

# 8 | IMPROVEMENT PROGRAM

## INTRODUCTION

This chapter presents proposed improvements to the City of Richland's (City) water system that are necessary to resolve existing system deficiencies and accommodate the projected growth of water customers. The water system improvements were identified following the water system analyses presented in **Chapter 3**. The water system improvements were sized to meet both the existing and future demand conditions of the system.

A Capital Improvement Program (CIP) number has been assigned to each improvement. The proposed 21-year planning-period improvements are shown in **Figures 8-1** and **8-2**. The improvements are organized and presented in this chapter according to the following categories.

- Water System Improvements since the 2010 *Water System Plan* (WSP).
- Water Main Improvements.
- Pressure Zone Improvements.
- Pumping Improvements.
- Storage Improvements.
- Miscellaneous Improvements.

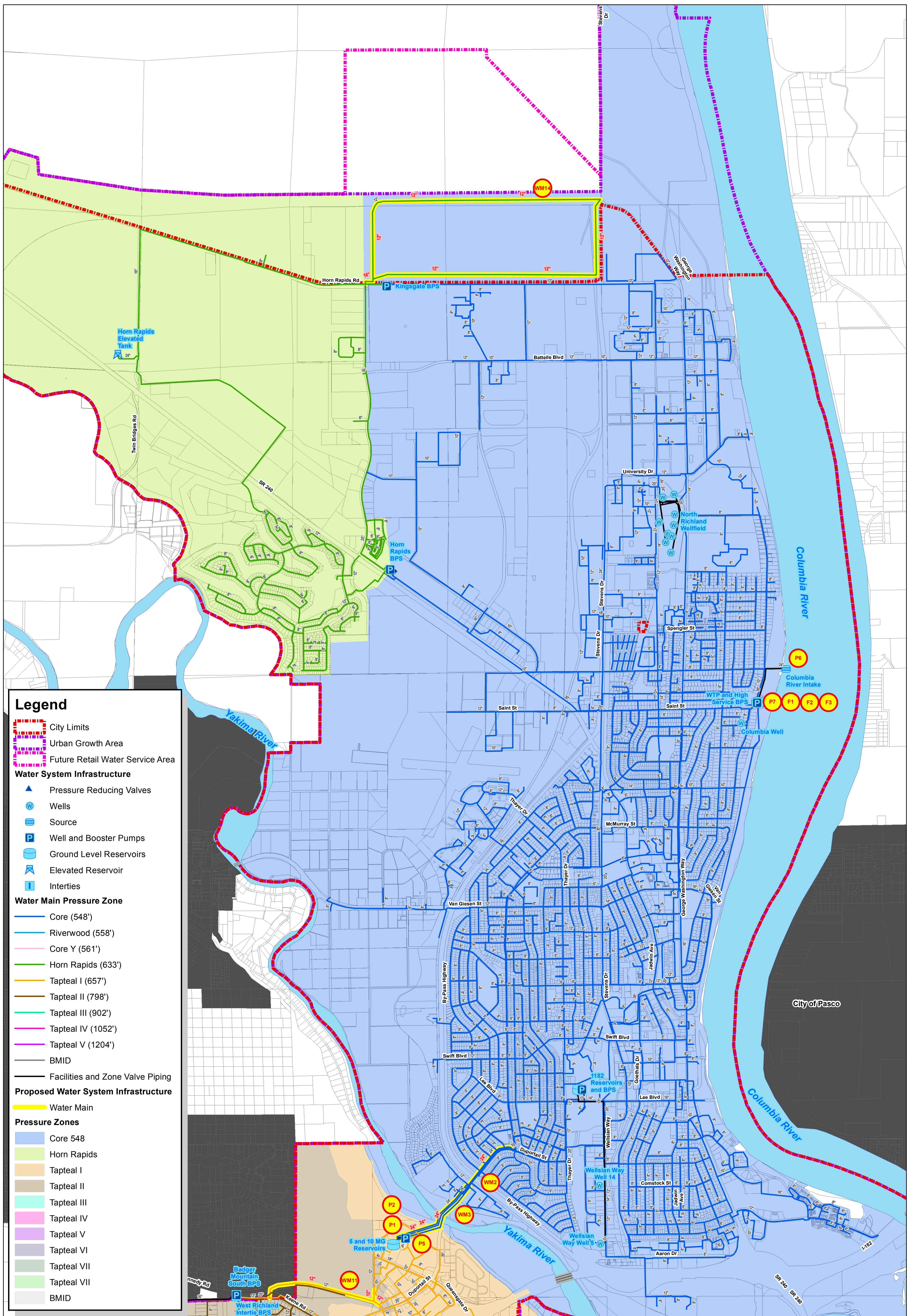
The remainder of this chapter presents a brief description of each group of improvements, the criteria for prioritizing, the basis for the cost estimates, and the schedule for implementation.

## DESCRIPTION OF IMPROVEMENTS

This section provides a general description of each group of improvements and an overview of the deficiencies they will resolve. Some of the improvements are necessary to resolve existing system deficiencies or to improve redundancy and operational flexibility within the system. However, improvements have also been identified for some undeveloped areas to illustrate the major facilities that will be required when future development occurs in those areas. The costs associated with these improvements shall be borne by the developers, rather than the existing water customers.

### WATER SYSTEM IMPROVEMENTS SINCE THE LAST WSP

The water system has undergone changes since 2010, when the City last updated its WSP. **Table 8-1** lists the CIP projects that have been completed since the City's 2010 WSP. These projects have primarily consisted of large diameter transmission main, reservoirs, and a booster pump station (BPS) to support growth primarily in the southern portion of the City's water service area.



**Legend**

- City Limits
- Urban Growth Area
- Future Retail Water Service Area
- Water System Infrastructure**
- Pressure Reducing Valves
- Wells
- Source
- Well and Booster Pumps
- Ground Level Reservoirs
- Elevated Reservoir
- Interties
- Water Main Pressure Zone**
- Core (548')
- Riverwood (558')
- Core Y (561')
- Horn Rapids (633')
- Tapteal I (657')
- Tapteal II (798')
- Tapteal III (902')
- Tapteal IV (1052')
- Tapteal V (1204')
- BMID
- Facilities and Zone Valve Piping
- Proposed Water System Infrastructure**
- Water Main
- Pressure Zones**
- Core 548
- Horn Rapids
- Tapteal I
- Tapteal II
- Tapteal III
- Tapteal IV
- Tapteal V
- Tapteal VI
- Tapteal VII
- BMID

\\RH2\DFS\RICHLAND\DATA\RIC\715-107\GIS\MAPS\FIG8-1.MXD BY: RWITHERS PLOT DATE: MAR 20, 2017 COORDINATE SYSTEM: NAD 1983 STATEPLANE WASHINGTON SOUTH FIPS 4602 FEET

**NORTH**

1 inch = 1,500 feet

0 750 1,500 3,000 Feet

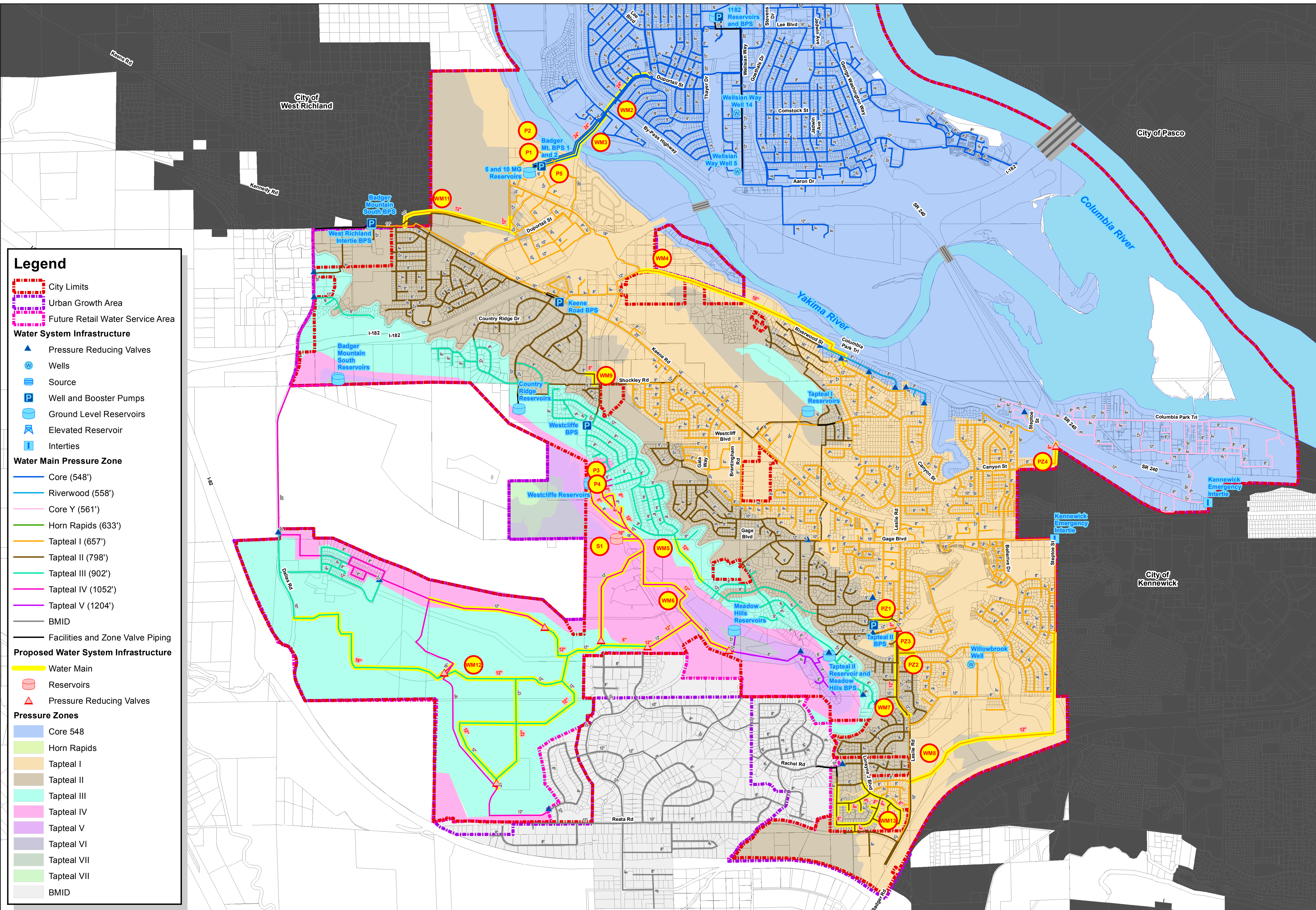
DRAWING IS FULL SCALE WHEN BAR MEASURES 2"



# Figure 8-1 Proposed Year 2036 Water System Improvements - North City of Richland 2017 Comprehensive Water System Plan

**Vicinity Map**

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**Legend**

- City Limits
- Urban Growth Area
- Future Retail Water Service Area

**Water System Infrastructure**

- Pressure Reducing Valves
- Wells
- Source
- Well and Booster Pumps
- Ground Level Reservoirs
- Elevated Reservoir
- Interties

**Water Main Pressure Zone**

- Core (548')
- Riverwood (558')
- Core Y (561')
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- Tapteal I (657')
- Tapteal II (798')
- Tapteal III (902')
- Tapteal IV (1052')
- Tapteal V (1204')
- BMID
- Facilities and Zone Valve Piping

**Proposed Water System Infrastructure**

- Water Main
- Reservoirs
- Pressure Reducing Valves

**Pressure Zones**

- Core 548
- Horn Rapids
- Tapteal I
- Tapteal II
- Tapteal III
- Tapteal IV
- Tapteal V
- Tapteal VI
- Tapteal VII
- BMID



**Figure 8-2**  
**Proposed Year 2036 Water System Improvements - South**  
**City of Richland**  
**2017 Comprehensive Water System Plan**

Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet



1 inch = 1,500 feet

0 750 1,500 3,000 Feet

Plot Date: 3/20/2017



**Table 8-1  
Improvements Completed Since 2010 WSP**

<b>Project Description</b>	<b>Size or Capacity</b>	<b>Length (feet)</b>	<b>Year</b>
Horn Rapids Elevated Tank	0.87 MG	---	2010
Sky Meadow Transmission Main	16"	1,200	2011
I-182 Crossing at Queensgate	12", 18"	3,700	2012
Badger Mt. South BPS	1,500 gpm	---	2013
Badger Mt. South Reservoirs	0.90 MG	---	2013
Badger Mt. South Water Main	6", 8", 12", 16", 20"	46,500	2013
Meadow Hills Reservoir B	0.20 MG	---	2013
Bellerive Drive and Claybell Park Water Main	8"	4,300	2014
BMID Intertie, Water Main, and Individual PRVs	Varies	---	2014

## WATER MAIN IMPROVEMENTS

The following water main improvements were identified from the results of the distribution and water main system analyses discussed in **Chapter 3**. The water main improvements involve replacing existing water main and constructing new water main to improve fire flow availability and serve future growth. These improvements have been described individually and are labeled as CIP WM2 through WM14, also shown in **Figures 8-1** and **8-2**. The City also has an annual water main replacement program that is grouped under the Annual Water Main Replacement Program project (CIP WM1), and a Galvanized Service Replacement and Meter Relocation Program project (CIP WM15)

### CIP WM1: Annual Water Main Replacement Program

The City completed a significant water main replacement program between 1990 and 2007 to replace approximately 70 miles of distribution main that contained non-standard water main materials or water main that was nearing the end of its useful life. The City's existing distribution system still includes some non-standard water main or water main nearing the end of its useful life, but the length of water main requiring near-term replacement is minimal. Approximately 97 percent of the distribution system is comprised of water main that is less than 40 years old as of 2015. In 2035, which is the 21-year planning period of this WSP, approximately 43 percent of the distribution system will be between 50 and 75 years old, which may be approaching the end of its useful life.

Although the majority of the existing distribution system is in relatively new condition, the City acknowledges that portions of the distribution system will require near-term replacement. However, the extent of the water main anticipated to be replaced in the next 10 years is significantly less than the extent of water main that may require replacement in subsequent years. As a result, an allowance of \$100,000 to \$250,000 per year has been established for the annual replacement of water main through 2021. The allowance increases to \$500,000 per year for the remaining years within the 21-year planning period.

All water main replacements will be constructed in accordance with the City's construction standards. The selection of specific projects will be accomplished annually during the City's budget

development process. This method for selecting projects provides the City with the flexibility to coordinate these projects with other projects that may occur within the same area.

### **CIP WM2: Duportail Street Transmission Main and Boring**

A single 36-inch-diameter main in Duportail Street crosses railroad tracks and State Route 240 to connect the City's supply facilities to the City's storage facilities and the City's customers in south Richland. A parallel main is proposed to be installed to provide a redundant conveyance route in the event that the existing 36-inch main fails or requires maintenance. The proposed main is recommended to be 24 inches in diameter to meet the existing domestic and emergency flow requirements of the system during average day demands, assuming that maintenance of the existing 36-inch main can be scheduled during low demand periods. The City does not believe there is sufficient space available in Duportail Street for a parallel main larger than 24 inches in diameter. If the Duportail Street route is not feasible, an alternate route for the redundant transmission main has been identified within Humphreys Street and Cottonwood Drive.

### **CIP WM3: Duportail Bridge Transmission Main**

The single 36-inch-diameter main described in CIP WM2 also crosses the Yakima River to connect the City's supply facilities to the City's storage facilities and the City's customers in south Richland. A Duportail Street bridge is scheduled for completion by 2020, with three parallel 24-inch-diameter water mains proposed to be installed on the bridge to provide the City a reliable conveyance route across the Yakima River to meet the future supply requirements of the water system. Sizing of this improvement is based on conveyance of up to 2,500 gpm to the City of West Richland. A 42-inch-diameter main is proposed to be installed in west of the Yakima River, between the proposed bridge and the existing Core Zone storage facilities.

### **CIP WM4: Columbia Park Trail Water Main**

Transmission through the Tapteal I Zone relies on a single 24-inch main in Keene Road. Install approximately 8,100 linear feet (LF) of 18-inch-diameter water main in Columbia Park Trail from Windmill Road to the intersection of Riverwood Street and Edgewood Drive. This main will provide a redundant conveyance route to supply the east side of the Tapteal I Zone if the 24-inch main in Keene Road is out of service for an extended period of time and the Tapteal I Reservoir empties.

### **CIP WM5: Tapteal III Zone Connection**

The City currently operates two separate Tapteal III Zones that can be connected during development of the land between the two zones. Install approximately 1,700 LF of 12-inch water main between Sicily Lane and Meadow Hills Drive to connect the two Tapteal III Zones. The eastern portion of the Tapteal III Zone is currently served by a pressure reducing valve (PRV) that is set at a hydraulic grade approximately 60 feet higher than the overflow elevation of the Westcliffe Reservoirs, which serve the western portion of the Tapteal III Zone. A check valve is recommended to allow the Westcliffe Reservoirs to supply emergency supply to the eastern portion of the Tapteal III Zone.

**CIP WM6: Tapteal IV Zone Connection**

The City currently provides water service to approximately 20 single-family residences immediately east of the Westcliffe Reservoirs. Pressures provided to these customers currently ranges between 30 and 40 pounds per square inch (psi) during normal operations. Future development occurring south and east of this location will require service at a higher hydraulic grade line. Installation of approximately 6,000 LF of 8, 10, and 12-inch-diameter water main is proposed to connect the proposed development in this area with the existing Meadow Hills Reservoirs 10-inch-diameter outlet pipe. A Tapteal V to Tapteal IV Zone PRV station is proposed to be located just west of the connection to the existing Meadow Hills Reservoirs outlet pipe, with a recommended PRV hydraulic grade line (HGL) set point of 1,050 feet. This HGL will approximately match the bottom of the fire flow storage component of the future Tapteal IV Reservoir (CIP S1), when headlosses in the proposed piping (between the PRV and the proposed development) are considered.

**CIP WM7: Leslie Road Tapteal II Water Main**

Transmission through the Tapteal II Zone in Leslie Road relies on a single 12-inch asbestos cement (AC) main from Center Boulevard north, which in turn is fed by a single 8-inch main discharging from the Tapteal II BPS. A future Tapteal II loop is proposed as part of CIP PZ1, but installation of approximately 3,000 LF of 12-inch main in Leslie Road is proposed to parallel the existing main between High Meadows Street and a location north of Center Boulevard. The improvement will increase the conveyance capacity in the area and reduce the volume of water required to be supplied from the Tapteal III Zone via the existing Meadow Hills Drive PRV. The set point of the Meadow Hills Drive PRV is recommended to be reduced to 25 psi following completion of this water main improvement.

**CIP WM8: Rachel Road Extension Water Main**

During construction of Rachel Road east of Leslie Road, install approximately 8,800 LF of 12-inch-diameter water main between Leslie Road and Steptoe Street. A proposed connection to existing 12-inch-diameter main in Steptoe Street at approximately Tiger Lane is recommended to provide looped supply to the southeastern portion of the Tapteal II Zone.

**CIP WM9: Tapteal II Loop**

Installation of approximately 600 LF of 8-inch-diameter main between Lariat Lane and Shockley Road will improve redundancy and water quality within the Tapteal II distribution system.

**CIP WM10: Tapteal VI Water Main**

As property develops in the Tapteal VI area above the City's Westcliffe Reservoirs, water main will be required to convey supply from the proposed Tapteal IV BPS (CIP P4) and the proposed development. The required water main will be dependent upon the location and configuration of the proposed development; however, 2,500 LF of 8-inch-diameter main has been assumed to be required for these analyses. It is recommended that the City confirm the proposed water main sizing and configuration during the design phase of this improvement.

**CIP WM11: Kennedy Road Water Main**

As the pumping volume increases at the City's Badger Mountain South BPS, additional Tapteal I Zone transmission main may be required to maintain pressures on the suction side of the BPS facilities. Installation of approximately 4,500 LF of 12-inch-diameter main in Kennedy Road, between Keene Road and Duportail Street is recommended to reduce headlosses between the City's Tapteal I Zone supply facilities and the BPS facilities on the west side of the Tapteal I Zone.

**CIP WM12: Badger Mountain South Subarea Water Main Improvements**

The Badger Mountain South Subarea (Subarea) is located within Badger Mountain Irrigation District's (BMID) water service area and within the City's urban growth area (UGA). Because the Subarea is within the City's UGA, and the City is currently supplying BMID's water system due to a temporary water service agreement, a schematic configuration of water system infrastructure required to supply the Subarea has been included with this WSP. Since 2013, the City has constructed the Badger South Reservoirs (approximately 1 million gallons of storage in the Tapteal IV Zone), the Badger Mountain South BPS (a 1,500 gpm capacity facility to pump water from the Tapteal I Zone to the Badger Mountain South Reservoirs), 20-inch-diameter Tapteal IV transmission main from the Badger Mountain South Reservoirs to the Subarea, and Tapteal III and IV distribution main within the Subarea. A 12- and 16-inch-diameter Tapteal IV Zone transmission main has been constructed to provide a connection to the existing BMID water service area.

As growth occurs in the predominantly low density residential Subarea, the Tapteal III and IV Zones infrastructure will be required to provide service to the development. Approximately 40,000 LF of 12- and 16-inch-diameter transmission main have been identified to serve the development and provide looping to improve the level of service and water quality provided. Five PRV stations are proposed to provide acceptable water service at elevations in the area that coincide with receiving water service from the Tapteal III Zone. All five PRV stations were assumed to have a set point of 938 feet HGL for the purposes of these analyses. It is recommended that the City confirm the proposed water main sizing, configuration, and PRV set points during the design phase of this improvement.

**CIP WM13: Lorayne J Water System Acquisition**

Kennewick Irrigation District (KID) currently owns and operates the Lorayne J potable water system, located northwest of the Leslie Road and Reata Road intersection in the southeastern portion of the City's water service area. KID desires to transfer ownership and operation responsibilities of the Lorayne J water system to the City. The Lorayne J water system consists primarily of 8-inch-diameter AC water main constructed in the mid-1950s, which does not meet the City's distribution system standards. The City is collaborating with the Washington State Department of Health (DOH) in 2016 to obtain a grant to determine the improvements necessary for the Lorayne J water system in order for it to meet the City's distribution system standards. In the event that the entire Lorayne J distribution system requires replacement, approximately 9,000 LF of existing AC main will be recommended to be replaced with 8-inch ductile iron main prior to the City's acquisition of the water system.

**CIP WM14: Department of Energy Land Transfer Improvements**

The Department of Energy (DOE) transferred ownership of an undeveloped 1,341-acre tract in the northern portion of the City's water system to the City and the Port of Benton in late 2015. Water

system improvements necessary to supply the tract are contingent upon the demands and fire flow requirements of the future tract development. Improvement alternatives to supply the tract include an on-site Core 548 Zone elevated reservoir, an off-site Core 548 Zone ground level reservoir, or an off-site Horn Rapids 603 Zone elevated reservoir. It is recommended that additional hydraulic analyses be performed once an improvement alternative has been selected, tract demands projections have been refined, and the fire flow requirements have been established to confirm the pressures and fire flows available to the tract. An April 2015 letter to the City from RH2 Engineering, Inc., estimated the costs for each improvement alternative, with the project costs including indirect costs ranging from approximately \$7,700,000 to \$10,600,000. Costs to construct the improvements necessary for this project are anticipated to be developer-funded.

#### **CIP WM15: Galvanized Service Replacement and Meter Relocation Program**

The City acknowledges that galvanized service lines are approaching the end of their service life and will require near-term replacement. Many of the service lines are shared between properties and have indoor basement meters. Replacement services lines will include a dedicated service line and outdoor water meter to conform with the City's current standards. An allowance of \$100,000 per year has been established for the replacement of galvanized service lines and the relocation of meters through 2021.

#### **CIP WM16: Sky Meadow Transmission Main**

In 2016, the City installed 8-inch-diameter Taptal II Zone water main in Sky Meadow Avenue and Firerock Avenue to loop water main that was originally installed as dead-end piping.



## PRESSURE ZONE IMPROVEMENTS

The following pressure zone improvements are proposed in areas of the City's water service that do not meet the City's pressure standards and will improve low pressure problem areas throughout the water system. A brief description of the existing deficiency and proposed improvement for each project are provided below.

### **CIP PZ1: Orchard Way Conversion from Tapteal I to Tapteal II**

The single-family residential area located in Orchard Way, east of the intersection with Greenview Drive, has a normal static pressure of approximately 34 psi. Pressures are approximately 28 psi during existing peak hour demand (PHD) conditions.

Convert approximately 900 LF of 8- and 10-inch water main in Orchard Way between the Tapteal II BPS discharge main in Orchard Way and Peach Tree Lane from the Tapteal I Zone to the Tapteal II Zone. Construct approximately 200 LF of 8-inch-diameter main in Leslie Road from High Meadows Street to an existing Tapteal I Zone 8-inch-diameter main to provide looped supply to the Tapteal II Zone in this area.

### **CIP PZ2: Broadmoor Street Conversion from Tapteal I to Tapteal II**

The single-family residential area located in Broadmoor Street, east of the intersection with Leslie Road, has a normal static pressure of approximately 35 psi, and pressures are as low as 27 psi during existing PHD conditions.

Install approximately 600 LF of 8-inch water main in Broadmoor Street to connect to the existing 8-inch Tapteal II main in Leslie Road. Convert 12 existing Tapteal I Zone customers to the Tapteal II Zone.

### **CIP PZ3: High Meadows Street and Leslie Road PRV (Tapteal II to Tapteal I)**

The single-family residential area located in neighborhoods on either side of Leslie Road, between approximately Broadmoor Street and Peach Tree Lane, experience pressures between 29 and 33 psi during existing PHD conditions.

Install a PRV station to supplement the Tapteal I Zone at approximately Leslie Road and High Meadows Street. The proposed PRV can be connected to the Tapteal 1.5 Zone serving Caliente Sands, or the Tapteal II Zone within Leslie Road or High Meadows Street. An 8-inch PRV is proposed to have a set point of 647 feet HGL. The resulting pressures in the adjacent neighborhoods is projected to increase to approximately 40 psi during projected 21-year PHD conditions.

### **CIP PZ4: Core Y Additional PRV**

The City's Core Y Zone is supplied by a single PRV station. Construct a second PRV station to improve the reliability to the zone. The PRV station is proposed to be located at the intersection of Steptoe Street and Tapteal Drive. An 8-inch PRV is proposed to have a set point of 550 feet HGL, and will function as the lag PRV to the Core Y Zone. Approximately 700 LF of 8-inch-diameter main is proposed in Steptoe Street, from Canyon Street to Tapteal Drive which includes a railroad crossing, to connect the proposed PRV to the Tapteal I and Core Y Zones.

## PUMPING IMPROVEMENTS

The following pumping improvements were identified from the results of the water system analyses that are discussed in **Chapter 3**. The improvements are primarily necessary to resolve future system supply deficiencies as a result of projected growth.

### **CIP P1: Tapteal I BPS**

The existing Tapteal I BPSs do not have sufficient pumping capacity to meet existing demands if one pump is out of service. Replacement of the existing 900 gallons per minute (gpm) pump in the Badger Mountain 1 BPS with a 2,500 gpm pump will allow the maximum day demand of the Tapteal I Zone to be supplied if any of the other five pumps at the Badger Mountain 1 and 2 BPSs are offline. Implementation of this improvement will allow the City to delay implementation of CIP P2, which proposes construction of an additional Tapteal I BPS facility.

### **CIP P2: Tapteal I BPS**

The existing Tapteal I BPSs do not have sufficient pumping capacity to meet the projected demands of the 10-, 12-, and 21-year planning periods.

Approximately 1,900 gpm of additional Tapteal I supply capacity is estimated to be needed to meet the projected 11,945 gpm demands of the 21-year planning period. The existing Badger Mountain 1 and 2 BPSs have a pumping capacity of 4,300 and 6,000 gpm, respectively; therefore, these BPSs either will need to be expanded or will need a third BPS to be constructed to operate in parallel with the existing BPSs. Although the City's projected 21-year supply requirement is approximately 11,945 gpm, the *2016 Regional Water Supply Feasibility Study* (RH2 Engineering, Inc.) identified a 14,700 gpm pumping requirement in the 50-year planning period. This pumping rate is dependent upon the City of Kennewick's ability to expand its existing water treatment plant (WTP) to meet future demands, and the City of West Richland's growth rate and development of additional source capacity. For the purposes of this WSP, the total 21-year pumping rate to the Tapteal I Zone is identified to be 14,700 gpm (new facility capacity of 4,400 gpm) for consistency with the *2016 Regional Water Supply Feasibility Study*. It is recommended that the City coordinate future pumping needs with the Cities of Kennewick and West Richland during the design phase of this improvement to confirm the proposed pumping rate.

### **CIP P3: Tapteal IV BPS**

As property develops in the Tapteal IV area southeast of the City's Westcliffe Reservoirs, the development can initially be supplied via the improvements identified in CIP WM6; however, a Tapteal IV BPS eventually will be required to provide regular supply to the area. The supply analyses in **Chapter 3** identify an additional need of 294 gpm of Tapteal IV supply capacity in the 21-year planning period. To meet the buildout demands of the Tapteal IV operating area, the pumping capacity of the proposed Tapteal IV BPS is estimated to be 500 gpm. It is recommended that the City confirm this proposed pumping rate during the design phase of this improvement.

### **CIP P4: Tapteal VI BPS**

As property develops in the Tapteal VI area above the City's Westcliffe Reservoirs, a Tapteal VI BPS will be required to provide regular supply to the area. The pumping capacity of the proposed

Tapteal VI BPS is estimated to be 50 gpm. It is recommended that the City confirm this proposed pumping rate during the design phase of this improvement.

### **CIP P5: Source Capacity Improvements**

Additional source capacity is required to meet the projected 21-year planning-period demands. The City drilled a pilot well in Summer 2016, and found that the water quality of the well is not suitable for use in the City's system. The City plans to evaluate other locations in south Richland that may have acceptable water quality throughout the 2027 planning period. Additional source capacity is not needed within the 12-year (2027) planning period of this WSP.

### **CIP P6: Columbia River Intake Screens**

The United States Army Corps of Engineers, Walla Walla District, published an environmental assessment in November 2015 regarding water intake facilities in the McNary and Ice Harbor Reservoirs. The City's Columbia River intake facility, originally constructed in 1963 and equipped with screens that do not meet the current National Marine Fisheries Service (NMFS) screen criteria for fry protection, was identified as requiring screen upgrades prior to 2020 in order to receive a renewed easement for the intake facility. Based on the current NMFS screen criteria and the cross-sectional area of the intake facility's two traveling belt screens, the capacity of the facility will be reduced to approximately 10 million gallons per day (MGD). The pumping capacity of the City's existing Columbia River Intake pumps is approximately 90 MGD. For the purposes of this analysis, barrel screens are proposed to be installed in the Columbia River to match the pumping capacity of the existing equipment.

### **CIP P7: High Service Pump No. 8**

The High Service BPS at the City's WTP has adequate pumping capacity to meet the existing supply requirements of the water system. However, the loss of one or more large pumps would put a strain on water supply in the summer. Specifically, the loss of High Service Pump No. 7 (HS7), which is the only pump at the High Service BPS equipped with a variable frequency drive (VFD), could make operation of the WTP cumbersome until HS7 could be returned to operation. A new pump, assumed to be named High Service Pump No. 8 (HS8), is proposed to be installed to improve the reliability of the facility. The pump is anticipated to be a vertical turbine pump with a design point of 6,500 gpm at 250 feet total dynamic head, and equipped with a 500 horsepower inverter duty motor.

A May 13, 2015, letter to the City (*City of Richland – Water Treatment Plant Pump HS8 Cost Estimate*, prepared by RH2 Engineering, Inc.), identified insufficient space in the High Service BPS pump room to install a VFD on the proposed HS8 without significantly blocking access for operation and maintenance, or interfering with the existing room chiller. Meeting NEC requirements for electrical equipment clearance will also be difficult. Therefore, it was recommended that the proposed HS8 VFD be installed outside of the High Service BPS in a waterproof enclosure. Completion of this project is not critical because the City meets all minimum reliability standards at the High Service BPS.

## STORAGE IMPROVEMENTS

The following storage improvements were identified from the results of the water system analyses that are discussed in **Chapter 3**. The improvements are primarily necessary to resolve future system storage deficiencies as a result of projected growth.

### **CIP S1: Tapteal IV Reservoir**

As property develops in the Tapteal IV area southeast of the City's Westcliffe Reservoirs and throughout the Subarea, a Tapteal IV Reservoir will be required to provide operational flexibility, redundancy, and emergency storage to the area. A 1.0 million gallon (MG) Tapteal IV Reservoir is proposed for the purposes of these analyses to provide supplemental storage to the Tapteal IV through the 21-year planning period and to meet the projected buildout storage requirements of the Subarea. It is assumed that the proposed Tapteal IV Reservoir will provide storage to the same operating area as the existing 0.98 MG Badger South Reservoirs. It is recommended that the City construct the proposed 1.0 MG Tapteal IV Reservoir with adequate capacity to meet the buildout requirements of the operating area, and that the estimated 1.0 MG storage capacity be confirmed during the design phase of this improvement.

### **CIP S2: Reservoir Drain and Overflow Modifications**

Review all reservoir drain and overflow systems to determine if there are deficiencies and develop a correction plan if necessary. The budget assumes one site per year will be modified, for a total of three sites at an estimated cost of \$25,000 per site. Although a review of all reservoirs is recommended, the following two are of specific interest.

- Review the potential for runoff damage should the Tapteal II Reservoirs overflow during the irrigation off-season.
- Review the drain size and drainage basin area for the Country Ridge Reservoirs.

## FACILITY IMPROVEMENTS

The following facility improvements were identified by the City and are primarily necessary to ensure these facilities remain up to date and reliable.

### **CIP F1: WTP Solids Handling Replacement**

The City's existing WTP solids handling system currently pumps solids to drying beds at the North Richland Wellfield. A replacement system has been evaluated, and identified three alternatives for future solids handling:

1. Treatment at the City's wastewater treatment plant;
2. Construction of danskin filters in the existing settling basins and mechanically scraping the filters for off-site disposal; and
3. Utilization of Geotubes in a roll-off dumpster to collect solids, with water returned to the Columbia River.

Alternative 3, the utilization of Geotubes, is the City's currently preferred alternative and was assumed to be the selected alternative for the purposes of this improvement project.

**CIP F2: Treatment and Supply System Rehabilitation**

A biennial budget of \$300,000 has been included for treatment and supply system rehabilitation and replacement projects. The purpose of this work is to ensure these facilities remain up to date and reliable.

**CIP F3: WTP Automation**

In 2013, an evaluation of the automation capability of the WTP took place to identify existing automation deficiencies, as well as automation and power upgrades. The backup power system and facility control system reviews contained in the evaluation identified the following improvement recommendations:

- Installation of a new switchgear to automatically transfer the power supply feed in the event of one supply feed going out of service;
- Installation of standby power for the existing motorized filter valves;
- Replacement of the Main PLC Panel and Primary Remote I/O Panel; and
- Upgrades to the HMI computer system.

The City has replaced the Main PLC Panel and Primary Remote I/O Panel, and has performed a more detailed evaluation of the standby power needed for the motorized filter valves and the upgrades needed for the HMI computer system. The detailed standby power evaluation concluded that a propane-fueled generator located on the west side of the filter gallery is the most feasible solution for emergency power. The HMI computer system evaluation concluded that software development could be accomplished at a lower cost through a control system contractor or integrator.

The estimated costs for this project have been updated to reflect completion of the Main PLC Panel and Primary Remote I/O Panel, as well as the revised implementation plan for the motorized filter valves backup power and the HMI computer system upgrades.

**CIP F4: Communications Upgrade for Telemetry and System Control**

The City currently uses a Microsystems Design Services, LLC. (MDS) licensed radio on Badger Mountain to communicate with the WTP SCADA system, and spread spectrum radio to communicate between BPSs and reservoirs with PLC's enabling WTP SCADA connectivity to control the facilities. Fiber communication is used at some water system facilities where it is available, and some facilities utilize both MDS radio and fiber communications. The City desires to continue to transition from the MDS radio communication to fiber communication for the water system facilities. An annual budget of \$50,000 has been included through 2021 for the City to continue to advance the transition to fiber communications.

## MISCELLANEOUS IMPROVEMENTS

The following miscellaneous improvements are planning efforts and program elements that are required to comply with various Washington State water regulations.

### **CIP M1: Comprehensive Water System Plan Update**

Washington Administrative Code (WAC) 246-290-100 requires that the City's WSP be updated every 6 years and submitted to DOH for approval. It is anticipated that WSP updates will only be required every 10 years in the future. Update the WSP every 10 years or as required by DOH.

### **CIP M2: Automatic Meter Reading System**

The City's electrical utility is currently implementing an automatic meter reading (AMR) system for each customer's electrical meter, and the City's water utility is evaluating the feasibility of implementing an AMR system for the City's water system meters. Costs to simultaneously implement an AMR system for both the electrical and water utilities are believed to be shared between the two utilities, with cost sharing and infrastructure efficiencies gained with data collectors, billing software, customer portal software, and software hosting. For the purpose of this analysis, only the costs of water meter transmitters and the labor to install the transmitters are included.

### **CIP M3: Core 545 Zone Surge Analyses**

The velocity in the 30- and 36-inch-diameter mains that convey supply from the City's WTP is expected to increase and approach 5.0 feet per second (fps) as system demands increase. Common design practice is to limit velocity in transmission mains to 5.0 fps or less, unless water hammer analysis and mitigation is provided. A water hammer analysis is recommended for each of the mains to identify the surge events that can be expected and the need for surge protection devices. Improvements to provide surge protection to these water mains have been estimated to cost \$750,000 for the purposes of these analyses and are included in this CIP.

### **CIP M4: Pump and Motor Condition Assessment**

The wire-to-water efficiency, energy signature, and vibration characteristics of the pumps and motors in each of the City's pumping facilities was evaluated in January and March 2012. It is recommended that the condition of each pump and motor be retested and reevaluated approximately every 5 years, using the data collected in 2012 as a baseline to evaluate pump and motor degradation over the service life of the equipment. Funding for the testing and evaluation will be provided from the City's operations and maintenance budget, but due to the applicability of this improvement to the WCP, it has been included here for reference.

## ESTIMATING COSTS OF IMPROVEMENTS

Project costs for the proposed improvements are presented in second quarter 2016 dollars and include the estimated construction cost of the improvement and indirect costs estimated at 35 percent of the construction cost for engineering preliminary design, final design, and construction management, permitting, legal, and administrative services. The project cost estimates include a 20-percent contingency and sales tax of 8.6 percent, and are shown for each water main diameter in **Table 8-2**. Construction cost estimates for water main projects were determined from the water main unit costs (i.e., cost per linear foot) shown in **Table 8-2** and the proposed diameter and approximate length of each improvement.

**Table 8-2**  
**Water Main Unit Costs**

<b>Water Main Diameter (inches)</b>	<b>Project Cost Per Foot Length (2016 \$/LF)</b>
6	\$162
8	\$167
10	\$171
12	\$173
16	\$183
18	\$188
20	\$194
24	\$202

The unit costs for each water main size are based on estimates of all construction-related improvements, such as materials and labor for the water main installation; water services; fire hydrants; fittings; valves; connections to the existing system; trench restoration; asphalt surface restoration; and other work for a complete installation. Additional costs were added to some water main improvements to cover anticipated increased costs related to the project location and degree of difficulty.

Costs for reservoirs and BPSs include the following assumptions.

- Land acquisition cost of \$50,000 per site.
- On-site piping costs assume that transmission mains are available adjacent to the site, unless provided for in other CIP items.
- Site work is included in the price, including stormwater, landscaping, parking, and fencing.

## SCHEDULE OF IMPROVEMENTS

The implementation schedule for the proposed improvements is shown in **Table 8-3**. The costs associated with each improvement have been categorized based on the purpose of the improvement.

- *Repair and Replacement* projects resolve existing system deficiencies.
- *Improvement* projects improve the level of service for existing water system customers.

- *Expansion/Funded by Others* include projects that facilitate new developments and water system expansion. Costs of these projects shall be borne by the developers, rather than the existing water customers.

## **FUTURE PROJECT COST ADJUSTMENTS**

All project costs were estimated in 2016 second-quarter dollars, and are presented as such for each project identified within the 12-year-planning period (through year 2027). All project costs for improvements identified in 2028 and beyond were adjusted in the schedule of improvements based on an estimated 3.0 percent annual increase to account for the effects of inflation and changing construction market conditions at the scheduled time of project implementation.



Table 8-3  
Proposed Implementation Schedule

CIP No.	Description	Estimated Cost (2018 \$)	21-Year Schedule of Improvements										Improvement Cost Breakdown (Inflation-Adjusted Costs)						
			2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028-2030	2031-2036	Repair and Replacement	Improvement	Expansion/ Funded by Others
<b>Water Main Improvements</b>																			
WM1	Annual Water Main Replacement Program	\$8,450,000	\$893K	\$1,000K	\$1,500K	\$2,000K	\$2,500K	\$2,500K	\$3,571K	\$3,571K	\$3,571K	\$3,571K	\$3,571K	\$3,571K	\$3,571K	\$3,571K	\$3,571K	\$3,571K	\$3,571K
WM2	Dupree Street Transmission Main and Boring	\$7,500,000		\$7,500K															
WM3	Chapin Road Water Main	\$7,500,000	\$341K	\$1,000K	\$3,500K	\$2,999K													
WM4	Chapin Road Water Main	\$7,500,000																	
WM5	Tiptoeal III Zone Connection	\$2,015,000																	
WM6	Tiptoeal IV Zone Connection	\$1,150,000																	
WM7	Leslie Road Tiptoeal II Water Main	\$520,000																	
WM8	Rachel Road Extension Water Main	\$1,530,000																	
WM9	Tiptoeal II Loop	\$1,011,000																	
WM10	Tiptoeal VI Water Main	\$420,000																	
WM11	Kennedy Road Water Main	\$760,000																	
WM12	Badger Mt. South Subarea Water Main Improvements	\$7,020,000																	
WM13	Lorayne J. Water System Acquisition	\$1,510,000																	
WM14	Department of Energy Land Transfer Improvements	\$10,560,000																	
WM15	Galvanized Service Replacement and Meter Relocations	\$500,000																	
WM16	Sky Meadow Transmission Main	\$11,433	\$111K																
<b>Pressure Zone Improvements</b>																			
PZ1	Orchard Way Conversion from Tap 1 to Tap II	\$35,000																	
PZ2	Bradford Street Conversion from Tap 1 to Tap II	\$110,000																	
PZ3	Highway 60 Street Conversion from Tap 1 to Tap II	\$1,015,000																	
PZ4	Core Y Additional TRV	\$410,000																	
<b>Pumping Improvements</b>																			
P1	Tiptoeal I BPS Capacity Upgrade	\$500,000																	
P2	Tiptoeal II BPS Facility	\$1,300,000																	
P3	Tiptoeal III BPS	\$215,000																	
P4	Tiptoeal IV BPS	\$213,000																	
P5	Source Capacity Improvements	\$2,197,200	\$1,697K	\$500K															
P6	Columbia River Intake Screens	\$4,630,000																	
P7	High Service Pump No. 8	\$623,000																	
P8	Harrison Well Improvements	\$76,000	\$75K																
<b>Storage Improvements</b>																			
S1	Tiptoeal IV Reservoir	\$1,300,000																	
S2	Reservoir Drain and Overflow Modifications	\$100,000																	
<b>Facility Improvements</b>																			
F1	WTP Solids Handling Replacement	\$400,000																	
F2	Treatment and Supply System Rehabilitation	\$3,000,000																	
F3	WTP Automation	\$1,561,000																	
F4	Communications Upgrade for Telemetry and System Control	\$250,000																	
F5	Future WTP Site Acquisition	\$69,282	\$69K																
<b>Miscellaneous Improvements</b>																			
M1	Comprehensive Water System Plan Update	\$300,000																	
M2	Automatic Meter Reading System	\$3,235,000																	
M3	Core 545 Zone Surge Analyses	\$50,000																	
M4	Pump and Motor Condition Assessment	OMF Funded																	
M5	Pump and Storage Renewal and Replacement	\$449,058	\$448K																
M6	Stevens Drive Roadway Improvement	\$28,580	\$29K																
M7	Completed Project Contingency	\$2,984	\$3K																
M8	Water System Security Improvements	\$5,218	\$5K																
M9	City-wide Software Program (ERP Project)	\$530,155	\$32K	\$311K	\$268K	\$202K													
<b>TOTAL ESTIMATED COSTS OF REPAIR AND REFINANCE PROJECTS</b>		\$31,083,000	\$2,051K	\$1,430K	\$2,368K	\$2,350K	\$4,705K	\$1,425K	\$1,483K	\$1,781K	\$633K	\$1,240K	\$672K	\$1,071K	\$2,994K	\$6,844K	\$31,083K	---	---
<b>TOTAL ESTIMATED COSTS OF IMPROVEMENT PROJECTS</b>		\$11,417,000	\$0K	\$1,010K	\$3,025K	\$25K	\$688K	\$457K	\$0K	\$1,308K	\$0K	\$0K	\$0K	\$248K	\$4,636K	\$11,417K	---	---	---
<b>TOTAL ESTIMATED COSTS OF EXPANSION/FUNDED BY OTHERS IMPROVEMENTS</b>		\$47,549,000	\$1,357K	\$906K	\$1,893K	\$1,600K	\$0K	\$250K	\$0K	\$923K	\$9,160K	\$0K	\$0K	\$248K	\$31,314K	\$47,549K	---	---	---
<b>Annual CIP Total</b>		\$90,049,000	\$3,408K	\$3,346K	\$7,288K	\$6,306K	\$4,730K	\$2,360K	\$1,949K	\$1,781K	\$2,769K	\$1,240K	\$672K	\$1,107K	\$3,476K	\$42,795K	---	---	---

NOTE: Components may not sum due to rounding.