PLANNING COMMISSION AGENDA
City Commission Chambers - City Hall
625 Center Street, Oregon City, Oregon 97045
October 24, 2011 at 7:00 p.m.

The Planning Commission agendas, including staff reports, memorandums, and minutes are available from the Oregon City Web site home page under meetings.(www.orcity.org)

1. CALL TO ORDER

2. PUBLIC COMMENT ON ITEMS NOT LISTED ON AGENDA

3. ADOPTION OF PLANNING COMMISSION MINUTES

   a. Planning Commission Minutes 6/13/2011

4. PLANNING COMMISSION HEARING

   a. L 10-02: Water Master Plan

5. COMMUNICATIONS

6. ADJOURN

Video Streaming & Broadcasts: The meeting is streamed live on Internet on the Oregon City's Web site at www.orcity.org and available on demand following the meeting. The meeting can be viewed live on Willamette Falls Television on Channels 23 and 28 for Oregon City and Gladstone residents; Channel 18 for Redland residents; and Channel 30 for West Linn residents. The meetings are also rebroadcast on WFTV. Please contact WFTV at 503-650-0275 for a programming schedule.

City Hall is wheelchair accessible with entry ramps and handicapped parking located on the east side of the building. Hearing devices may be requested from the City Recorder prior to the Commission meeting. Disabled individuals requiring other assistance must make their request known 48 hours preceding the meeting by contacting the Planning Dept. at 503-722-3789.

CITY OF OREGON CITY
PLANNING COMMISSION HEARING

June 13, 2011, 7:00 P.M.
City Commission Chambers - City Hall

1. CALL TO ORDER

Chair Stein called the meeting to order at 7 p.m.

Roll Call:
Chair Carter Stein
Commissioner Chris Groener
Commissioner Charles Kidwell
Commissioner Denyse McGriff
Commissioner Paul Espe
Commissioner Zachary Henkin

Staff Present:
Tony Konkol, Community Development Director
Christina Robertson Gardiner, Associate Planner

2. PUBLIC COMMENT ON ITEMS NOT LISTED ON AGENDA

There was no public comment on items not listed on the agenda.

3. ADOPTION OF PLANNING COMMISSION MINUTES

January 3, 2011 Draft Minutes

January 3, 2011 Draft Minutes

Motion by Commissioner Charles Kidwell, second by Commissioner Paul Espe to to approve the January 3, 2011, minutes as written.

A roll call was taken and the motion passed with Chair Carter Stein, Commissioner Chris Groener, Commissioner Charles Kidwell, Commissioner Denyse McGriff, Commissioner Paul Espe, Commissioner Zachary Henkin voting aye. [6:0:0]

January 10, 2011 Draft Minutes

January 10, 2011 Draft Minutes

Motion by Commissioner Chris Groener, second by Commissioner Charles Kidwell to to approve the January 10, 2011, minutes as written.

A roll call was taken and the motion passed with Chair Carter Stein, Commissioner Chris Groener, Commissioner Charles Kidwell, Commissioner Paul Espe, Commissioner Zachary Henkin voting aye and Commissioner Denyse McGriff abstained. [5:0:1]

January 24, 2011 Draft Minutes

January 24, 2011 Draft Minutes

Motion by Commissioner Denyse McGriff, second by Commissioner Charles Kidwell to to approve the January 24, 2011, minutes as written.

A roll call was taken and the motion passed with Chair Carter Stein, Commissioner Chris Groener, Commissioner Charles Kidwell, Commissioner Denyse McGriff, Commissioner Paul Espe, Commissioner Zachary Henkin voting aye. [6:0:0]

4. PRESENTATIONS

Oregon City Historic Review Program: Historic Survey and Update Project

Commission Report

Historic Resurvey Powerpoint

Oregon City Historic Survey and Update Project- Draft 5.20.11

Christina Robertson-Gardiner, Associate Planner, presented the results of the historic survey and update project. The project consisted of an update of the current historic inventory and survey of properties that had not been surveyed previously with a focus on mid century architecture. She explained the components of the update, landmarks update, reconnaissance survey, historic context statement, mid century modern styles, and regulatory review.

Commissioner McGriff suggested the number of craftsman homes be reviewed. She thought there were less craftsman and more bungalo.

There was discussion regarding public perception of the reconnaissance survey, the results of the survey, public education for owners, preservation grant program, and how to have energy efficient homes yet keep the historical integrity.

5. WORK SESSION

2011 Goals

Tony Konkol, Community Development Director, reviewed the rough draft of the Commission's 2011 goals.

There was discussion regarding the street tree and sidewalk repair policy, downtown parking, and the definition of industrial.

Chair Stein suggested adding the goal of including industrial uses to mixed use areas to allow citizens to live and work in the City.

There was discussion regarding options for mixed use and converting buildings to mixed use.

Mr. Konkol said staff could describe what uses would be compatible with residential or office development. There were a minimum number of units that was required for residential and industrial land and there were some industrial uses and industrial areas that would not be compatible with residential.

Commissioner McGriff suggested adding historic conservation to Number 5, promoting and educating citizens about innovative smart growth.

Mr. Konkol thought they should keep the goals general and prioritize them and as they worked on each one, come up with the ideas for implementation.

The Commission would review the goals and discuss them at the next Commission meeting.

6. ADJOURN

Chair Stein adjourned the meeting at 8:47 p.m.

Agenda Item No. 4a
Meeting Date: 24 Oct 2011

COMMISSION REPORT: CITY OF OREGON CITY

TO:	Planning Commission
FROM:	Pete Walter, Planner
PRESENTER:	Pete Walter, Planner
SUBJECT:	L 10-02: Water Master Plan
Agenda Heading: Public Hearing	
Approved by: Tony Konkol, Community Development Director	

RECOMMENDED ACTION (Motion):

Staff recommends that the Planning Commission take testimony from any member of the public who wishes to comment on this application, and following deliberation, recommend approval of the Oregon City Water Distribution System Master Plan, included as Exhibit 1, as an ancillary document to the Oregon City Comprehensive Plan to the City Commission for their consideration at the November 2nd, 2011 public hearing.

BACKGROUND:

On October 10, 2011 the Planning Commission heard a presentation from the applicant describing the proposed update to the Oregon City Water Distribution System Master Plan.

As an Ancillary Document to the City's Comprehensive Plan, the Water Distribution System Master Plan identifies existing water system deficiencies and required improvements, analyzes existing and future water demands and develops a capital improvement program (CIP) to meet these needs.

The attached Staff Report addresses how the proposed plan is consistent with the City's Comprehensive Plan and applicable Statewide Planning Goals.

BUDGET IMPACT:

FY(s):
Funding Source:

ATTACHMENTS:

See Attached.

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

FILE NO.:	Legislative File: L 10-02 - Water Distribution System Master Plan
HEARING DATE:	October 24th, 2011 - 7:00 p.m., City Hall - Commission Chambers 625 Center Street Oregon City, OR 97045
APPLICANT:	Oregon City Public Works Department – Nancy Kraushaar – City Engineer Attn: John Burrell, Project Manager 625 Center Street, Oregon City, Oregon 97045
REPRESENTATIVE:	West-Yost Associates Consulting Engineers Attn: Walt Meyer, P.E. 8100 SW Nyberg Rd., Suite 200, Tualatin, OR 97062
REQUEST:	Update of the Oregon City Water Distribution System Master Plan, an Ancillary Document to the Oregon City Comprehensive Plan (2004).
LOCATION:	City-wide.
REVIEWER:	Pete Walter, AICP, Associate Planner

RECOMMENDATION: Staff recommends approval of this application based on the satisfaction of all required criteria for a Legislative action.

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).
(Ord. No. 08-1014, §§ 1—3(Exhs. 1—3), 7-1-2009; Ord. No. 10-1003, § 1(Exh. 1), 7-7-2010)

IF YOU HAVE ANY QUESTIONS ABOUT THIS APPLICATION, PLEASE CONTACT TONY KONKOL IN THE PLANNING DIVISION OFFICE AT 657-0891.

Proposed Project
The proposal is to update the Oregon City Water Distribution System Master Plan, which is an adopted Ancillary Document to the Oregon City Comprehensive Plan (2004).

The purpose of the Water Distribution System Master Plan is to identify existing water system deficiencies and required improvements, to analyze existing and future water demands and develop a capital improvement program (CIP) to meet these needs.

According to the 2004 Oregon City Comprehensive Plan (Introduction, "Implementing the Plan" Page 4, Exhibit 6): "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."

The Oregon City Water Distribution System Master Plan is a "public facilities plan", which is defined in the administrative rules implementing Goal 11, OAR 660-0110005(1), and provides: "A public facility plan is a support document or documents to a comprehensive plan. The facility plan describes the water, sewer and transportation facilities which are to support the land uses designated in the appropriate acknowledged comprehensive plans within an urban growth boundary containing a population greater than 2,500. Certain elements of the public facility plan also shall be adopted as part of the comprehensive plan, as specified in OAR 660-11-045.".

A more detailed memorandum from Assistant City Attorney Carrie Richter detailing the Goal 11 requirements for the Water Distribution System Master Plan is provided in Exhibit 5.

Plan Document
The Water Distribution System Master Plan is a necessary part of the city's public facilities program relating to water infrastructure. The draft plan consists of an executive summary, nine chapters, and four (4) appendices (See Exhibit 1). Additionally, development of the master plan process resulted in three major work products which are included in the plan document:

1. A Diurnal Curve Development Technical Memorandum.
2. A recommended Capital Improvement Program (CIP) for the City's existing and future water system including renewal and replacement pipeline projects; and
3. A financing plan that addresses implementation of the recommended CIP. The 1996 City Charter requires rates to be rolled back to pro-bond levels once the bonds are paid which will occur in Fiscal Year 2014-15. The City must address this requirement before any long term water fund planning can realistically be established.

Recommended Capital Improvements
The executive summary describes recommended capital improvements which are organized into improvements to the existing water system, future improvements and renewal and replacement improvements.

Projects that will be required to extend water service into the urban growth boundary will primarily be funded by developers. Some projects could be funded by developers and could be reimbursed based on the capacity provided to other users. SDCs (System Development Charges) can be used to finance such improvements.

Planning Horizon and Growth Assumptions

The Water Distribution System Master Plan has a planning horizon of 2030 and future water demand is based on the anticipated rate of population growth in the city over the next 20 years based on Metro's 20 and 50 year regional population and employment forecasts, April 2009. The projections anticipate that the region will grow at an annual average rate of 1.14 to 1.3 percent. However, based on historical data for the 1990's, the plan recommends that the city consider the possibility of faster growth rates than the Metro projections, both 1.5 percent and 3.0 percent.

At a growth rate of 1.5 percent, the city's population of 30,405 will grow to 41,565 by 2030. At a growth rate of 3.0 percent, the population will grow to 56,562 by 2030.

Based on the 3.0 percent population projection, the Year 2030 Water Demand is 7.76 mgd. It is important to remember that this demand is planned only. Should the City grow more slowly than Metro or plan projections, improvements identified to upsize facilities to meet demand will not be triggered. However, changes in growth will have no effect on the overall system maintenance and operation costs.

The water demand calculations are a function of several measures, as described in Chapter 3 of the plan "Water Demand Analysis". These include an analysis of historical annual average demand, monthly average demand, maximum day demand, and peak hour demand. Based on these measures, the development of historical "peaking factors" is necessary to compare system-wide water use patterns in the city to other communities and for projecting future water use patterns.

Chapter 3 also presents water use in mgd (millions of gallon per day) by generalized customer classes which correlate to land use categories identified in the comprehensive plan and map: single family (2.32 mgd / 59%); institutional (0.33 mgd /8%), multi family (0.61 mgs / 16%); and industrial / commercial 0.69 mgd / 17%). Based on analysis of water demand by existing land use category within the city limit, a "unit demand factor" was derived that can be allocated to the various plan districts that provides a basis for future planning (See table 3-12 – Summary of Recommended Unit Water Demand Factors).

UGB Build-Out Water Demand Projection

The projection of water demand in the City at build-out of the urban growth boundary is based on the land use demand factors extrapolated for the City's ultimate urban area. Using these acreages and the unit demand factors developed for these customer use categories, the projected average annual water demand at the City's UGB build-out condition is 7.0 mgd.

Since the demand projection based on land use falls very close to the year 2030 estimate at a growth rate of 3.0 percent, the plan assumes that the City could achieve build-out of those lands within the existing UGB within 20 years. System development charges would allow for new development to cover these expansion costs.

Water Transmission and Fire Flow

In addition to water demand, the plan includes water distribution system service standards to ensure adequate water storage of a variety of contingencies including operational storage, equalization storage, fire storage and emergency storage. These standards include the need to provide a minimum allowable service pressure of 40 PSI, and a maximum day demand plus minimum fire flow minimum standards.

City Charter Implications

The financing section in Chapter 9 addresses the fiscal aspects of the 1996 City Charter rollback. Because the current City charter requires that rates be rolled back once the bonds are paid, several scenarios for future rates are evaluated. Scenarios include continuation of the existing level of services and costs without the rollback, a rollback of rates including cutbacks in operations, maintenance and upgrades, and identification of the rates that are required for maintaining the system at a sustainable level of system replacements.

FACTS

Service Area

As stated in the Executive Summary, the City of Oregon City currently provides potable water service to most of the City's residents. As shown on Figure ES-1 of the Executive summary the City's service area is approximately 4,134 acres. Areas within the City limits not served by City are served by the Clackamas River Water District (CRW). There are also portions of the City that are adjacent to undeveloped, unincorporated county land that has the potential for development and annexation into the City's service area.

From the 2004 Oregon City Comprehensive Plan (Page 80):
"Water Distribution and Storage. Surface water from the Lower Clackamas River is the source of potable water for Oregon City and West Linn. The wholesale water supplier is the South Fork Water Board, which is owned equally by Oregon City and West Linn. Water is distributed by each city under separate utility departments. The South Fork Water Board has rights to withdraw 42.6 million gallons per day (mgd), which is expected to meet demand for Source of Supply."

Public Involvement and Public Comment

The Water Distribution System Master Plan update process provides opportunities for public involvement in the legislative decision making process through the public hearing process, newspaper noticing, meetings with the Citizen Involvement Committee, and work sessions with the City Commission.

A meeting with the Citizen Involvement Council (CIC) was attended by project manager John Burrell on September 13, 2010 to present the Water Distribution System Master Plan. The CIC requested for the information to be made available on the City's website. A second meeting with the Citizen Involvement Council is scheduled for December 5th, 2011.

The Water Distribution System Master Plan (July 2010 draft) has been available for review on the Oregon City website at the following address: http://www.orcity.org/publicworks/water-master-plan-model-updates

Notice of the first Planning Commission public hearing for the proposal was published in the Clackamas Review on January 26, 2011, and mailed to the affected agencies, the CIC and all Neighborhood Associations January 21, 2011.

In accordance with ORS 197.610 and OAR 660-018-000, a Notice of Proposed Amendment to the Oregon City Comprehensive Plan was provided to the Oregon Department of Land Conservation and Development 45 days prior to the first noticed Evidentiary Hearing on January 21st, 2011.

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

Upcoming Informational Meetings:
A public informational meeting where all neighborhood associations will be invited to attend will be held at City Hall on November 30, 2011. A second meeting with the Citizen Involvement Council will be held December 5, 2011, and a second worksession with the City Commission is scheduled for December 13, 2011.

Comments were received from the following entities:

- Exhibit 2. Comments from Lee Moore, General Manager, Clackamas River Water (CRW), 4/18/2011.
- Exhibit 3. Comments from Paul Edgar, Canemah Neighborhood Association Land Use Chair, 1/26/2011.
- Exhibit 4. Comments from Paul Edgar, Canemah Neighborhood Association Land Use Chair, 10/10/2011.

None of comments received indicate which decision making criteria addressed below have not been met or cannot be met.

DECISION-MAKING CRITERIA:
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."

As an ancillary plan, the Water Distribution System Master Plan requires findings for consistency with applicable Comprehensive Plan Goals and Policies and also with Statewide Planning Goals. These findings are presented below.

Consistency with 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.*

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: The Water Distribution System Master Plan is a special purpose plan that is an adopted Ancillary Document to the Oregon City Comprehensive Plan. It is a technical document that requires regular review in order to maintain and update it. The applicant, Oregon City Public Works Department, has or will present the update of the Water Plan for input by the Citizen Involvement 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.***

As an ancillary document to the Comprehensive Plan, the Water Distribution System Master Plan Update provides an analysis of existing water distribution facilities and provides direction for future development, funding and needs. The plan provides a comprehensive review of the water distribution system and provides an adequate guide for future land use actions and the development of criteria to be utilized in land use actions.
The update includes updated construction cost estimates and contingencies for the planning and design of recommended water system facilities for the City (See Appendix D).

Adoption and implementation of the Water Distribution System Master Plan update accomplishes the following Goals and Policies of the adopted Oregon City Comprehensive Plan (2004).

- ***Whether the Plan still reflects community needs, desires, attitudes and conditions. This shall include changing demographic patterns and economics.***

The provision of a dependable, quality water supply is a basic human need. As part of this planning effort, the consultant conducted technical analysis of the city's existing water system and projected future demand within the planning area based on the land use designations in the City Comprehensive Plan. Water demands were projected through buildout of the City's Urban Growth Boundary (UGB) using a unit demand methodology based on land uses in the City's Comprehensive Plan. Individual water use (by meter) was linked to individual parcels using addresses. The unit demand factor for each land use designation was then calculated by dividing the total water use by the total parcel area for which it was linked. The same peaking factors used for existing water demands were used for future projections. Buildout water demand projections are shown by customer class in Table ES-2 of the Executive Summary.

Adoption of the Water Distribution System Master Plan update will address necessary improvements to ensure the orderly extension of water service to accommodate the projected growth envisioned in the City's Comprehensive Plan.

- ***Addition of updated factual information including that made available to the City by regional, state and federal governmental agencies.***

The consultant has included an analysis of the existing water distribution system based on available existing information provided by the City, the City's water supplier, and water metering data from Clackamas River Water (CRW).

The projections of water demand for existing and future service areas reflect updated population projections, recent comprehensive plan amendment areas (Park Place and East of Beavercreek Road), and new regulatory requirements at the state and federal level. This information is provided in the Water Demand Analysis in Chapter 3 and the Water Distribution System Service Standards in Chapter 4.

The City of Oregon City maintains benchmarks for service quality that are used to measure performance of the water utility. These benchmarks include service standards for water quality, quantity, and pressure, as well as the minimum supply levels for fire protection. For example, the Oregon City water distribution system was analyzed to ensure that service pressures are maintained above 40 psi during normal demand scenarios and fire flows are available without dropping system pressures below 20 psi. The service standards set forth in this master plan are derived from regulations, rules, and recommendations established by a variety of sources including the Oregon State Department of Human Services (DHS), the Environmental Protection Agency (EPA), the American Water Works Association (AWWA), the Insurance Services Office (ISO), and the Uniform Fire Code (UFC). A summary of these standards is presented in Table ES-3. A detailed description of the City's service standards is provided in Chapter 4.

The addition of this updated information will allow the City to keep the Water Distribution System Master Plan current.

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.
Finding: This goal is implemented through the applicable Goals and Policies in Section 1 of the Oregon City Comprehensive Plan: Citizen Involvement. A detailed description of the public involvement process for

development of the Water Distribution System Master Plan is provided in the project description on Page 5 under "Public Involvement and Public Comment". Additional public meetings to discuss the implementation of a water rate structure that will address the mandated rate roll-back in the City Charter will be necessary for plan implementation. The Water Distribution System Master Plan update process is consistent with Statewide Planning Goal 1.

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: This goal is implemented through the applicable Goals and Policies in Section 2 of the Oregon City Comprehensive Plan: Land Use. Because the Water Distribution System Master Plan is an ancillary document to the City's Comprehensive Plan, the application was processed pursuant to the legislative hearing process outlined in Section 17.50.170 of the Oregon City Municipal Code. The Water Distribution System Master Plan document and maps, analysis, projections, capital improvement program, cost estimates, and recommended funding mechanisms to finance the plan are based a variety of current sources which are cited throughout the plan. These sources include information, documents and technical data provided by the following departments and agencies:

- Oregon City Public Works Department
- Oregon City Geographic Information Systems (GIS)
- Oregon City Community Development Department
- Oregon City Utility Billing
- Clackamas River Water (CRW)
- South Fork Water Board (South Fork Water Distribution System Master Plan)
- Metro (Population projections)
- Engineering News Record Construction Cost Index (ENR CCI) of 8596 (20 Cities Average)
- USGS (United State Geological Survey)
- DOGAMI (Oregon Department of Geology and Mineral Industries)

The plan's Capital Improvement Plan (CIP) includes approximate alignments of future pipeline extensions within the City's Urban Growth Boundary (UGB) (See Appendix D). The alignments of future pipeline extensions shown on the drawings in Appendix D are estimates and actual alignments may be modified as necessary to accommodate actual development patterns when the extensions are actually proposed. The majority of these extensions will be constructed within public right-of-way. Future planning review of pipeline extensions would vary:

1. If the pipeline extension is part of newly dedicated public right-of-way within a development proposal, the alignment will be reviewed as part of a land use application such as a land division (subdivision or partition), site plan and design review, master plan, detailed development plan, or conditional use application.
2. If an extension or expansion is proposed to occur within an existing public right-of-way and will not affect private property, the project is typically exempt from land use review. In this case, there will be no impact on private property.

3. In all residential zones and commercial zones, the placement of new public utilities outside of the right-of-way requires a Conditional Use permit along with a Site Plan and Design Review application approved by the Planning Commission.
4. If any extensions / expansions are proposed within a an adopted City overlay district such as a Floodplain Overlay District, Natural Resource Overlay District or Geologic Hazard Overlay District, then applicable overlay review processes will apply when the extension is proposed. Within each of these overlay districts, the review process for utility lines currently codified in the Oregon City Municipal Code is as follows:

Overlay District	**OCMC**	**Subsection**
Natural Resource	17.49	-.080 (Exempt Uses), -190 (Standards for new Utility Lines)
Geologic Hazard	17.44	-.035 (Exemption for existing ROW) -.080 (new utilities require permit)
Flood Management	17.42	Water lines may be reviewed administratively by city engineer (subject to applicable site and construction standards / i.e. no net fill)
Willamette River	17.48	-.100 (compatibility review and public access to Willamette River).
Historic	17.40	May apply to new facilities not in existing ROW and where proposed development affects native soils, designated landmarks and structures.

Based on the existing review processes defined in the Oregon City Municipal Code and the adequacy of the facts provided in the proposed application, the proposed Water Distribution System Master Plan update is consistent with Statewide Planning Goal 2.

STATEWIDE PLANNING GOAL 5: To protect natural resources and conserve scenic and historic areas and open spaces.

Finding: 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. As stated in the responses to Statewide Planning Goal 2 above, the city code contains specific review criteria for the placement of public utilities within overlay districts to assure that designated Goal 5 resources are appropriately considered when development is proposed.

The Natural Resource Overlay District designation provides a review process for development proposals that have the potential to affect protection of Metro Title 3 and 13 lands (streams, wetlands, sensitive habitat areas) and Goal 5 resources within Oregon City. Utilities repair, replacement and expansions, including water lines, are either exempted from review or reviewed as a limited land use decision (Type II) or Planning Commission review (Type III) depending on the location.

Within the Historic Overlay District, which includes the Canemah historic district, McLoughlin Conservation district, designated Landmarks and Historic corridors, proposed public utility projects may be reviewed by the Historic Review Board if they are potential impact historic resources. The Historic Review Board has adopted character guidelines that pertain to improvements in the public right of way, utilities and related equipment to assure compatibility with historic resources.

Goal 5 resources outside the city limit within the Urban Growth Boundary are reviewed as part of the required Concept Planning for those areas prior to and subsequent with annexation. Concept plans must be implemented through zoning designations and overlay protections zones to assure that Goal 5 resources are protected to the extent required by State law and Metro. The City has mapped the known Goal 5 resource areas out to the current UGB based on the following documents:

1. The 1999 Oregon City Local Wetland Inventory.
2. The Oregon City Water Quality Resource Area Map (Ord. 99-1013).
3. 2004 Oregon City slope data and mapping (LIDAR).
4. Metro Regionally Significant Habitat Map (Aerial Photos taken 2002).
5. National Wetland Inventory (published 1992).
6. Beavercreek Road Concept Plan (adopted September 2008).
7. Park Place Concept Plan (adopted April 2008).

Based on the existing review processes defined in the Oregon City Municipal Code, the proposed Water Distribution System Master Plan update is consistent with Statewide Planning Goal 6.

STATEWIDE PLANNING GOAL 6: To maintain and improve the quality of the air, water and land resources of the state.

Finding: 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 water system repair and upgrade based on projected demand and land use patterns, the proposed plan will ensure that land suited for development will be served efficiently. Further, by identifying a proactive plan for maintenance will protect lands and waters of Oregon City from contamination resulting from facility corrosion or leaking. Water conservation objectives, as identified in the South Fork Water Board Master Plan remain a priority and will not be affected by this plan that is directed at providing maintenance and service extension objectives. As discussed above under the responses to Statewide Planning Goals 2 and 5, the proposed Water Distribution System Master Plan provides approximate locations for the locations of needed water facilities necessary to serve the Urban Growth Boundary. The alignments of future pipeline extensions and locations of other water facilities such as pump stations, pressure reducing valves and reservoirs is subject to further site planning when those facilities are proposed within the city limits. Based on the existing review processes defined in the Oregon City Municipal Code, the proposed Water Distribution System Master Plan update is consistent with Statewide Planning Goal 6.

STATEWIDE PLANNING GOAL 7: To protect people and property from natural hazards.

Finding: This goal is implemented through the applicable Goals and Policies in Section 7 of the Oregon City Comprehensive Plan: Natural Hazards. This goal primarily addresses how the city should plan development to avoid hazard posed by floods, steep slopes, geologically unstable areas and other natural hazards. The Water Distribution System Master Plan includes in the Appendices a seismic vulnerability assessment prepared by ABS Consulting Structural Engineers (Exhibit 1.ii.(b)). The report outlines the seismic hazards, facility evaluations, pipeline evaluations, and provides findings and recommendations for the short-term, mid-term and long term mitigation and protection of the existing water system from seismic hazards. New water facilities will be designed to avoid seismic hazards and identified hazard areas to the extent practicable. New facilities shall be constructed in conformance with the city's adopted public works standards and retrofitted where necessary according to the recommendations provided. Water line looping recommendations have been evaluated throughout the system, so that the water system may still function if one portion of the system has been disconnected. These measures, along with the existing review processes defined in the Oregon City Municipal Code, will assure that the proposed Water Distribution System Master Plan update is consistent with Statewide Planning Goal 7.

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: This goal is implemented through the applicable Goals and Policies in Section 9 of the Oregon City Comprehensive Plan: Economic Development. Identification of needed water facilities within the UGB includes areas identified for future job creation, notably the Beavercreek Concept Plan area east of Beavercreek Road. The proposed Water Distribution System Master Plan identifies the approximate location of needed pipelines in this area in Appendix D (pipeline project 14). This infrastructure will be constructed and driven by development of the Beavercreek Concept Plan Area. Adoption of the CIP for the Water Distribution System Master Plan will allow the incorporation of the costs of building this water infrastructure into the System Development Charge (SDC) schedule. In existing developed areas, the CIP identifies necessary renewal and replacement of the system to ensure a high quality water supply to existing residential, commercial and industrial areas. The water infrastructure investments in this proposed Water Distribution System Master Plan are essential to support the continued and sustained economic development of the city. Based on the existing review processes defined in the Oregon City Municipal Code, the proposed Water Distribution System Master Plan update is consistent with Statewide Planning Goal 9.

STATEWIDE PLANNING GOAL 10: To provide for the housing needs of citizens of the state.
Finding: This goal is implemented through the applicable Goals and Policies in Section 10 of the Oregon City Comprehensive Plan: Housing. A dependable and high quality water supply for existing Oregon City residents depends in timely upgrades to the existing system. Water service to newly annexed developing areas and those areas zoned to higher density within the existing city limits will be largely developer constructed and driven. Adoption of the Water Distribution System Master Plan update will address necessary improvements to ensure the orderly extension of water service to accommodate the projected growth envisioned in the City's Comprehensive Plan, which includes a variety of housing types. The proposed Water Distribution System Master Plan update is consistent with Statewide Planning Goal 10.

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: This goal is implemented through the applicable Goals and Policies in Section 11 of the Oregon City Comprehensive Plan: Public Facilities. A detailed memorandum from Assistant City Attorney Carrie Richter detailing the Goal 11 requirements for the Water Distribution System Master Plan is provided in Exhibit 5. The relevant goals and policies and findings are provided below.

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.
Finding: The Water Distribution System Master Plan is necessary to maintain compliance with Statewide Planning Goal 11, Public Facilities. Goal 11 requires that public facilities and services be provided in a timely, orderly and efficient manner. The goal's central concept is that local governments should plan public services in accordance with the community's needs as a whole rather than be forced to respond to individual

developments as they occur. This includes water distribution and storage. As shown in the findings below, the proposed update of the Water Distribution System Master Plan is consistent with Goal 11.1.

Policy 11.1.1
Ensure adequate public funding for the following public facilities and services, if feasible:
• Water distribution
Finding: the Water Distribution System Master Plan includes a comprehensive and detailed discussion of financing scenarios to assure that the existing and future water facilities can be funded. Because the current City charter requires that water rates be rolled back once the bonds are paid, several scenarios for future rates are evaluated. Scenarios include continuation of the existing level of services and costs, a rollback of rates coupled with an overall reduction of operations and maintenance, and the identification of rates that are required for maintaining the system at a sustainable level of system replacement. The plan recommends adoption of Scenario No. 3, adoption of water rates sufficient to assure maintenance of the system at a sustainable level of system replacements. This scenario would require amendment of the city charter and approval of voters, however it would ensure adequate funding for the city's water distribution system. The proposed Water Distribution System Master Plan is consistent with this policy.

Policy 11.1.2
Provide public facilities and services consistent with the goals, policies and implementing measures of the Comprehensive Plan, if feasible.
Finding: As discussed in this staff report, the Water Distribution System Master Plan provides guidance for the timely, efficient and economic provision of water service within the existing city and to new development areas within the Urban Growth Boundary consistent with the relevant goals, policies and implementing measures of the Comprehensive Plan. The proposed Water Distribution System Master Plan is consistent with this policy.

Policy 11.1.4
Support development on underdeveloped or vacant buildable land within the city where public facilities and services are available or can be provided and where land-use compatibility can be found relative to the environment, zoning, and Comprehensive Plan goals.
Finding: The plan includes a capital improvement program based on water demand for buildout of the city's urban growth boundary based on adopted land use categories within the City's Comprehensive Plan. The sizing of water pipes envisioned in the plan provides an adequate basis for evaluation of development and redevelopment proposals within the city. Chapter 7 of the plan evaluates the future water distribution system. This analysis is based on UGB buildout land use as shown on figure 7-2 and water duty factors developed in Chapter 3. The analysis includes underdeveloped and vacant buildable land within the city (See Figure 7-1). In most cases the extension of new water services will occur in existing or planned public right-of-ways as part of development in accordance with applicable public works standards, land division laws and zoning regulations, including applicable environmental overlay district standards depending on where development occurs. The specific locations of new city utility lines is not within the purview of this Plan, however the adopted city development code standard are sufficient to assure land use compatibility of future water service extensions identified in the Plan. The proposed Water Distribution System Master Plan is consistent with this policy.

Policy 11.1.5
Design the extension or improvement of any major public facility and service to an area to complement other public facilities and services at uniform levels.
Finding: The Water Distribution System Master Plan is designed to meet water distribution system services standards for existing and future development within the UGB. These standards are discussed in Chapter 4 of the plan and include Water Service Quality Standards, Fire Flow Requirements, Water Supply Capacity during High Demand Periods, Pumping Facility Capacity, Critical Pumping Facilities, Water Storage Capacity, and Water Transmission and Distribution System. These service standards, summarized in Table 4-1, reflect typical water system industry standards, including the Oregon State Department of Human Services (DHS), the Environmental Protection Agency (EPA), the American Water Works Association (AWWA), the Insurance Services Office, Inc. (ISO), and the Oregon Fire Code (OFC). The plan includes a detailed analysis of levels of service and existing and projected water demand within the UGB based on the City comprehensive plan. The plan also discusses the City's performance criteria for the water system (See Table 4-1). The city has adopted development code and engineering standards to ensure concurrent provision of public facilities and services at uniform levels. Pursuant to these requirements, water lines are typically required to be extended to a new development area at the same time as other public facilities such as sewer, storm drainage, and emergency services. The proposed Water Distribution System Master Plan is consistent with this policy.

Policy 11.1.7
Develop and maintain a coordinated Capital Improvements Plan that provides a framework, schedule, prioritization, and cost estimate for the provision of public facilities and services within the City of Oregon City and its Urban Growth Boundary.
Finding: The Water Distribution System Master Plan CIP in Chapter 8 for the years 2011-2022 which provides the necessary framework for scheduling, prioritization and cost estimates for existing and future capital improvements of the water system within the UGB. Chapter 9 includes three scenarios for financing the necessary capital improvements and a recommendation to the city commission to adopt scenario 3, which adopts a pay-as-you-go financing strategy to fund the project identified in the master plan. Tables 9-10 and 9-11 include an estimated schedule for when improvements could be funded addressing the need for a schedule identified in the city attorney's memo. The proposed Water Distribution System Master Plan is consistent with this policy.

Goal 11.3 Water Distribution
Seek the most efficient and economic means available for constructing, operating, and maintaining the City's water distribution system while protecting the environment and meeting state and federal standards for potable water systems.
Finding: As described in Chapter 4, the plan includes service standards for compliance with state and federal law, summarized in Table 4-1 which reflect typical water system industry standards, including the Oregon State Department of Human Services (DHS), the Environmental Protection Agency (EPA), the American Water Works Association (AWWA), the Insurance Services Office, Inc. (ISO), and the Oregon Fire Code (OFC). The CIP program and financing options described in Chapters 8 and 9 provide an adequate basis for determination of the most efficient and economic means to fund the construction, operation and maintenance of the water distribution system. The proposed Water Distribution System Master Plan is consistent with this policy.

Policy 11.3.1

Plan, operate and maintain the water distribution system for all current and anticipated city residents within its existing Urban Growth Boundary and plan strategically for future expansion areas.

Finding: The purpose of updating the Water Distribution System Master Plan is to assure that all current and anticipated city residents within the UGB can receive a dependable, high quality water supply as the city continues to develop. This includes maintenance and where needed, upgrading the existing system as well as to serve future expansion areas. The proposed Water Distribution System Master Plan is consistent with this policy.

Policy 11.3.2

Collaborate with the South Fork Water Board to ensure that an adequate water supply system is maintained for residents. Coordinate with the South Fork Water Board, the City of West Linn, and Clackamas River Water to ensure that there is adequate regional storage capacity.

Finding: The plan includes a description of the existing water distribution system in Chapter 2, along with a detailed discussion of how water supply is provided to the City of Oregon City by the South Fork Water Board and as discussion of the regional master metering system for the three customers sharing the water supply. The SFWB is a water wholesaler that works with its customers, City of Oregon City, City of West Linn and CRW to ensure that all residents have an adequate water supply. The Water Distribution System Master Plan is consistent with this policy.

Policy 11.3.3

Maintain adequate reservoir capacity to provide all equalization, operational, emergency, and fire flow storage required for the City's distribution system.

Finding: In addition to water demand, the plan includes water distribution system service standards to ensure adequate water storage of a variety of contingencies including operational storage, equalization storage, fire storage and emergency storage. These standards include the need to provide a minimum allowable service pressure of 40 PSI, and a maximum day demand plus fire flow minimum standard. The Water Distribution System Master Plan is consistent with this policy.

Policy 11.3.4

Adopt a progressive water rate structure that will encourage water conservation.

Finding: The proposed Water Distribution System Master Plan does not recommend the adoption of a progressive water rate structure at this time. Additional public meetings to discuss the implementation of a water rate structure that will address the mandated rate roll-back in the City Charter will be necessary for plan implementation.

Financing scenarios presented in the plan include continuation of the existing level of services and costs without the rollback, a rollback of rates including cutbacks in operations, maintenance and upgrades, and identification of the rates that are required for maintaining the system at a sustainable level of system replacements.

The South Fork Water Board promotes the conservation of treated water in several ways. One is through the SFWB Water Conservation Program. At the beginning of 2001 SFWB began implementing water conservation programs for both Oregon City and West Linn. South Fork Water Board began its conservation efforts in 1996 when it joined with other regional water providers to make up the Columbia Willamette Water Conservation Coalition, which is now the Regional Water Providers Consortium. Since then, regional water providers have been working together to further the role of water conservation and efficient water use region wide. The program consists of public education and incentives to promote and implement water conservation by the end user. For more information see http://www.sfwb.org/conservation.html.

Water conservation efforts by the city include maintenance and upgrade of the water system to minimize unaccounted-for water usage, as discussed on pages 3-9 and 3-10 of the water demand analysis chapter of the plan. Unaccounted for water was estimated at 16.8 percent for the years 2002-2008, and includes unmetered customers, transmission system leaks, reservoir leaks, main breaks, faulty meters, over-filling reservoirs, fire fighting activities, system flushing and other miscellaneous hydrant uses. Mitigation of this unaccounted-for water includes ongoing refinement of the master metering and record keeping practices, meter change-outs, and repair and replacement of the water distribution system in order to account for all usage.

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: This goal is implemented through the applicable Goals and Policies in Section 13 of the Oregon City Comprehensive Plan: Energy Conservation.

The water distribution system proposed will support efficient use of a land within the city limits and urban growth boundary based on the adopted land use designations within the City Comprehensive Plan and zoning categories within the city limit through the timely, orderly and efficient delivery of water system extensions where it is efficient to promote higher intensity land uses and avoiding leap-frog development.

The city promotes the efficient use of land and conservation of energy through its Comprehensive Plan and Zoning Code and through the implementation of building codes. Higher density and mixed use zoning, land division, and site plan design standards promote more compact development patterns, and promote bicycling and walking instead of relying on the automobile for routine errands. New annexations are required to show that public utilities can be efficiently extended to new urban areas. Metro-approved Concept Plans are required prior to annexation to the city to assure that urban services and amenities will be developed in logical places as the community develops. Building codes require that new homes and businesses conserve energy through choice of materials, insulation, and installation of efficient plumbing, heating and cooling systems. The proposed Water Distribution System Master Plan is consistent with Statewide Planning Goal 13.

RECOMMENDATION

Staff recommends that the Planning Commission recommend approval of the Oregon City Water Distribution System Master Plan, included as Exhibit 1, as an ancillary document to the Oregon City Comprehensive Plan to the City Commission for their consideration at the November 2nd, 2011 public hearing.

EXHIBITS

1) Oregon City Water Distribution System Master Plan – Full Document (On File).
   a) Executive Summary
      (1) Introduction
      (2) Existing Water Distribution System
      (3) Water Demand Analysis
      (4) Water Distribution System Service Standards
      (5) Hydraulic Model Update
      (6) Existing Water Distribution System Evaluation
      (7) Future Water Distribution System Evaluation
      (8) Recommended Capital Improvement Program
      (9) Water Distribution System Financing Plan (Revised)
   ii) Appendices
      (a) Diurnal Curve Development Technical Memorandum
      (b) Water System Seismic Vulnerability Assessment
      (c) Cost Estimating Assumptions
      (d) Project Sheets (Pipeline Project Maps and Data w/ Costs)
2) Comments from Lee Moore, General Manager, Clackamas River Water (CRW), 4/18/2011.
3) Comments from Paul Edgar, Canemah N.A. Land Use Chair, 1/26/2011.
4) Comments from Paul Edgar, Canemah N.A. Land Use Chair, 10/10/2011.
5) Memorandum from City Attorney Carrie Richter, regarding Goal 11 Requirements.
6) Oregon City Comprehensive Plan (2004). ***Note****: Goals and Policies for Public Facilities are in Section 11.*
7) Oregon City Water Master Plan (October 2004)

CITY OF OREGON CITY
LAND USE APPLICATION

2010 OCT 21 PM 3: 28
RECEIVED
CITY OF OREGON CITY

City of Oregon City, Community Development Department, 221 Molalla Ave., Ste. 200, P.O. Box 3040, Oregon City, OR 97045, (503) 722-3789

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
☐ Nonconforming Use review	☐ Detailed Development Review	☐ Code Interpretation / Similar Use
☐ Water Resources Exemption	☐ Geotechnical Hazards	☐ Concept Development Plan
	☐ Minor Partition	☐ Conditional Use
	☐ Minor Site Plan & Design Review	☒ Comprehensive Plan Amendment (Text/Map)
	☐ Nonconforming Use Review	☐ Detailed Development Plan
	☐ Site Plan and Design Review	☐ Historic Review
	☐ Subdivision	☐ Oregon City Municipal Code Amendment
	☐ Minor Variance	☐ Variance
	☐ Water Resource Review	☐ Zone Change

Application Number: LE-10-002

Proposed Land Use or Activity: UPDATE OF CITY'S WATER MASTER PLAN

Project Name: WATER MASTER PLAN Number of Lots Proposed (If Applicable): —

Physical Address of Site: CITY OF OREGON CITY

Clackamas County Map and Tax Lot Number(s):

Applicant(s):

Applicant(s) Signature: OREGON CITY PUBLIC WORKS

Applicant(s) Name Printed: NANCY KRAUSHAAR, CITY ENGINEER Date: 10/21/2010

Mailing Address: 625 CENTER STREET, OREGON CITY OR, 97045

Phone: 503-657-0891 Fax: 503-657-7892 Email:

Property Owner(s):

Property Owner(s) Signature: Nancy J T Kraushaar, City Enginer/PW Dir.

Property Owner(s) Name Printed: Nancy J.T. Kraushaar Date: 10-18-11 /KG

Mailing Address: 625 CENTER STREET, OREGON CITY OR, 97045

Phone: 503-657-0891 Fax: 503-657-7892 Email:

Representative(s):

Representative(s) Signature: WALT MEYER, P.E.

Representative (s) Name Printed: WEST YOST ENGINEERS Date:

Mailing Address: 1650 W 11th AVE, SUITE 1-A, EUGENE, OR 97402

Phone: 541-431-1280 Fax: 541-431-1290 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.

www.orcity.org

Land Use Application

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 Water Distribution;

The Water Master Plan addresses the current and future needs of the City's water distribution system to meet fire flows, development and water quality.

Policy 11.1.2 Provide public facilities and services consistent with the goals, policies and implementing measures of the Comprehensive Plan, if feasible.

The Water Master Plan addresses public facilities and services consistent with the goals, policies and implementing measures of the Comprehensive Plan.

Policy 11.1.3 Confine urban public facilities and services to the city limits except where allowed for safety and health reasons in accordance with state land-use planning goals and regulations. Facilities that serve the public will be centrally located and accessible, preferably by multiple modes of transportation.

The Water Master Plan meets the goals of policy 11.1.3 as the City's water distribution system and related facilities are located within the city limits. Interties to other jurisdictions water systems are located at various points around the city as allowed by state law. The water distribution system facilities are located at various locations around the city and are accessible by various modes of transportation.

Policy 11.1.4 Support development on underdeveloped or vacant buildable land within the city where public facilities and services are available or can be provided and where land-use compatibility can be found relative to the environment, zoning and Comprehensive Plan goals.

The Water Master Plan addresses future growth and development and recommends new or upgraded facilities to meet the future demands.

Policy 11.1.5 Design the extension or improvement of any major public facility and service to an area to complement other public facilities and services at uniform levels.

The Water Master Plan addresses future growth and development and recommends new or upgraded facilities to meet the future demands.

Policy 11.1.6 Enhance efficient use of existing public facilities and services by encouraging development at maximum levels permitted in the Comprehensive Plan, implementing minimum residential densities and adopting an Accessory Dwelling Unit Ordinance to infill vacant land.

The Water Master Plan addresses the needs of the existing water distribution system to meet current and future demands within the current city limits.

Policy 11.1.7 Develop and maintain a coordinated Capitol Improvements Plan that provides a frame work, schedule, prioritization and cost estimate for the provision of public facilities and services within the City of Oregon City and its Urban Growth Boundary.

The Water Master Plan develops a Capitol Improvements Plan that includes schedule, prioritization and coat estimates to meet the current and future needs of the City of Oregon City.

Goal 11.3 Water Distribution
Seek the most efficient and economic means available for construction, operating and maintaining the City's water distribution system while protecting the environment and meeting state and federal standards for potable water systems.

Policy 11.3.1 Plan, operate and maintain the water distribution system for all current and anticipated city residents within its existing Urban Growth Boundary and plan strategically for future expansion areas.

The Water Master Plan addresses how to operate and maintain the water distribution system to meet the current and future demands.

Policy 11.3.2 Collaborate with South Fork Water Board to ensure that an adequate water supply system is maintained for residents. Coordinate with the South Fork Water Board, City of West Linn and Clackamas River Water to ensure that there is adequate regional storage capacity.

The Water Master Plan addresses the City's storage needs as well as interties to other distribution systems to provide water supply when needed.

Policy 11.3.3 Maintain adequate reservoir capacity to provide all equalization, operational, emergency and fire flow storage required for the City's distribution system.

The Water Master Plan addresses the City's reservoir capacity to ensure adequate capacity to provide all equalization, operational, emergency and fire flow storage required for the City's current and future distribution system.

Policy 11.3.4 Adopt a progressive water rate structure that will encourage water conservation.

The Water Master Plan does not address the water rate structure, that is included in another plan.

Approval Criteria

- Plan implementation process
  1) Pre-Application Conference – held on 7/21/10
  2) Public Meeting – meet with the CIC on Monday 9/13/10
  3) Submittal of Land Use Application –
  4) Application Review – Planning will prepare notices
  5) Appeal

- Adequacy of the plan to guide land-use actions, including an examination of trends

  The Water Master Plan addresses future development by detailing facility needs to accommodate the growth.

- Whether the plan still reflects community needs, desires, attitudes and conditions, including changing demographic patterns and economics.

  The Water Master Plan addresses the current and future needs of the water distribution system and allows for a variety of development options.

- Addition of updated information about the City by regional, state and federal governmental agencies.

  ?????

Pre-Application Conference Summary

OREGON CITY

Pre-application conferences are required by Section 17.50.030 of the City Code, as follows:

(A) PURPOSE: The pre-application conference is to provide the applicant the necessary information to make an informed decision regarding their land use proposal.

(B) A pre-application conference is required for all land use permits.

(C) Time Limit: A pre-application conference is valid for a period of six (6) months.

(D) An omission or failure by the Planning Division to provide an applicant with relevant information during a pre-application discussion shall not constitute a waiver of any standard, criterion, or requirement of the City of Oregon City. Information given in the conference is subject available information and may be subject to change without notice. *NOTE: The subsequent application may be submitted to any member of the Planning Staff.*

==

PRE-APP #10-21 DATE: July 21, 2010

APPLICANT: City of Oregon City

SITE ADDRESS: Water Master Plan

PROPERTY DESCRIPTION: NA

STAFF: Walter ZONING: NA PROPOSED

USE/ACTIVITY: Update 2003 Water Master Plan

INFORMATION NECESSARY TO BEGIN DEVELOPMENT: This listing of information does not preclude the Community Development Department or hearings body from requesting additional data necessary to make a recommendation and/or decision regarding the proposed activity.

1. PLANNING

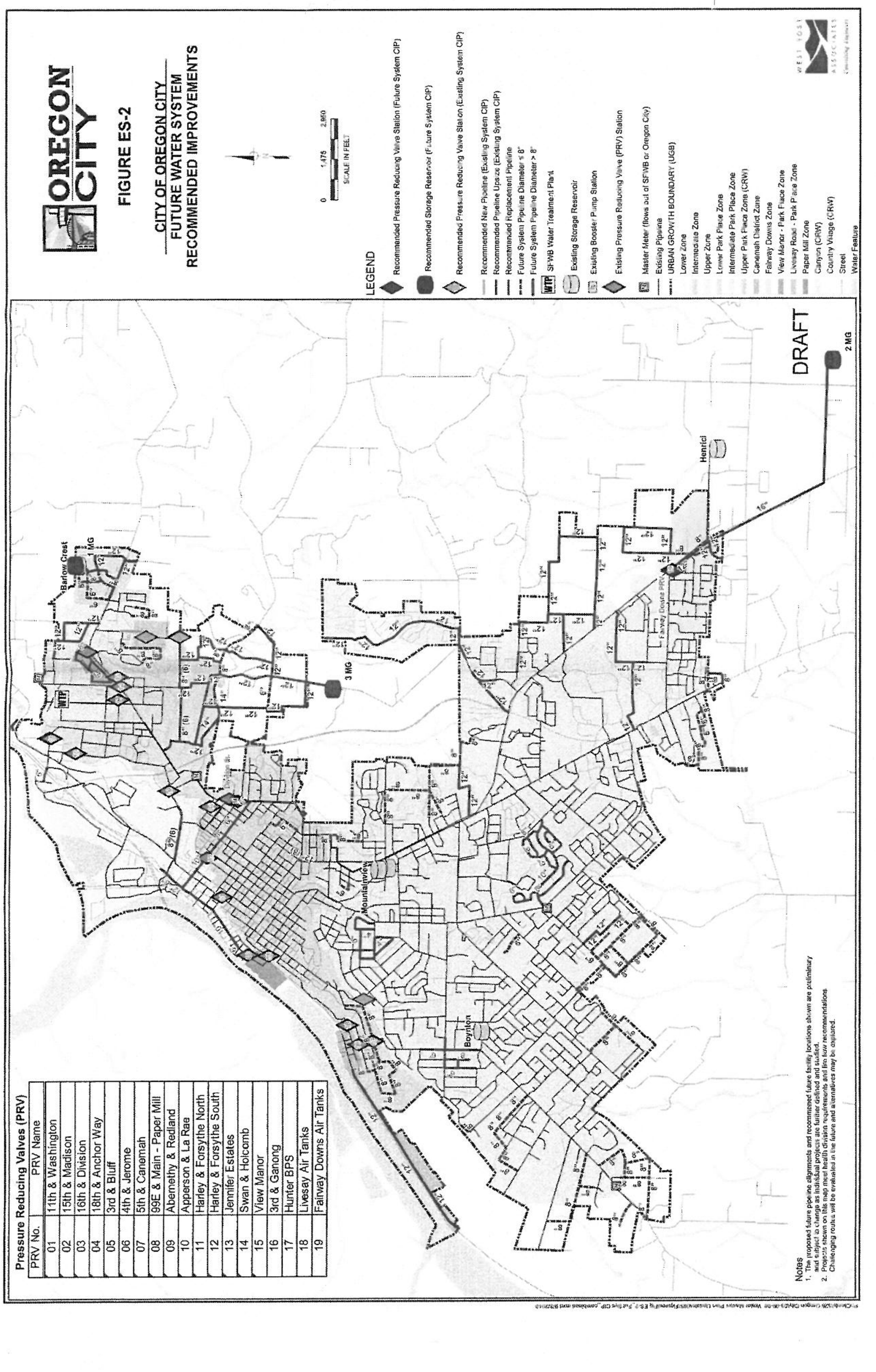
- ☐ Zoning/ Setbacks NA
- ☐ Is the Site in a Water Resource Overlay District? (Yes or No) NA
- ☐ Is the Site in a Historic Overlay District? (Yes or No) NA
- ☐ List of Minimum Required Planning Processes:

  1. *Legislative*
- ☐ *OCMC 17.50 – Administrative Processes*
- ☐ *Comprehensive Plan –*
  - ☐ *Chapter 1 – Public Involvement*
  - ☐ *Chapter 11 – Public Facilities* – Goal 11.3 - Water Distribution policies 11.3.1 → 11.3.4

Other: Address Goals 11.1, 11.3 & relevant policies
Address criteria for approving changes to the Comprehensive Plan on Page 16 (attached)

Tom Guyal [illegible]

Meet with CIC prior to submittal of application.
Planning will prepare notices.
Document open houses & Neighborhood Meetings.


OREGON CITY
FIGURE ES-2
CITY OF OREGON CITY
FUTURE WATER SYSTEM
RECOMMENDED IMPROVEMENTS
LEGEND
Recommended Pressure Reducing Valve Station (Future System CIP)
Recommended Storage Reservoir (Future System CIP)
Recommended Pressure Reducing Valve Station (Existing System CIP)
Recommended New Pipeline (Existing System CIP)
Recommended Pipeline Upsize (Existing System CIP)
Recommended Replacement Pipeline
Future System Pipeline Diameter ≤ 8"
Future System Pipeline Diameter > 8"
SFWB Water Treatment Plant
Existing Storage Reservoir
Existing Booster Pump Station
Existing Pressure Reducing Valve (PRV) Station
Master Meter (flows out of SFWB or Oregon City)
Existing Pipeline
URBAN GROWTH BOUNDARY (UGB)
Lower Zone
Intermediate Zone
Upper Zone
Lower Park Place Zone
Intermediate Park Place Zone
Upper Park Place Zone (CRW)
Canemah District Zone
Fairway Downs Zone
View Manor - Park Place Zone
Livesay Road - Park Place Zone
Paper Mill Zone
Canyon (CRW)
Country Village (CRW)
Street
Water Feature
DRAFT
2 MG
Henrici
Barlow Crest
1 MG
3 MG
Mountainview
Boynton
Pressure Reducing Valves (PRV)
PRV No. | PRV Name
01 | 11th & Washington
02 | 15th & Madison
03 | 16th & Division
04 | 18th & Anchor Way
05 | 3rd & Bluff
06 | 4th & Jerome
07 | 5th & Canemah
08 | 99E & Main - Paper Mill
09 | Abernethy & Redland
10 | Apperson & La Rae
11 | Harley & Forsythe North
12 | Harley & Forsythe South
13 | Jennifer Estates
14 | Swan & Holcomb
15 | View Manor
16 | 3rd & Ganong
17 | Hunter BPS
18 | Livesay Air Tanks
19 | Fairway Downs Air Tanks
Notes

OREGON CITY

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

NOTICE OF PUBLIC HEARING

Mailed on: January 21, 2011

PLANNING COMMISSION HEARING DATES:	On **March 14, 2011** the ***City of Oregon City - Planning Commission*** will conduct a public hearing at 7:00 p.m. in the City Hall Commission Chambers at City Hall, 625 Center Street, Oregon City 97045 to consider the following Type IV application:
CITY COMMISSION HEARING DATES:	On **April 6, 2011** the ***City of Oregon City - City Commission*** will conduct a public hearing at 7:00 p.m. in the City Hall Commission Chambers at City Hall, 625 Center Street, Oregon City 97045 on the following Type IV application:
FILE NUMBER:	L 10-02 – Update of Water Distribution System Master Plan
APPLICANT:	City of Oregon City Public Works – Attn. John Burrell 625 Center Street Oregon City, OR 97045
REQUEST:	The Applicant Requests Approval of an Update to the City's Adopted Water Distribution System Master Plan, an Ancillary Document to the Adopted Oregon City Comprehensive Plan (2004).
LOCATION:	City-wide
CONTACT PERSON:	Pete Walter, AICP, Associate Planner (503) 496-1568
NEIGHBORHOOD ASSOCIATION:	Citizen Involvement Committee
CRITERIA:	Administration and Procedures set forth in Chapter 17.50 of the Oregon City Municipal Code. The city code is available at www.orcity.org

The application and all documents submitted by or on behalf of the applicant are available for inspection at no cost at the Oregon City Planning Division, 221 Molalla Avenue, Suite 200, from 8:00AM-5:00PM. The staff report, with all the applicable approval criteria, will also be available for inspection **seven** days prior to the hearing. Copies of these materials may be obtained for a reasonable cost in advance.

Any interested party may testify at the public hearing or submit written testimony at or prior to the hearing. **Written comments must be received at City Hall by February 28, 2011 to be included in the Planning Commission staff report.** Written comments received after this date will be forwarded to the Planning Commission at the hearing. **Written comments must be received at City Hall by March 23, 2010 to be included in the City Commission staff report.** Written comments received after this date will be forwarded to the City Commission at the hearing. The procedures that govern the hearing will be posted at the hearing and are found in OCMC Chapter 17.50 and ORS 197.763.

Please be advised that any issue that is intended to provide a basis for appeal must be raised before the close of the hearing, in person or by letter, with sufficient specificity to afford the Planning Commission, the City Commission, and the parties an opportunity to respond to the issue. Failure to raise an issue with sufficient specificity will preclude any appeal on that issue. Any appeal will be based on the record. Contact (503) 657-0891 for more information.

A city-recognized neighborhood association requesting an appeal fee waiver pursuant to 17.50.290(C) must officially approve the request through a vote of its general membership or board at a duly announced meeting prior to the filing of an appeal.

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E-mail: legals@commnewspapers.com

AFFIDAVIT OF PUBLICATION

State of Oregon, County of Clackamas, SS
I, Charlotte Allsop, being the first duly sworn, depose and say that I am Accounting Manager of *Clackamas Review/Oregon City News*, a newspaper of general circulation, published at Clackamas/Oregon City, in the aforesaid county and state, as defined by ORS 193.010 and 193.020, that

City of Oregon City
Notice of Public Hearing/L10-02
CLK12204

a copy of which is hereto annexed, was published in the entire issue of said newspaper for
1
week in the following issue:
January 26, 2011

Charlotte Allsop

Charlotte Allsop (Accounting Manager)

Subscribed and sworn to before me this January 26, 2011.

Robin A. Burgess

NOTARY PUBLIC FOR OREGON
My commission expires

Acct #10048638
Attn: Pete Walter
City of Oregon City
PO Box 3040
Oregon City, OR 97045-0304

Size: 2 x 4.75"
Amount Due: $112.58*
*Please remit to the address above.

NOTICE OF PUBLIC HEARING

HEARING DATES: On March 14, 2011 the City of Oregon City - Planning Commission will conduct a public hearing at 7:00 p.m. in the City Hall Commission Chambers at City Hall, 625 Center Street, Oregon City 97045 and on April 6, 2011 the City of Oregon City - City Commission will conduct a public hearing at 7:00 p.m. in the City Hall Commission Chambers at City Hall, 625 Center Street, Oregon City 97045 on the following Type IV application:

FILE NUMBER: L 10-02 – Update of the Oregon City Water Distribution System Master Plan, an Ancillary Document to the Oregon City Comprehensive Plan (2004)

APPLICANT: City of Oregon City Public Works – Attn. John Burrell

LOCATION: City-Wide

CONTACT PERSON: Pete Walter, AICP, Associate Planner (503) 496-1568

APPLICABLE CRITERIA: Administration and Procedures set forth in Chapter 17.50 of the Oregon City Municipal Code. The city code is available at www.orcity.org

The application and all documents submitted by or on behalf of the applicant are available for inspection at no cost at the Oregon City Planning Division, 221 Molalla Avenue, Suite 200, from 8:00AM-5:00PM. The staff report, with all the applicable approval criteria, will also be available for inspection seven days prior to the hearing. Copies of these materials may be obtained for a reasonable cost in advance.

COMMENT DEADLINE: Any interested party may testify at the public hearing or submit written testimony at or prior to the hearing. Written comments must be received at City Hall by February 28, 2011 to be included in the Planning Commission staff report. Written comments received after this date will be forwarded to the Planning Commission at the hearing. Written comments must be received at City Hall by March 23, 2010 to be included in the City Commission staff report. Written comments received after this date will be forwarded to the City Commission at the hearing. The procedures that govern the hearing will be posted at the hearing and are found in OCMC Chapter 17.50 and ORS 197.763.
Publish 01/26/2011. CLK12204

OFFICIAL SEAL
ROBIN A BURGESS
NOTARY PUBLIC-OREGON
COMMISSION NO. 437285
MY COMMISSION EXPIRES MAY 16, 2013

FORM 1 DLCD Notice of Proposed Amendment

THIS FORM 1 **MUST BE RECEIVED** BY DLCD AT LEAST
45 DAYS PRIOR TO THE FIRST EVIDENTIARY HEARING
PER ORS 197.610, OAR 660-018-000

DATE STAMP

in person ☐ electronic ☐ mailed ☐

For DLCD Use Only

Jurisdiction: **CITY OF OREGON CITY**
Date of First Evidentiary Hearing: **MARCH 14, 2011**
Local File Number: **LE 10-02**
Date of Final Hearing: **APRIL 6, 2011**

Is this a REVISION to a previously submitted proposal? ☐ Yes ☒ No Date submitted:

☐ Comprehensive Plan Text Amendment
☐ Comprehensive Plan Map Amendment
☐ Land Use Regulation Amendment
☐ Zoning Map Amendment
☐ New Land Use Regulation
☐ Urban Growth Boundary Amendment
☐ Transportation System Plan Amendment
☒ Other: WATER MASTER PLAN

Briefly Summarize Proposal. Do not use technical terms. Do not write "See Attached"(limit 500 characters):
Update the Oregon City Water Distribution System Master Plan for distribution facilities and existing and projected future water demands. The project includes a recommended Capital Improvement Program and financing recommendations. The Water Master Plan (2003) is an Ancillary Plan to the City of Oregon City Comprehensive Plan, which was adopted in 2004. The City's existing service area is approximately 4,134 acres.

Has sufficient information been included to advise DLCD of the effect of proposal? ☒Yes, text is included
For Map Changes: Include 8½"x11" maps of Current and Proposed designation. ☐ Yes, Maps included
Plan map changed from: **N/A** To: **N/A**
Zone map changed from: **N/A** To: **N/A**
Location of property (do not use Tax Lot): **N/A**
Previous density: **N/A** New density: **N/A** Acres involved: **N/A**
Applicable statewide planning goals:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
☒	☒	☐	☐	☒	☒	☒	☐	☒	☒	☒	☐	☒	☒	☐	☐	☐	☐	☐

Is an exception to a statewide planning goal proposed? ☐ YES ☒ NO Goals:

Affected state or federal agencies, local governments or special districts (It is jurisdiction's responsibility to notify these agencies. DLCD only records this information):
SOUTH FORK WATER BOARD (SFWB), CLACKAMAS RIVER WATER (CRW), CLACKAMAS COUNTY, CLACKAMAS FIRE DISTRICT #1, OREGON CITY SCHOOL DISTRICT, CITY OF WEST LINN, CITY OF GLADSTONE, CITY OF MILWAUKIE, TRI-CITY SERVICES DISTRICT, METRO, ODOT

Local Contact: **Pete Walter, AICP, Associate Planner**
Phone: **(503) 496-1568** Extension:
Address: **221 Molalla Avenue, Ste. 200**
City: **Oregon City** Zip: **97045**
Fax Number: **(503) 722-3880**
E-mail Address: **pwalter@orcity.org**

DLCD file No. ______________________

EXECUTIVE SUMMARY

INTRODUCTION

This Water Distribution System Master Plan (WMP) is for the City of Oregon City's (City) distribution facilities and existing and projected future water demands. In order to evaluate the Oregon City water system, West Yost Associates (West Yost) updated a hydraulic model of the water system that was originally created for the 2004 WMP.

The following are the three major work products that resulted from this master planning effort:

- A Diurnal Curve Development Technical Memorandum,
- A recommended Capital Improvement Program (CIP) for the City's existing and future water system including renewal and replacement pipeline projects; and
- A financing plan that addresses implementation of the recommended CIP. The 1996 City Charter requires rates to be rolled back to pro-bond levels once the bonds are paid which will occur in Fiscal Year 2014-15. The City must address this requirement before any long term water fund planning can realistically be established.

The associated analyses and assessments related to these work products are briefly summarized below. Complete descriptions of the analyses and assessments are provided in the chapters and appendices of this Water Master Plan.

OVERVIEW OF THE OREGON CITY SERVICE AREA AND SOURCE

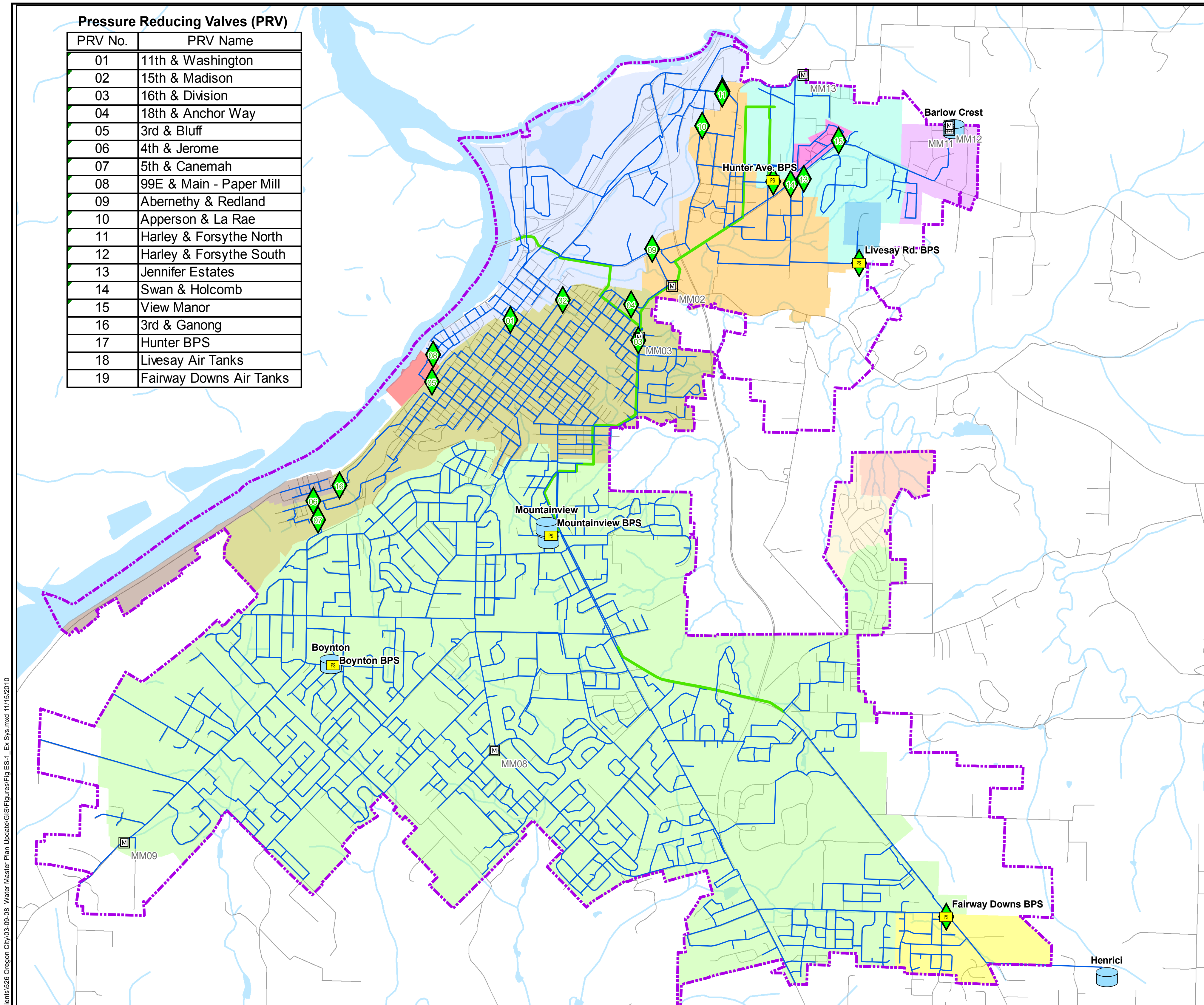
A detailed description of the City's existing service area and water distribution system is provided in Chapter 2. The following subsections present a brief overview of the service area.

Service Area

The City of Oregon City currently provides potable water service to most of the City's residents. The City is located in the Portland Metropolitan Area east of Interstate 205, southeast of the Willamette River. As shown on Figure ES-1, the City's service area is approximately 4,134 acres. Areas within the City limits not served by City are served by the Clackamas River Water District (CRW). There are also portions of the City that are adjacent to undeveloped, unincorporated county land that has the potential for development and annexation into the City's service area.

Source of Supply

The source of supply for the City is surface water from the lower Clackamas River which is supplied by the South Fork Water Board (SFWB). The SFWB is a wholesale water supplier that is equally owned by the Cities of Oregon City and West Linn. The SFWB operates an intake and pumping station just to the north of the Oregon City city limits which delivers raw water to the SFWB water treatment plant located in the City's Park Place area. The Oregon City water distribution system is supplied by the SFWB at five different locations.



Pressure Reducing Valves (PRV)

PRV No.	PRV Name
01	11th & Washington
02	15th & Madison
03	16th & Division
04	18th & Anchor Way
05	3rd & Bluff
06	4th & Jerome
07	5th & Canemah
08	99E & Main - Paper Mill
09	Abernethy & Redland
10	Apperson & La Rae
11	Harley & Forsythe North
12	Harley & Forsythe South
13	Jennifer Estates
14	Swan & Holcomb
15	View Manor
16	3rd & Ganong
17	Hunter BPS
18	Livesay Air Tanks
19	Fairway Downs Air Tanks

OREGON CITY

FIGURE ES-1

CITY OF OREGON CITY
EXISTING WATER SYSTEM

N

0 1,325 2,650

SCALE IN FEET

LEGEND

- WTP SFWB Water Treatment Plant
- Existing Storage Reservoir
- PS Existing Booster Pump Station (BPS)
- Existing Pressure Reducing Valve (PRV)
- M Master Meter (flows out of SFWB or Oregon City)
- Existing Pipeline Diameter < 18-inches
- Existing Pipeline Diameter ≥ 18-inches
- URBAN GROWTH BOUNDARY (UGB)
- Lower Zone
- Intermediate Zone
- Upper Zone
- Lower Park Place Zone
- Intermediate Park Place Zone
- Upper Park Place Zone (CRW)
- Canemah District Zone
- Fairway Downs Zone
- View Manor - Park Place Zone
- Livesay Road - Park Place Zone
- Paper Mill Zone
- Canyon (CRW)
- Country Village (CRW)
- Street
- Water Feature

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Consulting Engineers

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EXISTING AND FUTURE WATER DEMANDS

A detailed description of the City's existing and projected future water demands is provided in Chapter 3. The following subsections present a brief overview of existing and future water demands.

Existing Water Demands

Existing water demands for the City were determined based on historical water production at the SFWB, historical Master Meter Data for the Cities of West Linn and Oregon City, and historical consumption data for the City of Oregon City. Water use by customer class is shown in Table ES-1. Peaking factors for maximum day and peak hour demand were developed based on historical production records.

Table ES-1. Water Use by Customer Class, 2002-2008[(a)]

	Demand, mgd[(b)]				
Year	Single Family	Institutional	Multi-Family	Industrial/ Commercial	Total
2002	2.16	0.33	0.63	0.65	3.78
2003	2.42	0.29	0.65	0.68	4.04
2004	2.36	0.34	0.63	0.70	4.04
2005[(c)]	2.22	0.32	0.64	0.77	3.95
2006	2.42	0.42	0.62	0.72	4.17
2007	2.32	0.28	0.58	0.71	3.89
2008	2.22	0.30	0.55	0.66	3.74
Historical annual average demand	2.32	0.33	0.61	0.69	3.94
Percent of total annual average demand	59%	8%	16%	17%	100%

(a) Water use includes unaccounted for water
(b) Data provided by Utility Billing (Oregon City Water Consumption 2002-2009 (Account Type).xls)
(c) Utility Billing software upgraded data is not complete and is not used for determining Historical Annual Average Demand

Future Water Demands

Water demands were projected through buildout of the City's Urban Growth Boundary (UGB) using a unit demand methodology based on land uses in the City's Comprehensive Plan. Individual water use (by meter) was linked to individual parcels using addresses. The unit demand factor for each land use designation was then calculated by dividing the total water use by the total parcel area for which it was linked. The same peaking factors used for existing water demands were used for future projections. Buildout water demand projections are shown by customer class in Table ES-2.

Table ES-2. Summary of Buildout Water Demand Projections[a]

Customer Use Category	Average Day Demand, mgd	Maximum Day Demand[b], mgd	Peak Hour Demand[c], mgd
Single Family Residential	3.94	9.07	17.75
Institutional	0.37	0.85	1.66
Multi-Family Residential	0.80	1.85	3.62
Commercial/Industrial	1.90	4.38	8.57
Total	7.01	16.15	31.60

(a) Includes unaccounted for water.
(b) The City's maximum day demand is 2.3 times the average day demand.
(c) The City's peak hour demand is 4.5 times the average day demand.

WATER DISTRIBUTION SYSTEM SERVICE STANDARDS

The City of Oregon City maintains benchmarks for service quality that are used to measure performance of the water utility. These benchmarks include service standards for water quality, quantity, and pressure, as well as the minimum supply levels for fire protection. For example, the Oregon City water distribution system was analyzed to ensure that service pressures are maintained above 40 psi during normal demand scenarios and fire flows are available without dropping system pressures below 20 psi. The service standards set forth in this master plan are derived from regulations, rules, and recommendations established by a variety of sources including the Oregon State Department of Human Services (DHS), the Environmental Protection Agency (EPA), the American Water Works Association (AWWA), the Insurance Services Office (ISO), and the Uniform Fire Code (UFC). A summary of these standards is presented in Table ES-3. A detailed description of the City's service standards is provided in Chapter 4.

HYDRAULIC MODEL

A hydraulic model of the City's water system was developed for the 2004 WMP and was updated for this WMP using a series of steps that included the following:

- Model Update
- Roughness Factors Assigned for New Areas in InfoWater
- Water Demands Allocated in H_2OMAP.
- Elevations Allocated for New Areas in H_2OMAP.
- Naming Scheme Applied in InfoWater.

A detailed description of the City's hydraulic model update is provided in Chapter 5.

Table ES-3. City of Oregon City Planning and Design Criteria

Component	Criteria	Remarks / Issues
PERFORMANCE CRITERIA FOR PLANNING & DESIGN		
Fire Flow Requirements (flow [gpm] @ duration [hours])		
Single-Family Residential	1,500 gpm @ 2 hrs	Fire flows based on new development requirements. Existing development will be evaluated on a case by case basis, because of the historical varying standard.
Multi-Family Residential	1,500 gpm @ 3 hrs	
Institutional (schools, hospitals, etc.)	2,000 gpm @ 4 hrs (with approved automatic sprinkler system)	
Commercial/Industrial	3,000 gpm @ 4 hrs (with approved automatic sprinkler system)	
Water Supply Capacity		
Maximum Day Demand Plus Fire Flow	Provide capacity equal to maximum day demand plus fire flow	
Peak Hour Demand	Provide capacity equal to peak hour demand	
Pumping Facility Capacity		
Booster Pump Capacity	Equal to the maximum day demand for the pressure zone.	Design for maximum day plus fire flow or peak hour (whichever is larger), only if no gravity storage is available within the pressure zone and/or service area.
Backup Power	Equal to the firm capacity of the pumping facility.	On-site generator for critical stations.[(a)] Plug in portable generator for less critical stations.
Water Storage and System Peaking Capacity		
Equalization	25 percent of maximum day demand	
Fire	Varies (see requirements listed in remarks column)	Varies depending on required fire flow duration. Highest fire flow demand in any particular area controls size of required storage. See Table 4-2. 1,500 gpm @ 2 hrs = 0.18 MG 1,500 gpm @ 3 hrs = 0.27 MG 2,500 gpm @ 4 hrs = 0.60 MG
Emergency	Maximum day demand	Based on DHS recommendations.
Total Water Storage Capacity	Equalization + Fire + Emergency	
Water Transmission Line Sizing		
Diameter	18-inches in diameter or larger	Criteria based on requirements for new development, existing transmission mains will be evaluated on case-by-case basis. Evaluation will include age, material type, velocity, head loss, and pressure.
Average Day Demand Condition		
Minimum Pressure [psi]	40 psi	
Maximum Pressure [psi]	100 psi	
Maximum Velocity [ft/sec]	3 fps	
Maximum Day Demand Condition		
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/1000 ft]	3 ft/kft	
Maximum Velocity [ft/sec]	5 fps	
Peak Hour Demand Condition		
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/1000 ft]	3 ft/kft	
Maximum Velocity [ft/sec]	5 fps	
Hazen Williams "C" Factor	140	For consistency in hydraulic modeling.
Pipeline Material	Ductile Iron	
Water Distribution Line Sizing		
Diameter	Less than 18-inches in diameter	Must verify pipeline size with max day and fire flow analysis.
Average Day Demand Condition		Criteria based on requirements for new development, existing distribution mains will be evaluated on case-by-case basis. Evaluation will include age, material type, velocity, head loss, and pressure.
Minimum Pressure [psi]	40 psi	
Maximum Pressure [psi]	100 psi	
Maximum Velocity [ft/sec]	3 - 5 fps	
Maximum Day w/ Fire Flow Demand Condition		
Minimum Pressure [psi] (at fire node)	20 psi	
Maximum Head loss [ft/1000 ft]	10 ft/kft	
Maximum Velocity [ft/sec]	10 fps	
Peak Hour Demand Condition		
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/1000 ft]	10 ft/kft	
Maximum Velocity [ft/sec]	7 fps	
Hazen Williams "C" Factor	140	For consistency in hydraulic modeling.
Pipeline Material	Ductile Iron	
Maximum Valve Spacing		
Supply Pipeline	1 mile	
Transmission Pipeline	2,000 feet (minimum)	1,300 feet (preferred)
Residential Distribution Pipeline	800 feet	
Commercial Distribution Pipeline	500 feet	
Uniform Fire Code Hydrant Distribution Requirements		
Residential	500	
Commercial, Industrial, and Other High Value District	200-500	
OTHER CRITERIA		
Maximum Number of residential lots that can be served by a non-looped water pipeline	25 lots	If a non-looped water line goes out-of-service, all associated residences lose water service.

[(a)] A pumping facility is defined as critical if it provides service to pressure zones and/or service areas without sufficient emergency storage and that meet the following criterion:

- The largest facility that provides water to a particular pressure zone and/or service area;
- A facility that provides the sole source of water to single or multiple pressure zones and/or service areas; and
- A facility that provides water from a supply turnout into pressure zones and/or service areas.

EXISTING WATER SYSTEM

The existing water system is expected to deliver peak hour flows and maximum day demand plus fire flow within the acceptable pressure, velocity and head loss ranges as identified in the performance criteria presented in Chapter 4. However, the system was evaluated using pressure as the primary criterion. Recommended improvements needed to comply with the performance criteria will be added to the existing water system to fix any deficiencies found.

Overall the City of Oregon City has a storage surplus of 4.99 million gallons (MG) in the existing water system.

Mountainview and Hunter Avenue pump stations both have surplus pumping capacities for meeting existing flow requirements. Livesay Road and Fairway Downs Pump Stations both have significant deficits.

A detailed description of the evaluation of the existing water system is provided in Chapter 6 and the existing water system is shown here in Figure ES-1.

Several pipeline improvements are identified in Chapter 6 that address fire flow deficiencies in the pipeline network. These improvements are included in the CIP.

FUTURE WATER SYSTEM EVALUATION

The City of Oregon City has a projected water storage capacity deficit of 4.84 MG in the future water system. A new ground level storage reservoir is planned to be constructed just beyond the Henrici Reservoir at the 620 elevation contour. This tank will serve a new pressure zone created to encompass the Fariway Downs pressure zone. Another new tank is proposed to make up the remaining storage deficit near Holly Lane. These new storage reservoirs will alleviate the water storage capacity deficit in the future water system.

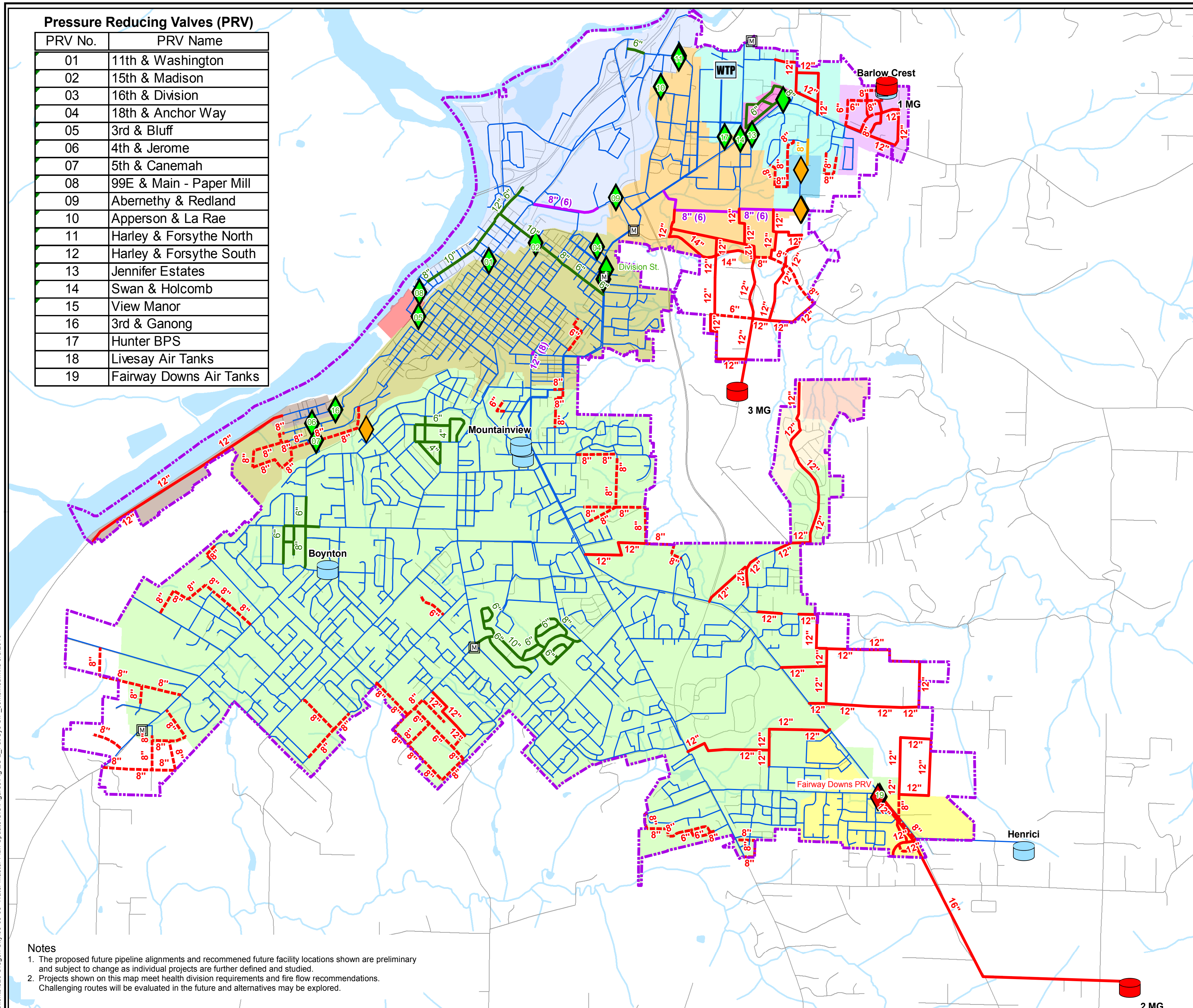
The City of Oregon City has a projected pumping deficit at the Fairway Downs Pump Station of 711 gpm and the Barlow Crest Pump Station of 874 gpm. With the new 620 elevation storage reservoir, however, the Fairway Downs area will be gravity fed and its pumping deficit becomes obsolete. The Barlow Crest Pump Station is only a concern when the City assumes responsibility for those customers from Clackamas River Water (CRW).

Maximum day demand plus fire flow simulation results indicate that there are numerous areas where the available fire flow, evaluated using the maximum day demand plus fire flow performance criteria, was less than the minimum required fire flow for the area. At most of these locations, the existing pipelines are undersized and would need to be replaced by larger diameter pipelines to supply a minimum fire flow required while meeting the maximum day demand plus fire flow performance criteria.

A detailed description of the evaluation of the future water system is provided in Chapter 7. Figure ES-2 shows the recommended future water system improvements.

Pressure Reducing Valves (PRV)

PRV No.	PRV Name
01	11th & Washington
02	15th & Madison
03	16th & Division
04	18th & Anchor Way
05	3rd & Bluff
06	4th & Jerome
07	5th & Canemah
08	99E & Main - Paper Mill
09	Abernethy & Redland
10	Apperson & La Rae
11	Harley & Forsythe North
12	Harley & Forsythe South
13	Jennifer Estates
14	Swan & Holcomb
15	View Manor
16	3rd & Ganong
17	Hunter BPS
18	Livesay Air Tanks
19	Fairway Downs Air Tanks



OREGON CITY

FIGURE ES-2

CITY OF OREGON CITY
FUTURE WATER SYSTEM
RECOMMENDED IMPROVEMENTS

0 1,475 2,950
SCALE IN FEET

LEGEND

- Recommended Pressure Reducing Valve Station (Future System CIP)
- Recommended Storage Reservoir (Future System CIP)
- Recommended Pressure Reducing Valve Station (Existing System CIP)
- Recommended New Pipeline (Existing System CIP)
- Recommended Pipeline Upsize (Existing System CIP)
- Recommended Replacement Pipeline
- Future System Pipeline Diameter ≤ 8"
- Future System Pipeline Diameter > 8"
- SFWB Water Treatment Plant
- Existing Storage Reservoir
- Existing Booster Pump Station
- Existing Pressure Reducing Valve (PRV) Station
- Master Meter (flows out of SFWB or Oregon City)
- Existing Pipeline
- URBAN GROWTH BOUNDARY (UGB)
- Lower Zone
- Intermediate Zone
- Upper Zone
- Lower Park Place Zone
- Intermediate Park Place Zone
- Upper Park Place Zone (CRW)
- Canemah District Zone
- Fairway Downs Zone
- View Manor - Park Place Zone
- Livesay Road - Park Place Zone
- Paper Mill Zone
- Canyon (CRW)
- Country Village (CRW)
- Street
- Water Feature

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Notes
1. The proposed future pipeline alignments and recommened future facility locations shown are preliminary and subject to change as individual projects are further defined and studied.
2. Projects shown on this map meet health division requirements and fire flow recommendations. Challenging routes will be evaluated in the future and alternatives may be explored.

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RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

A detailed description of the City's CIP is provided in Chapter 8.

Recommended Capital Improvements

Recommended capital improvements are organized into three CIP tables: Existing Improvements, Future Improvements, and Renewal and Replacement Improvements. Recommendations for improvements to the existing water system are described in Chapter 6 and are generally recommended to improve fire flows for existing customers. Chapter 7 describes the recommendations for improvements to the future water system which are for improvements related to growth of the system. Renewal and replacement improvements are recommended for areas where pipes are old, leaking or have significant maintenance needs. A summary of the recommended capital improvements is listed below.

<u>Existing System Improvements</u>

- PRV Stations
  - Construct a 6-inch PRV station from Upper Pressure Zone at Telford Road to address fire flow deficiencies at Center Street and Sunset Street in the Intermediate Pressure Zone.
- Pipeline Improvements
  - Install approximately 8,900 linear feet of pipelines ranging from 6 inches to 16 inches in diameter.

The locations of the recommended existing system CIP projects are shown on Figure ES-2.

<u>Future System Improvements</u>

- Storage Facility[1]
  - Construct a 2 MG storage reservoir at the 620 foot elevation contour to serve the Fairway Downs pressure zone and the Upper pressure zone.
  - Construct a 3 MG storage reservoir along Holly Lane to serve the Lower Park Place Pressure Zone.
  - 1 MG storage reservoir at the existing Barlow Crest storage reservoir site (the remainder of the buildout emergency storage requirement will be met from Mountainview Reservoir No. 2). This reservoir is shown on Figure ES-2, but not currently included in the CIP. This additional storage will only be required when CRW facilities are incorporated into the City.

[1] Projects that include the integration of CRW facilities into the Oregon City water system are not included in the CIP.

- PRV Stations
  - Construct two 6-inch PRV stations near Livesay Road pump station to increase fire flow supply availability in the Livesay Road pressure zone (one PRV will supply flow from Intermediate Park Place pressure zone and the other PRV can supply flow into the Lower Park Place pressure zone if needed).
- Pump Station[2,3]
  - Increase the firm pumping capacity at the Barlow Crest Pump Station by adding two additional 500 gpm booster pumps (in the event that the current Barlow Crest customers come to be served by Oregon City).
- Pipelines
  - Install approximately 78,000 linear feet of proposed pipelines ranging from 6 inches to 16 inches in diameter.

The locations of the recommended future system CIP projects are shown on Figure ES-2.

Renewal and Replacement Improvements

- PRV Stations
  - Station #2 Replacement
  - Station # 15 Replacement
- Pipelines
  - Install approximately 40,000 linear feet of proposed pipelines ranging from 4 inches to 10 inches in diameter.

The locations of the recommended future system CIP projects are shown on Figure ES-2.

Recommended Cost and Timing of Capital Improvements

Costs are presented in October 2009 dollars based on an Engineering News Record Construction Cost Index (ENR CCI) of 8596 (20 Cities Average). Total CIP costs include the following construction contingency and project cost allowances:

- Construction Contingency: 20 percent
- Project Cost Allowances:
  - Design: 10 percent
  - Construction Management: 10 percent
  - Administration: 8 percent

---

[2] Projects that include the integration of CRW facilities into the Oregon City water system were not included in the CIP.

[3] Cost estimate was based on the additional firm capacity required.

A summary of the costs for the recommended CIP by project type is provided in Table ES-4. As shown in Table ES-4, the total estimated recommended CIP cost for the City of Oregon City water system is estimated to be $53 million. Additional details of the probable construction costs of each individual project are provided in Chapter 8.

The construction of the improvements for the future system should be coordinated with the proposed schedules of future development to ensure that the required infrastructure will be in place to serve future customers. However, if the future system improvements are based on addressing deficiency in fire flow pumping or storage, emergency storage, or reliability issues, they should be a higher priority.

Table ES-4. Estimated Cost of Recommended CIP by Project Type

CIP Project Type	Existing System CIP, million dollars	Future System CIP[a,b,c], million dollars	Renewal and Replacement CIP, million dollars	Total CIP Cost[a], million dollars
Storage Facility	-	14.46	0.56	15.02
Pump Station	-	-	-	-
Pipeline Improvement	1.50	20.42	8.96	30.88
PRV Station	0.33	0.58	-	0.91
Operations Facility	6.05	-	-	6.05
Total[d]	7.88	35.46	9.52	$52.86

(a) Timing of future system improvements will be triggered by specific developments and increase in system demands.
(b) Future system CIP costs are in current dollars and have not been escalated by the CPI.
(c) Cost based on a ground level, pre-stressed concrete storage tank.
(d) Total cost based on the October 2009 ENR index of 8596 and includes construction contingency and project cost allowances.

CHAPTER 1. INTRODUCTION

MASTER PLAN PURPOSE

Since the previous Water Master Plan (WMP) was developed, the City of Oregon City has aggressively pursued that plan's Capital Improvement Plan (CIP) and made significant improvements to the water system. Due in part to the age of that plan and to the aggressive nature of improvements being constructed within the system, the previous plan is in need of an update. The intent of this WMP is to update the aging plan, identify existing system deficiencies and required system improvements, based on updated demand estimates and system evaluations, and to formulate a comprehensive CIP which meets the needs of existing and future customers.

MASTER PLAN OBJECTIVES

The objectives of this WMP are to:

- Develop operational and design criteria under which the existing system will be analyzed and future facilities will be formulated;
- Evaluate existing water demands and project future water demands;
- Analyze the existing capacity and operation of pump stations, and water storage facilities to meet existing and 2030 water demands;
- Identify potential new water storage facilities;
- Evaluate water service to new development areas;

AUTHORIZATION

West Yost Associates (West Yost) was authorized to prepare this WMP by the City of Oregon City on March 3, 2009.

REPORT ORGANIZATION

This WMP is organized into the following chapters:

- Chapter 2: Existing Water Distribution System
- Chapter 3: Water Demand Analysis
- Chapter 4: Water Distribution System Service Standards
- Chapter 5: Hydraulic Model Update
- Chapter 6: Existing Water Distribution System Evaluation
- Chapter 7: Future Water Distribution System Evaluation
- Chapter 8: Recommended Capital Improvement Program
- Chapter 9: Water Distribution System Financing Plan

The following appendices to this WMP contain additional technical information and assumptions:

- APPENDIX A: Diurnal Curve Development Technical Memorandum
- APPENDIX B: Water System Seismic Vulnerability Assessment
- APPENDIX C: Cost Estimating Assumptions
- APPENDIX D: Project Sheets

ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations have been used throughout this WMP to improve document clarity and readability.

AC	Asbestos Cement
ADD	Average Day Demand
af	Acre-Feet
af/service/yr	Acre-Feet Per Service Per Year
af/yr	Acre-Feet Per Year
AWWA	American Water Works Association
BPS	Booster Pump Station
bgs	below ground surface
BMPs	Best Management Practices
ccf	Hundred Cubic Feet
CCI	Construction Cost Index
cfs	Cubic Feet per Second
CFD	Clackamas Fire District
CI	Cast Iron
CIP	Capital Improvement Program
City	City of Oregon City
CL&C	Concrete Pressure Pipe
COP	Copper
CPI	Consumer Price Index
CRW	Clackamas River Water
DBPR	Disinfection By-Products Rule
DHS	Department of Human Services
DI	Ductile Iron
DOC	Dissolved Organic Compounds
EC or COND	Electrical Conductivity
ENR	Engineering News Record
EPA	Environmental Protection Agency
EPS	Extended Period Simulation
ESFU	Equivalent Single Family Unit
fps	Feet Per Second
ft	Feet

ft/kft	Feet Per Thousand Feet
ft/yr	Feet Per Year
GALV	Galvanized Pipe
GIS	Geographical Information System
gpcd	Gallons Per Capita Per Day
gpm	Gallons Per Minute
GPS	Global Positioning System
GSE	Ground Surface Elevation
HD	High Density
HGL	Hydraulic Grade Line
HPR	Hydrant Pressure Recorders
IDSE	Initial Distribution System Evaluation
ISO	Insurance Service Office
LD	Low Density
MCL	Maximum Contaminant Levels
MDD	Maximum Day Demand
MG	Million Gallons
mg/L	Milligrams Per Liter
mgd	Million Gallons Per Day
MHD	Medium High Density
MLD	Medium Low Density
MOU	Memorandum of Understanding
msl	Mean Sea Level
my	Million Years
NFPA	National Fire Protection Association
NO_3	Nitrate
O&M	Operations and Maintenance
OFC	Oregon Fire Code
PHD	Peak Hour Demand
PRV	Pressure Reducing Valve
PS	Pump Station
psi	Pounds Per Square Inch
PVC	polyvinyl chloride
R&R	Replacement and Renewal
RMS	Root Mean Square
SC	Specific Conductance
SCADA	Supervisory Control and Data Acquisition
SDC	System Development Charge
SFWB	South Fork Water Board
SID	Solano Irrigation District
SMCL	Secondary Maximum Contaminant Level
SS	Stainless Steel
STD STL	Standard Steel
TDS	Total Dissolved Solids
THM	Total Trihalomethane
total Cr	Total Chromium

TRANS	Transite
UAFW	Unaccounted-for Water
UCI	Unlined Cast Iron
UFC	Uniform Fire Code
UGB	Urban Growth Boundary
USBR	United States Bureau of Reclamation
USGS	U.S. Geological Survey
VLD	Very Low Density
VOC	Volatile Organic Chemical
WI	Steel Lined
WMP	Water Master Plan
WSS	Water Sampling Station
WWTP	Waste Water Treatment Plant
West Yost	West Yost Associates

ACKNOWLEDGEMENTS

The development of this WMP would not have been possible without the key involvement and assistance of the Oregon City staff. In particular, the following staff provided comprehensive information, significant input and important insights throughout the WMP development:

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- John Burrell, Project Manager
- Eli Deberry, Operations Supervisor
- Chris Dunlop, GIS Analyst
- Jason Frazier, Engineering Technician II
- Kevin Hanks, Utility Maintenance Team Leader
- Gail Johnson, Water Quality Coordinator

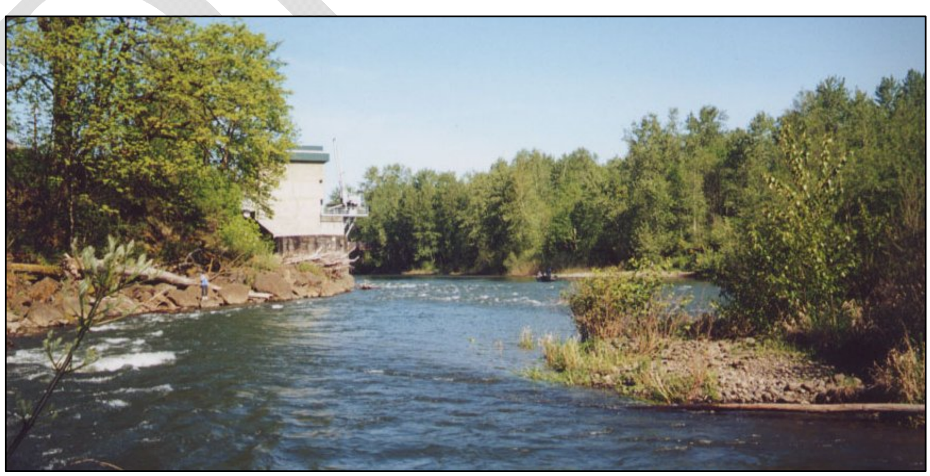
CHAPTER 2. EXISTING WATER DISTRIBUTION SYSTEM

The Oregon City water distribution system currently serves more than 4,000 acres of developed property within the City limits. The existing system is composed of an extensive pipeline network, five booster pumping stations, five reservoirs, nineteen pressure reducing valve (PRV) stations, two altitude valves, and ten interties with other water systems. This chapter provides background information on the various elements of the existing system as well as an overview of system operations.

SOURCE OF SUPPLY

The source of supply for the City of Oregon City is surface water from the lower Clackamas River (Figure 2-1) which is supplied by the South Fork Water Board (SFWB). Figure 2-2 is a map of the Clackamas River and surrounding river systems. The SFWB is a wholesale water supplier that is equally owned by the Cities of Oregon City and West Linn. The SFWB operates an intake and pumping station just to the north of the Oregon City city limits which delivers raw water to the SFWB water treatment plant located in the City's Park Place area. The treatment plant was originally constructed in 1958 and has undergone several renovations over the years. The most recent plant expansion was completed in 1986, bringing the plant's rated production capacity to 20 million gallons per day (mgd). The historical maximum day treated water production rate is 22 mgd. The most recent site expansion was completed in 2009 and added a 2 million gallon (MG) storage reservoir adjacent to the plant. The treatment process includes flocculation and sedimentation of suspended solids, filtration of the remaining particles, and chlorination for disinfection prior to pumping into the SFWB transmission system.

Figure 2-1. South Fork Water Board Raw Water Intake



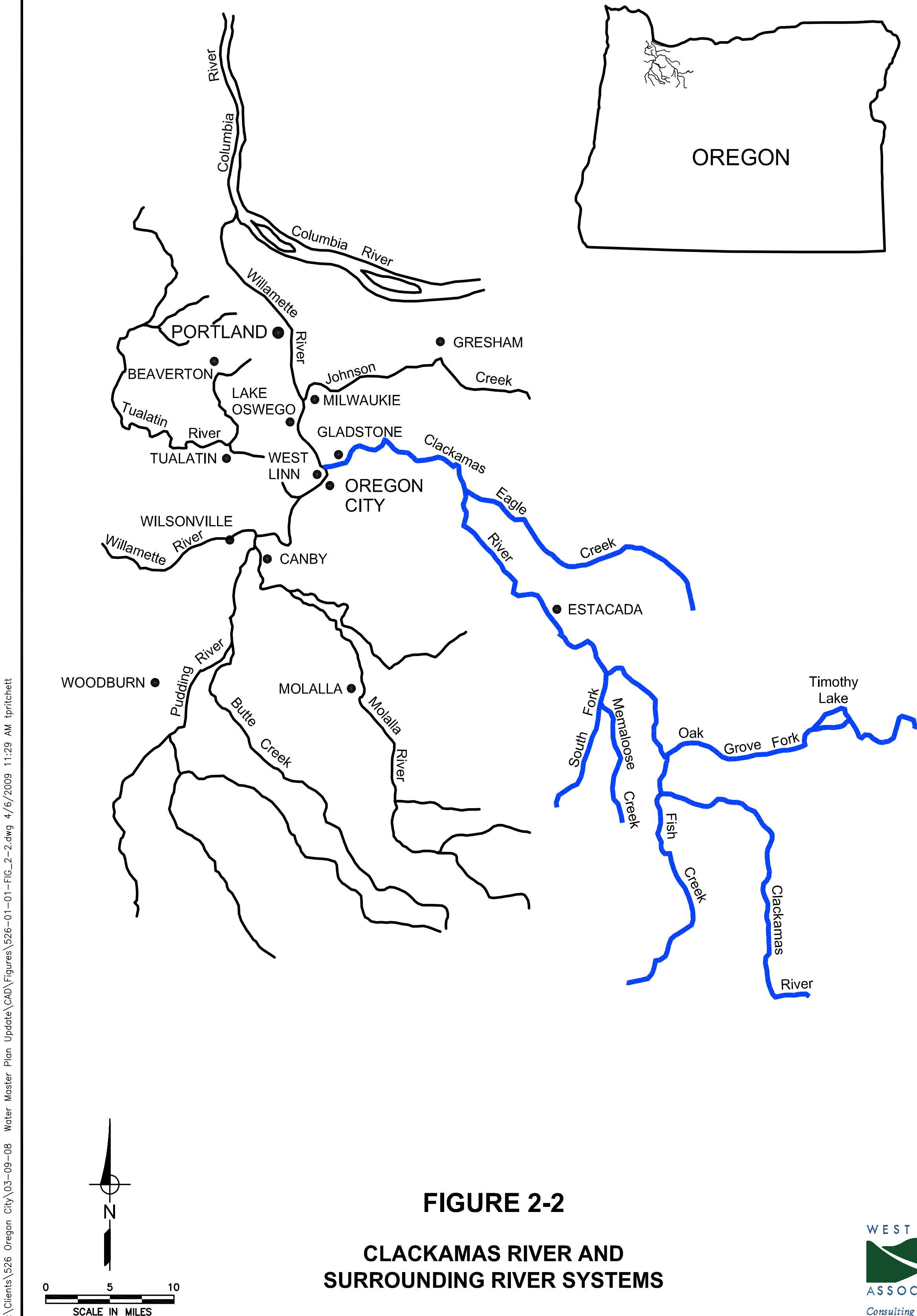


FIGURE 2-2

CLACKAMAS RIVER AND SURROUNDING RIVER SYSTEMS

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WATER SUPPLY RIGHTS

The SFWB holds four water rights on the Clackamas River and its tributaries which total 116 cubic feet per second (cfs) or nearly 75 mgd. However, the allowed maximum withdrawal rate for these water rights is based on available flow during summertime periods of low stream flow. As a result, it is estimated that the actual maximum withdrawal rate is 80 cfs or nearly 52 mgd. Since some of the water rights pertain to upstream locations on the South Fork of the Clackamas River and Memaloose Creek, the SFWB has taken legal steps in recent years to ensure access to these water rights at the existing water supply intake on the Lower Clackamas River. Currently, the SFWB has 46.9 cfs or 30.3 mgd of undeveloped rights at their intake structure.

REGIONAL MASTER METERING SYSTEM

The regional water supply master metering system measures the volumes of water delivered by the SFWB to its customers. The SFWB's three primary customers include the City of Oregon City, the City of West Linn, and Clackamas River Water District (CRW). CRW is a domestic water supply district that serves the unincorporated rural areas surrounding Oregon City and areas North of the Clackamas River East of the City of Milwaukie. The Oregon City water distribution system is supplied by the SFWB at five different locations, the City of West Linn is supplied at one location, and CRW is supplied at six locations. The City of Oregon City and the City of West Linn are directly supplied from the SFWB's transmission pipelines. One of the CRW connections is directly supplied by the SFWB and the other five connections are supplied through the Oregon City water distribution system. CRW also has two emergency interties with Oregon City's water distribution system. There is a master metering vault at each of these supply locations that is monitored on a monthly basis to determine delivered water volumes for billing purposes. Figure 2-3 illustrates a typical master metering station configuration. Table 2-1 summarizes important information about each of the twelve primary master metering stations.

Figure 2-3. Barlow Crest Master Meter Vault Plan

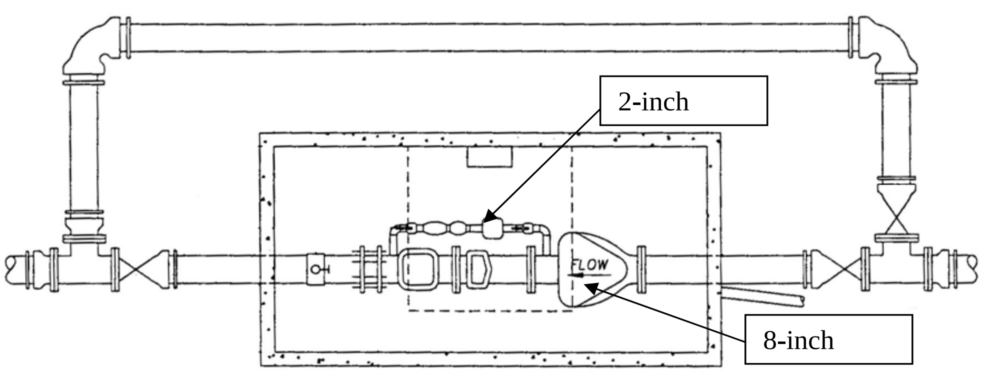


Table 2-1. Regional Master Meter Sites

Master Meter Station No.	Location	Meter Diameter and Type	Agency Served	Owner
1	Cleveland Street & Hiram Avenue	10-inch turbine	City of Oregon City	SFWB
2	Redland Road & Anchor Way	8-inch compound	Clackamas River Water	SFWB
3	17th & Division Street	16-inch magnetic	City of West Linn	SFWB
4	16th & Division Street	8-inch magnetic	City of Oregon City	SFWB
6	Mountainview Pump Station Pump Numbers 1, 2, & 3	16-inch turbine	City of Oregon City	SFWB
7	Mountainview Street	10-inch turbine	City of Oregon City	SFWB
8	Leland & Meyers Roads	6-inch compound	Clackamas River Water	Oregon City
9	South End Road & Impala Lane	6-inch, 2-inch turbine, piston	Clackamas River Water	Oregon City
10	Hunter Avenue Pump Station	10-inch turbine	City of Oregon City	SFWB
11	Barlow Crest Pump Station	6-inch turbine	Clackamas River Water	Oregon City
12	Barlow Crest Reservoir	8-inch, 2-inch turbine, piston	Clackamas River Water	Oregon City
13	Swan Avenue & Forsythe Road	6-inch, 2-inch turbine, piston	Clackamas River Water	Oregon City
Secondary	Old River Road & Highway 43	12-inch magnetic	City of Lake Oswego	West Linn
Secondary	SFWB Treatment Plant	24-inch magnetic	North Clackamas County Water Commission	SFWB

There are also two secondary water supply interties in the regional water system. The SFWB occasionally provides water to the City of Lake Oswego through an intertie with the City of West Linn's water distribution system and is also able to provide water to the North Clackamas County Water Commission system through an intertie at the SFWB treatment plant. The Lake Oswego meter is monitored and maintained by The City of West Linn staff whenever the intertie is active. The City of Lake Oswego can also pump into City of West Linn system at this location if the SFWB supply to West Linn is disrupted. The North Clackamas County Water Commission intertie, which is monitored and maintained by SFWB staff, is typically active when that agency is experiencing problems treating highly turbid water during winter flood events. Since neither of these interties is regularly in operation, the meters are not included in the monthly monitoring program. Instead, the City of West Linn and SFWB report metered water volumes to master meter billing staff as necessary. Table 2-1 also includes information on these two secondary master metering stations.

Figure 2-4 is a schematic that depicts the configuration of the master metering system, showing the primary master meters used for revenue calculations as well as the secondary flow meters that are used for operational or emergency purposes. Figure 2-5 is a map of the regional system that shows the location of each master metering station.

In addition to the formal master metered boundaries between agencies, there are also joint usage agreements between the City of Oregon City and CRW that govern special situations within the Oregon City distribution system. Under these agreements, CRW can serve customers directly from Oregon City pipelines that are upstream of their master meter. These joint usage areas, such as those along South End Road, typically occur where land that has been annexed into the Oregon City city limits but remain intermixed with unincorporated properties that are still served by CRW. CRW then reimburses Oregon City for the water supplied to joint usage areas based on individual customer meter summaries that are prepared each month.

DISTRIBUTION AND STORAGE SYSTEM

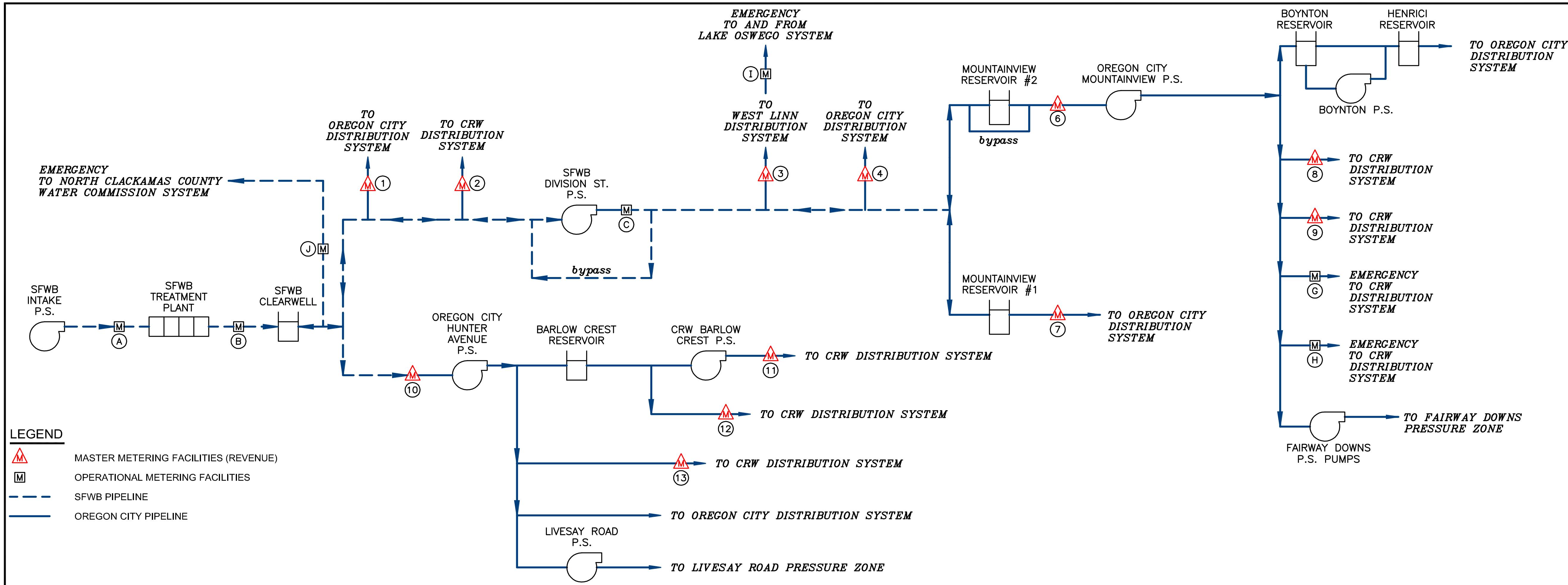
The following sections provide background information on each component of the water distribution and storage system. Figure 2-6 provides an overview of the Oregon City water distribution system, depicting the location of major facilities and all water distribution piping ten inches in diameter and larger. In addition, the figure shows facilities and transmission piping within Oregon City that are operated by the SFWB, City of West Linn, and CRW. Figure 2-6 also illustrates the existing city limits and urban growth boundary (UGB). The city limits mark the boundary of the existing service area and the UGB marks the boundary of the future service area. The City is nearing approval for three UGB expansion areas which will also be included in the future service area.

Pipeline Configuration

The City's water distribution pipeline configuration consists of approximately 150 miles of pipeline. Table 2-2 summarizes the water distribution system according to pipeline length and diameter. These pipeline material types are primarily cast iron or ductile iron and range in age up to approximately 100 years. However, there is some asbestos cement in the Park Place area.

Table 2-2. Water Distribution System Pipeline Network

Pipeline Diameter, inches	Length, miles	Percent of Water System
2	4.6	3.0
3	0.3	0.2
4	7.3	4.7
6	39.9	25.8
8	62.4	40.4
10	8.8	5.7
12	17.1	11.1
14	0.4	0.2
16	11.2	7.2
20	2.4	1.6
24	0.02	< 0.1
30	0.01	< 0.1
Total	154.4	100.0



MASTER METER KEY

1 Owner: SFWB
Location: Cleveland Street and Hiram Avenue
Purpose: Revenue
Agency Served: City of Oregon City
Diameter: 10-inch
Units: 500 cubic feet
Type: Sensus Turbo

2 Owner: SFWB
Location: Redland Road and Anchor Way
Purpose: Revenue
Agency Served: Clackamas River Water
Diameter: 8-inch, 4-inch, & 4-inch
Units: 100 cubic feet, 100 cubic feet, & cubic feet
Type: Hersey Compound

3 Owner: SFWB
Location: 17th and Division Street
Purpose: Revenue
Agency Served: City of West Linn
Diameter: 16-inch
Units: 1,000 gallons
Type: Magnetic

4 Owner: SFWB
Location: 16th and Division Street
Purpose: Revenue
Agency Served: City of Oregon City
Diameter: 8-inch, 4-inch, & 4-inch
Units: 100 cubic feet, 100 cubic feet, & cubic feet
Type: Hersey Compound

6 Owner: SFWB
Location: Mountainview Pump Station Pumps No. 1, 2, & 3
Purpose: Revenue
Agency Served: City of Oregon City
Diameter 16-inch
Units: 10,000 cubic feet
Type: Sensus Turbo

7 Owner: SFWB
Location: Mountainview Street
Purpose: Revenue
Agency Served: City of Oregon City
Diameter 10-inch
Units: 1,000 cubic feet
Type: Sensus Turbo

8 Owner: City of Oregon City
Location: Leland and Meyers Roads
Purpose: Revenue
Agency Served: Clackamas River Water
Diameter: 6-inch, 6-inch, & 6-inch
Units: 100 cubic feet, 100 cubic feet, & 100 cubic feet
Type: Hersey Compound

9 Owner: City of Oregon City
Location: South End Road and Impala Lane
Purpose: Revenue
Agency Served: Clackamas River Water
Diameter: 6-inch & 2-inch
Units: 500 cubic feet & 100 cubic feet
Type: Sensus Turbo

10 Owner: SFWB
Location: Hunter Avenue Pump Station
Purpose: Revenue
Agency Served: City of Oregon City
Diameter: 10-inch
Units: 100 cubic feet
Type: Sensus Turbo

11 Owner: City of Oregon City
Location: Barlow Crest Pump Station
Purpose: Revenue
Agency Served: Clackamas River Water
Diameter: 6-inch
Units: 10 gallons
Type: Sensus Turbo

12 Owner: City of Oregon City
Location: Barlow Crest Reservoir
Purpose: Revenue
Agency Served: Clackamas River Water
Diameter: 8-inch & 2-inch
Units: 500 cubic feet & 100 cubic feet
Type: Sensus Turbo

13 Owner: City of Oregon City
Location: Swan Avenue and Forsythe Road
Purpose: Revenue
Agency Served: Clackamas River Water
Diameter: 6-inch & 2-inch
Units: 500 cubic feet & 100 cubic feet
Type: Sensus Turbo

OPERATIONAL METER KEY

A Owner: SFWB
Location: Water Treatment Plant
Purpose: Operational - Raw Water Measurement
Diameter: 20-inch
Type: Propeller

B Owner: SFWB
Location: Water Treatment Plant
Purpose: Operational - Finished Water Measurement
Diameter: 20-inch
Type: Propeller

C Owner: SFWB
Location: Division Street Pump Station
Purpose: Operational - Pumping Rate Measurement
Diameter: 24-inch
Type: Sonic

G Owner: Clackamas River Water
Location: Beavercreek Road and Highway 213
Purpose: Emergency Intertie to CRW

H Owner: Clackamas River Water
Location: Beavercreek and Glen Oak Roads
Purpose: Emergency Intertie to CRW

I Owner: City of West Linn
Location: Old River Rd and Hwy 43
Purpose: Emergency Intertie to Lake Oswego
Diameter: 12-inch
Type: Magnetic Bi-Directional

J Owner: SFWB
Location: SFWB Treatment Plant
Purpose: Emergency Intertie to NCCWC
Diameter: 24-inch
Type: Magnetic

FIGURE 2-4

CITY OF OREGON CITY

MASTER METERING SYSTEM SCHEMATIC

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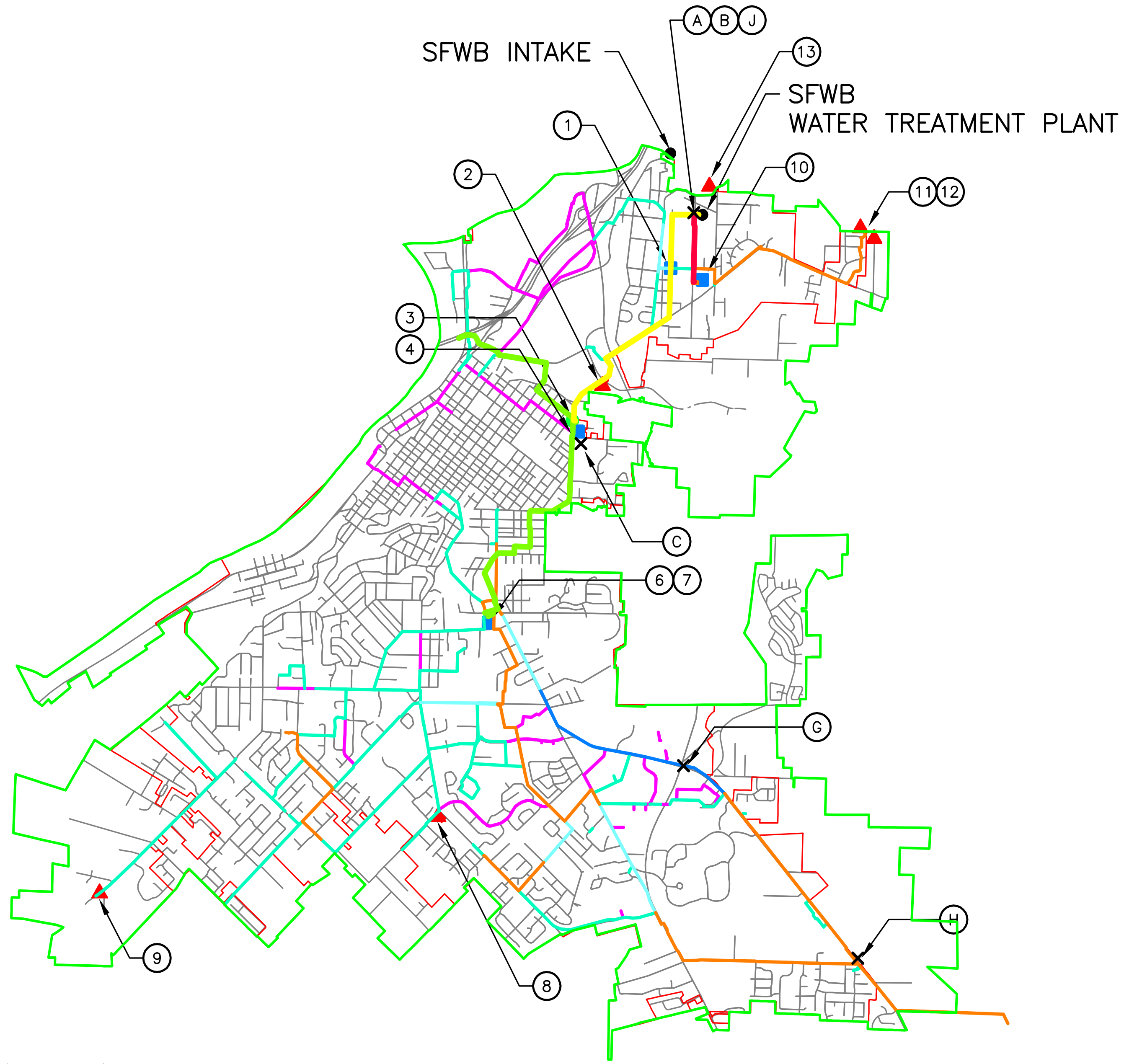
OREGON CITY

FIGURE 2-5

METER LOCATIONS

MASTER METERS

1. SERVES CITY OF OREGON CITY CLEVELAND STREET AND HIRAM AVENUE
2. SERVES CLACKAMAS RIVER WATER REDLAND ROAD AND ANCHOR WAY
3. SERVES CITY OF WEST LINN 17th AND DIVISION STREET
4. SERVES CITY OF OREGON CITY 16th AND DIVISION STREET
6. SERVES CITY OF OREGON CITY MOUNTAINVIEW PUMP STATION
7. SERVES CITY OF OREGON CITY MOUNTAINVIEW STREET
8. SERVES CLACKAMAS RIVER WATER LELAND AND MEYERS ROADS
9. SERVES CLACKAMAS RIVER WATER SOUTH END AND IMPALA ROADS
10. SERVES CITY OF OREGON CITY HUNTER AVENUE PUMP STATION
11. SERVES CLACKAMAS RIVER WATER BARLOW CREST PUMP STATION
12. SERVES CLACKAMAS RIVER WATER BARLOW CREST RESERVOIR
13. SERVES CLACKAMAS RIVER WATER SWAN AVENUE AND FORSYTHE ROADS



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OPERATIONAL METERS

A. RAW WATER SUPPLY SFWB TREATMENT PLANT
B. FINISHED WATER DELIVERED SFWB TREATMENT PLANT
C. PUMP STATION FLOW DIVISION STREET PUMP STATION
G. EMERGENCY INTERTIE TO CRW BEAVERCREEK ROAD AND HIGHWAY 213
H. EMERGENCY INTERTIE TO CRW BEAVERCREEK AND GLEN OAK ROADS
I. EMERGENCY INTERTIE TO LAKE OSWEGO OLD RIVER ROAD AND HIGHWAY 43, WEST LINN (NOT SHOWN)
J. EMERGENCY INTERTIE TO NORTH CLACKAMAS WATER CO – SFWB TREATMENT PLANT

LEGEND:

- URBAN GROWTH BOUNDARY (UGB)
- CITY LIMITS
- 10" } OREGON CITY PIPELINES
- 12"
- 14"
- 16"
- 20"
- 24" } SFWB PIPELINES
- 30"
- 42"
- ● MASTER METER TO WEST LINN
- ▲ MASTER METER TO CRW
- ■ MASTER METER TO OREGON CITY
- × OPERATIONAL METER

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OREGON CITY

FIGURE 2-6

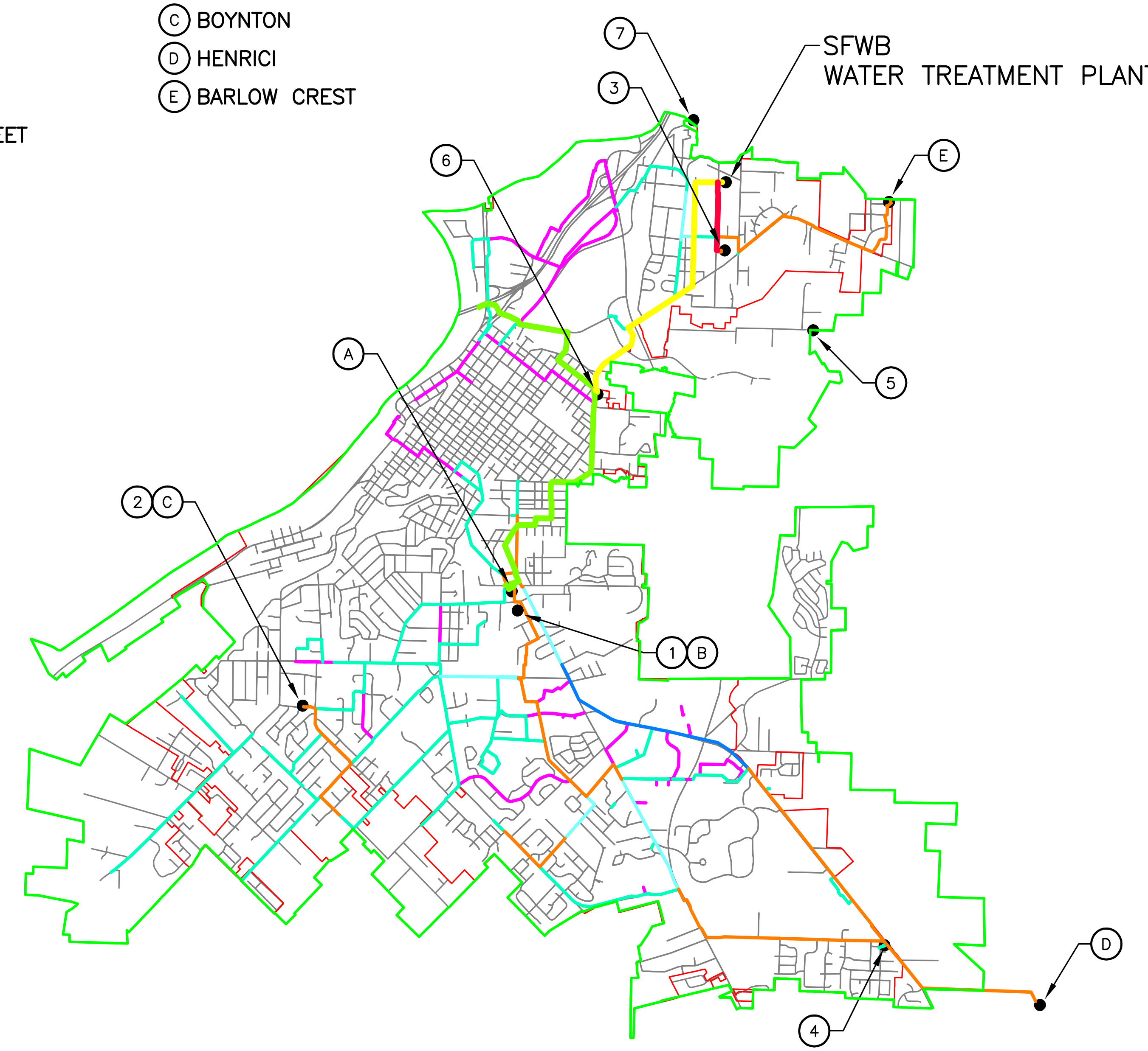
CITY OF OREGON CITY
WATER DISTRIBUTION SYSTEM

PUMP STATIONS

1. MOUNTAINVIEW
2. BOYNTON
3. HUNTER AVENUE
4. FAIRWAY DOWNS
5. LIVESAY ROAD
6. SFWB DIVISION STREET
7. SFWB INTAKE

RESERVOIRS

A. MOUNTAINVIEW #1
B. MOUNTAINVIEW #2
C. BOYNTON
D. HENRICI
E. BARLOW CREST



LEGEND:

- URBAN GROWTH BOUNDARY (UGB)
- CITY LIMITS
- 10” 12” 14” 16” 20” — OREGON CITY PIPELINES
- 24” 30” 42” — SFWB PIPELINES
- WATER SYSTEM FACILITIES

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Booster Pumping Stations

Oregon City's water distribution system includes five booster pumping stations that either transfer water to the higher pressure zones or boost system pressure during emergency conditions. Two of the transfer pump stations, Mountainview and Hunter Avenue (Figure 2-7), are designed to fill reservoirs that serve the higher pressure zones. The other two transfer pump stations, Fairway Downs and Livesay Road, operate to maintain a minimum system pressure in areas that are not served by reservoirs. The emergency pump station located at Boynton Reservoir (Figure 2-8) is designed to increase local pressures during emergency conditions. Table 2-3 details the design data for each of the system's pumping stations and the location of each facility is shown on Figure 2-6.

Figure 2-7. Hunter Avenue Pump Station

Figure 2-8. Boynton Pump Station

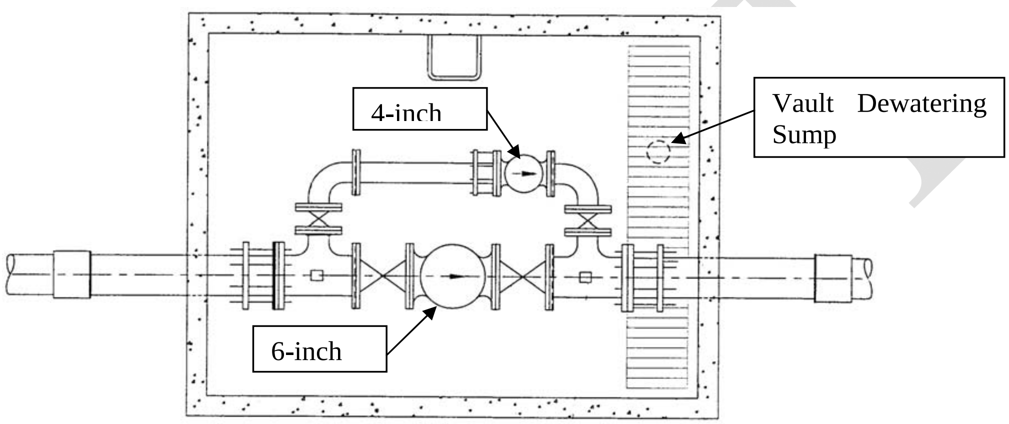
Table 2-3. Design Data for Existing Booster Pumping Stations

Pump Station Name	Pressure Zone Served	Reservoirs Served	Number of Pumps	Pump Motor Size and Speed, hp/rpm	Capacity of Each Pump, gpm	Ground Elevation, feet	Rated Discharge Head, feet
Mountainview	Upper, Fairway Downs	Boynton, Henrici	3	200/1780 200/1780 200/1780	4,000 4,000 4,000	465.5	150 150 150
Boynton	Upper, Fairway Downs	--	2	75/1750 75/1750	2,300 2,300	482	105 105
Hunter Avenue	Intermediate Park Place	Barlow Crest	3, 1 future	75/1700 75/1700 75/1700	900 900 900	198	250 250 250
Fairway Downs	Fairway Downs	--	4	3/3500 15/1750 15/1750 15/1750	50 500 500 500	494	81 60 60 60
Livesay Road	Livesay Road Park Place	--	1	7.5/3600	30	222	210

Pressure Reducing Valve Stations

The Oregon City water distribution system relies on seventeen pressure reducing valve (PRV) stations to supply water from higher pressure zones into the lower pressure zones and two pressure reducing valves at constant pumping stations for a total of nineteen. Table 2-4 lists the location of each PRV station along with its size and outlet pressure. The stations typically consist of a small PRV to supply the relatively low flows associated with normal demand conditions and a large PRV to supply the high water demand associated with a fire flow event (Figure 2-9). The location of the pressure reducing stations is shown in Figure 2-10.

Figure 2-9. Typical Pressure Reducing Valve Station Configuration (View Manor)



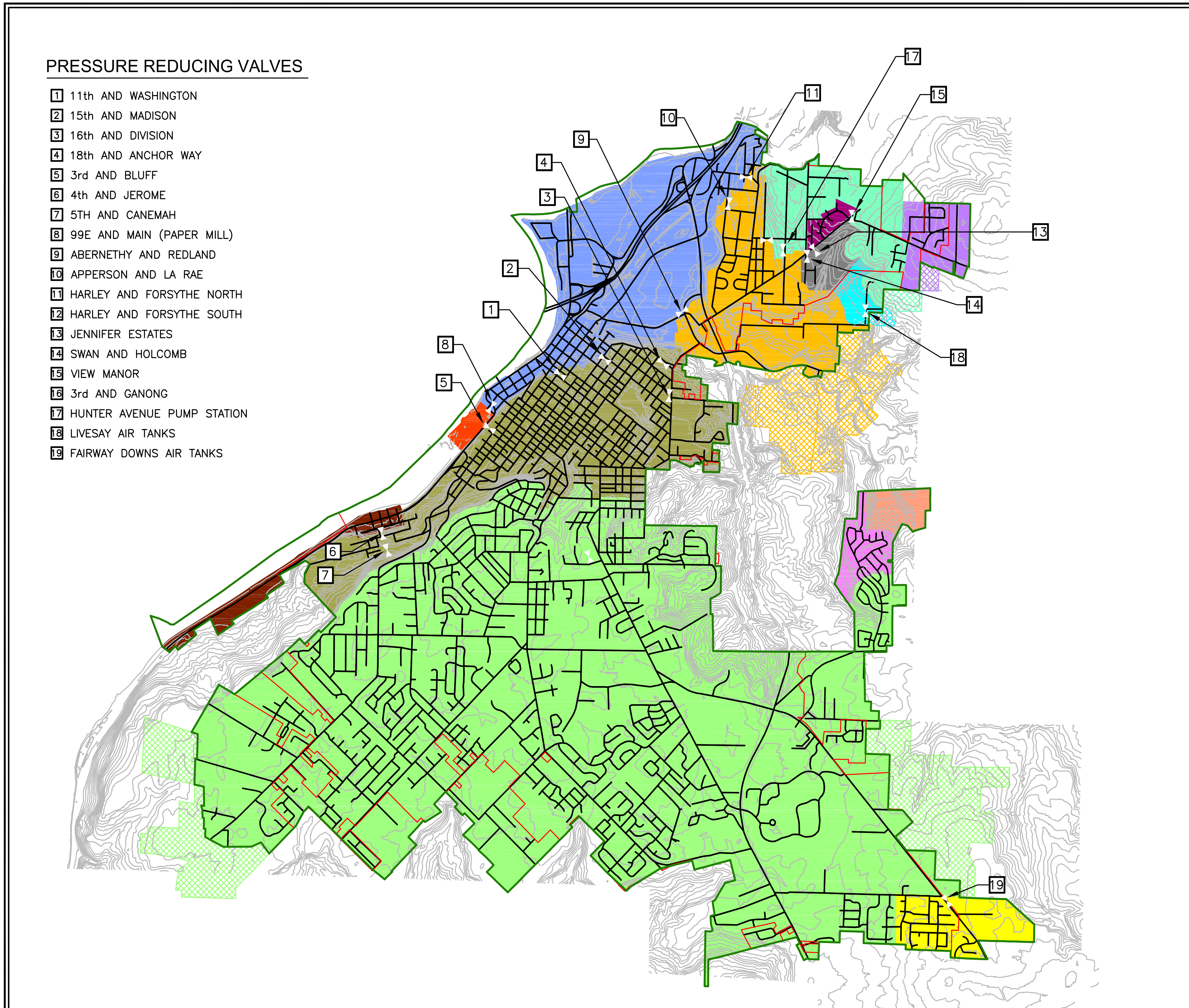
Reservoirs

There are five treated water storage reservoirs within the Oregon City water distribution system. Design information for the existing reservoirs is detailed in Table 2-5 and locations are shown on Figure 2-6, presented earlier. The operating reservoirs provide a total of 18.25 MG of treated water storage.

Mountainview Reservoir No. 2 (Figure 2-11) is the City's oldest operating and largest reservoir. The reservoir, constructed in 1916 with a capacity of 5 MG, originally served as the terminal point for the Mountain Line water supply system that brought water to Oregon City from Memaloose Creek, approximately eleven miles southeast of Estacada. The reservoir was expanded in 1952 to the current capacity of 10.5 MG through the addition of a vertical perimeter wall to the existing concrete basin. A roof system, consisting of laminated wood beams, plywood sheathing, and built-up roofing material supported on galvanized steel pipe columns, was installed in 1978. In 2007 this roof was replaced and seismic improvements were made to the vertical perimeter wall of the tank. The reservoir now meets current seismic standards.

Table 2-4. Pressure Reducing Valve (PRV) Stations

No.	Location	Pressure Zone Served	Elevation, feet	Size, inches	Outlet Pressure, psi
1	11th & Washington	Lower Zone	125	3 10	68 60
2	15th & Madison	Lower Zone	132	1.25 6	67 63
3	16th & Division	Intermediate Zone	260	1.25 10	90 100
4	18th & Anchor Way	Park Place Lower Zone	194	4 8 4 (relief)	53 50 63
5	3rd & Bluff	Lower Zone	175	3 10	55 50
6	4th & Jerome	Canemah Zone	180	2 6	55 50
7	5th & Canemah	Canemah Zone	270	1.25 4	83 80
8	99E & Main	Lower Zone (bi-directional)	58	3 10	80 75
9	Abernethy & Redland	Lower Zone	40	4 8 4 (relief) 4 (relief)	108 103 113 140
10	Apperson & La Rae	Lower Zone	78	2 4 6	80 79 76
11	Harley & Forsythe (north)	Lower Zone	115	12 4 (relief) 4 (relief)	79 95 95
12	Harley & Forsythe (south)	Lower Zone	115	1.5 6	Off 78
13	Wayne Drive & Holcomb	Jennifer Estates	240	4 8	140 57
14	Swan & Holcomb	Park Place Lower Zone	220	4 8	62 67
15	View Manor	View Manor Zone	323	4 8	100 23
16	3rd & Ganong	Canemah	119	2 6	80 80
17	Hunter Pump Station	Park Place Lower Zone	195	3 6	45 51



OREGON CITY

FIGURE 2-10

CITY OF OREGON CITY

ULTIMATE PRESSURE ZONE COVERAGE

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SCALE IN FEET

LEGEND:

- URBAN GROWTH BOUNDARY (UGB)
- PROPOSED UGB EXPANSION AREA
- CITY LIMITS
- 20' CONTOURS
- LOWER ZONE
- INTERMEDIATE ZONE
- UPPER ZONE
- FAIRWAY DOWNS
- CANEMAH DISTRICT
- COUNTRY VILLAGE (CRW)
- CANYON (CRW)
- LOWER-PARK PLACE
- INTERMEDIATE-PARK PLACE
- UPPER-PARK PLACE (CRW)
- LIVESAY ROAD-PARK PLACE
- VIEW MANOR-PARK PLACE
- JENNIFER ESTATES-PARK PLACE
- PAPER MILL ZONE
- PRESSURE REDUCING VALVE STATION (FUTURE)

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Figure 2-11. Mountainview Reservoir No. 2

Table 2-5. Design Data for the Existing Reservoirs

Reservoir Name	Primary Pressure Zone Served	Year Built	Construction Materials	Capacity, MG	Bottom Elevation, feet	Overflow Elevation, feet
Barlow Crest	Intermediate Park Place and Lower Park Place	1999	Steel	1.75	518	549
Boynton	Upper	1984	Steel Standpipe	2.0	484	592
Henrici	Upper	1994	Steel	2.0	573.5	592
Mountainview Number 1	Intermediate	2007	Concrete	2.0	463.75	490
Mountainview Number 2	Intermediate	1916 expanded 1952 seismic retrofit in 2007	Concrete	10.5	463.75	490

In 2007 Mountainview Reservoir No. 1 (Figure 2-12) was constructed on a nearly adjacent site to the Mountainview Reservoir No. 2 site. The two reservoirs are hydraulically connected and operate in parallel. Jointly the Mountainview Reservoirs provide water to the Intermediate and Lower Pressure Zones and are currently supplied by the SFWB's Division Street Pump Station. The Division Street Pump Station also supplies the City of West Linn through a 24-inch transmission main. Due to a higher hydraulic grade line in the Oregon City water distribution system relative to West Linn, water can backfeed from the Mountainview Reservoirs into the West Linn system when the Division Street Pump Station is not operating. Also, the Division Street Pump Station is equipped with a transfer valve between the discharge and suction piping which allows for filling of the SFWB clearwell from the Mountainview Reservoirs when the pump station is not operating. This controlled bypassing of the Division Street Pump Station has been necessary in the past since portions of Oregon City's Park Place district and portions of the CRW service area rely on supply from the clearwell even when the SFWB treatment plant is not operating. However, SFWB just completed construction of a new 2 MG clear well reservoir at the treatment plant site that should make this practice less regular.

Figure 2-12. Mountainview Reservoir No. 1

Boynton Reservoir (Figure 2-13) is a steel standpipe with a total capacity of 2.0 MG that serves the Upper Pressure Zone. Approximately 0.5 MG is available by gravity and the remainder can be boosted for fire flows and emergency flows by the manually controlled pump station located at the reservoir site. Water levels in Boynton Reservoir can be used to control pump operation at the Mountainview Pump Station.

Figure 2-13. Boynton Reservoir

Henrici Reservoir (Figure 2-14) is located just outside of the southeast boundary of the Oregon City UGB. This reservoir provides a second gravity supply source for the Upper Pressure Zone, allowing either Henrici or Boynton to be taken out of service for maintenance or repair while minimizing operational issues in the system. The location of Henrici at the southern extremity of the service area has greatly improved fire flow and peak demand condition pressures in that portion of the system. Henrici Reservoir tends to fill slowly relative to Boynton Reservoir when the Mountainview Pump Station is operating; however, this situation is expected to diminish in the future as pipeline improvements and network expansions take place in the vicinity of Henrici. As with Boynton Reservoir, water levels in Henrici Reservoir can also be used to control pump operation at the Mountainview Pump Station.

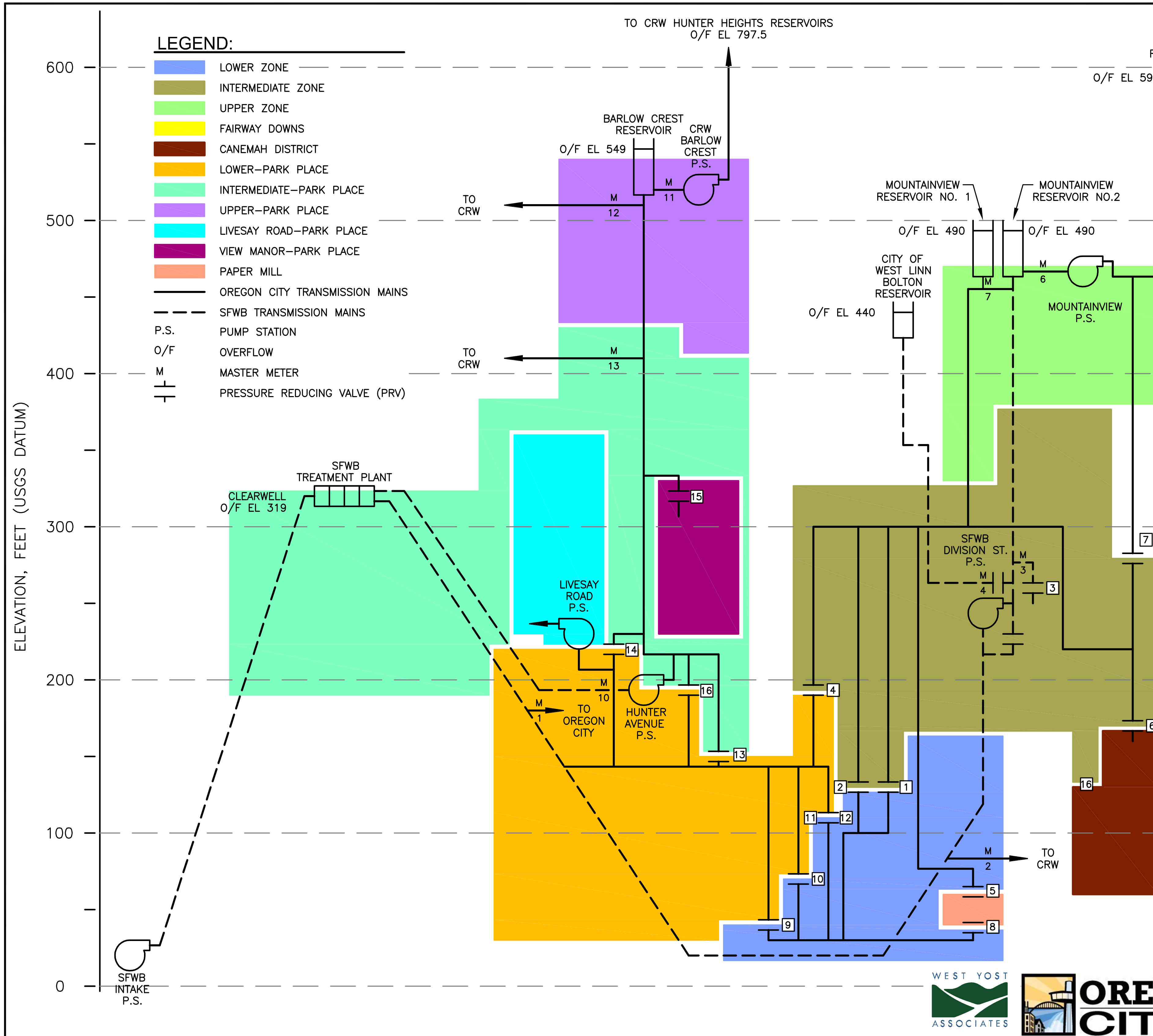
Figure 2-14. Henrici Reservoir

Barlow Crest (Figure 2-15) reservoir is located in the northeast corner of the Oregon City UGB and serves the Intermediate Zone of the Park Place District. The reservoir is filled by the Hunter Avenue Pump Station which is controlled by SCADA system monitoring of Barlow Crest reservoir water levels. CRW operates a pump station immediately adjacent to the reservoir. This pump station boosts water to CRW's Stoltz Reservoir which serves the Park Place Upper Zone.

Figure 2-15. Barlow Crest Reservoir

SERVICE PRESSURES

The urban growth boundary (UGB) for the City of Oregon City encompasses a wide range of elevations. Also, the City has annexed neighboring water distribution systems that contained independent water service pressure zones. As a result, the existing water distribution system is made up of eleven separate service pressure zones. Table 2-6 summarizes the service elevations and static pressure range for each pressure zone. The lower end of the pressure range is based on reservoirs at 80 percent full and the upper end is based on full reservoirs. Figure 2-16 illustrates the hydraulic profile of the Oregon City system including the SFWB facilities and Figure 2-10 illustrates the ultimate extent of each pressure zone within the Oregon City UGB. Only those areas within the present city limits are served by the existing Oregon City water distribution system with the exception of the Livesay Road area that is currently part of Clackamas County and an area near Winston, North of Holcomb Boulevard. CRW is currently serving the developed areas of these pressure zones outside of the city limits as well as all of the Upper Park Place Zone.



PRESSURE REDUCING VALVES

1. 11th AND WASHINGTON
2. 15th AND MADISON
3. 16th AND DIVISION
4. 18th AND ANCHOR WAY
5. 3rd AND BLUFF
6. 4th AND JEROME
7. 5TH AND CANEMAH
8. 99E AND MAIN (PAPER MILL)
9. ABERNETHY AND REDLAND
10. APPERSON AND LA RAE
11. HARLEY AND FORSYTHE (N)
12. HARLEY AND FORSYTHE (S)
13. JENNIFER ESTATES
14. SWAN AND HOLCOMB
15. VIEW MANOR
16. 3rd AND GANONG
17. HUNTER AVE. P.S.
18. LIVESAY AIR TANKS
19. FAIRWAY AIR TANKS

MASTER METERS

1. SERVES CITY OF OREGON CITY CLEVELAND STREET AND HIRAM AVE.
2. SERVES CLACKAMAS RIVER WATER REDLAND ROAD AND ANCHOR WAY
3. SERVES CITY OF WEST LINN 17th AND DIVISION STREET
4. SERVES CITY OF OREGON CITY 16th AND DIVISION STREET
5. SERVES CITY OF OREGON CITY MOUNTAINVIEW PUMP STATION
6. SERVES CITY OF OREGON CITY MOUNTAINVIEW STREET
7. SERVES CLACKAMAS RIVER WATER LELAND AND MEYERS ROADS
8. SERVES CLACKAMAS RIVER WATER SOUTH END ROAD AND IMPALA LANE
9. SERVES CITY OF OREGON CITY HUNTER AVENUE PUMP STATION
10. SERVES CLACKAMAS RIVER WATER BARLOW CREST PUMP STATION
11. SERVES CLACKAMAS RIVER WATER BARLOW CREST RESERVOIR
12. SERVES CLACKAMAS RIVER WATER SWAN AVENUE AND FORSYTHE ROAD

WEST YOST ASSOCIATES Consulting Engineers

OREGON CITY

FIGURE 2-16

CITY OF OREGON CITY

DISTRIBUTION SYSTEM HYDRAULIC PROFILE

P:\Clients\526 Oregon City\03-09-08 Water Master Plan Update\CAD\Figures\526-01-FIG_2-16.dwg 11/15/2010 9:58 AM opeters

Table 2-6. Pressure Zone Ranges

Zone	Lower Elevation, feet	Upper Elevation, feet	Pressure Range, psi
Lower Zone	10	116	68 - 114
Intermediate Zone	98	378	40 – 161
Upper Zone	292	500	34 – 141
Canemah Zone	74	140	54 –83
Fairway Downs Zone	470	518	55 –80
Lower Park Place Zone	44	218	43 – 118
Intermediate Park Place Zone	222	434	47 –142
Upper Park Place Zone – CRW	434	522	203 –233
View Manor Park Place Zone	324	326	35 –36
Livesay Road Park Place Zone	222	272	70-100
Paper Mill Zone	54	54	102

SYSTEM OPERATION

The general procedures for operation of the Oregon City water distribution system are discussed in the following sections.

South Fork Water Board Water Treatment Plant

The SFWB operates their water treatment plant (Figure 2-17) to fill the Oregon City and West Linn reservoirs. Therefore, the operating schedule varies with seasonal variations in water demand. During the low demand periods, the plant generally operates only during the evenings and night to take advantage of off-peak electrical power rates. Operational hours are extended during the high demand summer months, when the plant must operate nearly all day in order to keep the storage reservoirs full.

Figure 2-17. SFWB Water Treatment Plant

Booster Pumping Stations Serving Pressure Zones With Reservoirs

Those booster pumping stations that fill storage reservoirs (Mountainview and Hunter Avenue pump stations) are automatically controlled to maintain preset water levels. When sensors show that the water level in a reservoir has fallen below a preset threshold, the lead pump will activate and begin filling the reservoir to a high water level. If water demand on the reservoir is such that a single pump cannot maintain the water level, a lag pump (or pumps) will activate as necessary until the reservoir fills to a high water level. Although Boynton Pump Station serves a pressure zone with reservoirs, it is for emergency fire flow use only and is manually operated.

Booster Pumping Stations Serving Pressure Zones Without Reservoirs

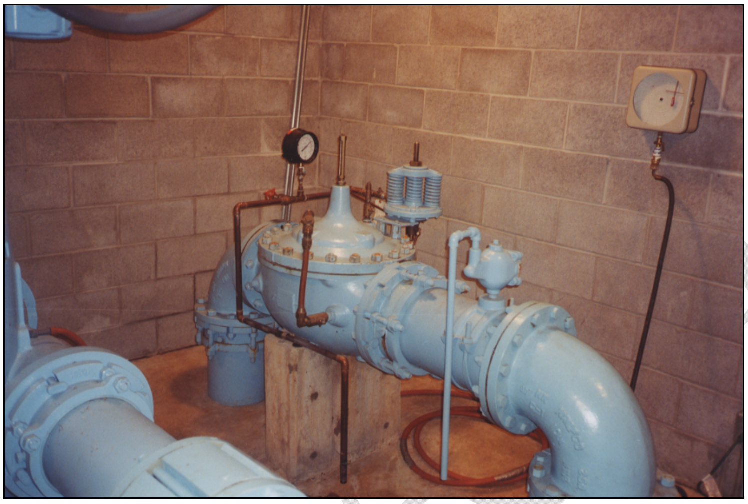
Those booster pumping stations that serve areas without storage reservoirs (Fairway Downs and Livesay Road pump stations) are automatically controlled to maintain a minimum discharge pressure at the pumping stations. For the Livesay Pump Station, when pressure sensors show that the discharge pressure has fallen below a preset threshold, the lead pump activates and pumps until the discharge pressure exceeds a high pressure level. At the Fairway Downs Pump Station, when water demand in the pump station's service area is such that a single pump cannot maintain the pressure level, a lag pump (or pumps) will activate as necessary until the system pressure is restored.

Reservoir Operation

The reservoirs in the water distribution system are generally maintained between 70 and 90 percent full, although levels may be lowered during low demand periods to improve turnover and ensure adequate chlorine residual levels. The fluctuating water volume represents the operating and equalization storage caused by pump station control strategies and non-uniform demand in the system. The remaining storage is allocated to providing fire flow requirements and emergency reserves.

Altitude valves (Figure 2-18) are in place to control the flow into and out of Boynton and Henrici reservoirs. These valves are designed to close when the reservoir is full and open when the system pressure drops. At Henrici Reservoir, the altitude valve is currently not in operation since the SCADA system is used to prevent overfilling. The other reservoirs in the distribution system float on the system.

Figure 2-18. Altitude Valve at Boynton Reservoir



Pressure Reducing Valve Operation

The pressure reducing valve (PRV) stations control the flow of water from upper pressure zones to lower pressure zones. Each station contains at least two PRVs, one large and one small. The small PRV provides service during normal operating conditions and the large PRV provides higher flows during a fire flow condition.

Supervisory Control and Data Acquisition (SCADA) System

The City recently upgraded the water distribution SCADA system to allow for improved monitoring and control of water operations. The new central computer system for the graphical user interface (GUI) is located at the Oregon City public works operations building at 122 South Center Street. Remote monitoring is also possible through the use of a laptop computer. The new SCADA system provides status information for each pump station, reservoir, and PRV station including the following:

1) Pump Stations:
   a) Run status
   b) Total elapsed run time
   c) All possible faults
   d) Suction and discharge pressure (Mountainview Pump Station)

   e) Pump station flow
   f) Intrusion
2) Reservoirs:
   a) Water level
   b) Hatch/Door intrusion
3) PRVs:
   a) Upstream pressure
   b) Downstream pressure
   c) Intrusion
   d) Power fail

Water operations staff control set points for pump operation at the Mountainview and Hunter Avenue pump stations. The system also monitors pump operation at Barlow Crest (a Clackamas River Water pump station) but does not control set points.

WATER QUALITY MONITORING

The City conducts regular water quality monitoring in the distribution system to ensure the provision of safe drinking water to customers. The City's regular activities focus on ensuring compliance with federal and state regulations, monitoring the flow of water through pump stations and reservoirs, and addressing any issues of concern to water customers. Table 2-7 shows the City's current monitoring sites.

Specific water quality sampling activities include the following:

- A minimum of 30 bacteriological samples are collected each month from locations that are representative of the entire distribution system.
- Compliance samples for Stage 1 Disinfectant By-Products Rule (DBPR) are collected from four designated sites on a quarterly basis. Results are reported to DHS quarterly.
- Sampling for Stage 2 DBPR compliance will begin in November 2013 at four designated sites. See Oregon City's Stage 2 DBPR Compliance Monitoring Plan for more information.
- In the limited areas where asbestos-cement pipe is still in service, asbestos sampling is required every three years.
- Lead and Copper Rule requirements are met via an Oregon DHS-approved Joint Monitoring Plan for Oregon City and West Linn.

As a community water system, the City delivers an annual water quality report to all water customers. The City also uses these reports to update the community on improvements to the water distribution system and to answer frequently asked questions.

Additional programs that optimize water quality in the distribution system include a program for controlling and eliminating cross connections and an annual (or as-needed) dead-end line flushing program.

Table 2-7. Water Sampling Stations (WSS)

Station Number	Location	Sample Type
WSS03	19225 Central Point Road	R
WSS04	304 5th Avenue	R
WSS05	14901 Glen Oak Road	R
WSS06	1810 Red Soils Court	R
WSS07	16298 Oak Tree Terrace	R
WSS08	816 Harrison Street	R
WSS09	19413 Cokeron Drive	R
WSS11	Gaffney/Meyers	R
WSS12	19445 Silverfox Parkway	R
WSS13	1826 Davis Road	R
WSS14	15057 Spy Glass Lane	R
WSS15	14168 Livesay Road	R + Asbestos
WSS16	11519 Parrish Road	R
WSS17	Hiram/Cleveland	R
WSS18	15815 Pope Lane	WQM
WSS19	224 Center Street	R
	19077 Dallas Street	R
	Traveler Road	WQM
	Toman Road	WQM
	1900 Clackamette Drive	R
	Whitehorse Court	WQM
	Pasture Way	WQM
	Scarlet Oak Street	WQM
	275 Amanda Court	R
	14212 Fir Street	R
	1220 Main Street	R
	Creed Street and Promontory Avenue	R
	13665 Holcomb Boulevard	R
	20079 Chanticleer Place	R
	Shore Pine Place	R
	Peter Skene	R
	Henrici Reservoir	R
	437 Mountainview Street – E	R
	437 Mountainview Street – W	WQM
	Sassafras Way	WQM

R = Routine sample site listed in Coliform Sampling Plan
WQM = Currently used for water quality monitoring only

CHAPTER 3. WATER DEMAND ANALYSIS

This chapter presents historic data on water deliveries to the City from the South Fork Water Board (SFWB) as well as customer demand data from the City's billing records. These historical data define the unique patterns that characterize water use in the City and provide a framework for projecting future water demand in the community. Analysis of the data also relates the various measures of water demand (maximum monthly demand, maximum daily demand, and peak hour demand) to the average annual demand through the use of peaking factors.

The projection of future water demand is based on unit demand factors that are indexed to land use categories and population levels. These future demand projections provide the basis for assessing the adequacy of the existing water distribution system and planning for future improvements.

EXISTING WATER USE

There are several measures of water use that are important to analyze during the development of the water master plan. Following is a description of the critical water demand factors that will guide planning decisions with respect to the City's water distribution system:

- Annual average demand – A measure of the average amount of water used by the community on an annual basis. The annual average demand can be compared to annual billing records to assess the unaccounted-for water rate.
- Monthly average demand – A measure of the amount of water used by the community in a given month. Review of monthly average water demand illustrates seasonal variations in demand due to such factors as climate, irrigation, industrial production, and domestic use patterns.
- Maximum day demand – A measure of the maximum amount of water used by the community in a single day. The maximum daily water demand is used to size booster pumping stations that serve areas with storage reservoirs. This measure of demand is also used in conjunction with fire demands and emergency supplies to size storage reservoirs.
- Peak hour demand – A measure of the maximum amount of water used by the community in a single hour. The peak hour water demand is used to size pipelines and booster pumping stations that serve pressure zones without reservoirs.

Analysis of the water demand factors described above allows for the development of peaking factors, expressed as a ratio of each factor to the annual average demand. Historical peaking factors are useful for comparing the system-wide water use patterns in the City to other communities and for projecting future water use patterns.

Historical Water Production and Consumption

Water production is the portion of SFWB's treated water that is delivered to the City while water consumption is the quantity of water actually consumed or used by its customers. As will be discussed later, the difference between production and consumption is unaccounted-for water.

The City regularly monitors master metering stations that record the volume of water delivered by the SFWB. The City reads the meters on a monthly basis for the purpose of calculating payments to the SFWB. Table 3-1, Monthly Historical Water Use, presents historical delivered water data for the past five years, from 2004 to 2008. Figure 3-1, Historical Water Production, presents this same information in a graphical form and compares total historical water production and historical average annual rainfall. As shown in Figure 3-1, the City's water demands increased at a relatively stable growth rate over the past 12 years, with a low demand period in 1995, followed by a sharp decrease in 2007. The low demand periods (including the sharp decrease in 2007) appear to be the result of above average rainfall (1994) and water conservation efforts, of which, the City has participated. A major component of the City's water conservation effort has been an aggressive approach to decrease the amount of unaccounted-for water. This is being accomplished through the installation of meters on City owned property and replacement and repair of leaky pipelines. Based on this program and the above average rainfall in 2006, the large increase in annual production in 2006 appears to be an anomaly. The City should consider investigating the causes of this spike and whether this was an anomaly or whether it should be removed from the average annual production estimates. Based on the data presented in Table 3-1, it is also possible to identify a peaking factor between the average annual demand and the maximum monthly demand. Table 3-2 summarizes the peaking factor analysis for maximum monthly demand.

From 2002 to 2008, master metering data indicated that the average annual demand ranged from 3.73 mgd to 4.16 mgd. The highest monthly average water demand was 7.80 mgd in August of 2005. Analysis of these historical data indicates that the average peaking factor for the maximum monthly demand is 1.77.

Figure 3-1. Historical Water Production

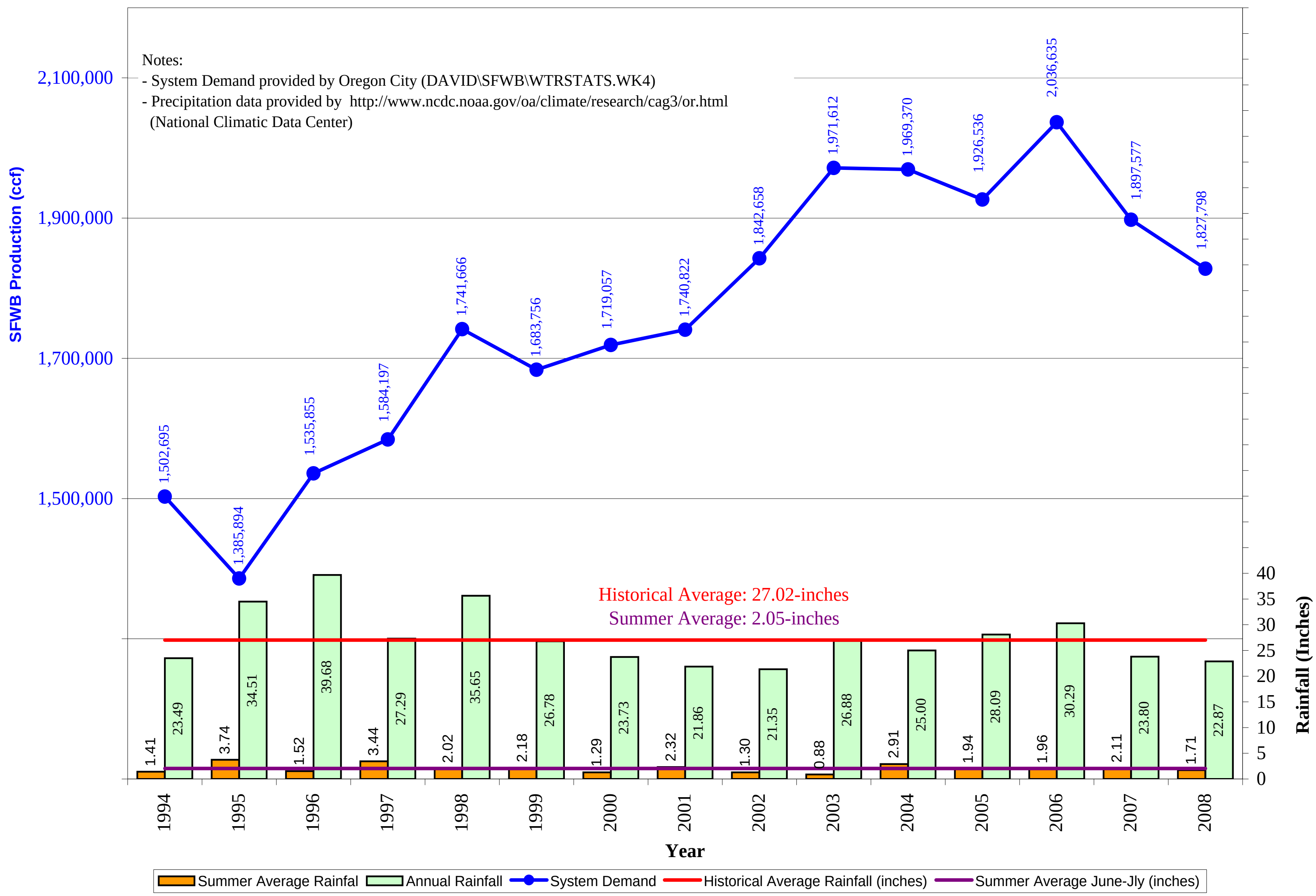


Table 3-1. Monthly Historical Water Use[a]

Month	Monthly Average Demand, mgd[b]				
	2004	2005	2006	2007	2008
January	2.93	3.33	3.23	3.36	2.52
February	2.82	2.71	2.67	2.63	2.65
March	2.92	3.10	2.72	2.70	2.67
April	3.62	2.95	2.77	2.98	2.82
May	4.13	3.44	4.53	3.89	3.29
June	4.94	3.65	4.80	5.14	4.66
July	6.89	5.40	7.45	6.62	6.46
August	6.43	7.80	6.97	5.24	5.60
September	3.94	5.78	5.48	5.67	5.24
October	3.59	2.95	3.28	2.74	3.18
November	3.01	3.12	3.15	2.78	2.94
December	2.98	3.12	2.82	2.80	2.75
Average Annual Demand	4.02	3.93	4.16	3.88	3.73
Maximum Month Demand	6.89	7.80	7.45	6.62	6.46
Monthly Peaking Factor	1.71	1.98	1.79	1.71	1.73
Average Annual Rainfall (inches)	25.00	28.09	30.29	23.80	22.87

[a] Data provided by Oregon City (DAVID\SFWB\WTRSTATS.WK4).
[b] mgd: million gallons per day.

Table 3-2. Maximum Monthly Demand Peaking Factor[a]

Year	Average Annual Demand, mgd	Maximum Monthly Demand, mgd	Maximum Month Peaking Factor
2002	3.76	6.43	1.71
2003	4.03	7.14	1.77
2004	4.02	6.89	1.71
2005	3.93	7.80	1.98
2006	4.16	7.45	1.79
2007	3.88	6.62	1.71
2008	3.73	6.46	1.73
Average	-	-	1.77

[a] Data provided by Oregon City (DAVID\SFWB\WTRSTATS.WK4).

Maximum Daily Water Demand

Since the City's master meters are read on a monthly basis, historical data on the daily delivered water volumes to the City are not available. However, the SFWB does maintain daily records of their overall water production volume. Since variations in the treatment plant's daily production typically correspond to the daily variations in demand within the served water systems, the peaking factor for the SFWB's daily production should roughly conform to the peaking factor for daily demand in the City's water distribution system. Table 3-3 presents the average annual, maximum month, and maximum daily production rates for the SFWB treatment plant from 2002 to 2008. Also, shown in the table are the resulting peaking factors for the maximum monthly and maximum daily flows.

Table 3-3. SFWB Water Production Data and Peaking Factors[(a)]

Year	Average Annual Production, mgd	Maximum Monthly Average, mgd	Maximum Daily Average, mgd	Maximum Month Peaking Factor	Maximum Daily Peaking Factor
2002	8.58	15.72	N/A	1.83	N/A
2003	9.50	17.10	19.70	1.80	2.07
2004	9.00	16.20	19.70	1.80	2.19
2005	8.80	16.40	19.60	1.86	2.23
2006	9.30	17.10	22.10	1.84	2.38
2007	8.70	15.20	20.00	1.75	2.30
2008	8.40	15.40	19.90	1.83	2.37
Average	-	-	-	1.81	2.26

(a) Data provided by Oregon City (DAVID\SFWB\WTRSTATS.WK4 and Plant Production data.pdf).

The maximum month peaking factor for the SFWB treatment plant of 1.81 corresponds well to the maximum month peaking factor of 1.77 that was independently determined for the City's water distribution system in the preceding section. It is reasonable to expect that the SFWB plant's maximum daily peaking factor of 2.26 will also correspond well to the maximum daily demand in the City.

Peak Hour Demand

The peak hour demand on a water distribution system in Western Oregon typically occurs during mid-summer when customers are heavily irrigating landscaped yards and parks. For the City of Oregon City, the peak hour demand would be expected to happen in the month of July or August during the peak day demand. An estimate of the peak hour demand is typically developed based on an analysis of hourly water production data from each of the reservoirs in the distribution system during the summertime peak demand period. In combination with hourly data on the SFWB delivered water rate for that period, it is then possible to identify the peak hour demand. Since this level of detail on system operations is currently not available from the City's SCADA system records, it was not possible to develop a precise estimate of peak hour demand for the City. However, a review of the peaking factors reported by other Western Oregon communities with similar variation in seasonal demand indicates that the system-wide peak hour demand for the City is likely to be 4.5 times the average annual demand. Since this is a system-wide peaking factor, local peaking factors may be higher for small areas or areas with exclusively single-family residences.

Summary of Existing Water Demand and Peaking Factors

Table 3-4 summarizes the system-wide water demand and peaking factors for the City based on analysis of data from the past five to seven years. The maximum day demand is estimated using a peaking factor from the SFWB treatment plant, and the peak hour demand is estimated using a general Western Oregon peaking factor. All of the identified peaking factor values are fairly typical for a Western Oregon community. The system-wide peaking factors for the City provide a basis for projecting future water demand patterns for the community.

Table 3-4. Existing Oregon City Demand and System-Wide Peaking Factor Summary[(a,b)]

Description	Current Demand, mgd	Peaking Factor
Average annual demand	3.73	1.0
Maximum month demand	6.46	1.8
Maximum day demand	8.74	2.3
Peak hour demand	16.79	4.5

(a) Data provided by Oregon City (DAVID\SFWB\WTRSTATS.WK4 and PSU Population Report 2002-2008).
(b) The average demand multiplied by the peaking factor yields the respective demand.

Per Capita Water Demand

Per capita water demand is also a useful demand measure that is derived from the preceding historical data. Table 3-5 presents the population for the City along with the average annual demand during the past seven years which allows for calculation of the average demand in gallons per capita per day (gpcd). Ranging from 123 gpcd to 143 gpcd, the average daily water demand is 136 gpcd. Note that this unit demand factor is based on water production and includes all uses: residential, commercial, industrial, institutional, and unaccounted-for or lost water. Variation in per capita demand from year to year is expected due to irregular water use patterns caused by unsteady weather and end user demand characteristics; however there appears to be a decreasing trend in the data for years 2007 and 2008. These years show noticeable drop in per capita demand that corresponds to a drop in production at the SFWB Treatment Plant. These drops could be due to the loss of a significant customer, the repair of significant leaks or conservation, for example. This information is presented graphically on Figure 3-2.

Figure 3-2. Comparison of Historical Per Capita Demand, System Demand & Population

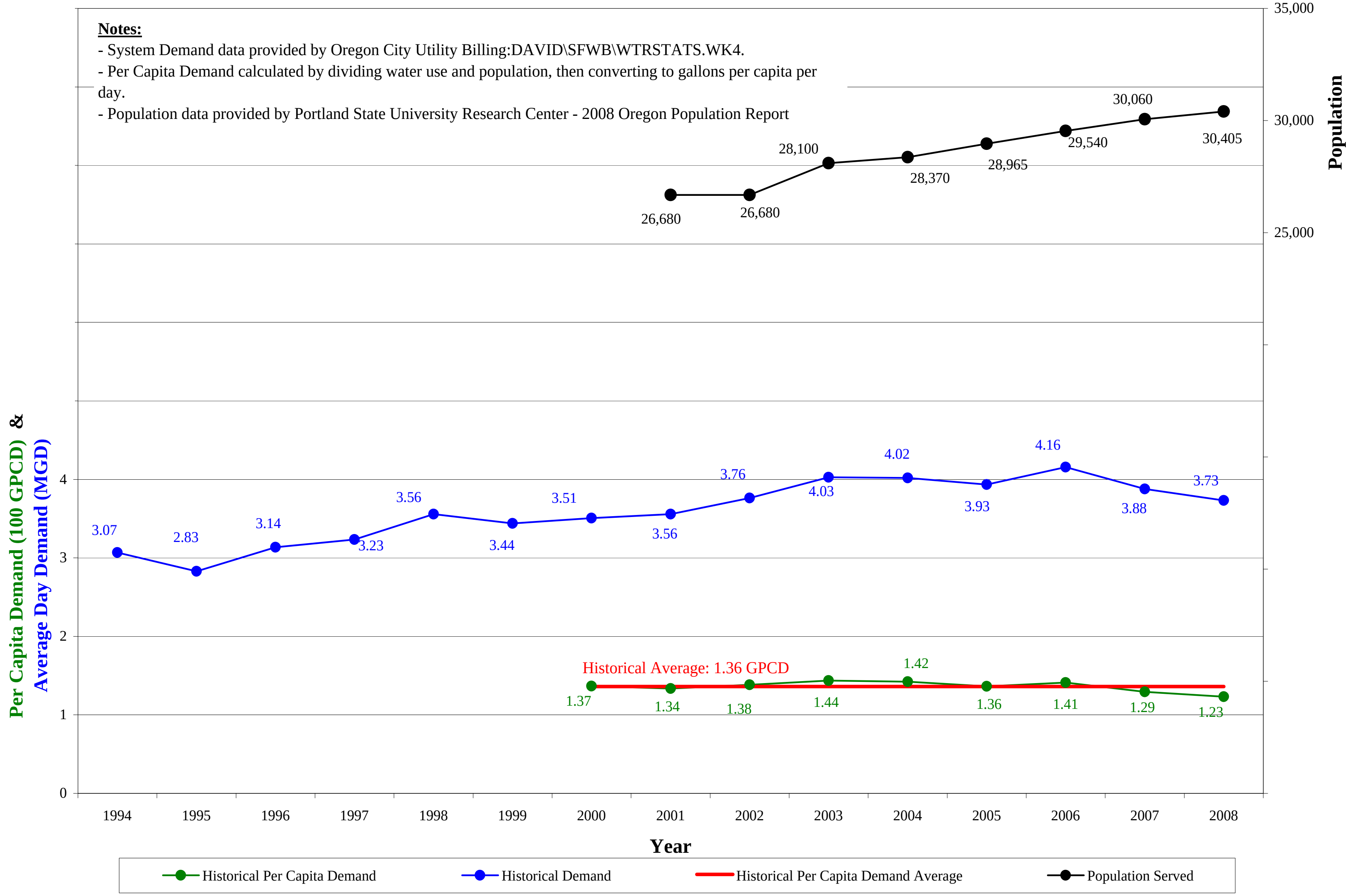


Table 3-5. Per Capita Water Demand for 2002 – 2008[a,b]

Year	Population	Average Demand, mgd	Average Demand, gpcd[c]
2002	27,270	3.76	138
2003	28,100	4.03	143
2004	28,370	4.02	142
2005	28,965	3.93	136
2006	29,540	4.16	141
2007	30,060	3.88	129
2008	30,405	3.73	123
Average	-	-	136

(a) Demand includes all uses (residential, commercial, industrial, institutional, and unaccounted).
(b) Data provided by Oregon City (DAVID\SFWB\WTRSTATS.WK4 and PSU Population Report 2002-2008).
(c) gpcd: gallons per capita per day.

High Consumption Water Customers

The City serves a number of high consumption water customers. In order to ensure that the high demand associated with these customers are accounted for in the planning process, the largest customers are identified by location to ensure an accurate allocation of large demands in the hydraulic model. Table 3-6 identifies the Top 25 customers with a water demand greater than 0.3 million gallons per month (0.011 million gallons per day), in addition to their location and user category.

Table 3-6. High Consumption Water Customers in Oregon City[a]

Facility	Address	User Category	Average Water Demand, mgd
Blue Heron Paper Mill	401 Main St	Industrial/Commercial	0.13
Clackamas Community College	19600 S. Molalla Ave	Institutional	0.083
Clackamas County Complex	2106 Kaen Road	Institutional	0.069
Providence Willamette Falls Medical Center	1500 Division St	Institutional	0.052
Pioneer Ridge Apartments	13826 S. Meyers Rd	Multi-Family	0.052
Chapin Park	Warner Parrott Road	City Account	0.051
King's Berry Heights Apartments	14290 Marjorie Ln	Multi-Family	0.050
Clackamas County Housing Authority	13930 Gain St	Institutional	0.041
Mountainview Cemetery	500 Hilda St	City Account	0.039
Clairmont Mobile Home Park	13531 Clairmont Way	Single-Family	0.033
OC Shopping Center	1900 McLoughlin Blvd	Commercial	0.021
Hidden Creek Apartments	19839 S Hwy 213	Multi-Family	0.020
South Ridge Shopping Center	1630 Beavercreek Rd	Commercial	0.018
Oregon City Health Care Center	148 Hood St	Institutional	0.018
Oregon City High School	19761 Beavercreek Rd	Institutional	0.017
Public Works/Sewer Pump Station [b]	Wild Bill Ct	City Account	0.017
Barclay Hills Apartments	775 Cascade St	Multi-Family	0.017
Sierra Vista Nursing home	1680 Molalla Ave	Institutional	0.017
Del Mesa Farms	2500 Beavercreek Rd	Industrial/Commercial	0.017
The Home Depot	2002 Washington St	Commercial	0.016
Mt Pleasant Mobile Home Park	18780 Central Point	Single-Family	0.016
Browning/Ferris Industries	2001 Washington St	Industrial/Commercial	0.013
Sandvik Medical Solutions	13963 Fir St	Industrial/Commercial	0.011
Fred Meyer Shopping Center	1839 Molalla Ave	Commercial	0.011
Gilman Park	2205 Gilman Dr	Multi-Family	0.011

(a) Data provided by Oregon City (DAVID\SFWB\WTRSTATS.WK4).
(b) Public works has located the source of this high water using pump station and reduced the use.

Unaccounted-for Water

All water distribution systems experience losses of water during distribution to the end user. These losses, known as unaccounted-for water, result from many situations including unmetered customers, transmission system leaks, reservoir leaks, main breaks, faulty meters, over-filling reservoirs, fire fighting activities, system flushing, and other miscellaneous hydrant uses. Thus, the total volume of water metered for all end users in the City is expected to be less than the volume of water delivered by the SFWB.

Table 3-7 shows the estimated volume of unaccounted-for water in millions of gallons (MG) and also as a percentage of total delivered water during the past seven years. Although the schedules for reading the master meters are quite different than the schedules for reading customer meters, the average unaccounted-for water rate over a full one-year period will provide a reasonable estimate. The seven year average number will be even more accurate. In this case, there appears to be an outlier in the year 2005 that is abnormally high as compared to adjacent years. As such, this number is discarded for the seven year average.

A distribution system in good condition typically shows a water loss rate of 10 to 15 percent. Therefore, the calculated unaccounted-for water rate of 16.8 percent indicates that the volume of under-reported water use in the City is fairly significant and warrants further attention. The drop off seen in 2008 could be the result of leak repairs by the City and may be the start of a lower average in years to come. Since the City has made significant efforts in recent years to install meters for all customers including City owned parks and facilities, unmetered customers are not expected to be a major source of unaccounted-for water. Since 2000, the City is also averaging 450 old meter change outs per year, as well as more than 10,000 feet of pipeline replacement per year. Ongoing refinement of master metering and record keeping practices is anticipated to further reduce the volume of unaccounted-for water in the coming years. The City may wish to consider implementing other programs that will reduce the unaccounted-for water rates such as continued replacement of old customer meters, metering of construction site water use, and improved monitoring of hydrant use for system flushing and fire fighting. The leak detection efforts made in recent years by the City should continue and should focus on the older, higher pressure areas of the distribution system where leaks are most to occur and are most likely to be significant.

Table 3-7. Unaccounted-for Water, 2002-2008[(a)]

Year	Delivered Water, MG	Metered Water, MG	Unaccounted-for Water, MG	Percent of Total Delivered Water
2002	1,378	1,177	201	14.6
2003	1,475	1,231	244	16.5
2004	1,473	1,196	278	18.9
2005	1,441	1,057	384	26.6[(b)]
2006	1,523	1,249	275	18.0
2007	1,273	1,185	235	18.5
2008	1,332	1,171	196	14.7
Average	-	-	-	16.8%

(a) Data provided by Oregon City (DAVID\SFWB\WTRSTATS.WK4).
(b) Discarded from average as an outlier.

Unit Demand Factors by Land Use

The development of water demand factors related to land use patterns provides another important perspective on water demand in the community. Based on historical billing data provided by the City's Finance Department for the period between 2002 and 2008, Table 3-8 summarizes the

Table 3-8. Historical Services by Revenue Class[a]

Year	Residential	Institutional	Commercial	Industrial	Multiple Units	Seniors Citizens	Residential Out	Comm/Ind Out	Total Services
2002	7,351	84	458	4	403	113	25	1	8,439
2003	7,587	86	456	4	402	122	22	1	8,680
2004	7,770	87	456	5	403	121	24	1	8,867
2005	8,056	83	464	2	404	123	23	1	9,156
2006	8,316	83	484	2	401	117	23	1	9,427
2007	8,564	84	494	2	404	110	23	1	9,682
2008	8,671	85	497	2	409	113	23	1	9,801
Historical Average	8,118	85	476	3	404	117	23	1	9,164
7-Year Average[b]	8,045	85	473	3	404	117	23	1	9,150
5 Year Average[c]	8,275	84	479	3	404	117	23	1	9,387
Average Annual % Growth	2.79%	0.19%	1.16%	-5.00%	0.18%	0.09%	-1.01%	0.00%	1.38%

(a) Data provided by Oregon City Water Consumption 2002-2009(Account Type).xls
(b) 7-Year Average: 2002-2008
(c) 5-Year Average: 2003-2007

total number of services by revenue class. Some revenue classes were combined with others to create four general customer class categories: single family residential, multi-family residential, institutional, and industrial/commercial. The "Senior Citizens" revenue class was combined with multi-family, "Residential Comm/Ind Out" was combined with industrial/commercial, and "Residential Out" was combined with single-family residential. Table 3-9 summarizes annual average water demand within these customer classes. As indicated in the percentage summary of annual average demand by customer class category, the single family residential classification accounts for almost two-thirds of the water used in the City.

Table 3-9. Water Use by Customer Class, 2002-2008[(a)]

Year	Demand, mgd[(b)]				
	Single Family	Institutional	Multi-Family	Industrial/ Commercial	Total
2002	2.16	0.33	0.63	0.65	3.78
2003	2.42	0.29	0.65	0.68	4.04
2004	2.36	0.34	0.63	0.70	4.04
2005[(c)]	2.22	0.32	0.64	0.77	3.95
2006	2.42	0.42	0.62	0.72	4.17
2007	2.32	0.28	0.58	0.71	3.89
2008	2.22	0.30	0.55	0.66	3.74
Historical annual average demand	2.32	0.33	0.61	0.69	3.94
Percent of total annual average demand	59%	8%	16%	17%	100%

(a) Water use includes unaccounted-for water
(b) Data provided by Utility Billing (Oregon City Water Consumption 2002-2009 (Account Type).xls)
(c) Utility Billing software upgraded data is not complete and is not used for determining Historical Annual Average Demand

To develop a unit demand factor for the four different customer use types, the water use data presented in Table 3-9 is combined with estimated areas for each of the customer use categories. Figure 3-3 shows the land use designations within the Urban Growth Boundary (UGB). Each land use classification was associated with one of the four major customer use types: single family residential, multi-family residential, institutional, and industrial/commercial. Table 3-10 summarizes the assignment of each land use classification to a customer use category.

Table 3-11 summarizes the existing land use acreages by customer use category for all areas within the City limits. The quotient of water demand and existing land use acreage yields a unit demand factor for each customer use category in gallons per acre per day (gpad), as summarized in Table 3-12. Based on these calculated unit demand factors, Table 3-12 also includes recommended unit demand factors for future planning. These planning level demand factors allow for more intensive water consumption patterns in the future, especially for the City's industrial/commercial land use, which currently exhibits relatively low levels of water demand.

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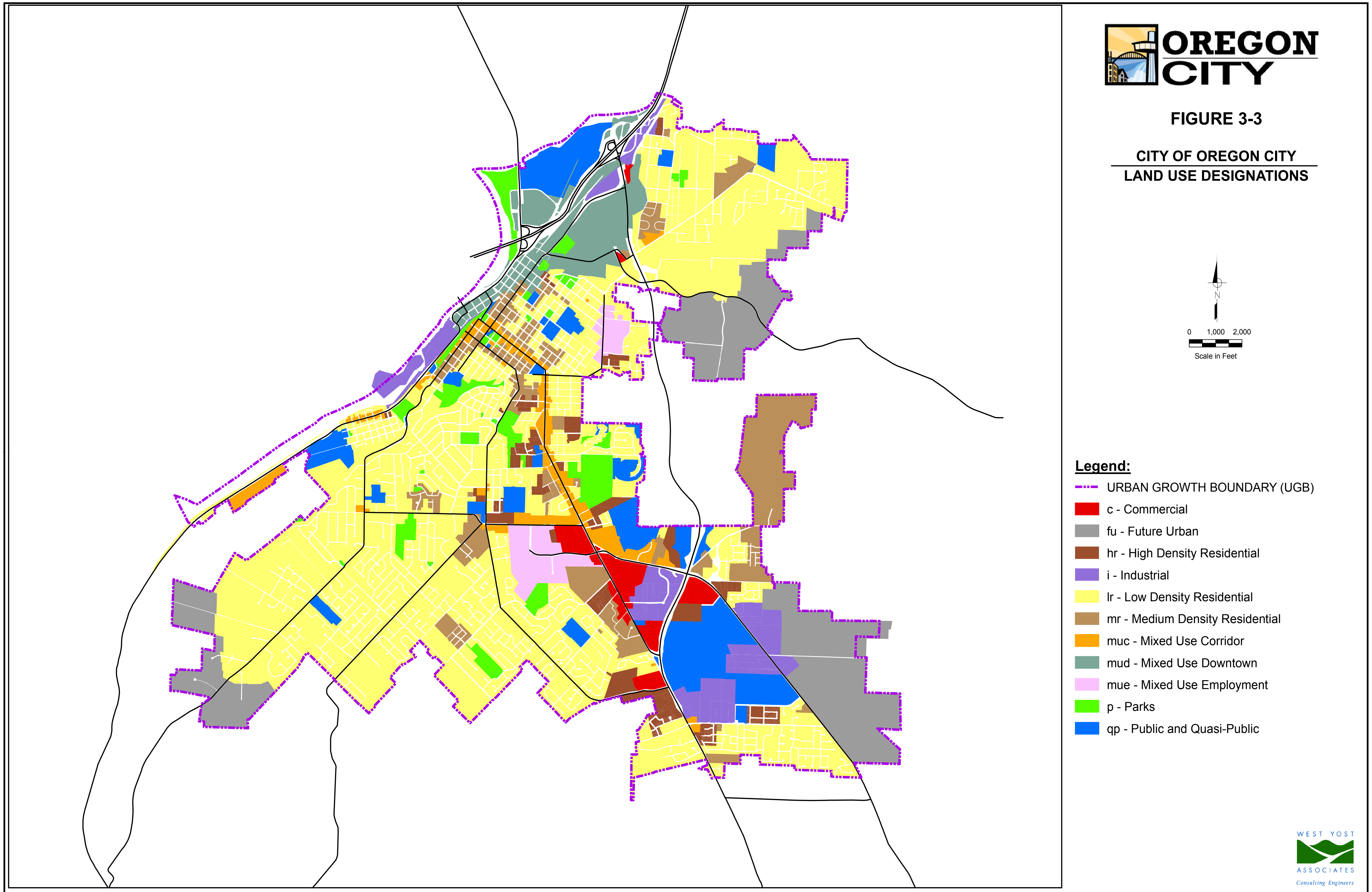


Table 3-10. Land Use Classification by Customer Use Category

	Customer Use Category			
	Single Family	Multi-Family	Institutional	Industrial/Commercial
Zoning Classifications	Low Density Residential	High Density Residential	Parks	Commercial
	Medium Density Residential		Public and Quasi-Public	Mixed Use Corridor
				Mixed Use Downtown
				Mixed Use Employment
				Industrial
				Future Urban

Table 3-11. Land Use in Acres

Customer Use Category	2001 Served Area[a], acres	Percentage	2008 Served Area[b], acres	Percentage
Single Family Residential			2,396	58
Institutional[c]	2,932	71	800	19
Multi-Family Residential	302	7	171	4
Commercial/Industrial	933	22	767	19
Total	4,167	100%	4,134	100%

(a) Area based on Table 3-10 in the 2004 WMP.
(b) Area based on taxlots data within the City Limits minus vacant area data without existing water use.
(c) Institutional water use category was combined with the Single Family Residential water use in the 2004 WMP.

Table 3-12. Summary of Recommended Unit Water Demand Factors[a]

Customer Use Category	2008 Water Use[b], mgd	2008 Served Area, acres	Calculated Unit Demand Factor, gpad	Normalized Unit Demand Factor[c], gpad
Single-Family Residential	2.22	2,396	930	1,050
Institutional	0.30	800	380	450
Multi-Family Residential	0.55	171	3,230	3,600
Commercial/Industrial	0.66	767	870	1,000
Total	3.74	4,134	--	--

(a) Data provided by Utility Billing (Oregon City Water Consumption 2002-2009 (Account Type).xls)
(b) Includes unaccounted-for water.
(c) Equal to the calculated unit demand factor multiplied by the normalization factor of 1.11 (based on 2006 annual production).

FUTURE WATER DEMAND

Projections of future water demand for the City's water distribution system are based on the unit demand factors developed in the preceding section. The following analysis presents estimates of the City's water demand for both the 20-year planning horizon (year 2030) and for build-out of the existing UGB.

Year 2030 Water Demand Projection

The year 2030 water demand projection is based on the anticipated rate of population growth in the City over the next 20 years. Since water demand patterns in the City are not anticipated to change significantly during the planning period, the projected future population provides a sound basis for estimating future water demand for the system. The most recent population projections by Metro (20 and 50 year Regional Population and Employment Range Forecasts, April 2009 draft) anticipate that the region will grow at an annual average rate of 1.14 to 1.3 percent. However, review of historical data indicates that the annual average growth rate in the City was six percent during the 1990s. Since the rate of growth will determine the necessary timing of certain improvement projects, it is recommended that the City consider the possibility of faster growth rates during development of the capital improvement plan and financing plan. To allow for consideration of potentially higher rates of growth than the Metro projections, all analysis of future conditions will consider both 1.5 percent and 3.0 percent annual growth rates (half that of the growth rate seen in the 1990s). At a growth rate of 1.5 percent, the City's existing population of 30,405 will grow to 41,565 by the year 2030. At a growth rate of 3.0 percent, the population will grow to 56,562 during the same period.

The future population can be translated into a future water demand using the per capita water demand factor of 136 gpcd developed earlier. Using this figure, the year 2030 average annual water demand will be 5.7 mgd at the 1.5 percent growth rate and 7.7 mgd at the 3.0 percent growth rate. Based on these estimates of the year 2030 average annual demand, the corresponding estimates of maximum day, and peak hour demand can be estimated using the historical peaking factors. Table 3-13 summarizes the water demand projections for the year 2030 condition.

Table 3-13. Year 2030 Water Demand Projection Summary[(a)]

Description	Current Water Demand, mgd	Year 2030 Water Demand at 1.5% Growth	Year 2030 Water Demand at 3% Growth
Average Annual	3.73	5.66	7.76
Maximum Day	8.74	13.26	18.17
Peak Hour	16.79	25.47	34.91

(a) Data provided by Oregon City (DAVID\SFWB\WTRSTATS.WK4).

UGB Build-Out Water Demand Projection

The projection of water demand in the City at build-out of the urban growth boundary is based on the land use demand factors developed earlier in conjunction with an estimate of the City's ultimate urban area. Assuming a future customer use profile similar to the existing community, Table 3-14 summarizes the acreage of properties within the UGB by customer use category. Using these acreages and the unit demand factors developed for these customer use categories, the projected average annual water demand at the City's UGB build-out condition is 7.0 mgd. Since this demand projection falls very close to the year 2030 estimate at a growth rate of 3.0 percent, it appears that the City could achieve build-out of the existing UGB within 20 years.

Table 3-14. UGB Buildout Water Demand Projections[(a)]

Customer Use Category	UGB Area[(b)], acres	Normalized Unit Demand Factor, gpad	Average Annual Demand[(c)], mgd
Single Family Residential	3,756	1,050	3.94
Institutional	821	450	0.37
Multi-Family Residential	223	3,600	0.80
Commercial/Industrial	1,904	1,000	1.90
Total	6,704	--	7.01

(a) Data provided by Oregon City (DAVID\SFWB\WTRSTATS.WK4).
(b) Area based on taxlots data within the UGB.
(c) Includes unaccounted-for water.

Based on this estimate of the build-out average annual demand, the corresponding estimates of maximum day, and peak hour demand can be estimated using the historical peaking factors. Table 3-15 summarizes the water demand projections for the UGB build-out condition.

Table 3-15. Summary of Buildout Water Demand Projections[(a)]

Customer Use Category	Average Day Demand, mgd	Maximum Day Demand[(b)], mgd	Peak Hour Demand[(c)], mgd
Single Family Residential	3.94	9.07	17.75
Institutional	0.37	0.85	1.66
Multi-Family Residential	0.80	1.85	3.62
Commercial/Industrial	1.90	4.38	8.57
Total	7.01	16.15	31.60

(a) Includes unaccounted-for water.
(b) The City's maximum day demand is 2.3 times the average day demand.
(c) The City's peak hour demand is 4.5 times the average day demand.

Master Meters

The City conveys SFWB water through its distribution system for delivery to Clackamas River Water District (CRW) and the City of West Linn at seven different locations. Since this practice will continue for the foreseeable future, it is necessary to plan for providing adequate system capacity for these water wheeling services in addition to serving the City's own customers. Table 3-16 summarizes the most recent annual average water deliveries to CRW and West Linn at each of the seven delivery locations. An estimate of the maximum day demand is also provided based on a peaking factor of 3.0. A maximum day peaking factor greater than the City's peaking factor is warranted due to the higher percentage of residential development within the CRW and West Linn service areas.

Table 3-16. Water Wheeled to CRW in 2008[(a)]

Location	Average Annual Demand, mgd	Maximum Daily Demand, mgd
Redland Rd & Anchor Way (MM2)	0.92	2.77
Meyers and Leland Roads (MM8)	0.07	0.20
South End Rd & Impala Ln (MM9)	0.04	0.10
Barlow Crest Pump Station (MM11)	0.24	0.73
Barlow Crest Reservoir (MM12)	0.01	0.02
Forsythe Rd & Swan Ave (MM13)	0.01	0.03
17th and Division (MM3)	2.97	2.77
Total	4.26	12.77

(a) Data provided by Oregon City (MasterMeterRecord2008.xls).

Future demand for the areas served by CRW through the City delivery locations is uncertain. Portions of the CRW service areas will be incorporated into the City's system as the city limits expand toward the UGB while CRW continues to add customers outside of the UGB. Metro projections for these unincorporated areas are not available, but CRW staff feel that two percent annual growth is a reasonable estimate. Therefore, for the purpose of the master planning process, it is assumed that the CRW demands on the City's future water system will grow at an average annual rate of two percent. Based on this growth rate, Table 3-17 summarizes CRW demands in the year 2030. Table 3-18 the total usage summary of Oregon City's water by sales category.

Table 3-17. Projection of Future Water Wheeled to CRW in 2030[a]

Location	Average Annual Demand, mgd	Maximum Daily Demand, mgd
Redland Rd & Anchor Way (MM2)	1.43	4.28
Meyers and Leland Roads (MM8)	0.10	0.31
South End Rd & Impala Ln (MM9)	0.05	0.16
Barlow Crest Pump Station (MM11)	0.37	1.12
Barlow Crest Reservoir (MM12)	0.01	0.03
Forsythe Rd & Swan Ave (MM13)	0.02	0.06
17th and Division (MM3)	4.60	13.79
Total	6.58	19.75

(a) Data provided by Oregon City (MasterMeterRecord2008.xls) and expanded using a 2% growth rate.

Table 3-18. Projection of Future Water Use by Use Category Year in 2030

Use Category	Average Annual Demand, mgd	Maximum Daily Demand, mgd	Peak Hour Demand, mgd
Retail Water Use	7.01	16.15	31.60
Wholesale Water Use	6.58	19.75	19.75
Total Water Use	13.59	35.90	51.35

CHAPTER 4. WATER DISTRIBUTION SYSTEM SERVICE STANDARDS

The purpose of this chapter is to define the water distribution service standards for analyzing the performance of the City's potable water distribution system. The service standards recommended in this chapter provide a basis for evaluating the City's existing water distribution system and guide the planning and design of those improvements to the water system that are necessary to meet future demands. These standards include the desired fire flow and flow duration, definition of "emergency events", pumping capacity, storage capacity components (including operational, fire flow and emergency), minimum and maximum system pressures, and maximum pipeline velocity and head loss. The water distribution system service standards used for this WMP are summarized in the following sections:

- Water Service Quality Standards
- Fire Flow Requirements
- Water Supply Capacity During High Demand Periods
- Pumping Facility Capacity
- Critical Pumping Facilities
- Water Storage Capacity
- Water Transmission and Distribution System

These service standards, summarized in Table 4-1, reflect typical water system industry standards, including the Oregon State Department of Human Services (DHS), the Environmental Protection Agency (EPA), the American Water Works Association (AWWA), the Insurance Services Office, Inc. (ISO), and the Oregon Fire Code (OFC).

WATER SERVICE QUALITY STANDARDS

Water service quality standards largely pertain to protecting public health and consistently delivering a satisfactory product to the customer. Most of the water quality considerations are related to supply and treatment issues and are not the subject of this chapter. In the water distribution network, a major water quality concern is maintaining compliance with the Oregon State DHS residual disinfectant requirements. The DHS requires that there is a measurable chlorine residual level throughout the system in at least 95 percent of all monthly samples and a chlorine residual of at least 0.2 mg/l where water enters the distribution system.

Stage 2 Disinfectants and Disinfection Byproducts Rule

To reduce disease incidence associated with the disinfection byproducts that form when public water supply systems add disinfectants, the Environmental Protection Agency (EPA) proposed the Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR). The Stage 2 DBPR supplements existing regulations by requiring water systems to meet disinfection byproduct

Table 4-1. City of Oregon City Planning and Design Criteria

Component	Criteria	Remarks / Issues
PERFORMANCE CRITERIA FOR PLANNING & DESIGN		
Fire Flow Requirements (flow [gpm] @ duration [hours])		
Single-Family Residential	1,500 gpm @ 2 hrs	Fire flows based on new development requirements. Existing development will be evaluated on a case by case basis, because of the historical varying standard.
Multi-Family Residential	1,500 gpm @ 3 hrs	
Institutional (schools, hospitals, etc.)	2,000 gpm @ 4 hrs (with approved automatic sprinkler system)	
Commercial/Industrial	3,000 gpm @ 4 hrs (with approved automatic sprinkler system)	
Water Supply Capacity		
Maximum Day Demand Plus Fire Flow	Provide capacity equal to maximum day demand plus fire flow	
Peak Hour Demand	Provide capacity equal to peak hour demand	
Pumping Facility Capacity		
Booster Pump Capacity	Equal to the maximum day demand for the pressure zone.	Design for maximum day plus fire flow or peak hour (whichever is larger), only if no gravity storage is available within the pressure zone and/or service area.
Backup Power	Equal to the firm capacity of the pumping facility.	On-site generator for critical stations.[a] Plug in portable generator for less critical stations.
Water Storage and System Peaking Capacity		
Equalization	25 percent of maximum day demand	
Fire	Varies (see requirements listed in remarks column)	Varies depending on required fire flow duration. Highest fire flow demand in any particular area controls size of required storage. See Table 4-2. 1,500 gpm @ 2 hrs = 0.18 MG 1,500 gpm @ 3 hrs = 0.27 MG 2,500 gpm @ 4 hrs = 0.60 MG
Emergency	Maximum day demand	Based on DHS recommendations.
Total Water Storage Capacity	Equalization + Fire + Emergency	
Water Transmission Line Sizing		
Diameter	18-inches in diameter or larger	Criteria based on requirements for new development, existing transmission mains will be evaluated on case-by-case basis. Evaluation will include age, material type, velocity, head loss, and pressure.
Average Day Demand Condition		
Minimum Pressure [psi]	40 psi	
Maximum Pressure [psi]	100 psi	
Maximum Velocity [ft/sec]	3 fps	
Maximum Day Demand Condition		
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/1000 ft]	3 ft/kft	
Maximum Velocity [ft/sec]	5 fps	
Peak Hour Demand Condition		
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/1000 ft]	3 ft/kft	
Maximum Velocity [ft/sec]	5 fps	
Hazen Williams "C" Factor	140	For consistency in hydraulic modeling.
Pipeline Material	Ductile Iron	
Water Distribution Line Sizing		
Diameter	Less than 18-inches in diameter	Must verify pipeline size with max day and fire flow analysis.
Average Day Demand Condition		Criteria based on requirements for new development, existing distribution mains will be evaluated on case-by-case basis. Evaluation will include age, material type, velocity, head loss, and pressure.
Minimum Pressure [psi]	40 psi	
Maximum Pressure [psi]	100 psi	
Maximum Velocity [ft/sec]	3 - 5 fps	
Maximum Day w/ Fire Flow Demand Condition		
Minimum Pressure [psi] (at fire node)	20 psi	
Maximum Head loss [ft/1000 ft]	10 ft/kft	
Maximum Velocity [ft/sec]	10 fps	
Peak Hour Demand Condition		
Minimum Pressure [psi]	40 psi	
Maximum Head loss [ft/1000 ft]	10 ft/kft	
Maximum Velocity [ft/sec]	7 fps	
Hazen Williams "C" Factor	140	For consistency in hydraulic modeling.
Pipeline Material	Ductile Iron	
Maximum Valve Spacing		
Supply Pipeline	1 mile	
Transmission Pipeline	2,000 feet (minimum)	1,300 feet (preferred)
Residential Distribution Pipeline	800 feet	
Commercial Distribution Pipeline	500 feet	
Uniform Fire Code Hydrant Distribution Requirements		
Residential	500	
Commercial, Industrial, and Other High Value District	200-500	
OTHER CRITERIA		
Maximum Number of residential lots that can be served by a non-looped water pipeline	25 lots	If a non-looped water line goes out-of-service, all associated residences lose water service.

[a] A pumping facility is defined as critical if it provides service to pressure zones and/or service areas without sufficient emergency storage and that meet the following criterion:

- The largest facility that provides water to a particular pressure zone and/or service area;
- A facility that provides the sole source of water to single or multiple pressure zones and/or service areas; and
- A facility that provides water from a supply turnout into pressure zones and/or service areas.

maximum contaminant levels (MCLs) at each monitoring site in the distribution system. The proposal also contains a risk-targeting approach to better identify monitoring sites where customers are exposed to high levels of disinfection byproducts (DBPs). The goal of this regulation is to reduce DBP exposure to provide more equitable health protection, and will result in lower cancer, reproductive and developmental risks.

The Stage 2 measure of DBP compliance is called a locational running annual average (LRAA). The LRAA differs from the Stage 1 DBPR compliance strategy which is based upon a system-wide running annual average. Under the Stage 2 Rule the LRAA at each monitoring location must be below the present regulatory DBP MCLs of 80 µg/L for total trihalomethanes (THM), and 60 µg/L for the 5 major haloacetic acids (HAA5). However, if a supplier exceeds a threshold, referred to as a significant excursion at any location, during any sampling event, there are additional requirements that will need to be performed.

Under the Stage 2 DBPR, systems will conduct an evaluation of their distribution system (Initial Distribution System Evaluation or IDSE), to identify monitoring locations that are most likely to have high levels of DBPs. These locations will then be used as the sampling sites for DBP compliance monitoring. The EPA provides guidance to assist suppliers in finding locations to include in the IDSE. The EPA has also designed a boilerplate study, called a Standard Monitoring Plan (SMP), to determine how newly identified locations compare to ones used for compliance with Stage 1 Rule. EPA will allow suppliers to demonstrate that new monitoring locations meet the intent of the IDSE though the use of specific alternatives means, referred to as a system specific study, or SSS. Following the IDSE, suppliers and their primacy agencies will determine which location will be used for Stage 2 LRAA compliance.

System Reliability

Attention to enhancing the reliability of the system under all conditions is another important part of maintaining high quality water service. Reliability is achieved through a number of system features including appropriately sized storage; redundant pumping, transmission, and rechlorination where required; and alternate power supplies. Reliability and water quality are also improved by designing looped water distribution pipelines and avoiding dead-end distribution mains whenever possible. Looping pipeline configurations reduces the potential for stagnant water and the associated problems of poor taste and low chlorine residuals and increased DBPs. Proper valve placement is also necessary to maintain reliable system operation under normal and abnormal operating conditions.

FIRE FLOW REQUIREMENTS

While the City is the purveyor of water, the Clackamas Fire District #1 (CFD) is also concerned with the availability of adequate water supply. The City is responsible for supply and distribution of water; whereas, CFD establishes minimum water flows required for fire fighting purposes.

CFD uses the 2007 OFC Table B105.1 *Minimum Required Fire-Flow and Flow Duration for Buildings* to assist them in establishing minimum fire flows and durations for individual structures.

The City's minimum design standards for fire flow are 1,500 gallons per minute (gpm) at a domestic residence 3,000 gpm for a commercial building, and 5,000 gpm for buildings in heavy commercial areas. However, actual fire flow requirements are determined by CFD and ISO on a case-by-case basis. Specific fire flow requirements are based on the size of building (in square feet) and type of construction (wood frame, metal, masonry, installation of sprinklers, etc.). Once the fire flow requirement is established, it is multiplied by the required duration to determine the total volume needed for fire flow storage. Table 4-2 represents the general fire flow requirements that have been established for planning the City's water system.

WATER SUPPLY CAPACITY DURING HIGH DEMAND PERIODS

In accordance with typical industry standards, the City's water supply system should have the capability to meet a system demand condition equal to the occurrence of a maximum day demand condition concurrent with a fire flow event. For planning purposes, it is assumed that the maximum day plus fire flow demand condition will consist of a single fire flow event.

Water Supply and Treatment Capacity

Since the City shares its source of supply with two other water purveyors, evaluations of the water supply and treatment capacity must account for overall demand on the South Fork Water Board (SFWB) facility.

<u>Source Supply</u>. The reliable yield of all sources of supply should exceed the projected maximum day demand on the system. The definition of reliable yield of water supplies is that which can be delivered to the City during the worst drought. The worst drought conditions are estimated from historical stream flow records. The reliable yield from the SFWB's water rights is nearly 52 mgd, well in excess of the historical overall maximum day demand of 22.1 mgd.

<u>Treatment Capacity</u>. Total potable water production and supply delivery capacity should be equal to or greater than the maximum day demand. It is recommended that the total maximum production capacity be at least ten percent greater than the maximum day demand to allow for concurrent fire flow demands, meeting drinking water quality standards with difficult water, or when repairing equipment. Since the overall historical maximum day demand on the system is above the 20 mgd treatment capacity of the SFWB plant, the SFWB's 1997 master plan called for expansion of the treatment plant and distribution facilities in the near future. SFWB is currently undergoing a Master Plan Update to determine the required improvements.

System Pressure Requirements

Under normal operating conditions, water pressure in the distribution system should range between 40 and 100 psi. The lower end of this pressure range is intended to ensure that adequate pressure is available for the highest fixture at a service connection during maximum demand

Table 4-2. Recommended Fire Flow Requirements[a,b]

Designation	Non-Sprinklered			Sprinklered[c,d]		
	Fire Flow, gpm	Duration, hours	Recommended Storage, MG	Fire Flow, gpm	Duration, hours	Recommended Storage, MG[e]
Single-Family Residential[f]	1,500	2	0.18	--	--	--
Multi-Family Residential[g]	1,500	3	0.27	--	--	--
Institutional[h]	3,000	4	0.72	2,000[i]	4	0.36
Industrial/Commercial[j]	5,000	4	1.20	3,000[i]	4	0.60

[a] Construction type and fire area are not generally known during the development of a master plan; consequently, fire flow requirements set forth in this table are based on previous estimates for these land use types and similar communities.

[b] Unique projects or projects with alternate materials may require higher fire flows and will be reviewed by the Fire Marshal on a case-by-case basis (e.g., proposed commercial/industrial areas and schools).

[c] The Fire Marshal normally allows up to a 50 percent reduction in fire flows if a building is sprinklered. However, the Fire Code also requires that no fire flow be less than 1,000 gpm for single family residential or 1,500 gpm for all other building types. For a more conservative fire flow estimate, Single Family and Multiple Family buildings were considered non-sprinklered for this Water Master Plan Update.

[d] Specific fire flows were determined from Table B105.1 of the 2007 OFC, and depend on construction type and fire area. These fire flow requirements are based on buildings being fully sprinklered.

[e] Recommended storage volumes do not include volume associated with 500 gpm sprinkler flow.

[f] Single Family includes Low Density Residential and Medium Density Residential land use.

[g] Multiple Family includes High Density Residential land uses.

[h] Institutional includes Parks & Recreation and Public and Quasi-Public land uses.

[i] Fire flow includes a 500 gpm demand for on-site sprinkler flow.

[j] Industrial/Commercial includes Commercial, Mixed Use Corridor, Mixed Use Downtown, Mixed Use Employment, Industrial and Future Urban land uses.

conditions. The higher end of this pressure range is intended to minimize system repairs, lower the potential for surge damage, minimize water leakage rates, and lower the expense of pipelines.

Under fire flow conditions, lower pressures in the distribution system are allowable. In accordance with DHS rules, the minimum system pressure under fire flow conditions shall be 20 psi as measured at the property line.

PUMPING FACILITY CAPACITY

Sufficient water system pumping capacity should be provided to meet the greater of these two demand conditions:

1. A maximum day demand concurrent with a maximum fire flow event with the largest pump at each booster pump station in standby mode.
2. A peak hour demand with the largest pump at each booster pump station in standby mode.

Consequently, the maximum demand requirement sets the pumping capacity requirement.

CRITICAL PUMPING FACILITIES

Critical pumping facilities are defined as those facilities that provide service to service area(s) without sufficient emergency storage (see emergency storage section) and that meet the following criteria:

- The largest pumping facility that provides water;
- A pumping facility that provides the sole source of water to a single or multiple pressure zone(s); and
- A pumping facility that provides water from a supply turnout.

All critical pumping facilities should be equipped with an on-site, back-up power generator. At less critical facilities, a plug-in adapter will be used to allow interconnection to a portable generator, which will be brought to the site by City staff during a prolonged power outage.

If unavailable by gravity storage, the fire flow should be supplied with a National Fire Protection Association (NFPA) rated fire pump. If an NFPA rated fire pump is not used, then a pump(s) and motor(s) combination with a backup power source of sufficient capacity to meet the required maximum fire flow and minimum residual pressure requirements, as determined by the CFD's Fire Marshal, will be required. The pump stations serving pressure zones without storage shall also be equipped with a hydropneumatic tank to limit pump cycling.

WATER STORAGE CAPACITY

Standards have been developed for determining treated water storage capacity needs within the individual pressure zones of a distribution system to meet diurnal operational peaks and emergency conditions. Storage requirements can generally be categorized into the following four components:

- Operational Storage
- Equalization Storage
- Fire Flow Storage
- Emergency Storage

The following discussion presents design guidelines for each of these four components.

Operational Storage

The operational storage component allows for the continued supply of water to the system from reservoirs during temporary shutdowns of the water treatment plant or booster pump stations. The necessary volume of operational storage is determined based on the anticipated timing and duration of temporary shutdowns during the maximum demand period. Since the necessary operational storage for treatment plant shutdowns is the responsibility of the SFWB, the City's operational storage needs are solely related to the operation of its booster pumping stations. Because the City's booster pumping stations are capable of operating as long as necessary during the maximum demand period, there is not a need for dedicated operational storage within the City's distribution system.

Equalization Storage

Over any 24-hour period, water demand on the distribution system will vary. Typically, water demand will be high in the morning when people are getting ready for the day, then will decline to a nominal baseline level that is dominated by the water use patterns of commercial and industrial areas. Demand will then begin to increase again in late afternoon, reaching a higher level in the early evening as people return home from work. During periods when the rate of demand exceeds the treatment plant's production rate, the excess demand is provided from equalization storage. During periods when the rate of demand is less than the treatment plant's production rate, the equalization storage is recharged. When a typical diurnal demand pattern is compared to the average daily demand, the necessary supply from equalization storage is typically equal to 25 percent of daily demand. Therefore, to ensure the availability of adequate equalization storage during a maximum day demand event, equalization storage requirements should be 25 percent of the maximum day demand.

Fire Storage

The highest fire flow requirement in a given pressure zone determines the necessary fire flow storage that must be provided by the reservoir(s) that serve that pressure zone. Since the lowest pressure zones in Oregon City are served through PRVs from the upper pressure zones, the fire flow reserves for these interconnected pressure zones are shared in common, allowing the pressure zones to be analyzed as a set.

Fire flows will be provided by storage unless a specific exception is approved by the City. Pumped fire flows can be allowed for small areas under the condition that the pump station provides an adequate firm capacity, sufficient pressure, and reliable operation. These areas would be small, isolated zones where construction of a gravity storage facility is not practical.

Emergency Storage

A reserve of treated water is also required to meet demands during emergency outage periods, when normal supply is interrupted. An emergency is defined as an unforeseen or unplanned event that may degrade the quality or quantity of potable water supplies available to serve customers. There are three types of emergency events that a water utility typically prepares for:

- <u>Minor emergency</u>. A fairly routine, normal, or localized event that affects few customers, such as a pipeline break, malfunctioning valve, hydrant break, or a brief power loss. Utilities plan for minor emergencies and typically have staff and materials available to correct them.
- <u>Major emergency</u>. A disaster that affects an entire, and/or large, portion of a water system, lowers the quality and quantity of the water, or places the health and safety of a community at risk. Examples include water treatment plant failures, raw water contamination, or major power grid outages. Water utilities infrequently experience major emergencies.
- <u>Natural disaster</u>. A disaster caused by natural forces or events that create water utility emergencies. Examples include earthquakes, forest or brush fires, hurricanes, tornados or high winds, floods, and other severe weather conditions such as freezing or drought.

Since the risk of an emergency situation varies from city to city, the amount of reservoir volume allocated to emergency storage also varies from city to city. The required emergency storage volume is a function of several factors including the diversity of the sources of supply, redundancy and reliability of the production facilities, and the anticipated length of the emergency outage. Review of other water system planning criteria for communities with a surface water supply shows that emergency storage volumes vary from 25 percent of maximum day demand to 150 percent of maximum day demand.

The Clackamas River is the sole source of supply for the City's water system. Although the reliability and quality of the City's water supply has been excellent, it is vulnerable to temporary contamination by chemical spills into the Clackamas River. Consideration of such a scenario is useful for preparing the City to manage emergency storage supplies during an emergency event. The following scenario allows for the determination of a reasonable volume of emergency storage:

- If the Clackamas River became contaminated, it is estimated that it would take up to three days to allow the contamination to pass by the water treatment plant or to modify the process to treat the contaminated water.
- Immediately following the water treatment plant shutdown, the public would be notified and advised to adopt water rationing measures to prolong the availability of emergency storage supplies.
- If the shutdown were to occur during a period of maximum demand, it would take up to 12 hours for water rationing measures to be adopted, after which the demand might drop to one-half the annual average day demand for the remainder of the shutdown period.
- It is important to note that the response to an emergency depends on the ability of the City to reach its citizens with the necessary information. An extensive emergency curtailment plan is essential to effectively reduce water demand during an emergency.

Given this scenario, the required emergency storage would be approximately 100 percent of maximum day demand. Therefore, one maximum day demand is the recommended emergency storage requirement for the City's water system.

Total Water Storage

The minimum treated water storage capacity in the system available to each pressure zone shall equal the sum of the following:

- Equalization. The storage allocated for meeting diurnal demand peaks should be equivalent to 25 percent of the maximum day demand. This storage volume should be located within the pressure zone.
- Fire Flow. The storage allocated to provide fire flows should be equivalent to the maximum fire flow in the pressure zone times the duration the flow rate must be maintained.
- Emergency. The minimum emergency storage volume allocated for providing water during periods when normal supply is interrupted should be equivalent to 100 percent of the City's maximum day demand.

A table comparing the existing storage volume in the system and the recommended storage volume is provided in Chapter 6, "Existing Water Distribution System Evaluation."

Reservoirs

Reservoir facilities shall be sized in accordance with the preceding discussion of system storage requirements. Reservoir inlet and outlet piping shall be designed to facilitate adequate turnover of stored water at the facility and avoid water quality problems. Reservoir management techniques such as lowering reservoir levels during periods of low demand will also ensure the freshness of the water supply and eliminate the need for rechlorination.

To ensure adequate service pressures, new reservoirs shall be placed so that the overflow elevation is 100 feet above the normal upper service elevation of the pressure zone it is serving. This arrangement will allow for fluctuations in reservoir level while maintaining system pressures within the desired range. In addition, it is recommended that the City consider equipping reservoirs with a remote controlled shut-off valve or seismic valve to prevent drainage after a significant earthquake.

WATER TRANSMISSION AND DISTRIBUTION SYSTEM

The following criteria are to be used as guidelines for new transmission and distribution pipeline sizing. However, the City's existing system will be evaluated on a case–by-case basis. For example, if an existing pipeline experiences head loss in excess of the criteria described below during a maximum day plus fire flow event, this condition, by itself, does not necessarily indicate a problem as long as the minimum pressure criterion is satisfied.

Although these criteria and guidelines have been established, and will be used to size new pipelines, the City's existing system will be evaluated using pressure as the primary criterion; and secondary criteria, such as velocity, head loss, age, and material type, will be used as indicators for where water system improvements may be needed.

Pipeline Networks

The pipelines and transmission mains in the City's distribution system will generally be sized based on the criteria described below for average, maximum day and peak hour demand conditions.

<u>Water Transmission System</u>

Transmission pipelines are generally 18 inches in diameter or larger, and should be designed based on the criteria described below for average day, maximum day and peak hour demand scenarios. The criteria reflect industry standards and West Yost's experience working in other Cities and Water Districts.

Average Day Demand

- Pressures should be maintained between a maximum of 100 psi and a minimum of 40 psi.
- Maximum velocity within transmission pipelines should be 3 feet per second (fps).

Maximum Day Demand

- The minimum allowable service pressure should be 40 psi.
- The maximum velocity within the transmission system pipelines should be 5 fps.
- Head losses within the transmission system pipelines should be limited to 3 ft/kft of pipeline.

Peak Hour Demand

- The minimum allowable service pressure should be 40 psi.
- The maximum velocity within the transmission system pipelines should be 5 fps.
- Head losses within the transmission system pipelines should be limited to 3 ft/kft of pipeline.

Water Distribution System

Distribution pipelines are generally less than 18 inches in diameter, and should be sized based on the criteria described below for average day, maximum day plus fire flow, and peak hour demand scenarios. The criteria reflect industry standards and West Yost's experience working in other Cities and Water Districts.

Average Day Demand

- Pressures should be maintained between a maximum of 100 psi and a minimum of 40 psi.
- The maximum velocity within the distribution system pipelines should be 3 to 5 fps.

Maximum Day Demand plus Fire Flow

- The minimum allowable residual pressure should be 20 psi at the flowing fire hydrant.
- The maximum velocity within the distribution system pipelines should be 10 fps.
- Head losses within the distribution system pipelines should be limited to 10 ft/kft of pipeline.

Peak Hour Demand

- The minimum allowable service pressure should be 40 psi.
- The maximum velocity within the distribution system pipelines should be 7 fps.
- Head losses within the distribution system pipelines should be limited to 10 ft/kft of pipeline.

The minimum distribution pipeline inside diameter shall be eight inches. The distribution system shall be looped at all possible locations to maintain adequate circulation and water quality. Long dead end pipelines shall be avoided whenever possible to prevent water quality problems. When unavoidable, a fire hydrant or blow-off hydrant shall be installed at the end of the line to facilitate periodic system flushing. A maximum development size of 25 lots will be allowed on a dead end line.

Valves

Valve location and spacing are important considerations in the design of a water distribution system. Pipelines must include an adequate number of properly located valves to allow for isolation of pipeline sections in the event of maintenance operations or new construction. ISO has developed standards for valve spacing on pipelines according to their function. These standards have been modified by the City as identified in Table 4-3. The supply pipelines that deliver water to the City's system are owned and operated by the SFWB. Transmission pipelines are the high capacity mains that form the framework for moving water around the system. The distribution pipelines provide the network grid from which most customer connections are served. A general guideline for locating valves in the distribution system is that smaller branch mains should be equipped with a valve so that any service problems on the branch pipeline does not require a shut-off of the major transmission line. Within the distribution grid, placement of a valve on all legs of tees and crosses will minimize the extent of a service disruption during system work. For the same reason of localizing service disruptions, system design should avoid direct service taps into transmission pipelines whenever possible.

Table 4-3. Maximum Valve Spacing Standards

Pipeline Function	Maximum Spacing
Supply pipeline	1 mile
Transmission pipeline	2,000 feet (minimum) 1,300 feet (preferred)
Residential distribution pipeline	800 feet
Commercial distribution pipeline	500 feet

Hydrants

Fire hydrants are dispersed throughout the distribution system to provide the emergency flows required for fire protection. The requirements for spacing fire hydrants are defined in the Uniform Fire Code and have been modified by the City's development codes as shown in Table 4-4. In applying the fire code, the CFD shall determine the required fire hydrant distribution based on their judgment. In addition to the maximum spacing requirements, any building must be within 250 feet of a fire hydrant. Distances are measured along the route that the CFD will use to deploy the fire hose.

Table 4-4. Uniform Fire Code Hydrant Distribution Requirements

Land Use Category	Maximum Hydrant Spacing, feet
Residential	500
Commercial, Industrial, and Other High Value Districts	200 – 500

No hydrant shall be installed on a water main with less than an 8 inch inside diameter and the hydrant shall have a minimum 6 inch inside diameter. Hydrants shall be located as close to the distribution main as possible and shall be no more than 40 feet away. To comply with this requirement, hydrants will generally be located on the same side of the street as the distribution main. In areas where required fire flows exceed 1,500 gallons per minute, the water supply must be provided by more than one hydrant.

CHAPTER 5. HYDRAULIC MODEL UPDATE

This chapter presents an overview of the methodology used to refine/update the hydraulic network model of the City's existing potable water distribution system. West Yost developed a hydraulic model of the City's water distribution system for the October 2004 Water Master Plan Update to allow for computer simulations of various existing and future demand conditions using the City's water distribution facilities. To refine and update the City's existing hydraulic network model, West Yost completed the following steps:

- Used the City's existing water distribution system maps (exported from the City's geographical information system (GIS)) to update the current hydraulic model.
- Incorporated new facilities that were constructed and operating as of January 2009.
- Verified that the current hydraulic model system configuration (pipeline sizes, alignments, connections, and other facility sizes and locations) was representative of the City's existing water system.
- Allocated water demands by using the City's meter data and West Linn and CRW's master meter data to properly distribute demands within the hydraulic model.

To accomplish these tasks, West Yost worked closely with City staff to obtain and review information regarding new transmission and distribution mains, reservoirs and other water facilities. The following sections summarize the refinement of the City's existing hydraulic network model.

REFINEMENT OF THE HYDRAULIC MODEL

West Yost updated the existing hydraulic model of the City's water system using a series of steps that included the following:

- Model Update
- Roughness Factors Assigned for New Areas in InfoWater
- Water Demands Allocated in H_2OMAP
- Elevations Allocated for New Areas in H_2OMAP
- Naming Scheme Applied in InfoWater

Each of these steps is discussed in more detail below.

MODEL UPDATE

The City's computerized hydraulic model was originally developed in H_2OMAP. For the October 2004 Water Master Plan Update Project, West Yost updated and calibrated the City's computerized hydraulic model (2004 Model). Since the completion of the 2004 Model, new facilities and service areas have continued to be constructed and developed within the City's service area. With the number of new facilities and significant changes to the service area, an updated model was required.

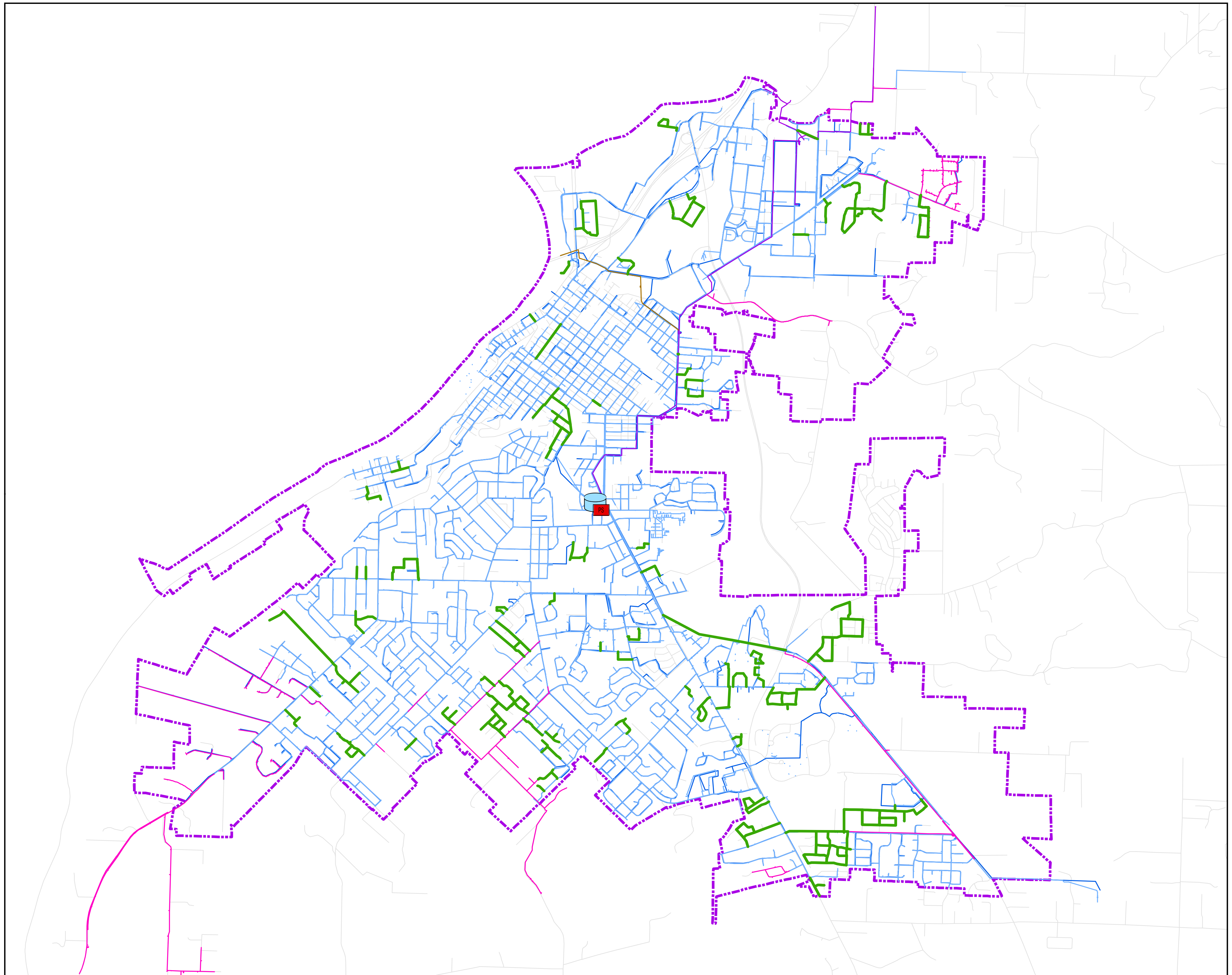
West Yost compared the 2004 Model with the GIS geodatabase file provided by City staff. Figure 5-1 illustrates the new facilities and service areas which were not included in the 2004 Model. These new facilities and service areas were consequently added into the 2004 Model. West Yost also verified and updated some pipeline configurations of the existing 2004 Model to be consistent with the City's GIS geodatabase file.

ROUGHNESS FACTORS ASSIGNED FOR NEW AREAS IN INFOWATER

Pipelines in the City's water system date from the 1920's and range in size from 2 to 30 inches in diameter. Pipeline materials in the City's water system include cast iron, steel, cement lined and coated steel, asbestos cement, and mortar-lined ductile iron. Roughness factors (C-factors) can range from a low of around 40 for old unlined cast iron pipes in poor condition to a high of 140 for newly installed, cement-lined ductile iron pipe. Each newly added pipeline was assigned a C-factor based on pipeline age. Table 5-1 summarizes the C-factors that were used in the model update. These coefficients were assigned to each pipe in the distribution system based on age.

Table 5-1. Pipeline Age-Based C-Factor Summary

Decade of Pipeline Construction	Hazen Williams C-Factor
Pre-1920s	40
1920s	60
1930s	70
1940s	80
1950s	90
1960s	100
1970s	110
1980s	120
1990s	130
2000s	140



OREGON CITY

FIGURE 5-1

CITY OF OREGON CITY
NEW FACILITIES SINCE 2004

N

0 1,500 3,000
SCALE IN FEET

Legend:

- Mtview Pump Station
- Mtview Reservoir No 1
- New Waterline

Existing Waterline

- OC
- CRWD
- South Fork
- West Linn
- URBAN GROWTH BOUNDARY (UGB)

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P:\Clients\526 Oregon City\03-09-08 Water Master Plan Update\GIS\Figures\Fig 5-1 new facilities.mxd 5/27/2010

WATER DEMANDS ALLOCATED IN H_2OMAP

The focus of the re-allocation of water demands was to confirm the location and quantity of the existing water demands within the City's water system. Existing water demands were re-allocated in the hydraulic model based on meter location. The methodology for calculating and allocating existing water demands into the hydraulic model is summarized below:

1. Allocate the City's existing water demands using geocoded water meter data provided by City staff.
2. Allocate existing master meter water demands (West Linn and CRW) using 2008 monthly SFWB invoice totals and the known spatial location of master meters.

These steps are discussed in more detail below.

Existing Water Meter Demands (City)

A GIS shapefile (UB Account Locations.shp) containing the City's water meter records from July 2008 was provided to West Yost by City staff in May 2009. The City's total geocoded water meter demand in July 2008 was equal to 5.62 mgd. Figure 5-2 illustrates the locations of the City's geocoded water meters with available records in July 2008.

Consequently, the City's existing water demands were allocated into the hydraulic model using the geocoded meter data discussed above and the Demand Allocation/Pro module of H_2OMAP[1] (Allocation Module). The Allocation Module automatically assigned the geocoded meter to the closest pipeline to its position in the water system. The City's water demands in the existing model were then scaled to represent an average day demand using the City's 2008 production data.

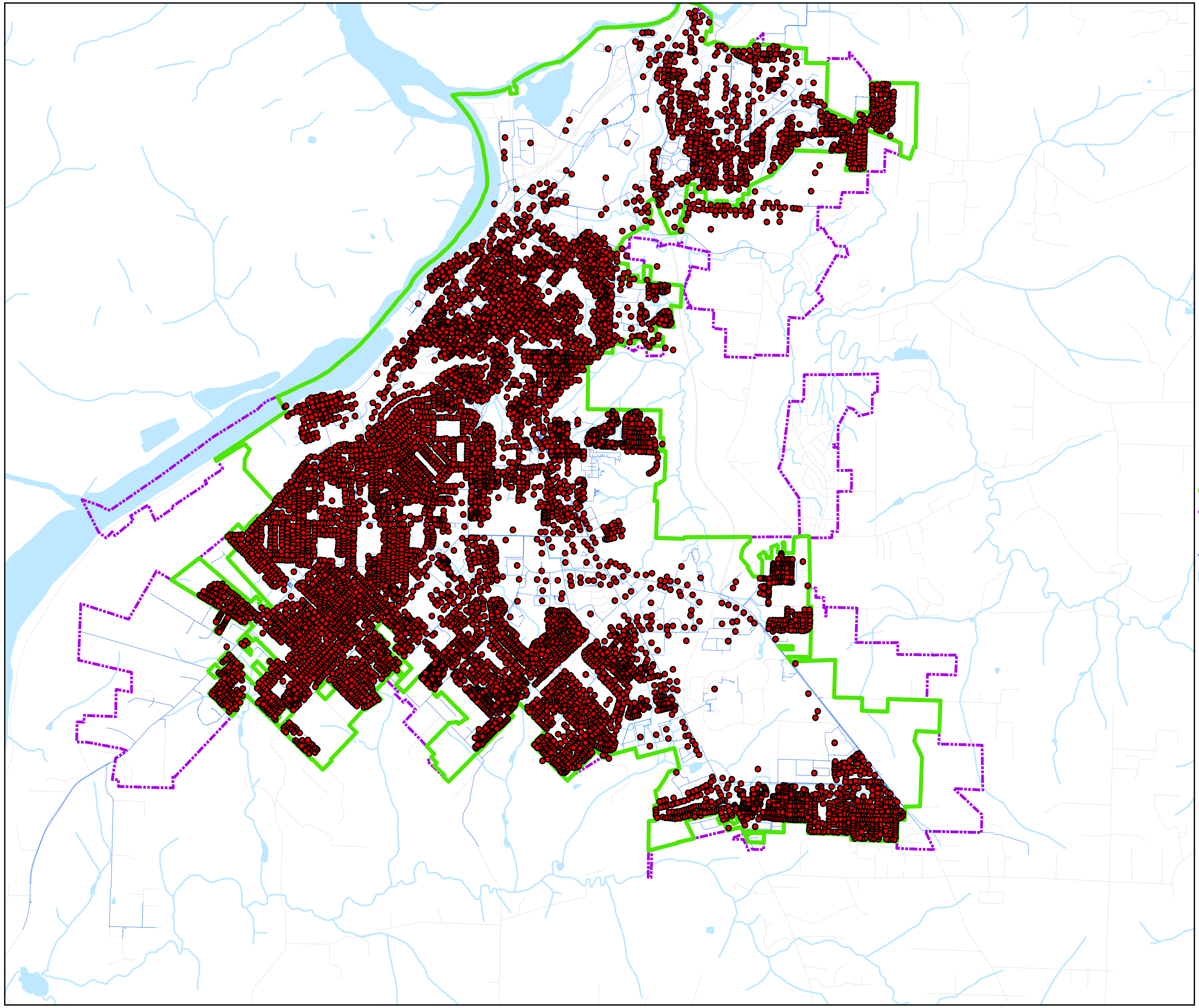
Additionally, West Yost was able to refine the City's future system demand allocations within the hydraulic model with land use designations, providing the City with additional flexibility in the future system model. Table 5-2 below presents the demand column assigned to each land use category within the hydraulic model.

[1] MWH Soft's H_2OMAP program was used to allocate water demands. Consequently, this information was then imported into the City's InfoWater model.

OREGON CITY

FIGURE 5-2

CITY OF OREGON CITY
SPATIALLY LOCATED ACCOUNTS



N

0 1,325 2,650
SCALE IN FEET

LEGEND
- City Limits
- URBAN GROWTH BOUNDARY (UGB)
- UB Account Locations
- Existing Pipeline
- Water Feature

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P:\Clients\526 Oregon City\03-09-08 Water Master Plan Update\GIS\Figures\Fig 5-1 Water Service Acct.mxd 12/20/2009

Table 5-2. Land Use Category Assignment

Land Use Category	Demand Column in Model[a]
Single Family Residential	1
Multi-Family Residential	2
Commercial/Industrial	3
Institutional	4
Master Meters	5
Future Use	6
Future Use	7
Future Use	8
Future Use	9
Future Use	10

(a) Column number corresponds to Demand # Column in the Junction database of the InfoWater model.

Existing Master Meter Demands (West Linn and CRW)

2008 monthly master meter invoice data from SFWB was provided to West Yost by City staff in April 2009. The 2008 average day demands from West Linn and CRW master meters were calculated based on these monthly SFWB invoices and then allocated manually into the hydraulic model using the master meter locations shown previously on Figure 2-5.

The combination of meter data from the City's water meters and the West Linn and CRW's master meters (now allocated in the hydraulic model) provides a realistic representation of actual water demands in the existing water system. In addition, this demand allocation methodology captures water demands from large users as they are already present in the City's geocoded water meter data.

ELEVATIONS ALLOCATED IN H_2OMAP

Digital topology information for the City was extracted as a GIS shapefile using the software program TopoDepot®. TopoDepot® provides elevation contours generated from the USGS National Elevation Database Digital Elevation Model (NED DEM). NED DEM consists of a grid of elevation values posted approximately every 30 meters. TopoDepot® runs this grid of elevations through a Surface Contouring Program to generate elevation contours; the resulting shapefile was imported into the hydraulic model and service elevations assigned to new nodes, within new service areas, in the updated model using H_2OMAP's[2] Elevation Interpolation feature.

[2] MWH Soft's H_2OMAP program was used to allocate elevations. Consequently, this information was then imported into the City's InfoWater model.

NAMING SCHEME APPLIED IN INFOWATER

After the major facilities were updated in the model, a naming scheme was applied to each model element added. The naming scheme helps identify the element's location and allows the modeler to easily locate specific elements or more readily identify potential problems during the calibration and verification process.

Consequently, each node and pipeline link in the system has a unique identification number. The identification number series corresponds to the Pressure Zone in which the node or pipe is located. For example, all identification numbers in the 1000 series are located in the Lower Pressure Zone, all identification numbers in the 2000 series are located in the Intermediate Pressure Zone, etc. Table 5-3 provides the index between pressure zones and identification number series.

Table 5-3. Model Element Naming Scheme

Pressure Zone	Identification Number Series
Lower Zone	1000
Intermediate Zone	2000
Upper Zone	3000
Lower Park Place Zone	4000
Intermediate Park Place Zone	5000
Upper Park Place Zone	6000
Canemah Zone	7000
Fairway Downs Zone	8000
View Manor Zone	9000
Swan Zone	10000
Livesay Road Zone	11000
Paper Mill Zone	12000
SFWB Transmission System	13000
CRW System	20000

MODEL VALIDATION

The City's model went through a full calibration effort in the development of the 2004 Model. However, for this update, the City was interested in developing an extended period simulation model, which would require the development of a diurnal curve and additional validation to evaluate how the City's facilities (i.e. pump stations and tanks) were trending over time. Overall, the results from the diurnal curve development task were inconclusive due to lack of sufficient hourly data to produce accurate demands in the system and chart the flow of water (see Appendix A). Due to the quantity of assumptions that were required to generate an hourly diurnal curve and the resulting inconsistencies with the hydraulic model, an extended period validation of the model was not undertaken at this time.

CONCLUSION

With the updates described in the preceding sections, the City's hydraulic model is representative of the City's January 2009 system configuration and 2008 average day demand condition. It is West Yost's opinion that the City's updated 2009 Model is ready for use in simulating existing and buildout hydraulic system conditions. However, West Yost does recommend that the City budget for additional calibration of the hydraulic model within the next two years. This would include continuing to update/verify pipeline system configurations in the model as new facilities are constructed and to collect additional data to support a more accurate approach to developing an hourly diurnal curve.

CHAPTER 6. EXISTING WATER DISTRIBUTION SYSTEM EVALUATION

This chapter presents an overview evaluation of the City's existing water distribution system (see Figure 6-1) and its ability to meet the recommended performance and planning criteria under existing demand conditions. Performance standards used to evaluate the water system are defined in Chapter 4.

The existing water system evaluation includes an analysis of water storage capacity, pumping capacity, and the existing distribution system's ability to meet recommended operational and design criteria under maximum day demand plus fire flow and peak hour demand conditions. The existing system evaluation is based on current water production data presented in Chapter 3 and the results of hydraulic analyses conducted using the updated hydraulic model.

Evaluations, findings, and recommendations to address the identified deficiencies in the existing water distribution system are included and summarized at the end of this chapter. The identified recommendations and estimated timings were then used to develop a CIP, including an estimate of probable construction costs. The recommended CIP is described further in Chapter 8.

EXISTING WATER DEMANDS

The existing water demands for the City's water system were spatially located using meter data provided by City staff for the month of July 2008. These existing water demands were then scaled using 2008 production data to represent an average day demand, maximum day demand, and peak hour demand. Additional discussion regarding meter data and its allocation into the hydraulic model is provided in Chapter 5. Table 6-1 summarizes the existing water demands for the City by pressure zone. Water demands from master meters serving CRW and West Linn have also been allocated in the City's hydraulic model and are included in Table 6-1.

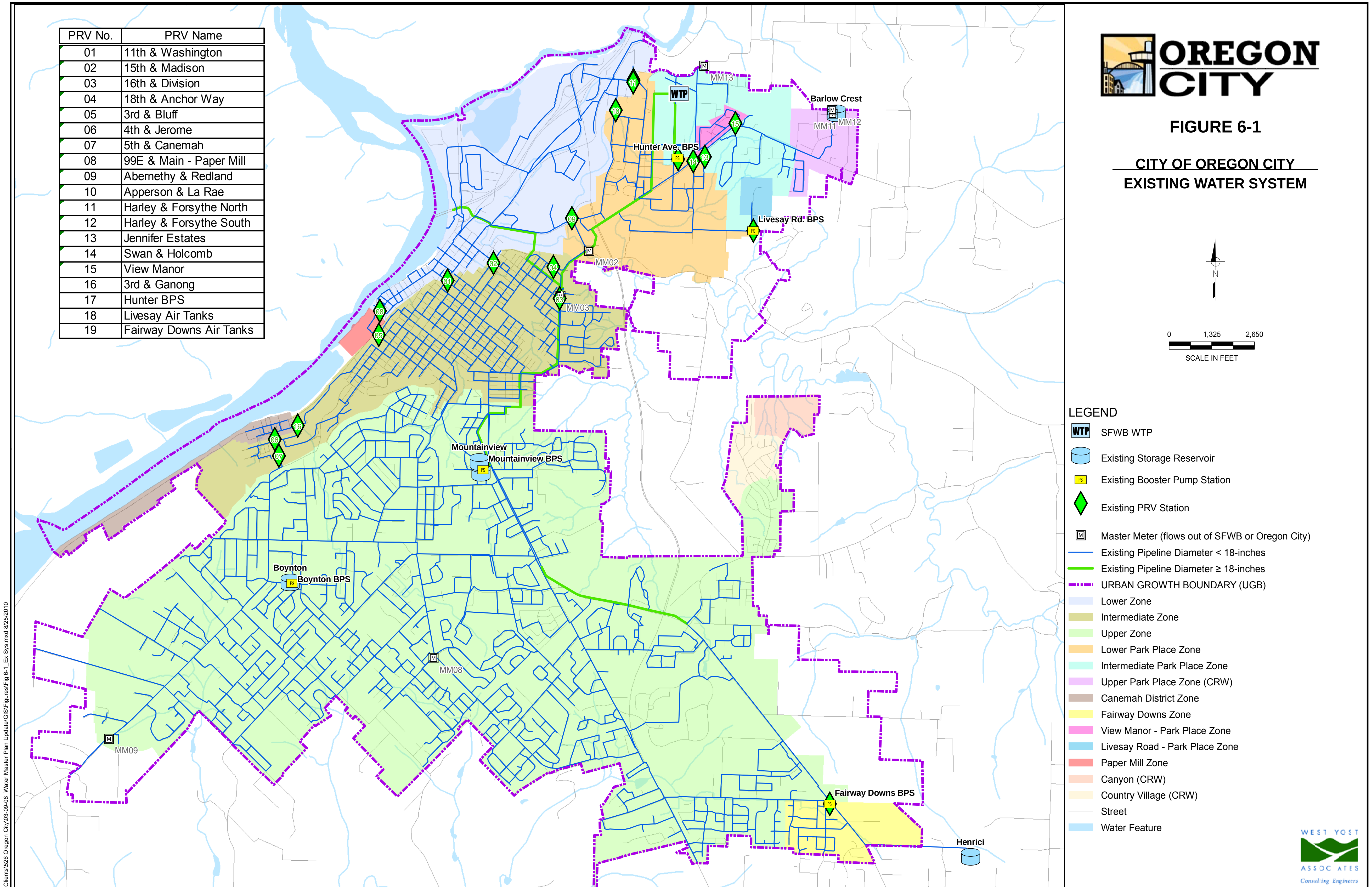
EXISTING WATER SYSTEM FACILITY EVALUATION

To evaluate the existing water system, the following system facilities analyses were conducted:

- Water Storage Capacity,
- Pumping Capacity, and
- Critical Supply Facilities.

The results of the existing water system facility analyses are discussed below.

PRV No.	PRV Name
01	11th & Washington
02	15th & Madison
03	16th & Division
04	18th & Anchor Way
05	3rd & Bluff
06	4th & Jerome
07	5th & Canemah
08	99E & Main - Paper Mill
09	Abernethy & Redland
10	Apperson & La Rae
11	Harley & Forsythe North
12	Harley & Forsythe South
13	Jennifer Estates
14	Swan & Holcomb
15	View Manor
16	3rd & Ganong
17	Hunter BPS
18	Livesay Air Tanks
19	Fairway Downs Air Tanks



OREGON CITY

FIGURE 6-1

CITY OF OREGON CITY
EXISTING WATER SYSTEM

Table 6-1. Water Demands for the Existing Water System

Pressure Zone	Average Day Demand[(a)]		Maximum Day Demand[(b)]		Peak Hour Demand[(c)]	
	gpm	mgd	gpm	mgd	gpm	mgd
Lower	200.7	0.29	461.7	0.67	903.3	1.30
Intermediate	295.7	0.43	679.9	0.98	1,330.1	1.91
Upper	1,858.5	2.68	4,274.2	6.15	8,362.5	12.04
Lower Park Place	91.5	0.13	210.4	0.30	411.7	0.59
Intermediate Park Place	71.4	0.10	164.4	0.24	321.5	0.46
Canemah	8.8	0.01	20.3	0.03	39.6	0.06
Fairway Downs	47.8	0.07	110.1	0.16	215.4	0.31
View Manor	14.8	0.02	34.0	0.05	66.6	0.10
Livesay Road	0.8	0.001	1.8	0.003	3.5	0.005
Paper Mill	0.4	0.001	0.8	0.001	1.7	0.002
City of Oregon City's Subtotal	*2,590.4*	*3.73*	*5,957.6*	*8.58*	*11,655.9*	*16.78*
Master Meter No. 2[(d)]	641.3	0.92	1,923.9	2.77	1,923.9	2.77
Master Meter No. 3[(d)]	2,064.7	2.97	6,194.1	8.92	6,194.1	8.92
Master Meter No. 8[(e)]	45.8	0.07	137.5	0.20	137.5	0.20
Master Meter No. 9[(e)]	23.4	0.04	70.3	0.10	70.3	0.10
Master Meter No. 11[(e)]	168.2	0.24	504.5	0.73	504.5	0.73
Master Meter No. 12[(e)]	5.1	0.01	15.2	0.02	15.2	0.02
Master Meter No. 13[(e)]	8.3	0.01	25.0	0.03	25.0	0.03
Master Meters Subtotal	*2,956.8*	*4.26*	*8,870.5*	*12.77*	*8,870.5*	*12.77*
Water System Total	**5,547.2**	**7.99**	**14,828.1**	**21.35**	**20,526.4**	**29.55**

(a) The City's average day demands are based on 2008 production data. Average day demand for master meters is based on data from 2008 monthly SFWB invoices.
(b) The City's maximum day demand is 2.3 times the average day demand. Maximum day demand for master meters is based on 3.0 times the average day master meter demand.
(c) The City's peak hour demand is 4.5 times the average day demand. Peak hour demand for master meters is based on 3.0 times the average day master meter demand.
(d) Master meter is served directly from the SFWB transmission main.
(e) Master meter is served by the City's water system.

Water Storage Capacity

The principal advantages that storage provides for the water system are the ability to equalize demands on supply sources, production facilities, and transmission mains; to provide emergency storage in case of supply failure; and to provide water to fight fires. The City's existing water system includes five water storage facilities serving ten pressure zones.

Together, these water storage facilities must be sufficient to meet the City's storage criteria for the existing water system. The volume required for each storage component is detailed below:

- Equalization Storage: 25 percent of maximum day demand,
- Emergency Storage: 100 percent of maximum day demand, and
- Fire Flow Storage: Determined using the largest fire flow requirement times the fire flow duration period as required by the Clackamas Fire District #1.

Typically the required storage volume for these three system storage components is determined individually within each pressure zone and then combined to identify the total amount of storage volume required for the overall system. However, since the lower pressure zones in the City are served through PRVs from the upper pressure zones, the fire flow storage for these interconnected pressure zones are shared in common, allowing the pressure zones to be analyzed as a set for fire flow storage. Consequently, the required fire flow storage for the existing water system will be based on the following maximum fire flow demands in the pressure zones served by each reservoir or group of reservoirs:

- A 3,000 gpm fire flow for the duration of 4 hours for the pressure zones served by Boynton, Henrici, and Mountainview No. 2 Reservoirs.
- A 5,000 gpm fire flow for the duration of 4 hours for the pressure zones served by Mountainview No. 1 Reservoir.
- A 3,000 gpm fire flow for the duration of 4 hours for the pressure zones served by Barlow Crest Reservoir.

The existing storage facilities were evaluated to determine whether the City's existing water system has sufficient capacity to provide the required system storage. Table 6-2 summarizes the evaluation of water storage capacity in the existing water system. The existing system contains an overall water storage capacity of 18.25 MG, which is sufficient to meet the current storage requirements. The City's existing water storage is primarily located in Mountainview Reservoir No. 2, which accounts for approximately 58 percent of the total available storage capacity. The other reservoirs have sufficient storage to meet the equalization and fire flow storage requirements for their pressures zones, but must rely on Mountainview Reservoir No. 2 for much of their emergency storage.

Seismic Vulnerability of Reservoirs

During the 2004 Master Plan a study was conducted to evaluate the City's storage reservoirs for seismic vulnerability (see full report in Appendix B). The seismic vulnerability assessment recommended the following improvements at the City's reservoirs:

- Dismantle the elevated tank at Mountainview Street (completed since 2004)
- Provide seismic reinforcement of the perimeter walls at Mountainview Reservoir No. 2 (completed since 2004)
- Provide seismic anchorage improvements at Boynton Reservoir.

Table 6-2. Summary of Existing Water Storage Evaluation

Reservoir Set (Volume)	Pressure Zones Served	[A] Total Available Storage, MG	[B] Required Storage Capacity, MG: Equalization [a]	[C] Required Storage Capacity, MG: Emergency [b]	[D] Required Storage Capacity, MG: Fire Flow [c]	[E] = [B]+[C]+[D] Total Required Storage, MG	[F] = [A]-[E] Storage Surplus (Deficit), MG
Boynton (2.0 MG) Henrici (2.0 MG) Mountainview No.2 (10.5 MG)	Upper	14.50	1.54	6.15	0.72	8.61	5.89
	Fairway Downs		0.04	0.16			
Mountainview No.1 (2.0 MG)	Intermediate	2.00	0.24	0.98	1.10	2.97	(0.97)
	Lower [d]		0.08	0.33			
	Lower Park Place [d]		0.04	0.15			
	Canemah		0.01	0.03			
	Paper Mill		0.00	0.00			
	Livesay Road [d]		0.00	0.00			
Barlow Crest (1.75 MG)	Intermediate Park Place	1.75	0.06	0.24	0.72	1.68	0.07
	Lower [d]		0.08	0.33			
	Lower Park Place [d]		0.04	0.15			
	View Manor		0.01	0.05			
	Livesay Road [d]		0.00	0.00			
Total		**18.25**	**2.14**	**8.58**	**2.54**	**13.26**	**4.99**

[a] Based on 25 percent of a maximum day demand (see Table 6-1).

[b] Based on a maximum day demand (see Table 6-1).

[c] Fire flow storage for Boynton, Henrici, and Mountainview No. 2 reservoir set based on a 3,000 gpm fire flow for the duration of 4 hours. Fire flow storage for Mountainview No. 1 reservoir based on a 5,000 gpm fire flow for the duration of 4 hours; however, the required storage was reduced by 0.10 MG to account for the fire storage tank at the Paper Mill. Fire flow storage for Barlow Crest reservoir based on a 3,000 gpm fire flow for the duration of 4 hours.

[d] Required storage capacity for this zone was split between Mountainview No.1 and Barlow Crest reservoirs.

Boynton Reservoir Circulation

Boynton Reservoir is fed by a single pipe that terminates at the bottom of the reservoir and serves as both the reservoir's inlet and outlet. This arrangement does not ensure that there is good circulation of water in this standpipe style reservoir. Although the City's regular water quality monitoring has not indicted problems during regular reservoir operation, it is possible that old water in the upper portions of the reservoir could be pumped into the system in the event of an emergency requiring operation of the Boynton Pump Station. Due to this situation, it is recommended that the City plan to make piping improvements at the reservoir that will enhance regular turnover of the reservoir. These improvements would involve dedicating the existing feed pipe to serve as the outlet only by adding a check valve and adding a new dedicated inlet pipe (with check valve) that extends into the upper portion of the reservoir. With water entering at the top of the reservoir and exiting from the bottom, the water in the reservoir will regularly turn over.

Pumping Capacity

The pumping capacity within the City's existing water system was evaluated to assess its ability to deliver a reliable firm capacity to the existing service area. Firm capacity assumes a reduction in total pumping capacity to account for pumps that are out of service at any given time due to mechanical breakdowns, maintenance, water quality, or other operational issues. For each booster pump station, the firm pumping capacity was defined as the total pump station capacity with the largest pump out of service.

There are five booster pump stations in the City's water distribution system. The Boynton pump station provides local emergency and fire flow service and is adequately sized to serve this function. The other four pump stations perform transfer pumping service, moving water from one pressure zone to another. The performance criteria for a transfer booster pumping facility serving a pressure zone(s) with storage requires that the pump station have adequate firm capacity to supply the maximum day demand within all dependent pressure zone(s) over a 24-hour period. For pressure zone(s) without storage, the planning criteria requires that the pump station have adequate firm capacity to supply peak hour demand plus fire flow requirements within the pressure zone(s).

Table 6-3 summarizes the evaluation of the pumping capacity in the existing water system. The pumping capacity analysis indicates that the existing capacity of the Hunter Avenue pump station, which serves pressure zones with storage, is adequate for meeting maximum day demand. The Mountainview pump station has surplus pumping and is therefore also adequate for meeting maximum day demand.

Both of the pump stations serving pressure zones without storage have capacity issues. The Fairway Downs pump station does not have adequate capacity for serving the required 1,500 gpm fire flow demand, and the normal service pump's capacity of 50 gpm appears to be low relative to an estimated peak hour demand of more than 200 gpm. However, the Fairway Downs pressure zone is also served by the Upper pressure zone through a few check valves, which may be able to eliminate the peak hour pumping capacity deficit within this pressure zone, but are not likely adequate to overcome the fire flow deficit for the long term. This pump station will be addressed further in the future system analysis as presented in Chapter 7. With respect to the

Table 6-3. Summary of Existing Pumping Capacity Evaluation

Pump Station	Pressure Zone/Master Meter Served	Pump 1, gpm	Pump 2, gpm	Pump 3, gpm	Pump 4, gpm	Total Capacity, gpm	Firm Capacity [a], gpm	Existing Maximum Day Demand, gpm	Existing Peak Hour plus Fire Flow Demand [b], gpm	Pumping Capacity Surplus (Deficit), gpm
Mountainview	Upper Fairway Downs CRW Master Meter No. 8 CRW Master Meter No. 9	4,000	4,000	4,000	--	12,000	8,000	4,592	--	3,408
Hunter Avenue	Intermediate Park Place View Manor Livesay Road CRW Master Meter No. 11 CRW Master Meter No. 12 CRW Master Meter No. 13	900	900	900	--	2,700	1,800	745	--	1,055
Fairway Downs	Fairway Downs	50	500	500	500	1,550	1,050	--	1,715	(665)
Livesay Road	Livesay Road	30	--	--	--	30	0	--	1,504	(1,504)

[a] Firm capacity is defined as the total booster pumping capacity with the largest pump out of service.

[b] Fire flow demand is defined as 1,500 gpm (residential land use).

Livesay Road pump station, it is adequately sized for serving normal peak hour demands, but lacks fire flow pumping capability. Since the Livesay Road pressure zone can be incorporated into the Intermediate Park Place pressure zone through a future system extension, it is recommended that the City plan to retire the Livesay Road pump station rather than upgrading the pump station to provide fire flow capacity.

Critical Supply Facilities

All critical supply facilities should be equipped with an on-site, backup power generator to provide pumping capacity during a power outage. Critical pumping facilities are defined as those facilities that provide service to pressure zone(s) without sufficient emergency storage and that meet the following criteria:

- The largest facility that provides water to a particular pressure zone(s);
- A facility that provides the sole source of water to a single or multiple pressure zones.

The following list summarizes the current available backup power facilities at each pump station.

- The Boynton pump station does not have backup power. As a result, this pump station cannot provide service during emergencies that involve a power outage.
- The Mountainview pump station has a diesel engine generator capable of operating the pump station at firm capacity.
- The Hunter Avenue pump station has a diesel engine generator capable of operating the pump station at firm capacity.
- The Fairway Downs pump station has a natural gas engine generator capable of operating the pump station at firm capacity.
- The Livesay Road pump station has no backup power source, but improvements are not necessary since this pump station will ultimately be decommissioned.

Based on the critical pumping facilities criteria and the available backup power facilities, the City's water system should be able to provide a reliable source of supply to the existing water system during a power outage.

WATER SYSTEM PERFORMANCE EVALUATION

This section discusses the performance criteria for, and results of, the existing water distribution system evaluation.

Existing Water System Performance Criteria

Steady state hydraulic analyses using the updated hydraulic model were conducted to identify areas of the existing water system that do not meet the recommended system performance criteria as presented previously in Chapter 4. The results of the evaluation of the existing water system are presented below for the following demand scenarios:

- Peak Hour Demand—A peak hour flow condition was simulated for the existing distribution facilities to evaluate their capability to meet a peak hour demand scenario. Peak hour demands are met by the combined flows from SFWB and storage reservoirs.
- Maximum Day Demand plus Fire Flow—To evaluate the existing water system under a maximum day demand plus fire flow scenario, InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow while meeting the maximum day demand plus fire flow performance criteria within the existing water system. Maximum day plus fire flow demands are met by the combined flows from SFWB and storage reservoirs.

These demand scenarios were selected to simulate critical conditions that are the most demanding of pipeline network performance capabilities.

Peak Hour Demand Scenario

As shown in Table 6-1, the peak hour demand for the City's existing water system was calculated to be 11,656 gpm (16.8 mgd). This peak hour demand represents a peaking factor of 4.5 times the average day demand. In addition, approximately 8,870 gpm (12.8 mgd) is delivered to CRW and West Linn through the master meter connections for a total peak hour system demand of 20,526 gpm (29.6 mgd).

During a peak hour demand scenario, a minimum pressure of 40 psi must be maintained throughout the water system. In addition, maximum head loss per thousand feet of distribution main should not exceed 10 ft/kft and maximum velocities should not exceed 7 fps. Details of the system pressures as simulated in the model under the peak hour demand scenario are discussed below.

Maximum Day Demand plus Fire Flow Scenario

As shown in Table 6-1, the maximum day demand for the City's existing water system was calculated to be 5,958 gpm (8.6 mgd). This maximum day demand represents a peaking factor of 2.3 times the average day demand. In addition, approximately 8,870 gpm (12.8 mgd) is delivered to CRW and West Linn through the master meter connections for a total maximum day system demand of 14,828 gpm (21.4 mgd).

This scenario was simulated in the hydraulic model to verify the availability of minimum fire flows for residential land use areas (1,500 gpm), as well as commercial, multi-family, and public facility land uses. InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow in the existing water system while meeting the minimum residual pressure criterion of 20 psi. The results from this evaluation will help City staff identify areas within the existing system where they may want to improve fire flow as future pipeline replacement projects are developed.

Recommended Improvements Criteria

The existing water system is expected to deliver peak hour flows and maximum day demand plus fire flow within the acceptable pressure, velocity and head loss ranges as identified in the performance criteria presented in Chapter 4. However, the system was evaluated using pressure as the primary criterion. Recommended improvements needed to comply with the performance criteria will be added to the existing water system to fix any deficiencies found and will also be described below.

Existing Water System Evaluation Results

This section addresses the results of the peak hour demand and maximum day demand plus fire flow analyses.

Peak Hour Demand Scenario

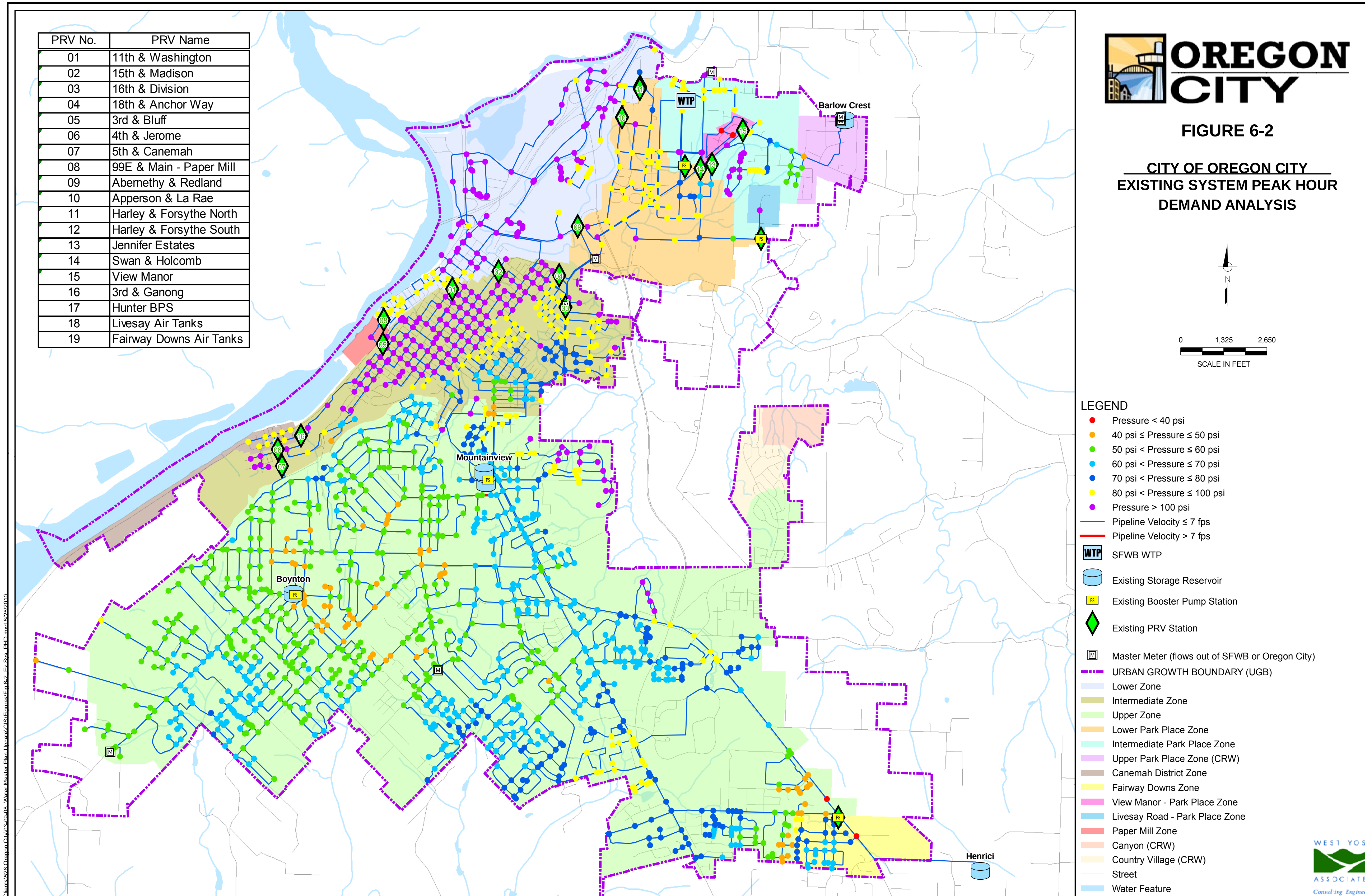
During a peak hour demand scenario, results indicate that the existing water system could not adequately deliver peak hour demands to meet the City's minimum pressure criterion of 40 psi as illustrated on Figure 6-2. Under this scenario, system pressures ranged from 35 to 164 psi.

As shown on Figure 6-2, a small area of low pressures (35-37 psi) was simulated in the Upper pressure zone downstream of Henrici Reservoir. Based on the location of this area of low pressures, it appears that the low pressures are caused by higher elevations. This result is comparable to the established pressure range for the Upper pressure zone, which is between 34-141 psi. Based on this information, no mitigation is recommended at this time.

As shown on Figure 6-2, a few junctions in the View Manor pressure zone also had simulated pressures slightly below 40 psi. This result is also comparable to the established pressure range for the View Manor pressure zone, which is between 35-36 psi. Currently, the View Manor PRV station has a control setting of 40 psi which City staff set to prevent pipe bursting. There have been numerous pipe breaks with the old cast iron pipe in the View Manor pressure zone.

As noted in Chapter 2, there are areas in the City's water system where high pressures are inherent to the existing pressure zone system. In particular, the Intermediate and Intermediate Park Place pressure zones span such a great range of elevations that pressures at the bottom of the pressure zone significantly exceed 100 psi in order to keep pressures at the top of the pressure zone above 40 psi. Figure 6-2 shows the location of the high pressure nodes in the City's water system. High pressure areas in the older parts of the water system would be prime targets for leak detection activities.

In general, the recommended corrective action for existing high pressure areas is the installation of individual pressure reducing valves on service connections. If leakage problems in the very high pressure areas (upwards of 120 psi) prove to be extensive, this situation may warrant the consideration of reconfiguring pressure zone boundaries. Reconfigured pressure zone boundaries would be achieved through modifications in pipeline configuration and the addition of new PRV stations. These reconfigurations would be harder in some areas of the system than others. For example, in the Intermediate pressure zone, modifying pressure zone boundaries would be a challenge since it is a heavily interconnected pipeline network.



PRV No. | PRV Name
01 | 11th & Washington
02 | 15th & Madison
03 | 16th & Division
04 | 18th & Anchor Way
05 | 3rd & Bluff
06 | 4th & Jerome
07 | 5th & Canemah
08 | 99E & Main - Paper Mill
09 | Abernethy & Redland
10 | Apperson & La Rae
11 | Harley & Forsythe North
12 | Harley & Forsythe South
13 | Jennifer Estates
14 | Swan & Holcomb
15 | View Manor
16 | 3rd & Ganong
17 | Hunter BPS
18 | Livesay Air Tanks
19 | Fairway Downs Air Tanks
WTP
Barlow Crest
Mountainview
Boynton
Henrici
OREGON CITY
FIGURE 6-2
CITY OF OREGON CITY
EXISTING SYSTEM PEAK HOUR
DEMAND ANALYSIS
N
0
1,325
2,650
SCALE IN FEET
LEGEND
Pressure < 40 psi
40 psi ≤ Pressure ≤ 50 psi
50 psi < Pressure ≤ 60 psi
60 psi < Pressure ≤ 70 psi
70 psi < Pressure ≤ 80 psi
80 psi < Pressure ≤ 100 psi
Pressure > 100 psi
Pipeline Velocity ≤ 7 fps
Pipeline Velocity > 7 fps
SFWB WTP
Existing Storage Reservoir
Existing Booster Pump Station
Existing PRV Station
Master Meter (flows out of SFWB or Oregon City)
URBAN GROWTH BOUNDARY (UGB)
Lower Zone
Intermediate Zone
Upper Zone
Lower Park Place Zone
Intermediate Park Place Zone
Upper Park Place Zone (CRW)
Canemah District Zone
Fairway Downs Zone
View Manor - Park Place Zone
Livesay Road - Park Place Zone
Paper Mill Zone
Canyon (CRW)
Country Village (CRW)
Street
Water Feature
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As illustrated on Figure 6-2, most of the pipelines in the existing water system meet the maximum velocity criterion during a peak hour demand scenario. Almost all of the pipelines exceeding the maximum pipeline velocity requirement of 7 fps are downstream of either a pump station or PRV station, which typically experience high velocities due to the large volumes of water being conveyed. It should also be noted that some of the 30-inch diameter transmission mains from the SFWB have velocities in the range of 5.8-7.6 fps, which exceeds the recommended transmission pipeline velocity of 5 fps. City staff may want to consider adding additional transmission pipeline capacity to the City's water system as water demands increase to reduce transmission pipeline velocities and to prevent excessive pressure loss.

However, since pipeline velocity is a secondary criterion, no improvements for pipelines that exceed the velocity criterion in the existing water system are recommended unless the primary criterion (pressure) is not met. Based on results of the peak hour simulation, none of the above pipelines are in the vicinity of the low pressure areas. Therefore, no mitigation is recommended at this time.

Maximum Day Demand plus Fire Flow Scenario

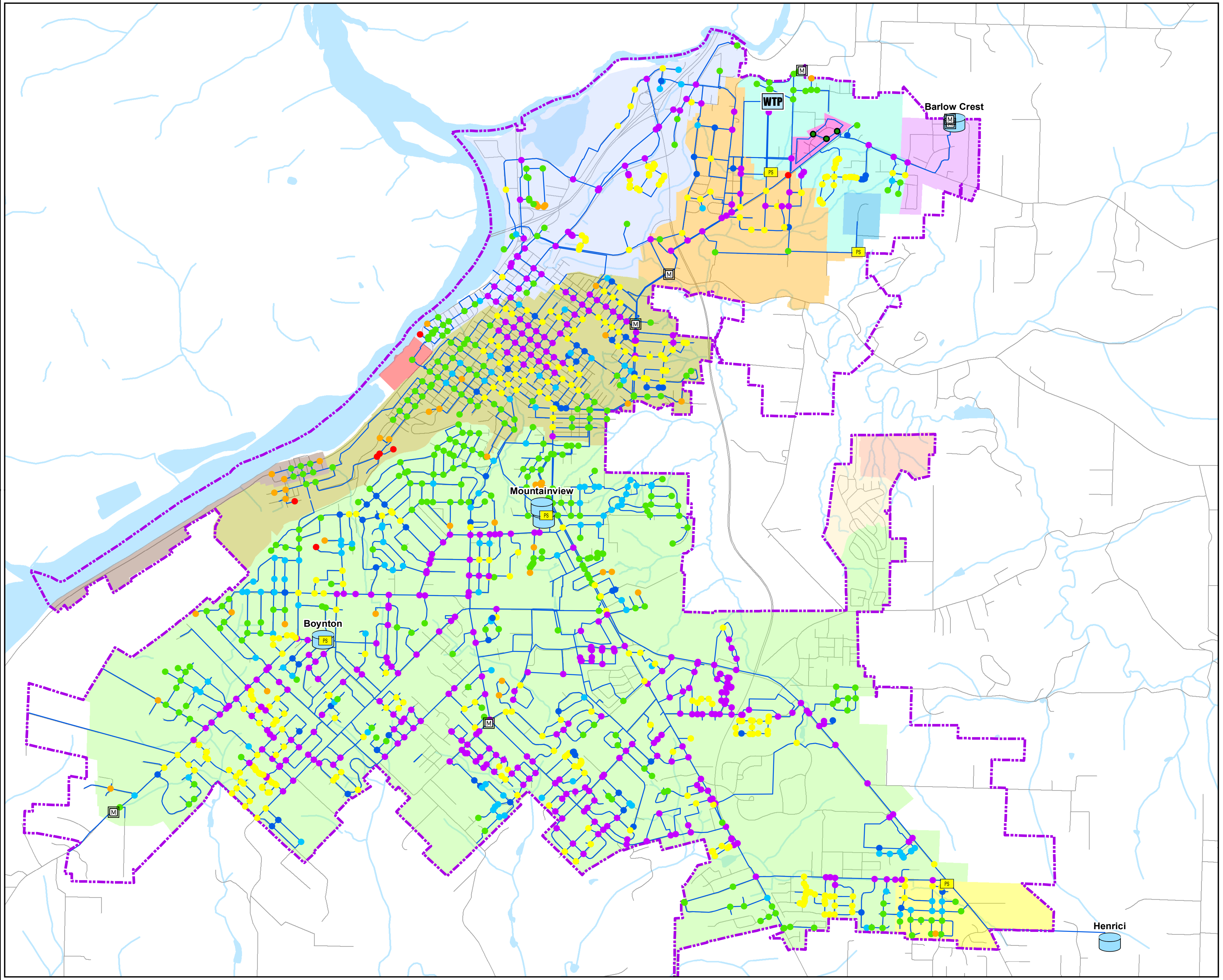
InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow at each junction within the existing water system under a maximum day demand scenario. Figure 6-3 illustrates the available fire flow at a residual pressure of 20 psi for each junction within the existing water system. In general, fire flow availability is very good in the City's existing system, but a review of Figure 6-3 indicates that there are a few areas in the system with extensive lengths of 6-inch or smaller diameter pipelines where the model simulated clusters of junctions that do not meet minimum fire flow requirements. However, most of these junctions have been identified previously for fire flow deficiencies as discussed below.

As an update to the 2004 WMP, West Yost reviewed the fire flow deficiencies identified previously to provide a current status on the City's previously identified fire flow deficiencies. Table 6-4 identifies the fire flow location, updated available fire flow estimate, required fire flow demand, and updated recommended corrective action for each of the previously deficient areas. The updated recommended corrective actions identified in Table 6-4 provide the basis for the development of the recommended CIP for fire flow deficiencies in the existing water system.

It is important to note that much of the existing CRW network within the City's UGB, such as those service areas along South End Road, are small diameter systems with inadequate fire flow availability. These pipelines will require upsizing when annexed into the City's water system in the future.

Table 6-4. Review of Maximum Day Demand plus Fire Flow Deficiencies Identified in 2004 WMP

Location and Model Junction ID	Pressure Zone	Updated Available Fire Flow, gpm	Required Fire Flow, gpm	Previously Recommended Corrective Action	Updated Recommended Corrective Action
Residential Land Use Areas					
Highway 99 1025	Lower	2000	1,500	Upsize 4-inch pipeline serving hydrant.	**Previously recommended corrective action has been completed.**
Blanchard-Canemah 2069, 2071	Intermediate	920	1,500	Cluster: Upsize 4-inch pipeline serving hydrants.	Same as 2004 WMP.
Center St. and Sunset 2283, 2471, 2127, 2281	Intermediate	600	1,500	Cluster: Upsize local 6-inch pipelines or add PRV feed from Upper Zone at Telford.	Add PRV feed from Upper pressure zone at Telford.
Third and East 2259, 2263	Intermediate	1400	1,500	Cluster: Upsize local 6-inch pipelines.	**Previously recommended corrective action has been completed.**
Caufield 3712	Upper	1,900	1,500	Upsize and loop 4-inch pipeline serving hydrant.	**Previously recommended corrective action has been completed.**
Woodfield 3300	Upper	1000	1,500	Close to required flow. No piping modification necessary if Boynton pump station on.	Same as 2004 WMP.
Forest Ridge Ln, Beutel Rd, CRW pipelines	Upper	180-750	1,500	CRW pipelines off South End Road require upsizing if annexed.	Same as 2004 WMP.
Livesay Road 4115, 4119	Lower Park Place	690	1,500	Upsize 6-inch pipeline and add feed through PRV station from Intermediate Park Place Zone.	Same as 2004 WMP.
Commercial and Multi-Family Land Use Areas					
7th and Polk 2433	Intermediate	5,200	4,500	Low priority. Upsize local 6-inch pipelines as opportunity arises.	**Previously recommended corrective action has been completed.**
Industrial, Institutions, and Public Land Use Areas					
5th and Main – Mill 12101	Paper Mill	2,450	5,000	Supplementary fire protection systems available. **No action recommended.**	Same as 2004 WMP.
Abernethy Road - County Shops, 1095	Lower	5,200	3,000	Low priority. Upsize 6-inch pipeline as opportunity arises.	**Previously recommended corrective action has been completed.**
King Street – School 3870	Upper	5,500	5,000	Upsize 8-inch pipeline.	**Previously recommended corrective action has been completed.**



OREGON CITY

FIGURE 6-3

CITY OF OREGON CITY
EXISTING SYSTEM AVAILABLE
FIRE FLOW (Residual Pressure ≥ 20psi)

N

0 1,325 2,650

SCALE IN FEET

LEGEND

- Available Fire Flow < 1,000 gpm for 4 hour duration
- 1,000 gpm ≤ Available Fire Flow ≤ 1,500 gpm for 4 hour duration
- 1,500 gpm < Available Fire Flow ≤ 3,500 gpm for 4 hour duration
- 3,500 gpm < Available Fire Flow ≤ 4,500 gpm for 4 hour duration
- 4,500 gpm < Available Fire Flow ≤ 5,000 gpm for 4 hour duration
- 5,000 gpm < Available Fire Flow ≤ 7,000 gpm for 4 hour duration
- Available Fire Flow > 7,000 gpm for 4 hour duration
- WTP SFWB WTP
- Existing Storage Reservoir
- PS Existing Booster Pump Station
- M Master Meter (flows out of SFWB or Oregon City)
- Existing Pipeline
- URBAN GROWTH BOUNDARY (UGB)
- Lower Zone
- Intermediate Zone
- Upper Zone
- Lower Park Place Zone
- Intermediate Park Place Zone
- Upper Park Place Zone (CRW)
- Canemah District Zone
- Fairway Downs Zone
- View Manor - Park Place Zone
- Livesay Road - Park Place Zone
- Paper Mill Zone
- Canyon (CRW)
- Country Village (CRW)
- Street
- Water Feature

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SUMMARY OF RECOMMENDED IMPROVEMENTS FOR EXISTING WATER SYSTEM

The recommended improvements needed to eliminate deficiencies identified in the evaluation of the existing water distribution system are summarized below and shown on Figure 6-4. These recommendations only identify improvements at a master plan level and do not constitute a design of such improvements. Subsequent detailed design is required to determine the exact sizes and/or locations of these proposed improvements. The estimated costs and timing for these recommended improvements are discussed in Chapter 8.

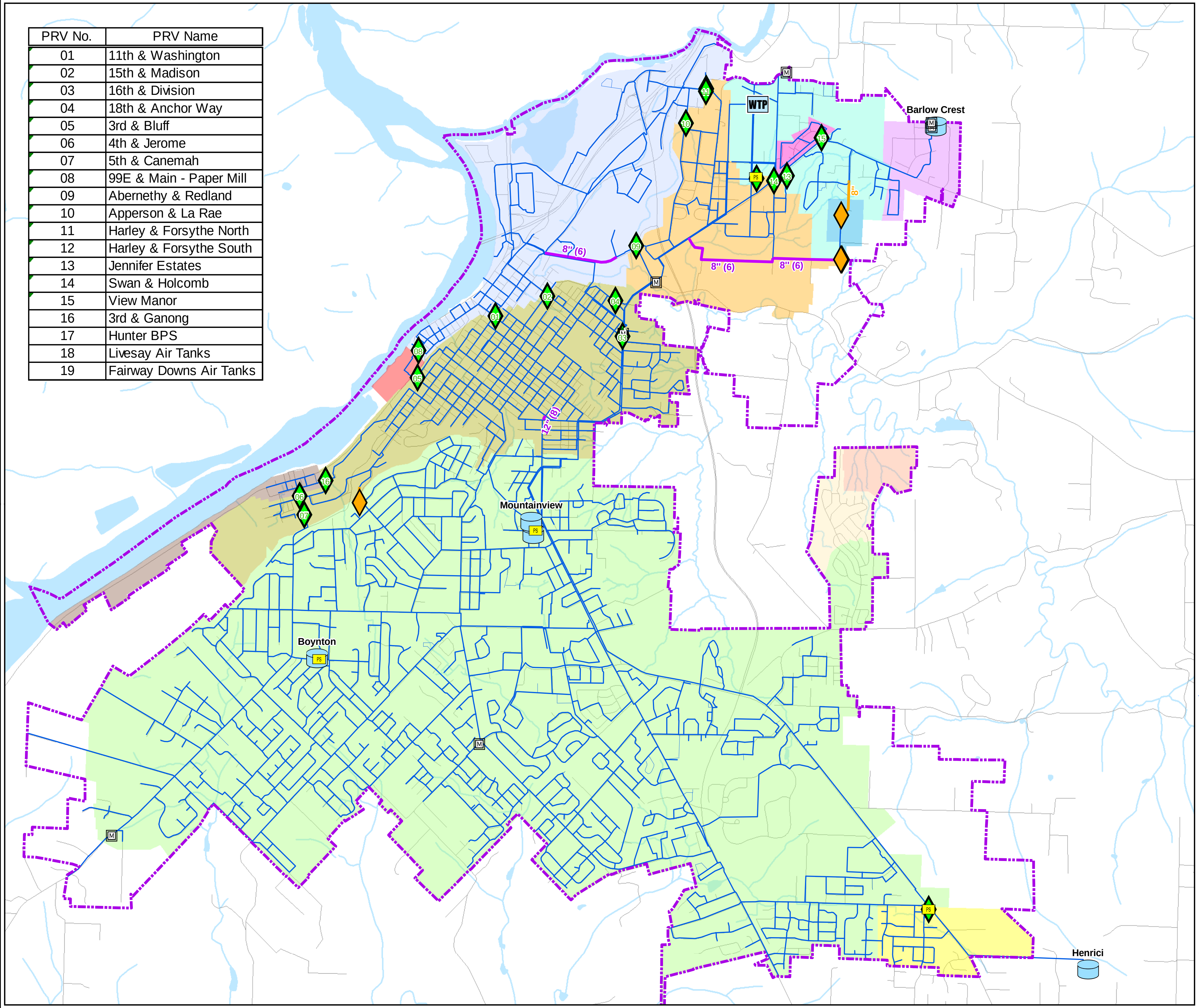
PRV Stations

- Construct a 6-inch PRV station from Upper pressure zone at Telford Road to address fire flow deficiencies at Center Street and Sunset Street in the Intermediate pressure zone.

Pipelines

- Construct pipeline improvements identified in Table 6-4 to address fire flow deficiencies.

PRV No.	PRV Name
01	11th & Washington
02	15th & Madison
03	16th & Division
04	18th & Anchor Way
05	3rd & Bluff
06	4th & Jerome
07	5th & Canemah
08	99E & Main - Paper Mill
09	Abernethy & Redland
10	Apperson & La Rae
11	Harley & Forsythe North
12	Harley & Forsythe South
13	Jennifer Estates
14	Swan & Holcomb
15	View Manor
16	3rd & Ganong
17	Hunter BPS
18	Livesay Air Tanks
19	Fairway Downs Air Tanks



OREGON CITY

FIGURE 6-4

CITY OF OREGON CITY
EXISTING WATER SYSTEM
RECOMMENDED IMPROVEMENTS

N

0 1,325 2,650
SCALE IN FEET

LEGEND

- Recommended PRV Station
- Recommended New Pipeline
- Recommended Pipeline Upsize
- WTP SFWB WTP
- Existing Storage Reservoir
- PS Existing Booster Pump Station
- Existing PRV Station
- M Master Meter (flows out of SFWB or Oregon City)
- Existing Pipeline
- URBAN GROWTH BOUNDARY (UGB)
- Lower Zone
- Intermediate Zone
- Upper Zone
- Lower Park Place Zone
- Intermediate Park Place Zone
- Upper Park Place Zone (CRW)
- Canemah District Zone
- Fairway Downs Zone
- View Manor - Park Place Zone
- Livesay Road - Park Place Zone
- Paper Mill Zone
- Canyon (CRW)
- Country Village (CRW)
- Street
- Water Feature

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CHAPTER 7. FUTURE WATER DISTRIBUTION SYSTEM EVALUATION

This chapter presents an overview evaluation of the City's future water distribution system and its ability to meet the recommended performance and planning criteria under buildout demand conditions. Performance standards used to evaluate the water system are defined in Chapter 4.

This chapter identifies the improvements to existing water system infrastructure that will be required to expand service to new areas and support the projected buildout water demands. The evaluation includes an analysis of water storage capacity, pumping capacity and the future system's ability to meet recommended operational and design criteria under buildout maximum day demand plus fire flow and peak hour demand scenarios.

West Yost conducted this evaluation using an updated hydraulic model that incorporated improvements needed to eliminate deficiencies identified in the existing water system evaluation (see Chapter 6), as well as distribution pipelines required to serve projected buildout demands[1]. These facilities are shown on Figure 7-1. Evaluations, findings, and recommendations for addressing the identified future water distribution system deficiencies are included and summarized at the end of this chapter. The identified recommendations and estimated timings were then used to develop a CIP, including an estimate of probable construction costs. The recommended CIP is described further in Chapter 8.

BUILDOUT WATER DEMANDS

The buildout water demands for the City were developed based on UGB buildout land use information provided by City staff as shown on Figure 7-2, and the adopted water duty factors as described in Chapter 3. These projected buildout water demands were then allocated into the future system hydraulic model. Table 7-1 summarizes the buildout water demands for the City by pressure zone. Projected buildout water demands from master meters serving CRW and West Linn have also been allocated in the City's hydraulic model and are included in Table 7-1.

FUTURE WATER SYSTEM FACILITY EVALUATION

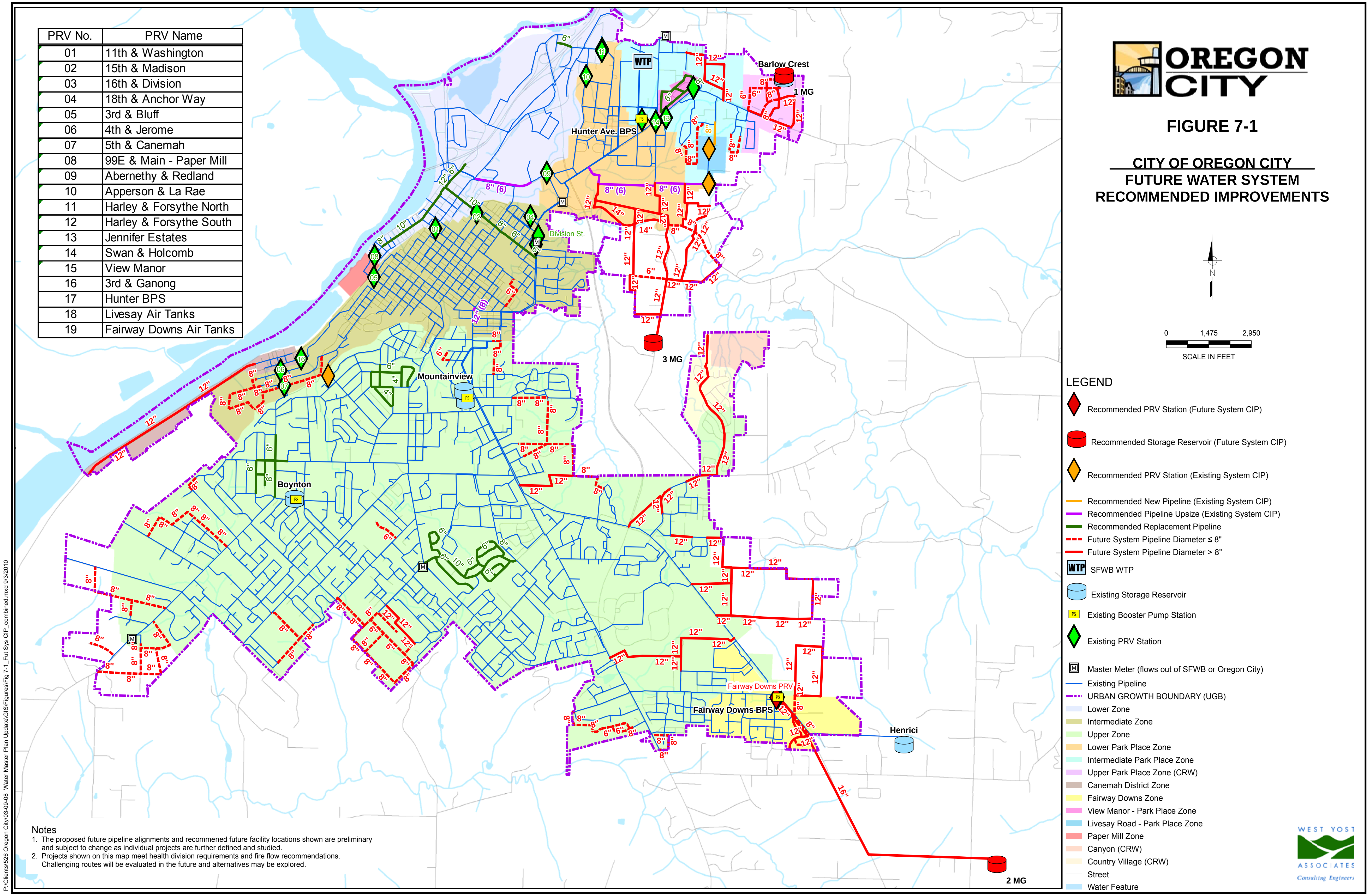
To evaluate the future water system, the following system facilities analyses were conducted:

- Water Storage Capacity,
- Pumping Capacity, and
- Critical Supply Facilities.

The results of the future water system facility analyses are discussed below.

---

[1] Some future UGB service areas are currently served by CRW, and it is unclear how these areas will be incorporated into the City's future water system (i.e., new pipelines or existing CRW pipelines). Consequently, it was assumed that some existing CRW pipelines would be added into the future system to serve these expanded areas.


PRV No. | PRV Name
01 11th & Washington
02 15th & Madison
03 16th & Division
04 18th & Anchor Way
05 3rd & Bluff
06 4th & Jerome
07 5th & Canemah
08 99E & Main - Paper Mill
09 Abernethy & Redland
10 Apperson & La Rae
11 Harley & Forsythe North
12 Harley & Forsythe South
13 Jennifer Estates
14 Swan & Holcomb
15 View Manor
16 3rd & Ganong
17 Hunter BPS
18 Livesay Air Tanks
19 Fairway Downs Air Tanks
OREGON CITY
FIGURE 7-1
CITY OF OREGON CITY
FUTURE WATER SYSTEM
RECOMMENDED IMPROVEMENTS
0 1,475 2,950
SCALE IN FEET
LEGEND
Recommended PRV Station (Future System CIP)
Recommended Storage Reservoir (Future System CIP)
Recommended PRV Station (Existing System CIP)
Recommended New Pipeline (Existing System CIP)
Recommended Pipeline Upsize (Existing System CIP)
Recommended Replacement Pipeline
Future System Pipeline Diameter ≤ 8"
Future System Pipeline Diameter > 8"
SFWB WTP
Existing Storage Reservoir
Existing Booster Pump Station
Existing PRV Station
Master Meter (flows out of SFWB or Oregon City)
Existing Pipeline
URBAN GROWTH BOUNDARY (UGB)
Lower Zone
Intermediate Zone
Upper Zone
Lower Park Place Zone
Intermediate Park Place Zone
Upper Park Place Zone (CRW)
Canemah District Zone
Fairway Downs Zone
View Manor - Park Place Zone
Livesay Road - Park Place Zone
Paper Mill Zone
Canyon (CRW)
Country Village (CRW)
Street
Water Feature
Barlow Crest
1 MG
WTP
Hunter Ave. BPS
Division St.
3 MG
Mountainview
Boynton
Fairway Downs PRV
Fairway Downs BPS
Henrici
2 MG
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Notes
1. The proposed future pipeline alignments and recommened future facility locations shown are preliminary and subject to change as individual projects are further defined and studied.
2. Projects shown on this map meet health division requirements and fire flow recommendations. Challenging routes will be evaluated in the future and alternatives may be explored.
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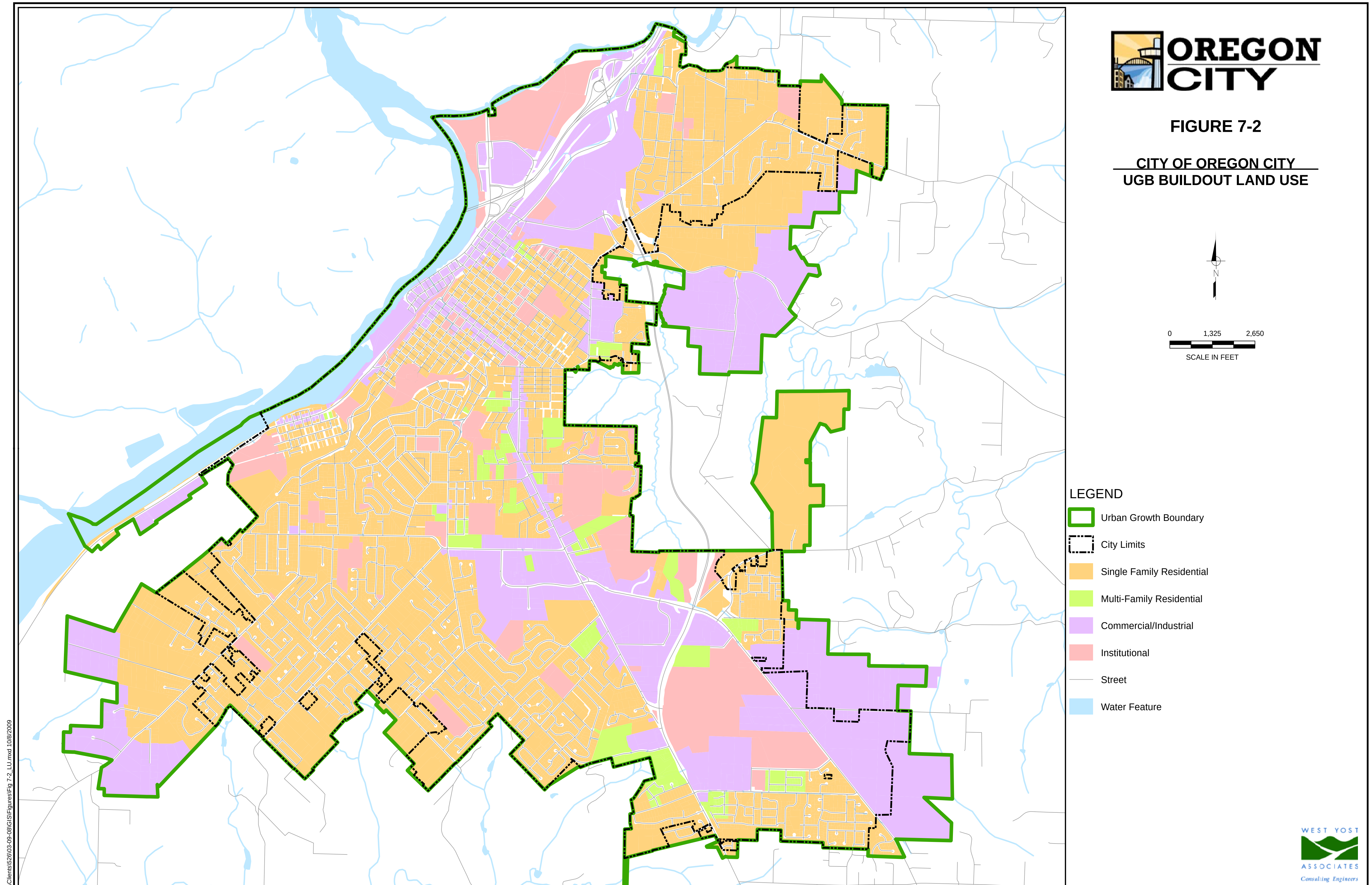
OREGON CITY
FIGURE 7-2
CITY OF OREGON CITY
UGB BUILDOUT LAND USE
N
0
1,325
2,650
SCALE IN FEET
LEGEND
Urban Growth Boundary
City Limits
Single Family Residential
Multi-Family Residential
Commercial/Industrial
Institutional
Street
Water Feature
WEST YOST
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Table 7-1. Water Demands for the Buildout Water System

Pressure Zone	Average Day Demand(a)		Maximum Day Demand(b)		Peak Hour Demand(c)	
	gpm	mgd	Gpm	mgd	gpm	mgd
Lower	296.8	0.43	682.7	0.98	1,335.6	1.92
Intermediate	387.1	0.56	890.2	1.28	1,741.7	2.51
Upper	3,235.9	4.66	7,442.6	10.72	14,561.7	20.97
Lower Park Place	426.7	0.61	981.6	1.41	1,920.4	2.77
Intermediate Park Place	198.9	0.29	457.6	0.66	895.2	1.29
Upper Park Place	72.1	0.10	165.8	0.24	324.4	0.47
Canemah	35.5	0.05	81.6	0.12	159.7	0.23
Fairway Downs	169.0	0.24	388.8	0.56	760.6	1.09
View Manor	16.4	0.02	37.8	0.054	73.9	0.11
Livesay Road	21.1	0.03	48.5	0.07	95.0	0.14
Paper Mill	16.2	0.02	37.2	0.054	72.9	0.10
City of Oregon City's Subtotal	*4,875.7*	*7.01*	*11,214.4*	*16.15*	*21,941.1*	*31.60*
Master Meter No. 2(d)	991.4	1.43	2,974.2	4.28	2,974.2	4.28
Master Meter No. 3(d)	3,192.0	4.60	9,576.0	13.79	9,576.0	13.79
Master Meter No. 8(e)	70.8	0.10	212.5	0.31	212.5	0.31
Master Meter No. 9(e)	36.2	0.05	108.7	0.16	108.7	0.16
Master Meter No. 11(e)	260.0	0.37	779.9	1.12	779.9	1.12
Master Meter No. 12(e)	7.9	0.01	23.6	0.03	23.6	0.03
Master Meter No. 13(e)	12.9	0.02	38.7	0.06	38.7	0.06
Master Meters Subtotal	*4,571.2*	*6.58*	*13,713.6*	*19.75*	*13,713.6*	*19.75*
Water System Total	**9,446.9**	**13.59**	**24,928.0**	**35.90**	**35,654.7**	**51.35**

(a) The City's average day demands were projected using the City's land use data within the UGB and the recommended water duty factors developed in Chapter 3. Average day demand for master meters was projected based on 2008 water use data plus a two percent annual growth up to 2030.
(b) The City's maximum day demand is 2.3 times the average day demand. Maximum day demand for master meters is based on 3.0 times the average day master meter demand.
(c) The City's peak hour demand is 4.5 times the average day demand. Peak hour demand for master meters is based on 3.0 times the average day master meter demand.
(d) Master meter is served directly from the SFWB transmission main.
(e) Master meter is served by the City's water system.

Water Storage Capacity

The principle advantages that storage provides for the water system are the ability to equalize demands on supply sources, production facilities, and transmission mains; to provide emergency storage in case of supply failure; and to provide water to fight fires. The City's existing water system includes five water storage facilities serving ten pressure zones.

Together, these water storage facilities must be sufficient to meet the City's storage criteria for the future water system. The volume required for each storage component is detailed below:

- Equalization Storage: 25 percent of maximum day demand,
- Emergency Storage: 100 percent of maximum day demand, and
- Fire Flow Storage: Determined using the largest fire flow requirement times the fire flow duration period as required by the Clackamas County Fire District.

Typically the required storage volume for these three system storage components is determined individually within each pressure zone and then combined to identify the total amount of storage volume required for the overall system. However, since the lower pressure zones in the City are served through PRVs from the upper pressure zones, the fire flow storage for these interconnected pressure zones are shared in common, allowing the pressure zones to be analyzed as a set for fire flow storage. Consequently, the required fire flow storage for the future water system will be based on the following maximum fire flow demands in the pressure zones served by each reservoir or group of reservoirs:

- A 3,000 gpm fire flow for the duration of 4 hours for the pressure zones served by Boynton, Henrici, and Mountainview No. 2 Reservoirs.
- A 5,000 gpm fire flow for the duration of 4 hours for the pressure zones served by Mountainview No. 1 Reservoir.
- A 3,000 gpm fire flow for the duration of 4 hours for the pressure zones served by Barlow Crest Reservoir.

The existing storage facilities were evaluated to determine whether the City's existing storage facilities have sufficient capacity to provide the required system storage for projected buildout water demands. Table 7-2 summarizes the evaluation of water storage capacity in the future water system. The future system contains an overall water storage capacity of 18.25 MG, which is not sufficient to meet the projected storage requirement of 24.17 MG. As summarized in Table 7-2, the City is projected to have a water storage capacity deficit of approximately 6 MG.

Consequently, the following storage facilities are recommended to increase the storage capacity in the future water system to meet projected storage requirements:

- 2 MG storage reservoir at the 620 foot contour elevation to serve the expanded Fairway Downs pressure zone and portions of the Upper pressure zone through pressure reducing valve stations.
- 3 MG storage reservoir along Holly Lane to serve the Lower Park Place pressure zone.
- 1 MG storage reservoir at the existing Barlow Crest storage reservoir site (the remainder of the buildout emergency storage requirement will be met from Mountainview Reservoir No. 2).

Table 7-2. Summary of Buildout Water Storage Evaluation

		[A]	[B]	[C]	[D]	[E] = [B]+[C]+[D]	[F] = [A]-[E]
			Required Storage Capacity, MG				
Reservoir Set (Volume)	Pressure Zones Served	Total Available Storage, MG	Equalization [a]	Emergency [b]	Fire Flow [c]	Total Required Storage, MG	Storage Surplus (Deficit), MG
Boynton (2.0 MG) Henrici (2.0 MG) Mountainview No.2 (10.5 MG)	Upper	14.50	2.68	10.72	0.72	14.12	0.38
Mountainview No.1 (2.0 MG)	Intermediate	2.00	0.32	1.28	1.10	4.41	(2.41)
	Lower [d]		0.12	0.49			
	Lower Park Place [d]		0.18	0.71			
	Canemah		0.03	0.12			
	Paper Mill		0.01	0.05			
Fairway Downs	Fairway Downs		0.14	0.56	0.36	1.06	(1.06)
Barlow Crest (1.75 MG)	Intermediate Park Place	1.75	0.16	0.66	0.72	3.50	(1.75)
	Upper Park Place		0.06	0.24			
	Lower [d]		0.12	0.49			
	Lower Park Place [d]		0.18	0.71			
	View Manor		0.01	0.05			
	Livesay Road		0.02	0.07			
Total		**18.25**	**4.04**	**16.15**	**2.90**	**23.09**	**(4.84)**

(a) Based on 25 percent of a maximum day demand (see Table 7-1).

(b) Based on a maximum day demand (see Table 7-1).

(c) Fire flow storage for Boynton, Henrici, and Mountainview No. 2 reservoir set based on a 3,000 gpm fire flow for the duration of 4 hours. Fire flow storage for Mountainview No. 1 reservoir based on a 5,000 gpm fire flow for the duration of 4 hours; however, the required storage was reduced by 0.10 MG to account for the fire storage tank at the Paper Mill. Fire flow storage for Barlow Crest reservoir based on a 5,000 gpm fire flow for the duration of 4 hours. Fire flow storage for Fairway Downs reservoir based on a 1,500 gpm fire flow for the duration of 4 hours.

(d) Required storage capacity for this zone was split between Mountainview No.1 and Barlow Crest reservoirs.

Pumping Capacity

The pumping capacity within the City's future water system was evaluated to assess its ability to deliver a reliable firm capacity to the buildout service area. Firm capacity assumes a reduction in total pumping capacity to account for pumps that are out of service at any given time due to mechanical breakdowns, maintenance, water quality, or other operational issues. For each booster pump station, the firm pumping capacity was defined as the total pump station capacity with the largest pump out of service.

There are five booster pump stations in the City's future water distribution system. The Boynton pump station provides local emergency and fire flow service and is adequately sized to serve this function. The other four pump stations perform transfer pumping service, moving water from one pressure zone to another. The performance criteria for a transfer booster pumping facility serving a pressure zone(s) with storage requires that the pump station have adequate firm capacity to supply the maximum day demand within all dependent pressure zone(s) over a 24-hour period. For pressure zone(s) without storage, the planning criteria requires that the pump station have adequate firm capacity to supply peak hour demand plus fire flow requirements within the pressure zone(s).

Table 7-3 summarizes the evaluation of the pumping capacity in the future water system. The pumping capacity analysis indicates that the existing capacity of the Hunter Avenue pump station, which serves pressure zones with storage, is adequate for meeting a buildout maximum day demand condition. However, the Mountainview pump station has a slight capacity deficit of approximately 150 gpm during a buildout maximum day demand condition. City personnel also report that the pumps at the Mountainview pump station can not pump their full firm capacity because the existing configuration constricts the flow and causes the pump station to pump at a higher pressure. Consequently, in the short term, Boynton and Henrici Reservoirs would be required to supply water to the Upper pressure zone during a maximum day demand. It is recommended that the City make improvement to the pipeline configuration in the immediate vicinity of the pump station to allow the pump station to use it full firm capacity without causing other system damage.

In addition, the Barlow Crest pump station has a capacity deficit of approximately 1,300 gpm under a buildout maximum day demand condition. While this station is currently owned and operated by CRW, should the time come that Oregon City serve the customers in the Upper Park Place pressure zone it would be recommended that the City install two additional pumps (700 gpm each) at the Barlow Crest pump station to increase the station's firm capacity to meet buildout maximum day demands.

The Fairway Downs pump station does not have adequate capacity for serving the required 1,500 gpm fire flow demand, and the existing normal service pump's capacity of 50 gpm is insufficient to meet projected peak hour demands of approximately 760 gpm. However, when the new Fairway Downs reservoir is constructed, this pump station will no longer be the source of supply for the Fairway Downs pressure zone. This station will change in function from a constant run station booster station to one that fills the new Fairway Downs reservoir. Preliminary modeling shows that the current pumps are adequate for this future purpose, however, this should be further refined and evaluated once the City has developed an extended period simulation model.

Table 7-3. Summary of Buildout Pumping Capacity Evaluation

Pump Station	Pressure Zone/Master Meter Served	Pump 1, gpm	Pump 2, gpm	Pump 3, gpm	Pump 4, gpm	Total Capacity, gpm	Firm Capacity [(a)], gpm	Buildout Maximum Day Demand, gpm	Buildout Peak Hour plus Fire Flow Demand [(b)], gpm	Pumping Capacity Surplus (Deficit), gpm
Mountainview	Upper									
	CRW Master Meter No. 8									
	CRW Master Meter No. 9	4,000	4,000	4,000	--	12,000	8,000	7,764	--	236
Hunter Avenue	Intermediate Park Place									
	Upper Park Place									
	View Manor									
	Livesay Road									
	CRW Master Meter No. 11									
	CRW Master Meter No. 12									
	CRW Master Meter No. 13	900	900	900	--	2,700	1,800	1,552	--	248
Barlow Crest [(c)]	Upper Park Place	450	450	--	--	900	450	--	1,324	(874)
Fairway Downs	Fairway Downs	50	500	500	500	1,550	1,050	--	1,761	(711)

[(a)] Firm capacity is defined as the total booster pumping capacity with the largest pump out of service.

[(b)] Fire flow demand is defined as 1,500 gpm (residential land use). However, if future development in these pressure zones include land uses other than single family residential, the capacity of these pump stations should be re-evaluated to accommodate additional fire flow demand.

[(c)] It was assumed that the Barlow Crest booster pump station (currently operated by CRW) will be incorporated into the City's future water system to serve projected water demands in the UGB from the Upper Park Place pressure zone.

Critical Supply Facilities

All critical supply facilities should be equipped with an on-site, backup power generator to provide pumping capacity during a power outage. Critical pumping facilities are defined as those facilities that provide service to pressure zone(s) without sufficient emergency storage and that meet the following criteria:

- The largest facility that provides water to a particular pressure zone(s);
- A facility that provides the sole source of water to a single or multiple pressure zones.

The following list summarizes the current available backup power facilities at each pump station.

- The Boynton pump station does not have backup power. As a result, this pump station cannot provide service during emergencies that involve a power outage.
- The Mountainview pump station has a diesel engine generator capable of operating the pump station at firm capacity.
- The Hunter Avenue pump station has a diesel engine generator capable of operating the pump station at firm capacity.
- The Fairway Downs pump station has a natural gas engine generator capable of operating the pump station at firm capacity.
- The Barlow Crest pump station has a generator capable of operating the pump station at firm capacity.

Based on the critical pumping facilities criteria and the available backup power facilities, the City's water system should be able to provide a reliable source of supply to the future water system during a power outage.

WATER SYSTEM PERFORMANCE EVALUATION

This section discusses the performance criteria for and results of the future water distribution system evaluation. The proposed future water system, which includes improvements recommended from the future water system facility evaluation, is illustrated on Figure 7-1.

Future Water System Performance Criteria

Steady state hydraulic analyses using the updated hydraulic model were conducted to identify areas of the future water system that do not meet the recommended system performance criteria as presented previously in Chapter 4. The results of the evaluation of the future water system are presented below for the following demand scenarios:

- Peak Hour Demand—A peak hour flow condition was simulated for the future distribution facilities to evaluate their capability to meet a peak hour demand scenario. Peak hour demands are met by the combined flows from SFWB and storage reservoirs.

- Maximum Day Demand plus Fire Flow—To evaluate the future water system under a maximum day demand plus fire flow scenario, InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow while meeting the maximum day demand plus fire flow performance criteria within the future water system. Maximum day plus fire flow demands are met by the combined flows from SFWB and storage reservoirs.

These demand scenarios were selected to simulate critical conditions that are the most demanding of pipeline network performance capabilities.

<u>Peak Hour Demand Scenario</u>

As shown in Table 7-1, the peak hour demand for the City's future water system was projected to be 21,941 gpm (31.6 mgd). This peak hour demand represents a peaking factor of 4.5 times the average day demand. In addition, approximately 13,714 gpm (19.8 mgd) is projected to be delivered to CRW and West Linn through the master meter connections for a total peak hour system demand of 35,655 gpm (51.4 mgd).

During a peak hour demand scenario, a minimum pressure of 40 psi must be maintained throughout the water system. In addition, maximum head loss per thousand feet of distribution main should not exceed 10 ft/kft and maximum velocities should not exceed 7 fps. Details of the system pressures as simulated in the model under the peak hour demand scenario are discussed below.

<u>Maximum Day Demand plus Fire Flow Scenario</u>

As shown in Table 7-1, the maximum day demand for the City's future water system was projected to be 11,214 gpm (16.15 mgd). This maximum day demand represents a peaking factor of 2.3 times the average day demand. In addition, approximately 13,714 gpm (19.75 mgd) is projected to be delivered to CRW and West Linn through the master meter connections for a total maximum day system demand of 24,928 gpm (35.9 mgd).

This scenario was simulated in the hydraulic model to verify the availability of minimum fire flows for residential land use areas (1,000 gpm), as well as commercial, multi-family, and public facility land uses. InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow in the future water system while meeting the minimum residual pressure criterion of 20 psi. The results from this evaluation will help City staff identify areas within the existing system where they may want to improve fire flow as future pipeline replacement projects are developed, as well as proposed areas where additional fire flow may be required.

<u>Recommended Improvements Criteria</u>

The future water system is expected to deliver peak hour flows and maximum day demand plus fire flow within the acceptable pressure, velocity and head loss ranges as identified in the performance criteria presented in Chapter 4. However, the system was evaluated using pressure as the primary criterion. Recommended improvements needed to comply with the performance criteria will be added to the future water system to fix any deficiencies found and will also be discussed in the following paragraphs.

The performance criteria described above was used to evaluate the future water system during peak hour demand and maximum day demand plus fire flow scenarios. The evaluation results are discussed below.

Future Water System Evaluation Results

This section addresses the results of the peak hour demand and maximum day demand plus fire flow analyses.

Peak Hour Demand Scenario

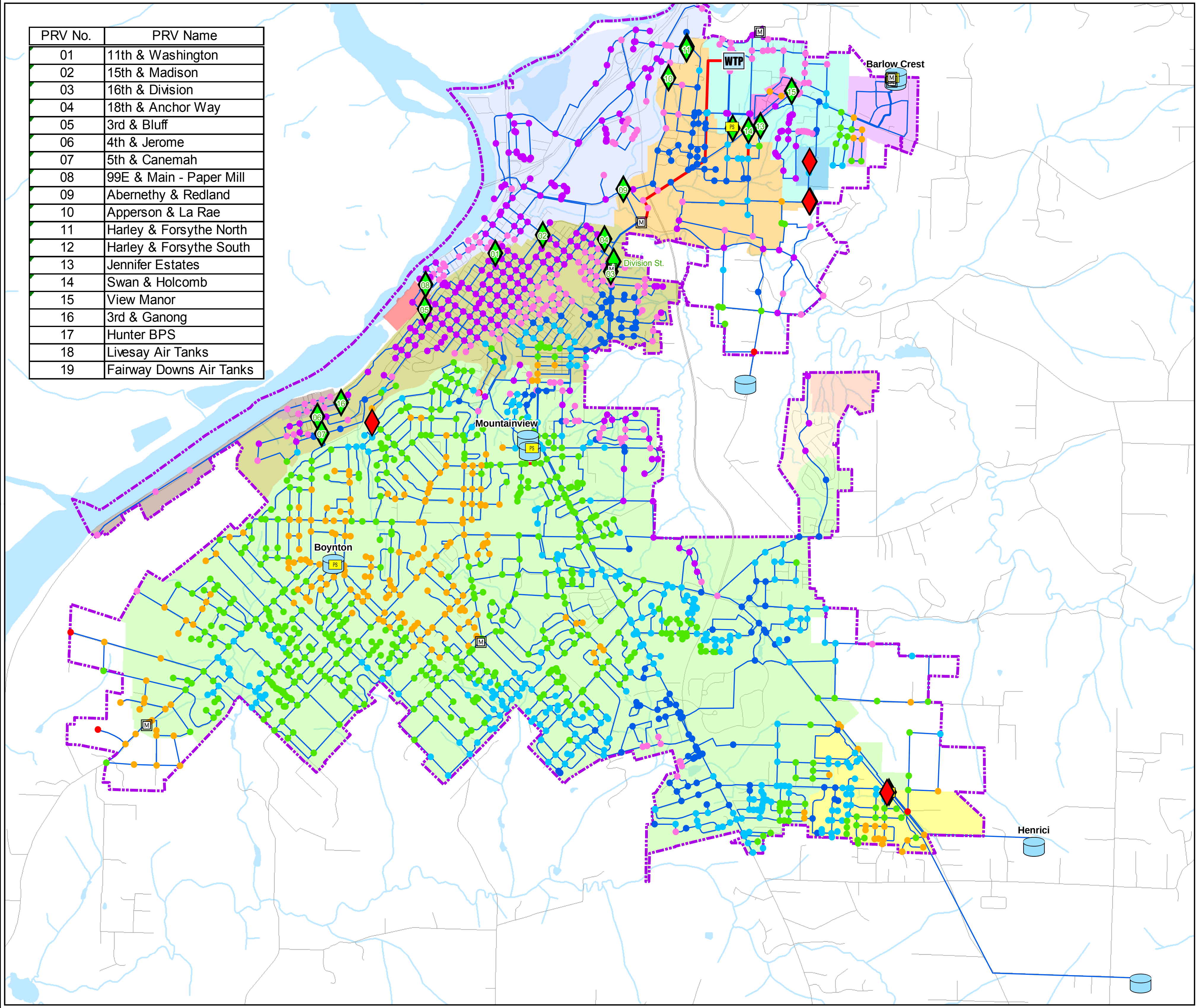
During a peak hour demand scenario, results indicate that the future water system could not adequately deliver peak hour demands to meet the City's minimum pressure criterion of 40 psi as illustrated on Figure 7-3. Under this scenario, system pressures ranged from 34 to 162 psi.

As shown on Figure 7-3, a small area of low pressures (34-39 psi) was simulated in the Upper pressure zone downstream of Henrici Reservoir and along the border of the Fairway Downs pressure zone. Based on the location of this area of low pressures, it appears that the low pressures are caused by higher elevations. This result is comparable to the established pressure range for the Upper pressure zone, which is between 34-141 psi. Based on this information, no mitigation is recommended at this time.

In addition, one junction in the Lower Park Place pressure zone also had a simulated pressure slightly below 40 psi. Based on the location of this area of low pressure, it appears that the low pressure is caused by the higher elevation. Consequently, it is recommended that the City consider the topographic constraints of this area while designing the recommended new storage reservoir along Holly Lane. Since the pressure is very close to the pressure requirement and future design of the Holly Lane storage reservoir can address this issue, no mitigation is recommended at this time.

As noted in Chapters 2 and 6, there are areas in the City's water system where high pressures are inherent to the existing pressure zone system. In particular, the Intermediate and Intermediate Park Place pressure zones span such a great range of elevations that pressures at the bottom of the pressure zone significantly exceed 100 psi in order to keep pressures at the top of the pressure zone above 40 psi. Figure 7-3 shows the location of the high pressure nodes in the City's water system. High pressure areas in the older parts of the water system would be prime targets for leak detection activities.

In general, the recommended corrective action for high pressure areas is the installation of individual pressure reducing valves on service connections. If leakage problems in the very high pressure areas (upwards of 120 psi) prove to be extensive, this situation may warrant the consideration of reconfiguring pressure zone boundaries. Reconfigured pressure zone boundaries would be achieved through modifications in pipeline configuration and the addition of new PRV stations. These reconfigurations would be more difficult in some areas of the system than others. For example, in the Intermediate pressure zone, modifying pressure zone boundaries would be a challenge since it is a heavily interconnected pipeline network.



PRV No.	PRV Name
01	11th & Washington
02	15th & Madison
03	16th & Division
04	18th & Anchor Way
05	3rd & Bluff
06	4th & Jerome
07	5th & Canemah
08	99E & Main - Paper Mill
09	Abernethy & Redland
10	Apperson & La Rae
11	Harley & Forsythe North
12	Harley & Forsythe South
13	Jennifer Estates
14	Swan & Holcomb
15	View Manor
16	3rd & Ganong
17	Hunter BPS
18	Livesay Air Tanks
19	Fairway Downs Air Tanks

OREGON CITY

FIGURE 7-3

CITY OF OREGON CITY
FUTURE SYSTEM PEAK HOUR DEMAND ANALYSIS

N

0 1,475 2,950
SCALE IN FEET

LEGEND

- Recommended PRV Station (Future System CIP)
- PRV Station
- Pressure < 40 psi
- 40 psi ≤ Pressure ≤ 50 psi
- 50 psi < Pressure ≤ 60 psi
- 60 psi < Pressure ≤ 70 psi
- 70 psi < Pressure ≤ 80 psi
- 80 psi < Pressure ≤ 100 psi
- Pressure > 100 psi
- Pipeline Velocity ≤ 7 fps
- Pipeline Velocity > 7 fps
- WTP SFWB WTP
- Storage Reservoir
- PS Booster Pump Station
- M Master Meter (flows out of SFWB or Oregon City)
- URBAN GROWTH BOUNDARY (UBG)
- Lower Zone
- Intermediate Zone
- Upper Zone
- Lower Park Place Zone
- Intermediate Park Place Zone
- Upper Park Place Zone (CRW)
- Canemah District Zone
- Fairway Downs Zone
- View Manor - Park Place Zone
- Livesay Road - Park Place Zone
- Paper Mill Zone
- Canyon (CRW)
- Country Village (CRW)
- Street
- Water Feature

WEST YOST ASSOCIATES
Consulting Engineers

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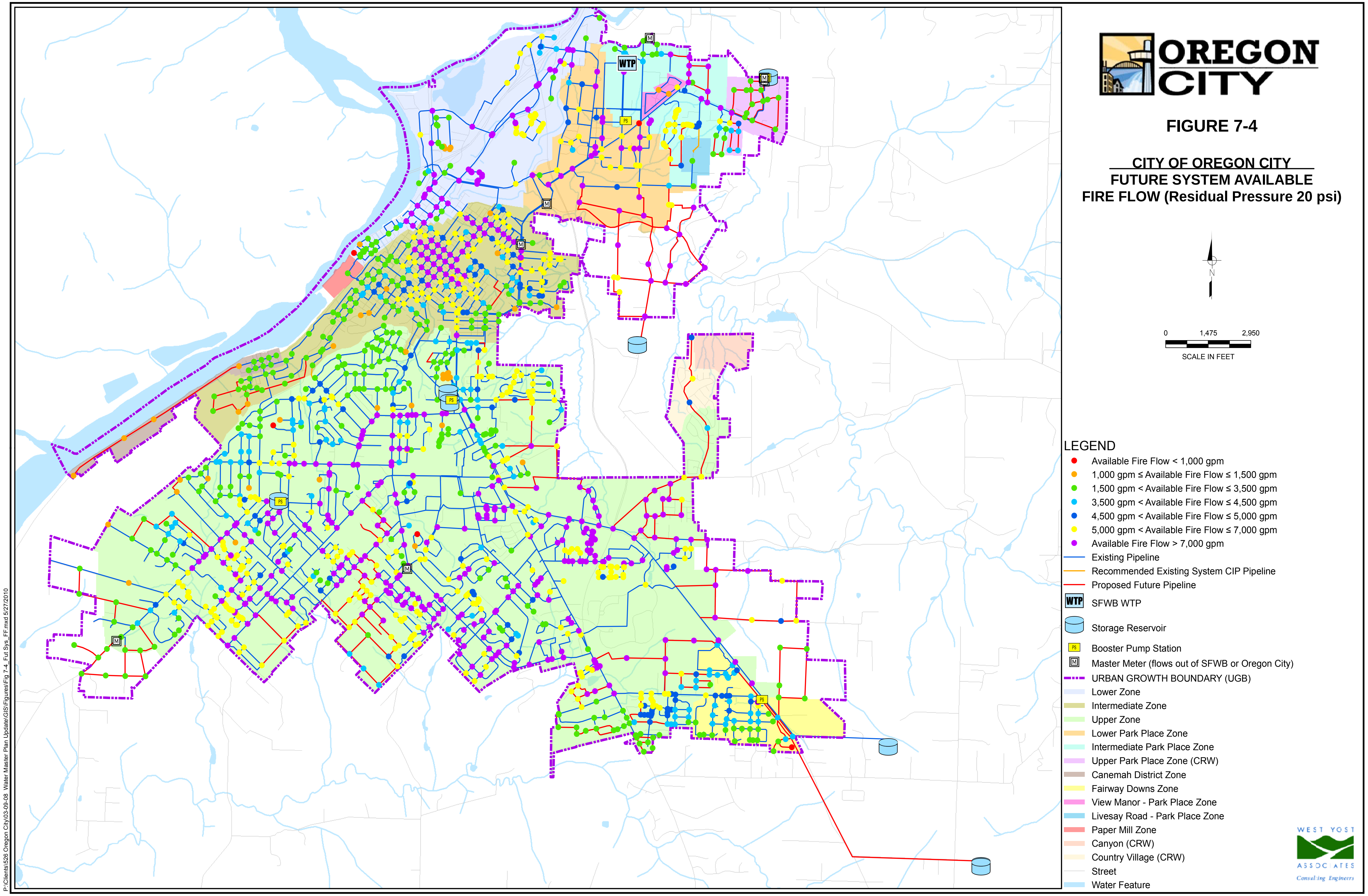
As illustrated on Figure 7-3, most of the pipelines in the future water system meet the maximum velocity criterion during a peak hour demand scenario. Almost all of the pipelines exceeding the maximum pipeline velocity requirement of 7 fps are downstream of either a pump station or PRV station (e.g., SFWB WTP, Mountainview pump station, PRV 14, etc.), which typically experience high velocities due to the large volumes of water being conveyed. It should also be noted that some of the 30-inch diameter transmission mains from the SFWB have velocities in the range of 6.1-8.8 fps, which exceeds the recommended transmission pipeline velocity of 5 fps. City staff will need to consider adding additional transmission pipeline capacity to the City's water system as water demands increase to reduce transmission pipeline velocities.

Since pipeline velocity is a secondary criterion, no improvements for pipelines that exceed the velocity criterion in the future water system are recommended unless the primary criterion (pressure) is not met. Based on results of the peak hour simulation, none of the above pipelines are in the vicinity of the low pressure areas. In addition, these pipelines discussed above are part of the existing water system; therefore, no mitigation is recommended at this time.

However, due to the high pipeline velocities (6.0-10.7 fps) simulated near the Mountainview pump station during a buildout peak hour demand scenario, it is recommended that the capacity of the existing pipelines be evaluated during the design of additional booster pumping capacity at this pump station.

Maximum Day Demand plus Fire Flow Scenario

InfoWater's "*Available Fire Flow Analysis*" tool was used to determine the available fire flow at each junction within the future water system under a buildout maximum day demand scenario. Figure 7-4 illustrates the available fire flow at a residual pressure of 20 psi for each junction within the future water system. In general, fire flow availability is very good in the City's future system, but a review of Figure 7-4 indicates that there are five junctions in the system where the model simulated fire flow results that do not meet minimum fire flow requirement of 1,500 gpm. Subsequent examination of these areas indicate that all of these junctions are located at either a 4-inch or 6-inch diameter dead-end main. Consequently, no mitigation is recommended at this time because additional fire flow can be supplied from hydrants available upstream of these dead-end mains.



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SUMMARY OF RECOMMENDED IMPROVEMENTS FOR FUTURE WATER SYSTEM

The recommended improvements needed to eliminate deficiencies identified in the evaluation of the future water distribution system are summarized below and shown previously on Figure 7-1. These recommendations only identify improvements at a master plan level and do not constitute a design of such improvements. Subsequent detailed design is required to determine the exact sizes and/or locations of these proposed improvements. The estimated costs and timing for these recommended improvements are discussed in Chapter 8.

Storage Reservoirs

To alleviate the future system water storage capacity deficit, the following storage reservoirs are recommended for the future water system:

- 2 MG storage reservoir along Wilson to serve the Fairway Downs and Upper pressure zones
- 3 MG storage reservoir along Holly Lane to serve the Lower Park Place pressure zone
- 1 MG storage reservoir at the existing Barlow Crest storage reservoir site

Pump Stations

To alleviate the future system pumping capacity deficit, the following booster pump modifications are recommended for the future water system:

- Fairway Downs pumps will convert from constant pumping for a closed zone to a booster station that pumps up to the new reservoir.

PRV Stations

- Construct two 6-inch PRV stations near Livesay Road pump station to increase fire flow supply availability in the Livesay Road pressure zone (one PRV will supply flow from Intermediate Park Place pressure zone and the other PRV can supply flow into the Lower Park Place pressure zone if needed).

Pipelines

- To serve future customers, construct/incorporate approximately 78,000 linear feet of proposed pipelines ranging in diameter from 6 to 16-inches as shown on Figure 7-1. (The specific alignments shown on Figure 7-1 are preliminary; the actual alignments will conform to future land use, development patterns, easement acquisition issues, and topographic considerations identified during the design phase of project implementation.)
- Due to the high pipeline velocities simulated during a buildout peak hour demand condition, evaluate the capacity of the existing pipelines at the Mountainview pump station to meet buildout demands.

CHAPTER 8. RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

This chapter presents the recommended Capital Improvement Plan (CIP) for the City of Oregon City's existing and future water system. Recommendations for improvements to the existing and future water system were described previously in Chapters 6 and 7, respectively. This chapter provides a summary of all the recommended improvement projects, along with estimates of probable construction costs. It should be noted that the recommended CIP only identifies improvements at a master plan level and does not constitute a design of such improvements. Subsequent detailed design is required to determine the exact sizes and locations of these proposed improvements.

Costs are presented in October 2009 dollars based on an Engineering News Record Construction Cost Index (ENR CCI) of 8596 (20 Cities Average). Total CIP costs include the following construction contingency and project cost allowances:

- Construction Contingency: 20 percent
- Project Cost Allowances:
  - Design: 10 percent
  - Construction Management: 10 percent
  - Administration: 8 percent

A complete description of the assumptions used in developing the estimates of probable construction cost is provided in Appendix C.

RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

Existing Water System Improvements

Chapter 6 provided a summary of the evaluation of Oregon City's existing water system and its ability to meet the recommended operational and design criteria described in Chapter 4. Based on this evaluation, improvements to the existing water system were recommended to eliminate existing deficiencies, as listed in the following section.

The existing system improvements have been grouped into several recommended CIP projects, and include the following:

- PRV Stations
  - Construct a 6-inch PRV station at the north end of the Livesay Pressure Zone to supply the Livesay Pressure Zone and potentially retire the Livesay Pump Station. Install 980 lf of 8-inch diameter pipeline and 410 lf of 6-inch diameter pipeline.
  - Construct a 6-inch PRV station from Upper Pressure Zone at Telford Road to address fire flow deficiencies at Center Street and Sunset Street in the Intermediate Pressure Zone.

- Construct a 6-inch PRV station from the Livesay Pressure Zone to the Lower Park Place Pressure Zone to address fire flow deficiencies in the Lower Park Place Pressure Zone. Install 67 lf of 6-inch diameter pipeline.

- Pipeline Improvements
  - Install approximately 8,900 feet of pipeline to improve looping, pressures and fire flows. These projects are described in Table 8-1 and specific project sheets are included in Appendix D for the corresponding CIP identification number.
- Operational Improvements
  - Maintenance management system - Implementation of the maintenance management system is needed to automate and prioritize maintenance activities. Programs are available but will require staff resources to populate the data base which will make for more efficient system maintenance. Based on the industry standards or staff directed frequencies, work orders will be generated for routine maintenance activities.
  - Automated meter reading – A pilot program should be planned that would provide additional information on the feasibility of an automated meter reading program. Such a system would reduce the ongoing cost for meter reading and provide a more robust system for setting charges including demand charges. Since much of the system expansion depends on peak demands, billings that encourage lower demand and conservation could offset future system expansion.

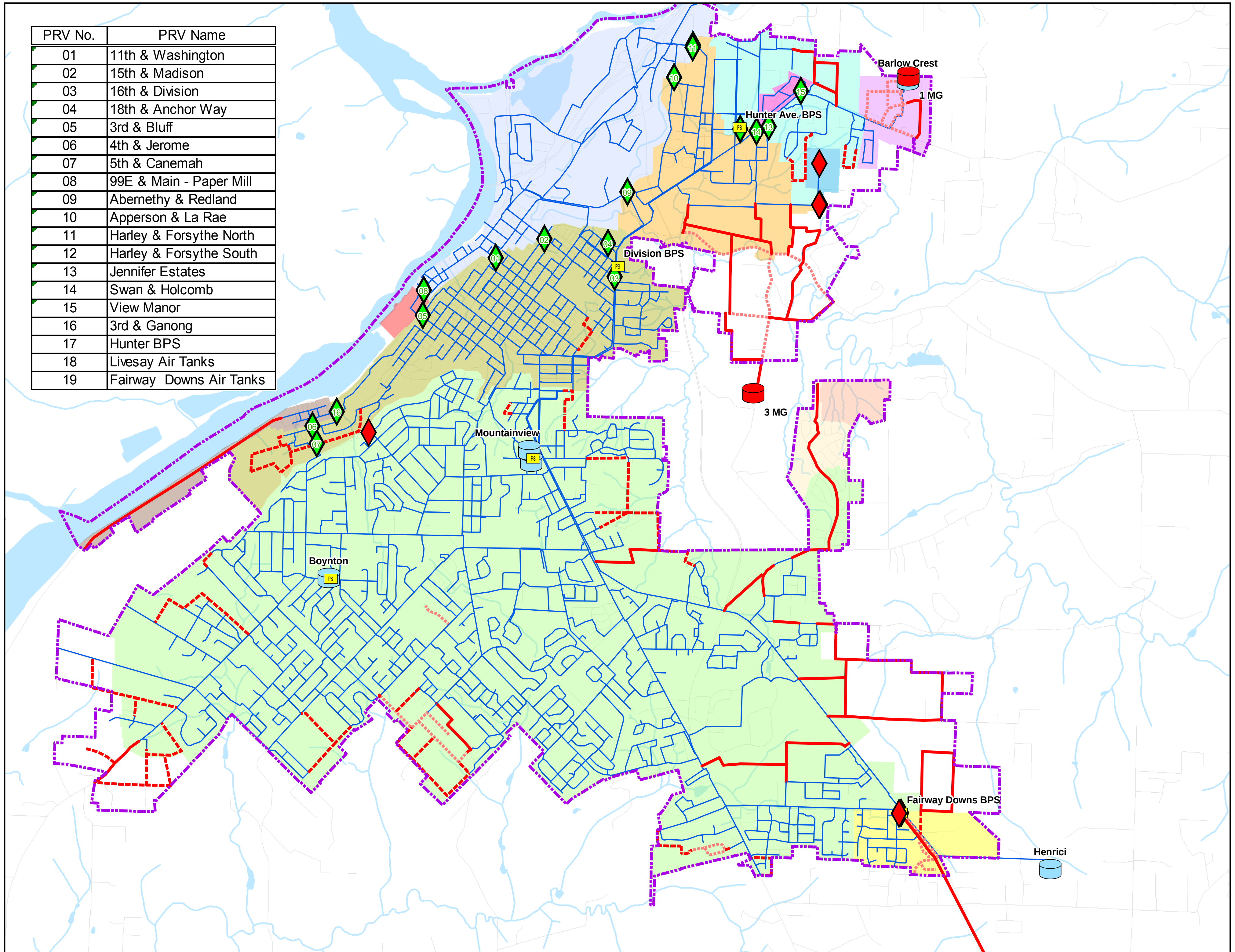
The locations of the recommended existing system CIP projects are shown on Figure 8-1. Details of the recommended existing system CIP projects are provided in Chapter 6. Project sheets are presented in Appendix D.

Future Water System Improvements

Chapter 7 provided a summary of the evaluation of Oregon City's future water system and its ability to meet the recommended operational and design criteria described in Chapter 4. Based on this evaluation, improvements to the future water system were recommended to meet projected demands. It should be noted that the timing of future system improvements will be triggered by specific developments and increase in system demands. Improvements have been grouped into several recommended CIP projects, and include the following:

- Storage Facility[1]
  - Construct a 2 MG storage reservoir at the 620 foot contour elevation to serve the Fairway Downs pressure zone and the Upper pressure zone.
  - Construct a 3 MG storage reservoir along Holly Lane to serve the Lower Park Place Pressure Zone.

[1] Projects that include the integration of CRW facilities into the Oregon City water system were not included in the CIP.



PRV No.	PRV Name
01	11th & Washington
02	15th & Madison
03	16th & Division
04	18th & Anchor Way
05	3rd & Bluff
06	4th & Jerome
07	5th & Canemah
08	99E & Main - Paper Mill
09	Abernethy & Redland
10	Apperson & La Rae
11	Harley & Forsythe North
12	Harley & Forsythe South
13	Jennifer Estates
14	Swan & Holcomb
15	View Manor
16	3rd & Ganong
17	Hunter BPS
18	Livesay Air Tanks
19	Fairway Downs Air Tanks

Note
1. The proposed future pipeline alignments and recommened future facility locations shown are preliminary and subject to change as individual projects are further defined and studied.
2. CRW piping is shown dashed. It is assumed that pipes will integrate with the Oregon system upon annexation of those areas.
3. Facilities in the Barlow Crest area are not included in the CIP at this time. City direction is required to identify, which if any, of these facilities will be available to serve these annexed areas.

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OREGON CITY

FIGURE 8-1

CITY OF OREGON CITY
WATER SYSTEM CIP
RECOMMENDED IMPROVEMENTS

N

0 1,475 2,950
SCALE IN FEET

LEGEND
- Recommended Storage Reservoir
- Recommended PRV Station
- Recommended CIP Pipeline Diameter ≤ 8"
- Recommended CIP Pipeline Diameter > 8"
- Future System Pipeline (CRW)
- Existing Pipeline
- New_Existing_Pipes
- Existing Storage Reservoir
- Existing Booster Pump Station
- Existing PRV Location
- URBAN GROWTH BOUNDARY (UGB)
- Lower Zone
- Intermediate Zone
- Upper Zone
- Lower Park Place Zone
- Intermediate Park Place Zone
- Upper Park Place Zone (CRW)
- Canemah District Zone
- Fairway Downs Zone
- View Manor - Park Place Zone
- Livesay Road - Park Place Zone
- Paper Mill Zone
- Canyon (CRW)
- Country Village (CRW)
- Street
- Water Feature

WEST YOST ASSOCIATES
Consulting Engineers

Table 8-1. Summary of Probable Construction Costs for Existing System CIP [(a)]

				2009-2015		2016 - 2020		2021 - 2025		2026 - 2030		2031-2035		
Improvement Type	Improvement Description	CIP ID	Quantity	Estimated Construction Cost	CIP Cost[(b)] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[(b)] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[(b)] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[(b)] (including contingency and cost allowances)	Estimated Construction Cost	CIP Cost[(b)] (including contingency and cost allowances)	Cost for Existing CIP by Project Type
EXISTING CAPITAL IMPROVEMENTS														
New Pipeline & PRV	6-inch PRV station from Upper pressure zone at Telford Road and Center Street to address fire flow deficiencies in the Intermediate pressure zone (8-inch diameter, 315 lf & 6-inch diameter, 200 lf)	CIP-V- 102	515 lf	$ 136,100	$ 209,050									$ 327,890
New Pipeline & PRV	6-inch PRV station near Livesay pump station to increase FF capacities in the Lower Park Place pressure zone (6-inch diameter, 67 lf)	CIP-V- 103	67 lf	$ 77,370	$ 118,840									
Pipeline Improvement [(c)]	Livesay Road, 8-inch diameter	CIP-P-104	4,767 lf	$ 667,380	$ 1,025,096									$ 1,499,843
Pipeline Improvement [(c)]	Abernethy Road, 8-inch diameter	CIP-P-105	2,022 lf	$ 283,080	$ 434,811									
Pipeline Improvement [(c)]	Taylor Street, 12-inch diameter	CIP-P-108	130 lf	$ 26,000	$ 39,936									
Total[(b)]				**$ 1,189,930**	**$ 1,828,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,828,000**
Construction Contingency (20%)				$ 237,986		$ -		$ -		$ -		$ -		
Total Construction Cost				**$ 1,427,916**		**$ -**		**$ -**		**$ -**		**$ -**		
Engineering (10%)				$ 142,792		$ -		$ -		$ -		$ -		
Construction Management (10%)				$ 142,792		$ -		$ -		$ -		$ -		
Program Implementation (8%)				$ 114,233		$ -		$ -		$ -		$ -		
Total Existing System CIP Cost[(b,d)]				**$ 1,828,000**		**$ -**		**$ -**		**$ -**		**$ -**		

(a) Costs shown are based on October 2009 dollars and an ENR CCI of 8596 (20 Cities Average).

(b) Total cost rounded to nearest $1,000.

(c) Projects motivated by fire flow deficiencies

(d) Cost is in current dollars and have not been escalated by the CPI of 3 to 5 percent.

- 1 MG storage reservoir at the existing Barlow Crest storage reservoir site (the remainder of the buildout emergency storage requirement will be met from Mountainview Reservoir No. 2). This reservoir is shown on Figure 8-1, but not currently included in the future CIP, Table 8-2. This additional storage will only be required when CRW facilities are incorporated into the City.

- Pump Station[2,3]
  - Increase the firm pumping capacity at the Barlow Crest Pump Station by adding two additional 500 gpm booster pumps (in the event that the current Barlow Crest customers come to be served by Oregon City).
- Pipelines
  - Install approximately 80,000 linear feet of proposed pipelines ranging from 6 inches to 16 inches in diameter.

The locations of the recommended future system CIP projects are shown on Figure 8-1 and the estimated costs are summarized in Table 8-2. Details of the recommended future system CIP projects are provided in Chapter 7. Project sheets are presented in Appendix D.

Pipeline Renewal and Replacement

Several high priority projects have been identified that replace existing pipelines. The locations of the replacement projects are shown on Figure 8-1 and the estimated costs are summarized in Table 8-3. Details of the replacement projects are provided in Chapter 7 and project sheets are presented in Appendix D.

In addition to the projects identified, there is a backlog of pipeline replacement projects that needs to be considered, especially if roadway improvements are planned. Table 8-4 shows these projects without any specific priorities.

SUMMARY

The recommended existing system CIP projects are presented in Table 8-1, along with their probable construction costs. The future system CIP projects are presented in Table 8-2 along with their probable construction costs. Renewal and replacement CIP projects are presented in Table 8-3 along with their probable construction costs. As shown, the existing system CIP cost is estimated to be approximately $1.83 million. The future system CIP cost is estimated to be approximately $35.46 million. The Renewal and replacement CIP cost is estimated to be approximately $9.5 million. Existing and future water system improvement costs should be appropriately allocated to existing and/or future users as shown in Tables 8-1 and 8-2. Renewal and replacement costs should be allocated to existing users as shown in Table 8-3.

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[2] Projects that include the integration of CRW facilities into the Oregon City water system were not included in the CIP.

[3] Cost estimate was based on the additional firm capacity required.

Table 8-2. Summary of Probable Construction Costs for Future System CIP [(a)]

Improvement Type	Improvement Description	CIP ID	Quantity	2009-2015 Estimated Construction Cost	2009-2015 CIP Cost[(b)] (including contingency and cost allowances)	2016 - 2020 Estimated Construction Cost	2016 - 2020 CIP Cost[(b)] (including contingency and cost allowances)	2021 - 2025 Estimated Construction Cost	2021 - 2025 CIP Cost[(b)] (including contingency and cost allowances)	2026 - 2030 Estimated Construction Cost	2026 - 2030 CIP Cost[(b)] (including contingency and cost allowances)	2031-2035 Estimated Construction Cost	2031-2035 CIP Cost[(b)] (including contingency and cost allowances)	Cost for Future CIP by Project Type
FUTURE CAPITAL IMPROVEMENTS														
Pipeline	Highway 99E/Mcloughlin Boulevard, 12 inch diameter	1	6,863 lf			$ 1,372,600	$ 2,108,314							
Pipeline	Joseph Way and Leland to Jessie, 8 inch diameter (161 lf) and 12 inch diameter (1839 lf)	8	2,964 lf			$ 390,340	$ 599,562							
Pipeline	Between Highway 213 and Beavercreek, 12 inch diameter	11	5,662 lf			$ 1,132,400	$ 1,739,366							
Pipeline	East side of Beavercreek near Fairway Downs Pump Station, 8 inch diameter (688 lf) and 12 inch diameter (5187 lf)	12	5,876 lf			$ 1,133,720	$ 1,741,394							
Pipeline	Loder Road, 12 inch diameter	13	7,303 lf			$ 1,460,600	$ 2,243,482							
Pipeline	East Side of Beavercreek from Loder to Maplelane, 12 inch diameter	14	8,690 lf					$ 1,738,000	$ 2,669,568					$ 20,421,366
Pipeline	Holly Lane to Greenfield, 12 inch diameter	15	6,311 lf					$ 1,262,200	$ 1,938,739					
Pipeline	Livesay Road south to New Holly Lane Reservoir (west side), 12 inch diameter (9580 lf) and 16 inch diameter (1070 lf)	20	10,620 lf					$ 2,183,500	$ 3,353,856					
Pipeline	Livesay Road south to New Holly Lane Reservoir (east side), 12 inch diameter	21	7,497 lf					$ 1,499,400	$ 2,303,078					
Pipeline	North of Holcomb, 12 inch diameter	24	4,140 lf			$ 828,000	$ 1,271,808							
Pipeline	North of Holcomb on the east side of the Barlow Crest Reservoir, 12 inch diameter	25	1,472 lf			$ 294,400	$ 452,198							
PRV	Fairway Downs Pressure Zone PRV	26	140 lf	$ 128,000	$ 196,608									
PRV	6-inch PRV station from Intermediate Park Place pressure zone at the north end of Livesay Road to increase fire flow capacity in the Livesay pressure zone, 8-inch diameter (980 lf) and 6-inch diameter (410 lf)	CIP-V- 101	1,390 lf	$ 252,300	$ 387,533									$ 584,141
Storage Reservoir	2 mg storage reservoir along Wilson Rd to serve Fairway Downs pressure zone, includes 16-inch diameter, 10,750 lf	CIP-TF-123	2.00 MG	$ 5,687,500	$ 8,736,000									$ 14,463,744
Storage Reservoir	3 mg storage reservoir along Holly Lane to serve Lower Park Place pressure zone, includes 12-inch diameter, 7,139 lf	CIP-TF-124	3.00 MG		$ -			$ 3,729,000	$ 5,727,744					
Total[(b)]				**$ 6,067,800**	**$ 9,320,000**	**$ 6,612,060**	**$ 10,156,000**	**$ 10,412,100**	**$ 15,993,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 35,469,000**
Construction Contingency (20%)				$ 1,213,560		$ 1,322,412		$ 2,082,420		$ -		$ -		
Total Construction Cost				**$ 7,281,360**		**$ 7,934,472**		**$ 12,494,520**		**$ -**		**$ -**		
Engineering (10%)				$ 728,136		$ 793,447		$ 1,249,452		$ -		$ -		
Construction Management (10%)				$ 728,136		$ 793,447		$ 1,249,452		$ -		$ -		
Program Implementation (8%)				$ 582,509		$ 634,758		$ 999,562		$ -		$ -		
Total Future System CIP Cost[(b,c)]				**$ 9,320,000**		**$ 10,156,000**		**$ 15,993,000**		**$ -**		**$ -**		

[(a)] Costs shown are based on October 2009 dollars and an ENR CCI of 8596 (20 Cities Average).
[(b)] Total cost rounded to nearest $1,000.
[(c)] Cost is in current dollars and have not been escalated by the CPI

Table 8-3. Summary of Probable Construction Costs for Renewal and Replacement CIP [(a)]

Improvement Type	Improvement Description	CIP ID	Quantity	2009-2015 Estimated Construction Cost	2009-2015 CIP Cost[(b)] (including contingency and cost allowances)	2016 - 2020 Estimated Construction Cost	2016 - 2020 CIP Cost[(b)] (including contingency and cost allowances)	2021 - 2025 Estimated Construction Cost	2021 - 2025 CIP Cost[(b)] (including contingency and cost allowances)	2026 - 2030 Estimated Construction Cost	2026 - 2030 CIP Cost[(b)] (including contingency and cost allowances)	2031-2035 Estimated Construction Cost	2031-2035 CIP Cost[(b)] (including contingency and cost allowances)	Cost for Future CIP by Project Type
FUTURE CAPITAL IMPROVEMENTS														
Pipeline	View Manor Pressure Zone, PRV#15, 4 inch diameter (150 lf) and 8 inch diameter (4397 lf)	50	4,547 lf	$ 700,580	$ 1,076,091									
Pipeline	Clairmont Area, 8 inch diameter (9513 lf) and 10 inch diameter (3920 lf)	51	13,433 lf	$ 1,959,020	$ 3,009,055									
Pipeline	Weleber St to Harding Blvd, 8 inch diameter	52	7,521 lf	$ 1,052,940	$ 1,617,316									
Pipeline	I-205 Crossing between Pope Lane and Park Place Ct, 8 inch diameter	53	555 lf	$ 77,700	$ 119,347									$ 8,960,118
Pipeline	15th St from Main St to Division St, PRV#2, 6 inch diameter (85 lf) , 8 inch diameter (1797 lf) and 10 inch diameter (2174 lf)	55	4,056 lf	$ 608,770	$ 935,071									
Pipeline	Main St from 5th St to 18th St, 8 inch diameter (1023 lf), 10 inch diameter (2558 lf) and 12 inch diameter (535 lf)	58	4,116 lf	$ 659,500	$ 1,012,992									
Pipeline	South End Rd and Warner Parrott Rd, 8 inch diameter	59	5,535 lf	$ 774,900	$ 1,190,246									
Storage Reservoir	Seismic and Mixing Improvements for Boynton Reservoir	60	1 ea	$ 365,000	$ 560,640									$ 560,640
	Total[(b)]			**$ 6,198,410**	**$ 9,521,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 9,521,000**
	Construction Contingency (20%)			$ 1,239,682		$ -		$ -		$ -		$ -		
	Total Construction Cost			**$ 7,438,092**		**$ -**		**$ -**		**$ -**		**$ -**		
	Engineering (10%)			$ 743,809		$ -		$ -		$ -		$ -		
	Construction Management (10%)			$ 743,809		$ -		$ -		$ -		$ -		
	Program Implementation (8%)			$ 595,047		$ -		$ -		$ -		$ -		
	Total Future System CIP Cost[(b,c)]			**$ 9,521,000**		**$ -**		**$ -**		**$ -**		**$ -**		

[(a)] Costs shown are based on October 2009 dollars and an ENR CCI of 8596 (20 Cities Average).
[(b)] Total cost rounded to nearest $1,000.
[(c)] Cost is in current dollars and have not been escalated by the CPI

Table 8-4. Unfunded Replacement Projects

S. Center St. between S. 2nd and 1st Street
Ogden Drive and Brighten Avenue between Telford Road and Jersey Avenue
Cherry Avenue between Holmes Avenue and Park Drive
South End Road between Barker Avenue and Barker Road
Barker Avenue between South End Road and Barker Road
Warner Perrot Road between S. End Road and Boynton
Belle and Glenwood between Holmes Lane and Linn Avenue
Valleyview Drive between Park Drive and McCarver Avenue
Canemah Court between Canemah Road and Telford Road
Randall Street between Canemah Road and Hartke Loop
Hartke Loop and Alderwood Place
Jersey Avenue between Charmon and Brighton Avenue
Center Street between 7th Street and 10th Street
Harrison Street between 7th Street and Division Street
Singer Creek Park from Mountain View Reservoir #1 to Linn Avenue
Division Street between Harrison Street and 13th/14th Street
All old main north of Division Street
Division Street between Anchor Way PRV Station and Davis Street

A summary of the costs for the recommended CIP by project type is provided in Table 8-5. This table also includes the amount that the Water Division is contributing to the new Operations Facility of $6,050,000. As shown in Table 8-5, the total estimated recommended CIP cost for the City of Oregon City water system, including the contribution to the Operations Facility, is estimated to be approximately $ 52.86 million.

Table 8-5. Estimated Cost of Recommended CIP by Project Type

CIP Project Type	Existing System CIP, million dollars	Future System CIP[a,b,c], million dollars	Renewal and Replacement CIP, million dollars	Total CIP Cost[a], million dollars
Storage Facility	-	14.46	0.56	15.02
Pump Station	-	-	-	-
Pipeline Improvement	1.50	20.42	8.96	30.88
PRV Station	0.33	0.58	-	0.91
Operations Facility	6.05	-	-	6.05
Total[d]	$7.88	$35.46	$9.52	$52.86

(a) Timing of future system improvements will be triggered by specific developments and increase in system demands.
(b) Future system CIP costs are in current dollars and have not been escalated by the CPI.
(c) Cost based on a ground level, pre-stressed concrete storage tank.
(d) Total cost based on the October 2009 ENR index of 8596 and includes construction contingency and project cost allowances.

CHAPTER 9. WATER DISTRIBUTION SYSTEM FINANCING PLAN

The development of a financing plan supports the planning for implementation of the recommended capital improvement plan (CIP). The following section presents information that the City will need to make financing and implementation decisions. The recommended CIP projects are presented in three groups. The projects for the improvement of the existing system and for renewal and replacement generally need to be funded from rates. Projects shown for future system expansion should primarily be funded from water system development charges (SDCs). Data on the number of users as well as background information regarding historical revenues and expenses associated with the City's water fund are presented as background information. This historical data provides a basis for projecting future water system revenues and expenses.

Because the current City charter requires that rates be rolled back once the bonds are paid, several scenarios for future rates are evaluated. Scenarios include continuation of the existing level of services and costs, a rollback of rates, and rates that are required for maintaining the system at a sustainable level of system replacements.

CIP PROJECT COST SUMMARY

The existing water distribution system can generally provide the required level of service with the exception that several pipeline improvement projects are needed to increase the available fire flows. Because some of the Oregon City water distribution system is relatively old, there is a backlog of pipeline replacement projects that need to be addressed. The most critical projects are included in the current CIP. The estimated capital costs for both the existing system improvements and the replacement projects are shown in Table 9-1.

Table 9-1. CIP Project Cost Summary by Source of Funds

Funding Source	Capital Cost, $
Existing System Improvements	1,828,000
Renewal and Replacement	9,521,000
Future System Improvements	48,786,000

There are approximately 154 miles of pipelines in the City. Experience has shown that the useful life of water lines in the area is somewhere between 50 and 75 years. Assuming a service life of 75 years, the City should replace approximately two miles per year to maintain the existing system in good condition. This would require a capital investment of $2.3 million per year in today's dollars. As currently planned, capital expenditures will not allow the City to maintain the water infrastructure on a long term sustainable basis. The City needs to move deliberately towards a more sustainable level of capital expenditures. A revision of the existing charter will be required to support this level of investment.

Also shown in Table 9-1 are the projects that will be required to extend water service into the urban growth boundary area that will be served by the City. As the City grows and developers need water system extensions, the City should be prepared to construct the improvements necessary for the planned growth. Some projects could be funded by developers and they could be reimbursed based on the capacity provided to other users. System development charges can be used to finance such improvements.

RATE PAYER BASE

The water customer profile in Oregon City is dominated by single family residential rate payers but also includes a mix of multi-family, commercial, institutional, and industrial customers. In order to evaluate water revenues from all customers and evaluate rate impacts, it is useful to consider the rate payer base in terms of equivalent single family units (ESFUs). Table 9-2 presents data for Fiscal Years 2008-09 through 2010-11and shows the total number of existing ESFUs and the average rate of revenue per ESFU. This data indicates that each single family customer (ESFU) paid about $370/year for water service or about $31/month. The typical single family customer uses an average of about 7,000 gallons of water per month. During years with a wet summer, domestic water consumption and corresponding revenue can drop significantly.

Table 9-2. Rate Payer Base Equivalent Single Family Units (ESFUs)

Fiscal Year	Total Water Rate Billings, $/year	Single Family Water Rate Billings, $/year	Single Family Residential Units	Average Payment per Single Family Unit, $/SFU/year	Total System ESFUs
2008/09	4,976,931	3,222,967	8,650	372.60	13,357
2009/10	$4,978,738	$3,244,067	8,615	376.60	13,221
2010/11	$5,089,063	$3,154,080	8,718	361.80	14,066

The number of single family connections decreased in 2009-10 when the economy suffered a recession but the number of connections has recovered. It is expected that the number of ESFUs served by the water system will continue to grow, and overall system water demand and revenues from water rates can be expected to increase comparably over time. As discussed in Chapter 3 – Water Demand Analysis of the City of Oregon City Water System Distribution Master Plan, water demand will most likely increase at an annual rate of three percent. For purposes of projecting future water system revenues, the ESFU growth is estimated at a conservative one percent annual rate of increase.

CITY FUNDING SOURCES

The City maintains two funds that can be used to finance capital improvement projects for the water distribution system. Each of these funding sources is described in the following sections and a baseline for revenue projections is identified for those funds.

Water Fund (501)

The water fund (identified by fund number 501) is the source of funding for ongoing water operations and improvements for the existing water system. Revenues for the water fund predominantly come from rates with smaller amounts derived from miscellaneous sources such as tapping fees, hydrant draw payments, and interest. Expenses for the water fund primarily include employee salaries and benefits, materials and contract services, capital outlays for new construction and equipment, and debt service on bonds. Table 9-3 summarizes historical revenues and expenses for the water fund during the last five fiscal years and shows the current budget.

Table 9-3. Historical Water Fund Revenue

	Actual 2006-2007	Actual 2007-2008	Actual 2008-2009	Actual 2009-2010	Estimated 2010-2011	Budgeted 2011-2012
Equivalent Single Family Units (ESFUs)			13,357	12,611	12,339	11,668
Beginning Balance	$3,746,830	$2,021,140	$2,536,651	$2,792,322	$1,403,363	$1,029,456
Revenues						
Water Bills	$4,840,566	$4,766,367	$4,976,931	$4,978,738	$5,089,043	$4,963,711
Misc. Revenues*	$371,926	$318,231	$155,419	$210,062	$230,100	$130,000
SFWB SDC	$488,301	$220,087	$103,255	$198,050	$117,687	$150,000
Total Charges for Services	$5,700,793	$5,304,685	$5,235,605	$5,386,850	$5,436,830	$5,243,711
Interest - LGIP	$119,462	$95,484	$52,810	$15,383	$6,124	$10,000
Debt Service Interest Income	$55,765	$42,065	$17,621	$4,737	$1,342	$2,000
Total Water Fund Revenue	$5,876,020	$5,442,234	$5,306,036	$5,406,970	$5,444,296	$5,255,711
Revenue per budget	$6,285,520	$5,449,026	$7,842,687	$8,199,292	$6,847,659	$6,285,167
Expenses						
Personal Services	$925,119	$996,216	$1,113,627	$1,210,350	$1,277,426	$1,363,626
Non-CIP Material and Services	$2,930,463	$2,618,700	$2,507,885	$2,694,578	$2,767,792	$3,010,617
Non-CIP Capital Outlays (new equipment)	$5,500	$0	$0	$35,704	$15,960	$5,000
CIP Material and Services	$21,568	$53,325	$106,791	$116,608	$59,760	$65,000
Debt Service Materials and Services	$1,000	$500	$500	$500	$500	$1,000
CIP Capital Outlays	$3,641,517	$960,243	$1,095,509	$1,785,142	$498,553	$300,000
Transfers to Fleet Reserve, Maintenance	$60,000	$61,000	$70,000	$55,000	$52,500	$70,000
Transfer to Rate Stabilization	$20,000	$0				$0
Transfer to Building Reserve	$0	$0	$45,000	$700,000	$450,000	$400,000
Debt Service	$406,045	$200,245	$199,345	$198,051	$196,318	$199,138
Total Expenses	$8,011,212	$4,890,229	$5,138,657	$6,795,933	$5,318,809	$5,414,381
Debt Coverage			$0	$0	$0	$49,785
Debt Service Reserve			$0	$0	$0	$201,393
Contingency						$619,608
Total Expenses with reserves and Contingency	$8,011,212	$4,890,229	$5,138,657	$6,795,933	$5,318,809	$6,285,167

The City currently pays debt service on one remaining bond through the water fund. The debt service schedule for these bonds is summarized in Table 9-4. This bond dates from 2002 and will be paid off in fiscal year 2014/15.

Table 9-4. Bond Debt Service Schedule

Fiscal Year	Debt Service Payment, $/year
2009/10	198,051
2010/11	196319
2011/12	199,138
2012/13	201,393
2013/14	198,179
2014/15	199,485

The historical/budget data and debt service schedule provide a basis for projecting future revenues and expenses for the water fund. Since the revenue budgeted necessarily needs to be conservative, the revenue projected in the various scenarios is somewhat more than the Fiscal Year 2011-12 budget.

For the purpose of developing water fund financial projections, water rate and miscellaneous revenues are expected to increase over time at a rate of one percent per year but with no growth for the first two fiscal years. Labor costs have historically grown more than the rate of inflation and are projected to increase at an annual rate of five percent. Material and services expenses are projected to increase at three percent per year. Future debt service on existing bonds is based on the debt service schedule. Interest income is expected to decline over time.

For purposes of evaluating future rate requirements, the following three scenarios are presented below:

1. Projection Scenario 1- No rollback of rates and 3% annual rate increase
2. Projection Scenario 2A – Rate rollback in Fiscal Year 2015-16 and 3% rate annual increases
3. Projection Scenario 2B – Rate rollback in Fiscal Year 2015-16 and a 3% rate increase in those years an increase was adopted by the commission
4. Projection Scenario 3 – Sustainable system investment with no rate rollback and higher rate increases to support capital improvements

<u>Projection Scenario 1</u>

The City has for several years increased charges at a rate of 3-percent per year which is the maximum allowed by the City Charter. This has been sufficient to construct some capital improvements ranging from $300,000 in the current fiscal year to $3.7 million in Fiscal Year

2006-07. If the City Charter were changed to eliminate the rate rollback and the rates were to continue to increase at a rate of three percent per year, capital expenditures could be maintained starting at $700,000 per year and slowly increasing to $1.5 million by Fiscal Year 2021-2022. This represents the total of funds available and capital expenditures for water system improvements would be reduced by the transfers to the building reserve fund. This projection is shown in Table 9-5.

<u>Projection Scenario 2</u>

The City Charter requires rates to be rolled back to pre-bond issue levels with an annual maximum increase of three percent. The final debt service payment will be made in Fiscal Year 2014-15 so revenue for the following year, Fiscal Year 2015-16, will decrease as the rates are reduced. It is not clear how the rollback of rates would be interpreted and the impact of the rollback could be quite variable.

Based on one possible scenario, Fiscal Year 2015-16 revenues are reduced by approximately $1.3 million to reflect the rollback of rates. This rollback is based on the following assumptions:

- The rate increase adopted by the City in Fiscal Year 1993-94 would be rolled back to the previous rates.
- Rates would be increased by three percent per year as allowed by the charter for each year following the rollback.

Once this rollback is implemented, the water fund will have an annual deficit of approximately $500,000 plus whatever funds are needed for capital expenditures including the building reserves. This is Scenario 2A and Table 9-6 shows the projections based on this set of assumptions.

If the assumption is that in those years when the City did not increase rates, no rate increase is computed, the rollback would cause an annual fund deficit of up to 1.5 million dollars with no capital expenditures. This is Scenario 2B and is presented in Table 9-7.

<u>Projection Scenario 3</u>

Utilities should invest in the replacement of their infrastructure based on the useful life of the facilities. While reservoirs and pump stations have a limited useful life, periodic rehabilitation can restore the useful life of these facilities. For example, the improvements to the Mountain View Reservoir improved its structural capacity to resist earthquakes based on current code requirements. However, pipelines have a fixed useful life and need to be replaced when they are at the end of their useful life. An annual investment of $2.3 million is recommended based on replacing an average of two miles of pipes each year. A 10-percent rate increase in Fiscal Year 2015-16 followed by two years of a 5-percent increase will allow the City to increase its investment to reach $2.3 million at the end of the planning period. At this level of investment, barring unforeseen demands related to water treatment, the utility will be operating on a sustainable, pay-as-you-go basis for long term operation. This projection scenario is shown in Table 9-8. The City Charted would need to be amended to accommodate this scenario.

Table 9-5. Projection Scenario 1 - No Rollback and 3% Rate Increases

Description	Fiscal Year										
	2011-2012	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-2020	2020-2021	2021-2022
Equivalent Single Family Units (ESFUs)	0	0	0	0	0	0	0	0	0	0	0
Beginning Balance	1,029,000	1,356,000	1,039,000	476,000	785,000	1,215,000	649,000	1,192,000	631,000	281,000	1,170,000
Revenues											
Water Bills	5,191,000	5,347,000	5,507,000	5,727,000	5,956,000	6,194,000	6,442,000	6,700,000	6,968,000	7,247,000	7,537,000
Misc. Revenues	130,000	134,000	138,000	144,000	150,000	156,000	162,000	168,000	175,000	182,000	189,000
SFWB SDC	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
Total Charges for Services	5,471,000	5,631,000	5,795,000	6,021,000	6,256,000	6,500,000	6,754,000	7,018,000	7,293,000	7,579,000	7,876,000
Interest - LGIP	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Debt Service Interest Income	2,000	2,000	2,000	2,000							
Total Water Fund Revenue	5,483,000	5,643,000	5,807,000	6,033,000	6,266,000	6,510,000	6,764,000	7,028,000	7,303,000	7,589,000	7,886,000
Expenses											
Personal Services	1,364,000	1,432,000	1,504,000	1,579,000	1,658,000	1,741,000	1,828,000	1,919,000	2,015,000	2,116,000	2,222,000
Non-CIP Material and Services	3,011,000	3,101,000	3,194,000	3,290,000	3,389,000	3,491,000	3,596,000	3,704,000	3,815,000	3,929,000	4,047,000
Non-CIP Capital Outlays (new equipment)	5,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
CIP Material and Services	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000
Debt Service Materials and Services	1,000	1,000	1,000	1,000							
CIP Capital Outlays	41,000	220,000	468,000	0	134,000	1,189,000	142,000	1,311,000	1,168,000	0	1,329,000
Transfers to Fleet Reserve, Maint.	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Transfer to Rate Stabilization	0										
Transfer to Building Reserve	400,000	850,000	850,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Debt Service	199,000	201,393	198,179	199,485	0	0	0		0	0	0
Total Expenses	5,156,000	5,960,393	6,370,179	5,724,485	5,836,000	7,076,000	6,221,000	7,589,000	7,653,000	6,700,000	8,253,000
Operation surplus	327,000	(317,393)	(563,179)	308,515	430,000	(566,000)	543,000	(561,000)	(350,000)	889,000	(367,000)
Ending Fund Balance	1,356,000	1,038,607	475,821	784,515	1,215,000	649,000	1,192,000	631,000	281,000	1,170,000	803,000

Table 9-6. Projection Scenario 2A - Rate Rollback and 3% Rate Increase

Description	Fiscal Year										
	2011-2012	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-2020	2020-2021	2021-2022
Equivalent Single Family Units (ESFUs)	0	0	0	0	0	0	0	0	0	0	0
Beginning Balance	1,029,000	1,097,000	1,000,000	905,000	1,214,000	759,000	302,000	(156,000)	(615,000)	(1,074,000)	(1,533,000)
Revenues											
Water Bills	5,191,000	5,347,000	5,507,000	5,727,000	4,437,000	4,614,000	4,799,000	4,991,000	5,191,000	5,399,000	5,615,000
Misc. Revenues	130,000	134,000	138,000	144,000	150,000	156,000	162,000	168,000	175,000	182,000	189,000
SFWB SDC	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
Total Charges for Services	5,471,000	5,631,000	5,795,000	6,021,000	4,737,000	4,920,000	5,111,000	5,309,000	5,516,000	5,731,000	5,954,000
Interest - LGIP	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Debt Service Interest Income	2,000	2,000	2,000	2,000							
Total Water Fund Revenue	5,483,000	5,643,000	5,807,000	6,033,000	4,747,000	4,930,000	5,121,000	5,319,000	5,526,000	5,741,000	5,964,000
Expenses											
Personal Services	1,364,000	1,432,000	1,504,000	1,579,000	1,658,000	1,741,000	1,828,000	1,919,000	2,015,000	2,116,000	2,222,000
Non-CIP Material and Services	3,011,000	3,101,000	3,194,000	3,290,000	3,389,000	3,491,000	3,596,000	3,704,000	3,815,000	3,929,000	4,047,000
Non-CIP Capital Outlays (new equipment)	5,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
CIP Material and Services	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000
Debt Service Materials and Services	1,000	1,000	1,000	1,000							
CIP Capital Outlays	300,000										
Transfers to Fleet Reserve, Maint.	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Transfer to Rate Stabilization	0										
Transfer to Building Reserve	400,000	850,000	850,000	500,000	0	0	0	0	0	0	0
Debt Service	199,000	201,393	198,179	199,485	0	0	0	0	0	0	0
Total Expenses	5,415,000	5,740,393	5,902,179	5,724,485	5,202,000	5,387,000	5,579,000	5,778,000	5,985,000	6,200,000	6,424,000
Operation surplus	68,000	(97,393)	(95,179)	308,515	(455,000)	(457,000)	(458,000)	(459,000)	(459,000)	(459,000)	(460,000)
Ending Fund Balance	1,097,000	999,607	904,821	1,213,515	759,000	302,000	(156,000)	(615,000)	(1,074,000)	(1,533,000)	(1,993,000)

Table 9-7. Projection Scenario 2B - Rate Rollback and 3% Rate Increase for Fiscal Years Adopted by the Commission

Description	Fiscal Year 2011-2012	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-2020	2020-2021	2021-2022
Equivalent Single Family Units (ESFUs)	0	0	0	0	0	0	0	0	0	0	0
Beginning Balance	1,029,000	1,097,000	1,000,000	905,000	1,214,000	(86,000)	(1,421,000)	(2,793,000)	(4,203,000)	(5,651,000)	(7,139,000)
Revenues											
Water Bills	5,191,000	5,347,000	5,507,000	5,727,000	3,592,000	3,736,000	3,885,000	4,040,000	4,202,000	4,370,000	4,545,000
Misc. Revenues	130,000	134,000	138,000	144,000	150,000	156,000	162,000	168,000	175,000	182,000	189,000
SFWB SDC	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
Total Charges for Services	5,471,000	5,631,000	5,795,000	6,021,000	3,892,000	4,042,000	4,197,000	4,358,000	4,527,000	4,702,000	4,884,000
Interest - LGIP	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Debt Service Interest Income	2,000	2,000	2,000	2,000							
Total Water Fund Revenue	5,483,000	5,643,000	5,807,000	6,033,000	3,902,000	4,052,000	4,207,000	4,368,000	4,537,000	4,712,000	4,894,000
Expenses											
Personal Services	1,364,000	1,432,000	1,504,000	1,579,000	1,658,000	1,741,000	1,828,000	1,919,000	2,015,000	2,116,000	2,222,000
Non-CIP Material and Services	3,011,000	3,101,000	3,194,000	3,290,000	3,389,000	3,491,000	3,596,000	3,704,000	3,815,000	3,929,000	4,047,000
Non-CIP Capital Outlays (new equipment)	5,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
CIP Material and Services	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000
Debt Service Materials and Services	1,000	1,000	1,000	1,000							
CIP Capital Outlays	300,000										
Transfers to Fleet Reserve, Maintenance	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Transfer to Rate Stabilization	0										
Transfer to Building Reserve	400,000	850,000	850,000	500,000	0	0	0	0	0	0	0
Debt Service	199,000	201,393	198,179	199,485	0	0	0	0	0	0	0
Total Expenses	5,415,000	5,740,393	5,902,179	5,724,485	5,202,000	5,387,000	5,579,000	5,778,000	5,985,000	6,200,000	6,424,000
Debt Coverage											
Debt Service Reserve											
Contingency											
Total Expenses with Reserves and Contingency	5,415,000	5,740,393	5,902,179	5,724,485	5,202,000	5,387,000	5,579,000	5,778,000	5,985,000	6,200,000	6,424,000
Total Operating Expenses	4,715,000	4,890,393	5,052,179	5,224,485	5,202,000	5,387,000	5,579,000	5,778,000	5,985,000	6,200,000	6,424,000
Operation Surplus	68,000	(97,393)	(95,179)	308,515	(1,300,000)	(1,335,000)	(1,372,000)	(1,410,000)	(1,448,000)	(1,488,000)	(1,530,000)
Ending Fund Balance	1,097,000	999,607	904,821	1,213,515	(86,000)	(1,421,000)	(2,793,000)	(4,203,000)	(5,651,000)	(7,139,000)	(8,669,000)

Table 9-8. Projection Scenario 3 - Sustainable System Investment

Description	Fiscal Year 2011-2012	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-2020	2020-2021	2021-2022
Equivalent Single Family Units (ESFUs)	0	0	0	0	0	0	0	0	0	0	0
Beginning Balance	1,029,000	1,356,000	1,039,000	476,000	654,000	459,000	378,000	583,000	851,000	1,148,000	601,000
Revenues											
Water Bills	5,191,000	5,347,000	5,507,000	5,727,000	6,357,000	6,738,000	7,142,000	7,428,000	7,725,000	8,034,000	8,355,000
Misc. Revenues	130,000	134,000	138,000	144,000	150,000	156,000	162,000	168,000	175,000	182,000	189,000
SFWB SDC	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
Total Charges for Services	5,471,000	5,631,000	5,795,000	6,021,000	6,657,000	7,044,000	7,454,000	7,746,000	8,050,000	8,366,000	8,694,000
Interest - LGIP	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Debt Service Interest Income	2,000	2,000	2,000	2,000							
Total Water Fund Revenue	5,483,000	5,643,000	5,807,000	6,033,000	6,667,000	7,054,000	7,464,000	7,756,000	8,060,000	8,376,000	8,704,000
Expenses											
Personal Services	1,364,000	1,432,000	1,504,000	1,579,000	1,658,000	1,741,000	1,828,000	1,919,000	2,015,000	2,116,000	2,222,000
Non-CIP Material and Services	3,011,000	3,101,000	3,194,000	3,290,000	3,389,000	3,491,000	3,596,000	3,704,000	3,815,000	3,929,000	4,047,000
Non-CIP Capital Outlays (new equipment)	5,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
CIP Material and Services	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000	65,000
Debt Service Materials and Services	1,000	1,000	1,000	1,000							
CIP Capital Outlays	41,000	220,000	468,000	131,000	1,160,000	1,248,000	1,180,000	1,210,000	1,278,000	2,223,000	1,963,000
Transfers to Fleet Reserve, Maint.	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Transfer to Rate Stabilization	0										
Transfer to Building Reserve	400,000	850,000	850,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000	500,000
Debt Service	199,000	201,393	198,179	199,485	0	0	0		0	0	0
Total Expenses	5,156,000	5,960,393	6,370,179	5,855,485	6,862,000	7,135,000	7,259,000	7,488,000	7,763,000	8,923,000	8,887,000
Operation Surplus	327,000	(317,393)	(563,179)	177,515	(195,000)	(81,000)	205,000	268,000	297,000	(547,000)	(183,000)
Ending Fund Balance	1,356,000	1,038,607	475,821	653,515	459,000	378,000	583,000	851,000	1,148,000	601,000	418,000
Rate Increase		3%	3%	3%	10%	5%	5%	3%	3%	3%	3%

System Development Charge Fund (511)

The SDC fund (identified by fund number 511) is the source of funding for the planning, design, and construction of water system expansion projects necessary to accommodate growth. Revenues for the SDC fund come from the SDCs paid by new connections to the water system and interest income. Expenses for the SDC fund primarily include new construction projects with additional funds spent on related planning and design work. Table 9-9 summarizes historical revenues and expenses for the SDC fund and shows that almost $1 million is available for eligible projects.

Table 9-9. SDC Fund Historical Data

	2007-08	2008-09	2009-10	2010-11
	Actual $	Actual $	Actual $	Actual, $
Beginning Balance	888,422	867,425	879,413	909,238
Revenues				
Grant				
SDC Revenues	491,219	232,949	443,101	265,602
Interest Income	36,009	18,433	6,184	4,638
Total Revenues	527,228	251,382	449,285	270,240
Expenses				
Material & Services	52,218	54,332	65,447	53,758
Capital Outlays	496,009	185,061	354,012	161,342
Total Expenses	548,227	239,393	419,459	215,100
Net Revenues	-20,999	11,989	29,826	55,140
Ending Balance	867,425	879,413	909,238	964,378

The SDC charges were adopted by the City Commission in June 2004. These charges are adjusted annually based on cost indices and the current SDC for a single family dwelling is $3,123. The ordinance provides for an increase based on the increase in construction costs.

Projects included in Table 8-2 are planned for serving the urban growth boundary and are fully eligible to be funded from SDC reserves. The timing for these projects will be driven by the timing of development.

WATER SYSTEM FINANCIAL PLAN

Table 9-10 summarizes the existing system improvements and the renewal and replacement projects. In addition to these projects, Chapter 8 identifies numerous additional projects presented as unfunded replacement projects because the available capital is less than needed for replacement projects. This backlog of projects will need to be addressed in the future.

Table 9-10. Capital Improvement Plan for the Water Fund

Capital Improvement Description	CIP Number	Capital Cost,$
Existing System Improvements		
New Pipeline & PRV	CIP-P- 108	39,936
New Pipeline & PRV	CIP-V- 102	209,050
New Pipeline & PRV	CIP-V- 103	118,840
Pipeline Improvement	CIP-P-104	1,025,096
Pipeline Improvement	CIP-P-105	434,811
Renewal and Replacement		
View Manor Pressure Zone, PRV#15, 4 inch diameter (150 lf) and 8 inch diameter (4397 lf)	50	1,076,091
Clairmont Area, 8 inch diameter (9513 lf) and 10 inch diameter (3920 lf)	51	3,009,055
Weleber St to Harding Blvd, 8 inch diameter	52	1,617,316
I-205 Crossing between Pope Lane and Park Place Court, 8 inch diameter	53	119,347
15th St from Main St to Division St, PRV#2, 6 inch diameter (85 lf) ,8 inch diameter (1797 lf) and 10 inch diameter (2174 lf)	55	935,071
Main St from 5th St to 18th St, 8 inch diameter (1023 lf), 10 inch diameter (2558 lf) and 12 inch diameter (535 lf)	58	1,012,992
South End Rd and Warner Parrott Rd, 8 inch diameter	59	1,190,246
Seismic and Mixing Improvements for Boynton Reservoir	60	560,640
Total Capital Expenditures		11,348,490

For Scenario 1, approximately half of the dollar value of the projects could be funded. As shown in Table 9-10, some capital expenditures are feasible but well below the level necessary for the identified projects or at a sustainable level of replacement. Table 9-11 is premised on a 2.5% rate of inflation for capital projects and an average of about $560,000 is available for capital improvements other than the building fund reserve.

For Scenario 2, no funds are available for financing improvements. Even with no capital improvements, the water fund will have an annual deficit between $0.5 million and $1.5 million.

For Scenario 3, pay-as-you-go financing is available to fund the projects defined in the master plan. As shown in Table 9-12, most of the projects identified in the master plan can be funded. More important, the level of funding that is established by this approach provides for a level of capital investment that is sustainable.

RECOMMENDATIONS

Based on the assessment of existing financial conditions, Oregon City should take immediate action to improve the water utility financial conditions. The City has a valuable investment in the water distribution infrastructure and should take steps to ensure its long term viability.

Recommendation 1	**Begin a dialogue with the citizens to explain the current conditions with the goal to remove the Charter requirement for a rate rollback and to allow a one-time rate adjustment.** The City will soon have retired its debt for the water system and the prospect for maintaining the system debt free is excellent. A rate rollback will reverse the gains that have been made in the system and will prevent the operation of the water utility on a sustainable basis. A recent review of staffing for operation and maintenance of water distribution systems was completed for Milwaukie, Oregon City, Clackamas River Water and the Oak Lodge Water District. Oregon City has a staffing level that is comparable to these systems and significant staffing cuts are not viable.
Recommendation 2	**Implement rate increases to place the water distribution system on a pay-as-you-go financing program for replacement of old pipelines.** While rate increases are difficult, a proactive program to replace aged piping will save future expenditures. Experience in the industry has clearly shown that a proactive replacement program saves money. Once a significant percentage of a utility system exceeds its useful life, system breaks and leaks will increase and emergency response is more expensive and causes more public disruption. The deterioration of the system will continue to the degree where a pay-as-you-go financing program will no longer be viable because the backlog of required work will be overwhelming.
Recommendation 3	**Bill system users directly for water treatment costs that are adopted by the South Fork Water Board**. The costs for water production depend on the actions of the South Fork Water Board (SFWB) and are outside the direct control of the City Commission, except to the degree that the City participates on the board. When the South Fork Water Board adopts higher rates, the City would bill these rates as approved by the SFWB. Higher water treatment costs should not diminish the source of funding for the water distribution system. The SFWB needs to set rates which the City can bill and pass on the revenue to the SFWB based on the collected revenue corresponding to the approved SFWB rates.

Table 9-11. Scenario 1 Financial Plan

Capital Improvement Description	CIP Number	Capital Cost,$	Fiscal Year 2011-2012	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-2020	2020-21	2021-2022
Existing System Improvements													
Pipeline Improvement	CIP-P-108	39,936	40,934										
New Pipeline & PRV	CIP-V- 102	209,050		219,633									
New Pipeline & PRV	CIP-V- 103	118,840					134,457						
Pipeline Improvement	CIP-P-104	1,025,096						1,188,797					
Pipeline Improvement	CIP-P-105	434,811			468,244								
Renewal and Replacement													
View Manor Pressure Zone, PRV#15, 4 inch diameter (150 lf) and 8 inch diameter (4397 lf)	50	1,076,091								1,311,112			
Clairmont Area, 8 inch diameter (9513 lf) and 10 inch diameter (3920 lf)	51	3,009,055											
Weleber St to Harding Boulevard, 8 inch diameter	52	1,617,316											
I-205 Crossing between Pope Lane and Park Place Court, 8 inch diameter	53	119,347							141,866				
15th Street from Main Street to Division Street, PRV#2, 6 inch diameter (85 lf) , 8 inch diameter (1797 lf) and 10 inch diameter (2174 lf)	55	935,071									1,167,776		
Main Street froM 5th Street to 18th Street, 8 inch diameter (1023 lf), 10 inch diameter (2558 lf) and 12 inch diameter (535 lf)	58	1,012,992											1,329,133
South End Road and Warner Parrott Road, 8 inch diameter	59	1,190,246											
Seismic and Mixing Improvements for Boynton Reservoir	60	560,640											
Total Capital Expenditures		11,348,490	40,934	219,633	468,244	0	134,457	1,188,797	141,866	1,311,112	1,167,776	0	1,329,133
Operating Surplus			327,000	(317,000)	(563,000)	309,000	430,000	(566,000)	543,000	(561,000)	(350,000)	889,000	(367,000)
Available Funds from Water Operations		1,029,000	1,356,000	1,039,000	476,000	785,000	1,215,000	649,000	1,192,000	631,000	281,000	1,170,000	803,000

Table 9-12. Scenario 3 Financial Plan

Capital Improvement Description	CIP Number	Capital Cost,$	Fiscal Year 2011-2012	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-2020	2020-21	2021-2022
Existing System Improvements													
Pipeline Improvement	CIP-P-108	39,936	40,934										
New Pipeline & PRV	CIP-V- 102	209,050		219,633									
New Pipeline & PRV	CIP-V- 103	118,840				131,177							
Pipeline Improvement	CIP-P-104	1,025,096					1,159,802						
Pipeline Improvement	CIP-P-105	434,811			468,244								
Renewal and Replacement													
View Manor Pressure Zone, PRV#15, 4 inch diameter (150 lf) and 8 inch diameter (4397 lf)	50	1,076,091						1,247,936					
Clairmont Area, 8 inch diameter (9513 lf) and 10 inch diameter (3920 lf)	51	3,009,055							1,180,351	1,209,860	1,277,685		
Weleber Street to Harding Boulevard, 8 inch diameter	52	1,617,316										2,070,301	
I-205 Crossing between Pope Lane and Park Place Court, 8 inch diameter	53	119,347										152,774	
15th Street from Main Street to Division Street, PRV#2, 6 inch diameter (85 lf) , 8 inch diameter (1797 lf) and 10 inch diameter (2174 lf)	55	935,071											1,226,894
Main Street from 5th Street to 18th Street, 8 inch diameter (1023 lf), 10 inch diameter (2558 lf) and 12 inch diameter (535 lf)	58	1,012,992											
South End Road and Warner Parrott Road, 8 inch diameter	59	1,190,246											
Seismic and Mixing Improvements for Boynton Reservoir	60	560,640											735,608
Total Capital Expenditures		11,348,490	40,934	219,633	468,244	131,177	1,159,802	1,247,936	1,180,351	1,209,860	1,277,685	2,223,075	1,962,502
Operating Surplus			327,000	(317,000)	(563,000)	178,000	(195,000)	(81,000)	205,000	268,000	297,000	(547,000)	(183,000)
Ending Water Fund Balance		1,029,000	1,356,000	1,039,000	476,000	654,000	459,000	378,000	583,000	851,000	1,148,000	601,000	418,000

APPENDIX A

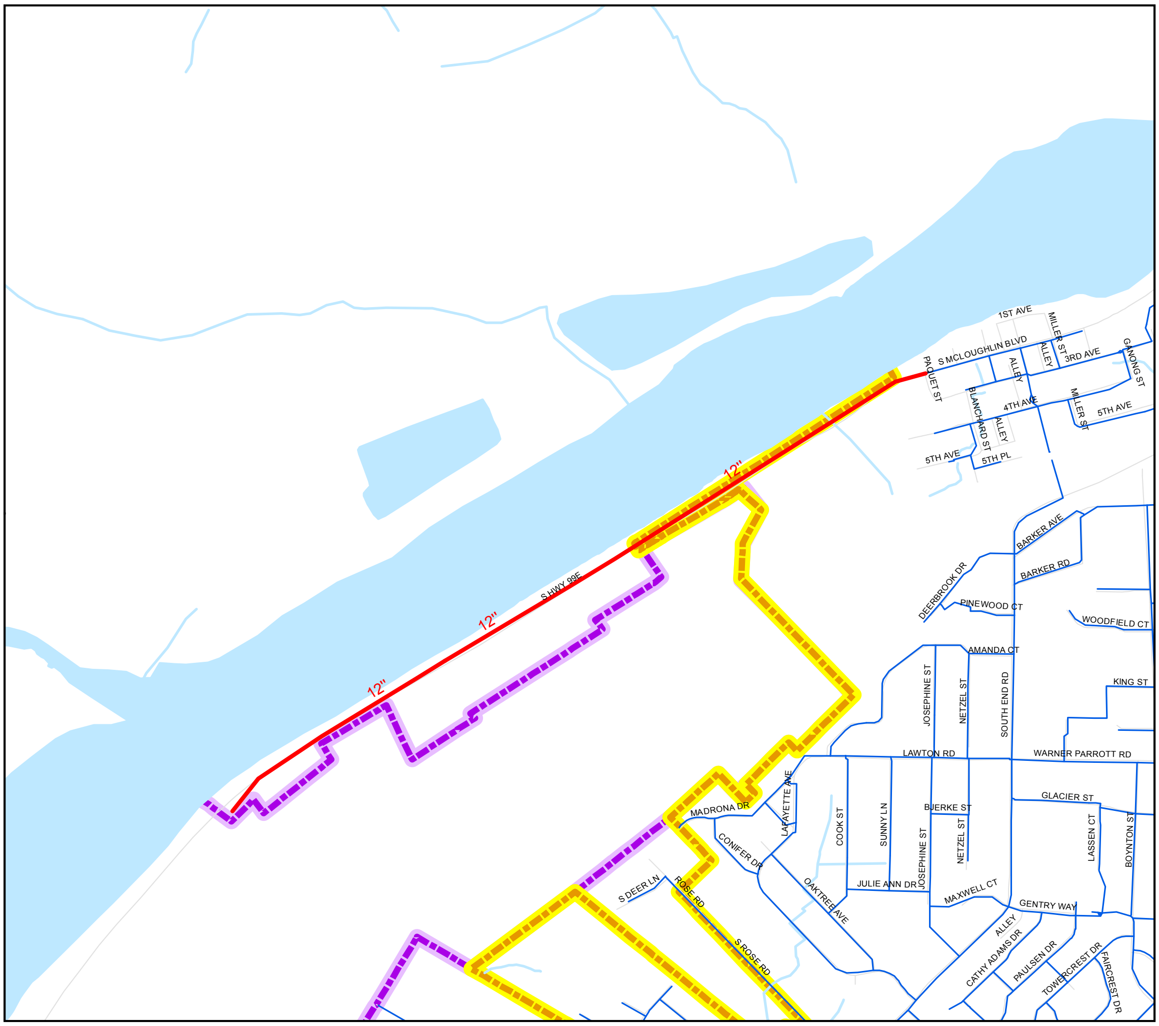
City of Oregon City, Water System – Diurnal Curve Development Technical Memorandum, March 3, 2010

APPENDIX D

Project Sheets

APPENDIX D. PROJECT SHEETS

The following data sheets provide a summary of the location, size and length of each project identified in the CIP. The alignments of future pipeline extensions shown on the drawings are estimates and actual alignments may be modified as necessary to accommodate actual development patterns.



Pipeline Project Number: 1

Project Vicinity: Highway 99E/McLoughlin Blvd.

Project Description: This project is intended to provide service and fire flow protection to the service area along Highway 99E and the Willamette River. Add 6,863 feet of 12-inch diameter piping along Highway 99E.

Existing Pipeline
CIP Pipeline
City Limits
UGB

OREGON CITY

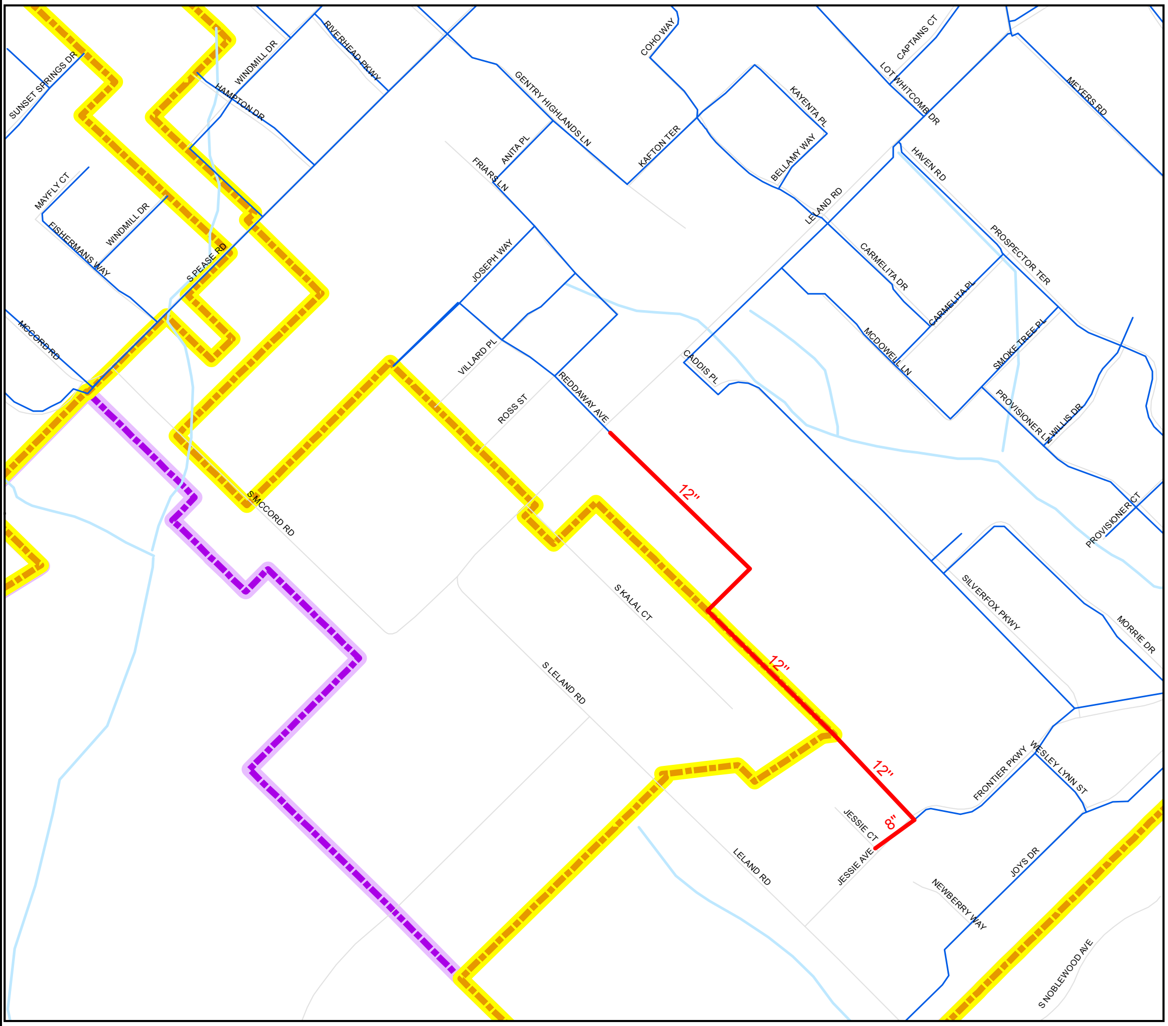
WEST YOST ASSOCIATES

Project Data Table				
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	12	6863	$200	$1,372,600
Total		6,863		$1,372,600

N

0 500 1,000
Scale in Feet

1



Pipeline Project Number: 8

Project Vicinity: Joseph Way and S Leland Rd to S Jessie Ave.

Project Description: This project is intended to improve fire flows in the area and add additional looping for added reliability. Route shown may have constructability issues and will need refinement at the time of design. Add 1,839 feet of 12-inch diameter piping between Leland Road and Frontier Parkway South of Silverfox Parkway..

Existing Pipeline
CIP Pipeline
City Limits
UGB

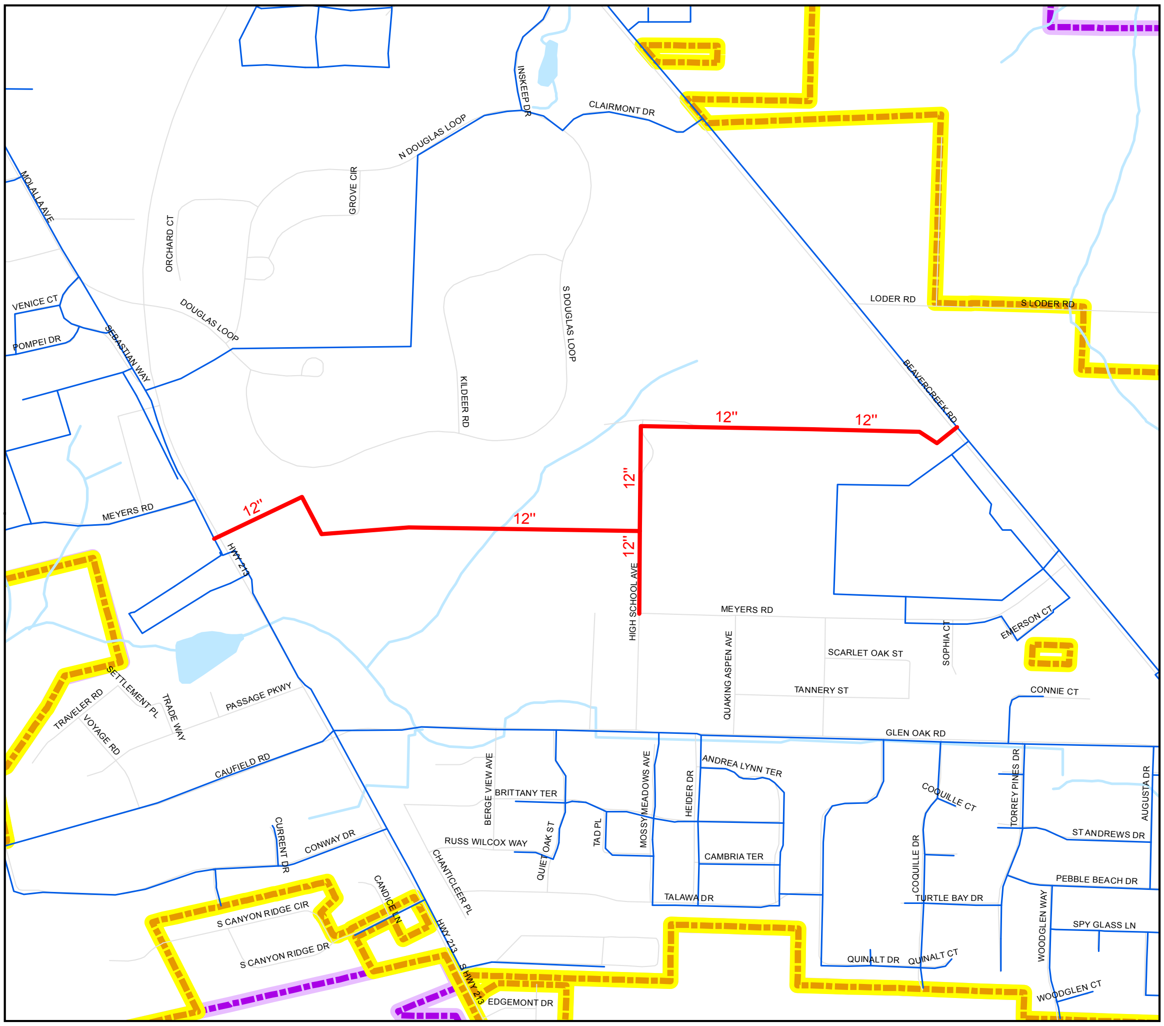
OREGON CITY

WEST YOST ASSOCIATES

Project Data Table				
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	8	161	$140	$22,540
	12	1,839	$200	$367,800
Total		2,000		$390,340

N

0 200 400
Scale in Feet



Pipeline Project Number: 11

Existing Pipeline
CIP Pipeline
City Limits
UGB

Project Vicinity: Between Highway 213 and Beavercreek Rd.

Project Description: This project is intended to supply future growth in the area, improve fire flows in the area and add additional looping for added reliability. Route shown may have constructability issues and will need refinement at the time of design. Add 5,662 feet of 12- inch diameter piping between Beavercreek Road and Highway 213 near Meyers Road.

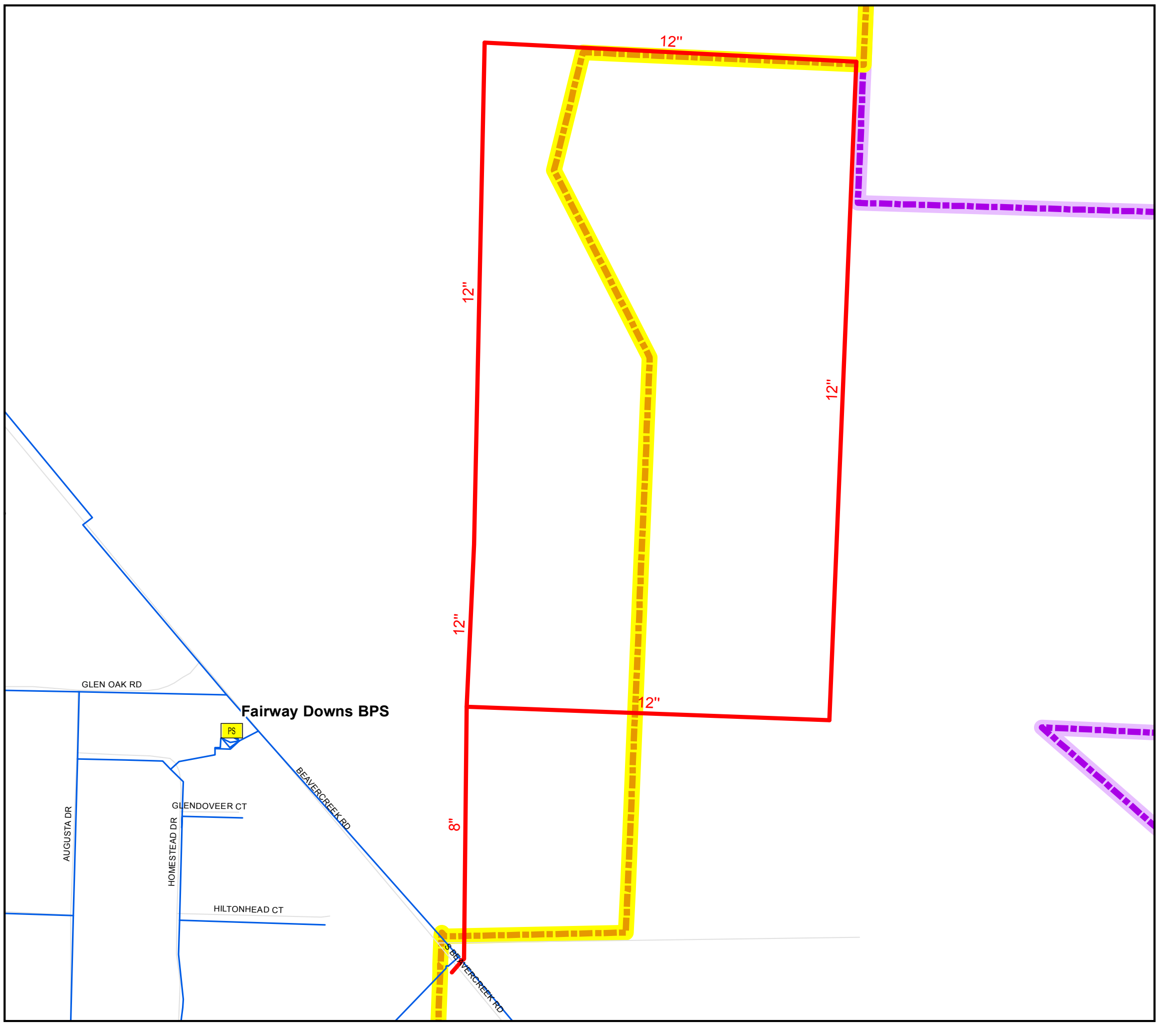
OREGON CITY

WEST YOST ASSOCIATES

Project Data Table				
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	12	5662	$200	$1,132,400
Total		5,662		$1,132,400

N

0 350 700
Scale in Feet



Pipeline Project Number: 12

Project Vicinity: East side of Beavercreek Rd, adjacent to Fairway Downs Pump Station.

Project Description: This project is intended to supply future growth in the area and will likely be developer driven. Route shown may have constructability issues and will need refinement at the time of design. Add 5,187 feet of 12-inch diameter piping and 688 feet of 8-inch diameter piping North of Beavercreek road.

Existing Pipeline
CIP Pipeline
City Limits
UGB

OREGON CITY

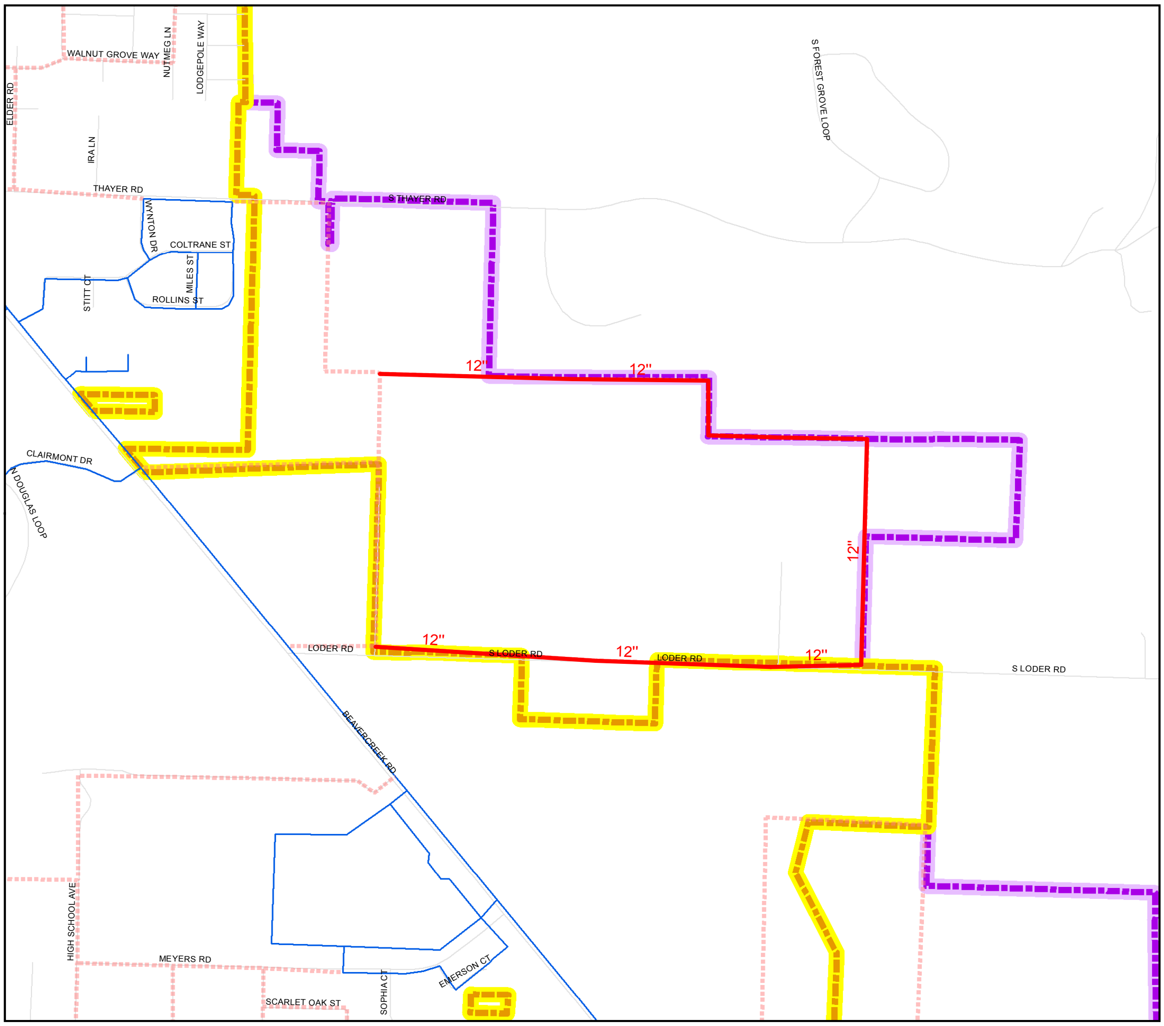
WEST YOST ASSOCIATES

Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	8	688	$140	$96,320
	12	5,187	$200	$1,037,400
Total		5,875		$1,133,720

0 150 300
Scale in Feet

N



Pipeline Project Number: 13

Project Vicinity: Loder Road.

Project Description: This project is intended to supply future growth in the area and will likely be developer driven. Route shown may have constructability issues and will need refinement at the time of design. Add 7,303 feet of 12-inch diameter piping Northeast of Beavercreek Road.

- Existing Pipeline
- CIP Pipeline
- Future System Pipeline
- City Limits
- UGB

OREGON CITY

WEST YOST ASSOCIATES

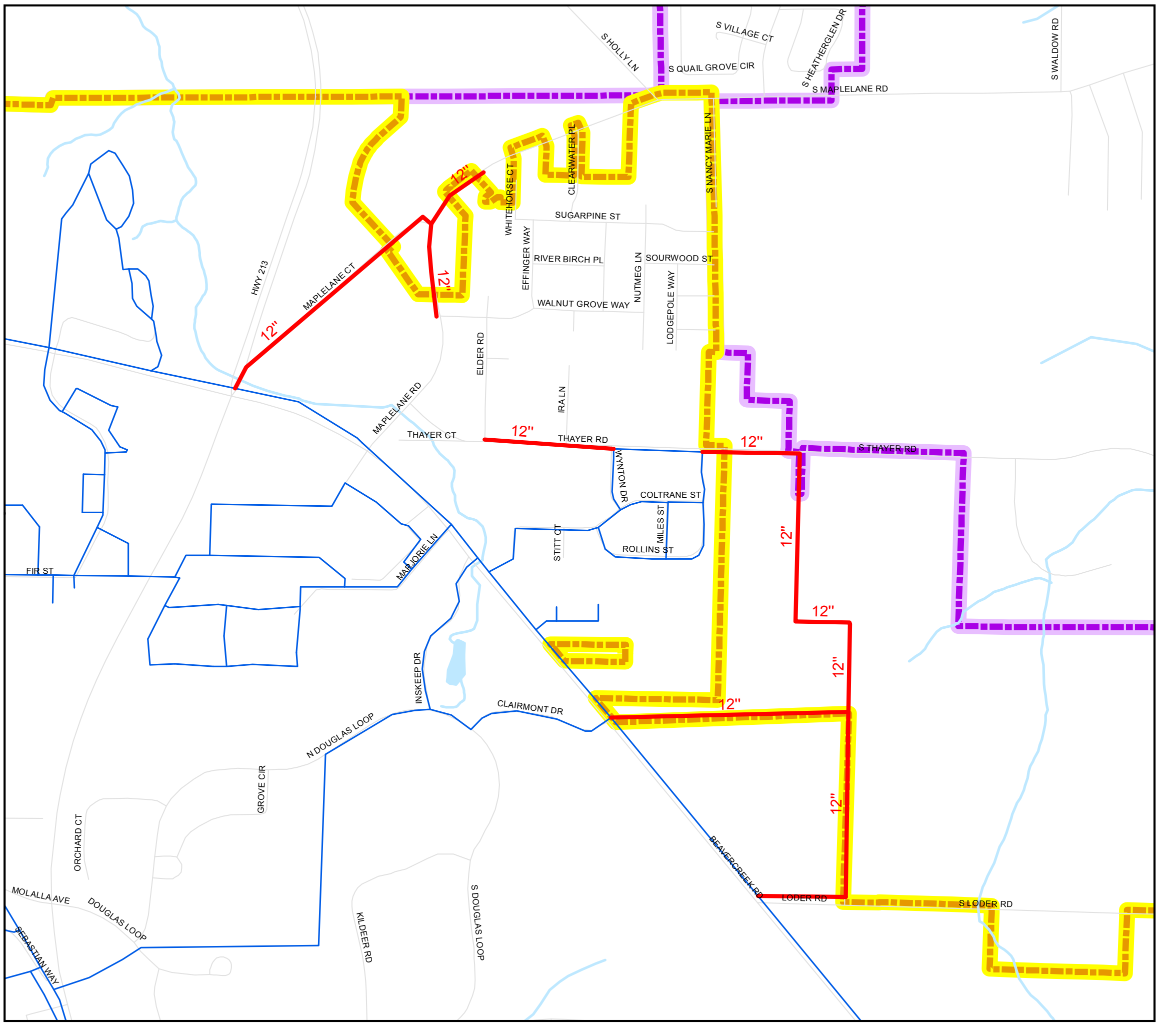
Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	12	7,303	$200	$1,460,600
Total		7,303		$1,460,600

N

0 350 700

Scale in Feet



Pipeline Project Number: 14

Project Vicinity: East side of Beavercreek Rd from Loder Road to Maplelane Ct.

Project Description: This project is intended to supply future growth in the area and will likely be developer driven. Route shown may have constructability issues and will need refinement at the time of design. Add 8,690 feet of 12-inch diameter piping Northeast of Beavercreek Road.

Existing Pipeline
CIP Pipeline
City Limits
UGB

OREGON CITY

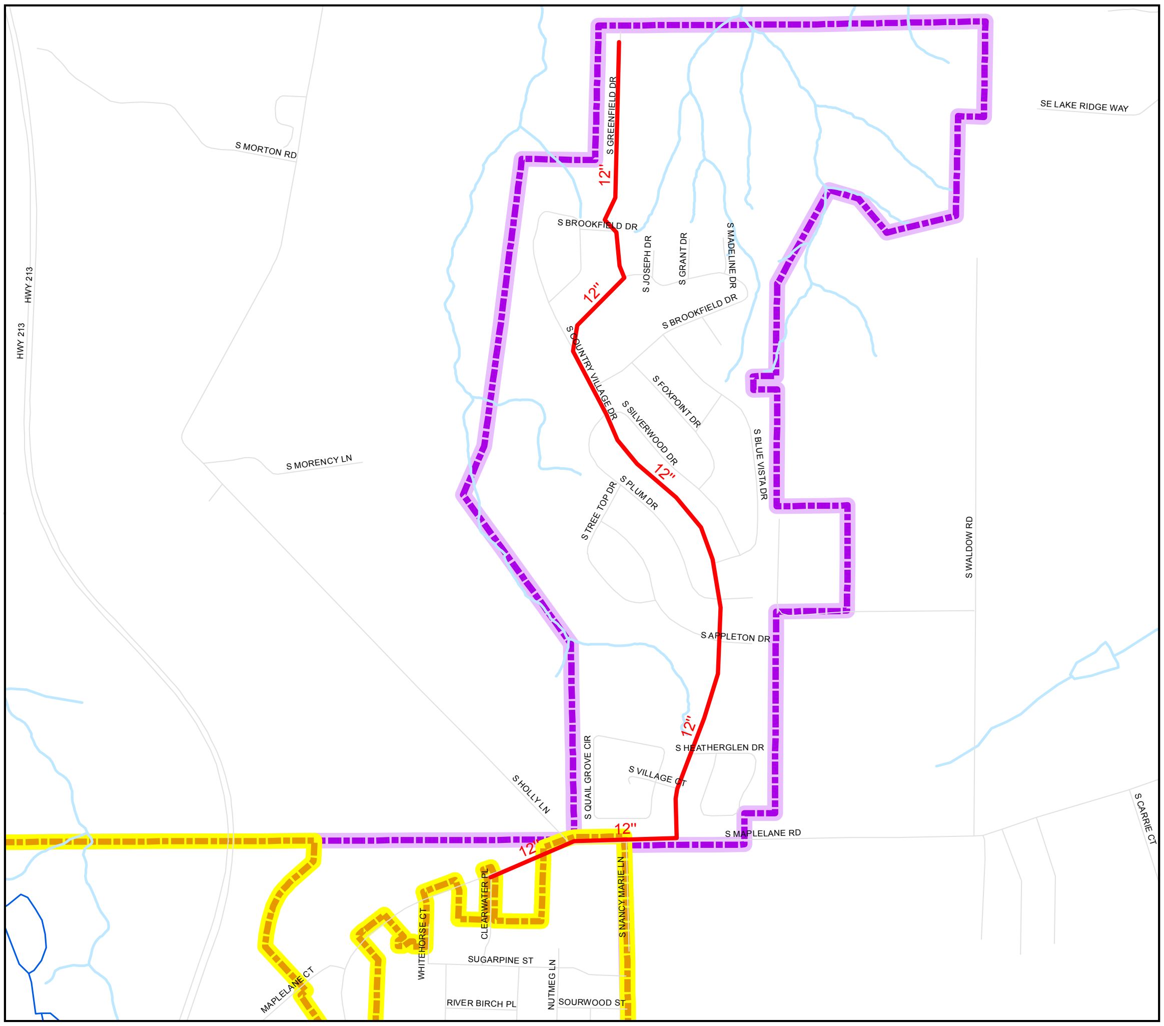
WEST YOST ASSOCIATES

Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	12	8,690	$200	$1,738,000
Total		8,690		$1,738,000

N

0 350 700
Scale in Feet



Pipeline Project Number: 15

Project Vicinity: Maplelane Rd to S Greenfield Dr

Project Description: This project is intended to supply future growth in the area and will likely be developer driven. Route shown may have constructability issues and will need refinement at the time of design. Add 6,311 feet of 12-inch diameter piping North of Maplelane Road.

Existing Pipeline
CIP Pipeline
City Limits
UGB

OREGON CITY

WEST YOST ASSOCIATES

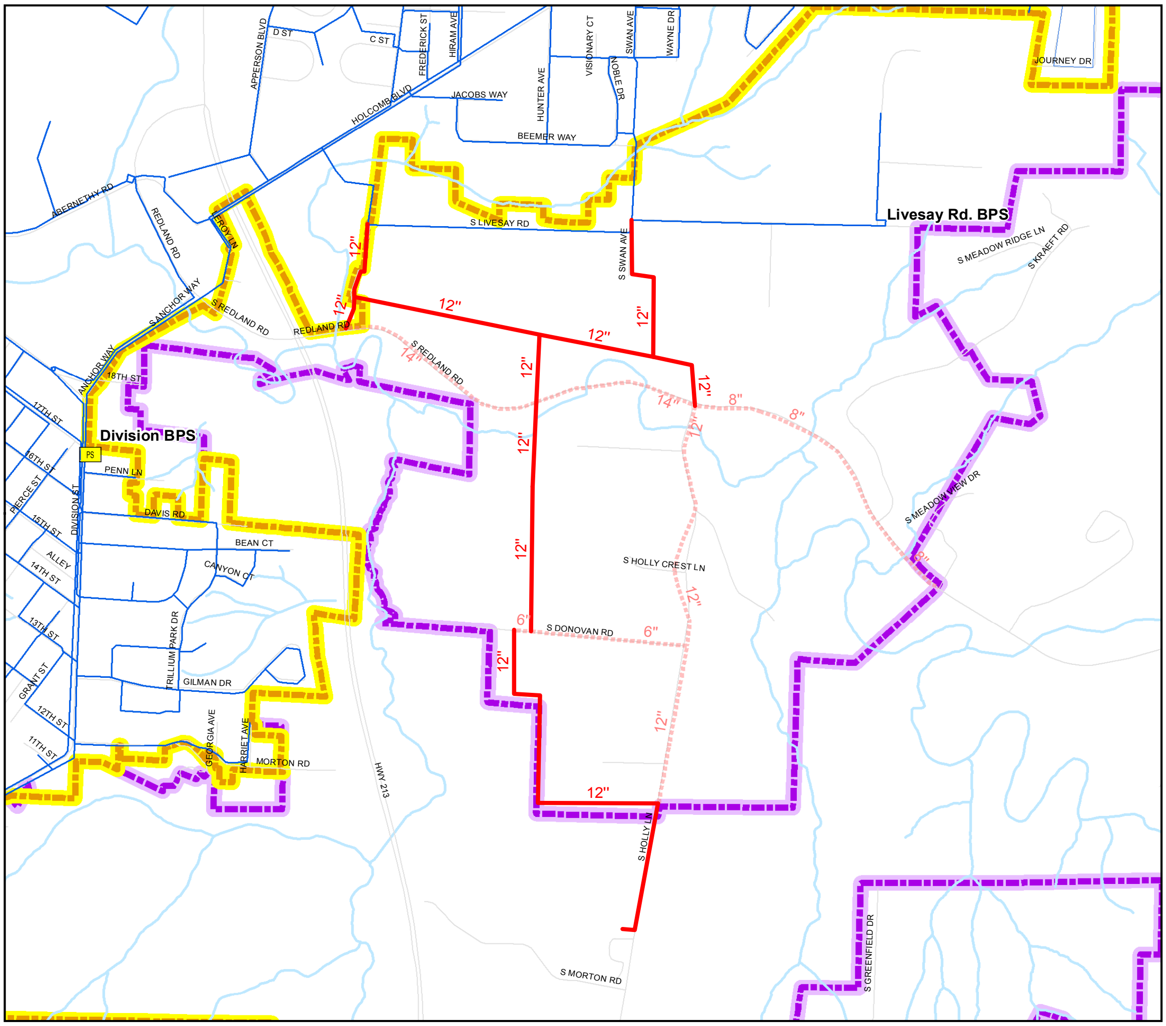
Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	12	6,311	$200	$1,262,200
Total		6,311		$1,262,200

0 350 700
Scale in Feet

7

4a. L 10-02: Water Master Plan



Pipeline Project Number: 20

Project Vicinity: S Livesay Rd south to new Holly Lane Reservoir (west side).

Project Description: This project is intended to supply future growth in the area and will likely be developer driven. Route shown may have constructability issues and will need refinement at the time of design. Add 9,580 feet of 12-inch diameter piping and and 1,070 feet of 16-inch diameter piping South of Livesay Road.

- Existing Pipeline
- CIP Pipeline
- City Limits
- UGB

OREGON CITY

WEST YOST ASSOCIATES

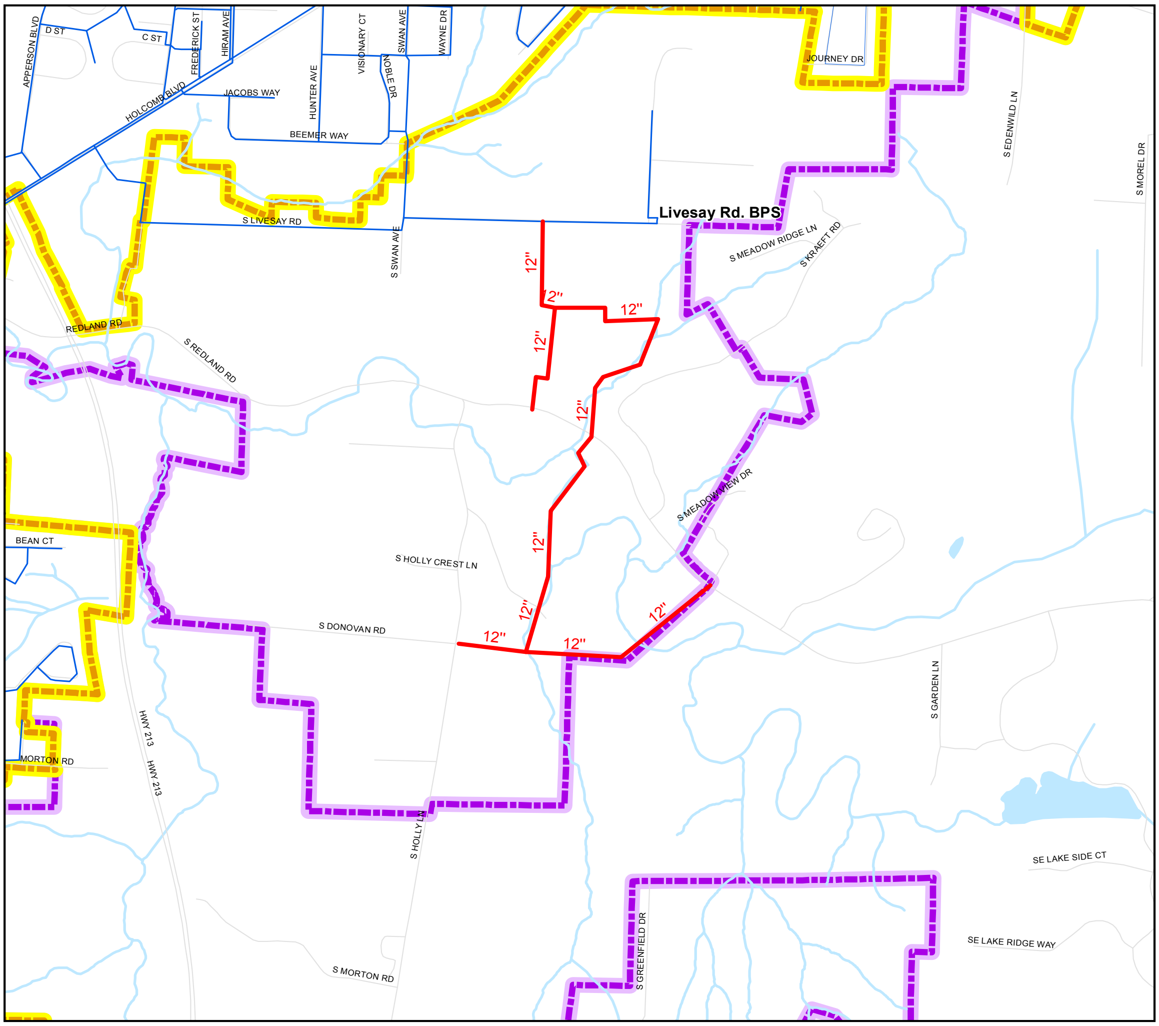
Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	12	9,580	$200	$1,916,000
	16	1,070	$250	$267,500
Total		10,650		$2,183,500

N

0 400 800

Scale in Feet



Pipeline Project Number: 21

Project Vicinity: S Livesay Rd south to new Holly Lane Reservoir (east side).

Project Description: This project is intended to supply future growth in the area and will likely be developer driven. Route shown may have constructability issues and will need refinement at the time of design. Add 7,497 feet of 12-inch diameter piping South of Livesay Road.

Existing Pipeline
CIP Pipeline
City Limits
UGB

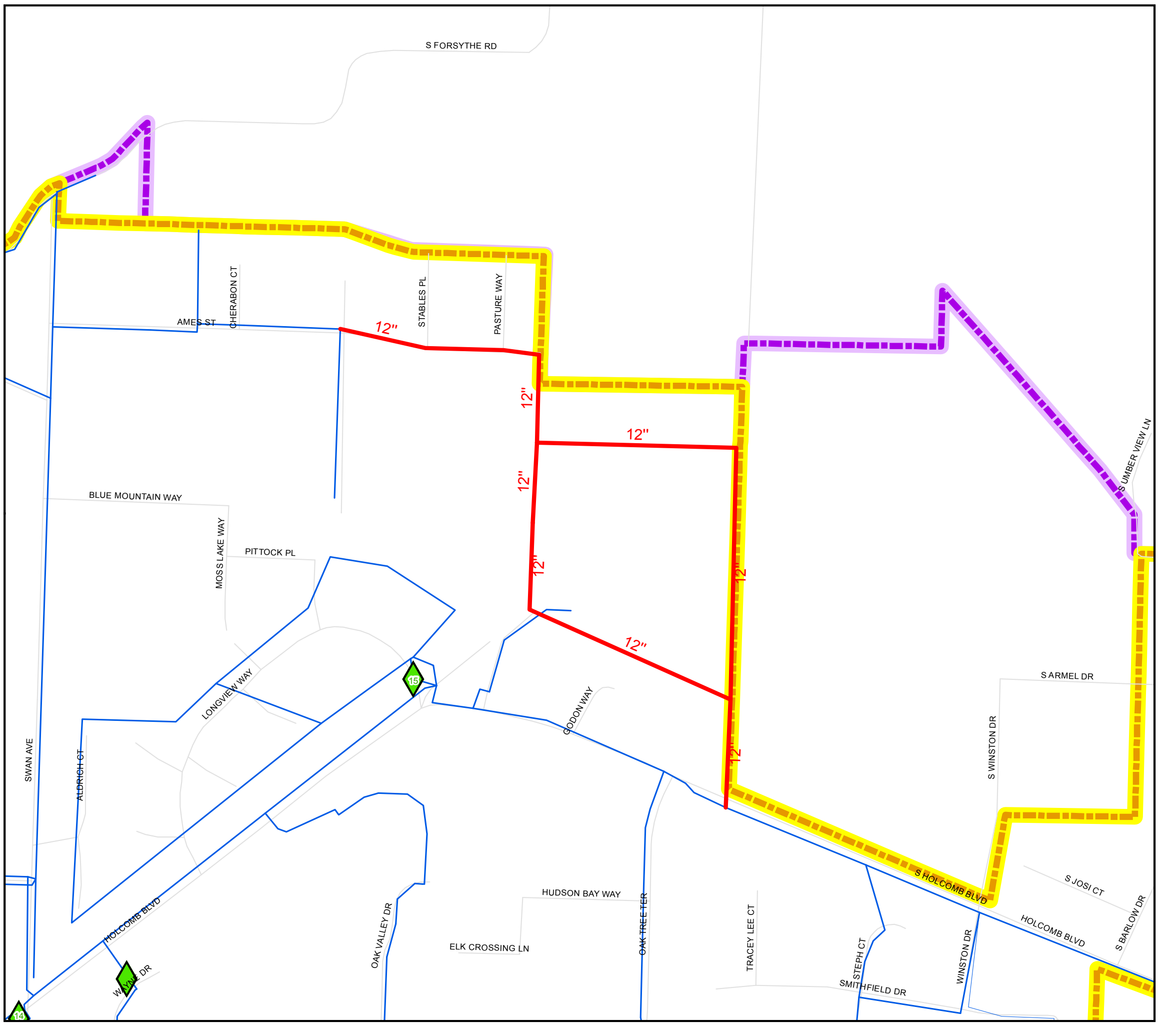
OREGON CITY

WEST YOST ASSOCIATES

Project Data Table				
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	12	7,497	$200	$1,499,400
Total		7,497		$1,499,400

N

0 400 800
Scale in Feet



Pipeline Project Number: 24

Project Vicinity: Ames St to S Holcomb Blvd.

Project Description: This project is intended to supply future growth in the area and will likely be developer driven. It also completes a loop in the area providing enhanced reliability of the system. Route shown may have constructability issues near the school and will need refinement at the time of design. Add 4,140 feet of 12-inch diameter piping North of Holcomb Boulevard.

Existing Pipeline
CIP Pipeline
City Limits
UGB
PRV Station

OREGON CITY

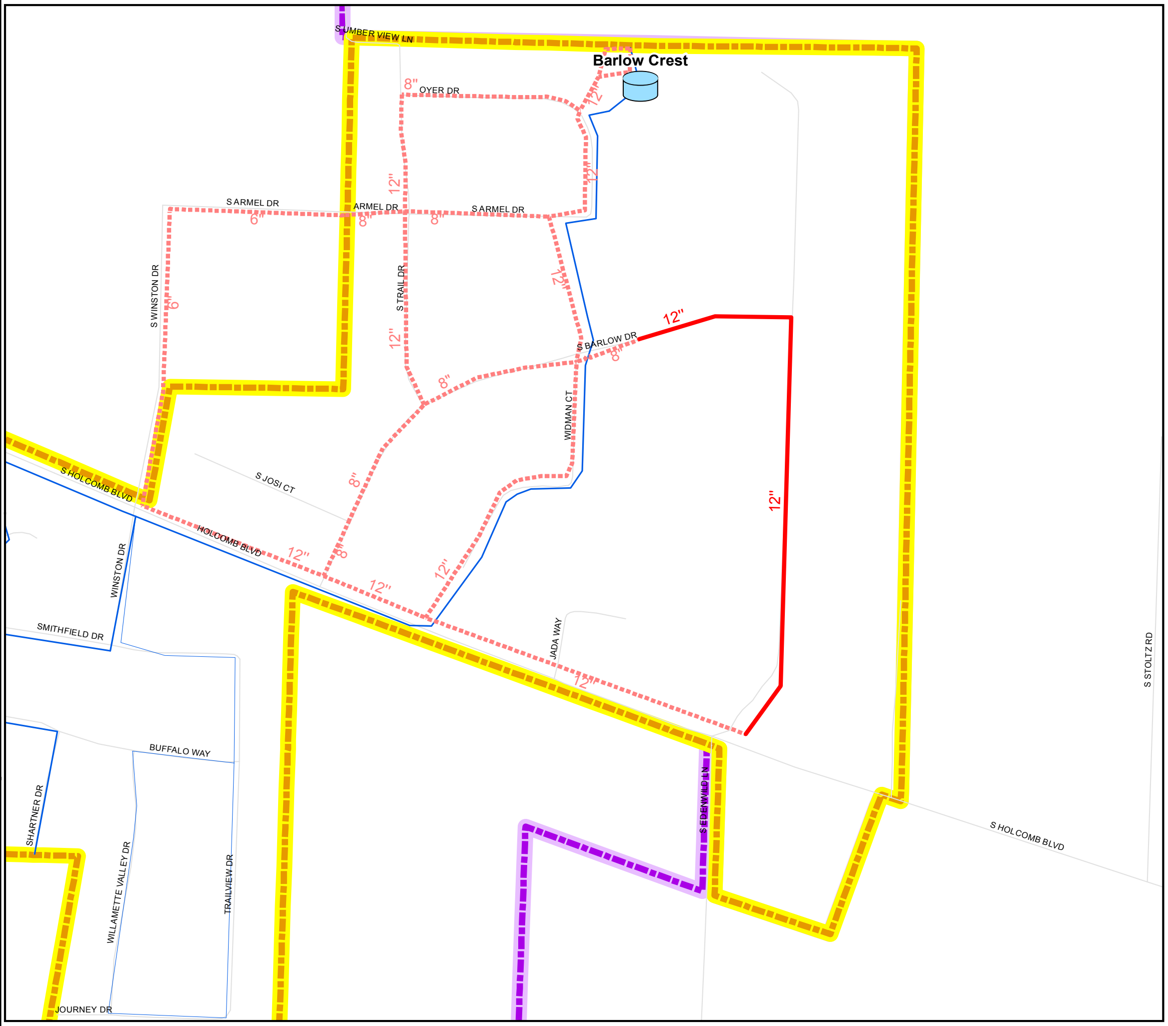
WEST YOST ASSOCIATES

Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	12	4,140	$200	$828,000
Total		4,140		$828,000

0 200 400
Scale in Feet

10



Pipeline Project Number: 25

Project Vicinity: Clackamas Heights Airport from S Barlow Dr to S Holcomb Blvd.

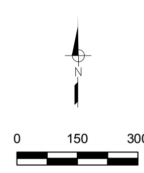
Project Description: This project is intended to supply future growth in the area and add additional looping for added reliability. It will likely be developer driven, and will not be the responsibility of the City until this area is taken over from CRW. Route shown may have constructability issues and will need refinement at the time of design. Add 1,472 feet of 12-inch diameter piping North of Holcomb Boulevard.

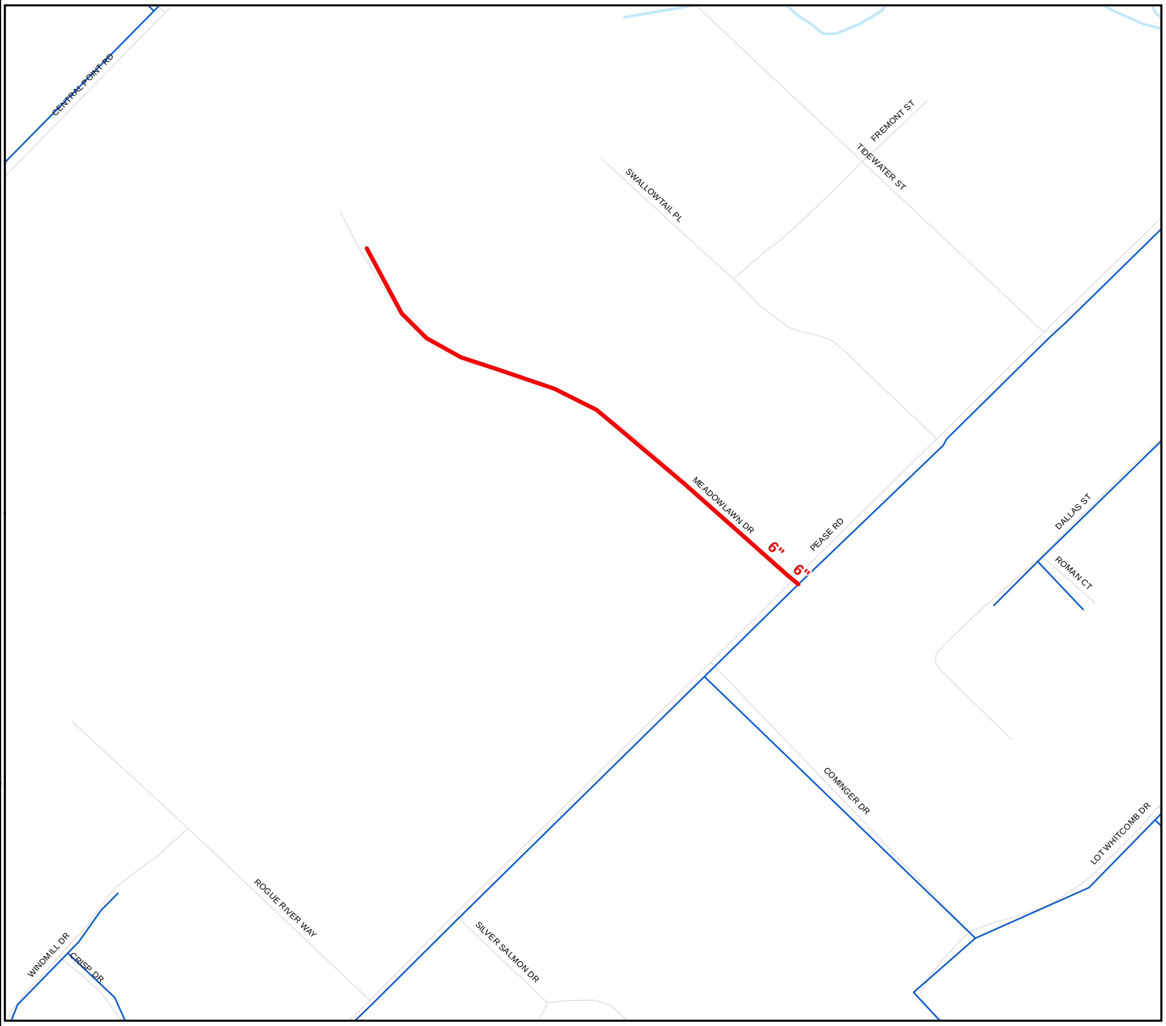
Existing Pipeline
CIP Pipeline
CRW Pipeline
City Limits
UGB

OREGON CITY

WEST YOST ASSOCIATES

Project Data Table				
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	12	1,472	$200	$294,400
Total		1,472		$294,400





Pipeline Project Number: 27

Existing Pipeline
CIP Pipeline

Project Vicinity: S. Meadowlawn Court and Pease Road.

Project Description: This project consists of 893 feet of 6-inch diameter piping to be added along S. Meadowlawn Court to improve fireflows in the area.

OREGON CITY

WEST YOST ASSOCIATES

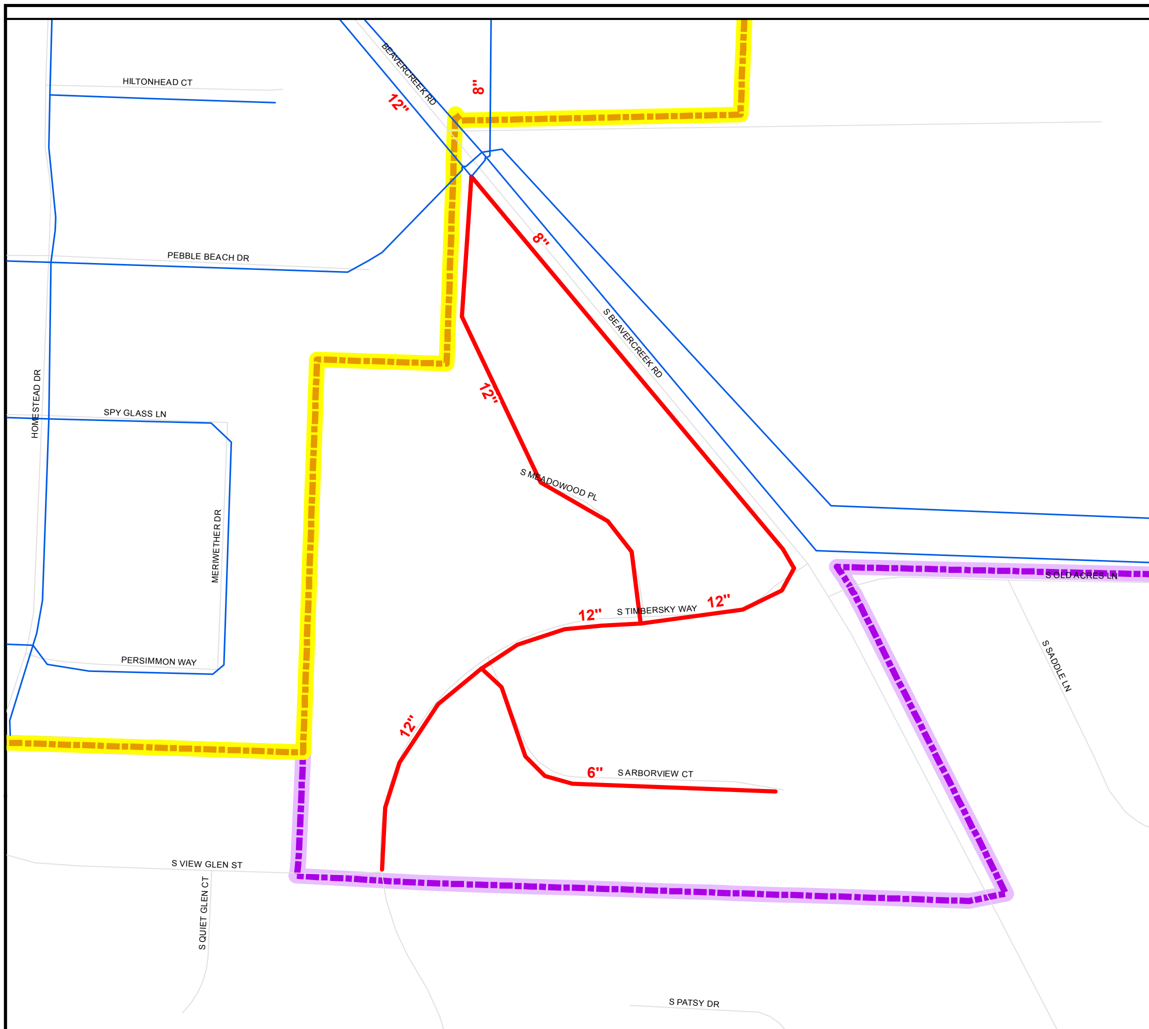
Project Data Table				
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	6	893	$110	$98,230
Total		893		$98,230

N

0 90 180
Scale in Feet

12

4a. L 10-02: Water Master Plan



Pipeline Project Number: 28

Project Vicinity: West side of Beavercreek Rd, Southeast of the Fairway Downs Pump Station.

Project Description: This project is intended to supply future growth in the area and improve looping. Add 1,774 feet of 12-inch diameter piping, 27 feet of 8-inch diameter piping and 582 feet of 6-inch diameter piping West of Beavercreek road.

Existing Pipeline
CIP Pipeline
City Limits
UGB

OREGON CITY

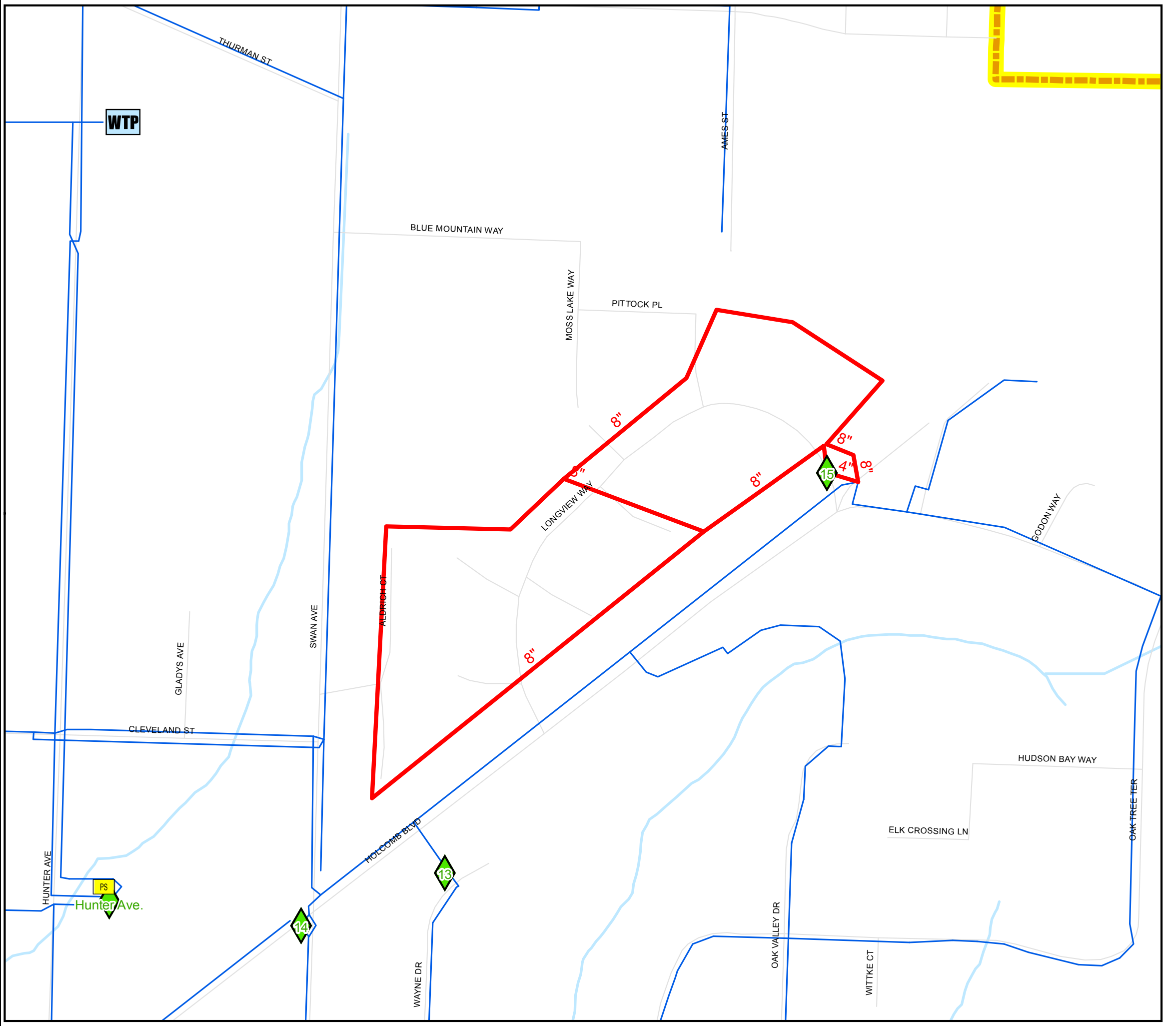
WEST YOST ASSOCIATES

Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	6	582	$110	$64,020
	8	827	$140	$115,780
	12	1,774	$200	$354,800
Total		3,183		$534,600

N

0 150 300
Scale in Feet



Pipeline Project Number: CIP-50

Project Vicinity: View Manor Pressure Zone.

Project Description: This project is intended to replace piping in the vicinity of the View Manor Pressure Zone Northwest of Holcomb Boulevard. Add a new PRV 15, 150 feet of 4-inch diameter piping and 4,397 feet of 8-inch diameter piping.

Existing Pipeline
CIP Pipeline
City Limits
PRV Station

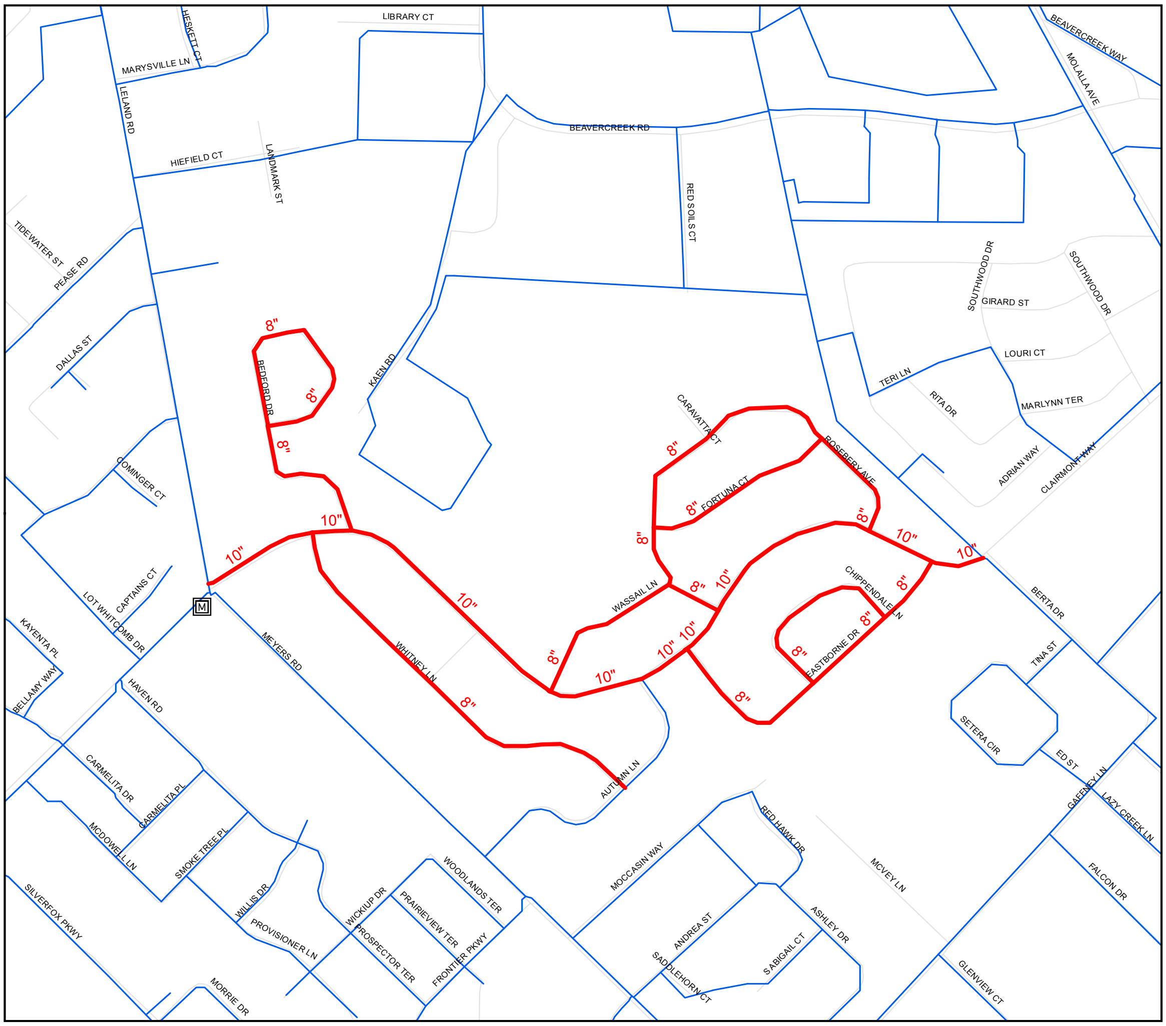
Project Data Table				
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	4	150	100	$15,000
	8	4,397	140	$615,580
4" PRV				$70,000
Total				$700,580

OREGON CITY

WEST YOST ASSOCIATES

0 150 300
Scale in Feet

N



Pipeline Project Number: CIP-51

Project Vicinity: Clairmont area.

Project Description: This project is intended to replace piping in the Clairmont area East of Leland Road and Meyers Road. Add 9,513 feet of 8-inch diameter piping and 3,920 feet of 10-inch diameter piping.

Existing Pipeline

CIP Pipeline

Master Meter

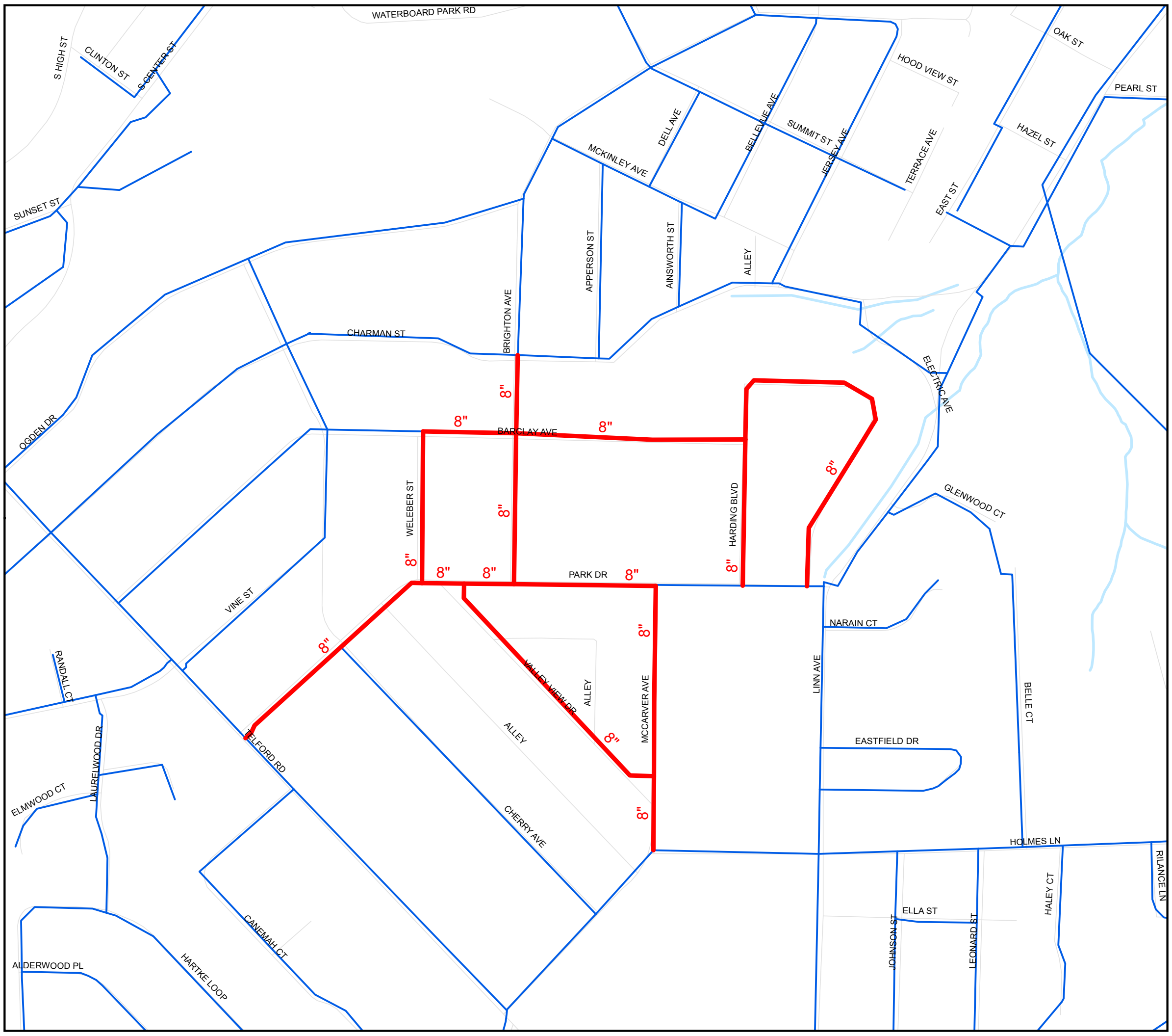
Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	8	9,513	$140	$1,331,820
	10	3,920	$160	$627,200
Total		13,433		$1,959,020

0 250 500

Scale in Feet

15



Pipeline Project Number: CIP-52

Project Vicinity: Weleber St to Harding Blvd.

Project Description: This project is intended to replace piping in the area of Weleber Street and Harding Boulevard. Add 7,521 feet of 8-inch diameter piping.

OREGON CITY

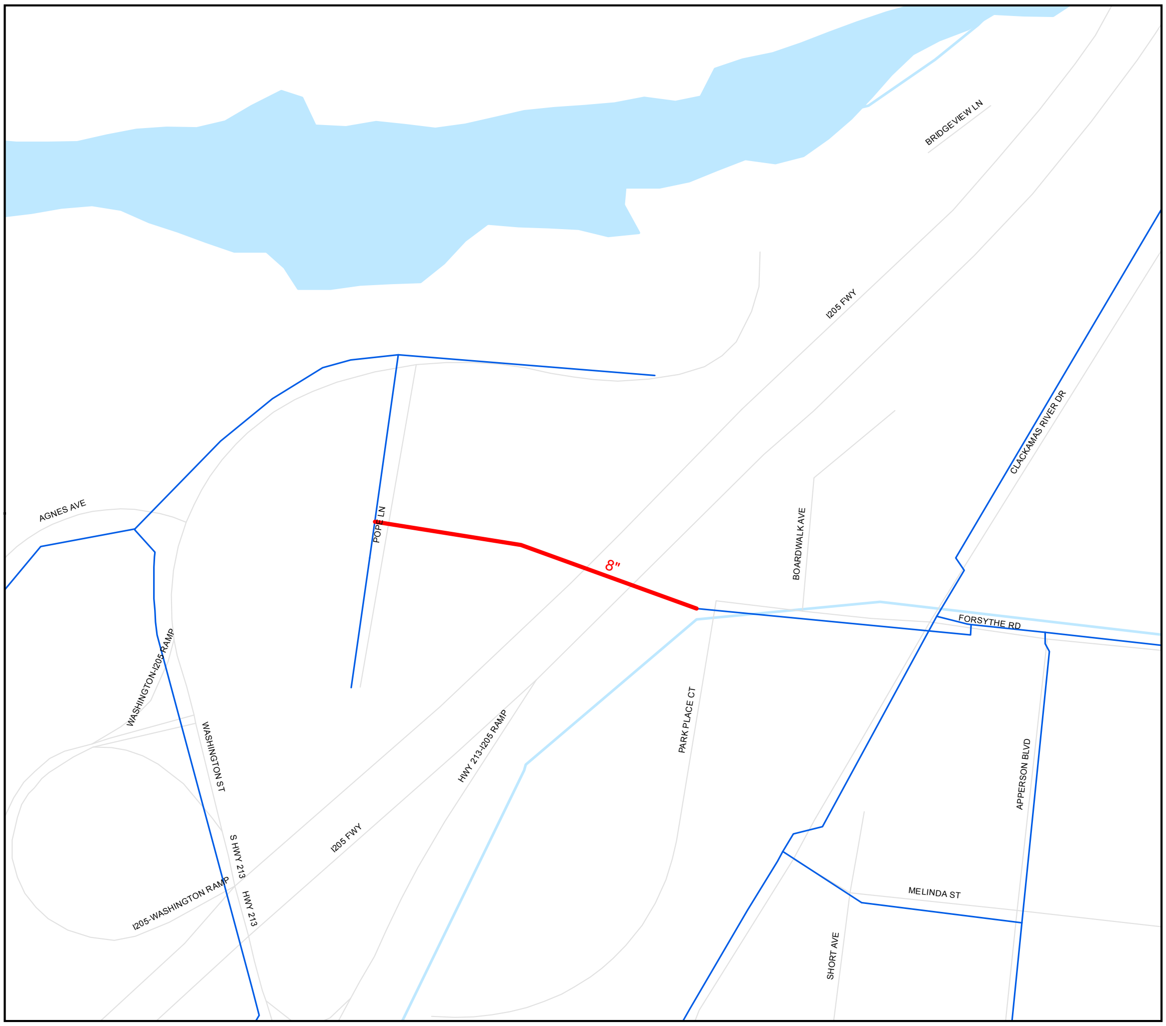
WEST YOST ASSOCIATES

Project Data Table				
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	8	7,521	$140	$1,052,940
Total		7,521		$1,052,940

0 200 400

Scale in Feet

16



Pipeline Project Number: CIP-53

Project Vicinity: I-205 crossing between Pope Lane and Park Place Ct.

Project Description: This project is intended to replace piping that crosses the I-205 Freeway at Forsythe Road. Add 555 feet of 8-inch diameter piping and a freeway crossing.

Existing Pipeline
CIP Pipeline

OREGON CITY

WEST YOST ASSOCIATES

Project Data Table

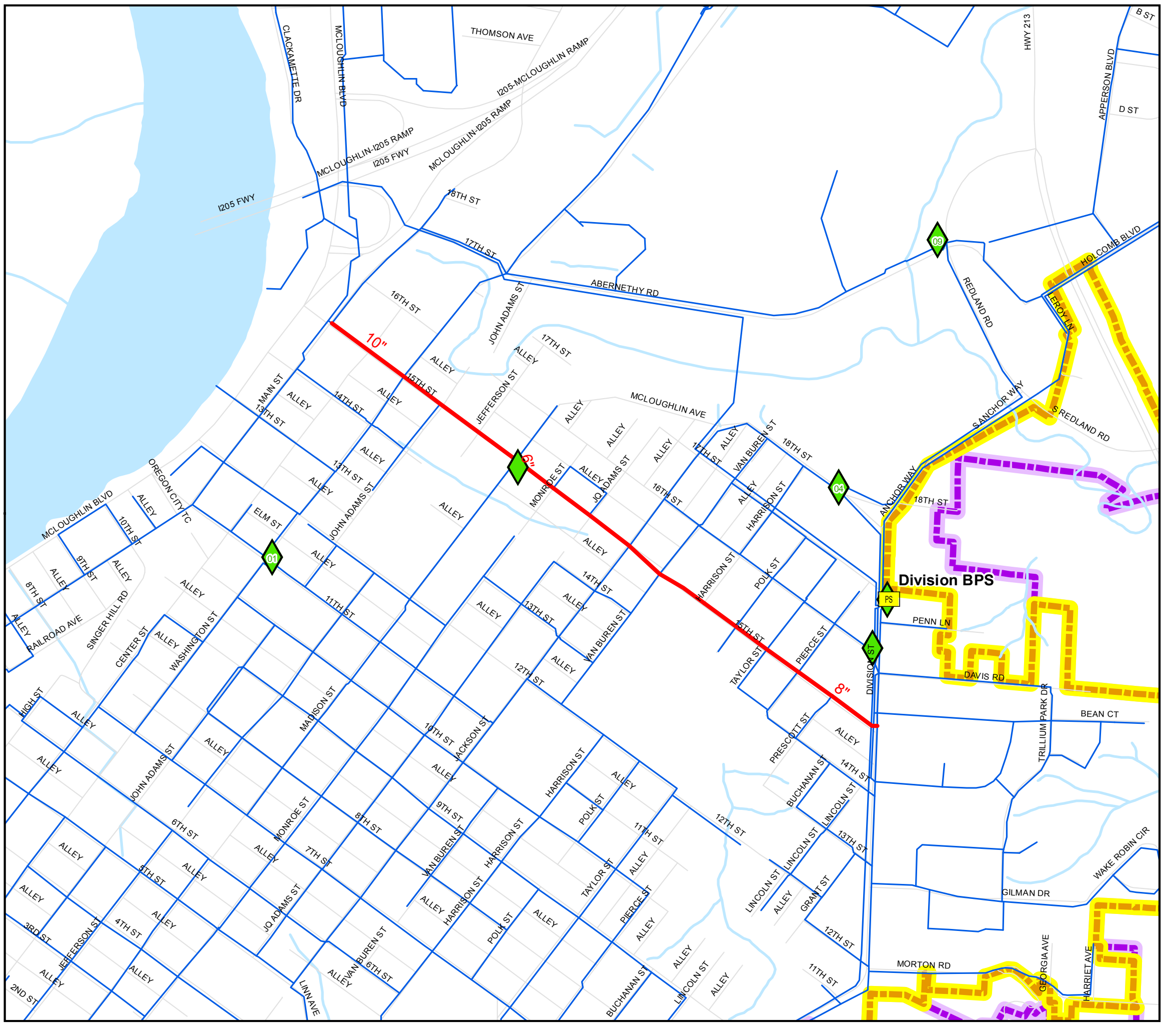
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	8	555	$140	$77,700
Total		555		$77,700

N

0 100 200
Scale in Feet

17

4a. L 10-02: Water Master Plan



Pipeline Project Number: CIP-55

Project Vicinity: 15th St from Main St to Division St.

Project Description: This project is intended to replace piping along 15th Street. Add a new PRV 2, 85 feet of 6-inch diameter piping, 1,797 feet of 8-inch diameter piping and 2,174 feet of 10-inch diameter piping.

Existing Pipeline
CIP Pipeline
City Limits
UGB
PRV Station

OREGON CITY

WEST YOST ASSOCIATES

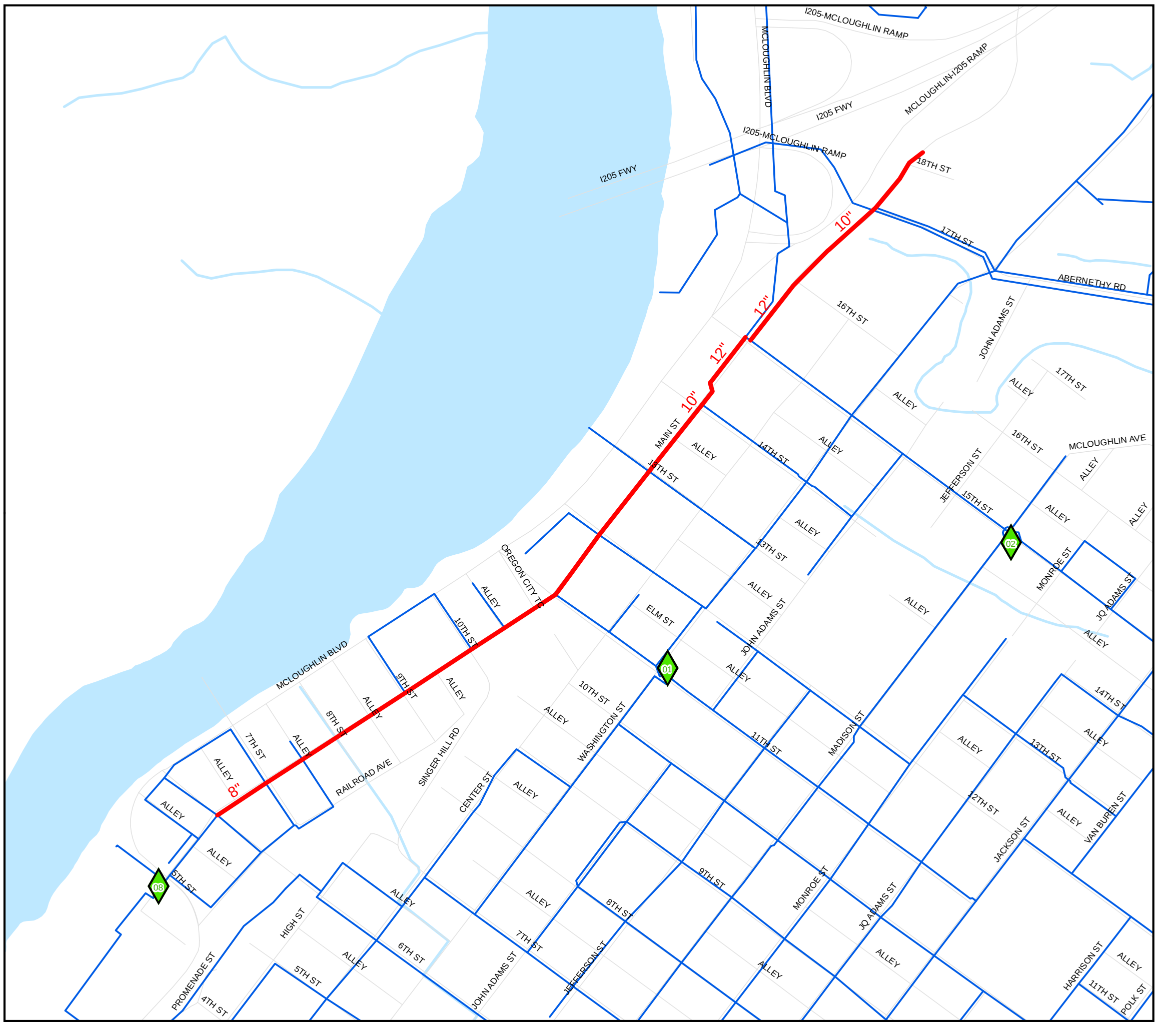
Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	6	85	$110	$9,350
	8	1,797	$140	$251,580
	10	2,174	$160	$347,840
PRV				$70,000
Total		4,056		$678,770

N

0 350 700

Scale in Feet



Pipeline Project Number: CIP-58

Project Vicinity: Main St from 5th St to 18th St

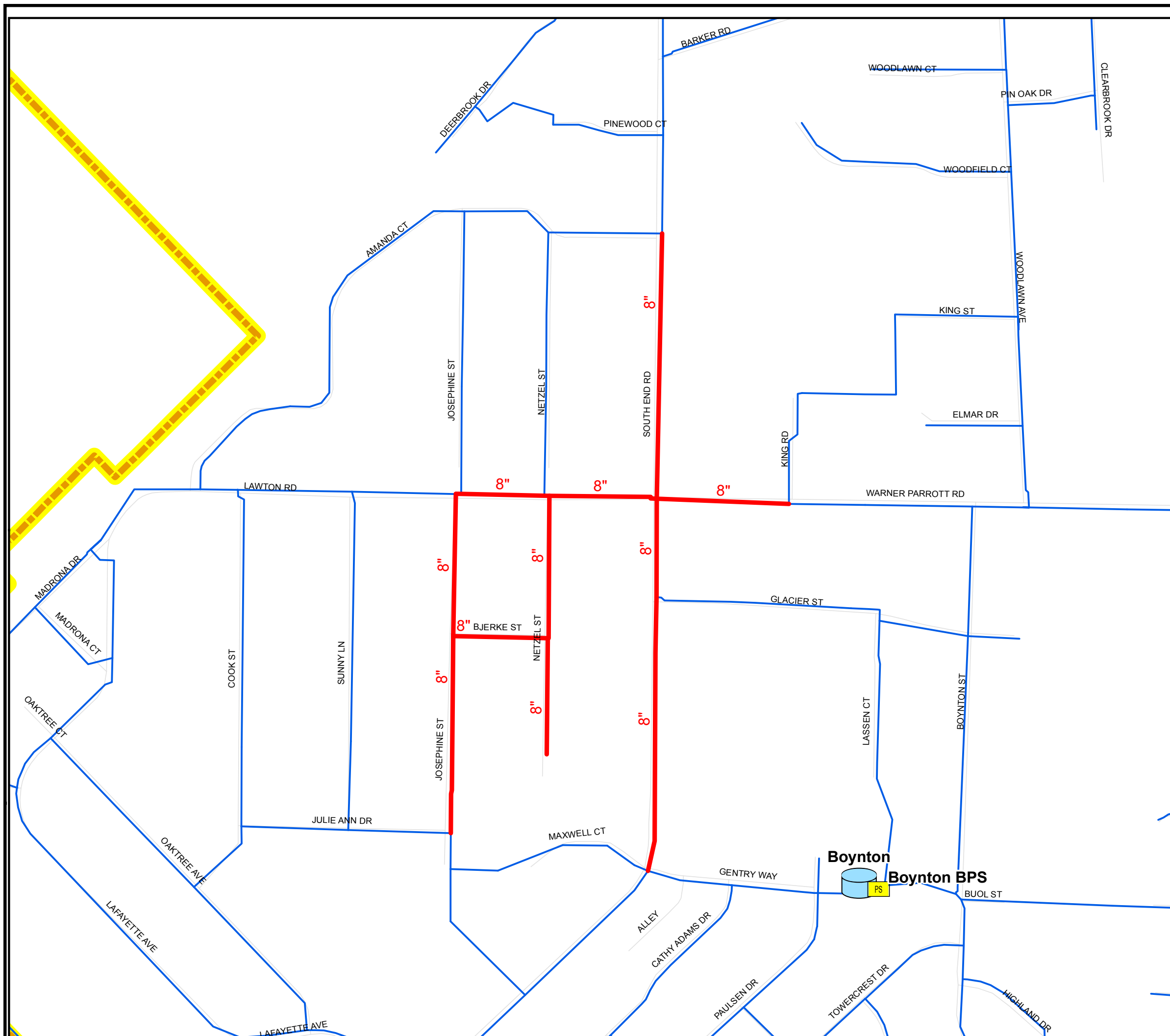
Project Description: This project is intended to replace piping along Main Street in the downtown area. Add 241 feet of 8-inch diameter piping, 3,340 feet of 10-inch diameter piping and 535 feet of 12-inch diameter piping.

Existing Pipeline
CIP Pipeline
PRV Station

Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	8	241	$140	$33,740
	10	3,340	$160	$534,400
	12	535	$200	$107,000
Total		4,116		$675,140

0 250 500
Scale in Feet



Pipeline Project Number: CIP-59

Project Vicinity: South End Rd and Warner Parrott Rd.

Project Description: This project is intended to replace piping along South End Road and Warner Parrot Road. Add 5,535 feet of 8-inch diameter piping.

Existing Pipeline
CIP Pipeline
City Limits

OREGON CITY

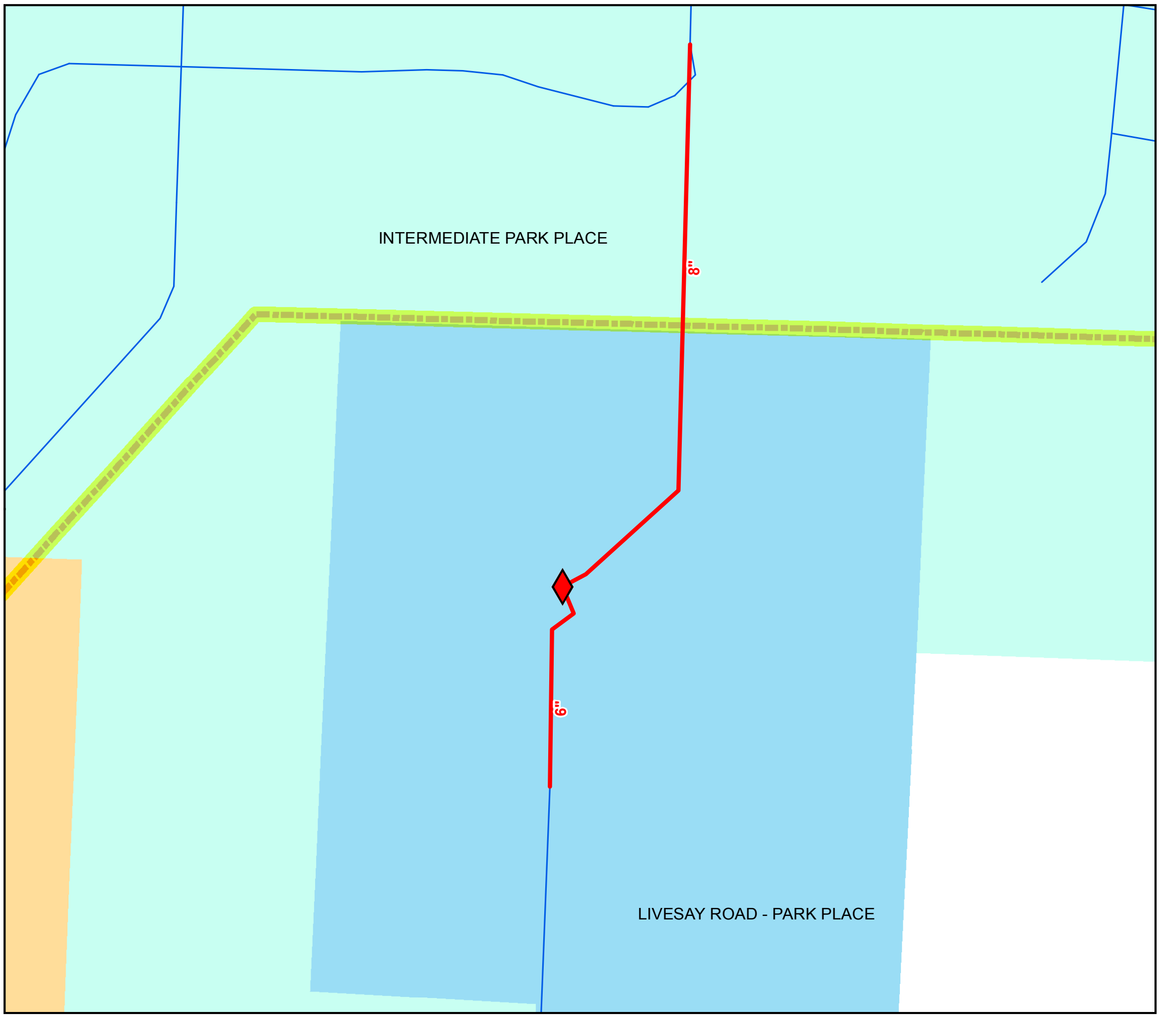
WEST YOST ASSOCIATES

Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	8	5,535	$140	$774,900
Total		5,535		$774,900

0 200 400
Scale in Feet

20



Pipeline Project Number: CIP-V-101

Project Vicinity: S Livesay Rd

Project Description: This project consists of a 6-inch diameter PRV station from the Intermediate Park Place Pressure Zone to the Livesay Road-Park Place Pressure Zone. It is intended to provide adequate fire flows to the Livesay Road area. Add a 6-inch diameter PRV station, 410 feet of 6-inch diameter piping on Livesay Road and 980 feet of 8-inch diameter piping between Oak Tree Terrace and Livesay Road.

Existing Pipeline
CIP Pipeline
PRV Station
City Limits

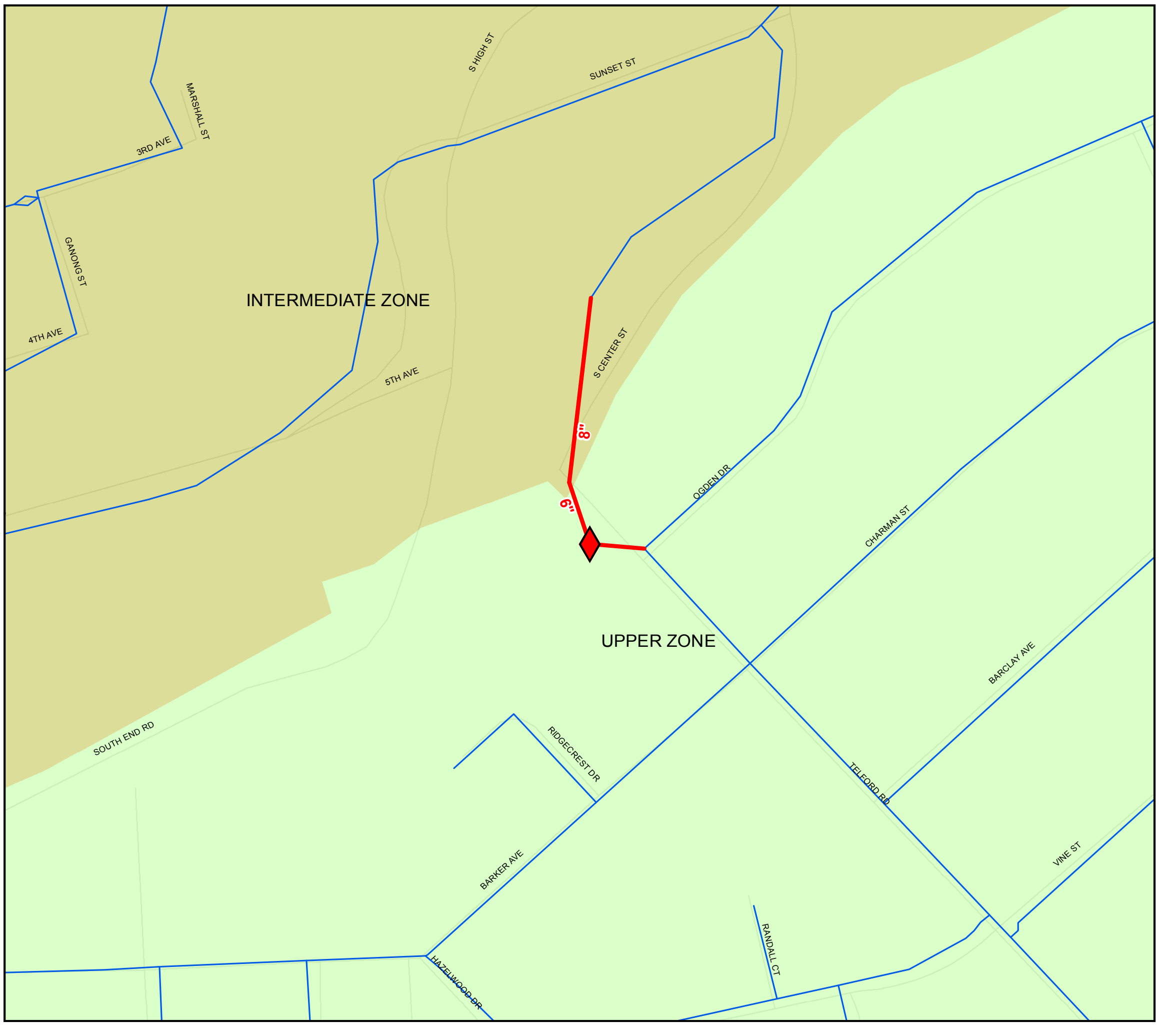
OREGON CITY

WEST YOST ASSOCIATES

Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	8	980	$140	$137,200
	6	410	$110	$45,100
6" PRV				$70,000
Total		1,390		$252,300

0 100 200
Scale in Feet



Pipeline Project Number: CIP-V-102

Project Vicinity: S Center St and Odgen Dr

Project Description: This project consists of a 6-inch diameter PRV station from the Upper Pressure Zone to the Intermediate Pressure Zone. It is intended to provide adequate fire flows to the Upper Zone near Ogden Drive and Teleford Road. Route shown may have constructability issues and will need refinement at the time of design. Add a 6-inch diameter PRV station, 200 feet of 6-inch diameter piping and 315 feet of 8-inch diameter piping as shown.

Existing Pipeline
CIP Pipeline
PRV Station

Project Data Table

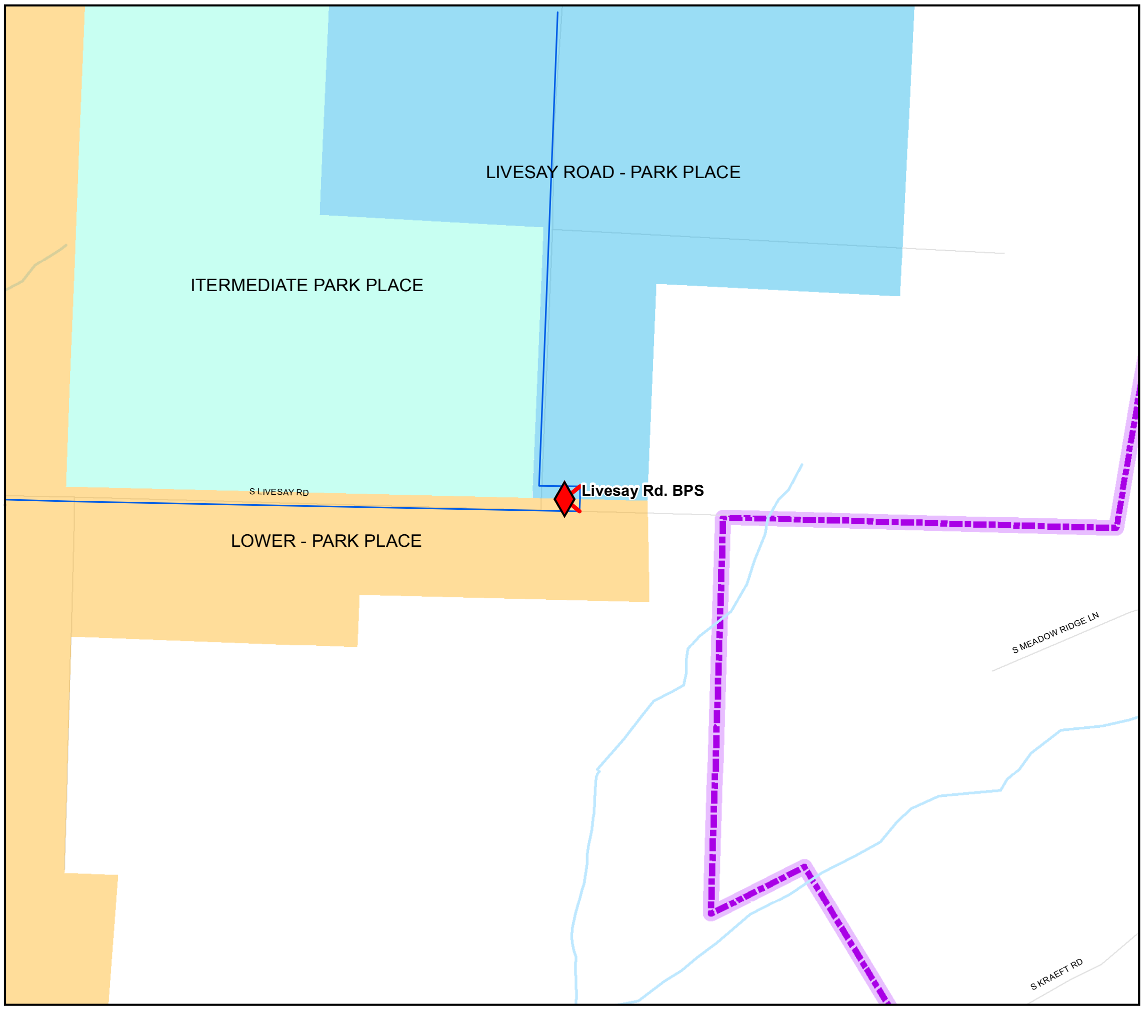
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	8	315	$140	$44,100
	6	200	$110	$22,000
6" PRV				$70,000
Total		515		$136,100

OREGON CITY

WEST YOST ASSOCIATES

N

0 100 200
Scale in Feet



Pipeline Project Number: CIP-V-103

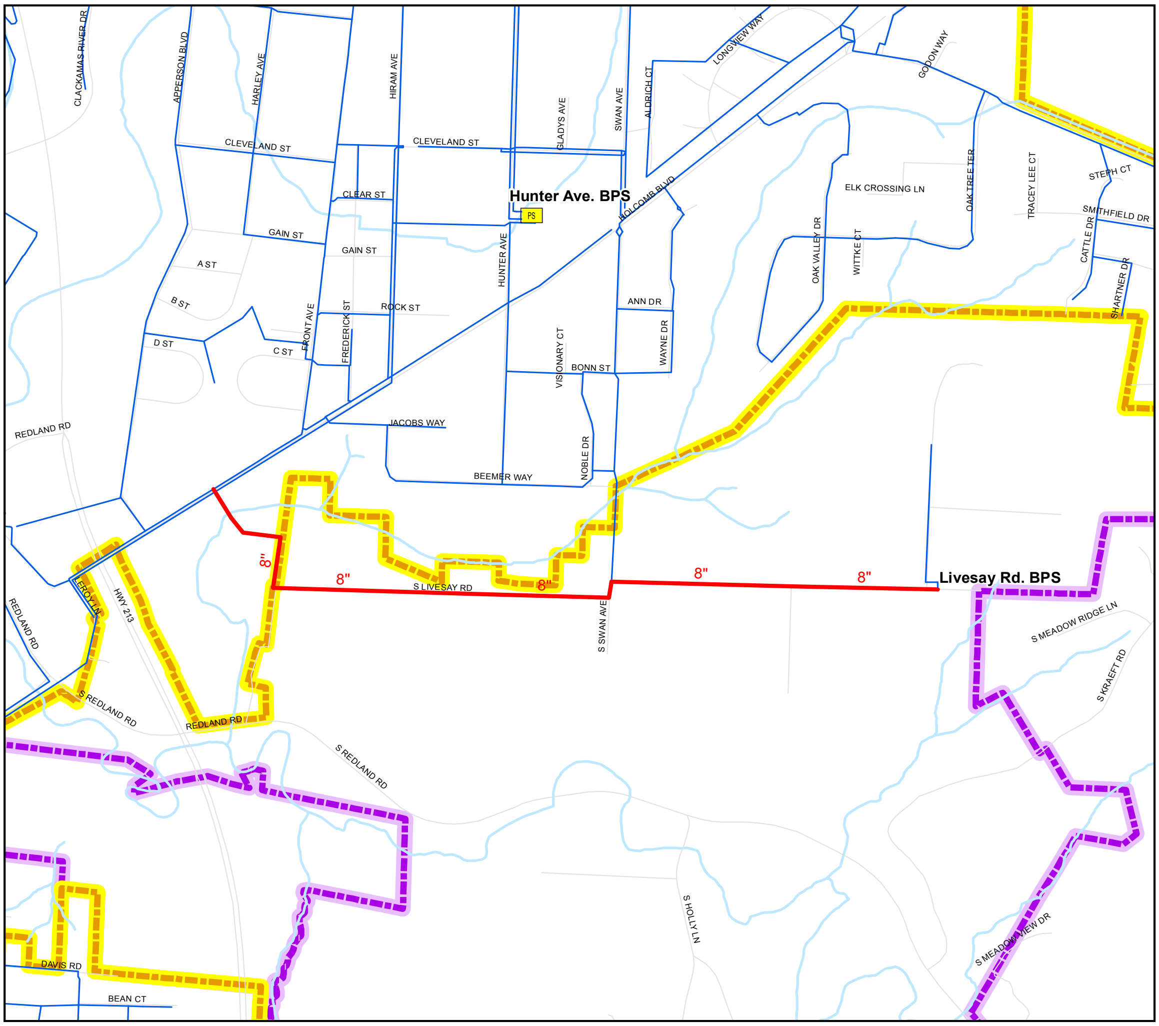
Project Vicinity: Livesay Pump Station

Project Description: This project consists of a 6-inch diameter PRV station from the Livesay Road-Park Place Pressure Zone to the Lower Park Place Pressure Zone. It is intended to provide adequate fire flows to the Lower Park Place area. Add a 6-inch diameter PRV station and 67 feet of 6-inch diameter pipeline.

Existing Pipeline
CIP Pipeline
PRV Station
UGB

Project Data Table				
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	6	67	$110	$7,370
6" PRV				$70,000
Total		67		$77,370

0 100 200
Scale in Feet



Pipeline Project Number: CIP-P-104

Project Vicinity: Livesay Rd.

Project Description: This project consists of the upsizing of a pipeline that is intended to provide adequate fire flow to the Livesay Road area. Upsize 4,767 feet of pipeline to 8-inch diameter along and extended from Livesay Road.

Existing Pipeline
CIP Pipeline
City Limits
UGB

OREGON CITY

WEST YOST ASSOCIATES

Project Data Table

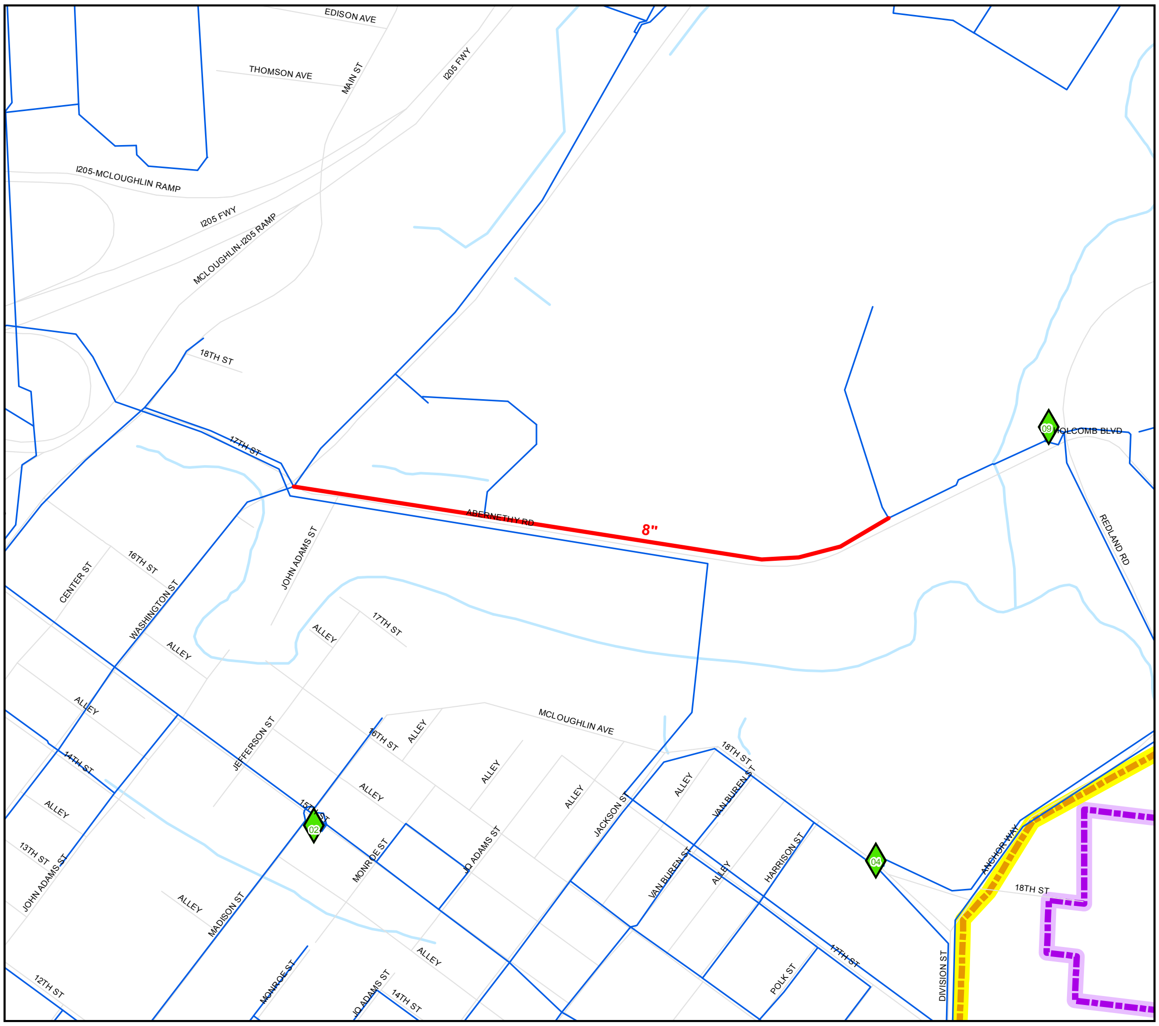
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	8	4767	$140	$667,380
Total		4,767		$667,380

N

0 350 700

Scale in Feet

24



Pipeline Project Number: CIP-P-105

Project Vicinity: Abernethy Rd.

Project Description: This project is intended to improve fire flows in the area by upsizing a loop of piping. Upsize 2,022 feet of pipeline to 8-inch diameter piping along Abernethy Road.

Existing Pipeline
CIP Pipeline
City Limits
UGB
PRV Station

OREGON CITY

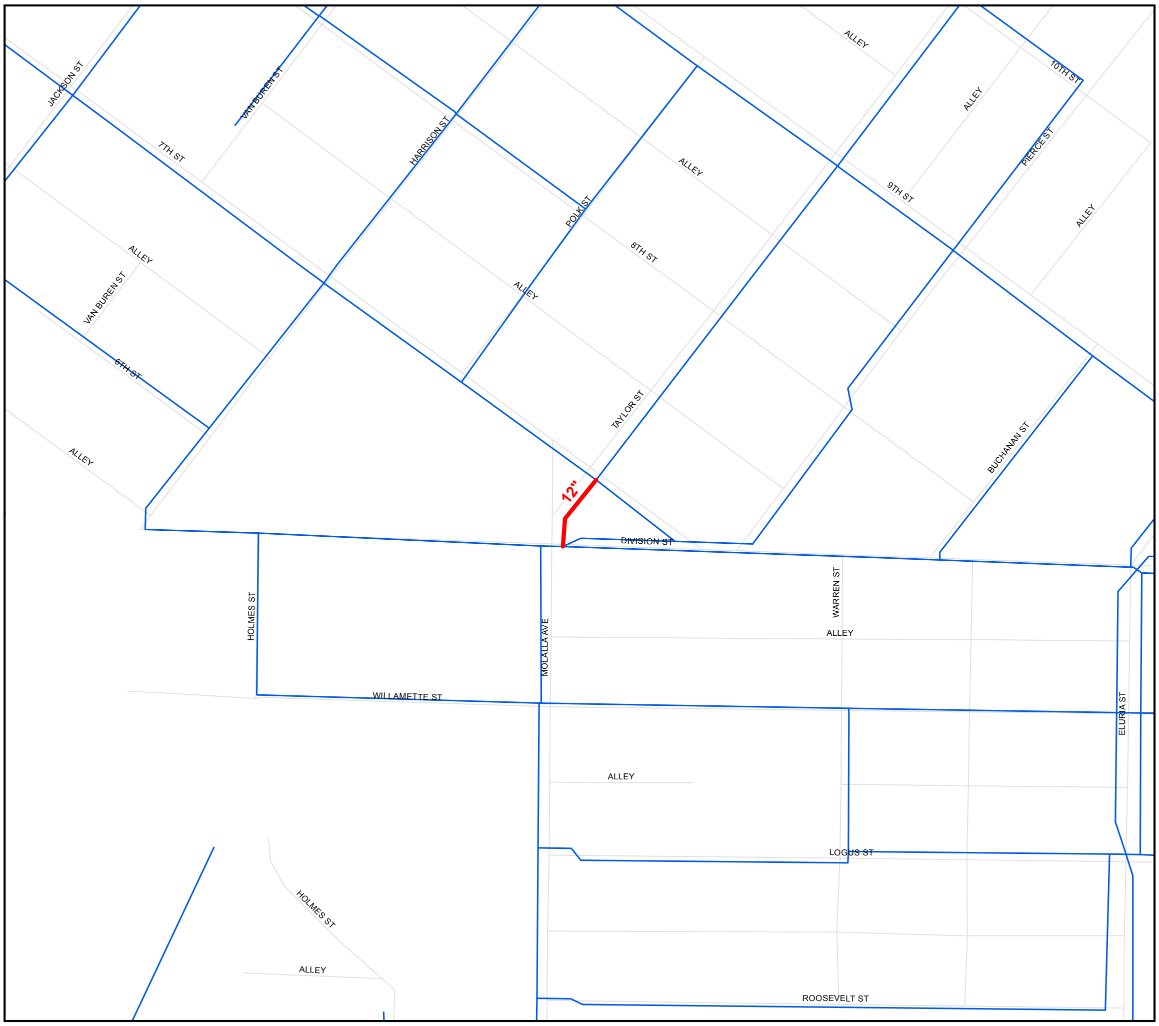
WEST YOST ASSOCIATES

Project Data Table

	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	8	2022	$140	$283,080
Total		2,022		$283,080

N

0 200 400
Scale in Feet



Pipeline Project Number: CIP-P-108

Existing Pipeline
CIP Pipeline

Project Vicinity: Abernethy Rd.

Project Description: This project is intended to improve fire flows in the area by upsizing a loop of piping. Upsize 130 feet of pipeline to 12-inch diameter piping on Taylor Street.

OREGON CITY

WEST YOST ASSOCIATES

Project Data Table

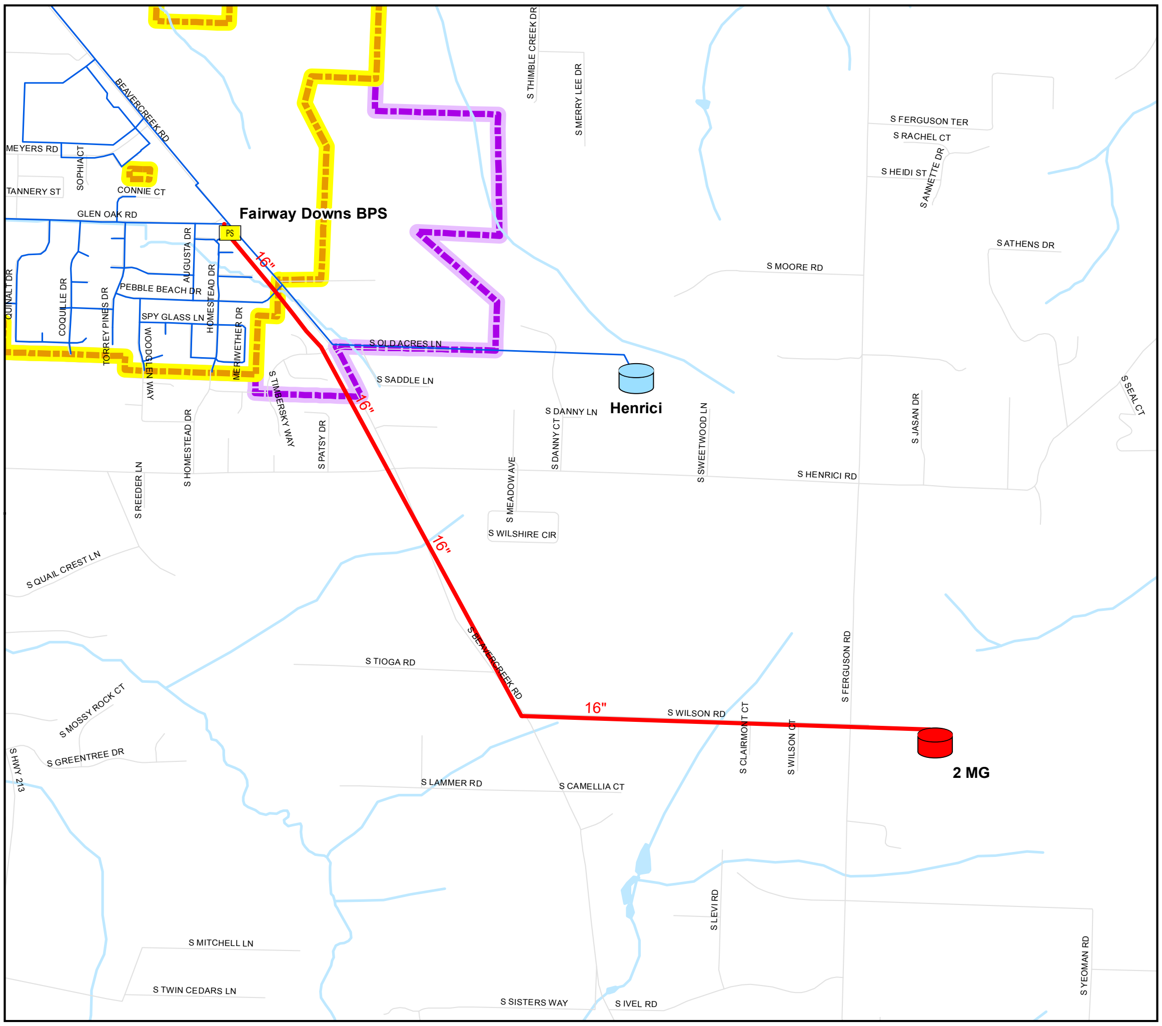
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	12	130	$200	$26,000
Total		130		$26,000

N

0 100 200

Scale in Feet

26



Pipeline Project Number: CIP-TF-123

Project Vicinity: South Wilson Rd.

Project Description: This project is intended to create storage for a newly created pressure zone in the Fairway Downs areas. It will require a siting study prior to design. Add a 2 mgd storage facility and 10,750 feet of 16-inch diameter piping out South Wilson Road South of the Henrici Storage Reservoir.

Existing Pipeline
CIP Pipeline
Storage Reservoir
City Limits
UGB

Project Data Table				
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
	16	10,750	$250	$2,687,500
2mgd Storage				$3,000,000
Total		10,750		$5,687,500

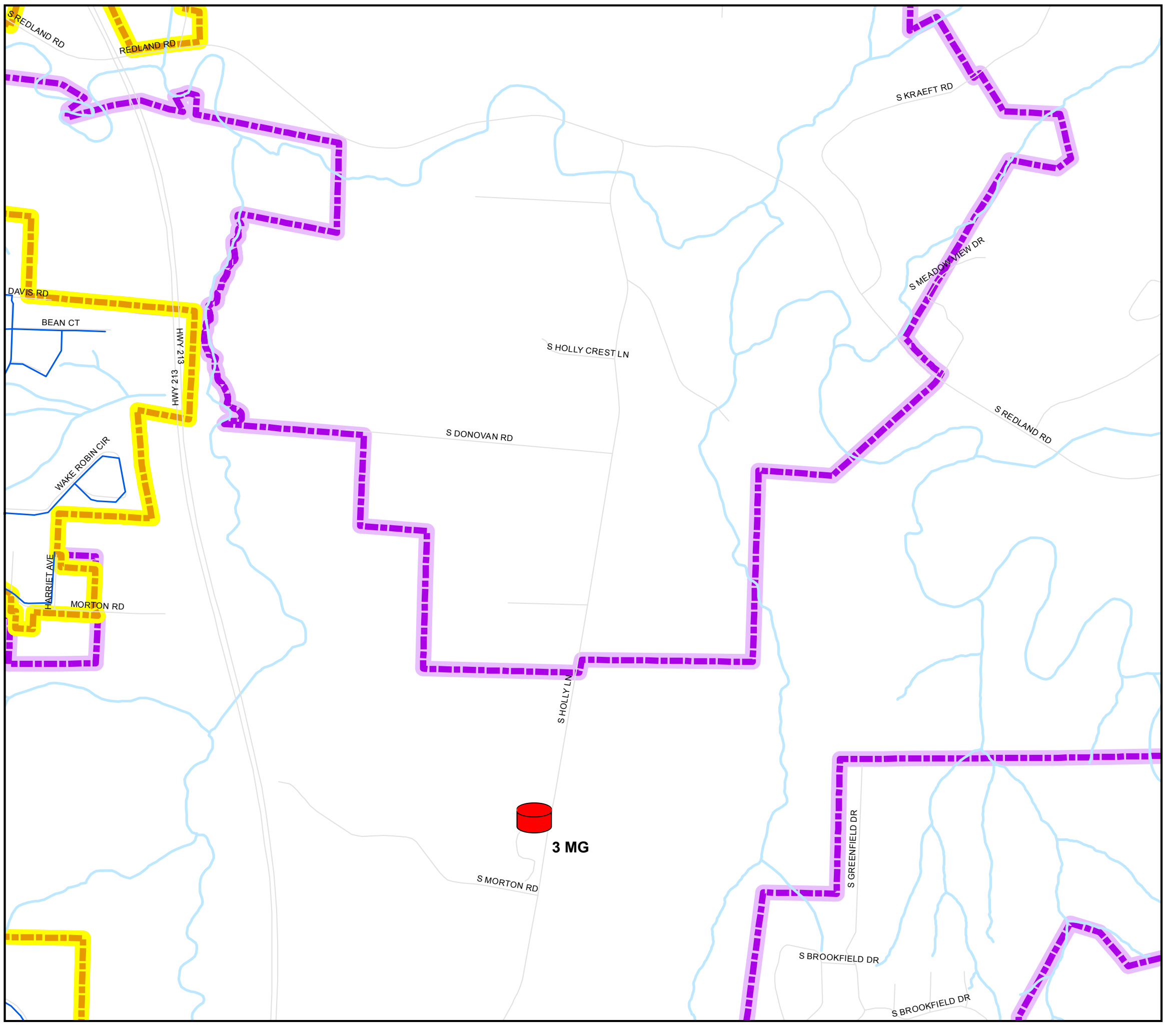
OREGON CITY

WEST YOST ASSOCIATES

N

0 650 1,300

Scale in Feet



Pipeline Project Number: CIP-TF-124

Project Vicinity: North of S Morton Rd along S Holly Ln.

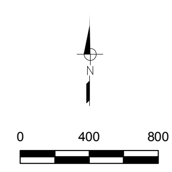
Project Description: This project is intended to add storage to the Lower Park Place Pressure Zone and will be needed as development increases in the area. The project will require a siting study prior to design. Add a 3 mgd storage facility.

Existing Pipeline
Storage Reservoir
City Limits
UGB

OREGON CITY

WEST YOST ASSOCIATES

Project Data Table				
	Pipe Size (inch)	Pipe Length (feet)	Construction Cost/ft ($)	Total Construction Cost ($)
3 mgd Storage				$3,729,000
Total				$3,729,000



APPENDIX C

Cost Estimating Assumptions

COST ESTIMATING ASSUMPTIONS

This appendix provides the assumptions used by West Yost to estimate the construction costs for the planning and design of recommended water system facilities for the City of Oregon City. The costs were developed based on data supplied by manufacturers, published industry standard cost data and curves, construction costs for similar facilities built by other public agencies, and construction costs previously estimated by West Yost for similar facilities with similar construction cost indexes.

Additionally, these costs are for construction only and do not include estimating uncertainties or unexpected construction costs (e.g., variations in final quantities) or cost estimates for land acquisition, engineering, legal costs, environmental review, inspections and/or contract administration. These additional cost items are referred to as construction contingency costs and project cost allowances, and are further described in the last section of this appendix.

All construction costs have been adjusted to reflect October 2009 costs at an Engineering News Record (ENR) Construction Cost Index (CCI) of 8596 (20 Cities Average). These costs are to be used for conceptual cost estimates only, and should be updated regularly. Construction costs presented in this appendix are not intended to represent the lowest prices in the industry for each type of construction; rather they are representative of average or typical construction costs. The planning level cost estimates have been prepared for guidance in evaluating various options, and are intended for budgetary purposes only, within the context of this master planning effort.

CONSTRUCTION COSTS

Pipelines

Unit construction costs for potable water pipelines 6 through 36 inches in diameter are provided in Table 1. These costs are to be used for typical pipeline construction in developed areas and for construction across open fields or areas that are not yet developed (undeveloped). These costs generally include pipeline materials, trenching, placing and jointing pipe, valves, fittings, hydrants, service connections, placing imported pipe bedding, native backfill material, and asphalt pavement replacement, if required. The costs presented in Table 1 do not include the cost of boring and jacking pipe. The costs shown in Table 2 should be added where required for this purpose.

Table 1. Unit Construction Costs for Pipelines[a]

Pipe Diameter, inches	Unit Construction Cost, $/linear foot	
	Developed Areas	Undeveloped Areas
6	110	100
8	140	120
10	160	140
12	200	160
14	220	190
16	250	210
18	280	230
20	300	260
24	350	290
30	430	360
36	500	410

(a) Based on the October 2009 ENR index of 8596.

Table 2. Unit Construction Costs for Jack & Boring[a]

Size	Unit Construction Cost, $/linear foot[b]
8-inch pipe (16-inch casing)	390
12-inch pipe (21-inch casing)	450
16-inch pipe (24-inch casing)	520
20-inch pipe (30-inch casing)	640
54-inch pipe (66-inch casing)	1,280
Tunnel	2,670

(a) Based on the October 2009 ENR index of 8596.
(b) Conductor pipe not included in cost.

Treated Water Storage Reservoirs

Table 3 lists the estimated construction costs for water storage reservoirs between the size ranges of 0.1 to 6.0 MG. These costs generally include the storage tank, site piping, earthwork, paving, instrumentation, and all related sitework. As previously stated, these costs are representative of construction conducted under normal excavation and foundation conditions, and would be significantly higher for special or difficult foundation requirements.

Table 3. Construction Costs for Treated Water Storage Reservoirs[a]

Capacity, MG	Estimated Construction Cost, million dollars	
	Partially Buried Pre-Stressed Concrete	Welded Steel
0.1	1.6	1.0
0.5	1.9	1.3
1.0	2.3	1.6
2.0	3.0	2.2
3.0	3.7	2.8
4.0	4.5	3.4
5.0	5.2	4.0
6.0	5.9	4.6

(a) Based on the October 2009 ENR index of 8596.

Treated Water Booster Pump Stations

Distribution pumping station costs vary considerably, depending on such factors as architectural design, pumping head, and station capacity. Estimated average construction costs for distribution pumping stations, as shown in Table 4, are based on enclosed stations with architectural and landscaping treatment suitable for residential areas. Booster pump station cost estimates include a backup/standby generator plus SCADA, and are based on a typical industry configuration, which includes 1 to 3 pumps at approximately 1 to 2 mgd.

Table 4. Construction Costs for Booster Pump Stations[a]

Firm Capacity[b], mgd	Estimated Construction Cost, million dollars
0.5	1.0
1	1.0
2	1.2
3	1.3
5	1.5
10	2.1

(a) Based on the October 2009 ENR index of 8596.
(b) The pumping capacity with the largest pump out of service or on standby.

CONTINGENCIES AND OTHER PROJECT COSTS

Contingency costs must be reviewed on a case-by-case basis because they will vary considerably with each project. However, to assist the City of Oregon City with budgeting for these future construction projects, contingency costs have been added to the planning budget as percentages of the estimated construction cost using these two categories: Construction Contingency Costs and Other Project Cost Allowances.

Construction Contingency Costs

The construction costs presented above are representative of the construction of water system facilities under normal construction conditions and schedules; consequently, it is appropriate to allow for estimating and construction uncertainties unavoidably associated with the conceptual planning of projects. Factors such as unexpected construction conditions, the need for unforeseen mechanical items, and variations in final quantities are only a few of the items that can increase project costs for which it is wise to make allowances in these preliminary cost estimates. An allowance of 20 percent of the base construction cost will be included to cover such project related construction contingencies.

Other Project Cost Allowances

Other project cost allowances are divided into three subcategories, totaling 28 percent:

- Design services associated with new facilities include preliminary investigations and reports, right-of-way acquisition, foundation explorations, preparation of drawings and specifications for construction, surveying and staking, sampling of testing material, and start-up services. The cost of these items may vary, but for the purpose of this study, it is assumed that engineering design costs will equal 10 percent of the construction costs after construction contingencies have been applied.
- Construction management covers items such as contract management and inspection during construction. The cost of these items may vary, but for the purpose of this study, it is assumed that construction management costs will equal 10 percent of the construction costs after construction contingencies have been applied.
- Administration costs cover items such as legal fees, environmental compliance requirements, financing expenses, and interest during construction. The cost of these items may vary, but for the purpose of this study, it is assumed that program implementation costs will equal 8 percent of the construction costs after construction contingencies have been applied.

An example application of these allowances to a project with an assumed base construction cost of $1.0 million is shown in Table 5. As shown, the total cost of all project construction contingencies (construction, design, construction management, and administration costs) is approximately 54 percent of the base construction cost for each project.

Table 5. Example Application of Construction Contingency Costs and Other Project Cost Allowances

Cost Component	Percent	Cost	Total Cost
Estimated Base Construction Cost before Contingencies		$1,000,000[a]	
Construction Contingency Costs	20%	200,000	
Estimated Construction Cost with Contingencies			*$1,200,000*
Other Project Cost Allowances:			
Design	10%	$120,000	
Construction Management	10%	120,000	
Administration	8%	96,000	
Total Project Cost Allowances			$336,000
Estimated Total Project Cost			**$1,536,000**

[a] Assumed cost of example project.

APPENDIX B

Water System Seismic Vulnerability Assessment
City of Oregon City, Oregon, December 2002

ABS Consulting
EQE STRUCTURAL ENGINEERS DIVISION

FINAL REPORT

Water System
Seismic Vulnerability Assessment

City of Oregon City, Oregon

December 2002

Prepared for:

West Yost and Associates

Prepared by:

ABS Consulting
1411 4th Ave. Bldg, #500
Seattle, WA 98101
(206) 624-8687

ABS Project #1053895

EQE STRUCTURAL ENGINEERS DIVISION

December 30, 2002, 2002

Mr. Mark Zinniker
WEST YOST & ASSOCIATES, LLC
132 East Broadway, Suite 431
Eugene, OR 97401

Subject: Transmittal of Draft Report: Water System Seismic Vulnerability Assessment, City of Oregon City, OR

Dear Mark:

Enclosed please find seven (7) copies of the subject report. If you have any questions on this or other matters, please do not hesitate to call. It is a pleasure to be of service to the City of Oregon City and West Yost and Associates.

Sincerely yours,
ABSG CONSULTING INC.

Donald B. Ballantyne, P.E.

General Manager, Seattle Office

V P Lifeline Services

Enclosures

Table of Contents

1. Introduction

This report presents the findings of ABS Consulting's seismic vulnerability assessment of the Oregon City's water facilities. This vulnerability assessment was performed in accordance with the agreement between ABS Consulting and West Yost and Associates dated December 12, 2001. The assessments are based on review of available drawings, site walk-downs conducted on January 28 and 29, 2002, and performance of similar facilities in previous earthquakes.

1.1. Purpose

The purpose of this report is to assess the seismic vulnerability of the City's water distribution facilities. The vulnerabilities of the various facilities were projected based on the following factors: type and quality of construction, configuration, age, and condition of each structure (if such information was available), design criteria used; structural design and details; local geology and seismicity; distance from faults; site susceptibility to liquefaction and lateral spreading; and performance of similar structures in previous earthquakes.

1.2. Scope of Work

Seven tasks step through the vulnerability assessment project as described below. This proposal is based on evaluating five pump stations, four tanks (one 10.5-MG concrete, and three 2-MG steel), 15 PRV vaults, and the pipeline distribution system. A qualitative assessment of the pipeline distribution system is included.

The scope of work for this project included the following:

1.2.1. *Task 1, Kickoff Meeting, Gather, and Review Information.*

ABS Consulting met with City representatives to review the project objectives and scope. We reviewed information provided by the City, including drawings for the tanks. We also obtained and reviewed hazard information from the United States Geological Survey (USGS) and Oregon State Department of Geology and Mineral Industries (DOGAMI). We visited four tanks, five pump stations, and selected PRV vaults, and observed the general layout of the service area.

1.2.2. *Task 2, Hazard Assessment.*

ABS Consulting evaluated ground motion, soil liquefaction, and lateral spread hazards using information available from the USGS and DOGAMI, and other reports available from the City. This information was used to estimate the damage to pipelines, tanks, and pump stations. The earthquake assessment was conducted for three levels of earthquakes: 1) 72-year return period (50% probability in 50 years), 2) 475-year return period (10% probability of exceedance in 50 years), and 3) for an earthquake located on the Portland Hills Fault (PHF). An opinion of the duration of shaking for the three different earthquakes was also provided. DOGAMI has developed liquefaction susceptibility mapping for the City service area that we used to assist in evaluating pipeline vulnerability. We prepared a summary of the hazard information to be used in the project report.

1.2.3. *Task 3, Facility Evaluation.*

ABS Consulting engineers evaluated the five pump stations, PRV vaults, and four tanks. We used the ground motion information available from the USGS. The task findings are documented in the report.

For the pump stations and PRV vaults, we reviewed the structures to identify possible deficiencies. Available drawings were reviewed. Generally small structures such as pump stations are resistant to earthquakes with the exception that they may not have adequate roof-to-wall and wall-to-foundation anchorage. We reviewed pump station equipment installations to determine anchorage. If there are deficiencies with the buildings, vaults, or equipment, we provided sketches of mitigation alternatives, and a preliminary rough-order-of-magnitude (ROM) opinion of construction cost. We provided a preliminary assessment of the electrical power reliability based on previous work in the Portland area, and observation of the transformer installations serving the pump stations. We evaluated SCADA equipment installations used by the City.

For the tanks, we performed preliminary structural calculations to determine how the tanks will perform in each of the three levels of earthquakes. The assessment considered the foundation, tank shell anchorage to the foundation, tank geometry, and shell structure/wall thickness. Impact to the tank roof from sloshing was also considered. For the tanks that are not anchored, we identified deficiencies with connecting piping. For foundation, tank, or piping deficiencies, we provided sketches of mitigation options and an ROM opinion of construction cost.

1.2.4. Task 4, Qualitative Pipeline Evaluation.

ABS Consulting qualitatively evaluated the vulnerability of the pipeline distribution system. This assessment was based on observations of performance of similar pipe types in past earthquakes, and knowledge of pipe damage mechanisms. We documented the damage mechanisms for the pipe types found in the system and the earthquake hazards to which they can be subjected. We observed the relative locations between the distribution piping and soil liquefaction and landslide hazards, and developed the likely performance of the system. For example, cast iron pipe with leaded joints performs much worse than ductile iron pipe with elastomeric gaskets. Pipe performs worse in soils that liquefy than in competent soils. Mitigation recommendations are provided for identified pipeline deficiencies. The pipeline evaluation is documented in a section of the project report.

1.2.5. Task 5, System Evaluation.

Based on the findings of the two previous tasks, we developed a water system damage scenario for each of the three levels of earthquakes. Each scenario describes the likely performance of the various system components, and the system as a whole. We recommended improvements so that the system can meet suggested performance objectives over the long term. The damage scenarios and recommendations are documented in a section of the report.

1.2.6. Task 6, Mitigation Recommendations.

We gathered the mitigation recommendations identified for the facilities, pipelines, and the system evaluation into a single prioritized list. Preliminary construction costs are provided. The City can use this list as input into a capital improvement plan. The mitigation recommendations are prioritized on risk to the system considering probability of occurrence and consequences of failure.

1.2.7. Task 7. Report Preparation and Presentation to the City.

ABS Consulting developed a draft report and provided the City with seven (7) copies of the report for review. We made a presentation to City representatives on the project findings and recommendations, incorporated comments into a final report, and delivered seven report copies to the City.

1.3. Limitations

Our professional services have been performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable engineers practicing in the field of structural or civil engineering in this or similar localities at this time. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has been prepared for the City of Oregon City to be used solely in its evaluation of the subject facilities. The report has not been prepared for use by other parties, and may not contain sufficient information for purposes of other parties of other uses.

1.4. Report Outline

An overview of the City's service area and system, seismic hazards, and findings and recommendations are described in Chapter 2. Chapter 3 discusses the regional and site-specific seismic hazards. Chapter 4 provides a description of seismic vulnerabilities for the reservoirs, pump stations, and PRVs. Chapter 5 discusses the expected performance of the pipeline system. Based on the identified vulnerabilities and the system characteristics, overall system performance findings and system level upgrade recommendations are described in Chapter 6.

1.5. Terminology

Design Basis Earthquake (DBE) – defined to have a 10 percent chance of exceedance in 50 years (equivalent to a 475-year average return interval).

Lateral Spreading – Horizontal ground movement initiated by strong ground shaking. Lateral spreading tends to occur in liquefiable soils involving coastlines and riverbanks.

Liquefaction – occurs when saturated, cohesionless soils are strongly vibrated and soil shear strength is lost. If the liquefaction is sloped, the liquefied soils may flow (lateral spread). Soil liquefaction can allow structures to sink or allow buoyant elements such as empty pipelines to float.

Maximum Credible Earthquake (MCE) – represents a conservative upper bound on the maximum expected ground shaking that could occur at the site independent of time considerations. The MCE generally represented a worst-case scenario in regard to potential assess damage and business interruption.

Modified Mercalli Index (MMI) – A qualitative intensity scale based on observed damage. MMI intensities of I to V represent low levels of ground shaking and do not cause damage to structures. MMI intensities VI to X are characterized by increasing damage to facilities and economic loss. Intensities XI and XII only occur in the epicentral region of great earthquakes (M8+) and relate primarily to permanent ground displacement.

Operating Basis Earthquake (OBE) – defined to have a 50 percent chance of exceedance in 50 years (equivalent to a 72-year average return interval).

Richter Magnitude (M) – An objective, instrumentally determined scale based on a standardized measure of the amplitude of seismic waves 100 kilometers from the earthquake epicenter. The scale is logarithmic in design with each whole number representing an increase in the measured earthquake wave amplitude and an approximate increase of 32 times in the amount of energy released.

2. Summary

2.1. Summary

The seismic vulnerability assessment of the Oregon City water system includes four tanks, five pump stations, 15 PRV vaults, and the pipeline distribution system.

The purpose of the effort was to assess the seismic vulnerability of the above facilities and develop prioritized upgrade mitigation costs. The vulnerabilities are projected based on the following factors: type and quality of construction; configuration, age, and condition of each structure (if such information was available); design criteria; structural design and details; local geology and seismicity; distance from faults; site susceptibility to soil liquefaction and lateral spreading; and performance of similar structures in previous earthquakes.

Our findings and mitigation recommendations are discussed in the following sections.

2.2. System Description

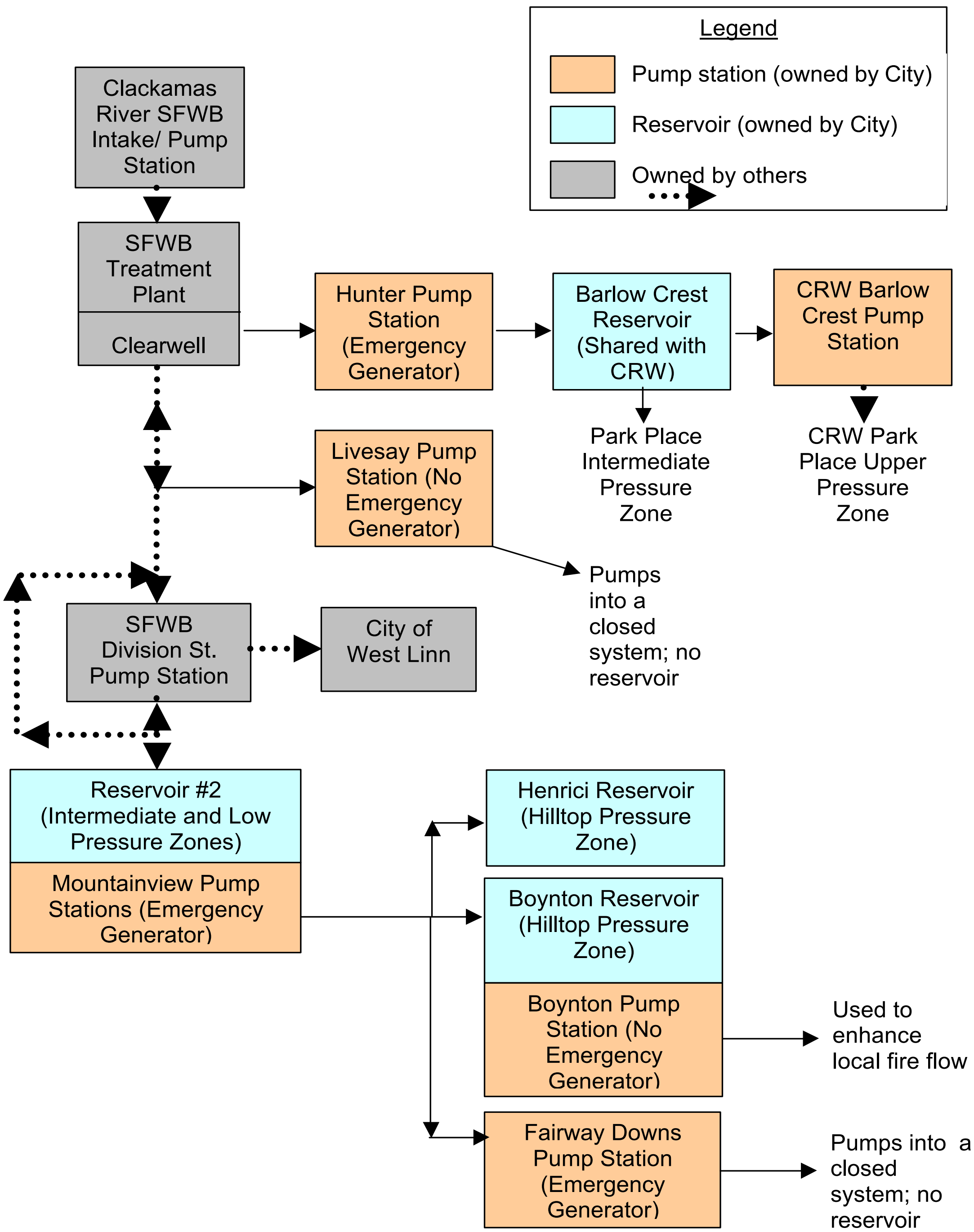
The South Fork Water Board (SFWB), an agency equally owned by the City of Oregon City and the City of West Linn, owns and operates the system backbone as shown in Figure 2-1. They pump water from the Clackamas River to the SFWB treatment plant. From there, water flows by gravity to the Division St. Pump Station that pumps it to Reservoir #2. Reservoir #2 serves the Intermediate and Low Pressure Zones, as well as supplies the City of West Linn when the SFWB is not pumping. The Mountainview Pump Stations move water from Reservoir #2 to the Upper Pressure Zone. The redundant Boynton and Henrici reservoirs float on the Upper Pressure Zone. The Boynton Pump Station is used to boost pressure for fireflows. The Mountainview Pump Stations have diesel emergency generators with adequate capacity to operate pumps to provide winter flow demands. The Boynton Pump Station does not have an emergency generator.

The Hunter Pump Station pumps water from the SFWB treatment plant clearwell to the Barlow Crest Reservoir that serves the Park Place Intermediate Pressure Zone, as well as a portion of the CRW system. The Clackamas River Water (CRW) Barlow Crest Pump Station pumps from the tank into the CRW's Park Place Upper Pressure Zone. The Livesay and Fairway Downs pump station each pump into a small pressure zone with no storage. The Hunter and Fairway Downs pump stations have emergency generators. The Livesay Pump Station does not.

Other than the two reservoirs for the Upper Pressure Zones (Boynton and Henrici), there are no redundant facilities in the system including supply, storage, and pumping. If the SFWB treatment plant is not operating, water can be backfed from Reservoir # 2, around the Division St. Pump Station, into the treatment plant clearwell, as well as to the City of West Linn.

Reservoir #1 and the Elevated Tank, both on the same site as the Mountainview Pump Stations and Reservoir #2, have been permanently removed from service. Antennas for City police, fire, and public works communications have recently been relocated from the Elevated Tank to a new communication tower across the street.

Figure 2-1: System Schematic



2.3. Earthquake Levels Evaluated

The effects of earthquake ground motions expected in an operating basis earthquake (OBE) (8 to 10 percent of gravity; 50 percent chance of occurring in 50 years), and a design basis earthquake (DBE) (15 to 20 percent of gravity; 10 percent chance of occurring in 50 years), were evaluated. Some observations are provided for expected water system performance following an event on the Portland Hills Fault that would be expected to produce ground accelerations of 50 to 60 percent of gravity. A Portland Hills Fault event is expected to occur on the average every 5,000 to 10,000 years.

2.4. Seismic Stability of Site Soils

Soils under all the reservoirs and pump stations are generally competent. Pockets of soil along the Willamette and Clackamas rivers are liquefiable.

2.5. Findings

This section summarizes findings in terms of expected performance of system components for three earthquakes, the OBE, DBE, and a Portland Hills Fault event.

The entire system is totally dependent on the SFWB supply. Our scope of work did not include evaluation of the SFWB system.

2.5.1. OBE Expected Performance

For the OBE, with a recurrence interval of 72 years, the system is expected to perform relatively well. Ground motions in the order of 8 to 10 percent times gravity are expected. Minimal liquefaction is expected even in the areas that are highly susceptible.

The four tanks and five pump stations all have a low vulnerability to ground motions expected in an OBE, and minimal damage is expected. It is likely that there will be a regional loss of power that will last on the order of one day following an OBE. All of the

City pump stations have emergency generators except Livesay, but this pump station only serves three customers.

2.5.2. DBE Expected Performance

For the DBE, with a recurrence interval of approximately 475 years, significant damage is expected. The most likely source for this earthquake is a Cascadia Subduction event, with ground motions on the order of 15 to 20 percent times gravity. Soils with a high liquefaction susceptibility in the Central Business District, along I-205, and along Redland Road may liquefy in this scenario.

There is a high probability of failure of the upper wall sections of Reservoir #2. Sloshing is likely to damage the roof as well. Depending on the extent of the damage, the reservoir would likely not be usable. Loss of Reservoir #2 storage capacity would impact the entire system operation.

The Henrici Reservoir should perform well with the exception that sloshing may damage the roof. The redundant Boynton Reservoir is moderately vulnerable.

The Mountainview Pump Stations and Pump No. 3 House are expected to have some structural damage, but would likely remain functional. There may be some damage to unanchored/inadequately-anchored equipment at all facilities. If the elevated tank is full, there is a significant potential that it may collapse and damage the adjacent Mountainview Pump Stations.

Pipeline damage due to liquefaction is expected in the Central Business District, along I-205, and along Redland Road. Pipe connections to PRV vaults will likely be damaged in areas where liquefaction occurs. Damage is expected to the 16-inch-diameter cement-lined steel pipe with leaded joints transmission line serving the Henrici Reservoir, however, portions of this pipeline were replaced during the summer of 2002.

2.5.3. Portland Hills Fault Expected Performance

The Portland Hills Fault event is expected to recur every 5,000 to 10,000 years. Ground motions would be expected to be four times those from a Cascadia Subduction or 475-year return earthquake, and three to four times larger than the forces that facilities were designed to resist. For this scenario, infrastructure throughout the entire region will be heavily damaged.

All four reservoirs would be expected to be damaged. Extensive structural damage is expected at the Mountainview Pump Stations, with the ability to continue operation doubtful. The modern pump stations may have limited damage. Pipeline damage would be more severe than in the DBE. Liquefaction would be more extensive, and pipe damage due to wave propagation more severe.

2.6. Recommendations

This section describes recommended mitigation measures for the short, medium, and long term planning scenarios.

2.6.1. Short-Term Mitigation (2 years) ($25,000)

These quick-fix recommendations would enhance the emergency response following a 475-year return earthquake.

- Drain and/or remove the elevated tank at the Mountainview site. (TBD)
- Anchor miscellaneous equipment in pump stations and PRV vaults. ($5,000, potentially in-house project)
- Structurally upgrade the Mountainview Pump Stations. ($20,000)
- Document and exercise valves on pipelines in liquefiable soils in the Central Old Town district, along I-205, and Redland Road. (in-house project)
- Communicate with the jurisdiction providing fire protection about the vulnerability and potential failure of water service in these areas following a major earthquake. (incidental cost)

- If the SFWB transmission line seismic vulnerability has not been evaluated, the City should encourage that a hydraulic, structural, and condition assessment be performed. (TBD by SFWB)

- Transfer the Livesay Pump Station service area to the Barlow Crest Tank. (non-seismic related budget)

2.6.2. Medium-Term Mitigation (5 years) ($700,000)

This recommendation would result in maintaining system operation following a 475-year return event.

- Seismically upgrade Reservoir #2. ($700,000)

2.6.3. Long-Term Mitigation (20 years) ($50,000)

These recommendations would enhance post-earthquake recovery, particularly following a 475-year event.

- Complete replacement of the 16" steel pipe transmission line with leaded joints serving the Henrici Reservoir. (cost TBD)

- Replace the cast iron pipe with leaded joints in the Central Old Town district in liquefiable soils with ductile iron pipe with restrained joints. (cost TBD)

- Seismically upgrade the Boynton Reservoir. ($50,000).

Please note that the above costs include construction only. Approximately 40% should be added for design, inspectors, construction support, project management, contingency, permitting, and taxes.

3. Seismic Hazards

3.1. Introduction

This section addresses seismic hazards including ground motion and liquefaction.

3.2. Regional Seismicity and Ground Motions

Seismic hazards in the Portland area are dominated by two sources: deep earthquakes along the Cascadia subduction zone occurring at the interface between the subducting Juan de Fuca Plate and the North American Plate, and shallow crustal events within the North American Plate. The regional tectonic structure is shown in Figure 3-1.

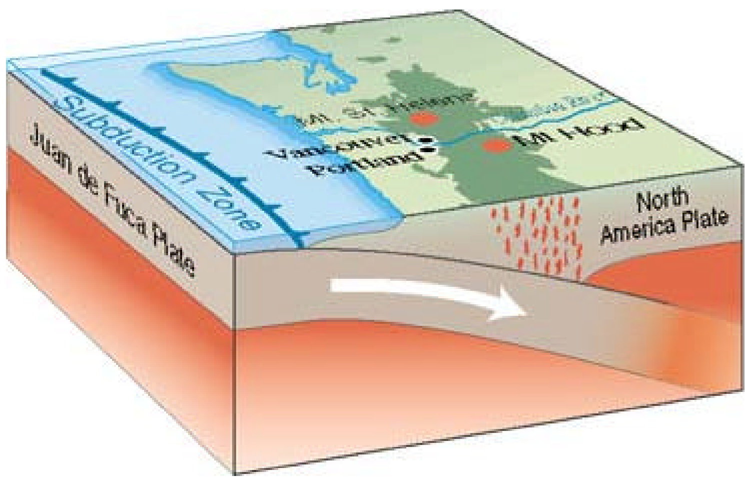


Figure 3-1

Pacific Northwest Tectonic Structure (after USGS)

There is geologic evidence that subduction earthquakes occur approximately every 500 years, the most recent being in 1700.

The USGS has included a third earthquake source zone in the Seattle area but not in the Portland area, even though the two areas arguably have a similar tectonic structure. In the USGS model, earthquakes that occur within the Juan de Fuca Plate (termed intraplate earthquakes) are not considered likely in the Portland area because of the subducting plate geometry. The 1949 magnitude 7.1, 1965 magnitude 6.5 , and 2001 M6.8 earthquakes near Seattle were intraplate events. As a result, the probabilistic earthquake ground motions in the Portland area are lower than those used for the Seattle area.

The 1993 magnitude 5.6 Scott's Mills Earthquake, and the 1962 magnitude 5.2 Portland earthquakes were crustal events. The USGS and other researchers have identified shallow (crustal) faults and lineaments in the Portland area, the most pronounced of which is the Portland Hills Fault paralleling the Willamette River through downtown Portland. The Portland Hills Fault is modeled with a slip rate of 0.1 mm/yr, with a characteristic earthquake of magnitude 7.0 with a return period on the order of 10,000 years. Other investigators have assigned slightly higher slip rates with a corresponding return period of 5,000 years. With the low slip rate/long return periods, the fault has little effect on 475-year return probabilistic ground motions. The Portland Hills Fault runs south directly toward Oregon City, but may stop short just north of the Clackamas River. If the fault broke south, moving towards Oregon City, there could be directional effects that would result in very large ground motions. If the fault broke moving north, the ground motions would be somewhat less. Other regional faults include the Molalla-Canby Fault and the Mount Angel Fault.

3.2.1. Strong Ground Motion

Strong ground motion is a significant hazard to City facilities, whose vulnerability varies depending primarily on the type of construction and the earthquake criteria to which the facility was designed.

Strong ground motion can be characterized in two ways:

- **Probabilistic**, where a hazard curve is developed for a site, expressing the probability of various levels of PGA due to all sources.
- **Scenario**, where peak ground acceleration (PGA) is determined at a site or sites given a specified earthquake occurrence; i.e., magnitude and epicentral location are uniquely defined.

Peak ground acceleration (PGA) is a measure of earthquake ground motion. It is often presented as a percent of gravity. Typically, the largest component of PGA is in the horizontal direction, with about two-thirds of the value in the vertical direction. PGA is the result of earthquake waves propagating through the ground. These waves have a range of frequencies. The highest PGAs are at frequencies of less than 1 cycle/second. Sometimes ground motion information is provided in response spectra that includes accelerations over a range of frequencies.

PGA damages structures because it effectively pushes on them laterally. Damage to vulnerable structures can occur at very low PGAs of say 5 percent times gravity. Structures can be designed to resist loads as high as 100 percent of gravity or more. Ground motion can also cause soils to consolidate/settle differentially, liquefy, spread laterally, and lurch. Structures or pipe buried in the soil can be damaged if the soil moves.

PGAs can be estimated for a specific earthquake given the earthquake magnitude and distance away from the site. Ground motion can be amplified by soft soils on the site.

Probabilistic PGAs are calculated by combining ground motions from all the possible earthquakes and weighting their contribution depending on their probability of occurrence. The probabilistic earthquake ground motion, probability of occurrence, and return period are all related. The lower the probability of occurrence within a given period, the larger the expected ground motion, and the longer the return period.

In the Oregon City area, the ground motion for an earthquake with a 50 percent probability of occurrence in 50 years is about 8 to 10 percent times gravity. Such an earthquake has a 72-year return period. Similarly, the ground motion for an earthquake with a 10 percent probability of occurrence would be about 15 to 20 percent times gravity, with a recurrence period of 475 years. The 475-year return event's primary ground motion contribution is from a subduction earthquake. These ground motions are generally consistent across the Portland area, with a slight reduction moving east away from the potential subduction earthquake source zone. The Portland Hills fault may produce a PGA in the order of 60 to 80 percent times gravity in the City.

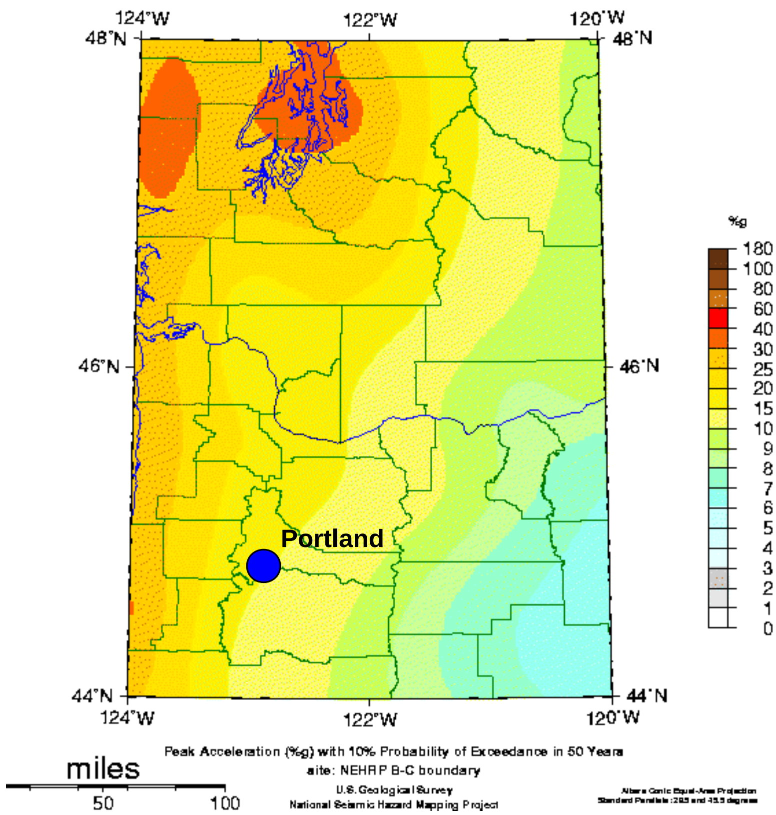


Figure 3-2

Peak Acceleration With 10% Probability of Exceedance in 50 Years

Surface faulting is not a concern in the Portland area, based on:

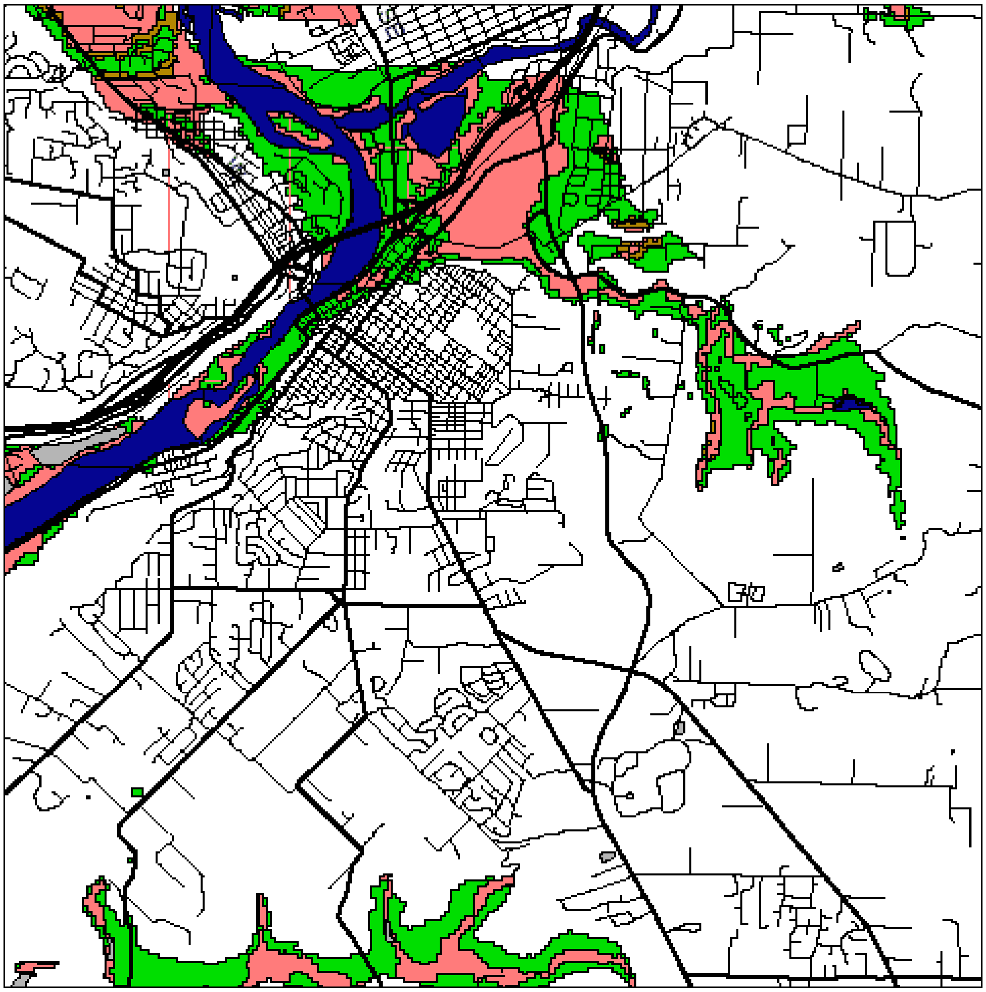
- Fault rupture associated with a subduction earthquake would be located off the Oregon coast, and should be of no consequence to City facilities.
- Thrust or reverse faults that may result from north-south crustal compression typically do not reach the surface. By comparison, the San Andreas and Hayward strike slip faults in California have a very significant surface expression, and are considered when design facilities cross them.
- There is no evidence of surface faulting in the Portland area over the last 5,000 years.

3.2.2. Earthquake Hazard Summary

Probabilistic earthquake ground motions on the order of 8-10 percent gravity for a 72-year return, and 15-20 percent gravity for a 475-year earthquake can be expected in Oregon City. These will be amplified on soft soil sites. Scenario earthquake ground motions, such as from the Portland Hills Fault, may be as large as 60 to 80 percent times gravity, but these would only be expected to occur every 5,000 years.

3.3. Liquefaction Susceptibility

The Oregon Department of Geology and Mineral Industries (DOGAMI) has developed liquefaction susceptibility mapping for the City's service area (Figure 3-3). The pink shaded area has the highest liquefaction susceptibility. Minimal liquefaction is expected in an OBE event, whereas significant liquefaction would likely occur in a DBE event, or an event on the Portland Hills Fault. The liquefaction information is of most significance to City pipeline vulnerability, and will be discussed in that section.



Legend:
pink = high susceptibility
brown = moderate susceptibility
green = low susceptibility
white = not liquefiable

Figure 3-3: Liquefaction Areas in Oregon City (DOGAMI).

4. Facility Evaluation

4.1. General

The seismic vulnerability assessments for the City's water system components are presented in this chapter. The facilities included were the City's reservoirs (No. 2, Boynton, Henrici, and Barlow Crest); five pump stations and pump houses, and 15 PRVs. Assessments were made for the seismic hazards associated with the OBE and DBE and Portland Hill's Fault events defined in Chapter 3. The sites were visited by ABS Consulting engineers on January 28 and 29, 2002.

Our findings and upgrade recommendations in the event of these scenario earthquakes are discussed in the following sections. A discussion of the water system vulnerabilities and prioritized recommendations are presented in Chapter 6.

4.2. Criteria for Review

This assessment is based on the following:

- A review of the available civil and structural drawings for the facilities.
- A visual survey of the structures to establish their condition and the general quality of construction.
- A review of geological, fault, and earthquake data for the sites.
- An estimate of the probable ground motions at each site for three levels of earthquakes.
- Knowledge of the performance of similar facilities in past earthquakes and engineering judgment.
- Limited engineering calculations.

4.3. Reservoirs

The City's water reservoirs include both steel and reinforced concrete construction. Table 4-1 summarizes reservoir age, construction type, seismic risk, and applicable seismic upgrade costs. The following paragraphs summarize typical seismic vulnerabilities for these types of reservoirs.

Evaluation of the elevated tank at Mountainview is not included in the scope of work. However, if the tank collapses, it is likely to heavily damage the Mountainview Pump Stations. In the short-term, the City should either remove the tank, or drain the tank to reduce its vulnerability to collapse.

Ground-supported steel-shell reservoirs have traditionally been designed based on AWWA standards, which permit tanks to be unanchored under certain conditions. In an earthquake, the shell rigidly contains a lower portion of the liquid, while the remaining upper portion sloshes inside. The critical tank elements are: 1) the vertical shell which may buckle along the bottom due to tank rocking, 2) the welded seam between the bottom plate and the vertical shell, 3) the roof-to-shell connections, and 4) the attached piping. Typical upgrade solutions involve foundation anchors along the perimeter of the tank or flexible piping connections.

Oregon City steel reservoir descriptions and findings are included in Table 4-1. In summary, the Boynton standpipe includes a reinforced concrete mat foundation with anchor bolts at the base of the tank. The existing standpipe is adequate for the OBE scenario. The existing anchorage is inadequate to resist the DBE forces. There is potential for anchorage failure and/or shell rupture. For the PHF scenario, substantial foundation improvements would also be required.

The Henrici reservoir is relatively flat in profile. Consequently sloshing of water dominates the tank response. The tank appears to be adequately designed for the OBE scenario. In the DBE scenario there exists potential for roof damage due to sloshing. Roof damage and piping damage is likely in the PHF scenario.

The Barlow Crest is a modern steel reservoir of base anchorage which appears to be adequate for the OBE event and marginal for the DBE scenario. In the PHF scenario there is potential roof damage due to sloshing.

Historically, reinforced concrete water storage tanks have generally performed well in previous earthquakes. (There is a concern about Reservoir #2.) The primary cause of reinforced concrete tank failure can be attributed to the lack of positive connections between elements, tank deterioration, or foundation failure. The wall-to-foundation connection is the most critical in maintaining tank integrity and preventing leakage. Roofs that are not connected to the walls can slide. In addition to roof damage, interior columns may be subjected to excessive lateral forces if the roof is not anchored. Sloshing forces can also damage roofs or walls near the roof-to-wall interface. This type of damage usually occurs near or above the water level line, and these tanks are expected to remain functional after experiencing sloshing damage. Tank walls would only be expected to experience damage from inertial forces if they have deteriorated from the original design condition. Consequently, wall cracking with significant efflorescence should be investigated to determine if reinforcement corrosion has occurred. Vertical wall cracks are most significant because they may indicate a loss in hoop (tangential) stress capacity, or lead to deterioration of reinforcing designed to resist hoop stresses.

Reservoir #2 construction consists of a 1915-vintage open concrete reservoir that was modified in 1951 (concrete perimeter wall) to add storage capacity. In 1978 a wood-framed roof and interior posts were added.

The principal concern is the adequacy of the perimeter walls and roof damage due to sloshing effects. The reservoir appears to be adequate for the OBE scenario. In the DBE scenario, roof damage is possible due to sloshing. The perimeter wall is marginal if overtopped by a sloshing wave. The reservoir would likely fail in the PHF scenario.

4.4. Pump Stations

In general, the pump stations consist of relatively small “box-like” structures housing pumps and electrical panels. Construction consists of wood-framing or reinforced masonry units (CMU). Significant damage for these types of structures generally occurs due to a lack of wall connections at the roof or foundation level, or due to a soil failure. Table 4-2 summarizes general characteristics, findings, and recommendations for each structure.

The Mountainview Pump Stations may lack foundation anchorage. Consequently, both of these facilities are considered moderate risks and may experience severe structural damage in a DBE event. Verification of wall/roof anchorage for these structures is recommended.

Soil stability issues (landsliding and liquefaction) do not appear to be a significant issue at pump station sites.

Equipment and nonstructural issues were also noted during our walkthroughs of the pump stations. In general, the electrical panels, pumps, and motors were found to be adequately anchored to prevent damage in a major earthquake. However, a space heater and start-up batteries at the Hunter Pump Station should be properly restrained.

4.5. Pressure Reducing Valve Vaults

Generally, pressure-reducing valves are housed in below ground, reinforced concrete vaults. In the absence of soil failures, such structures are reliable in earthquakes. However, if liquefaction/PGD occurs, the vault may move with the surrounding soil or float. In either case the connecting piping would likely be damaged. Liquefaction susceptibility and associated pipeline vulnerability is discussed further in Chapter 5.

The piping inside the vault is generally supported at the vault wall penetrations and usually has a gravity support under the pressure-reducing valve. This should be adequate to resist lateral loading for OBE and DBE events. In a Portland Hills Fault event, piping inside the vaults could fail laterally, in bending. We noted installations where air/vacuum release valves were supported only on the small diameter threaded piping connecting them to the larger pipe. There is a significant potential for the heavy air/vacuum release valve to respond as an inverted pendulum. In a DBE it could break off where small diameter pipe is attached to the larger diameter pipe. Addition of lateral bracing is recommended.

Table 4-1

RESERVOIR DESCRIPTIONS AND FINDINGS

Water Reservoir	Pressure Zone	Year Built	Capacity (MG)	Structural Material and System	Seismic Concerns	Scenario Seismic Risk[1]			Upgrade Priority	ROM Upgrade Cost (DBE)
						OBE	DBE	PH3		
No. 2	Low and intermediate	1915/ 1951 1978	10.5	Reinforced concrete, wood-framed roof	• Concrete wall failure • Wood-framed roof damage (sloshing)	Low	High	Very High	High	$700,000
Boynton	Upper	1984	2.0	Steel anchored	• Inadequate foundation anchorage (DBE event) • Pipe rupture • Inadequate foundation (pH)	Low	Moderate	High	Moderate	$50,000
Henrici	Upper	1994	2.0	Steel unanchored	• Sloshing • Pipe rupture	Low	Low	Moderate	N/A	N/A
Barlow Crest	Low and Intermediate Park Place	1999	1.75	Steel anchored	• None (OBE event)	Low	Low	Moderate	N/A	N/A

1. Scenarios:
   OBE = Operational Basis Earthquake
   DBE = Design Basis Earthquake
   PHF = Portland Hills Fault Earthquake

Table 4-2

PUMP HOUSE DESCRIPTIONS AND FINDINGS

Pump House	Reservoir Served	Year Built	Structural System	Seismic Concerns	Scenario Seismic Risk			Upgrade Priority	ROM Upgrade Cost
					OBE	DBE	PH		
Pump House No. 3	Henrici, Boynton	1950s	CMU walls w/ wood-framed roof	Verify foundation and roof anchorage	Low	Moderate	High	High	$10,000
Pump House No. 1, 2, 4	Henrici, Boynton	1960s	CMU walls w/ wood-framed roof	Verify foundation and anchorage	Low	Moderate	High	High	$10,000
Boynton	local fire flow	1984	CMU walls w/ wood-framed roof	None observed	Low	Low	Moderate	Low	N/A
Fairway Downs	none	1998	Wood-framed roof and walls	None observed	Low	Low	Moderate	Low	N/A
Hunter	Barlow Crest	1999	CMU walls w/ wood-framed roof	Anchor suspended space heater Strap start-up batteries	Low	Low	Moderate	Low	$1,000

1. Scenarios:
   OBE = Operational Basis Earthquake
   DBE = Design Basis Earthquake
   PHF = Portland Hills Fault Earthquake

5. Pipeline Evaluation

5.1. Introduction

In this chapter the vulnerability of the pipeline distribution system is evaluated geographically relating soils susceptible to liquefaction with City pipelines. The general vulnerability of the pipeline network to ground shaking and liquefaction is then described, and specific vulnerabilities related to liquefaction are addressed. Mitigation recommendations are provided.

5.2. Pipeline Vulnerability

Buried pipelines are vulnerable to ground shaking and liquefaction/lateral spreading. The failure rate for pipelines subjected to liquefaction/lateral spread is on the order of ten times that for ground shaking.

Pipelines with bell and spigot joints with elastomeric gaskets perform well when subjected to ground motion. Even asbestos cement pipe performs well when there is no permanent ground deformation because it is more flexible than cast iron. Asbestos cement pipe has a shorter laying length and has a “double” bell and spigot (coupling works as a double bell and spigot). Pipe with rigid joints and/or a weak barrel performs the worst in an earthquake-shaking environment. Cast-iron pipe installed before about 1960 (approximate) may have leaded joints. Leaded joints have brittle behavior.

Thin-walled steel pipe has performed poorly particularly when weakened by corrosion. Screwed joint pipe also has a poor track record when subjected to shaking because it has no longitudinal flexibility. That is compounded by the fact that the threads reduce the structural cross section of the pipe, and the material properties of the steel are changed when the threads are cut.

Pipe subjected to permanent ground deformation from liquefaction/lateral spreading or landslide generally does not perform well. Only strong ductile pipe with restrained joints or continuous pipe such as high-density polyethylene or steel with welded joints performs moderately well.

5.3. Expected Performance of City Pipelines

Expected performance of sections of the pipeline transmission and distribution system is described. The locations of concern due to liquefaction are listed below, and shown in Figure 5-1.

> SFWB transmission pipeline Clackamas River to Treatment Plant (Raw Water Line), and Treatment Plant to Reservoir #2 – We understand that this is concrete cylinder pipe with bell and spigot joints. There have been joint failures in the past. The pipe generally traverses along areas of competent soil with the exception of the slope from the Clackamas River to the treatment plant, and the low point near Redland Road. We understand that the slope from the Clackamas River to the Treatment Plant has been addressed over the past few years. This is a critical pipeline. If it has not been evaluated, we recommend that the City encourage the SFWB to conduct a detailed hydraulic (transients), structural, and condition assessment of this pipeline in the short-term.
>
> South end of system south of Warner Milne Road –It appears that this is a newer portion of the system constructed with ductile iron pipe. There are no liquefiable soils in this area, so the pipe vulnerability should be low in a DBE, and moderate in a PHF event.
>
> Transmission line from Mountainview Pump Stations to Henrici Reservoir along Beaver Creek Road – We understand that this pipe is steel with leaded joints. Leaded joints do not perform well when subjected to earthquake wave propagation. This pipe vulnerability is Low in an OBE, Moderate in a DBE, and High in a PHF event. We understand that a portion of this transmission line was replaced in the summer of 2002.

Central Old Town portion of system north of Warner Milne Road – Much of the pipe in this area appears to be cast iron. The joint type is unknown. There are several blocks where the soil has a high susceptibility to liquefaction (see Figure 5.1). The vulnerability of cast iron pipe with leaded joints in a DBE is Moderate in competent soils, and High in liquefiable soils. If this pipeline fails, water service may be lost locally. We recommend documenting the location and regularly exercising valves required to isolate the section of pipe in liquefiable soils in the short term, and replacing it in the long-term.

Northeast section of system north of Redland Road – Much of the pipe in this area appears to be asbestos cement. The soils are competent. Asbestos cement pipe performs well in competent soils, accommodating the differential movement due to wave propagation in the gasketed joint. The pipe has a low vulnerability in a DBE, and a moderate vulnerability in a PHF event.

Northwest section of system in the area of I-205 – Much of the pipe in this area is ductile iron, but the soils are liquefiable (see Figure 5.1). If significant liquefaction and associated lateral spreading occurs, the ductile iron pipe joints could pull apart. The pipe has a moderate vulnerability in a DBE, and High vulnerability in a PHF. We recommend documenting the location and regularly exercising valves in this area that would be required to isolate the damaged pipe from the system.

Redland Road – Sections of the pipe are identified to be cast iron (joint type unknown), and is an area identified to be highly susceptible to liquefaction (DOGAMI) (see Figure 5.1). The vulnerability of cast iron pipe with leaded joints in a DBE is Moderate in competent soils, and High in liquefiable soils. If this pipeline fails, water service may be lost locally. We recommend documenting the location and regularly exercising valves required to isolate the section of pipe in liquefiable soils in the short term, and replacing it in the long-term. If this pipeline serves as a transmission line to other parts of the system, consideration should be given to replacing it in the short-term. This is the periphery of the Oregon City system; the transmission pipeline for Clackamas River Water District continues outside of the service area.

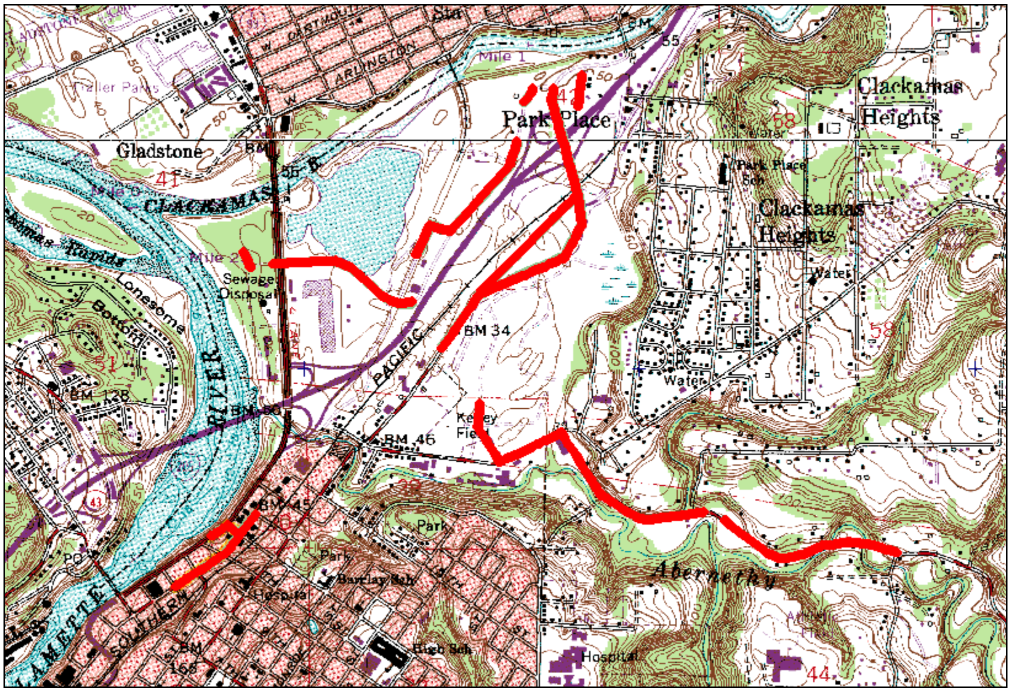


Figure 5-1. Pipelines in the Oregon City system that are in areas susceptible to liquefaction (shown in red).

5.4. Mitigation Recommendation Summary

This section summarizes recommendations to address pipeline vulnerability.

Short-Term (2 years) – For pipelines in liquefiable soils in Central Old Town, along I-205, and Redland Road, the City should document and exercise valves. In addition, the City should communicate with the jurisdiction providing fire protection about the vulnerability and potential failure of water service in these areas following a major earthquake. If the SFWB transmission line seismic vulnerability has not been evaluated, the City should encourage that a hydraulic, structural, and condition assessment be performed.

Long-Term (20 years) – The steel pipe transmission line with leaded joints serving the Henrici Reservoir should be replaced. The cast iron pipe with leaded joints in the Central Old Town in liquefiable soils should be replaced with ductile iron pipe with restrained joints.

6. Findings and Recommendations

6.1. Findings

This section summarizes findings in terms of expected performance of system components for three earthquakes, the OBE, DBE, and the PHF event.

The entire system is totally dependent on the SFWB supply. The scope of work did not include evaluation of that system.

6.1.1. OBE Expected Performance

For the OBE, with a recurrence interval of 72 years, the system is expected to perform well. Ground motions in the order of 8 to 10 percent times gravity are expected. Minimal liquefaction is expected even in the areas that are highly susceptible.

The four tanks and five pump stations all have a low vulnerability to ground motions expected in an OBE, so minimal damage is expected.

It is likely that there will be a regional loss of power that will last on the order of one day following an OBE. All of the City pump stations have emergency generators except Livesay. Further, there is no storage in the Livesay service area, so service would be lost immediately on loss of power. We understand that the Livesay Pump Station service area could receive service through a new PRV from the Barlow Crest Reservoir. We recommend that this project move ahead.

6.1.2. DBE Expected Performance

For the DBE, with a recurrence interval of approximately 475 years, significant damage is expected. The most likely source for this earthquake is a Cascadia Subduction event, with ground motions on the order of 15 to 20 percent times gravity. Soils with a high liquefaction susceptibility in Central Old Town, along I-205, and along Redland Road are expected to liquefy.

There is a high probability of failure of the upper wall sections of Reservoir #2. Sloshing is likely to damage the roof as well. Depending on the extent of the damage, the reservoir would likely not be usable. This could result in failure of the entire system.

The Boynton Reservoir is moderately vulnerable. Tank wall buckling would be likely, with some potential of the tank bursting a seam at the bottom. The Henrici Reservoir should perform well with the exception that sloshing, particularly from a Cascadia Subduction Earthquake, may damage the roof.

The Mountainview Pump Stations are expected to have some structural damage, but would likely remain functional. There may be some damage to unanchored/ inadequately-anchored equipment at all facilities. If the elevated tank is full, there is a significant potential that it may collapse and damage the Mountainview Pump Stations. Its collapse would also result in failure of the radio communication system as the tank supports the system antennas. Regional power outage is expected to last three days, so the Livesay Pump Station service area would be without water.

Pipeline damage due to liquefaction is expected in Central Old Town, along I-205, and along Redland Road. Pipe connections will likely be damaged to PRV vaults in areas where liquefaction occurs. Damage is expected to the steel transmission line serving the Henrici Reservoir.

6.1.3. Portland Hills Fault Expected Performance

The Portland Hills Fault event is expected to recur every 5,000 to 10,000 years. Ground motions would be expected to be four times those from a Cascadia Subduction or 475-year return earthquake, and three to four times larger than the facilities were designed to resist. With such ground motions, infrastructure throughout the entire region will be heavily damaged.

All four reservoirs would be expected to fail. Extensive structural damage is expected at the Mountainview Pump Stations, with the ability to continue operation doubtful. The modern pump stations may have little damage.

Pipeline damage would be more severe than in the DBE. Liquefaction would be more extensive, and pipe damage due to wave propagation more severe.

6.2. Mitigation Recommendations

This section describes recommended mitigation measures to be addressed in the short, medium, and long term.

6.2.1. Short-Term Mitigation (2 years) ($25,000)

These quick-fix recommendations would enhance the emergency response following a 475-year return earthquake.

- Drain and/or remove the elevated tank at the Mountainview site. (TBD)
- Anchor miscellaneous equipment in pump stations and PRV vaults. ($5,000, potentially in-house project)
- Structurally upgrade the Mountainview Pump Stations. ($20,000) See Figure 6-1 for foundation anchorage detail.
- Document and exercise valves on pipelines in liquefiable soils in Central Old Town, along I-205, and Redland Road. (in-house project)
- Communicate with the jurisdiction providing fire protection about the vulnerability and potential failure of water service in these areas following a major earthquake. (incidental cost)
- If the SFWB transmission line seismic vulnerability has not been evaluated, the City should encourage that a hydraulic, structural, and condition assessment be performed. (TBD by SFWB)
- Transfer the Livesay Pump Station service area to the Barlow Crest Tank.

6.2.2. *Medium-Term Mitigation (5 years) ($700,000)*

This recommendation would result in maintaining system operation following a 475-year return event.

- Seismically upgrade Reservoir #2. ($700,000) See wall upgrade concept in Figure 6-2.

6.2.3. *Long-Term Mitigation (20 years) ($50,000)*

These recommendations would enhance post-earthquake recovery, particularly following a 475-year event.

- Replace the steel pipe transmission line with leaded joints serving the Henrici Reservoir. (cost TBD)
- Replace the cast iron pipe with leaded joints in Central Old Town in liquefiable soils with ductile iron pipe with restrained joints. (cost TBD)
- Seismically upgrade the Boynton Reservoir. ($50,000) See tank anchorage detail in Figure 6-3.

Please note that the above costs include construction only. Approximately 40% should be added for design, inspectors, construction support, project management, contingency, permitting, and taxes.

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PRELIMINARY
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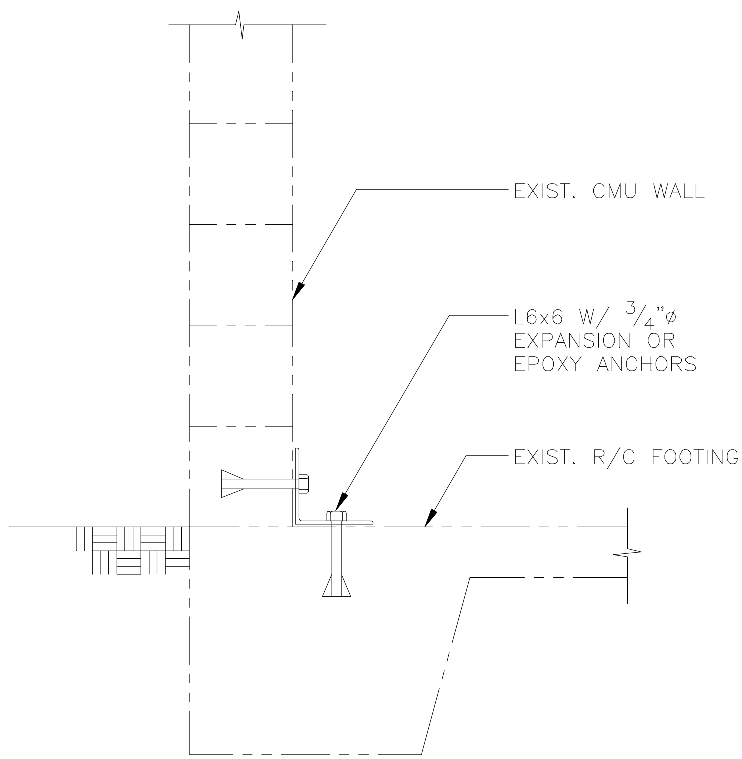

WALL-TO-FOUNDATION DETAIL
N.T.S.

Figure 6-1: Pump Station Foundation Anchorage

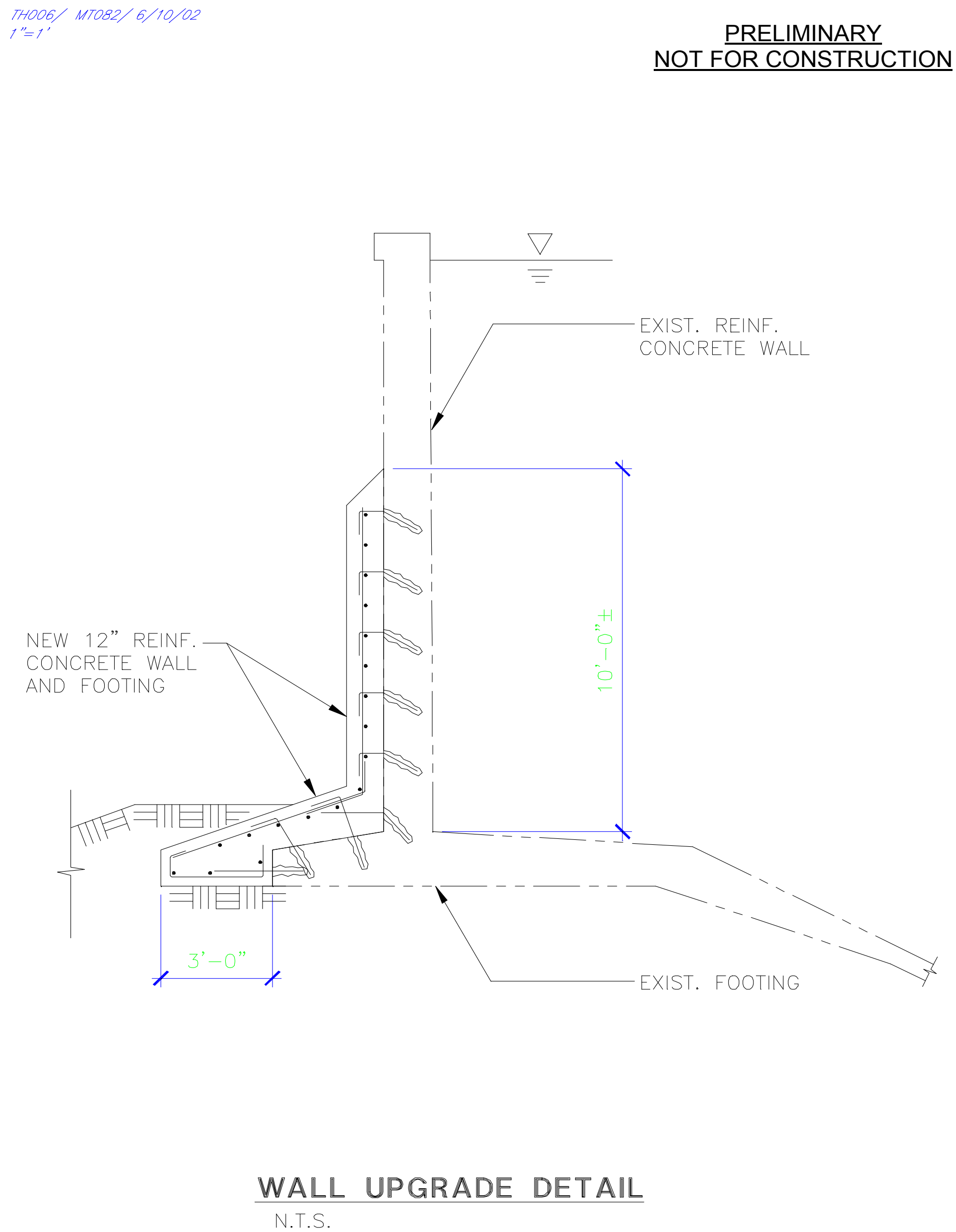

Figure 6-2: Reservoir #2 Wall Retrofit Concept

PRELIMINARY
NOT FOR CONSTRUCTION

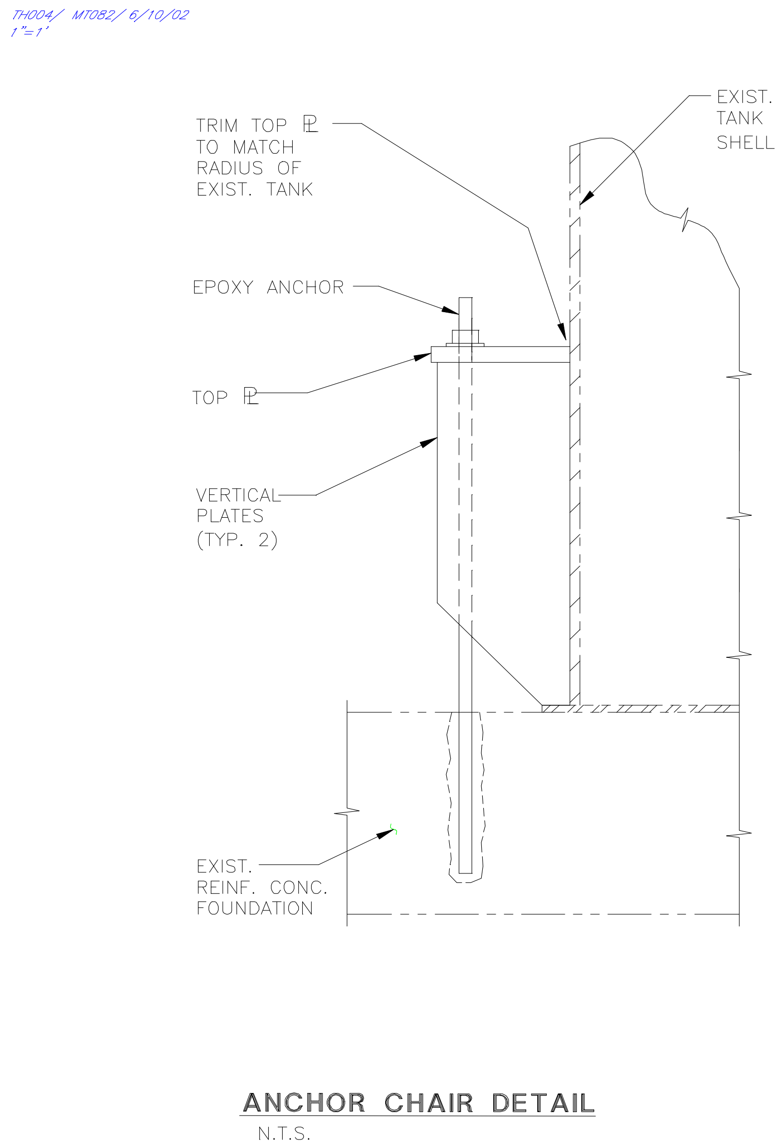

Figure 6-3: Steel Tank Anchorage Detail

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WEST YOST ASSOCIATES
Consulting Engineers

REGISTERED PROFESSIONAL ENGINEER
73588PE
Corie Peterson
OREGON
Jan. 13, 2004
CORIE PETERSON
EXPIRES: 12/31/2010

TECHNICAL MEMORANDUM

DATE:	March 3, 2010	Project No. : 526-03-09-08
TO:	John Burrell, Project Manager	
FROM:	Corie Peterson	
REVIEWED BY:	Charles Duncan	
SUBJECT:	City of Oregon City, Water System – Diurnal Curve Development Technical Memorandum	

The purpose of this Technical Memorandum (TM) is to document West Yost Associates' (WYA) development of a city wide diurnal curve for the development of an Extended Period Simulation (EPS) hydraulic water model of the City of Oregon City (City) water system. The following sections of this TM describe the data, methodology, and results used to create the diurnal curve for the City's water system. Subsequent sections of this TM are as follows:

- Summary of Results
- Pressure Zone Description
- Diurnal Curve Development

SUMMARY OF RESULTS

Overall, the results from the diurnal curve development are inconclusive due to lack of sufficient hourly data to produce accurate demands in the system and chart the flow of water. Due to the quantity of assumptions that were required to generate a hourly diurnal curve and the resulting inconsistencies with the hydraulic model, validation of the model was not undertaken at this time. It is our recommendation that the City continue to update/verify pipeline system configurations in the model as new facilities are constructed and to collect additional data to support a more accurate approach to developing an hourly diurnal curve. In addition, it is our recommendation to reallocate demands using existing metered information prior to attempting a serious validation of this the developed curve and the hydraulic model.

PRESSURE ZONE DESCRIPTION

Figure 1 represents the existing pressure zone boundaries within the City's service area. Per the Oregon City Water Master Plan 2003, under normal operating conditions, the City's water system shall maintain a minimum pressure of 40 pounds per square inch (psi) and a maximum pressure of 100 psi at the service connection. Because of this requirement and the variation in elevation, the City's water distribution system is divided into eleven (11) separate pressure

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zones. There are eight (8) pressure zones interconnected by pressure reducing or pressure sustaining valves (PRV). The separate service levels mitigate the problem of excessive pressures in lower elevations and insufficient pressures at higher elevations. Table 1 summarizes the approximate service elevation range for each of the eleven pressure zones. The lower end of the pressure range is based on reservoirs at 80 percent full and the upper end is based on full reservoirs. Figure 2 shows the entire system schematic.

Table 1. Pressure Zone Elevations and Pressure Ranges[(a)]

Zone	Zone Bottom Elevation, feet	Zone Top Elevation, feet	Pressure Range, psi
Lower Pressure Zone	10	116	68 - 114
Paper Mill Pressure Zone	54	54	102
Canemah District Pressure Zone	74	140	54 –83
Lower Park Place Pressure Zone	44	218	43 – 118
Intermediate Pressure Zone	98	378	40 – 161
Intermediate Park Place Pressure Zone	222	434	47 –142
View Manor Park Place Pressure Zone	324	326	35 –36
Livesay Road Park Place Pressure Zone	222	272	70-100
Upper Pressure Pressure Zone	292	500	34 – 141
Fairway Downs Pressure Zone	470	518	55 –80
Upper Park Place Pressure Zone – CRW	434	522	203 –233

(a) Based on node elevation allocation in the hydraulic model not including the public open space.

Lower Pressure Zone

The Lower Pressure Zone is located within the northwestern portion of the City's service area. The general boundaries of the pressure zone are from the Interstate 205 in the west to Apperson Boulevard in the east, from Interstate 205 and Clackamas River Drive in the north to Railroad Avenue and Abernethy Road in the south.

The Lower Pressure Zone receives supply from eight (8) PRV's from Lower Park Place and Intermediate Pressure Zones. Flow leaves the pressure zone through one (1) master meter serving Clackamas River Water (CRW). Each facility is presented in Table 2.

Table 2. Lower Pressure Zone Facilities

Supplied From	Facility	Supplied To
Lower Park Place Pressure Zone	PRV- Harley Avenue & Foresythe (south)	Lower Pressure Zone
Lower Park Place Pressure Zone	PRV-Harley Avenue & Foresythe (north)	Lower Pressure Zone
Lower Park Place Pressure Zone	PRV-Apperson Boulevard & La Rae Road	Lower Pressure Zone
Lower Park Place Pressure Zone	PRV-Abernethy Road & Redland Road	Lower Pressure Zone
Intermediate Pressure Zone	PRV-15th Street & Madison Street	Lower Pressure Zone
Intermediate Pressure Zone	PRV-11th Street & Washington Street	Lower Pressure Zone
Intermediate Pressure Zone	PRV-3rd Street & Bluff	Lower Pressure Zone
Paper Mill Pressure Zone	PRV-Highway 99 E & Main Street (bi-directional)	Lower Pressure Zone
Lower Pressure Zone	Master Meter No. 2	CRW

Paper Mill Pressure Zone

The Paper Mill Pressure Zone is located within the northwestern portion of the City's service area. The general boundaries of the pressure zone are from the Willamette River in the west to Highway 99E in the east, from approximately 5th Street in the north to the Paper Mill's Road and the south property line in the south.

The Paper Mill Pressure Zone receives supply from one (1) PRV from Intermediate Pressure Zone. Flow leaves the zone through a bi-directional PRV at 99E and Main Street, but can be reversed in case of an emergency in the Paper Mill Pressure Zone. Each station is presented in Table 3.

Table 3. Paper Mill Pressure Zone Facilities

Supplied From	Facility	Supplied To
Intermediate Pressure Zone	PRV-3rd Street & Bluff	Paper Mill Pressure Zone
Paper Mill Pressure Zone	PRV-Highway 99E & Main Street (bi-directional)	Lower Pressure Zone

Canemah District Pressure Zone

The Canemah District Pressure Zone is located within the southwestern portion of the City's service area. The general boundaries of the pressure zone are from Paquet Street in the west to

Ganong Street in the east, Willamette River in the north to Railroad Avenue and Abernethy Road in the south.

The Canemah District Pressure Zone receives supply from one (1) PRV from the Intermediate Pressure Zone. This station is presented in Table 4.

Table 4. Canemah District Pressure Zone

Supplied From	Facility	Supplied To
Intermediate Pressure Zone	PRV-4th Street and Jerome Street	Canemah District Pressure Zone

Lower Park Place Pressure Zone

Lower Park Place Pressure Zone is in the North-eastern portion of the City's service area. The general boundaries of this service level are from Apperson Boulevard in the west to Frank Avenue in the east and from Taylor Lane on the north to Livesay Road on the south.

The Lower Park Place Pressure Zone is served from one (1) South Fork Water Board (SFWB) master meter connection and four (4) PRV's from Intermediate and Intermediate Park Place Pressure Zones. Flow leaves this zone through four (4) PRV's. Each station is presented in Table 5.

Table 5. Lower Park Place Pressure Zone Facilities

Supplied From	Facility	Supplied To
South Fork Water Board	Master Meter 1	Lower Park Place Pressure Zone
Intermediate Park Place Pressure Zone	PRV- Cleveland Street & Hiram Avenue (inactive)	Lower Park Place Pressure Zone
Intermediate Park Place Pressure Zone	PRV-Hunter Pump Station	Lower Park Place Pressure Zone
Intermediate Park Place Pressure Zone	PRV- Swan Avenue & Holcomb Boulevard	Lower Park Place Pressure Zone
Intermediate Pressure Zone	PRV-18th Street & Anchor Way	Lower Park Place Pressure Zone
Lower Park Place Pressure Zone	PRV-Harley Avenue & Forsythe Road (south)	Lower Pressure Zone
Lower Park Place Pressure Zone	PRV-Harley Avenue & Forsythe Road (north)	Lower Pressure Zone
Lower Park Place Pressure Zone	PRV-Apperson Boulevard & La Rae Road	Lower Pressure Zone
Lower Park Place Pressure Zone	PRV-Abernethy Road & Redland Road	Lower Pressure Zone

Intermediate Pressure Zone

Intermediate Pressure Zone is in the northwestern portion of the City's service area. The general boundaries of this pressure zone are from Highway 99E in the west to the Oregon City city limits in the east and from 18^{th} Street in the north to Ogden Drive and Pearl Street in the south.

Intermediate Pressure Zone is served from one (1) SFWB master meter connection, the Mountainview Reservoirs and two (2) PRV's from SFWB and Upper Pressure Zone. Flow leaves this zone through five (5) PRV's. Each station is presented in Table 6.

Table 6. Intermediate Pressure Zone Facilities

Supplied From	Facility	Supplied To
South Fork Water Board	Master Meter 4	Intermediate Pressure Zone
Upper Pressure Zone	PRV- 5th Street & Canemah Road	Intermediate Pressure Zone
South Fork Water Board	PRV-16th Street & Division Street	Intermediate Pressure Zone
Intermediate Pressure Zone	PRV-18th Street & Anchor Way	Lower Park Place Pressure Zone
Intermediate Pressure Zone	PRV-11th Street & Washington Street	Lower Pressure Zone
Intermediate Pressure Zone	PRV-15th Street & Madison Street	Lower Pressure Zone
Intermediate Pressure Zone	PRV-3rd Street & Bluff	Lower Pressure Zone
Intermediate Pressure Zone	PRV-4th Street and Jerome Street	Canemah District Pressure Zone

Intermediate Park Place Pressure Zone

Intermediate Park Place Pressure Zone is in the northern portion of the City's service area. The general boundaries of this pressure zone are from Hiram Avenue in the west to Oregon City city limits on the east and from Forsythe Road in the north to Oak Tree Terrace in the south.

Intermediate Park Place Pressure Zone is served from one (1) SFWB master meter connection via the Hunter Avenue Pump Station. Flow leaves the zone through one (1) master meter serving CRW and four (4) PRV's. Each station is presented in Table 7.

Table 7. Intermediate Park Place Pressure Zone Facilities

Supplied From	Facility	Supplied To
South Fork Water Board	Master Meter 10	Intermediate Park Place Pressure Zone
Intermediate Park Place Pressure Zone	Master Meter 13	CRW
Intermediate Park Place Pressure Zone	PRV-Cleveland Street & Hiram Avenue (inactive)	Lower Park Place Pressure Zone
Intermediate Park Place Pressure Zone	PRV-Swan Avenue & Holcomb Boulevard	Lower Park Place Pressure Zone
Intermediate Park Place Pressure Zone	PRV-Hunter Avenue Pump Station	Lower Park Place Pressure Zone
Intermediate Park Place Pressure Zone	PRV-Jennifer Estates	Jennifer Estates

View Manor Park Place Pressure Zone

View Manor Park Place Pressure Zone serves a very small area in the northern portion of the City's service area. The general boundaries of this pressure zone are from Swan Avenue in the west to Longview Way in the east and from Pittock Place in the north to Holcomb Boulevard in the south.

The View Manor Park Place Pressure Zone receives supply from one (1) PRV from Intermediate Park Place Pressure Zone. The station is presented in Table 8.

Table 8. View Manor Park Place Pressure Zone Facilities

Supplied From	Facility	Supplied To
Intermediate Park Place Pressure Zone	PRV- View Manor	View Manor Park Place Pressure Zone

Livesay Road Park Place Pressure Zone

Livesay Road Park Place Pressure Zone is a closed loop zone serving three (3) homes outside Oregon City city limits, but within the Urban Growth Boundary. The general boundaries of this pressure zone are from Witke Court in the west to Tracey Lee Court in the east and from Journey Drive in the north to Livesay Road in the south.

The Livesay Road Park Place Pressure Zone receives supply from one (1) pump station from Intermediate Park Place Pressure Zone. The station is presented in Table 9.

Table 9. Livesay Road Park Place Pressure Zone Facilities

Supplied From	Facility	Supplied To
Lower Park Place Pressure Zone	Livesay Pump Station	Livesay Rd Park Place Pressure Zone

Upper Pressure Zone

Upper Pressure Zone is in the southern portion of the City's service area. The general boundaries of this pressure zone are from Maywood Street in the west to the Oregon City city limits in the east and from Peal Street in the north to Oregon City city limits in the south.

Upper Pressure Zone is served from one (1) SFWB master meter connection. Mountainview 2, Boynton and Henrici are the reservoir's serving this zone. Flow leaves this zone through the Fairway Downs Pump Station and two (2) master meters serving CRW. Each station is presented in Table 10.

Table 10. Upper Pressure Zone Facilities

Supplied From	Facility	Supplied To
South Fork Water Board	Master Meter 5	Upper Pressure Zone
Upper Pressure Zone	Master Meter 8	CRW
Upper Pressure Zone	Master Meter 9	CRW

Fairway Downs Pressure Zone

Fairway Downs Pressure Zone is a closed loop zone in the southeastern portion of the City's service area. The general boundaries of this pressure zone are from Coquille Drive in the west to Urban Growth Boundary in the east and from Glen Oak Road in the north to the Urban Growth Boundary in the south.

The Fairway Downs Pressure Zone receives supply from one (1) pump station from the Upper Pressure Zone. The station is presented in Table 11.

Table 11. Fairway Downs Pressure Zone Facilities

Supplied From	Facility	Supplied To
Upper Pressure Zone	Fairway Downs Pump Station	Fairway Downs Pressure Zone

Upper Park Place Pressure Zone

Upper Park Place Pressure Zone is in the northeastern portion of the City's service area. The general boundaries of this pressure zone are from Winston Drive in the west to the Oregon City city limits in the east and from the Oregon City city limits in the north to Journey Drive in the south. This pressure zone is served by CRW and is therefore not considered part of the Oregon City distribution system.

DIURNAL CURVE DEVELOPMENT

A diurnal pattern is required for extended period simulations. A diurnal pattern shows the hourly variations in customer demand (hourly peaking factors) over a 24-hour period. Diurnal patterns are typically developed from historic hourly flow data that is analyzed to determine variations in customer demands that have been adjusted to account for flows going into storage or passed through to other zones, i.e., during parts of the day, some flows in the system may be going to re-fill storage rather than to meet customer demands.

If detailed system-specific information is not available, then WYA reviews diurnal pattern information developed by other agencies to recommend a typical diurnal pattern for the analysis. For this evaluation, system-specific hourly data was not available for the entire City; therefore, the diurnal pattern is based on available information, incorporating as much of the actual hourly flow data as possible. The following paragraphs describe the steps WYA followed in developing the composite diurnal curve for the City.

WYA collected electronic and hard copy data available from the City and SFWB during the period from July 1 to September 31, 2007 and July 1 to September 31, 2008. Facilities for which data was requested included pump stations, reservoirs, PRVs and master meters between Oregon City, CRW and SFWB. Table 12, provides a summary of the electronic data available to develop the diurnal curve for Oregon City. As shown, SCADA does not collect PRV flow or pressure readings; master meters are only read monthly; and up and downstream pressures are not collected for pump stations. Due to these limitations, complete diurnal curves for each pressure zone or for the whole City were not possible. The only zone that has no master meters or PRVs in or out of the zone is the Fairway Downs Pressure Zone. WYA considered using this zone to create a diurnal curve and apply it to the entire city, but elected not to because it is not representative of the system as a whole since it is only residential.

Using the best data available, WYA determined that generic diurnal trends could be created by observing the filling and draining of the two groups of reservoirs in the City. One curve was created for the upper zones, including the Upper Pressure Zone and Fairway Downs Pressure Zone, that trended the filling and draining of the Henrici and Boynton Reservoirs. Another curve was created for the lower zones, including the Intermediate Pressure Zone, the Lower Pressure Zone and the Canemah District Pressure Zone, that trended the filling and draining of the Mountainview Reservoirs. The date of July 15, 2008 was selected from SCADA as a peak day to create these curves as they are presented in Figure 3.

Table 12. Available City SCADA Information

Service Level	Facility	SCADA – Electronic Pressure Discharge	Pressure Suction	Level	Flow
Lower Service Level					
	Master Meter 2	NA	NA	NA	Monthly
	PRV- Harley Avenue & Forsythe (south)	None	None	NA	None
	PRV-Harley Avenue & Forsythe (north)	None	None	NA	None
	PRV-Apperson Boulevard & La Rae Road	None	None	NA	None
	PRV-Abernethy Road & Redland Road	None	None	NA	None
	PRV-15th Street & Madison Street	None	None	NA	None
	PRV-11th Street & Washington Street	None	None	NA	None
	PRV-3rd Street & Bluff	None	None	NA	None
	PRV-Highway 99 E & Main Street (bi-directional)	None	None	NA	None
Paper Mill Service Level					
	PRV-3rd Street & Bluff	None	None	NA	None
	PRV-Highway 99E & Main Street (bi-directional)	None	None	NA	None
Canemah District Service Level					
	PRV-4th Street and Jerome Street	None	None	NA	None
Lower Park Place Service Level					
	Hunter Avenue Pump Station	Hourly	Hourly	NA	Hourly
	Master Meter 1	None	None	NA	Monthly
	Master Meter 10	None	None	NA	Monthly
	PRV- Cleveland Street & Hiram Avenue (inactive)	None	None	NA	None
	PRV-Hunter Pump Station	None	None	NA	None
	PRV- Swan Avenue & Holcomb Boulevard	None	None	NA	None
	PRV-18th Street & Anchor Way	None	None	NA	None
Intermediate Service Level					
	Division Street Pump Station	None	None	NA	None
	Mountainview Reservoir No. 1	NA	NA	Hourly	NA
	Mountainview Reservoir No. 2	NA	NA	Hourly	NA
	Master Meter 3	None	None	NA	Monthly
	Master Meter 4	None	None	NA	Monthly
	Master Meter 7	None	None	NA	Monthly
	PRV- 5th Street & Canemah Road	None	None	NA	None
	PRV-16th Street & Division Street	None	None	NA	None
	PRV-Jennifer Estates	None	None	NA	None
View Manor Park Place Service Level					
	PRV- View Manor	None	None	NA	None
Livesay Road Park Place Service Level					
	Livesay Pump Station	None	None	None	None
Upper Service Level					
	Mountainview Pump Station	Hourly	Hourly	NA	Hourly
	Henrici Reservoir	NA	NA	Hourly	NA
	Boynton Reservoir	NA	NA	Hourly	NA
	Boynton Pump Station	None	None	None	None
	Master Meter 5	None	None	NA	Monthly
	Master Meter 8	None	None	NA	Monthly
	Master Meter 9	None	None	NA	Monthly
Fairway Downs Service Level					
	Fairway Downs Pump Station	None	None	No	None
Upper Park Place Service Level					
	Barlow Crest Reservoir	NA	NA	Hourly	NA
	Barlow Crest Pump Station (CRW)	None	None	NA	Hourly
	Master Meter 11	None	None	NA	Monthly
	Master Meter 12	None	None	NA	Monthly

Upper Zones Curve Development

The upper zone diurnal curve was developed using fill and drain data from Boynton and Henrici Reservoirs, flows from the Mountainview Pump Station and an hourly flow generated from the monthly data for the CRW Master Meters leaving the Upper Pressure Zone. The calculation for the demand curve adds all the flow into the two zones from the pump station and reservoir and subtracts the master meters and any filling of the two reservoirs for each hourly time step. The demand is then divided by the average demand for the day to yield a unitless diurnal curve as shown in Figure 3.

Lower Zones Curve Development

The lower zones diurnal curve was developed using fill and drain data from the Mountainview Reservoirs only. Hourly data for the Division Street Pump Station was not available but reservoirs alone are adequate to see the diurnal trend of the lower zones. The calculation for the demand curve is simply the flow out of the reservoirs minus the flow in for each hourly time step. The demand is then divided by the average demand for the day to yield a unitless diurnal curve as shown in Figure 3.

City-wide Diurnal

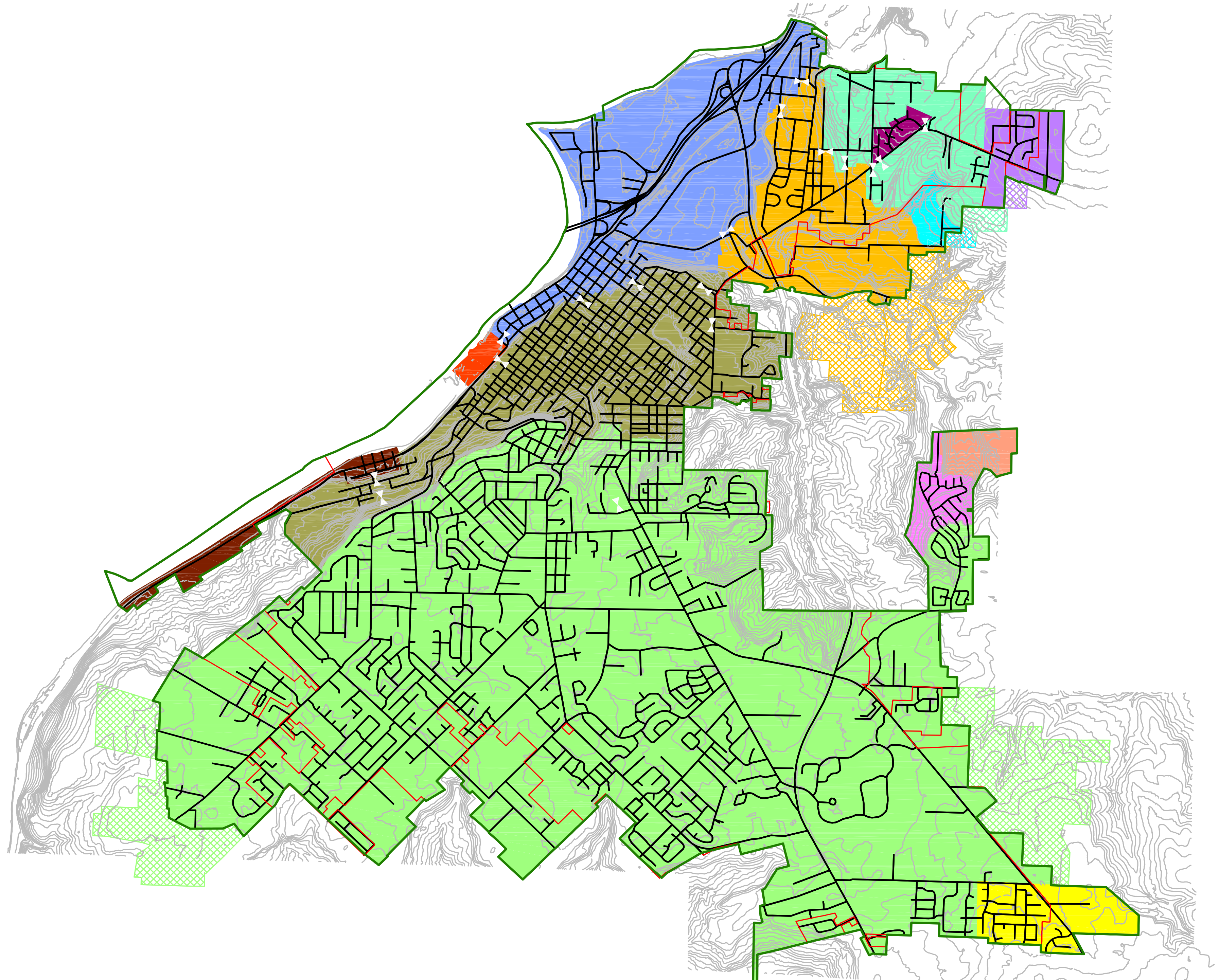
While both the upper and lower zones curves appeared to yield reasonable diurnal patterns, the upper zones consist predominately of residential customers and the lower zones have a broader mix of uses. To get a representative city wide diurnal curve a composite hourly curve was produced from the upper and lower zone curves. Figure 4 shows the diurnal pattern used for the Oregon City's system. Figure 4 is a unitless profile that shows the ratio of the hourly flow to the average daily flow rate over a 24-hour period (starting with 0 hours at midnight). The hourly factors are applied to the average daily flow to obtain the hourly flow rates. This diurnal patterns reflect the variation of customer demands over a 24-hour period, and account for use of storage within the City's system, e.g., filling of storage and taking water out of storage to meet demands.

In the future, if the City obtains complete system-specific hourly flow data over a 24-hour period for the system as a whole and/or by pressure zone, that reflects customer demands and accounts for use of storage, this hourly information could be used to develop more accurate system-specific diurnal patterns for the City system.

FINDINGS AND CONCLUSIONS

In the absence of hourly City wide flow and pressure data, a combination of hourly and monthly production data from Oregon City and SFWB was used to generate the maximum day demand for Oregon City. Resulting demands are lower than what was reported in the 2003 water master plan report. The primary method in developing the hourly diurnal curve was based the tanks filling and draining, which encompasses only a portion of the overall City. With only these two inputs, lower demands and a partial City diurnal, being based on significant assumptions, our confidence in an accurate validation of the hydraulic model is extremely low. Because of this, it can be concluded that the developed diurnal curve is adequate for use in planning, however should not be used to support operational decisions. Furthermore, it is recommended that the City look at installing temporary digital meters at those key locations in the distribution system to allow for a more representative diurnal curve to be developed.

If the City desires to continue pursuit of an operational EPS model, demands in the system could be reallocated which would remove one of the two major uncertainties that currently exist. The uncertainties surrounding curve generation using only tank filling and draining cycles would remain but validation may be more realistic.



OREGON CITY

FIGURE 1

CITY OF OREGON CITY
PRESSURE ZONES

LEGEND:

- URBAN GROWTH BOUNDARY (UGB)
- PROPOSED UGB EXPANSION AREA
- CITY LIMITS
- 20' CONTOURS
- LOWER ZONE
- INTERMEDIATE ZONE
- UPPER ZONE
- FAIRWAY DOWNS
- CANEMAH DISTRICT
- COUNTRY VILLAGE (CRW)
- CANYON (CRW)
- LOWER–PARK PLACE
- INTERMEDIATE–PARK PLACE
- UPPER–PARK PLACE (CRW)
- LIVESAY ROAD–PARK PLACE
- VIEW MANOR–PARK PLACE
- PAPER MILL ZONE
- PRESSURE REDUCING VALVE STATION (FUTURE)

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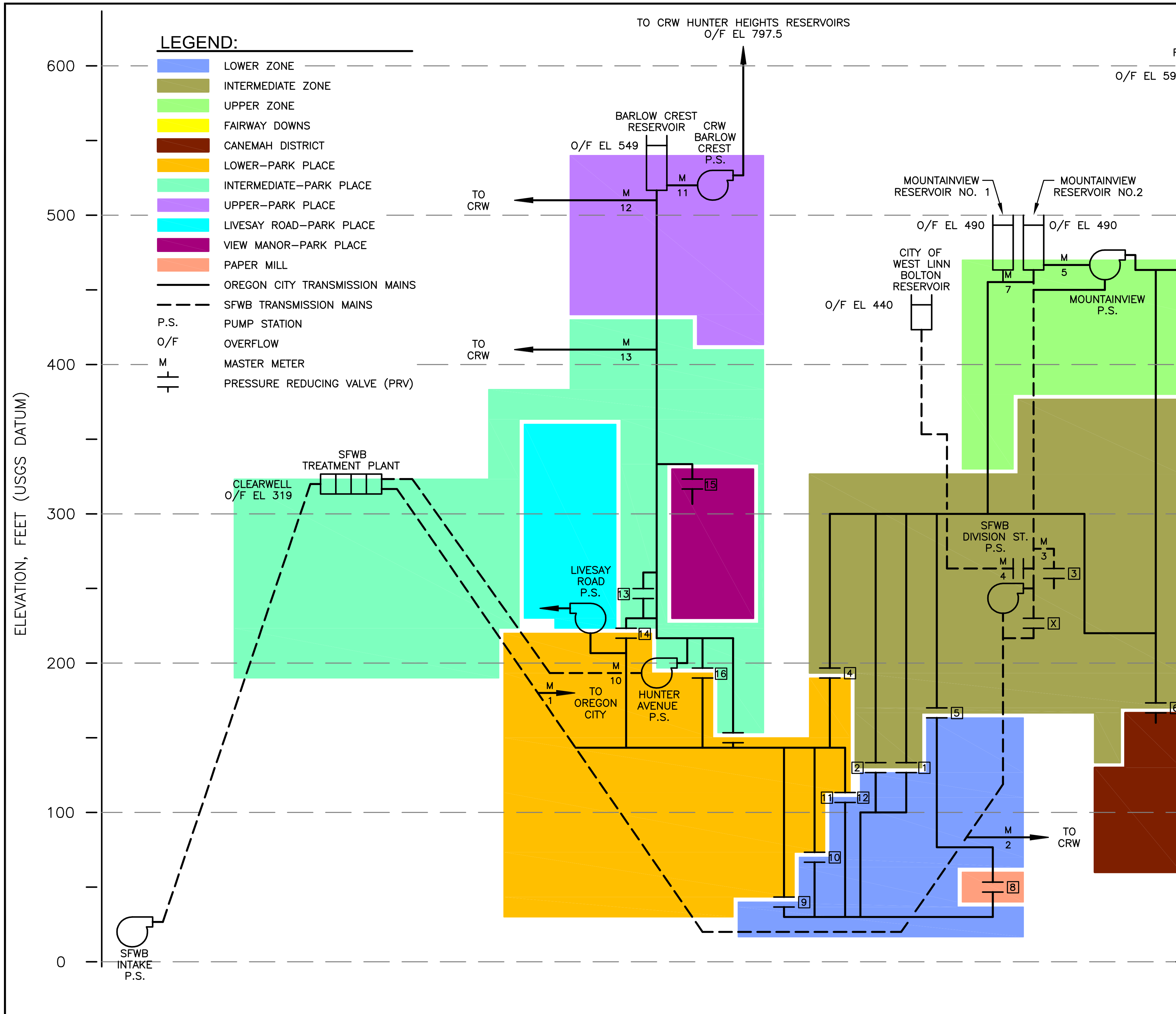

PRESSURE REDUCING VALVES

1. 11th AND WASHINGTON
2. 15th AND MADISON
3. 16th AND DIVISION
4. 18th AND ANCHOR WAY
5. 3rd AND BLUFF
6. 4th AND JEROME
8. 99E AND MAIN
9. ABERNETHY AND REDLAND
10. APPERSON AND LA RAE
11. HARLEY AND FORSYTHE (N)
12. HARLEY AND FORSYTHE (S)
13. JENNIFER ESTATES
14. SWAN AND HOLCOMB
15. VIEW MANOR
16. HUNTER AVE. P.S.
17. 3rd AND GANONG
18. LIVESAY AIR TANKS
19. FAIRWAY AIR TANKS

MASTER METERS

(1) SERVES CITY OF OREGON CITY CLEVELAND AND HIRAM ROADS
(2) SERVES CLACKAMAS RIVER WATER REDLAND ROAD AND ANCHOR WAY
(3) SERVES CITY OF WEST LINN 17th AND DIVISION STREET
(4) SERVES CITY OF OREGON CITY 16th AND DIVISION STREET
(5) SERVES CITY OF OREGON CITY MOUNTAINVIEW PUMP STATION PUMPS No.1, 2, AND 4
(7) SERVES CITY OF OREGON CITY MOUNTAINVIEW STREET
(8) SERVES CLACKAMAS RIVER WATER LELAND AND MEYERS ROADS
(9) SERVES CLACKAMAS RIVER WATER SOUTH END AND IMPALA ROADS
(10) SERVES CITY OF OREGON CITY HUNTER AVENUE PUMP STATION
(11) SERVES CLACKAMAS RIVER WATER BARLOW CREST PUMP STATION
(12) SERVES CLACKAMAS RIVER WATER BARLOW CREST RESERVOIR
(13) SERVES CLACKAMAS RIVER WATER SWAN AVENUE AND FORSYTHE ROADS

OREGON CITY

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FIGURE 2

CITY OF OREGON CITY

DISTRIBUTION SYSTEM HYDRAULIC PROFILE

Figure 3. Oregon City Diurnal Pattern July 15, 2008

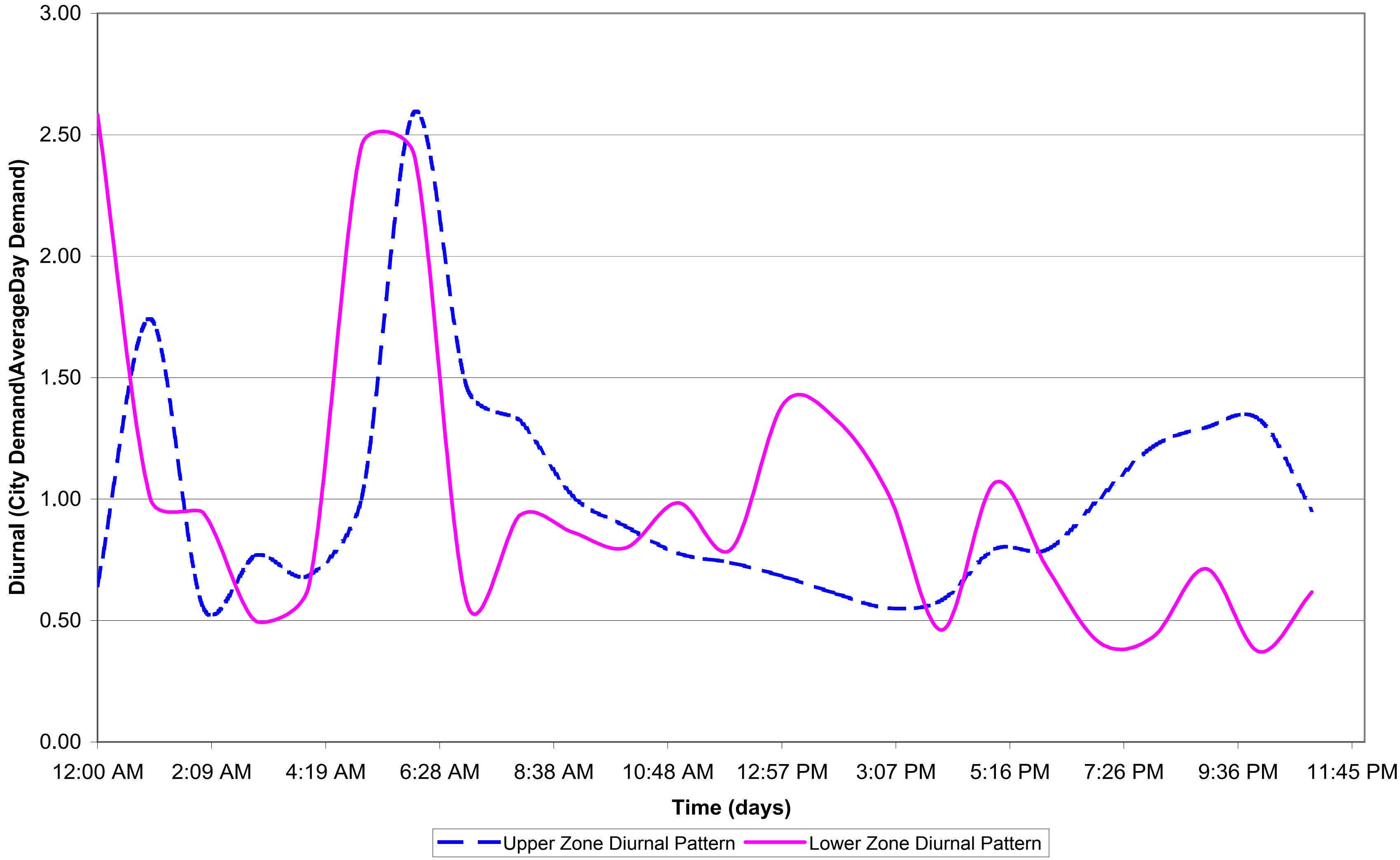
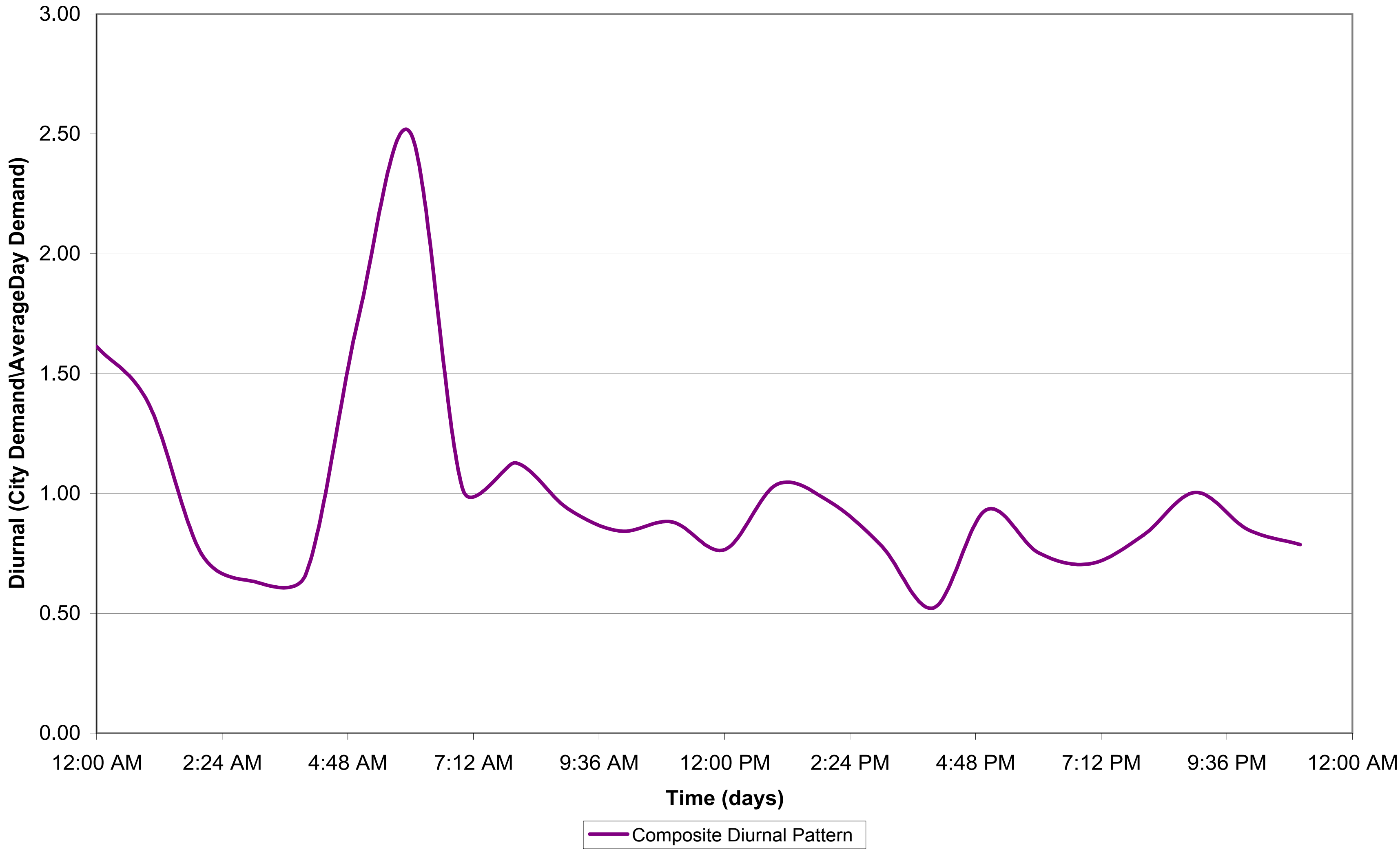


Figure 4. Oregon City Diurnal Pattern July 15, 2008



West Yost Associates
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Last Revised: 04-27-09

City of Oregon City
Diurnal Curve Development
Technical Memorandum

G A R V E Y S C H U B E R T B A R E R

MEMORANDUM

TO: Nancy Kraushaar, Pete Walter and Tony Konkol

COPY TO: Ed Sullivan and Bill Kabeiseman

FROM: Carrie Richter

DATE: October 12, 2011

RE: Water Distribution System Master Plan

All comprehensive plan amendments must be consistent with the statewide land use goals. ORS 197.175(2) and 197.250. Adoption of the draft Water Distribution System Master Plan will become part of the City's Comprehensive Plan and therefore, requires compliance with the goals, including Goal 11, Public Facilities and Services. ORS 197.712(2)(e) requires the adoption of public facility plans to ensure that an adequate supply of water is available to City residents and provides:

> "A city or county shall develop and adopt a public facility plan for areas within an urban growth boundary containing a population greater than 2,500 persons. The public facility plan shall include rough cost estimates for public projects needed to provide sewer, water and transportation for the land uses contemplated in the comprehensive plan and land use regulations. Project timing and financing provisions of public facility plans shall not be considered land use decisions."

A "public facilities plan" is defined in the administrative rules implementing Goal 11, OAR 660-011-0005(1), and provides:

> "A public facility plan is a support document or documents to a comprehensive plan. The facility plan describes the water, sewer and transportation facilities which are to support the land uses designated in the appropriate acknowledged comprehensive plans within an urban growth boundary containing a population greater than 2,500. Certain elements of the public facility plan also shall be adopted as part of the comprehensive plan, as specified in OAR 660-11-045."

The administrative rule identifies components that must be included in a public facilities master plan, OAR 660-011-0010(1), and requires:

> "(a) An inventory and general assessment of the condition of all the significant public facility systems which support the land uses designated in the acknowledged comprehensive plan;
>
> (b) A list of the significant public facility projects which are to support the land uses designated in the acknowledged comprehensive plan. Public facility project descriptions or specifications of these projects as necessary;
>
> (c) Rough cost estimates of each public facility project;

(d) A map or written description of each public facility project's general location or service area;

(e) Policy statement(s) or urban growth management agreement identifying the provider of each public facility system. If there is more than one provider with the authority to provide the system within the area covered by the public facility plan, then the provider of each project shall be designated;

(f) An estimate of when each facility project will be needed; and

(g) A discussion of the provider's existing funding mechanisms and the ability of these and possible new mechanisms to fund the development of each public facility project or system.

(2) Those public facilities to be addressed in the plan shall include, but need not be limited to those specified in OAR 660-011-0005(5). Facilities included in the public facility plan other than those included in OAR 660-011-0005(5) will not be reviewed for compliance with this rule.

(3) It is not the purpose of this division to cause duplication of or to supplant existing applicable facility plans and programs. Where all or part of an acknowledged comprehensive plan, facility master plan either of the local jurisdiction or appropriate special district, capital improvement program, regional functional plan, similar plan or any combination of such plans meets all or some of the requirements of this division, those plans, or programs may be incorporated by reference into the public facility plan required by this division. Only those referenced portions of such documents shall be considered to be a part of the public facility plan and shall be subject to the administrative procedures of this division and ORS Chapter 197."

"Public facility systems" included in OAR 660-011-0005(5) relating to water systems include: "(A) Sources of water; (B) Treatment system; (C) Storage system; (D) Pumping system; (E) Primary distribution system." Although the plan may include the identification of additional water system components, such as a public works facility, or provide for its funding, any components beyond "public facility systems" do not need to include funding or timing estimates that would otherwise apply.

The draft Plan appears to contain all of the required components set forth in the rule except for the estimated timing for improvements element. OAR 660-011-0025, prescribes particular requirements for evaluating timing and provides:

"(1) The public facilities plan shall include a general estimate of the timing for the planned public facility projects. This timing component of the public facilities plan can be met in several ways depending on whether the project is anticipated in the short term or long term. The timing of projects may be related directly to population growth, e.g., the expansion or new construction of water treatment facilities. Other facility projects can be related to a measure of the facility's service level being met or exceeded, e.g., a major arterial or intersection reaching a maximum vehicle-per-day standard. Development of other projects may be more long term and tied neither to specific population levels nor measures of service levels, e.g., sewer projects to correct infiltration and inflow problems. These projects can take place over a long period of time and may be tied to the availability of long-term funding. The timing of projects may also be tied to specific years.

(2) Given the different methods used to estimate the timing of public facilities, the public facility plan shall identify projects as occurring in either the short term or long term, based on those factors which are related to project development. For those projects designated for development in the short term, the public facility plan shall identify an approximate year for development. For those projects designated for development over the long term, the public facility plan shall provide a general estimate as to when the need for project development would exist, e.g., population level, service level standards, etc. Timing provisions for public facility projects shall be consistent with the acknowledged comprehensive plan's projected growth estimates. The public facility plan shall consider the relationships between facilities in providing for development.

(3) Anticipated timing provisions for public facilities are not considered land use decisions as specified in ORS 197.712(2)(e), and, therefore, cannot be the basis of appeal under ORS 197.610(1) and (2) or 197.835(4)."

"Short term" is the period from year one through five of the plan. "Long term" is the period from year six through the remainder of the planning period. Although the City is not bound by these estimated timing obligations and they cannot be a basis for seeking review at LUBA, they should be included.

Other provisions in the rule that may be germane to the City's review and adoption provide that the plan needs to identify only the "general location of the public facility project in specificity appropriate for the facility." The assumption is that the location of projects identified in the short term can be more specific than those projects identified for the long term. Further, it is "anticipated that locations for public facilities may require modifications based on subsequent environmental impact studies, capital improvement programs, or land availability." OAR 660-011-0030. The plan need not be modified in the event that there are modifications to a project that "do not significantly impact the project's general description, location, sizing, capacity, or other general characteristic of the project." OAR 660-011-0045. In other words, variations in line alignment are anticipated.

Finally, "rough cost estimates" are "approximate costs expressed in current-year (year closest to the period of public facility plan development) dollars. It is not intended that project cost estimates be as exact as is required for budgeting purposes." OAR 660-011-0005(2).

In summary, the City has an obligation under state law and Goal 11 to serve areas within an urban growth boundary based on densities and development patterns identified in the City's Comprehensive Plan. This obligation includes identification of existing deficiencies, future demand, estimated costs, the estimated timing for construction of each facility and possible funding mechanisms. The draft plan largely complies with these requirements and with the inclusion of some timing requirements will fully satisfy Goal 11.

Pete Walter

From: Paul Edgar [pauloedgar@qwest.net]
Sent: Wednesday, January 26, 2011 1:57 PM
To: Pete Walter; Tom Geil - Chair CIC
Cc: William Gifford; Nancy Kraushaar; John Burrell; David Frasher; Doug Neeley; Howard Post - Canemah
Subject: Re: LE 10-02 Water Master Plan Update - Email Transmittal

Some of what maybe outlined in the plan for Canemah, may not be applicable in today's world. Could this be true for other areas?

How we cover the cost of growth in SDC's collections and fees for water and sanitary/storm sewer must be accurately reflected in what is being shown, are they?

What is the detail for each encumbered fund account, with short and long term projections? How do we pay for all of this?

Each neighborhood should go through these plans/projections. Neighborhood "Town Hall Meetings"?

The implication are too great and this is a lot of money. There should be NO rush of this!

My thoughts.

Paul

On 1/21/2011 11:59 AM, Pete Walter wrote:
Dear CIC and all Neighborhood Association representatives:

COMMENTS DUE BY: **Please provide written comments two weeks in advance of the hearings** for inclusion in the staff report, however, comments will be accepted until the close of the Public Hearings.

HEARING DATE: Type IV – March 14, 2011 (Planning Commission) & April 6, 2011 (City Commission)

HEARING BODY: __Staff Review; _**X**__PC; _**X**___CC

IN REFERENCE TO Oregon City Water Master Plan Update

FILE # & TYPE: LE 10-02 (Legislative)

PLANNER: Pete Walter, AICP, Associate Planner (503) 722-3789

APPLICANT: Oregon City Public Works – Attn. John Burrell

REQUEST: The Applicant Requests Approval of an Update to the City's Adopted Water Distribution System Master Plan, an Ancillary Document to the Adopted Oregon City Comprehensive Plan (2004).

LOCATION: City-Wide

This application material is referred to you for your information, study and official comments. If extra copies are required, please contact the Planning Department. Your recommendations and suggestions will be used to guide the Planning staff when reviewing this proposal. If you wish to have your comments considered and incorporated into the staff report, **please return the attached copy of the Transmittal form** to facilitate the processing of this application and ensure prompt consideration of your recommendations.

Thanks,

Pete Walter

Pete Walter, AICP, Associate Planner
pwalter@orcity..org
Community Development Department
Planning Division
221 Molalla Avenue, Ste. 200
Oregon City, Oregon 97045
503-496-1568 Direct
503-722-3789 Front Desk
503-722-3880 Fax
Website: www.orcity.org

Need an answer? Did you know that our website can help you 24-hours a day, 7-days a week? Online, you have access to permit forms, applications, handouts, inspection results, codebooks, info on permits applied for since 2002, inspection information, application checklists, and much more. You can request inspections online, and if you are a contractor, you can even apply for permits online.

Zoning and other Tax Lot Information - Quickly and easily view, print, and save maps and reports of your property.
Property Zoning Report
Online Mapping is available at OCWebMaps

=======
Email scanned by PC Tools - No viruses or spyware found.
(Email Guard: 7.0.0.21, Virus/Spyware Database: 6.16770)
http://www.pctools.com
=======

Pete Walter

From:	Paul Edgar [pauloedgar@q.com]
Sent:	Monday, October 10, 2011 11:00 AM
To:	Pete Walter; Tony Konkol; Nancy Kraushaar
Cc:	David Frasher; Doug Neeley; James Nicita; Rocky Smith, Jr.; Kathy Roth; Betty Mumm; Howard Post - Canemah; Tom Geil - Chair CIC
Subject:	Planning Commission Meeting, please distribute this to the Planning Commission in advance of tonight's meeting

I hope I still have some friends on the Planning Commission, to where I can talk frankly!

Back this last January, I sent an email to Peter Walters asking some questions and apparently they are going to be discussed as part of this hearing. They were Global in nature and I believed that they needed to be aggressive in their Goal One outreach/review out into the neighborhoods.

Why aggressive? From what I was seeing, just with my understanding of Canemah, the recommendations being made and reflected in their Map, Figure ES-2, show a lot of future potential infrastructure that is not needed and/or may not be justified. I will go into that in detail tonight. This area identified is mostly park lands, in Canemah proper with all residential development precluded. It is like someone looked at map and said that this property is within the City Limits and it does not have water pipes to it, without understanding on the ground considerations. That to me is scary!

Please note my next question was on the big world of SDC's and getting enough money brought in from SDC/Growth to pay for growth, with those who create growth and where those who are hanging on by their nails are not paying for something that should not be their problem. Table 9-8, SDC Fund Historical Data, shows balances going up, even with significantly SDC Revenues. Notice the reduced, interest income?
Should we be considering increasing these fees based on the needs analysis associated with our requirements to meet projected growth within UGB more so then within the City limits of Oregon City? Are we forecasting correctly the future growth based on the realities, now as we see that the electorate is not approving annexations. Should we be considering special taxing districts that more localize the cost of growth of facilities/infrastructure to those who create the demand/need.

We will have a lot of people attempting to "Age in Place" and we have disproportionately higher percentage of these citizenry in Oregon who are attempting to: "Age in Place". Any time the cost of services goes up, this can have devastating and rippling effect on our senior population. We know that the cost of Water in rates, Sewer in rates Storm Sewer in rates, Street/Roads Maintenance in rates, Garbage in rates, Property Taxes in automatic adjustments, Electricity in rates and now a forecasted doubling of Medicare in 2014, will make extremely difficult for seniors to age in place in Oregon City. We have to think about the effect of all of what is being planned with the cost on mankind.

I know we have and Elephant in the Closet, with the possibility of a "Rate Roll Back in 2014/2015, without a understanding of what in reality will happen.

I also see where we are extracting large amounts of money from our "Table 9-3, Historical Water Fund Revenue" for the building of a potential new Public Works Compound/offices. This should stop and with what I am seeing this redirection can come to rest on our seniors attempting to "Age in Place". There backs will not be able to take what is be planned and projected within the Water Master Plan. Any monies that are in this Public Works, Building Reserve Encumbered Account, transferred from Historical Water Fund Revenue debt-ed back to reduce contingencies in this fund.

In "Table 9-7, Projection Scenario 3 - Sustainable System Investments"
based on what I see just with Canemah investments, that to me cannot be justified, it brings a lot questions on most everything that is being
talked about as part of these , "Sustainable System Investments". Then
above and beyond, is who pays and are there more responsible approaches that more accurately place the burden on those who create the need.

I ask you all to please think smart.

Paul Edgar, Land Use Chair
Canemah Neighborhood Association

Clackamas River Water

P.O. Box 2439
Clackamas, Oregon 97015-2439
(503) 722-9220
Fax (503) 656-7086
16770 SE 82nd Drive, Clackamas
customerservice@crwater.com

April 18, 2011

Mr. Tony Konkol, Community Development Director
City of Oregon City Planning Department
221 Molalla Avenue, Suite 200
Oregon City, OR 97045

RE: Notice of and Hearing for Update of Water Distribution System Master Plan for L 10-02;Clackamas River Water ("CRW") Water Master Plan Response

Mr. Konkol:

This letter contains CRW's comments to support CRW's request that the application for the above referenced updated master plan should be deemed incomplete by the City. CRW is a domestic water supply district organized under ORS Chapter 264 and is therefore a necessary party to this proceeding.

This filing is CRW's initial comments concerning the proposed update of Water Distribution System Master Plan (L 10-02) for Oregon City. These comments are related to the three major work products that resulted for the updated water master plan.

- The Diurnal Curve development Technical Memorandum
    - **CRW Response** : No Comment
- The recommended Capital Improvement Program (CIP) for the City's existing and future water system including renewal and replacement pipeline projects.
    - **CRW Response:** Based on Figure ES-2, the map indicated several essential transmission mains that are currently owned and operated by CRW appear to be incorporated into the City future distribution system. These transmission mains will remain critical to the continuation of operations of CRW. If service is provide by the City in these proposed expanded areas we should mutually agree to negotiate a service agreement, similar to what we have done in other areas of the distribution system.

      The City's updated Master Plan has not yet been communicated with CRW. Absent such communication we run the risk of developing and maintaining dual mains within common service areas and possible duplication of storage requirements.
    - It should be noted that Figure ES-2 does not include the boundaries of the Urban and Rural Reserves. These boundaries are critical in long term planning for water for both the City and CRW. Areas such as Henrici Road, the Park Place Concept

Plan area, Barlow Crest/Forsythe are all within the boundaries as outlined in the IGA between Metro and Clackamas County. These areas need to be closely coordinated to provide water service at the most reasonable cost.

- The financing plan addresses implementation of the recommended CIP. It is our understanding that the 1996 city charter requires the rates to be rolled back to pro-bond levels once the bonds are paid, which will occur in the Fiscal Year 2014-15. It is also our belief that the City is required to address this requirement before any long term water fund planning can realistically be established.
    - **CRW Comment:** It appears that the City may have future financing issues related to water improvements. Both the City and CRW would benefit financially if common use of facilities could be determined as part of the long term plan to service.

      In addressing the financial criteria required for future infrastructure the City may want to consider whether the Water Master Plan will eliminate or avoid unnecessary duplication of services between our respective entities.

While this list is a partial list of comments, CRW will also reserve the right to raise additional issues that are not, and cannot be, adequately addressed until a final copy of the master plan is development and provided for CRW's review.

It is understood that annexations and service boundary withdrawals are not covered in the water master plan. In working with the City's City Engineer/Public Works Director both the City and CRW are in the process of bringing this issue to a discussion level. These discussions will need to address assumption of liabilities and indebtedness as provided under ORS 222.520.

While CRW would like to support this update of Water Distribution System Master Plan, it cannot do so at this time because of the issues discussed above. CRW is confident that through continued discussions with the City's City Engineer/Public Works Director these issues will be resolved. Both the City and CRW are planning and budgeting toward this end. If the City has any questions or need additional information concerning our comments, please do not hesitate to contact me (503-722-9240) or CRW's District Engineer, Bob George (503-722-9248)

Very truly yours,

Lee E.

Lee E. Moore, Sr.
General Manager

cc: Bob George
Dean M. Phillips
Nancy Kraushaar

OREGON CITY

Public Works

625 Center Street | Oregon City OR 97045
Ph (503) 657-0891 | Fax (503) 657-7892

TO:	Pete Walter and Planning Commission
CC:	Nancy J.T. Kraushaar, P.E., City Engineer/Public Works Director
FROM:	John Burrell, Project Manager
DATE:	October 6, 2011
SUBJECT:	Water Master Plan Update, comments received from Clackamas River Water (CRW)

As part of the update to the City's Water Master Plan, public comments about the document were solicited. The following are the comments received from CRW and the City's response to these comments.

CRW comment #1:

Comment: CRW Response: Based on Figure ES-2, the map indicated several essential transmission mains that are currently owned and operated by CRW appear to be incorporated into the City future distribution system. These transmission mains will remain critical to the continuation of operations of CRW. If service is provided by the City in these proposed expanded areas we should mutually agree to negotiate a service agreement, similar to what we have done in other areas of the distribution system.

The City's updated Master Plan has not yet been communicated with CRW. Absent such communication we run the risk of developing and maintaining dual mains within common service areas and possible duplication of storage requirements.

City Response:

As areas are annexed to the City, an analysis by CRW will be needed to determine if existing CRW mains are needed by CRW or if ownership of these can be transferred to the City. Such transfers will need to be negotiated. We agree that communication between CRW and Oregon City is important to ensure efficient service to the users and we plan to work with CRW on a case by case basis. The Water Distribution System Master Plan provides a template of how areas can be served with the Oregon City system. Details for any given annexation will need to be negotiated with CRW.

CRW comment:

Comment: It should be noted that Figure ES-2 does not include the boundaries of the Urban and Rural Reserves. These boundaries are critical in long term planning for water for both the City and CRW. Areas such as Henrici Road, the Park Place Concept Plan area, Barlow Crest/Forsythe are all within the boundaries as outlined in the IGA between Metro and Clackamas County. These areas need to be closely coordinated to provide water service at the most reasonable cost.

City response:

Planning for the Urban and Rural Reserves is far enough in the future that we anticipate several updates of the Master Plan before these areas become part of the Urban Growth Boundary. This master plan addresses areas within the current Urban Growth Boundary. We agree with CRW that service to these areas will need to be coordinated to ensure efficient service.

CRW comment:

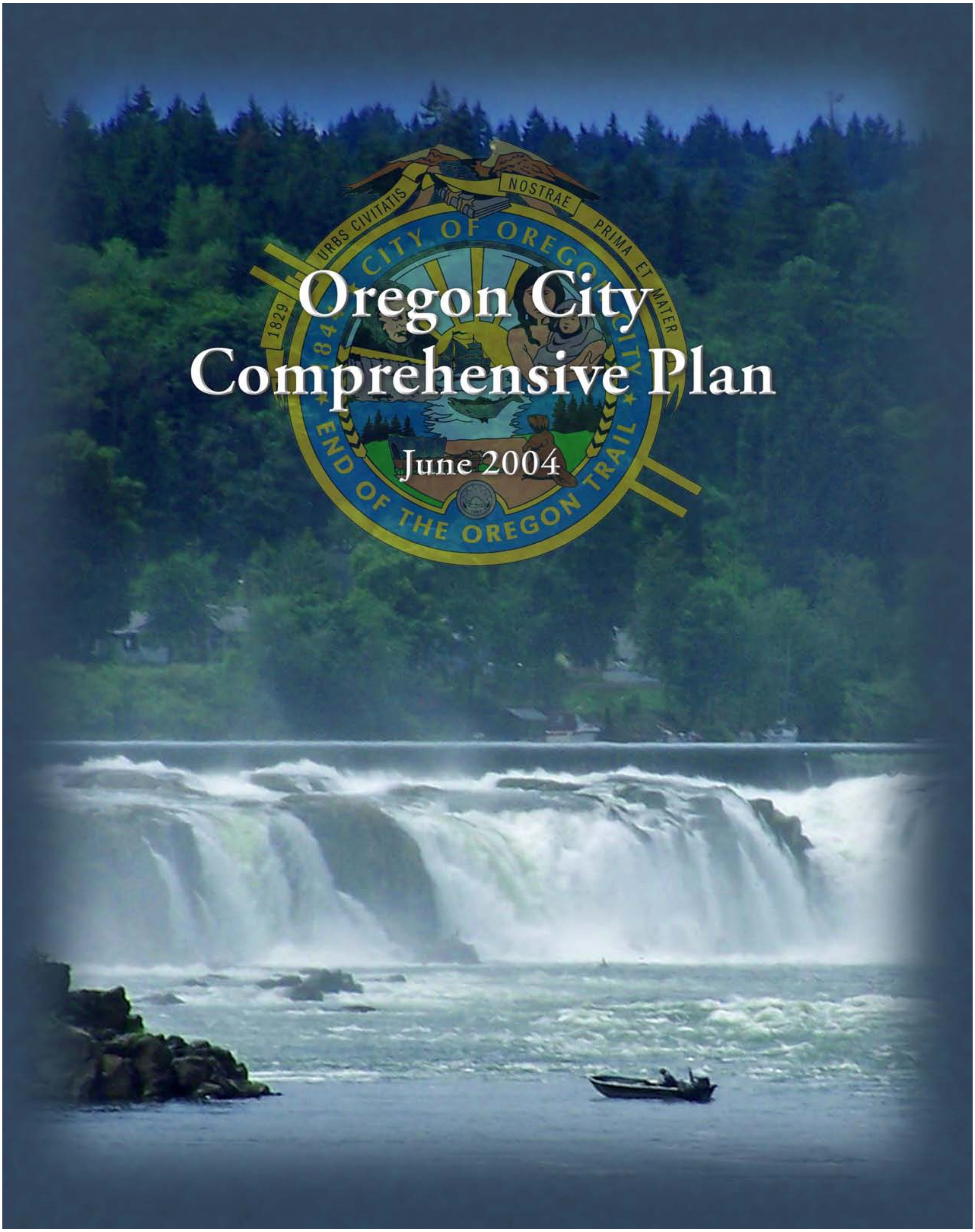
Comment: It appears that the City may have future financing issues related to water improvements. Both the City and CRW would benefit financially if common use of facilities could be determined as part of the long term plan to service.

In addressing the financial criteria required for future infrastructure the City may want to consider whether the Water Master Plan will eliminate or avoid unnecessary duplication of services between our respective entities.

City response:

We agree with CRW that common use of facilities should be explored and negotiated for the benefit of all system users. A case-by-case assessment will be needed as specific areas are annexed to the City. The Master Plan provides a system-wide overview of how the City can serve the area using the City’s standards for water service. Any efficiency that can be achieved through cooperation with CRW can be pursued for the benefit of all system users.

Oregon City will continue to cooperate with CRW and negotiate as appropriate. The Water Distribution System Master Plan provides the City with the basic information on needed infrastructure which does not preclude pursuit of efficiency and negotiation.


Oregon City
Comprehensive Plan
June 2004
URBS CIVITATIS
NOSTRAE
PRIMA ET MATER
1829
CITY OF OREG
END OF THE OREGON TRAIL

City Boards and Staff Acknowledgements

City Commission	Alice Norris, Mayor Tom Lemons, Commission President Doug Neeley, Commissioner Bob Bailey, Commissioner Gary Hewitt, Commissioner
Planning Commission	Linda Carter, Chair Dan Lajoie, Vice Chair Renate Mengelberg Lynda Orzen, First City Tim Powell, Citizens Involvement Committee Council
Citizens Involvement Committee Council	Julie Hollister Rick Winterhalter (Former Chair)
Planning Staff	Dan Drentlaw, Community Development Director Tony Konkol, Senior Planner Sean Cook, Associate Planner Christina Robertson-Gardiner, Associate Planner David Knoll, GIS Chris Dunlop, GIS William Kabeiseman, Assistant City Attorney
Consultant Team	Gillian Zacharias, David Evans and Associates, Inc. Chris Cocker, David Evans and Associates, Inc. Laura Hudson, David Evans and Associates, Inc. Alex Dupey, David Evans and Associates, Inc. Richard Friday, David Evans and Associates, Inc. Aaron Turecek, David Evans and Associates, Inc. Ed Murphy, Ed Murphy & Associates
Citizen Technical Advisory Committee	Tim Powell, Citizen Involvement Committee Council (CICC) Rick Winterhalter, Citizen Involvement Committee Council (CICC) Linda Carter, Planning Commission Renate Mengelberg, Planning Commission Lynda Orzen, Planning Commission/First City Jerry Herrmann, Environmental Interests Brenda Bernards, Metro – Land Use John Kluken, Commerce/Industry Bill Taubman, Commerce/Industry Gloria Lewton, Low Income Housing Betty Schaafsma, Transportation Advisory Committee Adam Kendall, Youth/Oregon City High School Student Roberta Herndon, Oregon City School District Les Smelser, Private Developer

Oregon City Comprehensive Plan

June 2004

City of Oregon City Planning Department
P.O. Box 3040
320 Warner-Milne Road
Oregon City, Oregon 97045
503-657-0891
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Introduction

This document represents the first major revision of the 1982 *Oregon City Comprehensive Plan*. From 2002 to 2004, many, many citizens dedicated hundreds of hours assisting the City Commission, Planning Commission, and City staff revise the plan and the City Development Code (Title 17 of the *City of Oregon City Municipal Code*). The effort included several open houses, many work sessions, and several well-attended public hearings. The plan reflects the comments, suggestions, and vision of Oregon City residents and expresses that vision in its land-use policies, regulations, and map designations.

Oregon City's Comprehensive Plan and implementation ordinances must comply with applicable Statewide Planning Goals adopted by the Land Conservation and Development Commission as the result of a 1973 state law. The plan must also comply with the relevant portions of Metro's 1998 *Urban Growth Management Functional Plan*.

The plan is intended to do more than simply meet the requirements of the law, however. The City Commission firmly believes that the plan is necessary to protect and maintain the quality of life and social and economic vitality of the community. The City Commission understands that good planning is necessary to ensure that land resources are thoughtfully and efficiently used, that public services are cost-effective and adequate, that natural and historic resources that help define the city's character are protected and preserved, and that citizens will have continuing influence on the on-going decisions about the growth and development of their community.

Statements of Principle

Oregon City's Comprehensive Plan is founded on a number of principles, which shape the City Commission's vision for the future growth and development of the city. The principles help determine the scope of issues, concerns, and actions that will guide development, and they are reflected in the plan's goals and policies.Statements of these principles, listed below, are not legally binding. They are instead intended to help citizens understand the kind of city this plan will help to achieve.

Promote sustainability and sustainable development. Images of the Earth taken from space in the late 1960s helped awaken people to the fact that the Earth's resources are finite. The City Commission agrees with citizens who believe it is incumbent on the City of Oregon City to use its land, water, and air resources in a sustainable manner, which means meeting the city's social, environmental and economic needs in a way that benefits all citizens but does not undermine the ability of future generations to meet their needs. This is the essence of sustainable development. Taken together, the policies in the Oregon City Comprehensive Plan will enhance the likelihood of a sustainable community but cannot guarantee it. Land-use decisions will be made with the concept of sustainability in mind to ensure that development enhances the long-term quality of life in Oregon City.

Contain urban development. Accommodating population growth while controlling the spread of development into surrounding rural resource lands is one the city's greatest challenges. The effects of suburban sprawl cause or contribute to a wide variety of economic and social losses, dislocations, environmental degradation, and ultimately, loss of civic identity. The City Commission strongly supports containing urban sprawl within a defined geographic extent of the city as it is in the best long-term interest of the citizens of Oregon City. Containment will promote redevelopment within older areas of the city, promote transportation alternatives, conserve and protect the rural lands surrounding the city, and help promote the identity of the City of Oregon City. Specifically, the Commission declares that the future southern limits of the City of Oregon City should extend no farther south than the northern edge of the steep topography of the Beavercreek canyon drainage and that the area to the south should remain rural.

Promote redevelopment. Oregon City's history is important to the culture, economy, and civic identity of the community. Redevelopment and restoration of historic structures and neighborhoods are increasingly embraced as necessary and desirable to maintain these values. Redevelopment of older and underutilized areas within the city makes efficient use of land and existing public services, protects the city's historic character, avoids sprawl into surrounding rural areas, and facilitates economic development. The City Commission will promote redevelopment through land-use policies and by making public investments in deteriorated public facilities and underutilized areas of the city, using Urban Renewal funding and other mechanisms.

Protect natural resources. The City of Oregon City contains abundant, diverse, and unique natural resources that contribute to the quality of life, help define the city's identity, and provide great enjoyment for residents. The most obvious of these resources are the Willamette River and its thunderous falls, the Clackamas River, Newell Creek canyon, and the steep cliffs and bluffs over which the city is draped. However, many other resources are present: small streams, wetlands, wooded areas and oak savannahs, views of the Cascade Mountains, and abundant fish and wildlife, including salmon, sturgeon, deer, ospreys, and bald eagles. The City Commission strongly supports protecting these many natural resources and is committed to measures to ensure that these resources are secure even as development proceeds within the city.

Foster economic vitality. Oregon City was once an economically prosperous city built on abundant timber and agricultural resources, cheap energy from the Willamette Falls, and ready transportation by river and rail. Today, Oregon City lacks a strong manufacturing and commercial economic base, which could provide residents with local jobs, build investment in the community, and support a strong tax base for city services. The City Commission will use this land-use plan to encourage and support sustainable economic development and promote and enable job creation. The commission has identified several areas within the city and Urban Growth Boundary that are designated for job creation as a top priority.

Provide efficient and cost-effective services. Water, sewer, fire protection, police services, streets, storm drainage, and other public services are directly affected by land-use decisions. This plan ensures that land-development decisions are linked to master plans for specific services such as water or sewer and to capital improvement plans that affect budgets and require taxes to build. The City Commission believes that citizens are economically well-served through compact urban form, redevelopment of existing areas, and public investments (for example, street improvements) that are carefully tied to private investments when development occurs.

Ensure a sense of history and place. The historical character of Oregon City is one of its defining features while its pivotal role in the great westward movement of the United States is the city's most profound legacy. The city's geographic setting is powerful. These are values that long-time residents cherish and new residents feel. The commission is committed to protecting and enhancing the city's strong sense of history and defined sense of place. These values will be respected and accounted for in development and land-use decisions.

Plan Contents

The Oregon City Comprehensive Plan is divided into 15 sections. The number of the section is the same as the Land Conservation and Development Commission (LCDC) Statewide Planning Goal the section is intended to show compliance with. Each section begins with background information, followed by goals and policies. A glossary of key terms is at the end of the document.

Goals and policies are official statements from the City Commission that provide standards for applying land-use plan designations to real property and making decisions about specific development. Because this plan is by law and necessity a comprehensive land-use plan, there is no hierarchy implied in the order of the sections and none of the goals or policies has priority except as stated in particular policies. When used to make decisions, all relevant goals and policies must be accounted for and considered.

Implementing the Plan

The Oregon City Comprehensive Plan is implemented through City Codes, ancillary plans, concept plans, and master plans.

City Codes are enforceable, detailed regulations regarding land use, land development, protection of natural resources, building design, traffic management, etc. For land use, City Codes particularly emphasize the City Zoning Ordinance, which lists specific standards for uses of land in the city; Subdivision Ordinance, which provides standards and regulations for new subdivisions and other land development; and related ordinances for issues such as steep slopes, tree cover, historic review, and site design or architectural design standards. The City Commission is responsible for adopting all code.

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.

Concept plans are land-use plans for areas of the city that have just been included in the Urban Growth Area. Before these areas can be zoned or subdivided, a concept plan must be completed and adopted by the City Commission and accepted by Metro. Concept plans require a detailed assessment of the area to determine the most appropriate intensity and type of land use, and when completed, are adopted as part of the comprehensive plan.

Master plans are required for large, phased development proposals for institutional uses such as the health services district around Willamette Falls Hospital. Master plans are intended to accommodate a variety of land uses types and address community factors at a neighborhood scale.

Section 1

Citizen Involvement

I know no greater depository of the ultimate powers of society but the people themselves. And if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their indiscretion through education. That is the true corrective of abuses of constitutional power.

— Thomas Jefferson

This section is intended to show compliance with Land Conservation and Development Commission (LCDC) Statewide Planning Goal 1, Citizen Involvement, which requires local governments "to develop a citizen involvement program that insures the opportunity for citizens to be involved in all phases of the planning process." The Citizen Participation Goal in the 1976 *Land-Use Policies for Oregon City* is to "provide an active and systematic process for citizen and public agency involvement in the land use decision-making for Oregon City." The goal is based on the philosophy that a neighborhood program would provide the best means for citizens to become involved in the planning process.

Recognizing the importance of providing citizens with opportunities to be informed about, and involved in, the planning process, Oregon City established a Citizen Involvement Program in the 1980s. The program has two major components: neighborhood associations and a Citizen Involvement Committee (CIC). The CIC is the officially recognized citizen advisory committee to meet LCDC Statewide Planning Goal 1, and as required by Goal 1, is responsible for developing, implementing, and evaluating the Citizen Involvement Program. The CIC coordinates and communicates various aspects of citizen participation in the community and advises the City Commission, the Planning Commission and other planning and advisory bodies. The City Manager provides a City Liaison, and the Public Affairs Manager provides staff assistance. The overall goal of the CIC is to help improve the quality of life in Oregon City.

Prior to beginning the Comprehensive Plan update in the spring of 2002, the CIC revised the citizen involvement procedures for Oregon City. The CIC developed a five-year strategic plan (*Citizen Involvement Program Five-Year Strategic Plan*, 2002), which includes a mission statement, vision, values, roles and responsibilities; wrote bylaws, approved by the membership on January 11, 2000; and wrote a Citizen Involvement Handbook. The documents were developed over three years by the entire CIC, which consisted of the elected leadership of the City-recognized neighborhood associations in Oregon City.

The five-year strategic plan and bylaws were written to comply with the intent of LCDC Statewide Planning Goal 1, which requires citizens to be involved in all aspects of land-use planning and other livability issues.

The CIC serves the area within the current legal city limits and all areas of impact within the current Urban Growth Boundary such as county islands within the neighborhood association boundaries; areas of the county adjacent to recognized neighborhood associations; and areas of the county not adjacent to a recognized neighborhood association but within the Urban Growth Boundary and not represented by a county-recognized neighborhood association (called Community Planning Organizations or CPOs).

In February 1999, the City sponsored a meeting to evaluate a proposal for a "visioning process" and how the city might benefit from the undertaking. At the meeting, it was concluded that the process could work if properly structured with realistic "visions" that could be accomplished by volunteers working with the community; government, medical community, educational leaders, and business organizations. From that meeting, the First City's Future Initiating Task Force was created.[1] The task force then developed a strategy to create a vision for Oregon City.

In November 2000, the task force held its first community-wide open house, which was attended by 125 community members and City staff. From that meeting, a vision statement emerged that brought forward shared common goals for the future of Oregon City (*First City's Future, Visioning Project, Phase 1 Report*, 2001). The visioning process is an ongoing project and needs to be updated periodically. A successful visioning process is a constant, dynamic process that must be initiated and maintained by the community. The First City's Future Initiating Task Force visioning effort represented a major citizen participation project.

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

[1] "First City" is a reference to the fact that Oregon City was the first incorporated town west of the Rockies and the seat of the first provisional government of the Oregon Territory.

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, 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.

Policy 1.2.1
Encourage development and refinement of CIC and neighborhood association bylaws that will govern the groups' formation and operations.

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.

Policy 1.3.1
Encourage training of volunteers involved with the CIC and neighborhood associations.

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.

Policy 1.5.1
Support the CIC in initiating and planning events in cooperation with the City on issues of mutual interest. Topics may include such things as working with local schools regarding citizen involvement and stakeholders involved with Comprehensive Plan development and Urban Growth Boundary expansion.

Goal 1.6 CIC Continuous Development

Support the CIC's team spirit and dedication to community involvement to ensure continuous improvement.

Policy 1.6.1
Assist the CIC in finding funding for the Community Involvement Program's current and future development.

Policy 1.6.2
Support an Annual Leadership Development Conference for CIC members, to include updating the CIC strategic plan, if funding is available.

Goal 1.7 Neighborhood Plans

Adopt neighborhood plans that encompass a broad range of concerns for each neighborhood over a five- to ten-year period as refinements of the Oregon City Comprehensive Plan.

Policy 1.7.1
Ensure that neighborhood plans are consistent with the Comprehensive Plan.

Policy 1.7.2
Provide opportunities for property owners, residents, and businesses within the neighborhood to be involved in all phases of the preparation of a neighborhood plan.

Policy 1.7.3
Use the neighborhood plans to make recommendations to city boards, commissions, and agencies regarding public improvements and land-use decisions.

Goal 1.8 Advisory Committees

Establish and support citizen advisory committees and commissions.

Policy 1.8.1
Identify the areas of City government in which the counsel of a formal citizen advisory committee or commission is warranted if funding is available to provide appropriate staff support.

Policy 1.8.2
Solicit and support citizen participation on citizen advisory committees and commissions. Identify desirable expertise from the Portland metro area as needed to best serve the interests of Oregon City.

Section 2

Land Use

Land Conservation and Development Commission (LCDC) Statewide Planning Goal 2, Land Use Planning, establishes a land-use planning process and policy framework with which local Comprehensive Plans must comply. Another influence on local plans in the Portland metropolitan area is *Metro's 2040 Growth Concept* (1995), which defines regional growth and development, including a vision for Downtown Oregon City as a Regional Center.

We abuse the land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.

— Aldo Leopold,
A Sand County Almanac,
1949

This section of the Comprehensive Plan contains the City's land-use planning goals and policies, consistent with state and regional requirements. Oregon City's Comprehensive Plan Land-Use Map (Appendix A) shows the established land-use designations. Other relevant documents are the *Oregon City Waterfront Master Plan* (2002) and *Oregon City Downtown Community Plan* (1999), which will help revitalize the residential aspects of Downtown and the Clackamette Cove area and to implement the Regional Center vision for Downtown.

The Comprehensive Plan and Land-Use Map are used to guide land uses and development in the city. The map shows geographic areas that have been designated for general land uses in accordance with the Comprehensive Plan. The map also shows the general development pattern of the city and indicates which areas are best suited for residences, commercial, office, and industrial uses, and which areas should be left undeveloped.

State and Metro Requirements

[The city planning process] should undertake to develop principles ... [that] should be constructed into policies that will ensure that the resources of the city, site, and artifacts, are recognized as values and determinants of form, both in planning and the execution of works. Rio differs from Kansas City, New York from Amsterdam, and Washington [D.C.] from all of them, for good and sufficient reasons. They lie, at base, in the geological history, climate, physiography, soils, plants and animals that constitute the history of the place and the basis of its intrinsic identity.

— Ian McHarg, Design with Nature, 1969

Comprehensive plans in Oregon must comply with the land-use planning process and policy framework established by LCDC Statewide Planning Goal 2. The goal requires land-use plans to identify issues and problems, conduct inventories of land, create policies, and implement ordinances to achieve applicable statewide planning goals. A primary focus of statewide land-use planning has been to require the efficient use of existing urban land to protect against unnecessary urban encroachment into prime agricultural and forest land.

In the mid-1990s, Metro adopted the *Regional Urban Growth Goals and Objectives* (RUGGO), which is part of the *Regional Framework Plan* (1997) and includes *Metro's 2040 Growth Concept* (1995). RUGGO was developed to implement regional compliance with state goals for land use in a coordinated way and to ensure that housing and employment growth could be accommodated equitably across the region. The *Urban Growth Management Functional Plan* (1998), or UGMFP, implements RUGGO and contains several requirements for local implementation.

Metro's 2040 Growth Concept requires cities and counties to draw boundaries for each of the design types as defined in Title 1 of the UGMFP. The design types correspond to the general boundaries shown in *Metro's 2040 Growth Concept* map (Appendix B). Design types applicable to Oregon City are Regional Centers, Industrial Areas, Corridors, Inner Neighborhoods and Outer Neighborhoods. Design types are defined in the glossary and shown on Oregon City's Comprehensive Plan Land-Use Map (Appendix A).

Regional Centers serve large market areas outside the central city and have connections via high-capacity transit and highways. Metro has designated Oregon City as one of nine Regional Centers. Molalla Avenue, 7th Street, Beavercreek Road, and Highway 99 are identified as Corridors, which are intended to feature a high-quality pedestrian environment, convenient access to transit, and somewhat higher than current densities. A boundary between Inner and Outer Neighborhoods was drawn to distinguish residential areas with smaller lot sizes and more access to jobs and neighborhood businesses from residential areas with larger lot sizes that are farther from large employment centers. Industrial Areas are areas set aside primarily for industrial activities with limited supporting uses.

Oregon City's Comprehensive Plan

The Comprehensive Plan is the principal land-use planning ordinance and the City's controlling land-use document. It establishes the City's legal record of policy on land use and other development and conservation issues. As a land-use planning document, the Comprehensive Plan represents a future, desired vision of Oregon City.

All cities and counties in Oregon are required to prepare and adopt a fully developed Comprehensive Plan that addresses statewide goals. Oregon City must also comply with the relevant portions of Metro's *Urban Growth Management Functional Plan* (1998), or UGMFP. The UGMFP is a regional land-use plan that implements *Metro's 2040 Growth Concept* (1995). The previous Oregon City Comprehensive Plan was acknowledged by the state in 1982.

In 1999, the goals and policies from the *Oregon City Downtown Community Plan* (1999) were added to the 1982 Comprehensive Plan. The goals and policies have been incorporated in the Economic Development and Housing sections of this Comprehensive Plan (Sections 9 and 10, respectively). The *Downtown Community Plan* in its entirety (Phase 1) is considered ancillary to the Comprehensive Plan.

Efficient Use of Land

Mixed uses and promotion of infill and higher density redevelopment encourage more efficient land use. Regional Centers serve large market areas outside the central city and are connected to the city by high-capacity transit and highways.

Separating residential, commercial, and industrial activities was a major trend beginning in the early twentieth century; cities tried to prevent incompatible uses from creating problems for both citizens and businesses and to allow outward expansion without considering the cost in terms of loss of vibrancy in downtowns or loss of resource lands. The trend has now shifted to include more mixed uses and more intensive development where appropriate. For example, retail and residential uses in central business districts can greatly enhance the safety, livability, and vibrancy of an area.

Policies that comply with other UGMFP requirements, such as minimum density standards, residential and job capacities, and protection of employment areas, are addressed in this section, in Section 9, Economic Development, and in Section 10, Housing.

Downtown and Corridor Redevelopment

Metro's 2040 Growth Concept (1995), as discussed above, includes the Regional Center and Corridor design types for Oregon City. The *Oregon City Waterfront Master Plan* (2002), *7th Street Corridor Design Plan* (1996), *McLoughlin Boulevard Enhancement Plan* (in progress), and *Oregon City Downtown Community Plan* (1999) will help revitalize the residential aspects of Downtown and the Clackamette Cove area, and implement a vision of the Downtown area as a Regional

Center. New policies to implement the Downtown community and waterfront master plans have been developed and are listed at the end of this section.

Transit corridors are designated with the new Mixed Use Corridors (MUC) district to encourage somewhat more intensive and mixed-use development than exists, creating more efficient land-use and travel patterns. The MUC designation is intended to implement Metro's vision of the Corridor design type.

Residential Development

Because neighborhood livability depends largely on good design and the efficient use of land, policies and action items should call for evaluating development standards and for developing incentives to ensure that new development contributes to the city's livability.

The City recognizes neighborhoods as the essential building blocks of a livable city. Neighborhoods and specific places within them give people an orientation, sense of history, community, and "groundedness." A place may be a feature such as a large public clock Downtown where people meet before going to lunch or a bench near the edge of a bluff with a great view. Place-making adds to the quality of life for a community. As the city grows, existing places should be protected and opportunities for creating new, special places explored.

Commercial Land Use

Policies that encourage neighborhood commercial uses are presented in this section as part of the City's desire to create more efficient land-use and travel patterns. However, retail uses are discussed in more detail in Section 9, Economic Development. Because several areas of the city lack convenient, small-scale neighborhood commercial centers that would reduce the distances residents must travel to obtain essential goods and services, policies that allow and encourage such development have therefore been adopted and are part of this Comprehensive Plan.

Retail Business

Retail outlets and shopping areas are commonly classified by how much square footage they occupy, the types of private investment, the size of their market, and the type of commercial service provided. Classifications include Neighborhood Retail Centers, Community Retail Centers, and Regional Retail Centers. These classifications, described below, are critical for ensuring that the scale of commercial development and level of services are compatible with their locations. For example, some neighborhoods are underserved by Neighborhood Retail Centers.

Neighborhood Retail Center. This provides convenience goods (foods, drugs and sundries) and personal services (laundry, dry cleaning, barbering, shoe repair) for the day-to-day needs of the immediate neighborhood. Size may range from 30,000 to 100,000 square feet.

Community Retail Center. This provides a wider range of facilities with a greater variety of merchandise. Many are built around a junior department store, variety store or discount department store as the major tenant. Others are built around multiple anchors in power centers or super community centers. Size may range from 100,000 to 300,000 (or more) square feet.

Regional Retail Center. This provides general merchandise, apparel, furniture and home furnishings in depth and variety, as well as a range of services and recreational facilities. It is built around one or two full-line department stores of generally not less than 75,000 square feet. Size may range from 250,000 to 900,000 square feet. A Regional Retail Center provides services typical of a business district but is not as extensive as the larger Super Regional Center, which may include aspects of big box development (industrial-style, stand-alone retail, typically with 20,000 to 200,000 square feet and 3 stories or height of 30 feet).

Industrial Land

There is often pressure to convert industrially zoned land to easily developable sites and other uses. The goals of the City are to protect existing industrial land from conversion, where appropriate, to annex industrial land and expand the Urban Growth Boundary to add urbanizable industrial land to the inventory, and to ensure that public facilities can serve future development.

Planned Land-Use Types

As the official long-range planning guide for land-use development in the city by type, density and location, the Oregon City Comprehensive Plan and Land -Use Map should be reviewed regularly. The land-use categories shown on the map (Appendix A) are:

- Low Density Residential (LR) — primarily single-family detached homes.
- Medium Density Residential (MR) — residential developments with dwelling unit types such as attached single-family units, rowhouses, and townhouses. Included in this classification is the McLoughlin Conditional Residential district, which is unique in that it allows existing residential uses, assuming they

were established legally, and new single-family homes on existing lots. More intensive new and redeveloped residential construction can be built at medium densities under certain circumstances.

- High Density Residential (HR) — typically high-density, multiple-dwelling residential. Permitted uses include apartments, condominiums, and single-family attached and rowhouse dwellings.
- Commercial (C) — commercial uses serving local, city-wide, and regional needs, such as retail and service commercial. Typically this classification is associated with newer, suburban development and located along arterial streets.
- Industrial (I) — uses related to manufacturing, processing and distribution of goods. Employment-based uses are encouraged. Intensive or heavy industrial uses are allowed in certain zones. Zones in the Comprehensive Plan Land-Use Map district are designed to comply with requirements of Title 4 of Metro's *Urban Growth Management Functional Plan* (1998).
- Mixed Use Corridor (MUC) — higher density mixed uses that are supportive of transit and conducive to pedestrian traffic. Urban density residential and commercial goods and services are typical uses. Zones in the Comprehensive Plan Land-Use Map district are intended to be compatible with Metro's Corridor design type.
- Mixed Use Employment (MUE) — employment-intensive uses such as offices, research and development, light manufacturing, and associated commercial uses.
- Mixed Use Downtown (MUD) — urban density, mixed uses that are conducive to pedestrian and transit uses. This category is intended to be used to implement the *Oregon City Downtown Community Plan* (1999), the *Oregon City Waterfront Master Plan* (2002), and Metro's Regional Center concept, particularly in terms of connecting the Downtown with the waterfront. A design overlay is included in this area and is intended to promote development consistent with Oregon City's traditional Downtown form.
- Public and Quasi-Public (QP) — publicly owned lands other than city parks, such as schools, cemeteries, undeveloped lands, open space, government buildings and public utility facilities, such as the sewage treatment plant and water reservoirs.
- Parks (P) — city parks.
- Future Urban Holding (FUH) — undesignated, pending development and approval of a "concept plan," a Metro requirement that cities plan land uses in areas being converted from rural to urban uses.

Comprehensive Plan Maintenance and Implementation

Maintaining the Comprehensive Plan simply means keeping it current. Changes in attitudes or needs may make some policies inapplicable. In addition, land-use information should be updated regularly and the Comprehensive Plan revised as required by the updated information.

The Comprehensive Plan and implementing ordinances should be reviewed for compliance with Metro's goals, objectives, and functional plans. In addition, land-use information should be kept current and changes made to the Comprehensive Plan periodically to reflect those changes.

In implementing the Comprehensive Plan, careful consideration should be given to the economic, environmental, social, and energy impacts of proposed programs and regulations. The Planning Commission is responsible for reviewing the Comprehensive Plan approximately every five years to determine if revisions or amendments to the goals and policies, Comprehensive Plan Land-Use Map, or implementing ordinances are needed. City staff is responsible for ensuring that the plan is consistent with current trends and complies with state and regional requirements.

Ancillary Plans. Since 1982, several documents have been adopted as ancillary to the 1982 Comprehensive Plan: the *Public Facilities Plan* (1990), *Oregon City Transportation System Plan* (2001), *Oregon City Downtown Community Plan* (1999), *Oregon City Waterfront Master Plan* (2002), *City of Oregon City Water Master Plan* (2003), *City of Oregon City Sanitary Sewer Master Plan* (2003), *Drainage Master Plan* (1988, updated in 1999 as the *City of Oregon City Public Works Stormwater and Grading Design Standards*), *Caufield Basin Master Plan* (1997), *South End Basin Master Plan* (1997), *Molalla Avenue Boulevard and Bikeway Improvements Plan* (2001), the *Oregon City Park and Recreation Master Plan* (1999), and the *Oregon City Trails Master Plan* (2004).

Two park-specific master plans for Jessie Court and Chapin Park were adopted as ancillary documents to the *Oregon City Park and Recreation Master Plan* (1999). This Comprehensive Plan references these documents but does not incorporate them as elements of, or as ancillary to, the plan because they contain details that are too specific for a Comprehensive Plan (for example, street standards). When those types of details need to be changed, an amendment to the Comprehensive Plan is therefore not necessary.

A new institutional and/or public facilities master planning process to accommodate the development of school, institutional, and government facilities has been developed. Plans that are developed during this planning process, if approved, can form the basis for Comprehensive Plan changes.

Zoning. Oregon City's zoning ordinance was adopted in 1954 and has been amended many times since. Most of the amendments to the 1982 Comprehensive Plan were changes to the zoning and subdivision ordinances. As a result of piecemeal changes, there are inconsistencies and outdated concepts that should be corrected through a major code update.

Subdivision Regulations. Title 16 of the *City of Oregon City Municipal Code* (1991) governing subdivisions implement several provisions of the Comprehensive Plan.

Design Review. Site plan and design review provisions are intended to promote design integrity and neighborhood livability. New design guidelines were added to the zoning ordinance in 2001. It is expected that the guidelines will continue to be refined to strike the right balance of predictability for developers and neighborhood protection and livability. The City hopes to develop a design overlay for the Downtown.

Regular Review and Update. Periodically, technical review of the Comprehensive Plan should be conducted by City planning staff. Recommendations for updating the Comprehensive Plan should be presented to the Citizen Involvement Committee. The Planning Commission should make a recommendation to the City Commission for input and discussion. The technical review should consider:

- the plan implementation process
- adequacy of the plan to guide land-use actions, including an examination of trends
- whether the plan still reflects community needs, desires, attitudes and conditions, including changing demographic patterns and economics
- addition of updated information about the City by regional, state and federal governmental agencies

Goal 2.1 Efficient Use of Land

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

Policy 2.1.1
Create incentives for new development to use land more efficiently, such as by having minimum floor area ratios and maximums for parking and setbacks.

Policy 2.1.2
Encourage the vertical and horizontal mixing of different land-use types in selected areas of the city where compatible uses can be designed to reduce the overall need for parking, create vibrant urban areas, reduce reliance on private automobiles, create more business opportunities and achieve better places to live.

Policy 2.1.3
Encourage sub-area master planning for larger developments or parcels, including re-development, where it may be feasible to develop more mixed uses, or campus-style industrial parks, with shared parking and landscaping areas. Allow developments to vary from prescriptive standards if planned and approved under this provision.

Policy 2.1.4
Use redevelopment programs such as urban renewal to help redevelop underutilized commercial and industrial 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.

Policy 2.2.1
Redefine the Metro Regional Center concept to recognize the unique character of Oregon City while being in accordance with *Metro's 2040 Growth Concept*.

Policy 2.2.2
Support multi-modal transportation options throughout the Regional Center and to other Regional and Town Centers.

Policy 2.2.3
Develop and promote a vision for the economic development and redevelopment of the Downtown area that solidifies the *Oregon City Downtown Community Plan* and *Oregon City Waterfront Master Plan*.

Policy 2.2.4
Target public infrastructure investments and create public/private partnerships to leverage maximum benefits from public investment and to help ensure that the Regional Center develops to its maximum capacity and realizes its full potential.

Policy 2.2.5
Encourage the development of a strong and healthy Historic Downtown retail, office, cultural, and residential center.

Policy 2.2.6
Working with major stakeholders, develop and implement a strategy to help the Historic Downtown Area enhance its position as a retail district. Such a strategy might include funding for a "Main Street" or similar program.

Policy 2.2.7
Explore options for improving Downtown vehicle circulation and parking in a manner that promotes revitalization.

Policy 2.2.8
Implement the *Oregon City Downtown Community Plan* and *Oregon City Waterfront Master Plan* with regulations and programs that support compatible and complementary mixed uses, including housing, hospitality services, restaurants, civic and institutional, offices, some types of industrial and retail uses in the Regional Center, all at a relatively concentrated density.

Policy 2.2.9
Improve connectivity for vehicles, bicycles, and pedestrians within the Oregon City Downtown community and waterfront master plan areas and improve links between residential areas and the community beyond.

Policy 2.2.10
Develop the Clackamette Cove area through the implementation of the *Oregon City Waterfront Master Plan* to achieve a balance between the natural and built environments, including wildlife habitat, multi-family residential development, office and retail, and family recreation.

Policy 2.2.11
Investigate an interpretive scheme that incorporates the End of the Oregon Trail Interpretive Center, the waterfront, and Downtown. Describe environmental, social, and historic aspects including the concept of a greenway along Abernethy Creek and nearby structures of historic significance.

Policy 2.2.12
Ensure a master plan is developed at the Blue Heron Paper Company site at such time as the property owner proposes a large-scale development, which addresses transitioning the overall site from industrial to non-industrial land uses.

Policy 2.2.13
Monitor the redevelopment within the Downtown Design District and investigate the need to require retail and service uses on the first floor and limit residential and office uses to the second floor and above.

Goal 2.3 Corridors

Focus transit-oriented, higher intensity, mixed-use development along selected transit corridors.

Policy 2.3.1
Ensure planning for transit corridors includes facilities and access management, aesthetics (including signage and building facade improvements), infill

and redevelopment opportunities, high-density residential development, and business assistance to existing businesses.

Policy 2.3.2
Work with Clackamas County, Gladstone, Milwaukie, and Metro to develop a plan for the redevelopment of the 99E corridor that connects the Oregon City Regional Center with the Milwaukie Town Center.

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.

Policy 2.4.1
Develop local neighborhood plans to strengthen and protect residential neighborhoods and historic areas from infill development; such as development along linear commercial corridors.

Policy 2.4.2
Strive to establish facilities and land uses in every neighborhood that help give vibrancy, a sense of place, and a feeling of uniqueness; such as activity centers and points of interest.

Policy 2.4.3
Promote connectivity between neighborhoods and neighborhood commercial centers through a variety of transportation modes.

Policy 2.4.4
Where environmental constraints reduce the amount of buildable land, and/or where adjacent land differs in uses or density, implement Comprehensive Plan and zoning designations that encourage compatible transitional uses.

Policy 2.4.5
Ensure a process is developed to prevent barriers in the development of neighborhood schools, senior and childcare facilities, parks, and other uses that serve the needs of the immediate area and the residents of Oregon City.

Goal 2.5 Retail and Neighborhood Commercial

Encourage the provision of appropriately scaled services to neighborhoods.

Policy 2.5.1
Encourage the redevelopment of linear commercial corridors in ways that encourage expansion of existing businesses and infill development, and at the same time reduces conflicting traffic movements, improves the aesthetic character of these commercial areas, and encourages trips by transit, bicycling and walking.

Policy 2.5.2
Allow and encourage the development of small retail centers in residential neighborhoods that provide goods and services for local residents and workers. Generally, these centers should be located at the intersections of two or more streets that are classified as neighborhood collectors or higher.

Policy 2.5.3
Review design standards and the sign code to ensure compatibility with existing neighborhoods.

Policy 2.5.4
Encourage the development of successful commercial areas organized as centers surrounded by higher density housing and office uses, rather than as commercial strips adjacent to low-density housing.

Policy 2.5.5
Encourage commercial and industrial development that enhances livability of neighborhoods through the design of attractive LEED^{TM}-certified buildings and environmentally responsible landscaping that uses native vegetation wherever possible, and by ensuring that development is screened and buffered from adjoining residential neighborhoods and access is provided by a variety of transportation modes.

Policy 2.5.6
Develop a concept plan for South End that includes commercial designations in an amount sufficient to serve the needs of the South End neighborhood. The area designated as "Future Urban Holding" on South End Road lacks sufficient commercial services.

Goal 2.6 Industrial Land Development

Ensure an adequate supply of land for major industrial employers with family-wage jobs.

Policy 2.6.1
Work with Metro to ensure that there is enough land available within the Urban Growth Boundary to meet the need for industrial and/or commercial development. If there is not enough, identify areas outside the boundary that may be appropriate to annex. The selection of these areas will be based on market factors, protection of environmentally sensitive areas, compatibility with adjoining and nearby uses, public facilities and infrastructure, proximity to expressways and transit, site requirements of specific types of industries, and the desires of the property owners.

Policy 2.6.2
Ensure that land zoned or planned for industrial use is used for industrial purposes, and that exceptions are allowed only where some other use supports industrial development. New non-industrial uses should especially be restricted in already developed, active industrial sites.

Policy 2.6.3
Protect the city's supply of undeveloped and underdeveloped land zoned for industrial uses by limiting non-industrial community uses, such as schools, parks, and churches on such properties and by limiting larger commercial uses within those areas.

Policy 2.6.4
Protect existing and planned undeveloped and underdeveloped industrial lands from incompatible land uses, and minimize deterrents to desired industrial development.

Policy 2.6.5
Ensure that land-use patterns create opportunities for citizens to live closer to their workplace.

Policy 2.6.6
Identify industrial uses that could partner with Clackamas Community College as training centers and future employers of students graduating from CCC.

Policy 2.6.7
Establish priorities to ensure that adequate public facilities are available to support the desired industrial development.

Policy 2.6.8
Require lands east of Clackamas Community College that are designated as Future Urban Holding to be the subject of concept plans, which if approved as an amendment to the Comprehensive Plan, would guide zoning designations. The majority of these lands should be designated in a manner that encourages family-wage jobs in order to generate new jobs and move towards meeting the city's employment goals.

Goal 2.7 Oregon City Comprehensive Plan Land-Use Map
Maintain the Oregon City Comprehensive Plan Land-Use Map as the official long-range planning guide for land-use development of the city by type, density and location.

Policy 2.7.1
Maintain a sufficient land supply within the city limits and the Urban Growth Boundary to meet local, regional, and state requirements for accommodating growth.

Policy 2.7.2
Use the following 11 land-use classifications on the Oregon City Comprehensive Plan Land-Use Map to determine the zoning classifications that may be applied to parcels:

- Low Density Residential (LR)
- Medium Density Residential (MR)
- High Density Residential (HR)
- Commercial (C)
- Mixed Use Corridor (MUC)
- Mixed Use Employment (MUE)
- Mixed Use Downtown (MUD)
- Industrial (I)
- Public and Quasi-Public (QP)
- Parks (P)
- Future Urban Holding (FUH)

Policy 2.7.3
Recognize the design types of *Metro's 2040 Growth Concept*. Establish boundaries for the Regional Center in Downtown Oregon City; Corridors along 7th Street, Molalla Avenue, Beavercreek Road, and Highway 99; Industrial areas; and for Inner and Outer Neighborhoods.

Section 3

Agricultural Lands

Land Conservation and Development Commission (LCDC) Statewide Planning Goal 3, Agricultural Lands, requires local governments "to preserve and maintain agricultural lands." Comprehensive plans for counties are required to identify, preserve, and maintain lands for farm use, consistent with existing and future needs for agricultural products, forest and open space and with the state's agricultural land use policy expressed in the Oregon Revised Statues.

Goal 3 states that only land that lies outside Urban Growth Boundaries can be classified as agricultural. Oregon City, which lies wholly within an Urban Growth Boundary, therefore contains no agricultural land according to this definition. However, Oregon City supports preserving designated farm lands in rural areas outside its city limits by encouraging compact growth within the city. The efficient use of urban land in Oregon City slows urban expansion into rural areas. Section 14, Urbanization, discusses appropriate and timely urban expansion.

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Section 4

Forest Lands

Land Conservation and Development Commission (LCDC) Statewide Planning Goal 4, Forest Lands, requires local governments "to conserve forest lands by maintaining the forest land base and to protect the state's forest economy by making possible economically efficient forest practices that assure the continuous growing and harvesting of forest tree species as the leading use on forest land consistent with sound management of soil, air, water, and fish and wildlife resources and to provide for recreational opportunities and agriculture."

Under Goal 4, land is considered forest land if it was acknowledged as such when the goal was adopted. Oregon City has not identified any forest lands within its city limits and has therefore not adopted any goals or policies related to commercial forestry. However, Oregon City recognizes the importance of preserving trees in the urban environment and has adopted goals and policies pertaining to tree preservation (see Section 5, Open Spaces, Scenic and Historic Areas, and Natural Resources).

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Section 5

Open Spaces, Scenic and Historic Areas, and Natural Resources

This section addresses Land Conservation and Development Commission (LCDC) Statewide Planning Goal 5, which requires that open spaces and natural, scenic, and historic resources be protected.

Oregon City is blessed with a wealth of natural resources that visually and physically contribute to its high quality of life and provide a range of ecosystem services. The city's steep topography is carved into 13 watersheds, which benefit from western Oregon's ample rain and collectively support a wide variety of habitats. Oregon City is home to a number of species of fish, wildlife, and plants that are regionally and nationally significant.

As awareness of the importance of natural resources and their relationship to the quality of life has increased, so has concern for protecting the natural environment. Protecting the city's valuable natural resources is thus one of Oregon City's primary goals. In addition, the City must comply with federal, state, and regional laws protecting natural resources, including sensitive, threatened, and endangered species and their habitats.

Oregon City stands out in the region because of its historic character. This section is intended to foster protection of that character by identifying the resources that define the city's historic character and by promoting the development of an aggressive and systematic process that will preserve and enhance Oregon City's special identity.

Open Space

The *Oregon City Park and Recreation Master Plan* (1999) defines natural open space as undeveloped land that is completely or almost completely in a natural state and that is used for passive rather than active recreational purposes.

Open space is usually publicly owned or managed. According to the master plan, the City owns a total of about 38 acres of open space in four sites: Old Canemah Park, River Access Trail, Singer Creek Park, and Waterboard Park. Only Waterboard Park is entirely undeveloped. Clackamas County, Metro, the State of Oregon and the public schools own a total of approximately 278 acres of open space within Oregon City. The master plan recommends adding 250 acres of natural open space, most of which is in Canemah Bluff and Newell Creek Canyon. Metro has already purchased a significant amount of open space in Newell Creek Canyon, the Canemah Bluff and along the Willamette Greenway.

Scenic Views and Sites

Oregon City is blessed with topography that provides outstanding scenic views and sites that create a sense of place and civic identity for both residents and visitors. Distant views of Mount Hood and the Cascade Mountains, as well as nearer views of the Willamette and Clackamas Rivers, Willamette Falls, scenic cliffs, and wooded areas such as Newell Creek Canyon, provide Oregon City with an abundance of scenic amenities, many dramatic and unique. The views and sites are economic and aesthetic resources that contribute to the overall distinctiveness and identity of Oregon City, and they should be protected.

While views of distant landscapes from promontories and high elevations are often protected, views from lower elevations of the higher topographic points of Oregon City have not been as appreciated or protected. These lower elevation views should be considered when development is proposed.

Views can be preserved in a variety of ways, from prohibiting development in particularly significant view corridors to designing structures that are appropriate to a site, using, for example, color and landscaping to hide or minimize visual incongruity. The City should develop guidelines for integrating the built environment with natural resources and continue to adopt and use guidelines to address scenic views, both looking down from higher points and up from lower points.

Major scenic views have been inventoried by the City.

Historic Preservation

In the 1960s, many of the nation's older buildings were lost to urban renewal programs, which negatively affected inner-city core areas by destroying established residential neighborhoods. Many of these neighborhoods were mixed-use, offering a variety of housing and commercial opportunities. The misguided programs led to a loss of inner-city amenities and quality housing and encouraged residential dislocation into the suburbs.

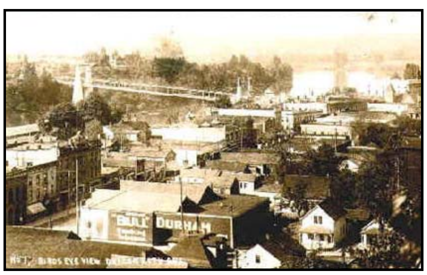
> *[Preservation] ... is not just a romantic indulgence in nostalgia. It is a physical restatement of the long hallowed American values of frugality, good craftsmanship, and community responsibility.*
>
> *— Bruce Chapman, National Trust*

A new attitude toward historic preservation and redevelopment has emerged in the last few decades. Losses in architectural and historic resources and the resulting urban dislocation created a new appreciation for and an awareness of the need to retain the character of neighborhoods. Areas where people have traditionally lived and worked are as worthy of preservation as individual landmarks and memorial sites.

Today, it is recognized that a variety of building types (residential and commercial) and styles contribute to the unique character of a community. When planning for historic preservation, an effort must be made to conserve whole neighborhoods. Retaining these irreplaceable assets requires strong community leadership and cooperation among private and public interests.

Preservation in Oregon City

It would be difficult to find a community in the West with more significant local, state and regional heritage than Oregon City. As the seat of the first provisional government of the Oregon Territory (1843–1849), capital of the Oregon Territory (1849–1850), and the first incorporated town west of the Rockies (1844), Oregon City has many homes, commercial buildings, and sites that are related to its important place in history.



Preservation of these community resources—landmark sites, historic buildings and areas, and archaeological sites—offers an opportunity to maintain and enhance Oregon City's unique identity. A well-developed preservation program can benefit property owners, local historians, students, community spirit, and tourism and increase the appreciation residents have for their city's cultural heritage.

Certified Local Government Program

The State Historic Preservation Office (SHPO) has designated the City of Oregon City as a Certified Local Government (CLG). Administered by the National Park Service, a CLG Program integrates local governments with the National Historic Preservation Program through activities that strengthen decision-making regarding historic places at the local level. The CLG Program seeks to (1) maintain and develop local historic preservation programs that influence zoning and permitting decisions critical to preserving historic properties, and (2) ensure the broadest possible participation of local governments in the National Historic Preservation Program while maintaining preservation standards established by the Secretary of the Interior. Participating in the CLG Program allows Oregon City to apply for non-competitive and competitive grants administered by SHPO. Surveys of the McLoughlin District in 2002 and the Historic Downtown in 2000 were funded using this grant process. The City is committed to maintaining an active participation in the CLG Program.

Archaeological Sites

Oregon City has important prehistoric and historic resources. For example, Willamette Falls was an important center in Native American culture and attracted great activity well before the 1800s.

Archaeological resources in Oregon have been overlooked by many communities, including Oregon City. Special attention should be given to proposed locations for new construction to avoid impacting archaeological sites. A number of state and federal antiquity laws now provide varying degrees of protection for archaeological sites. Once a site has been damaged by extensive building cover, archaeological values are likely to be lost. If it is likely that a site may yield archeological resources, further review may be needed to ensure that the site can be protected.

Historic Districts

Historic Districts are areas where buildings with national or local historical and/or architectural significance are concentrated. A Historic District is recognized for retaining its "sense of place," meaning that a traditional atmosphere of distinct character is evident. Generally, a Historic District designation requires, through the Historic Overlay Ordinance, that proposed construction, exterior alterations, and demolitions within the district's boundaries be reviewed. To be designated as a Historic District, an area must:

- have architectural features that are well-related and have continuity
- appear as a discrete entity
- exhibit visual harmony in the character of public ways consistent with the architectural character of the area
- have generally compatible uses, including intended uses
- have a majority of properties with historic significance

Oregon City's older areas are valued for their neighborhood character, architecture, and the identity they possess as a result of their role in the development of the city. Unfortunately, some structures have been allowed to deteriorate with a corresponding effect on the character of these areas.

Designation as an historic property ensures an owner that a compatible setting will be maintained. All residents and property owners benefit from the protection and enhancement of property values, incentives for revitalization, and stabilization of an area.

Existing Historic District: Canemah. Canemah is an important example of a relatively intact riverboat town with architectural resources dating from the 1860s. Having evolved from a community for the elite of the riverboat industry to a workers' community, Canemah retains essentially the same sense of place it had in the latter half of the 19th century. Situated above the Falls of the Willamette, it was an important portage town and the major shipbuilding center on the upper Willamette River.

Present Status. Canemah was listed as a Historic District in the National Register of Historic Places in 1977. The area was zoned in 1954 for industry along the river, commercial and multi-family along McLoughlin Boulevard, and multi-family along Third Avenue and portions of Fifth Avenue. In 1982, a majority of the area was rezoned as residential except for a small strip on McLoughlin Boulevard, which was rezoned to Historic Commercial.

In the last 20 years, many homes within the district have been rehabilitated, but some have not been maintained to a level that ensures their significance and status as contributing structures. New construction and exterior alterations need to be reviewed for their long-term effect on the neighborhood and National Register Historic District status.

Proposed Historic District: Downtown. Downtown Oregon City has historical significance as the original town site, following Dr. John McLoughlin's claim of the Willamette Falls area in 1829. The Downtown was surveyed by Sidney Moss in 1842 and Jesse Applegate in 1844. The city grew between the Willamette River and the bluff between 1843 and 1865. Industrial, commercial and residential development all took place. McLoughlin set aside a Mill Reserve in the area closest to the falls where the mills developed. Commercial establishments grew along lower Main Street, and residences were built throughout the area.

After the Civil War, industrial development increased rapidly. A woolen mill was built in 1865, and other small industries and trading establishments expanded. The residential quality of the area deteriorated as the commercial district grew. Access to the upper level was developed and residents relocated there, some physically moving their houses. Over the years, commercial uses have continued to grow, transforming the original pioneer settlement into a Central Business District.

While many of the original impressive Downtown buildings have been lost, a substantial number of historic and/or architecturally significant buildings still stand. The areas from 5th to 9th Streets and from the river to the bluff contain the largest concentration of historic buildings that merit preservation. The area is generally cohesive, and intrusive or out-of-character uses are relatively few. Improvements could be made in the public rights-of-way to enhance the area as a district without disruption to commercial activity.

The proposed Downtown District consists of eight city blocks from the original Oregon City plat. Total land area of the district is approximately 21 acres. The area is commercial and professional office in use and character and contains approximately 44 structures. Parking lots exist on all but one block.

Present Status. In 2000, a re-survey of the Historic Downtown was conducted to determine the current status of buildings and the potential for the area to be listed as a National Register Historic District. Although the re-survey indicated that Oregon City's central business district is not eligible as a National Register Historic District, it did show that there is potential for restoring a sufficient amount of historic character to resources currently categorized as "Non Contributing in Current State," which would bring the percentage of "Contributing Resources" to an eligible level for a Historic District designation.

The Historic Downtown area is part of the Downtown Community Plan Phase II Implementation Program. Rezoning based on that plan, along with new design guidelines that directly address exterior alterations and new construction in the area, will ensure that future development is compatible with the significant structures of the area.

Proposed Historic District: McLoughlin Conservation District. The McLoughlin District is currently designated as a city Conservation District. However, the findings of a 2002 re-survey of the district, as described below, support its designation as a National Register Historic District.

Conservation Districts

A Conservation District designation is intended to protect the buildings within the district through an ordinance that requires a review of proposed construction, exterior alterations to designated structures, and demolitions. Although not as comprehensive as a Historic District, a Conservation District can ensure that a neighborhood's significance does not erode.

Existing Conservation District: McLoughlin. Many of Oregon City's historic and architecturally significant buildings are above the bluff in the McLoughlin neighborhood. The original Oregon City plat includes the neighborhood area up to Van Buren Street, and it is within this area that early residential development took place, beginning in the 1850s. As the Downtown area changed from a residential to commercial district, home building increased above the bluff. All of the churches that originally stood in the Downtown eventually relocated to the McLoughlin area as well.

Present Status. In 2002, a re-survey was undertaken to determine the current status of buildings and the potential for the area to be listed as a National Register Historic District. In 2003, Oregon City High School moved from the McLoughlin neighborhood to a new facility on Beavercreek Road. Moving the school provides the City an opportunity to work with the school district to reuse the historic high school building. The City supports any rehabilitation of the campus that would continue its role as a community gathering place and keep it consistent with the Secretary of Interior Standards for Rehabilitation and the Goals and Policies of the Historic Review Board.

Proposed Conservation Districts. Other Historic Districts may exist in this historically important community. The Ely, Park Place, and Rivercrest neighborhoods have many historic properties and may be eligible for designation as Conservation Districts. An appropriate, well-constructed historic preservation plan will provide for identification and establishment of safeguards of these areas, which are important to the quality of Oregon City as a whole and to the identity of the Northwest.

Historic Buildings Outside Identified District Boundaries

There are many historic buildings outside the designated Historic Districts. Some of the buildings are among the oldest in the city, and many stand alone because they were originally built outside of "urban" Oregon City in what used to be farm and pastureland. City areas outside the Canemah and McLoughlin areas have been surveyed to identify the most significant buildings.

Present Status. Efforts to preserve individual historic buildings have been scattered. There is little public recognition of the historic value of significant buildings outside of McLoughlin and Canemah except for the more prominent and expensive estate homes. The Ely, Park Place, Rivercrest, and South End areas in particular have deteriorated, and some of the older homes have been demolished, often to the detriment of the area. Demolition and major incompatible remodeling are critical problems for historic preservation because they are usually irreversible. Private preservation and restoration efforts should be encouraged and assisted by local recognition of significant individual historic buildings throughout Oregon City.

Historic Landmarks

Historic landmarks are structures or sites with unusual historic importance and contribute to the city's identity. Maintenance costs are often returned in tourism revenues. Appreciation of local culture and history is enhanced. Criteria for designation as a historic landmark are:

- association with a major historic person
- association with an historic event or period of time
- association with a former or continuing institution that has contributed to the life of the city
- embodiment of the distinctive characteristics of a type, period, or method of construction, or representation of the work of a master, or possession of high artistic values, or representation of a significant and distinguishable entity where components may lack individual distinction
- association with a group, organization, enterprise in history

Natural Resources

Oregon City's natural resources are the result of the city's topographic complexity, which was created by volcanic activity, erosion and scouring from the post-Ice Age Missoula Floods, and erosion and deposition from the modern Willamette and Clackamas rivers, Abernethy and Newell creeks, and other minor streams. Metro has inventoried, evaluated, and mapped important Goal 5 resources in the region as part of developing a regionwide fish and wildlife habitat protection plan. Two large areas in Oregon City scored 6 (medium quality habitat) on a scale of 1 to 9: along the steep slopes and bluffs overlooking the Willamette River on the western edge of the city, and Newell Creek Canyon. Oregon City will coordinate with Metro to maintain the City's Goal 5 resources inventory in accordance with the new protection plan. The City will also coordinate with the Fisheries Department of the National Oceanic and Atmospheric Administration (NOAA Fisheries, formerly NMFS) and on actions that may affect salmonid habitats.

Anadromous fish, including salmonids such as coho, chinook, and chum salmon, as well as lamprey eel, were historically plentiful in Oregon City's major waterways. These species supported a rich ecosystem that included a wide range of animals, from insects and small invertebrates within the stream and riparian corridor to large animals such as seals and bears, and birds such as osprey and bald eagles. Native people also relied on these stream resources for food and culture, returning annually to Willamette Falls to harvest salmon and other fish. Declines in anadromous fish species in the Willamette River Basin is a consequence of a variety of land-use practices that have altered or destroyed habitat and changed the hydrographic profile of runoff. Several species of salmonids, including chinook salmon and steelhead trout, have been listed as threatened under the federal Endangered Species Act (ESA), which has triggered significant protection and restoration activities throughout the region.

In Oregon City, the Clackamas River along the northern boundary of the city, as well as Abernethy, Newell, Holcomb, Potter, and other creeks provide both spawning and rearing habitat for steelhead trout, coho salmon, and cutthroat trout, which are not currently warranted for listing under the ESA. Riparian corridors, the areas on either side of a stream, are critical to protecting the stream ecosystem and quality of habitat for salmonids and other stream-dependent species.

Oregon City can protect or improve habitat conditions for salmonids and other species by:

- adopting standards and implementing programs that protect vegetation along riparian corridors from destruction or alteration
- removing invasive non-native plant species and re-planting native riparian vegetation
- reducing pulsed storm runoff that can erode banks and alter streambed profiles and gravels
- maintaining water quality and quantity in streams
- maintaining or providing fish passage in all streams

Because virtually all rainfall in the city eventually runs to a stream, these standards and programs need to be applied citywide. Ancillary plans such as the *Oregon City Waterfront Master Plan* (2002), *Oregon City Transportation System Plan* (2001), *Oregon City Park and Recreation Master Plan* (1999), and *City of Oregon City Public Works Stormwater and Grading Design Standards* (1999) are important in ensuring that these resources are protected.

Other unique and important habitats and ecological resources in Oregon City have been identified, including:

- Newell Creek Canyon
- Canemah Bluffs, which contain a variety of unique habitats and plant assemblages
- the rocky cliffs along the Willamette River, which are home to a number of rare plants
- Willamette Falls
- other streams, rivers, bogs and wetland areas

These habitats and resources will be inventoried in the Goal 5 update subsequent to adoption of this Comprehensive Plan.

Because lands surrounding the city within the Urban Growth Boundary have significant undeveloped habitat areas, these lands need to be inventoried to identify important ecological resources to ensure the resources are protected before development occurs. The City and Clackamas County should ensure that Urban Growth Management Agreements contain provisions for identifying and protecting these resources.

Wetlands. Wetlands and their associated hydrology, soils, vegetation, and wildlife provide a wide range of valuable services to the public. Wetlands enable the City to efficiently meet a number of goals in maintaining the quality of life in Oregon City, such as:

- preventing degradation of stream quality and damage from flooding during storms by storing runoff from precipitation and moderating its release into stream networks
- preventing pollutants and sediments from roadways and other development from reaching streams by filtering the flow of groundwater toward streams
- recharging groundwater aquifers for slow release later into streams and through uptake by vegetation into the environment by reducing the speed of runoff and enabling water to percolate into the ground
- providing habitat for wildlife that is important to residents
- providing open space, recreational opportunities, aesthetic and landscape amenities to buffer various uses, all of which maintain the unique environmental setting of Oregon City

Important wetlands have been identified and mapped by the City and Metro in a Local Wetlands Inventory that will be the basis for protection measures through the Comprehensive Plan, implementing ordinances, and other measures. The inventory is kept by the City.

Streams. Streams define the physical configuration of Oregon City and thus its land-use patterns, transportation patterns, and community functions. The Willamette and Clackamas rivers, major waterways of regional significance, border two sides of the city and create an aesthetic and recreational setting of great value to the city. Other principal streams are:

- Abernethy Creek and Newell Creek, tributaries of the Willamette River; these creeks create major topographic and ecologic areas within the city
- Beaver Creek, a tributary of the Willamette River; Beaver's Creek's minor tributaries create the topographic definition of the city's southern edge
- other creeks that drain directly to the Willamette, such as Singer Creek and Coffee Creek, which drain from the Hilltop area through the McLoughlin and Canemah neighborhoods, respectively.

Together, these rivers and streams contribute to the uniqueness of Oregon City and to the variety of natural resource, recreational, and open space values enjoyed by residents and visitors.

Vegetation. The many wooded areas in the city—mainly parks, undeveloped slopes, and undeveloped lots within the Urban Growth Boundary—offer a variety of recreational opportunities, scenic views, and wildlife habitats. Trees in these and other areas should be preserved because trees provide a variety of benefits to the city. They are natural visual, noise, and wind buffers; enhance air quality; filter pollutants from rainwater; help control stormwater runoff; prevent erosion on steep slopes and riverbanks; and help separate conflicting land uses. Trees and treed areas are one means of providing an orderly transition from rural to urban land uses. Total tree cover in the city has diminished as development has occurred without mechanisms to protect urban trees.

The city could benefit from a comprehensive program to conserve and enhance tree cover on public lands and private property. Such a program should include standards and regulations pertaining to cutting of trees on private, undeveloped lands and in view corridors, planting of new trees as part of street or property landscaping, and incentives and assistance for tree planting and maintenance.

Water Quality. Oregon City receives an average of 46 inches of precipitation every year. Other parts of the Willamette and Clackamas river watersheds receive more than 80 inches per year. The city has significant ground- and surfacewater resources that contribute to the physical and cultural identity and natural heritage of the city and to the quality of life for residents. These water resources provide important habitat and ecological conditions for a wide range of fish, wildlife, and plants. Water resources include the Willamette and Clackamas rivers and tributaries of Abernethy, Newell, and Beaver creeks and associated minor creeks. Other water resources include bogs and wetlands perched on Oregon City's unique topography and groundwater that percolate under the city. Because land-use practices and patterns, development design, and city infrastructure and practices can affect the quality and quantity of water resources in the city, the City will seek to protect and restore these resources through a variety of means, including the application of a Water Resources Overlay District, development standards, and civic projects.

Groundwater. The geology of the rocks underlying Oregon City, coupled with high annual rainfall, create conditions for significant groundwater flowing beneath the city and, in some areas, a relatively high water table (groundwater is close to the surface). Groundwater is important to the city in several ways. It can affect the safety and function of buildings and other development, such as streets, when construction meets groundwater. It can also carry chemical pollutants from development, roads, landfills, and industrial sites into drinking water wells and streams. Groundwater provides a slow release mechanism for precipitation that would otherwise run quickly into streams and increase the likelihood of flooding. Groundwater has historically been the source of domestic drinking water for some residences and agricultural wells within the area.

Groundwater provides essential water for the vegetative cover that is so important to Oregon City.

Groundwater within 1.5 feet of the surface is defined as a "high water table." High water tables are of special concern because of their vulnerability to contamination and interception. Because much of Oregon City lies on basalt bedrock that was scoured clean of overlying soils during the post-glacial Missoula Flood events, water does not penetrate deeply or rapidly. Consequently, there are many areas with high water tables in Oregon City. These areas have been inventoried by the State Department of Geology and Mineral Industries. The inventories are kept by the City. Proposed development in these areas is subject to the City's development codes to ensure that it meets applicable engineering standards.

Goal 5.1 Open Space

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

Policy 5.1.1
Conserve open space along creeks, urban drainage ways, steep hillsides, and throughout Newell Creek Canyon.

Policy 5.1.2
Manage open space areas for their value in linking citizens and visitors with the natural environment, providing solace, exercise, scenic views and outdoor education. Built features in open space sites should harmonize with natural surroundings.

Goal 5.2 Scenic Views and Scenic Sites

Protect the scenic qualities of Oregon City and scenic views of the surrounding landscape.

Policy 5.2.1
Identify and protect significant views of local and distant features such as Mt. Hood, the Cascade Mountains, the Clackamas River Valley, the Willamette River, Willamette Falls, the Tualatin Mountains, Newell Creek Canyon, and the skyline of the city of Portland, as viewed from within the city.

Policy 5.2.2
Maximize the visual compatibility and minimize the visual distraction of new structures or development within important viewsheds by establishing standards for landscaping, placement, height, mass, color, and window reflectivity.

Goal 5.3 Historic Resources

Encourage the preservation and rehabilitation of homes and other buildings of historic or architectural significance in Oregon City.

Policy 5.3.1
Encourage architectural design of new structures in local Historic Districts, and the central Downtown area to be compatible with the historic character of the surrounding area.

Policy 5.3.2
Evaluate the establishment of Historic and Conservation Districts to preserve neighborhoods with significant examples of historic architecture in residential and business structures.

Policy 5.3.3
Promote the designation of qualifying properties outside Historic and Conservation Districts as historic.

Policy 5.3.4
Support the preservation of Oregon City's historic resources through public information, advocacy and leadership within the community, and the use of regulatory tools and incentive programs.

Policy 5.3.5
Support efforts to obtain historic designation at the city, state and national levels for public and private historic sites and districts. Natural and cultural landscapes should also be considered.

Policy 5.3.6
Maintain Oregon City's status as a Certified Local Government in the National Historic Preservation Program.

Policy 5.3.7
Encourage property owners to preserve historic structures in a state as close to their original construction as possible while allowing the structure to be used in an economically viable manner.

Policy 5.3.8
Preserve and accentuate historic resources as part of an urban environment that is being reshaped by new development projects.

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 5.4.3
Identify, initiate and cooperate in partnerships with other jurisdictions, businesses, neighborhoods, schools and organizations to conserve and restore natural resources within and adjacent to Oregon City.

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 5.4.5
Ensure that riparian corridors along streams and rivers are conserved and restored to provide maximum ecological value to aquatic and terrestrial species. This could include an aggressive tree and vegetation planting program to stabilize slopes, reduce erosion, and mitigate against invasive species and stream impacts where appropriate.

Policy 5.4.6
Support and promote public education, interpretation, and awareness of the city's ecological resources.

Policy 5.4.7
The City shall encourage preservation over mitigation when making decisions that affect wetlands and a "no net loss" approach to wetland protection.

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 5.4.10
Encourage and promote the restoration of the hydrologic and ecological character and function of streams and wetlands that have been degraded by channeling or eliminated from the landscape by routing into culverts.

Policy 5.4.11
Maintain and enhance the function and quality of natural wetlands and create, where appropriate, wetlands or swales to moderate the quantity and velocity of water runoff entering streams during storm events and to reduce the amount of pollutants carried into streams.

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.

Policy 5.4.13
Adopt and/or establish standards for all new development that promote the use of pervious surfaces and prevent negative ecological effects of urban stormwater runoff on streams, creeks and rivers.

Policy 5.4.14
Comply with federal and state regulations for protecting, conserving and restoring threatened and endangered species and critical habitat.

Policy 5.4.15
Partner with Metro, Clackamas County, the Oregon Department of Transportation (ODOT) and other agencies to establish an invasive weeds management strategy.

Policy 5.4.16
Protect surfacewater quality by:

- providing a vegetated corridor to separate protected water features from development
- maintaining or reducing stream temperatures with vegetative shading
- minimizing erosion and nutrient and pollutant loading into water
- providing infiltration and natural water purification by percolation through soil and vegetation

Policy 5.4.17
Protect and maintain groundwater recharge through conservation and enhancement of wetlands and open space.

Policy 5.4.18
Encourage use of native and hardy plants such as trees, shrubs and groundcovers to maintain ecological function and reduce maintenance costs and chemical use.

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Section 6

Quality of Air, Water, and Land Resources

Land Conservation and Development Commission (LCDC) Statewide Planning Goal 6 deals with maintaining and improving the quality of these resources. Waste discharges, defined as solid waste, thermal, noise, atmospheric and water contaminants and pollutants that cause harm to human health or the environment, must not "violate or threaten to violate" federal or state statutes. With respect to the air, water and land resources described or included in state environmental quality regulations, such discharges "shall not (1) exceed the carrying capacity of such resources, considering long-range needs; (2) degrade such resources; or (3) threaten the availability of such resources."

All manner of land uses can be sources of waste. The City's influence over potential impacts from waste can be through direct regulation, such as with stormwater treatment standards, through ensuring compliance with federal and state standards, and through actions, such as education and development incentives, to encourage the reduction of impacts.

Air Quality

The quality of air is increasingly recognized as a key factor in the health of individuals, the attractiveness and livability of communities, and the ability of the community to attract and accommodate growth and development. Oregon City has a relatively high quality of air during most of the year, but it also receives airflows from other parts of the urban region that can carry airborne pollutants. Air quality tends to be lower when prevailing winds are from the northwest.

Motor vehicles are the largest source of air pollution in Oregon, and there is growing concern about "personal pollution" from cars, woodstoves, gasoline-

powered lawn mowers, boat engines, paint, outdoor burning, and aerosol products such as hairspray and air fresheners. Other sources of air pollution are dust from agriculture and land development and particulates in smoke from agriculture, forestry, and industry. The Portland metropolitan area is currently designated an "Air Quality Maintenance Area," which means that the area has a history of not meeting National Ambient Air Quality Standards. However, a variety of pollution reduction programs have enabled the region to meet federal air quality standards.

Air quality standards are set by the Oregon Department of Environmental Quality (DEQ). Oregon City should continue to work with DEQ to ensure that existing and new sources of industrial and commercial pollution comply with state and federal standards and to encourage citizens to reduce the amount of air pollution they generate. One of the most important ways Oregon City can help reduce air pollution is to promote land-use practices and transportation alternatives that reduce the use of single-occupancy vehicles. It is also important for the City to encourage the conservation and enhancement of tree cover as a means of filtering particulate pollution in the air.

Water Quality

The City's ground- and surfacewater resource is significant and adequate for its residents. Water resources are:

- the Willamette and Clackamas rivers
- tributaries of Abernethy, Newell, and Beaver creeks and associated minor creeks
- bogs and wetlands
- groundwater under the city

Because land-use practices, development design, and city infrastructure can affect the quality and quantity of water resources, the City will protect and restore these resources through a variety of means. One way is through the Water Resources Overlay District, which is a zoning overlay with development standards to protect surface waters. The overlay district implements the requirements of Title 3 of Metro's *Urban Growth Management Functional Plan* (1998). Another way is through civic projects to restore water features. Restoration and protection of these resources is covered primarily in Section 5 (Open Spaces, Scenic and Historic Areas, and Natural Resources).

DEQ has mapped groundwater flows, also called aquifers, that are known to or have the potential to carry pollutants. Most of these sensitive aquifers are along Abernethy Creek in the floodplain along the Clackamas River. The aquifer in the Abernethy Creek area near the former Rossman's landfill has been contaminated during the past 100 years with a variety of pollutants from the landfill and other activities. Clearance from DEQ may be necessary for future development of properties in this area. DEQ does not allow the construction of drinking or irrigation wells because the contaminated groundwater in the aquifer could be released into the environment and adversely impact public health and safety. DEQ allows only groundwater wells that monitor contaminants associated with the landfill.

Erosion is defined as the movement of solids (earth, mud, and rock) by wind, water, or gravity. Erosion can be a natural process or caused by human activity. Erosion can cause a loss of productive soil, damage stormwater and the sanitary sewer infrastructure, and degrade water quality in streams and rivers, thus affecting habitat quality for aquatic species. Excessive sediment deposition behind dams can decrease reservoir storage capacity and increase the risk of flooding. Removing excess sediment from behind dams and areas of unwanted deposition, such as reservoirs and streams, can be costly. Soil runoff from construction sites is by far the largest source of excess sediment deposition in developing urban areas.

Complying with LCDC Statewide Planning Goal 6 requires adopting policies and standards that protect water quality. The erosion and sediment control requirements of Title 3 will significantly reduce sediment loading to receiving streams. LCDC Statewide Planning Goal 6 and Title 3 requirements are implemented in Oregon City through the Water Resources Overlay District, Erosion and Sediment Control standards, and other provisions of the *City of Oregon City Municipal Code* (1991).

Quality of Land Resources

Nighttime Light Pollution. Artificial light has extended many human activities well into evening and night and provides much-needed safety along roadways and at intersections. However, much of the nighttime light is wasted into space, as confirmed by satellite images of the earth at night from space. Nighttime light can interfere with viewing starry skies and other outdoor experiences, intrude through windows into homes, and lead to unsafe situations from glare and shadows. In Oregon City, the Haggart Astronomical Observatory at Clackamas Community College is an educational resource for the entire community that is diminished by nighttime light pollution.

New nighttime lighting technology makes nighttime light appropriate for the situation and prevents safety problems and pollution. The technology is readily available, and its benefits to the community are easy to understand. All that is required is a commitment to applying the technology in a flexible and appropriate way.

Noise Pollution. Noise is a part of city life. Noise is generated by, for example, vehicular traffic, emergency vehicles, industrial activities, railroads, aircraft, leaf blowers, sound systems, and construction. Loud, persistent noise is recognized as a serious environmental problem by both state and federal authorities. In 1971, the Oregon Legislature authorized the Environmental Quality Commission to adopt and enforce noise control standards, which are administered through DEQ. The standards cover noise from motor vehicles and industrial and commercial activities.

The most significant sources of noise in Oregon City are major vehicular corridors (for example, Interstate 205, McLoughlin Boulevard, Highway 213, Molalla Avenue, and South End Road), the railroad corridor through downtown and the Canemah neighborhood, the industrial operations of the Blue Heron Paper Mill, and the natural roar of Willamette Falls, especially during the winter. Nuisance noise can also originate from neighborhoods and homes. Local noise control is handled primarily through the Nuisance Code (Section 6 of the *City of Oregon City Municipal Code*) and through design review of development projects to ensure that industry and commercial activities do not negatively impact the immediate neighborhood environment.

Mineral and Aggregate Operations. The Oregon Department of Geology and Mineral Industries has inventoried four areas within Oregon City's Urban Growth Boundary that contain mineral and aggregate resources. These areas are listed in the Natural Resources Inventory of the 1982 *Oregon City Comprehensive Plan*. There are currently no commercial mineral or aggregate removal operations at any of the four sites. Although mineral and aggregate removal operations can be beneficial to a local economy, they are not compatible with urban land uses and quality of life in Oregon City because of noise, dust, traffic, water quality, and other issues.

Goal 6.1 Air Quality

Promote the conservation, protection and improvement of the quality of the air in Oregon City.

Policy 6.1.1

Promote land-use patterns that reduce the need for distance travel by single-occupancy vehicles and increase opportunities for walking, biking and/or transit to destinations such as places of employment, shopping and education.

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

Policy 6.1.3
Set an example through City operations by using and demonstrating practices and technologies that reduce air pollution and protect air quality.

Policy 6.1.4
Encourage the maintenance and improvement of the city's tree canopy to improve air quality.

Goal 6.2 Water Quality

Control erosion and sedimentation associated with construction and development activities to protect water quality.

Policy 6.2.1
Prevent erosion and restrict the discharge of sediments into surface- and groundwater by requiring erosion prevention measures and sediment control practices.

Policy 6.2.2
Where feasible, use open, naturally vegetated drainage ways to reduce stormwater and improve water quality.

Goal 6.3 Nightlighting

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

Policy 6.3.1
Minimize light pollution and reduce glare from reaching the sky and trespassing onto adjacent properties.

Policy 6.3.2
Encourage new developments to provide even and energy-efficient lighting that ensures safety and discourages vandalism. Encourage existing developments to retrofit when feasible.

Policy 6.3.3
Employ practices in City operations and facilities, including street lighting, which increases safety and reduces unnecessary glare, light trespass, and light pollution.

Goal 6.4 Noise

Prevent excessive noise that may jeopardize the health, welfare, and safety of the citizens or degrade the quality of life.

Policy 6.4.1
Provide for noise abatement features such as sound-walls, soil berms, vegetation, and setbacks, to buffer neighborhoods from vehicular noise and industrial uses.

Policy 6.4.2
Encourage land-use patterns along high-traffic corridors that minimize noise impacts from motorized traffic through building location, design, size and scale.

Goal 6.5 Mineral and Aggregate Operations

Protect the livability and environment of Oregon City by prohibiting commercial aggregate extraction operations within the city and Urban Growth Boundary.

Policy 6.5.1
Prohibit new commercial aggregate removal operations and encourage relocation of existing operations. Aggregate removal for habitat improvement or for public recreational needs is not considered a commercial operation.

Section 7

Natural Hazards

This section is intended to show compliance with Land Conservation and Development Commission (LCDC) Statewide Planning Goal 7, Areas Subject to Natural Hazards, which requires local governments to "… reduce risk to people and property from natural hazards." The section is also intended to show compliance with Title 3 of Metro's *Urban Growth Management Functional Plan* (1998), which requires local governments to comply with regional regulations pertaining to flooding and water quality.

The natural features and processes that shape the topographic, scenic, and natural resource setting of Oregon City present a variety of hazards to people and human activities, such as flooding, rock falls, landslides, wildfires, and earthquakes. Some of the hazards are related to steep topography, saturated soils and bedrock, and bare soil and rock that have been exposed by removing vegetation, movement of the earth, and erosion.

Floods that were once referred to as 100-year floods may occur more often now in Oregon City because humans have altered the watersheds and hydrology of the Willamette and Clackamas river systems. Heavy winter rain events can saturate soils and cause localized landslides and rock falls that can damage roadways and buildings in areas where the topography is steep. Even the seemingly durable rocky cliffs around Oregon City are subject to thermal expansion in summer and freezing in winter that can lead to dangerous rock falls. Mt. Hood and other Cascade Mountain volcanoes erupt every several thousand years. Major subduction-zone earthquakes, potentially catastrophic, occur in the Pacific Northwest every 300 to 800 years, while smaller but nonetheless potentially destructive

earthquakes can occur every ten years. Wildfires are hazardous to people, especially in developed areas.

Reducing or eliminating long-term risk to people and property from natural hazards is called "hazard mitigation." There are two basic types of mitigation. One is to manage the hazard itself, when this is possible, and the other is to manage development to avoid hazards. Both types require an understanding of geological processes, the use of engineering practices that address potential hazards at a reasonable cost over a reasonable time, and an understanding of the consequences of intervention. For instance, in some cases, it may be appropriate to keep a developed area dry by draining water from the area to control small-scale flooding or high water tables. In other cases, it may be safer, less costly, and ultimately wiser to prohibit development in high-velocity floodways or on slide-prone slopes.

City policies can help minimize the risks and impacts of natural hazards by limiting development in areas where hazardous events are most likely to occur and by working with the residents of these areas. In 1998, Oregon City adopted the *Oregon City Hazard Mitigation Plan*, written by a community planning team in consultation with a number of federal, state, and regional governmental agencies. The plan describes potential hazards in Oregon City, lists goals, objectives and mitigation measures, and describes an action plan. The plan also contains maps of the 100-year and 1996 flood areas, potential landslide areas, relative earthquake hazard, and the location of hazardous materials, natural gas pipelines, and essential facilities.

Flooding

Most flooding in Oregon City is the result of overflows of one or more of its three major streams—the Willamette River, Clackamas River, and Abernethy Creek—although localized, minor flooding can occur during storms. Flooding is most likely between October and April and generally results from a series of heavy rainfall events that can be aggravated, as in 1964 and 1996, by concurrent snowmelt in the watershed.

Because the Willamette River is influenced by tidal height nearly to the base of the falls, flooding at the confluence of the Clackamas and Willamette rivers and Abernethy Creek can be exacerbated by high river levels caused by high winter tides and storm surge on the coast. Areas associated with the Willamette and Clackamas rivers and Abernethy Creek that are subject to flooding have been mapped and are shown in the *Oregon City Hazard Mitigation Plan* (1998).

Localized flooding also occurs in Oregon City, principally due to high water tables, relatively level topography that does not drain quickly, and alterations of natural streams by culverts and storm sewers that are inadequate during storms. A *Drainage Master Plan* (1988), updated in 1999 as the *City of Oregon City Public Works Stormwater and Grading Design Standards*, contains an inventory of areas with drainage and localized flooding problems. A number of structures in these areas are subject to flooding, including key public facilities such as the wastewater treatment plant for Oregon City, West Linn, and Gladstone, the intake on the Clackamas River for the City's water treatment plant, the sub-regional solid waste transfer station, an electrical substation, and a site with hazardous waste.

In 1999, Oregon City adopted a Flood Management Overlay District as part of the *City of Oregon City Municipal Code.* An overlay district is an area that contains a specific resource or potential hazard and is subject to regulations related to the resource or hazard. Examples are historic areas and floodplains. The purpose of a Flood Management Overlay District is to minimize public and private losses due to flooding through a variety of means.

Areas in the Flood Management Overlay District are within the 100-year floodplain, flood areas, and floodways as shown on the Federal Emergency Management Agency flood insurance maps including areas of special flood hazard delineated in 1979 and the area inundated by the 1996 flood, and have physical or documented evidence of flooding based on aerial photographs of the 1996 flooding and/or the water quality and flood management areas maps.

Unstable Soils

Unstable soils are types of soils or soils in locations, such as on steep slopes, that are not stable enough to support development, and may be hazardous to surrounding uses. Unstable soils are subject to slumping or earth flow on slopes, high groundwater level, landslide or erosion, or identified by field investigation performed by a geotechnical engineer or engineering geologist. Areas of unstable foundation soils have been mapped for Oregon City and are on file at the Oregon City Planning Department. In 1994, the City adopted an Unstable Soils and Hillside Constraint Overlay District to provide "safeguards in connection with development on or adjacent to steep hillside and landslide areas and other identified known or potential hazard areas, thereby preventing undue hazards to public health, welfare and safety." The hazardous areas in the overlay district were identified by the State of Oregon Department of Geology and Mineral Industries (DOGAMI) in 1979 and in subsequent mappings of Oregon City and by Portland State University in 1992. DOGAMI published its findings in *Geology and Geological Hazards of North Clackamas County, Oregon, Bulletin 99* (1979), and Portland State University published its findings in *Environmental Assessment of Newell Creek Canyon, Oregon City, Oregon* (1992). Other areas of concern are shown on other city, county, state and federal maps. These publications are available at the Oregon City Planning Department.

Development and construction in areas with unstable soils require that special development standards be met on a site-specific basis to prevent or minimize damage caused by unstable soils. Maintaining existing vegetation or revegetating may be required for excavation and road slopes in areas designated as landslide-prone.

Landslides. Landslides include rockslides, mudslides, debris flows, earthflows, and slumping. These phenomena are natural geologic processes that occur principally when soils and rock in steep areas become saturated with water, increasing weight and lubricating the mass. Gravity pulls the affected areas downhill. Landslides can be exacerbated by adding fill material to a slope, removing vegetation, altering drainage and runoff patterns, and undercutting a slope. Landslides can be triggered by heavy rains, groundshaking from earthquakes and heavy traffic, and undercutting the lower edge of a slope, which can be caused by erosion along stream banks, and by development, such as cuts in road construction.

Areas most susceptible to landslides in Oregon City are those with slopes of greater than 25 percent. These areas have been mapped by DOGAMI and are shown in the *Oregon City Hazard Mitigation Plan* (1998). The Unstable Soils and Hillside Constraint Overlay District requires geotechnical surveys of other potential hazard areas and provides standards that are used to determine the potential risk of landslides on slopes with various degrees of steepness in relation to the development.

Seismic Activity

Although predicting seismic events is extremely difficult, some prediction is possible by looking at the history of a particular region. Oregon is in a region with a history of intense seismic activity, generated by the subduction of the Juan de Fuca Plate under the North American Plate and by the collision of the Pacific Plate with the North American Plate along the San Andreas Fault and associated faults in California. Known catastrophic subduction-zone seismic events in the Pacific Northwest, which have occurred every 300 to 800 years, have caused a down-drop of land, generated enormous tsunamis along the coast, and triggered major landslides throughout the region. The last such event took place in 1700.

Tectonic uplift of the entire Pacific Northwest region, driven by subduction of the Juan de Fuca Plate far offshore, has spawned many faults throughout the region, including the West Hills Fault along the axis of the toe of Portland's West Hills. An earthquake in March of 1993 near Molalla just south of Oregon City, dubbed the "Spring Break Quake," had a magnitude of 5.6 on the Richter scale and caused significant damage to buildings throughout the region. In February 1999, a small earthquake with a magnitude of 2.7 cracked plaster at Oregon City High School.

Most of the damage to people and property from earthquakes is caused by groundshaking, which varies from place to place, depending on subsurface geology. Areas with floodplain soils, gravels, and significant water are likely to experience far more severe groundshaking than areas that stand on solid basalt bedrock, which resists movement. Areas of potential seismic hazard have been mapped by DOGAMI and are shown in the *Oregon City Hazard Mitigation Plan* (1998). Not surprisingly, the most hazardous area coincides with the most severe flood-prone area north of Abernethy Creek, due primarily to the alluvial soil and high water table that are most vulnerable to liquefaction during an earthquake. Areas in the McLoughlin neighborhood and on the Hilltop are far less vulnerable to groundshaking because they are underlain by basalt flows with little soil cover.

Oregon City can take several steps to minimize damage caused by seismic events. These include retrofitting existing public facilities and other buildings to withstand shaking, requiring new development to be built to new standards designed to withstand shaking, and developing an emergency response plan.

Other Hazards

Oregon City is also subject to wildfires, wind and ice storms, and volcanic activity, although the risk of these hazards is far less than the others discussed above.

Wildfires. Dry summers, dense vegetation, and the invasion of non-native weeds in parts of Oregon City make the city vulnerable to wildfires. Wildfires are particularly likely in areas with steep slopes and limited groundwater, leading to dry vegetation in late summer, where there is combustible brush or debris, and where structures with flammable exterior materials are present. The danger of wildfire can be exacerbated by a lack of adequate road access for fire equipment and by inadequate or poorly placed fire hydrants. While much of Oregon City is not vulnerable to wildfires, some areas are, especially in the so-called "wildland-urban interface" where dwellings are in the middle of heavily treed or vegetated areas and where steep, vegetated terrain can contribute to a "chimney effect" as fires burn uphill. The same conditions could apply to areas near Waterboard Park, Canemah Bluffs, Park Place, and canyons such as Singer Creek and Newell Creek.

Wind and Ice Storms. In fall and winter, major storms from the Pacific Ocean bring high winds to the Oregon coast but are generally moderated by the time they reach Oregon City. However some storm events result in damaging high winds, as was the case in October 1962. More often, a combination of climatic conditions in winter result in freezing rain and ice storms throughout western Oregon, which can result in loss of life and property damage. These storms affect the entire city but damage can be more severe where trees are blown over and trees limbs droop onto power and telephone lines. Electrical power service can be interrupted because of downed lines, which can lead to additional safety and comfort complications for the city and for residents. Traffic signals, emergency communications, roads, and other public facilities are especially vulnerable. These events are usually of short duration, from a few hours to a few days.

Volcanic Activity. Oregon City's landscape was shaped by volcanic activity; much of Oregon City lies on a series of basalt flows that resulted from volcanic eruptions many thousands of years ago. Other small lava buttes and cinder cones form the forested buttes between Oregon City and Gresham. Mt. Hood, 35 miles northeast of the city, is the most visually attractive example of the volcanic activity, but it is only one of several volcanic features in the region. Other volcanoes in the Cascade Mountain Range include Mt. St. Helens, about 70 miles away in Washington state, which erupted in May and July of 1980, and South Sister, east of Eugene, which shows distinct signs of subsurface volcanic activity.

Although Mt. Hood has not erupted recently, it has the potential to erupt with lava, ash, and flows of hot ash mixed with water. These materials would flow swiftly down the flanks of the mountain and could reach the Columbia River. Depending on wind conditions, ash could drift across the city and present a health and structural hazard.

While volcanic events are rare, they can occur at any time and with enormous force. Scientists are developing the capability to predict when and where eruptions will occur. It is unlikely that Oregon City would be directly affected by a volcanic eruption in the region. More likely are secondary effects from airborne ash that would severely affect air quality. Ash, mudflows, and pyroclastic flows would affect the Clackamas River watershed, thus potentially compromising the supply of water for Oregon City and West Linn.

Goal 7.1 Natural Hazards

Protect life and reduce property loss from the destruction associated with natural hazards.

Policy 7.1.1

Limit loss of life and damage to property from natural hazards by regulating or prohibiting development in areas of known or potential hazards.

Policy 7.1.2
Protect existing development from natural hazards through mitigation measures identified in the *Oregon City Hazard Mitigation Plan*.

Policy 7.1.3
Reduce risk to residents and businesses by maintaining accurate information on the existence and potential of hazards.

Policy 7.1.4
Ensure that key public facilities (emergency service) are located outside recognized hazard areas.

Policy 7.1.5
Minimize the risk of loss of life and damage to property from flooding by limiting development in the 100-year floodplain and by ensuring that accepted methods of flood proofing are used.

Policy 7.1.6
Encourage the use of land and design of structures that are relatively unaffected by the periodic effects of flooding, such as parking and other uses not normally occupied by humans.

Policy 7.1.7
Prohibit uses in areas subject to flooding that would exacerbate or contribute to hazards posed by flooding by introducing hazardous materials, filling or obstructing floodways, modifying drainage channels, and other detrimental actions.

Policy 7.1.8
Provide standards in City Codes for planning, reviewing, and approving development in areas of potential landslides that will prevent or minimize potential landslides while allowing appropriate development.

Policy 7.1.9
Locate, design, and construct structures in conformance with current building codes and standards for seismic-resistant design.

Policy 7.1.10
Evaluate the need to retrofit existing public facilities such as water reservoirs, bridges, pipelines, and hospitals to better withstand earthquakes.

Policy 7.1.11
Prioritize roadways needed for public service, medical, and emergency vehicles during emergencies.

Policy 7.1.12
Ensure that key public services, such as water and sewer; and key public facilities such as police, fire, and hospital structures have the capability to back-up electricity during emergencies.

Policy 7.1.13
Minimize the risk of loss of life and damage to property from wildfires within the city and the Urban Growth Boundary.

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Section 8

Parks and Recreation

This section is intended to show compliance with Land Conservation and Development Commission (LCDC) Statewide Planning Goal 8, Recreation Needs, which directs jurisdictions to inventory recreational needs and opportunities and ensure that recreational facilities are appropriately sited with respect to compatibility with other land uses and availability of resources.

Because parks and recreational opportunities enhance the livability of a city and contribute to the well-being of its citizens, Oregon City is committed to providing its growing population with recreational facilities and services.

The major recreational facilities in Oregon City are the End of the Oregon Trail Interpretive center, McLoughlin House National Historic Site, Barclay House, the Buena Vista Club House, Ermatinger House, Aquatic Center, Carnegie Center, and Pioneer Community Center.

Major Recreational Facilities in Oregon City

The End of the Oregon Trail Interpretive Center. The End of the Oregon Trail Interpretive Center is located on an 8-acre site in the north portion of town adjacent to the County Maintenance Shops. While the City owns and maintains the site, the Oregon Trail Foundation maintains the site as well as operates the interpretive facility and a Visitor Information Center.

McLoughlin House National Historic Site and Barclay House. The McLoughlin House National Historic Site and the Barclay House (713 and 719 Center Street) are historic homes that are now museums. They are owned by the National Park Service (NPS). The McLoughlin Memorial Association has operated the site but is transferring those responsibilities to NPS.

Buena Vista Club House. Owned and maintained by Parks and Recreation, the Buena Vista Club House at 1601 Jackson Street houses recreational programs and is available for community rentals.

Ermatinger House. One of the oldest buildings in Oregon, the Ermatinger House at 619 6th Street is managed by Parks and Recreation. The roof and foundation have been renovated, but some major structural upgrades are still needed to make it safe for large groups and a viable tourist attraction. Open hours are currently limited. Some special events and period teas are held.

Aquatic Center. The Aquatic Center is adjacent to the former Oregon City High School on Jackson Street. The facility has an indoor pool, wading pool, and meeting space and is used heavily by the school district for swimming lessons, the Oregon City High School Swim Team, and residents of Oregon City and surrounding areas. The center has deteriorated from age and inadequate maintenance, and parking is limited due to its location in a residential area. Because fixing these problems would require a significant public investment, a feasibility study should be conducted to investigate rehabilitating or expanding the facility or constructing a new facility either as a stand-alone pool or as part of a full-service community center in a more suitable location.

Carnegie Center. Formerly the home of the city library, the Carnegie Center is now a cultural arts facility with an art center, children's area, and coffee shop. The center sits on the 1.3-acre Library Park site in the middle of the McLoughlin neighborhood. Recent renovations include recreating the original façade and upgrading fire safety features to required standards. The park includes a spray pool, playground and pathway system. A recently completed plan calling for program upgrades, better marketing and relocation of the Children's Museum should be implemented.

Pioneer Community Center. The Pioneer Community Center at 615 6th Street is used primarily during the day for senior-citizen activities, and in the evenings and on weekends for recreational programs, classes, public meetings, social events and rentals. The main level is heavily used, but the basement is underutilized because there is neither an elevator nor a public stairway connecting the two floors. In addition, there are continuing problems with water damage. This facility has suffered from heavy use and many years of deferred maintenance. Much of the equipment, especially in the kitchen, is original and needs to be replaced.

Additional facilities on the site are a peace garden, pathway system, and parking area.

Oregon City Park and Recreation Master Plan

The most recent *Oregon City Park and Recreation Master Plan* (1999) is one of the several ancillary documents to the Comprehensive Plan. It is the primary inventory, planning, and implementation document for those resources. The 1999 master plan substantially changed the way the City administers its parks and recreational services. In 2000, parks and cemeteries were combined with recreation (Carnegie Center, Aquatics, Pioneer Center and city-wide recreational programming), paving the way for greater implementation of the entire master plan. The master plan also contains provisions for protecting open spaces and natural habitats, which are addressed in Section 5, Open Spaces, Scenic and Historic Areas, and Natural Resources.

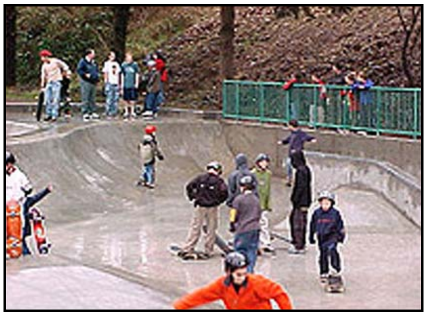
Oregon City should continue to implement the master plan and periodically review it, with special attention given to areas that are experiencing rapid growth. Because it is difficult to purchase large tracts of parkland in developed areas, the City should look to newly annexed areas and to areas within potential expansions of the Urban Growth Boundary for possible regional and community park sites while relatively inexpensive property with substantial acreage still exists.

The City should partner with other service providers as well as private industry when possible to develop green spaces and sites for active recreation. A proposed sports complex near Clackamette Cove, under consideration in cooperation with Tri-Cities (Environmental Services),[2] is a prime example. When possible, the City should work with subdivision developers to include park sites that are established according to City standards and subsequently given to the City to operate and maintain.

Because of funding constraints and the need to maintain existing facilities, regional and community parks should include revenue-producing amenities that at least partially fund maintenance of the facilities. The City should create an endowment fund or some other steady source of revenue to offset adding maintenance responsibilities to an already overburdened system.

The development of bike and pedestrian connections through greenways, natural parks and existing parks as well as through newly acquired property and easements should be aggressively pursued. In particular, agreements with

[2] Tri-Cities consists of a consortium of the Cities of Oregon City, Gladstone, and West Linn that, under the guise of Clackamas County Environmental services, provide wastewater treatment.



Metro and Clackamas County to implement Metro's Regional Trail System through and around Oregon City should be pursued. The City should consider taking the lead in joint applications for state and federal trail grants.

Heavy emphasis needs to be placed on developing new recreational facilities as the City continues to grow. Demands for a community center with a swimming pool and other recreational amenities are increasing, as shown in the series of town hall meetings in 2001 as part of the First City's Future planning (see Section 1, Citizen Involvement). Programming for youth and families in Oregon City is becoming ever more important. Activities for teens appear to be the greatest current need.

With rapid growth bringing new families into the city and surrounding area, reviewing the 1999 *Oregon City Park and Recreation Master Plan* every five to ten years is imperative, as new residents bring new ideas and demands.

Goal 8.1 Developing Oregon City's Park and Recreation System

Maintain and enhance the existing park and recreation system while planning for future expansion to meet residential growth.

Policy 8.1.1
Provide an active neighborhood park-type facility and community park-type facility within a reasonable distance from residences, as defined by the *Oregon City Park and Recreation Master Plan*, to residents of Oregon City.

Policy 8.1.2
When property adjacent to an existing neighborhood or community park becomes available, consider adding property to the park and developing it to meet the current needs of existing neighborhoods.

Policy 8.1.3
Develop regional and community parks in such a way that revenue-producing amenities are included to bring in a revenue stream to partially fund maintenance of the parks system.

Policy 8.1.4
Create either an endowment fund or a steady revenue stream to offset adding maintenance responsibilities to an already overburdened system.

Policy 8.1.5
Identify and construct a network of off-street trails throughout the city for walking and jogging.

Policy 8.1.6
Provide land for specialized facilities such as sports fields and indoor recreational facilities.

Policy 8.1.7
Seek out opportunities to coordinate and partner with other departments, agencies, and jurisdictions to fulfill the aims of the *Oregon City Park and Recreation Master Plan*.

Policy 8.1.8
Explore the possibility of developing a full-service community recreation center that has an aquatics facility and that focuses on providing programming and activities for the youth and families of Oregon City.

Policy 8.1.9
Emphasize retaining natural conditions and the natural environment in proposed passive recreation areas.

Policy 8.1.10
Identify revenue-producing opportunities for inclusion in existing and future parks to offset operational costs.

Policy 8.1.11
Explore opportunities for the school district and the City to share recreational facilities such as athletic fields and meeting space.

Policy 8.1.12
Identify and protect land for parks and recreation within the Urban Growth Boundary.

Policy 8.1.13
Explore the development of a riverfront promenade along the Willamette River from River View Plaza at 5th Street to Clackamette Park.

Policy 8.1.14
Require or encourage developers to dedicate park sites as part of the subdivision review process. When possible, require or encourage developers to build parks to City standards and give them to the City to operate and maintain.

Policy 8.1.15
Investigate the possibility of forming a regional parks and recreational district to replace City-provided services.

Policy 8.1.16
Investigate partnerships with existing and new heritage organizations for joint programming and/or management of historic buildings such as the Ermatinger House and the Buena Vista Club House.

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Section 9

Economic Development

This section is intended to show compliance with Land Conservation and Development Commission (LCDC) Statewide Planning Goal 9, Economy of the State, which calls for diversification and improvement of the economy. Goal 9 also requires local governments "to inventory commercial and industrial lands, project future needs for such lands, and plan and zone enough land to meet those needs." The section is also intended to show compliance with Title 1 of Metro's *Urban Growth Management Functional Plan* (1998).

Oregon City should strive to increase economic activity that increases local, family-wage jobs. The amount of vacant, industrial land inside the Urban Growth Boundary should be monitored to ensure that there is a sufficient supply to support continued economic growth. In addition, industrial land should be used efficiently by encouraging uses that employ a relatively high number of employees per acre. Coordination between public agencies and the business community, adequate transportation for goods and services, job training, and support for home-based businesses are important methods for ensuring that employment lands are developed successfully.

This section, together with its resource document, the *Economic Development Technical Report* (2002), demonstrates that Oregon City's supply of commercial and industrial land is sufficient to continue to promote opportunities for a healthy economy.

Oregon City has long had a significant role in commerce in Oregon and the Willamette Valley, in large part because of its location on the banks of the Willamette River. From early times, the need to portage around the Willamette Falls created an opportunity for development. Regular river steamer service beginning in 1850 made Oregon City a hub for the exchange and transfer of goods from the upper and lower Willamette River and the land routes on the east side of the river. The first large industry in Oregon City, the Oregon Woolen Mills, built in 1864, was based on waterpower.

Currently, the city has a well developed by industrial and commercial base. Most of the land zoned for commercial uses has already been developed. Industrial areas, such as the Fir Street light industrial area and the Red Soils industrial park, are also near completion.

Employment

No single employer or sector dominates the employment picture in Oregon City because the majority of employers are small businesses. Seventy-four percent (1,215 out of 1,632 registered businesses) have fewer than five employees. Less than 1 percent (9 employers) have 100 or more employees, while the top three have more than 200 employees: Willamette Falls Hospital (726), Fred Meyer (275), and Blue Heron Paper Company (250). These nine employers account for almost 20 percent of the total number of private-sector employees in Oregon City.

Based on business licenses and information from public agencies, in 2002 there were a total of 13,005 employees in Oregon City—9,718 in the private sector and 3,287 in the public sector. However, these numbers are likely to be low because not every business has a business license, and businesses may report a lower number of employees than they actually have since business license fees are based on number of employees. In addition, the public sector employment number does not include state and federal workers. If both the public and private employees are underestimated by 10 percent, a more accurate number of employees for 2002 is 14,305. In 1982, there were an estimated 7,291 employees.

With 726 employees, Willamette Falls Hospital is by far the largest private employer in Oregon City. Another 997 people are employed by other providers of health care. Willamette Falls Hospital and Clackamas Community College should both be supported in their effort to grow because in some respects, they are mutually supportive. For example, the medical technology and nursing programs at Clackamas Community College provide trained employees for the hospital and other health-care employers.

A breakdown of employment by industry sector reveals that 967 employees work in eating and drinking establishments,[3] 400 in fabricated metals and primary metal industries, 250 in paper and allied products (at Blue Heron Paper Mill), 248 in auto repair services and auto repair shops, and 185 in credit agencies or banking.

[3] Employment categories are Standard Industry Classifications.

About one-third of the total employment in Oregon City is in the public sector. With 1,080 employees, the Oregon City School District is currently the largest public employer. In 1982, Clackamas Community College was the largest public employer, with 750 to 850 seasonal employees, but the college now employs less than half that number (349). The City of Oregon City has fewer employees now than it did in 1982 (159 now compared to 165 in 1982). There are a total of 3,287 employees in the city and county governments, school district, and community college. There are also state and federal employees, such as the Oregon City Self-Sufficiency Center, which has 146 employees.

Buildable Land

In 2002, a consultant hired by the City inventoried the current buildable land that may be available for commercial and industrial development. The report, the *Economic Development Technical Report* (2002), indicates that there are few remaining buildable acres for commercial development within the city limits and the Urban Growth Boundary—only 22.7 developable acres of vacant and redevelopable, commercially zoned property. There were 181 acres of developable land zoned for, or planned to be used for, industrial purposes. Most of this land is in the Downtown area, north of Abernethy Creek and south of Highway 213, and near Clackamas Community College along both sides of Beavercreek Road. Constraints on land north of Abernethy Creek make it more suited to mixed uses, and it was rezoned, reducing further the amount of industrial land available.

The report is available at the Oregon City Planning Department.

Metro Requirements

Metro's *Urban Growth Management Functional Plan* (1998) established employment targets and other economic policy directives for jurisdictions within Metro. Oregon City must comply with the functional plan or justify exceptions to it.

Metro has assigned a target of 8,185 jobs to Oregon City, the number of jobs the city should plan to accommodate between 1994 and 2017 within the 1996 city limits. Clackamas County has allocated 2,987 jobs to the area between the 1996 city limits and the Urban Growth Boundary, which was part of Clackamas County's employment and housing target distribution in the urban unincorporated area surrounding Oregon City (*Clackamas County Urban Growth Management Functional Plan Compliance Report* [2000]). Although Oregon City has never formally agreed to the County's employment distribution of 2,987 jobs, combining Metro's job capacity for Oregon City (8,185) with the County's allocation for the Urban Growth Boundary (2,927) results in a target of 11,172 new jobs to be created between 1994 and 2017.

The *Economic Development Technical Report* examines the density of commercial development and the number of employees per acre for different types of commercial and industrial land uses and estimates future employment capacity based on available land—how many employees could be accommodated within Oregon City and the current Urban Growth Boundary. The report concludes that, with the implementation of the *Oregon City Downtown Community Plan* (1999) and other modest changes to the zoning ordinance and the Comprehensive Plan Land-Use Map (changing the area north of the Fairways Airport land strip to industrial and adding two neighborhood commercial centers), Oregon City will be able to accommodate 9,048 jobs between 1994 and 2017. This is short of the 11,172 combined employment target by 2,124 employees; that is, Oregon City will be able to reach 81 percent of the target.

The Downtown area is designated as a Regional Center design type in *Metro's 2040 Growth Concept* (1995) and is planned to encourage the development of very high density, mixed-use retail, office, and residential uses, served by high-quality transit service and multi-modal street networks. The City has adopted the *Oregon City Downtown Community Plan* (1999), which is consistent with the Regional Center designation. The zoning proposed in the Downtown community plan assigns a new Mixed Use Downtown (MUD) zone designation for current industrial zone designations on some of the properties. The effect will be to replace some exclusively industrial land with mixed uses that will generate employment but not in light or heavy industries.

Another design type assigned to Oregon City in *Metro's 2040 Growth Concept* is Employment Areas. Oregon City has elected to apply the Industrial Area design type to its Comprehensive Plan Land-Use Map by including all industrial designations in that category.

Title 4 of Metro's *Urban Growth Management Functional Plan* (1998) restricts "big-box retailers" (i.e., single retailers with over 60,000 square feet of gross leasable space) from locating within areas identified as Employment Areas on Metro's Employment and Industrial Areas map. A new Mixed Use Employment District restricts retail uses to less than 60,000 gross square feet for a single business in a single building.

Once a concept plan is completed for the Urban Growth Boundary expansion along Beavercreek Road, it is anticipated that a significant amount of industrial land will be added to the city's industrial land supply. To ensure efficient, orderly, and adequate provision of services and creation of compatible industrial development, a concept plan (see Section 2, Land Use) must be adopted prior to any proposed urban levels of development.

Preserving and Growing Oregon City's Economy

Ensuring an adequate supply of industrial land is only part of the equation for economic health. The City can participate in other ways to help grow the local economy. The City can work with local businesses, organizations and other jurisdictions to create development partnerships, create incentives to help promote development, and keep abreast of changing conditions that might require regulatory or plan adjustments. Other activities include encouraging the creation of a skilled workforce, working to retain and expand existing employers, promoting tourism and home-based businesses, and ensuring that the transportation system can meet the needs of industry and employees. Transportation bottlenecks can constrain the expansion of businesses and prevent new ones from locating here because of the added costs that congestion imposes. Alternative transportation modes and transportation demand management strategies can relieve some of the pressures on the roadway system.

Economic Development Incentives. During the public involvement process for the Comprehensive Plan update, citizens recommended creating market-based incentives to encourage development in the Downtown and waterfront areas. Market-based incentives fall into several categories:

- Public commitments and actions such as locating city offices Downtown, supporting transit operations, and following through on critical City projects recommended in the Downtown community and waterfront master plans.
- Regulatory code compliance relief from development standards such as setbacks, parking, landscaping, and site coverage; relief from fees or charges such as System Development Charges.
- Public support, including design assistance, small business and marketing assistance, marketing studies or pro-forma analysis, promotion of Downtown in City publications, and support of special events like parades, farmers' markets, and antique fairs.
- Financial assistance from, for example, the City's Capital Improvement Program and Urban Renewal Program, improvements to public infrastructure and building parking lots, low-interest loans and direct grants, local improvement districts (with or without the City's assuming part of the design and administration costs), and property tax abatement.
- Direct assistance with development such as public/private partnerships or co-development (i.e., sharing the cost of building and maintaining a parking structure with spaces allotted to both the public and the private business), land assembly and resale, and loan guarantees.

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.

Policy 9.1.1
Attract high-quality commercial and industrial development that provides stable, high-paying jobs in safe and healthy work environments, that contributes to a broad and sufficient tax base, and that does not compromise the quality of the environment.

Policy 9.1.2
Contribute to the health of the regional and state economy by supporting efforts to attract "traded sector industries" such as high technology and production of metals, machinery, and transportation equipment. (Traded sector industries compete in multi-state, national, and international markets and bolster the state's economy by bringing money in from sales of goods and services outside of the state.)

Goal 9.2 Cooperative Partnerships

Create and maintain cooperative partnerships with other public agencies and business groups interested in promoting economic development.

Policy 9.2.1
Seek input from local businesses when making decisions that will have a significant economic impact on them.

Policy 9.2.2
Carefully consider the economic impacts of proposed programs and regulations in the process of implementing the City's Comprehensive Plan.

Policy 9.2.3
Simplify, streamline, and continuously improve the permitting and development review process.

Policy 9.2.4
Use financial tools available to the City, including its Urban Renewal Program and Capital Improvement Program, to support its economic development efforts.

Policy 9.2.5
Use public-private partnerships as a means to leverage private investment when appropriate.

Goal 9.3 Retention of Existing Employers

Retain existing employers, both public and private, and encourage them to expand their operations within the City.

Policy 9.3.1
Protect existing industries from encroachment by incompatible land uses, and ensure that expansion options are available to them wherever possible.

Policy 9.3.2
Support programs of Clackamas County, the Oregon Department of Economic and Community Development, the Small Business Administration and other agencies that provide business-related services such as low-interest loans, job training, and business counseling.

Policy 9.3.3
Encourage the retention and expansion of Clackamas County as a major employer inside the city.

Policy 9.3.4
Work cooperatively with Clackamas Community College, Clackamas County (for Red Soils Facility), and Willamette Falls Hospital to help facilitate their expansion, and encourage master planning for future expansions.

Goal 9.4 Education, Skills And Workforce Training

Ensure that the major employers in Oregon City are able to find qualified and skilled workers to meet their needs.

Policy 9.4.1
Encourage Clackamas Community College and the Oregon City High School to continue providing job training. Support partnerships between Clackamas Community College and potential employees such as Willamette Falls Hospital and other private businesses and new employers on the City's industrial lands, especially near the college.

Policy 9.4.2
Promote the development of ongoing partnerships between Clackamas Community College, the Oregon City School District, the Workforce Investment Council of Clackamas County, local and regional businesses, the Oregon Employment Department, and other agencies to train new workers.

Goal 9.5 Retail Service

Allow a variety of retail outlets and shopping areas to meet the needs of the community and nearby rural areas.

Policy 9.5.1
Develop local neighborhood or specific plans, when appropriate, to blend infill development along linear commercial areas into existing neighborhoods.

Policy 9.5.2
Develop plans to provide necessary public services to surrounding rural industrial lands for future development.

Goal 9.6 Tourism

Promote Oregon City as a destination for tourism.

Policy 9.6.1
Protect historic, recreational, and natural resources as the basis for tourism, such as the Historic Downtown Area.

Policy 9.6.2
Ensure land uses and transportation connections that support tourism as an important aspect of the City's economic development strategy. This could include connections to the End of the Oregon Trail Interpretive Center and the train depot.

Policy 9.6.3
Provide land uses in the Downtown Historic Area, 7th Street corridor, and the End of the Oregon Trail Interpretive Center that support tourism and visitor services.

Policy 9.6.4
Encourage and support citywide events that would attract visitors and tie to the historic attractions of the city. Preserve tourism-related transportation services like the Oregon City Elevator and trolley.

Policy 9.6.5
Encourage river-related tourism facilities and services, such as docking facilities, river transit and river tours.

Policy 9.6.6
Encourage private development of hotel, bed and breakfast, restaurant facilities and other visitor services.

Goal 9.7 Home-Based Businesses

Provide a supportive climate for home-based businesses.

Policy 9.7.1
Encourage home-based businesses that are low impact and do not disrupt the residential character of the neighborhoods in which they are located.

Policy 9.7.2
Encourage the support services that home-based businesses need.

Goal 9.8 Transportation System

Recognize the importance of the land use-transportation link and encourage businesses to locate in areas already served by the type of transportation system they need.

Policy 9.8.1
Through coordination with TriMet and local employers, encourage and promote the use of mass transit to travel between residential areas and employment areas.

Policy 9.8.2
Participate in regional efforts to encourage employers to promote telecommuting and other flexible work arrangements.

Policy 9.8.3
Assess the feasibility of implementing Transportation Management Associations in the city.

Policy 9.8.4
Promote "shared parking" and transportation demand management techniques such as transit vouchers, car or van pooling, and flexible schedules and telecommuting options to reduce peak hour trips.

Policy 9.8.5
Work with the Oregon Department of Transportation to preserve and improve the capacity of Highway 213 and its intersection with I-205.

Policy 9.8.6
Encourage the provision of multi-modal transportation to support major existing employers.

Policy 9.8.7
Assess methods to integrate the pedestrian, bicycle and elevator transportation modes into the mass transit system.

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Section 10

Housing

This section is intended to show compliance with Land Conservation and Development Commission (LCDC) Statewide Planning Goal 10, Housing. The goal requires cities to plan for needed housing types such as multi-family and manufactured housing, to inventory buildable residential land, to project future needs for the land, and to zone enough buildable land to meet those needs. The goal prohibits cities from discriminating against needed housing types. Oregon City is also subject to regional requirements to provide an adequate supply of vacant and buildable land for future residential growth. This section is supported by the resource document, *Housing Technical Report* (2002).

Oregon City recognizes that the health of the city depends largely on the health of its neighborhoods. The housing goals and policies listed in this section are intended to ensure that the integrity of existing neighborhoods is protected and that planning for new neighborhoods is comprehensive and inclusive of a range of housing types and residential services.

Oregon City is unique for its role in Oregon history and for the age and diversity of its housing. Many of the older homes and buildings have historical significance. Therefore, housing planning is aimed at both development of new housing and preservation or careful redevelopment of older historic housing. Like many other communities in the Willamette Valley, Oregon City's population grew more quickly than expected in the 1990s, nearly doubling (see table, next page). More housing will be needed to accommodate new residents and those wishing to move into different types of housing.

In 2002, the City hired a consultant to determine if existing Comprehensive Plan and zoning designations would accommodate growth in Oregon City through 2017. The report, *Housing Technical Report* (2002), includes an inven-

Oregon City's population, 1988 to 2003

		Change from previous year	
Year	**Population**	**Number**	**Percentage**
1988	15,030		
1989	14,975	–55	–0.4%
1990	16,100	+1,125	+7.5%
1991	16,760	+660	+4.1%
1992	16,810	+50	+0.3%
1993	17,315	+505	+3.0%
1994	17,545	+230	+1.3%
1995	18,980	+1,435	+8.2%
1996	20,410	+1,430	+7.5%
1997	21,895	+1,485	+7.3%
1998	22,560	+665	+3.0%
1999	23,405	+845	+3.7%
2000	24,940	+1,535	+6.6%
2001	26,200	+1,260	+5.1%
2002	26,680	+480	+1.8%
2003	28,100	+1,420	+5.3%

Source: City of Oregon City

tory of existing vacant buildable and underutilized land, characteristics of existing housing and demographics in Oregon City and how they compare to the region, and a forecast of housing needs.

According to the report, affordability of housing in Oregon City in 2002 was an issue, as it is in many cities. The U.S. Department of Housing and Urban Development has set 30 percent of monthly income as the maximum that should be spent on housing, and based on this figure, 12 percent of Oregon City's residents cannot afford a studio apartment and more than 23 percent cannot afford a two-bedroom apartment. Rent is slightly higher in the Portland metro area; 12 percent cannot afford a studio apartment and 26 percent cannot afford a two-bedroom apartment.

Other comparisons to the Portland metro area include the following:

- The percentage of people in Oregon City living in group quarters (for example, correctional institutions, nursing homes and residential care facilities) is higher (3.5 percent in Oregon City) than in the metro area (1.8 percent). The number of residents seeking housing in group quarters is likely to increase if the population ages and the Clackamas County correctional facility expands.
- Oregon City's population is slightly younger.

- The percentage of female-headed households in Oregon City living in poverty is significantly higher (25 percent in Oregon City; 20 percent in the metro area).
- Average household income is similar.
- Types of housing (for example, single-family detached and multi-family) are similar.
- Percentage of renters versus owners is similar.

State and Metro Requirements

As noted above, both the State of Oregon and Metro have requirements that Oregon City must fulfill with respect to its comprehensive planning for residential needs. Part of complying with Goal 10 is ensuring that there is an adequate supply of vacant and buildable land for future growth and that the land is designated for a variety of housing types to fit a range of incomes, needs, and preferences. Compliance with Goal 10 is demonstrated through a housing inventory and analysis, which is also one of Metro's requirements. The housing inventory and analysis completed for this updated Comprehensive Plan is discussed below within the context of compliance with *Metro's 2040 Growth Concept* (1995).

Oregon City has two Metro requirements to fulfill. The first is related to *Metro's 2040 Growth Concept*. The second is related to Title 7 of the *Urban Growth Management Functional Plan* (1998) and concerns provisions for affordable housing. Both requirements are discussed below.

Metro's 2040 Growth Concept defines regional growth and development in the Portland metropolitan region with policies, a map of land uses, and a *Regional Framework Plan* (1997), which further establishes the policy direction. Metro's *Urban Growth Management Functional Plan* (1998) became the implementing ordinance that sets requirements for local governments. The functional plan established growth management regulations to ensure that the region complies with state goals for land use in a coordinated way and that housing and employment growth is accommodated equitably across the region.

After the Urban Growth Boundary was established, the affected cities and counties negotiated targets for new dwelling units and jobs. In 1994, Metro and Clackamas County estimated that Oregon City should expect to need to accommodate 9,940 additional housing units between 1994 and 2017 within the city and the Urban Growth Boundary. To comply with the Metro target, Oregon City needed to demonstrate that, after subtracting units built between 1994 and 2002, the land-use designations on remaining vacant and underutilized land would accommodate the difference in needed new dwelling units. If Oregon

City could not do so, the City would need to find other ways to meet the capacity target, most likely through increasing minimum residential densities within the city and Urban Growth Boundary.

The 2002 housing inventory revealed that 3,665 dwelling units were built between 1994 and 2002, which left 6,075 new units needed to meet the Metro 2017 target. After accounting for expected future accessory dwelling units and environmentally constrained land, the overall planned density of residential land in Oregon City and within the Urban Growth Boundary was not sufficient to meet the dwelling unit target established by Metro. Full development of all vacant and partially vacant land under the current Comprehensive Plan designations would result in only 4,593 new units, falling short of the target by more than 1,400 units. The projected shortage of housing units would mean that future population growth, projected to increase from 28,100 in 2003 to approximately 47,500 in 2017, could not be accommodated with the City's current zoning and available land.

Two avenues were pursued to make up the shortfall: (1) map and zoning code amendments to increase densities in targeted areas, and (2) expansion of the Urban Growth Boundary in three locations. With input from a citizen advisory group, the City made changes to the Comprehensive Plan Land-Use Map and zoning code, providing additional units within the city limits. As part of encouraging more intensive development (as well as a wider range of housing types), a new designation of "Mixed Use" was developed to include the mixed-use zones planned for Downtown and other areas of the city suited to combinations of compatible uses. To increase the range of available housing types as well as add the potential for more units, some areas of the city were recommended to be redesignated to more intense residential uses based on the following location criteria:

- along collectors, arterials and transit corridors
- close to business districts and employment and education centers
- in the Downtown mixed-use area
- adjacent to similar more intense densities

As part of the recent Urban Growth Boundary expansion process, Oregon City applied for and received approval of expansions at South End Road, Redland Road, and Beavercreek Road. Land within the 2002 expanded Urban Growth Boundary provides additional land for future annexation and will help the City meet the demand for housing.

In 2001, Metro adopted amendments to Title 7 of the *Urban Growth Management Functional Plan* to implement the *Regional Affordable Housing Strategy* (2000), which identifies measures to provide adequate affordable housing in the Metro region. The amendments require local jurisdictions to consider adopting a number of tools and strategies for promoting the creation and retention of affordable housing. Metro defines an affordable housing unit as one that requires no more than 30 percent of household income for people earning 50 percent of the median household income in their jurisdiction. By that definition, an affordable housing unit in Oregon City in 2000 would cost $570 per month or less. The 2002 housing inventory and analysis showed that the number of lower-cost units in Oregon City was inadequate to meet both the current (2002) and projected housing needs of the city's lower-income residents. Title 7 tools and strategies have been adopted as Goal 10.2 and Policies 10.2.1 through 10.2.4.

Many of the policies in the 1982 Comprehensive Plan have been retained in the updated plan because they are still relevant. Because the housing inventory conducted in 2002 established baseline data for housing, the City will track development as it occurs, to keep the information current.

Goal 10.1 Diverse Housing Opportunities

Provide for the planning, development and preservation of a variety of housing types and lot sizes.

Policy 10.1.1
Maintain the existing residential housing stock in established older neighborhoods by maintaining existing Comprehensive Plan and zoning designations where appropriate.

Policy 10.1.2
Ensure active enforcement of the *City of Oregon City Municipal Code* regulations to ensure maintenance of housing stock in good condition and to protect neighborhood character and livability.

Policy 10.1.3
Designate residential land for a balanced variety of densities and types of housing, such as single-family attached and detached, and a range of multi-family densities and types, including mixed-use development.

Policy 10.1.4
Aim to reduce the isolation of income groups within communities by encouraging diversity in housing types within neighborhoods consistent with the *Clackamas County Consolidated Plan*, while ensuring that needed affordable housing is provided.

Policy 10.1.5
Allow Accessory Dwelling Units under specified conditions in single-family residential designations with the purpose of adding affordable units to the

housing inventory and providing flexibility for homeowners to supplement income and obtain companionship and security.

Policy 10.1.6
Allow site-built manufactured housing on individual lots in single-family residential zones to meet the requirements of state and federal law. (Pursuant to state law, this policy does not apply to land within designated historic districts or residential land immediately adjacent to a historic landmark.)

Policy 10.1.7
Use a combination of incentives and development standards to promote and encourage well-designed single-family subdivisions and multi-family developments that result in neighborhood livability and stability.

Goal 10.2 Supply of Affordable Housing

Provide and maintain an adequate supply of affordable housing.

Policy 10.2.1
Retain affordable housing potential by evaluating and restricting the loss of land reserved or committed to residential use. When considering amendments to the Comprehensive Plan Land-Use Map, ensure that potential loss of affordable housing is replaced.

Policy 10.2.2
Allow increases in residential density (density bonuses) for housing development that would be affordable to Oregon City residents earning less than 50 percent of the median income for Oregon City.

Policy 10.2.3
Support the provision of Metro's Title 7 Voluntary Affordable Housing Production Goals.

Policy 10.2.4
Provide incentives that encourage the location of affordable housing developments near public transportation routes. Incentives could include reduction of development-related fees and/or increases in residential density (density bonuses).

Section 11

Public Facilities

This section is intended to show compliance with Land Conservation and Development Commission (LCDC) Statewide Planning Goal 11, Public Facilities. Goal 11 requires that public facilities and services be provided in a timely, orderly and efficient manner. The goal's central concept is that local governments should plan public services in accordance with the community's needs as a whole rather than be forced to respond to individual developments as they occur.

Public facilities and services include:

- wastewater collection and treatment, water distribution and storage, and stormwater management
- solid waste (trash) disposal
- transportation infrastructure
- fire protection and emergency services
- police protection
- library
- parks and recreation

Oregon City is committed to providing its residents with safe and accessible public facilities and services that are developed in a timely, orderly and efficient fashion and that contribute to their welfare and quality of life.Oregon City also has an interest in its citizens having access to utilities provided by other agencies and the private sector, such as electricity, gas, telecommunications, health care, and education.

Wastewater Collection and Treatment, Water Distribution, and Stormwater Management

Oregon City's wastewater collection and treatment, water distribution, and stormwater management facilities and services are funded by user fees and governed by the following ancillary documents:

- *City of Oregon City Sanitary Sewer Master Plan* (2003)
- *Caufield Basin Master Plan* (1997)
- *South End Basin Master Plan* (1997)
- *Drainage Master Plan* (1988), updated in 1999 as the *City of Oregon City Public Works Stormwater and Grading Design Standards*
- *City of Oregon City Water Master Plan* (2003)

Wastewater Collection and Treatment. The *City of Oregon City Sanitary Sewer Master Plan* (2003) contains specifications for the existing wastewater collection system and discusses how the specifications will need to change during the next 20 years, based on projected growth. According to the master plan, Oregon City's sanitary sewer system is in relatively good condition with isolated areas of capacity problems, and will remain adequate within the Urban Growth Boundary for the next 20 years. The greatest deficiency is the older pipes that need repair, rehabilitation, or replacement. The City continues to work with the Tri-City Service District to reduce inflow and infiltration into the collection system.

Wastewater is treated at the Tri-City Water Pollution Control Facility. Located in Oregon City, Tri-City treats wastewater from Oregon City, West Linn and Gladstone. Wastewater flows from the greater Clackamas County area were recently diverted to Tri-City as a result of a cost-efficient strategy that benefited Tri-City ratepayers. Flows to Tri-City may increase if the Kellogg Creek Water Pollution Control Plant in Milwaukie closes and as planned growth occurs in the Damascus area. The need for a major expansion of Tri-City will have to be weighed against preserving the valuable property around the treatment plant for future parks, recreation, and mixed-use development. Oregon City and Tri-City should continue to collaborate on the Clackamette Cove area improvements identified in the *Tri-City Service District, Tri-City Water Pollution Control Facility (WPCF) Master Plan Plant Advanced Facilities Plan* (2002) and the *Oregon City Waterfront Master Plan* (2002).

Water Distribution and Storage. Surface water from the Lower Clackamas River is the source of potable water for Oregon City and West Linn. The wholesale water supplier is the South Fork Water Board, which is owned equally by Oregon City and West Linn. Water is distributed by each city under separate utility departments. The South Fork Water Board has rights to withdraw 42.6 million gallons per day (mgd), which is expected to meet demand for at least 30 years. However, Oregon City will need to increase water storage capacity within its distribution system.

Stormwater Management. The focus of stormwater management has changed over the years from underground stormwater and sanitary sewers combined and piped systems to open, natural drainage channels where possible. The *Caufield Basin Master Plan* (1997) and *South End Basin Master Plan* (1997) call for drainageways to remain in a natural state for maximum water quality, water resource preservation, and aesthetic benefits. The *City of Oregon City Public Works Stormwater and Grading Design Standards* (1999) encourages the use of open ponds for stormwater runoff control where feasible. Detention ponds that serve more than one development and regional detention facilities are preferred because they require a lower level of monitoring and maintenance effort than single- or on-site detention. Updated plans for all of the drainage basins in Oregon City should be developed using a watershed planning approach.

The City's stormwater management program is subject to the City's National Pollution Discharge Elimination System Municipal Separate Storm and Sewer System (NPDES) MS-4 permit, which is administered by the Oregon Department of Environmental Quality (DEQ) for the U.S. Environmental Protection Agency (EPA).

Oregon City and the other urban municipalities in Clackamas County have operated since 1996 under a joint NPDES permit that prescribes requirements for each agency. Oregon City is responsible for monitoring and maintaining its stormwater management system to ensure the environmental integrity of the system's receiving waters (the Willamette and Clackamas rivers), and for preparing annual reports showing permit compliance.

Solid Waste (Trash) Disposal

For most residences and businesses within the city limits, Oregon City Garbage Company, a private company contracted by Oregon City, collects garbage and recyclables at the curb for distribution to Metro disposal and transfer facilities. Metro oversees regional garbage disposal, recycling and waste reduction programs and owns the Metro South Transfer Station. Regional landfill sites are estimated to have the capacity to serve the region until mid-century (*Regional Solid Waste Management Plan, 1995-2005* [1999]). Therefore, no capacity issues are anticipated for the duration of this Comprehensive Plan.

Transportation Infrastructure

The transportation infrastructure in Oregon City is governed by the *Oregon City Transportation System Plan* (Oregon City TSP), adopted in 2001. Oregon City's transportation system is discussed separately in Section 12, Transportation.

Fire Protection and Emergency Services

Oregon City provided its own fire protection and emergency services until it contracted them out. In 1999, the responsibilities were contracted by Tualatin Valley Fire and Rescue (TVFR), East Division. Since July 2003, Clackamas County Fire District #1 has provided fire protection and emergency services.

There are three fire stations in Oregon City: the main station at the old City Hall in the McLoughlin Neighborhood, a substation along Molalla Avenue near Clackamas Community College, and a new station on South End Road.

Electricity, Gas and Telecommunications

Several utilities provide energy and communication services to residents and businesses in Oregon City. Portland General Electric, which owns generating and transmission facilities, provides electricity to Oregon City. The Bonneville Power Administration markets wholesale electrical power and operates a high-voltage transmission line south of Oregon City and east of Holly Lane in Newell Canyon. Currently, there is sufficient electricity capacity in the Oregon City area to support industrial, commercial, and residential expansion.

New transmission line facilities should be located underground where economically and technically feasible to preserve the aesthetic quality of neighborhoods and reduce the risk of power outages. Local service lines in new subdivisions should be underground. Development of a new program to bury existing power and telephone lines should be investigated.

Northwest Natural (NWN) pipes natural gas to homes and businesses in the Metro area. NWN's system is sized to support existing customers. Planning for future capacity needs is focused primarily on the supply of natural gas, rather than on the supply of pipelines. There are no infrastructure capacity constraints with the existing natural gas pipeline system.

Qwest Communications International, Inc., provides local, long distance, and wireless telephone services as well as broadband data, and voice and image communications for businesses and consumers. Qwest maintains both older telephone transmission lines and newer fiber-optic lines. Beavercreek Telephone also provides local services.

Emerging technologies such as wireless communications, geographic information systems, and digital subscriber lines (DSL) are becoming increasingly important to the economy and education. However, these technologies are growing so rapidly and are so volatile that documenting information about transmission resources, providers, demand, and use in the Oregon City area is extremely difficult. Because information transmission resources are federally regulated, the Federal Communications Commission maintains a list of its Clackamas County licensees, which indicates that all of these emerging technologies are or will be available to Oregon City residents. Because most of these resources are privately owned, the City's role in the information transmission system should be to inform residents and businesses about available resources and act as an advocate for providing up-to-date services to residents and businesses. City staff needs to keep abreast of methods of mitigating adverse impacts that can result from both the volatility of the industry and the construction of system infrastructure such as cell towers and in-ground fiber-optic lines.

Health Care

Healthcare services in Oregon City are provided by Willamette Falls Hospital, the Clackamas County Department of Human Services, and a variety of private entities such as retirement communities, assisted living facilities, and nursing homes. Clackamas County's health services are found in various locations throughout the city.

Willamette Falls Hospital anticipates the need for expansion during the next 10 to 20 years. The hospital has been purchasing nearby properties in anticipation of expansion, but traffic circulation continues to be a challenge and may hinder future expansion. The City and County should continue to work with the hospital to balance the needs of the neighborhood, patients, and the hospital. New facilities, such as medical and dental offices, should be compatible in size with the surrounding areas. A City-approved master plan is needed to ensure adequate facilities and infrastructure during construction.

Although regional healthcare planning is done by public and private healthcare providers, Oregon City should stay abreast of trends in health care and changes in population that may affect land uses. For example, "aging in place" refers to providing citizens accommodations that can be adapted to the physical limitations associated with aging, thereby limiting disruption to individuals. In addition, the City should support the revisions of the *Uniform Building Code* that accommodate accessibility for the disabled.

Education

K-12. The public education system in Oregon City consists of elementary schools, middle schools, and one high school. The Oregon City School District projects enrollment based on demographic trends and a ratio of 0.94 school children per residential household. A rolling five-year projection is done every fall to ensure that the facilities will accommodate growth. The preferred number of students per classroom is 25, with the maximum considered to be 30.

To the extent possible, future school facilities should be located in, or at least adjacent to, residential areas to reduce traffic impact, maintain convenience for students, provide a focus for the neighborhoods, and promote energy conservation. Neighborhood schools and their athletic facilities should also serve as community centers by being available for community meetings and events in the evenings and on weekends.

The Oregon City School District and Oregon City should proceed with the disposition of the original high school, which was vacated in 2003, and other vacant school properties to ensure that the properties are used for the mutual benefit of all residents.

Post-Secondary. Clackamas Community College (CCC) has been, and will continue to be, an important resource and significant partner in the character and development of Oregon City. The college offers an array of educational opportunities, job training programs, social programs, recreational facilities, and meeting spaces that benefit the residents of Oregon City and the surrounding communities.

CCC is connected to Oregon City High School to the south by a foot path, giving high school students easy access to advanced classes. Development on nearby industrial land should offer opportunities for internships and employment for students at both the high school and CCC.

The TriMet hub on the center of campus will play a role in future public transportation routes through Oregon City and should be enhanced to improve service. The Environmental Learning Center offers a valuable community resource as an educational and demonstration site. The Haggart Observatory on the CCC campus has one of the largest telescopes in the Pacific Northwest and is an educational resource that should be protected. Because nighttime light pollution can impair the telescope's ability to see into space, the development of lighting standards, including minimum lighting standards where suitable, and appropriate shielding of parking, street, path, and building lights, would benefit the observatory. For more information on nighttime light pollution, see Section 6 (Air, Water, and Land Resources).

CCC and Oregon City should work together to zone CCC's 164-acre site to allow for taller buildings in order to increase the efficient use of the remaining vacant property in a compact and dense, urban form. Master planning of the site is also critical to ensuring that adequate facilities are available in a timely manner for students, and that the pedestrian and transportation system, including the extension of Meyers Road, will support the increased enrollment that will follow from the expanded services the college plans to provide. The City should support expansion that is consistent with good site planning and design and compatible with adjacent uses.

Police Protection

The Oregon City Police Department consists of three divisions: support, records, and operations (chiefly patrol, including traffic). The departmental facilities at City Hall are severely deficient. The City should develop additional funding to support the minimum level of police service as the city continues to grow.

Library

The Oregon City Public Library houses its collection of 98,000 items in a leased, 13,000-square-foot facility in Danielson's Hilltop Mall on Warner Milne Road. The library program is partially funded by a county library levy and the City's general fund. Funds are distributed to the libraries in the county based on size of service area and circulation of library materials.

A new facility is desperately needed to accommodate Oregon City's population. In 1993, a construction bond measure for a new library was unsuccessful. In 1995, the library was moved to its current location. The facility is not large enough to meet the needs of Oregon City residents and the county residents. According to Oregon Library Association standards, the number of Oregon City Public Library employees is inadequate for the size of its service area. The library does not have public meeting, study, or equipment rooms.

In 1998, Oregon City hired Providence Associates, Inc., a nationally recognized consultant in library building development, to evaluate the library and its services. Their report, *From One Century to the Next: A Twenty Year Needs Assessment for the Oregon City Public Library* (1998) indicated that a 59,000-square-foot facility would be needed to meet the needs of the residents in 2020.

In 2000, the City Commission discussed plans for building a new, 32,000-square-foot library. The Library Building Committee is currently searching for an appropriate site in the Hilltop area, near retail services and with good access to Oregon City neighborhoods, multiple modes of transportation (car, transit, pedestrian, bicycle), and major roads from rural areas to the east and south. The site must have at least four acres to be able to accommodate the building, parking and future expansion. A stand-alone facility and a civic complex that includes a library are both feasible options.

Parks and Recreation

Oregon City owns and maintains a number of parks and recreational facilities throughout the city. The major facilities are the End of the Oregon Trail Interpretive Center, McLoughlin House National Historic Site, Barclay House, Buena Vista House, Ermatinger House, Aquatic Center, Carnegie Center, and Pioneer Community Center. See Section 8, Parks and Recreation, and the *Oregon City Park and Recreation Master Plan* (1999) for more information.

Other Public Facilities and Services

Reservoirs and Pump Stations. Reservoirs and pump stations are located at strategic locations throughout the city and are secured, controlled, and monitored through telemetry.

Operations Division of the Public Works Department. The Operations Division of the Public Works Department resides in facilities throughout the city. Facilities include staff offices, shops for sign fabrication and fleet maintenance, and storage for equipment, tools, and pump station and pipe maintenance equipment.

City Hall. City Hall, located on Warner Milne Road, contains offices and other facilities for the City Commission, City Manager, Municipal Court, and the departments of Community Development, Public Works, Finance, Police, and Community Services. City Hall consists of a permanent building connected by covered walkways to three portable buildings.

The Community Development Department provides long-range planning and development review. Within this department, Geographic Information System (GIS) services provide mapping and critical support for all planning functions.

The Public Works Department plans and constructs capital improvements, operates and maintains city infrastructure, administers the Downtown parking program, and provides code enforcement.

The Finance Department oversees the annual budget, is responsible for accounts receivable, accounts payable, and utility billing services, and provides human resources support for all departments.

The Community Services Department plans and operates the city's library and parks and recreational activities.

The facility City Hall occupies is severely undersized not only for existing staff but also for much needed additional staff. The City is continuing its efforts to develop a long-term plan for a permanent home for City Hall and the services it provides.

Funding. Oregon City's public facilities and services can be funded in a number of ways.

- The **General Fund** is a limited revenue source from property taxes and shared by a multitude of other governmental agencies and special districts.

- **Urban Renewal** funding comes from designating specific areas as deficient in assessed values and development ability and creating a plan for increasing property tax values and revenues through public infrastructure improvements and private development incentives. The Urban Renewal tax mechanism affords municipalities the opportunity to collect revenues for highly needed, value-based improvements for which other resources are insufficient. The improvements, in turn, provide a higher tax base for future City budgets.
- The **Capital Improvement Program** provides a detailed financial analysis of proposed projects. It is generally a short-term plan (one to five years) for public facility improvements and extension.
- **Special levies** or **bond issues** can be submitted to voters to raise funds for specific projects. These tools have traditionally been used for large projects such as school funding, construction or purchase of recreational facilities, and sewer or water system replacement.
- **Grants** may be available for many projects meeting certain federal and/or state guidelines.
- **Local Improvement Districts (LIDs)** are useful for many projects deemed necessary for small areas.
- **User fees** can be assessed for many services. Water, wastewater, stormwater, street maintenance, power, gas, telephone, garbage removal, health services, and some governmental services (courts and permit issuance) can be funded in this manner.
- **System development charges (SDCs)** are collected when building permits are issued and are used to construct infrastructure required to serve new development and growth of system needs. The SDC is directly related to the Capital Improvement Program for transportation, water, wastewater, stormwater, and parks.
- **Tax increases** may also be used, although they are usually insufficient and highly unpopular.
- **Zoning, subdivision control, site plan review.** Although funding is not directly addressed, many planning mechanisms, including zoning, subdivision control, site plan review, and others are used to require or encourage installation of many public facilities and services.
- **Better coordination of services and improved operating efficiency** are highly desirable, when possible.
- **Builders and residents.** The cost of public facilities serving new developments should be borne as much as possible by builders and residents of developments. Development proposals should be approved only if the vital public facilities

necessary for additional land development and population growth are existing or committed.

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
- Wastewater collection
- Stormwater management
- Police protection
- Fire protection
- Parks and recreation
- Water distribution
- Planning, zoning and subdivision regulation
- Library services
- Aquatic Center
- Carnegie Center
- Pioneer Community Center
- City Hall
- Buena Vista House
- Ermatinger House

Policy 11.1.2
Provide public facilities and services consistent with the goals, policies and implementing measures of the Comprehensive Plan, if feasible.

Policy 11.1.3
Confine urban public facilities and services to the city limits except where allowed for safety and health reasons in accordance with state land-use planning goals and regulations. Facilities that serve the public will be centrally located and accessible, preferably by multiple modes of transportation.

Policy 11.1.4
Support development on underdeveloped or vacant buildable land within the city where public facilities and services are available or can be provided and where land-use compatibility can be found relative to the environment, zoning, and Comprehensive Plan goals.

Policy 11.1.5
Design the extension or improvement of any major public facility and service to an area to complement other public facilities and services at uniform levels.

Policy 11.1.6
Enhance efficient use of existing public facilities and services by encouraging development at maximum levels permitted in the Comprehensive Plan, implementing minimum residential densities, and adopting an Accessory Dwelling Unit Ordinance to infill vacant land.

Policy 11.1.7
Develop and maintain a coordinated Capital Improvements Plan that provides a framework, schedule, prioritization, and cost estimate for the provision of public facilities and services within the City of Oregon City and its Urban Growth Boundary.

Goal 11.2 Wastewater

Seek the most efficient and economic means available for constructing, operating, and maintaining the City's wastewater collection system while protecting the environment and meeting state and federal standards for sanitary sewer systems.

Policy 11.2.2
Plan, operate and maintain the wastewater collection system for all current and anticipated city residents within the existing Urban Growth Boundary. Plan strategically for future expansion areas.

Policy 11.2.2
Given the vision for Clackamette Cove, investigate strategies to deal with increased flows, including alternate locations for treatment, from growth in the Damascus area and the potential closure of the Kellogg Creek Water Pollution Control Plant.

Policy 11.2.3
Work with the Tri-City Service District to provide enough collection capacity to meet standards established by the Oregon Department of Environmental Quality (DEQ) to avoid discharging inadequately treated sewage into surfacewater.

Policy 11.2.4
Seek economical means to reduce inflow and infiltration of surface- and groundwater into the wastewater collection system. As appropriate, plant riparian vegetation to slow stormwater, and to reduce erosion and stream sedimentation.

Policy 11.2.5
Implement the City's wastewater policies through the *City of Oregon City Sanitary Sewer Master Plan*.

Goal 11.3 Water Distribution

Seek the most efficient and economic means available for constructing, operating, and maintaining the City's water distribution system while protecting the environment and meeting state and federal standards for potable water systems.

Policy 11.3.1
Plan, operate and maintain the water distribution system for all current and anticipated city residents within its existing Urban Growth Boundary and plan strategically for future expansion areas.

Policy 11.3.2
Collaborate with the South Fork Water Board to ensure that an adequate water supply system is maintained for residents. Coordinate with the South Fork Water Board, the City of West Linn, and Clackamas River Water to ensure that there is adequate regional storage capacity.

Policy 11.3.3
Maintain adequate reservoir capacity to provide all equalization, operational, emergency, and fire flow storage required for the City's distribution system.

Policy 11.3.4
Adopt a progressive water rate structure that will encourage water conservation.

Goal 11.4 Stormwater Management

Seek the most efficient and economical means available for constructing, operating, and maintaining the City's stormwater management system while protecting the environment and meeting regional, state, and federal standards for protection and restoration of water resources and fish and wildlife habitat.

Policy 11.4.1
Plan, operate, and maintain the stormwater management system for all current and anticipated city residents within Oregon City's existing Urban Growth Boundary and plan strategically for future expansion areas.

Policy 11.4.2
Adopt "green streets" standards to reduce the amount of impervious surface and increase the use of bioswales for stormwater retention where practicable.

Policy 11.4.3
Ensure parking lot designs that mitigate stormwater impacts. Take measures to reduce waterflow and increase water absorption through the use of bioswales, vegetated landscaped islands with curb cuts to allow water inflow, and tree planting.

Policy 11.4.4
Maintain existing drainageways in a natural state for maximum water quality, water resource preservation, and aesthetic benefits.

Policy 11.4.5
Design stormwater facilities to discharge surfacewater at pre-development rates and enhance stormwater quality in accordance with criteria in *City of Oregon City Public Works Stormwater and Grading Design Standards.*

Policy 11.4.6
Regularly review and update the above standards to reflect evolving stormwater management techniques, maintenance practices, and environmental compatibility.

Policy 11.4.7
Provide stormwater management services and monitor, report and evaluate success of the services consistent with the NPDES MS-4 permit requirements.

Goal 11.5 Solid Waste

Seek to ensure that the most cost-effective, integrated solid waste plan is developed and implemented.

Policy 11.5.1
Acknowledge Metro's responsibility for preparing and implementing the *Regional Solid Waste Management Plan, 1995-2005* because solid waste disposal is a regional concern requiring regional solutions.

Policy 11.5.2
Coordinate with Metro and Clackamas County as needed to help implement the goals and objectives of the *Regional Solid Waste Management Plan, 1995-2005*.

Policy 11.5.3
Commit to long-term sustainability and recognize the link between reduction of solid waste, reuse and recycling of materials, and protection of natural 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.

Policy 11.6.2
Advocate for local, state, and regional cooperation in achieving an integrated connected system such as for the Amtrak station, light rail, and bus transit.

Goal 11.7 Private Utility Operations

Coordinate with utilities that provide electric, gas, telephone and television cable systems, and high-speed internet connection to Oregon City residents to ensure adequate service levels.

Policy 11.7.1
Require local service lines in new subdivisions be placed underground.

Policy 11.7.2
Coordinate with private utility providers to install infrastructure during street construction and maintenance to reduce the need to repeatedly cut into newly paved streets.

Policy 11.7.3
Adopt lighting practices in streets and other public facilities, and encourage them in private development, that reduce glare, light pollution, light trespass, and energy use, while maintaining even lighting ensuring good visibility and safety for the public.

Policy 11.7.4
Encourage development of broadband networks in street rights-of-way in a coordinated way to provide state-of-the-art technology to residents.

Policy 11.7.5
Maintain and enforce the cell tower ordinance. Adopt, support and encourage innovations in reducing, camouflaging or screening cell towers.

Goal 11.8 Health and Education

Work with healthcare and education providers to optimize the siting and use of provider facilities.

Policy 11.8.1
Work with Clackamas County as needed to ensure that county services are sited appropriately and that citizens of Oregon City continue to have access to County health and human services.

Policy 11.8.2
Coordinate with the master planning efforts by Willamette Falls Hospital to address environmental, neighborhood and health provider concerns about expansion plans, parking, traffic, and circulation.

Policy 11.8.3
Coordinate with the Oregon City School District to ensure that elementary and middle school sites are located centrally within the neighborhoods they serve, to the extent possible.

Goal 11.9 Fire Protection

Maintain a high level of fire protection and emergency medical services.

Policy 11.9.1
Ensure that all areas, including newly annexed areas, receive fire protection and emergency medical services.

Policy 11.9.2
Attempt to maintain the City's Class IV fire insurance rating and work towards achieving a Class III rating, as funds are available.

Policy 11.9.3
Promote public awareness of fire prevention techniques, emergency management, and emergency preparedness education programs as important components of community safety.

Goal 11.10 Police Protection

Preserve the peace and provide for the safety and welfare of the community.

Policy 11.10.1
Maintain continuous liaison with other elements of the criminal justice system.

Policy 11.10.2
Strive to provide rapid response to emergency and non-emergency calls.

Policy 11.10.3
Promote traffic safety to reduce property loss, injuries and fatalities.

Policy 11.10.4
Continually evaluate operations to maximize effectiveness and efficiency.

Policy 11.10.5
Seek to have a department and community committed to the philosophy of community-oriented policing. Develop community partnerships so that both the community and department are empowered to solve problems and seek creative solutions.

Policy 11.10.6
In addition to law enforcement, help deter crime through proactive programs that emphasize education, prevention, and cooperation.

Goal 11.11 Civic Facilities

Strategically locate civic facilities to provide efficient, cost-effective, accessible, and customer friendly service to Oregon City residents.

Policy 11.11.1
Locate City facilities in a way that ensures customer service and provides easy access to the majority of residents. Access should be provided for the physically impaired and for those traveling by transit, bicycle, or foot.

Policy 11.11.2
Investigate options for obtaining or building a new City Hall.

Policy 11.11.3
Implement measures to maximize and leverage resources and increase services to the public.

Policy 11.11.4
Incorporate measures to meet long-term rising demand for services. Provide for future needs of increased staff, space and storage when purchasing or building new city facilities.

Goal 11.12 Library

Ensure that the library has an adequate facility and resources to maintain its vital role in the community and accommodate growth of services, programs and the population of the entire service area.

Policy 11.12.1
Identify and acquire, if possible, an appropriate site for a permanent library that is centrally located to the service area. This could include a mixed-use facility with retail space and Friends of the Library activities, etc.

Policy 11.12.2
Explore partnerships with schools and other community groups in regard to shared programming, public meeting rooms and other community-use spaces.

Policy 11.12.3
Develop, if possible, a means of funding a permanent library facility.

Section 12

Transportation

This section is intended to show compliance with Land Conservation and Development Commission (LCDC) Statewide Planning Goal 12, Transportation, which aims to provide "a safe, convenient and economic transportation system." A transportation system that functions well contributes to a city's well-being, enhances quality of life, and increases opportunities for growth and development.

Oregon City Transportation System Plan (TSP)

The 2001 *Oregon City Transportation System Plan* (TSP) is an ancillary plan to the Comprehensive Plan (ancillary plans are available at City Hall). The TSP functions as a guide for the management and development of Oregon City's transportation facilities to the year 2020. It is based on a vision of a community that integrates efficient land use with a multi-modal transportation system. The goals and policies of the TSP are designed to enhance the quality of life in Oregon City and facilitate the movement of goods and services for local businesses. This section of the Comprehensive Plan summarizes key parts of the TSP.

The LCDC administrative rule known as the Transportation Planning Rule (TPR) (Oregon Administrative Rule 660-12) requires that TSPs contain a plan for roads, public transit, bicycles, pedestrians, rail and air travel, and transmission lines. The Oregon City TSP and its subdocuments provide details about the state and regional regulatory framework for transportation, plans for existing and future road, pedestrian, transit, and bicycle networks, and the projects and policies that are needed to implement those networks.

Other Transportation Plans

Other ancillary transportation plans are discussed in this section, including the *Oregon City Downtown Community Plan* (1999), *7th Street Corridor Design Plan* (1996), the *Molalla Avenue Boulevard and Bikeway Improvements Plan* (2001). The city is also working on plans for the Highway 99E corridor to improve access control, landscaping, pedestrian safety, and the connection to the riverfront.

Downtown Community Plan. Implementation of the *Oregon City Downtown Community Plan* would enable a more efficient land-use pattern to emerge in the Downtown area. Improved efficiency would result in a more vital and vibrant Downtown area that is better equipped to capture and serve the traveling public, particularly pedestrians and transit riders.

The McLoughlin Boulevard corridor represents a vital transportation link in achieving the goals of the *Oregon City Downtown Community Plan* and Metro's vision for Oregon City as a Regional Center (*Metro's 2040 Growth Concept* [1995]). Regional Centers serve large market areas outside the central city and have connections via high-capacity transit and highways, such as Highway 99, which is designated as a Corridor in *Metro's 2040 Growth Concept* (see Section 2, Land Use, for more detail). Oregon City will provide leadership to improve access by vehicles and transit to Downtown and to the connection between Downtown and the Willamette River.

7th Street Corridor and Molalla Avenue. Implementation of the *7th Street Corridor Design Plan* (1996) and the *Molalla Avenue Boulevard and Bikeway Improvements Plan* (2001) would enable the 7th Street corridor to evolve into one that is more accessible by pedestrians and transit with land uses that support multi-modal transportation. Additional land-use planning is needed for the redevelopment of underutilized parcels along Molalla Avenue that represent opportunities for transit-oriented development with higher density and mixed uses. These plans contain proposed improvements that are consistent with Metro's 2040 Corridor designation for this important transportation link.

The 7th Street plan contains a multi-modal vision of the corridor with recommended action items. The vision for the street is a cohesive design with a historical character, slower traffic, and lively pedestrian activity. One of the objectives is to revitalize the area by providing parking and transportation improvements. Support for rehabilitating building façades and the pedestrian environment is also discussed as a means to make the area more attractive to pedestrians, shoppers, and tourists. An emphasis is placed on pedestrians with easy access across 7th Street, benches, street trees, curb extensions, and other elements to identify "Pedestrian Places." Traffic would move more slowly with a narrower pavement width, curb extensions, traffic calming devices, and trees. Neighborhood safety would be enhanced by more pedestrian activity and mix of uses.

Visual and physical connections with Downtown and the McLoughlin neighborhood would improve the vitality of the corridor as well. The 7th Street plan calls for supporting the existing businesses and preserving the architectural heritage of the community. The business environment should invite new and complementary development and redevelopment that is compatible in scale and style with the neighborhood. New public facilities, such as a branch library, elementary school, civic institutions, and Community Theater, should be encouraged while existing public facilities like the park and promenade system should be retained and enhanced. Diverse mixed use and infill housing should be encouraged because increased density can contribute to the economic vitality of the corridor. The corridor could also function as a buffer between commercial uses and the adjoining single-family neighborhood.

The *Molalla Avenue Boulevard and Bikeway Improvements Plan* (2001) was developed to address deficiencies that arose from new development along the corridor and the limitations imposed by the mix of land uses, roadway configurations, and streetscape characteristics. This plan identifies regional, local, and neighborhood needs and objectives for the corridor, and integrates them into an overall vision. The plan includes specific recommendations for providing and maintaining safe and efficient facilities and services for public transportation, private automobiles, pedestrians, and bicyclists.

Highway 213. The *Highway 213 Urban Corridor Design Study* (2000) contains a detailed evaluation of existing and projected congestion on Highway 213 between Henrici Road and I-205 and recommended improvements. Highway 213 changes from a large high-volume facility on the north end to a rural, two-lane road at the south end. The preferred alternatives for improvements have been adopted into the Oregon City TSP, but a long-term solution to congestion on Highway 213 will also require improvements on I-205. The City, together with the Oregon Department of Transportation and Metro, should conduct a study of the I-205 corridor in this area.

Roadway System. A key component of the Oregon City TSP is a plan for a roadway system that will accommodate the expected needs of the street network in Oregon City to 2020. The plan includes:

- new alignments and connections for streets
- a road classification system that establishes a hierarchy of street types and the types of travel expected on them
- capital improvements that address near- and long-term roadway and intersection capacity, and operational and safety improvements
- identification of substandard roadway sections that should be upgraded to city standards

- street and access management standards to ensure that the roadway system fits adjacent land uses and accommodates expected demand

Land uses along roadways should be integrated with the roadway classification while keeping function, safety, aesthetics, and overall livability in mind. Higher density housing and non-residential uses should be clustered around collectors and arterials. Single-family housing should be oriented to the front of the street to avoid backyards and associated fencing from creating a tunnel affect.

Roadway connectivity requirements are intended to create better circulation patterns that reduce average auto trip lengths, provide greater options for reaching deserved destinations and improve multi-modal accessibility. The Oregon City TSP contains proposed roadway connections and facilities that would improve circulation, access, and traffic operations and fulfill the long-term needs of the city's transportation network. The planned street connections are designed to comply with the *2000 Regional Transportation Plan* (RTP) requirements for street connectivity.

In addition to the guidance provided by the Oregon City TSP for roadway connections, the *Street Connectivity Plan* (in progress) helps the City, land owners, and developers choose street connections that improve local access and circulation and preserve the integrity of the regional street system. The plan, expected to be adopted in 2005 as part of the Oregon City TSP, will comply with the design standards for street connectivity presented in the RTP.

Roadway Design Standards

Design standards for roadways are based on characteristics such as travel volume, capacity, travel speed, adjacent land use, composition of traffic, and safety. The *City of Oregon City Street Design Standards,* a subdocument of the TSP, is intended to ensure that new and improved roadways are consistent with the overall plan for the road network.

Optional "green street" standards, intended to reduce the impact from roadways on water quality, stream corridors, and vegetation, will be added to the TSP. Examples of green street standards are minimizing the amount of impervious surface by making streets narrower, creating more permeable surfaces, and using swales for treatment and conveyance.

Multi-Modal Transportation

The Oregon City TSP contains recommended improvements in public transit and facilities for bicycles and pedestrians. The key objectives in the development of pedestrian and bicycle systems are to provide accessible and safe connections between major activity centers, such as housing, commercial areas, schools, recreation areas, and to improve the safety of pedestrians and bicyclists throughout the city.

Transit service provides mobility to residents who do not have access to automobiles and an alternative mode of transportation for those who do. Public transportation in the Oregon City is currently provided by TriMet, the South Clackamas Transit District, Canby Area Transit, and the Oregon City Municipal Elevator. The Pioneer Community Center operates two vans that provide transportation for seniors on a point-to-point, pre-arranged schedule.

Community input during development of the Oregon City TSP stressed the need for improved service on weekends, expanded service on weekdays, and expanded service area coverage in certain parts of the city. The City will continue to monitor the adequacy of the transit service and work with TriMet and other providers to expand service as necessary. In addition, both the City and TriMet should promote a greater public awareness of the public transit that is available. In particular, the City should promote the South Corridor bus and light rail that serves Oregon City. The City should also work with TriMet to locate park-and-ride facilities at convenient neighborhood nodes to facilitate access to regional transit.

Local transit service opportunities should be explored to promote non-single-occupancy vehicle travel to help prolong the adequacy of the infrastructure capacity.

A local Transportation Management Association (TMA) that would serve businesses and local trolley-type transit service along major and minor arterials should be considered. Trolley service would provide convenient, economical mobility for all ages and reduce the need for additional vehicular lanes. Connections to local transit corridors should be ensured by reliable links between Hilltop, Downtown, Beaver Creek (education and employment centers), and the surrounding neighborhoods.

Rail Transportation

Union Pacific Railroad (UPRR) provides freight rail service in the region. The UPRR rail line in Clackamas County is not experiencing capacity constraints although some at-grade crossings have caused some concern because of the slower speeds needed to maintain safety at the crossings. In areas where pedestrian and motor vehicle ways cross train tracks, trains are required to travel more slowly. With slower speeds, fewer trains can use the tracks, thereby affecting the efficiency of the rail system.

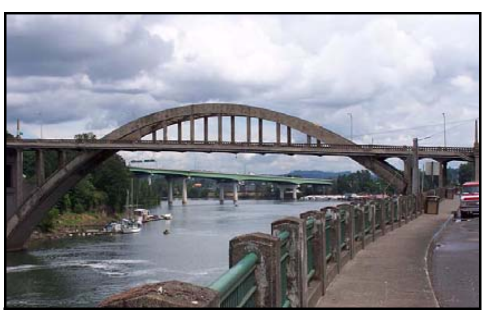
Four Amtrak passenger trains travel daily on the UPRR mainline. A new Amtrak station has opened on Washington Street west of the End of Oregon Trail Interpretive Center. The station provides rail connections to Portland, Eugene, and other Amtrak locations.

Because at-grade crossings and steep and varied topography constrain the rail system in the Oregon City area, the City should be involved with solving the problems associated with at-grade railroad crossings. The City should also be involved with maximizing safety where other transportation modes cross rail lines, minimizing capacity constraints on roadways that cross rail lines, and minimizing delays for trains and other transportation modes at railroad crossings. Possible policies and action items include:

- obtaining federal and state funding, where possible, for railroad-related improvements
- restoring a pedestrian and bicycle connection at the 17th Street crossing, which was closed because of the construction of the Amtrak station, to ensure non-auto connectivity between the End of the Oregon Trail area, the Oregon City Shopping Center, and Clackamette Cove; the connection could be restored by building a pedestrian overpass, underpass, or other alternative
- maintaining adequate active warning devices that control traffic during train crossings

Marine Transportation

The Willamette and Clackamas rivers are the navigable waterways within the City of Oregon City Urban Growth Boundary. The Willamette River provides a through-route for commercial vessels from the Willamette Valley to the Columbia River via the Willamette Falls Locks. There is one commercial dock facility within Oregon City, at Sportcraft Marina. There are two recreational boat ramps, one at Clackamette Park and another at Sportcraft Marina. The Clackamas River is a recreational waterway only. In addition to the boat ramp at Clackamette Park on the Clackamas River, there is another Clackamas River boat ramp in Riverside Park at the end of Water Avenue, approximately one-half mile east of Gladstone.



Boats traveling upstream on the Willamette River past Oregon City must pass through the Willamette Falls Locks. In continuous operation since 1873, the locks are the oldest multi-lock system in America. The locks contribute to Oregon City's recreational system, and while there is currently no commercial dock in the city, the locks also support the regional commercial marine system. The City should continue to support the Willamette Falls Locks as both a recreational and commercial facility.

Oregon City and the Oregon Marine Board are in the process of building a floating commercial dock off John Storm Park between I-205 and the Rivershore Hotel. The dock will provide a stopping point near Willamette Falls for commercial tours or private boats and connect via a gangway to the stairs behind the County Courthouse building and to Downtown. The dock should enhance commercial and recreational opportunities on the river and provide economic benefits to the city.

Oregon City's role in the Marine System Plan (part of the *Oregon City Transportation Plan,* 2001) at the regional level is to continue to ensure adequate commercial access to regional, national, and international marine services through associations with the Port of Portland, Metro, and the Oregon Department of Transportation. Oregon City's role at the local level is to facilitate connections between the roadway network and the waterway system for both commerce and recreation. It is especially important to Oregon City's development as a tourist destination to encourage the development of river-related tourism facilities and services, such as docking facilities, river transit, and river tours.

The City actively supports the continued presence of boat launches in the area for recreational users. The *Oregon City Waterfront Master Plan* (2002) incorporates existing and proposed boat launches and docks in its discussion of future development along the waterfront. The creation of multi-use paths and other facilities that promote the multi-modal use of the recreational areas along the shores of the Willamette and Clackamas rivers should also be encouraged. Finally, the City will encourage, and participate in, any regional study dedicated to the investigation of marine transport as an effective commuter transportation mode.

Air Transportation

Air transportation for Oregon City passengers and freight is provided primarily by four regional airports, all of which are owned and operated by the Port of Portland: Portland International Airport (PDX), Hillsboro Airport, Troutdale Airport, and Mulino Airport. Because none of the airports are located in Oregon City, Oregon City needs effective ground transportation service to the airports. As such, the City will focus on enhancing ground transportation and will consider supporting:

- improved connections to I-205 for better access to PDX, Hillsboro Airport, and Troutdale Airport
- improved connections to Highway 213 for better access to Mulino Airport
- the extension of light rail service to Oregon City along I-205 to provide a transit connection to PDX

- the development of, in cooperation with TriMet and other transportation service providers, an airport shuttle service and/or other public transportation connections

The City will also continue to play an active role in air transportation planning at the regional and statewide levels.

Information Technologies

Information technologies such as wireless communications, geographic information systems, and the Internet play a role in telecommuting and transportation system information. The City should focus on disseminating information about these resources and investigating ways to use these information technologies to improve the entire transportation system. The City will work to make the traffic and travel planning information that is available on the Internet also available to residents who do not have access to the Internet—perhaps through their employers. The City will also work with Internet providers to develop a network that provides space for broadband fiber-optic lines along road rights-of-way as roads are constructed or retrofitted.

Infrastructure Funding

Intelligent Transportation Systems (ITS) use advanced technology to solve transportation problems, improve safety, provide services to travelers, and help implement traffic management strategies. ITS can increase the efficiency of an existing transportation system while reducing the need to add capacity (for example, new travel lanes, transit equipment). Efficiency is achieved by providing better management of the transportation system, and by providing services and information to travelers and transportation system operators so they can (and will) make better travel decisions, thus reducing overall demand on the transportation systems. Clackamas County is the lead agency in developing a countywide ITS plan and Oregon City is a participant in that effort. The City should continue to look for appropriate ways to implement ITS to improve the efficiency of the city's transportation network and reduce the need to add capacity.

Parking

The Oregon City TSP complies with Metro's parking requirements in the *Urban Growth Management Functional Plan* (1998) by establishing maximum parking standards.

Oregon City's Code Enforcement Division operates, maintains, and provides enforcement for metered parking, city-owned parking lots, and other parking restrictions throughout Oregon City. Strategies for Downtown parking accessibility should be reviewed regularly to support the *Oregon City Downtown Community Plan* (1999). To ease demand for parking in these areas, the City will work to provide better transit, pedestrian, and bicycle connections where appropriate.

The Oregon City Public Works Street Division maintains city streets. As of 2002, transportation infrastructure maintenance was funded primarily by a gas tax. The revenue provides no funding for improvements such as pavement reconstruction, curbs, and traffic signals. Oregon City has historically sold bonds to pay for improvements, but the pay-back obligation cripples maintenance funding. Based on pavement management data and capital improvement needs, alternative funding sources are needed to maintain the City's transportation infrastructure.

The City should work with TriMet to develop park-and-ride facilities at convenient neighborhood nodes to facilitate access to regional transit.

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.

Policy 12.1.2
Continue to develop corridor plans for the major arterials in Oregon City, and provide for appropriate land uses in and adjacent to those corridors to optimize the land use-transportation connection.

Policy 12.1.3
Support mixed uses with higher residential densities in transportation corridors and include a consideration of financial and regulatory incentives to upgrade existing buildings and transportation systems.

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.

Policy 12.1.5
Investigate the possibility of a new street connection between South End Road and Highway 99E between Downtown and New Era.

Policy 12.1.6
Investigate the possibility of a new east-west connection from Highway 213 to Willamette Falls Hospital.

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.

Policy 12.2.1
Explore local and regional transit opportunities that will increase non-single-occupancy vehicle travel to prolong infrastructure capacity.

Policy 12.2.2
Target local transit where it is expected to be particularly effective, such as frequent, reliable links between Hilltop, Downtown, Willamette Falls Hospital, the Beavercreek educational and employment centers, and the adjacent neighborhoods.

Policy 12.2.3
Work with TriMet to locate park-and-ride facilities at convenient neighborhood nodes to facilitate access to regional transit.

Policy 12.2.4
Consider establishing a local Transportation Management Association (TMA) to serve area businesses. The TMA would fund a local trolley or bus transit service along the major and minor arterials to reduce the need for widening rights-of-way for additional lanes as well as provide convenient and economical mobility to everyone.

Policy 12.2.5
Advocate for a new regional bus rapid transit and rail transit connections to Oregon City.

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.[4]

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.

[4] A 10-percent reduction in the number of vehicle miles traveled per capita has been assumed within the 20-year projection consistent with and reflected in the Metro travel demand forecasting model used to evaluate the transportation system and identify needs.

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 12.3.7
Promote the connection and expansion of rail and river transportation services to and through Oregon City.

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.

Policy 12.3.10
Develop, if possible, dock facilities along the Willamette River to support a range of public and private boat and water transportation opportunities.

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.

Policy 12.4.1
Support light rail development to Oregon City.

Policy 12.4.2
Explore local service transit opportunities to promote non-single-occupancy vehicle travel and prolong infrastructure capacity.

Policy 12.4.3
Ensure efficient use of local transit by providing frequent, reliable links between the land uses and community associated with the Hilltop, Downtown, the Hospital, the Beavercreek educational and employment centers, and the adjacent neighborhoods.

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.

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.

Goal 12.7 Sustainable Approach

Promote a transportation system that supports sustainable practices.

Policy 12.7.1
Support "green street" construction practices.

Policy 12.7.2
Encourage the use of materials geared for long life cycles in both public and private transportation facilities.

Policy 12.7.3
Encourage the use of reused and recycled materials.

Policy 12.7.4
Promote multi-modal transportation links and facilities as a means of limiting traffic congestion.

Policy 12.7.5
Treat roadway pollution along transportation routes through the most effective means.

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.

Policy 12.8.2
Provide transportation system improvements that facilitate the timely implementation of the *Oregon City Downtown Community Plan* and protect regional and local access to the End of the Oregon Trail Interpretive Center.

Policy 12.8.3
Provide incentives for private sector contributions to multi-modal transportation links and facilities, for example, establishing new standards in the zoning code.

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Section 13

Energy Conservation

This section is intended to show compliance with Land Conservation and Development Commission (LCDC) Statewide Planning Goal 13, Energy Conservation. Goal 13 declares that "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."

Consumption of energy is affected by many things—land use, placement of structures, modes of transportation, and proximity of different types of land uses, among others. Oregon City's goals and policies related to Goal 13, to be implemented through development ordinances, internal policies, and private sector incentives, are intended to demonstrate the City's commitment to energy conservation.

As fossil fuels become scarcer and the cost of non-renewable energy increases, it is becoming more and more important to conserve the remaining available energy and to find new sources of energy. Energy conservation and sources of renewable energy are part of a larger concept of sustainability. The State of Oregon defines sustainability as "using, developing and protecting resources at a rate and in a manner that enables people to meet their current needs and also provides that future generations can meet their own needs." Energy conservation and sustainable consumption can be enhanced by efficient land-use patterns and sustainable land development practices.

The objectives of Goal 13 are to:

- improve the efficiency of fossil fuel consumption
- encourage design that takes advantage of natural light and energy resources
- encourage energy contributions from solar energy systems
- slow increases in central station generation demand

- reduce energy demand during peak periods
- promote non petroleum-fueled transit
- encourage conservation of materials
- enable full potential to be taken from new energy supply technologies and efficient measures

Energy Sources

Oregon City lies near the Willamette River Falls, which was a principal energy source for the emerging settlement in the 1800s and which subsequently provided the electricity for the first long-distance transmission of electrical energy from Oregon City to Portland. The falls have been modified as subsequent electrical and direct waterpower technologies were applied. Today, the Willamette Falls Hydroelectric Project combines power generated by Portland General Electric (PGE) and the Blue Heron Paper Company at the falls on the Oregon City side of the Willamette River. In addition, the West Linn Paper Company has power-generating facilities on the West Linn side of Willamette Falls. PGE retains ownership of the former hydroelectric site at the Willamette Falls and is in the process of obtaining a permit to re-license the facility. It is not likely that the electrical-generating capability at Willamette Falls will be expanded dramatically for a variety of economic and ecological reasons.

Solar energy is not likely to be a significant source of energy for Oregon City because of the climate, but new technologies make solar energy a viable supplemental source to help heat building space and water. Solar energy can also be converted directly into electricity in specific applications such as powering remote communication facilities.

No sources of natural gas or petroleum are known in the city. However, methane gas from the former Rossman landfill on the north end of the city and co-generation of electricity from methane generated from operations at the Tri-Cities Waste Water Treatment Facility may be supplemental sources of energy.

A significant source of energy is the energy that is conserved by citizens and businesses. Unused energy is a source that can be used as surely as if it were newly created energy. The City can promote and stimulate this source by advocating efficient land-use development patterns and sustainable development practices through an appropriate balance of incentives and regulations. These conservation methods are discussed in the following sections.

Conservation Method: Land Use

The way urban land is used affects energy consumption both directly and indirectly. Energy is used directly for heating, cooking, driving, and other similar tasks. Energy is used indirectly by creating consumer goods and services that consume energy. Conservation techniques in land use address both types of energy use.

Zoning regulations often segregate types of land use—industrial, commercial and residential—to separate incompatible uses. The result is often longer travel distances from work to home and to other destinations. Regulations that instead promote mixed-use development, compact development, residential clustering, increased densities near activity centers, flexible parking requirements, increased landscaping for cooling purposes, water quality, and home-based occupations can promote energy conservation.

Subdivision design can contribute to energy conservation. For example, how a home is oriented affects how much solar energy the home will generate and use. For example, the largest wall and window areas should face north and south rather than east and west because the south side of a building at a latitude of 40 degrees receives three times as much winter sun as the east or west side. Factors such as street connections, environmental constraints like steep slopes and wetlands, and infill development may make solar orientation impractical, but accommodating these factors properly can contribute to resource conservation.

Landscaping can increase the benefits of sun exposure. Trees reduce heat loss from buildings in winter and absorb radiation in summer. Trees on the south, southeast or southwest sides of a building are preferably deciduous, providing summer shade while allowing low winter sun to shine through.

Planned unit developments (PUDs) should be encouraged to allow for energy-efficient higher density and mixed uses within neighborhoods. PUDs can reduce the use of energy for transportation between living, working and shopping areas. The neighborhood commercial district concept is another way to reduce energy by shortening the trips people need to make to obtain necessities. Commercial, office, and industrial uses should be located along or near major transit corridors. Residential density usually decreases as one moves away from these corridors. To encourage alternative means of transportation, sidewalks and bikeways should be designed for maximum safety, convenience and weather protection, and should allow access to working and shopping areas and schools from residential areas.

Existing structures should be preserved and materials recycled to save energy that is required to manufacture building materials and construct new buildings. Recycling collection and storage facilities should be encouraged, not only in industrial areas, but also in more convenient commercial areas. Metro's South Transfer Station near Highway 213 and Washington Street provides an opportunity for residents to drop off recyclable materials.

Conservation Method: Transportation

Transportation systems can help conserve fossil fuels by designing them for maximum efficiency. Land use in Oregon City should encourage alternatives to single-occupancy vehicles such as walking, carpooling, transit, and bicycling.

Bikeways should be constructed along with safe bicycle parking areas. Designated “bikes only” lanes along major streets should be developed where possible, such as the recently designated lanes along Warner Parrott Road, South End Road, and Molalla Avenue. Multi-use paths should be built in appropriate areas where bicycle- and pedestrian-generator uses are located. Local merchants should be required to supply bicycle racks (preferably under some type of cover) for riders’ convenience and as an incentive for bicycle use. Streets should be designed for efficient multi-modal transportation while also helping to protect the quality of the region’s stream systems.

Use of carpools, transit, and preference parking should be examined. Vanpools operated by large firms and agencies in Oregon City for their local employees should also be considered. Areas with employment concentrations—Oregon City Shopping Center, Downtown, the hospital area, and Molalla/7th Street—should also be considered for use of vanpools. Amenities for transit riders, such as appropriate shelters and or seating, can be required or encouraged in association with site development along transit routes.

See Section 12 (Transportation), the *Oregon City Transportation System Plan* (2001), and Section 8 (Parks and Recreation) for more information on this topic.

Conservation Method: Structures

The purpose of this section is to suggest policies designed to optimize energy efficiency and conservation in structures.

Alternative renewable energy systems should be considered. Energy from the wind, sun, water, and solid waste will become increasingly important as fossil fuel supplies diminish. Interior improvements designed to save energy include insulating water heaters and pipes and appropriately locating windows and doors. Architectural design can also play a major part in conservation. Integration of green design techniques, especially the use of low-cost green design and construction practices will help the City move towards its energy goals. Some general design practices to be encouraged are building design strategies, siting, land use and landscaping, energy systems, resource-friendly products and materials, and increased salvage practices on job sites.

Incentives and Implementation

Implementation of energy conservation policies typically occurs through both public and private sector incentives and through development ordinances. For example, density bonuses can be awarded as incentives to developments that incorporate energy-efficient design.

Transportation policies from the *Oregon City Transportation System Plan* (2001) and other ancillary documents are designed to create more efficient travel networks for alternative modes such as walking, biking, and public transit by improving facilities and connections between modes.

The *Uniform Building Code* is the major implementing device for structural conservation methods. This code describes minimum building standards and should be strictly enforced by the City.

The City should carry out recycling in its own operations and facilitate resource recovery and recycling throughout the community.

Goal 13.1 Energy Sources

Conserve energy in all forms through efficient land-use patterns, public transportation, building siting and construction standards, and city programs, facilities, and activities.

Policy 13.1.1
Maintain the historic use of Willamette Falls as an energy source for industrial and commercial development.

Policy 13.1.2
Encourage siting and construction of new development to take advantage of solar energy, minimize energy usage, and maximize opportunities for public transit.

Policy 13.1.3
Enable development to use alternative energy sources such as solar through appropriate design standards and incentives.

Policy 13.1.4
Wherever possible, design and develop public facilities to take advantage of solar energy, develop co-generation, and conserve energy in operations and public access.

Goal 13.2 Energy Conservation

Plan public and private development to conserve energy.

Policy 13.2.1
Promote mixed-use development, increased densities near activity centers, and home-based occupations (where appropriate).

Policy 13.2.2
Create commercial nodes in neighborhoods that are underserved to reduce vehicle miles traveled.

Policy 13.2.3
Plan for complementary mixed uses when considering annexation of new, under- or undeveloped areas so that new urban residential areas have closer access to jobs and services.

Policy 13.2.4
Encourage use of carpools and transit in cooperation with TriMet and other state and regional transportation agencies.

Policy 13.2.5
Construct bikeways and sidewalks, and require connectivity of these facilities to reduce the use of petroleum-fueled transportation.

Policy 13.2.6
Support the concept of sustainability over the long term by:

- encouraging education efforts such as developing and/or distributing educational materials to the public about energy efficiency and sustainability
- encouraging designs that achieve a minimum Leadership in Energy and Environmental Design (LEED) certification
- implementing sustainable concepts within the Oregon City government facilities that receive a minimum "Platinum" LEED rating
- implementing design guidelines that address sustainability for private sector development
- taking advantage of up-to-date technology to reduce energy use
- developing incentive programs to apply to private sector development, where feasible

Section 14
Urbanization

This section is intended to show compliance with Land Conservation and Development Commission (LCDC) Statewide Planning Goal 14, Urbanization. Goal 14 requires cities to estimate future growth and the need for land and to zone enough land to meet that need. The goal calls for each city to establish an "urban growth boundary" to "identify and separate urbanizable land from rural land."

As Oregon City continues to grow, it must manage the growth for the benefit of its citizens and businesses. The goals and policies of this section are intended to ensure that the city grows in ways that are fiscally sound, result in high-quality development, allow services to be provided efficiently and protect natural resources. Oregon City will urbanize in a thoughtful and deliberate manner to protect, preserve, and enhance the positive facets of city life.

Urbanization is the conversion of rural or natural resource lands to urban uses. In 1982, Oregon City occupied 3,000 acres. In 2002, the city occupied 7,295 acres—5,892 acres within the city limits and 1,403 acres outside the city limits but within the Urban Growth Boundary. Urbanization at the edge of Oregon City is constrained by the Willamette River and the City of West Linn to the west, Clackamas River and the City of Gladstone to the north, and steep topography to the south and east.

A 1990 Urban Growth Management Agreement (UGMA) between the City and Clackamas County guides land-use designations and the extension of public services to urbanizing areas. Under the agreement:

- Oregon City, rather than Clackamas County, provides public services in urbanizing areas.

- Oregon City Comprehensive Plan designations apply within urbanizing areas.
- The County zones properties inside the Urban Growth Boundary to the Future Urbanizable (FU-10) zone district until the City annexes the property and applies a city zone district.

Because the City, under City land-development regulations, cannot provide sewer and water services to properties within the Urban Growth Boundary until the properties have been annexed or the property owners have agreed to annexation, urban-level development can occur only within city limits. The UGMA appears to be working well, in that urban-level development has not occurred outside the city limits, as has happened in other jurisdictions within the region. As expansion of the Urban Growth Boundary becomes more difficult, the UGMA may need to be amended to ensure that the City and County provide for the efficient transition and provision of public services.

Growth and Urbanization Issues

How will the city continue to urbanize? How do the City government and other governmental agencies that serve the city guide the type, location, quality and design of new development? Some of the challenges facing Oregon City are:

- protecting and enhancing existing development, including older development that is now considered historic, along with new growth
- ensuring an adequate supply of housing in a range of prices and types, including housing that is affordable to low- and moderate-income families
- attracting multi-story offices, unique commercial centers, vibrant mixed-use centers, and productive employment areas
- ensuring that the city's basic utilities and facilities, especially its transportation system, have the capacity to handle the growth
- creating an urban environment, while keeping significant amounts of open space and parks available and accessible to residents
- balancing private property rights with public goals and needs as the City adopts new programs and regulations aimed at shaping the city's built and natural environment

The City will need to use all available tools in a strategic and coordinated manner to encourage high-quality development and redevelopment in appropriate locations, and at the same time protect and enhance the livability of the city. The goals and policies to meet the challenges described above are in some measure implemented through other sections of the Comprehensive Plan, such as good urban design in development, compact growth to reduce the need for expansion of the Urban Growth Boundary, multi-modal transportation initiatives, and viable neighborhoods that have a variety of uses. Other themes the City should consider as it grows are discussed below.

Expansion of Boundaries. Oregon City cannot expand west or north because of rivers and the adjacent cities of West Linn and Gladstone. The city will ultimately run out of land on which to accommodate new development, both within the current city limits and the Urban Growth Boundary.

As the region grows, the city will need to expand its limits to accommodate a fair share of the future demand for housing and jobs. This should be done in a rational and planned manner, in coordination with the City's Capital Improvement Program and its ability to provide services to new areas. In addition, the City should consult with residents who would be affected by a proposed Urban Growth Boundary expansion to get their input, including what their concerns are and what they expect the impacts to be, and to assess the level of support.

The Urban Growth Boundary is established to identify and separate urbanizable land from rural land, as described in LCDC Statewide Planning Goal 14. Metro regulates the expansion of the Metro Urban Growth Boundary, which includes Oregon City's Urban Growth Boundary, through Title 11 of the *Code of the Metropolitan Service District* (2003). However, Oregon City can apply for a major amendment to the Urban Growth Boundary every year except years in which Metro updates its five-year analysis of buildable land supply.

Metro considers the following when evaluating proposed changes to the Urban Growth Boundary:

- demonstrated need to accommodate long-range urban population growth
- need for housing, employment opportunities, and livability
- orderly and economic provision of public facilities and services
- maximum efficiency of land uses within, and on the fringe of, the existing urban area
- environmental, energy, economic and social consequences
- retention of high-quality, productive agricultural land
- compatibility of the proposed urban uses with nearby agricultural activities

An application for an expansion must demonstrate that growth cannot be reasonably accommodated within the current Urban Growth Boundary, that proposed uses would or could be compatible with existing uses, and that the long-term environmental, economic, social, and energy consequences after mitigation would not be significantly greater than they would be elsewhere in Metro's jurisdiction.

Title 11 requires cities to include the land within their Urban Growth Boundaries in their Comprehensive Plans prior to urbanizing that land. Title 11 intends to promote the integration of land added to the Urban Growth Boundary with existing communities by ensuring that concept plans are developed for areas proposed for urbanization or annexation. Concept plans must include a conceptual transportation plan; natural resources protection plan to protect areas with fish and wildlife habitat, water quality enhancement and mitigation and natural hazards mitigation; a conceptual public facilities and services plan for wastewater, water, storm drainage, transportation, parks, and police and fire protection; and a conceptual school plan. Metro requires Oregon City to adopt concept plans for areas added to the Urban Growth Boundary.

Once inside the Urban Growth Boundary, areas can be proposed for annexation. The Oregon City zoning code lists factors for evaluating a proposed annexation. The Planning Commission and City Commission should not consider issues related to annexations that are better suited to development reviews. The City should consider its ability to adequately provide public facilities and services to an area and leave development plans and related issues to the site development/design review process.

The City is required to refer all proposed annexations to the voters. Rather than asking voters to approve property owners' requests to annex one at a time, the City should implement an annexation plan. The City could then annex large blocks of properties, with voter approval, rather than in a piecemeal fashion. Annexation would be tied more directly to the City's ability to provide services efficiently, maintain regular city boundaries, and help the city meet Metro targets for housing and employment. The zoning of the property should be considered when the Planning Commission and City Commission review the annexation request.

Applications for annexation, whether initiated by the City or by individuals, are based on specific criteria contained in the *City of Oregon City Municipal Code.* An annexation may not be approved because the City cannot provide public services to the area in a timely fashion, as required by state and metro regulations. Therefore, an annexation plan that identifies where and when areas might be considered for annexation can control the expansion of the city limits and services to help avoid conflicts and provide predictability for residents and developers. Other considerations are consistency with the provisions of this Comprehensive Plan and the City's public facility plans, with any plans and agreements of urban service providers, and with regional annexation criteria.

Partnerships with Other Governments. The City does not provide all of the urban services within the city limits. Clackamas County, the Oregon City School District, the Oregon Department of Transportation, the TriCities Sewer

District, Clackamas Community College, and many other agencies also provide necessary services to residents and employees. In order to efficiently and effectively use the public dollars available to all of these different agencies, the City should be proactive in forming excellent working relationships with other agencies to address urban service issues.

Green Corridors. "Green corridors" are lands and waterways left in a natural condition to provide open space, recreational opportunities, habitat, and a sense of separation of various areas. Metro has identified green corridors in the region in *Metro's 2040 Growth Concept* (1995). Although there are no green corridors within the city now, there may be in the future. Beavercreek and its tributaries are potential green corridors. Clackamas County is establishing green corridors adjacent to Oregon City on Highway 99E from Canemah to New Era and on Highway 213 from the Oregon City city limits to Molalla. The City recognizes the value of green corridors and will ensure that any such corridor within its city limits or Urban Growth Boundary is adequately protected.

Options for implementing green corridor concepts elsewhere include:

- providing a gradual transition from green corridor to urban environment
- implementing a green belt or green corridor policy of parks and open spaces along these corridors; this could include purchase and development of parks along corridors and restricting development in natural areas with steep slopes, wetlands, or other flooding issues from development along these corridors
- preserving these areas by adding zoning language to implement scenic roads policies
- reviewing development standards along the corridor to extend setbacks, increase landscaping requirements, encourage native vegetation
- developing incentive programs and educational programs
- linking tourism promotion or historic preservation to green corridors

Goal 14.1 Urban Growth Boundary

Establish, and amend when appropriate, the Urban Growth Boundary in the unincorporated area around the city that contains sufficient land to accommodate growth during the planning period for a full range of city land uses, including residential, commercial, industrial, and institutional.

Policy 14.1.1

The Urban Growth Boundary shall conform to Title 11 of the *Code of the Metropolitan Service District* and will provide sufficient land to accommodate 20-year urban land needs, resulting in efficient urban growth and a distinction between urban uses and surrounding rural lands, and promoting appropriate infill and redevelopment in the city.

Policy 14.1.2
Concept plans that provide more detail than the city's Comprehensive Plan will be required prior to development of lands within the Urban Growth Boundary.

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.

Policy 14.2.1
Maximize public investment in existing public facilities and services by encouraging redevelopment as appropriate.

Policy 14.2.2
Encourage redevelopment of city areas currently served by public facilities through regulatory and financial incentives.

Goal 14.3 Orderly Provision of Services to Growth Areas

Plan for public services to lands within the Urban Growth Boundary through adoption of a concept plan and related Capital Improvement Program, as amendments to the Comprehensive Plan.

Policy 14.3.1
Maximize new public facilities and services by encouraging new development within the Urban Growth Boundary at maximum densities allowed by the Comprehensive Plan.

Policy 14.3.2
Ensure that the extension of new services does not diminish the delivery of those same services to existing areas and residents in the city.

Policy 14.3.3
Oppose the formation of new urban services districts and oppose the formation of new utility districts that may conflict with efficient delivery of city utilities within the Urban Growth Boundary.

Policy 14.3.4
Ensure the cost of providing new public services and improvements to existing public services resulting from new development are borne by the entity responsible for the new development to the maximum extent allowed under state law for Systems Development Charges.

Goal 14.4 Annexation of Lands to the City

Annex lands to the city through a process that considers the effects on public services and the benefits to the city as a whole and ensures that development within the annexed area is consistent with the Oregon City Comprehensive Plan, City ordinances, and the City Charter.

Policy 14.4.1
Promote compact urban form and support efficient delivery of public services by ensuring that lands to be annexed are within the City's Urban Growth Boundary, and contiguous with the city limits. Do not consider long linear extensions, such as cherry stems and flag lots, to be contiguous with the city limits.

Policy 14.4.2
Include an assessment of the fiscal impacts of providing public services to unincorporated areas upon annexation, including the costs and benefits to the city as a whole as a requirement for concept plans.

Policy 14.4.3
Evaluate and in some instances require that parcels adjacent to proposed annexations be included to:

- avoid creating unincorporated islands within the city;
- enable public services to be efficiently and cost-effectively extended to the entire area; or
- implement a concept plan or sub-area master plan that has been approved by the Planning and City Commissions.

Policy 14.4.4
Expedite the annexation of property as provided by state law in order to provide sewer service to adjacent unincorporated properties when a public health hazard is created by a failing septic tank sewage system.

Goal 14.5 Partnerships with Other Governments

Create and maintain cooperative, collaborative partnerships with other public agencies responsible for servicing the Oregon City area.

Policy 14.5.1
Amend as necessary the 1990 Urban Growth Management Agreement with Clackamas County to control land uses in the unincorporated area around the city to ensure that conversion of rural lands to urban uses upon annexation is orderly and efficient and in conformance with the Comprehensive Plan for Oregon City.

Policy 14.5.2
Coordinate public facilities, services and land-use planning through intergovernmental agreements with the school district, Clackamas Community College, Clackamas County Fire District #1, Tri-Cities Services District and other public entities as appropriate.

Policy 14.5.3
Coordinate with Clackamas County and Metro to contain city boundaries and future urban land uses to areas on relatively level land north of the steep lands of Beaver Creek and its tributaries that border the southern portion of the city and the steep lands of the tributaries to Abernethy Creek that border the east and southeasterly portions of the city.

Goal 14.6 Green Corridors and Green Belts

Promote green corridors and green belts in lands beyond Oregon City's Urban Growth Boundary to maintain the rural character of the landscape and unincorporated communities and to protect the agricultural economy of the region.

Policy 14.6.1
Support green corridor policies and practices along major transportation routes designated by Clackamas County to neighboring cities.

Policy 14.6.2
Maintain a green belt around the southern and eastern edge of the city by confining urban land uses to the relatively level lands north of the steep slopes of Beaver Creek and its tributaries along the southern portion of the city and the steep lands of the tributaries to Abernethy Creek that border the eastern and southeastern portions of the city.

Policy 14.6.3
Maintain the rural forested appearance along the Willamette River along US Highway 99E and from Canemah to South End Road at Beaver Creek by requiring vegetative screening and setbacks to provide a visual buffer and by regulating signage and lighting.

Section 15

Willamette River Greenway

This section is intended to show compliance with Land Conservation and Development Commission (LCDC) Statewide Planning Goal 15, Willamette River Greenway. Goal 15 sets forth procedures for administering the 300 miles of greenway that protect the Willamette River.

In 1973, the Oregon State Legislature designated the Willamette River Greenway (WRG) to protect the Willamette River corridor from Eugene to the confluence with the Columbia River. The intent was to protect the corridor's natural, scenic and recreational qualities and to preserve its historical sites, structures, facilities, and objects for education and enjoyment.

The *Willamette River Greenway Plan* was developed by the Oregon Department of Transportation (ODOT), pursuant to ORS 390.318. In 2004, responsibility for overseeing the plan was transferred from ODOT to the Oregon Parks and Recreation Department.The plan contains an inventory of resource lands and the location of the WRG boundary for all affected jurisdictions, the resources that are to be protected, policy considerations, and development review criteria. LCDC implemented Goal 15 to carry out the legislative directive and to provide the parameters within which the Department of Transportation's Greenway Plan could be carried out by local governments in their Comprehensive Plans. LCDC is authorized under Goal 15 to determine whether local Comprehensive Plans satisfy the requirements of the statutes.

Goal 15 requires local jurisdictions to plan for and protect uses within the WRG by adopting the relevant portions of the Greenway Plan into their Comprehensive Plans. Consequently, the City of Oregon City is required to establish a WRG boundary, the uses allowed within the WRG boundary, the Compatibility Review Boundary (within 150 feet of the ordinary low waterline of the Willamette River), and the processes for development review and criteria for approval.In addition, each Comprehensive Plan must discuss areas that have been identified for possible public acquisition and the conditions under which such acquisitions may occur as set forth in the state's Greenway Plan.

The WRG boundary was established after significant inventory work had been done in the early 1980s, and the inventory was included in the 1982 Comprehensive Plan. The City is responsible for mapping and updating the boundary, and a map showing the boundary is available at the Oregon City Planning Department. Land within the WRG in Oregon City is subject to the goals and policies of this section of the Comprehensive Plan and to the regulations in applicable implementing ordinances.

The goals and policies herein provide the basis for an overlay zone in Title 17 of the *City of Oregon City Municipal Code* (1991), which regulates allowed uses within the WRG boundary. Oregon City reviews proposals for any change, or intensification of use, or development (as defined in Goal 15) within the WRG through Greenway permit applications. Land within 150 feet of the ordinary low waterline is considered to be within the WRG Compatibility Review Boundary and is subject to a compatibility review through the conditional use process. Compatibility review is an additional level of protection for sensitive resources at the river's edge to ensure the best possible balance of appearance, habitat, water quality, public access, and scenic, economic, and recreational qualities. Procedures for, and criteria to be used in, the conditional use/compatibility review processes are consistent with requirements in Goal 15 and are implemented through the Willamette River Greenway Overlay District.

This section of the Comprehensive Plan discusses properties that may become available to Oregon City for acquisition and the conditions under which the acquisitions could occur.

Documents Affecting Implementation of the WRG

Several documents adopted since 1982 affect future and existing development within the Willamette River Greenway. They are:

- *Oregon City Waterfront Master Plan* (2002), which highlights open space improvements and mixed-use redevelopment within the district, generally along the waterfront from 5th Street in downtown north to the Clackamas River and east along the Clackamas River to I-205
- *Oregon City Downtown Community Plan* (1999), which establishes a framework for preserving and strengthening the historic character of Oregon City, refining the mix of land uses and emphasizing pedestrian-oriented design (see Section 2, Land Use)

- Water Resources Overlay District of Title 17 (zoning) of the *City of Oregon City Municipal Code* (1991), which implements Title 3 of Metro's *Urban Growth Management Functional Plan* (1998)
- Flood Management Overlay District of Title 17 of the *City of Oregon City Municipal Code*
- Erosion and sediment control requirements of the *City of Oregon City Municipal Code*

The adoption of the *Oregon City Waterfront Master Plan* (2002) and the *Oregon City Downtown Community Plan* (1999) and the regulations to implement them has the potential to complicate the regulations that apply to land within the WRG. Some of the implementing ordinances that affect the WRG conflict with the regulations that apply to the WRG, particularly development regulations. The City will review these ordinances, remove any conflicts, ensure that the goals of the Greenway Plan are met, and add substance where needed. In 1999, after the 1996 flood that inundated portions of the greenway, a new floodplain section in the natural resources section of the Comprehensive Plan was adopted to better address the management of development in the floodplain. See Section 5, Open Spaces, Scenic and Historic Areas, and Natural Resources. In addition, a city-sanctioned Natural Resources Committee was established by ordinance in 2002 and should be encouraged to provide input in projects or concerns relating to the Greenway.

Privately Owned Land within the WRG

During the 1990s, the City acquired many of the privately owned parcels along the Willamette and Clackamas rivers that the 1982 Comprehensive Plan recommended acquiring. Parcels along Clackamette Drive near the I-205 bridge around Clackamette Cove were acquired in the late 1990s.

The majority of waterfront properties in the Canemah District remain in private ownership. It is important for the City to acquire and maintain open space in Canemah to provide bike and pedestrian connections along Highway 99E to the Willamette River Trail as well as river access and view corridors. Equally important is the protection and enhancement of degraded riparian areas in the Canemah District through municipal, public service, and community planting projects.

The remaining privately owned parcels within the WRG Compatibility Review Boundary are owned primarily by the Union Pacific Railroad and Blue Heron Paper Company. The railroad is an important link in the transportation system and plays a critical role in regional freight and passenger transportation (Amtrak).

The Blue Heron Paper Company continues to play a vital role in providing jobs in Oregon City. The existing use plays a role in enhancing the river-related

economic resources (that being power and raw material for the pulp and paper manufacturing). However, it makes it difficult for the City to achieve compatibility with the Greenway goals of protecting natural, recreational and scenic resources of the river corridor and inside the WRG Compatibility Review Boundary. Debris cleanup and riparian planting projects involving citizens working with the Blue Heron Paper Company are currently possible and should be pursued.

Oregon City should not pursue acquiring parcels adjacent to McLoughlin Boulevard that have commercial or office uses. These parcels will be zoned to implement the *Oregon City Downtown Community Plan* and are integral to the Greenway Plan's goals as well as *Metro's 2040 Growth Concept* (1995) regional goals for Oregon City as a regional center.

Goal 15.1 Protect the Willamette River Greenway

Ensure the environmental and economic health of the Willamette River by adopting goals, policies and procedures that meet LCDC Statewide Planning Goal 15, Willamette River Greenway.

Policy 15.1.1
Protect the significant fish and wildlife habitat of the Willamette River by maximizing the preservation of trees and vegetative cover.

Policy 15.1.2
Preserve major scenic views, drives and sites of the WRG.

Policy 15.1.3
Encourage access to and along the river consistent with the *Oregon City Park and Recreation Master Plan* and the *Oregon City Waterfront Master Plan*.

Policy 15.1.4
Restrict new substations and power line towers in the WRG and river view corridor.

Policy 15.1.5
Protect and maintain parks and recreation areas and facilities along the Willamette River to minimize effects in the WRG, in accordance with the *Oregon City Park and Recreation Master Plan* and the *Oregon City Waterfront Master Plan*.

Policy 15.1.6
Review uses proposed for inside the Willamette River Greenway Compatibility Review Boundary for consistency with local goals and policies for that area.

Appendix A

Oregon City's Comprehensive Plan Land-Use Map

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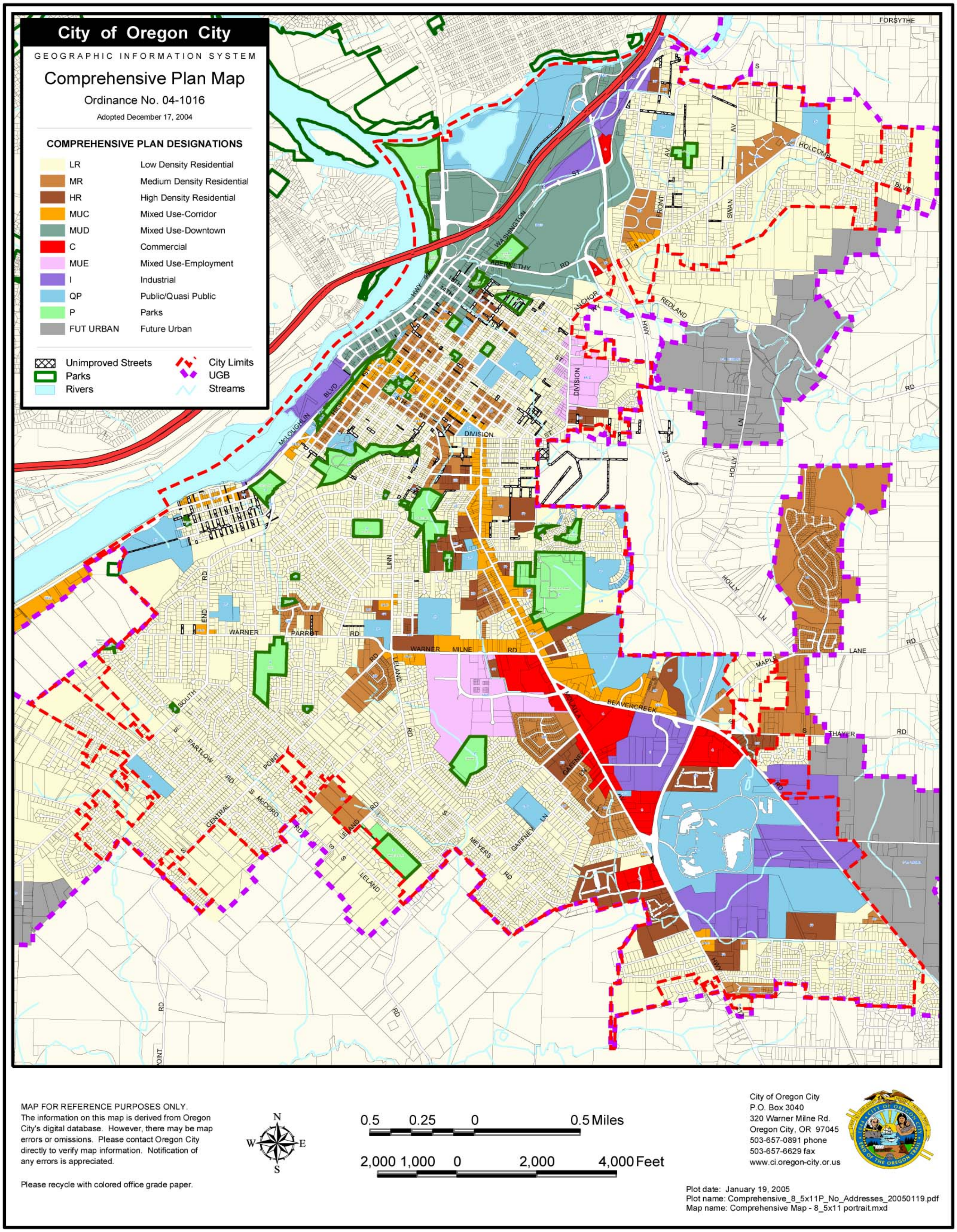

4a. L 10-02: Water Master Plan

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Appendix B

Metro's 2040 Growth Concept Map

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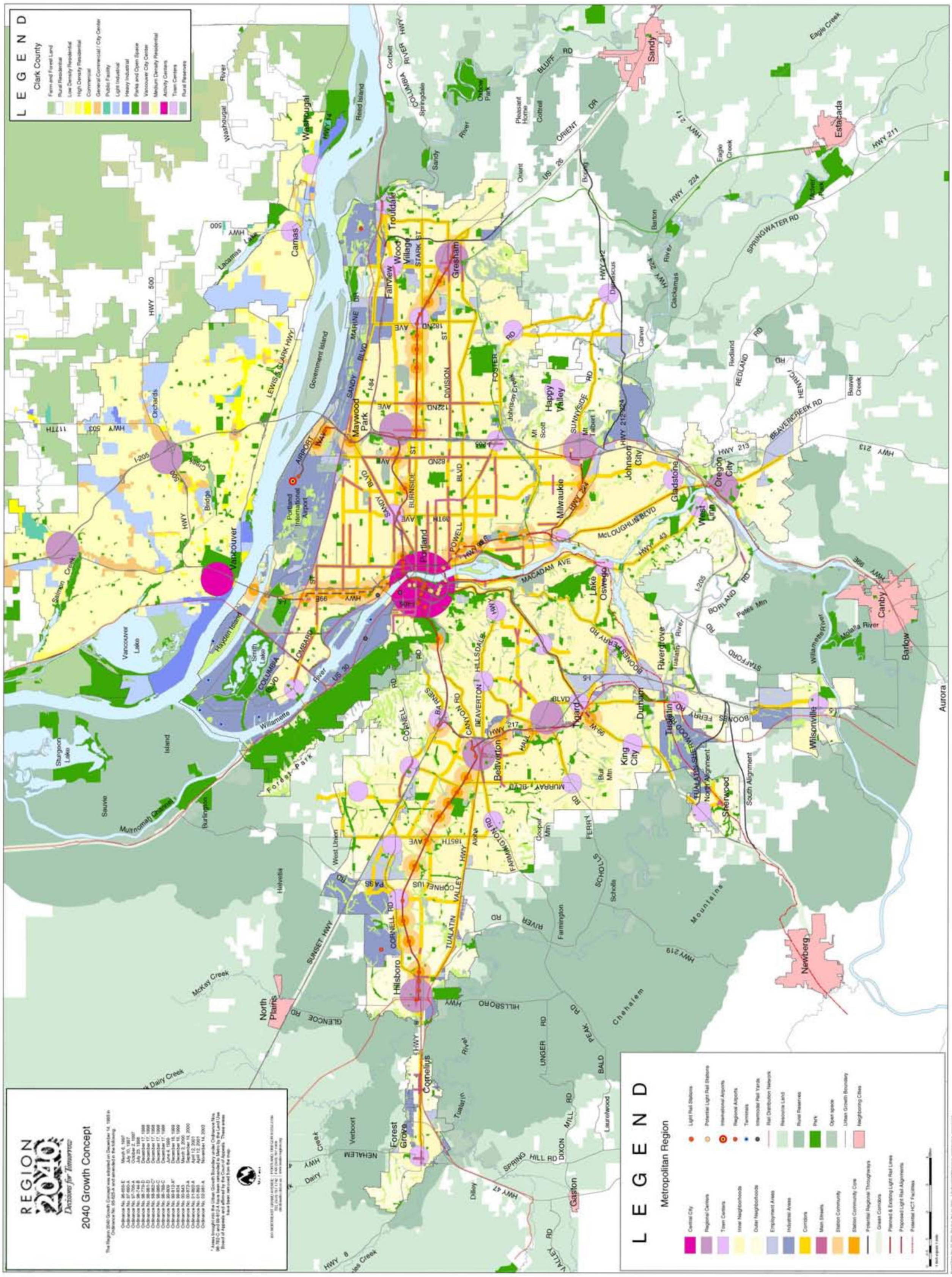

4a. L 10-02: Water Master Plan

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Glossary

Accessory dwelling unit. Attached or detached dwelling that is secondary to the primary dwelling unit and intended to provide a convenient and affordable housing opportunity.

Active recreation area. Area suitable for intensive recreation. Often open, with trees or shrubs along the perimeters, providing areas for sports fields, large built facilities such as swim centers and sports complexes and areas for large celebrations and events.

Affordable housing. Defined by Metro as a housing unit that requires no more than 30 percent of household income for people earning 50 percent of the median household income in their jurisdiction.

Aggregate resource. Rock, sand, or gravel.

Ambient noise. Average level of background noise.

Ancillary plan. Auxiliary, subordinate, or supplement to a comprehensive plan, such as a transportation system plan or a park and recreation master plan.

Capital Improvements Program. Description of when a community's major public facilities (e.g., roads, libraries, sewer systems, police stations) will be built, how much it will cost, and source of funding. Usually covers three to ten years.

Carrying capacity. Level of use that can be accommodated and sustained without unacceptable damage to the environment, including air, land, and water quality.

Comprehensive plan. Official document of a local government that includes goals and policies that direct how the community will develop. It may also include action measures or strategies for implementing the goals and policies. Oregon Administrative Rules further define a comprehensive plan as a "generalized, coordinated land use map and policy statement of the governing body of a local government that interrelates all functional and natural systems and activities relating to the use of lands, including, but not limited to, sewer and water systems, transportation systems, educational facilities, recreational facilities, and natural resources and air and water quality management programs." In Oregon, a comprehensive plan is adopted by ordinance, has the force of law, and is the basis for zoning and subdivision ordinances. A number of other City planning documents support and/or implement the plan.

Corridor. See "Design types."

Dark skies. Night skies unaffected by light pollution.

Density. The number of families, individuals, dwelling units, households, or housing structures per unit of land.

Design types. Conceptual areas described in the *Metro 2040 Growth Concept* text and map in Metro's regional goals and objectives.

Corridor. Major street that serves as a key transportation route for people and goods. Served extensively by transit. While some are continuous, narrow bands of high-intensity development along arterial roads, others are more "nodal," that is, a series of smaller centers at major intersections or other locations along an arterial that have high-quality pedestrian environments, good connections to adjacent neighborhoods and good transit service. As long as the average target densities and uses are allowed and encouraged along the corridor, many different development patterns-nodal or linear-may meet the corridor objective. Along good quality transit lines, a corridor features a high-quality pedestrian environment, convenient access to transit, and somewhat higher than current densities. An average of 25 persons per acre is recommended.

Employment Areas. Areas with mixed types of employment including manufacturing, distribution and warehousing, commercial and retail development, as well as some residential development. Retail uses should primarily serve the needs of people working or living in the immediate employment area. Exceptions to this general policy can be made only for certain areas indicated in a functional plan. Various types of employment and some residential development are encouraged in employment areas with limited commercial uses. Average recommended density is 20 persons per acre.

Industrial Area and Freight Terminal. Serves as hub for regional commerce, industrial land and freight facilities for truck, marine, air and rail cargo. Provides the ability to generate and move goods in and out of the region. Access centered on rail, regional freeway system, and key roadway connections. Keeping these connections strong is critical to maintaining a healthy regional economy.

Inner Neighborhood. Residential area accessible to jobs and neighborhood businesses with smaller lot sizes.

Main Street. Similar to a Town Center, a Main Street has a traditional commercial identity but on a smaller scale with a strong sense of the immediate neighborhood. A Metro concept for streets with a concentration of retail and service establishments, typically accessible by transit, that serve neighborhoods and draw some people from other parts of the region. Includes residential uses but does not imply that the City will meet Metro's density guidelines.

Neighborhood. Under Metro's 2040 Growth Concept, most existing neighborhoods will remain largely the same. Some redevelopment can occur so that vacant land or under-used buildings could be put to better use. New neighborhoods are likely to have an emphasis on smaller single-family lots, mixed uses and a mix of housing types including row houses and accessory dwelling units. The growth concept distinguishes between slightly more compact inner neighborhoods, and outer neighborhoods, with slightly larger lots and fewer street connections.

Neighboring City/Green Corridor. Communities such as Sandy, Canby, Newberg and North Plains have a significant number of residents who work or shop in the metropolitan area. Cooperation between Metro and these communities is critical to address common transportation and land-use issues. Neighboring cities are connected to the metro area by Green Corridor transportation routes

Outer Neighborhood. Residential neighborhoods farther away than Inner Neighborhoods from large Employment Centers with larger lot sizes and lower densities.

Regional Center. As a center of commerce and local government services serving a market area outside the central city, accessible to hundreds of thousands of people, a Regional Center is the focus of transit and highway improvements. Characterized by two- to four-story compact employment and housing development served by high-capacity transit and highways. Nine Regional Centers will become the focus of compact development, redevelopment and high-quality transit service and multimodal street networks

Design review guidelines. Standards related to the appearance and construction of buildings and related facilities (e.g., trees, street lights, and sidewalks). Typically applied to specific types of development or specific zones and reviewed by City staff. Can be either optional or mandatory but are often called guidelines because they are suggestions. Mandatory requirements are often referred to as development or design standards.

Drainageways. Open linear depressions, either natural or man-made, for collection and drainage of surface water. May be permanently or temporarily filled with water.

Ecological/scientific areas. Land or water that has retained much of its natural character, though not necessarily completely natural, and significant because of historical, scientific, palaeontological, or natural features.

Employment Area. See "Design types."

Essential facilities. As defined in Oregon Revised Statutes 455.447 and pertaining to natural hazards regulations:

- hospitals and other medical facilities with surgery and emergency treatment areas
- fire and police stations
- tanks or other structures containing, housing or supporting water or fire-suppression materials or equipment required for the protection of essential or hazardous facilities or special occupancy structures
- emergency vehicle shelters and garages
- structures and equipment in emergency-preparedness centers
- standby power generating equipment for essential facilities
- structures and equipment in government communication centers and other facilities required for emergency response

Economic, Social, Environmental and Energy (ESEE) analysis. Required under Land Conservation and Development Commission Statewide Planning Goal 5. Purpose is to inventory natural resource sites and identify their relative resource value to determine an appropriate level of protection through land-use regulations.

Federal Emergency Management Agency (FEMA). Administrator of the National Flood Insurance Program.

Floodplain. Land subject to periodic flooding, including the100-year floodplain as mapped by Federal Emergency Management Agency (FEMA)

Flood Insurance Studies or as indicated by other substantial evidence of flood events.

Floodway. Portion of watercourse required for the passage or conveyance of a given storm event, as identified and designated by the City. Includes the channel of the watercourse and the adjacent floodplain that must be reserved in an unobstructed condition in order to discharge the base flood.

4(d) Rule. Federal rule that establishes regulations to protect species listed as threatened under the Endangered Species Act (ESA). These requirements can be used by local governments to ensure that their activities and regulations are consistent with the ESA.

Goal 5 Rule. Oregon Administrative Rule requiring local governments to develop and maintain inventories of natural resources, scenic and historic areas, and open spaces. The rule provides cities with the option of following general requirements for identifying "significant" resources or using state criteria to determine which resources are significant.

Green streets. Transportation infrastructure that incorporates a variety of design and engineering concepts to reduce the adverse impacts of streets on air quality, water quality, wildlife habitat, and the pedestrian environment.

Historic District. An area containing a number of lots, blocks, and buildings that have special historical, architectural, or cultural significance as part of the heritage of the City. The McLoughlin area has been designated as a Historic District.

Home occupation. Any activity carried out for gain by a resident and conducted as a customary, incidental, and accessory use in the resident's home. Standards for home occupations are included in Oregon City's Community Development Code.

Impervious surface. Solid surfaces, such as streets, parking lots, and roofs, that prevent rain from being absorbed into the soil, thereby increasing the amount of water runoff that typically reaches a receiving stream.

Industrial Area and Freight Terminal. See "Design types."

Infill. Use of vacant lots in predominantly developed areas, or the undeveloped portion of developed lots, to make more efficient use of land resources.

Infiltration. Seepage of groundwater into cracks of sewer or stormwater collection pipes. Also used to describe the process of absorption of liquids into the ground.

Inflow. Entry of water into the sewer or stormwater collection system through manholes, gutters connecting to the stormwater system, and similar open facilities. Typically used in combination with infiltration to describe impacts on a sewer or stormwater collection system from unintended outside sources.

Infrastructure. Facilities and structures used to provide public services to City residents and businesses. Examples are roads, sewer and water transmission lines, administrative buildings, and parks and recreation properties and structures.

Inner Neighborhood. See "Design types."

Land Use Compatibility Statement. Must be submitted by a business applying for a permit from the Oregon Department of Environmental Quality. Must be reviewed and signed by a local city planner approving or rejecting a new project. By signing, the City indicates that the proposed project is compatible with the comprehensive plan and other land-use ordinances.

Level of service (LOS). Used to measure the effectiveness for the operation of a public service or facility, most typically used when assessing the functioning level of road or street intersections or links. It is similar to a report card rating based on average vehicle delay. For example, with respect to roads, LOS A, B, and C indicate conditions where vehicles can move freely. LOS D and E are progressively worse. LOS F represents conditions where traffic volumes exceed the capacity of the facility or a specific movement.

Main Street. See "Design types."

Median household income. Divides income distribution into two equal groups, one having incomes above the median, and other having incomes below the median. Median income for an area can be calculated from U.S. Census Bureau statistics.

Metro. Regional government of the metropolitan area, the elected Metro Council as the policy setting body of government.

Metro Title 3 Requirements. Regional requirements adopted by Metro to protect water quality and fish and wildlife habitat, primarily through standards for riparian areas and floodplains.

Metropolitan Statistical Area (MSA). Used by the U.S. Bureau of the Census to define urban areas. According to the Census Bureau, an MSA consists of a "large population nucleus, together with adjacent communities having a high degree of social and economic integration with that core." MSAs are defined by the U.S. Office of Management and Budget (OMB).

Mixed-use development. Combination of different types of uses. Most often refers to allowing homes and businesses to be located in the same area (e.g., apartments over shops or other businesses or apartments adjacent to grocery stores or other commercial establishments).

Natural resource. Functioning natural system such as a wetland, riparian corridor, or fish and wildlife habitat and associated vegetation, including significant trees.

Natural resource area. Land containing a natural resource that is to be protected.

Neighborhood. See "Design types."

Neighborhood park. A combination playground and park intended primarily for non-organized recreation. It is generally relatively small (3 to 7 acres) and serves people who live within one-half mile of the park. Typical facilities include children's playgrounds, picnic areas, trails, open, grassy areas for organized or passive activities, and outdoor basketball courts.

Neighborhood plan. Includes goals and policies that define and shape the unique characteristics of a neighborhood. It also includes specific improvement projects that enhance a neighborhood.

Neighboring City/Green Corridor. See "Design types."

Noise-sensitive use. An activity or building that is particularly negatively impacted by noise, such as a home, school, library, or hospital.

Non-point pollution. Pervasive and from multiple sources, such as carbon monoxide from automobiles and urban stormwater runoff.

Open space. Land that is undeveloped and planned to remain so indefinitely. Encompasses parks, forests, and farm land. May refer only to land zoned as available to the public, including playgrounds, watershed preserves, and parks.

Outer Neighborhood. See "Design types."

Out-of-direction travel. Travel that is not toward the eventual destination of a trip, often caused by a lack of adequate connections between destinations.

Passive recreation area. Suitable for unstructured uses and low intensity recreation. Passive spaces are planned landscapes that may vary from open meadows to areas with shrub plantings, trees, benches, tables and pathways.

Particulates. Small particles in the air that are a component of air pollution. They can be inhaled and when lodged in the lungs, may damage lung tissue and lead to respiratory problems.

Performance standards. Requirements that govern impacts or characteristics of facilities rather than uses. Standards may be related to building size, noise, air, and water pollution, traffic generation or other attributes. Can limit the kinds of uses based on these impacts or characteristics.

Planned Unit Development (PUD). A type of development based on a comprehensive design addressing the entire complex of land, structures, and uses as a single project. The design plan for the project takes the place of the general site development regulations of the zoning on the site, providing more flexibility in land use and site design.

Point source of pollution. Single, discrete facility or other source of air or water pollution such as a smokestack or sewage outfall pipe.

Public facilities plan. A plan for the sewer, water, and transportation facilities needed to serve a city. Less specific than a Capital Improvements Program and required by Oregon law for cities with a population of 2,500 or more.

Reclamation plan. Typically developed for sites formerly used for mining or waste disposal (e.g., landfills). Describes the proposed reclamation of land that has been adversely affected by a surface mining operation or exploration and how the land will be returned to a natural-appearing condition and potentially reused for another purpose (e.g., open space or recreational use or limited types of development). Plan must be submitted to and approved by the Oregon Department of Geological and Mineral Industries as required by Oregon statutes. Further defined in ORS 517.750.

Redevelopment. Additional or new residential, commercial, or industrial development on land that is already developed, but has the capacity for additional or more intensive development through remodeling or demolition and reconstruction.

Regional Center. See “Design types.”

Regional park. A recreation area that serves people who live in and outside the City. Usually a large site with unique facilities or characteristics, often offering opportunities for a variety of active and passive uses (e.g., playing fields, hiking trails, picnic area, bird-watching, etc.). Mary S. Young State Park is an example.

Reuse plan. Proposal to transform or redevelop a site for another use that may be similar to or different from the previous one. Examples are using a former mine site (once it has been "reclaimed") for a park or housing development, or converting a former warehouse into loft apartments.

Riparian area. Area associated with streams, lakes, and wetlands where vegetation communities are predominately influenced by their association with water.

Seismic hazard. Geologic condition that is potential danger to life and property that includes but is not limited to earthquake, landslide, liquefaction, tsunami inundation, fault displacement and subsidence.

Service District. Local government agency that provides one or more specific services to people within the district (e.g., water, sewer, or fire protection). May encompass or overlap multiple municipalities. Also used to describe the area served by the agency and sometimes used interchangeably with "special district," defined by Oregon Statute as "any unit of local government, other than a city, county, metropolitan service district formed under ORS chapter 268 or an association of local governments performing land use planning functions under ORS 195.025 authorized and regulated by statute."

Setback. Required separation between a structure and a road/right-of-way or property line (e.g., the distance from a sidewalk to the front of a house).

Special District. Any unit of local government, other than a city, county, metropolitan service district formed under ORS Chapter 268 or an association of local governments performing land-use planning functions under ORS 195.025, authorized and regulated by statute. Includes but not limited to water control districts, domestic water associations and water cooperatives, irrigation districts, port districts, regional air quality control authorities, fire districts, school districts, hospital districts, mass transit districts and sanitary districts. ORS 197.015.

Stormwater detention facility. Pond, swale, or other facility used to store and eventually disperse stormwater runoff from roads, parking lots, buildings, and other paved surfaces.

Stream. A body of running water moving over the earth's surface in a channel or bed, such as a creek, rivulet, or river. Flows at least part of the year and may be perennial or intermittent. Dynamic in nature with a structure that is maintained by build-up and loss of sediment.

Sustainability. An approach to development wherein society balances its social and economic desires and actions with those of providing for long-term environmental health and quality (Northwest Regional Council of the President's Council on Sustainable Development).

Telecommuting. Working at home using a computer and telecommunications to access one's place of employment.

Telecommunity center. A conveniently located place where people can access computers, the Internet, and other technology that make it efficient to get work done or obtain services electronically that otherwise might require longer trips.

Transit street. Provides exclusive transit lanes and/or transit priority measures on streets to facilitate operations for bus and light rail over an identified corridor.

Transportation Demand Management. Process or set of techniques used to control or reduce the amount of traffic in a given area, or at a specific time of day. Tools often focus on employer-based programs such as flexible work hours, telecommuting (see definition above), and providing free transit passes or other incentives to use different modes of transportation or travel at different times of day.

Transportation System Plan (TSP). Provides an inventory and service assessment of a community's existing and planned 20-year multi-modal transportation system.

Urban Growth Boundary. Line encompassing an area that is adopted and planned for urban development and within which urban services (e.g., public sewer and water facilities) will be provided. Outside the boundary, the provision of services and the level of development are restricted and development is restricted in intensity. Oregon City's Urban Growth Boundary is part of the regional boundary administered by Metro.

Urban Growth Management Functional Plan. A set of regional requirements adopted by Metro for cities and counties to implement the Metro's 2040 Growth Concept. Addresses issues such as projected housing and job growth, parking management, water quality, and the regional road system.

Urban Reserve. Former label used for lands outside an Urban Growth Boundary identified as having the highest priority for inclusion within the boundary when additional urbanizable land was needed, consistent with the requirements of Land Conservation and Development Commission Statewide Goal 14 (Urbanization). Metro discontinued using the term in 1999.

Watershed. Geographical unit defined by the flow of rainwater or snowmelt. All land in a watershed drains to a common outlet, such as a stream, river, lake, or wetland.

Wetland. Area inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and, under normal circumstances do support, vegetation primarily adapted for life in saturated soil. Generally include swamps, marshes, bogs, and similar areas. Areas identified and delineated by a qualified wetland specialist as set forth in the 1987 Corps of Engineers Wetland Delineation Manual.

Willamette River Greenway. Land along the banks of the Willamette River intended to be protected and conserved for its natural, scenic, historical, agricultural, economic, and recreational qualities. Cities and counties are responsible for administering the Willamette River Greenway Plan within their boundaries by restricting development and providing access for recreation.

Zoning (also base zone, zone district). Delineation of districts and establishment of regulations governing the use, placement, spacing, and size of land and buildings.

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Metro's 2040 Growth Concept (1995)

Molalla Avenue Boulevard and Bikeway Improvements Plan (2001)

Oregon City Comprehensive Plan (1982)

Oregon City Downtown Community Plan (1999)

Oregon City Hazard Mitigation Plan (1998)

Oregon City Park and Recreation Master Plan (1999)

Oregon City Trails Master Plan (2004)

Oregon City Transportation System Plan (2001)

Oregon City Waterfront Master Plan (2002)

Public Facilities Plan (1990)

Regional Affordable Housing Strategy (2000)

Regional Framework Plan (1997)

Regional Solid Waste Management Plan, 1995-2005 (1999)

Regional Urban Growth Goals and Objectives (RUGGO), part of the *Regional Framework Plan* (1997)

South End Basin Master Plan (1997)

Street Connectivity Plan, expected to be adopted in 2005 as part of the *Oregon City Transportation System Plan*

Tri-City Service District, Tri-City Water Pollution Control Facility (WPCF) Master Plan Plant Advanced Facilities Plan (2002)

Uniform Building Code

Urban Growth Management Functional Plan (1998)

Willamette River Greenway Plan, pursuant to ORS 390.318

CITY OF OREGON CITY

WEST YOST & ASSOCIATES
OCTOBER 2004

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

Page

TABLE OF CONTENTS (continued)

Page

TABLE OF CONTENTS (continued)

Page

TABLE OF CONTENTS (continued)

Page

LIST OF FIGURES

TABLE OF CONTENTS (continued)

CHAPTER 1

EXECUTIVE SUMMARY

This master plan presents the results of the water distribution system planning effort conducted for the City of Oregon City. The plan summarizes the components of the existing water distribution system, analyzes local water demand patterns, evaluates the performance of the water system with respect to critical service standards, identifies the improvements necessary to remedy system deficiencies and accommodate future growth. Based on this analysis, the study recommends specific projects for inclusion in the water distribution system Capital Improvement Program (CIP). These projects will ensure that the water distribution system continues to provide adequate and reliable service to the City. Finally, the master plan presents a financing plan that will facilitate successful implementation of the recommended CIP.

Source of Supply

The source of supply for the City of Oregon City is surface water from the lower Clackamas River which is supplied by the South Fork Water Board (SFWB). The SFWB is a wholesale water supplier that is equally owned by the Cities of Oregon City and West Linn. The SFWB operates an intake and pumping station just to the north of the Oregon City city limits which delivers raw water to the SFWB water treatment plant located in the City's Park Place area. The Oregon City water distribution system is supplied by the SFWB at six different locations.

Existing System

The Oregon City water distribution system currently serves more than 5,500 acres of developed property within the city limits. The existing system is composed of approximately 140 miles of pipeline network, five booster pumping stations, four reservoirs, seventeen pressure reducing valve (PRV) stations, two altitude valves, and eight interties with other water systems. The service area contains twelve pressure zones which are summarized in Table 1-1 along with their respective static pressure ranges.

Water Demand

Analysis of historical water demand data illustrate the water use patterns that characterize the City of Oregon City. These water use patterns also provide the basis for estimating future water demand in the community when the urban growth boundary (UGB) has been built out. Table 1-2 summarizes existing water demand in terms of average annual, maximum month, maximum day, and peak hour demand and provides projections for the UGB build-out condition. The City has also received preliminary approval for three UGB expansion areas that would increase annual average demand by approximately 0.8 million gallons per day (mgd) for the future service area at UGB build-out.

Table 1-1. Pressure Zone Ranges

Zone	Zone Bottom Elevation (feet)	Zone Top Elevation (feet)	Pressure Range (psi)
Lower Zone	20 - 50	80 - 170	48 - 113
Intermediate Zone	80 - 170	320 - 380	45 - 178
Upper Zone	320 - 380	470 - 500	38 - 118
Canemah Zone	60	130 - 180	50 - 102
Fairway Downs Zone	470	530	49 - 85
Park Place Lower Zone	40 - 130	190 - 220	42 - 120
Park Place Intermediate Zone	190 - 220	410 - 430	49 - 156
Park Place Upper Zone - CRW	410 - 430	540	112 - 168
Park Place View Manor Zone	230	330	36 - 79
Park Place Livesay Road Zone	220	360	39 - 100
Park Place Jennifer Estates	200	265	40 - 68
Paper Mill Zone	40	60	102 - 110

Table 1-2. Water Demand Summary for Oregon City

Description	Current Water Demand, mgd[a]	Build-Out Water Demand, mgd[a]
Average Annual	3.6	7.2
Maximum Month	5.4	11
Maximum Day	7.6	15
Peak Hour	16.2	32

[a]mgd: millions of gallons per day

Water Distribution System Service Standards

The City of Oregon City maintains benchmarks for service quality that are used to measure performance of the water utility. These benchmarks include service standards for water quality, quantity, and pressure, as well as the minimum supply levels for fire protection. For example, the Oregon City water distribution system was analyzed to ensure that service pressures never fall below 40 psi during normal demand scenarios and fire flows are available without dropping system pressures below 20 psi. The service standards set forth in this master plan are derived from regulations, rules, and recommendations established by a variety of sources including the Oregon State Department of Human Services (DHS), the Environmental Protection Agency (EPA), the American Water Works Association (AWWA), the Insurance Services Office (ISO), and the Uniform Fire Code (UFC).

Distribution System Modeling

A computer based hydraulic model of the Oregon City water distribution system was developed as part of the master planning effort to evaluate the ability of the system to meet current and projected demands. Field calibration work confirmed that the model accurately simulates operation of the water distribution system. The model was used to evaluate the existing and future water distribution system under three conditions:

- Peak hour demand
- Maximum day demand plus fire flow
- Low demand during booster pump station operation

System Evaluation and Capital Improvement Plan Recommendations

The Oregon City water distribution system was analyzed to evaluate its performance and capacity under current and future demand conditions relative to critical service standards. This analysis identified system improvements necessary to maintain adequate performance through build-out of the UGB. These improvements were developed to either eliminate existing deficiencies in system performance or expand service to satisfy community growth. The elements of the water distribution system that were evaluated include treated water storage capacity, booster pumping capacity, and pipeline network performance. A seismic vulnerability assessment was also conducted to identify all facilities upgrades necessary to limit the potential for water system damage from earthquakes.

Table 1-3 presents the specific costs for reservoir, pump station, and pipeline projects that are targeted for implementation through build-out of the UGB. These costs account for developer participation in the financing of some pipeline expansion projects. Costs shown are the City's estimated share of the pipeline extensions and do not include the costs to be borne by developers. Figure 1-1 illustrates how the new pump stations and reservoirs will fit into the existing hydraulic profile of the water distribution system. Figure 1-2 shows the layout of the future system including new pipelines and reservoirs.

The planned timing of projects is based on the anticipated rate of growth in water demand, the City's review and prioritization of improvements, as well as the anticipated locations of developer driven system expansions. Some adjustment of timing and priorities should be expected to accommodate the eventual sequence of development.

Financing and Implementation Plan

The development of a financing plan is a key element for successful implementation of the recommended capital improvement program (CIP). Projects in the CIP that improve the existing system but do not increase system capacity must be funded from water rates. Projects that increase water system capacity for future growth are eligible for funding from system development charges (SDCs). Financial projections were developed based on the City's historical revenue stream from water rates and SDCs. The SDC projections reflect the updated SDC which was adopted by the City Commission in June 2004. These projections indicate that available revenue streams will be adequate to fund the recommended CIP during the first and

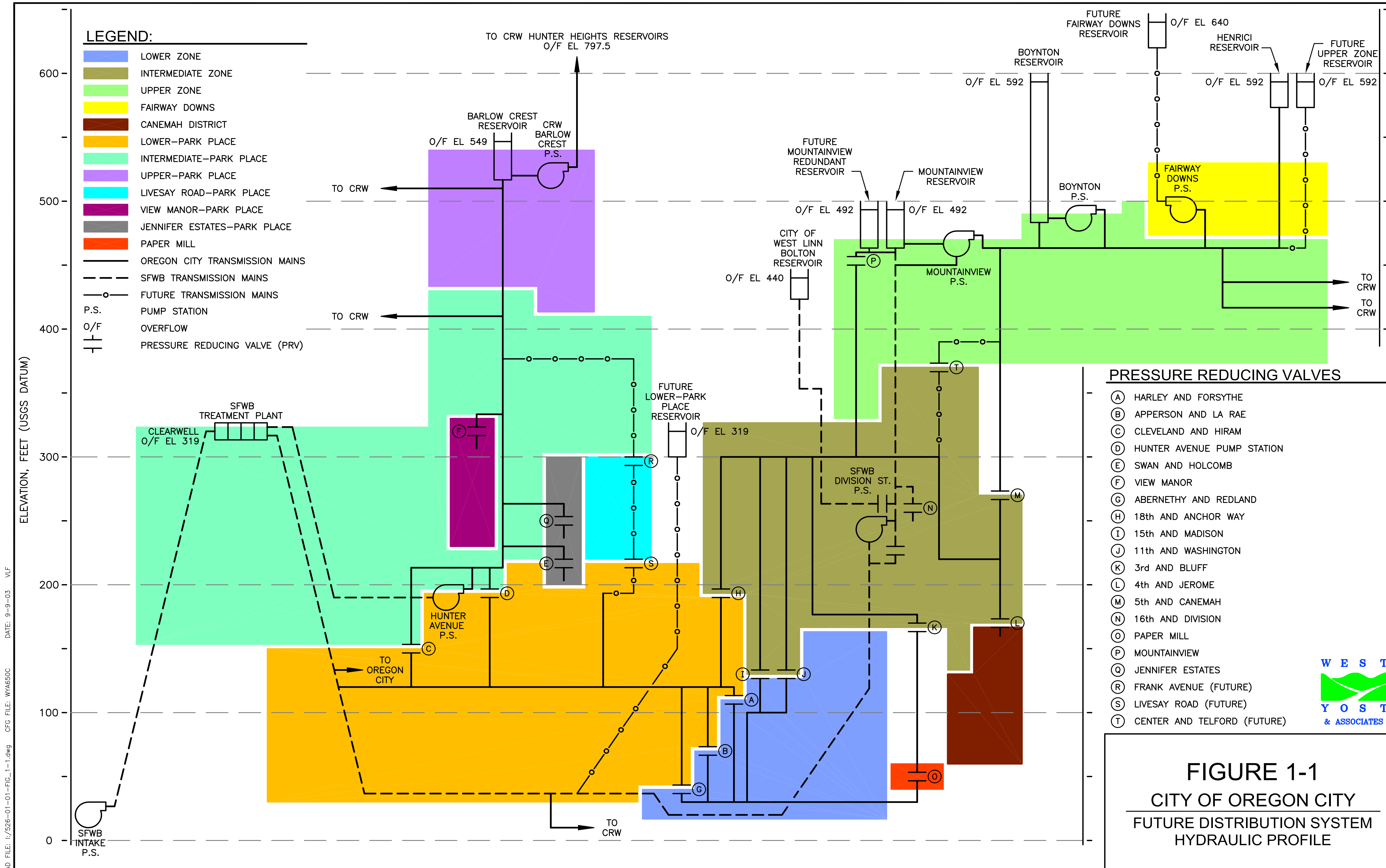
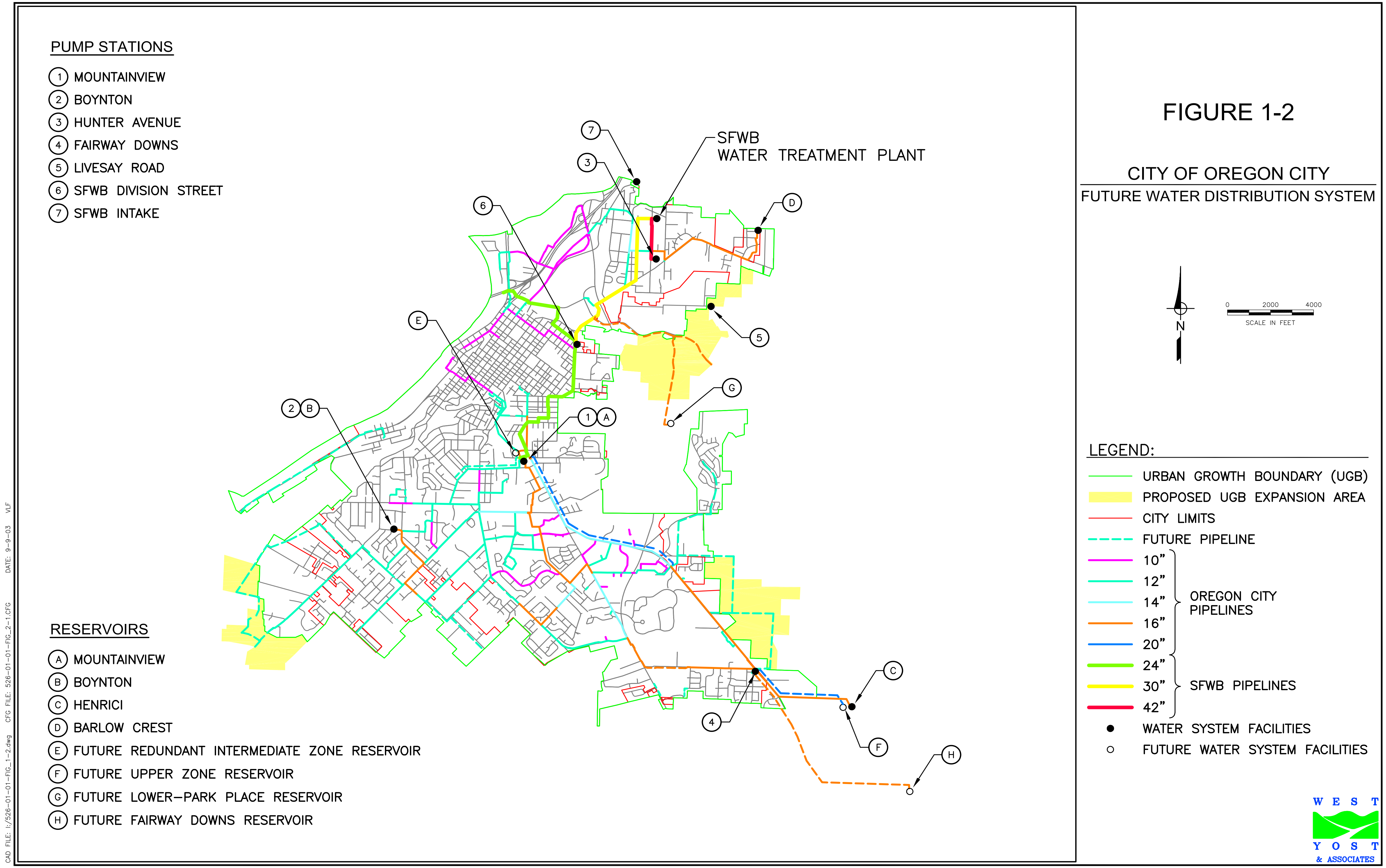


FIGURE 1-1

CITY OF OREGON CITY

FUTURE DISTRIBUTION SYSTEM HYDRAULIC PROFILE


PUMP STATIONS
1 MOUNTAINVIEW
2 BOYNTON
3 HUNTER AVENUE
4 FAIRWAY DOWNS
5 LIVESAY ROAD
6 SFWB DIVISION STREET
7 SFWB INTAKE
SFWB WATER TREATMENT PLANT
RESERVOIRS
A MOUNTAINVIEW
B BOYNTON
C HENRICI
D BARLOW CREST
E FUTURE REDUNDANT INTERMEDIATE ZONE RESERVOIR
F FUTURE UPPER ZONE RESERVOIR
G FUTURE LOWER–PARK PLACE RESERVOIR
H FUTURE FAIRWAY DOWNS RESERVOIR
FIGURE 1-2
CITY OF OREGON CITY
FUTURE WATER DISTRIBUTION SYSTEM
N
0 2000 4000
SCALE IN FEET
LEGEND:
URBAN GROWTH BOUNDARY (UGB)
PROPOSED UGB EXPANSION AREA
CITY LIMITS
FUTURE PIPELINE
10”
12”
14”
16”
20”
OREGON CITY PIPELINES
24”
30”
42”
SFWB PIPELINES
WATER SYSTEM FACILITIES
FUTURE WATER SYSTEM FACILITIES
WEST YOST & ASSOCIATES
CAD FILE: I:/526-01-01-FIG_1-2.dwg CFG FILE: 526-01-01-FIG_2-1.CFG DATE: 9-9-03 VLF

third improvement phases, while additional financing will be necessary to complete funding for projects during the second improvement phase. To meet the projected shortfalls during the second improvement phase, the implementation plan recommends that the City acquire revenue bonds totaling approximately $8.9 million. The annual debt service on a revenue bond of this amount would require a rate increase of twelve percent. By City ordinance, the sale of revenue bonds and a rate increase greater than three percent will require a vote of the people.

Table 1-3. Estimated Capital Costs for CIP Project

Recommended Improvements	Capital Cost, $1,000[a]
Period 2004 – 2009	
Treated Water Storage	8,207
Pump Stations	534
Pipelines	5,450
Total	14,191
Period 2009 – 2014	
Treated Water Storage	283
Pump Stations	2,940
Pipeline Replacement	6,665
Other	200
Total	10,088
Period 2014 – 2024	
Treated Water Storage	2,860
Pipelines	14,493
Other	200
Total	17,553
Grand Total	41,832

[a] Capital costs based on an Engineering News – Record (ENR) Construction Cost Index (CCI) of $6,650.