1,927	304	0	0	0	0
	Outside Title 3	1,960	282	2,676	168	4,304	238	0	0	0	0
	% covered by baseline	*4.2%*	*6.3%*	*10.0%*	*21.9%*	*30.9%*	*56.1%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Option 2A	**Inside Title 3**	0	0	88	20	39	16	386	86	1,797	249
	Outside Title 3	0	0	2,071	305	4,980	236	572	62	1,318	86
	% covered by baseline	*0.0%*	*0.0%*	*4.1%*	*6.2%*	*0.8%*	*6.3%*	*40.3%*	*58.1%*	*57.7%*	*74.3%*
Option 2B	**Inside Title 3**	5	1	145	29	362	92	1,797	249	0	0
	Outside Title 3	9	2	2,080	315	5,499	286	1,352	86	0	0
	% covered by baseline	*35.7%*	*33.3%*	*6.5%*	*8.4%*	*6.2%*	*24.3%*	*57.1%*	*74.3%*	*0.0%*	*0.0%*
Option 2C	**Inside Title 3**	84	8	409	110	1,762	248	55	5	0	0
	Outside Title 3	1,138	193	3,442	276	4,319	219	41	0	0	0
	% covered by baseline	*6.9%*	*4.0%*	*10.6%*	*28.5%*	*29.0%*	*53.1%*	*57.3%*	*100.0%*	*0.0%*	*0.0%*

Results

The following observations are made from Figures 4-24 and 4-25, and Table 4-15.

Basic statistics and baseline protection

- Thirteen percent of habitat and impact areas comprise vacant residential land (SFR and MFR).
- Baseline protection only covers about 17 percent of vacant single-family land and about 30 percent of multi-family land. More restrictive WQRA restrictions are applied to about 10 percent of SFR land and a little over 20 percent of MFR land. An additional seven percent of SFR and eight percent of MFR are covered by FMA design guidelines.

Comparison of options

- Applying urban development values (options 2A-C) does not substantially change treatments applied to residential land.
- *Minimum impact:* Option 1C, followed by 2C, would apply the least stringent treatments to the largest acreage of residential land (both SFR and MFR). 2,346 acres (SFR & MFR) in option 1C and 1,423 acres in 2C would receive an allow treatment.
- *Maximum impact:* a prohibit designation would affect 7,700 acres in 1A and 3,450 acres in 2A of vacant SFR & MFR.
- Options 1A, 1B and 2A each would apply some type of limit or prohibit decision to ***all*** residential land with significant habitat.
- Option 1A would have the most impact on residential land with significant habitat, applying a prohibit treatment to almost 60 percent of SFR and over 55 percent of MFR,

strictly limit to about 30 percent (both SFR and MFR), and the remaining acres would receive a lightly limit treatment.

- Option 2A is more restrictive on MFR than SFR: about 40 percent of MFR is covered by prohibit and strictly limit treatments compared to about 30 percent of SFR.
- As described above, some of the vacant residential land is already covered by baseline regulations that limit housing location and development options. Limit and prohibit treatments would have less impact in those areas.
- All options apply a lightly limit treatment to some portion of the vacant residential land. A small percentage is already covered by baseline regulations in all options, but in options 1C and 2C over 20 percent of MFR land that receives a lightly limit treatment is covered by baseline, reducing the impact.
- All options except for 1A apply a moderately limit treatment to some portion of the vacant residential land with significant habitat. In options 1C and 2C over 50 percent of land receiving a moderately limit treatment is covered by baseline regulations, reducing the impact.
- All options except for 1C apply a strictly limit treatment to some portion of the vacant residential land with significant habitat. In 1A only a small percentage of land receiving strictly limit is covered by baseline, but in all other options the area covered by baseline that receives strictly limit ranges from 31 percent to 100 percent, reducing the impact.
- Only options 1A and 2A apply a prohibit treatment to vacant residential land with significant habitat. A significant portion of the habitat that would receive a prohibit treatment is covered by baseline, especially in 2A with 58 percent of SFR and 74 percent of MFR, reducing the impact.

Jobs

Employment opportunities typically occur on land that is zoned for commercial, industrial, or institutional uses. Vacant land zoned for commercial, industrial, or mixed-use development makes up 28 percent of the land within the fish and wildlife habitat inventory, and almost half is not constrained by Title 3. The location of these lands is an important factor in determining the social impact of allowing, limiting, or prohibiting use in these areas. Metro is able to add land to the UGB if employment capacities are reduced due to habitat protection.

However, it is important to consider the social impacts of adding employment land on the urban fringe. Will job opportunities located in newly developed areas be equivalent to lost opportunities located near existing concentrations of housing? Residents choosing to work in locations further from their homes will incur additional travel expenses as well as a reduction in quality of life due to more time spent commuting and away from home. Additionally, the types of jobs may be different, as a company that might choose to locate in an existing commercial or industrial area may not choose to move to a new location. Figure 4-26 graphically depicts the treatments for vacant employment land by option as compared to the baseline. Table 4-16 provides additional information on the existing environmental constraints on vacant employment land and the increment of regulations added by option.

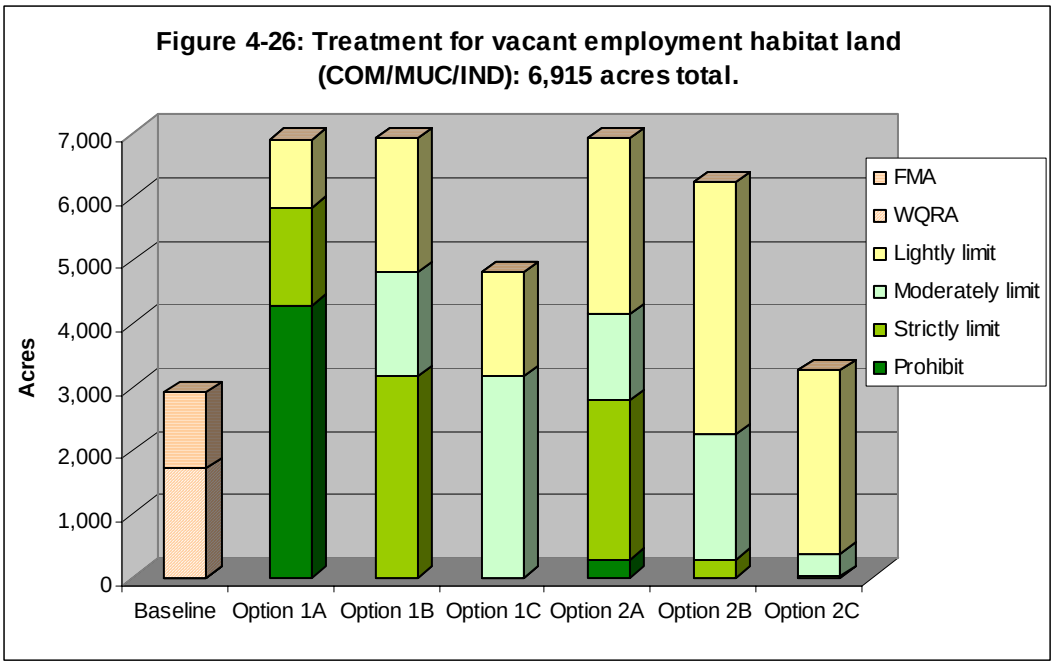


Table 4-16. Vacant employment land: acres potentially affected.

	Status of vacant land	Allow		Lightly limit		Moderately limit		Strictly limit		Prohibit	
		COM/ MUC	IND	COM/ MUC	IND	COM/ MUC	IND	COM/ MUC	IND	COM/ MUC	IND
Option 1A	**Inside Title 3**	0	0	21	162	0	0	7	78	572	2,077
	Outside Title 3	0	0	229	671	0	0	486	964	599	1,046
	% covered by baseline	*0.0%*	*0.0%*	*8.4%*	*19.4%*	*0.0%*	*0.0%*	*1.4%*	*7.5%*	*48.8%*	*66.5%*
Option 1B	**Inside Title 3**	0	0	26	235	133	458	442	1,624	0	0
	Outside Title 3	0	0	511	1,328	370	678	433	676	0	0
	% covered by baseline	*0.0%*	*0.0%*	*4.8%*	*15.0%*	*26.4%*	*40.3%*	*50.5%*	*70.6%*	*0.0%*	*0.0%*
Option 1C	**Inside Title 3**	26	235	133	458	442	1,624	0	0	0	0
	Outside Title 3	512	1,328	370	678	433	676	0	0	0	0
	% covered by baseline	*4.8%*	*15.0%*	*26.4%*	*40.3%*	*50.5%*	*70.6%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Option 2A	**Inside Title 3**	0	0	28	259	85	442	366	1,514	121	101
	Outside Title 3	0	0	690	1,783	364	479	215	403	46	18
	% covered by baseline	*0.0%*	*0.0%*	*3.9%*	*12.7%*	*18.9%*	*48.0%*	*63.0%*	*79.0%*	*72.5%*	*84.9%*
Option 2B	**Inside Title 3**	2	120	141	1,224	337	872	121	101	0	0
	Outside Title 3	66	491	799	1,814	405	359	46	18	0	0
	% covered by baseline	*2.9%*	*19.6%*	*15.0%*	*40.3%*	*45.4%*	*70.8%*	*72.5%*	*84.9%*	*0.0%*	*0.0%*
Option 2C	**Inside Title 3**	86	1,187	393	1,021	120	104	2	4	0	0
	Outside Title 3	561	1,812	650	827	105	41	1	3	0	0
	% covered by baseline	*13.3%*	*39.6%*	*37.7%*	*55.2%*	*53.3%*	*71.7%*	*66.7%*	*57.1%*	*0.0%*	*0.0%*

Results

The following observations are made from Figure 4-26 and Table 4-16.

Basic statistics and baseline protection

- Seven percent of habitat and impact areas are vacant and zoned for employment (MUC, COM, IND).
- Baseline protection covers about 40 percent of the vacant employment land in the habitat inventory. More restrictive WQRA restrictions are applied to about 20 percent of employment land; about 18 percent is covered by FMA design guidelines.

Comparison of options

- Applying urban development values (options 2A-C) substantially changes treatments applied to employment land.
- *Minimum impact:* Option 2C has the least impact on job location and choices, as it applies an allow treatment to 3,646 acres of vacant employment land.
- *Maximum impact:* Applying urban development values reduces the number of vacant acres that would receive a prohibit treatment from 4,300 in 1A to 286 in 2A.
- Options 1A, 1B and 2A each would apply some type of limit or prohibit decision to ***all*** employment land.
- Option 1A would have the most impact on employment land, applying a prohibit treatment to almost 60 percent, strictly limit to a little over 20 percent, and lightly limit to the remaining 20 percent (impact areas).
- As described above, some of the vacant employment land is already covered by baseline regulations that limit job location and development options. Limit and prohibit treatments would have less impact in those areas
- The urban development value options (2A-C) apply stricter treatments to more land that is already covered by baseline than the habitat-based options (1A-C), reducing the potential impact on jobs.
- Most of the vacant employment land that would receive a prohibit treatment in Option 2A is already covered by baseline regulations. Similarly, in Option 1A a substantial portion of the land that would receive a prohibit treatment is covered by baseline.

Performance of options

All six regulatory options have some impact on housing and job location and choices. The options that apply more stringent treatments to a larger part of the landscape are likely to have more of an impact than the options that apply lightly limit or allow treatments. Applying the urban development values in Options 2A-C benefits employment land more than residential land.

Table 4-17. Performance of options in meeting Social Criterion 2: Jobs and housing location and choices.

Rank	Option	Performance
1	Option 2C	Employment land benefits the most from the application of the urban development values, however residential land would receive almost as the same treatments as in Option 1C.
2	Option 1C	Residential land fares better under this option but employment land is substantially more impacted than in Option 2C.
3	Option 2B	Urban development values affect the amount of employment land receiving stringent treatments; residential land receives some benefit as well.
4	Option 1B	This option applies a similar level of protection to residential and employment land.
5	Option 2A	Employment land fares substantially better than residential land under this option.
6	Option 1A	This option has a significant effect on the location and choices available for jobs and housing.

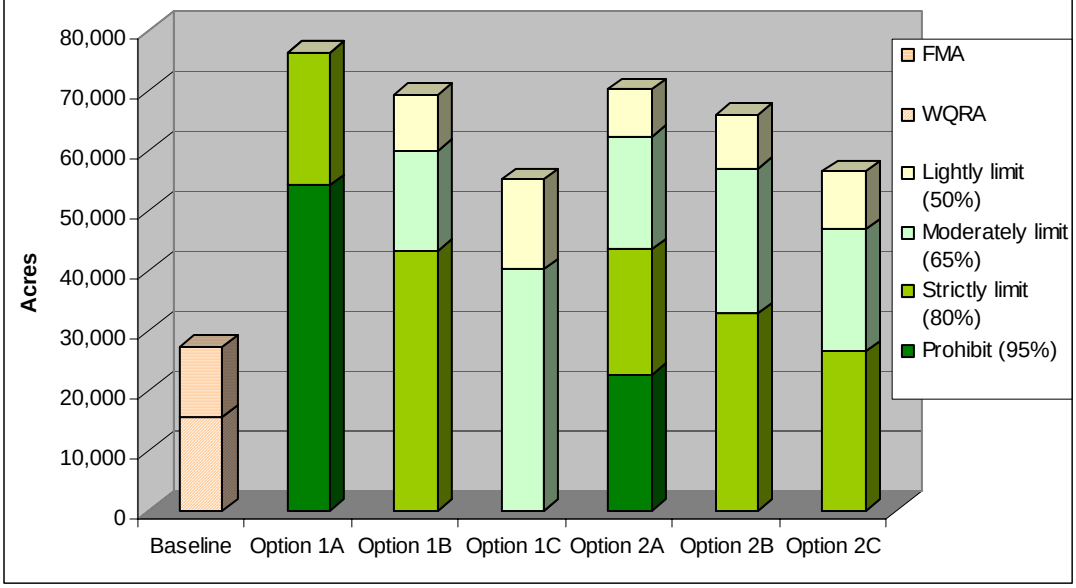
3. Preserves resources for future generations

An important social responsibility for people today is to preserve resources for future generations. The Iroquois Confederacy stated: "In every deliberation, we must consider the impact of our decisions on the next seven generations." This criterion is based on the concept that our children and grandchildren should be able to enjoy the resources we do now, from the perspective of species diversity and environmental quality as well as the potential economic benefits derived from fish and wildlife habitat. An example is the plethora of pharmaceutical applications found in the natural world, from the Amazon jungle to the cancer fighting agents found in the yew tree.

One way to assess the performance of each option in addressing this criterion is the total number of habitat acres protected. An allow treatment can be assumed to protect zero acres and therefore is not shown in Figure 4-27 on the following page, while a prohibit treatment can be assumed to do a substantial job of protecting habitat where applied. The three types of limit protect the habitat to varying degrees.

While the role of restoration is important for the environmental health of the future, Environmental Criterion 1 addresses this. Opportunities for restoration are best addressed by options that protect existing habitat.

Figure 4-27. Potential habitat protected by option (includes developed and vacant land - ALP assumptions applied to vacant land; does not include impact area).



Results

The following observations are made from Figure 4-27.

Basic statistics and baseline protection

- All habitat land is included in this criterion, 80,234 acres.
- Baseline protection covers about 30 percent of the habitat inventory (not including impact areas), or 27,300 acres. More restrictive WQRA restrictions are applied to about 15 percent of habitat land; about 15 percent is covered by FMA design guidelines.

Comparison of options

- Applying ALP disturbance area assumptions to the base of 80,234 acres results in varying levels of habitat protection. This ranges from a minimum of 41,000 acres protected in Option 1C to a maximum of 72,000 acres in Option 1A.
- Options 1A and 2A would apply the stringent treatments to the most acres, preserving the most habitat for future generations.
- Option 1C leaves the most habitat at risk for loss to future generations.

Performance of options

All six regulatory options protect some habitat for future generations. The options that apply more stringent treatments to a larger part of the landscape would preserve more habitat and potential for restoration.

Table 4-18. Performance of options in meeting Social Criterion 3: Preserves habitat for future generations.

Rank	Option	Performance
1	Option 1A	Preserves the most habitat for future generations by applying strict treatments to all habitat types.
2	Option 2A	Applying urban development values reduces the amount of habitat preserved but this option still protects a substantial amount of habitat.
3	Option 1B	A moderate level of protection is applied across the landscape, focused on high value habitat.
4	Option 2B	Close to the same level of protection as 1B, but more habitat is left unprotected in areas of high urban development value.
5	Option 2C	Habitat in areas of high urban development value is not preserved, more protection than Option 1C.
6	Option 1C	Leaves the most habitat at risk for loss to future generations, also reduces potential for restoration.

4. Maintains cultural heritage and sense of place

Protection of fish and wildlife habitat preserves many important social values. These include our cultural heritage, regional identity, sense of place, and neighborhood character. Opportunities for education abound in areas with healthy fish and wildlife habitat. Part of the region's cultural heritage is the retention of the salmon and other endangered species. The salmon are a ubiquitous symbol for the Pacific Northwest, and a key aspect of Native American culture. It is difficult to measure how well these more ambiguous values are retained by the application of the six potential program options. As a proxy for a more specific quantitative measure, retention of Habitats of Concern and Riparian/wildlife Class I habitat is used to assess how well each option addresses this criterion (the same measurements are used in Environmental Criterion 5). Habitats of Concern are places that have been identified by local field biologists and other experts as providing habitat for critical species, while Class I riparian areas are essential to providing habitat for threatened and endangered salmon, as well as birds, deer and other wildlife that are of cultural importance in the region.

Figure 4-28. Treatment of Habitats of Concern by option (developed & vacant): 25,822 acres.

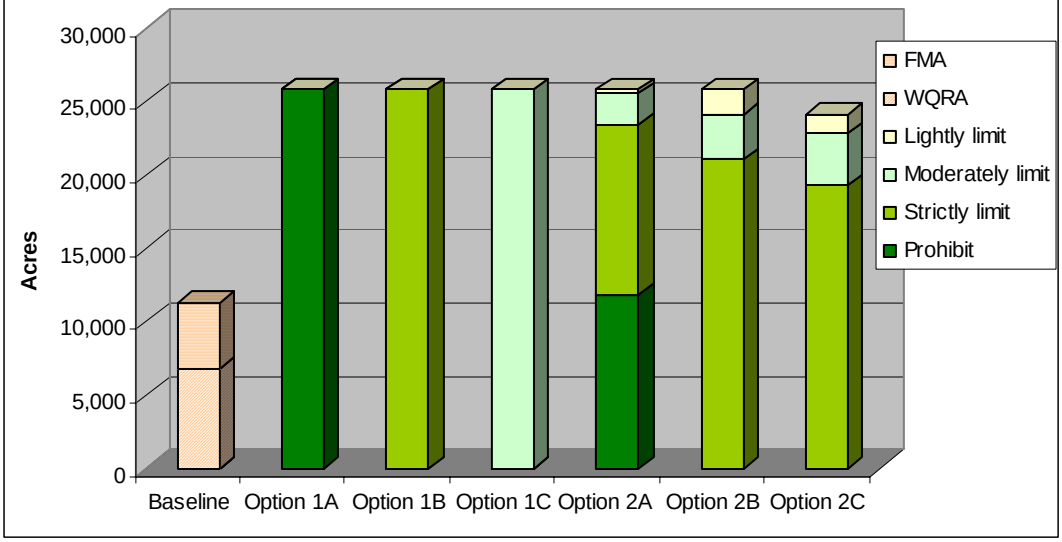
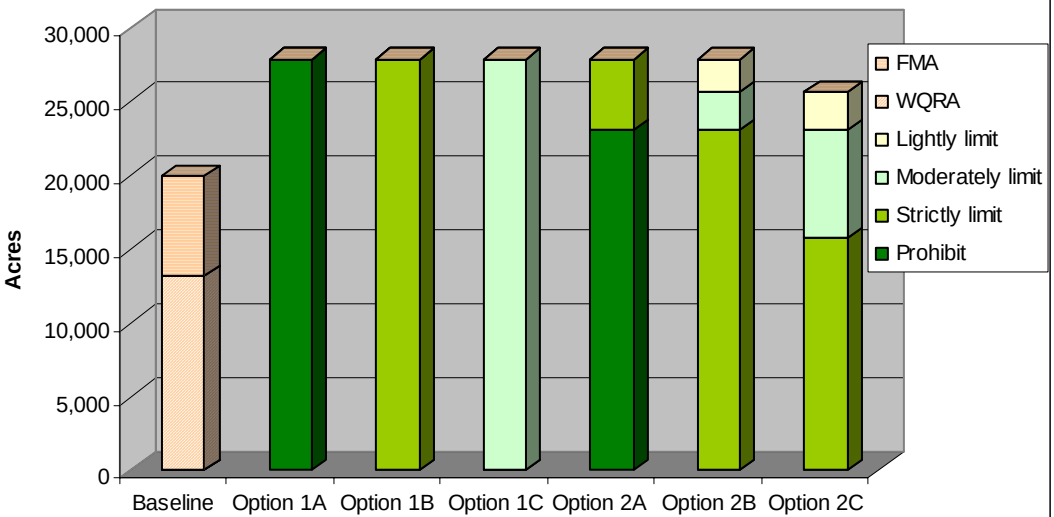


Figure 4-29. Protection level of Class I Riparian/wildlife habitat by option: (developed and vacant) 27,876 acres.



Results

The following observations are made from Figures 4-28 and 4-29.

Basic statistics and baseline protection

- Class I riparian includes 27,872 acres, Habitats of Concern (HOCs) encompass 25,822 acres. Some of the HOCs are included in the Class I riparian, but it is useful to consider them as a group due to their importance.
- Baseline protection covers about 65 percent of the Class I habitat and about 40 percent of HOCs. More restrictive WQRA restrictions are applied to about 42 percent of Class I and 22 percent of HOCs; FMA design guidelines cover a little over 20 percent of Class I and about 18 percent of HOCs.

Comparison of options

- Option 1A, 1B, and 2A would apply a strictly limit or prohibit treatment to all Class I habitat.
- Applying urban development values leads to loss of a small amount of HOCs and Class I habitat with allow and lightly limit treatments.
- Option 1C would apply the least stringent treatments to the largest amount of HOCs and Class I habitat.

Performance of options

All six regulatory options help to preserve cultural heritage and sense of place. The options that apply more stringent treatments to a larger part of the landscape have more of a positive impact than the options that apply lightly limit or allow treatments.

Table 4-19. Performance of options in meeting Social Criterion 4: Cultural heritage and sense of place.

Rank	Option	Performance
1	Option 1A	Does the best job of preserving cultural heritage and sense of place when measuring the effect on Class I habitat and Habitats of Concern. However, if a prohibit treatment resulted in an expansion of the urban growth boundary the resulting environmental effects could negatively impact cultural heritage and the salmon.
2	Option 2A	Comparable to 1A, however the application of urban development values would result in slightly less protection of cultural heritage and sense of place in areas with high urban development value.
3	Option 1B	Applies a strictly limit treatment to all Class I habitat and Habitats of Concern, providing substantial benefit to salmon and other endangered species but without as much potential for expansion of the UGB.
4	Option 2B	A large amount of Class I and Habitats of Concern receive stringent treatments in this option, with lightly limit applied to areas of high urban development value.
5	Option 2C	Similar to 2B, however a small amount of these highest value habitat areas would be lost due to the application of an allow treatment in high urban development value areas.
6	Option 1C	Applies the lowest level of protection to the highest value habitat, putting some of the social values contained in cultural heritage and sense of place at risk of loss.

5. Preserves amenity value of resources

The amenity value of habitat land on quality of life, property values, and regional attractiveness is an important consideration. For example, proximity to some types of natural areas actually increases property values, thus preservation of these habitats could positively impact nearby property owners. Private individuals and firms can capture the value of location, such as nearby parks, open space or schools, or good accessibility to services or transportation infrastructure. This results in higher demand and higher dollar valuation of these properties. On the other hand, public parks, schools, highways, and other perceived amenities capture individual or commercial value by the usage, time, and willingness of people to pay for them.

One way to assess the effectiveness of each option in addressing this criterion is the reliability of protection provided to the fish and wildlife habitat. An option that relies more on regulations and applies strict treatments to habitat land is more likely to produce reliable protection. Options that rely less on regulations and more on voluntary actions or incentives that are dependent on funding sources may be less likely to provide certainty of habitat protection. Thus, the amenity value that attracted landowners to purchase particular properties in the first place may be lost due to the absence or ineffectiveness of protection measures on adjacent lands. Figures 4-30 to 4-33) on the following page graphically depict the treatments to vacant land in the highest four habitat classes as a proxy for retaining amenity value.

Figure 4-30. Treatment of vacant Class I Riparian/wildlife land by option: 12,549 acres total.

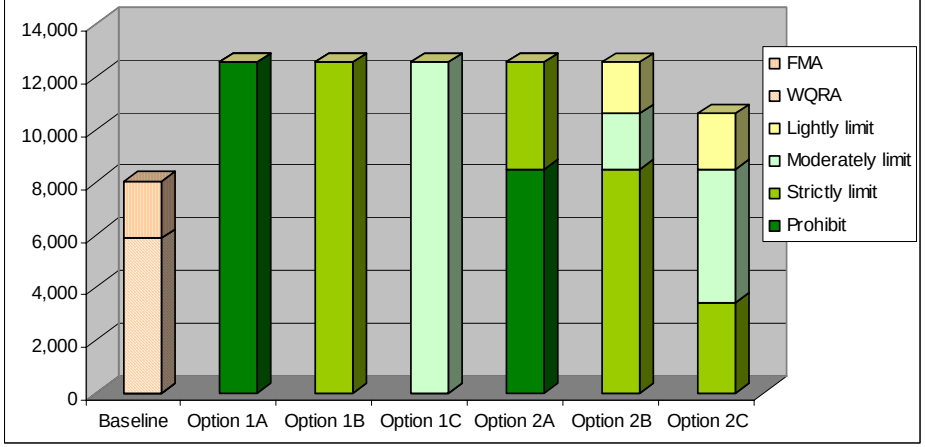


Figure 4-31. Treatment of vacant Class II Riparian/wildlife land by option: 3,907 acres total.

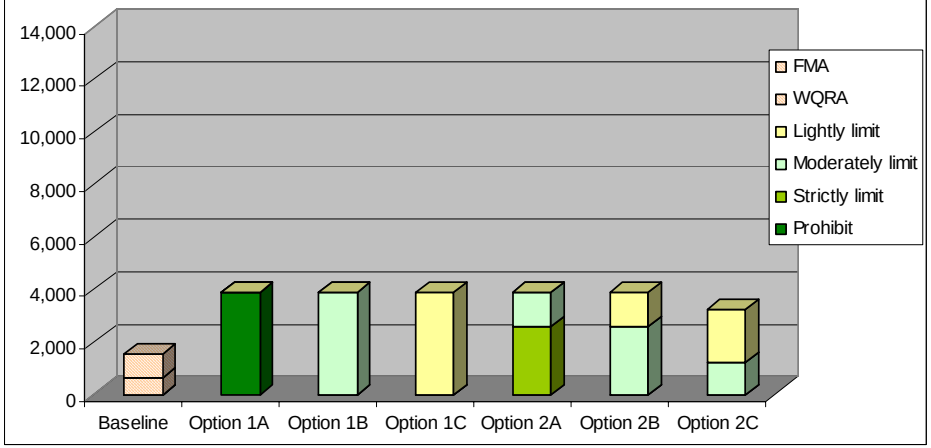


Figure 4-32. Treatment of vacant Class A Wildlife land by option: 8,508 acres total.

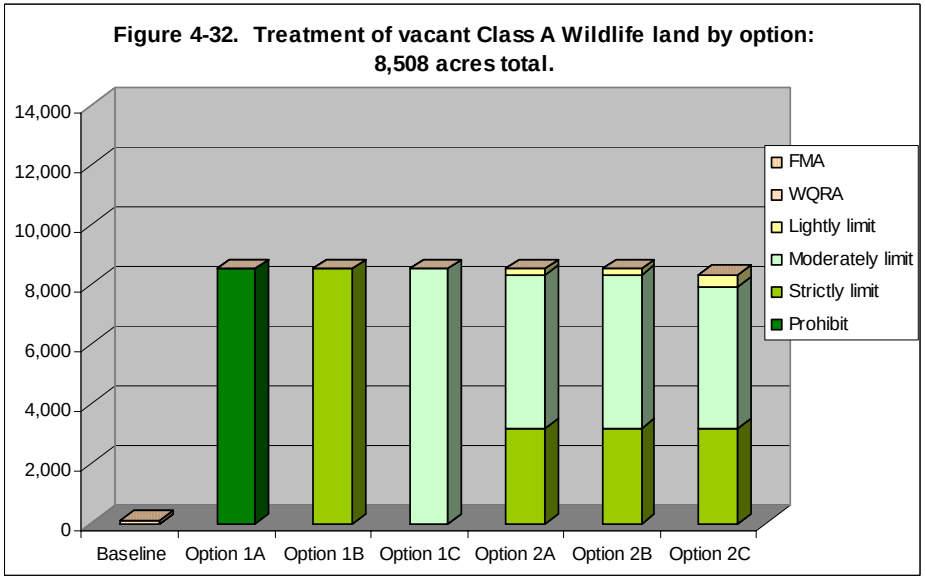
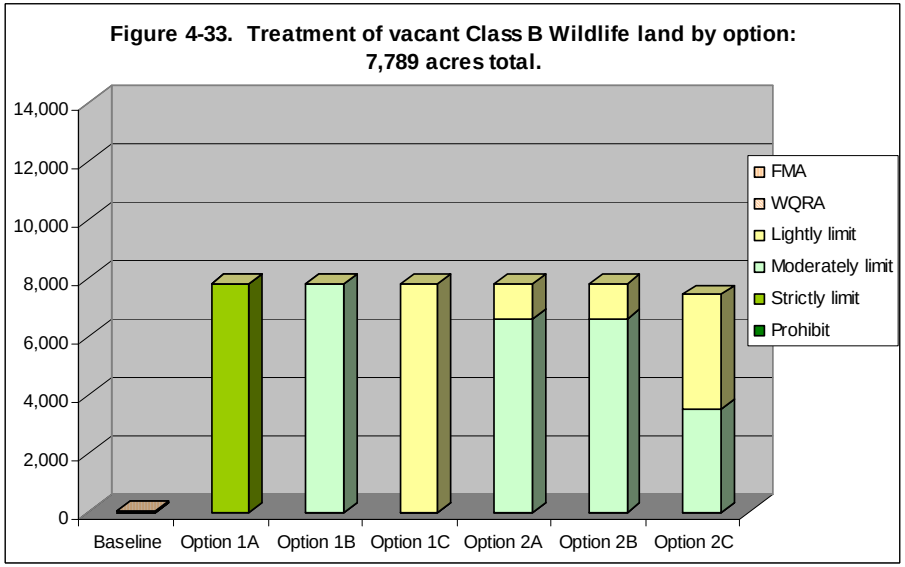


Figure 4-33. Treatment of vacant Class B Wildlife land by option: 7,789 acres total.



Results

The following observations are made from Figures 4-30 to 4-33.

Basic statistics and baseline protection

- Vacant Class I riparian includes 12,549 acres, vacant Class II riparian includes 3,907 acres, vacant Class A wildlife includes 8,508 acres, and vacant Class B wildlife includes 7,789 acres.
- Baseline protection covers about 65 percent of the Class I riparian, 40 percent of Class II riparian, and only one percent of Class A and B wildlife. More restrictive WQRA restrictions are applied to about 47 percent of Class I, 16 percent of Class II, about one percent of Class A and B wildlife; FMA design guidelines cover 17 percent of Class I, 24 percent of Class II, and a negligible amount of Class A and B wildlife.

Comparison of options

- Options 1A, 1B, and 2A would apply a strictly limit or prohibit treatment to all Class I habitat.
- Option 1A is the only option that would apply a prohibit treatment to Class A wildlife habitat and Class II riparian habitat, treatments for these habitat types range from strictly limit to allow in the other options.
- Applying urban development values does not substantially effect the treatment of Class A wildlife habitat, due to the fact that very little of this habitat type is in the high urban development category.
- Option 1C would apply the least stringent treatments to Class II and Class B habitats.

Performance of options

All six regulatory options help to preserve amenity value. The options that apply more stringent treatments to a larger part of the landscape have more of a positive impact than the options that apply lightly limit or allow treatments.

Table 4-20. Performance of options in meeting Social Criterion 5: Amenity value.

Rank	Option	Performance
1	Option 1A	Preserves amenity value consistently in all four of the highest habitat classes.
2	Option 2A	Applying the urban development values results in a small loss of amenity value in areas with high urban development value; preserves more amenity value in riparian habitat than wildlife habitat.
3	Option 1B	Applies consistent level of protection to all four habitat types, but riparian habitats are not as well preserved as in 2A.
4	Option 2B	Urban development values result in very similar protection for wildlife habitat as 2A, but riparian protection would be less than in 1B.
5	Option 2C	Amenity value provided by the highest value wildlife habitat receives similar protection to 2A, but the other three habitat categories receive less stringent treatment.
6	Option 1C	Retains the least amount of amenity value in wildlife habitat areas, provides a bit more protection for riparian habitat.

Evaluation of environmental criteria

The environmental portion of this phase of the ESEE analysis is intended to compare the potential effects of the six program options on fish and wildlife habitat. Five criteria will assist in this process:

1. Conserves existing watershed health and restoration opportunities;
2. Retains multiple functions provided by forest canopy cover;
3. Promotes riparian corridor continuity and overall habitat connectivity;
4. Conserves habitat quality and biodiversity provided by large habitat patches; and
5. Promotes biodiversity through conservation of sensitive habitats and species.

Criteria were selected based on the findings in Metro's Technical Report for Goal 5 and Phase I ESEE analysis (Metro 2002, Metro 2003). Charts depicting program performance for the most vulnerable habitat are embedded in the text. Habitat lands in parks and Title 3 WQRA are typically omitted from the graphs because they are currently afforded some protection. Habitat lands in Title 3 FMA are included in charts that illustrate vulnerability of the fish and wildlife habitat under the options because FMA areas do not protect vegetation.

The summary of each criterion includes a table ranking the programs in order of performance, from most to least protective. The criteria provide important new information about how each program performs relative to the others, and will aid Metro, its partners, and the public in designing a fish and wildlife habitat protection program appropriate to the region.

1. Conserves existing watershed health and restoration opportunities

The amount of fish and wildlife habitat protected or partially protected by each regulatory program option will help determine whether the option preserves habitat, existing ecosystem functions, and restoration opportunities for the future.

Potential impacts on fish and wildlife habitat

Partial or full loss of natural habitat impairs ecological functioning. The type and extent of impairment depends on the habitat class and, within each habitat class, the attributes that make each area valuable to fish and wildlife habitat. Metro's Phase I ESEE analysis (Metro 2003) describes the impacts on ecological systems when such functions are removed, and the Technical Report for Goal 5 (Metro 2002) describes how the region's natural habitats have been altered over time.

In riparian areas, highest value habitats provide the most functions. Class I riparian habitats provide at least three of the five key, or "primary," ecological functions mapped in the inventory. These areas are typically near streams and wetlands and often include forests or undeveloped floodplain areas; they are critical to maintaining aquatic habitat and water quality. Class II habitats provide one or two primary functions, and often also several secondary functions. Class III areas are lower value areas that still provide some degree of ecological function, such as small forest patches that are disassociated from the stream. Thus, protection of Class I is most important, followed by Class II, then Class III.

Wildlife habitat is similarly valued in a tiered approach; Class A is more valuable to wildlife than Class B, and Class B is more important than Class C. Metro mapped wildlife habitat based on spatial ecology principles, where large patches that are well connected to other patches, contain less edge habitat, and contain good water resources are considered most valuable. However, in the case of wildlife habitat, removal of lower valued habitats (Class C) can negatively impact the remaining habitats to a higher degree than for riparian due to connectivity issues (see criterion 3, Connectivity).[24]

Potential impacts on restoration opportunities

Restoration potential is preserved where habitat areas still exist (e.g., not paved); therefore, the level of protection provided by each program option illustrates the relative amount of potential restoration opportunities retained. This analysis does not identify the precise location or quality of restoration opportunities; however, because as habitats differ between classes, so do restoration opportunities. For example, areas of low-structure vegetation along streams may provide excellent opportunities to control non-native species and increase native tree and shrub cover; this would increase habitat to support diverse native wildlife communities. Native tree and shrub cover provide many vital ecological functions, including valuable riparian wildlife habitat, shading streams for cooler water, etc. Low-structure areas near streams are most typically found in Class II riparian and Class B wildlife.

Restoration opportunities are also found in high-value habitat areas; for example, Forest Park contains substantial amounts of non-native, invasive English Ivy. Efforts to control such invasions are ongoing. Because Forest Park is currently protected from development, the habitat and the restoration opportunities continue to exist. In upland areas, restoration is often needed to enhance wildlife habitat or control non-native species, particularly near forest edges. Thus, small habitat patches or long, narrow patches that contain a high proportion of edge habitat also provide restoration opportunities. Streams, wetlands, lakes and rivers can often be rehabilitated to create channel meanders, enhance water filtration capacity, or re-connect to natural floodplain areas. [25]

Metro's habitat inventories focused on the most important remaining habitats, and did not include every potential restoration opportunity due to the large scale nature of the regional inventory and because the Goal 5 rule applies to existing habitat.

Measuring the criterion

For each habitat class and each program option, the acreage that falls under various ALP designations is the measure for this criterion. The data is broken down between developed and vacant lands, because the time frame for habitat risk is different. Redevelopment will presumably occur over a longer time frame than new development. Additionally, habitats on

[24] It is important to consider the interactions between the riparian and wildlife inventories. The two inventories were conducted separately then reconciled so that a program could be developed for a single inventory map. As a result, some of each inventory was allocated to the other. For example, when Class I riparian coincided with any wildlife class, the wildlife portion became Class I riparian. Thus the loss of one habitat type may also include loss of another due to the extensive spatial overlap of the two inventories.

[25] Metro's Technical Report for Goal 5 (Metro 2002) includes a chapter describing how to go about watershed planning and prioritizing opportunities for restoration and other ecologically important activities.

vacant lands unconstrained by existing protection are more likely to be subjected to new conflicting uses. Title 3 WQRA acreage is excluded from this criterion because it is already partially protected (see introductory chapter). Similarly, Criterion 1 does not include parks, but focuses on habitat areas that may be placed at risk through development or redevelopment.

Results

Figures 4-34 through 4-37 illustrate the findings. Program options that are likely to protect more fish and wildlife habitat overall, as well as more of the most valuable habitat, are assumed to perform better than other options.

Basic statistics

- This criterion includes 80,143 acres of fish and wildlife habitat. Of that:
  - 27,851 acres are in class I riparian (34 percent of total)
  - 7,901 acres are in class II riparian (10 percent of total)
  - 4,434 acres are in class III riparian (6 percent of total)
  - 19,662 acres are in class A wildlife (25 percent of total)
  - 12,828 acres are in Class B wildlife (16 percent of total)
  - 7,468 acres are in Class C wildlife (9 percent of total)
- Riparian habitat comprises 17,500 acres (38 percent), while wildlife habitat comprises 28,960 acres (62 percent).

Baseline protection (Title 3)

- This analysis removed WQRA because it provides a degree of habitat protection.
- Of total habitat lands, 19 percent is in WQRA (7 percent parks, 4 percent in developed urban, and 8 percent in vacant).
- Of total habitat lands, 17 percent is in parks.
- If WQRA are included in the acreage figures, nearly half of Class I habitat and one-fourth of Class II habitat are WQRA, with all other habitat classes containing less than 5 percent WQRA.
- Fifteen percent of developed urban and vacant habitats are in Title 3 FMA, but vegetation is not protected in FMA and wetlands may be filled with proper DSL permission. Thus FMA does not protect habitat, and only partially protects the water storage function in riparian habitats. FMA are included as vulnerable to conflicting uses in Figures 4-34 through 4-37.
- The acres included under this criterion are outside WQRA and are subject to conflicting uses if no increase in protection level is applied; therefore, any program option that is not allow will provide incrementally more protection on the lands considered in Figures 4-34 through 4-37.

Potential effects of treatments vary by development status and habitat class

- Two-thirds of these habitat lands are vacant and one-third is developed urban. Treatments applied to vacant lands may have disproportionately high impacts compared to the same treatments applied to developed urban.
- Of vacant habitats, riparian comprises 34 percent, while wildlife comprises the remaining 66 percent. Of developed urban habitats, riparian only comprises 15 percent, with the remaining 85 percent in wildlife. These opposing trends indicate that treatments applied to vacant lands may disproportionately influence riparian habitats, whereas treatments applied to developed

urban lands may more strongly influence wildlife habitat.

- Class I dominates vacant riparian, comprising 63 percent of the acreage, but only 29 percent of developed urban riparian (Class III comprises half of the riparian acreage in developed urban). Treatments applied to vacant Class I riparian will profoundly influence the future ecological conditions of aquatic and riparian habitats.
- Class A comprises 41 percent of vacant wildlife and 32 percent of developed urban wildlife. Treatments applied to both vacant and developed urban wildlife will be important determinants of future wildlife conditions.
- Average riparian and wildlife habitat values tend to be lower in developed urban compared to vacant, because conflicting uses tend to degrade habitats. For example, developed floodplains do not retain the same ecological functions as the original floodplain, and riparian and wildlife habitat is more fragmented in developed areas.

Impact Areas

- Impact areas are designated where adjacent land use may harm the habitat.
- An allow decision in impact areas may harm remaining habitat over time, whereas a lightly limit decision may help protect habitat.
- Lightly limit program definitions may need to differ between habitats and impact areas, because impact areas, by definition, are not habitat. For example, impact areas to protect streams may require low impact development standards upon redevelopment.
- If a program option is selected that includes an allow decision for certain habitats, it would be sensible to administer an allow decision for adjacent impact areas, because impact areas are designed to address where adjacent land use might adversely affect *existing* resources.

Program Option performance

- In options 2A-2C, the urban development value plays a role in what may happen to the habitat because treatments change based on both habitat class and by urban development value. Options 1A-1C are based solely on habitat value.
- For wildlife habitat, options 1A and 1B are most protective.
- For riparian habitat, options 1A and 2A are most protective.
- Options 1C and 2C are the least protective for both riparian and wildlife habitat.
- Potential effects of program options depend in part on the amount of land falling within each habitat class; Class I, Class A and Class B contain the most acreage, whereas Class III and Class C hold the least. For example, options affording less protection to Class B (1C, 2B, 2C) will have greater adverse effects on overall wildlife habitat protection.
- Class C wildlife is most vulnerable to loss under all options (least protective treatments applied). Class II and III are also vulnerable under certain program options (e.g., 1C, 2C).

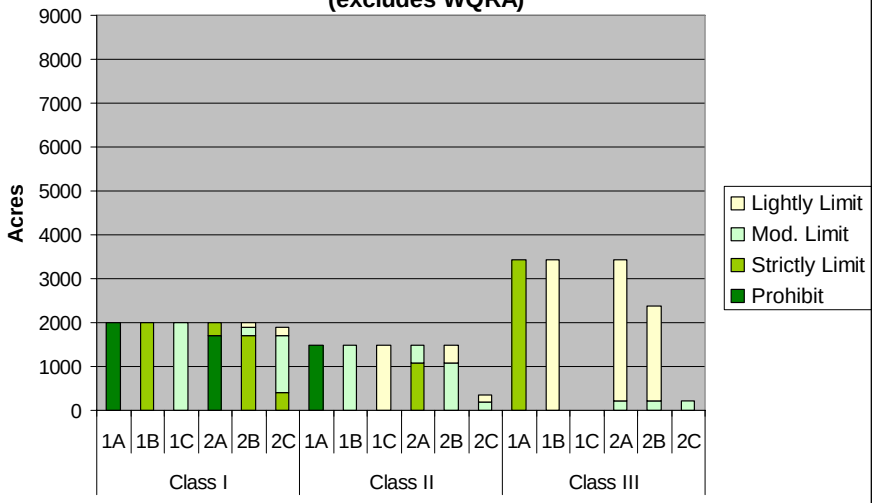
Summary

Program options show a marked decline in protection levels, as indicated in Table 4-21 below. The options that apply more stringent treatments to a larger portion of resources, particularly high value resources, will protect a larger proportion of regionally significant resources in the long term. Table 4-21 provides a ranking of program options for this criterion.

Table 4-21. Performance of options in meeting Environmental Criterion 1: Conserves existing watershed health and restoration opportunities.

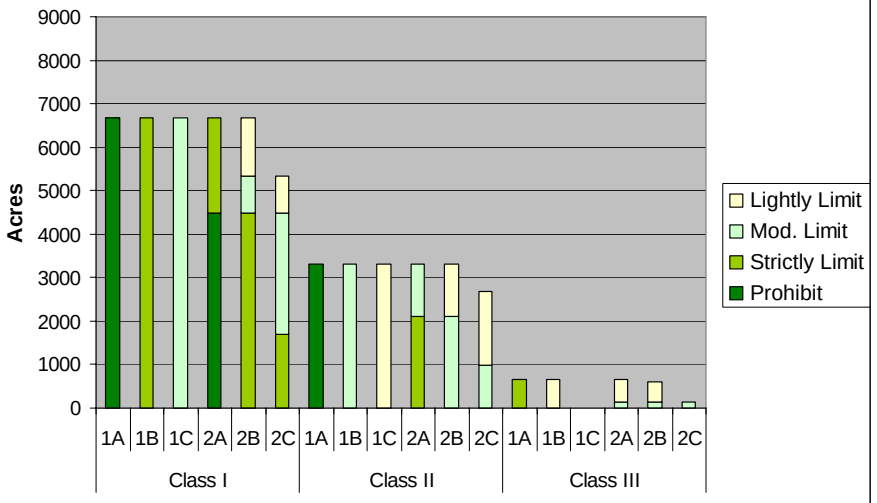
Rank	Option	Performance
1	1A	Charts 1a-1d indicate that this option will provide the most effective protection for the highest value resources (class I and class A habitat). This option also provides the highest protection levels for the remaining resource categories.
2	2A	This option still provides excellent protection for the majority of class I resources, and good protection for other riparian classes. The protection level is diminished, but still good for wildlife resources; however, option 1B provides better protection for wildlife habitat than 2A.
3	1B	Protection for all classes of riparian habitat is substantially reduced in this option compared to 1A and 2A. Class III riparian in appears to be particularly vulnerable. For wildlife habitat, this option performs at a higher level than 2A, but the importance of riparian habitat was considered first in this criterion.
4	2B	Performs moderately well for the higher classes in both riparian and wildlife habitat. This is the point at which protection levels drop off significantly for lower value resources. Poses substantial risk to habitat in classes III and C, due to lower protection levels and because some acreage is in the allow category.
5	2C	Lower protection levels for all resources. In particular, classes III and C are predominantly allow. Likely to result in substantial loss of riparian function unless extensive non-regulatory programs are put in place.
6	1C	Low protection levels for all habitat classes. Likely to result in significant habitat loss and ecosystem function over time in both developed and vacant lands.

Figure 4-34. Criterion 1a: Comparison of allow, limit, prohibit treatments by riparian class in developed urban lands (excludes WQRA)



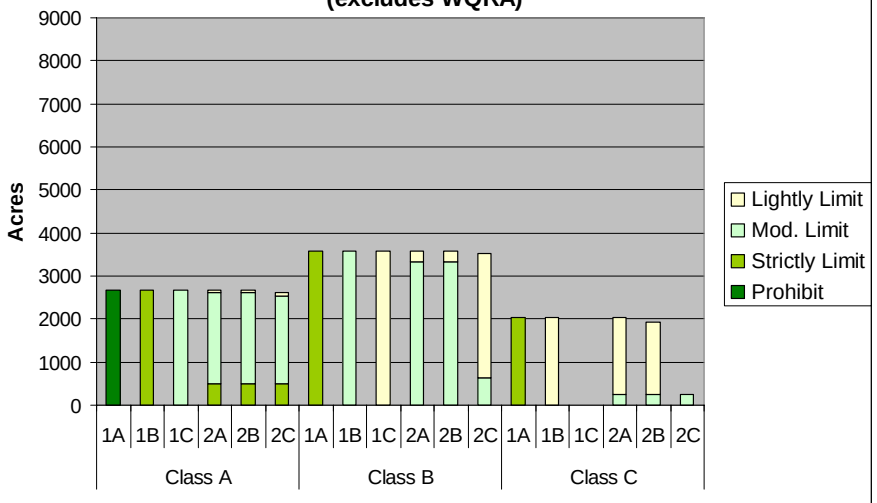
Program Option and Riparian Class
WQRA = 3,023 acres, non-WQRA = 6,909 acres

Figure 4-35. Criterion 1b: Comparison of allow, limit, prohibit treatments by riparian class in vacant lands (excludes WQRA)



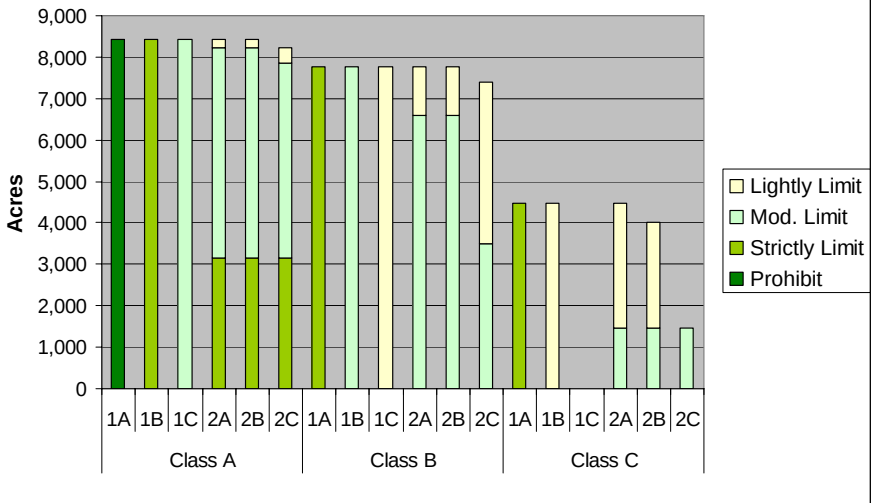
Program Option and Riparian Class
WQRA = 6,466 acres, non-WQRA = 10,636 acres

Figure 4-36. Criterion 1c: Comparison of allow, limit, prohibit treatments by wildlife class in developed urban lands (excludes WQRA)



Program Option and Wildlife Class
WQRA = 89 acres, non-WQRA = 8,286 acres

Figure 4-37. Criterion 1d: Comparison of allow, limit, prohibit treatments by wildlife class in vacant lands (excludes WQRA)



Program Option and Wildlife Class
WQRA = 133 acres, non-WQRA = 20,638 acres

2. Retains multiple functions provided by forest canopy cover

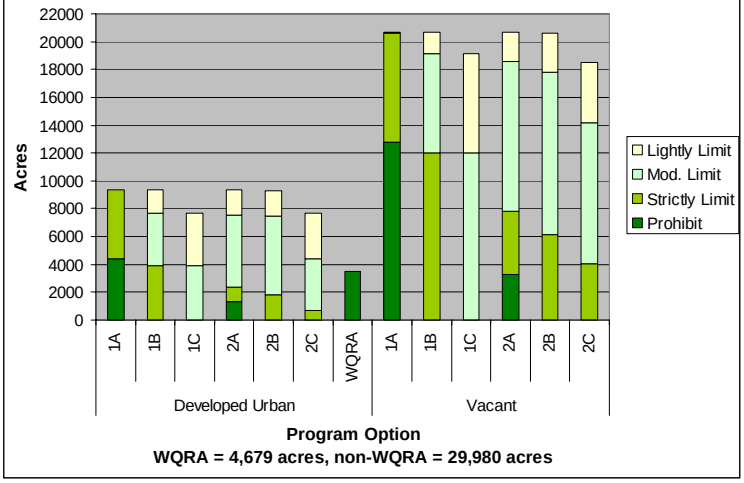
The Metro region is naturally forested, and trees play a pivotal role in maintaining healthy fish and wildlife habitat and regional biological diversity. Local studies affirm the importance of trees to stream health both near streams and throughout the watershed. Forest canopy plays a major role in all five ecological functions mapped in Metro's riparian habitat inventory, and forest habitat comprise the majority of the wildlife inventory.

Trees are also directly linked to each of the eight major ecological impact categories described in the ESEE Phase I discussion draft (Metro 2003). For example, trees help prevent altered hydrology and physical stream damage, and mitigate flooding caused by altered hydrology. They maintain water quality by taking up excess nutrients, heavy metals and other toxins, and provide shade over streams to cool water. Trees provide a primary source of wildlife habitat, and salmon and other aquatic wildlife frequently linger in shaded stream areas for thermal and predator protection.

Measuring the criterion

This criterion is measured by calculating the acreage of forest associated with each ALP category by program option. Forest canopy is a component of every habitat class, therefore this analysis does not differentiate by habitat class (for analysis by habitat classes, see criterion 1). The analysis does differentiate between vacant and developed status, because developed lands are less likely to experience much further tree loss, whereas vacant lands may be developed with substantial tree loss. However, forest loss can be an issue when redevelopment occurs, particularly when redevelopment occurs at higher densities. Program options that are likely to protect more acres of trees overall will receive a better rating in this criterion.

Figure 4-38. Criterion 2: Comparison of allow, limit, prohibit treatments for forest canopy (excludes WQRA)



WQRA = 4,679 acres, non-WQRA = 29,980 acres

Results

Figure 4-38 illustrates the findings from acreage calculations. Program options that are more likely to protect forest canopy cover are assumed to perform better than options providing less protection.

Basic statistics

- This criterion considers 50,134 acres of forested fish and wildlife habitat.
- Parks comprise 15,475 acres (31 percent of total forested acres), developed urban comprises 10,504 acres (21 percent of total forested acres), and vacant comprises 24,155 acres (48 percent of total forested acres).
- The bar chart for this criterion considers the most at-risk categories (developed urban and vacant, both outside WQRA).

Baseline protection (Title 3)

- WQRA comprise 2,916 forested park acres, 1,165 forested urban developed acres, and 3,514 forested vacant acres, or 15 percent of total forest habitat.
- Comprising about a third of forested lands, parks provide important protection to trees.
- The graph for criterion 2 excludes WQRA for the same reasons as stated in criterion 1.

Potential effects of treatment vary by development status

- Nearly half of forested habitat is in vacant lands. Of this, only 15 percent is protected as WQRA, while the remaining 85 percent is unprotected. Many of these lands are in rural zoning in new Urban Growth Boundary expansion areas.
- Of developed lands, two thirds receive some level of protection through parks or WQRA.
- Eleven percent of developed urban lands with forest are in WQRA. The remaining 9,339 acres are vulnerable to conflicting uses, particularly if redevelopment occurs at higher densities.
- Treatments applied to vacant lands may have disproportionately high impacts to forest habitat compared to the same treatments applied to developed urban lands.

Program option performance

- Options 1A and 1B are most protective of forest canopy in both developed urban and vacant lands. Options 2C and 1C are least protective.
- Options 2A and 2B fall in the mid-range in terms of protecting forest canopy.
- Option 1A is substantially more protective than option 1B. The difference between options 1B and 2A are less clear.
- The program options do not vary much between developed urban and vacant in terms of the proportions falling within allow, limit, prohibit designations.

Summary

Program options vary considerably in terms of forest canopy protection. The options that apply more stringent treatments to a larger part of the forested landscape will protect more forest canopy over the long term. Table 4-22 below provides a ranking of program options for this criterion, based on the most at-risk acres illustrated in Figure 4-38.

Table 4-22. Performance of options in meeting Environmental Criterion 2: Retains multiple functions provided by forest canopy.

Rank	Option	Performance
1	1A	Protects by far the most canopy cover of any other program option for vulnerable forested lands in both vacant and developed.
2	1B	Substantially less protection than option 1A, but still performs better than the remaining options. However, options 1B and 2A appear relatively close in terms of potential effects on the region's forest canopy. No Allow designations mean that all forest habitat would be afforded at least some level of protection.
3	2A	Similar to 1B.
4	2B	Little Allow (76 acres), but overall protection levels lower than options 1B and 2A.
5	2C	Low protection levels for forest canopy, with 38 percent of vacant and developed urban in Lightly Limit or Allow. Likely to result in significant habitat loss over time in both developed and vacant lands.
6	1C	Low protection levels for forest canopy, with 47 percent of vacant and developed urban in Lightly Limit or Allow. Likely to result in significant forest habitat loss over time.

3. Promotes riparian corridor continuity and overall habitat connectivity

Habitat connectivity is important to fish and wildlife for several reasons. Riparian, or longitudinal, connectivity ensures continued ecological functioning of streams and helps enable fish passage to areas upstream. Many fish and wildlife species must migrate seasonally to meet basic needs for food, shelter and breeding, and connections between habitat patches, including aquatic habitat, allow this migration to occur.

Fish and wildlife populations that are connected to each other are more likely to survive over the long term than an isolated population. In addition, when connectivity is lost between habitats the remaining habitat tends to become less native, attracting non-native and generalist wildlife species that can out-compete more sensitive native species, thereby reducing biodiversity. Metro's Phase I ESEE report describes the importance of connectivity to regional fish and wildlife habitat and populations (Metro 2003).

Measuring the criterion

Connectivity is an important indicator of habitat fragmentation. It is also very difficult to accurately measure, and prohibitively time-intensive to measure for six different program options. As a proxy for connectivity this criterion examines the following indicators:

- Criterion 3a: Riparian corridor continuity. Measures the amount of habitat within 150 feet of streams that falls within each allow, limit, prohibit designation for each program.
- Criterion 3b: The relative risk to all fish and wildlife habitat by program option.
- Criterion 3c: Discussion of the potential for disproportionate impacts by Metro's 27 subwatersheds.

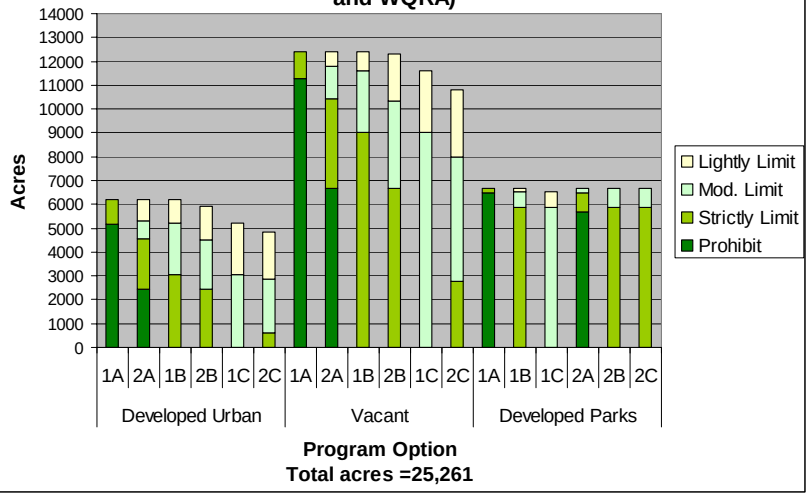
Results: Criterion 3a - Riparian corridor continuity

The figure below illustrates the findings. Program options that protect more habitat within 150 feet of streams are more likely to retain existing riparian corridor continuity.

Basic statistics

- This criterion includes 25,260 acres of fish and wildlife habitat near streams.
  - 6,186 acres are in developed urban (24 percent of total).
  - 12,395 are in vacant (49 percent of total).
  - 6,680 acres are in parks (26 percent of total).

Figure 4-39. Criterion 3a: Comparison of allow, limit, prohibit treatments for habitat within 150' of streams (includes parks and WQRA)



Baseline protection (Title 3)

- Of developed urban, 2,579 acres (40 percent) are in WQRA.
- Of vacant, 4,936 acres (40 percent) are in WQRA.
- Of parks, 3,221 acres (48 percent) are in WQRA.

This analysis included WQRA and parks because it constitutes a significant portion of riparian corridor continuity. The bar chart does not specifically delineate WQRA due to graph complexity.

Potential effects of treatments vary by development status

- About half of the acreage is vacant, with another quarter each in parks and developed urban. Parks are afforded some degree of protection, and so are WQRA.
- Excluding parks and WQRA, 7,459 acres are at risk in vacant. Less than half that amount, 3,607 acres, is in developed urban. Treatments applied to vacant habitat may have disproportionately high impacts on riparian corridor continuity.
- Parks are assumed to have some existing level of protection, but conflicting uses could impact these resources as well. However, nearly half of park acres are in WQRA.

Program option performance

- For all development statuses, Option 1A is most protective of habitat within 150 feet of streams, followed closely by Option 2A. Option 1B provides the next best protection, followed by 2B.
- Options 1C and 2C are least protective for these resources, and could negatively influence riparian corridor continuity.

Results: Criterion 3b – Relative risk to all fish and wildlife habitat

This sub-criterion is derived from Criterion 1. Figures 4-34 through 4-37 illustrate the findings. Program options that are likely to protect more fish and wildlife habitat overall, as well as more of the most valuable habitat, are assumed to perform better than other options. Here the findings from Criterion 1 are summarized as they related to Criterion 3b:

Basic statistics

- This criterion includes 80,143 acres of fish and wildlife habitat:
  - 27,851 acres are in Class I riparian (34 percent of total); of that, 2,005 developed acres are vulnerable (outside of parks or WQRA) and 6,683 vacant acres are vulnerable.
  - 7,901 acres are in Class II riparian (10 percent of total); of that, 1,475 developed acres are vulnerable and 3,301 vacant acres are vulnerable.
  - 4,434 acres are in Class III riparian (6 percent of total); of that, 3,427 developed acres are vulnerable and 659 vacant acres are vulnerable.
  - 19,662 acres are in Class A wildlife (25 percent of total); of that, 2,682 developed acres are vulnerable and 8,435 vacant acres are vulnerable.
  - 12,828 acres are in Class B wildlife (16 percent of total); of that, 3,580 developed acres re vulnerable and 7,756 vacant acres are vulnerable.
  - 7,468 acres are in Class C wildlife (9 percent of total); of that, 2,041 developed acres are vulnerable and 4,466 vacant acres are vulnerable.

Baseline protection (Title 3)

- See criterion 1 for baseline statistics.
- Nearly half of Class I habitat and one-fourth of Class II habitat are WQRA, with all other habitat classes containing less than 5 percent WQRA. This leaves lower habitat classes more vulnerable than the top two riparian classes.

Potential effects of treatments vary by development status and habitat class

- Class B and C wildlife habitat, in terms of acreage, provide disproportionately important connectivity links, such as stepping-stones between larger patches for migratory stopover and other wildlife movement.
- Class B and C wildlife habitat comprise 39 percent of vulnerable resources outlined above. Because these habitat patches are small, this equates to an high number of connector patches.
- Class B and C wildlife habitat tend to receive lower protective treatments in the program options compared to other habitat classes.
- The majority (68 percent) of vulnerable Class B and C acres are vacant, therefore program treatments applied to vulnerable vacant lands may have a disproportionate negative impact on regional connectivity.

Program Option performance

- Option 1A afford highest protection to Class B and C wildlife habitat, with strictly limit designations assigned to all acres.
- Option 1B provides less protection, but still provides protection to Class B and C habitat at the moderately and lightly limit levels, respectively.
- Options 2A and 2B provide less protection, but are generally similar to one another.
- Option 2C performs poorly, placing an allow designation on the majority of Class C habitat.
- Option 1C completely fails to protect vulnerable Class C habitat. Class C wildlife is most vulnerable to loss under all options (least protective treatments applied).

Results: Criterion 3c – Potential for disproportionate impacts by subwatershed

The findings for Criterion 3a are illustrated in the two figures below.

Basic statistics

- This criterion includes all 80,143 acres of regionally significant fish and wildlife habitat in Metro's 27 subwatersheds, plus 15,730 acres of impact areas (see context chapter for more information on distribution of impact areas by development status).
- Impact areas are addressed in this subcriterion because conflicting uses in impact areas may adversely impact fish and wildlife habitat.
- Resources sites with a lower percentage of fish and wildlife habitat typically contain proportionally more impact areas. These subwatersheds are also typically more developed.
- Of the total, 53,939 acres are in developed, while 41,934 are in vacant.
- The criterion discerns between the most vulnerable habitats and those with some existing protection.

Baseline protection (Title 3)

- Of developed urban habitat and impact areas, 3,795 acres (seven percent of developed urban; four percent of all acres) are in WQRA.
- Of vacant habitat and impact areas, 6,881 acres (16 percent of vacant; seven percent of all acres) are in WQRA.
- Of all acres, 25,212 acres (26 percent) are in parks, shown in black in Figure 4-40.

Potential effects of treatments vary by subwatershed

- Variability exists between subwatersheds; some subwatersheds contain more habitat/impact areas overall, while others contain varying proportions of habitat within the subwatershed.
- In all subwatersheds, WQRA comprises a relatively small proportion of acreage, whether considering vacant or developed urban habitat.
- The bar chart illustrates that some subwatersheds contain more vulnerable lands than others. For example, subwatersheds #8, 26, and 27 contain relatively high amounts of vulnerable developed habitat and impact areas; these areas would be most vulnerable under redevelopment. Subwatersheds #11, 18, and 27 contain relatively high amounts of vulnerable vacant habitat and impact areas; these habitat acres are more immediately vulnerable.
- Some subwatersheds contain low proportions of habitat and impact areas. Examples include subwatersheds #6, 20 and 24, containing from 20-22 percent of acres in habitat or impact areas. Because these subwatersheds contain relatively little existing habitat, program treatments could have disproportionately high impacts on existing connectivity.

Figure 4-40. Criterion 3c: Developed lands - Habitat and impact areas in Metro's 27 subwatersheds

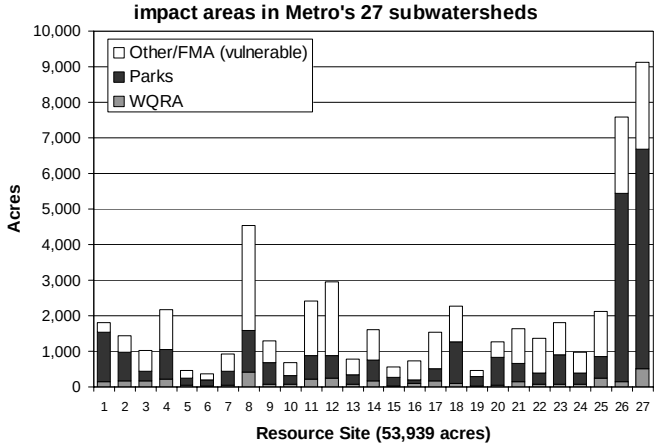
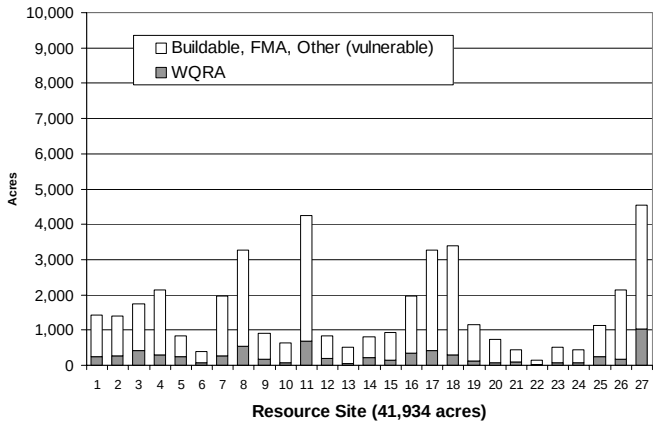


Figure 4-41. Criterion 3c: Vacant lands - Habitat and impact areas in Metro's 27 subwatersheds



Program option performance

- Some subwatersheds contain more habitat and impact areas than others.
- Criterion 1 describes how the six options perform in terms of protecting various habitat classes. More protective options are more likely to retain existing connectivity.
- Large habitat patches (see criterion 4), while vulnerable to fragmentation, may not be as important to systemic connectivity as smaller patches or more linear habitats.
- Program options providing more protection to lower value habitat areas, which tend to be small but important connectors or stepping stones, are more likely to promote connectivity,

particularly in subwatersheds with lower proportions of habitat.

- Options 1A, 2A, and to a lesser extent, 1B are likely to best protect the region's existing connectivity.
- Options 2B, 2C and 1C are likely to significantly reduce connectivity in the region.

Summary

Program options show a marked decline in protection levels, as indicated in Table 4-23 below. The options that apply more stringent treatments to a larger portion of habitat, particularly high value habitat, will protect a larger proportion of regionally significant habitat in the long term. Table 4-23 provides a ranking of program options for this criterion.

Table 4-23. Performance of options in meeting Environmental Criterion 3: Promotes riparian corridor continuity and overall habitat connectivity.

Rank	Option	Performance
1	1A	Program option 1A perform best for all three sub-criteria. This option is most likely to promote riparian corridor continuity and overall habitat connectivity.
2	2A	For riparian corridor continuity (sub-criterion 3a) and protecting subwatersheds from disproportionate impacts (sub-criterion 3c), program option 2A performs best. However, for risk to smaller connector habitats (sub-criterion 3b), 1B is the best performer.
3	1B	This option performs better for protecting small connector habitats than 2A, but does not perform as well for riparian corridor continuity and protecting subwatersheds from disproportionate impacts.
4	2B	This program option performs at a reduced, but fairly consistent, level for all three sub-criteria.
5	2C	This option greatly reduces protection levels for all three sub-criteria, and is likely to result in significantly reduced regional connectivity.
6	1C	This option greatly reduces protection levels for all three sub-criteria, and is likely to result in significantly reduced regional connectivity. In particular, class C wildlife habitat is 100% allow under this option.

4. Conserves habitat quality and biodiversity provided by large habitat patches

The extent to which large habitat patches are disrupted by conflicting uses will help determine habitat quality. Program options that perform better in this regard are more likely to retain the region's biological diversity.

Potential impacts on fish and wildlife habitat

Large habitat patches are primarily forested areas, but also include wetlands. Larger habitat patches are more valuable to native wildlife than smaller patches because more species are retained over time, and species sensitive to human disturbance still have a place to live. Long-term trends in wildlife populations are directly related to the area of habitat available – the larger the patch size, the longer a population can sustain itself. Larger habitat patches also retain more natural predators to keep rodent populations in check[26].

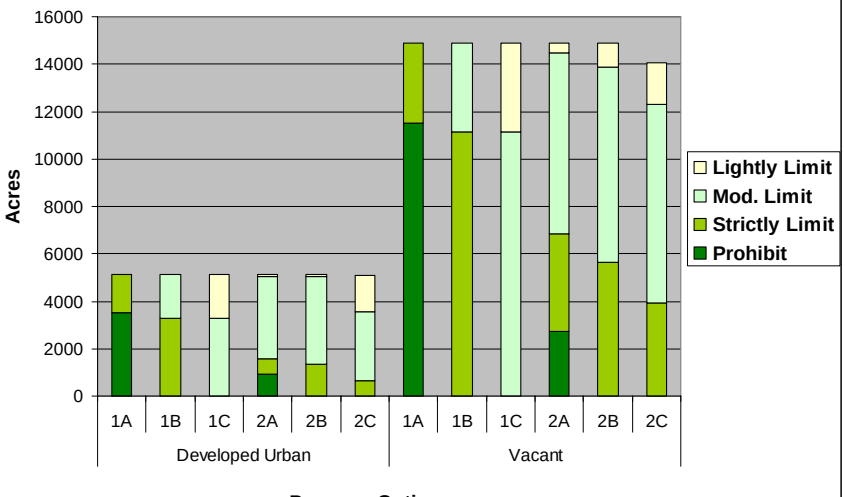
Habitat quality tends to be higher in large patches because negative edge effects, such as invasive species introductions and increased nest predation, are reduced. Local studies show that the complex multi-layered forest and shrub structure important to birds, small mammals and other wildlife is enhanced in larger habitat patches. Large patches also typically contain more woody debris.

Certain sensitive species and groups of species, such as Neotropical migratory songbirds and area-sensitive species, are likely to be negatively affected by less protective options. Large habitat patches are also linked, directly or indirectly, to each of the eight major ecological impact categories described in the ESEE Phase I discussion draft (Metro 2003). Thus, large habitat patches are a key component to retaining the region's biodiversity.

Measuring the criterion

Habitat patch size was a criterion in Metro's wildlife habitat inventory. Because the wildlife and riparian inventories were subsequently combined, portions of large habitat patches near waterways were incorporated into riparian Classes I and II. As a result, large patches were typically split into Class I and II riparian or Class A and B wildlife. For this criterion the wildlife model score prior to reconciling the two inventories, including patches scoring 6-9 points, was used in an effort to gauge the potential programmatic results on large habitat patches.

Figure 4-42. Criterion 4: Comparison of allow, limit, prohibit treatments for large habitat patches (excludes WQRA)



WQRA = 8,080 acres, non-WQRA = 25,136

[26] See Metro's Technical Report for Goal 5, Metro 2002.

Results

For each program option, the acreage of large habitat patches that fall under various ALP designations was calculated. The data is reported separately for vacant and developed lands, for the reasons described under criterion 1; similarly, WQRA and parks are excluded in Figure 4-42. Figure 4-42 illustrates the most at-risk acres.

Basic statistics

- The total amount of large habitat patches, as defined in this criterion, is 38,360 acres.

Baseline protection (Title 3)

- Parks comprise 14,155 acres, or 37 percent of the total.
- WQRA comprise 8,090 acres (including 3,899 in parks) for 21 percent of the total.
- Six percent of the total habitat is in Title 3 FMA, but vegetation is not protected in FMA, therefore FMA areas do not protect large habitat patches.
- Excluding parks and WQRA, there are 20,014 acres of at-risk fish and wildlife habitat illustrated in Figure 4-42.
- The acres included in Figure 4-42 are subject to conflicting uses if no increase in protection level is applied; therefore, any program option that is not allow will provide incrementally more protection on these lands.

Potential effects of treatments vary by development status

- Excluding parks and WQRA, developed urban contains 26 percent of this habitat type, while 74 percent falls under vacant.
- The high percentage in vacant suggests that vacant habitat may be disproportionately affected by program choices.
- Developed urban is vulnerable as redevelopment occurs.
- The majority of habitat lands fall in single family residential zoning.
- Current trends for smaller lot sizes render large patches in both developed urban and vacant vulnerable to loss or fragmentation over time.

Program Option performance

- Urban development values in options 2A-2C substantially reduce protection of large habitat patches.
- For both vacant and developed urban habitat, Program Option 1A and to a lesser extent, Option 1B are most likely to keep large patches intact.
- Options 2A and 2B are marginal and may result in significant large patch encroachment.
- Options 2C and 1C are unlikely to retain large patches within the system.

Summary

Program options show a marked decline in protection levels, as indicated in Table 4-24 below. Options that apply stronger protection levels to large patches have a much greater chance of retaining the integrity of these important wildlife resources over time, and thus retaining good habitat quality and biodiversity. Incremental drops in protection may have more severe consequences in this criterion than in most other environmental criteria, because each drop in protection level raises the potential for large patch fragmentation.

Table 4-24. Performance of options in meeting Environmental Criterion 4: Conserves habitat quality and biodiversity provided by large habitat patches.

Rank	Option	Performance
1	1A	Figure 4-42 indicates that this option will provide the most effective protection for large habitat patches, with protection levels of Prohibit or Strictly Limit for all habitat.
2	1B	Protection level diminished, but still good, with Strictly or Moderately Limit for all habitat. However, any reduction in protection level will increase fragmentation of large patches, particularly with trends toward higher density development.
3	2A	Protection levels slightly lower than Option 1B. Three percent of vacant, unprotected habitat would fall under Lightly Limit in this option, with the remainder in Moderately Limit (51 percent), Strictly Limit (28 percent), or Prohibit (18 percent). No Allow.
4	2B	An incremental drop in protection levels compared to 2A. Seven percent of vacant, unprotected habitat would fall under Lightly Limit in this option, with the remainder in or Moderately Limit (55 percent) or Strictly Limit (38 percent).
5	2C	Substantially lower protection levels, with six percent of vacant, unprotected habitat in Allow, 12 percent in Lightly Limit, 56 percent in Moderately Limit, and 26 percent in Strictly Limit. No Prohibit. Likely to result in significant fragmentation of large patches.
6	1C	2C and 1C are fairly similar. 1C has decreased protection levels for all habitat classes, with 25 percent of vacant, unprotected habitat in Lightly Limit and 75 percent in Moderately Limit. Likely to result in significant fragmentation of large patches.

5. Promotes biodiversity through conservation of sensitive habitats and species

The amount and configuration of fish and wildlife habitat play important roles in the region's biodiversity, and these are addressed in Criteria 1 through 4. Also important, but not implicit in the first four criteria, are species and habitats that may be disproportionately at risk due to natural scarcity, habitat loss, or other factors.

Potential impacts on fish and wildlife habitat

For the purposes of this criterion both Habitats of Concern and Class I riparian habitat are included, because high-value riparian areas are widely acknowledged to be at-risk and because these habitats are mapped comprehensively for the region. In addition, known Species of Concern sightings are included to provide a relative measure of risk to wildlife. For these already-depleted habitats and species, a small habitat reduction could deal a major blow to regional biodiversity.

Criterion 5a: Habitats of Concern.

Habitats of Concern are specific areas known to provide a unique and at-risk habitat type, a unique and vital wildlife function, or both. Examples include wetlands, Oregon white oak habitat, riverine delta and island habitat, and critical migratory pathways. Habitats of Concern are premier wildlife areas that are elevated in importance and status within the inventory; all Habitats of Concern fall in either Class I riparian or Class A wildlife. Many of these areas, such as small wetlands, are less than the two-acre minimum established for the wildlife inventory but are included as Habitats of Concern due to their regional importance to biological diversity.[27] Program options providing more protection to these habitats will do a better job of retaining Habitats of Concern throughout the region.

Criterion 5b: Class I riparian.

The Habitats of Concern data is incomplete because it relies on local knowledge rather than comprehensive surveys. Therefore, for the purposes of this criterion Class I riparian habitat is also included because it is a widely acknowledged at-risk habitat and is mapped comprehensively for the region. Some of the implications of Class I habitat loss are described in Criterion 1. In addition to the ecological functions described there, high value riparian habitat contains more species than most other habitats; for example, the region's riparian areas are known to support approximately 93 percent of native bird species at some point in their lives. They also support more sensitive species, such as those found in Criterion 5c. Riparian areas provide vital fish and wildlife habitat connectivity throughout the region. The more a program option places Class I habitat at risk, the more negatively it will affect regional biological diversity.

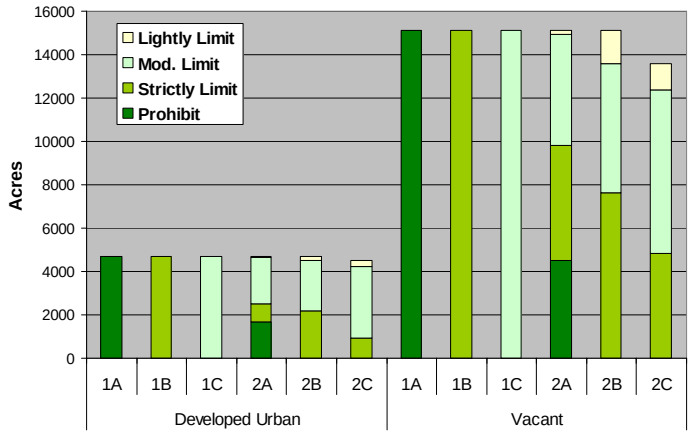
[27] Metro collected information on Species of Concern and Habitats of Concern for the Goal 5 wildlife habitat inventory from a variety of sources with site-specific knowledge of the region. ODFW, USFWS, the Oregon Biodiversity Project, and the Oregon-Washington chapter of Partners in Flight identify wetlands, native grasslands, Oregon white oak habitat, and riparian forests as the top four Willamette Valley habitats at risk. ODFW also lists urban natural area corridors as important at-risk habitats. Metro used these habitat types, plus other key contributors to diversity such as riverine islands and deltas and key migratory bird stopover habitats, to map Habitats of Concern.

Measuring the criterion

For each program option, acreage of Habitats of Concern (Criterion 5a) and Class I riparian (Criterion 5b) falling under various ALP designations was calculated. The two are reported separately and are not mutually exclusive.

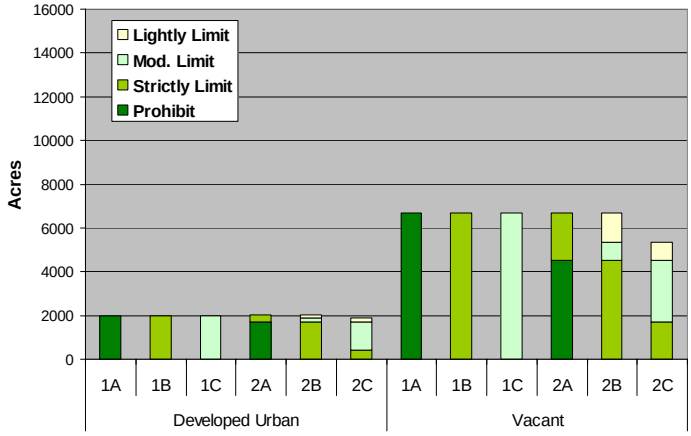
The data are reported separately for vacant and developed urban habitats, for the reasons described under Criterion 1. Similarly, Title 3 Water Quality Resource Areas (WQRA) and parks are excluded from Figures 4-43 and 4-44 in order to focus on the habitats most at risk of development or other conflicting uses.

Figure 4-43. Criterion 5a: Comparison of allow, limit, prohibit treatments for Habitats of Concern (excludes WQRA)



WQRA = 7,846 acres, non-WQRA = 19,816 acres

Figure 4-44. Criterion 5b: Comparison of allow, limit, prohibit treatments for Class I (excludes WQRA)



WQRA = 7,683 acres, non-WQRA = 8,681 acres

Results

Figures 4-43 and 4-44 illustrate Habitats of Concern, Class I riparian habitat, and Species of Concern, respectively. Program options that are likely to protect more at-risk habitats and species are assumed to perform better than other options.

Basic statistics: Habitats of Concern and Class I riparian

- The data illustrated by Figures 4-43 and 4-44 represent the portion of the habitat expected to be most at risk through development or redevelopment.
- The bar charts include 19,616 acres of Habitats of Concern and 8,688 acres of Class I riparian.
- Figures 4-43 and 4-44 exclude WQRA and parks from analysis for the same reasons stated in criterion 1.

Potential effects of treatments vary by habitat class, development status, and urban development value

- There are many more acres of vacant Habitats of Concern and Class I riparian than there are in developed urban. Therefore, the degree of protection afforded by each program option will have a stronger influence on vacant than on developed urban habitat.
- Where Habitats of Concern fall within Class I riparian, they are treated similarly under the various program options but where they are Class A wildlife, they receive lower protection

levels than Class I under options 2A-2C.

- This places non-riparian Habitats of Concern more at risk than riparian Habitats of Concern.

Program Option performance

- Options 1A and 1B are most protective of Habitats of Concern.
- Options 1A and 2A are most protective of riparian Class I.
- There is a larger discrepancy in protection levels between the two most protective options for Habitats of Concern than for Class I riparian.
- Options 1C and 2C are least protective for Habitats of Concern and are likely to result in substantial further loss of these depleted habitats.
- Options 2B and 2C are least protective of Class I riparian and are likely to result in substantial further loss of these depleted habitats. Option 1C is not much better.

Summary

Habitats of Concern and Class I riparian habitat are closely associated with declining or sensitive species in the region, and these habitats have declined greatly in extent and quality. It will be important to consider the relative rarity of the remaining habitats addressed in this criterion, because substantial further loss may result in regional species extirpations or potential Endangered Species Act listings. More protective options are more likely to prevent or minimize these undesirable results.

Table 4-25. Performance of options in meeting Environmental Criterion 5: Promotes biodiversity through conservation of sensitive habitats and species.

Rank	Option	Performance
1	1A	This option provides the highest protection levels for both Habitats of Concern and Class I riparian by assigning a Prohibit designation to all acres.
2 / 3	1B / 2A	Option 1B is important for Habitats of Concern, which includes more than twice as many acres as Class I riparian. However, Option 2A performs best for Class I riparian, and at a higher protection level than 1B provides Habitats of Concern.
4	2B	This option performs better than 1C or 2C for all Habitats of Concern, and for developed urban Class I riparian. However, for vacant Class I riparian it is difficult to discern whether Option 2B or 1C is more protective.
5	1C	Substantially lower protection levels, but consistent among development status and resource type, with all acres falling within Moderately Limit.
6	2C	Protection levels lowest of all options, with nine percent Allow in unprotected Habitats of Concern and 17 percent Allow in unprotected Class I riparian. Likely to result in substantial loss of sensitive habitats and sensitive species.

Evaluation of energy criteria

The analysis of energy criteria is intended to compare the potential effects of the six program options on energy use in the region. Two criteria will assist in this process:

1. Promotes compact urban form, and
2. Promotes green infrastructure.

Criteria were selected based on the findings in Metro's Technical Report for Goal 5 and Phase I ESEE analysis (Metro 2002, Metro 2003). The energy criteria discussed here are applied using data already collected in the Social, Environmental, and Economic Phase II ESEE analyses.

The summary of each criterion includes a table ranking the programs in order of performance, from most to least energy efficient as relates to each criterion. The criteria provide important new information about how each program performs relative to the others, and will aid Metro, its partners, and the public in designing an energy-efficient fish and wildlife habitat protection program.

1. Promotes compact urban form

A compact urban form conserves energy by reducing transportation related energy output and infrastructure needs, reduces the spatial extent of vegetation loss, and reduces the spatial extent of the urban heat island effect.[28] The amount of fish and wildlife habitat protected or partially protected by each regulatory program option and the zoning type and development status influence whether the option increases the need for Urban Growth Boundary expansions.

Importance of urban development priorities

The region's 2040 Growth Concept is designed to provide a compact urban form through efficient land use, a well-planned transportation system, and protection of natural areas. The second energy criterion below addresses natural area protection.

The extent to which a program option supports development priorities influences the ability to maintain a compact urban form, thus conserving energy by reducing transportation and infrastructure energy output. While program options 1A-1C consider only habitat value, program options 2A-2C incorporate the importance of land value, employment density, and the 2040 Design Types.

Importance of substitutability of lands

The Goal 5 rule requires Metro to consider the effect a Goal 5 program may have on the inventory of buildable lands. Any changes in density requirements may be difficult to reallocate within the current Urban Growth Boundary.

Some land uses can be more easily re-allocated, or substituted, to other parts of the region than other land uses. This can relate to a number of factors such as scarcity, lot size requirements, and the physical characteristics needed for certain land use types. For example, residential land

[28] See Metro's Economic, Social, Environmental and Energy Analysis (ESEE), September 2003.

comprises a majority of the region's vacant zoning and housing can be built on relatively small parcels in a variety of landscapes. As a result, residential lands to a certain extent can be flexible in how they are located on a site, and more sites may be available compared to other land use types. However, Metro cannot force existing residential neighborhoods to accommodate density increases.[29]

Conversely, industrial lands are much more difficult to relocate, and there is a regional shortage of industrial sites to meet our needs over the next 20 years. Industrial sites typically require flat terrain, access to transportation facilities, and some industrial sites need large contiguous parcels. Mixed use zoning, a highly energy efficient land use, can also be difficult to place in alternative sites if it doesn't meet market needs. Commercial land placement affects driving distance and infrastructure requirements.

Thus these land uses may be less substitutable within the existing Urban Growth Boundary than other land use types. New restrictions imposed by a program may limit the capacity for meeting housing and employment needs, and may increase energy use associated with the need for Urban Growth Boundary expansions and related transportation and infrastructure needs.

Measuring the criterion and results

As outlined above, urban development priorities and the substitutability of lands are both important to maintaining a compact urban form. Each of these is addressed in other ESEE criteria. Therefore no new data was collected for this criterion, and the results are available through other ESEE criteria:

- "Supports urban development priorities" (economic criterion 1), and
- "Reduces impact on types/location of jobs and housing" (social criterion 2).

Economic criterion 1, "Supports urban development priorities," assessed program performance for supporting urban development priorities. In descending order of performance, the program options for economic criterion 1 were ranked as follow: 1C, 2C, 2B, 1B, 2A and 1A.

Social criterion 2, "Reduces impact on types/locations of jobs and housing," assessed program performance for limiting new restrictions on vacant industrial, mixed use, and commercial lands (see figure xx in social section, "Treatment of vacant employment habitat land"). In descending order of performance, the program options for social criterion 1 ranked as follow: 2C, 1C, 2B, 1B, 2A and 1A.

Summary

Information pertaining to maintaining a compact urban form has already been assessed under economic criterion 1 and social criterion 2. The program performance for both criteria is similar but not identical, as summarized in the table below. For the energy criterion, emphasis was given to urban development priorities when program rankings differed (i.e., 2C and 1C), due to the importance of the 2040 Growth concept in regional planning.

[29] See Metro Ordinance #xxx.

Table 4-26. Performance of options in meeting Energy Criterion 1: Promotes compact urban growth form.

Rank	Option	Performance
1	1C	Provides the most support (lack of development restrictions) for lands with high urban development priorities and the second-best support for allowing development on existing vacant industrial, mixed use, and commercial lands.
2	2C	Substantial support for lands with high urban development value, and excellent support for lands with medium urban development value. Provides the best support for allowing development on existing vacant industrial, mixed use, and commercial lands.
3	2B	Good support for urban development priorities and allowing development on existing vacant industrial, mixed use, and commercial lands.
4	1B	Moderate support for maintaining a compact urban growth form. No prohibit treatments for urban development priorities, but significantly stronger impact than 2A or 1A. For vacant industrial, mixed use, and commercial lands, performs at a slightly reduced level compared to option 2A.
5	2A	Slightly less support for urban development priorities than 1B due to a small proportion of prohibit treatment. For vacant industrial, mixed use, and commercial lands, provides slightly more support than option 1B.
6	1A	Promotes compact urban form the least. Substantial restrictions possible on high urban development priorities and on development potential for existing vacant industrial, mixed use, and commercial lands.

2. Promotes green infrastructure

Trees and other vegetation reduce energy demand by moderating stream and air temperature increases, flooding, and air pollution associated with energy use.[30] Fish and wildlife habitat that are considered important or necessary to support cities and suburbs can be considered a type of infrastructure: "green infrastructure." The energy benefits provided by green infrastructure are a type of ecosystem service.

Ecosystem services may be defined as the processes and functions of natural ecosystems that sustain life and are critical to human welfare (see Evaluation of Energy, Criterion 2 for more detail). For example, trees help clean air and water, and wetlands and floodplains store water and help avert flooding. When ecosystem services are removed or diminished, a common alternative is to implement technological surrogates such as stormwater piping or water purification systems. Such solutions tend to require more energy than preserving existing green infrastructure and ecosystem functions.

Measuring the criterion and results

The amount of fish and wildlife habitat protected or partially protected by each program option, as well as the value of that habitat, help determine whether the option protects the energy-related green infrastructure and ecosystem services provided by trees, other vegetation, wetlands and floodplains. Green infrastructure and ecosystem services are strongly related.

This criterion is best assessed using a combination of three criteria from the environmental and economic ESEE:

- "Promotes retention of ecosystem services" (economic criterion 2);

[30] See Metro's Economic, Social, Environmental and Energy Analysis (ESEE), September 2003.

- "Conserves existing watershed health and restoration opportunities (environmental criterion 1); and
- "Retains multiple functions provided by forest canopy cover (environmental criterion 2).

This combination of criteria appropriately addresses energy concerns. No new data was collected, and the detailed results are available through the relevant criteria in the environmental and economic sections.

Ecosystem services are addressed in economic criterion 2, "Promotes retention of ecosystem services." In that criterion, areas with more ecological functions and/or areas with functions closer to streams, wetlands, or floodplains ranked higher than areas with fewer functions or with functions further away from water features. Economic criterion 2 ranked identically to environmental criterion 1: 1A, 2A, 1B, 2B, 2C, and 1C.

Although green infrastructure is addressed in all environmental criteria environmental criterion 1, "Conserves existing watershed health and restoration opportunities" and criterion 2, "Retains multiple functions provided by forest canopy cover," are particularly relevant to energy use. These are the resources that protect existing ecosystem functions.

Environmental criterion 1 assesses the performance of program options in conserving existing watershed health and restoration opportunities based on protection levels for fish and wildlife habitat. In descending order of performance, the program options for environmental criterion 1 were ranked as follow: 1A, 2A, 1B, 2B, 2C, and 1C.

Environmental criterion 2 estimates how well each program option would protect existing forest canopy cover, identified in the Phase I ESEE analysis as a key energy-related feature. This is an important separate measure because although all forest is ecologically important to the region, not all forest ranks as high-value fish and wildlife habitat. In descending order of performance, the program options for environmental criterion 2 ranked as follow: 1A, 1B, 2A, 2B, 2C, and 1C.

Summary

Information pertaining to retaining green infrastructure and ecosystem services has already been assessed under economic criterion 1 and environmental criteria 1 and 2. The program performance for all three criteria is similar but not identical, as summarized in the table below.

Table 4-27. Performance of options in meeting Energy Criterion 2: Promotes green infrastructure.

Rank	Option	Performance
1	1A	Provides the most protection for all habitats and best protection to forest canopy cover and ecosystem services.
2	2A	Protection level substantial for high-value riparian habitat, and good for other habitat classes. Ecosystem services also reflect this ranking. However, 1B provides better protection for upland wildlife habitat. Options 2A and 1B fairly similar for forest canopy.
3	1B	Substantially reduced protection for all riparian habitat compared to 1A and 2A. Ecosystem services also reflect this ranking. For wildlife habitat, performs better than 2A. For forest canopy, fairly similar to option 2A.
4	2B	Options 2B, 2C and 1C ranked identically for habitat, tree canopy, and ecosystem service protection. Moderate performance for higher riparian and wildlife classes, but protection drops significantly for lower habitat classes. Similar findings for forest canopy and ecosystem services.
5	2C	Places nearly 40 percent of all forest canopy at risk through low or no protection levels. Low protection levels for all resources. May result in substantial loss of riparian and upland habitat functions, ecosystem services, and forest canopy over time.
6	1C	Places nearly half of all forest canopy at risk through low or no protection levels. Low protection levels for all resources. Most likely to result in substantial loss of riparian and upland habitat functions, ecosystem services, and forest canopy over time.

Evaluation of federal Endangered Species Act

The Endangered Species Act's (ESA's) ultimate goal is to recover species and conserve the ecosystems upon which they depend so they no longer need regulatory protection. Twelve salmon species or runs are listed as either threatened or endangered in the Columbia River and Willamette River basins. The National Oceanic and Atmospheric Administration (NOAA) Fisheries is the federal agency responsible for these species.

The U.S. Fish and Wildlife Service (FWS) has jurisdiction over terrestrial species and aquatic species that spend the majority of their life cycle in fresh water. Listed species under their jurisdiction that currently or historically occurred in the Metro region include bald eagle, bull trout, golden Indian paintbrush, Willamette daisy, water howellia, Bradshaw's lomatium, Kincaid's lupine, and Nelson's checker-mallow. The FWS was petitioned to list pacific lamprey, western brook lamprey and river lamprey in January 2003; processing of the petition has not yet been completed and is currently on hold. Additionally, several candidate species and species of concern are also known to occur in the Metro region. Although these species do not currently receive ESA regulatory protection, efforts to conserve these species may help to sustain existing populations and preclude the need for future listings.

Will a Metro fish and wildlife habitat protection program meet the ESA? There is no clear answer, because program details are not yet developed and it is not possible to fully predict the outcome of any program. It is also worth noting that the full suite of factors that affect the habitats upon which these species depend will not all be addressed in Metro's Goal 5 program. For example, stormwater runoff can have significant impacts on stream health and channel complexity, but Goal 5 is not designed to explicitly or comprehensively address stormwater management.

However, the Goal 5 program will help to define the types of land uses that will be allowed within and near regionally significant habitats, ultimately determining the degree to which these habitats and their ecological functions are conserved over time. The program's non-regulatory components, particularly the degree of investment in restoration, will also play a key role. An effective Metro program that provides adequate species protection could provide a template that could serve as a model for local jurisdictions to come into ESA compliance, and may also contribute to efforts designed to prevent future ESA species listings.

The federal ESA portion of this phase of the ESEE analysis is intended to compare the potential effects of the six program options on listed fish and wildlife and related species of conservation interest such as the three species of lamprey that have been petitioned for listing. Three criteria will assist this process:

1. Protects slopes, wetlands, and areas of high habitat value;
2. Maintains hydrologic conditions; and
3. Protects riparian functions.

These criteria provide important information about how each program performs relative to the others in protecting habitats and watershed health, and will aid Metro, its partners, and the public

determine the general consequences to fish and wildlife species under each program.

1. Protects slopes, wetlands and areas of high habitat value

Steep slopes are vulnerable to erosion and landslides that can negatively affect aquatic resources, particularly when trees and other vegetation are removed.[31] Wetlands provide important off-channel rearing habitat for young salmon and functions important to stream health. They also provide key habitat for many of the region's other known at-risk species – for example, bald eagles, northern red-legged frogs, northwestern pond turtles, and numerous neotropical migratory bird species[32]. At-risk species relate to the ESA because if they continue to decline, they may become future candidates for ESA listings. Habitats of Concern include wetlands, riparian bottomland forest, stands of Oregon white oak, native grassland, important migratory pathways, and other critical habitats that potentially support listed plants and animals, as well as numerous other at-risk species. Large habitat patches retain higher habitat quality than smaller patches and provide homes to species most sensitive to human disturbance, such as neotropical migratory songbirds[33], and maintaining the connections between these valuable habitats is vital to supporting the region's sensitive species over time.

Measuring the criterion

Steep slopes are addressed in Metro's riparian GIS model as a primary and secondary functional contributor to Bank Stabilization, Sediment and Pollution Control. Wetlands receive primary functional value in the riparian model under the Streamflow Moderation and Water Storage and Bank Stabilization, Sediment and Pollution Control criteria, and are also captured under Class I riparian as Habitats of Concern. Areas of highest habitat value, including all Habitats of Concern and most large habitat patches, are captured under Class I riparian and Class A wildlife habitat. In addition, large habitat patches were specifically addressed in environmental criterion 2. Thus, this criterion is best assessed using a combination of criteria from the Environmental ESEE:

- Class I riparian and Class A wildlife habitat derived from the criterion entitled "Conserves existing watershed health and restoration opportunities" (environmental criterion 1);
- Promotes riparian corridor continuity and overall habitat connectivity (environmental criterion 3);
- Conserves habitat quality and biodiversity provided by large habitat patches (environmental criterion 2); and
- Promotes biodiversity through conservation of sensitive habitats and species (environmental criterion 5).

Results

The data tables and graphs associated with this criterion are available in the Environmental ESEE section. Option 1A provides the most protection for this criterion, but Options 2A and 1B

[31] The ecological damage associated with excess sediments entering streams is described in Metro's Technical Report for Goal 5 (Metro 2002) and Phase I ESEE report (Metro 2003).
[32] See Metro's species list for at-risk species and their general habitat associations.
[33] Neotropical migratory songbirds have been identified by ODFW as an at-risk group of species. Local studies (Hennings and Edge 2003) confirm that Neotropical migrants are negatively associated with urbanization.

also provide substantial protection. Option 2B provides a moderate level of protection. Options 2C and 1C are least likely to protect sensitive species over time, because substantial habitat and connectivity may be lost.

Table 4-28. Performance of options in meeting ESA criterion 1: Protects slopes, wetlands, and areas of high habitat value.

Rank	Option	Performance
1	1A	Most protective of all variables assessed. Best option for protecting slopes, wetlands, and areas of high habitat value; most likely to reduce need for future ESA listings.
2 / 3	2A / 1B	Option 2A is second-most protective for Class I habitat, promoting overall connectivity. Option 1B is second-most protective for Class A habitat and large patches. Options 2A and 1B are similar in terms of protecting sensitive habitats and species.
4	2B	Incrementally less protection for all variables assessed. Options 2A and 2B are similar in terms of protecting Class A habitat.
5	2C	Ranks fifth for Class A, overall connectivity, and large patches. Ranks sixth for Class I and sensitive habitats. More likely to result in species depletion or loss over time, and may increase future ESA listings.
6	1C	Minimal protection for Class A, overall connectivity, and large patches. Ranks fifth for Class I and sensitive habitats. Most likely to result in species depletion or loss over time, and may increase future ESA listings.

2. Maintains hydrologic conditions

Hydrology, in part, refers to how water is delivered to streams and rivers during storms. Under natural hydrologic conditions in the Pacific Northwest, rainwater movement to streams is slowed and retained by trees, plants, wetlands, floodplains and soils. When these natural features are altered or removed and hard (impervious) surfaces are installed, rainwater is delivered quickly, in high volumes, to streams and rivers. This causes channel damage, excessive flooding, groundwater depletion, and alters habitat such that animals adapted to natural conditions are sometimes no longer able to survive there. Altered hydrology has strongly, negatively impacted the region's threatened salmon and other native aquatic species including lamprey.

All habitat in Metro's inventory is important to maintaining hydrologic conditions. In this naturally forested region, trees are particularly important to hydrology because they slow and store large quantities of stormwater.[34]

Measuring the criterion

This criterion is best assessed using a combination of criteria from the Environmental ESEE:

- "Conserves existing watershed health and restoration opportunities" (environmental criterion 1), and
- Retains multiple functions provided by forest canopy cover (environmental criterion 2).

[34] Metro's field studies showed that the amount of tree cover, both near streams and throughout watersheds, is positively associated with stream health (Frady et al. 2002).

Results

The data tables and graphs associated with this criterion are available in the Environmental ESEE section. Option 1A provides the most protection for this criterion, but Options 2A and 1B also provide substantial protection. Options 2C and 1C are least likely to protect sensitive species over time, because substantial habitat and connectivity may be lost. Less protective options may lead to an increase in future ESA species listings.

Table 4-29. Performance of options in meeting ESA criterion 2: Maintains hydrologic conditions.

Rank	Option	Performance
1	1A	This option provides the most protection and restoration opportunities for existing fish and wildlife habitat, and therefore provides the strongest regulatory approach to maintain current hydrologic conditions.
2 / 3	2A / 1B	Option 2A ranks second for conserving existing watershed health and restoration opportunities, but ranks third for retaining forest canopy cover. Both options could aid in maintaining hydrologic conditions, depending on the amount of habitat retained and whether new trees and habitat are added over time.
4	2B	Ranks fourth for conserving watershed health and restoration opportunities, as well as for conserving forest canopy. Unlikely to maintain hydrologic conditions over time without substantial non-regulatory investments.
5	2C	Ranks fifth for conserving watershed health and restoration opportunities, as well as for conserving forest canopy. Unlikely to maintain hydrologic conditions over time, even with substantial non-regulatory investments. Strong likelihood for increased harm to salmon habitat and increased potential for future ESA species listings.
6	1C	Ranks last for conserving watershed health and restoration opportunities, as well as for conserving forest canopy. Unlikely to maintain hydrologic conditions over time due to extensive loss of existing resources and loss of restoration opportunities. Strong likelihood for increased harm to salmon habitat and increased potential for future ESA species listings.

3. Protects riparian functions

Metro's extensive review of the scientific literature revealed that ecological functions are not limited to the areas nearest the stream. Existing riparian habitat areas protect water quality and provide key habitat to many of the region's at-risk species, including those living on the land or in water. Due to the extent of riparian habitat loss over time, all remaining riparian areas are important to stream health. Lower value areas not only contribute to watershed function, but also provide key restoration opportunities that may help improve watershed health and offset detrimental effects from future development elsewhere in the watershed.

Measuring the criterion

This criterion is derived from the riparian corridor portion of the criterion entitled "Conserves existing watershed health and restoration opportunities" (environmental criterion 1). It measures the amount of riparian habitat affected by allow, limit, prohibit treatments under each program option. Class I riparian receives special consideration in Table 4-29 due to the multiple ecological functions provided in these high-value areas.

Results

The data tables and graphs associated with this criterion are available in the Environmental ESEE section. It is important to note that no matter which option is selected, riparian habitat

may be lost and remaining habitat degraded over time due to continued development within the UGB and the urban effects associated with development, such as increased runoff and decreased water quality. The extent to which a program protects riparian function depends, in part, on non-regulatory program elements such as restoration in existing resources and new habitat creation in key areas of importance.

Option 1A provides the most protection for all riparian habitat. Option 2A provides less protection for habitat within one site potential tree height, and Option 1B is a substantial step downward in protection levels. Option 2B is slightly less protective of riparian habitat than Option 1B. Option 2C provides a substantially reduced level of protection for Class I and II habitat, and very little protection for Class III. Option 1C provides low level protection for Class I and II, and no protection at all for Class III riparian; this option is least likely to protect riparian functions. Options 1C and 2C are unlikely to protect existing sensitive species, and will likely result in future ESA listings over time as riparian habitat is lost or damaged.

Table 4-30. Performance of options in meeting ESA criterion 3: Protects riparian corridors

Rank	Option	Performance
1	1A	Most likely to retain existing riparian function and watershed health. Class I and II habitat in prohibit designation, and Class III in strictly limit. Most likely to help conserve sensitive species and aid in preventing future ESA listings.
2	2A	Incrementally less protection for riparian habitat, but generally still good protection levels for Class I and II. Protection drops significantly for Class III, with the majority in lightly limit designation.
3	1B	Substantially less protection compared to Options 1A and 2A. Class III riparian in appears to be particularly vulnerable, with lightly limit designations.
4	2B	Incrementally less protection than previous options. Moderate loss of high-value riparian habitat likely, with potential for negative effects on sensitive species. Protection levels drop off significantly for Class III habitat, with primarily lightly limit designation, similar to option 2A. May increase potential for future ESA listings.
5	1C	Class I receives moderately limit, Class II lightly limit, and Class III receives allow designations. Less likely to protect existing sensitive species than options above. May result in substantial loss of riparian habitat and increases potential for future additional ESA listings.
6	2C	Poor protection for riparian habitat. Least likely to protect existing sensitive species. Most likely to lead to future ESA listings.

Evaluation of federal Clean Water Act

The federal Clean Water Act (CWA) sets a national goal to "restore and maintain the chemical, physical and biological integrity of the Nation's waters." In Oregon, the Department of Environmental Quality (DEQ) implements the CWA, with review and approval by the U.S. Environmental Protection Agency.

The DEQ is responsible for protecting the beneficial uses of rivers, streams and lakes of the state. The DEQ carries out this responsibility in part by identifying those water bodies that are not meeting current water quality standards. This inventory is known as the 303(d) list. For waters identified on the 303(d) list, DEQ must develop total maximum daily loads (TMDLs) for those pollutants that exceed water quality standards. The TMDLs become part of implementation plans at the watershed scale intended to meet water quality standards. In urban areas, local governments are often the parties responsible for such plans, with input from watershed councils, landowners and other stakeholders.

The DEQ recently informed Metro Council that a Goal 5 program that provides shading, pollutant removal, and infiltration could protect and restore fish and wildlife habitat and help meet water quality standards in the Willamette and Tualatin Basins. Retaining fish and wildlife habitat, and the ecological functions these areas provide, is less expensive than constructing water quality treatment facilities. Potentially, the amount of Goal 5 resources preserved for protection and restoration may be an important management measure in a watershed's TMDL implementation plan.

The federal CWA criterion compares the potential effects of the six program options on the importance of fish and wildlife habitat to the region's water quality. Four criteria will assist this process:

1. Protects steep slopes and wetlands;
2. Protects resources within 150 feet of streams;
3. Maintains hydrologic conditions (see ESA criterion 2); and
4. Protects forested areas throughout the watershed.

Some of the criteria used to assess program performance related to the CWA are similar to those assessed for the federal ESA, because existing fish and wildlife habitat also protects water quality. These criteria provide important information about how each program performs relative to the others, and will aid Metro, its partners, and the public in determining the relative consequences to water quality under each program.

1. Protects slopes and wetlands

Steep slopes are vulnerable to erosion and landslides, particularly when trees and other vegetation are removed.[35] Wetlands collect and treat soil runoff and help control stream bank erosion to help meet turbidity, sedimentation, and nutrient TMDLs. Wetlands collect and treat

[35] The ecological damage associated with excess sediments entering streams is described in Metro's Technical Report for Goal 5 (Metro 2002) and Phase I ESEE report (Metro 2003).

pesticides, heavy metals, and other toxic pollutants to help meet TMDLs for these pollutants. Wetlands also collect and store water to provide base flow in streams during summer low-flow months, which helps meet temperature TMDLs.

Measuring the criterion

Steep slopes are addressed in Metro's riparian GIS model as a primary and secondary functional contributor to Bank Stabilization, Sediment and Pollution Control. Wetlands receive primary functional value in the riparian model under the Streamflow Moderation and Water Storage, Bank Stabilization, Sediment and Pollution Control, and are also captured as Class I riparian as a Habitat of Concern.

This criterion is best assessed using a subset of one of the criteria from the Environmental ESEE. Class I and Class II riparian habitat derived from the criterion entitled "Conserves existing watershed health and restoration opportunities" (environmental criterion 1) captures all wetlands and the majority of vegetated steep slopes near streams. As in the ESA criteria, the extent to which restoration is included as part of any Goal 5 program will help determine its effectiveness in protecting water quality.

Results

The data tables and graphs associated with this criterion are available in the Environmental ESEE section and associated appendices. Option 1A provides the most protection for Class I and II riparian habitat. Option 2A provides incrementally less. Options 1B and 2B fall in the middle. Options 1C and 2C perform poorly in protecting these habitat areas, and are likely to result in future 303(d) listings and TMDL requirements due to unprotected steep slopes and wetland areas.

Table 4-31. Performance of options in meeting CWA criterion 1: Protects slopes and wetlands.

Rank	Option	Performance
1	1A	Highest protection level for all Class I and Class II riparian habitat; most likely to protect steep slopes and wetlands. **For every program option, restoration will still be needed to meet temperature and other standards.**
2	2A	Excellent protection for Class I habitat. Good protection for Class II habitat, but definitely a step downward from 1A, with about two thirds of Class II in moderately limit designations and the remainder in Lightly Limit. Where steep slopes occur in Class II, may increase erosion and sedimentation and degrade water quality.
3	1B	Incrementally less protection for Class I and Class II habitat.
4	2B	Somewhat less protection for Class I and II habitat compared to Option 1B, but most habitat areas still receive strictly or moderately limit designations.
5	1C	Substantially reduced protection for steep slope areas and wetlands. Likely to result in non-compliance for existing TMDLs and future 303(d) listings and TMDL requirements.
6	2C	Poor protection for Class I resources (particularly in Developed Urban areas), and dismal protection for Class II. Highly likely to result in degraded water quality, non-compliance for existing TMDLs, and increased future 303(d) listings and TMDL requirements.

2. Protects resources within 150 feet of streams

The importance of riparian areas in maintaining water quality is well documented.[36] These areas provide shading to help meet temperature TMDLs, collect and treat soil runoff, and control stream bank erosion to help meet turbidity, sedimentation, and nutrient TMDLs. Riparian areas collect and treat bacteria in runoff to help meet bacteria TMDLs and collect and treat pesticides, heavy metals, and other toxic pollutants to help meet TMDLs for these pollutants. Like wetlands (and generally including wetlands), riparian areas collect and store water to provide base flow in streams during summer low-flow months, helping to meet temperature TMDLs.

Measuring the criterion

This criterion is assessed using the riparian corridor continuity portion of the criterion entitled "Promotes riparian corridor continuity and overall habitat connectivity" (environmental criterion 3a). It measures the amount of habitat within 150 feet of streams affected by allow, limit, prohibit treatments under each program option.

Results

The data tables and graphs associated with this criterion are available in the Environmental ESEE section. Option 1A provides the most protection for Class I and II riparian habitat. Option 2A, 1B and 2C provide incrementally less protection for areas within one site potential tree height, respectively. Options 1C and 2C perform very poorly in protecting these habitat areas, and are likely to result in future 303(d) listings and TMDL requirements due to habitat loss closest to streams, as well as non-compliance with existing TMDLs.

Table 4-32. Performance of options in meeting CWA criterion 2: Conserves habitat within 150 feet of streams.

Rank	Option	Performance
1	1A	Excellent performance for conserving existing habitat within 150 feet of streams, with primarily Prohibit plus some Strictly Limit designations. This option is most likely to assist in meeting current TMDLs and preventing future non-compliance issues. **For every program option, restoration will still be needed to meet temperature and other standards.**
2	2A	Substantial step downward from 1A, but still good protection levels. About half of the habitat within 150 feet of streams receives Prohibit treatment, with the remainder falling within the three degrees of limit. Loss of any habitat within this zone, particularly without restoring key areas, is likely to decrease water quality and increase CWA non-compliance issues.
3	1B	Incremental step downward from Option 2A. Increases likelihood of water quality issues and CWA non-compliance.
4	2B	Relatively small step downward from Option 1B, with similar repercussions possible.
5	1C	Very poor protection for near-stream habitat. Unlikely to conserve existing resources or retain restoration opportunities within 150 feet of streams. Highly likely to degrade water quality, resulting in non-compliance with current TMDLs and necessitating future 303(d) and TMDL listings.
6	2C	Similar to Option 1C, but slightly worse.

[36] See Metro's Technical Report for Goal 5 (Metro 2002) and Phase I ESEE Report (Metro 2003).

3. Maintains hydrologic conditions

This criterion is described and measured in ESA criterion 2. Altered hydrology is a leading cause of degraded water quality. The key negative effects associated with altered hydrology are described in Metro's Technical Report for Goal 5 and Phase I ESEE documents (Metro 2002, 2003). Program options for this criterion rank as follow, from best to worst in terms of maintaining hydrologic conditions: 1A, 2A/1B, 2B, 2C, and 1C.

4. Protects forested areas throughout the watershed

Trees are vitally important to the region's water quality, as demonstrated through local studies and as recognized by DEQ.[37] Trees provide infiltration to recharge both groundwater and down gradient streams, providing base flow for streams during summer low-flow months and helping to meet temperature TMDLs. Trees are especially effective in reducing sedimentation and erosion, runoff speed and volume, excess nutrients, and water temperature, thereby helping to meet nutrient, sediment, turbidity, and temperature TMDLs.

Measuring the criterion

This criterion is measured using Environmental criterion 2, "Retains multiple functions provided by forest canopy cover."

Results

The data tables and graphs associated with this criterion are available in the Environmental ESEE section. Option 1A provides the most protection for the region's upland and riparian forests. Option 1B provides substantially less protection, with Option 2A close behind. Options 1B and 2B fall in the middle. Option 2C performs very poorly in protecting forest canopy, and is likely to result in future 303(d) listings and TMDL requirements due to unprotected steep slopes and wetland areas.

[37] Metro's field studies showed that the amount of tree cover, both near streams and throughout watersheds, is positively associated with stream health (Frady et al. 2002).

Table 4-33. Performance of options in meeting CWA criterion 4: Protects forest canopy throughout the watershed.

Rank	Option	Performance
1	1A	Protects by far the most canopy cover of any other program option for vulnerable forested lands in both vacant and developed lands. This option is most likely to aid in current Clean Water Act compliance and help prevent future 303(d) listings and TMDL requirements. **For every program option, restoration will still be needed to meet temperature and other standards.**
2	1B	Substantially less protection than option 1A, but still performs better than the remaining options. However, options 1B and 2A appear relatively close in terms of potential effects on the region's forest canopy, and therefore, water quality. No Allow designations mean that all forested habitat would be afforded at least some level of protection.
3	2A	Similar to 1B, with slightly less protection.
4	2B	Little Allow, but overall protection levels lower than options 1B and 2A. Potential for significant forest loss and increased water quality issues.
5	2C	Low protection levels for forest canopy, with 38 percent of vacant and developed urban in Lightly Limit or Allow. Likely to result in significant forest canopy loss over time. Highly likely to degrade water quality, resulting in non-compliance with current TMDLs and likely necessitating future 303(d) and TMDL listings.
6	1C	Low protection levels for forest canopy, with 47 percent of vacant and developed urban in Lightly Limit or Allow. Likely to result in significant forest habitat loss over time. Highly likely to degrade water quality, resulting in non-compliance with current TMDLs and likely necessitating future 303(d) and TMDL listings.

Summary of analysis of regulatory options

Metro's analysis of the six regulatory program options against the 19 criteria provides a substantial amount of information for the Metro Council to use in their consideration of a program direction for protecting fish and wildlife habitat. Generally, the options that protect more habitat (Options 1A and 2A) perform similarly across criteria. The option that least protects the highest value habitat (Option 1C) and the option with the lowest level of protection for habitat in industrial areas and centers (Option 2C) also perform similarly. However, Option 2C favors factors important for urban development by focusing on the economic concerns, while Option 1C reduces protection equally for all land uses. Table 4-34 summarizes the analysis.

Table 4-34. Summary of program option analysis.

Criteria	Option 1A: Most habitat protection *Highest level of protection for all habitats*	Option 1B: Moderate habitat protection *High level of protection for highest value habitat, moderate protection for other habitats*	Option 1C: Least habitat protection *Moderate level of protection for higher value habitats, no protection for lowest value habitat*	Option 2A: Most habitat protection *Moderate level of protection in high urban development value areas, high level of protection in other areas*	Option 2B: Moderate habitat protection *Low level of protection in high urban development value areas, moderate level of protection in other areas*	Option 2C: Least habitat protection *No protection in high urban development value areas, moderate level of habitat protection in other areas*
Economic factors						
1. Supports the regional economy by providing development opportunities (such as residential, commercial, industrial)	**Ranks 6th**: Provides least development opportunities due to highest levels of habitat protection on residential, commercial and industrial lands.	**Ranks 4th:** Provides some development opportunities for residential, commercial and industrial.	**Ranks 2nd:** Provides substantial development opportunities for all types of development.	**Ranks 5th:** Provides minimal development opportunities because residential development in some high value habitat is prohibited.	**Ranks 3rd:** Provides moderate development opportunities due to less habitat protection in all commercial and industrial areas and some residential land.	**Ranks 1st:** Provides most development opportunities due to relaxed habitat protection; provides more development opportunities in commercial and industrial areas than in residential areas.
2. Supports economic values associated with ecosystem services (such as flood control, clean water, recreation, amenity values)	**Ranks 1st**: Retains most existing ecosystem services across all habitat classes. Highest protection for habitat.	**Ranks 3rd**: Retains moderate ecosystem services with moderate protection to high value habitat.	**Ranks 6th**: Retains least ecosystem services overall for all habitat classes.	**Ranks 2nd**: Retains substantial ecosystem services with strict protection to high and medium value stream corridors.	**Ranks 4th**: Retains some ecosystem services. Applies moderate protection to stream corridors but higher protection to upland wildlife habitat.	**Ranks 5th**: Retains minimal ecosystem services due to relaxed protection in areas with high and medium development value.
3. Promotes recreational use and amenities	**Ranks 1st**: Promotes the most recreational benefits by prohibiting development in highest quality habitat lands.	**Ranks 3rd**: Provides moderate recreational benefits by applying relatively strong protection to the highest value habitats.	**Ranks 6th**: Provides least recreational benefits because it applies only moderate protection to highest value habitat.	**Ranks 2nd**: Promotes substantial recreational benefits of stream corridors, does not apply same protection to wildlife habitat.	**Ranks 4th**: Promotes some recreational benefits, mostly on park land.	**Ranks 5th**: Promotes minimal recreational benefits mostly on park land.
4. Distribution of economic tradeoffs	**No rank:** Privately-owned habitat land bears greater proportion of highest protection than publicly-owned habitat.	**No rank**: Privately-owned and publicly-owned land bears equal proportion of highest protection.	**No rank:** Privately-owned and publicly-owned land bears equal proportion of highest protection.	**No rank:** Publicly-owned habitat land bears greater proportion of highest protection than privately-owned habitat land.	**No rank:** Publicly-owned habitat land bears greater proportion of highest protection than privately-owned habitat land.	**No rank:** Publicly-owned habitat land bears greatest proportion of highest protection.
5. Minimizes need to expand the urban growth boundary (UGB) and increase development costs.	**Ranks 6th**: Affects the need to expand the UGB the most; highest level of protection restricts development.	**Ranks 4th**: Moderately affects the need to expand the UGB because of restrictive protection levels.	**Ranks 1st**: Least need to expand UGB; lowest protection levels provide most development opportunity.	**Ranks 5th**: Substantially affects need to expand the UGB because of restrictive protection levels.	**Ranks 3rd**: Some need to expand UGB but less restrictive protection.	**Ranks 2nd**: Minimal need to expand the UGB because low level of protection provides development opportunity.
Social factors						
6. Minimizes impact on property owners	**Ranks 6th:** Affects the most property owners with the highest level of habitat protection regardless of zoning.	**Ranks 4th:** Moderately affects all property owners, but does not apply highest habitat protection anywhere.	**Ranks 1st:** Affects the least number of property owners and applies lower levels of habitat protection.	**Ranks 5th:** Substantially affects large number of property owners with strong protection, especially in residential and rural areas.	**Ranks 3rd:** Affects some business landowners with moderate protection, but high protection is applied to residential and rural owners.	**Ranks 2nd:** Minimally affects business landowners, but many residential and rural property owners are affected with lower levels of protection.
7. Minimizes impact on location and choices for housing and jobs	**Ranks 6th:** Most effect on the location and choices available for jobs and housing by	**Ranks 4th:** Moderate effect on the location and choices available for jobs and housing,	**Ranks 2nd:** Minimal effect on housing location and choices, some effect on job location	**Ranks 5th:** Substantial effect on housing location and choices, moderate effect on	**Ranks 3rd:** Some effect on job location and choices, moderate effect on housing	**Ranks 1st:** Least effect on job location and choices, minimal effect on housing location and

Criteria	Option 1A: Most habitat protection *Highest level of protection for all habitats*	Option 1B: Moderate habitat protection *High level of protection for highest value habitat, moderate protection for other habitats*	Option 1C: Least habitat protection *Moderate level of protection for higher value habitats, no protection for lowest value habitat*	Option 2A: Most habitat protection *Moderate level of protection in high urban development value areas, high level of protection in other areas*	Option 2B: Moderate habitat protection *Low level of protection in high urban development value areas, moderate level of protection in other areas*	Option 2C: Least habitat protection *No protection in high urban development value areas, moderate level of habitat protection in other areas*
	applying high protection levels to all habitats.	applies a medium protection level to residential and employment land.	and choices. Applies lower protection levels to all land regardless of zoning.	job location and choices. Applies high protection levels to residential land, medium protection levels to most employment land.	location and choices. Applies lower protection levels to employment land, moderate protection levels to residential land.	choices. Applies lowest protection levels to employment land, moderate protection levels to residential land.
8. Preserves habitat for future generations	**Ranks 1st:** Preserves the most habitat for future generations by applying high levels of protection to all habitats.	**Ranks 3rd:** Preserves a moderate amount of habitat for future generations, focuses protection on higher value habitats.	**Ranks 6th:** Preserves the least amount of habitat for future generations, applies lower level of protection to higher value habitats.	**Ranks 2nd:** Preserves a substantial amount of habitat for future generations. Higher protection levels applied to highest value stream corridors, moderate and high protection applied to other habitats.	**Ranks 4th:** Preserves some habitat for future generations. Applies some protection to highest value habitats and moderate protection to other habitats.	**Ranks 5th:** Preserves a minimal amount of habitat for future generations. Habitat in areas of high urban development value is not preserved, habitat in other areas receives low and moderate protection.
9. Maintains cultural heritage and sense of place	**Ranks 1st:** Provides the most protection for the highest value habitat, highest level of protection may result in need for expanding the UGB.	**Ranks 3rd:** Provides moderate protection for highest value habitat, less potential for expanding the UGB.	**Ranks 6th:** Provides the least protection to highest value habitat, habitat outside UGB at less risk.	**Ranks 2nd:** Provides substantial protection to highest value habitat, a small portion in high urban development value areas receive moderate protection.	**Ranks 4th:** Provides some protection to highest value habitat; applies low protection to habitat in high urban development value areas.	**Ranks 5th:** Provides minimal protection to highest value habitat, habitat in high urban development values receives no protection.
10. Preserves amenity value of resources (quality of life, property values, views)	**Ranks 1st:** Retains the most amenity value in the highest value habitats.	**Ranks 3rd:** Retains moderate level of amenity value in the highest value habitats.	**Ranks 6th:** Retains least level of amenity value in wildlife habitat, slightly more in stream corridors.	**Ranks 2nd:** Retains substantial amenity value in highest value habitats, more protection for streams than upland habitat.	**Ranks 4th:** Retains some level of amenity value in highest value habitat, more protection for streams than upland habitat.	**Ranks 5th:** Retains a minimal level of amenity value, highest value wildlife habitat receives more protection.
Environmental factors						
11. Conserves existing watershed health and restoration opportunities	**Ranks 1st**: Preserves most high value habitat; provides substantial protection to other habitats.	**Ranks 3rd**: Preserves moderate amount of all habitats; higher protection for highest value habitat.	**Ranks 6th**: Preserves least amount of habitat; moderate protection for higher value habitat; no protection for lowest value habitat.	**Ranks 2nd:** Preserves substantial amount of habitat. Highest protection levels for most high value habitat, moderate protection for other habitats.	**Ranks 4th**: Preserves some amount of habitat. Higher value habitats receive moderate protection levels; other habitats receive lower protection.	**Ranks 5th**: Preserves minimal amount of habitat. Provides low protection levels for all habitat classes, no protection for highest value habitat in some circumstances.
12. Retains multiple habitat functions provided by forest areas	**Ranks 1st**: Retains the most forest cover in both vacant and developed habitat lands.	**Ranks 2nd**: Retains substantial amount of forest cover in both vacant and developed habitat lands.	**Ranks 6th:** Retains least amount of forest cover, likely to result in significant forest habitat loss over time.	**Ranks 3rd**: Retains moderate amount of forest cover, some protection for all forested habitat areas and highest protection for forested habitat in stream corridors.	**Ranks 4th:** Retains some amount of forest cover, some protection for almost all forested habitat areas.	**Ranks 5th**: Retains minimal amount of forest cover, low protection levels for most forested habitat areas.
13. Promotes riparian corridor connectivity and overall habitat	**Ranks 1st:** Promotes most stream corridor continuity and overall habitat connectivity.	**Ranks 3rd:** Promotes moderate retention of connectivity. Provides small	**Ranks 6th**: Promotes least retention of connectivity and likely to result in most	**Ranks 2nd:** Promotes substantial retention of stream corridor continuity; moderate	**Ranks 4th:** Promotes some retention of connectivity in stream corridors and between	**Ranks 5th:** Promotes minimal retention of connectivity, likely to result in significantly

Criteria	Option 1A: Most habitat protection	Option 1B: Moderate habitat protection	Option 1C: Least habitat protection	Option 2A: Most habitat protection	Option 2B: Moderate habitat protection	Option 2C: Least habitat protection
	Highest level of protection for all habitats	*High level of protection for highest value habitat, moderate protection for other habitats*	*Moderate level of protection for higher value habitats, no protection for lowest value habitat*	*Moderate level of protection in high urban development value areas, high level of protection in other areas*	*Low level of protection in high urban development value areas, moderate level of protection in other areas*	*No protection in high urban development value areas, moderate level of habitat protection in other areas*
connectivity		connector habitats with higher protection, does not preserve as much stream corridor continuity.	reduction of regional connectivity. No protection for small connector habitats.	protection for small connector habitats.	upland habitats.	reduced regional connectivity.
14. Conserves habitat quality and biodiversity provided by large habitat areas	**Ranks 1st**: Conserves the most large habitat areas.	**Ranks 2nd:** Conserves a substantial amount of large habitat areas, moderate risk for urban development fragmenting large habitats.	**Ranks 6th**: Conserves least amount of large habitat areas, likely to result in significant fragmentation.	**Ranks 3rd:** Conserves moderate amount of large habitat areas, small amount of low protection applied to portions of some large habitats.	**Ranks 4th:** Conserves some amount of large habitat areas, lower protection levels applied to all large habitats.	**Ranks 5th:** Conserves minimal amount of large habitat areas, likely to result in significant fragmentation of large habitats.
15. Supports biodiversity through conservation of sensitive habitats and species	**Ranks 1st**: Supports the most biodiversity by applying highest levels of protection to sensitive habitats and stream corridors.	**Ranks 2nd/3rd:** Supports a substantial amount of biodiversity, applies more protection to sensitive habitats than stream corridors.	**Ranks 5th:** Supports a minimal amount of biodiversity, applies moderate protection level to sensitive habitats and stream corridors.	**Ranks 2nd/3rd:** Supports a substantial amount of biodiversity, applies more protection to stream corridors than sensitive habitats.	**Ranks 4th:** Supports some biodiversity, applies higher protection to stream corridors than sensitive habitats.	**Ranks 6th:** Supports the least amount of biodiversity, likely to result in substantial loss of sensitive habitats and sensitive species.
Energy Factors						
16. Promotes compact urban form	**Ranks 6th**: Promotes compact urban form the least. Highest protection levels applied to vacant land intended for urban uses (housing & jobs).	**Ranks 4th:** Moderately promotes compact urban form. Some reduction in development potential on all habitat land.	**Ranks 1st**: Promotes compact urban form the most. Development allowed in lowest habitats, moderate protection to other habitat lands.	**Ranks 5th:** Minimally promotes compact urban form. Development opportunities reduced in all habitat areas.	**Ranks 3rd:** Promotes some amount of compact urban form. Development opportunities reduced in most habitat areas.	**Ranks 2nd:** Substantially promotes compact urban form. Development opportunities on business land less impacted than residential land.
17. Promotes green infrastructure	**Ranks 1st:** Conserves the most vegetation and forested areas.	**Ranks 3rd:** Conserves a moderate amount of vegetation and forested areas.	**Ranks 6th:** Conserves the least amount of vegetation and forested areas.	**Ranks 2nd:** Conserves a substantial amount of vegetation and forested areas.	**Ranks 4th:** Conserves some vegetation and forested areas.	**Ranks 5th:** Conserves a minimal amount of vegetation and forested areas.
Other criteria						
18. Assists in protecting fish and wildlife protected by the federal Endangered Species Act	**Ranks 1st:** Provides most protection to sensitive habitats; most protection for hydrology and riparian functions; most likely to protect sensitive species.	**Ranks 3rd**: Provides substantial protection to sensitive habitats and species. Similar to 2A, but provides less protection for hydrologic conditions.	**Ranks 6th:** Provides least protection to sensitive habitats and species, hydrology. Minimal protection for riparian functions.	**Ranks 2nd:** Provides substantial protection to sensitive habitats and species. Similar to 1B, but provides more protection for hydrologic conditions.	**Ranks 4th:** Provides some protection to sensitive habitats; less likely to maintain hydrologic conditions or riparian functions.	**Ranks 5th:** Provides minimal protection to sensitive habitats and species and hydrology. Provides least protection for riparian functions.
19. Assists in meeting water quality standards required by the federal Clean Water Act	**Ranks 1st:** Provides most protection for clean water. Most protective of forest canopy, habitat near streams and on steep slopes; most protection for hydrology.	**Ranks 3rd**: Provides moderate protection for clean water. Moderate protection for for slopes, wetlands, and resources near streams. Substantial protection for forested areas.	**Ranks 5th:** Provides minimal protection for the natural resources important to protecting water quality. Least protection for forested areas.	**Ranks 2nd:** Provides substantial protection for clean water, with strict protection for slopes, wetlands, and resources near streams. Moderate protection for forested areas.	**Ranks 4th:** Some protection for slopes and wetlands, hydrologic conditions, habitat near streams, hydrologic conditions and forest. Potential for decreased water quality.	**Ranks 6th:** Provides least protection for slopes and wetlands, habitat near streams, and hydrology; minimal protection for forested areas. Most potential for poor water quality.

CHAPTER FIVE: SUMMARY AND CONCLUSIONS

Protecting fish and wildlife habitat in the urban area is complex, and there are many important tradeoffs to balance. Metro's consideration of several non-regulatory tools for habitat protection describes several approaches that could be developed further, building on the restoration, education, and acquisition work that Metro currently does. Metro's analysis of the six regulatory program options identifies the number of affected acres of land in each habitat and urban development class, and describes the economic, social, environmental, and energy consequences associated with various protection levels. Evaluating the performance of each option against the 19 criteria provides the Metro Council with valuable information necessary to choose which type of regulatory approach makes the most sense for the region. Non-regulatory and regulatory tools can be complementary, increasing the effectiveness of each approach. This chapter includes:

- a brief summary of the potential non-regulatory tools,
- results of the analysis of the six regulatory options,
- a discussion of the interaction between non-regulatory and regulatory tools,
- potential funding sources, and
- the next steps in the development of a regional fish and wildlife habitat protection program.

Potential non-regulatory tools for habitat protection

While there is substantial evidence of current non-regulatory efforts accomplishing habitat protection, restoration, and education in the Metro region, they have not been successful in preventing the decline in overall ecosystem health. Most non-regulatory programs are dependent on unsteady sources of grant funding, volunteerism, and good stewardship, often without recognition or reward. Each program conducts important work, but even taken as a whole over the past decade only a small portion of the habitat in the region received the attention needed. There is a much greater need for restoration dollars; technical assistance for landowners, developers, and local jurisdictions; and permanent protection for critical habitats than is currently available.

There are many types of non-regulatory tools that could be used to protect and restore fish and wildlife habitat in the region. All of these tools require some type of funding, whether to pay for staff or provide direct dollars to purchase or restore land. Many of the non-regulatory tools could be implemented at either the local or regional level. Below is a list of tools identified in this report:

- Stewardship and recognition programs
- Grants for restoration and protection
- Information resources
- Technical assistance program
- Habitat education activities
- Volunteer activities
- Agency-led restoration activities
- Acquisition

Acquisition is the most effective non-regulatory tool to achieve habitat protection. Acquisition achieves permanent protection and also preserves land to be restored at a later date. However,

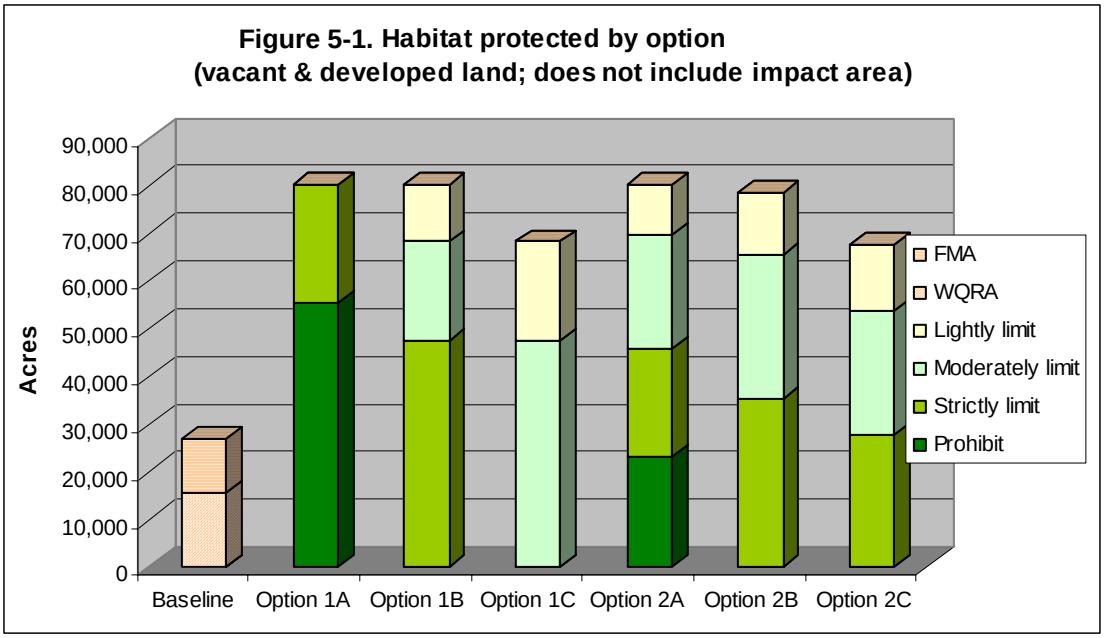
the high cost of purchasing land, especially within the urban growth boundary, and the dependence of an acquisition program on willing sellers limits the effectiveness of such a program.

Many of the other non-regulatory habitat protection and restoration tools considered in this report are most effective when used in combination with each other and/or along with a regulatory program. A regulatory program can provide the incentive and motivation to develop innovative solutions to land development while protecting habitat. Grants and technical assistance are the tools that could be most effective in protecting and restoring habitat, in the absence of an acquisition program. A stewardship recognition program could help promote grants and serve to educate others about innovative practices. Coordinating with existing agencies and volunteer groups that conduct restoration as well as providing funds to focus efforts could be effective in enhancing regionally significant habitat.

Comparison of regulatory options

Metro developed six regulatory options to protect land classified as regionally significant fish and wildlife habitat. Three of the options consider habitat quality (1A, 1B, and 1C) and three options (2A, 2B, and 2C) consider habitat quality and urban development value. Five possible treatments are applied in the options, identifying whether development would be allowed, lightly limited, moderately limited, strictly limited, or prohibited. The six options were evaluated based on how they met 19 criteria. Most of the criteria were based on the issues identified in Metro's general evaluation of the economic, social, environmental, and energy tradeoffs, two criteria were based on how well the options met the federal Endangered Species Act and Clean Water Act. Figure 5-1 graphically illustrates how the five treatment levels are applied in the six options as compared to the baseline regulations (Title 3).

Figure 5-1. Habitat protected by option (vacant & developed land; does not include impact area)



Overall, the options that protect the highest-value habitat (Options 1A and 2A) perform similarly. The option that provides the least protection for the highest-value habitat (Option 1C) and the option with the lowest level of protection in the industrial and commercial areas (Option 2C) also perform similarly. However, Option 2C favors factors important for urban development while Option 1C reduces protection levels equally for all land uses. Table 5-1 compares the tradeoffs of applying the six regulatory options.

Table 5-1. Comparing the regulatory options.

Options 1A, 2A	Options 1B, 2B	Options 1C, 2C
• Reduces development opportunities within the existing urban growth boundary • Increases possibility of expanding the urban growth boundary, potentially increasing development costs (such as streets and utility connections) • Potentially adds to the cost of urban development (such as environmental review process, low impact development standards) • Protects the most habitat and restoration opportunities • Preserves the most ecosystem services (such as flood management and water quality) • Promotes conservation of sensitive species (such as Pileated woodpeckers and painted turtles) and at risk habitats (such as white oak forests and wetlands) • Supports cultural heritage (such as salmon), regional identity (such as proximity to open spaces), and amenity values (such as property values) • Greatest affect on the location and choices for jobs and housing • Increases property owner concerns about limiting use of land, especially single family residential	These options provide the middle ground between the most restrictive and least restrictive options.	• Provides the most development opportunities within the current urban growth boundary • Minimizes need to expand the urban growth boundary by allowing compact urban development • Supports urban centers and industrial areas by not applying new regulations (Option 2C) • Minimizes habitat protection and preserves the fewest restoration opportunities (but may increase future cost to restore ecosystem services such as flood control) • Increases habitat fragmentation along streams and between streams and upland habitats • Reduces variety of plants and animals that make up a healthy ecosystem • Increases energy demand for cooling air and water temperatures by removing trees and vegetation • Reduces opportunity for future generations to enjoy fish and wildlife habitat and their associated benefits • Minimizes property owner concerns about limiting use of land, especially residential and business land

Interaction of non-regulatory and regulatory tools

A program to protect fish and wildlife habitat may be most effective if it includes a variety of tools and approaches, both non-regulatory and regulatory. Both approaches have strengths and weaknesses, for example non-regulatory tools rely heavily on funding and willing landowners, while regulations only apply when triggered by a land use action. While regulatory and quasi-regulatory tools can offer some flexibility, regulations can and often are used to achieve a baseline level of protection. Protection can be greatly enhanced by supplementing a regulatory component with non-regulatory tools for fish and wildlife habitat protection. If a program option is chosen that includes less regulatory protection then it may be necessary to apply more non-regulatory approaches and a higher level of funding if the same level of habitat protection is

desired. The following constitutes a brief summary of how acquisition and incentives can interact with and increase the effectiveness of regulatory tools.

Incentives and regulations

When used in conjunction with regulations, the opportunity of incentives to encourage fish and wildlife habitat protection on private lands cannot be overstated. Through tax benefits, regulatory certainty, public recognition, cost sharing, and other incentives, landowners can be encouraged and rewarded for protecting valuable fish and wildlife habitat on their property. Takings issues, whether actual or perceived, are important to many property owners, thus regulatory programs may be unpopular. The application of incentives, however, can provide willing landowners some kind of compensation for conserving habitat on their land. Incentives can thus be used to support compliance with regulations or to fill in protection gaps for regionally significant habitat where regulations are not applied.

The Riparian Lands Tax Incentive Program (RLTIP), for example, can potentially apply in already urbanized areas to protect regionally significant riparian corridors adjacent to private property where the standards of buffer programs may be difficult to implement. Inside the UGB, where most of the significant riparian corridor habitat is developed rather than vacant, incentives can offer a tremendous opportunity to encourage voluntary protection and restoration. Other incentives[38] can apply to new development or redevelopment where habitat-friendly development is a feasible option for stormwater management and erosion and sediment control.

Acquisition and regulations

Just as incentive programs and regulatory tools can work together to protect significant habitat, combining acquisition with regulatory and quasi-regulatory approaches can create a more comprehensive protection strategy for fish and wildlife habitat. Further, where regulatory tools and incentive programs fail to provide adequate protection, acquisition of land from willing sellers offers a last line of defense for the habitat. Acquisition, by willing sellers, can be applied to conserve some of the remaining significant habitat.

Regulatory flexibility

Regulations to protect fish and wildlife habitat limit development options on land with habitat value. Some ways in which regulations could limit development include lowered density, minimum disturbance areas, and setbacks from significant resources. Incentives can work with regulations to allow development to occur in a manner that reduces the impact on the habitat. For example, cluster development, streamside buffers, and habitat-friendly development

[38] Such as: the City of Portland's Bureau of Environmental Services (BES) Ecobiz and Ecoroof Programs, the city's Office of Sustainable Development's (OSD) G-Rated Program, and Oregon Department of Environmental Quality's (DEQ) Nonpoint Source Pollution Control Facility Tax Credit Program (NSPCFTC). BES's Ecoroof Program, for example, provides developers with sewer rate discounts for building greenroofs on new buildings or for retrofits, while the DEQ's NSPCFTC program provides cost share opportunities for other innovative LID stormwater management designs. The soon-to-be-implemented Ecobiz program will serve to further encourage the use of LID for new and redevelopment by publicly recognizing landscapers who use these designs.

techniques can all provide some level of regulatory flexibility that allows development to occur while protecting habitat.

Cluster development

Clustering and open space development are land division and development tools used to conserve land on one portion of a site in exchange for concentrated development on another portion of the site. Typically, road frontages, lot sizes and setbacks are relaxed to allow the preservation of open space areas. Clustering has the potential for regulatory flexibility because ordinances implementing these tools can be designed to establish performance standards with objective evaluation criteria for protecting resources from development.

Riparian buffer performance standards

Riparian buffers frequently establish predominantly fixed-width setback standards to protect habitat in and around streams, wetlands and riparian areas. Buffer programs tend to regulate actions rather than establish standards to achieve a specific outcome or performance. However, the potential exists to establish performance standards when implementing buffer programs and to protect fish and wildlife habitat. Some of these standards can include, but are not limited to: variable-width provisions that allow a buffer to expand and contract with the landscape; maintaining or enhancing percentages of native forest cover within buffer areas; and reducing impervious surfaces and road crossings through buffer areas.

Low impact, habitat-friendly development

Low Impact Development (LID) tools, especially those for reducing impervious surfaces and controlling stormwater, contain the most flexible standards from a performance-based perspective. Since the primary objectives of LID are to improve hydrologic conditions and increase water quality in urban watersheds, many LID ordinances, whether mandatory or voluntary, provide flexibility in the types of practices that can be used to meet these objectives. Since LID tools also focus on improving water quality, many jurisdictions specify objective criteria that can be used to evaluate the outcome or performance. Such criteria include, but are not limited to: the number and lengths of roads and other impervious surfaces reduced; percentages of tree canopy maintained or created; maintenance or reduction of stream temperatures; amount of sediment, nutrient, and pollutant loading to water reduced; and the minimization of runoff volumes.

Funding

Protecting and restoring fish and wildlife habitat costs money, with either a non-regulatory focus, regulatory approach, or a combination of the two. All non-regulatory programs would require some type of funding, either to purchase land, restore habitat, provide grants for habitat-friendly development, or to retain staff to develop a technical assistance or stewardship recognition program. Nor are regulations without cost. Staff time (regional and local) is used to develop ordinances and implement new laws and changes in development capacity may result in a reduced property tax base for local partners.

Funding for habitat protection programs could be provided by a non-specific mechanism such as a bond measure or Metro's excise tax on solid waste, or a funding source could be tied to

specific activities that impact fish and wildlife habitat. Below are several ideas for raising funds for protecting and restoring fish and wildlife habitat that could be implemented at the regional or local level.

Increase Metro's excise tax

Metro collects an excise tax on each ton of solid waste produced within the region. An additional per ton fee could be added that would be dedicated to funding the protection and restoration of fish and wildlife habitat. Such a decision would require an action of the Metro Council.

Urban area inclusion fee

Metro manages the region's urban growth boundary (UGB), expanding it according to development needs as the region grows. Land outside the UGB is not allowed to develop at urban capacities. When the boundary expands the new lands increase in value due to the increased ability to develop. An urban area inclusion fee would capture a portion of this increase in the value of property due to inclusion within the UGB. Funds raised could be used to purchase or restore habitat land within Metro's jurisdiction. It could be targeted to lands in the expansion areas as they are developed.

The *Incentives Report* included substantial review of this tool. Based on that study, a partition fee seemed to have the best potential for successful implementation as a method of collecting revenue. A partition fee could be imposed as a flat fee uniformly applied across all land parcels on a per lot or per acre basis. Since the fee would be collected when land is partitioned (typically a one-time event), it would not be assessed multiple times on the same property. Revenue would depend on the amount of developable land brought inside the UGB, the pace of development in the expansion areas, and the proposed fee rate.

Systems development charge (SDC) program

Local jurisdictions, typically municipalities, across the state regularly apply SDCs to new development in an attempt to pay for the cost of new infrastructure. SDCs can only be charged for specified purposes, *water supply*, *treatment and distribution*, *drainage and flood control*, and *parks and recreation* all could be construed to relate to the protection and restoration of fish and wildlife habitat. SDCs are a major cost for new development, and the imposition of any additional charge is likely to be challenged in a court of law.

An SDC could be collected to fund mitigation of the environmental impacts of development on fish and wildlife habitat. Fees would be collected by the permitting agency. However, fees generated through an SDC must be used on "capacity increasing capital improvements " that "increase the level of performance or service provided by existing facilities or provides new facilities" (ORS § 223.307(2)). It may be difficult to tie protection or restoration of habitat to a capacity increasing improvement. A more legally viable argument could be made if a regional SDC was collected for stormwater management.

Stormwater management fee

Water providers (e.g., Clean Water Services, Portland Bureau of Environmental Services) collect fees for stormwater management purposes. Some of these funds are currently used for restoration activities, but Metro could encourage these agencies to devote more dollars to habitat protection and restoration. Metro could also impose a regional fee to be used for restoration and protection of significant fish and wildlife habitat to be collected by the water providers.

Bond measure

Metro could put forth a regional bond measure to raise funds to purchase or restore habitat lands from willing sellers. The 1995 Parks and Openspaces bond measure was very successful and allowed the creation of a system of regional parks and trails that will be appreciated for generations. A similar approach could be taken focused on Metro's fish and wildlife habitat inventory. The voters would need to pass a bond measure, and polling has shown that a targeted approach is most likely to be successful. Fish and wildlife habitat targets could include purchasing and restoring Habitats of Concern and floodplains. Funds could also be used to purchase properties that are significantly affected by new regulations.

Funds from outside sources

There are funds to protect fish and wildlife habitat that could be raised from other sources such as national non-profits and federal agencies. Land conservancy organizations could be contacted to encourage the purchase of targeted habitat types (e.g., Nature Conservancy, Trust for Public Land). The US Fish and Wildlife Service has funds available for restoration in urban areas, and has worked in partnership with Metro's Parks Department to provide grants to property owners and organizations to conduct restoration activities. The city of Portland received a grant from the Federal Emergency Management Agency (FEMA) to acquire lands in the Johnson Creek floodplain after the floods of 1996. Additional partnerships with federal agencies could be pursued. Such an effort would require staff time to develop and implement programs for protection or restoration.

Next steps

The Metro Council is scheduled to consider a program direction, including non-regulatory and regulatory components, in May 2004 after a rigorous review process during which the public, local partners, and interested stakeholder groups will have the opportunity to provide input on the best approach for protecting fish and wildlife habitat in the region. Metro will then develop a program to protect fish and wildlife habitat to be considered by the Council in December 2004. Metro's program would include a standard ordinance and may include provisions for a riparian or wildlife district plan as a means of substantial compliance.

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EXHIBIT F -- ORD. NO. 05-1077C
ATTACHMENT 5. SEPT. 2004 HABITAT INVENTORY UPDATE

Habitat Class & Habitat Conservation Area (HCA)	Developed			Parks			Total Devel. & Park Habitat	Vacant				Total Vacant Habitat	Total Devel., Park, & Vacant Habitat
								Constrained			Unconstrained Outside Title 3		
	Inside Title 3 FMA	Inside Title 3 WQRA	Outside WQRA/FMA	Inside Title 3 FMA	Inside Title 3 WQRA	Outside WQRA/FMA		Inside Title 3 FMA	Inside Title 3 WQRA	Outside WQRA/FMA			
Class I Riparian Corridors													
HIGH HCA	624	1,499	1,654	3,729	5,041	3,509	16,056	1,517	4,425	1,002	4,127	11,070	27,126
MODERATE HCA	85	227	81	168	123	22	707	537	687	227	633	2,084	2,790
LOW HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
ALLOW	1	0	1	0	0	0	3	2	0	0	0	2	5
Total acres	*711*	*1,726*	*1,736*	*3,897*	*5,164*	*3,532*	*16,765*	*2,056*	*5,112*	*1,229*	*4,760*	*13,156*	*29,921*
Class II Riparian Corridors													
HIGH HCA	1	2	2	1	1	4	11	1	1	0	1	4	14
MODERATE HCA	163	742	1,121	667	350	602	3,645	480	778	253	1,742	3,254	6,899
LOW HCA	142	303	325	17	7	5	799	378	312	162	795	1,646	2,445
ALLOW	6	1	6	0	0	1	14	4	0	1	2	6	20
Total acres	*311*	*1,048*	*1,453*	*685*	*359*	*612*	*4,468*	*862*	*1,092*	*416*	*2,540*	*4,910*	*9,378*
Class III Riparian Corridors													
HIGH HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
MODERATE HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
LOW HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
ALLOW	2,165	156	1,000	62	7	134	3,523	61	23	99	482	665	4,188
Total acres	*2,166*	*156*	*1,000*	*62*	*7*	*134*	*3,524*	*61*	*23*	*99*	*482*	*665*	*4,189*
Class A Wildlife Habitat													
HIGH HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
MODERATE HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
LOW HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
ALLOW	34	63	2,536	51	107	6,858	9,649	32	201	891	6,254	7,379	17,027
Total acres	*34*	*63*	*2,536*	*51*	*107*	*6,858*	*9,649*	*32*	*201*	*891*	*6,254*	*7,379*	*17,028*
Class B Wildlife Habitat													
HIGH HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
MODERATE HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
LOW HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
ALLOW	7	27	3,343	8	16	1,323	4,724	25	97	716	7,312	8,150	12,874
Total acres	*7*	*27*	*3,343*	*8*	*16*	*1,323*	*4,724*	*25*	*97*	*716*	*7,312*	*8,150*	*12,874*
Class C Wildlife Habitat													
HIGH HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
MODERATE HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
LOW HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
ALLOW	16	14	1,901	13	16	805	2,766	70	81	459	3,776	4,386	7,152
Total acres	*17*	*14*	*1,901*	*13*	*16*	*805*	*2,766*	*70*	*81*	*459*	*3,776*	*4,386*	*7,152*
Total Habitat	*3,246*	*3,035*	*11,969*	*4,715*	*5,668*	*13,263*	*41,897*	*3,105*	*6,607*	*3,810*	*25,124*	*38,646*	*80,542*
Impact Areas													
HIGH HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
MODERATE HCA	0	0	2	0	0	0	2	0	0	0	0	0	2
LOW HCA	0	0	0	0	0	0	0	0	0	0	0	0	0
ALLOW	361	763	9,809	166	131	968	12,197	103	326	608	3,327	4,364	16,561
Total acres	*361*	*763*	*9,810*	*166*	*131*	*968*	*12,199*	*103*	*327*	*608*	*3,327*	*4,365*	*16,564*

Cathy Behrendt

12674 Swallowtail Place, Oregon City, OR 97045
Ph: (503) 476-9825 / Fx: (503) 476-9864
Email: cmbehrendt@gmail.com

January 22, 2018

Sent via email to dwebb@orcity.org
Dayna Webb
Sr. Project Engineer

Sent via email to lterway@orcity.org
Laura Terway
Community Development Director
City of Oregon City
625 Center St
Oregon City OR 97045

Re: Projects ps-16-024, L 17-03, 1-17-04

I am unable to attend tonight's hearing, but would like to state my opinion on the proposed changes involving areas surrounding Highway 213 and Beavercreek Road.

It seems this project is focused on "refinements" that have been labeled as an "Alternative Mobility Target" project. The only real improvement for our entire area will be to put money into NEW ROADS or bring light rail all the way out to Molalla. These little improvement projects that are proposed get us nowhere. I can deal with growth and expanding boundaries when done properly and efficiently, but I've seen our city spend thousands on sidewalks and landscaped dividers only to tear them up a couple of years later. I've seen over the years the changes made to the intersection of Highway 213 and Beavercreek Road, and it still is not sufficient. We can't allow an increase in population without the roads to support the growth. Why are the new home developments allowed prior to an increase in infrastructure? It seems logical to me that if 100 homes go in to a field, there will be at least 100 more drivers on the roads surrounding. Light rail isn't here in OC, and most citizens will not ride Trimet buses. Therefore, we need new roads to support the traffic since City and County has allowed the growth. It should not be up to the current citizens to fund it though.

The funds should already be in the basket of our local government. I've seen many pieces of acreage go from a large parcel paying $2500/yr in property taxes that later develops into hundreds of homes now paying $4000/yr in property taxes *per lot*. That should be putting the bankroll into the black. Citizens are told that there is no money for improvements on infrastructure nor new schools. Go explore the newest area of Happy Valley out towards Foster Road and Damascus and then come back to the OC. It's quite eye-opening that they have new roads/bi-ways and schools that were mostly implemented prior to the builds. Come back to the

OC and the clogged-up streets are full of cars and potholes. Aren't the two cities within the same county??

Since 1987 I have lived here and have seen NO improvements to this city. None. Yes, we get new restaurants and some new stores now and then, but the overall *health* of the city has not improved at all. I am disgusted and saddened at the officiates in County & City for allowing the traffic issue to explode and then leave it to the citizens to try and figure out how to survive in it. All of this should be taken care of prior to new developments coming into our city. We now have more pot shops than schools. This city of ours pays a higher salary for a community events coordinator than a police officer.

I feel that Clackamas County should bear a lot of the responsibility of the costs for any new improvements in the areas that your proposals direct. We have hundreds of County employees that now work on the hill in those large new buildings on Kaen Road that contribute to most of the traffic in the morning coming into Oregon City off Highway 213 and then again in the evenings leaving Oregon City. And then you have the guest traffic to Jail, Juvenile, etc. Clackamas County needs to fund the fix, in my opinion. And I know that someday that vacant field on between Kaen Road and Warner-Milne Road will also be County campus. Oregon City can't handle any more traffic up here on the hill.

In the meantime, I'm all for roundabouts to keep traffic flowing and HOV lanes up and down Highway 213 to encourage less traffic. I think that commercial truck traffic should be limited on Highway 213. Too much of it is traveling on our backroads in order to avoid I205 traffic. The trucks are then cutting through town and country backroads to connect with other outlying areas.

Until a new high school in a different location is built, the traffic on Beavercreek Road coming in and out of the high school needs to be rerouted with a direct pass off Highway 213 by expanding Meyers Road. If that cannot be done, expand the number of lanes on Beavercreek Road to include a "school lane" and start charging a toll for it. There are too many parents driving their kids to and from school and too many kids driving solo to and from school. Why should residents of those neighborhoods be stuck in that school traffic?

Thank you for your courtesies.

Sincerely,

Cathy Behrendt

Cathy Behrendt

From:	Laura Terway
To:	Kelly Reid; Dayna Webb; John M. Lewis
Subject:	Fwd: Ref: Highway 213 Corridor Alternative Mobility Targets
Date:	Sunday, January 21, 2018 6:35:56 AM

-Laura Terway

Begin forwarded message:

From: Steve Callistini <steve@cascadejets.com>
Date: January 20, 2018 at 11:26:13 PM PST
To: "lterway@orcity.org" <lterway@orcity.org>
Subject: Ref: Highway 213 Corridor Alternative Mobility Targets

Attn: Laura Terway

Ref: Highway 213 Corridor Alternative Mobility Targets
January 22, 2018 Meeting

In reviewing agenda items for the Monday, Jan 22, 2018 Oregon City Planning Meeting, I would like to make a couple of comments regarding the proposed changes to the Oregon City Municipal Code, specifically the proposed change to the Mobility Targets, and about increasing the VC index of .99 to a VC index of 1.10.

I am strongly against increasing the target index above the .99 threshold. I live almost 2 miles from the OR213/Beavercreek Rd intersection next to the golf course on Beavercreek Rd. Between the traffic from generated from the schools and the outer lying towns, I often see 15 minute travel times to navigate that 1.8 miles to my home from this intersection. Traveling through this intersection and on Beavercreek Rd is a bumper to bumper stop and go stream starting 6am for about 3 hrs and again around 3pm for 3-4 hours and should be an embarrassment to the City of Oregon City. I moved from Gladstone/Milwaukie to get away from traffic, and it appears that I misjudged the huge traffic and congestion that Oregon City offers its membership and guests.

I understand the financial dilemma that the city has found itself in, but I would suggest that the City work on budgeting in the monies over the next ten years for this OR213/Beavercreek Rd intersection, and work closer with ODOT in elevating this as a priority, and maybe hope for some matching funds from the State in the future. I realize this would put a hold on development on Beavercreek Rd and elsewhere, but out of control development is what got us into this predicament.

I would agree with adding a proposed RH merge lane on west bound Beavercreek Rd to OR213 northbound. I've seen plenty of rear end collisions because there is no acceleration ramp and this makes good sense.

Also, I would suggest not putting any traffic sign boards up on Northbound OR213. These only cause rear end collisions caused from drivers stopping to read them. Seen it for years on 205 after ODOT installed the sign board at Mall 205.

The biggest recommendation I have for this dangerous intersection is for ODOT to reduce the speed limit from 55MPH to 45 MPH! Often, traffic is traveling at up to 65MPH or more through this intersection, and it's too dangerous even at 55 MPH with the amount of traffic in this 4 way intersection. This would reduce the amount of collisions exponentially and make it safer for bicycle and foot traffic crossing!

Ultimately, I feel a full diamond design should be the target design and best solution for this intersection.

Please include this letter in the file for this topic at your Monday evening meeting and circulate a copy among the committee members. Thank you!

With kind regards,

Steve Callistini
Homeowner
Oregon City, OR 97045
T: (971)223-2905

From:	Paul Edgar
To:	Laura Terway; Kelly Reid
Cc:	Bob La Salle
Subject:	Seaside Transportation System Plan & Alternative Mobility Targets, Oregon Consensus
Date:	Sunday, January 14, 2018 1:55:59 PM
Attachments:	Seaside TSP_OTC AMS Rec-Attachment D.doc

Please attach this email and referenced attachments and Word Doc to the record on the hearing scheduled to go before the Oregon City Planning Commission on "Alternate Mobility Targets for Hwy 213 Corridor.

I would like to recommend to the Oregon City Transportation Committee and the Oregon City Planning Commission, a continuance of the up-coming hearing, where an effort can be made to assess the:

Results of the 2011 Seaside Oregon - TSP consensus process can be now reviewed some 6+ years later, with what were the Wins and Losses, have the problems been solved and the needs addressed?

With ever increasing Incidents of Travel within within the Metro Region, also reflected with the State Hwy 213 Corridor and at the intersection of Hwy 213 and Beavercreek Road, at levels of approximately 5% per year compounded, do we truly know the consequences. There are limited effective opportunities to incrementally to mitigate the consequences of forecasted growth in congestion through the strategies and tools associated with the implementations of "Alternative Mobility Targets & Standards".

If congestion is allowed to grow/increase to where it becomes quickly unacceptable, it can have major long term negative impacts on these strategic "Urban Freight Routes" and decrease values of properties, businesses, economic development potential and job creation and all of this needs greater assessments made, as to the impending potential consequences.

Oregon City needs to have these same conversations with all constituencies (inside and out side of Oregon City) gaining the perspective developers, property owners, businesses and users of the corridors of Beavercreek Road and State Hwy 213. This just has not happened!!

Now we have a just published article from the Pamplin Media Group on the growing transportation problem: http://pamplinmediagroup.com/cr/24-news/383297-270709-metro-evaluates-regional-transportation-needs

Paul Edgar, Oregon City Resident, was a member of the Clackamas County Transportation Committee that developed the Clackamas County - Regional TSP

Alternative Mobility Targets was to have been a cornerstone of the Seaside Oregon TSP, with the creation of Alternative Mobility Standards to guide future improvements on Highway 101.

http://oregonconsensus.org/wp-content/uploads/2013/12/09-022one-pagehandout_003.pdf

City residents advocated for a bypass since the 1980's. In 2000, an ODOT created a plan for improvements without a bypass and it grew to become very controversial during the final

design stages.

Seaside successfully sued ODOT for the right to vote on the project. The project was voted down by a narrow margin, and millions of federal and state funds were withdrawn from the community.

Neighbors were divided and relationships damaged between Seaside and ODOT.

After two years of community dialogue and development, the Seaside Transportation System Plan (TSP) was adopted in by the Seaside City Council on June 27, 2011.

Through out their plan development, the City of Seaside and the State agreed on the need of the TSP to be reasonable and implementable.

Direct conversations were held with stakeholders and community members about the constraints surrounding larger capital projects; such as a highway bypass, major widening efforts and grade-separated over-crossing.

These conversations were well-received with the end result being a prioritized set of recommendations for each implementing agency. See word attachment: Seaside TSP_OTC AMS Rec-Attachment D.doc

Attachment E

Seaside Alternative Mobility Standards
Executive Summary and Recommendation

ODOT Region 2 Recommendation to the Oregon Transportation Commission August 12, 2011

Executive Summary

After more than two years of community dialogue and development, the Seaside Transportation System Plan (TSP) was adopted by the Seaside City Council on June 27, 2011. The adopted TSP recommends a variety of projects that improve access, safety, and connectivity throughout the city while maintaining the community fabric and minimizing congestion and impacts to the environment. **One central element of the TSP requires Oregon Transportation Commission (OTC) approval** – the highway recommendations depend on OTC adoption of alternate mobility standards along US 101 through Seaside (between Lewis and Clark Road and Avenue U).

With a year-round population of 6,200 residents, Seaside's residency swells on summer weekends. The City is deemed the official end of the Lewis and Clark Trail, has been a vacation resort on the Oregon Coast for over a century, and is host to several high profile events and attractions, including:

- Miss Oregon Scholarship Pageant
- Hood to Coast (location of race finale)
- Beach Volleyball Tournament
- Seaside Aquarium
- Pearl Harbor Memorial Bridge

In May 2005, residents of Seaside voted down a project to widen US 101 to five lanes throughout Seaside. Following this vote on the Pacific Way to Dooley Bridge (Pac-Dooley) project, ODOT funds to construct the project were used elsewhere in the state. Provisions were stated at that time that before a different project could be considered for funding, the community would need to develop a TSP in accordance with Oregon Administrative Rules (OAR) 660-012. Projects identified in the TSP would need to compete for funding. The adopted TSP meets those requirements.

In many ways, the Seaside TSP followed a typical TSP process – gather information, identify needs, brainstorm ideas, evaluate ideas, and develop recommendations. However, certain elements of the TSP have been unique:

- ***Seaside is a coastal community with high seasonal traffic.*** Seaside's traffic congestion is seasonal in nature, which results in a wide variance of traffic volumes between summer and winter months. Average daily traffic (ADT) is approximately 14,000 vehicles with July and August daily volumes around 18,000 vehicles and January and December ADT around 11,000 vehicles. The difference between summer and winter traffic volumes is 60 percent. Concerns exist about building a roadway to meet 30th highest hour conditions which occur only during the summer weekend peak. Building to meet the summer peak demand results in a bigger highway footprint than the community of Seaside is willing to support.
- ***Early TSP efforts experienced high levels of community distrust.*** Many individuals within the community of Seaside voiced a distrust of the state and the City as a result of the Pac-Dooley process. Through outreach efforts which focused on full disclosure and transparency, and featured a website updated at least once a week; regular meetings with community leaders; and earned trust through listening and responding to community concerns, community opinion of the TSP slowly became positive. Similarly, the City of Seaside also started with a strained working relationship with ODOT. Through the TSP process and ultimately through ODOT's willingness to consider smaller highway footprints and, as a result, lower alternate mobility standards, this relationship has grown into one of mutual respect and trust.
- ***Focus on implementation.*** Throughout the plan development, the City of Seaside and the state have agreed on the need for the TSP to be *reasonable and implementable.* Direct conversations were held with stakeholders and community members about the constraints surrounding larger capital projects such as a

highway bypass, major widening efforts, and grade-separated overcrossings. These conversations were well-received with the end result being a prioritized set of recommendations for each implementing agency.

The Seaside TSP team explored, evaluated, and is now recommending Alternative Oregon Highway Plan (OHP) Mobility Standards for US 101. The specifics of these standards are that (1) operational analysis would be for average annual weekday peak hour conditions instead of the 30th Highest Hour, and (2) the mobility standard for four intersections with US 101 would change to 1.0, for the durations shown in the table below.

Intersection	Current OHP Mobility Standard	Proposed Mobility Standard	Future (2030) Projected Average Annual Conditions*	Expected Duration of Delay
US 101 / Lewis and Clark Road	0.80	1.0	1.10	2 hours (3-5pm)
US 101 / 12th Avenue	0.85	1.0	1.05	1 hour (4-5pm)
US 101 / Broadway	0.85	1.0	1.10	3 hours (3-6pm)
US 101 / Avenue U	0.85	1.0	0.95	<1 hour (does not exceed 1.0)

*assumes the construction of several improvements on both the local and state system consistent with TSP recommendations.

These standards are predicated on the following four tenets:

1. ***Investment in the local street network –*** the City has committed to investing in improvements to alternate, parallel routes to US 101 (namely Wahanna Road) and major collectors that connect the highway to the local street network (namely 12th Avenue, Broadway, Avenue F/G, and Avenue U), to encourage local users to reduce their use of the highway.
2. ***Investment in alternative modes –*** the City of Seaside and the Sunset Empire Transportation District (SETD) have both committed to investing in infrastructure and service to support bicycling, walking, and transit use. In fact, the vast majority of the City- or SETD-led TSP projects focus on bicycle, pedestrian, or transit improvements.
3. ***Strong access management measures –*** a short-term recommendation of the Seaside TSP is to develop a detailed access management plan for US 101. In the meantime, the City of Seaside and ODOT have included access management measures in the Seaside TSP to improve safety and reduce congestion along US 101 by looking for opportunities through new development, redevelopment, or construction projects to: relocate driveways onto local streets; provide alternate access along the local street network to discourage left-turns onto the highway; consolidate multiple accesses; share accesses; and restrict side street access to right-in/right-out if dictated by safety or congestion problems.
4. ***Strong consideration of land use / future development along the highway –*** the fourth tenet of the alternate mobility standards material calls for a land use overlay for parcels directly adjacent to US 101. The purpose of the overlay zone is to promote walking and bicycling to uses along the highway. The overlay zone features review and check in with the Seaside Planning Commission for uses that attract more than 50 trips in the peak hour, and encourages development to the sidewalk with parking in the rear or side of the building. No Comprehensive Land Use Plan changes are contemplated with the adoption of the TSP and the TSP is based on implementation of the existing adopted Land Use Plan over the 20-year planning horizon.

ODOT staff recommends approval of the Alternate OHP Mobility Standard of 1.0 on US 101 in Seaside at the identified intersections using the average annual weekday peak hour traffic volumes instead of 30th highest hour conditions as the primary analysis period. This recommendation is backed by the project partners, including the City of Seaside City Council, Planning Commission, and staff; the Department of Land Conservation and Development, and Clatsop County.

From:	Laura Terway
To:	Kelly Reid; Dayna Webb; John M. Lewis
Subject:	Fwd: Oregon City congestion/ Mon 22nd meeting
Date:	Sunday, January 21, 2018 4:28:41 PM

-Laura Terway

Begin forwarded message:

From: Janine Offuttt <j9hypnoziz@yahoo.com>
Date: January 21, 2018 at 3:04:14 PM PST
To: "Lterway@orcity.org" <Lterway@orcity.org>
Subject: Oregon City congestion/ Mon 22nd meeting
Reply-To: Janine Offuttt <j9hypnoziz@yahoo.com>

Dear Laura Terway - Community Development Director City of Oregon City -
I hear the city is considering upping the current limits to allow for more traffic on our roads. It's easy to see how this will multiply our traffic problems and create more congestion.

I think the city should cap development for a few years, and wait to see how recent developments effect our roads and communities. For instance, when the Cove project is completed, it will add more burden to current traffic issues where 205 meets up with routes 99 and 213 and 43.

A sane planning policy would encourage citizens to drive far less. Driving fewer miles is one of the most important things we can do to mitigate climate change.

Please listen to your concerned citizens ... not just to developers looking to turn a profit. thanks, D. Janine Offutt

OREGON CITY GOLF CLUB
20124 S BEAVERCREEK RD.
OREGON CITY, OR 97045

503-518-2846

City of Oregon City
625 Center St.
Oregon City, OR 97045

January 22, 2018

RE: Support for Alternative Mobility Standards Adoption

Dear City Commissions:

The city identified a need for refinement plans due to at intersections along the 213 corridor while updating its Transportation System Plan in 2012. In 2017, the city formed Advisory Groups to identify the type of transportation improvements necessary to meet Oregon Highway Plan mobility targets at intersections along Highway 213. Specifically the intersections at Beavercreek and Redland Roads are projected to exceed current mobility standard in 2035.

If Alternative Mobility targets are not adopted for this area, the Beavercreek Road Concept Plan cannot be implemented. At this time, many projects that could be assisting the city with needed revenue are hindered, stalled, and delayed. Other projects are currently in an indeterminate state while the issue of finding meaningful and financially feasible mobility or congestion targets can be resolved. Some developers have been discouraged with the length of time this this process has taken and chose to build in other cities where the development path is clear and concise.

The city is unable to provide the necessary required funding for necessary solutions on its own and will need the assistance from others, such as new businesses locating in the Beavercreek Employment Lands area and developers building workforce housing and small commercial centers to support the economic development the Beavercreek Concept Plan was designed to provide.

The benefit to our city of adopting these mobility targets is improved future mobility and safety, reduced bottleneck, and additional economic stability for our city and its citizens.

I support the adoption of the Alternative Mobility Standards and urge you to support them as well.

Thank you for your consideration.

Sincerely,

Rose Holden

Rose Holden
Oregon City Golf Club,, INC

From:	Laura Terway
To:	Kelly Reid; Dayna Webb; John M. Lewis
Subject:	Fwd: Oregon City congestion/ Mon 22nd meeting
Date:	Sunday, January 21, 2018 4:28:41 PM

-Laura Terway

Begin forwarded message:

From: Janine Offuttt <j9hypnoziz@yahoo.com>
Date: January 21, 2018 at 3:04:14 PM PST
To: "Lterway@orcity.org" <Lterway@orcity.org>
Subject: Oregon City congestion/ Mon 22nd meeting
Reply-To: Janine Offuttt <j9hypnoziz@yahoo.com>

Dear Laura Terway - Community Development Director City of Oregon City -
I hear the city is considering upping the current limits to allow for more traffic on our roads. It's easy to see how this will multiply our traffic problems and create more congestion.

I think the city should cap development for a few years, and wait to see how recent developments effect our roads and communities. For instance, when the Cove project is completed, it will add more burden to current traffic issues where 205 meets up with routes 99 and 213 and 43.

A sane planning policy would encourage citizens to drive far less. Driving fewer miles is one of the most important things we can do to mitigate climate change.

Please listen to your concerned citizens ... not just to developers looking to turn a profit. thanks, D. Janine Offutt

From:	Laura Terway
To:	Kelly Reid
Subject:	Fwd: Ordinances 18-1004 and 18-1005
Date:	Saturday, January 20, 2018 6:24:53 PM

-Laura Terway

Begin forwarded message:

> **From:** Roseann Sheeon <rsheeon@yahoo.com>
> **Date:** January 20, 2018 at 6:06:45 PM PST
> **To:** lterway@orcity.org
> **Subject: Ordinances 18-1004 and 18-1005**
>
> We are new to Oregon City. Over the last two years the growth with no consideration for the overcrowded schools and traffic patterns is unconscionable! My grandson has 33 students in his 5th grade classroom. As a retired teacher...that is an impossible number for the teacher and the children. Please DO NOT pass these two items until the infrastructure is addressed and fixed.
>
> Carl and Roseann Sheeon
> 20257 Quinalt Dr
> 503.722.3890
>
> Sent from my iPad



Exhibit 1-4. Four-legged DLT intersection with major street displaced lefts and channelized right turns (Baton Rouge, LA).[1]

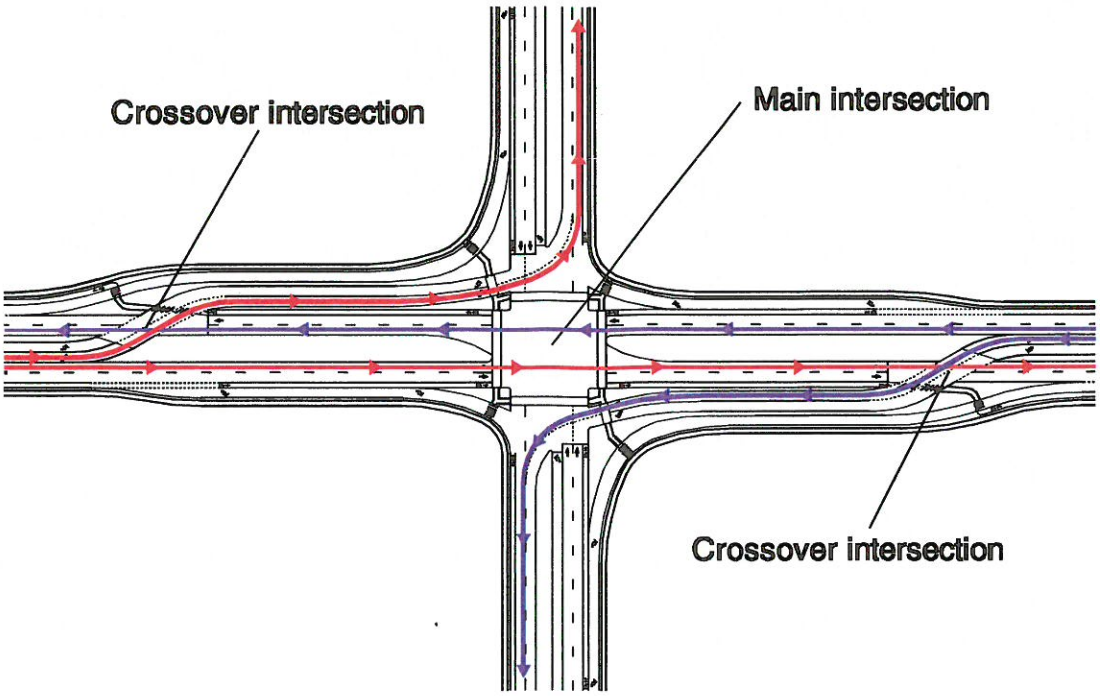


Exhibit 1-1. Four-legged DLT with displaced lefts on a major street.

Exhibit 1-1 shows a DLT intersection where the displaced left-turn movement has been implemented on two legs on the major street. In some cases, the displaced left turns are on the minor street instead of the major street. The left-turn movements for the minor road continue to take place at the main intersection. There are five junctions with traffic signal control at a four-leg DLT intersection: the main intersection and the four left-turn crossover intersections.

APPLICATION

Several DLT intersections have been installed throughout the United States, and each location is documented in the Appendix. Exhibit 1-2 shows the location of existing DLT intersections in the United States, as of the publication of this guide.

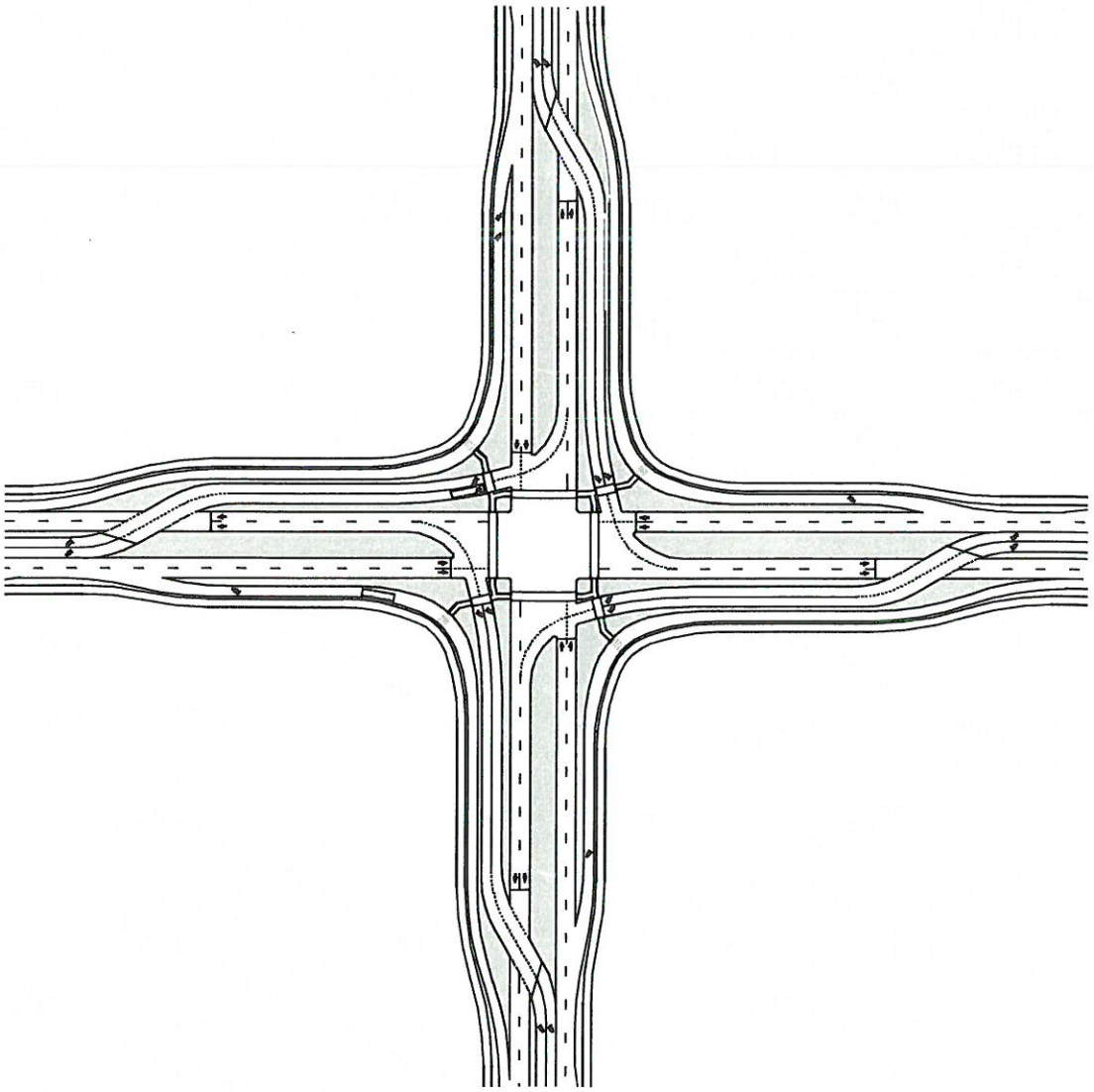


Exhibit 1-12. DLT intersection with displaced left turns on all approaches.

City of Oregon City Planning Commission
Meeting of January 22nd, 2018

RE: Agenda Item 3a – L17-03 Alternative Mobility Standards

Testimony of: Christine Kosinski, Unincorporated Clackamas County

To me, the Alternative Mobility Targets have been all smoke and mirrors. Yes, the City recognizes there is a huge capacity issue at Beavercreek Rd and Hwy 213, but you have gone through a process, that frankly, has failed to bring any real solutions, but you want the citizens to buy into it.

The addition of another Right Hand turn lane on Beavercreek Rd for motorists turning North on Hwy 213, I feel will be of little help. You have already recognized that many Rear End accidents happen here, but adding another lane will just create even more rear end accidents as motorists try to merge onto the highway while some motorists will be reluctant to let them in, slowing traffic down. Where was "Citizen Safety" in all of your meetings? To use a bandaid to fix this problem and then to put the citizens in harm's way from rear end crashes is NO solution.

What Oregon City is experiencing is the result of developing too fast at any cost and without the Grade Separated Intersection and infrastructure needed to support this large build-out.

My suggestions to the City would be, don't add the Right Hand turn lane, save your money, spare the people and stop more rear end crashes. Asking the people to jeopardize their lives while traveling this corridor is wrong, the people should never have to pay for mistakes of the City. Your key to growth is by building the Grade Separated Intersection, until you do this, your current traffic problems at this intersection will just become disastrous. I've had several phone calls from people both inside and outside of the City. Many of them are making plans to leave the City, some have already bought homes elsewhere and they say it is due to the heavy, fast and unsafe traffic conditions that the City has created.

No bandaids, I vote for real change that will make a difference in the years ahead. Do as the City of Seaside did, they put the Alternative Mobility Targets to a vote of the people, and through the process of listening to their people, they found solutions they can all live with.

FAX TRANSMISSION

COPY

John C. Spencer
SPENCER & KUPPER

555 NW Park Avenue, #231
Portland, Oregon 97209
Tel/Fax: 503/226-1067 282-9853

Date: September 10, 1993

To: Ron Weinman, Clackamas County

From: John Spencer, OCURA

Subject: **HWY. 213/BEAVERCREEK ROAD INTERSECTION (Revised from 9/9/93)**

Message: Please find attached proposed draft amendments to the MOU of Feb. 92, and proposed comprehensive plan policies to be added to OC's transportation plan. We are reviewing these proposals with the city attorney, and would like your comments. Please contact me at 226-1067.

John

Number of pages including this one: 8.

Containing Memo of Understanding signed by OR City

September 10, 1993

MEMORANDUM

TO: Charlie Leeson, Henry Mackenroth, Denyse McGriff, City of Oregon City
Mark Greenfield

FROM: John Spencer, Oregon City Urban Renewal Agency

RE: HWY. 213/BEAVERCREEK ROAD INTERSECTION (Revised from 9/9/93)

As a follow-up to the meeting on June 24 with Clackamas County and ODOT officials, I agreed to summarize our discussions which will be the basis for a revised Memorandum of Understanding between the City, County, and ODOT.

Overall Intent

It is the intent of all parties to provide for and implement the various transportation projects called for in the Draft Warner-Parrott Rd.-Oregon City Bypass Environmental Assessment. These projects include an at-grade interchange improvement of the Highway 213/Beavercreek Road intersection, and the future construction of a grade-separated interchange. All parties agree that existing traffic congestion at this intersection is at unacceptable levels. Until intersection and other improvements have been constructed, any new development permitted in the vicinity of this intersection should not increase the congestion problems beyond current levels. It is also agreed that if the sponsors of new development can prove that proposed development will not increase the congestion problems, then development will be allowed only when in compliance with adopted plans for an at-grade interchange at the Highway 213/Beavercreek Road intersection.

Proposed Modifications to the Draft MOU of 2/92

The Draft Memorandum of Understanding is attached. The following changes are proposed:

Paragraph 4.a., add the following:

The State, County and City consider the interchange project as high priority.

Delete paragraph 4.b.

Delete paragraph 7 and add the following:

The County and City agree that grade-separated interchange improvements for Highway 213/Beavercreek Road are adopted as part of their Comprehenstve Plans. The County and City also agree that their respective Comprehensive Plans require that major intersections operate at Level of Service (LOS) D or better. The County

and City agree that when new developments are proposed for properties along Beavercreek Road prior to construction of grade-separated interchange improvements, a professional traffic analysis shall be required prior to the issuance of any land use permits. Land use permits shall not be approved unless the traffic analysis demonstrates that the Highway 213/Beavercreek Road intersection and other nearby intersections will operate at Level of Service D or better with the proposed development. If the traffic analysis demonstrates that the Highway 213/Beavercreek Road intersection will operate at LOS D or better with the proposed development, the development plan, including access to Beavercreek Road, will not interfere with, impede the implementation of, or substantially increase the cost of the adopted grade-separated interchange improvements for Highway 213/Beavercreek Road.

First Draft Comprehensive Plan Amendments

In order to meet the obligations outlined in the paragraph above, Oregon City will need to amend the transportation element of its Comprehensive Plan. The first obligation is to adopt the interchange plan. That has been done with Ordinance 92-1002 attached. Following are draft policies to meet the other obligations outlined above.

a. *All intersections requiring full signals as shown on Figure 2, Traffic Signal Locations, Oregon City Transportation Master Plan, 1989, and any other intersections where full traffic signals are warranted, shall operate at Level of Service D or better. Level of Service (LOS) is defined in Appendix B of the Oregon City Transportation Master Plan, 1989.*

b. *A professional traffic analysis shall be required prior to the issuance of any land use permits when new developments are proposed for properties in the vicinity of fully signaled intersections. Land use permits shall be approved only when the traffic analysis demonstrates that the signalized intersection will operate at Level of Service D or better with the proposed development, and that the development plan will not interfere with, impede the implementation of, or substantially increase the cost of any adopted transportation improvements identified in the City's Comprehensive Plan*

c. *Right-of-way shall be required as a condition of approval when developments are proposed near adopted transportation improvements identified in the City's Comprehensive Plan.*

Please provide comments on these proposed plan amendments to me by the end of next week. Thanks,

John

CITY OF OREGON CITY

MEMORANDUM OF UNDERSTANDING
Between the
STATE OF OREGON,
CLACKAMAS COUNTY,
And
CITY OF OREGON CITY

(1) The Oregon Department of Transportation, Highway Division, hereinafter referred to as "State"; CLACKAMAS COUNTY, a political subdivision of the State of Oregon, acting by and through its Board of Commissioners, hereinafter referred to as "County"; CITY OF OREGON CITY, a municipal corporation of the State of Oregon, acting by and through its City Officials, hereinafter referred to as "City"; enter into this Memo of Understanding to set forth the principles of mutual commitment to the proposed Cascade Highway South at Beavercreek Road Interchange.

(2) State and County previously entered into a construction finance agreement No. 8119, on June 21, 1984 for the Warner-Parrott Rd. - Oregon City Bypass project.

(3) When the Warner-Parrott Rd. - Oregon City Bypass project is constructed, State, County, and City agree the increased traffic flow will cause congestion at the Cascade Highway South / Beavercreek Rd. intersection, and all parties agree that improvements may be necessary. Proposed at this time is an at-grade interchange at Cascade Hwy. South / Beavercreek Rd.

(4) State, County, and City agree to the following conditions in preparation for the proposed interchange agreement:

(a) State will support County and City in seeking the necessary funds from Metro to construct the interchange project.

(b) The County and/or City will be responsible for the survey, writing the descriptions, and the acquisition of any necessary right-of-way for construction of at-grade interchange.

(c) The County will have the lead role in project engineering and construction management.

(d) Prior to construction of the Cascade Hwy. South / Beavercreek Rd. Interchange, State, County, and City shall enter into a cooperative improvement agreement for construction and maintenance responsibilities for the at-grade interchange.

B3193001

⑤ The State, County, and City agree to consider a joint project for a future "grade-separated" interchange at the Cascade Hwy. South / Beavercreek Rd. location. The determination of financial participation will occur as part of the State's Six-year Transportation Improvement Program update process when future project becomes necessary.

⑥ Any cost of right-of-way and other improvements incurred in constructing the previously proposed at-grade project shall be considered in determining the shares of the cost of the grade-separated project.

⑦ The County and City agree to prevent additional development in areas identified as needed for constructing the Cascade Hwy. South / Beavercreek Rd. grade-separated interchange and prevent additional access that would conflict with the public's need for access control to the extent identified in the attached State drawing.

⑧ Terms of this Memorandum of Understanding can be terminated by any of the parties with 30 day, written notice.

⑨ Upon receipt of a signed copy of this Memo of Understanding, County and City shall start the process for acquiring the necessary funds for the construction of the proposed at-grade project and State shall review and release the Environmental Assessment document.

OREGON DEPT. OF TRANSPORTATION

Region Manager

Date_____

CLACKAMAS COUNTY
Board of Commissioners

_____
Chair

_____
Commissioner

_____
Commissioner

Date_____

CITY OF OREGON CITY

Jennifer W. Lowe
Mayor

William B. Isaacgren
City Recorder

Date 2-10-92

B3193001

CITY OF OREGON CITY

Incorporated 1844

DEVELOPMENT SERVICES DEPARTMENT
Planning, Building, Engineering
320 Warner-Milne Road
Oregon City, OR 97045
(503) 657-0895
FAX (503) 657-3339

May 27, 1993

Ron Weinman
Clackamas County
902 Abernethey Road
Oregon City, Oregon, 97045-1100

Mr. Weinman:

The Oregon City Commission, at its May 19th meeting, rescinded its approval given on February 17th, of the Memorandum of Understanding between the State of Oregon, Clackamas County and the City regarding the proposed interchange on Cascade Highway South at Beavercreek Road, effective immediately.

The Commission is concerned about the provisions and implications of the paragraph addressing the prevention of development on private lands. They further understood that the agreement was in it's final form when they originally authorized signing.

The City Commission has directed staff to reopen negotiations regarding this agreement. An identical letter is being transmitted to Ted Keasy at Region 1, of Oregon State Highway Division.

Please contact me to arrange further discussions on this matter.

Charles Leeson
City Manager

cc: City Commission
Ed Sullivan, City Attorney
Henry Mackenroth, Project Manager

COPY

ORDINANCE 92-1002

AN ORDINANCE AMENDING THE TRANSPORTATION MASTER PLAN AND THE TRANSPORTATION ELEMENT PLAN OF THE COMPREHENSIVE PLAN TO ADD TWO FUTURE ROAD PROJECTS AND A POLICY FOR COLLECTOR STREETS.

WHEREAS, the State Highway Division has requested that a proposed road project at Highway 213 and Beavercreek Road be included in the Oregon City Comprehensive Plan, and

WHEREAS, based on development patterns a future collector street needs to be designated outside of the City limits, but in the Urban Growth Boundary, and

WHEREAS, a policy on access management is needed to guide development along collector streets, and

WHEREAS, the Oregon City Planning Commission, on December 12, 1991, conducted a public hearing to consider the adoption of these proposals, and

WHEREAS, the proposed amendments to the Transportation Master Plan and Transportation Element of the Comprehensive Plan is designed to best meet the land use planning needs of the City.

OREGON CITY ORDAINS AS FOLLOWS:

Section 1. That the Transportation Master Plan and the Transportation Element of the Comprehensive Plan are hereby amended to add the following to read as follows:

I. Add the grade separation of Highway 213/Beavercreek Road.

a. The State Highway Division has forwarded a request to add the grade separation at Highway 213/Beavercreek Road. The proposal would include maps of the proposed Phase 1 and 2 project to page 63 of the Transportation Master Plan as an addition to the roadway laneage and access control map.

b. Roadway Laneage/Access Control Plan, page 64 of the Transportation Master Plan - Widen Highway 213 to six lanes between Beavercreek Road and I-205, with a grade separation at Beavercreek Road (to include Phase 1 and Phase 2 roadway and laneage needs).

2. Add S. Caufield Road as a future collector street - (For approximately 500 feet from Highway 213 to a proposed street that would be located berween S. Caufield Road and S. Canyon Ridge Drive; added to page 60 of the Transportation Master Plan.

3. Add a policy - Regarding access management on collector streets to Policy 4 on page L-35 of the Transportation Element of the Comprehensive Plan:

New subdivision/residential development shall minimize access on collector streets unless infeasible. If feasible, lots shall be oriented to have frontage on local streets with back yards to the collector street.

Read first time at a regular meeting of the City Commission held on the 5th day of February, 1992, and the foregoing ordinance was finally enacted by the City Commission this 5th day of February, 1992.

Jean K. Elliott

JEAN K. ELLIOTT, City Recorder

ATTESTED this 5th day of February, 1992.

Daniel W. Fowler

DANIEL W. FOWLER, Mayor

ORDINANCE NO. 92-1002

Effective: March 6, 1992

January 22, 2018

Testimony to the Oregon City Planning Commission

Subject: L 17-03 Legislative Amendment to amend Chapter 12.04.205 of the OCMC for Alternative Mobility Standards on Highway 213

From: Paul Edgar, Oregon City

I would like to ask all of you an aspirational question, as to what responsibility we all have to make sure our children are given the chance to reach their Full Potential.

Please think about this!

What is being asked, is about placing limits on the future and to me that is not the American Way. We want to allow the cream to rise to the top, we want to do whatever is reasonable to allow for excellence. We do not want to crib anyone, as to their future. We want to try as hard as we can to make sure the next generation, our children and our children's - children will not have unreasonable limits placed on them.

None of us have a Crystal Ball that allows us to look into the future. But we know that the next generation needs every opportunity and the best education possible to meet, whatever challenge they may face.

Well "L 17-03: Legislative Amendment to amend to Chapter 12.04.205 of the Oregon City Municipal Code for alternative mobility standards for Highway 213 intersections at Beavercreek and Redland Roads, and to amend the Transportation System Plan project list", puts unreasonable limits on our region's Transportation system - economic future.

This Code being proposed is to allow for congestion to increase, which can only restrict the free movement of freight and all the people that will have to travel the Hwy 213 corridor and through the Intersection of Hwy. 213 and Beavercreek Road.

Many of us find that to be inconsolable, where critical Freight Movement will be allowed to experience, an ever increasing high levels of degradation, which we all know increases the Cost of Freight Movement and which will stagnate all business development and job creation, over a period of time.

We need to make our area and Clackamas County is as inviting to investment as possible. When the families and business people alike experience a stupid level of congestion in Oregon City and Clackamas County they will question as to why they would move to a place that.

In the core of the Portland Metropolitan Area, "incidents of travel are increasing at unprecedented levels of greater than 5% per year compounded" and people and businesses are looking for a place to go. Where can they go that is not just a "Me To Alternative", with the same intolerable conditions and costs?

We need a long term solutions and what is being proposed is less than "just kick the can down the road!". Volume over Capacity = V/C.1 says we have a failing thoroughfare, which is a full glass of water and we are going to give everyone the ability to pour more water into the glass and you will just have to deal with it.

There are so many undeveloped Properties on Beavercreek Road and others on Highway 213/Meyers Rd., these changes will decrease all opportunities into the future, because this unchecked ability to increase congestion, thus increase the cost of doing business, will affect the decision making with all potential buyers - developers and businesses, thus making your property investments worth less.

ODOT, Metro - JPAC, TriMet, PBOT, Multnomah County, and Washington County all have priority over Transportation Funding and that leaves Clackamas County "Sucking the Hind Tit", as we are the weakest piglet. With these proposed Code Changes, we are providing those entities with the ability to take all of the available Transportation Funding and implement their strategy, and this allows them to get away with it.

To me we have to make a stand. We have to get everyone with Common Since, all of the business community, the Chamber of Commerce and citizens inside and outside of Oregon City to think through this, because what is being asked for, has never been done before in our Metro Region – ODOT Region One.

"Is it smart of put a permanent throttle that adds to congestion and restricts on all future movement of people and commerce that needs Highway 213 Corridor and its arterial's of Beavercreek and Redland Roads".

We don't have a lot of options to move people and commerce to the Hilltop of Oregon City and those areas east, west and south. To me, we just have to protect this critical transportation Corridor of Highway 213 and Beavercreek Road that carries the status of being a strategic Urban Freight Routes, within the City, Clackamas County and the State of Oregon, in their TSP's and Comprehensive Plans.

I don't know how anyone could live with limiting the promise of the future, for short term gains.

Thanks,


30

Oregon

Department of Transportation
Region 1 Headquarters
123 NW Flanders Street
Portland, Oregon 97209
(503) 731.8200
FAX (503) 731.8531

January 22, 2018

Planning Commission
City of Oregon City
PO Box 3040
Oregon City, OR 97045

The Oregon Department of Transportation (ODOT) is pleased to offer our support for the City of Oregon City's proposed alternative mobility targets in the vicinity of Highway 213 and Beavercreek Road. ODOT staff participated in the development of the City's Transportation System Plan which included direction to perform a refinement plan to develop alternative mobility targets. ODOT staff also participated in the Technical Advisory Group and Community Advisory Group for the Highway 213 Corridor Alternative Mobility Targets effort.

ODOT supports the proposed alternative mobility targets at OR 213 and Beavercreek Road based on inclusion of the westbound right turn merge lane project at OR213/Beavercreek Road in the City's TSP *and* in the Financially Constrained RTP project list, as well as the addition of the Beavercreek Road sidewalk infill and Hwy 213 and Beavercreek Road safety Improvement projects into the City's TSP. The length of the merge lane is to be determined during project development, must be approved by ODOT, and should not be specified in the project description. ODOT supports the proposed performance measurement methodology based on average annual weekday peak hour performance.

ODOT advises the City that alternative mobility targets are not needed at Redland Road based on inclusion of a proposed project (TSP project D79, RTP project 10119) in the Financially Constrained RTP project list. With this project in place, the intersection meets current Oregon Highway Plan mobility targets. The project may be assumed to be in place for purposes of future plan amendments based on the Transportation Planning Rule (TPR), OAR 660-0012-0060(4)(b)(C). Any one of the options under section -0060(4) are sufficient for projects to be considered planned improvements that jurisdictions and applicants are able to rely on for purposes of compliance with section -0060 of the TPR.

ODOT requests that the City state its intent to pursue actual funding of both the Beavercreek and Redland Road projects (as described in the City's TSP and Financially Constrained RTP) as opportunities arise, including the proposed regional transportation funding bond measure.

Upon local adoption of the proposed alternative mobility targets, ODOT staff will work with the City to take the proposed targets to the Oregon Transportation Commission for adoption. Let us know if we can be of any more assistance,

Jon Makler

Jon Makler
Planning Manager
ODOT Region 1

Laura Terway

From: Paul Edgar <pauloedgar@q.com>
Sent: Thursday, April 12, 2018 1:48 PM
To: Matthew L. Garrett
Cc: Jon Makler - ODOT Region 1, Planning Mgr; guttmcg@msn.com; Laura Terway; Paul Savas - County Commissioner
Subject: Thank you for the time you gave me yesterday and this opportunity to chat about Hwy 213 and Beavercreek Road Intersection

I think back to you and I and Cam Gilmore thinking through the ODOT Region One opportunities as well as my getting advise from David Cox and it all brings smiles to think back about that and all we went through with the CRC process.

I still have most all of those documents from the CRC days on the calculated effect of diversion brought about by tolling on I-5 corridor with a CRC Project.

I still believe that there is only so much that can be done in the I-5 Corridor and the I-205 Corridor has the greatest opportunity for creating an ROI with the necessary ROW in place and that it is flat and safe.

There has always been this need to think smart and creatively about how to look at the big picture and now I am trying to get you and others look at this intersection of Beavercreek Road and State Highway 213!

At one time the State came forward and helped fund a Jughandle Project on Hwy, 213, knowing how important this Hwy 213 corridor is to so many people, communities and businesses and that has not changed.

We all knew why we needed to have this Freeway/Corridor of Hwy 213 and in the Big Picture it has all proved out.

However when transportation dollars got real tight and hard to come by, things happen and that is why I am trying to do is bring to light is that somethings get lost in the listed needs of the STIP process somehow.

Trip generation in these corridors Beavercreek Road and Hwy 213 are growing and growing at now double digits rates, compounded annually, and this is our new normal in most of ODOT Region One.

But by approving New Methods for measuring congestion (Alternative Mobility Targets) at this Intersection, the trips somehow do not become less and this might well make things worse.

This will open the door to greater development, with little or no constraints of impacts, but worse to me is by not having a legitimate overpass intersection identified in the STIP, no-one is accruing SDC Fees to help defer the eventual needs and cost of a Full Hwy 213 and Beavercreek Road Interchange.

This to me, this is sticking our collective heads in the sands and limiting the ability to collect and target funding needed to do what we all know has to happen.

We will be throwing this into the laps of ODOT, Clackamas County and Oregon City as we kick the can down the road. I would sure not like to be east and south of this intersection.

Those Trip Generators who contribute to the problem, that are part of new development and job contributors within the economic engines that needs access to the marketplace and the I-205 Corridor will be screwed.

They will be considered part of the problem, will not have been putting their funding into the cost of doing what everyone agrees is the only long term solution to this problem/opportunity.

The problems is that each of these Roads/Highways at this intersection have Comprehensive Plan as being Strategic Urban Freight Routes, critical identification to a greater Community and thus having justification for solutions, that are better than Band-Aids.

As I said to you yesterday, approximately 70% of all of the Trips going through this intersection are not generated in Oregon City or ending within Oregon City's boundaries.

This to me requires a Greater Umbrella over all, who are equally responsible and should be included in capturing the necessary Impact/SDC Fees to help fund out the eventual needs of this intersection.

This intersection has been historically at LOS F congestion measurement for multiple centuries with Band-Aids improvements happening one step before total collapse.

We even had a joint agreement with Oregon City, Clackamas County and ODOT in our collective TSP's reflecting a need a Fly Over Interchange, where 213 goes underneath.

Than came 2013 and the Development of new Comprehensive Plans and TSP's and the need to list priorities and everyone chose to punt, as we were all told that there is NO Money available to fund out a $30M Interchange project.

We get to finger pointing and this need to list the highest priorities like the Sunrise Corridor and the I-205 corridor between Stafford and Oregon City, we know how important those priorities are and who can be blamed.

This should not be about blame, this is about a reality that is going to have so many negative effects on economics of so many businesses and commuters that cannot afford an Interchange that does not work properly.

We need to do the fund preliminary engineering for a full interchange Project at Hwy 213 and Beavercreek Road.

We than think ahead and buy the Property/ROW, to have it set-aside, when it cost 10 cents on a dollar.

We just have to have the needed property for a full Beavercreek Road and Hwy 213 interchange and that is just common sense.

It will still be at LOS F, but now we can tell everyone it is at V/C.1 and we have this ability to take/create one hour from averaging trips for 365 days per year and suggest that everything is OK.

We will suggest that we have it under-control and that the corrective ability to solve all of the congestion problems with one west bound free flowing lane turning right off of Beavercreek Road and down Hwy 213 and that will solve all of the congestion problems.

We currently have 4 hours in the PM Peak Periods Congestion that can may have 2% to 5% difference in the total of their trip counts at this intersection Monday through Friday.

We have virtually NO bike or PED traffic/activity at this intersection. We don't have TriMet Transit and Bus stops that have measurable effects close to this intersection.

We do have Oregon City School District - School Buses going through the intersection and their effect will be reduced with how the OC School District has moved their Bus Barn and with a new Myers Road getting cut through to Hwy 213 further down the road 213 going south towards Molalla.

My recommendation is to again list this need for a full Interchange in the STIP and create a greater umbrella for funding and collection of Impact/SDC Fees, effectively having an encumbered fund accounts where Regional SDC Fees go.

I can't blame Oregon City for saying we/they should not have to pickup the tab for this Interchange, for Clackamas County staying on focus of their highest priorities and everyone kicking this can to the State of Oregon as a Regional problem/opportunity.

Thanks, Paul Edgar

Laura Terway

From: Elizabeth Graser-Lindsey <egraserlindsey@gmail.com>
Sent: Saturday, April 14, 2018 8:38 AM
To: Kattie Riggs; Laura Terway; Laura Terway
Subject: Re: REVISED Agenda for 4-18-2018 City Commission Meeting

Laura,

As you know, I oppose the mobility targets at the OR213/Beavercreek Road intersection being weakened to the detriment of all the roadway users. I also oppose the grade-separated interchange not being added to the TSP even as an aspirational goal as many of the projects are.

Attachment C Exhibit 2 is missing the following:
APPENDICES
Appendix A – CAG and TAG Meeting Notes and Technical Memorandums
Appendix B – Oregon City GIS Maps
Appendix C – BlueMAC Data
Appendix D – Crash Data
Appendix E – Traffic Volumes
Appendix F – Operations Analysis
Appendix G – Cost Estimates
Appendix H – ODOT Letter of Support

Elizabeth Graser-Lindsey

On Fri, Apr 13, 2018 at 3:51 PM, Kattie Riggs <kriggs@orcity.org> wrote:

> Attached is the REVISED agenda for April 18, 2018 City Commission meetings
>
> 6:30 p.m. Urban Renewal Commission Regular Meeting (Open to the Public) held in the Commission Chambers at City Hall.
>
> 7:00 p.m. City Commission Regular Meeting (Open to the Public) held in the Commission Chambers at City Hall.
>
> PLEASE NOTE THE CHANGE:
>
> - Addition of items 3a. and 7c. to the City Commission Agenda.
>
> **Please post the agenda where required, then send confirmation.**

The agenda packet may also be found at the following link:

https://oregon-city.legistar.com/Calendar.aspx

Thank you,

Kattie Riggs, CMC

City Recorder

kriggs@orcity.org
City of Oregon City
PO Box 3040
625 Center Street
Oregon City, Oregon 97045
503-496-1505 Direct phone
503-657-0891 City phone
503-657-7026 fax

Website: www.orcity.org | Recorder Page |Facebook!|Twitter

PUBLIC RECORDS LAW DISCLOSURE: This e-mail is subject to the State Retention Schedule and may be made available to the public.

OREGON CITY

Community Development – Planning

221 Molalla Ave. Suite 200 | Oregon City OR 97045
Ph (503) 722-3789 | Fax (503) 722-3880

LAND USE APPLICATION FORM

Type I (OCMC 17.50.030.A)	Type II (OCMC 17.50.030.B)	Type III / IV (OCMC 17.50.030.C)
❑ Compatibility Review	❑ Extension	❑ Annexation
❑ Lot Line Adjustment	❑ Detailed Development Review	❑ Code Interpretation / Similar Use
❑ Non-Conforming Use Review	❑ Geotechnical Hazards	❑ Concept Development Plan
❑ Natural Resource (NROD) Verification	❑ Minor Partition (<4 lots)	❑ Conditional Use
❑ Site Plan and Design Review	❑ Minor Site Plan & Design Review	❑ Comprehensive Plan Amendment (Text/Map)
	❑ Non-Conforming Use Review	❑ Detailed Development Plan
	❑ Site Plan and Design Review	❑ Historic Review
	❑ Subdivision (4+ lots)	☒ Municipal Code Amendment
	❑ Minor Variance	❑ Variance
	❑ Natural Resource (NROD) Review	❑ Zone Change

File Number(s): LE 17-03

Proposed Land Use or Activity: Adoption of Alternative Mobility Targets for OR213 at Beavercreek Road and Redland Road, Amendments to the TSP

Project Name: Alternative Mobility Targets Number of Lots Proposed (If Applicable): N/A

Physical Address of Site: Hwy 213 Corridor: Redland Road to Beavercreek Road

Clackamas County Map and Tax Lot Number(s): _____

Applicant(s):

Applicant(s) Signature: _____

Applicant(s) Name Printed: Tony Konkol, City Manager Date: 12/13/17

Mailing Address: PO Box 3040, Oregon City, OR 97045

Phone: 503-657-0891 Fax: _____ Email: tkonkol@orcity.org

Property Owner(s):

Property Owner(s) Signature: _____

Property Owner(s) Name Printed: _____ Date: _____

Mailing Address: _____

Phone: _____ Fax: _____ Email: _____

Representative(s):

Representative(s) Signature: _____

Representative (s) Name Printed: _____ Date: _____

Mailing Address: _____

Phone: _____ Fax: _____ Email: _____

All signatures represented must have the full legal capacity and hereby authorize the filing of this application and certify that the information and exhibits herewith are correct and indicate the parties willingness to comply with all code requirements.

L 17-03 – Alternate Mobility Standards

Applicant Narrative:

Oregon City's 2013 Transportation System Plan (TSP) determined that the Highway 213 (OR213) corridor from Redland Road to Molalla Avenue (including the intersection of Beavercreek Road) will exceed the current mobility target in 2035, resulting in more congestion than is allowed. The OR213 intersection with Molalla Avenue is anticipated to meet the target; however, Beavercreek Road and Redland Road are not anticipated to meet the target.

The existing mobility target at the OR213/Beavercreek Road intersection is a volume-to-capacity (v/c) ratio at or below 0.99 during the peak first and second hours. The existing mobility target at the OR213/Redland Road intersection is a v/c ratio at or below 1.1 during the peak first hour and 0.99 during the peak second hour, as this intersection is located in a regional center. The alternatives that would meet the existing mobility targets at the OR213/Beavercreek Road and OR213/Redland Road intersections are not cost feasible, given the financial constraints of the City and other agency partners.

These alternatives can be further considered in the future if additional funding becomes available.

Lacking the financial capability of implementing major capacity-increasing projects at these locations, alternative mobility targets are necessary at each of these intersections; however, some improvements are feasible in the cost-constrained TSP to improve safety and minimize future congestion.

The following improvements are recommended for the intersection of OR213 and Beavercreek Road:

- Construct a westbound right-turn merge lane. High visibility pavement markings and signage are recommended for pedestrians and bicycles to cross the channelized lane safely, and consideration should be given to installing a rectangular rapid flash beacon (RRFB) for increased visibility.
- Infill sidewalk on Beavercreek Road from south of the Coltrane Path to north of Marjorie Lane.
- Install various safety improvements outlined on pages 33 and 35 of the final report.

The above improvements will be added as projects in the TSP for future consideration.

For the intersection of OR213 and Beavercreek Road, the following mobility standards apply:

- During the first, second and third hours, a maximum v/c ratio of 1.00 shall be maintained.

Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.

For the intersection of OR213 and Redland Road, the following mobility standards apply:

- During the first and second hours, a maximum v/c ratio of 1.10 shall be maintained. Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.
- During the third hour, a maximum v/c ratio of 1.05 shall be maintained. Calculation of the maximum v/c ratio will be based on an average annual weekday peak hour.

Changes to the TSP to incorporate these improvements and the alternative mobility targets are part of this Legislative application to City's Planning Commission and City Commission. The alternative mobility target and financially feasible improvements that are needed will need to be agreed upon by ODOT and approved by the Oregon Transportation Commission.

The attached full report discusses the process and proposal in greater detail.

This application is being submitted as a legislative amendment to amend the municipal code and the Transportation System Plan project list. The Transportation System Plan is an ancillary document to the Comprehensive Plan.

1. PLANNING CRITERIA

- *17.50 Processes*
- *Comprehensive Plan – Goals and Policies*
- *RTP*
- *Oregon Highway Plan*
- *Oregon Transportation Plan*
- *TPR*

Oregon City Comprehensive Plan

Regular Updates to *Ancillary Documents* Assure Consistency with the Oregon City Comprehensive Plan

Chapter O of the 2004 Oregon City Comprehensive Plan, Comprehensive Plan Maintenance and Update, contains criteria for approving changes to the comprehensive plan and plan map. Review of the comprehensive plan should consider:

1. *Plan implementation process.*
2. *Adequacy of the Plan to guide land use actions, including an examination of trends.*
3. *Whether the Plan still reflects community needs, desires, attitudes and conditions. This shall include changing demographic patterns and economics.*
4. *Addition of updated factual information including that made available to the City of regional, state and federal governmental agencies.*

The Oregon City Comprehensive Plan is implemented through City Codes, ancillary plans, concept plans, and master plans.
Ancillary plans are adopted by the City Commission for such things as parks and recreation, transportation systems, water facilities, and sewer facilities. Usually prepared by City departments through a public process, ancillary plans are approved by the City Planning Commission and adopted by the City Commission to provide operational guidance to city departments in planning for and carrying out city services. These plans are updated more frequently than the comprehensive plan."

Relevant Comp Plan and Statewide Planning Goals

Relevant Comprehensive Plan Goals and Policies to Address

Section 1 Citizen Involvement
Goal 1.2 Community and Comprehensive Planning
Ensure that citizens, neighborhood groups, and affected property owners are involved in all phases of the comprehensive planning program.
Policy 1.2.1 - Encourage citizens to participate in appropriate government functions and land-use planning.
Goal 1.4 Community Involvement - Provide complete information for individuals, groups, and communities to participate in public policy planning and implementation of policies.
Policy 1.4.1 - Notify citizens about community involvement opportunities when they occur.
Goal 1.5 Government/Community Relations -Provide a framework for facilitating open, two-way communication between City representatives and individuals, groups, and communities.

RESPONSE: A Community Advisory Group (CAG) and Technical Advisory Group (TAG) were formed to help the City evaluate the feasibility and practicality of the alternatives set forth in this project. The Community Advisory Group (CAG) purpose was to provide meaningful advice and guidance to inform staff, Planning Commission and City Commission concerning Alternative Mobility Targets along the Hwy 213 Corridor. Representatives of these groups included:

Community Advisory Group (CAG)

- Planning Commission representative
- City Commission representative
- Citizen Involvement Committee representative
- Transportation Advisory Committee representative
- Resident/Property Owner:
    - Maple Lane/Thayer Road area
    - Forest Edge area
    - City wide
- Advocate for:
    - Accessibility
    - Transit

    - Cycling
- Business/Property Owner: Commercial/Industrial
- Community Development Department Stakeholder Group representative
- Oregon City Chamber of Commerce representative
- Oregon City Business Alliance representative
- Clackamas Community College representative
- Hamlet of Beavercreek representative

Technical Advisory Group (TAG)

- Oregon Department of Transportation (ODOT)
    - Traffic
    - Transportation Planning
- Metro
- Oregon Department of Land Conservation and Development (DLCD)
- Clackamas County
    - Traffic
    - Transportation Planning
- TriMet
- City of Oregon City
    - Planning
    - Economic Development
    - Engineering
    - Traffic Consultant

The City advertised widely and broadly for representatives to serve on the Community Advisory group. The City held three meetings of the Community Advisory Group during the planning process. In addition, the City created a project webpage and posted all meeting materials and drafts as they became available, and held an open house and work session on December 12, 2017. Attendance at the open house was approximately 20 people. The City's notice process for this Legislative amendment will also include a Citywide mailed notice and multiple public hearings.

Section 6: Quality of Air, Water and Land Resources
Goal 6.1 Air Quality -Promote the conservation, protection and improvement of the quality of the air in Oregon City.
Goal 6.2: Water Quality
Control erosion and sedimentation associated with construction and development activities to protect water quality.
RESPONSE: The proposed amendment adds a TSP project for a right turn acceleration land that adds a limited amount of capacity to the intersection. The Advisory Groups considered, among the alternatives, infrastructure upgrades that would alleviate more congestion but that would also have an impact on nearby natural resources such as Newell Creek and associated wetlands and vegetated corridors. The proposed changes would not have an impact on water quality because they do not require widening of the roadways.
The adoption of alternate mobility standards will result in the City's ability to accept greater levels of traffic congestion at these intersections during peak congestion times. This recommendation balances

various goals, including the provision of public facilities, traffic safety, protection of natural resources, economic development, and livability.

Goal 11.1 Provision of Public Facilities
Serve the health, safety, education, welfare, and recreational needs of all Oregon City residents through the planning and provision of adequate public facilities.
Policy 11.1.1
Ensure adequate public funding for the following public facilities and services, if feasible:
• Transportation infrastructure

RESPONSE: The City does not have funding to complete large infrastructure projects at these intersections to fully alleviate congestion. Thus, the Advisory Groups evaluated various alternatives, considering the costs and benefits of each. The proposed project for HWY 213 and Beavercreek is estimated to cost $2.7M, which is achievable with the City's current and project resources.

Goal 11.6 Transportation Infrastructure
Optimize the City's investment in transportation infrastructure.
Policy 11.6.1
Make investments to accommodate multi-modal traffic as much as possible to include bike lanes, bus turnouts and shelters, sidewalks, etc., especially on major and minor arterial roads, and in regional and employment centers.
Goal 12.1 Land Use-Transportation Connection
Ensure that the mutually supportive nature of land use and transportation is recognized in planning for the future of Oregon City.
Policy 12.1.1 - Maintain and enhance citywide transportation functionality by emphasizing multi-modal travel options for all types of land uses.
Goal 12.3 Multi-Modal Travel Options
Develop and maintain a transportation system that provides and encourages a variety of multi-modal travel options to meet the mobility needs of all Oregon City residents.
Policy 12.3.1 -Provide an interconnected and accessible street system that minimizes vehicle miles traveled and inappropriate neighborhood cut through traffic.
Policy 12.3.2 -Provide an interconnected and accessible pedestrian system that links residential areas with major pedestrian generators such as employment centers, public facilities, and recreational areas.
Policy 12.3.3 - Provide a well-defined and accessible bicycle network that links residential areas, major bicycle generators, employment centers, recreational areas, and the arterial and collector roadway network.
Policy 12.3.4 -Ensure the adequacy of pedestrian and bicycle connections to local, county, and regional trails.
Policy 12.3.5 -Promote and encourage a public transit system that ensures efficient accessibility, mobility, and interconnectivity between travel modes for all residents of Oregon City.
Policy 12.3.6 -Establish a truck route network that ensures efficient access and mobility to commercial and industrial areas while minimizing adverse residential impacts.
Policy 12.3.8 -Ensure that the multi-modal transportation system preserves, protects, and sup- ports the environmental integrity of the Oregon City community.
Policy 12.3.9 -Ensure that the city's transportation system is coordinated with regional transportation facility plans and policies of partnering and affected agencies.

RESPONSE: Beavercreek Rd currently includes bicycle lanes and sidewalks, except for a gap between Maplelane Road and the Coltrane pedestrian path. This proposal includes an additional TSP project to fill the sidewalk gap in the project area on Beavercreek Road. Highway 213 does not include bicycle and pedestrian infrastructure as a state highway.
Safety improvements identified by the City for further investigation, or to be included as part of future projects in the area include:

- Install intersection enhancements including potential raised crosswalks, bike lane striping continuation, ladder-style crosswalks, and lane narrowing.
- Add wayfinding signage for people walking and biking.
- Enhance bike lanes on Beavercreek Road with additional markings and green striping in transition areas.
- Add buffers to bike lanes on Beavercreek Road where feasible.
- Add ADA curb ramps in the OR213/Beavercreek Road area where missing.
- Add pedestrian facilities to Maple Lane Road between Beavercreek Road and Thayer Road.
- Add transit stop amenities to existing stops in the area.

These projects will contribute to the multi-modal goals of the Oregon City transportation system.

Goal 12.5 Safety

Develop and maintain a transportation system that is safe.
Policy 12.5.1 -Identify improvements that are needed to increase the safety of the transportation system for all users.
Policy 12.5.2 -Identify and implement ways to minimize conflict points between different modes of travel.
Policy 12.5.3 -Improve the safety of vehicular, rail, bicycle, and pedestrian crossings.

RESPONSE: The OR213/Beavercreek Road intersection was identified in the 2013 TSP as a high collision intersection. The intersection was in the top 5% of the ODOT Safety Priority Index System (SPIS) List for the years
2012-2014. The SPIS List is maintained by ODOT and updated each year with the latest available year of crash records and traffic volumes. 2012-2014 is the most current SPIS list. The intersection also has a crash rate that exceeds the Critical Crash Rate meaning that it exceeds the crash rate of other comparable intersections.
As shown in the final report, the most predominant crash type at the OR213/Beavercreek Road intersection is rear-end crashes. Beavercreek Road is the first at-grade intersection on OR213 for over two miles south of Redland Road, in a corridor that generally feels rural. A lack of driver expectation of southbound queues from the signal may contribute to the high number of reported rear-end crashes at the intersection. The reported fatality occurred in 2011, and was an angle crash in which the driver ran a red light under dark and rainy conditions. The 2010-2014 crash rate of 1.20 is already lower than the crash rate of 2.05 identified in the 2013 TSP, indicating that safety and/or driver attentiveness have improved in recent years. Lengthening the dual eastbound left-turn lanes to provide additional storage (Project D27; funded) and an advanced queue warning system on southbound 213 will further improve safety at the intersection.
As shown in Tables 11 and 12, the planned TSP and proposed improvements will reduce the number of expected annual crashes at the OR213/Beavercreek Road and OR213/Redland Road intersections. The potential financially feasible improvements at OR213/Beavercreek Road are predicted to reduce crashes

at the intersection by almost 5%, and planned improvements at OR213/Redland Road are predicted to reduce crashes by more than 10%.

Goal 12.6 Capacity

Develop and maintain a transportation system that has enough capacity to meet users' needs.
Policy 12.6.1 - Provide a transportation system that serves existing and projected travel demand.
Policy 12.6.2 - Identify transportation system improvements that mitigate existing and projected areas of congestion.
Policy 12.6.3 - Ensure the adequacy of travel mode options and travel routes (parallel systems) in areas of congestion.
Policy 12.6.4 - Identify and prioritize improved connectivity throughout the city street system.

RESPONSE: The analysis in Tables 13 and 14 shows that, without improvements, the OR213/Beavercreek Road and OR213/Redland Road intersections will exceed current mobility targets in 2040 (shown in red). With potentially financially feasible improvements in place (i.e. a westbound right-turn merge lane at OR213/Beavercreek), the intersections will still exceed the existing mobility targets under 30th highest hour traffic conditions. Therefore, it is recommended that alternative mobility targets be based on average annual conditions, allowing the v/c ratio to exceed 0.99 for one hour per day at the OR213/Beavercreek Road intersection (upper limit of 1.0) and three hours per day at the OR213/Redland Road intersection (upper limit of 1.1).

Goal 12.8 Implementation/Funding
Identify and implement needed transportation system improvements using available funding.
Policy 12.8.1 - Maximize the efficiency of the Oregon City transportation system, thus minimizing the required financial investment in transportation improvements, wit out adversely impacting neighboring jurisdictions and facilities.
RESPONSE: The cost of adding an additional northbound and southbound through lane at OR213/Redland Road, consistent with TSP project D79, was recently estimated by OBEC to be almost $10 million.
The cost of the westbound right-turn merge lane at OR213/Beavercreek Road is estimated to be approximately $2.7 million based on the design shown in Figure 2. This estimate does not include right of- way acquisition.
The KAI and OBEC cost estimates, as well as exhibits of the proposed financially feasible improvements at OR213/Beavercreek Road can be found in Appendix "G".

CONSISTENCY WITH STATEWIDE PLANNING GOALS

STATEWIDE PLANNING GOAL 1:
To develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process.

See responses above.

STATEWIDE PLANNING GOAL 5:
To protect natural resources and conserve scenic and historic areas and open spaces.

RESPONSE: No scenic, historic areas, or open spaces are identified in the project area. Natural resources include Newell Creek. The proposed changes avoid creek and wetland impacts.

STATEWIDE PLANNING GOAL 6:
To maintain and improve the quality of the air, water and land resources of the state.

See responses above.

STATEWIDE PLANNING GOAL 9:
To provide adequate opportunities throughout the state for a variety of economic activities vital to the health, welfare, and prosperity of Oregon's citizens.

RESPONSE: The adoption of these standards will allow the City to approve new development in the area that contributes to economic vitality.

STATEWIDE PLANNING GOAL 11:
To plan and develop a timely, orderly and efficient arrangement of public facilities and services to serve as a framework for urban and rural development.

RESPONSE: The proposal includes upgrades to public facilities that balances costs, environmental impacts, livability, safety, and traffic congestion.

STATEWIDE PLANNING GOAL 12:
To provide and encourage a safe, convenient and economic transportation system.

RESPONSE: The proposal will result in fewer crashes and will increase the capacity of the intersection.

Oregon Transportation Plan (2006)
The Oregon Transportation Plan (OTP) is the state's long-range multimodal transportation plan. The OTP is the overarching policy document among a series of plans that together form the state transportation system plan (TSP). A TSP must be consistent with applicable OTP goals and policies. Findings of compatibility will be part of the basis for TSP approval. The most pertinent OTP goals and policies for city transportation system planning are provided below.
POLICY 1.2 – Equity, Efficiency and Travel Choices
It is the policy of the State of Oregon to promote a transportation system with multiple travel choices that are easy to use, reliable, cost-effective and accessible to all potential users, including the transportation disadvantaged.
POLICY 2.1 - Capacity and Operational Efficiency
It is the policy of the State of Oregon to manage the transportation system to improve its capacity and operational efficiency for the long term benefit of people and goods movement.
POLICY 2.2 – Management of Assets
It is the policy of the State of Oregon to manage transportation assets to extend their life and reduce maintenance costs.
POLICY 3.1 – An Integrated and Efficient Freight System
It is the policy of the State of Oregon to promote an integrated, efficient and reliable freight system involving air, barges, pipelines, rail, ships and trucks to provide Oregon a competitive advantage by moving goods faster and more reliably to regional, national and international markets.
POLICY 3.2 – Moving People to Support Economic Vitality

It is the policy of the State of Oregon to develop an integrated system of transportation facilities, services and information so that intrastate, interstate and international travelers can travel easily for business and recreation.

POLICY 4.1 - Environmentally Responsible Transportation System

It is the policy of the State of Oregon to provide a transportation system that is environmentally responsible and encourages conservation and protection of natural resources.

POLICY 5.1 – Safety

It is the policy of the State of Oregon to continually improve the safety and security of all modes and transportation facilities for system users including operators, passengers, pedestrians, recipients of goods and services, and property owners.

POLICY 7.1 – A Coordinated Transportation System

It is the policy of the State of Oregon to work collaboratively with other jurisdictions and agencies with the objective of removing barriers so the transportation system can function as one system.

POLICY 7.3 – Public Involvement and Consultation

It is the policy of the State of Oregon to involve Oregonians to the fullest practical extent in transportation planning and implementation in order to deliver a transportation system that meets the diverse needs of the state.

POLICY 7.4 – Environmental Justice

It is the policy of the State of Oregon to provide all Oregonians, regardless of race, culture or income, equal access to transportation decision-making so all Oregonians may fairly share in benefits and burdens and enjoy the same degree of protection from disproportionate adverse impacts.

RESPONSE: The proposal was developed with Advisory Groups including multiple ODOT staff. The proposal will go before the Oregon Transportation Commission for final approval.

Oregon Highway Plan

The 1999 Oregon Highway Plan (OHP) establishes policies and investment strategies for Oregon's state highway system over a 20-year period and refines the goals and policies found in the OTP. Policies in the OHP emphasize the efficient management of the highway system to increase safety and to extend highway capacity, partnerships with other agencies and local governments, and the use of new techniques to improve road safety and capacity. These policies also link land use and transportation, set standards for highway performance and access management, and emphasize the relationship between state highways and local road, bicycle, pedestrian, transit, rail, and air systems. The policies applicable to the Oregon City TSP are addressed below.

Policy 1A *(Highway Classification) defines the function of state highways to serve different types of traffic that should be incorporated into and specified through IAMPs.*

Policy 1C *(State Highway Freight System) states the need to balance the movement of goods and services with other uses.*

Policy 1B *(Land Use and Transportation) recognizes the need for coordination between state and local jurisdictions.*

Policy 1F *(Highway Mobility Standards) sets mobility standards for ensuring a reliable and acceptable level of mobility on the highway system by identifying necessary improvements that would allow the interchange to function in a manner consistent with OHP mobility standards.*

Policy 1G *(Major Improvements) requires maintaining performance and improving safety by improving efficiency and management before adding capacity. ODOT works with regional and local governments to address highway performance and safety.*
Policy 2F *(Traffic Safety) improves the safety of the highway system.*

RESPONSE: The OHP Policy 1F establishes mobility targets (as defined by motorized vehicle volume-to-capacity ratios) for state facilities that vary by region, facility classification, and whether or not the roadway is located inside an urban growth boundary (UGB). It states, "It is the policy of the State of Oregon to maintain acceptable and reliable levels of mobility on the state highway system, consistent with expectation for each facility type, location and functional objectives. Highway mobility targets will be the initial tool to identify deficiencies and consider solutions for vehicular mobility on the state system.

Specifically, mobility targets shall be used for:
• Identifying state highway mobility performance expectations for planning and plan implementation;
• Evaluating the impacts on state highways of amendments to transportation plans, acknowledged comprehensive plans and land use regulations pursuant to the Transportation Planning Rule (OAR 660-12-0060); and
• Guiding operations decisions such as managing access and traffic control systems to maintain acceptable highway performance."

The OHP Policy 1F allows for development of alternative mobility targets in areas where it is "infeasible or impractical to meet the mobility targets". The policy allows for the use of alternative mobility targets to "balance overall transportation system efficiency with multiple objectives of the area being addressed." It requires that targets "shall be clear and objective and shall provide standardized procedures to ensure consistent application of the selected measure. The alternative mobility target(s) shall be adopted by the Oregon Transportation Commission as an amendment to the OHP." The OHP currently includes alternative mobility targets in many locations throughout the State; however, none have been adopted within the Portland Metro area to date.

OAR 660 Division 12 Transportation Planning Rule (TPR)
The purpose of the TPR is "to implement Statewide Planning Goal 12 (Transportation) and promote the development of safe, convenient and economic transportation systems that are designed to reduce reliance on the automobile so that the air pollution, traffic and other livability problems faced by urban areas in other parts of the country might be avoided." A major purpose of the Transportation Planning Rule (TPR) is to promote more careful coordination of land use and transportation planning, to ensure that planned land uses are supported by and consistent with planned transportation facilities and improvements.

RESPONSE: Mobility targets for state highways, as established in this policy or as otherwise adopted by the Oregon Transportation Commission (OTC) as alternative mobility targets, are considered the highway system performance standards in compliance with the Transportation Planning Rule (TPR) (OAR 660-012), including applicability for actions that fall under Section -0060 of the TPR.

The TPR Section -0060 applies when cities or counties are considering zone changes or plan amendments that would allow for additional development that would significantly impact or worsen the performance of existing or planned transportation facilities. Currently, significant impacts are found to exist when levels of automobile traffic cause roadway facilities to exceed motorized vehicle standards, such as mobility targets. If there is a significant impact, jurisdictions are required to "ensure that allowed land uses are consistent with the identified function, capacity, and performance standards of the facility measured at the end of the planning period identified in the adopted Transportation System Plan."

Regional Transportation Plan

The Regional Transportation Functional Plan (RTFP) directs how Oregon City should implement the RTP through the TSP and other land use regulations. The RTFP codifies existing and new requirements which local plans must comply with to be consistent with the RTP. If a TSP is consistent with the RTFP, Metro will find it to be consistent with the RTP.

RESPONSE: The RTP includes a project in the area for Southbound OR 213 Advanced Warning System. This project is retained in the existing proposal.

Caufield Neighborhood Association Meeting Minutes Sept. 26th, 2017

Attendance: 15 neighbors, 3 guests

Pledge of Allegiance (at 6:48PM)

Co-Chair Browning reminded us that we can follow the Caufield NA Facebook page, which can be found at: www.Facebook.com/CaufieldNeighborhoodAssociation

Business meeting and Community Announcements

Meeting minutes from May 23rd, 2017 were approved by unanimous voice vote.

Explanation of Oregon City Parks Foundation drop-in fund-raising program (bottle and can deposits) and distribution of blue bags. - Kristina Browning

Chairman Malchow reported on letter he wrote for Oregon City to get a grant.

Announcement of search for filling CNA Secretary position and police chief advisory board position.

Police Report & News report *by Officer Michael Villanti*
Ballot measure for Bond for the new building passed by 80%; he also reported on traffic enforcement and other events.
Oregon City has three times the number of crashes that it should because of the number of people driving through the city. He has been hired as a new traffic officer hoping to make an impact on the crash numbers.
The "Shred It" event will be held September 30th from 9-12.
October 31st, they are handing out candy at the police station from 4-6pm.
In November, a **women's self-defense class** will be held.
New annual report is on the website for your review.
Next Sunday (Oct. 1) is the start of the new distracted driver law…no cell phones in your hand…hands free, hands off. Mounting the phone is ok on your dash so long as you don't hold it.

Update on Newell Creek Canyon *by Tannen Printz (Metro - landscape engineer involved with Newell creek park development)*
METRO has been working with a consultant to prepare a land use plan to the city. It was submitted last month and was accepted yesterday (9-27-17). The city has 90 days to determine compatibility for proposed uses for site based on zoning and code. 233 acres have been broken down into three major use areas: day-use, trail network and conservation. The trail network will be for hiking, off-road cycling and multi-use, with portions of the trail available for both uses. The site entrance is off Fox Lane (turn east at the light at Molalla Ave and Warner-Milne Rd.). Restrooms and an information kiosk will be near entrance with parking for 20-25 cars + a Tri-Met bus stop. The center of the day-use site is focused on meadow restoration. They have been working with their ecologist on staff to improve the ecological health of the site. The park will include some picnic tables and a viewing overlook. A nature play area is on the future plan but is not currently funded (However, those numbers would be easily found as his project manager is working on a similar play area in Sandy currently - so a local group could spearhead funding this if they wanted to). Trail construction is slated for Winter 2017-2018 and Spring/Summer 2018 with opening slated for Fall 2018.

Oregon City Planning Dept. Report - *Kelly Reid, OC Planning Dept. Liaison*

Glen Oak Park – The city is working on requests for proposal for construction drawings and schedules, and is anticipating construction to be completed by the summer of 2019.

Beavercreek Concept Plan – All appeals to the Plan have been resolved [see website: https://www.orcity.org/publicworks/beavercreek-road-concept-plan]. The plan stands, and the city will take the next step, which is implementation of that plan through zoning codes. We have a grant from ODOT to move forward with plans to eventually widen Beavercreek Road. Evergreen Housing Development Group has building permits and is currently working on plans for 100 - 200 "live/work" units to be built across from the high school (ideal for CCC college students). The entrance to the site is being worked out with the city. The CNA neighbors hope it will be at the Meyers Road intersection.

Oregon City Golf Course site update: The owner applied for annexation and it was approved. There are two pieces of property totaling 115 acres which is now part of the city limits. There has been no further action on that property; awaiting zoning to be adopted for the Beavercreek master plan. The city got a grant or loan for design work for a sewer extension to bring the sewer line further down Beavercreek Rd. (from Marjorie Lane past Loder Road to near the high school).

Meyers Road Extension completion: The city is working on getting engineering and permits in place and for having the Meyers road development paid for chiefly through fees from developers. They are also working with the current property owners to gain right of way. For the past ten years, it has been zoned campus industrial/light manufacturing in order to bring jobs to the area. There is a long list of industrial uses that this zoning is used for – zoning is similar to the warehouses along Fir Street (area between Fred Meyer and Wilco Farm Store).

Riverwalk update: The concept plan for the full $60 million project is done and approved. The city/county/METRO consortium will build the first $20 million phase this coming year, which includes construction of a place to view the falls, some demolition and clean up along with some wildlife habitat restoration.

Trees: There have been some questions in the past from CNA members about street trees that are removed or dead. Kelly responded that by city ordinance, it is the responsibility of the homeowner to have the tree removed after getting a permit, then they can choose a species of tree from a city-approved list that will do well in this environment. If a tree is watered properly when it's young, its roots should not destroy the sidewalk as it grows. It is case by case. It's best to check with the city. First check online since they have a long list of documents about trees at https://www.orcity.org/forms . OCRequest online can handle code enforcement… https://www.orcity.org/community/oc-request-faqs-and-requests

The Beavercreek/Hwy 213 intersection and mobility standards program is adopting new mobility standards for that intersection after careful study and multi-week meetings by a special committee. The intersection gets congested during rush hour and models show that by 2035 with new development in Oregon City and Molalla, this intersection is going to be over-capacity. They looked at solutions that OC can afford since the solutions we currently have on the books don't pencil out because of lack of funding for them. The committee recommended a new mobility target and some improvements. One of the improvements you will see: If you are driving North toward 213 and you want to turn right to go to 205, the right turn lane will be expanded so you don't have to stop and look in order to merge. An early warning system will also be installed to let people know there is slow traffic approaching to reduce rear-end accidents. We will also be enhancing other modes of transportation; to encourage walking, biking and transit. Study data can be viewed here: https://www.orcity.org/publicworks/project/ps-16-024

Citizen Concerns – none voiced

Meeting Adjourned at 8:30pm

Next Meeting - Nov 28th, 2017 at OCDS Facilities & Maintenance Center

OREGON CITY

SEPT. 26, 2017
Meeting Date

Caufield Neighborhood Association

	NAME	ADDRESS
	ROBERT MALCHOW	20153 WOODGLEN WAY
	~~SETH~~ SCALES	20243 HERMITAGE DR
	VONNIE COWAN	20231 " "
	Marcella Stoke	20226 " "
	Dan & Karen Quesinel	14425 S. ANDREA LYNN TER.
NEW	Darren & Lindell Bennett	15084 Persimmon Way
NEW	Ann Fisher	14671 Thayer Rd
CHANGE	Mary Jo Tyler	20006 Mossy Meadows
	Maggie ~~GRANT~~	14946 Coquille Ct
	Robert Cook	14477 Andrea Lynn Ter
	Dee Dee & Joe Watson	20196 Quinault Dr.
	KRISTINA BROWNING	18913 WYNTON DR.
NEW	CAMIAN LARSON (WAS NOT ~~ABLE TO ATTEND~~)	15025 ST. ANDREWS DR
	TANNER PRITZ	METRO
	KELLY REID	O.C. PLANNING DEPT.
	OFF. MICHAEL VILLANTI	O.C. POLICE DEPT.

~~TANNER PRITZ~~ ~~METRO~~

Gaffney Lane Neighborhood Association

Minutes of the General Meeting
July 13, 2017

1. Call to Order – Amy Willhite – 7:05 p.m.
2. **In Attendance**:

- Amy Willhite - chair
- Angela Wright - Secretary/Treasurer
- Joan Schultze
- Pamalyn Richardson
- Jack Wright
- Ed Turpin
- Michelle Don – Citizens Bank
- Cynthia Gates OCPD
- Dayna Webb – OC Public Works
- Larry Stopper
- Jay Russell
- Sharon Mora
- Joseph Scharlau
- Shirley Maxcy

3. **Old Business** - Minutes of the Meeting held on April 27, 2017 were approved unanimously.

4. **New Business**

- **Dayna Webb,** Oregon City Pubic Works, Project Engineer. Alternative mobility target for 213/Beavercreek Road and 213/Redland Road both of which are estimated to have more congestion than they can effectively handle by 2035. Additional turn lanes from Beavercreek and continuing on to 213 - cost $2.5-$3 million - will relieve morning congestion. (visuals on file)
  Redland Road/213 interchange – extension of 2 lanes north and south bound to 3 lanes past the underpass – cost $9.8 million. Looking for grant opportunities as ODOT says does not have the necessary funds.
  Meyers Road extension project (visuals on file) from bus barn to 213. Concern raised of additional traffic on residential Meyers Road. Construction to possibly start late Spring 2018.

Molalla Avenue Grant Project runs from Beavercreek to 213. The City was awarded a $3.8 million Federal grant, which the City will match with an additional $4 million. (visuals on file). Full replacement of traffic signals at Clairmont and Gaffney. Propose installing three flashing light beacons (similar to the one by the Library) at Adrian Way, Garden Meadow and Char Diaz with median resting spots. All ADA ramps to be replaced. Entire roadway to be resurfaced. Federal funds available in October 2018. Hope to start project in summer of 2019.
Concern was raised about access from Char Diaz for vehicles turning left on to Molalla. Also the Fire Station will be involved in the restructuring of Molalla.
OC Request to report any problem with tree root growth on sidewalks, etc.

- **OCPD Officer Cynthia Gates** presented the current call statistics. (on file)
Bond for the new Public Safety Building will be voted on in September. Present property is not big enough or seismic ready and any new building needs to be by 2020. No privacy in present facility. Current $6.50 per month on the utility bill is ONLY for this project and will cease on completion. Design concept available on Oregon City web site. Historically Police Station has never had it's own building!
New officer dedicated for transient population – Mike Day. Oregon City has approximately 11% of the population of Clackamas County but it has 17% of the homeless. Increase in numbers possibly result of "Father's Heart" being just a day facility for the homeless. Also prison discharges.
August 1 - National Night Out 5:30 to 8:30 pm at Mount Pleasant School.
Local thefts and car vandalizing discussed.
Tell your neighbors when you are going to away for any length of time. Neighborhood Watch program details available from Chris Wadsworth at OCPD.
September 30 - Shred event at the Police Station 9:00 to midday
August 26 – child car seat check at Police Station 1:00 – 3:00 pm.
July 24-28 - OCPD Kids Summer Camp - 3rd, 4th, 5th graders – at Gaffney Lane Elementary School.
Citizens Academy - Wednesday evenings September to November to learn about all aspects of the police department. Applications being accepted now.
Drop off for old medicines in the lobby of the police station.
Chickens in neighborhood – no roosters allowed. Rats attracted by feed.
Compliment paid to OCPD.
Feel free to contact Cynthia Gates with any questions or neighborhood issues.

- **Amy** reported on CIC meetings. **ODOT** replaced rock wall after City replaced a water pipe by the tunnel. Tunnel illumination project next year replace lighting. From tunnel going north with right turn on to Railroad, pedestrian walkway dangerous so turn will be changed. Electrical sign system proposed. Obsolete railroad track to possibly be removed.
Trimet - HOP pass – like a debit card for travel. Daily and monthly passes.
Concerts in the Park – at the End of the Oregon Trail.
August – movies in the park – Friday at Wesley Lynn Park.
Rose Farm – Holmes Lane – a little gem!
Fire on 213 South caused by muffler causing sparks. Detour necessary.
Fire Station 16 replacement building going ahead.
Steering Committee Meeting for new by-laws for meetings every other month. Will report at next meeting.

- **Meeting adjourned at 8:38 pm** Next meeting on September 14, 2017.

7/13/

GAFFI LANE
NEIGHBORHOOD ASSOCIATION

PLEASE PRINT ARLY

NAME	HOME ADDRESS	EMAIL ADDRESS
CHRISTINE CORE	14052 Conway Dr	quilting77@centurylink.net
Dayna Webb - Oregon city PW		dwebb@orcity.org
Larry Stopper	Pioneer Ridge	KROYALTEN@OUTLOOK.com
JAY RUSSELL	13017 S ellsworth cir OC	jayrussell@johnl nat.com
Cynthia Gates	OCPD	cgates@orcity.org
Ed Turpin	13911 So. Caufield Rd OC.	edandjuby@hotmail.com
Michelle Don - Citizens Bank	19245 Molalla Ave OC	mdon@citizensebank.com
Shawn Mora	19857 Castleberry Lp	
Joseph Scharlau	19856 Castleberry	joe[redacted]fs@comcast.net
Joann Chelos	19213 Cokeman dr	
Jack Wright	13718 Char Diaz Dr. - O.C.	
Joan Schultz	Stillmeadow	
Penelope Richardson	Meadows Courtyard	
Stanley Madey		
Amy		

Angela.

16

7:05

8:38.

Hillendale Neighborhood Association

General membership meeting – July 11, 2017, 7:00 PM Hillendale Park Picnic

Attendees: Georgia Reagan, William Gifford, Joyce Gifford, Donna Johnson, Vern Johnson, Anna Harris, Roy Harris, Nick Shamp, Kim Shamp, Shawn Karns, Josh Kayser, Merry Goodner

Guests:, John Fetzer, Spencer Rohde, Tony Konkol, Dayne Webb

1. Call to order: Self-introductions
2. OCPD HNA Report: Officer John Fetzer and Spencer Rohde
   a) Sept special election on bond measure
   b) National Night Out, August 1st
   c) August 26th Child Safety Seat check OCPD 1-3PM
   d) Shred event Sept 30th 9-noon
   e) June stats provided
   f) New facility plans include public meeting room, Planning Dept moving to Annex @Mt Pleasant site April 2018. Kim Shamp asked if there will be an opportunity for OC residents to purchase a brick from old school.
   g) Reminder that traffic accidents increase during warmer weather and kids playing during summer.
   h) Cell-Phone Law fines are increasing. "Evade Class", driving refresher course given by traffic officers for 1st time offenders
   i) Homeless Liaison Officer Day receiving positive press
   j) OCPD will be hiring an officer to serve CCC campus

   Dayne Web, OC Public Works:
   a) Alternative Mobility Targets on three major OC intersections: Hwy 213/Bvk, 99E/14 St, Hwy 213/Redland Rd
      - Hwy 213/Beavercreek Rd – Community Group explored options
        - Full rebuild $40 million+ w/impact on Newal Creek Canyon
        - W Bvk to N Hwy 213 additional merging lane, $2.5 million (Right acceleration lane)
        - 3 Thru Lanes entire intersection
      - Molalla Completion Project designing starts Oct 2017 with construction planned Summer 2019
      - Meyers Rd Extension, construction Summer 2018

Park Place Neighborhood Association

January 18, 2018

Steering Committee Meeting

Notes regarding discussion of L 17-03 Alternate Mobility Targets:

Kelly Reid, Planner with Oregon City, attended the meeting to present the City's proposed code amendments to Chapter 12.04 of the Municipal Code. These amendments would adopt the proposed mobility standards for Highway 213 and Beavercreek Road and Highway 213 and Redland Road.

Kelly described the project to the meeting attendees, including the predicted future congestion levels, existing and proposed code changes and the improvement projects at Beavercreek and Redland intersections. She gave a more detailed description of the HWY 213 and Redland Rd project, which is within the Park Place neighborhood. Additional through lanes on HWY 213 would provide a total of three northbound and three southbound lanes, including extension of the left turn lane onto Redland. The project is already designed and engineered, so construction could begin fairly soon after funding is obtained. Funding is uncertain due to only a small portion of the project eligible for System Development Charges (SDCs), meaning the City has to rely on ODOT and County funding to supplement, or find other outside sources. Until funding can be obtained, the City is proposing to raise the mobility standards slightly, which would allow for peak hour congestion for a longer period of time per day (2 hours rather than one hour).

Members of the neighborhood association then discussed the following:

Alternative improvements to the Redland intersection – were other designs considered? What about on ramps from Holcomb? Topography issues make that difficult. The project was developed and designed as part of the jughandle project, and alternatives were considered.

With more traffic congestion at that intersection, people will take alternate routes, including Forsythe to Clackamas River Drive. The City should look at the potential need for a traffic signal at Forsythe and Clackamas River Drive.

The project could speed up traffic through Redland only to see the same or worse congestion at the I-205 onramp. There are improvements to I-205 planned as well. Kelly will follow up with more information on what is planned for I-205.

Emergency routes are needed if HWY 213 is closed due to rock falls or other reasons. In Mulino, it was recently closed for a rock fall. Kelly can follow up after asking ODOT what the emergency route is.

The city collects SDCs from new development to fund expansions of the transportation system. How do Oregon City's rates compare to other jurisdictions? Do we need to raise our rates so we can afford more improvements? Kelly explained that our rates for new residences are among the highest in the region, and for commercial we are somewhere in the middle. She will follow up by sending the most recent rate study to the NA chair.

The group discussed the information used to predict traffic growth and that the model assumes growth throughout the region (background growth) as well as growth within Oregon City through development

of vacant land and underdeveloped land, based on adopted land uses. The model assumes full buildout of the City's concept plan areas by 2040.

The group discussed funding sources for transportation including gas tax and tolls, and noted that Clackamas County does not charge its own gas tax. Kelly explained that a portion of state gas taxes are distributed to jurisdictions based on population. The funding issues and congestion issues are not unique to Oregon City – they are happening throughout the region and the state. Other jurisdictions have also adopted alternate mobility standards, including Seaside, OR.

Last, the group discussed the idea of just halting development in the City for a time until the transportation projects can be built. The impacts of that would be that the City would not be collecting SDCs to fund the projects during that time, and that background growth would continue.

Kelly invited the group to attend the public hearing at Planning Commission on January 22nd and explained that the next hearing date would be determined at the meeting. The code amendment approval process requires City Commission approval, and then the Oregon Transportation Commission will review the proposal from Oregon City before it can be officially adopted.

JANUARY 18, 2018

PARK PLACE NEIGHBOORHOOD ASSOCIATION

SIGN IN SHEET

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Martie & Gary Moody	16551 Oaktree Terr	503-305-8010	MARTIL97223@gMail.com
Marie D. Soleta	16285 Front St OC	5038881860	

3. Tony Konkol, City Manager: extensive report re: Accomplishments and Goals of OC
    - Finance Dept Award
    - Safety Record
    - Waterfront Award
    - OCPD, increased number of officers and assigned roles w/on-call mental health worker
    - Library completion and increased usage
    - Cove Development
    - Parks (over 30): Concerts, Movies, Pool
    - River Walk
    - Economic Enterprise Zone
    - Grant ($100,000) to explore affordable housing options
    - Public Works facility

Round-Table:

- Merry Goodner mentioned the house on Roseberry Ave that appears to be a group home for disabled that concerns neighbors re: noise and treatment of residents. Possible actions were discussed
- High weeds are a fire hazard on Metro Property for Newell Creek Canyon

Adjourn with door prizes for families and children who attended picnic

Next meeting – HNA/TVNA Board meet at NNO