City of Spokane

Water System Plan

May 2014

Revised March 2016

Contents

Chapter and Section

City of Spokane
Water System Plan
March 2016

Certificate of Engineer

The material and data contained in this report were prepared under the direction and supervision of the undersigned whose seal as a professional engineer, licensed to practice in the State of Washington, is affixed below.

James S. Sakamoto, P.E.
Principal Engineer
City of Spokane Water Department

OFFICE OF THE CITY CLERK
808 W. SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3342
509.625.6350

October 28, 2015

City Clerk File Nos.:
RES 2015-0112

COUNCIL ACTION MEMORANDUM

RE: RESOLUTION 2015-0112 ADOPTING UPDATES TO THE CITY'S COMPREHENSIVE WATER SYSTEM PLAN

During the Spokane City Council's 6:00 p.m. Legislative Session held Monday, October 12, 2015, Council Member Snyder provided an overview of Resolution 2015-0112 adopting updates to the City's Comprehensive Water System Plan. The following actions were then taken:

> **Motion** by Council Member Snyder, seconded by Council Member Mumm, **to substitute** the new version of Chapter 4 (for the previously filed version); **carried 5-1 (Council Member Fagan voting "no" and Council Member Allen absent).**
>
> **Motion** by Council Member Waldref, seconded by Council Member Mumm, **to accept** the edits in Chapter 9; **carried 5-1 (Council Member Fagan voting "no" and Council Member Allen absent).**

Subsequent to public testimony and Council commentary, the following action was taken:

> **Upon 5-1 Roll Call Vote (Council Member Fagan voting "no" and Council Member Allen absent),** the City Council **adopted Resolution 2015-0112** adopting updates to the City's Comprehensive Water System Plan.

Terri L. Pfister, MMC
Spokane City Clerk

SPOKANE ENVIRONMENTAL ORDINANCE

(WAC 197-11-970) Section 11.10.230(3) File No. COS WSP
Determination of Non-Significance (DNS)

DETERMINATION OF NON-SIGNIFICANCE

Description of Proposal: City of Spokane Water System Plan

Proponent: City of Spokane, Water Department

Location of proposal, including street address, if any: City of Spokane Water Service Area as defined by the Spokane County Coordinated Water Systems plan

Lead agency: City of Spokane, Integrated Capital Management

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An Environmental Impact Statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed Environmental Checklist and other information on file with the lead agency. This information is available to the public on request.

[ ] There is no comment period for this DNS.

[ ] This DNS is issued after using the optional DNS process in Section 197-11-355 WAC. There is no further comment period on the DNS.

[X] This DNS is issued under 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below. Comments must be submitted by February 4, 2015.

Responsible official: P. Mike Taylor

Position/Title: Director, Integrated Capital Management Phone: (509) 625-6307

Address: 2nd Floor, City Hall, 808 W. Spokane Falls Blvd., Spokane, WA 99201-3334

Date: January 21, 2014 Signature: _____

You may appeal this determination to P. Mike Taylor, Director, Integrated Capital Management

at (location): 2nd Floor, City Hall, Spokane, WA 99201-3334

no later than (date): February 4, 2015

by (method): written

You should be prepared to make specific factual objections.

Contact John Halsey at (509) 625-6300 to read or ask about the procedures for SEPA appeals.

Chapter 1

Description of Water System

CHAPTER 1

Description of Water System

1.1 Ownership and Management

Name

The City of Spokane Water & Hydroelectric Services Department ("Water Department") provides all potable water to citizens within the City limits, and to some outside the City. As required by State law, the City operates the system under the Washington State Public Water System Identification No. 83100K.

Type of Ownership

The Water System is wholly owned and operated by the City of Spokane, Washington. The Water Department operates as an "Enterprise Fund," a separate account from the General Fund of the City. As an Enterprise Fund, the Water Department pays utility taxes to the City of Spokane, as well as to the State of Washington.

Management Structure

The City of Spokane is operated under the laws of the State of Washington as a first-class municipal corporation. The City has a mayor-council form of government with an elected "strong" mayor who oversees all administrative functions. A seven-member elected City Council, which includes the Council President, serves as the legislative branch. Under the Mayor is an appointed City Administrator who oversees the City's day-to-day operations.

The management structure within the Water Department is as follows:

The Water Department Director has general oversight of the Water Department and reports to the Utilities Division Director. The Water Department Director develops the budget for the department's operation, maintenance, and capital projects. The Director presents information on the departmental budget. Ultimately, the Mayor and his staff propose the annual budget for the City, and the City Council adopts it.

Water Department Director. The Director oversees operations, administration, and the Hydroelectric Project and is involved with administrative decisions, and assists in setting policy for the Department.

Water Superintendent. The Superintendent is responsible for the daily operation and maintenance of the water system which includes small, in-house construction projects that enhance the Water System infrastructure. Large construction projects are bid out to private contractors, and the City's Engineering Services Department oversees these projects. The Superintendent fulfills the duties of the Director, should the Director be absent.

Principal Engineer. The Principal Engineer is responsible for all engineering activities within the Water Department. Engineering includes design of new projects, design modifications of existing water facilities, as well as engineering support for the operation, maintenance, and construction functions of the department. The Principal Engineer may fulfill the duties of the Director, should the Director be absent.

Superintendant of Water Operations and Hydroelectric Services. The Superintendant of Water Operations and Hydroelectric Services is responsible for the safe operation of the dam at Upriver. This position also provides supervision for maintenance and operation of the wells, booster stations, storage facilities, SCDA and assists in engineering with oversight of capital projects at these sites.

Water Services Supervisor. The Water Services Supervisor is responsible for the repair and maintenance of the water system.

1.2 System History and Background

History of Water System Development and Growth

In 1883, the City of Spokane purchased a private water system that was serving the downtown area. The original system was comprised of a water-driven pump installed in the Echo Flour Mill on Havermale Island to serve Spokane River water to a few customers in the new city. Some of the cast iron water mains constructed for this system continue to be used today. Later, in 1888, the pumping plant was relocated and a second pump was added to serve the expanding city.

Because of growth, the Spokane River water quality was deteriorating, creating the need for a new water pumping site. A new site was chosen adjacent to the Spokane River, five miles upstream. The new site was named Upriver. In 1896, the Upriver pumping facility began operation. Just upstream of the pumping station, the Water Department constructed a wood crib dam. Water in the reservoir created by the dam was diverted via a canal to mechanically powered water turbine pumps. These pumps then sent water from the Spokane River into the Water Department distribution system for delivery to its customers.

During the construction of the Upriver pumping station, workers encountered a great deal of subsurface water that appeared to be coming from a source separate from the river. Other than a nuisance at the time of construction, little or no interest was expressed in this separate source of water.

About 10 years later, increased population and pollution of the Spokane River renewed the search for a high-quality water source. It was remembered that large amounts of underground water were encountered during construction of the Upriver facilities. Studies conducted by engineers determined that the water that was a nuisance during the Upriver construction resulted from an underground water flow separate from the Spokane River.

In 1907, the first well was constructed at Upriver to tap the groundwater source. The existing river pumps were converted to pump water from the new well, putting an end to using the Spokane River as a potable water source. This new water source was later named the Spokane Valley-Rathdrum Prairie Aquifer. In 1910 and 1925, additional wells were added at the Upriver facility, again tapping the aquifer.

In 1936, a new, taller concrete dam replaced the wood crib dam. The water behind the dam, with its increased head, was now diverted to a new hydroelectric powerhouse that housed three 1.3 megawatt generators. All wells now had pumps that were powered by electric motors, bringing an end to the use of water turbine pumps.

As Spokane grew, new well pumping stations, booster pump stations, reservoirs, transmission mains, and distribution mains were constructed to keep pace with the growing population's demand for water. In 1967, at the request of land developers, the Water Department began water service to customers outside the City Limits.

Today, the City of Spokane continues to use the Spokane Valley-Rathdrum Prairie Aquifer as its sole source of potable water. The water system has 7 well stations with 14 wells and 27 well pumps, 25 booster pump stations with 72 booster pumps, 22 pressure zones with 34 reservoirs, and more than 1,000 miles of water pipes.

From 1981-1984, major improvements increased the hydroelectric generating capacity at the Upriver facility. The three original powerhouse generators were upgraded to produce 2.0 megawatts each. A second powerhouse was constructed that houses two 5.58 megawatt generators. The hydroelectric power generation allows the Water Department to sell power during times of low electrical demand from the City water pumps. Money realized from these power sales offset the cost of pumping water which helps keep water rates low.

In 1995, the Water Department replaced its last uncovered reservoir with two covered concrete tank reservoirs, protecting the water system from potential airborne contamination. The Water Department is committed to providing facilities that not only meet the needs of the present, but also are sized with future demand in mind.

The long range planning of the water infrastructure is discussed in chapter 8 of this Water System Plan covering the capital improvement program.

The limit of expansion for the City of Spokane Water System is determined by the Spokane County Coordinated Water System Plan (CWSP). The CWSP is part of the General Water Plan for Spokane County and is a mechanism that coordinates the activities between the water purveyors located in Spokane County. The defined City of Spokane service area boundary shown in the CWSP is larger than the corporate limits of the City and frames the total service area for the City. The City's present retail service area is smaller than the total service area. Total and retail service areas are discussed in more detail in Section 1.6.

Geography

The origin of the Spokane aquifer system is one of the most interesting geologic stories worldwide. Northern Idaho, Spokane, and a large portion of Eastern Washington have been repeatedly scoured (as many as 40 times by some accounts) by catastrophic water flows. These massive flows are referred to as the Missoula Floods.

During the Pleistocene Epoch (Ice Age), Glacial Lake Missoula, located in today's Northwestern Montana, breached ice dams that were instrumental in forming and re-forming this massive lake. It has been estimated the Lake included 500 cubic miles of water. Each dam breach brought floodwaters, estimated at 750 million cubic feet per second, through the present day sites of Pend Oreille and Coeur d'Alene Lakes, Rathdrum Prairie and the Spokane Valley, and out across the Columbia Plateau of Eastern Washington. The

waters then passed through the Pasco and Umatilla Basins, and the Columbia River Gorge, to the Pacific Ocean. Today, evidence of these floods can be seen throughout Eastern Washington, where numerous coulees are cut into the basalt, resulting in the topographic relief known as the "channeled scablands." As the flood waters passed through the Rathdrum Prairie-Spokane Valley area, large volumes of boulders, cobbles, and coarse gravels were deposited. These flood deposits form the existing highly permeable aquifer beneath the Rathdrum Prairie of northern Idaho, Spokane Valley, and Spokane. The aquifer and the Spokane River are hydraulically connected. Recent studies reveal that the pumping of groundwater from the aquifer has an impact on the flow rate of the Spokane River.

The Spokane River originates as the outflow of Lake Coeur d'Alene, travels from East to West and cuts through the heart of the City. On the western fringes of downtown Spokane, the river turns north forming in some places the west City limits. Latah (Hangman) Creek enters the City from the south, and travels in a northerly direction to intersect the Spokane River at the elbow where the Spokane River turns to the north.

Within the City's service area the South side of the City (South Hill) rises from the Spokane River to Moran Prairie and the western slopes of Browne's Mountain. Elevations range from the valley floor of 1,870 feet above sea level to about 3,000 feet. To the West, elevations vary from a low of 1,735 feet in the Latah (Hangman) Creek-Vinegar Flats area to 2,580 feet on the West Plains. The North side of the City (generally north of the Spokane River) experience elevations that range from 1,683 feet to 2,145 feet. Also on the North side is a plateau known as the Five Mile Prairie, a prominent geographical feature. Elevations of the prairie feature range from 2,145 feet at its base, to 2,400 feet on the plateau.

The wide variety of geographical features and substantial elevation changes found in and around the City, create the need for numerous water system pressure zones.

Ordinances/Bylaws

The Water Department is subject to ordinances approved by the City Council. City of Spokane Municipal Code Chapters 13.04 and 13.08 govern the operation of the water system.

Neighboring/Adjacent Purveyors

Neighboring systems adjoining the City of Spokane water system are:

- Spokane Co. Water District #3
- Whitworth Water District #2
- North Spokane Irrigation District #8
- City of Airway Heights
- Carnhope Irrigation District #7
- Orchard Avenue Irrigation District #6
- City of Medical Lake
- Four Lakes Water District #10
- Pasadena Park Irrigation District
- East Spokane Water District #1
- Fairchild Air Force Base
- Vel View Water District #13

Figure 1.2.1 shows the City of Spokane's Future Water Service Area which corresponds to the City of Spokane water service area bounded by the neighboring water purveyors' service area and the neighboring purveyors. **Figure 1.2.2** is Map #2 showing West Spokane

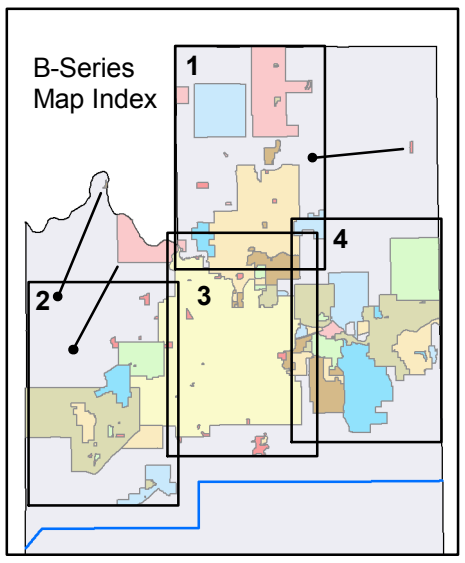
County providing additional detail of the Coordinated Water System Boundary of the City of Spokane Water Service Area.

Figure 1.2.3 is Map #3 showing Central Spokane County providing additional detail of the Coordinated Water System Boundary of the City of Spokane Water Service Area and neighboring water purveyors. The Spokane County Coordinated Water System Plan is discussed in further detail in Section 1.7 of this document.

CWSP

Coordinated Water System Plan

Spokane County Water Systems



Pend Orielle County

Stevens County

Lincoln County

Kootenai County, ID

Whitman County

S.C.W.D. #3-9

Stevens County PUD

AlohaPinesEst.

EloikaPinesEst.

Reflection Water Assoc.

Riverside Village M.H.P.

Deer Park

S.C.W.D. #3-7

Snowblaze

Syringa M.H.P.

Chattaroy Valley M.H.P.

Wildrose Village MHP

B & J Water

S.C.W.D. #3-6

Green Bluff

River Bluff

Whitworth

S.C.W.D.#3-5

Rivervale

S.C.W.D.#3-4

KaiserN.

Nine Mile Manor

Vel View

Whitworth College

Kaiser S.

S.C.W.D. #3-3

Mt.St. Michaels

N.Spokane I.D.

Pasadena Park I.D.

Trentwood I.D.

Moab I.D.

Indian Village Est.

White Bluff

Ridgeview

Hutton Settlement

Pioneer

Timberline M.H.P.

Spokane Industrial Park

Consolidated I.D.

Orchard Ave. I.D.

Millwood

Irvin

Pinecroft M.H.P

S.C.W.D. #3-1

Liberty Lake Sewer & W.D.

Greenridge Est.

Hutchinson

Modern Electric

Carnhope I.D.

E.Spokane

ESLLIC

West Prairie Vill.

Deep Creek Ranchettes

Balmer Gardens

Airway Heights

Fairchild M.H.P.

Fairview Heights T.C.

Hilltop Motel & T.P.

S.C.W.D. #3-1

S.C.W.D.#3-2

Model I.D.

Starlite Motel& M.H.P.

Shady Pines T.P.

Hide-a-Way T.P.

Spokane

Vera

Fairchild AFB

Patterson Add.

S.C.W.D.#3-2

Medical Lake

Consolidated Support Services

Picnic Pines T.P.

E.Wash. Bible Camp

Strathview

Four Lakes

Consolidated Support Services

Clear Lake Pines

Clear Lake Water Users Assoc.

Clear Lake Resort

Mullanhill Terr. M.H.P.

Marshall Community

Valley of Horses

Hidden Hills Est.

Ridge Water Assoc.

Hangman Hills

Cheney

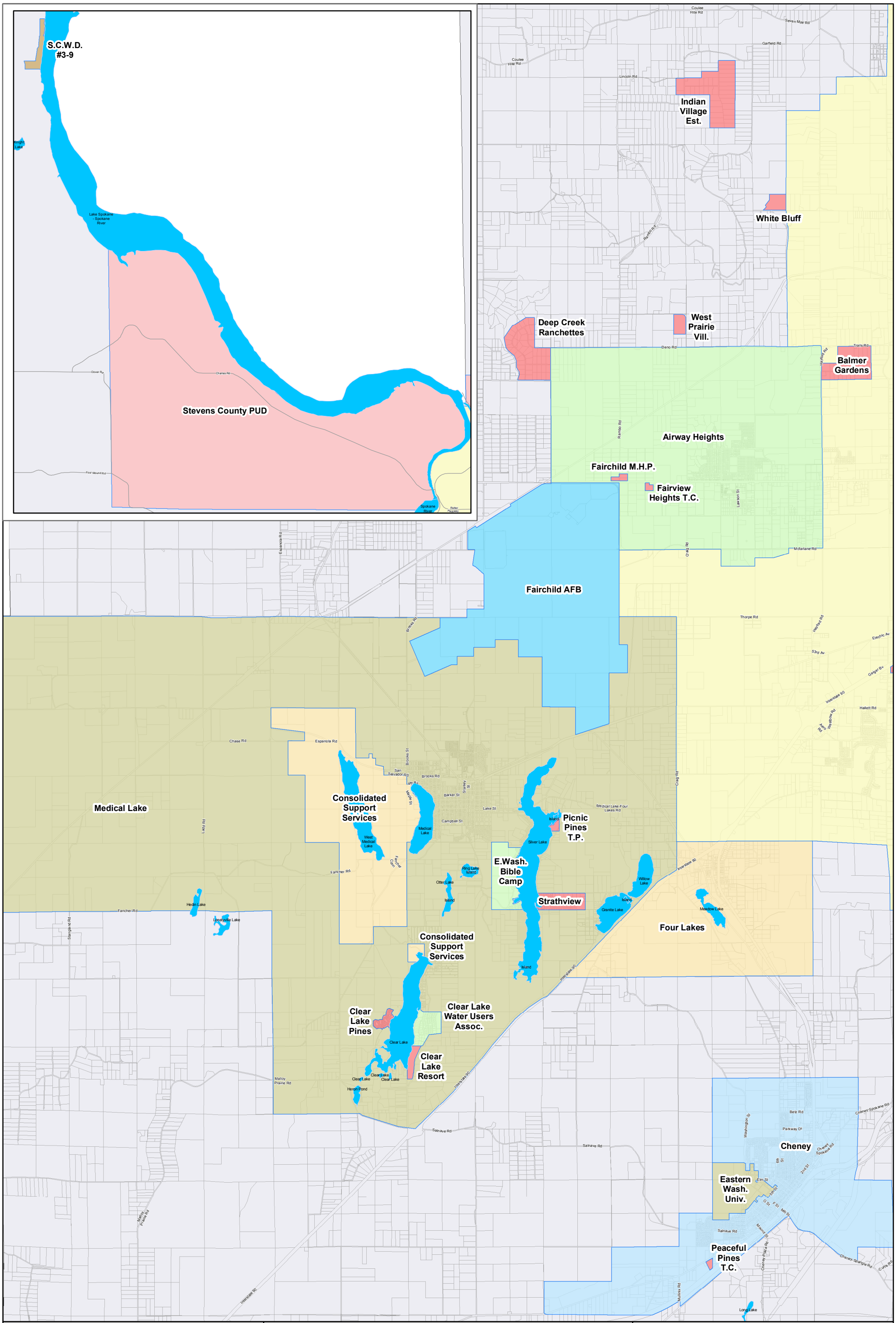
Eastern Wash. Univ.

Peaceful Pines T.C.

Scale: 0 1 2 3 4 5 Miles

Created by Spokane County Utilities - Steve Kirk - Date Printed: 3/16/2010

Figure 1.2.1



Scale: 0 0.5 1 1.5 Miles

CWSP

Coordinated Water System Plan - Spokane County

Map #2 - Parcels

Created by Spokane County Utilities
Steve Kirk
Date Printed: 3-16-2010

Figure 1.2.2

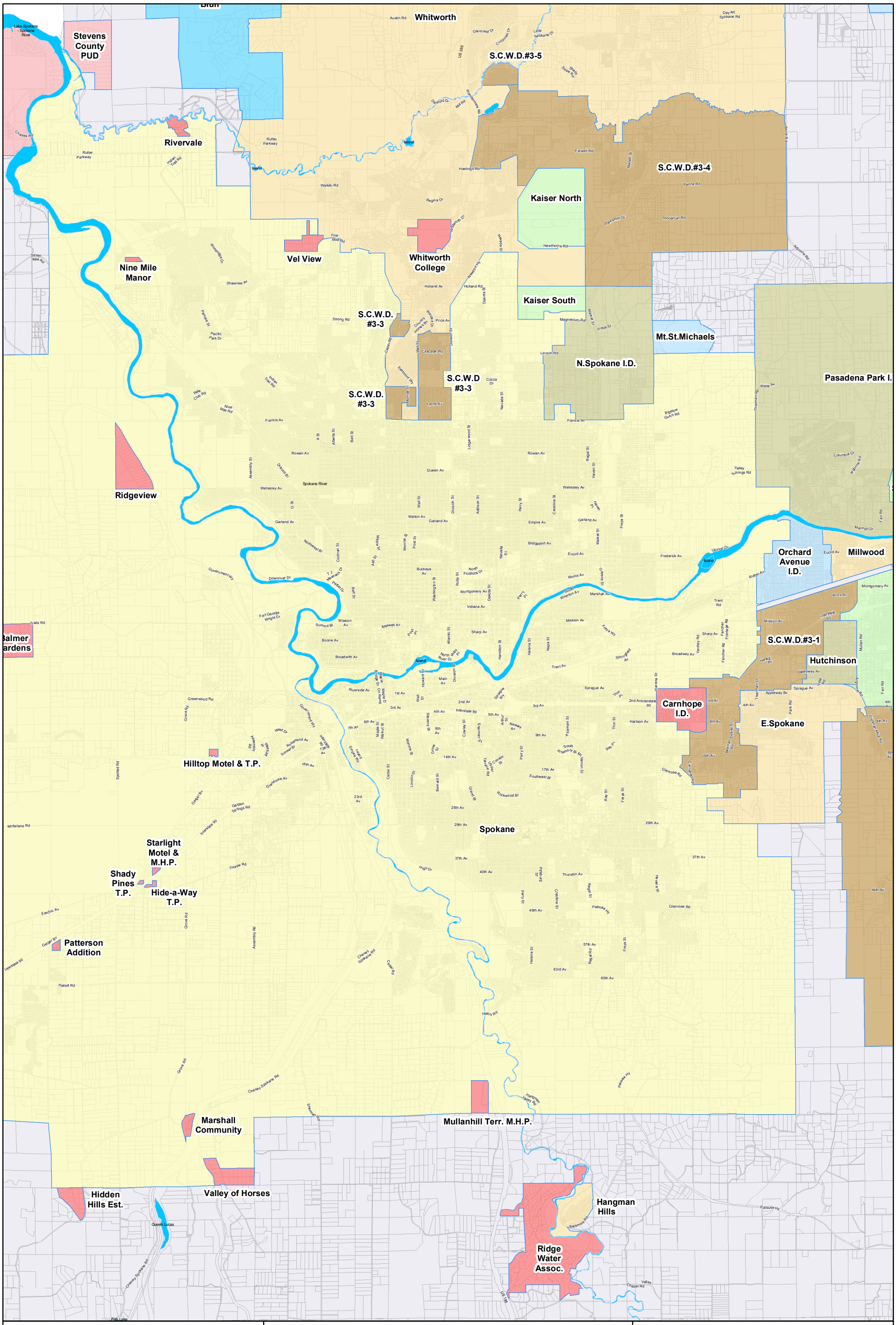

Stevens County PUD
Rivervale
Nine Mile Manor
Vel View
Whitworth College
Whitworth
S.C.W.D.#3-5
S.C.W.D.#3-4
Kaiser North
Kaiser South
S.C.W.D. #3-3
S.C.W.D #3-3
S.C.W.D. #3-3
Mt.St.Michaels
N.Spokane I.D.
Pasadena Park I.
Ridgeview
Hilltop Motel & T.P.
Starlight Motel & M.H.P.
Shady Pines T.P.
Hide-a-Way T.P.
Patterson Addition
Spokane
Orchard Avenue I.D.
Millwood
S.C.W.D.#3-1
Hutchinson
Carnhope I.D.
E.Spokane
Marshall Community
Mullanhill Terr. M.H.P.
Hidden Hills Est.
Valley of Horses
Hangman Hills
Ridge Water Assoc.
Scale: 0 0.5 1 1.5 Miles
CWSP
Coordinated Water System Plan - Spokane County
Map #3 - Parcels
Created by Spokane County Utilities
Steve Kirk
Date Printed: 3-16-2010

Figure 1.2.3

1.3 Inventory of Existing Facilities and Pressure Zones

The major components of the City's water system are:

- Pressure Zones
- Energy Sources
- Well Stations
- Pipelines
- Booster Pump Stations
- Pressure Reducing Valve Stations
- Storage Reservoirs
- System Control Facilities
- Service Connections
- Interties

The physical facilities for each of these components will be described and their operation discussed. A delineation of the water system's pressure zones is shown on **Figure 1.3.1**. In addition to again showing the pressure zones, the location of major components of the system, which includes Upriver Dam and Hydroelectric Facilities, well pump stations, transmission mains, booster pump stations, and storage reservoirs, are shown on **Figure 1.3.2**. A copy of the latest Washington State Department of Health "Water Facilities Inventory" is found in **Exhibit 1.3.1**.

Pressure Zones

The City of Spokane water system has 22 (hydraulic) Pressure Zones. These zones allow maximum pressures to be restricted to acceptable limits throughout the system. Sizing guidelines presented by the Washington State Department of Health suggest that static pressures in the range of 40 pounds per square inch (psi) to 80 psi are to be provided at the customer's point of service, and are considered normal. The pressures observed in the City's water system range from over 160 psi to just above 30 psi. The minimum static pressure required by the City for new developments since 1995 is 45 psi. For those areas where pressures are over 80 psi, the City requires pressure-reducing valves. The pressure zones are discussed as follows.

Low Pressure Zone

The Low Pressure Zone was the first water conveyance system built and supplies water to the downtown business district, northwest along the river, and south along the Latah (Hangman) Creek Valley. The Low Pressure Zone receives water from 3 of the 7 well stations within the water system: Well Electric, Parkwater, and Nevada Well Stations. Six reservoirs totaling 28.75 million gallons provide storage for the Low Pressure Zone. These reservoirs are Shadle, Rockwood Vista, Ninth and Pine, West Drive, Thorpe Road, and Qualchan. The Latah Booster Pump Station helps to boost flow within the pressure zone to the Qualchan Reservoir.

Current annual demand within the Low Pressure Zone is about 35 percent of the total water supplied to the entire water system. The maximum overflow elevation for all the Low Pressure Zone reservoirs is 2,100.87 feet.

CITY OF SPOKANE
WATER DEPARTMENT
PRESSURE ZONES

Water Pressure Zones

- Cedar Hills
- Eagle Ridge
- Eagle Ridge 2
- Five Mile
- Geiger Heights
- Glennaire
- Hatch Road
- High
- Highland
- Indian Hills
- Intermediate
- Kempe
- Low
- Midbank
- North Hill
- Northwest Terrace
- SIA
- Shawnee
- Southview
- Top
- West Plains
- Woodland Heights
- Woodridge

- City Limits
- Airport
- Highway
- Railroad
- Arterials
- Rivers

0 4,700 9,400 14,100 Feet

Geographic Information System

N W E S

THIS IS NOT A LEGAL DOCUMENT:
The information shown on this map is compiled from various sources and is subject to constant revision. Information shown on this map should not be used to determine the location of facilities in relationship to property lines, section lines, streets, etc.

Print date: 12/16/2013

Figure 1.3.1

CITY OF SPOKANE
WATER DEPARTMENT
WATER FACILITIES

ID	TANKS
1	14TH & GRAND
2	33RD & LAMONTE
3	9TH & PINE
4	BROWNE PARK 1 & 2
5	CEDAR HILLS
6	EAGLE RIDGE I
7	EAGLE RIDGE II
8	FIVE MILE
9	GARDEN PARK
10	GEIGER HEIGHTS
11	GLENNAIRE 1 & 2
12	HIGHLAND
13	INDIAN HILLS
14	INDIAN TRAIL
15	KEMPE
16	LINCOLN HEIGHTS 1 & 2
17	MALLEN HILL
18	MIDBANK
19	NORTH HILL
20	QUALCHAN
21	ROCKWOOD VISTA
22	SHADLE PARK
23	SHAWNEE 1 & 2
24	SIA 1 & 2
25	SOUTHVIEW
26	STRONG RD
27	SUNSET
28	THORPE RD
29	WEST DR
30	WOODRIDGE

ID	BOOSTERSTATIONS
1	35TH & RAY
2	9TH & E ST
3	ABBOTT
4	BELT ST
5	BISHOP CT
6	DIVISION & MANITO
7	LATAH
8	MILTON
9	SHAWNEE
10	SPOTTED
11	EAGLE RIDGE

ID	WELLSTATIONS
1	CENTRAL
2	GRACE & NEVADA WELLS
3	HOFFMAN
4	PARKWATER
5	RAY ST
6	WELL ELECTRIC

ID	PRESSURE REDUCING STATIONS
1	16TH & MILTON
2	3303 S INLAND EMPIRE WAY
3	BPA TRANSMISSION EASEMENT
4	BURCHWOOD & NINE MILE ROAD
5	EAGLE RIDGE 2 TANK
6	ELECTRIC & SODA (SIA)
7	F ST & WOODLAND
8	GROVE ST ISLAND
9	GROVE & SUMNER ISLAND
10	HATCH RD #1
11	HATCH RD & TOMAKER LN
12	J & WALTON ISLAND
13	KEMPE
14	LATAH HILLS CT & SHELBY RIDGE
15	LINCOLN WY & OSPREY HGTS
16	MORAN VIEW & WOODLAND CT
17	PANORAMA & WOODLAND CT
18	PRAIRIE DR & FLEETWOOD CT
19	RIVER RIDGE & N INLAND ST
20	RIVER RIDGE & SAND RIDGE
21	SHOSHONE & LINCOLN
22	SUMMERWOOD & SHELBY RIDGE
23	SUNDANCE DR & ACOMA DR
24	W REGENCY LN & N PARK VIEW LN
25	WALNUT ST ISLAND
26	WALNUT ST & CEDAR RD
27	WESTWOOD LN

- Individual Booster Station
- Tank or Reservoir with or without adjoining Booster Station
- Pressure Reducing Station
- Well Station

Water Pressure Zones

- Cedar Hills
- Eagle Ridge
- Eagle Ridge 2
- Five Mile
- Geiger Heights
- Glennaire
- Hatch Road
- High
- Highland
- Indian Hills
- Intermediate
- Kempe
- Low
- Midbank
- North Hill
- Northwest Terrace
- SIA
- Shawnee
- Southview
- Top
- West Plains
- Woodland Heights
- Woodridge

- Water Transmission Lines
- Highway
- Arterials
- Railroad
- Rivers
- City Limits

0 5,000 10,000 15,000 Feet

Geographic Information System

N W E S

CITY OF SPOKANE

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Print date: 12/16/2013

Figure 1.3.2

North Hill Pressure Zone

The North Hill Pressure Zone is supplied from four well stations: Central, Grace, Hoffman, and Well Electric. This zone lies adjacent to the north side of the Low Pressure Zone. The North Hill Pressure Zone supplies water to those areas north of Euclid Street to Francis Avenue and northwesterly along Indian Trail Road. The North Hill Pressure Zone also supplies water to the Northwest Terrace Pressure Zone through two pressure reducing valve (PRV) stations. Three reservoirs totaling 25.60 million gallons provide storage for this Zone. These reservoirs are North Hill, Five Mile, and Indian Trail.

Current annual demand within the North Hill Pressure Zone is about 28 percent of the total water supplied to the entire water system. The overflow elevation in the three reservoirs is 2,189.87 feet.

Intermediate Pressure Zone

Adjacent and directly south of the Low Pressure Zone lays the Intermediate Pressure Zone. The Intermediate Pressure Zone serves water to the strip of land between elevations 1,957 feet and 2,192 feet, along the middle to lower tier of the South Hill. The Intermediate Pressure Zone receives its supply of water from 3 well stations, and 2 booster pump stations that lift water from the Low Pressure Zone. The 3 well stations are Well Electric, Parkwater, and Ray Street. The 2 booster pump stations are Ninth and Pine and Bishop Court.

Current annual demand within this pressure zone is about 3 percent of the total water supplied to the entire water system. The Lincoln Heights #1 and #2 reservoirs plus the 14th and Grand reservoir serve this pressure zone with a combined storage capacity of 20.52 million gallons, at an overflow of 2,279.87 feet.

High Pressure Zone

The High Pressure Zone provides water service for the land adjacent to and south of the Intermediate Pressure Zone. Two reservoirs serve this zone, Garden Park and 33rd and Lamonte, with total storage capacity of 4.35 million gallons with an overflow elevation of 2,465.87 feet. Two booster pump stations, Lincoln Heights and 14th and Grand, lift water from the Intermediate Pressure Zone to the High Pressure Zone. Current annual demand within the High zone is about 7 percent of the total water supplied to the entire water system.

Top Pressure Zone

The Top Pressure Zone is located south of the High Pressure Zone. It provides service to the extreme southern portions of the City as well as areas outside the city limits. Water is lifted to the Top Pressure Zone from the High Pressure Zone by way of three booster pump stations located at Garden Park, Division-Manito, and 35th and Ray. The two reservoirs that serve this zone, Browne Park #1 and #2, have capacities of 5 million gallons each. Browne Park #1 has an overflow elevation of 2,546.87 feet and Browne Park #2 has an overflow elevation 2,545.87 feet. Current annual demand within the Top Pressure Zone is about 14 percent of the total water supplied to the entire water system.

Glennaire Pressure Zone

The Glennaire Pressure Zone is located along the western slopes of Browne's Mountain. One 150,000 gallon reservoir, Glennaire #1, and a 1,000,000 gallon reservoir, Glennaire #2, have overflow elevations of 2,851.87 feet. Water is lifted from the Top Pressure Zone by the Glennaire Booster Pump Station located just below the two Browne Park Reservoirs. At present, the service area of the Glennaire Pressure Zone lies outside the city limits. The Glennaire Pressure Zone has a current annual demand within the zone of about 0.7 percent of the total water supplied to the entire water system.

Southview Pressure Zone

The Southview Pressure Zone is located along the western slopes of Browne's Mountain, adjacent to and south and east of the Glennaire Pressure Zone. The Southview Reservoir, has an overflow elevation of 2,998.87 feet and stores 48,000 gallons of water. The Southview Booster Pump Station lifts water from the Glennaire Pressure Zone to the Southview Pressure Zone and was designed to accommodate future development needs. The reservoir site is large enough to construct an additional 500,000-gallon reservoir, should future development require. The Southview Pressure Zone has a current annual demand within the zone of about 0.1 percent of the total water supplied to the entire water system.

Woodland Heights Pressure Zone

The West Drive Booster Pump Station lifts water from the Low Pressure Zone to the Woodland Heights Pressure Zone. The Woodland Heights Pressure Zone is located to the south of Indian Canyon Golf Course, just west of the Low Pressure Zone. This zone utilizes the Sunset Tank with storage capacity of 350,000 gallons. This zone has a current annual demand within the zone of about 1 percent of the total water supplied to the entire water system. The Sunset tank overflow elevation is 2,281.87 feet.

Highland Pressure Zone

The Highland Pressure Zone is located north and south of the Interstate 90 freeway on the City's west side; south of the Woodland Heights Pressure Zone, and west of the Low Pressure Zone. The Highland Tank with storage of 1 million gallons has an overflow elevation of 2,385.87 feet. The Milton Booster Pump Station lifts water from the Low Pressure Zone to the Highland Pressure Zone. Water can also be supplied from the Woodland Heights Pressure Zone utilizing the Sunset Booster Pump Station located at the base of the Sunset Tank. Current annual demand within the Highland Pressure Zone is about 1.1 percent of the total water supplied to the entire water system.

Midbank Pressure Zone

Located on the north side of the City, the Midbank Pressure Zone provides water service along the south and west slopes of Five-Mile Prairie between the Five-Mile and North Hill Pressure Zones. The Belt Street Booster Pump Station lifts water from the North Hill Pressure Zone to the Midbank Pressure Zone. The Midbank Standpipe, with a capacity of 580,000 gallons provides storage for the zone. Overflow elevation of the standpipe is 2,292.87 feet. Current annual demand within the zone is about 1 percent of the total water supplied to the entire water system.

Shawnee Pressure Zone

The Shawnee Pressure Zone is located on the northwest slope of the Five Mile Prairie. The Shawnee Booster Pump Station lifts water from the North Hill Pressure Zone to a 20,000-gallon tank, Shawnee Tank #1, and a 54,000 gallon tank, Shawnee Tank #2. Each reservoir has an overflow elevation of 2,276.87 feet. Current annual demand within this zone is about 0.2 percent of the total water supplied to the entire water system.

Woodridge Pressure Zone

The Woodridge Pressure Zone is located to the north and east of the Shawnee Pressure Zone and is also on the northwest slope of the Five-Mile Prairie. The Woodridge Booster Station lifts water from the Shawnee Pressure Zone to the Woodridge Reservoir that feeds the Woodridge Pressure Zone. The Woodridge Reservoir has a capacity of 228,000 gallons and has an overflow elevation of 2,420.58 feet. Current annual demand within this zone is about 0.2 percent of the total water supplied to the entire water system.

Five-Mile Pressure Zone

The Five Mile Pressure Zone is located on Five-Mile Prairie, a prominent geological feature located on the City's north side. The Five-Mile Booster Pump Station, located adjacent to the Five Mile Reservoir, lifts water from the North Hill Pressure Zone to the Strong Road Tank and the Five Mile Pressure Zone. The Strong Road Tank, with a storage capacity of 2 million gallons, has an overflow elevation of 2,520.87 feet. Current annual demand within this zone is about 1.5 percent of the total water supplied to the entire water system.

Kempe Pressure Zone

The Kempe pressure zone is located to the north of the Five Mile Pressure Zone on the Five Mile Prairie. The in-line Kempe Booster Station is located along North Five Mile Road to boost water from the Five Mile Pressure Zone to the Kempe Tank. The Kempe Tank has a storage capacity of 1.1 million gallons with the overflow elevation of 2567.46 feet.

Indian Hills Pressure Zone

The Indian Hills Pressure Zone extends along the western slopes of Five Mile Prairie. The primary source of water is from the Five Mile Pressure system through an altitude valve servicing the Indian Hills Tank. The standpipe has an overflow elevation of 2,330.87 feet. Current annual demand within this zone is about 0.1 percent of the total water supplied to the entire water system.

Spokane International Airport (SIA) Pressure Zone

The SIA Pressure Zone surrounds and includes the Spokane International Airport located west of the City. Originally built in the 1960s to supply the airport with water, the system consisted of two water supply wells and one storage reservoir. These facilities were constructed for the former Geiger Field Air Force Base. The City acquired ownership of the Spokane International Airport's water system and one well in 1980. That well has been abandoned, closed and sealed. A second reservoir was built adjacent to the original. The overflow elevation of SIA Tank #1 is 2,490.09 feet whereas the overflow elevation of SIA Tank #2 is 2,489.28 feet. The two reservoirs give the SIA Pressure Zone a combined storage capacity of 4.5 million gallons. All of the water used in this zone is pumped from the Low

Pressure Zone, through the Thorpe Road Booster Pump Station. Current annual demand within this zone is about 4 percent of the total water supplied to the entire water system.

Plains Pressure Zone

The Plains Pressure Zone is adjacent to and south and west of the SIA Pressure Zone. This zone serves an area that extends west from Spotted Road and south of Electric Avenue. The Mallen Hill reservoir with a capacity of 4 million gallons and an overflow elevation of 2,634.87 feet stores the water that is distributed in this zone. The area is generating considerable interest from land developers as large portions of land remain open space. Current annual demand within this zone is about 0.6 percent of the total water supplied to the entire water system.

Northwest Terrace Pressure Zone

The Northwest Terrace Pressure Zone is located north of Francis Avenue, south of Johannsen Road, paralleling Nine Mile Road in the northwest quadrant of the City. The system receives water from the Low Pressure Zone and the North Hill Pressure Zone through PRV stations. The pressure reducing valves maintain an outlet Hydraulic Grade Line of approximately 1,940 feet. There is no dedicated reservoir for this zone, although the Low and North Hill Pressure Zones can be considered reservoirs. The construction of a reservoir for this zone is included as a Capital Improvement project presented in Chapter 8. Current annual demand within the zone is about 1.5 percent of the total water supplied to the entire water system.

Eagle Ridge Pressure Zone

The Eagle Ridge Pressure Zone is located on the hillsides to the west of the Latah (Hangman) Creek Valley. It is west of the Low Pressure Zone, bounded on the south by the Spokane City Limits and on the north by the Cedar Hills Pressure Zone. The Eagle Ridge Reservoir has a capacity of 542,000 gallons and an overflow elevation 2,331.87 feet. Current annual demand within this zone is about 0.5 percent of the total water supplied to the entire water system.

Eagle Ridge II Pressure Zone

The Eagle Ridge II Pressure Zone is located adjacent to and north of the Eagle Ridge Pressure Zone. The Eagle Ridge II Standpipe has a capacity of 1.22 million gallons and has an overflow elevation of 2,457.00 feet. Current annual demand within this growing zone is about 0.1 percent of the total water supplied to the entire water system.

Cedar Hills Pressure Zone

The Cedar Hills Pressure Zone is located on the hillsides to the west of the Latah (Hangman) Creek Valley. It is west of the Low Pressure Zone and is bounded on the south by the Eagle Ridge Pressure Zone. The reservoir for this zone, Cedar Hills, has a capacity of 300,000 gallons and an overflow elevation of 2,259.87 feet. Current annual demand within this zone is about 0.1 percent of the total water supplied to the entire water system.

Hatch Road Pressure Zone

The Hatch Road Pressure Zone is located on the lower east slopes of the Latah (Hangman) Creek Valley. The Low Pressure Zone forms the north and west boundaries, the Top Pressure Zone forms the east boundary, and the Spokane City Limits forms the south boundary. The Hatch Road Pressure Zone has no reservoir of its own, thus it is supplied water from the Top Pressure Zone. The water supply must travel through two pressure reducing valve stations prior to serving the zone. The pressure reducing valves maintain a Hydraulic Grade Line of approximately 2,188 feet. Current annual demand is about 0.1 percent of the total water supplied to the entire water system.

Energy Sources

The Water Department owns its own dam and hydropower facilities at the Upriver Complex. The department is continuously buying and selling electricity with Avista Utilities, the local power company. The department's hydropower facilities produce enough electricity to meet the yearly total power demands for all its water pumps with some electricity left over to sell. The department has a contract through November 30, 2021, to sell this excess power to Avista. During the late fall, winter, and spring months when the department's water pumping demands are low and river flows are good, excess electricity is sold to Avista. During the summer months, when water pumping demand is high and river flows are low, the department purchases electricity from Avista. During the time that this Comprehensive Water System Plan will be in effect and all of the costs of buying and selling electricity are netted out, the Water Department will most likely have a net gain ranging from $2.0 million to $2.5 million per year, which helps maintain low water rates for customers.

Well Stations

The Department has seven well stations which provide direct service to the three primary pressure zones—the Low, Intermediate, and North Hill. All well stations draw water from the Spokane Valley-Rathdrum Prairie Aquifer. Some well stations have multiple wells and multiple pumps. No well station has less than two well pumps. Different pump types are used at the well stations including; horizontal centrifugal, vertical line shaft turbine, and submersible. **Table 1.3.1** shows data regarding each well station's specific pumping equipment. **Figure 1.3.3** shows the relationship of the pumping facilities to the hydraulic profile.

Disinfection of the water occurs at each well head with the injection of gaseous chlorine at a rate of one ton chlorine per 1.2 billion gallons. Due to the high quality of water in the aquifer, no other water treatment is needed or is being used at this time. A brief description of each well station is presented in this section.

TABLE 1.3.1
City of Spokane Well Stations Data

Hydraulic Zone	Pump Station (Note 1)	No. Of Wells @ Site	No. Of Pumps Serving Zone	Connected Horsepower (Hp)	Typical Outlet Pressure (psi)	Capacity (MGD)
Low	Well Electric (1996)	2	1	1,000	80	21.6
	Parkwater (1949**)**	4	6	3600	68	69.0
	Nevada (2-1958/2-2003)	1	4	2400	68	36.0
North Hill	Well Electric (1925)	2	2	1,800	140	24.2
	Grace Avenue (1950)	1	2	1,800	110	27.4
	Hoffman Avenue (1938)	2	2	1,200	55	15.7
	Central Avenue (1960)	2	4	1,800	55	24.2
Intermediate	Well Electric (1996)	2	1	900	180	10.8
	Parkwater (1-1949/1-2003)	4	2	1900	145	21.7
	Ray Street (1937, 1950)	2	3	2,700	157	31.0
Totals			**27**	**19,100**		**281.6**

Notes:

1) Year following pump station name indicates the date of newest pump installations.

Well Electric Well Station

The oldest well station in the water system, Well Electric is located adjacent to the Spokane River at the Upriver Complex. The well station consists of two 48-foot diameter wells. One well supplies water to a single 900 hp horizontal centrifugal pump that pumps water to the North Hill Pressure Zone. The second well supplies water to three pumps. One pump, another 900 hp horizontal centrifugal, also provides water to the North Hill Pressure Zone. The second pump, a 900 hp vertical line shaft turbine, lifts water to the Intermediate Pressure Zone. The third pump is a 1,000 hp vertical line shaft turbine that lifts water to the Low Pressure Zone. In 2013, the Well Electric Station provided 28.9 percent of the entire water system supply. Typical outlet pressures for the station are 180, 140, and 80 psi for the Intermediate, North Hill, and Low systems, respectively. The two vertical turbine high efficiency pumps were installed in 1996 as replacements for two less efficient pumps.

Parkwater Well Station

The Parkwater Well Station was completed in 1949 and is located one-half mile south and east of the Well Electric Well Station. The Parkwater Well Station houses eight pumps in four 18-foot-diameter wells. All of the pumps are vertical line shaft turbines. One pump is a 900 horsepower unit and another pump is a 1,000 horsepower unit, both units supplying water to the Intermediate Pressure Zone at an outlet pressure of 145 psi. The other six pumps are 600 horsepower and supply water to the Low Pressure Zone at an outlet pressure of about 68 psi. The 1,000 horsepower pump was installed in 2003, replacing one of the older pumps to improve energy efficiency. The Parkwater Well Station in 2013 supplied 33.2 percent of the entire water system demand.

Nevada Well Station

At the intersection of Nevada Street and North Foothills Drive is the Nevada Well Station. The Nevada Well Station supplies water to the Low Pressure Zone. The well was constructed in 1956 and has two 400 horsepower submersible pumps installed in 1956 and two 800 horsepower vertical line shaft turbine pumps installed in 2003 replacing two older 1956 pumps to improve energy efficiency and station redundancy. Typical outlet pressures at this station are 68 psi. In 2013, the Nevada Well Station supplied 14.4 percent of the total water system demand.

Grace Avenue Well Station

Located directly east of the Nevada Well Station is the Grace Avenue Well Station. Two identical 900 horsepower vertical line shaft turbine pumps occupy a single 18-foot-diameter well and supply water to the North Hill Pressure Zone at a discharge pressure of 110 psi. In 2013, the Grace Avenue Well Station supplied 8.2 percent of the total water system demand.

Ray Street Well Station

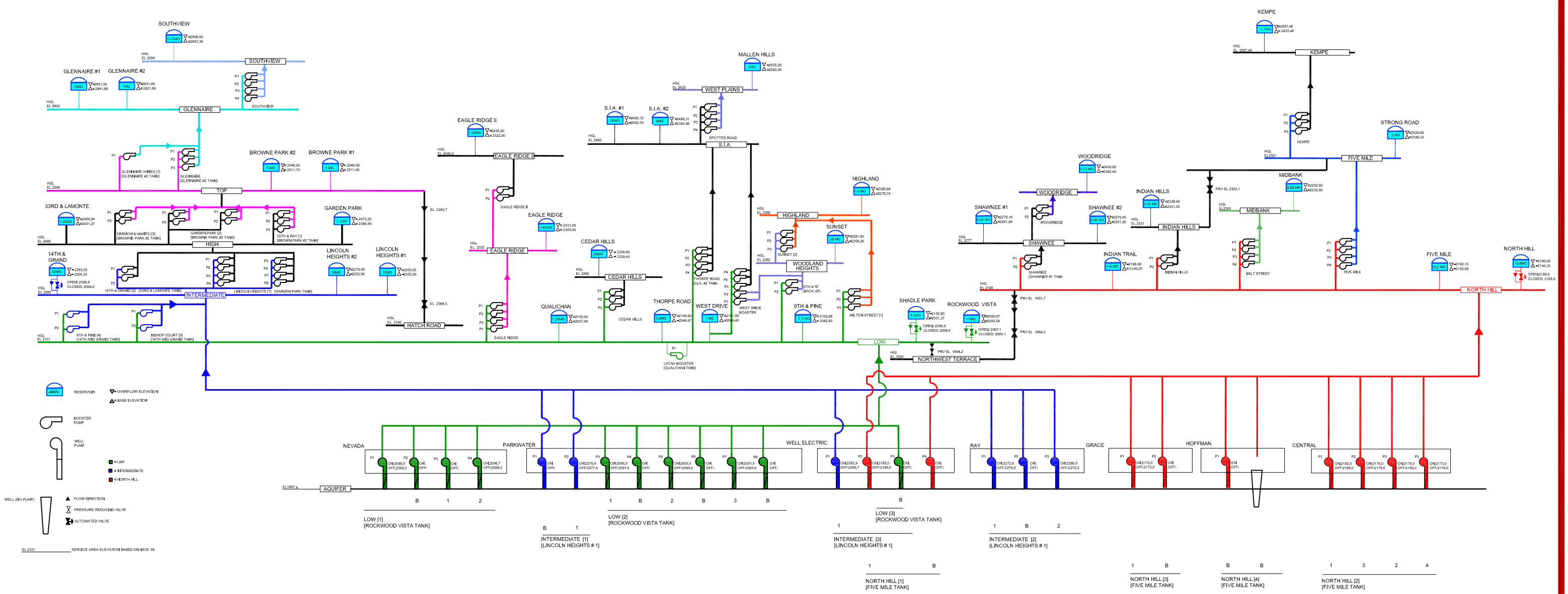
The Ray Street Well Station is located at the intersection of Ray Street and Hartson Avenue. The Ray Street Well Station pumps water to the Intermediate Pressure Zone. The well station houses two 24-foot-diameter wells and three 900 hp pumps, two pumps in one well and a single pump in the second well. The discharge pressure normally observed at the outlet of the Ray Street well is 157 psi. This well station in 2013 supplied 6.8 percent of the total water system demand.

Hoffman Well Station

Hoffman Well Station is located at Hoffman Avenue and Crestline Street. The well station houses two 16 foot diameter wells that are 40 feet apart. Each well has a 600 horsepower vertical line shaft turbine pump. Normal outlet pressure for the pump station is 55 psi. One pump is out of service for well lining repairs to be complete by 2008. Hoffman Well Station in 2013 supplied 1.5 percent of the total water system demand.

Central Avenue Well Station

The Central Avenue Well Station is on Central Avenue two blocks west of Division Street. The Well Station has two 7-foot-diameter wells and two 450 hp submersible pumps in each well. Normal outlet pressure is 55 psi. This well station in 2013 provided 7.0 percent of the total water system demand.



CITY OF SPOKANE
WATER SYSTEM OPERATION
2013

Rev 9/10/13
Rev 8/2013
Dwg.by RSR
Checked by J. sakamoto
Rev 8/2011
Dwg. by RSR
Check by M.Mandagopal
Elevation Info B. Uhlenkott

Pipelines

The transmission and distribution pipelines vary from 6 inches to 48 inches in diameter. The water system has several different pipe materials in use, with the majority being cast iron or ductile iron. Before ductile iron was available, the Department typically specified the use of cast iron pipe for the smaller distribution piping and steel for the larger transmission mains. All new pipelines are ductile iron.

Areas of concern for the Water Department has been the condition of aging distribution infrastructure. This distribution piping includes lead and leadite joint cast iron pipe, kalamein steel pipe and asbestoes cement pipe. As of 2015, 95 % of Kalamein pipe has been replaced with ductile iron pipe. Any isolated segments of Kalamein are replaced as they are located. Asbestos cement pipe has been effectively removed from the water system and any remaining pipe discovered is replaced. A program to replace lead and leadite joint distribution pipe is detailed in Chapter 8 and is part of the Integrated Engineering program for cost benefit of replacement of streets and utilities in coordination.

Since 2007, the Water Department has made a concerted financial effort to upgrade its aging 70- to 100-year-old transmission pipeline infrastructure, which, as the ongoing water water may show, could be a factor in the City's Distribution System Loss ("DSL") rate of 17.8% in 2014. These are steel pipelines ranging in size from 18 inches to 48 inches in diameter. The type of steel pipeline being replaced is predominately riveted steel although some welded steel is being replaced as well. The result of this effort is the replacement of about 14 miles of pipelines to date. Over the next six years, the Department has a program to replace another 13.5 miles and within 20 years an additional 12.8 miles.

Booster Pump Stations

The City of Spokane water system uses 27 Booster Pump Stations to lift water from the three primary pressure zones to pressure zones located at higher elevations. The Booster Pump Stations are listed in **Table 1.3.2**. The relationship of the Booster Pump Stations and Pressure Zones are shown in **Figure 1.3.3**. The table indicates the Pressure Zone that is served, the number of pumps in each station, pump capacity, and other characteristics of each booster station. The piping configuration in a typical Booster Pump Station includes suction shutoff valves, pumps, check valves, and outlet shutoff valves. The Five-Mile and Thorpe Road Booster Stations also have surge protection devices installed.

TABLE 1.3.2
City of Spokane—Booster Pump Station Data

Pressure Zone Served	Booster Station (Date Constructed)	No. Of Pumps	Connected Horsepower	Typical Inlet/Outlet Pressure (psi)	Nameplate Capacity (MGD)	Total Pumping Capacity (MGD)
Intermediate	9th & Pine (1966)	2	500	8 / 82	11.09	

	Bishop Court (1989)	2	400	50/122	9.22	20.31
High	Lincoln Heights (1931,53,63)	8	2800	7 / 92	56.30	
	14th & Grand (1989)	2	400	27 / 112	9.90	66.20
Top	Division & Manito (1963)	3	90	43 / 80	4.35	
	Garden Park (1963)	4	300	31 / 65	17.70	
	35th & Ray (1986)(2005)	3	300	40 / 78	15.84	37.89
Glennaire	Glennaire (1971,95)	4	130	18 / 160	1.43	1.43
Midbank	Belt Street (1963)(2006)	4	110	40 / 86	1.93	1.93
Indian Hills	Indian Hills (1969)*	2	85	60 / 120	1.80	1.80
Shawnee	Shawnee (2004)	2	60	47 / 90	1.61	1.61
Five Mile	Five Mile (1976)(2006)	3	450	10 / 136	5.81	5.81
Kempe	Kempe (2010)	3	80		5.47	5.47
Highland	Milton (1972,80)	3	245	56 / 170	3.30	
	Sunset (1969)	3	18	6 / 52	0.72	4.02
Woodland Heights	9th & E (1929,32)**	2	90	41 / 128	1.66	
	West Drive (2008)	2	120		2.30	3.96
Southview	Southview (1995)	4	50		1.30	1.30
Eagle Ridge	Eagle Ridge (1997)	3	200	80 / 180	2.30	2.30
Cedar Hills	Cedar Hills (1999)	3	75	19 / 88	1.51	1.51
SIA	Thorpe Road (1976)	4	1000	17 / 185	10.48	
	West Drive (2008)	3	900		9.76	20.24
Plains	Spotted Road (1985)	2	170	39 / 108	4.90	4.90
Eagle Ridge II	Eagle Ridge II (2005)	2	500	8/130	7.20	7.20
Woodridge	Woodridge (2005)	2	40	40/62	1.93	1.93
Low	Latah (2004)	1	500	115/150	23.04	23.04
Total		**76**				**212.85**

Notes: *The Indian Hills System is currently fed by the Five Mile System through and altitude valve. The Indian Hills Booster Station is currently not in service but remains for redundancy.

**A portion of the new West Drive Booster Station replaced pumping duty to Woodland Heights. The 9th and E Booster Station is currently not in service but remains for redundancy.

Pressure Reducing Valve Stations

The varied terrain found in the City can cause localized high pressures. To reduce and maintain acceptable pressures within the distribution system, pressure reducing valve ("PRV") stations have been installed in some locations within various pressure zones. The Northwest Terrace Pressure Zone and the Hatch Road Pressure Zone control pressures throughout the entire pressure zone with PRV stations. **Table 1.3.3** lists the locations of PRV stations within the distribution piping system.

The Water Department requires property owners to install PRVs on individual water services when pressures are between 80 psi and 100 psi. In areas that exceed 100 psi, a PRV station within the distribution system, as described above, plus individual PRVs on services are required.

TABLE 1.3.3
Pressure Reducing Valve Stations Data

Location	Valve Sizes (inches)	Inlet (Psi)	Outlet (Psi)
Shoshone & Lincoln	6 & 1-1/2	120	65
Panorama & Walnut Court	6 & 2	100	56
Walnut St. & Cedar Rd.	6 & 2	80	66
Assembly & Dalke (Extd.) (South)	6 & 1-1/2	80	8
Assembly & Dalke (Extd.) (North) (Northwest Terrace - Low Zone)	8 & 3	80	8
Sundance Dr. & Acoma? Dr. Upper Intertie (Northwest Terrace #1 - Nh Zone)	10 & 4	115	26
BPA Transmission Easement Lower Intertie (Northwest Terrace #2 - Nh Zone)	10 & 4	150	110
Burchwood & 9 Mile Road	8 & 2	120	55
Moran View & Woodland Court (Eagle Ridge)	6 & 3	123	68
Hatch Road (6200 South) #1	10 & 4	110	35
Hatch Road & Tomacher Ln. #2	10 & 4	125	45
Latah Hills Ct & Shelby Ridge (Eagle Ridge)	6 & 3	95	55
Summerwood & Shelby Ridge (Eagle Ridge)	8 & 3	95	55
Prairie Dr & Fleetwood Ct	8 & 3	113	63
16th Ave & Milton	10 & 6 & 3	175	55
River Ridge & Sand Ridge	10 & 6 & 3	120	65
River Ridge & Government Way	10 & 6 & 3	110	55

Storage Reservoirs

Each Pressure Zone, with the exception of the Northwest Terrace Pressure Zone and the Hatch Road Pressure Zone, has one or more storage reservoir(s). The pressure within each Pressure Zone is determined by the elevation of the water within the reservoir. **Figure 1.3.3** illustrates the hydraulic relationship of the various reservoirs in the water system. **Table 1.3.4** lists the storage reservoirs found in the water system. The table indicates the volume of storage, the zone served, the type of material, and the overflow and floor elevations for each of the 34 reservoirs.

TABLE 1.3.4
City of Spokane—Reservoirs and Storage Data

Hydraulic Zone	Reservoir Name	Elevations			Type	Diameter (ft.)	Reservoir Storage (Mg)	Zone Storage (Mg)
		Over-Flow	Tank Bottom	Base				
Low	Shadle (1965)	2100.87	2031.34	2031.34	Steel Reservoir	107’	4.80	
	Rockwood Vista (1948)	2099.64	2083.51	2083.51	Underground Concrete	2-1/2 ac.	11.00	
	9th & Pine (1964)	2100.64	2082.87	2082.87	Steel Reservoir	260’	7.20	
	West Drive (1956)	2101.65	2066.37	2066.37	Steel Reservoir	72’	1.00	
	Thorpe Road (1983)	2101.87	2045.91	2045.91	Steel Reservoir	104’	3.50	28.75
	Qualchan (1992)	2101.87	2057.87	2057.87	Concrete w/liner	71’	1.25	
Intermediate	14th & Grand (2005)	2283.25	2206.12	2206.12	Steel Standpipe	34’	0.52	
	Lincoln Heights # 1 (1995)	2279.87	2249.87	2249.87	Concrete w/liner	240’	10.00	20.52
	Lincoln Heights # 2 (1995)	2279.87	2249.87	2249.87	Concrete w/liner	240’	10.00	
High	Garden Park (1956)	2470.23	2396.92	2396.92	Steel Reservoir	65’	3.10	
	33rd & Lamonte (1930)	2465.91	2431.24	2347.14	Elevated Riv. Steel Tank	78’	1.25	4.35
Top	Browne? Park #1 (1958)	2546.21	2511.73	2511.72	Steel Reservoir	160’	5.00	
	Browne? Park #2 (1990)	2545.87	2511.72	2511.72	Steel Reservoir	160’	5.00	10.00
Glennaire	Glennaire #1 (1958)	2851.87	2841.85	2841.85	Concrete w/sealer	43.33’ x 47’	.15	
	Glennaire #2 (1991)	2851.82	2821.87	2821.87	Concrete w/liner	75’	1.00	1.15
North Hill	North Hill (1986)	2189.87	2144.37	2144.37	Steel Reservoir	200’	10.80	
	Five Mile (1956)	2190.12	2159.65	2159.65	Steel Reservoir	240’	10.20	25.60
	Indian Trail (1996)	2189.87	2149.87	2149.87	Concrete w/liner	140’	4.60	
Midbank	Midbank (1960)	2292.87	2230.87	2230.87	Steel Standpipe	40’	0.58	0.58
Indian Hills	Indian Hills (1995)	2330.87	2300.87	2305.87	Steel Standpipe	14’	0.03	0.03

TABLE 1.3.4
City of Spokane—Reservoirs and Storage Data (continued)

Hydraulic Zone	Reservoir Name	Elevations			Type	Diameter (ft.)	Reservoir Storage (Mg)	Zone Storage (Mg)
		Over-Flow	Tank Bottom	Base				
Shawnee	Shawnee #1 (1978)	2275.50	2261.50	2261.50	Steel Reservoir	15’	0.02	
	Shawnee #2 (1993)	2276.62	2261.87	2261.87	Steel Reservoir	25’	0.054	0.074
Five Mile	Strong Road (1982)	2520.87	2396.30	2396.30	Steel Standpipe	55’	2.00	2.00
Kempe	Kempe (2010)	2567.46	2433.46	2433.46	Steel Reservoir		1.10	1.10
Highland	Highland (1966)	2385.81	2276.71	2276.71	Steel Standpipe	40’	1.00	1.00
Woodland Hts.	Sunset (1968)	2281.87	2258.23	2258.23	Steel Reservoir	50’	0.35	0.35
SIA	SIA #1 (1935)	2490.09	2452.67	2362.89	Elevated Riv. Steel Tank	48’	0.50	
	SIA #2 (1984)	2489.28	2364.53	2364.53	Steel Standpipe	78’	4.00	4.50
Southview	Southview (1996)	2998.87	2956.87	2956.87	Steel Standpipe	14’	0.048	0.048
Eagle Ridge	Eagle Ridge (1995)	2331.87	2309.37	2309.37	Steel Reservoir	62’	0.542	0.542
Cedar Hills	Cedar Hills (1999)	2259.77	2239.37	2239.37	Steel Reservoir	52’	0.30	0.30
Plains	Mallen Hill (1985)	2634.87	2580.22	2580.22	Steel Reservoir	110’	4.00	4.00
Hatch Road	No Reservoir*							
NW Terrace	No Reservoir *							
Eagle Ridge #2	Eagle Ridge 2	2466.14	2336.14	2336.14	Steel Reservoir	40’	1.22	1.22
Woodridge	Woodridge	2407.96	2385.29	2385.29	Steel Reservoir	42’	.228	.228
					TOTAL STORAGE			**106.342 mg**

* Pressure zone controlled by prv stations.

Note: Elevations shown in this table refer to NAV 88 DATUM

System Control Facilities

In 1985, a Control Center was established at the Upriver Complex with the installation of a Supervisory Control and Data Acquisition (SCADA) system. The SCADA system provides operational control and monitoring of all major facilities within the water system. As with most computer applications, the SCADA system is subject to frequent updating. The latest updated SCADA system was fully installed June 2007. The next update of the SCADA system software and hardware is expected to be completed by November 2015. Some of the functions that SCADA monitors and/or controls are:

- Storage reservoir levels
- Pump starts, stops, and run times
- Well drawdown elevations
- System chlorine residuals
- Dam and hydroelectric powerhouse

The Control Center is staffed 24 hours a day, 7 days a week by State of Washington Department of Health Certified Water Distribution Managers.

Service Connections

A Service Connection consists of a Water Service Tap and a Service Line. A Water Service Tap and Service Line is defined as: *The Water Service Tap is the connection of a service line to the Distribution Main. The Service Line is the pipe which extends from the Service Tap to the customer's property line and water meter.* This service line delivers potable water to the property. Typical uses for the water include: domestic needs, commercial and industrial needs, irrigation, and fire protection. There are presently more than 76,250 service connection accounts to the City of Spokane water system.

Prior to the installation of a water tap and meter, a permit must be purchased from the City. Purchase of the permit not only supplies the meter, but it also establishes an account to which maintenance and billing records can be attached.

If a meter is installed at the property line, the City requires that it be placed in a concrete meter box as defined in the City Design Standards, and that the meter be placed so that the valve located at the property line will allow water to be shut off prior to entering the meter.

Ownership and protection of the water meter is the responsibility of the property owner. The City will maintain the water meter to insure its operating integrity, but if it is determined that the owner, through neglect or damage, caused the need to repair a meter, the owner will be responsible for the costs of any required repairs.

Interties

Interties are the mechanism for the transfer of water from one water system to another and can be used for permanent water supply; to supplement limited supply capacity of a purveyor; provide water to an area that has limited storage capacity; provide water to meet a peak or fire demand; or to provide for emergency service, such as an equipment failure. Because of the size and redundancies of the City's Water System and the desire to isolate the City's system, all interties with the City anticipate and provide for flow going only from the City's system into the adjoining purveyor's system. However, if some emergency event

required the City to receive flow from a certain purveyor for a significant period of time, reasonably quick plumbing changes can accomplish this.

Seven adjoining purveyors have interties with the City of Spokane Water System. All interties are metered and the purveyor is billed for the water used per rates established in Municipal Code 13.04.2014. A list of the interties is shown in **Table 1.3.5**. Copies of intertie agreements are found in **Exhibit 1.3.2**. The Municipal Code is found at: www.spokanecity.org.

TABLE 1.3.5
City of Spokane Interties

Purveyor	Intertie Location
City of Airway Heights	10800 West U.S. Hwy. 2
Spokane County Water District # 3	#1 - 1500 North Thierman Road
	#2 - 2000 South Carnahan Road
	#3 - 5400 South Perry Street
	#4 - 5221 East Desmet Avenue
Whitworth Water District #2	Hawthorne Road/Nevada Street Intersection
Fairchild Air Force Base	2108 W. Spotted Rd.
Vel View Water District #13	3609 West Vel View Drive
North Spokane Irrigation District #8	Francis Avenue/Freya Street Intersection
City of Medical Lake	Hwy 902/Craig Road Intersection

Descriptions of interties are as follows:

Spokane County Water District #3

Of Water District #3's four interties with the City, one (#4) provides the entire water supply needed to serve this area, while the others are for fire flow and other emergency uses.

Whitworth Water District #2

This system's intertie with the City of Spokane is for emergency use only.

North Spokane Irrigation District #8

This District has one intertie with the City of Spokane for emergency use.

City of Airway Heights

Airway Heights has an intertie with the City of Spokane and has purchased a significant amount of water in the past. It has new water facilities which are expected to provide the majority of its potable water in future years.

City of Medical Lake

Medical Lake is currently in negotiations for an intertie with the City of Spokane.

Fairchild Air Force Base

Fairchild has an emergency intertie with the City of Spokane and has purchased water in the past.

Vel View Irrigation District #13

Vel View has emergency intertie with the City of Spokane.

1.4 Related Plans

The following planning documents were identified as having potential impacts on the future plans of the Water Department. Reviewing related plans is necessary to avoid inconsistencies and conflicts between planning agencies.

Comprehensive Plans

For land use and planning projections, the Water System Plan gets guidance from the City's Comprehensive Plan and any applicable local comprehensive plans where service is provided. The City's Comprehensive Plan complies with the Growth Management Act and provides the necessary links with the Spokane County Comprehensive Plan and the County Wide Planning Policies for water service outside the City's boundaries. A major update to this plan is due in 2017.

Stormwater Plans

The City of Spokane has developed and is now implementing through its Wastewater Department a stormwater management plan to control the impacts of non-point source pollution resulting from storm water runoff which can affect the beneficial uses of the Spokane River, Latah Creek, and Spokane Valley/Rathdrum Prairie Aquifer. The City's stormwater management plan can be found on the City's website at: https://static.spokanecity.org/documents/publicworks/stormwater/management/2014-stormwater-management-program.pdf .

Wastewater Plans

The City of Spokane's Wastewater Department has plans to add an additional level of treatment at the City's Wastewater Reclamation Plant. Design work is under way, as is a pilot project to test membrane treatment technology. This $100 million project will be the largest expansion at the plant in decades. Additionally, a third digester and another primary clarifier will be added at the plant. Spokane County, meanwhile, retains 10 million gallons of treatment capacity at the City's wastewater plant. However, it also has constructed and now operates its own plant just east of the City limits. This additional leval of treatment work will be operational in 2021.

On-Site Sewage Disposal Regulations

On-site sewage disposal regulations are found in the City's Municipal Code, and allow septic tanks to be installed in areas where sewer service is unavailable. Septic tanks are governed by a permitting process through the Spokane Regional Health District. Customers are referred to the City's Wastewater Management Department for connection availability. Should service be unavailable, the customer can then contact the Spokane Regional Health District to determine if a septic tank permit will be approved. In general, the City tries to avoid and discourage the use of septic tanks.

Spokane County Coordinated Water System Plan

The present Spokane County Coordinated Water System Plan ("CWSP") was adopted by Spokane County in July 1999. The City of Spokane took an active role in development of this CWSP. The CWSP is further discussed in Section 1.7.

Wellhead Protection Plan

The City of Spokane's Wellhead Protection Plan Phase 1 Technical Report was completed in February 1998. The Phase 2 implementation Report was completed in June 2000. The plan was updated in 2015. These plans and resulting programs are discussed in detail in Chapter 5.

1.5 Status of Watershed Plans

Watershed planning in Washington State is conducted under the framework of the Watershed Management Act (ESHB 2514) passed by the Washington State Legislature in 1998. The Act enables local citizens, interest groups, and government organizations to collaboratively identify and solve water-related issues in the state's 62 Water Resource Inventory Areas ("WRIA").

The goal of watershed planning is to assess the water resources within each watershed and make recommendations to ensure the state's water resources are used wisely by:

- Protecting existing water rights
- Protecting in stream flows for fish
- Forecasting the future water resource needs
- Ensuring future water availability

The City of Spokane is the largest metropolitan area, and the City Water Department is the largest public owned utility, in all local watersheds. As such, the City finds itself an initiating agency and is involved in four watershed planning processes.

A "Watershed System Plan Checklist" is included in **Exhibit 1.5.1**. A brief discussion on the status of each plan is presented as follows:

WRIA 54 – The Lower Spokane River Watershed

The WRIA 54 Watershed involves the Spokane River and all of the tributaries that flow into the Lower Spokane River downstream of its confluence with Hangman (Latah) Creek to its confluence with the Columbia River.

The WRIA 54-Lower Spokane Watershed Detailed Implementation Plan was presented in December 2010 providing the framework for implementation of watershed planning strategies presented in the 2009 WRIA 54 Watershed Plan. Implementation of the Watershed Detailed Implementation plan represents moving into Phase 4 of the process outlined in Washington's 1998 Watershed Planning Act (Chapter 90.82 RCW). The WRIA 54-Lower Spokane Watershed Detailed Implementation Plan, December 2010 and the WRIA 54-Lower Spokane Watershed Plan, August 2009 are available on the Spokane County website at http://www.spokanecounty.org/WQMP/project54/.

WRIA 56 Latah (Hangman) Creek Watershed

The WRIA 56 Watershed spans two states and four counties before it outflows into the Spokane River about a mile west of the Spokane Falls in downtown Spokane. WRIA 56 includes the portion of this watershed that is within Washington State.

The Spokane County Conservation District ("SCCD") initiated the watershed planning process in Latah (Hangman) Creek. In 1999, the SCCD received funds from the Washington State Department of Ecology to constitute a planning unit and develop a scope of work for the planning process. Additional funding was received for a watershed assessment and the development of a watershed management plan.

The WRIA 56 Latah (Hangman) Creek Detailed Implementation Plan, dated February 19, 2008, is intended to be used for the coordination and implementation of the 68 recommendations of the WRIA 56 Latah (Hangman) Creek Watershed Management Plan. The final WRIA 56 Latah (Hangman) Creek Watershed Management Plan was completed in September 2005 completing Phases 1-3, the Detailed Implementation Plan represents Phase 4 of the process outlined in Washington's 1998 Watershed Planning Act (Chapter 90.82 RCW).

The WRIA 56 Latah (Hangman) Creek Watershed Management Plan dated May 19, 2005, is available on the Spokane County Conservation District (SCCD) website at http://www.sccd.org/pdfs/WR_DL/HC%20Final%20Draft%20Report%2005-19-05.pdf and the Detailed Implementation Plan may be found at http://www.sccd.org/pdfs/WR_DL/WRIA%2056%20DIP%20FINAL.pdf. In stream flow, water quality and water storage are the primary issues being addressed in this watershed. The goal is to protect the watershed's in stream resources and associated habitat balanced with the economic interests within the watershed.

WRIA 55 – Little Spokane River Watershed & WRIA 57 - Middle Spokane River Watershed

WRIA 55 Little Spokane River Watershed spans three counties before it outflows into the Spokane River approximately 3 miles downstream of the Nine Mile Falls Dam.

WRIA 57 Watershed is comprised of the Spokane River drainage basin that begins at the state line of Washington and Idaho and ends at its confluence with Latah (Hangman) Creek.

In 1998, the watershed planning effort was initiated when funding was provided by Washington State Department of Ecology. A planning unit made up of local agencies and various interest groups was formed to plan for future water use in the Middle Spokane and Little Spokane watersheds.

The WRIA 55/57 Watershed Plan was approved by the Planning Unit on July 6, 2005. The Watershed Plan was then presented to the initiating agencies for approval. After some minor adjustments the WRIA 55/57 Watershed Plan was adopted by the County Commissioners of Pend Oreille, Spokane, and Steven Counties on January 31, 2006.

A significant component of the WRIA 55/57 Watershed Plan was its watershed simulation modeling, based upon detailed data, which demonstrated the strong hydraulic links between the Spokane River and the Spokane Valley-Rathdrum Prairie Aquifer. There is indication that groundwater pumping has an impact on flow rates in the Spokane River.

A Detailed Implementation Plan for WRIA 55/57 was approved February 20, 2008, for the coordination of the implementation of the 107 recommendations outlined in the WRIA 55/57 Management Plan. These recommendations address central issues to water resource management. Implementation of the Watershed Detailed Implementation plan represents moving into Phase 4 of the process outlined in Washington's 1998 Watershed Planning Act (Chapter 90.82 RCW). Recommendations fall into the following categories:

- In stream flow needs
- Water conservation, reclamation and reuse
- Domestic exempt wells
- Water rights and claims
- Strategies for base flow augmentation
- Strategies for ground water recharge augmentation
- Approaches to plan implementation

The City of Spokane Water Department has a strong interest in the programs that are being proposed in the WRIA 55/57 Watershed Plan. The Water Department will budget funds for the costs of implementing the Plan recommendations, with the full intent that others will join to share in those costs.

1.6 Service Area and Characteristics

Existing and Retail Service Areas and Characteristics

The existing and retail service areas as shown within the future service area in **Figure 1.6.1** is approximately 80 square miles in size. Water service in rural areas may be allowed subject to meeting the intent of the Growth Management Act (GMA) to not promote urban development in a rural area. These rural water services will be provided in accordance with the comprehensive planning documents and state and local regulations. If water service is provided, any existing water right associated with the previous or existing water supply shall be conveyed to the City of Spokane.

The existing service area consists of a central core business district surrounded by other centers and corridors, as defined in the City of Spokane Comprehensive Plan. Other pockets of commercial activity are scattered throughout the service area. The majority of the industrial zones are located along the City's eastern boundary, the northeastern portions of the City, and in the West Plains area. Public lands are interspersed throughout the service area, as parks, playgrounds, and government complexes. Extensive medical facilities are located just south of the central core with others interspersed throughout the area. There are

significant pockets of multi-family housing areas. However, the largest land area presently served is made up of single family residential land use. Small portions of presently rural areas are also served. A land use map is included in Chapter 2, **Figure 2.1.1**.

The retail service area and the existing service area share a common boundary in this water system plan. Anticipated growth within the next 6 years will be within infill areas located within this common boundary. The retail service area boundary does not include possible expansions of the Urban Growth Area boundaries. Any expansions of the Retail Service Area shall be in compliance with the City of Spokane's Comprehensive Water System Plan, SMC Section 13.04.1921 and all other applicable rules and regulations prior to review and inclusion to the retail service area.

The City of Spokane shall provide water service consistent with this plan and the Washington State Growth Management Act (GMA). The City completed a land quantity analysis for 20-year planning purposes in 2010. This analysis indicated the existence of sufficient land capacity for residential, commercial and industrial land within the City to accommodate projected population, commercial, and industrial growth for the next 20 years.

It is the intent of the City to meet the demand for growth within its existing retail water service area in order to provide the most cost-efficient governmental services. Any expansions of the Retail Service Area will be in accordance with the SMC, this plan and any other applicable rules and regulations, and subject to approval by City Council.

As previously referenced, a detailed system map showing location of the major facilities including wells, storage reservoirs, booster stations, and transmission main piping is provided in **Figure 1.3.2**. The current pressure zones are provided in **Figure 1.3.1**.

Future Service Area and Characteristics

The future service area is defined by and matches the Coordinated Water System Plan area for the City of Spokane Water Department service area. The City of Spokane worked with a Consultant to provide a third party water demand forecast for future demand and the report is attached as Exhibit 1.6.1. The future service area can be provided future service by existing water rights.

Service Area Consideration for Place of Use for City of Spokane Water Rights

Figure 1.6.2 shows the existing water retail service area plus the future water service area presently reserved for the City of Spokane. In addition, it shows adjoining water purveyor service areas that are presently wholesale or emergency intertie customers.

The City of Airway Heights has been a consistent wholesale water customer. Whitworth Water District #2, Vel View Water District #13, North Spokane Irrigation District #8, the portion of Spokane County Water District #3 service area located to the east of the City, Kaiser North, Kaiser South, Mount Saint Michaels, and two different service areas belonging to Spokane County Water District #3 Pasadena Park Irrigation District, Orchard Avenue Irrigation District #6, Carnhope Irrigation District #7, East Spokane Water District #1, the City of Medical Lake and Four Lakes Water District #10 are all reserved for places of use for City of Spokane water rights and are therefore intended for the use or sale of water

by the City and do not include the transfer of water rights to any other entity. All agreements for the sale of water to adjoining purveyors are subject to the approval of the City Council.

1.7 Coordinated Water System Plan (CWSP) Agreement

The City of Spokane as a member of the Water Utility Coordinating Committee (WUCC) and also with a service area within the confines of the critical water supply area is part of the 1999 Spokane County CWSP. Although a significant portion of the CWSP identifies service area boundaries by collecting in one location the water service plans of several local purveyors, Section 3 of the CWSP establishes the mechanism for service area agreements between all local water purveyors within the critical water supply area. Exhibit 3-2 of the CWSP, provided herein as **Exhibit 1.7.1**, is the Water Utility Service Area Agreement. The City has had one amendment to the agreement. This "Amendment No. 1" is also included in **Exhibit 1.7.1.**

Section 3-1 of the CWSP outlines common service area transfer requirements. The water service area boundaries for each purveyor, typically following streets, are identified in Section 3-2 and Exhibit 3-1 of the CWSP. These boundaries are also shown in **Figure 1.2.1** of this plan. Exhibit 3-4 of the CWSP, "Service Area Boundary Amendment Procedure" shown herein as **Exhibit 1.7.2**, details the procedure to make boundary adjustments. Amendments to the defined service area boundaries can occur if both utilities agree to the change. The CWSP has provided a form to make such a change and is provided herein as **Exhibit 1.7.3**. Service Area terms of agreement are identified in the CWSP in Exhibit 3-6, Certificate of Completion Service Area Adjustment, herein shown as **Exhibit 1.7.4**. Documents for the Spokane County Coordinated Water System Plan are maintained on the Spokane County website and may be accessed at https://www.spokanecounty.org/WQMP/

As discussed in Section 1.6, the Future Service Area Boundary matches the Coordinated Water System Plan Service Area for the City of Spokane Water system. The City of Spokane Water System Plan's service area policies are consistent with the "timely and reasonable" requirement for approval or denial of new requests for water service of Section 8.2 of the Spokane County CWSP. A detailed discussion and flow chart on retail water service requests follows in Section 1.8, "Service Area Policies". For purposes of requests for water service outside the City's retail water service area, the provision of service will be "reasonable" if (1) the conditions of the request for service comply with the Comprehensive Plan and development regulations and all federal, state and local rules and regulations., (2) the conditions of service and the associated costs are consistent with those documented in this water system plan, and (3) the conditions of service and the associated costs in each particular case are consistently applied to other applicants requesting similar water services.

City of Spokane Retail Service Area

Figure 1.6.1

Print date: 3/1/2016

City Limits
Arterials
Urban Growth Area
Rivers
Existing Retail Service Area
Future Service Area

Geographic Information System GIS

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W E
S

CITY OF SPOKANE

THIS IS NOT A LEGAL DOCUMENT:
The information shown on this map is compiled from various sources and is subject to constant revision. Information shown on this map should not be used to determine the location of facilities in relationship to property lines, section lines, streets, etc.

CITY OF SPOKANE WATER DEPARTMENT

PLACE OF USE FOR CITY OF SPOKANE WATER RIGHTS

Print date: 8/21/2014

AREA INDEX

Carnhope Irrigation District #7
Clear Lake Pines
Clear Lake Resort - Fairchild A.F.B.
Clear Lake Water Users Assoc.
Consolidated Support Services
East Spokane W.D.#1
Kaiser North
Kaiser South
Medical Lake, City of
Mount St. Michaels
North Spokane Irrigation #8
Orchard Avenue Irrigation District #6
Pasadena Park Irrigation Dist.
S.C.W.D.#3-4 Mead
S.C.W.D.#3-5 Pine River Park

- Present City of Spokane existing service area
- City Limits
- Present City of Spokane wholesale customers service areas for water rights place of use
- Adjoining service areas for future emergency interties or future wholesale for water rights place of use
- Adjoining service areas for existing emergency interties or future wholesale for water rights place of use
- Future water service area for City of Spokane water rights place of use

Note: Small private water systems located within or contiguous to the primary purveyor service areas are included for water right place of use.

Highway — Railroad
Arterials — Rivers

Geographic Information System

N
W E
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CITY OF SPOKANE

THIS IS NOT A LEGAL DOCUMENT: The information shown on this map is compiled from various sources and is subject to constant revision. Information shown on this map should not be used to determine the location of facilities in relationship to property lines, section lines, streets, etc.

FIGURE 1.6.2

1.8 Service Area Policies

General Policy

The City's duty to provide water service to new service connections must be consistent with the City's utility service extension policy and ordinances, the SMC, this Plan and any applicable local plans and regulations as well as WAC 246-290-106. The service area policy is provided in **Exhibit 1.8.0**. The City will not serve new connections outside of the Retail Service Area unless authorized pursuant to SMC 13.04.1921.

The City will honor prior commitments for water service by a special connection or latecomers agreement. In the case of a prior commitment for water service, the vested water capacity exists with the commitment and the parcels included in the prior commitment will be included in the retail water service area upon City Council approval.

The City will evaluate any new requests for retail water service which are outside the City's retail water service area within 120 days of the request, pursuant to the flow chart for retail water service requests provided with the service area policy in **Exhibit 1.8.0**. It is the policy of the City to ensure that requests for expansion of the Retail Service Area be considered at least annually.

Water Rates to Other Purveyors

The City has a separate rate for water sold to other purveyors for any purpose. This rate is found in Municipal Code 13.04.2014.

Annexation

When owners of properties outside the City Limits intend to use City water, in addition to obtaining any necessary permits from the County, they must also either annex into the City or sign an annexation agreement as shown in **Exhibit 1.8.1**.

Satellite Systems

For service within the City's future service area, the City prefers direct connections to its piping system. The City will consider, on a case-by-case basis, a satellite system within its future service area to be operated by others on an interim basis until an appropriate time when the system can be connected directly to the City's system. The final decision for such an arrangement will be made by the Water Department Director subject to Mayor and City Council approval.

Rates for Outside City Customers

Outside City customers pay higher rates due to the higher cost to provide water to the outlying areas. For single-family residences, the rates are as outlined in Municipal Code 13.04.2012. Rates for commercial, industrial and all other customer premises not specifically identified as a single-family residence are listed in Municipal Code 13.04.2016.

Formation of Local Improvement Districts

Property owners within the City Limits who wish to form a Local Improvement District ("LID") to build a water system extension can do so by contacting the City's Engineering Services Department. The Engineering Services Department will help the property owner go through all the necessary procedures. The procedures for a property owner wishing to do a LID outside the City and within the retail service area are basically the same except they will have to prepare a "Request for LID Covenant" as shown in **Exhibit 1.8.2**. LIDs shall only be served within the retail service area. The City's Hearing Examiner will review all LID proposals and make the final decision regarding each LID.

Oversizing

The complete "Water Main Oversize" policy for upsizing water pipe for necessary present or future application appears in **Exhibit 1.8.3**. The policy was adopted in 1999 and remains in effect. The upsizing policy of water mains installed by private contract provides the flexibility to upsize water mains above what is required by a developer so the City may participate in the upsize of water mains to meet the needs of downstream customers. The "Water Main Oversize Justification Approval" form is shown in **Exhibit 1.8.4**. Oversizing water piping is subject to the approval of the Water Department Director.

Cross Connection Program

The cross connection program is addressed in Chapter 6 of this Plan.

Service Extension Requests

Typically the Water Department pays for wells, pumps, reservoirs, and transmission mains. However, should a developer need infrastructure installed prior to the time and financing as provided for in the Water Department capital plans, the developer, upon request and approval by the City, may proceed at their own expense, provided these service extensions are within the service area. Distribution main extensions and service connections most typically are paid for by developers/property owners. All work must be designed by a licensed engineer and constructed in accordance with City design and construction standards.

Satellite Management Agencies

The Water Department does not currently manage any other water systems and has no plans to become a Satellite Management Agency. However, the Department will evaluate future opportunities or requests on a case-by-case basis.

Conditions of Service

Conditions of service are specific requirements that facilitate the implementation of the City's Water Department service area policies. Conditions of service requirements are provided to each project proponent at time of their request for a permit and/or predevelopment information requests and can include one or more of the following items:

- Purveyor responsibilities
- Customer responsibilities

- Connection fee schedule
- Meter and materials specifications
- Consent agreements for inspection, maintenance, and repair activities that may disrupt water service
- Cross-connection control requirements
- Developer extension requirements, design standards, financing responsibilities, and professional engineer design requirements
- Annexation policies as addressed at the beginning of this section
- Inclusion within the City's Retail Service Area

Each scenario in the process to obtain water for a property, from the initial development of land to the purchase of an established residence, has a set procedure governed by the City's municipal codes, ordinances, and design standards.

City of Spokane Responsibilities

Responsibility of the City for providing operation and maintenance of the water system begins within the public domain and extends to the property line. For this reason most shutoff valves are placed within the public domain and at the property line. Maintenance of the portions of the water system within public domain is performed by City Water Department personnel with City purchased and supplied equipment. As stated in Municipal Code 13.04.140, "The City assumes no responsibility whatsoever for any private water pipes, mains, devices, fixtures, or appurtenances located either within or outside public property or public right-of-way."

City water personnel are not allowed to proceed onto the homeowner's property except at the homeowner's invitation, (i.e. inspection of existing or newly installed equipment, or requested repairs).

Water taps and water meter installations are initiated through a permitting process in City Hall and scheduling with the Water Department. After the applicable work orders (**Exhibit 1.8.5** and **1.8.6**) are completed, and the tap and/or water meter fees are collected, City employees complete the installations in the public domain using City supplied materials. These work orders are done in compliance with "City of Spokane Water Department Rules and Regulations for Water Service Installations" (**Exhibit 1.8.7**). Minimum water service vault dimensions are shown in **Exhibit 1.8.8**.

Single Family Homeowner Responsibilities within City Limits

The simplest procedures are those associated with the purchase of an established residence within the City's service area with all water service equipment in place. Prior to purchase, it is the responsibility of the potential homeowner to determine the condition of the water service equipment on the property by working with the real estate agent and/or the property owner. All water service equipment should be in good operating condition, and must conform to the standards outlined by the City in the "City of Spokane's Design Standards."

Once the property is purchased, maintenance and service leak repairs on the property become the responsibility of the current property owner. Furthermore, any repairs and equipment replacement must conform to the City's current standards and must be

approved by a Water Department Inspector prior to covering. Meters that meet the City's specifications will be furnished by the City and will be charged to the customer at cost, on their monthly utility bill.

If the water service has not been interrupted, the new property owner is required to inform the City Utility Billing Department of new ownership and have the billing transferred into their name.

If construction is necessary, City ordinances allow the homeowner to hire state licensed and bonded qualified contractors to perform repairs and to use the street shutoff cock during the work and testing of the new service. If desired, a homeowner may hire the City Water Department to make repairs on their property. Should the homeowner/contractor retain the City, an additional billing would be provided for these services. The additional charge would be provided on the homeowner's utility bill for those repairs.

Rates for water usage within the City's limits are established by Council Resolution, are addressed in Municipal Code 13.04.2002, and are published in the City's Official Gazette.

Single Family Homeowner Responsibilities Outside of the City Limits

Homeowners that utilize the City's water service but are living outside of the City's boundaries are subject to the same rules and regulations as those within the City boundaries. Rates for this class of customer are addressed in Municipal Code 13.04.2012 and published in the City's Official Gazette.

Connection Fee Schedule

Tap and meter fee rates are based on the pipe sizes specified by the engineer/designer of the project proponent. Charges for a 2 inch tap, or smaller are addressed in Municipal Code 13.04.2026. Costs for services that require a tap that is 3 inches or larger are addressed in Municipal Code 13.04.2028.

Should a meter require a concrete box installation there is a separate charge.

To facilitate meter reading Automatic Reader Box (ARB) costs are included in the meter fees.

Several rules apply prior to installation. They are:

- When taps are installed outside of the City's limits, the customer must either annex to the City or sign an annexation covenant as mentioned earlier
- L.I.D. and future main extension waivers are required on all approved long services.
- Taps 1-inch or smaller are required to have a pressure-reducing valve (PRV) placed before the meter if the pressure is greater than 80 psi (the costs for a PRV and its installation are borne by the project proponent)
- Taps larger than 1-1/2-inches are required to have a PRV placed after the meter if the pressure is greater than 80 psi (the costs of a PRV and its installation are borne by the project proponent)
- Tap fees are based on tap size and street right of way width. Meter fees are based on meter size and type (domestic, irrigation, and/or fire). All tap and meter fees are subject to periodic review and change

Special water service connection fees (General Facility Charges (GFCs)) (as mentioned earlier in this section) are also assessed. These fees are for the purpose of helping to pay for major water infrastructure needed to serve an area, and may include wells, pumps, reservoirs, and large transmission mains. This fee is addressed in Municipal Code 13.04.2042 and as above is also based on size of service.

Meter and Materials Specifications

All specifications for water service meters and materials are in the "City of Spokane's Design Standards." Vault dimensions have been defined by the City for larger water services. The required vault sizes are shown on the handout "Water Service Minimum Vault Dimensions," located in **Exhibit 1.8.8**.

Consent Agreements for Inspection, Maintenance, and Repair Activities that may Disrupt Water Service

Consent agreements to disrupt water service are not required for inspection, maintenance, and repair activities requested by the homeowner. Notice to terminate service is also not required when the service interruption is necessary for repair in an emergency, or for any other reason. However, the Department makes every effort to coordinate disruptions and meet the needs of the customers. As outlined in the City's Municipal Code, an actual notice to terminate water service is only applicable when executed because of nonpayment. See Municipal Code 04.02.180 "Notice of Termination."

Developer Projects

Developer projects that intend to use City water must first apply for a permit. All permits start with the Planning Department at City Hall. The developer should schedule a pre-development meeting arranged by the City's Planning Department. At the pre-development meeting, all applicable City departments and the developer meet to discuss the project. These meetings are held only for projects within the City's limits.

Through the permitting process, property platting is checked and a SEPA review is performed and routed to all of the City's infrastructure departments (water, sewer, street, and stormwater). Following the departmental reviews, two public meetings are held.

Any water system extensions required by the project must be designed by a licensed engineer and be in compliance with all of the City's design and specification standards. The Municipal Code states that all financial responsibility lies with the developer to prepare the design and install the system extensions.

Following receipt of the project information, the City engineer prepares a report describing the project for the City Council. As the final step, all plans/projects must be approved by the City Council.

When the approval process is complete, the developer will receive a letter of approval for the project's plans. The developer is required to coordinate and pay for the appropriate elements of the construction of the project and coordinate with the City for inspection services. The developer is also responsible to purchase tap permits.

1.9 Duty to Service Requirement

The City of Spokane Water Department as a municipal water supplier has a duty to provide service to all new connections requested in its retail service area. Service within the retail service area will be provided when the service connection request meets all four elements stated in RCW 43.20.260:

1. **Capacity**: The water system has sufficient capacity to serve water to the new service requested in a safe and reliable manner. Capacity is and will be sufficient to meet all flow requirements and will not impede or reduce existing services below all required flow requirements.
2. **Consistency**: All new service requests shall be consistent with adopted State and local development regulations including but not limited to the Urban Growth Boundary and its requirements on growth and all requirements of the City of Spokane's Comprehensive Plan.
3. **Water Rights**: Available water rights must be sufficient to provide for all new service requested.
4. **Timely and Reasonable**: The water system shall have the necessary infrastructure in place to provide for any new service or must have in the capital improvement plan, the necessary infrastructure improvements to provide for new services in a timely and reasonable manner. A developer may elect to construct infrastructure improvements at their cost, but all such infrastructure improvements shall meet all applicable rules and regulations and shall be consistent with all development regulations.

If these elements for a new water service request within the City's retail service area are met and per the details presented in Sections 1.6, 1.7, and 1.8 of this chapter, water service shall be provided by the City of Spokane Water Department and will comply with the "duty to serve" requirement of RCW 43.20.

1.10 Local Planning Consistency Determination

Water service provided complies with the City of Spokane's Comprehensive Plan, which in turn addresses the necessary links with Spokane County's Comprehensive Plan and the Countywide Planning Policies. Consistency checklists are provided in **Exhibit 1.10.1** for Spokane County Planning, Spokane County Utilities, and City of Spokane Planning. Consistency documents are also provided for the City of Spokane Valley for a small already developed area within Spokane Valley where the City of Spokane provides retail water service, and for the City of Airway Heights.

Chapter 2

Basic Planning Data and Water Demand Forecasting

CHAPTER 2

Basic Planning Data and Water Demand Forecasting

Introduction

This chapter defines the basic planning data involving current and future population, land use, and water demand for this Comprehensive Water System Plan to assist the City Water Department plan to accommodate existing and future water needs by providing the basis for the capital improvements plan. The use of population projections, rate of growth, and growth areas provide the basis for the estimated current service population, service connections, water use and equivalent residential units (ERU), and also the projected land use, population, and water demands for the 6 and 20 year planning horizons. A consultant recently completed an extensive demand forecast for the Water Department, and is discussed in Section 2.2.

2.1 Current Population, Land Use, Service Connections, Water Use, and Equivalent Residential Units

Current Population

The 2010 U.S. Census data concludes that the City of Spokane has about 208,916 people within the city limits. The Water Department currently provides water service to areas outside of the City limits within Spokane County and within its water service area defined as the retail service area. Using the 2010 census data and the GIS parcel information including meter location data, the total estimated water service population for the Department's retail service area for 2010 is 227,455 people. The present retail service area is approximately 80 square miles.

Current Land and Water Use

The City of Spokane Comprehensive Plan's existing land use definitions include over 175 separate land use categories. **Figure 2.1.1** is a map showing current land uses. For ease of projecting water demands, these separate categories have been aggregated into four major water use categories in compliance with the 1997 Washington State Department of Health "Water System Planning Handbook" ("Handbook"). (It should be noted that although the Handbook lists an agricultural category, the City of Spokane does not provide water to an agricultural component, and therefore, the City does not report on this category. Businesses related to agriculture (such as dairies or wineries) are included in the "Commercial/Industrial" category.)

The four major use categories are as follows:

- Single Family Residential
- Multi-Family Residential
- Commercial/Industrial

- Governmental

Single Family Residential

The single family residential category includes residential densities of 4 to 10 units per acre. Example uses include: single-family residential, duplexes, planned developments, and mobile home parks.

Multi-Family Residential

Multi-family residential includes triplexes and other larger sized facilities. In addition, households on commercial property, permanent resident hotels, mobile home parks, dormitories and fraternity houses are also included.

Commercial/Industrial

The commercial category includes retail and wholesale businesses, as well as medical and professional businesses. Groupings of wholesale, retail, department, and variety stores are included. Example uses include: service industries, shopping malls, automobile sales and repair, banks, hotels and motels, restaurants, gas stations, hospitals, and entertainment facilities.

The industrial category includes businesses that are involved in the manufacture, storage, processing or packaging of articles, merchandise, or products. Included in this category are both heavy and light activities. Heavy industrial operations include activities that give off smoke, dust, odor, fumes, noise, or other hazards that may affect the surrounding areas. Example uses include: asphalt manufacturing, rock crushers, aluminum smelting, boat assembly, and rendering plants. Light industrial operations include operations which would not be objectionable because of smoke, dust, odor, fumes, noise, or other hazards. Example uses include: bakeries, bottling plants, beverage distributors, food processing plants, and high-tech manufacturing.

Governmental

This category includes city/county/state/federal governmental buildings and grounds, local services district facilities, public and private educational facilities, public and private golf courses, parks, and playfields.

Current Service Connections

The City of Spokane has an electronic water billing system that provides three sets and subsets of information:

1. Account Location
   - Inside the City limits
   - Outside the City limits
   - Water meters located within the airport area
2. Water User Category
3. Water Use by Category

The current data, as of March 2014, associated with the four water use categories identified in the previous sections is provided in **Table 2.1.1**.

Table 2.1.1 CURRENT Categories	
Total Service Connections Within Service Area Boundary—2014	
Account Type	**Total Number**
Single Family Residential	65,952
Multi-Family Residential	2,501
Commercial/Industrial	6,869
Governmental	928
Totals	**76,250**

Variations in System Demand

Variations in system demand occur continually throughout the day and year. These variations must be identified to design the necessary water system improvements to meet existing and future system demands. This subsection develops the following system demand relations:

- Existing Demands
- Average Daily Demand
- Seasonal Water Demand
- Maximum Day Demand
- Diurnal System Demand/Peak-Hour Demand
- Peaking Factors
- Non-Revenue Water
- Equivalent Residential Units ("ERU")

Existing Demands

The existing demands for the City's water system presented in this section were developed from the well supply production records and consumption records. **Table 2.1.2** tabulates the annual quantities of water pumped for the years 2007 – 2014.

Table 2.1.2

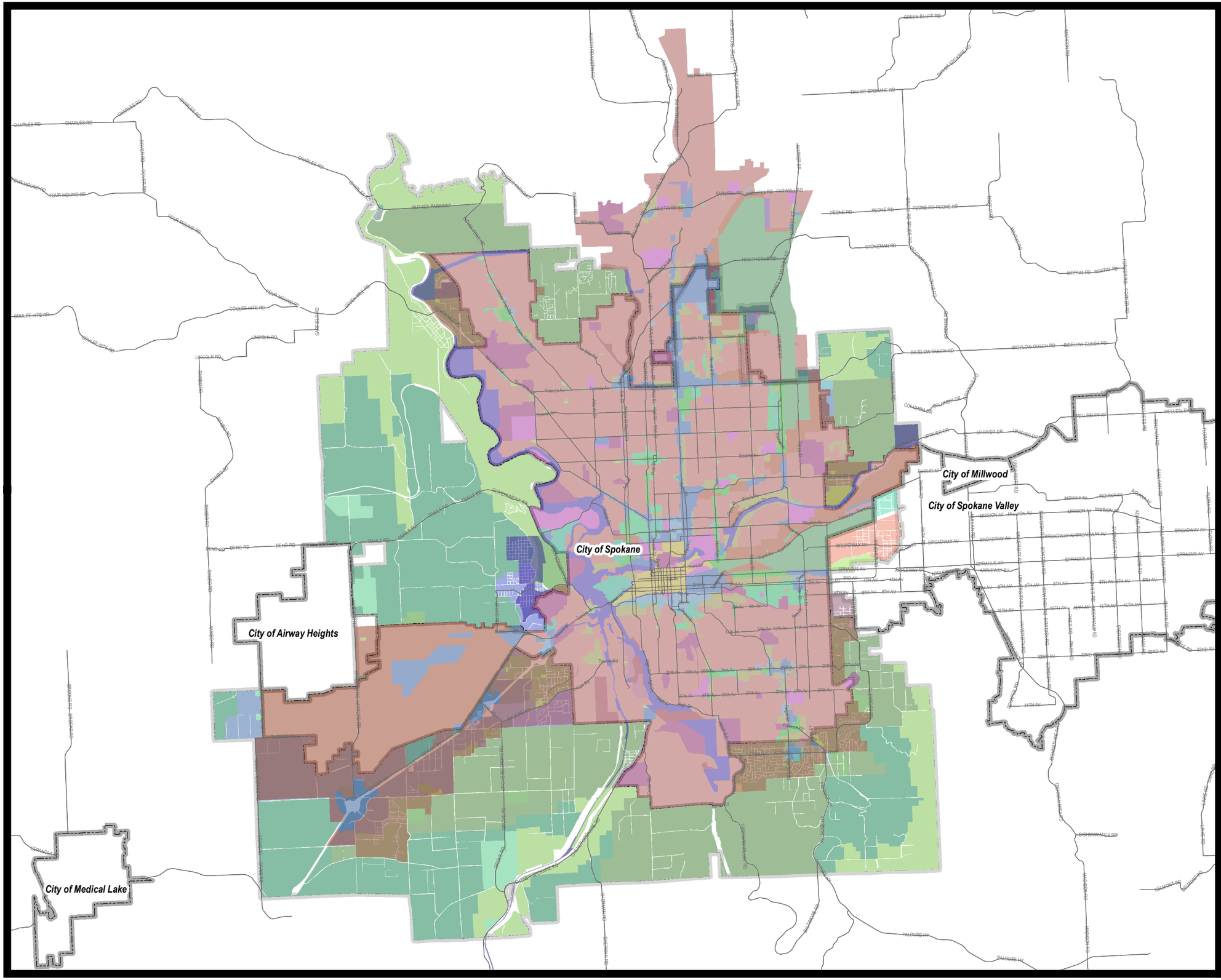
Annual Pumpage/Consumtion Summary (in thousand gallons)

Source	2007	2008	2009	2010	2011	2012	2013	2014
Well Electric	3,332,330	1,357,000	1,291,300	3,253,649	3,284,928	1,906,719	1,933,586	649,197
Parkwater	5,125,513	6,398,458	6,837,605	4,061,713	3,900,939	6,100,590	4,860,922	7,434,283
Nevada St	1,960,592	2,395,606	2,077,184	2,577,317	3,137,555	1,686,794	3,058,570	2,094,454
Low System	**10,418,435**	**10,151,064**	**10,206,089**	**9,892,679**	**10,323,422**	**9,694,103**	**9,853,078**	**10,177,934**
Well Electric	1,188,800	694,500	1,356,500	400,400	144,303	1,498,783	1,887,271	1,565,592
Parkwater	2,880,049	2,780,769	2,867,008	2,444,469	1,752,050	1,837,765	2,173,840	2,170,225
Ray St	1,637,961	1,785,771	1,636,085	2,102,812	2,861,003	2,303,949	1,438,922	1,876,335
Intermediate	**5,706,810**	**5,261,040**	**5,859,593**	**4,947,681**	**4,757,356**	**5,640,497**	**5,499,351**	**5,612,152**
Well Electric	1,250,071	2,020,147	1,988,831	2,136,950	924,826	1,442,865	2,312,873	2,549,319
Central	3,486,333	2,478,737	3,080,748	1,685,892	900,155	1,216,915	1,486,867	2,009,966
Hoffman	391,950	101,907	352,969	201,885	37,779	167,131	310,485	394,106
Grace	1,253,459	1,224,548	967,593	1,743,713	3,757,982	2,861,471	1,741,248	1,895,123
North Hill	**6,381,813**	**5,825,339**	**6,390,141**	**5,768,440**	**5,620,742**	**5,688,392**	**5,851,473**	**6,848,514**
Pumpage Total	**22,507,058**	**21,237,443**	**22,455,823**	**20,608,800**	**20,701,520**	**21,022,982**	**21,203,902**	**22,638,600**
Average Daily Demand	61,663	58,185	61,523	56,462	56,716	57,597	58,093	62,024
Maximum Day Demand	194,845	192,277	186,446	171,637	195,104	167,710	208,092	178,056
Peaking Factor	3.2	3.3	3	3	3.4	2.9	3.6	2.9
Three Year Running Average (Pumpage)	22,365,833	22,493,180	22,066,775	21,434,022	21,255,381	20,777,767	20,976,135	21,621,828
Consumption (Accounted)	**20,799,000**	**19,127,465**	**19,031,458**	**16,869,482**	**16,536,826**	**16,991,008**	**17,416,785**	**18,606,145**
Percent Unaccounted	7.60%	9.90%	15.20%	18.10%	20.50%	19.20%	17.90%	17.80%

CITY OF SPOKANE
WATER DEPARTMENT

CURRENT LAND USE

Print date: 7/1/2015



Legend

Inside City Land Use

- Agriculture
- Center and Corridor Core Area
- Center and Corridor Transition Area
- Conservation Open Space
- Downtown
- General Commercial
- Heavy Industrial
- Institutional
- Light Industrial
- Mini Center
- Mining
- Neighborhood Retail
- Office
- Open Space
- Potential Open Space
- Residential 10-20
- Residential 15+
- Residential 15-30
- Residential 4-10
- Unclassified

Spokane Valley Land Use

- Community Commercial
- Corridor Mixed Use
- Heavy Industrial
- Light Industrial
- Low Density Residential
- Regional Commercial

Outside City Land Use

- Community Commercial
- Heavy Industrial
- High Density Residential
- Light Industrial
- Low Density Residential
- Low Density Residential Plus
- Medium Density Residential
- Mineral Lands
- Mixed Use
- Mixed Use Zone
- Neighborhood Commercial
- Regional Commercial
- Rural Activity Center
- Rural Conservation
- Rural Traditional
- Rural-5
- Urban Reserve

- Municipal Boundaries
- Water Service Area
- Arterials
- Stream or River, Perennial

0 6,900 13,800 20,700

Feet

Geographic Information System

N
W E
S

THIS IS NOT A LEGAL DOCUMENT:
The information shown on this map is compiled from various sources and is subject to constant revision. Information shown on this map should not be used to determine the location of facilities in relationship to property lines, section lines, streets, etc.

Figure 2.1.1

Average Daily Demand

Average daily demand ("ADD") is the total annual quantity of water delivered to the system divided by the number of days in the year. Based on **Table 2.1.2** the running average of the ADD is 59.0 mgd which is a 2.8% decrease from the amount reported in the 2006 Comprehensive Water System Plan. The average value from 2007 to 2014 is used to represent the ADD by normalizing annual fluxuations seen in the Table 2.1.2 values. The reason for the reduction is as addressed below in "Non-Revenue Water" and conservation measures addressed in Chapter 4.

Seasonal Water Demand

October through April has the lowest average monthly use, ranging from 31.2 to 44.2 mgd. May through September is the peak water demand period with an average ranging from 64.3 to 122.7 mgd. Peak use typically occurs in July and August due to the irrigation and cooling demands. Also, since Spokane is located in an arid climate, water demand in the summer is highly dependent on weather patterns. A cool and wet spring and summer as compared to a hot and dry summer will have more impact on water usage than any other factor.

Maximum Day Demand

Maximum day demand ("MDD") is the quantity of water supplied during the highest-use day of the year. The MDD, for each year for the period 2007 through 2014, occurred in the period of July thru September. The Maximum Day Demand from metered use is shown in **Table 2.1.2** and the best conservative value for present MDD is 185 mgd.

Diurnal System Demand/Peak Hour Demand

Water demand variations occur throughout the day, each and every day of the year. These daily demand variations are best represented graphically on a "diurnal demand curve" that shows the relationship between time of day and water demand. The hourly peak water demand in the City system varies in each pressure zone depending upon the predominant land uses within the zone.

Peaking Factors

Peaking factors (demand ratios) show the relationship between the various demand conditions. The peaking factors developed for the existing demands are used for projecting the future demand conditions. An important peaking factor is the relationship between the ADD and the MDD. Over the last six years this peaking factor has varied from 2.9 to 3.6 ADD. Therefore, 3.2 will be used as the best single representative value. The peak hour demand is 1.7 times MDD.

Non-Revenue Water

The difference between the total water pumped at the well sources and the metered consumption constitutes the amount of non-revenue water. The percent of non-revenue water for each year 2007 – 2014 is 7.6%, 9.9%, 15.2%, 18.1%, 20.5%, 19.2%, 17.9% and 17.8% respectively. A marked increase is seen starting in 2009. This increase is due to the discovery of an accounting error within the City of Spokane billing system when actual consumption data was extracted from the billing data. Since the reporting of the 2009 numbers, these numbers represent the City's best information about the volume of non-revenue water. Some extracted

readings were double counted resulting in an erroneously high metered consumption and corresponding accounted water number which when corrected increased unaccounted water use.

The following factors can have significant effects to the amount of non-revenue water volume:

- Inaccurate meters, either at the source or service connections, or both
- Pipeline leakage
- Unauthorized use, such as illegal connections
- Authorized and unauthorized use from fire hydrants
- Unmetered uses such as system operational needs, construction use, street cleaning, line flushing, water main testing, main breaks, reservoir flushing, and fighting fire

The City has made significant progress in reducing the amount of unaccounted for non-revenue water and will continuously work to identify and correct deficiencies in this area. The measures described here will further bolster that effort. With the completion of the ongoing water audit – currently projected for 2016, the City will be able to design and implement measures toward the goal of DSL of 10% or less. Following the discovery of the water accounting error in 2009, the City took efforts and implemented programs to reduce the non-revenue water. The major ongoing programs include:

- Dedicated Leak Detection Program:

  The City maintains at least one full time leak detection crew working within the City on a continual basis. Service connections are included within the monitoring program. One of the Water Department's performance measures is to leak survey a minimum of 90 miles of water main per quarter, allowing the system to be leak surveyed every three years.

- Residential Meter Replacement Program:

  The City has a robust meter replacement program. On average, the City replaces about one hundred residential meters every month. The priority for meter replacement is based on a combination of age and total flow through the meter. Also, during the monthly billing cycle, if low flows are observed, the suspect meter is also replaced.

- Commercial Meter Replacement Program:

  Between 1999 and 2005, the City replaced, repaired, and recalibrated all commercial meters 1 ½ inches and larger. The City continues to replace or recalibrate all inch and a half and two inch meters every four years and all meters three inches and larger every year.

- Cast Iron Pipe with Poured Lead and Leadite Joints Replacement Program:

  Since 2004 The Water Department is replacing cast iron pipe with leadite joints, as it has proven to fail in a spiral fracture that causes catastrophic damage. In addition, older lead joint distribution main is being replaced in coordination with street projects as part of an integrated strategy to replace aging roads and infrastructure. The older lead joint pipe, which represents a large portion of the City's existing water pipes, is prone to leakage when disturbed and the cost benefit of replacing the aging distribution main in coordination with street projects is beneficial.

- Source Meter Replacement Program:

  Beginning with Fiscal Year 1998, the City began replacing the source meters at all of the water sources. The supply meter replacement program was completed in 2002. Currently all well sources are metered. Beginning in 2012 all source meters have been evaluated and are being replaced as needed. The data from those meters will help ensure that the DSL percentages get increasingly accurate, year after year.

- Long Service Elimination Program:

  The City of Spokane, starting in 2015, is working to eliminate long services that cross several parcels by a distribution main extension or by metering the service at the first property line. These long services present maintenance issues for access and have been the source of detected leak points in the past. Typically these long services have a meter located in the residence or business leaving miles of privately owned service lines unmetered.

The accounted for portion of non-revenue water includes construction use, street cleaning, fire flow, and system operational needs. These flows are not metered but the water is considered accounted for in that it is known that the use is taking place and the amount of use is estimated. The estimated amount is based on a detailed study done by the department about ten (10) years ago where the use of each hydrant was monitored and the amount of flow for each use estimated. This usage amounted to about 28,000,000 cubic feet per year which is about 1% of total pumpage. It is felt this usage has not changed significantly over the last ten (10) years.

Equivalent Residential Units

An Equivalent Residential Unit ("ERU") is defined by the State's adopted Water System Design Manual (Department of Health) as the average quantity of water, in gallons per day, needed by a single family residential unit. Using the last three years of production and connection data in Chapter 4, the City-wide ERU is 359 gallons per day. It should be noted that this is the average for the entire City. While older core areas of the City have smaller lots, which tends to bring the average down, newer developments within the City have ERU's closer to 439 gallons per day. Both numbers can be used for design purposes depending on design conditions.

2.2 Future Land Use, Population, and Water Demand for 6 and 20 Year Horizons

Future populations are projected from historical growth trends. The future water demands are then based on these projections and on the land use projections. The majority of data used to develop this section is based on information provided by the City's Planning Department. The population trending information is based on data received and reviewed from the State of Washington. As expressed earlier from the 2010 census, the 2010 population within the City limits of the City of Spokane is 208,916. The 2010 retail service area population was 227,455 which results from service provided outside the City limits. The current retail service area is approximately 80 square miles.

Future Land Use

The Water Department is governed by the City of Spokane's Comprehensive Plan which provides that "[g]rowth will be managed to allow a mix of land uses that fit, support and enhance Spokane's neighborhoods, protect the environment, and sustain the downtown area and broaden the economic base of the community." The City's Comprehensive Plan emphasizes infill growth but also recognizes the possibility of outward growth. Under the Comprehensive Plan, "[p]ublic facilities and utilities will be provided concurrently with a growing population to meet the safety, utility, transportation, educational, and cultural needs of residents." The Water Department is able to support this vision.

Future Population

Population projections for the future suggest growth rates of around 1 percent annually. Using the City of Spokane growth rate projection, the estimated 2013 retail service area population is 235,500. The Water Department is prepared to accommodate growth within its existing retail service area, as defined by policy. The Comprehensive Plan emphasizes infill development, water conservation measures, and responsible stewardship of our water resources. Managing growth according to the values stated in the Comprehensive Plans will determine the size and ultimate growth of the retail service area over time. The City will entertain updates to the retail water service area on an annual basis or more frequently, if requests for water service are pending.

Spokane County is in the process of estimating an acceptable growth rate projection for Spokane County in coordination with cities and planning jurisdictions within the county. When the growth rate projection for Spokane County is completed by Spokane County and accepted by the cities and local planning agencies, the City of Spokane Planning Department will review it to ensure the adequacy of the system.

Future Water Demand

Non-Revenue Water

Table 2.2.3 indicates the projection of non-revenue water. In 2014, the aggregate non-revenue water for the system was about 17.8 percent.

In the next six years, many improvements, discussed in section 2.1 above, will be made to identify and control system loss. The transmission main replacement program will further reduce non-revenue water.

Water Rates and Rate Impacts on Water Demand

The Department has supported an inclining block rate structure. The block rate structure for water consumption charges customers more when they use more water. Block rates and other measures and the demand impacts are discussed further in Chapter 4. The rate structure is addressed further in Chapter 9.

Water Demand Forecasting

For details on water demand forecasting refer to Chapter 4, Section 4.1, Subsections: "Conservation Program-Next Six Years" and "Water Demand Forecast."

A water demand forecast, attached as **Exhibit 1.6.1**, for the build out of the City of Spokane future water service area has been completed. The City commissioned a consultant to prepare this water demand forecast to estimate the future water demand within the future water service area at the time of build out. This forecast is not tied to a set time schedule since large areas of the future service area are outside of the Urban Growth Boundary and the retail service area and growth into these areas is regulated through long range planning by the relevant jurisdictions. The water demand forecast is intended as a tool in water rights assessment to aid in the determination of the adequacy of the existing water rights for the City of Spokane. **Table 2.2.3** indicates the projection of annual water consumption in the three primary classification categories, plus the average daily, and maximum daily demands for the planning periods.

Table 2.2.3
Projected Water Use by Customer Class

Classification	Water use				
		Without Conservation		With Conservation	
	2014	2019	2034	2019	2034
	Billions of gallons per year				
Residential	11.3	11.9	14.2	11.7	12.9
Commercial/Industrial	4.0	4.2	5.0	4.1	4.6
Government	2.5	2.6	3.2	2.5	2.9
Non-Revenue	4.4	4.6	5.5	4.5	5.0
Total	**22.6**	**23.3**	**27.9**	**22.8**	**25.4**
	Millions of gallons per day				
Average Daily Demand	59.0	63.8	76.4	62.4	69.3
Maximum Day Demand	178	204	244	200	222
	Millions of gallons per hour				
Peak Hour Demand	12.6	14.4	17.3	14.1	15.7

Note: Based on populations of 238,200, 252,200, and 299,400 for 2014, 2019, and 2034, respectively.

Chapter 3

System Analysis

CHAPTER 3

System Analysis

Introduction

This chapter presents a broad-based look at the design standards that have been established for use on the City of Spokane Water System. Chapter 7 presents a more detailed look at design standards. These design standards have been developed using historical water system records, water system operating procedures, state and federal requirements, standards of the industry, and addressing geographic and elevation challenges, and are based on a thorough understanding of the collective facilities and their components which operate as the complete water system.

Additionally, this chapter describes the criteria which are used to judge the adequacy of the entire City of Spokane's water system under various demand conditions. These criteria are presented for sizing well stations, storage volume and siting, distribution systems, pressure zone boundaries, booster pump stations, and system operations.

The sources for design standards include the Insurance Services Office (ISO), the State of Washington Department of Health (DOH), American Water Works Association (AWWA) and the 10 States Standards.

The intent of the City's standards is to strike an appropriate balance between the level of service delivered and the costs of installation and maintenance. If standards are too low, customers will not be satisfied. If standards are too high, the cost of installing facilities becomes prohibitive.

3.1 Water System Design Standards

Each of the following standards is further developed in the subsequent subsections. Most of the information in this chapter is also discussed elsewhere in this Plan, primarily Chapters 1, 2, 6, and 7.

- Water Quality Parameters
- Average and Maximum Daily System Demands
- Peak Hour Peaking Factor
- Storage Requirements
- Booster Pump Station Requirements
- Fire Flow Rate and Duration
- Normal Maximum and Minimum System Pressures
- Minimum Pipe Diameters
- System Control Facilities
- Backup Power Requirements
- Valve and Hydrant Spacing
- Facility Materials
- Pipeline Layout Requirements
- Back-flow Criteria
- Standard Pipe Sizes
- Customer Metering

Water Quality Parameters

The Water Department pumps from the Spokane Valley/Rathdrum Prairie Aquifer. The aquifer water is a high quality product in its natural state. As an extra precaution, the

Water Department injects gaseous chlorine at each wellhead to disinfect the raw water. A 0.2 parts per million (ppm) or milligrams per liter (mg/l) free chlorine residual is maintained throughout the water system to ensure proper disinfection and prevent bacterial growth within the system.

Additionally, the Water Department has an ongoing program that monitors the chlorine residual at various points throughout the water system with particular attention being given to those water mains farthest from the well stations. Chlorine residuals are taken at least 120 times per month at sampling sites located throughout the system.

Additionally, to assure the customer receives the highest quality water, the City has on-line turbidity monitors located at Well Electric Wells 1&2, Park Water Well #4, and Nevada Well Station plus a particle counter at Well Electric. Additional tests for PH, conductivity, temperature, and turbidity are taken at varying intervals throughout the systems and at well sites to confirm that no reduction of water quality takes place.

Water Quality is discussed further later in this chapter as well as in Chapter 6.

Average Daily System Demands

Average daily demand ("ADD") is the total annual quantity of water delivered to the system divided by the number of days in the year. The present ADD is 62.0 million gallons per day (mgd) with a running average between 2007 to 2014 is 59.0 mgd which represents a 2.8% decrease from the amount reported in the 2006 Comprehensive Water System Plan.

Maximum Daily Demand

Maximum day demand (MDD) is the quantity of water supplied during the highest-use day of the year. The MDD, for each year for the period 2007 through 2014, occurred in the period of July thru September. The MDD from metered use is shown in **Table 2.1.2** and the running average value for present MDD is 185 mgd.

Peak Hour Peaking Factor

Peaking factors (demand ratios) show the relationship between the various demand conditions. The peaking factors developed for the existing demands are used for projecting the future demand conditions. Peak-hourly demand (PHD) is the largest water demand over a one-hour period. Usually, but not always, the PHD occurs during the maximum day. Using equation 5-3 from the DOH Water System Design Manual, the ratio of PHD to MDD is slightly over 1.6. The Water Department has rounded up and has traditionally used 1.7.

Storage Requirements

System storage is used in a water system to meet peaking demands and provide a reliable supply in the event of a fire or failure of supply sources. Reservoir storage volume is comprised of the following components:

- Operational Storage (OS)
- Equalization Storage (ES)
- Fire Suppression Storage (FSS)
- Standby Storage (SB)
- Dead Storage (DS)

See Section 3.8 for an analysis of the storage requirements for the City's Water System.

Booster Pump Station Requirements

Minimum design standards for booster stations are provided in the design standards of the City of Spokane. All new booster stations require a minimum of three pumps for flexibility in system operations. The total capacity of multiple pumps in a given pump station should generally be approximately twice the calculated MDD for the pressure zone the station serves. This allows a pump, even the largest pump, to be taken out of service and repaired without severely reducing supply capability.

All booster stations are required to include a telemetry system to allow the station to be operated and monitored remotely. Generally, backup power systems are not required for booster stations in the City water system where multiple booster stations provide water to the pressure zone. Within the City, all systems or pressure zones supplied by booster stations are also served with at least one reservoir.

Fire Flow Rate and Duration

Fire fighting flow is required at a relatively high rate for a short period of time. A water system should have a supply, storage, and distribution system grid of sufficient capacity to provide fire fighting needs while maintaining adequate service to residential and commercial customers.

The City of Spokane design standards provide that for residential areas, required fire flows are determined by the Fire Marshal for the area served. Typically a minimum fire flow of 1,000 gallons per minute for a two-hour duration is required for residential areas with homes containing 3,600 square feet or less floor space (includes the sum total of all interior floor levels excluding the garage) and 1,750 gallons per minute for a two-hour duration is required for residential areas with homes containing over 3,600 square feet floor space (includes the sum total of all interior floor levels excluding garage). Where the area served by the reservoir is relatively small and water quality could be affected by large storage volumes, the duration requirement may be reduced, but to not less than 30 minutes, when approved by the Fire Marshal and the Water Department. In considering such a reduction, factors such as home size, density, topography, landscaping, and traffic flow will be evaluated. Fire flow requirements for commercial and industrial areas are determined by the Fire Marshal on a case-by-case basis.

The City generally exceeds the conservative Insurance Services Office (ISO) of Washington State fire flow rates as well as the fire flow requirements set forth by the Washington Administrative Code (WAC 246-293-640), resulting in a very good insurance rating for the City.

Normal Maximum and Minimum System Pressures

Due to the varying topography of the areas served, the system is divided into separate pressure zones to control maximum and minimum pressures. The City of Spokane water system has 22 hydraulic (pressure) zones. These zones allow pressures to be restricted to acceptable limits throughout the system.

Since 1995, the normal minimum and maximum static water system pressure required in new developments (at the water meter) has ranged from 45 to 80 pounds per square inch (psi), respectively. Exceptions to the static pressure standards must be made because streets and mains do not conveniently follow ideal ground contours. If the maximum pressure exceeds 80 psi, but is less than 100 psi, an individual pressure reducing valve ("PRV") on water services is required per the Uniform Plumbing Code ("UPC"). If the pressure exceeds 100 psi a PRV station is installed within the distribution system, plus the individual PRVs on services is required. For pressures below 45 psi, specific written approval is required from the City of Spokane Water Department before service is provided.

Minimum Pipe Diameters

The determination of minimum pipe sizes is based on domestic water demand in addition to fire flow requirements and the overall grid or loop system found in the water system. The function of the distribution system is to convey water to customers at adequate service pressures and to provide fire flow. A hydraulic analysis is required by the Water Department for the sizing of water mains. In most cases the hydraulic analysis will include a computer model analysis.

System Control Facilities (Telemetry System)

In 1985, the Water Department installed its first Supervisory Control and Data Acquisition ("SCADA") system. The data was transmitted from the remote sites to the SCADA system computer control center via dedicated phone lines. Today, the City uses radio frequency ("RF") communication for the SCADA system.

As with all computer technology, the SCADA system is in a continual state of upgrades and improvements. The next generation SCADA system utilizes distributed control technology that transmits data via a broad spectrum radio system and was completed in 2007. Additional upgrades are schedule in 2015. The communication system between the Central Control Client Server ("CCCS") site and the remote Programmable Logic Controllers ("PLC") located at the various water facilities throughout the water system is fully operational. The PLC's are designed to be "stand alone". Thus, in the event of a loss of communication, the PLC can continue to provide limited control using system pressures at the remote facility.

Transmitted information is processed by the CCCS system located at the Upriver Complex that then monitors the PLC's. The control functions of the various components in the water system are monitored by the Water System Operator. The Water System Central Control Room is staffed 24-hours a day and 7 days a week, by certified operators. This subject is also discussed in Chapter 1.

Some of the functions that SCADA monitors and/or controls are:

- storage reservoir levels;
- pump starts, stops, and run times;
- well drawdown elevations;
- system chlorine residuals;
- dam and hydroelectric powerhouse;
- intruder alarms and station security; and

- system pressures in the various pressure zones.

Backup Power Requirements

The City has permanent backup electrical generation facilities for the Well Electric and Parkwater Well Stations. These well stations are equipped for dual electric service. Typically, the Well Electric Well Station and the Parkwater Well Station operate on electric power supplied from the Water Department's Upriver Dam. However, power is also available from Avista Corporation for these two well stations. The ability to operate the Well Electric and Parkwater Well Stations with such backup power provides considerable redundancy for supplying water to the Low, Intermediate, and North Hill Systems.

All other pumping facilities are largely dependent on the Avista power for operations. Electrical outages are infrequent in the Spokane area and there is extensive storage capacity to meet emergency water demands on a short to medium term basis (24 to 48 hours) in the event of power outages. The most significant power outage the City has experienced was during "Ice Storm" in November 1997. Restoring power to the City's pumping facilities is placed on a high priority by Avista. In the case of "Ice Storm", power was restored within 48 hours to those pumping stations which lost power.

The Avista electrical system in Spokane is strong with considerable gridding and redundancy, which is further strengthened by the presence of the Avista corporate offices in Spokane. Avista has locally-based field staff available for responding to emergency power outages. Historically, power outages have been of rather short duration with a couple of exceptions, for example Ice Storm of 1996 and Wind Storm of 2015. To assure a higher level of reliability of its water pumping capability, the Department has purchased a portable generator driven by a diesel engine and is on standby status. The generator is a 500 kVa, 3 phase, dual voltage (240V/480V) unit capable of driving the largest pump in any of the City's pumping stations with the exception of the Well Electric Stations, the Lincoln Heights and the Ninth & Pine Stations, which operate on a different voltage (2,300V) than the rest of the stations.

Additionally, the Department is planning to add two additional large portable 500 to 600 kVa dual voltage generators for backup power requirements. The reasoning for the additional generators is to be able to provide backup power to critical points in the system in the event of a large scale power failure. The City was considering the installation of a backup generator at the Lincoln Heights Pumping Station however the current plan is to configure one of the larger portable generators to this task. The Department is also re-evaluating the installation of backup generators at key booster station locations as a result of lessons learned during the Wind Storm of 2015. Following station assesments and evaluations backup generation projects will be prioritized and added to the capital plan for programing and implementation.

Valve and Hydrant Spacing

The general requirements for Valve and Hydrant Spacing are:

- Distribution system gate valves shall be spaced between every hydrant and at the right-of-way line entering and exiting every major intersection. Transmission line valves shall be located so as to isolate well-defined lengths of line. The maximum length between valves shall not typically exceed 3,000 feet.
- Fire hydrant spacing shall typically not exceed 500 feet primarily in residential areas. In areas where high fire flows are required, the fire hydrant spacing shall be adjusted to meet International Fire Code (IFC), State, and local requirements—typically not exceeding 250 feet.

Facility Materials

The City's standard materials for water system facilities are available from the City of Spokane Water Department. Since these materials change from time to time, they are not provided within this Comprehensive Water Plan. However, general guidance is provided in Chapter 7 where referenced documents are listed.

Pipeline Layout Requirements

The minimum size for water mains shall be not less than 6 inches in diameter, shall be designed for fire flow, and shall be looped wherever possible. Four-inch diameter mains will be allowed in some permanent cul-de-sacs under special permission where no hydrants are connected to the main, where the length of the main is 250 feet or less, where no more than 12 dwelling units will be served, where no dwelling unit in the cul-de-sac will be no further than 250 feet from a fire hydrant, and where an engineering hydraulic analysis (computer model) demonstrates that water velocities and minimum water pressures are within acceptable ranges.

All public water mains shall be located in a public right-of-way, unless authorized in writing by the Director of the Water Department allowing and accepting an exclusive easement, at least 25-feet wide, to accommodate the pipeline.

Eight-inch diameter pipeline shall be the minimum size for permanent dead ends except for cul-de-sacs as discussed above. Six-inch pipelines shall be the minimum size for short, dead end streets which are scheduled or projected to be extended such that the proposed water main will be eventually looped, provided however, that adequate capacity is provided in the interim for domestic demands and fire protection. There will be no dead end mains longer than 1,000 feet.

A hydraulic analysis is required by the Water Department for the sizing of water mains. In most cases, the hydraulic analysis will include a computer model analysis. Normal pipeline velocities should be maintained between 3 to 5 feet per second for pumped systems, allowing a maximum velocity 7.5 feet per second for normal peak conditions. Velocities up to 10 feet per second are commonly allowed within the yard piping of a pump station to reduce capital costs of appurtenances at the station. Maximum allowable velocity during a fire flow event is 15 feet per second.

Predominantly, the depth of pipes to the invert of any water main shall be 5.5 feet. If the water line is placed in a dedicated right-of-way, the ground surface must be rough-graded within 6 inches of approved established grade. No other utilities, cable or conduit shall occupy the same trench as a water line except as approved by the Water Department. Minimum service line size shall be 1 inch.

Back-flow Criteria

Back-flow devices shall be installed on all systems as required by the State and local regulations. Back-flow criteria are discussed in more detail in Chapter 6 and in Chapter 7.

Standard Pipe Sizes

Standard pipe sizes for distribution and transmission water mains are: 4, 6, 8, 10, 12, 18, 24, 30, 36, 42, and 48 inches. Typically, only ductile iron pipe and ductile iron fittings are allowed. Pipe joints shall be push-on type per AWWA. Fitting joints shall typically be ductile iron, mechanical joint per AWWA.

Customer Metering

Spokane Municipal Code section 13.04.0802 addresses water service taps and meters. Generally, each individual building is to be served by its own water service. Minimum meter size shall be ¾ inch. Planned Unit Developments ("PUD"s) are master metered at the property line. Residential meters will be installed in an approved meter box at the property line. Meters, 2 inches and above, are installed either in meter boxes at the property line or in the building being served at the point of the service line entry. Larger meters are installed either in concrete meter vaults at the property line or in the building being served at the point of the service line entry – generally in the mechanical room. For commercial and industrial service lines, the City requires that customer's project engineer or architect provide the determination of the service line size based on needs of the facility for fire protection, process water, domestic needs, irrigation, etc. The City reviews the proposed service line for compliance with the City's standards. If the City review finds the service line in compliance with the City's standards, it will be approved. Provisions for a remote reader receptacle shall be included to allow the meter to be read without having to enter the building.

Hydraulic Modeling

The City of Spokane has recently completed calibration of its hydaulic water model and is currently using InfoWater Suite 11.5 by Innovyze for hydaulic modeling. Calibration included steady state and extended period modeling for the existing water system and updating the base scenarios for Average Day Demand (ADD), Maximum Day Demand (MDD) and fireflowconditions for existing and future demand conditions. An evaluation was completed in conjuction with the model calibration of the fire flow and Peak Hour Demand (PHD) analysis to identify potential deficiencies. Results of this evaluation is discussed in Section 3.10. A Technical Memorandum prepared by the Consultant outlining the calibration process is included in **Appendix 3.1.1** and a CD with the results of the water system evaluation along with the model input and ouput reports is provided in the Exhibits and Appendicies.

3.2 Water Quality Analysis

Water Quality Laboratory Certifications

The City of Spokane Water Department Water Quality Laboratory ("WQL") is certified by the Department of Ecology to perform both bacteriological and analytical tests. The Bacteriological tests consist of Heterotrophic Plate Counts, Colilert Total/Fecal coliform Presence/Absence, and Colilert Total/Fecal coliform enumeration. The Analytical tests include total and residual chlorine analysis, alkalinity, total dissolved solids, turbidity, pH, conductivity, and total hardness.

Sample Collection and Analysis

The WQL is responsible for collecting at least 120 samples per month representative of the distribution system and analyzing them for the presence/absence of total and fecal coliforms and chlorine residual. The WQL also is responsible for collecting and analyzing system health samples and through the use of Heterotrophic Plate Counts determine where and when flushing is required. Quarterly samples are also collected from the wells for required analytical work such as volatile organic compounds. This analytical work is performed at Anatek Laboratory and North Creek Analytical Laboratory. Periodically, the lab also collects distribution system samples to be tested for Lead and Copper in at risk areas. The laboratory is also responsible for analyzing samples taken at the sites of new construction for total/fecal coliforms.

Surface Water Infiltration

In order to ensure that the City's wells are not being contaminated by the river, the WQL also monitors Well Electric and Parkwater wells for signs of surface water infiltration every week. During high river elevation this monitoring is performed daily. In addition, once a month, all running wells are analyzed for signs of surface water infiltration.

Water Quality Reports

The City of Spokane's drinking water is of very high quality. To maintain this valuable asset, the City conducts many different tests at varying intervals to confirm that the water delivered to customers remains a very high quality product. The Environmental Programs Department of the City has summarized the test results in reports titled "Report on Spokane Drinking Water Quality". The latest report is for 2014 and is provided in **Appendix 3.2.1**.

Since 1999, the City of Spokane has issued to each customer on an annual basis its "Water Quality Consumer Confidence Report (CCR)." The CCR informs each customer about the excellent quality of water supplied to them and provides tips and encouragement for aquifer protection and water conservation. The report also lists emergency contact phone numbers. A copy of the latest report is in **Appendix 3.2.2**. Water Quality is further discussed in Chapter 6.

3.3 Source Description and Condition

Well Electric Well Station (DOH Source #S02)

The oldest operating Well Station in the water system, Well Electric Well Station is located adjacent to the Spokane River within the Upriver Complex. The Well Station consists of two large 48 foot diameter wells. The wells are adjacent to each other in a north-south orientation. The City identifies the north well as Well No. 4 and the south well as Well No. 5

Well No. 4 contains a single 900 horsepower (hp) horizontal centrifugal pump that provides water to the North Hill Pressure Zone. Well No. 5 supplies water to three pumps. One pump, another 900 hp horizontal centrifugal, also pumps water to the North Hill Pressure Zone. The second pump, a 900 hp vertical turbine pump lifts water to the Intermediate Pressure Zone. The third pump is a 1,000 hp vertical turbine pump that lifts water to the Low Pressure Zone. In 2013, the Well Electric station provided 28.9 percent of the entire water system supply. Typical outlet pressures for the station are 180, 140, and 80 psi for the Intermediate, North Hill, and Low systems, respectively. Pump inlet suction elevations at this station are approximately elevation 1865.7 feet. The minimum recorded water level in the well during pumping is 1887.5 feet, which leaves sufficient submergence of the pump intakes. The two vertical turbine, high efficiency pumps were installed in 1996 as replacements for two less efficient horizontal centrifugal pumps.

The maximum total instantaneous withdrawal rate for the well station is 39,300 gpm, which is the total nameplate capacity of the pumps. The total capacity of the wells exceeds the pumping capacity, but the actual potential yield of the well station is unknown to the City. The water right allows 54,750 gpm.

Due to its close proximity to the Spokane River, from 1998 through 2001 Well Electric was intensively studied to determine if it was ground water under the influence of surface river water. The study concluded with monthly samples taken throughout 2001 for Microscopic Particulate Analysis. The conclusion is there is no river influence during normal operation. However, during certain flood stages in the river the well is flooded by the river at which times the well is shut down until normal operations can again resume.

As mentioned above, this is the oldest well in the system. However, it is in good condition. Historically, there have been no significant variations in source capacity or water table levels at or near this site. The well and pumps are in good condition, showing no signs of diminished performance. The well station piping also shows no signs of deterioration and is in good condition.

Parkwater Well Station (DOH Source #S03)

The Parkwater Well Station is located 1/2 mile south and east of the Well Electric Well Station. Completed in 1949, the Parkwater Well Station houses eight pumps in four 18 foot diameter hand dug wells. The wells are adjacent to each other in an east-west orientation. The City identifies the east well as Well No. 1 and continues the numbering scheme westward with the west well being Well No. 4. All of the pumps are vertical lineshaft turbine pumps. Six pumps are 600 hp and supply water to the Low Pressure Zone with typical outlet pressures of 68 psi. The two remaining pumps include a 900 hp unit, and a 1,000 hp unit that supply water to the Intermediate Pressure Zone at an outlet pressure of

145 psi. The 1,000 hp pump was installed in 2003 replacing a less efficient low system (600 hp) pump to improve energy efficiency and pumping redundancy to the Intermediate Pressure Zone. Pump inlet suction elevations at this station are approximately elevation 1870.0 feet. The minimum recorded water level in the well during pumping is 1887.5 feet, which leaves sufficient submergence of the pump intakes. The Parkwater Well Station in 2013 supplied 33.2 percent of the entire water system demand.

The maximum total instantaneous withdrawal rate of the well station is 63,000 gpm, which is the total nameplate capacity of the pumps and also the maximum allowed per the water right. The total yield of the wells exceeds the pumping capacity, but the actual potential yield of the well station is unknown to the City.

Historically, there have been no significant variations in source capacity or water table levels at or near this site. The well and pumps are in good condition, showing no signs of diminished performance. The well station piping also shows no signs of deterioration and is in good condition.

Nevada Well Station (DOH Source #S01)

At the intersection of Nevada Street and North Foothills Drive is the Nevada Well Station. The Nevada Well Station supplies water to the Low Pressure Zone. The Well Station has two 400 hp submersible pumps that were installed in 1956 and two 800 hp vertical turbine pumps that were installed in 2003 to replace two older less efficient pumps and to improve station redundancy. Typical outlet pressures at this station are 68 psi. Pump inlet suction elevations at this station are approximately elevation 1,846 feet. The minimum recorded water level in the well during pumping is 1,855.37 feet, which leaves sufficient submergence of the pump intakes. In 2013, the Nevada Well Station supplied 14.4 percent of the total water system demand.

The maximum instantaneous withdrawal rate of the well station is 25,000 gpm which is the amount allowed per the water right. The actual pumping capacity is 31,000 gpm, which equates to the total capacity of the pumps. The total yield of the well exceeds the water right, but the actual potential yield of the well station is unknown to the City.

Historically, there have been no significant variations in source capacity or water table levels at or near this site. The well and pumps are in good condition, showing no signs of diminished performance. The well station piping also shows no signs of deterioration and is in good condition.

Grace Avenue Well Station (DOH Source #S06)

Located directly East of the Nevada Well Station is the Grace Avenue Well Station. It houses two identical 900 hp vertical line shaft turbine pumps that occupy a single 18 foot diameter well. This Well Station supplies water to the North Hill Pressure Zone, at a discharge pressure of 110 psi. The suction bells of the pumps are at elevation 1,849.87 feet, whereas the lowest observed low water level in the well was 1,859.37 feet, which leaves sufficient submergence of the pump intakes. The Grace Avenue Well Station in 2013 supplied 8.2 percent of the total water system demand.

The maximum instantaneous withdrawal rate of the well station is 19,000 gpm, which is the total nameplate capacity of the pumps. The total yield of the well exceeds the pumping

capacity, but the actual potential yield of the well station is unknown to the City. The water right allows 31,000 gpm.

Historically, there have been no significant variations in source capacity or water table levels at or near this site. The well and pumps are in good condition, showing no signs of diminished performance. The well station piping also shows no signs of deterioration and is in good condition.

Ray Street Well Station (DOH Source #S04)

The Ray Street Well Station is located at the intersection of Ray Street and Hartson Avenue at the base of the South Hill. The Ray Street Well Station pumps water to the Intermediate Pressure Zone. The Well Station houses two 24 foot diameter wells. The wells are adjacent to each other in a north-south orientation. The City identifies the north well as Well No. 1 and the south well as Well No. 2. The Station contains three 900 hp vertical turbine pumps, two pumps in Well No. 1 and a single pump in Well No. 2. The suction bells of the pumps are positioned at approximate elevation 1,858 feet. Maximum observed drawdown has been to elevation 1,868.37 feet, which leaves sufficient submergence of the pump intakes. The pressure normally observed at the outlet of the Ray Street well is 157 psi. This well station in 2013 supplied 6.8 percent of the total water system demand.

The maximum instantaneous withdrawal rate of the well station is 21,550 gpm, which is the total nameplate capacity of the pumps. The total yield of the wells exceeds the pumping capacity, but the actual potential yield of the well station is unknown to the City. The water right allows 24,850 gpm.

Historically, there have been no significant variations in source capacity or water table levels at or near this site. The well and pumps are in good condition, showing no signs of diminished performance. The well station piping also shows no signs of deterioration and is in good condition.

Hoffman Well Station (DOH Source #S05)

Hoffman Well Station is located on Hoffman Avenue at the intersection of Crestline Street on the north side of the City. The Well Station houses two 16 foot diameter wells, 40 feet apart, in an east-west orientation. The City identifies the west well as Well No. 1 and the east well as Well No. 2. Each well contains a 600 hp vertical line shaft turbine pump. Pump suctions are at elevation 1,843.37 feet. The maximum observed drawdown pumping level has been to elevation 1,859.37 feet, which leaves sufficient submergence of the pump intakes. Normal outlet pressure for the pumps is 55 psi. Hoffman Well Station in 2013 supplied 1.5 percent of the total water system demand. The maximum instantaneous withdrawal rate of the well station is 10,920 gpm, which is the total nameplate capacity of the pumps. The total yield of the wells exceeds the pumping capacity, but the actual potential yield of the well station is unknown to the City. The water right allows 11,600 gpm.

Historically, there have been no significant variations in source capacity or water table levels at or near this site. The pumps and west well are in good condition. The well station piping also shows no signs of deterioration and is in good condition. Analysis is being done to determined if the existing well should be rehabilitated or if a new well should be drilled at this location.

Central Avenue Well Station (DOH Source #S08)

Pump inlet suction elevations at this station are approximately elevation 1,846 feet. The minimum recorded water level in the well during pumping is 1,855.37 feet, which leaves sufficient submergence of the pump intakes.

The Central Avenue Well Station is the most northerly Well Station in the system, being located on Central Avenue two blocks west of Division Street. The Well Station has two 7 foot diameter wells. The wells are approximately 130 feet apart in a southwest-northeast orientation. The City identifies the southwest well as Well No. 1 and the northeast well as Well No. 2. Well No. 1 contains one 450 hp submersible pump and Well No. 2 contains two 450 hp submersible pumps. Normal outlet pressure is 55 psi. In 2013 Central Avenue Well Station provided 7.0 percent of the total annual water system demand.

The maximum instantaneous withdrawal rate of the well station is 11,900 gpm, which is the total nameplate capacity of the pumps. The total yield of the wells exceeds the pumping capacity but the actual potential yield is unknown to the City. The water right allows 30,900 gpm.

Historically, there have been no significant variations in source capacity or water table levels at or near this site. The Central Avenue Well station is currently in the CIP for rehabilitation. Well No. 1 is planned for rehabilitation in 2016 and Well No.2 in 2018. Details for the Central Avenue Well Rehabilitation projects are are provided in Chapter 8.

3.4 Source Capacity Analysis

With information provided by land use planners regarding population and land growth within the water service area of the City (as discussed in Chapter 2, Table 2.2.3, specifically), water use demands were extrapolated into the future for 6 and 20 years. To determine the maximum day demand (production requirements), the average day demands were increased uniformly by the 3.2 peaking factor addressed in Chapter 2.

As earlier indicated, the distribution area is divided into various pressure zones due to the terrain. However, only three zones – LOW, INTERMEDIATE, and NORTH HILL – have Well Pump Stations and all the other zones have their source pumping by means of Booster Stations. Thus, for total quantity of water pumped, only pumpage at the well stations are considered.

Table 3.4.1 shows the comparison of present Well Station capacity compared to the current and future water needs. As shown, the name plate capacities far exceed the anticipated demand. Hence, the current supply system coupled with conservation has the potential to serve the City of Spokane for many more years into the future.

TABLE 3.4.1
Source Capacity and Future Demands

		Maximum Day Demand (MGD) (including unaccounted water)				
			w/o Conservation		With Conservation	
Supply Well	**Capacity MGD**	**2013**	**2018**	**2033**	**2018**	**2033**
		Low Zone System				
Nevada Street	44.6					
Well Electric	21.6					
Parkwater	69.0					
Total Capacity	135.2	86.4	91.5	109.0	90.9	103.7
		Intermediate Zone System				
Well Electric	10.8					
Parkwater	21.7					

TABLE 3.4.1
Source Capacity and Future Demands (continued)

		Maximum Day Demand (MGD) (including unaccounted water)				
			w/o Conservation		With Conservation	
Supply Well	**Capacity MGD**	**2013**	**2018**	**2033**	**2018**	**2033**
Ray Street	26.9					
Total Capacity	59.4	41.6	44.2	52.6	43.5	49.2
		North Hill Zone System				
Well Electric	24.2					
Grace	23.0					
Hoffman	7.9					
Central	17.1					
Total Capacity	72.2	51.3	54.3	64.7	53.5	60.7

3.5 Booster Pump Station Capacity Analysis

A Booster Station with its booster pumps provides the means of conveying water from lower pressure zones to higher pressure zones. **Table 3.5.1** summarizes the capacities and demands of each Booster Station throughout the system.

TABLE 3.5.1
Booster Pump Station Capacity and Future Water Demands
City of Spokane Water Department

			Maximum Day Demand, MGD (including unaccounted water)				
				w/o Conservation		With Conservation	
Pressure Zone Serviced	**Booster Pump Station**	**Pump Capacity (MGD)**	**2005**	**2012**	**2026**	**2012**	**2026**
Intermediate*	9th and Pine	11.09					
	Bishop Court	9.22					
Total Intermediate		20.31	8.54	9.34	11.16	8.65	9.75
High	Lincoln Heights	56.30					
	14th & Grand	9.22					
Total High		65.52	24.40	26.70	31.92	24.73	27.86
Top	Division Manito	3.46					
	Garden Park	17.70					
	35th & Ray	15.84					
Total Top		37.00	15.40	16.84	20.13	15.56	17.56

TABLE 3.5.1
Booster Pump Station Capacity and Future Water Demands
City of Spokane Water Department (continued)

			Maximum Day Demand, MGD (including unaccounted water)				
				w/o Conservation		With Conservation	
Pressure Zone Serviced	**Booster Pump Station**	**Pump Capacity (MGD)**	**2005**	**2012**	**2026**	**2012**	**2026**
Glennaire	Glennaire	2.39	1.30	1.42	1.42	1.32	1.32
Midbank	Belt Street	3.84	1.20	1.31	1.57	1.22	1.38
Shawnee	Shawnee	1.61	0.20	0.22	0.26	0.21	0.23
Five Mile	Five Mile	5.81	2.50	2.73	3.27	2.53	2.86
Kempe	Kempe	5.47					
Highland	Milton Street	2.3					
	Sunset	0.72					
Total Highland		4.02	1.30	1.42	1.70	1.32	1.49
Woodland							
	West Drive	2.30					
Total Woodland		3.96	0.40	0.44	0.52	0.41	0.46
Southview	Southview	1.30	0.10	0.11	0.13	0.11	0.12
Eagle Ridge	Eagle Ridge	6.91	1.60	1.75	2.09	1.62	1.83
Cedar Hills	Cedar Hills	1.51	0.01	1.05	1.25	0.97	1.10
SIA	Thorpe Road	10.62					
	West Drive	8.64					
SIA Total		19.26	5.20	5.68	6.79	5.26	5.93
Plains	Spotted Road	8.12	2.30	2.51	3.00	2.33	2.62
Eagle Ridge II	Eagle Ridge II	7.20	0.23	0.25	0.30	0.24	0.27
Woodridge	Woodridge	0.72	0.41	0.45	0.54	0.42	0.48
Low	Latah**	23.04					

* These two Intermediate Pressure Zone booster stations pump from the Low System augmenting the supply from the well stations, see Table 3.4.1.

** The Latah Station is an in-line pressure booster and does not add to the capacity.

3.6 Treatment

The water that the Water Department pumps from the Spokane Valley/Rathdrum Prairie Aquifer is a high quality product in its natural state. However, the Water Department chooses to inject gaseous chlorine at each wellhead to disinfect the raw water. This step is vital in the effort to protect the health of the customers and the public-at-large.

A 0.2 parts per million (ppm) or milligram per liter (mg/l) free chlorine residual is maintained throughout the water system to ensure proper disinfection and prevent bacterial growth within the system.

Additionally, the Water Department has an ongoing program that monitors the chlorine residual within the water system. The monitoring involves routine testing for the chlorine residual at various points throughout the system with particular attention being given to those water mains farthest from the well stations. Chlorine residuals are taken at least 120 times per month at sampling sites located throughout the system. Monitoring efforts are increased during seasons of low water demand for further assurance that chlorine residuals are being properly maintained.

Additionally, to assure the customer receives the highest quality water, the City conducts many other water quality tests at varying intervals to confirm that no reduction of water quality takes place.

3.7 Storage Description and Condition

Each pressure zone, with the exception of the Northwest Terrace Pressure Zone, and Hatch Road Pressure Zone, has at least one storage reservoir. In many pressure zones, more than one reservoir has been built for redundancy and operational purposes. **Table 3.7.1** gives a general description of the various reservoirs found in the water system. This table indicates the volume of storage, the zone served, the type of material, the turnover rate of water, and the date of construction for each of the thirty reservoirs.

Each reservoir is inspected weekly and is assessed for any reportable damage and/or deterioration. The operations staff has also conducted an assessment of each reservoir and determined they are in excellent condition and have a predicted life expectancy in excess for 50 years from 2006.

TABLE 3.7.1
City Of Spokane Water Department
Reservoirs And Storage

Hydraulic Zone	Reservoir Name & Age	Type	Diameter or Size	Average Rate of Water Turnover	Reservoir Storage (MG)	Zone Storage (MG)
Low	Shadle (1965)	Steel Reservoir	107 feet	2 days	4.80	28.75
	Rockwood Vista (1948)	Underground Concrete	2-1/2 acres		11.00	
	9th & Pine (1964)	Steel Reservoir	260 feet		7.20	
	West Blvd. (1956)	Steel Reservoir	72 feet		1.00	
	Thorpe (1983)	Steel Reservoir	104 feet		3.50	
	Qualchan (1992)	Concrete with liner	71 feet		1.25	
Intermediate	14th & Grand (2005)	Rivet Steel Standpipe	34 feet	6.5 days	0.52	20.52
	Lincoln Heights # 1 (1995)	Concrete w/liner	240 feet		10.00	
	Lincoln Heights # 2 (1995)	Concrete w/liner	240 feet		10.00	
High	Garden Park (1956)	Steel Reservoir	65 feet	1.5 days	3.10	4.35
	33rd & Lamonte (1930)	Elevated Riv. Steel Tank	78 feet		1.25	
Top	Brown Park #1 (1958)	Steel Reservoir	160 Feet	3 days	5.00	10.00
	Brown Park #2 (1990)	Steel Reservoir	160 Feet		5.00	
Glennaire	Glennaire #1 (1958)	Concrete w/sealer	43.33 feet x 47 feet	10 days	.15	1.15
	Glennaire #2 (1991)	Concrete w/liner	75 Feet		1.00	
North Hill	North Hill (1986)	Steel Reservoir	200 feet	3 days	10.80	25.60
	Five Mile (1956)	Steel Reservoir	240 feet		10.20	
	Indian Trail (1996)	Concrete w/liner	140 feet		4.60	
Midbank	Midbank (1960)	Steel Standpipe	40 feet	5 days	0.58	0.58
Indian Hills	Indian Hills (1995)	Steel Standpipe	14 feet	2 days	0.03	0.03
Shawnee	Shawnee #1 (1978)	Steel Reservoir	15 feet	6 days	0.02	0.074

TABLE 3.7.1
City Of Spokane Water Department
Reservoirs And Storage (continued)

Hydraulic Zone	Reservoir Name & Age	Type	Diameter or Size	Average Rate of Water Turnover	Reservoir Storage (MG)	Zone Storage (MG)
	Shawnee #2 (1993)	Steel Reservoir	25 feet		0.054	
Five Mile	Strong Road (1982)	Steel Standpipe	55 feet	12 days	2.00	2.00
Kempe	Kempe (2010)	Steel Standpipe	38 feet		1.1	1.1
Highland	Highland (1966)	Steel Standpipe	40 feet	3 days	1.00	1.00
Woodland	Sunset (1968)	Steel Reservoir	50 feet	6 days	0.35	0.35
SIA	SIA #1 (1935)	Rivet Steel Elev. Tank	48 feet	4.5 days	0.50	4.50
	SIA #2 (1984)	Steel Standpipe	78 feet		4.00	
Southview	Southview (1996)	Steel Standpipe	14 feet	2.4 days	0.048	0.048
Eagle Ridge	Eagle Ridge 1995)	Steel Reservoir	62 feet	4.0 days	0.542	0.542
Cedar Hills	Cedar Hills (1999)	Steel Reservoir	52 feet	8.0 days	0.30	0.30
Plains	Mallen Hill (1985)	Steel Reservoir	110 feet	10.0 days	4.00	4.00
NW Terrace	No Reservoir					
Hatch Road	No Reservoir					
Eagle Ridge 2	Eagle Ridge 2	Steel Reservoir	40	8.5 days	1.22	1.22
Wood Ridge	Wood Ridge	Steel Reservoir	42	7.6 days	.228	.228
				Total Storage		**105.492 mg**

3.8 Storage Capacity Analysis

Each individual pressure zone was analyzed for storage adequacy. Operational Storage (OS), Equalization Storage (ES), Fire Suppression Storage (FSS), Standby Storage (SB), and Dead Storage (DS) were all reviewed as part of the evaluation for each pressure system.

With the exception of the Glennaire and Eagle Ridge pressure zones, equalization storage needs for each of the pressure zones and reservoirs calculated out to be zero. The Water Department's long time standard has been to size pumping stations to meet the maximum day demand (MDD) for the system they serve with the largest pump out of service. Since equalization storage is calculated by taking the peak hour demand (PHD) less the sum of all installed and active sources of supply over a given amount of time (150 minutes), and the City's ratio of PHD to MDD is less than 2 with all pumps in service, most pressure zones are able to operate without the use of equalization storage.

The effective storage for each reservoir and pressure system was calculated by removing both the operational storage and the dead storage from the overall volume of the tank. The remaining storage capacity of the reservoir is considered the "effective storage", and it is the amount of water available for emergency use. "Effective storage" for each pressure zone is shown in **Table 3.8.1**. With the consolidation, or "nesting", of the fire suppression storage and the standby storage, the WSDM dictates that the larger of these two storage elements, plus any required equalization storage, becomes the "required storage" for the system. These values are also shown in **Table 3.8.1.** A letter from the Fire Marshall allowing the practice of consolidating the FSS and the SB is contained in **Exhibit 3.8.1** of the appendix.

Each of the City of Spokane's reservoirs has more than one source of supply, as defined by the DOH's Water System Design Manual (WSDM). Therefore, the Standby Storage for each of the pressure zones was calculated based upon Equation 9-3 of the WSDM which is expressed as: $SB=(2\ Days)(ADD)(N)-t_m(Q_s-Q_l)$. Using this equation, the standby storage for each and every pressure zone calculated out to be zero. The robust size and redundancy of sources to each reservoir are great enough, in every case, to adequately supply the system without being required to relying upon emergency storage. However, the WSDM recommends that the SB volume not be less than 200 gallons/ERU. This becomes the required standby storage volume. **Table 3.8.2** shows the Operational Storage (OS), the Equalization Storage (ES), the Standby Storage (SB), the Fire Suppression Storage (FSS), and the Dead Storage for each of the City's reservoirs.

Fire suppression storage for each pressure zone has been determined by the City of Spokane Fire Department, or appropriate fire protection authority in locations of the service area outside the City of Spokane. The amount of the fire suppression storage required is based on the largest fire demand anticipated as dictated by building types within the pressure zone.

Due to the topography of the City's service area coupled with the City's capability to pump MDD, there are isolated incidences where individual reservoirs serving some intermediate or remote pressure zones may not have all the storage required to fulfill standby or fire suppression needs. However, due to the department's two operation centers which are staffed 24 hours a day year round and the availability of immediate on-call work crews, reservoirs which lie in-line and above the pressure zone in question can be brought into

emergency service in times of need. Department staff is able to monitor system operation through the SCADA system and can operate sources of supply remotely should an unusual emergency need arise. Should a pressure zone need additional emergency storage supply, the reserve capacity of the reservoirs at a higher hydraulic grade line can quickly be made available to the pressure zone below. The summation of "total available emergency storage" for each pressure zone is shown in **Table 3.8.1**. A listing of which storage facilities are available to provide addition emergency storage to each pressure zone are listed in **Table 3.8.3.**

Table 3.8.1 also summarizes the existing storage compared to the current, 6 years, and 20 years required storage.

TABLE 3.8.1
Storage Capacity and Demand
City of Spokane Water Department

					Storage Required (MG)				
						w/o Conservation		With Conservation	
Pressure Zone Served	**Reservoir Name**	**Total Capacity (MGD)**	**Effective Storage**	**Total Available Emergency Storage**	**2005**	**2012**	**2026**	**2012**	**2026**
Low	Shadle Park	4.8							
	Rockwood Plaza	11.0							

TABLE 3.8.1
Storage Capacity and Demand
City of Spokane Water Department (continued)

Pressure Zone Served	Reservoir Name	Total Capacity (MGD)	Effective Storage	Total Available Emergency Storage	Storage Required (MG)				
						w/o Conservation		With Conservation	
					2005	2012	2026	2012	2026
	9th & Pine	7.2							
	West Drive	1.0							
	Thorpe Road	3.5							
	Qualchan	1.25							
	Total	28.75	14.11	49.50	7.68	8.40	10.03	7.78	8.76
Intermediate	14th & Grand	0.52							
	Lincoln Heights #1	10.0							
	Lincoln Heights #2	10.0							
	Total	20.52	19.13	27.02	2.03	2.22	2.65	2.06	2.32
High	Garden Park	3.10							
	33rd & Lamonte	1.25							
	Total	4.35	1.10	7.94	1.93	2.11	2.53	1.95	2.21
Top	Browne Park #1	5.0							
	Browne Park #2	5.0							
	Total	10.0	5.71	6.84	2.24	2.45	2.93	2.27	2.56
Glennaire	Glennaire #1	0.15							
	Glennaire #2	1.0							
	Total	1.15	1.08	1.12	0.25	0.25	0.25	0.25	0.25
North Hill	North Hill	10.8							
	5-Mile	10.2							
	Indian Trail	4.6							
	Total	25.6	14.00	15.72	7.72	8.43	10.08	7.81	8.81
Midbank	Midbank	0.58							
	Total	0.58	0.36	0.36	0.21	0.21	0.21	0.21	0.21
Indian Hills	Indian Hills	0.03							
	Total	0.03	0.0*	1.07	0.21	0.21	0.21	0.21	0.21
Shawnee	Shawnee #1	0.020							
	Shawnee #2	0.054							
	Total	0.074	0.06	0.27	0.21	0.21	0.21	0.21	0.21
Five Mile	Strong Road	2.0							
	Total	2.0	1.07	1.07	0.22	0.24	0.29	0.22	0.26

TABLE 3.8.1
Storage Capacity and Demand
City of Spokane Water Department (continued)

Pressure Zone Served	Reservoir Name	Total Capacity (MGD)	Effective Storage	Total Available Emergency Storage	Storage Required (MG)				
						w/o Conservation		With Conservation	
					2005	2012	2026	2012	2026
Highland	Highland	1.0							
	Total	1.0	0.47	0.71	0.68	0.68	0.68	0.68	0.68
Woodland Heights	Sunset	0.35							
	Total	0.35	0.32	0.32	0.68	0.68	0.68	0.68	0.68
Geiger Heights	Geiger Heights	0.25							
	Total	0.25	0.23	0.23	0.21	0.21	0.21	0.21	0.21
SIA	SIA #1	0.5							
	SIA #2	4.0							
	Total	4.5	2.05	5.76	1.44	1.44	1.44	1.44	1.44
Southview	Southview	0.05							
	Total	0.05	0.05	0.05	0.21	0.21	0.21	0.21	0.21
Eagle Ridge	Eagle Ridge	0.54							
	Total	0.54	0.50	1.27	0.24	024	0.24	0.24	0.24
Cedar Hills	Cedar Hills	0.3							
	Total	0.3	0.27	0.27	0.21	0.21	0.21	0.21	0.21
Plains	Mallen Hill	4.0							
	Total	4.0	3.71	3.71	1.44	1.44	1.44	1.44	1.44
Hatch Road	No Reservoir	0	0	6.84	0.21	0.21	0.21	0.21	0.21
Northwest Terrace	Reservoir planned for 2008	0	0	65.2	1.61	1.76	2.10	1.63	1.84
Eagle Ridge #2	Eagle Ridge #2	1.22							
	Total	1.22	0.77	0.77	0.21	0.21	0.21	0.21	0.21
Woodridge	Woodridge	0.23							
	Total	0.23	0.21	0.21	0.21	0.21	0.21	0.21	0.21

* This pressure zone is normally served from the Strong Road Reservoir through a pressure reducing valve thereby providing adequate “effective storage”.

TABLE 3.8.2
Storage Summary
City of Spokane Water Department

Pressure Zone Served	Facility Name	Operational Storage	Dead Storage	Required Standby Storage	Required Fire Storage	Required Equalization Storage
Low	9th & Pine	2,385,890	0			
	Qualchan	184,431	388,697			
	Rockwood Vista	3,374,233	0			
	Shadle Park	553,346	2,666,549			
	Thorpe Rd	395,716	1,593,664			
	West Dr	220,106	140,953			
	Total			7,681,695	1,440,000	0
Intermediate	14th & Grand	123,079	296,531			
	Lincoln Heights #1	5,073,913	0			
	Lincoln Heights #2	5,073,913	0			
	Total			2,026,994	960,000	0
High	33rd & Lamonte	560,228	491,628			
	Garden Park	496,233	1,192,945			
	Total			1,934,154	675,000	0
Top	Brown Park #1	1,503,382	1,846,153			
	Brown Park #2	1,503,382	1,846,153			
	Total			2,244,826	960,000	0
Glennaire	Glennaire #1	8,461	0			
	Glennaire #2	163,515	0			
	Total			110,616	210,000	38,125
Southview	Southview	17,265	150	14,000	210,000	0
Woodridge	Woodridge	51,796	0	65,000	210,000	0
Shawnee	Shawnee #1	9,553	0			
	Shawnee #2	29,363	0			
	Total			12,524	210,000	0
Geiger Heights	Geiger Heights	140,942	1,221	80,453	210,000	0
Woodland Heights	Sunset	102,770	0	45,889	675,000	0
Highland	Highland	187,923	519,512	174,958	675,000	0
SIA	SIA #1	270,609	0			
	SIA #2	685,636	2,374,894			
	Total			460,323	1,440,000	0
Plains	Mallen Hill	1,065,874	126,484	1,036,800	1,440,000	0
Eagle Ridge	Eagle Ridge	112,871	0	21,714	210,000	27,083
Eagle Ridge #2	Eagle Ridge #2	234,903	318,153	34,512	210,000	0
Cedar Hills	Cedar Hills	79,397	10,004	97,522	210,000	0
Five Mile	Strong Rd	177,646	1,184,897	223,557	210,000	0
Indian Hills	Indian Hills	5,755	0	21,532	210,000	0
Midbank	Midbank	46,981	198,540	107,039	210,000	0

TABLE 3.8.2
Storage Summary
City of Spokane Water Department (continued)

Pressure Zone Served	Facility Name	Operational Storage	Dead Storage	Required Standby Storage	Required Fire Storage	Required Equalization Storage
North Hill	North Hill	2,266,818	3,201,733			
	Five Mile	3,348783	0			
	Indian Trail	1,151,027	1,355,909			
	Total			7,715,598	1,440,000	0

TABLE 3.8.3
Available Emergency Storage
City of Spokane Water Department

Pressure Zone Served	Storage Facility Name (without zone)	Additional Emergency Storage Facility Names	Source System of Emergency Storage
Low	9th & Pine	Sunset	Woodland Heights
	Qualchan	Highland	Highland
	Rockwood Vista	Geiger Heights	Geiger Heights
	Shadle Park	SIA #1	SIA
	Thorpe Rd	SIA #2	SIA
	West Dr	Mallen Hill	Plains
		Cedar Hills	Cedar Hills
		Eagle Ridge #1	Eagle Ridge
		Eagle Ridge #2	Eagle Ridge #2
		14th & Grand	Intermediate
		Lincoln Heights #1	Intermediate
		Lincoln Heights #2	Intermediate
		33rd & Lamonte	High
		Garden Park	High
		Brown Park #1	Top
		Brown Park #2	Top
		Glennaire #1	Glennaire
		Glennaire #2	Glennaire
		Southview	Southview
Intermediate	14th & Grand	33rd & Lamonte	High
	Lincoln Heights #1	Garden Park	High
	Lincoln Heights #2	Brown Park #1	Top
		Brown Park #2	Top
		Glennaire #1	Glennaire
		Glennaire #2	Glennaire
		Southview	Southview
High	33rd & Lamonte	Brown Park #1	Top
	Garden Park	Brown Park #2	Top
		Glennaire #1	Glennaire
		Glennaire #2	Glennaire
		Southview	Southview
Top	Brown Park #1	Glennaire #1	Glennaire
	Brown Park #2	Glennaire #2	Glennaire
		Southview	Southview

TABLE 3.8.3
Available Emergency Storage
City of Spokane Water Department (continued)

Pressure Zone Served	Storage Facility Name (without zone)	Additional Emergency Storage Facility Names	Source System of Emergency Storage
Glennaire	Glennaire #1	Southview	Southview
	Glennaire #2		
Southview	Southview		
Woodridge	Woodridge		
Shawnee	Shawnee #1	Woodridge	Woodridge
	Shawnee #2		
Geiger Heights	Geiger Heights		
Woodland Heights	Sunset		
Highland	Highland	Geiger Heights	Geiger Heights
SIA	SIA #1	Mallen Hill	Plains
	SIA #2		
Plains	Mallen Hill		
Eagle Ridge	Eagle Ridge	Eagle Ridge #2	Eagle Ridge #2
Eagle Ridge #2	Eagle Ridge #2		
Cedar Hills	Cedar Hills		
Five Mile	Strong Rd		
Indian Hills	Indian Hills	Strong Rd	Five Mile
Midbank	Midbank		
North Hill	North Hill	Indian Hills	Indian Hills
	Five Mile	Shawnee #1	Shawnee
	Indian Trail	Shawnee #2	Shawnee
		Woodridge	Woodridge
		Midbank	Midbank
		Strong Rd	Five Mile
Hatch Rd	Fed by PRV Station	Brown Park #1	Top
		Brown Park #2	Top
		Glennaire #1	Glennaire
		Glennaire #2	Glennaire
		Southview	Southview
Northwest Terrace	Fed by PRV Station	North Hill	North Hill
		Five Mile	North Hill
		Indian Trail	North Hill
		Indian Hills	Indian Hills
		Shawnee #1	Shawnee
		Shawnee #2	Shawnee
		Woodridge	Woodridge
		Midbank	Midbank
		Strong Rd	Five Mile
		9^{th} & Pine	Low
		Qualchan	Low
		Rockwood Vista	Low
		Shadle Park	Low
		Thorpe Rd	Low

TABLE 3.8.3
Available Emergency Storage
City of Spokane Water Department (continued)

Pressure Zone Served	Storage Facility Name (without zone)	Additional Emergency Storage Facility Names	Source System of Emergency Storage
		West Drive	Low
		Sunset	Woodland Heights
		Highland	Highland
		Geiger Heights	Geiger Heights
		SIA #1	SIA
		SIA #2	SIA
		Mallen Hills	Plains
		Cedar Hills	Cedar Hills
		Eagle Ridge #1	Eagle Ridge
		Eagle Ridge #2	Eagle Ridge #2
		14th & Grand	Intermediate
		Lincoln Heights #1	Intermediate
		Lincoln Heights #2	Intermediate
		33rd & Lamonte	High
		Garden Park	High
		Brown Park #1	Top
		Brown Park #2	Top
		Glennaire #1	Glennaire
		Glennaire #2	Glennaire
		Southview	Southview

3.9 Distribution/Transmission System

Pipe System

Shown on **Table 3.9.1** is a summary of the length, size, age and type of pipes within the distribution/transmission system. The system is comprised of pipe sizes ranging from two (2) inches to 48 inches in diameter. Several pipe types also serve the system.
As shown, many of the larger diameter pipelines are older, and as a result, the City is actively working on rehabilitation and replacement programs for this aging infrastructure.

Table 3.9.1

City of Spokane Water Department – Type & Age of Pipelines

Material	Diameter (in.)	0-25 Yrs	25-50 Yrs	50+ Yrs	Grand Total
Cast Iron	1.3			145.0	145.0
	2		1,627.0	3,797.0	5,424.0
	4	60.0	16,990.0	27,534.0	44,584.0
	6	705.0	705,836.0	1,466,375.0	2,172,916.0
	8		223,827.0	183,060.0	406,887.0
	10	2,600.0	60,321.0	78,275.0	141,196.0
	12	2,600.0	260,594.0	181,577.0	444,771.0
	16		73.0	21,450.0	21,523.0
	18		3,770.0	1,360.0	5,130.0
	20			1,205.0	1,205.0
	24			2,490.0	2,490.0
	30		1,240.0		1,240.0
Cast Iron Total		5,965.0	1,274,278.0	1,967,268.0	3,247,511.0
Ductile Iron	4	21,555.0	11,477.0	660.0	33,692.0
	6	321,586.7	111,762.0	744.0	434,092.7
	8	195,015.4	14,919.0	1,193.0	211,127.4
	10	7,102.0			7,102.0
	12	269,287.7	24,688.0		293,975.7
	18	58,300.0	3,961.0		62,261.0
	20	2,205.0			2,205.0
	24	88,909.7			88,909.7
	30	65,505.0			65,505.0
	36	46,943.0		487.0	47,421.0
	42	4,589.0			4,589.0
Ductile Iron Total		1,080,988.5	166,807.0	3,075.0	1,250,880.5
Galvanized Steel	2	341.0	970.0	6,327.0	7,638.0
	4		609.0	186.0	795.0
Galvanized Steel Total		341.0	1,579.0	6,513.0	8,433.0
Kalamien	4			182.0	182.0
	6		250.0	4,107.0	4,357.0
	10			2,368.0	2,368.0
	12			5,927.0	5,927.0
	14		144.0	153.0	297.0
Kalamien Total		0.0	394.0	12,737.0	13,131.0
PVC	4	700.0			700.0
	6	3,520.0			3,520.0
	8		1,700.0		1,700.0
PVC Total		4,220.0	1,700.0	0.0	5,920.0

Table 3.9.2

City of Spokane Water Department – Type & Age of Pipelines (continued)

Material	Diameter (in.)	0-25 Yrs	25-50 Yrs	50+ Yrs	Grand Total
Steel	6		684.0	660.0	1,344.0
	8		1,048.0	1,740.0	2,788.0
	10		477.0		477.0
	12	335.0	4,914.0		5,249.0
	14			60.0	60.0
	16		48.0	6,726.0	6,774.0
	18	724.0	43,947.0	37,733.0	82,404.0
	24	9,338.0	41,736.0	102,319.0	153,393.0
	28			12,663.0	12,663.0
	30	1,856.0	52,403.0	75,929.0	130,188.0
	36	433.0	8,873.0	55,063.0	64,369.0
	42			970.0	970.0
	48			13,962.0	13,962.0
Steel Total		12,686.0	154,130.0	307,825.0	474,641.0

General Condition

The overall condition of the City's distribution/transmission system is quite good. In many water systems pipeline failures can be attributed to very aggressive soils that attack the outer wall of the pipe or by the water chemistry within the pipe that will eat away at the inner wall. From years of in-field observations of exposed pipes, the Water Department has determined that the system does not experience either aggressive soils (excepting localized "hot spots") or corrosive water. Hence, the City water system deteriorates as a result of aging and not corrosion. Water Department personnel take pride in their pro-active approach to maintaining and improving the water system. A description of the pipeline system components is provided in Chapter 1.

Water/Sewer Line Separation Requirements

Water and sewer line separation requirements are defined in the City's standard plans and details. A cross section showing standard locations is in **Exhibit 3.9.1**.

Location of Dead Ends

Although discouraged, the City does have a number of pipeline dead ends in the distribution system. These dead ends are monitored and flushed as needed to maintain water quality. As allowed through right-of way acquisition, continued development, or other means, dead ends are removed from the system through expansions, upgrades, and improvements.

Frequency, Cause and Type of System Leaks

The Water Department has a full-time leak correlation team. This pro-active approach helps to create a tight system. The correlation crew is continuing its work of monitoring the water system, with special emphasis being placed on the older pipelines and in downtown Spokane. It has been observed that most leaks are the result of a pipe joint failure.

Occasionally, a leak will be found that can be attributed to poor installation practices or pipe damaged by the construction work of others.

Distribution/Transmission System Replacement Program

There are a number of considerations used to prioritize replacement of both transmission and distribution system water mains. These considerations are:

System Integrity

The age of a water main is a major factor used when making decisions relative to maintaining water system integrity. It is important to note however that there are water mains in the system still in service today that were installed over 100 years ago. In many cases, these old water mains still have decades of reliable service left in them. A better indicator of the condition of a portion of the system is the amount of maintenance required to keep it in operation. Areas where the maintenance effort is recognized to be above the norm are given top priority for replacement.

Concrete Paving

Replacement of asphalt with concrete in major intersections is now a fairly common practice. The concrete is superior to asphalt in durability but makes utility maintenance chores more difficult and costly to accomplish. Since concrete intersections are expected to last approximately 50 years, it has become the Water Department's practice to replace all water lines under proposed concrete paving which the Department feels will not last that long. Additionally, whenever possible, valves or other appurtenances which require periodic maintenance are also relocated beyond the bounds of the area where the concrete intersection is constructed.

Asphalt Paving Projects

Careful evaluation of water mains and services under proposed street reconstruction or resurfacing projects is essential to ensure no newly rehabilitated street needs to be cut for repairs to the water system. Consideration is given to the age of the system, the type of joints (Leadite being of primary concern), and the results of leak surveys in determining whether the water system needs major reconstruction ahead of any proposed paving project. In general, if the Department feels that the pipe will not last 20 years, the pipe is replaced.

Cast Iron Pipe with Leadite Joints

Leadite jointed cast iron pipe is similar to lead jointed pipe. Leadite jointed piping has been associated with devastating types of main breaks. These breaks almost always originate at a Leadite poured bell and cause an entire length of pipe to break spirally from end to end. The resulting damage to the street and surrounding area can be severe. There are almost never any warning signs of an impending break of this type. 12" cast iron Leadite poured joint pipe is most frequently involved. Efforts are now being directed at identifying where in the system this joint type exists for purposes of evaluating and prioritizing replacement.

Replacement Due to Leaks

First priority pipeline replacement projects are those that have been found to be leaking. Although sometimes difficult to identify in long term planning and management programs, those areas that have been known to have troublesome leaking are added to the replacement program. Currently, there are no large projects identified in the program for replacement due to identified leaks.

Large Steel Transmission Mains

The very large transmission mains installed 70 to 100 years ago are steel pipe, predominately riveted steel pipe. Over recent years, the Water Department has observed a degradation of the riveted joints. In order to avert catastrophic failure, the Department has initiated a replacement program. Over the last eight years, about 14 miles of pipe have been replaced. Over the next six years, the Department has a program to replace another 13.5 miles and within 20 years, an additional 12.8 miles. Most of the pipe being replaced will be riveted steel, although some welded steel will also be replaced.

Method of Recording Changes

The Water Department maintains a Geographic Information System (GIS) detailing the location and condition of all pipes (transmission and distribution), valves, hydrants, fittings and appurtenances, service locations, pressure zones, booster stations, well stations, and reservoirs. Information from the GIS system is available in a digital format at all times for both office and field personnel (mobile users). Additional products are published regularly from the GIS systems in a variety of formats (tabular report, map graphics, field atlas books, and digital web content).

All updates to the water system GIS are completed in a timely manner as need dictates. Changes normally result from new development, infrastructure improvement, and field verification of system structure. The utility of the GIS system is extended with connections to infrastructure management and utility billing database systems. These systems are employed in such a way that information tracked by outside departments is not unnecessarily reproduced. Additionally, the GIS system is also an information source for both a steady state and extended period hydraulics analysis model. This model tracks and predicts water quality and monitors system growth.

The prioritization of the GIS system for the Water Department have been defined to the programmers as:

1. Maintain the quality and accuracy of exiting GIS System
2. Extend the cross-functionality of water department computer systems
3. Ensure the security, reliability and ease of use for water department computer system users.

Water System Pressures

Water system pressures are monitored on an ongoing basis at the Water System Control Center, located at the Upriver Complex. Abnormal pressures, high or low, are alarmed and are acted upon when received.

Required Valve Locations and Hydrant Spacing

The City of Spokane Water Department standards for valve locations and hydrant spacing are detailed in the City of Spokane Design Standards for New Construction. In general, valves on distribution mains shall be placed at street intersections so as to allow the distribution system to be isolated and shutdown, block by block, for maintenance and repairs with minimal service disruption. Valves on transmission mains are to be located at interconnection points and other points as appropriate to limit the extent of main shut-down for maintenance or repair. Valves are also required between fire hydrants and the water main. Fire hydrants shall be placed within 250 feet of structures, and not more than 500 feet apart. Fire hydrants shall be placed at intersections where practicable, and all hydrant locations shall be reviewed by the City Fire Department or other fire jurisdiction as applicable.

3.10 Summary of System Deficiencies

As part of the hydraulic model calibration a fire flow and Peak Hour Demand (PHD) analysis was completed. The analysis identified seven locations with potential deficiencies mainly due to undersized piping. In addition to the analysis option for resolving each deficiency is presented. The City is currently evaluating the results of this analysis and plans to utilize the hydraulic model further to identify future deficiencies. The Technical Memorandum with the analysis, results and recommendations is presented in **Appendix 3.10.1**.

3.11 Proposed Improvement Projects – Deficiency Related

Regarding the deficiencies referenced in Section 3.10 the capital program outlined in Chapter 8 includes distribution main rehabilitation which is funded annually. To addresses the deficiencies following evaluation and prioritization the projects will identified and corrected with the distribution main rehabilitation capital line item.

Chapter 4

Water Resource Analysis & Water Use Efficiency (WUE)

CHAPTER 4

Water Resource Analysis & Water Use Efficiency (WUE)

4.1 Water Use Efficiency (WUE)

Municipal Water Law Requirements

In 2003, the Washington State Legislature passed the Municipal Water Law ("MWL") to address increasing demands on the state's water resources. In support of this measure and in accordance with WAC 246-290-810, the Department of Health ("DOH") is directed to oversee the Water Use Efficiency ("WUE") Program with the goal of ensuring a safe and reliable drinking water supply.

Water Use Efficiency (WUE) Goals and Measures

The Spokane City Council first addressed water conservation in a significant way with the adoption of Resolution 2006-0049 on May 10, 2006. This resolution adopted the City of Spokane Water Stewardship Program, which outlined goals and reporting requirements which were intended to meet WAC 246-290-840.

Since that time, in order to maintain compliance with the WUE Goal Setting requirements outlined in WAC 256-290-830, the City of Spokane Water Department evaluated and re-established demand side WUE goals as part of this Water System Plan approval under WAC 246-290-100.

The City of Spokane City Council approved Resolution 2014-0043 on April 21, 2014, adopting revised WUE goals following a public hearing and a public comment period. **Exhibit 4.1.1** is a copy of the City of Spokane Council Memorandum concerning the revised WUE goals and Resolution 2014-0043. The goals, provided below, are revised to meet the WUE Goal Settings requirements in WAC 246-290-830 as part of the water system plan approval.

Washington state law provides that the City is required to integrate operational and conservation efforts and to set and achieve water conservation goals.[1] Washington law also mandates that the City must:

- estimate the amount of water saved through implementation of the water use efficiency program over the last six years;
- describe the water use efficiency goals chosen;
- evaluate whether the City's water use efficiency measures are cost-effective;

[1] RCW 70.119A.180(4)(c)(i).

- describe all water use efficiency measures to be implemented within the next six years including a schedule and a budget that demonstrates how the water use efficiency measures will be funded;
- describe how consumers will be educated on water use efficiency practices;
- estimate projected water savings from selected water use efficiency measures;
- describe how the water use efficiency program will be evaluated for effectiveness; and
- evaluate water distribution system leakage.

Accordingly, staff will develop specific strategies for the City to meet its goals and present the strategies for meeting the goals, as well as the measurable outcomes connected with the goals, to the City Council annually.

Resolution 2014-0043 Water Use Efficiency ("WUE") Goals

1. Continue the reduction of indoor residential use by one half percent (0.5%) on average for residential connections annually, over the next six (6) years.
2. Reduce outdoor residential use by two percent (2%) on average for residential connections annually, over the next six (6) years.
3. Reduce metered outdoor irrigation commercial/industrial use by two percent (2%) for Commercial/Industrial connections annually, over the next six (6) years.
4. Reduce outdoor metered governmental use by two percent (2%) for governmental connections annually, over the next six (6) years.

Measures including but not limited to those listed in the following **Table 4.1.1** will be evaluated and implemented to meet the revised WUE goals and separated into indoor and outdoor measures. A brief summary of the proposed measures is presented in the Conservation Program following the table divided into indoor and outdoor measures.

Table 4.1.1

Water Use Efficiency Measures

Measure	Indoor	Outdoor	Total
Water Use Audits	X	X	2
Retrofit Campaign	X	X	2
Rebates & Credits	X	X	2
Education (schools)	X	X	2
Education (website)	X	X	2
Informational Bill Inserts	X	X	2
Consumption History on Bill	X	X	2
Metering	X	X	2

Inclining Block Water Rate	X	X	2
Government Partnerships		X	1
Total	9	10	**19**

Conservation Program

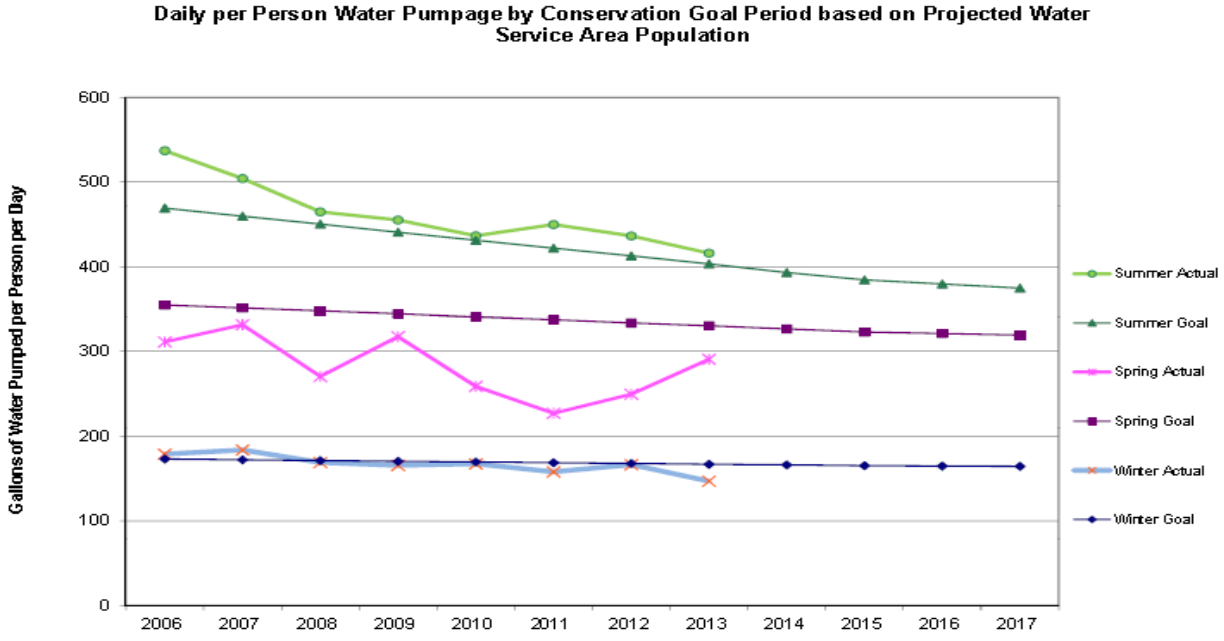
The City encourages its water customers to "Slow the Flow" of water and promote water stewardship. Protecting and preserving our water resources is a long-term goal of the City and is part of our sustainability efforts. Of course, the City must meet water conservation goals as part of state and federal requirements, but using less water also translates into savings on citizens' utility bills and helps ease the need for projects to expand the capacity of the City's water and wastewater systems.

Previous Results

Prior to the adoption of new Water Use Efficiency goals in the April 2014 that clearly focus on changing behavior on the demand side, the City tracked progress toward per capita water use reduction goals laid out in its 2006 Water Stewardship Plan. Those goals tracked total water pumped by season, rather than metered use.

The goals were as follows:

- October through March – 0.5% reduction per year
- April through June – 1.0% reduction per year
- July through September – 2.0% reduction per year



The City consistently met its goals for the winter and spring seasons, but had not achieved its summertime use goals.

From 2006 through 2013, the City used a variety of tools to help meet these goals, including educational and outreach efforts and different rebate programs. Educational and outreach activities have included a TV and radio marketing campaign aimed at reducing summer usage, utility bill inserts, attendance at local events, outreach to local school children, outreach to high users of water, and sharing of information through media, social media, and the web. Additionally, at different times, the City provided customers with rebates for installing water-saving toilets and appliances, adding smart controllers onto outdoor irrigation systems, and replacing traditional grass turf with xeriscaping. At times, the City partnered with other agencies on these outreach and rebate programs to extend their reach.

The City also adopted a block rate structure for water consumption that charges customers more when they use more water. In collaboration with the City's Wastewater Department, pilot projects on the use of reclaimed water also were carried out during this time, including tests at the City-owned Downriver and Creek at Qualchan golf courses.

And, as detailed in other chapters, the Water Department has promoted conservation through programs to detect and repair leaks, improve metering at well sources and other locations within the distribution system, and to properly account for water used for non-metered activities, like fire suppression and construction needs.

Future Conservation Program Plans

The City is working to improve and expand its water conservation program for the next six years to meet with the intent of Water Use Efficiency Rules and to benefit the Water Department, the Wastewater Department, and the region. The City completed a survey of water customers in early 2014 that also will be used to inform this program.

The 2014 budget for community outreach and education activities was $80,000 in addition to City staff time. A new wastewater credit program, which will encourage lower water use, will cost an additional $700,000. Budgets for these activities in future years will be determined annually and are expected to increase over time. The City Water Wastewater Fund will pay all costs for the water conservation programs.

Here's a look at the Measures the City will use to encourage conservation both for indoor and outdoor uses:

Water Use Audits:Water use audits can help customers understand how they can reduce water consumption in their homes and outside of them. Audits allow homeowners the opportunity to assess how efficiently water is being used and identify opportunities to lower water use. Indoor household water audits can result in savings of 20 to 30 gallons a day, while audits of outdoor irrigation systems can result in even greater water savings. The City is evaluating the option of providing audit kits to allow homeowners or renters to identify savings opportunities themselves.

Retrofit Campaigns:

The City has partnered with SustainableWorks, a non-profit organization that promotes energy efficiency, to help City utility customers save water. City water customers who participate in SustainableWorks' "Save Energy Today" audit program will receive a water

conservation kit, provided by the City of Spokane, along with the energy-saving products and recommendations provided through the audit. The water kit includes aerators and low-flow shower heads. SustainableWorks expects to visit about 300 homes within the Department's service area annually. The City is considering expanding this partnership to include water audits with this program.

The City is evaluating the possibility of adding a retrofit campaign for outdoor use, providing property owners with hose timers, rain sensors, or similar products at the conclusion of an outdoor water audit or as part of an outdoor water use audit kit.

Rebates for Indoor Appliances:

The City is considering a program that would provide rebates to consumers who purchase water-efficient appliances, including toilets, washing machines, and dishwashers. An evaluation needs to be completed that compares the cost of such a program with the potential long-term water conservation benefit.

Education:

Public education and outreach is critical for any water conservation program to promote long-term changes in water use habits. The City will use multiple communications tools to reach its audience with educational information, including:

- A School Education Program, which includes presentations to youth and related materials to teach about saving water. Tours of the City's Upriver Facility also will be part of this program.
- Information on the City's web site and social media sites. The City actively maintains information on its web site, encouraging citizens to "Slow the Flow" through many easy-to-use tips. Information also is shared through the City's Facebook, Twitter, and Instagram pages on water-saving ideas. The City also is launching an email newsletter on this topic.
- Development of news releases with water-saving information that are sent periodically to local news media. The City identifies news-worthy timing to provide information on water conservation.
- Participation in Community Events. The City will set up informational displays and tables at community events to have direct educational opportunities with citizens. New displays are under development that would be more interactive and thought-provoking.
- Advertising, sponsorships, partnerships and marketing. The City will continue to look for paid opportunities or partnerships with other agencies that have the potential to reach many citizens with information on water conservation. Particular emphasis on the interrelationship between the Spokane River and the Spokane Valley-Rathdrum Prairie Aquifer, which is the City's sole source aquifer.

Information provided through bills:

Since customers receive City utility bills monthly, bills provide a great opportunity for educational information. The Water Department annually develops bill inserts with water conservation tips, checklists, and related information. Additionally, each customer's bill

includes information on their water use history. A customer can use this information to determine whether his or her water use is typical or unusual for a certain time period and also to track changes in use.

The Department will provide education, tools and incentives for all residential water users to reduce their consumption, including their consumption rates on their bill.

Metering:

As discussed in other chapters, the City has a robust source and service metering program that provides staff with data to identify leaks in the distribution system and within domestic services.

Water Rates:

The City continues to have an inclined block water rate structure. That means customers who use more water pay more, providing a financial incentive to conserve water. This is especially true during the summer irrigation season.

Wastewater Conservation Credit:

Starting in 2015, the City will implement a wastewater bill discount for single-family residential customers who use less water. The credit program is designed to introduce equity in wastewater billing and allow customers to make choices that could lead to lower monthly bills. Under the program, the lowest 20 percent of indoor water users receive credits totaling $60 a year, distributed in $5 monthly amounts. The lowest 20 percent of indoor water users is determined annually based on water use during the winter. Although a credit toward the wastewater portion of the bill, this program will help the City achieve its water use efficiency goals by encouraging lower indoor residential water use. The annual cost of this program is about $700,000.

Special Projects:

The City will continue to seek out special projects to reduce water use. For example, the Water Department is beginning to work with the City's Parks Department to find ways to update wasteful and aged irrigation systems in City parks. Schools are another

4.2 Distribution System Leakage (DSL)

Water Loss Control Action Plan (WLCAP)

The Water Department is diligently working to reduce our Distribution System Loss (DSL). The DLS for the water system in 2013 stands at 17.9%, with a three-year running average of 19.2%. Pumping and accounted water totals for the past 7 years are tabulated in Chapter 2. In 2009, an increase in DSL was reported because of the discovery of an accounting error within the City of Spokane billing system when consumption data was extracted from the billing data. Some extracted readings were double counted, resulting in erroneously high metered consumption and corresponding accounted water number which, when corrected, increased unaccounted water use and increased DSL.

Following the conclusion of the water use audit, the city will create a water loss control action plan in accordance with WAC 246-290-820(4).

The following programs are ongoing programs to help identify apparent losses within our system. These programs center on data collection and data accuracy so we may better asses and address real losses. Data collection and accuracy is the first step forward to reducing our DSL.

- Source Meter Replacement Program:

  Beginning with Fiscal Year 1998, the City began replacing the source meters at all of the water sources. The supply meter replacement program was completed in 2002 and all well sources are metered. However the accuracy of some source meters is in question due to location of the meters. Currently, the Source Meter Replacement Program is active with the thought of replacing older meters and meters with questionable accuracy. Calibration of the meters and testing accuracy is part of this program.

- Booster Station Metering Program:

  Starting in 2012, the Water Department started this program to meter booster stations that serve different pressure zones and move water from one zone to the next. By metering booster stations, it will be possible to better account for water traveling though pressure zones and identifying potential leaks and losses by better water accounting in a pressure zone.

- Meter Data:

  In order to accurately tabulate meter data recording use, the Water Department is beginning to use raw data collected prior to its conversion in the City's Customer Star program to billing data. The use of raw data directly from the meter readings requires additional manipulation and indexing that is done by the billing software but eliminates the manipulation process that is causing inaccurate consumption numbers.

- Residential Meter Replacement Program:

  The City has had a residential meter replacement program in place since approximately 2004. In the last two years, approximately 100 residential meters were replaced every month. The priority for meter replacement is based on a combination of age and total flow through the meter. Also, during the monthly billing cycle, if low flows are observed, the suspect meter is also replaced.

- Commercial Meter Replacement Program:

  Between 1999 and 2005, the City replaced or tested, repaired, and recalibrated all commercial meters 1 ½" and larger. There is an ongoing program to recalibrate or replace 1 ½" and two inch meters every four years and three inch and above annually.

Concurrently with data collection and data accuracy in assessing apparent losses, the City is continuing to make progress in reducing the amount of real losses includes the following ongoing programs:

- Dedicated Leak Detection Program:

  The City has maintains at least one full time leak detection crew working within the City on a continual basis. Service connections are included within the monitoring program.

- Pipe Replacement:

  12" Cast Iron pipe with Leadite joints.

  In 2004, the Water Department began replacing 12" Cast Iron pipe that has leadite joints, as it has proven to fail in a spiral fracture that causes catastrophic damage and is prone to joint leakage upon any disturbance due to the brittle aged joint material.

In addition the following factors can be shown to have a significant effect to the amount of non-metered non-revenue water volume affecting DSL:

- Pipeline leakage.
- Unauthorized use such as illegal connections.
- Authorized and unauthorized use from hydrants .
- Unmetered uses such as system operational needs, construction use, street cleaning, line flushing, water main testing, main breaks, reservoir flushing, and fighting fire.

The Water Department is working to more accurately capture non-metered water use with the following programs:

- Fire Suppression Use:

  Currently, we receive an annual estimated use from the Spokane Fire Department on the amount of water used in fire suppression activities. Numbers received to date for accounting purposes appear low. Working with the Fire Department, we would like to implement a better accounting system for water used possibly by incident/training exercise to ensure estimated water use reported is accurate.

- Construction Use/ Hydrant Permits:

  The Water Department currently issues hundreds of non-metered hydrant use permits to contractors and businesses. The use ranges from construction use to use by landscape companies and other small businesses. In 2012-2013, we received meter data from a construction use of a hydrant permit and determined that the current estimates for use under hydrant permits for construction were grossly underestimated. In order to provide a more accurate accounting for these uses, the Water Department is exploring the possibility of metering some of these hydrant uses to provide an accurate baseline for similar hydrant permit uses.

- Street Cleaning/Sewer work/Other Utility Work with Water:

  Continuing the Water Department's ongoing discussion and dialog to receive estimated consumption numbers with other utilities that use City Water in their daily/weekly/monthly operations from an un-metered water source.

The City is working to decrease the Distribution System Loss (DSL) to 10% or less according to State DOH rules. The first step is the evaluation process that is currently ongoing that includes assessing data accuracies and defining real and apparent losses. This includes the metering and data assessment and will have capital programs of $180,000/year until 2016 dedicated to source and booster station metering. Following the assessment in 2015-2016, the City will perform a water audit following the initial assessment.

4.3 Source of Supply Analysis

A source of supply analysis is required of all systems that will be pursuing water rights within 20 years. The City does not plan to pursue additional water rights within the next 20 years.

The City has not studied the question of depletion within the aquifer due to pumping. Seasonal fluctuations due to snowpack and recharge have been seen at City wells. The City is actively monitoring well levels in the event of sustsained low precipitation years that may affect aquifer recharge.

Regional Hydro-Geologic Setting and History

Spokane is located within the Rathdrum Prairie/Spokane groundwater basin. The aquifer has been described as one of the most prolific in the nation. The aquifer travels east to west through the Spokane Valley, then turns north and northwest after it passes the east City Limits of Spokane. This places the aquifer under the City and affords the City the opportunity to tap this resource at well sites located throughout the City.

The aquifer was formed during the Pleistocene Era when the Glacial Lake Missoula breached the ice dam that formed the lake. As the lake breached the dam, an estimated 750 million cubic feet per second (484 trillion gallons per day) of water rushed out of the lake into the Pend Oreille, Coeur d'Alene and Spokane areas leaving behind great quantities of sediments of all sizes transported by the ensuing flood. Geologic evidence now points to as many as 40 floods of similar magnitude. The coarser materials were deposited along the main valley floor (today's Rathdrum Prairie in Idaho and Spokane Valley/City of Spokane area in Washington) in the line of greatest flow during the flood, while the smaller sediments were carried as far away as Portland, Oregon. The larger, coarser materials formed the medium through which the aquifer now travels.

Recharge and Discharge

The groundwater system in the aquifer area is recharged by infiltration of precipitation and subsurface flow, infiltration from rivers and lakes, and regional groundwater under-flow. Groundwater is discharged by seepage to the Spokane River, Little Spokane River, and pumping from wells.

It is estimated that within the aquifer between 300 and 600 mgd flows into the Spokane Valley across the Washington-Idaho border. These estimates of groundwater flow are based on past studies of the aquifer that have been limited in scope. Currently, a more comprehensive Interstate Aquifer Study is being finalized by the United States Geologic Survey (USGS), State of Washington, and State of Idaho. This study provides an improved scientific estimate of the quantity of flow found in the aquifer, as well as a model of its flow characteristics. According to the Watershed Management Plan for WRIA 55&57,[2] the City's groundwater extraction can have the impact of depleting flow in the Spokane River. Modeling of ground and surface water connections conducted as a part of the Watershed Management Plan process revealed that the aquifer and river are an integrated resource. Full extraction of the City's inchoate (paper) water rights would result in an additional 150-250 cubic feet per second (cfs) decrease in Spokane River volume. This decrease is noteable given that low flows in the river have been below 600 cfs in 8 of of the last 28 years.

[2] See page 31 (6-6-2006 draft, later adopted 1-31-2006).

Historically, prior to 1940, the lowest flows measured in the river each year were above 1,200 cfs.

Effective February 27, 2015, the Department of Ecology implemented an in-stream flow rule. The City is committed to maintaining the river volumes mandated by the in-stream flow rule. Accordingly, the City has developed conservation measures, including the consideration of water rates and the overall water rate structure, toward the goals of preserving the natural resource river flow volumes.

4.4 Service Reliability

Source Reliability

The reliability over the past 100 years of the Spokane Valley-Rathdrum Prairie Aquifer has not been a concern. However a comprehensive study of the aquifer is progressing to better address long-term quantity issues. Also over the past few years the City has been engaged in the Wellhead Protection Program, which has provided a better understanding of the aquifer system and water quality issues.

Water Right Adequacy

The existing water rights will allow the City to grow as planned within the 20 year planning horizon and beyond. While the City has ample water rights, being good stewards and conserving water is very much a high priority.

Facility Reliability

Facility Reliability of the water system is quite high. Much of the power supply is provided through the Avista Corporation's electrical grid. Avista's electrical grid is very reliable and any outages that have occurred have been very short term. Also the City water system is very high on Avista's restore power list when outages do occur.

In addition, the Water Department owns its own hydroelectric power generating facilities at the Upriver Dam Complex. Much of this power is used directly to power the Departments Well Electric and Parkwater Well Stations, as these stations are located near the Upriver Dam Complex. These well stations provide about half of the City's water supply so in the event of a long-term shutdown of Avista's system, the Water Department can still supply water to the Low Pressure Zone, North Hill Pressure Zone, and the Intermediate Pressure Zone which represent about half of the City's present retail water service area. Low river flows in July and August will limit this ability, but nevertheless various amounts of water can still be pumped depending on the amount of flow in the river. In addition, the Water Department has a large diesel generator mounted on a trailer that can be moved from booster station to booster station to refill reservoirs in higher pressure zones. A diesel motor driven pump at the Lincoln Heights Booster Station can pump water from the Intermediate Pressure Zone to the High Pressure Zone serving a large area on the City's South Hill. The Department also has a small natural gas driven generator which can supply power for some of the smaller pumps.

In addition to the above electrical power backups, the Water Department's storage reservoir capacity is such that the City could supply water for non-irrigation purposes for 2 or 3 days and longer if water were rationed to just the very basic needs. Also the department has

taken great pains to provide as much redundancy as practical in both piping and pumping so that, should a portion of the system fail, service can continue.

When addressing reliability, besides worrying about water quantity, water quality is important too. The Water Department diligently monitors the water quality in the system so that a reliable product can be delivered to the Department's customers.

Shortage Response Plan

In the event the City is unable to provide the water quantity desired by the residents of Spokane, a shortage response plan has been developed. For details of this plan, refer to the Phase I report of the Wellhead Protection Program.

Monitoring Water Levels

Water levels at each of the seven Well Stations are monitored through the SCADA system. In the event a low water level is observed by the SCADA system, an alarm will alert the water system operators. In addition, the Water Department continuously monitors and records the water level of the aquifer at nine additional monitoring well sites, both inside and outside of the City to observe aquifer level trends. The City has never experienced a problem with aquifer levels.

4.5 Water Rights Evaluation

This section discusses the City's water sources, existing and future supply needs, water quality and water rights claims.

Source Type

The City of Spokane currently taps the aquifer with seven well stations. The water rights for specific sites date back to 1948 with the year of priority dating to 1907.

At present, the pumping capacity at all the listed well stations is 195,570 gpm. The permitted capacity is 241,100 gpm. On an annual basis, the historical maximum water quantity distributed over the service area has been about 70,000 acre-feet per year. The permitted quantity is 147,570 acre-feet per year.

Source Location

All well stations are located in a narrow corridor in the central and eastern parts of the City that conform to the main body of the aquifer. **Figure 1.3.2** maps the Well Station locations.

The Legal description of each Well Station is as follows:

Central Avenue:	One well in Lot 17 and the other in Lot 20, both in Block 4 of Byrne Addition, within the NE 1/4, Section 31, T. 26, R. 43 E.W.M
Grace Avenue:	One well in Lot 8, Block 37 of Wolverton & Conlan Addition, within the NE 1/4, Sec. 8, T. 25, R. 43 E.W.M.
Nevada Street:	One well in Lot 7, Block 37 of Wolverton & Conlan Addition, within the NE 1/4, Sec. 8, T. 25, R. 43 E.W.M.
Hoffman Avenue:	Two wells in Lots 27, 28, 29, & 30, Block 4 of Arlington Heights, within the NE 1/4, Sec. 4, T. 25, R. 43 E.W.M.

Parkwater:	Four wells in Lots 1, 2, 3, & 4, Block 33 of Parkwater Addition, within the SE 1/4, Sec. 11, T. 25, R. 43 E.W.M.
Well Electric:	Two wells, within the NE 1/4 , Sec. 11, T. 25, R. 43 E.W.M.
Ray Street:	Two wells, in south half of Block 1, 3rd Addition to Eureka, within the NW 1/4, Sec. 22, T. 25, R. 43 E.W.M.

The Well Station Inventory and Pumping Capacities are summarized in **Table 4.5.1**.

TABLE 4.5.1

Well Stations

DOH Source No.	Source Name	Source Category	Use	Well Depth (feet)	Pumping Capacity (gpm)
S01	Nevada Street	Well	All Year Long	122	25,000
S02	Well Electric	Well	All Year Long	50	39,300
S03	Parkwater	Well	All Year Long	126	63,000
S04	Ray Street	Well	All Year Long	75	21,550
S05	Hoffman Avenue	Well	Seasonal	235	10,920
S06	Grace Avenue	Well	Seasonal	124	19,000
S08	Central Avenue	Well	All Year Long	272	16,800

In addition to the existing well stations listed the City of Spokane is actively investigating and perusing an additional well station location. During the winter of 2014 the City submitted a change application to the Department of Ecology for a change in the points of withdrawal on some if its water rights to existing well stations and for the additional well station. The Reports of Examination for Water Right Change for Water Rights Numbers 548-A and 504-D were received from the Department of Ecology dated Febuary 24, 2015. This consolidation allows the transfer of these rights in the application to existing well stations listed as the other points of withdrawl in the application.

Water Rights Self Evaluation

Table 4.5.2 shows the six year history of the annual quantities of water withdrawn from the aquifer versus water rights at the various Well Stations. Spokane lies within the "rain shadow" of the Cascade Mountains, resulting in an arid climate. As is typical with most areas, weather plays a major role in water consumption. Hot and dry weather is the key to above average water consumption, which is used primarily for lawn and garden irrigation during the summer months.

TABLE 4.5.2

Annual Supply Versus Water Rights

Acre-Feet/Year

Station	Annual Withdrawal Water Rights	Annual Withdrawals						
		2007	2008	2009	2010	2011	2012	2013
Nevada Street	20,000	6,017	7,352	6,375	7,910	9,629	5,176	9,387
Well Electric	36,000	17,712	12,496	14,230	17,773	13,363	14,880	18,825
Parkwater	51,240	21,500	28,172	29,784	19,968	17,349	24,363	21,590
Ray Street	4,740	5,027	5,480	5,021	6,454	8,780	7,071	4,416
Hoffman Avenue	1,280	1,202	313	1,083	620	116	513	953
Grace Avenue	5,080	3,847	3,758	2,967	5,351	11,533	8,782	5,344
Central Avenue	29,230	10,700	7,607	9,455	5,174	2,763	3,735	4,563
Total	147,570	66,005	65,178	68,915	63,250	63,533	64,520	65,078

Note:

Table 4.5.3 identifies the existing water rights and compares with existing water usage. **Table 4.5.4** lists the 20-year forecasted need. Currently, the City does not need to request additional water rights within the planning horizon of this water plan.

Purpose of Use

The City of Spokane, by owning water rights, has the ability to supply the needs of residential, commercial/industrial and government customers. This includes supplying adequate quantity, combined with reliability, to maintain the City's high Fire Industry rating for water systems. The City currently has a Class 3 Fire Insurance Rating, a good score translating into lower hazard insurance premiums for the customers.

Place of Use

The place of use listed on all City of Spokane water rights is, "The area served by the City of Spokane, all within Spokane County." This, of course, includes the City's water service area as defined in the Spokane County Coordinated Water System Plan plus other purveyors that have interties with the City's Water System.

Time of Use

The pumping and storage operations run 24 hours a day, 365 days a year. However, as delineated in **Table 4.3.1** Hoffman Avenue and Grace Avenue Well Stations are operated on a seasonal basis during peak demand days of the months May through September.

Provisions or Limiting Conditions

All the studies that have been undertaken on the Spokane Valley-Rathdrum Prairie Aquifer, indicate a good supply of excellent quality water for the near future. However, long term demands on this resource are a concern. Also, a major threat is contamination due to septic tanks, petroleum storage, pipeline spills, or commercial/industrial activities. The Wellhead Protection program, described in Chapter 5, addresses possible contamination of the Aquifer near the wells. In addition, the possible impacts of climate change on the Aquifer and river flows have not been adequately studied and are currently unknown.

The Water Department works to build redundancy into key areas of the water system. This redundancy provides operating flexibilities in operating pump stations and storage reservoirs, limiting the exposure of the water system to severe area wide emergencies, but also allows for maximum efficiency in pumping strategies.

The Well Electric Well Station because of its close proximity to the Spokane River has under gone significant testing to determine if there is surface water influence. Results of these tests indicate there is no surface water influence. As a precaution, the Well Electric Well Station is not operated during time of rapid river rise and flooding. The Upriver Complex that houses the Well Electric Well Station also contains the Department's Water Quality Testing Laboratory which allows for continued monitoring of this well.

The City of Spokane should also consider the possibility of placing some of its water rights into trust status in order to preserve river flows.

Hydropower Water Rights

All water rights discussed to this point have been for potable water use. The Water Department also has surface water rights from the Spokane River needed for the operation of Upriver Dam. These rights are as follows:

- Surface Water Certificate No. 1014
  400 cubic feet per second, Spokane River, Priority date of June 12, 1935
- Surface Water Certificate No. S3-26064C
  7,600 cubic feet per second, Spokane River, Priority date of September 11, 1978
- Reservoir Permit No. R3-28402P
  4,000 acre-feet of storage, Spokane River, Priority date of October 9, 1987

TABLE 4.5.3: Existing Water Right(s) Status

Permit Certificate of Claim #	Name of Right-holder or claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Existing Pumping Capacity & Annual Consumption		Current Water Right Status (Excess/Deficiency)	
					Maximum Instantaneous Flow Rate (Q_i) gpm	Maximum Annual Volume (Q_a) Acre-ft	Maximum* Instantaneous Flow Rate (Q_i) gpm	Maximum Annual Volume (Q_a) Acre-ft	Maximum Instantaneous Flow Rate (Q_i) gpm	Maximum Annual Volume (Q_a) Acre-ft
3199-A	CITY	1956	S 01 NEVADA ST	Primary	25,000	20,000	25,000	12,615	0	7,385
504-D	CÍTY	1926 1907	S 02 WELL ELECTRIC	Primary	54,750	36,000	39,300	20,519	15,450	15,481
548-A	CITY	1946	S 03 PARKWATER	Primary	63,000	51,240	63,000	24,791	0	26,449
505-D 593-D 504-D 507-D	CITY	1937 1907 1926 1945	S 04 RAY STREET	Primary	14,000 7,000 1,250 2,600**	1,870 350 2,000 520**	21,550	6,057	3,300	(1,317)
506-D	CITY	1938	S 05 HOFFMAN AVE	Primary	11,600	1,280	10,920	1,418	680	(138)
728-A 593-D	CITY	1950 1907	S 06 GRACE AVE	Primary	11,000 20,000	4,080 1,000	19,000	4,026	12,000	1,054
3903-A 593-D 4503 728-A	CITY	1959 1907 1961 1950	S 08 CENTRAL AVE	Primary	7,000 7,000 7,900 9,000	11,480 350 12,640 4,760	16,800	12,084	14,100	17,146
TOTAL FOR PRIMARY WELLS					241,100	147,570	195,570	70,374***	45,530	77,196***
G3-27181	CITY		SIA	Not presently used	200****	526****			200	526
508-D	CITY (PARKS)		S 09 INDIAN CANYON	Golf Course Irrigation	728	265	750	250	(22)	15

PENDING WATER RIGHT APPLICATION	NAME ON PERMIT	DATE SUBMITTED	PRIMARY or SUPPLEMENTAL	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Q_i) Requested gpm	Maximum Annual Volume (Q_a) Requested Acre-ft
None					

* Based on water right or maximum installed pumping capacity, whichever is the lesser amount. Nevada Street Well Station is only one based on water right. Maximum pumping capacity of Nevada Street is 31,000 gpm.

** These are Baxter Well water rights which was officially decommissioned in 2003 with water rights transferred to the Ray Street Well as shown. Priority date is January 12, 1945.

*** Based on maximum total from Table 4.3.2. Individual well volumes based on maximum year for that well in Table 4.3.2. Well use can vary from year to year based on energy costs, pump maintenance, etc. Therefore, sum of individual numbers will not equal total numbers.

**** 250 gpm and 89 acre feet were sold and transferred to Goodrich Corporation in 2005 for $350 per acre-foot, processed through the Washington State Department of Ecology. The City is looking for a beneficial use of the remaining water right.

TABLE 4.5.4: 20-Year Forecasted Water Right(s) Status with Conservation

Permit Certificate of Claim #	Name of Right-holder or claimant	Priority Date	Source Name/ Number	Primary or Supplemental	Existing Water Rights		Forecasted Pumping Capacity & Annual Consumption		Forecasted Water Right Status	
					Maximum Instantaneous Flow Rate (Q_i) gpm	Maximum Annual Volume (Q_a) Acre-ft	Maximum* Instantaneous Flow Rate (Q_i) gpm	Maximum Annual Volume (Q_a) Acre-ft	Maximum Instantaneous Flow Rate (Q_i) gpm	Maximum Annual Volume (Q_a) Acre-ft
3199-A	CITY	1956	S 01 NEVADA ST	Primary	25,000	20,000	25,000	14,500	0	5,500
504-D	CÍTY	1926 1907	S 02 WELL ELECTRIC	Primary	54,750	36,000	49,000	23,500	5,750	12,500
548-A	CITY	1946	S 03 PARKWATER	Primary	63,000	51,240	63,000	29,300	0	21,940
505-D 593-D 504-D 507-D	CITY	1937 1907 1926 1945	S 04 RAY STREET	Primary	14,000 7,000 1,250 2,600	1,870 350 2,000 520	24,850	4,700	0	40
506-D	CITY	1938	S 05 HOFFMAN AVE	Primary	11,600	1,280	11,600	1,200	0	80
728-A 593-D	CITY	1950 1907	S 06 GRACE AVE	Primary	11,000 20,000	4,080 1,000	19,000	4,700	12,000	380
3903-A 593-D 4503 728-A	CITY	1959 1907 1961 1950	S 08 CENTRAL AVE	Primary	7,000 7,000 7,900 9,000	11,480 350 12,640 4,760	19,000	14,100	11,900	15,130
TOTAL FOR PRIMARY WELLS					241,100	147,570	211,450	80,500**	29,650	67,070**

PENDING WATER RIGHT APPLICATION	NAME ON PERMIT	DATE SUBMITTED	PRIMARY or SUPPLEMENTAL	PENDING WATER RIGHTS	
				Maximum Instantaneous Flow Rate (Q_i) Requested gpm	Maximum Annual Volume (Q_a) Requested Acre-ft
None					

* Based on water right or maximum installed pumping capacity, whichever is the lesser amount.

** Based on projected use as presented in Table 2.2.3. Individual well volumes based on maximum potential use on a year to year basis subject to which wells are used as determined by energy costs, pump maintenance, etc. Therefore, sum of individual numbers will not equal total numbers.

4.6 Water Rates

Water rates are approved by the City Council and addressed in the Spokane Municipal Code Title 13, Chapter 13.04, Section 13.04.2002 through Section 13.04.2042. The Municipal Code is available at: www.spokanecity.org. The City has committed to limiting utility rate increases to the average cost of inflation to maintain affordability and predictability for customers. In November 2014, the City Council approved increases of 2.9 percent annually for 2015, 2016, and 2017. This is the first time the City has approved multi-year rate changes.

For water, the City's rates include a base charge and a water consumption component. The consumption portion of the rate is based on an increasing block rate structure which charges more per unit as increased amounts of water are used. The City also charges a monthly integrated capital fee for capital replacement projects for water and wastewater. The integrated capital fee and the base fee are flat rates for residential customers. For commercial/industrial/governmental customers, the fees are based on the amount of water used.

The City provides its customers with a single bill for all utility services, including water, wastewater, stormwater, and solid waste charges. The City applies partial payments to the water utility last and has the authority to shut off water for non-payment.

4.7 Interties

Existing Interties

The City has established a number of interties with five of its adjacent purveyors. It has one intertie with the City of Airway Heights; four with Spokane County Water District #3; one with Whitworth Water District; one with Fairchild Air Force Base; and one with Velview Water District. All of these interties are metered, and supply water on an as-needed basis. Section 1.3 provides additional discussion regarding these interties. **Table 4.8.1** lists the locations, capacity, purpose, and installation date for each existing intertie.

TABLE 4.8.1
City of Spokane Water Department Interties

Purveyor	#	Intertie Location	Size	Purpose	Date installed
Airway Heights, City of	1	10800 West U.S. Highway 2	12 inch	I	7/15/86
Spokane County Water District #3	1	1500 N. Theirman Road	10 inch	I	10/28/74
	2	2000 South Carnahan Road	6 inches	I, F	2/1/78
	3	5400 South Perry Street	8 inches	F, C	6/2/60
	4	5221 East Desmet Avenue	12 inces.	I	9/16/60
Whitworth Water District #2	1	Hawthorne & Nevada	12 inch	E, F	8/90
Fairchild Air Force Base	1	2108 W. Spotted Road.	10 inch	E	3/13/02
Velview Water District	1	3609 West Velview Dr		I	

TABLE 4.8.1

City of Spokane Water Department Interties

Purveyor	#	Intertie Location	Size	Purpose	Date installed
North Spokane Irrigation Dist #8	1	6400 North Freya Street	8	I,F	5/8/07

Note:
E—Emergency,
F—Fire Flow,
I—Intermittent Retail;
C—Continuous Retail

New Intertie Proposals

Any future intertie proposals must be approved by the City Council.

Intertie Agreements

The City has established formal agreements for all interties. All agreements are based on the capacity of the City's water system and the amount of water required by the purveyor. In the event water supplies are in jeopardy, water service to the City will take precedence over any and all intertie agreements. Copies of the intertie agreements are included in **Exhibit 1.3.2**.

Chapter 5

Source Water Protection

CHAPTER 5

Source Water Protection

5.1 Wellhead Protection Program

Overview

Details of the City's Wellhead Protection Program are provided in a separate multi-volume report. For specific details of the wellhead program, reference should be made to the report. The following is a brief summary of the activities performed in that program.

The City of Spokane Water Department currently operates seven Well Stations that draw groundwater from the Spokane Valley/Rathdrum Prairie Aquifer for a potable water supply. The purpose of the wellhead protection program is to proactively reduce the potential threat of contamination of this groundwater resource. The relatively shallow depth to groundwater and the absence of low permeability layers that could prevent contamination from entering the groundwater makes the City's groundwater supply vulnerable to a variety of contamination threats. In 1994, in response to known groundwater contamination incidents, and the existence of numerous potential contaminant sources, the City established a wellhead protection program. A technical assessment report was completed and approved by the Washington State Department of Health ("DOH") in 1998.

The following components were required as part of the plan:

- Susceptibility assessments.
- One-, five-, and 10-year delineated wellhead protection area ("WHPA") for each well and/or well-field.
- An inventory of potential contamination sources.
- Preparation of contingency plans to provide alternate water sources.
- Inclusion of public participation.
- Implementation of a wellhead protection program.

The first four elements outlined above are described in detail in the above referenced report published in February 1998 titled, "Wellhead Protection Program Technical Assessment". The Spokane City Council accepted this publication on February 23, 1998, after being approved by DOH the same year.

The last two items are currently being conducted with the Spokane Aquifer Joint Board ("SAJB") (local purveyors in Spokane County). To better solidify the regional planning efforts of all the purveyors, the City of Spokane became a member of the SAJB in late 1999. The cooperative program with the SAJB involves an ongoing education and awareness campaign, household hazardous waste collection programs, small business assistance programs done in partnership with the Washington Department of Ecology ("DOE"), and maintaining the Potential Contaminant Source Inventory. Subject to unknown circumstances the City expects to maintain its membership with the SAJB throughout the duration of this Comprehensive Plan.

The following is a brief "Executive Summary" of the major elements of the first phase of the program.

Susceptibility Assessment

The City of Spokane completed and submitted susceptibility assessments for each of its eight wells (1998) to the Washington DOH. As mentioned in several places within this plan, the Water Department now operates seven Well Stations. The susceptibility assessments are on file with the Washington State DOH.

Wellhead Protection Area Information

Data Collection Program

It must be noted here, that the State of Washington, State of Idaho, and the U.S. Geological Survey continue to work on refined modeling of the Spokane Valley/Rathdrum Prairie Aquifer to provide us with better information to implement protection of our drinking water. These models better delineate the aquifer boundary conditions that exist as it makes its journey from northern Idaho through the Spokane Valley and under the City of Spokane to where it flows as springs into the Little Spokane River and Spokane River north and east of the City. Additionally, the models also provide a clearer understanding of the quantities of water flows found within the aquifer. The intent is that this data be used to conduct better land use planning and water use by all entities that depend on the aquifer.

Much of the information within this section was generated in the later 1990's, and even though it is somewhat dated, it remains the best data that is currently available. A section on current activities to enhance wellhead protection is included at the end of the chapter.

Technically sophisticated methods, such as computerized numeric modeling were required to delineate applicable wellhead protection areas in a large and complex hydrogeologic environment like the Spokane Aquifer. Before numerical modeling could be performed, an accurate conceptualization of the hydrogeologic setting had to be developed. Although the Spokane Aquifer has been studied extensively, additional characterization was needed to support the development of a detailed and expansive numerical model.

An extensive review of previous aquifer investigations provided the basis to determine locations where additional data was needed. Field data collection activities included the development of an aquifer wide water level network, monitoring well installations, long term water level monitoring, geophysical investigations, and aquifer flow testing. This information was used to develop a new "wellhead protection" numerical model with a higher degree of definition of the properties of the Spokane Aquifer than previously available. Since the Spokane Aquifer "wellhead protection" model was first developed the USGS with States of Washington & Idaho participation developed the Bi-State Spokane Valley-Rathdrum Prairie Aquifer model (2007). Then in 2012 with DOH support the City of Spokane and SAJB had the original "wellhead protection" model updated and expanded to cover the full Spokane Valley-Rathdrum Prairie Aquifer.

Delineation of Wellhead Protection Areas

Numerical modeling yields a more accurate Wellhead Protection Area ("WHPA") delineation than other available methods since it incorporates and accommodates most of the known variables in aquifer properties and dynamics. For the City's project, a three-dimensional numerical model was constructed using the MicroFem code to simulate pumping conditions and responses caused by groundwater extraction throughout the aquifer. With the calibrated numerical model, estimated groundwater capture zones using particle tracking procedures were determined for special, 1, 5, and 10 year times-of-travel ("TOT"). Particle tracking was conducted for the City's seven existing well fields and two possible future well sites. These particle tracking path-line plots were then used to develop wellhead protection areas. A map showing the capture zones/wellhead protection area is shown in **Exhibit 5.1.1**.

Potential Contamination Source Inventory ("PCSI")

Potential sources of groundwater contamination and known groundwater contamination incidents within the Spokane Aquifer were inventoried as part of the wellhead protection plan's contamination source inventory. The sources included improperly maintained underground storage tanks, industrial and commercial activities, known hazardous material leaks, chemical spills, landfills, and potential contaminants related to vehicle transportation, and chemical transportation.

Using a variety of information sources, a list of businesses within proposed wellhead protection areas was created to identify sites that contain potential sources of pollution. This inventory provides water purveyors the tools to track potential contamination sources. The PCSI inventory also provides federal, state, and local regularity agencies with information that may be critical for guarding public health from possible airborne contamination, or equally crucial for cleaning up contaminants in the event of a spill over the aquifer. There is an on-going program to keep the PCSI records updated.

Notification of Findings

In conjunction with SAJB, letters have routinely been sent to selected businesses advising them that they may be a potential contamination source to the Aquifer and need to conduct their operations accordingly. A sample letter is found in **Exhibit 5.1.2**.

As required, federal, state, and local regulatory agencies were also sent listings of the potential sources that received notification as well as other pertinent wellhead protection information. A copy of the PCSI list is included in **Exhibit 5.1.3.**

Contingency Plan

Contingency plans consist of a sequence of planned actions that may be taken if accidents occur or changes in groundwater quality are observed in a monitoring well, production well, or wellhead protection area. Different actions would be taken depending on the event and its proximity to a production well. In working these issues the Water Department has an ongoing working relationship with law enforcement, fire departments, and health jurisdictions. Detailed contingency plan information is found in Section 5 of the previously referenced 1998 "Wellhead Protection Program Technical Assessment" report and is included in **Appendix 5.1.1**.

Regional Implementation Efforts

In 1997, the City of Spokane recognized the benefit of working together with all regional water purveyors using the Spokane Aquifer as their source of potable water. As a result, the City of Spokane signed an agreement to jointly fund and develop wellhead protection programs with several other purveyors who had formed the SAJB. In 1999, the City became a member of the SAJB. The consolidated actions better protect the region's sole source of potable drinking water and ensure that any regulations and/or programs are consistent throughout the local region. Experience demonstrates that it is more cost-effective to implement proactive pollution prevention than to pay for an alternative drinking water supply sources or to initiate groundwater remediation efforts. It is also more cost effective for the purveyors to work together through the SAJB than to go it alone. The regional implementation efforts remain an on-going process.

Implementation Strategies

As stated above, the City Water Department is a member of SAJB and has teamed with SAJB members to implement wellhead protection strategies. SAJB has also worked closely with Spokane County on this effort. Besides being more cost effective, it is important that the City work with other SAJB members and the County because many of the wellhead protection areas extend across boundaries for local jurisdictions. The implementation strategies being carried out through SAJB are as follows:

1. An ongoing education and awareness campaign that includes television and radio spot ads, an informative web page, school visits by Aqua Duck (a skilled acting student in costume) and other informative people, educational comic books for kids that discuss protecting the aquifer, a mobile display for public events, and school tours provided at the Department's Upriver Complex.
2. Free household hazardous waste collection at the City's Waste to Energy Facility and the Spokane County's North Side and Valley transfer stations. The free service is available to make it easy for citizens to dispose of wastes properly.
3. A business assistance program to proactively help small business so they know how to properly handle and store products that could contaminant the aquifer. This program is done in collaboration with the Washington State Department of Ecology.
4. Providing for keeping the Potential Contaminant Source Inventory up to date.
5. Promotion of the new EnviroStars waste directory that directs individuals and businesses to resources to properly handle wastes. The Spokane River Forum was integral in creation of this on-line resource.

Pipeline Issues

All wells were surveyed to identify Sanitary/Storm sewers within a 100' radius. These sewers have been identified for location, date of construction, and material (see **Exhibit 5.1.4**). Sanitary pipes located within the sanitary area have been lined to or replaced provide a joint less pipe union to reduce leakage. These pipes will be routinely monitored and replaced or relined as necessary. A video showing the current condition of the insides of these sewers are available.

All well station restroom toilets and urinals (black water) have been removed from service and capped off. Only sinks and floor drains (gray water) are still connected to the sewer service.

A high pressure fuel line (presently referred to as the Conoco pipeline – previously the Yellowstone pipeline) traverses across the Spokane Valley. Failure of this line could affect a number of wells in the Spokane Valley area that belong to a number of different water purveyors. The greatest concern the City of Spokane Water System has regarding this line is that it passes within about 100 feet from the City's Parkwater Well Station. Failure of the line in this location could have severe impacts to the Parkwater Station and possibly also the City's Well Electric Well Station. The City is currently looking for ways to reduce the potential impacts caused by this high pressure fuel pipeline, including permitting of a new well site in west Spokane.

Current Efforts to Enhance Wellhead Protection

In the last several years, efforts have been under way to propose a set of recommendations for consistent, region-wide Wellhead Protection measures. This work has been led by the Spokane Valley Rathdrum Prairie Wellhead Protection Policy Coordinating Committee, which includes members from the SAJB, the City, and variety of water districts, state and local agencies and local jurisdictions.

In 2014, the Committee published its set of recommendations intended to compliment the current aquifer protection measures and are specifically targeted at protecting public drinking water wells located within the aquifer. The Committee recommendations are included in **Appendix 5.1.2.**

Among other things, the committee included recommendations about:

- Adopting Regulated Special Wellhead Protection Areas, participating in the Aquifer Protection Council, and adopting notification requirements for proposed projects in wellhead protection areas.
- Proper stormwater treatment and disposal.
- Mitigation of stormwater contamination.
- Proper wastewater collection and conveyance strategies.
- Guidelines for approving new septic systems.
- Consistent land use and utility regulations for wellhead protection areas.
- Regulation of potentially harmful activities within wellhead protection areas.

These recommendations have been forwarded to the various local jurisdictions for their consideration and ultimate implementation.

At the City of Spokane, Environmental Programs and Planning staff are evaluating what ordinances or regulations would need to be changed to implement the recommendations. Additionally, staff are working to identify the impacts to potential development and to

develop detailed mapping to show the relationship of the proposed regulated wellhead protection zones to existing development and zoning. Staff will work with elected leaders to move forward with enhanced wellhead protection measures.

Chapter 6

Operation and Maintenance Program

CHAPTER 6

Operation and Maintenance Program

6.1 Water System Management and Personnel

The Water Department's structure and how it relates to the City of Spokane government structure is shown in **Figure 6.1.1.** The Director of Water reports to the Utilities Division Director.

Four major management divisions report to the Director of Water: Operation and Maintenance; Engineering; Hydroelectric Services; and Accounting. The Director, the Superintendent of Operation and Maintenance and other appropriate staff, as discussed in Section 6.2, have mandatory water operations certification as required by the Washington State Department of Health ("DOH"). Detailed organization charts are shown in **Figures 6.1.2 (A,B, C & D)**.

The Department's organization structure illustrates the lines of internal communication during normal operating and maintenance modes. Refer to Section 6.5 – Emergency Response Program, which details lines of communication in the event of an emergency.

6.2 Operation Certification

WAC 246-290-400, Waterworks Operator Certification, requires Class A public water systems in Washington State to retain in their employment individuals who are certified, by examination, as competent in water supply operation and/or management. The DOH determines the level and number of certified positions based on the population and complexity of the water system. The DOH requires the City Water Department to operate with 4 certified water distribution managers. The most recent letter from DOH specifying required certified operators is included in **Exhibit 6.2.1.**

In addition to the above, the Water Department maintains a list of all the employees of the Water Department that maintain current Washington State Certifications. **Figure 6.2.1** charts the positions of authority held by the certified employees. The grade of certification and the number of employees holding certifications satisfies the requirements of the DOH. The Water Department will notify the State Certification Board should the number of certified employees fall below the DOH requirements.

6.3 System Operations and Control

Identification of Major System Components

The City of Spokane water system has 22 pressure zones serviced by pumping stations and reservoirs. These pressure zones and system components including required maps have been addressed in Chapter 1, Section 1.3. The following list will describe the facilities that serve each pressure zone.

CITY OF SPOKANE WATER DEPARTMENT

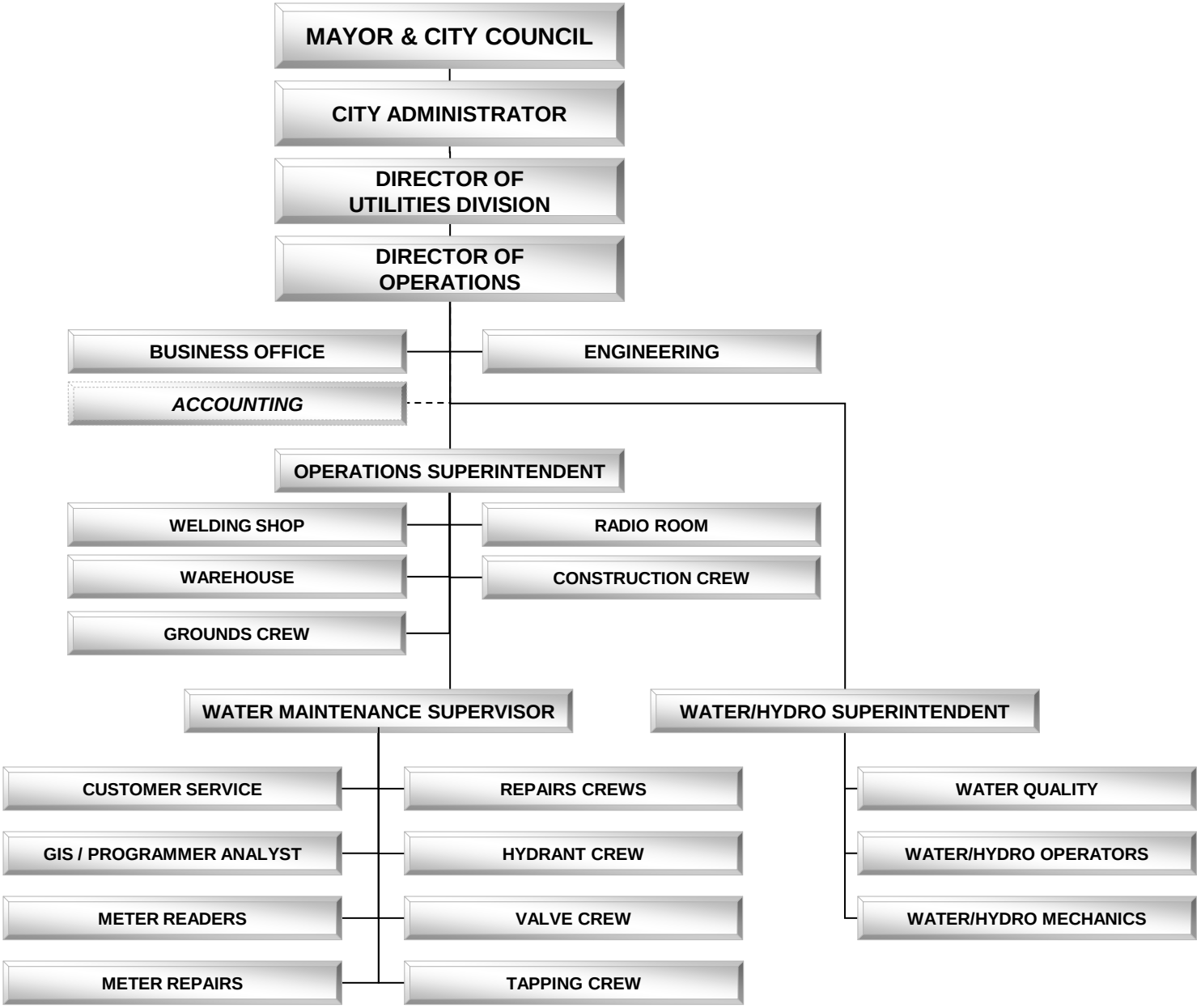


Figure 6.1.1

CITY OF SPOKANE WATER DEPARTMENT
ORGANIZATIONAL CHART

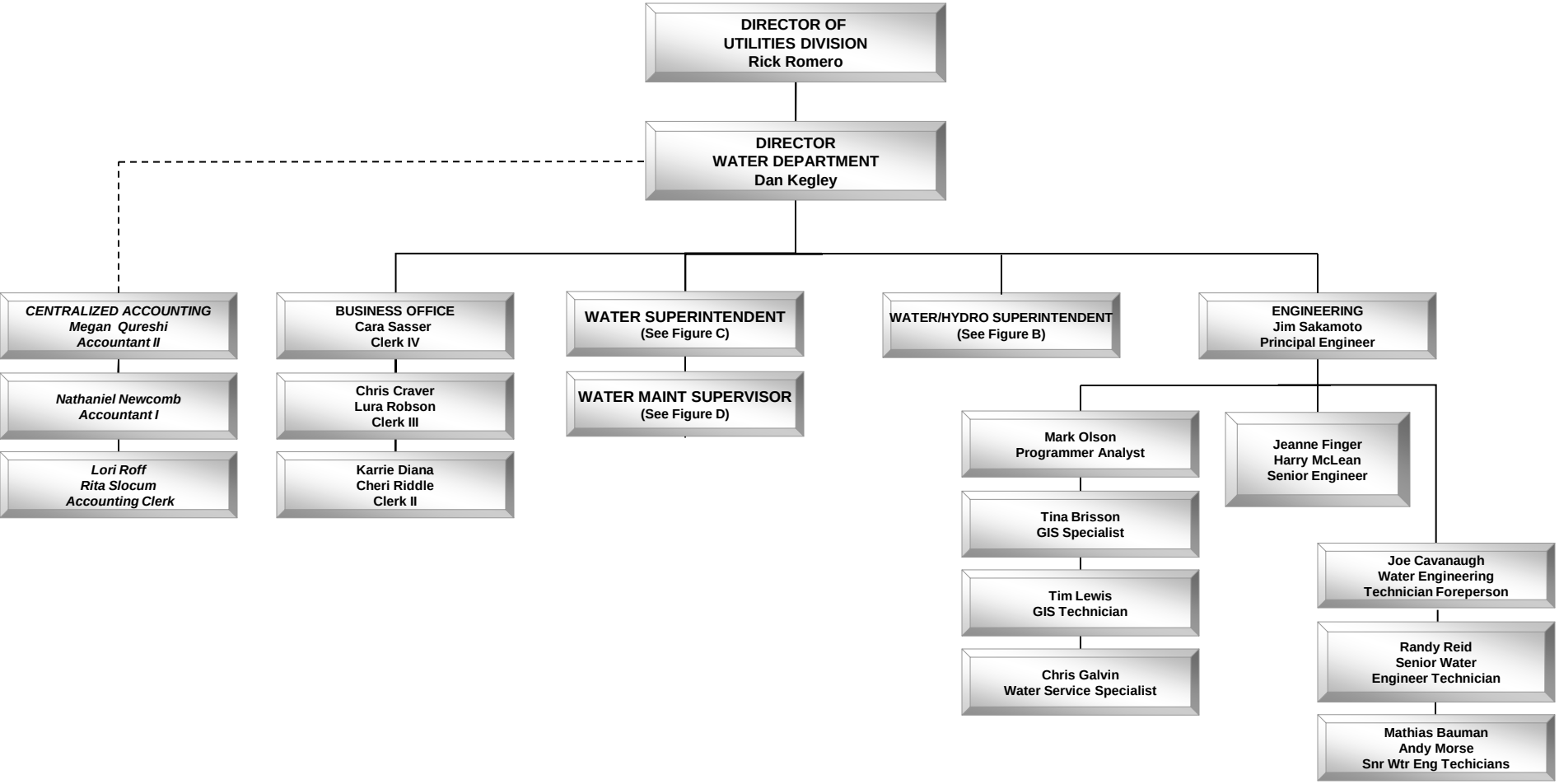


Figure 6.1.2A

CITY OF SPOKANE WATER DEPARTMENT
ORGANIZATIONAL CHART (continued)

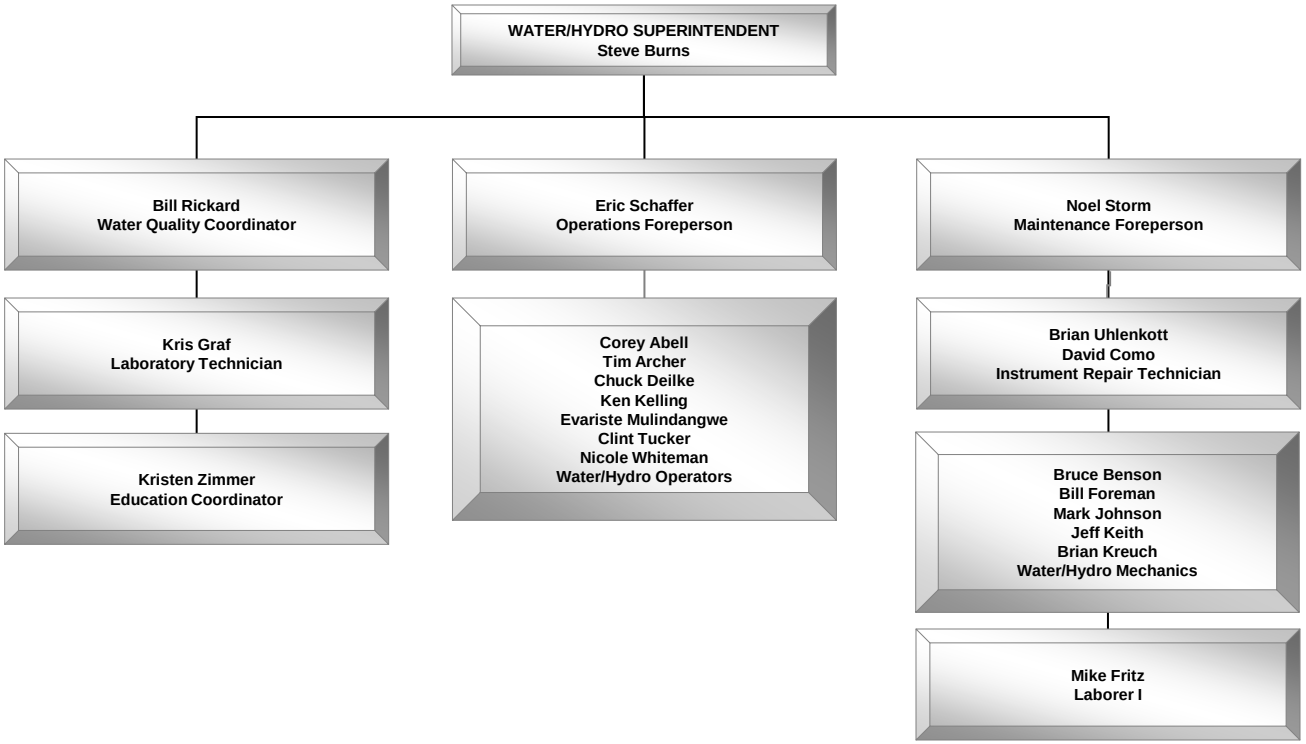
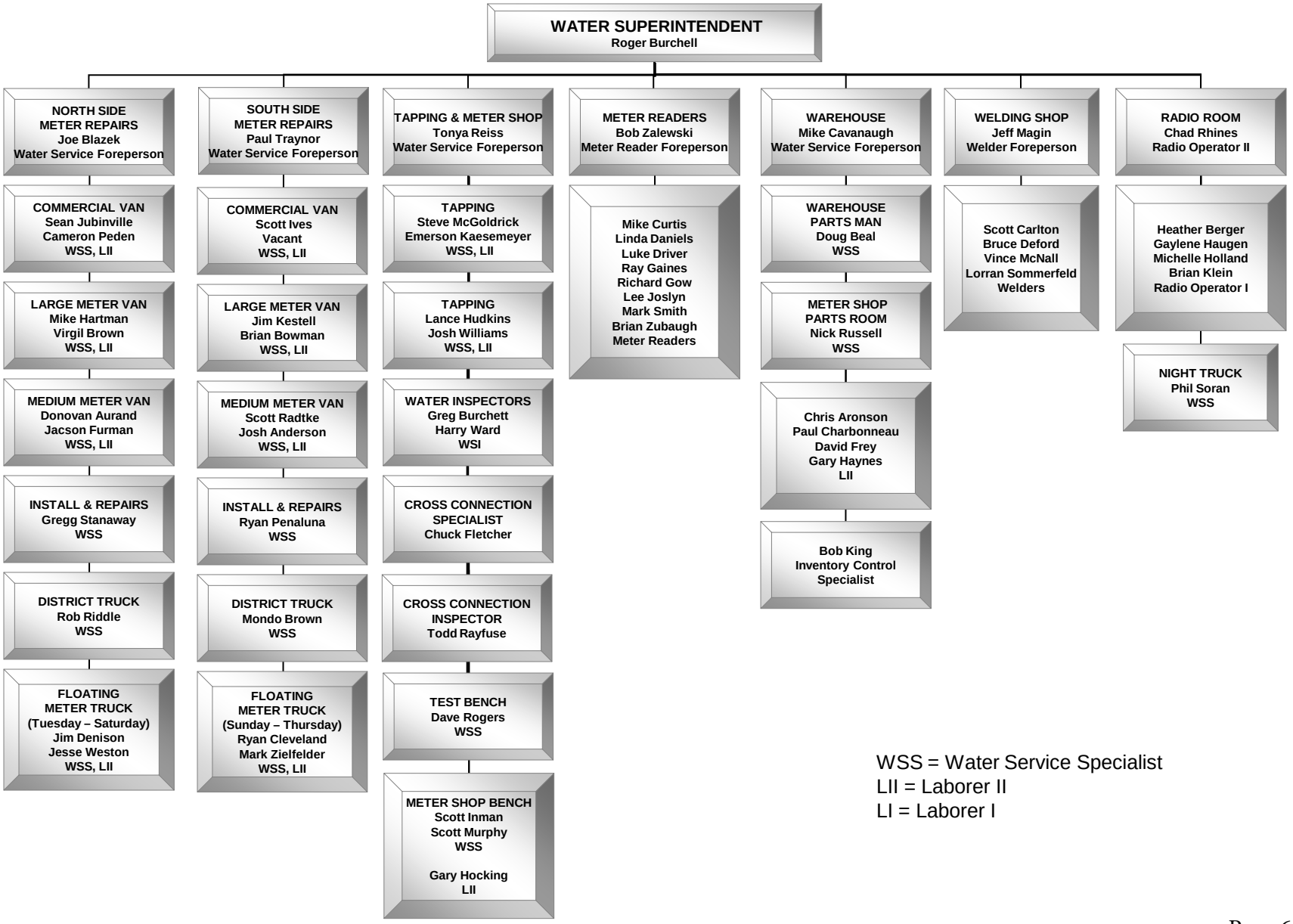


Figure 6.1.2B

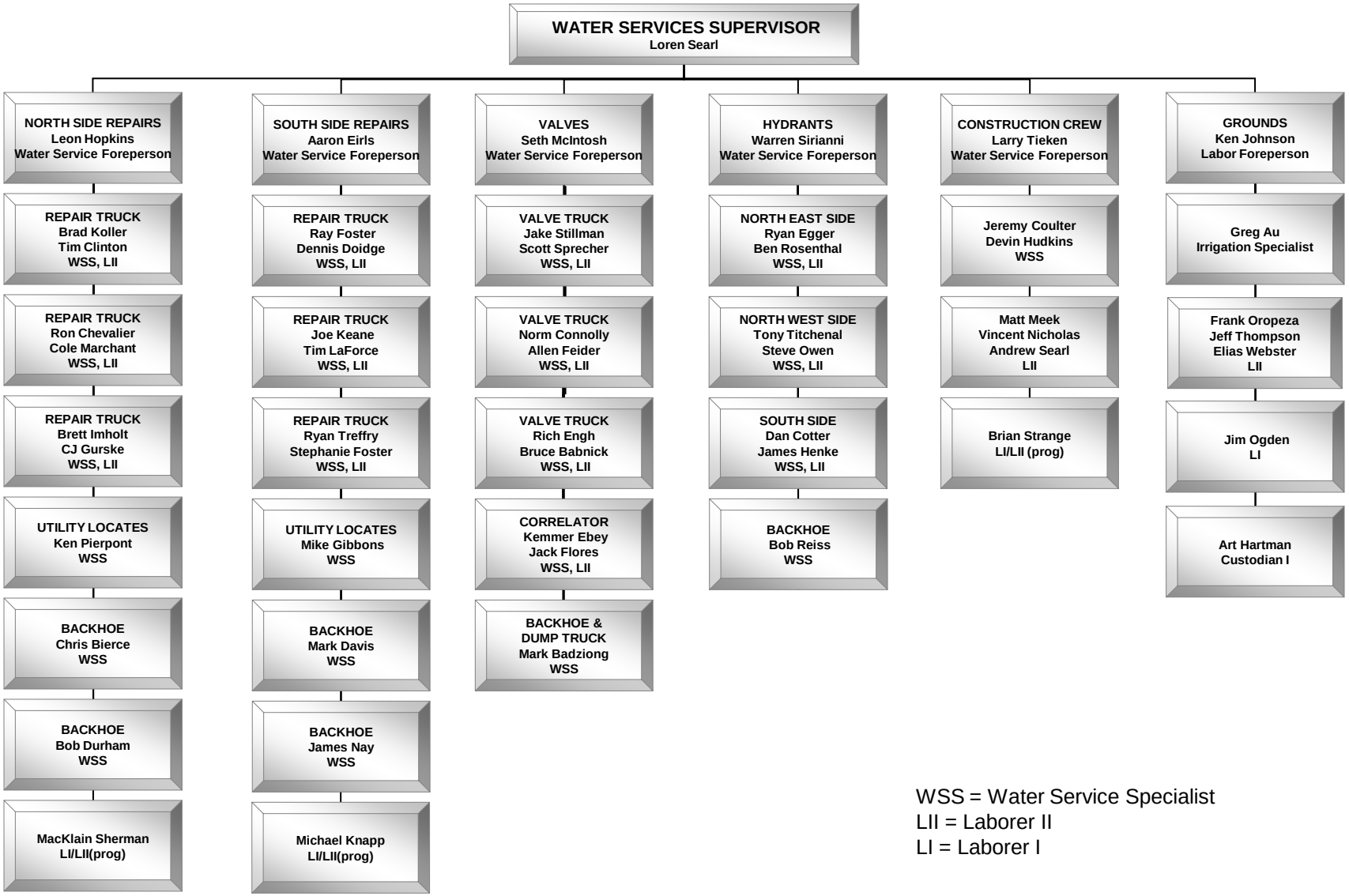
CITY OF SPOKANE WATER DEPARTMENT
ORGANIZATIONAL CHART (continued)



WSS = Water Service Specialist
LII = Laborer II
LI = Laborer I

Figure 6.1.2C

CITY OF SPOKANE WATER DEPARTMENT
ORGANIZATIONAL CHART (continued)



WSS = Water Service Specialist
LII = Laborer II
LI = Laborer I

Figure 6.1.2D

CITY OF SPOKANE WATER DEPARTMENT
CERTIFICATION CHART

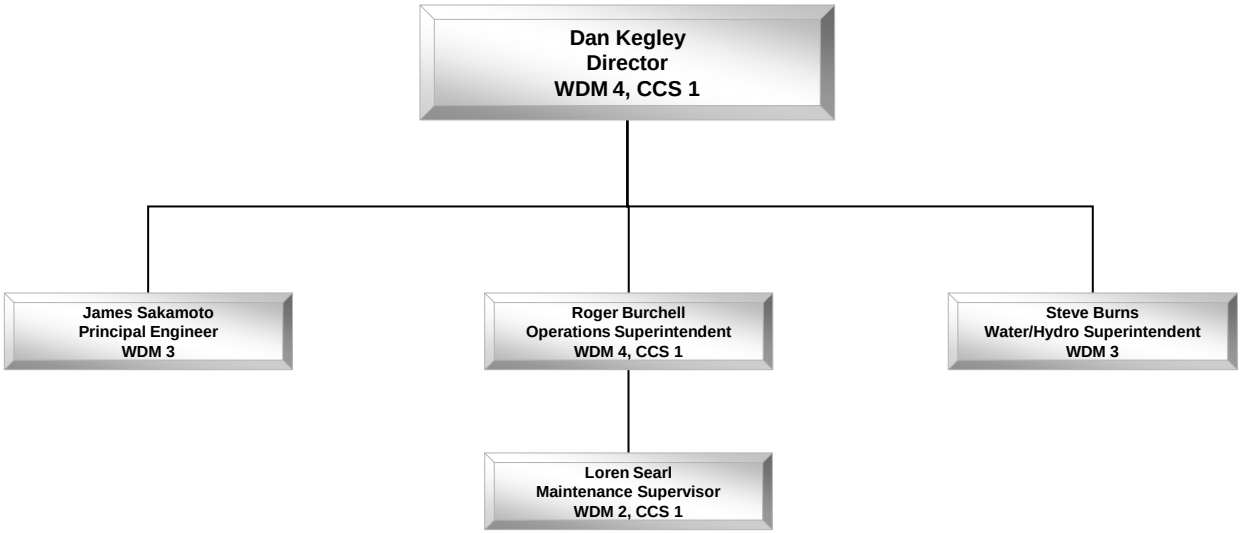


Figure 6.2.1

Low Pressure Zone

The Low Pressure Zone is served by source supply well pumps located at Well Electric, Parkwater, and Nevada Well Stations. There are six reservoirs with total storage of 28.75 million gallons in the Low Pressure Zone which are Shadle Park, Rockwood Vista, Ninth & Pine, West Drive, Thorpe Road, and Qualchan. The operator normally uses Ninth and Pine as the zone control reservoir and the pumps are scheduled to operate as needed to keep the water level in the reservoir within its normal operating range. If there is not enough water in the Thorpe Road reservoir when Rockwood Vista and Ninth and Pine reservoirs are nearly full, electrically operated valves can be closed to shut off flow into these two reservoirs, allowing continued pumping of water to Thorpe Road. The Qualchan reservoir can be supplemented by the Latah booster station in the event Ninth and Pine is full and additional flow is needed in the southwest portion of the Low system.

North Hill Pressure Zone

The North Hill Pressure Zone is served by source supply well pumps located at Central, Grace, Hoffman, and Well Electric Well Stations. Three reservoirs with total storage of 25.6 million gallons serve the North Hill Zone namely North Hill, Five Mile, and Indian Trail. Five Mile is normally used as the zone control reservoir, and the North Hill reservoir has an electric valve which can be operated to force water to the northwest portion of this pressure zone.

Intermediate Pressure Zone

The Intermediate Pressure Zone is served by source supply well pumps in the Well Electric, Parkwater, and Ray Street Well Stations. In addition, booster pumps located in the Ninth & Pine and Bishop Court Booster Stations lift water to this pressure zone from the Low Pressure Zone. There are two reservoirs with a total capacity of 20 million gallons of water at Lincoln Heights and a 520 thousand gallon reservoir at 14th & Grand that serve this pressure zone.

High Pressure Zone

Three Booster Stations lift water from the Intermediate Pressure Zone to the High Pressure Zone. The booster stations include Lincoln Heights, Lincoln Heights Annex, and 14th & Grand Blvd. The reservoirs serving this zone are the Garden Park and 33rd & Lamonte Street with total storage of 4.35 million gallons.

Top Pressure Zone

The Top Pressure Zone is supplied by booster pumps located at Garden Park, Division & Manito, and 35th & Ray Street Booster Stations. These booster stations lift water from the High Pressure Zone. The two Browne Park Reservoirs, that serve this zone, have storage capacities of 5.0 million gallons each.

Glennaire Pressure Zone

The Glennaire Booster Station lifts water from the Top Pressure Zone to supply the Glennaire Pressure Zone. The Glennaire Reservoirs #1 and #2 provide a total storage capacity of 1.15 million gallons.

Southview Pressure Zone

The Southview Pressure Zone served by the Southview Booster Station lifts water from the Glennaire Pressure Zone. The Southview Reservoir has a storage capacity of 48 thousand gallons. The water that is distributed in the Southview Pressure Zone has been pumped five times, lifting the water in excess of 1,150' above that of the original water source.

Woodland Heights Pressure Zone

The West Drive Booster Station lifts water from the Low Pressure Zone to the Sunset Reservoir (350 thousand gallons) and the Woodland Heights Pressure Zone. The Woodland Heights Pressure Zone can also be supplied by allowing water to drain from the Highland Pressure Zone.

Highland Pressure Zone

This Highland Pressure Zone is served by two booster pump stations and a reservoir. The Milton Street Booster Station lifts water from the Low Pressure Zone, while the Sunset Booster Station lifts water from the Woodland Heights Pressure Zone. Storage capacity of the Highland Reservoir is 1.0 million gallons.

SIA Pressure Zone

Thorpe Road Booster Station lifts water from the Low Pressure Zone to two reservoirs at the Spokane International Airport. The total storage capacity of these reservoirs is 4.5 million gallons. If needed, a limited supply of water can be provided to the SIA Pressure Zone by valving water from the Abbott Road Booster Station and the Geiger Heights Pressure Zone.

Plains Pressure Zone

The Spotted Road Booster Station serves the Plains Pressure Zone by lifting water from the SIA Pressure Zone to the Mallen Hill Reservoir. The Mallen Hill Reservoir has a storage capacity of 4 million gallons. The Spotted Road Booster Station also contains an electrically operated valve that can be used to drain water from the Plains Pressure Zone to supply the SIA Pressure Zone. This draining process can be utilized in the event of operating difficulties at the Thorpe Road Booster Station.

Eagle Ridge Pressure Zone #1

The Eagle Ridge Booster Station lifts water from the Low Pressure Zone to the Eagle Ridge Reservoir. The Eagle Ridge Reservoir has a storage capacity of 542 thousand gallons.

Eagle Ridge Pressure Zone #2

The Eagle Ridge Booster #2 Booster Station lifts water from Eagle Ridge #1 pressure zone to the Eagle Ridge #2 Reservoir. Eagle Ridge #2 Reservoir has a storage capacity of 1.22 million gallons.

Cedar Hills Pressure Zone

The Cedar Hills Booster Station lifts water from the Low Pressure Zone to the Cedar Road Reservoir. The storage capacity of the Cedar Road Reservoir is 300 thousand gallons.

Northwest Terrace Pressure Zone

The Northwest Terrace Pressure Zone is unique in the Spokane Water System in that it is one of two pressure zones served entirely by Pressure Reducing Stations that contains pressure-reducing valves. One pressure reducing valve (PRV) station accepts water from the Low Pressure Zone. The second feed into this zone comes from the North Hill Pressure Zone, where two pressure reducing stations step down the pressure to acceptable levels.

Hatch Road Pressure Zone

The Hatch Road Pressure Zone is the only other pressure zone within the system served entirely by two PRV stations with the water supplied from the Top Pressure Zone.

Midbank Pressure Zone

The Midbank Pressure Zone, supplied by booster pumps located in the Belt Street Booster Station, lifts water from the North Hill Pressure Zone. The capacity of the Midbank Reservoir that serves this pressure zone is 580 thousand gallons.

Five Mile Pressure Zone

The Five Mile Booster Station, located adjacent to the Five Mile Reservoir, lifts water from the North Hill Pressure Zone to the Strong Road Reservoir. The Strong Road Reservoir that serves this pressure zone has a capacity of 2.0 million gallons.

Indian Hills Pressure Zone

The Indian Hills Pressure Zone receives water supplies from the Five Mile Pressure Zone through a pressure reducing station that is located adjacent to the reservoir. In the event that the Indian Hills pressure regulator fails or needs maintenance, the Indian Hills Booster Station is a backup station that pumps from the North Hill Pressure Zone into the Indian Hills Reservoir. The storage capacity of the Indian Hills Reservoir is 30 thousand gallons.

Shawnee Pressure Zone

The Shawnee Booster Station lifts water from the North Hill Pressure Zone to the Shawnee Pressure Zone. The two Shawnee Reservoirs have a combined storage capacity of 74 thousand gallons.

Woodridge Pressure Zone

The Woodridge Pressure Zone is fed by the Woodridge Booster Station which pumps from the Shawnee System. The Woodridge Reservoir has a capacity of 228 thousand gallons.

Kempe Pressure Zone

The Kempe Pressure zone is fed by the Kempe Bosster Station which pumps from the Five Mile System. The Kemp Reservoir has a capacity of 1.1 million gallons.

Routine System Operation

The City of Spokane Water Department has a Water System Control Room located at Upriver Complex. The control room is staffed 24 hours per day, seven days per week by a certified operator who controls the operation of all pumping facilities and reservoirs in the

water system. This same operator controls operation of the Upriver Dam and Hydroelectric Facilities. The water system operator must have a Water Distribution Manager I certification. In addition, on alternate days a second operator visits and checks each pumping station. While at each station, readings such as pumpage, and chlorine use are recorded. The operator reports any abnormalities.

The normal starting and stopping of pumps is controlled by water levels in the reservoirs. The pumps operate as needed to maintain the reservoir levels within their normal operating range. This is done using a telemetry system to communicate to the remote stations. The telemetry system consists of a SCADA (Supervisory Control and Data Acquisition) system that uses a central computer located in the Upriver Complex Control Room. The SCADA system communicates with seven well station, 24 booster stations, and 34 reservoirs over four multiplexed leased phone lines and a broad spectrum radio system. The Water Department is currently developing and installing a new state-of-the-art SCADA system.

The monitoring at well stations includes well level, pump operation, station voltage, motor amperage, discharge pressure, discharge flow rates, and chlorine residuals and usage. The monitoring at booster stations includes pump operation, suction and discharge pressures, station voltage, motor amperage, and discharge rates. Monitors at the reservoirs record water levels, inlet/outlet valve positions, as well as checking for flooded vaults. All facilities also are fitted with intrusion monitors that will activate an alarm. The SCADA system uses a continuous polling process that updates information to the control room every one to three minutes. If a station fails to respond, a communication alarm is generated.

Alarms are generated when any quality falls above or below the defined normal operating range. As an example, the water level alarms will activate on both high and low set point values as defined for each specific reservoir. The inlet/outlet valves at the reservoirs are monitored and will also activate an alarm should they close. Alarms located in well stations or booster stations include suction and discharge pressures, intruders, high or low voltage or amperage use. The SCADA computer generates an alarm to alert the water system operator stationed at the water system control room.

The well pumps are started or stopped by the operator based on his/her professional opinion. The SCADA system starts and stops booster pumps on an as needed basis. The computer programs utilized in the SCADA system can be changed to suit the season or weather condition. The operator monitors the operation of the booster stations and changes or overrides the control strategies as necessary. In the event SCADA communication fails with a well station or booster station, each pump can be manually operated.

The normal operation in the summer is different than in the winter because of the difference in demand. Average winter pumpage is about 33 million gallons per day. Average summer pumpage approaches 155 million gallons per day after a week of hot dry weather. Typically, three weeks of hot dry weather will bring with it very high demands for water. High demands for water in the summer months mean that some pumping stations are activated for summer use and deactivated during winter months. Well stations commonly used for summer peaking demands are Grace and Hoffman. Booster Stations used primarily in the summer are Ninth & Pine, Bishop Court, and Division & Manito.

The Water Department's primary objective is to schedule pump operations to ensure an uninterrupted supply of water in adequate quantities and at appropriate pressures throughout the water system. A secondary goal is to operate the system efficiently. Pump scheduling is changed for winter and summer operations so that the pumps that best match the demand are used first. The secondary goal of improving operating efficiency entails using the most efficient pump first. "The most efficient pump" is based on pump curves for new pumps and results from field efficiency tests.

At times, pressure considerations within the water system will override the need to operate pumps efficiently. These times are dwindling however, as infrastructure modifications are improving the water system. Each reservoir has a defined water level range, which in turn defines when pumps are cycled on and off. Each pressure zone has a different combination of pump capacity, reservoir storage, and water demands. Thus, each pressure zone has control strategies that are unique. Copies of the control strategies for each pressure zone can be found in **Appendix 6.3.1**

Safe operating procedures and protection of the employees are of the utmost importance. The City of Spokane has a Risk Management Department that is responsible for advising the Water Department employees about safety requirements. The City's "Safety Manual" is furnished to supervisors and all employees receive an employee handbook with safety measures. The City's safety procedures are in compliance with WISHA and OSHA standards, as implemented by the Department of Labor and Industries. In addition, water system operators are trained in specific safety tasks and procedures. Outlines of these tasks and procedures are presented in **Appendix 6.3.2**.

Also part of "Routine System Operations" is meter reading. Meter readers read water meters and record water consumption. The meter readers provide the consumption data to the City of Spokane Utility Billing Department, which produces the utility bills. The meters of residential customers are read bi-monthly, while the meters for commercial customers are read monthly.

Operations Calendar

Daily/Every other day

Trapline or Station Checking

- Check all operating stations.
- Record pumpage at each station and pump hour meters.
- Record chlorine usage for each well pump.
- Make out trouble reports for deficiencies.
- Check charts for proper operation.
- Check operating pumps for noise, vibration, temperature, oil level, leaks and proper voltage & amperage.
- Check station for security and/or vandalism.

Shift Operations

- Check station for security and/or vandalism.
- Make rounds every four hours taking readings and filling out charts and logs.

- Monitor pump operation and change control strategies as necessary.
- Respond to alarms generated by SCADA.
- Answer Phones and radio calls and respond as necessary.
- Take chlorine residuals for Well Electric operating pumps.
- Record pumpage and chlorine usage for Well Electric and hour meters.
- Record Electrical meter readings for pump load.

Weekly

Station Checking

- Take chlorine residual on all operating pumps.
- Change recording charts.

Shift Operators

- Fill and change logs and charts.

Spare Operator & Tank Checking

- Change chlorine tanks and exchange with chlorine supplier as needed.
- Check all tanks and reservoirs for vandalism.
- Record chlorine residual at all tanks.
- Check for leaks and abnormal conditions.

Monthly

Station Checker or Spare Operator

- Get end of month hour meter reading.
- Bring in station logs and start next month's log.
- Attend safety meeting.

Quarterly

Spare Operator

- Download information from monitoring wells.

Annually

All Operators

- Gather information necessary for annual reporting.

Maintenance Calendar

Daily

- Perform assessment work at each assigned station.
- Note deficiencies and report to foreman.

Monthly

- Check vibration and bearing temperatures on all running pumps.

- Attend safety meetings.

Winter

- Make repairs to pumps in well stations as necessary.
- Service Well Electric pumps and auxiliaries.
- Calibrate and service flow meters.
- Clean switch gear.

Spring

- Perform pump maintenance in booster stations .
- Clean switch yards and transformers.
- Place stations in service as needed - Indian Canyon, Bishop Court, Grace, Hoffman.
- Check out and service stations as they are put in operation.

Summer

- Respond to trouble reports to keep all units in operating condition.
- Make sure air coolers and vent fans are working properly.
- Service hydroelectric generators and other elements of hydro dam.

Fall

- Shut down and winterize stations when they are no longer needed.
- Drain air coolers at stations.
- Check and service all heaters in vaults, sumps, and stations.
- Begin repairs of pumps that failed or need service from summer operations.
- Check current on pumps.

Preventative Maintenance Program

In addition to the daily checks made by the operator, each station is assigned a maintenance mechanic to perform maintenance on the equipment. The assigned mechanic, as part of an Assessment Program, performs preventive maintenance checks on the equipment in the station. These preventative examinations include noting; pump and motor bearing temperatures, pump and motor vibration, unusual noise, lack of lubrication, and servicing the electrical equipment. Air coolers, heaters and vent fans are also included in these checks. Work that is beyond the scope of the Assessment Program is reported to the foreman and is scheduled for repair.

Typically, normal maintenance projects are scheduled during the off-season. This provides assurances that equipment will provide reliable service during the months of high demand plus scheduling large replacement and repair jobs during the off-season provides the opportunity to be more efficient, and keep costs to a minimum. Therefore, for water pumps, motors and related equipment major work is scheduled for late fall, winter, and early spring when water demand is lowest. For the Department's hydroelectric facilities major work is scheduled for summer when river flows are low.

Equipment, Supplies, and Chemical Listing

The City of Spokane's water comes solely from the Spokane Valley/Rathdrum Prairie (SVRP) Aquifer. Treatment of the water is not required; however, chlorine is added at the wellhead as a disinfectant. Chlorine is the only chemical that is stored, and the quantity stored is only the amount that is currently in use. The chlorine is purchased on a yearly contract and the supplier is required to maintain sufficient quantities at their storage facilities to satisfy on-going needs. Typically, the City uses 2,000 lb and 150 lb cylinders of gaseous chlorine. Chemicals used for water testing, such as chlorine residual sampling, are supplied by a chemical supplier that stores them off-site. No more than the current week's supply of these chemicals is stored on City of Spokane property, and the amount stored at any given location never exceeds 2,500 pounds at any time.

6.4 Comprehensive Monitoring (Regulatory Compliance) Plan

The Federal Safe Drinking Water Act ("SDWA") provides direction for the Department's water quality monitoring program. The water quality monitoring program is based on compliance with WAC 246-290-300, Public Water System Rules and Regulations, as established by the State Board of Health and the Environmental Protection Agency ("EPA"). Enforcement of the program is the responsibility of the DOH, specifically the Department's Eastern Regional office located in Spokane. The Safe Drinking Water Act, as it is implemented and enforced through the EPA, at times drives City monitoring directly, because programs such as the Unregulated Contaminant Monitoring Rule ("UCMR") require preemptive monitoring of potential emerging contaminant threats.

The Department's Water Quality Section, along with the support of the City's Environmental Programs Department, manages water quality for the City of Spokane. The Water Quality Section consists of two people with appropriate water quality expertise plus an in house laboratory. Other branches of the water department assist on an as-needed basis. The following sections provide a summary of the water quality monitoring program.

Water Quality Section

The Water Quality Section ensures that the City is in compliance with all state and federal drinking water regulations. Responsibilities include:

- Controls access to sampling points and maintains all water quality records.
- Maintains and operates a certified drinking water laboratory.
- Carries out field tests, laboratory tests, bacteriological & protozoa sampling and tests chlorine residuals in the water at designated sampling points.
- Records field data at the time of source sampling, maintains continuous monitoring instrumentation, and carries out river and GWI monitoring.
- Maintains lists of EPA-approved laboratories, their testing capabilities, and utilizes their services as necessary.
- Maintains the monitoring system that measures groundwater depth and downloads the aquifer groundwater depth data (nine sites).
- Writes the Consumer Confidence Report on an annual basis.
- Advises Water Department personnel and other departments on water quality issues.

- Works with regional groups regarding water quality

Environmental Programs

The City's Environmental Programs Department assists the water quality program by performing the following activities:

- Coordinates the source and special testing programs.
- Writes technical water quality reports.
- Maintains a file of duplicate source test records.
- Maintains a source water quality database.
- Maintains searchable contaminant source inventory databases.
- Maintains the wellhead protection-groundwater aquifer model.
- Keeps abreast of new regulatory requirements and assists in their implementation.
- Brings water quality issues to the floor in planning processes.

Source Testing

Locations

Since all of the City's well stations draw their water from the same aquifer, the Water Department considers each source well station as an individual well requiring a single sample for each parameter representing each well within the well station. This meets the DOH "Well Field and Monitoring Requirements" **Appendix 6.4.1**.

Over the past several years, the City has added special raw water sampling pumps and ports at various well stations. The City considers bacterial testing on the raw (untreated) well water an important indicator of the water quality found in the aquifer. The City has also been asked to continue this raw water sampling by DOH staff. The City has raw water sample points at all well stations except Central Avenue Well Station.

Photographs of representative sample taps at the City's source pump stations can be seen in **Appendix 6.4.2**. Each photograph is followed by a list of pump stations with similar sample points. The actual pump station where the photograph was taken is the first name listed.

Water quality staff also records detailed field data at the time of sample collection. This includes information regarding the exact sampling location, the pumping rate at the sample location, the pumping rate at other nearby well locations, and the groundwater elevations and conditions. Two types of these recording forms can be found in **Appendix 6.4.3**.

Inorganic Chemical/Physical Monitoring

The City Water Department is responsible for Chemical/Physical Monitoring (i.e. total inorganics, nitrates, chloride, etc.).

See **Table 6.4.1** for sample type information.

The City uses the "Full List" Inorganic test at a certified lab to meet the nitrite requirement, as it currently has the same "one in three year" compliance schedule. For chlorine residual monitoring, the City usually monitors for free chlorine residual. The required Water Quality

Parameters ("WQP") have varied with each testing program, and those that can be done by City staff have varied by program as well. The WQP-GWI field testing includes conductivity, pH, temperature, and turbidity being done by City water quality personnel. While turbidity is not generally required, it is and has been required for special testing programs as noted above.

Radionuclides

Monitoring requirements have been met for the initial monitoring compliance period through December 31, 2007. Regular compliance monitoring to meet the Radionuclide Rule will begin with the next monitoring cycle. See **Table 6.4.1**.

Organic Chemical Monitoring

Samples for Organic Chemical monitoring have including regulated and unregulated Volatile and Synthetic Organic Compounds, collected at the source. Samples are collected, depending on the type of sample needed, from each source at locations mentioned previously. Sampling procedures require drinking water samples be collected in kits provided by the lab and shipped overnight, cold packed and appropriately preserved, in order to arrive at the lab in a timely manner. Travel blanks are included in the kit. The laboratory typically rejects samples that exceed quality control parameters for analysis, including samples that report positive travel blanks. More recently, EPA protocols require the labs to check arrival temperatures and pH before accepting samples for testing for some parameters. Some tests, including volatile organics, require a field preservation step in addition to the chemicals that are placed in the sample container by the lab. See **Table 6.4.1**.

Bacteria

The City collects and tests bacterial samples of raw water from all operating well stations on a monthly basis. This is a voluntary activity to determine the quality of the source water over time. The samples are collected, cooled, and transported to the laboratory within the prescribed 6-hour holding time. See **Table 6.4.1**.

TABLE 6.4.1

DRINKING WATER TEST LOCATIONS & FREQUENCIES

Current as of November 1, 2005

TEST PARAMETER	Source Tests Done	Type of Sample	Required by State and/or EPA	Required Frequency per Source
Chemistry - Inorganic				
Asbestos	No	Treated	Yes	1 per 9 years
Chlorine Residual	Yes	Raw	Yes	1 per day
Full List of Inorganic Contaminants	Yes	Raw	Yes	1 per 3 year
Copper	Yes	Treated	Yes	50 per 3 year
Lead	Yes	Treated	Yes	50 per 3 year
Nitrate	Yes	Treated	Yes	1 per year
Nitrite	Yes	Treated	Yes	1 per 3 year
Temperature	Yes	Both	No	Monthly/Quarterly
Turbidity	Yes	Both	No	Monthly/Quarterly
WQP*-GWI	Yes	Raw	Yes	1 per week
*WQP – Water Quality Parameters				
Radionuclides				
Alpha particle activity	Yes	Either	Yes	4 qtrs, 1y in 4y
Beta particle activity	Yes	Either	Yes	4 qtrs, 1y in 4y
Radon	Yes	Treated	Yes	4 quarters
Chemistry - Organic				
Volatile Organics	Yes	Treated	Yes	1 per 3 year
Trihalomethanes	Yes	Treated	Yes	Quarterly
Haloacetic Acids (HAA%5)	Yes	Treated	Yes	Quarterly
Chemistry – Synthetic Organic				
Carbamates (531.1)	Yes	Treated	Yes	2 qts per 3y
Dioxin (1631)	No	Treated	Yes	1 per 3 year
Diquat & Paraquat (549)	Yes	Treated	Yes	1 per 3 year
EDB & DBCP (504.1)	Yes	Treated	Yes	1 per 3 year
Endothal (548)	Yes	Treated	Yes	1 per 3 year
Glyphosate (547)	Yes	Treated	Yes	1 per 3 year
Herbicides (515.1)	Yes	Treated	Yes	2 qts per 3y
Pesticides (525.2)	Yes	Treated	Yes	2 qts per 3y
Bacteria				
Total Coliforms	Yes	Raw	No	1 / year min. [1/month]
Fecal Coliforms	Yes	Raw	No	1 / year min. [1/month]
Heterotrophic Plate Counts	Yes	Raw	No	1 / year min. [1/month]
Total Coliforms	Yes	Treated	Yes	120 per month
Fecal Coliforms	Yes	Treated	Yes	120 per month
Heterotrophic Plate Counts	Yes	Treated	No	120 per month

Schedule

Source testing generally follows a once in three year cycle within a nine-year sampling framework. The City's scheduled source testing is designed to meet State & Federal requirements, meet City informational needs regarding citizen concerns and proposed regulations, and finally provide as broad a look at source quality as possible.

Every opportunity is taken to combine testing needs into single sampling events. Other circumstances that could change the projected sampling schedules are discussed under "Adjustments to Monitoring Program" presented later in this chapter. **Appendix 6.4.4** shows the "2005 Drinking Water Source – Completed Quarterly Monitoring". Current and projected future schedules can be found in **Appendix 6.4.5**.

Most sampling is done in the month of July because this is the only month, of the four usually used, where it is practical to have all the well stations operating. In the winter months, two well stations are winterized, Grace and Hoffman.

The City has planned source sampling events to fall on the last Tuesday of the month, in the first month of each quarter (i.e. January, April, July, October). County and City testing at the wells is performed at one time, saving mobilization costs and providing a cross check on lab data where duplicate tests are run. Approximately 30 days before the planned sampling date, Environmental Programs staff review the projected sample plan and make adjustments as deemed appropriate. The Department's Water Quality Section, the necessary labs, and other sampling participants are contacted to confirm sampling dates. A projected sampling list is generated and sent to all participants.

Past schedules of lab work are retained and annual test result summaries are produced. Efforts are being made to record expenditures, and laboratories used, on the projected work schedule.

Waivers

The City has taken advantage of some source testing waivers offered by DOH. The City has not tested for parameters waived on a statewide basis (for example dioxin). In the past 3-year compliance period, the City chose not to take advantage of such waivers and instead did two quarters of testing at each of the well sites for the synthetic organic chemicals (SOCs) required by the State to be tested. Waiver costs, and anticipated monitoring benefits and costs, are weighed against each other in determining when the City will take advantage of State monitoring waivers.

Written requests for and responses to waiver requests are saved both at the Water Department and the City's Environmental Programs Department. Waivers can be contingent on a well's vulnerability and susceptibility ratings. See **Appendix 6.4.6** for the City well vulnerability and susceptibility ratings.

The City anticipates that some SOC parameters will continue to be waived on a statewide or area basis. City water will evaluate these waivers as notices are received and decide which are appropriate to use.

The Ray well station has been on quarterly nitrates analysis since the level was found just over half the MCL (5 mg/L) in March 1997. Since that time, the nitrate concentrations have

been typically 5 mg/L or less, but as there have been intermittent exceedances of half the MCL, the City will continue quarterly monitoring for nitrates at Ray Street Well Station.

With the SOC testing, the City has had three chemicals detected, all below MCL levels. Di (2-ethylhexyl) Phthalate, Di (2-ethylhexyl) Adipate, and Di-n-Butylphthalate have each been detected more than once, but never consistently (for more detail see the Water Quality Section 3.2). The State has not required follow-up quarterly testing because there is reason to believe that the results may be laboratory errors.

Options

As discussed earlier, with DOH approval, the City does use the option of considering single test point data representative of well station discharge in cases where there are multiple holes (wells/casings) and pumps. The City also uses the option of treating the entire system as a single treatment plant for the purposes of disinfectant byproduct monitoring.

Laboratories

The Water Department contracts, and/or otherwise engages, State-accredited laboratories to perform drinking water testing as required by regulation. The City has a Department of Ecology accredited Water Laboratory and an accredited Wastewater Laboratory. The Wastewater Laboratory tests nitrate samples at the Ray Well Station for the City, as a cross-check with results obtained from other laboratories.

The City puts out a Request for Proposals every three years and awards a contract for water quality testing in this manner. The City also runs some samples through a County contracted, State approved lab, in connection with an Agreement between the City and Spokane County. The County then provides the City with an annual aquifer water quality report and access to aquifer wide sampling results.

The City of Spokane has used the following laboratories over the last several years for drinking water analysis:

City of Spokane
Water Quality Laboratory
2701 N Waterworks St.
Spokane WA 99212

Anatek Labs
504 E Sprague Ave Ste D
Spokane WA 99202

Spokane County Health District
1101 W College Ave
Spokane WA 99201-1440

North Creek Analytical Laboratories
11922 E 1st Ave
Spokane Valley WA 99206

Special Monitoring

As discussed in the Water Quality Section (Chapter 3.2), the City has been engaged in special sampling at Well Electric. DOH has required this testing in an effort to help determine if this well is or can be influenced by the Spokane River. It has been determined that Well Electric is hydraulically connected to the Spokane River, but has been determined by DOH to not be under the direct influence of surface water.

In fall 1994, and spring 1995, an outside consultant took groundwater measurements in approximately 100 wells located throughout the Washington portion of the Spokane Valley/Rathdrum Prairie Aquifer as part of the wellhead protection program. The Spokane River stage data was also collected during the same periods. This work, along with seismic profiling of the aquifer bottom in a number of locations, was done to further the development of an aquifer model used in determining potential wellhead protection areas, as required by the State's Wellhead Protection Program. For further information see City of Spokane "Wellhead Protection Program Technical Assessment" report.

Other special testing required by DOH, that the City has had done, includes quarterly and annual testing for volatile organics following detections, and quarterly checks on nitrate levels following the exceedance of half the MCL.

City special testing in the past has included a number of tests that were done voluntarily, to meet City needs. This included testing for nitrate, radon, cryptosporidium, giardia, microscopic particle analysis, coliform bacteria, heterotrophic plate counts in raw source water, and synthetic organics.

The American Water Works Association ("AWWA") has recommended that utilities in areas where radon is found in groundwater begin taking quarterly samples for radon at the entry points to the distribution system. This testing, which they recommend be done for one year, is not currently required but would provide a baseline and would likely meet forthcoming requirements.

The City has nine ground water level monitoring points in the aquifer besides the production well level monitoring. This level monitoring network was installed as a part of the City's Wellhead Protection Program. Each of the monitors, but one, is located in a new monitoring well. One of the monitors is located in an old "208" monitoring well and is dubbed the "Central PreMix 208" monitoring site. City water quality staff downloads the data from these locations on roughly a quarterly basis. The downloaded information is also sent to the Environmental Programs Department. Pictures of each of the sites, along with the name and location, are in **Appendix 6.4.7**.

Future Monitoring Requirements

It is expected that additional chemicals and microbiological contaminants will be added to the required EPA monitoring list. It is anticipated that such changes will not significantly affect the City but will fit within the existing testing that is already required.

City staff is continually working to identify future monitoring requirements. The advanced schedules of planned monitoring help keep the potential events in perspective.

Distribution System Testing

Locations

Distribution system sampling locations are generally testing program specific and will be discussed here by program.

Asbestos Monitoring

There is no longer any asbestos-cement pipe in the City of Spokane water distribution system.

Coliform Monitoring

There are fixed distribution system sites where coliform sampling occurs on a regular basis. See "Coliform Monitoring Plan" for details, **Appendix 6.4.8**.

Disinfectant Residual Monitoring

Water Quality personnel continuously monitor the disinfectant residual, drawing samples from fixed locations throughout the distribution system.

Lead - Copper Rule Testing

The federal Lead-Copper Rule required the City to identify homes with lead service lines (981 homes identified) and homes with copper plumbing with lead soldered joints less than five years old (671 homes identified). Fifty of each of these types of listed homes (100 altogether) were originally tested twice for lead-copper. All 100 tests were below the EPA action levels which qualified the Water Department for reduced monitoring. Reduced monitoring involves sampling only 25 of the previously sampled sites of each type (50 total). Specific information about the location of homes tested, and test results are available at the Water Department. The City is currently classified as optimized for corrosion control. See **Appendix 6.4.9**.

Disinfection Byproduct Testing

The Stage II Disinfectants and Disinfection By-Product Rule set new limits for trihalomethanes, establishes limits for haloacetic acids and limits for disinfectants. This requires at least quarterly checks for trihalomethanes and haloacetic acids at the point of maximum residence time. The City uses Mallen Tank as the point of maximum residence time during the Winter and Spring quarters, and a sampling station located at Nine Mile Road and Ridgecrest Drive, referred to as the BPA transmission easement, during Summer and Fall quarters.

Schedule

Coliform bacterial monitoring and the associated disinfectant residual monitoring are continuous monitoring programs designed to exceed the minimum monthly sampling requirements set by State and Federal regulation. For more information about the schedule, see **Appendix 6.4.5**.

Waivers

The City has not sought State waivers for distribution system testing. The State can waive some Lead-Copper testing, based on past results, when action levels are not exceeded.

Special Monitoring

Other than some follow-up coliform monitoring and the UCMR testing, which was special monitoring for EPA, no other special monitoring is currently required.

Record Keeping

Analysis reports for all water-quality monitoring are maintained in the City of Spokane Water Quality Laboratory. Duplicate records are kept at the Environmental Programs Department office in City Hall. The Water Quality Section and Environmental Programs both have databases of past results. Results of bacteriological sampling are maintained at the City of Spokane Water Quality Laboratory for ten years. The samples are catalogued by month and sorted out as drinking water, raw water, new construction, and sanitary survey. Environmental Programs Department keeps copies of recent raw water and Spokane River bacteriological results. Additional detail water quality testing information is provided in the "Report on Spokane Drinking Water for 2005" in **Appendix 3.2.1**. Representative laboratory reports for the various tests are located in **Appendix 6.4.10**.

Adjustments to Monitoring Programs

The City of Spokane has to be prepared to modify the monitoring program for any and/or all of the following reasons:

1. State or Federal regulations change.
2. The State Department of Health or US EPA may require additional testing.
3. Current monitoring results may trigger re-sample requirements.
4. The City's Contingency Plan and/or Emergency Response Plan may result in the need for additional testing. See Chapter 5 of the City of Spokane's 1998 "Wellhead Protection Technical Assessment" report and **Table 6.4.2**.

TABLE 6.4.2

RE-SAMPLING FOR DETECTIONS OF CONTAMINANTS		
Inorganic Chemicals		
	Asbestos	None required, State discretion
	Metals	None required, State discretion
	Nitrate	Four quarterly samples when >=5 mg/L
	Nitrite	Four quarterly samples when >=0.5 mg/L
	Turbidity	Re-sample within one hour if > 1.0 NTU
Radiochemicals		
	Alpha Particle	If > 2 pCi/L recommend Ra-226 & Ra-228
	Beta Particle	If > 5 pCi/L required Ra-226
	Radium 226	If > 3 pCi/L required Ra-228, State may require annual Ra-226 testing

Organic Chemicals		
	SOCs	Quarterly testing, two quarters minimum
	VOCs	Quarterly testing, two quarters minimum
Bacteria		
	Total/Fecal Coliforms	At least three repeat samples per positive coliform sample taken within 24 hours of results. (See Coliform Monitoring Plan for details)
Re-sampling for MCL exceedances in each of the major contaminant groups is addressed below.		
Inorganic Chemicals		
	Asbestos	Monitor quarterly
	Metals	Quarterly monitoring; State may require re-sample within 2 weeks
	Nitrate	Re-sample within 24 hours or notify public
	Nitrite	Re-sample within 24 hours or notify public
	Secondary Contaminants	Three additional samples within 30 days.
Radiochemicals		
	Alpha Particle	Quarterly monitoring
	Total Radium	Quarterly monitoring
	Man-made	Monthly testing
Organic Chemicals		
	Trihalomethanes	4 distribution samples per treatment plant per quarter
	Haloacetic Acids	4 distribution samples per treatment plant per quarter

6.5 Emergency Response Program

Preparedness, response mitigation, and recovery form the essential elements of an emergency management plan. Mitigation planning involves performing a vulnerability analysis, identifying facilities whose functions are critical to the functioning of the community such as hospitals, critical patient's homes, and the like. For a large system like the City of Spokane Water system, many of the problems that may be viewed as critical situations with respect to a small system, could be handled routinely. Thus, this plan addresses the most critical of the factors and the response/notification plans are implemented to address such situations.

Water System Personnel Emergency Call-Up List

An emergency notification flow chart is a vital part of the Emergency Response Program. This chart is posted in both the 24 hour - staffed Water Department Radio/Dispatch Room located at the department's business office at 914 E. North Foothills Drive and the 24 hour - staffed Upriver Complex Water System Control Room located at 2701 N. Waterworks St. The location of these facilities is shown on the map in **Figure 1.3.2**. The flow chart lists the personnel to be notified in the event of a major emergency and is revised as personnel changes occur. The notification chart is provided as **Figure 6.5.1**.

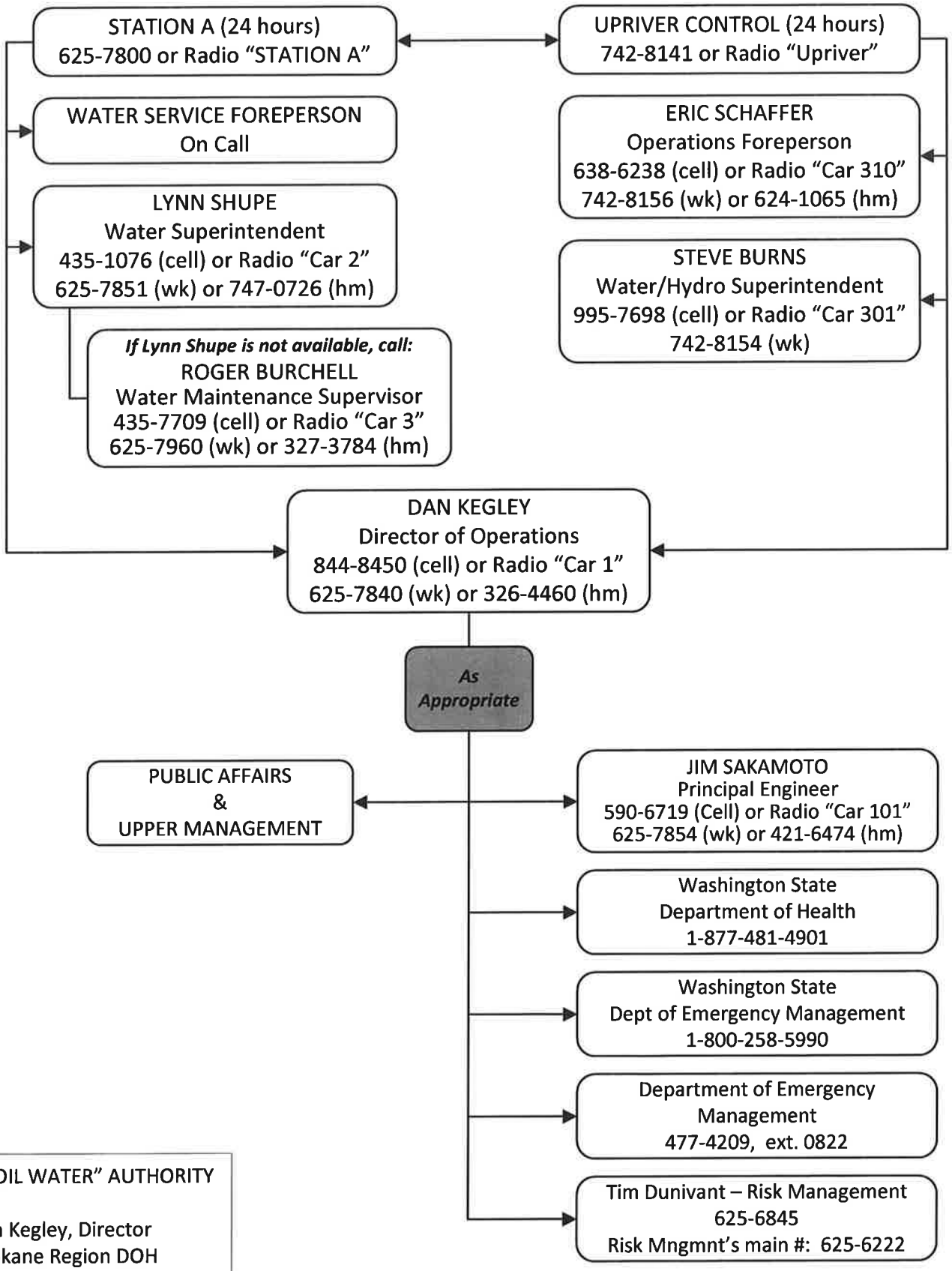
Water Emergency Communications Plan

The Department has developed a Water Emergency Communciations Plan to communicate effectively with the citizens of the City of Spokane and all customers of the City's Water Department during emergencies that impact the quality of their drinking water. The plan

supports a comprehensive multi-media approach to reach customers in ways that are convenient for them. The Plan is attached in **Appendix 6.5.1**.

CITY OF SPOKANE WATER DEPARTMENT
EMERGENCY NOTIFICATION FLOW CHART

WATER SYSTEM RELATED EMERGENCY



NOTE: "BOIL WATER" AUTHORITY

Dan Kegley, Director
Spokane Region DOH
WSDOH

FIGURE 6.5.1

Vulnerability Analysis

Major System Facilities

The Spokane Water System's major facilities and pressure zones are shown in **Figure 1.3.2** and **1.3.3**.

Disaster Effects

The natural and man-made disasters that could possibly affect the City of Spokane Water System are listed in **Table 6.5.1**.

TABLE 6.5.1
Disaster Probability & Severity

Types of Disaster	Probability	Severity	Reference
NATURAL:			
Earthquake	2	2	National
Severe Wind Storm	8	5	Weather
Severe Snow Storm	6	5	Service
Ice Storm	5	6	
Severe Cold Period	8	3	
Drought	6	2	
Flooding	6	2	
Severe Thunderstorm	5	4	
Tornado	1	4	
MAN MADE:			
Industrial Discharge	2	2	WSDOE
Sabotage	2	7	Police Dept.
Bomb Blast	2	6	Police Dept.
Aquifer Pollution	2	10	

Note: Rating Scale 1-10, 10 being high; Severity considers the water system as a whole

How a particular disaster may affect individual components of the Water System is listed in **Table 6.5.2**.

TABLE 6.5.2

DISASTER EFFECTS ON SYSTEM COMPONENTS

DISASTER TYPE	AQUIFER	WELL STATIONS	BOOSTER PUMP STATIONS	RESERVOIRS	TRANSMISSION MAINS	DISTRIBUTION MAINS	POWER SOURCE	COMMUNICATION	TRANSPORTATION
Natural:									
Earthquake		X	X	X	X	X	X	X	X
Sever Wind Storm				X			X	X	X
Sever Snow Storm							X	X	X
Sever Thunder Storm		X	X				X	X	X
Tornado				X			X	X	X
Ice Storm							X		X
Sever Cold Period				X		X			
Drought	X	X							
Flooding	X	X							
Man-made									
Industrial Discharge	X	X							
Sabotage	X	X	X	X					
Bomb Blast			X	X					X
Aquifer Pollution	X	X			X	X			

Contingency Operational Plan

Aquifer

The Aquifer is the main source of the water system during normal conditions. Any major disaster to the aquifer, like pollution or contamination, would result in potentially crippling the water supply. The City will have to resort to testing water from each individual well station and selectively pump from wells that have not been contaminated. However, depending upon the type of contamination, City wide emergency notifications need to be made and people need to be warned against use of water for domestic purposes in this type of event.

Under severe drought conditions, aquifer levels may be affected. Depending on the severity, rationing may need to be enforced. Flooding of the Spokane River may cause the possibility of ground water being influenced by the surface water. Only Well Electric Well Station is within 200′ of the river. As a precaution, during periods of river flooding, withdrawal of water from the Well Electric is suspended.

Pump Stations

For normal conditions, the well stations and booster stations pumping systems have built in redundancies that can provide the demand for water should portions of the system be out of service. In each of the pressure zones, the combination of pump stations and reservoirs are such that any problems occurring in individual components of the system can be addressed.

Reservoirs

Under normal conditions, and during high demand periods, the storage is kept at maximum. During low demand periods, the storage volumes in most of the reservoirs are kept lower.

Earthquake, severe windstorms, severe cold periods may affect individual reservoirs. Anytime an earthquake is reported, all storage structures are inspected. All City-operated reservoirs have been designed for seismic and wind loadings, using AWWA and Uniform Building Code standards for the geographical area.

Transmission Mains

Transmission mains normally transport water from pump stations to reservoirs. Transmission mains are buried a minimum of five and one half feet to the pipe invert. Transmission main ruptures cause severe disruption of water service in the area served. Also, the possibility of flooding, damage to properties, and impediments to transportation may result. Immediate action to isolate the main is undertaken.

Distribution Mains

The results are similar to Transmission Mains, but usually less severe.

Communication

Spokane Water Department Offices have one or more operator available at all hours of the day. Telephone [(509) 625-7800] is the primary source when communicating with the

general public. Radio dispatch [Station A - freq. 153.590 MHz] is the primary communication tool used when the Water Department contacts an employee, should that employee be working outside of the Business Office. If a problem exists with the main phone PBX, an alternate telephone [(509) 489-3858] is available.

Upriver Control Center has one or more personnel available at all hours of the day. Telephone [(509) 742-8141] is the primary source when communicating with the general public. Radio [Upriver - freq. 153.590 MHz] is the primary communication tool used when contacting Operations personnel, should that employee be working outside the Operations offices. During swing and graveyard shifts, the Upriver radio operator communicates to Station A radio at a preset time, typically once each hour.

In case of emergencies, exchanging information over the Radio with the construction and operational personnel is the best means as all the vehicles have radio systems. This frees up the phone lines for inter-communication with others who have no access to the radio.

Control of pumps and data collection, including information gathering about any alarms in individual facilities, is normally through the SCADA system at the City Upriver Operations Center. The means of communication between the Upriver Control Center and individual facilities is again through a combination of radio and phone lines. In the event of a problem, personnel will resort to manual local control.

Power Source

Avista is the local electrical utility and is responsible for maintaining reliable power supply in the area, with Inland Power and Light supplying power for a few of the outlying systems. Under peak demand conditions, water withdrawn solely from the reservoirs in each system should be able to provide two to three hours supply, in a worst case scenario. With the elimination of irrigation flows this can be extended to 2 or 3 days. With very strict rationing to just the very basic needs this could be extended further. The power sources are normally very reliable and outages are normally very short. In addition, the Department's hydroelectric facilities will allow for some degree of pumping of Well Electric and Parkwater Well Stations. The amount of pumpage from these two well stations will depend on river flows and will vary from full pumpage in the winter and spring months to a much smaller fraction of that in the summer and fall months. Nevertheless there is the capability to pump various amounts of source well water into the system at all times of the year. The Department also has a large mobile diesel generator and a small natural gas powered generator which can be moved from booster station to booster station as needed. Also a diesel powered pump, for emergency purposes, is located at Lincoln Heights Booster Station. To date, the City Water System has not had to curtail water service due to a power outage. However, should a severe long term blackout occur, rationing may have to be initiated.

6.6 Safety Procedures

The Safety Program that has been developed for employees of the Water Department is presented in **Appendix 6.6.1**. As with most programs, it is in a continuous state of change to adjust to new standards and situations.

6.7 Cross Connection Control Program

The purpose of a cross connection control and backflow prevention program is to protect the health of water consumers and retain a potable water supply. It is also intended to define and establish the policies and procedures necessary to properly implement a cross connection control program as required by ordinance and established in WAC 296-290-490. An outline of the "Cross Connection Control Program" is presented in **Appendix 6.7.1** with enforcing information presented in **Appendix 6.7.2**.

Extra attention for cross connection control is concentrated on "Table 9" facilities and equipment using hazardous materials. An ongoing survey and inspection program is carried out to make sure approved air gaps are used for filling with water any tanks or containers holding hazardous material such as chemical sprays for lawns etc. Approved air gaps are also required for anyone using a fire hydrant to fill a tank or container. For private parties, such as contractors, using a City hydrant requires a permit and the adequacy of their equipment and filling procedures is determined at that time.

6.8 Customer Complaint Response Program

The current method for addressing customer complaints is as follows:

1. The 24-hour radio/dispatch center receives all calls relating to customer concerns/ complaints. Approximately 50 to 60 calls are taken annually.
2. Based upon the dispatcher's initial line of questioning, a determination of the seriousness of the concern/complaint is made.
3. In cases where public health is not at risk, the dispatcher responds to their concerns/complaints by asking additional questions. These questions allow the dispatcher to address their concerns/complaints over the telephone.
4. In cases where public health is not at risk, but a field investigation is warranted, an appointment is made with the customer at his/her earliest convenience—typically the following day. The City receives approximately 25 to 30 of these types of calls annually.
5. In cases where the concern/complaint may be a possible risk to public health, a Water Quality staff experienced in water quality issues is dispatched to investigate the nature and scope of the concern/complaint.
6. Based on the field investigation the inspector will specify the corrective action needed.
7. If water quality is suspected of being compromised, a water quality sample will be drawn immediately, and taken to the City of Spokane laboratory for immediate analysis.
8. Anytime a water quality sample is taken, a copy of the water analysis results will be mailed to the complainant and a copy kept in Department files.
9. The complaints that have required a field inspection are logged into the water quality computerized database and also recorded on the appropriate "repair card" and added to the water quality files.

10. The Department has implemented a maintenance management system which has a caller log form to track customer service concerns/complaints.

6.9 Recordkeeping and Reporting

Water quality complaints are added to the Water Quality computer database along with a written record affixed to a "work order" that is placed in the Water Quality file, by address. Water quality complaint records are kept in the 24 hour radio/dispatch center for ready access. Water quality complaint records become permanent records and are held indefinitely.

Water consumption records are generated monthly by Utility Billing—General Services Department. Water source pumpage records are generated monthly by the Upriver Complex - Water System Control Station. Water consumption and pumpage records are held at the Water Department office for 6 years. After this period they are transferred off-site where they are stored indefinitely. The procedures followed by the Water Department for Recordkeeping and Reporting are in accordance with WAC 246-290-480.

6.10 O & M Improvements

Improvements that will have financial impacts on the water system's operation and maintenance are addressed in Chapter 8.

Chapter 7

Design and Construction Standards

CHAPTER 7

Design and Construction Standards

7.1 Project Review Procedures

Several processes are utilized in the review of project reports and construction documents for Water Department infrastructure. Projects may be designed in-house, by consultants contracted by the City, or by consultants engaged by an individual or developer for a project including City water facility infrastructure required for their respective needs.

- For projects designed by City engineering staff, the reports and construction documents are reviewed by the Water Department Engineering staff and by the Water Department Construction & Maintenance staff. When construction of a distribution system provides fire protection, the City Fire Department will review these plans for projects within its jurisdiction. For projects outside the City limits, the Fire Marshal of the affected Fire District reviews the plans for the project.

- For projects designed by consultants engaged by the City, reports and construction documents are reviewed by City Engineering Services Design Section Engineering staff, by the Water Department Engineering staff and the Water Department Construction & Maintenance staff. When construction of a distribution system provides fire protection, the City Fire Department will review these plans for projects within its jurisdiction. For projects outside City limits, the Fire Marshal of the affected Fire District reviews the plans for the project.

- For projects designed by a consultant engineer engaged by an individual or developer that include City water facility infrastructure improvements (*i.e.*, projects constructed by Private Contract), the reports and construction documents are reviewed by the City Developer Services Engineering staff, by the Water Department Engineering staff and by the Water Department Construction & Maintenance staff. When construction of a distribution system provides fire protection, the City Fire Department will review these plans for projects within its jurisdiction. For projects outside City limits, the Fire Marshal of the affected Fire District reviews the plans for the project.

For all projects, the design and construction documents must reference the City's approved Design Standards which includes the Standard Specifications for Road, Bridge, and Municipal Construction, as amended and published jointly by the Washington State Department of Transportation ("WSDOT") and the American Public Works Association ("APWA"), and the City of Spokane General Special Provisions for Private Contracts as amended. The most up-to-date versions on the City of Spokane Design Standards, General Special Provisions for Private Contacts and the City of Spokane Standard Plans are available on the City of Spokane Engineering Services website at https://beta.spokanecity.org/business/resources/. Any deviation from the Design Standards requires WDOH review and approval. Changes to the City's approved Design

Standards may require an addendum to the City of Spokane's Comprehensive Water Plan which must be submitted to DOH for review and approval.

Reports and construction documents are reviewed to assure the project designs comply and meet the minimum design standards and policies set forth by the City. In addition, the documents are reviewed to ensure state drinking water regulations, local ordinances, and any other applicable requirements are met.

Please refer to **Exhibits 7.5.1, 7.5.2,** and **7.5.3** for examples of correspondence, approvals, inspection documentations, record drawings and reports, Council actions, DOH correspondence, reports and approvals.

7.2 Policies and Requirements for Outside Parties

The basic policy provisions for providing water service are codified in the City of Spokane Municipal Code Title 13.04, Public Utilities and Services, Water. Additional policy provisions are as identified in this Comprehensive Plan. Much of the information below is also found in Chapter 1, Section 1.8.

Water Rates to Other Purveyors

The City has separate rates for water sold to other purveyors for any purpose. These rates are found in the Spokane Municipal Code 13.04.2014. The code is provided at: www.spokanecity.org.

Annexation

Owners of properties located outside the City Limits and inside the City's water service area as defined by DOH, can request connection to the City's water system. In addition to obtaining any necessary permits from the County, they must also contact the City and either request annexation into the City or sign an agreement of annexation as shown in **Exhibit 1.8.1**. Annexation covenants are in addition to other terms and conditions for delivery of water service.

Satellite Systems

For service within the City's service area, the City prefers direct connections to its piping system. The City may consider on a case-by-case basis, a satellite system within its service area to be operated by others on an interim basis until such time as the system can be connected directly to the City's system. The final decision for such an arrangement will be made by the Water Department Director subject to Mayor and City Council approval.

Rates for Outside City Customers

Outside City customers pay higher rates generally due to higher costs associated with providing service to the outlying areas. For single-family residences, the rates are outlined in SMC 13.04.2012. Rates for commercial, industrial and all other customer premises not specifically identified as a single-family residence are listed in SMC 13.04.2016.

Formation of Local Improvement Districts

Property owners within the City Limits who wish to form a Local Improvement District to build a water system extension can do so by contacting the City's Engineering Services Department. The Engineering Services Department will help the property owner go through all the necessary procedures. The procedures for a property owner requesting to do a LID outside the City is generally the same except a "Request for LID Covenant" as shown in **Exhibit 1.8.2** will need to be prepared. The City's Hearing Examiner will review all LID proposals and make the final decision regarding each LID.

Oversizing

The complete "Water Main Oversize" policy for upsizing water pipe for necessary present or future application appears in **Exhibit 1.8.3**. The "Water Main Oversize Justification Approval" form is shown in **Exhibit 1.8.4**. Oversizing water piping is subject to the approval of the Water Department Director.

Cross-Connection Program

The cross-connection program is addressed in Chapter 6 of this plan.

Service Extension Requests

Typically the Water Department provides for the backbone water infrastructure such as wells, pumps, reservoirs, and transmission mains. Should developers need such infrastructure prior to Water Department capital plans and cash flow being sufficient to provide, they may proceed at their own expense, provided these service extensions are within the retail service area. Distribution main extensions and service connections most typically are paid for by developers/property owners. All work must be designed by a licensed engineer, reviewed and accepted by the City and constructed in accordance with City design and construction standards.

Franchise Agreements

If a water main extension is required to be constructed in a right-of-way that is not the jurisdiction of the City of Spokane, either a new franchise agreement or an amendment to an existing agreement must be obtained to allow for construction, operation, and maintenance of the water facility from the appropriate authority prior to final approval being granted. It is the responsibility of the project proponent to secure the agreement in the City's name.

Satellite Management Agencies

The Water Department does not currently manage any other water systems and has no plans to become a Satellite Management Agency. However, the Department will evaluate future opportunities on a case-by-case basis.

Conditions of Service

Conditions of service are property specific and development specific requirements in order to facilitate the implementation of the City's water department retail service area policies and are based on location and proposed use of the property. The specific conditions of

service requirements are provided to each project proponent at the time of request for water service availability and can include one or more of the following items:

- Purveyor responsibilities
- Customer responsibilities
- Specific considerations based on the proposed use for property
- Connection fee schedule
- Meter and materials specifications
- Consent agreements for inspection, maintenance, and repair activities that may disrupt water service
- Cross-connection control requirements
- Developer extension requirements, design standards, financing responsibilities, and professional engineer design requirements.
- Annexation policies as addressed at the beginning of this section.
- Location within the City's retail service area.

Each scenario in the process to obtain water for a property, from the initial development of land to the purchase of an established residence, has an established procedure governed by the City's municipal code, ordinances, and design standards, and state law.

City of Spokane Responsibilities

The City's responsibility to provide for the operation and maintenance of the water system begins within the public domain and extends to the property line. For this reason, most shutoff valves are placed within the public domain and at the property line. Maintenance of the portions of the water system within public domain is performed by City water department personnel with City purchased and supplied equipment. As stated in SMC 13.04.140, "The City assumes no responsibility whatsoever for any private water pipes, mains, devices, fixtures, or appurtenances located either within or outside public property or public right-of-way."

City water personnel are not allowed to proceed onto the homeowner's property except at the homeowner's invitation, (*i.e.*, inspection of existing or newly installed equipment, or requested repairs).

Water taps and water meter installations are initiated through a permitting process in City Hall and scheduling with the Water Department. After the applicable work orders (**Exhibit 1.8.5** and **1.8.6**) are completed, and the tap and/or water meter fees are collected, City employees complete the installations in the public domain using City-supplied materials. These work orders are done in compliance with "City of Spokane Water Department Rules and Regulations for Water Service Installations" (**Exhibit 1.8.7**).

Single Family Homeowner Responsibilities within City Limits

The simplest procedures are associated with the purchase of an established residence within the City's service area with all water service equipment in place. Prior to purchase, it is the responsibility of the potential homeowner to determine the condition of the water service equipment on the property. All water service equipment should be in good operating condition, and must conform to the standards outlined by the City in the "City of Spokane's Design Standards."

All maintenance and service leak repairs on the property are the responsibility of the property owner. Any repairs and equipment replacement must conform to the City's current standards and be approved by a Water Department inspector prior to covering. All replacement meters are supplied by the City and can be charged to the customer at cost on the monthly utility bill.

If the water service has not been interrupted, the new property owner is required to inform the City Utility Billing Department of new ownership and have the billing transferred into their name.

If construction is necessary, City ordinances allow the homeowner to hire state licensed and bonded qualified contractors to perform repairs and to use the street shutoff cock during the work and testing of the new service. The homeowner must also complete and submit a "City of Spokane Construction Services Form" (**Exhibit 1.8.8**) to inform the City of intended desire to operate the shut off cock. If desired, a homeowner may hire the City Water Department to make repairs on their property. Should the homeowner/contractor retain the City, an additional billing would be provided for these services. The additional charge would be provided on the homeowner's utility bill for those repairs.

Rates for water usage, within the City's limits, are established by Council Resolution and are addressed in SMC 13.04.2002 and are published in the City's Official Gazette.

Single Family Homeowner Responsibilities Outside of the City Limits

Homeowners that use the City's water service but live outside the City's corporate limits are subject to the same rules and regulations as those homeowners within the City limits. Rates for this class of customer are addressed in SMC 13.04.2012 and published in the City's Official Gazette.

Connection Fee Schedule

Tap and meter fee rates are based on the pipe sizes specified by the engineer/designer of the project proponent. Charges for a 2-inch tap, or smaller are addressed in SMC 13.04.2026. For services that require a tap that is 3-inch or larger, the costs are addressed in SMC 13.04.2028.

Should a meter require a concrete box installation (24 inches only with no excavation), there is a separate charge.

To facilitate meter reading, radio reading device or AMR costs are included in the meter fees.

Prior to installation, the following rules apply:

- When taps are installed outside of the City's limits, the customer must either annex to the City or sign an annexation covenant as mentioned earlier
- LID and future main extension waivers are required on all approved long services
- Taps of 1 inch or smaller are required to have a pressure-reducing valve (PRV) placed before the meter if the pressure is greater than 80 pounds (the cost of a PRV and its installation is borne by project proponent)

- Taps larger than 1-1/2 inch are required to have a PRV placed after the meter if the pressure is greater than 80 pounds. The cost of a PRV and its installation is borne by project proponent.
- Tap fees are based on tap size and street right-of-way width. Meter fees are based on meter size and type (domestic, irrigation, and/or fire). Dedicated fire only services that utilize a DCDVA the meter few will be determined by the size of the tap. All tap and meter fees are subject to periodic review and change.

Special water service connection fees (General Facility Charges), as mentioned earlier in this section, also are assessed. These fees are for the purpose of helping to pay for major water infrastructure needed to serve an area such as wells, pumps, reservoirs, and large transmission mains. This fee is addressed in SMC 13.04.2042 and, as above, is also based on size of service.

Meter and Materials Specifications

All specifications for water service meters and materials are in the "City of Spokane's Design Standards." Vault dimensions have been defined by the City for larger water services. The required vault sizes are shown on the handout "Water Service Minimum Vault Dimensions," located in **Exhibit 1.8.9**.

Consent Agreements for Inspection, Maintenance, and Repair Activities that may Disrupt Water Service

Consent agreements to disrupt water service are not required for inspection, maintenance, and repair activities requested by the homeowner. Notice to terminate service also is not required when the service interruption is needed for an emergency repair or for any other reason. However, the Department makes every effort to coordinate disruptions to meet the needs of the customers. As outlined in the City's Municipal Code, an actual notice to terminate water service is only applicable when executed because of nonpayment. See SMC 04.02.180 "Notice of Termination."

Private Development Projects within the Retail Service Area

All developer projects that intend to utilize City water must first apply for a permit. All permits start within the City's Planning Department. If desired, the developer can schedule a pre-development meeting. At the pre-development meeting, all applicable City departments and the developer meet to discuss the project. These meetings are held only for projects within the City's limits.

Through the permitting process, property platting is checked and a SEPA review is performed and routed to all of the City's infrastructure departments (water, sewer, street, and storm water). Following the departmental reviews, two public meetings are held.

Any water system extensions required by the project must be designed by a licensed engineer and be in compliance with all of the City's design and specification standards. All projects must meet the design standards set out in "City of Spokane Design Standards" (Section 2). The Municipal Code states that all financial responsibility lies with the developer to prepare the design and install the system extensions.

Following receipt of the project information, the City engineer prepares a report describing the project for the City Council. As the final step, all plans/projects must be approved by the City Council.

When the approval process is complete, the developer will receive a letter of approval for the project's plans. The developer is required to coordinate and pay for the appropriate elements of the construction of the project and coordinate with the City for inspection services. The developer is also responsible to purchase tap permits.

The developer is responsible to obtain for the City approval of any alterations to an existing franchise from the Board of County Commissioners in order to allow the construction, operation and maintenance of a water system in the street concerned.

Water Service Interties

Water service to other purveyors within or abutting the Water Department service area will be based upon meeting the following requirements.

- County and DOH approval of the connecting system
- Water service will be provided on an estimated average annual day volume with maximum day and peak hour demand met by local storage of groundwater supplies to make maximum use of available resources
- Water service will be provided intermittently when demand exceeds supply
- Water service will require contracting entity to implement conservation efforts
- Water service will be used in crisis situations increasing system reliability. (Emergency Source)
- Water rates charged will be based upon a negotiated rate schedule, plus applicable service charges
- In the event of anticipated water shortages to City customers, water service to purveyors through interties may be curtailed

Plan Review

The main goals in reviewing design plans developed by a private party are to assure that the project will satisfy City Design Standards and deliver a safe, adequate, and high-quality drinking water product. To assist the private party in their effort, the City asks that the following factors be considered as they make their plans for development:

- The availability of an existing public water system that has the capability of providing water for domestic, commercial, irrigation and fire protection purposes with consideration for adequate water pressures and required flow volumes within the proximity of the project. In the absence of these, the developer must consider the costs associated with extending, or upgrading, the water system to the project location. Generally, all costs associated with extending water to a project location are the responsibility of the owner or developer.

- Water pressure evaluations—the normal pressure to be supplied at the customer service connection shall be 45 to 80 psi.
- If the pressure exceeds 80 psi, then a PRV will be required on all of the individual services. A PRV is required to comply with the Uniform Plumbing Code to protect the building's plumbing system from excessive water pressure.
- If the pressure is less than 45 psi, the property owner may not be able to efficiently operate all their appliances or irrigation equipment. To avoid future problems, the need for a new water system pressure zone may be required to provide proper water pressure. The Water Department Director will determine the need for establishing a new water system pressure zone and the assessment of costs.
- Regardless of available water pressure, individual booster pumping systems for individual service connections are not allowed. Such systems represent a cross connection, which have the potential to create back-flow conditions into the public water system that have the possibility of contaminating the water supply. Additionally, if a water main break should occur, allowing air into the pipe, the air could reach the Booster Station potentially causing damage to the pump(s) and/or the customer's equipment.
- Generally, fire hydrants located within the public right-of-way are publicly owned and maintained by the Water Department. Fire hydrants not located within the public right-of-way are considered private, with maintenance requirements a responsibility of the property owner. The Water Department Director can rule on exceptions.
- Projects that have the potential of creating a back-flow condition into the public water supply, known as a cross-connections, are required to install an approved back-flow device on the water service in order to comply with City of Spokane Water Department Rules and Regulations and Washington State law. The possibility of contaminating the public water supply needs to be eliminated in order to assure that the drinking water will always be safe for consumption. In some cases, cross-connection(s) can be corrected by proper plumbing system design and/or modifications to existing plumbing systems, eliminating the need to install a back-flow prevention device on the service. The inspectors at the Water Department will assist the developer in evaluating remedial alternatives.
- The City Water Department requires project proponents to make the determinations as to the amount of water and size of services needed for a project. With advances in computer technology and water hydraulic analysis programs (water system modeling), the Water Department requires that applicants for water service demonstrate via a hydraulic analysis (computer water system model), the water demands for the proposed project as well as how those water demands integrate into the overall water system. The City Water Department then reviews the submitted materials for accuracy and adequacy.
- If an existing building, with an existing water service, has been abandoned without water service (*i.e.*, meter turned off) for one year or more, a new service line may be

required. An existing water service often deteriorates under such conditions and the Water Department is interested in avoiding water quality problems.

- If an existing building, with an existing water service, is to be demolished and the water service has been turned off, a new service line will generally be required for any new structure that is built.
- If the estimated cost of constructing necessary public water system improvements is less than $70,000, the Water Department can, by State law, contract with the project owner for the construction of the improvements. The Water Department charges a fee to provide a cost estimate (firm bid). The estimate will include Water Department engineering services to design the water system improvements and for the Water Department to construct those improvements. The Department will schedule and undertake the construction only upon receiving full payment of the estimate. The owner may seek the services of private engineer and private contractors for the design and construction of public water main extensions. Should such plans be developed by a private engineer, they are subjected to the full review process outlined in this Comprehensive Water System Plan.
- For the installation of a public fire hydrant the Water Department charges a fee to provide a cost estimate (firm bid). This estimate will include engineering services to design the public fire hydrant installation and construction services. The Water Department will schedule the job upon receiving full payment of the estimate.
- When requested, and with payment of the required fee, the Water Department will provide field services to perform flow tests on public fire hydrants. The results of the flow tests are given to the party submitting the request. The flow tests are also added to the Water Department's file of flow test records. Results of previous flow tests are filed and maintained at the Water Department. Should the Water Department receive a request for fire flow information that already exists, that information will be made available at no additional cost.
- To recover the cost of labor, equipment, and material, the Water Department charges fees for a water service and tap at the time an application for water service is filed.

7.3 Design Standards

The City's Department of Engineering Services is responsibility for maintaining and updating the City's Design Standards. These Standards are developed to normalize design elements for consistency and to assure minimum requirements of public safety and health are met. Further, the Standards govern design for new construction and upgrading all streets, sewers, water lines and other utilities in new or existing City rights-of-way, easements or areas which are proposed for dedication to the City of Spokane.

The Design Standards also reference and include the Standard Specifications for Road, Bridge, and Municipal Construction, as amended and published jointly by the Washington State Department of Transportation (WSDOT) and the American Public Works Association (APWA), and the City of Spokane Supplemental Specifications to the WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction, as amended.

The Standards for Water are provided in Section 8.0 of the Design Standards.

An abridged copy of the Design Standards is provided in **Appendix 7.1.1** that includes:

- Table of Contents
- Section 1.0, *Overview* (which includes Purpose and Scope as well as Definitions)
- Section 2.0, *Developer/Consultant Services*
- Section 8.0, *Water*

An abridged copy of the City of Spokane Supplemental Specifications to the WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction as amended is provided in **Appendix 7.1.2** which includes:

- Table Of Contents
- Section 7-10, *Trench Excavation Bedding and Backfill for Water Mains*
- Section 7-11, *Pipe Installation for Water Mains*
- Section 7-12, *Valves for Water Mains*
- Section 7-13, *Valve Chambers*
- Section 7-14, *Hydrants*
- Section 7-15, *Service Connections*
- Section 9-30, *Water Distribution Materials*

Provided in **Appendix 7.1.3**, is an abridged copy of the Standard Plans which are a component of the City of Spokane Supplement Specifications as follows:

- Table of Contents
- Standard Plan No. W-109A, *Underground Utility Location*
- Standard Plan No. W-110, *Water-Sewer Parallel Construction*
- Standard Plan No. W-111, *Sewer Crossing*
- Standard Plan No. Y-101, *Typical Hydrant Setting*
- Standard Plan No. Y101A, *Typical Hydrant Offset Setting*
- Standard Plan No. Y102, *Typical 2-Inch Air Valve for Ductile Iron Pipe*
- Standard Plan No. Y103, *Section of 4-Inch Blow-Off in Pre-Cast Drywell*
- Standard Plan No. Y-103A, *4-Inch Blowoff in Drywell, Multi-drain, Remote Setting*
- Standard Plan No. Y-108, *Ductile Iron Pipe Clamp for Pipe Up to 12-Inch Diameter*
- Standard Plan No. Y-109, *Cast Iron Valve Box*

In addition, the following publications are included as a part of the Design Standards the City references relative to system design for performance and sizing:

- *Water System Design Manual* as published by DOH, Environmental Health Programs, Division of Drinking Water, Publication DOH #331-123, August 2001 edition including the most current revisions thereof or most current edition thereof.

- The *Group A Public Water Systems, Chapter 246-290* WAC publication as published by the DOH, Division of Drinking Water, Publication DOH #331-010, Effective June 2004 edition, including the most current revisions thereof or most current edition thereof.

- The American Water Works Association AWWA Standards.

- The American Water Works Association AWWA Manual of Water Supply Practices No. M11, Steel Pipe—A Guide for Design and Installation.
- The American Water Works Association AWWA Manual of Water Supply Practices No. M14, Recommended Practice for Backflow Prevention and Cross-Connection Control.
- The American Water Works Association AWWA Manual of Water Supply Practices No. M22, Sizing Water Service Lines and Meters.
- The American Water Works Association AWWA Manual of Water Supply Practices No. M31, Distribution System Requirements for Fire Protection.
- The American Water Works Association AWWA Manual of Water Supply Practices No. M33, Flowmeters in Water Supply.

The following are design standards for the different components of the City of Spokane water system. Also a Table of Contents for the City of Spokane Municipal Code pertaining to water is included in **Exhibit 7.3.1**.

Pipelines

- The minimum size for water mains shall be not less than 6 inches in diameter, shall be designed for fire flow, and shall be looped wherever possible.
- Four-inch diameter mains will be allowed in some permanent cul-de-sacs under special permission (see Design Standards Section 8.4) where no hydrants are connected to the main, where the length of the main is 250 feet or less, where no more than 12 dwelling units will be served, where no dwelling unit in the cul-de-sac will be no farther than 250 feet from a fire hydrant and where an engineering hydraulic analysis (computer model) demonstrates that water velocities and minimum water pressures are within acceptable ranges as provided in the City of Spokane's Design Standards (see Design Standards Sections 8.3 and 8.4).
- All public water mains shall be located in a public right-of-way, unless authorized in writing by the Director of the Water Department, allowing and accepting an exclusive easement, at least 25-foot wide, to accommodate the pipeline.
- Eight-inch diameter pipe shall be the minimum size for permanent dead ends, except for cul-de-sacs as discussed above. Six-inch pipe shall be the minimum size for short, dead end streets, which are scheduled or projected to be extended such that the proposed water main will be eventually looped, provided however, that adequate capacity is provided in the interim for domestic demands and fire protection.
- There will be no dead end mains longer than 1,000 feet.
- A hydraulic analysis is required by the Water Department for the sizing of water mains. In most cases the hydraulic analysis will include a computer model analysis.

- Normal pipeline velocities should be maintained between 3 to 5 feet per second for pumped systems, allowing a maximum velocity 7.5 feet per second for normal peak conditions. Velocities up to 10 feet per second are commonly allowed within the yard piping of a pump station to reduce capital costs of appurtenances at the station. Maximum allowable velocity during a fire flow event is 15 feet per second.

- Predominantly, the depth of pipes to the invert of any water main shall be 5.5 feet (see Design Standards Section 8.7). If the water line is placed in a dedicated right-of-way, the ground surface must be rough-graded within 6 inches of approved established grade.

- No other utilities, cable or conduit shall occupy the same trench as a water line except as approved by the Water Department. Minimum service line size shall be 1 inch. Service line pipe type shall be in accordance with Design Standards Section 8.5.

- All customer water use shall be metered. Minimum meter size shall be ¾ inch and all new meters shall be equipped with an approved remote radio device (AMR). The Water Department will furnish and install the complete meter unit after proper application has been made and fees paid. Meters are owned by the property owner but maintained by the Water Department.

Valves

- Distribution system valves shall be spaced between every hydrant and typically at the right-of-way line entering and exiting every major intersection. Transmission main valves shall be located so as to isolate well-defined lengths of pipelines. The maximum length between valves shall not exceed 3,000 feet.

- Valves, 3 inches to 12 inches in size shall be resilient seat gate valves conforming to ANSI/AWWA C509 and Standard Specification Section 9-30.3(1). Valves 14 inches and 16 inches in size shall be gate valves conforming to ANSI/AWWA C500 and with the Standard Specifications Section 9-30.3(2). Valves 18 inches and larger in size shall be butterfly type conforming to ANSI/AWWA C504 and Standard Specifications 9-30.3(3). All valves shall open **clockwise**. Valves shall be installed in accordance with Standard Specifications Section 7-12.

Hydrants

All fire hydrants shall include a Storz fitting on the main port, a shutoff valve located at the main, and be installed in accordance with Standard Specification Section 7-14. Fire hydrants shall conform to ANSI/AWWA C502 and Standard Specification Section 9-30.5. For specified locations of fire hydrants, see Design Standards Section 8.8. The required fire flow shall be available with a 20 psi minimum residual at all points throughout the distribution system (see Design Standards Sections 8.2-3 and 8.3). As a rule, fire hydrant spacing shall not exceed 500 feet - typically only applicable in residential areas. Hydrants shall, as a minimum, be located at each street intersection. In areas where high volume fire flows are required, the fire hydrant spacing shall be adjusted to meet IFC, State, and local requirements—typically not exceeding 250 feet.

Water Service Pressure

The policy for minimum water pressures within the City of Spokane water service system relative new development hereafter shall be as follows:

> New public water systems or additions to existing systems shall be designed for minimum static pressure of 45 psi. Pressures are to be measured at all existing and proposed water service meters or along property lines adjacent to mains if no meter exists and under the condition where all equalizing storage has been depleted or the supplying reservoirs water level are at the bottom of the normal operating range – whichever is less. In no case, shall any point in the system be permitted to drop below 20 psi (140 KPa) during fire flow conditions.

This policy meets or exceeds the State of Washington law for Group A Public Water Systems, Chapter 246-290 WAC, Subsection WAC 246-290-230 Distribution Systems, Paragraph (5), which provides minimum criteria that must be met by water systems similar in size to the City of Spokane.

Fire Flow

Minimum required fire flows are set by the Spokane Fire Department for projects within its jurisdiction and by the Fire Marshal for those Fire Districts for projects within that district's area of jurisdiction. Additionally, for projects outside the City of Spokane, Spokane County may choose to set the required fire flows for a project. In general, the following provides a discussion on fire flow requirements.

Fire fighting flow is required at a relatively high rate for a short period of time. A water system should have a supply, storage, and distribution system grid of sufficient capacity to provide fire fighting needs while maintaining adequate service to residential and commercial customers. This is discussed in more detail later in this Chapter.

Fire flow volumes are typically calculated based on the largest fire flow that could occur in a pressure zone. The fire flow volume is determined by multiplying the designated fire flow by the duration to calculate the storage volume.

Generally the City exceeds the conservative ISO fire flow storage minimums. This is discussed in more detail later in this Chapter.

Over the years, the Water Department has conducted numerous field fire flow tests to verify the water system's fire flow capacity. The Water Department maintains a record of these tests. Lastly, to provide a strong water system for providing fire protection, the Water Department designs each system with adequate pumping capacity to allow for the largest pump to be out of service while still supplying the maximum day demand.

Ordinances/Bylaws: The Water Department is subject to the contents of the City of Spokane Municipal Code (SMC), Section 13.04.000 and Section 13.08.000 (please reference www.spokanecity.org on the Internet).

Service Taps and Meters

City Ordinance Section 13.04.0802 addresses water service taps and meters. Generally, each individual building is to be served by its own water service.

Planned Unit Developments (PUDs) are master metered at the property line. Residential meter will be installed in an approved meter box at the first property line. Commercial meters, 1 ½" inches and 2" meters are installed either in meter boxes at the property line or in the building being served at the point of the service line entry. Larger meters are installed either in concrete meter vaults at the property line or in the building being served at the point of the service line entry—generally in the mechanical room.

For commercial and industrial service lines, the City requires that a customer's project engineer or architect provide the determination of the service line size based on needs of the facility for fire protection, process water, domestic needs, irrigation, etc. The City reviews the proposed service line for compliance with the City Standards. If the City review finds the service line in compliance with the City Standards, it will be approved. Provisions for a remote reader receptacle shall be included to allow the meter to be read without having to enter the building.

Storage

System storage is used in a water system to meet peaking demands and provide a reliable supply for operational services, in the event of a fire, and for failure of supply sources. Reservoir volume is the combined total of all five components of storage. These components are operational storage (OS), equalization storage (ES), standby storage (SB), fire suppression storage (FSS), and dead storage (DS). Operational storage is the volume of storage used to operate the system under normal conditions, between the supply sources cycling off and on. Equalization storage is a factor of pumping capacity to the maximum day demand of the entire built out area being served by the reservoir. Standby storage is provided to supply a measure of reliability should supply sources fail for a period of time. Fire storage is determined by identifying the largest fire flow rate within the area being served and the expected duration of the fire. The lesser volume of SB and FSS may be nested into the larger volume. Dead storage is the volume of the reservoir too low in elevation to provide adequate pressure for normal service.

Effective Storage is the sum of SB and FSS, or the larger of those two components should they be nested.

Equalizing Storage (ES)

Minimum equalizing storage is the quantity of storage needed to meet peak demands that exceed the supply capacity. However, over a 24-hour period, total supply capacity must equal or exceed total 24-hour maximum day demand. Equalizing storage requirements are greatest on the day of maximum demand.

The WDOH provides a Water System Design Manual, DOH #331-123, that identifies guidelines in determining equalizing storage requirements. Equalizing storage is determined by the following equation.

E.S. = (PDH - Qs) * 150

Where:	E.S.	=	Equalizing Storage (gallons)
	PDH	=	Peak hourly demand (gpm) Defined in Chapter 5 of the Design Manual
	Qs	=	Source Capacities (gpm)

The City's supply stations, whether they are booster stations or well stations, are typically designed the meet the MDD of the pressure zone they serve with the largest pump out of service. With all pumps in service, these stations can typically serve the system with the PHD thereby eliminating the need for equalization storage. However, as future reservoirs are in the process of being designed, the equalizing storage component must be addressed for each particular case taking into account potential growth in the system, sub-storage needs for future higher water systems served by the storage, other reservoirs proposed in the future for the system, and any particular operational needs for the system—all in addition to the equation above.

Fire Suppression Storage (FSS)

Fire flow volumes are typically calculated based on the largest fire flow that could occur in a pressure zone. The fire flow volume is determined by multiplying the designated fire flow by the expected duration to calculate the required storage volume.

The process the City follows in calculating appropriate fire flow storage involves examining existing zoning and planning (i.e., residential, commercial, industrial, etc.) as well as proposed future development within the area to be served by the reservoir, and consultations with the Fire Marshall of jurisdiction who will provide guidance relative to the needed fire flow volume and duration based on the zoning and planned development within the subject area. Based on the information obtained, and based on the engineering analysis of the system, the appropriate sizing of the proposed reservoir is determined to include sufficient storage for fire protection.

The Insurance Services Office (ISO) of Washington State guidelines for fire flow storage, as administered by the Washington State Rating Bureau (WSRB), specify that enough storage and supply capacity be available to meet required fire flows during the MDD. The fire fighting volume specified by these guidelines is the amount needed to meet the recommended fire fighting flow for a minimum of 2 hours. For flows in excess of 2,500 gpm, an additional 1 hour of flow duration is required for every 1,000 gpm of flow required. The City generally exceeds the conservative ISO fire flow storage minimums resulting in the good insurance rating for the City of Spokane.

The Washington Administrative Code minimum fire flow storage (WAC 246-293-640) requires, as a minimum, 500 gpm for 30 minutes (15,000 gallons) for residential fires, 750 gpm for 60 minutes for commercial fires (45,000 gallons), and 1,000 gpm for 60 minutes (60,000 gallons) for industrial fires.

The City of Spokane Fire Department requires a much greater volume be reserved for FSS than either the Washington Administrative Code or the ISO guidelines. The standard they employ is the International Fire Code (IFC) which dictates the storage requirements as follows:

- Residential Units < 3,600 sq. ft = 120,000 gallons (1,000 gpm for 2 hours)
- Residential Units > 3,600 sq. ft. = 210,000 gallons (1,750 gpm for 2 hours)
- Multifamily Residential = 675,000 gallons (3,750 gpm for 3 hours)
- Retail Centers (large) = 960,000 gallons (4,000 gpm for 4 hours)
- Storage Centers (warehouse) = 1,440,000 gallons (6,000 gpm for 4 hours)

Fire Flow Rate and Duration

Fire fighting flow is required at a relatively high rate for a short period of time. A water system should have a supply, storage, and distribution system grid of sufficient capacity to provide fire fighting needs while maintaining adequate service to residential and commercial customers.

The City of Spokane Design Standards provides for residential areas: Required fire flows are determined by the Fire Marshal for the area served. Typically a minimum fire flow of 1,000 gallons per minute for a two-hour duration is required for residential areas with homes containing 3,600 square feet or less floor space (includes the sum total of all interior floor levels excluding the garage) and 1,750 gallons per minute for a two-hour duration is required for residential areas with homes containing over 3,600 square feet floor space (includes the sum total of all interior floor levels excluding garage). If the area served by the reservoir is relatively small and water quality could be affected by large storage volumes, the duration requirement may be reduced, but to not less than 30 minutes, when approved by the Fire Marshal and the Water Department. In considering such a reduction, factors such as home size, density, topography, landscaping, and traffic flow will be evaluated. Fire flow requirements for commercial and industrial areas are determined by the Fire Marshal on a case-by-case basis.

Again, the City generally exceeds the conservative ISO fire flow rates as well as the fire flow requirements set forth by the Washington Administrative Code (WAC 246-293-640), resulting in a good insurance rating for the City.

Standby Storage (SB)

The WDOH requires an emergency or reserve storage volume called "standby storage" to be incorporated into the design of any storage facility. Standby storage is defined as the storage necessary to meet demands during an emergency such as a pump station being taken out of service because of power failure, transmission pipeline failure, or a pressure reducing valve being taken out of service for repair, or when unusual conditions impose water demands higher than anticipated. The SB volume for a single source will vary from SB volume with multiple sources. The required standby storage for each pressure zone is based upon equations 9-2 and 9-3 of the Washington State Department of Health Water System Design Manual (August 2001). Standby storage and fire flow storage are typically nested with each other, with the larger of the two volumes becoming the storage capacity the facilities are required to provide.

Storage Siting

Reservoir siting criteria is related to the hydraulic grade line elevation required to operate the storage effectively with the available supply into an area and to match existing storage within the pressure zone. Storage is situated to minimize the distance that the distribution pipeline grid must convey water. Normally, the City of Spokane locates storage and supply at opposite sides of the distribution system to provide consistent pressures in the system. Often the City will prefer to site a reservoir on high ground, if a site is available within a reasonable distance to the system storage needs. This provides a lower profile structure for aesthetic purposes, and allows for the most storage volume within the operating range of the reservoir. Storage also is located so it may be filled by as many sources as possible,

providing for the operation of the system as normally as possible during an interruption of supply from one of the sources.

Booster Stations

Minimum design standards for Booster Stations are provided in the Design Standards of the City of Spokane.

All new Booster Stations require a minimum of three pumps for flexibility in system operations. The total capacity of multiple pumps in a given pump station should generally be approximately twice the calculated MDD for the pressure zone the station serves. This allows a pump, even the largest pump, to be taken out of service and repaired without severely reducing supply capability.

All Booster Stations are required to include a Telemetry System to allow the station to be operated and monitored remotely. The Telemetry System is discussed in the Design Standards, and also in Chapter 3.

Generally, backup power systems are not required for Booster Stations in the City water system where multiple Booster Stations provide water to the pressure zone. Emergency/Backup power is discussed later in this Chapter.

Within the City, all systems or pressure zones supplied by Booster Stations are also served with at least one reservoir. The criterion for the design of a Booster Station is provided in **Table 7.3.1**.

TABLE 7.3.1
Booster Station Design Standards

Identified Criteria	With Reservoir Storage
Design Flow	MDD*
Size Peaking Factor with Largest Pump Out of Service	1.0
Minimum Number of Operational Pumps	3
Fire Flow Pump Required	No

* MDD = Maximum Day Demand

Backup Power

The City has permanent backup electrical generation facilities for the Well Electric and Parkwater Well Stations. These Well Stations are equipped for dual electric service. Typically, the Well Electric Well Station and the Parkwater Well Station operate on electric power supplied from the Water Department's Upriver Dam. However, Avista Electric Utility power is also available to these two well stations. The ability to operate the Well

Electric and Parkwater Well Stations with such backup power provides considerable redundancy for supplying water to the Low, Intermediate and North Hill Systems.

All other pumping facilities are largely dependent on power provided by Avista Utilities for operations. Electrical outages are infrequent in the Spokane area, and there is extensive storage capacity to meet emergency water demands on a short- to medium-term basis in the event of power outages. Restoring power to the City's pumping facilities is a high priority by Avista. The Avista electrical system in Spokane is strong with considerable gridding and redundancy. Additionally, Avista's corporate offices are located in Spokane, providing locally based field staff who can respond quickly to emergency power outages. Thus, historically, power outages are of rather short duration.

To assure a higher level of reliability of its water pumping capability, the Department has a portable generator driven by a diesel engine. The generator is a 500 kVa, 3 phase, dual voltage (240V/480V) unit capable of driving the largest pump in any of the City's pumping stations with the exception of the Well Stations, and the Lincoln Heights and the Ninth & Pine Stations, which operate on a different voltage (2,300V) than the rest of the stations.

In addition to the large portable generator, the Department has a smaller portable generator driven by a natural gas engine. The generator is an 18 kVa, 3-phase, dual voltage (240V/480V) unit capable of driving the pumps in some of the City's smaller pumping stations. The portable generator is easily transportable and is located at the Department's main office building for potential power outages at the site or other locations.

Additionally, the Department is in the process of installing a backup generator for the Lincoln Heights Pumping Station. The generator is built on the diesel backup pump that is being re-purposed for emergency power. This backup power will have the ability to start and operate a portion of the Lincoln Heights Station in an emergency situation

7.4 Construction Standards (Materials and Methods)

Construction Standards developed for the City of Spokane include the following references:

Standard Specifications

The Standard Specifications are comprised of the following: Standard Specifications for Road, Bridge, and Municipal Construction, as amended and published jointly by the Washington State Department of Transportation (WSDOT) and the American Public Works Association (APWA), and the City of Spokane Supplemental Specifications to the WSDOT/APWA Standard Specifications for Road, Bridge, and Municipal Construction as amended—are hereinafter collectively referred to as the "Standard Specifications."

Group A Public Water Systems

The Group A Public Water Systems, Chapter 246-290 WAC publication as published by the Washington State Department of Health, Division of Drinking Water, Effective June 2004 edition including the most current revisions thereof or most current edition thereof are also referenced in these construction standards.

American Water Works Association (AWWA) Standards

The American Water Works Association (AWWA) Standards are also used by the City. The specific standards typically referenced for construction are:

Ductile-Iron Pipe and Fittings

C104/A21.4-95	American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
C105/A21.5-93	American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
C110/A21.10-93	American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids
C111/A21.11-95	American National Standard for Rubber-Gasket Joints for Ductile-Iron Pipe and Fittings
C150/A21.50-96	American National Standard for the Thickness Design of Ductile-Iron Pipe
C151-A21.51-96	American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
C153/A21.53-94	American National Standard for Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm Through 610 mm)and 54 In. Through 64 In. (1,400 mm Through 1,600 mm), for Water

Steel Pipe

C200-97	AWWA Standard for Steel Water Pipe - 6 In. (150 mm) and Larger
C203-91	AWWA Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
C205-95	AWWA Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. (100 mm) and Larger - Shop Applied
C206-97	AWWA Standard for Field Welding of Steel Water Pipe
C207-94	AWWA Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
C208-96	AWWA Standard for Dimensions for Fabricated Steel Water Pipe Fittings
C209-95	AWWA Standard for Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines

C210-92	AWWA Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
C213-96	AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
C214-95	AWWA Standard for Tape Coating Systems for the Exterior of Steel Water Pipelines
C219-91	AWWA Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe
C221-97	AWWA Standard for Fabricated Steel Mechanical Slip-Type Expansion Joints

Valves and Hydrants

C502-94	AWWA Standard for Dry-Barrel Fire Hydrants (Includes addendum C502a-95.)
C504-94	AWWA Standard for Rubber-Seated Butterfly Valves
C509-94	AWWA Standard for Resilient-Seated Gate Valves for Water Supply Service (Includes addendum C509a-95.)
C510-92	AWWA Standard for Double Check Valve Backflow-Prevention Assembly
C511-92	AWWA Standard for Reduced-Pressure Principle Backflow-Prevention Assembly
C512-92	AWWA Standard for Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
C550-90	AWWA Standard for Protective Epoxy Interior Coatings for Valves and Hydrants

Pipe Installation

C600-93	AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances
C602-95	AWWA Standard for Cement-Mortar Lining of Water Pipelines in Place 4 in. (100 mm) and Larger

Disinfection of Facilities

C651-92	AWWA Standard for Disinfecting Water Mains
C652-92	AWWA Standard for Disinfection of Water-Storage Facilities

Meters

C700-95	AWWA Standard for Cold-Water Meters—Displacement Type, Bronze

C701-88	AWWA Standard for Cold-Water Meters—Turbine Type, for Customer Service
C702-92	AWWA Standard for Cold-Water Met—Compound Type
C703-96	AWWA Standard for Cold-Water Met—Fire Service Type
C704-92	AWWA Standard for Propeller-Type Meters for Waterworks Applications
C706-96	AWWA Standard for Direct-Reading, Remote-Registration Systems for Cold-Water Meters
C707-82 (R92)	AWWA Standard for Encoder-Type Remote-Registration Systems for Cold-Water Meters

Service Lines

C800-89	AWWA Standard for Underground Service Liner Valves and Fittings

Storage

D100-96	AWWA Standard for Welded Steel Tanks for Water Storage
D102-97	AWWA Standard for Coating Steel Water-Storage Tanks
D115-95	AWWA Standard for Circular Prestressed Concrete Water Tanks with Circumferential Tendons
D130-96	AWWA Standard for Flexible-Membrane-Lining and Floating-Cover Materials for Potable Water Storage

Pumping

E101-88	AWWA Standard for Vertical Turbine Pumps - Line Shaft and Submersible Types

- The American Water Works Association AWWA Manual of Water Supply Practices No. M11, Steel Pipe—A Guide for Design and Installation
- The American Water Works Association AWWA Manual of Water Supply Practices No. M14, Recommended Practice for Backflow Prevention and Cross-Connection Control
- The American Water Works Association AWWA Manual of Water Supply Practices No. M22, Sizing Water Service Lines and Meters
- The American Water Works Association AWWA Manual of Water Supply Practices No. M31, Distribution System Requirements for Fire Protection
- The American Water Works Association AWWA Manual of Water Supply Practices No. M33, Flowmeters in Water Supply

Other Codes and Standards

Also referenced and applicable are:

- ANSI—American National Standards Institute
- A—American Society for Testing and Materials
- CFR—Code of Federal Regulations
- FSS—Federal Specifications and Standards, General Services Administration
- HIPS—Hydraulic Institute Pump Standards
- IEEE—Institute of Electrical and Electronics Engineers
- NEC—National Electric Code
- NEMA—National Electrical Manufacturers' Association
- NEPA—National Environmental Policy Act
- NFPA—National Fire Protection association
- OSHA—Occupational Safety and Health Administration
- RCW—Revised Code of Washington (Laws of the State)
- SEPA—State Environmental Policy Act
- SSPC—Steel Structures Painting Council
- IBC —International Building Code
- UL—Underwriter Laboratory listing
- UPC—Uniform Plumbing Code
- IFC - International Fire Code
- WAC—Washington Administrative Code
- WISHA—Washington Industrial Safety and Health Administration

Connections to Existing System

While construction of new water infrastructure is often done by outside contractors, it is the City of Spokane Water Department's policy that only Water Department staff will make the final connections from a completed, inspected, chlorinated, and tested system component to the existing live system. Only Water Department crews are permitted to work on live system components. This includes all connections, tapping for services or hydrants, and the operating system valves.

Service Taps and Meters

City Ordinance Section 13.04.0802 governs Service Taps and Meters. Taps and meters are installed by the Water & Hydroelectric Services Department to the property line—generally this is the public right-of-way line. This topic is discussed in more detail in Section 7.3, *Design Standards* in this Chapter. Also, please refer to **Appendix 7.1.1** and **7.1.2** for City of Spokane Water Department Rules and Regulations for Water Service Installations.

7.5 Construction Certification and Follow-Up Procedures

All projects constructed that are related to the improvement of the water system are inspected by City staff or by a consultant engineer engaged by the City. In some cases where the project is particularly large or when insufficient staff time is available for proper inspection, a consultant engineer is engaged by the City for construction inspection.

Construction inspection includes the examination of construction procedures, methods of installation, a comparison of work with the construction documents and design, materials used and installed compared to that specified in the construction documents, care of handling and storage of material, safety practices, sanitary practices by the contractor's staff, and progress of work. When appropriate, material samples will be taken to a lab for testing and analysis. Pressure tests are performed by the Contractor and witnessed by the City inspector prior to commissioning the project. All disinfecting of water mains, reservoirs, and pumping equipment are performed by the Water Department Construction & Maintenance staff that are trained in the procedures. Water quality sampling is also performed by the Water Department Construction & Maintenance staff that is trained in the procedures for sampling. Sample(s) are taken to a lab for testing and analysis.

Construction record drawings are prepared by the City Engineering Services Construction Management Section Engineering staff and included into the design drawings by the City Engineering Services staff. The original drawings are then filed at City Hall. A copy of the construction record drawings are submitted to the Water Department The water system maps are updated and the drawings are filed for future reference.

As required in WAC 246-290-040, within 60 days following the completion of and prior to use of the project or portions thereof, a Construction Report must be completed by a professional engineer and submitted to the Washington State Department of Health Drinking Water Division (DOH) Regional Engineer. This responsibility rests with the City professional engineering official in charge of the inspection and construction management for the project. Generally this is the City Engineering Services Construction Management Section Principal Engineer. Alternatively, for projects being constructed under the inspection and construction management of the Water Department Services staff, the Water Systems Engineer will submit the Construction Report.

Exhibits 7.5.1, **7.5.2** and **7.5.3** have examples of correspondence, approvals, inspection documentations, record drawings & reports, Council actions, and DOH correspondence, reports & approvals for processing of project forms.

Chapter 8

Capital Improvement Program

CHAPTER 8

Capital Improvement Program

8.1 Prioritizing Capital Improvements

This chapter provides a summary of the improvement projects identified for the City of Spokane water system together with their estimated project costs and a schedule for the improvements. The improvement projects are divided into five categories:

- Sources
- Booster Pump Stations
- Storage Systems
- Distribution/Transmission Piping
- Other Improvements

As shown in the following tables, the identified improvements consist of projects needed to replace/rehabilitate aging infrastructure, projects needed to accommodate economic growth, projects having a mixture of those elements, and operational/planning type projects. The estimated costs shown herein have been increased to allow for inflation at the anticipated time of construction. Unless specifically identified as something else, costs for all improvements will be paid for with Water Department or Water-Wastewater Integrated Capital funds. Sources of these funds are addressed in Chapter 9.

The summaries provided are divided into two timetables. The two timeframes presented are the 6-year capital improvements projects and the 7- to 20-year capital improvement projects.

The 6-year capital improvement projects for the five categories are governed by the City of Spokane Six Year Comprehensive Water Program that is updated annually. The plan is part of the City's overall capital plan and is approved annually by the City Council in a public process. The projects in the 6-year capital summary provided in this chapter are taken directly from the approved City of Spokane Six Year Comprehensive Water Program 2015-2020. A copy of the current Comprehensive Water Program is provided in Appendix 8.1.1 which includes projected funding sources. The anticipated completion schedule and costs are summarized in the tables.

The 7- to 20-year capital improvement projects for the five categories are intended to repopulate the City of Spokane Six Year Comprehensive Water Program during the annual update and approval process. As capital improvement projects are completed in accordance with the Six Year Comprehensive Water Program projects from the 7- to 20-year capital improvement project list are prioritized and moved to the Six Year Program during the annual update.

8.2 Source Improvements

Source improvements involve well stations and well pumps. The projects included in this capital plan include rehabilitation of existing wells, replacement/rehabilitation of existing well pumps, and the creation of new supply sources. **Table 8.2.1** displays the proposed source improvement projects in the City of Spokane Six Year Comprehensive Water Program 2015-2020.

As shown in **Table 8.2.1**, the majority of the planned improvements are being conducted to maintain integrity of the supply system as a result of aging facilities. The West Central Well project is the exception, as it will be a new facility when it is constructed.

Table 8.2.1

Source Improvements 6-Year

Project Name	Funding Source	To Date	2015	2016	2017	2018	2019	2020	Project Total
Central Avenue Station 1st Well Rehabilitation	Utility Rates	$75	$1,855	$0	$0	$0	$0	$0	$1,855
	Total	$75	$1,855	$0	$0	$0	$0	$0	$1,855
Central Avenue Station 2nd Well Rehabilitation	Utility Rates	$0	$0	$0	$75	$1,500	$0	$0	$1,575
	Total	$0	$0	$0	$75	$1,500	$0	$0	$1,575
Hoffman Well	Utility Rates	$0	$0	$0	$150	$1,350	$0	$0	$1,500
	Total	$0	$0	$0	$150	$1,350	$0	$0	$1,500
New West Central Well	Utility Rates	$0	$100	$700	$0	$0	$10,000	$0	$10,800
	Total	$0	$100	$700	$0	$0	$10,000	$0	$10,800
Parkwater Station Upgrade	Utility Rates	$0	$250	$0	$0	$0	$0	$0	$250
	Total	$0	$250	$0	$0	$0	$0	$0	$250
Category Total		$75	$2,205	$700	$225	$2,850	$10,000	$0	$15,980

Costs in Thousands of Dollars

Additional details of the source improvements are included in the City of Spokane Six Year Comprehensive Water Program 2015-2020. **Table 8.2.2** lists the 7- to 20-year Capital improvement projects for source improvements that will be evaluated and prioritized for eventual inclusion into the Six Year Comprehensive Water Program.

Table 8.2.2

Source Improvement 7-20 Year

Project Name		Project Estimate (x1000)
Ray Street Well Station	Station Upgrade - *Note 1*	$1,500
Hoffman Well Rehabilitation/Reconstruction	Station Upgrade - *Notes 1, 2*	$2,000
Well Electric - North Hill Elements	Station Upgrade - *Note 1*	$800
Parkwater - Low System Elements	Station Upgrade - *Note 1*	$800

***Note 1*:** All of the well stations were constructed between1925 and 1960. Over the next 20 years, this program will undertake well station overhaul, rehabilitation, modernization, and upgrades which may include some increases in pumping capacity for increased system redundancy, reliability, and operational flexibility.

Note 2: One of the two well casings at this location has been compromised due to a shift in the earth. Reconstruction, or the construction of a new casing, may be required in order to regain full utilization of this well station.

8.3 Booster Pump Station Improvements

Similar to the source system improvements, the majority of booster pump station improvements are a result of aging infrastructure, with a few projects needed to meet growth demands. **Table 8.3.1** displays the proposed booster pump station projects in the City of Spokane Six Year Comprehensive Water Program.

Table 8.3.1

Booster Pump Stations 6-Year

Project Name	Funding Source	To Date	2015	2016	2017	2018	2019	2020	Project Total
Booster Station Metering	Utility Rates	$0	$180	$180	$0	$0	$0	$0	$360
	Total	$0	$180	$180	$0	$0	$0	$0	$360
Five Mile Booster Replacement	Utility Rates	$0	$0	$0	$200	$1,800	$0	$0	$2,000
	Total	$0	$0	$0	$200	$1,800	$0	$0	$2,000
Plains System New Booster	Utility Rates	$0	$100	$0	$1,100	$0	$0	$0	$1,200
	Total	$0	$100	$0	$1,100	$0	$0	$0	$1,200
Upriver Headers	Utility Rates	$0	$0	$150	$1,850	$0	$0	$0	$2,000
	Total	$0	$0	$150	$1,850	$0	$0	$0	$2,000
Category Total		$0	$280	$330	$3,150	$1,800	$0	$0	$5,560

Costs in Thousands of Dollars

Additional details of the booster pump station improvements are included in the City of Spokane Six Year Comprehensive Water Program 2015-2020. **Table 8.3.2** lists the 7- to 20-year Capital improvement projects for booster pump stations that will be evaluated and prioritized for eventual inclusion into the Six Year Comprehensive Water Program.

Table 8.3.2

Booster Pump Station Improvement 7-20 Year

Project Name		Project Estimate (x1000) (X1000)
Milton	Station Upgrade - ***Note 1***	$250
Southview	Station Upgrade - ***Note 1***	$100
Sunset	Station Upgrade - ***Note 1***	$400
9th and Pine	Station Upgrade - ***Note 1***	$750
Shawnee	Station Upgrade - ***Note 1***	$1,200
Five Mile #2	Station Upgrade - ***Note 1***	$1,500
14th and Grand	Station Upgrade - ***Note 1***	$4,000
Cedar Hills	Station Upgrade - ***Note 1***	$300
Thorpe Road	Station Upgrade - ***Note 1***	$750
Bishop Court	Station Upgrade - ***Note 1***	$200
35th and Ray St.	Station Upgrade - ***Note 1***	$500

***Note 1*:** This program will undertake booster station construction or reconstruction, overhaul, rehabilitation, modernization, facility upgrades and upsizing, as needed, over the next 20 years.

8.4 Storage System Improvements

Additional storage capacity is needed in select areas of the water system. Shown in **Table 8.4.1** are the identified storage improvements. The improvements are for growth, hydraulic consistency and/or redundancy purposes.

Table 8.4.1

Storage System Improvements 6-Year

Project Name	Funding Source	To Date	2015	2016	2017	2018	2019	2020	Project Total
High System Tank	Utility Rates	$0	$0	$0	$200	$2,800	$0	$0	$3,000
	Total	$0	$0	$0	$200	$2,800	$0	$0	$3,000
Lincoln Heights Tank #2	Utility Rates	$0	$700	$0	$0	$0	$0	$0	$700
	Total	$0	$700	$0	$0	$0	$0	$0	$700
Plains System Large Capacity Reservoir	PWTF	$300	$0	$0	$0	$0	$0	$0	$0
	Utility Rates	$360	$0	$0	$0	$0	$0	$0	$0
	Utility Rates	$0	$5,340	$0	$0	$0	$0	$0	$5,340
	Total	$660	$5,340	$0	$0	$0	$0	$0	$5,340
SIA System Additional Reservoir	Utility Rates	$0	$0	$150	$1,850	$0	$0	$0	$2,000
	Total	$0	$0	$150	$1,850	$0	$0	$0	$2,000
Tank Rehabilitation	Utility Rates	$0	$0	$500	$500	$500	$500	$500	$2,500
	Total	$0	$0	$500	$500	$500	$500	$500	$2,500
Thorpe Road Reservoir No. 2	Utility Rates	$0	$0	$0	$0	$0	$200	$3,000	$3,200
	Total	$0	$0	$0	$0	$0	$200	$3,000	$3,200
Category Total		$660	$6,040	$650	$2,550	$3,300	$700	$3,500	$16,740

Costs in Thousands of Dollars

Additional details of the storage system improvements are included in the City of Spokane Six Year Comprehensive Water Program 2015-2020. **Table 8.4.2** lists the 7- to 20-year Capital improvement projects for storage systems that will be evaluated and prioritized for eventual inclusion into the Six Year Comprehensive Water Program.

Table 8.4.2

Storage System Improvement 7-20 Year

Project Name		Project Estimate (x1000)
Reservoir Rehabilitation Program	Storage Improvements - *Note 1*	$1,000/year
Five Mile Reservoir #2	Storage Improvements - *Note 2*	$4,000
Eagle Ridge #3	Storage Improvements - *Note 2*	$3,000

***Note 1*:** This program will undertake storage facility rehabilitation such as interior and exterior coatings, liners, sealing, and other work necessary to extend the useful life of the facility as needed over the next 20 years.

Note 2: Construction of a new facility to augment storage, incease reduncancy and reliability, allow for operational flexibility, balance the system hydraulically, and allow for maintenance activities.

8.5 Distribution/Transmission Piping Improvements

Below are the transmission pipeline projects anticipated over the next six years. These projects consist of a combination of replacing/rehabilitating old infrastructure and constructing new infrastructure to accommodate economic growth. **Table 8.5.1** shows the proposed projects and projected timetable.

Table 8.5.1

Transmission Mains 6-Year

Project Name	Funding Source	To Date	2015	2016	2017	2018	2019	2020	Project Total
16th Ave Transmission Main, Chestnut to Milton Booster	Utility Rates	$0	$0	$0	$0	$0	$150	$2,000	$2,150
	Total	$0	$0	$0	$0	$0	$150	$2,000	$2,150
57th Transmission Main Rehabilitation/Replacement	DWSRF	$0	$0	$350	$3,778	$0	$0	$0	$4,128
	Total	$0	$0	$350	$3,778	$0	$0	$0	$4,128
Central Well to Indian Trail	Utility Rates	$0	$0	$0	$0	$0	$0	$400	$715,000
	Total	$0	$0	$0	$0	$0	$0	$400	$715,000
Cleveland Avenue from Buckeyeto Greene	DWSRF	$0	$0	$0	$0	$0	$0	$0	$0
	Utility Rates	$0	$0	$0	$60	$0	$0	$0	$60
	Total	$0	$0	$0	$60	$0	$0	$0	$60
Glenrose/57th/Havana/37th	DWSRF	$0	$4,049	$1,500	$0	$0	$0	$0	$5,549
	Total	$0	$4,049	$1,500	$0	$0	$0	$0	$5,549
Kempe to Woodridge Transmission Main	Utility Rates	$30	$270	$0	$0	$0	$0	$0	$270
	Total	$30	$270	$0	$0	$0	$0	$0	$270

Manito Boulevard from 14th to 33rd Avenue	DWSRF	$0	$200	$3,124	$0	$0	$0	$0	$3,324
	Total	$0	$200	$3,124	$0	$0	$0	$0	$3,324
Monroe-Lincoln, 8th Ave to Main Ave	Utility Rates	$0	$550	$0	$0	$0	$0	$0	$550
	Total	$0	$550	$0	$0	$0	$0	$0	$550
North/South Freeway Crossings	Utility Rates	$0	$300	$1,700	$0	$0	$0	$0	$2,000
	Total	$0	$300	$1,700	$0	$0	$0	$0	$2,000
Category Total		$30	$5,369	$6,674	$3,838	$0	$150	$2,400	$18,431

Costs in Thousands of Dollars

The following are the distribution pipeline projects anticipated over the next six years. These projects consist of a combination of replacing/rehabilitating old infrastructure and constructing new infrastructure to accommodate economic growth. **Table 8.5.2** shows the proposed projects and projected timetable.

Table 8.5.2

Distribution Mains 6-Year

Project Name	Funding Source	To Date	2015	2016	2017	2018	2019	2020	Project Total
13th Avenue; Wall to Bernard	Utility Rates	$0	$300	$0	$0	$0	$0	$0	$300
	Total	$0	$300	$0	$0	$0	$0	$0	$300
Clarke Ave./Water Ave. Distribution Replacement	Utility Rates	$0	$25	$450	$0	$0	$0	$0	$475
	Total	$0	$25	$450	$0	$0	$0	$0	$475
Distribution Main Rehabilitation	Utility Rates	$0	$0	$0	$450	$450	$450	$450	$1,800
	Total	$0	$0	$0	$450	$450	$450	$450	$1,800
Long Service Elimination	Utility Rates	$0	$0	$400	$400	$400	$400	$400	$2,000
	Total	$0	$0	$400	$400	$400	$400	$400	$2,000
Category Total		$0	$325	$850	$850	$850	$850	$850	$4,575

Costs in Thousands of Dollars

Additional details of the transmission and distribution main improvements are included in the City of Spokane Six Year Comprehensive Water Program 2015-2020. **Table 8.5.3** lists the 7- to 20-year Capital improvement projects for transmission and distribution main improvements that will be evaluated and prioritized for eventual inclusion into the Six Year Comprehensive Water Program.

Table 8.5.3

Transmission/Distribution Mains 7-20 Year

Project Name		Project Estimate (x1000)
Greene Street - Mission to Buckeye	30" – 4,150 l.f. - ***Note 1***	$1,100
Waterworks – Well Electric to 11th and Myrtle	48" – 14,724 l.f. - ***Note 1***	$4,700
Parkwater Yard Piping	48 & 36" - 3,850 l.f. - ***Note 1***	$1,900
33rd – Manito to Howard	24" – 3,293 l.f. - ***Note 1***	$900
Hatch – 9th to Rockwood Vista	30" – 132 l.f. - ***Note 1***	$60
Jefferson – 5th to 7th	18" – 700 l.f. - ***Note 1***	$100
Lincoln Heights to Lamonte – 29th/33rd	36" – 13,010 l.f. - ***Note 1***	$3,000
6th Ave – Jefferson to Hemlock	18" – 3,515 l.f. - ***Note 1***	$550
Fairview – Belt to Euclid - Atlantic	18" – 7,850 l.f. - ***Note 1***	$1,800
Latah Creek Crossing at 5th Ave	18" – 2,000 l.f. - ***Note 1***	$1,200
Central Well to Indian Trail	30" – 21,450 l.f. - ***Note 2***	$4,400
Melville Rd. –Thomas Mallen Rd. to Hayford Rd. Main	18" – 8,000 l.f. - ***Note 3***	$2,100
Spotted Road to Mallen Tank	36" – 15,150 l.f. - ***Note 4***	$3,250
Sunset Bridge Replacement	18" – 1,307 l.f. - ***Note 5***	$900
Distribution Main Rehabilitation	***Note 6***	$450/year
Downtown Main Replacements	***Note 7***	$8,000

***Note 1*:** These are large diameter steel transmission water mains which have been in service from 65 years to over 100 years. The older mains have generally reached the end of their useful lives, and the remainder will have reached the end of their useful lives within the next 20 years. These mains are scheduled for replacement in order to properly maintain this infrastructure in a safe and reliable condition.

Note 2: This pipeline would increase the ability to fully utilize the well capacity at the Central Well Station in fulfilling the water demands in the Indian Trail area. Growth in this area is anticipated to exhaust existing piping capacity in the 20 year time frame.

***Note 3*:** This water main will loop the system and eliminate a long dead end. However, for the project to move ahead, additional long range planning work needs to be done to confirm what size the line should be.

Note 4: This pipeline would run approximately parallel to the existing 24" main that connects this booster and tank. The new pipeline would increase capacity as well as reliability and redundancy.

Note 5: This project would replace the pipeline that crosses over Latah Creek on the Sunset Bridge. The existing pipeline has a poor repair record and replacement would save repair costs while increasing reliability.

***Note 6*:** As reported, cast iron pipe with leadite joints poses a significant concern for leakage and devastating main breaks. This ongoing project replaces 8-inch and 12-inch leadite joint cast iron pipe prior to reconstruction of streets as part of projects undertaken by other department/utilities.

***Note 7*:** The existing water system infrastructure in the City's downtown core area is predominantly cast iron pipe, some of which was installed in the late 1800s. The program will replace this old plumbing with ductile iron pipe to reduce maintenance costs as well as to enhance the reliability of the system. This project will be particularly difficult as businesses and traffic will be impacted during construction.

8.6 Other Improvements

Table 8.6.1 identifies other improvements consisting of major studies, programs and/or operational changes. The purpose of these improvements is to continually strive to operate the water system at higher levels of efficiency.

Table 8.6.1

Facilities and Operations 6-Year

Project Name	Funding Source	To Date	2015	2016	2017	2018	2019	2020	Project Total
Metering	Utility Rates	$0	$500	$500	$500	$500	$300	$300	$2,600
	Total	$0	$500	$500	$500	$500	$300	$300	$2,600
Rebuild Generator #2 in Powerhouse #2	Utility Rates	$0	$0	$30	$300	$0	$0	$0	$330
	Total	$0	$0	$30	$300	$0	$0	$0	$330
Rebuild Generator #1 in Powerhouse #1	Utility Rates	$0	$0	$0	$30	$300	$0	$0	$330
	Total	$0	$0	$0	$30	$300	$0	$0	$330
Rebuild Generator #1 in Powerhouse #2	Utility Rates	$0	$30	$300	$0	$0	$0	$0	$330
	Total	$0	$30	$300	$0	$0	$0	$0	$330
Rebuild Generator #2 in Powerhouse #1	Utility Rates	$0	$0	$0	$0	$30	$300	$0	$330
	Total	$0	$0	$0	$0	$30	$300	$0	$330
Rebuild Generator #3 in Powerhouse #1	Utility Rates	$0	$0	$0	$0	$0	$30	$300	$330
	Total	$0	$0	$0	$0	$0	$30	$300	$330
SCADA System	Utility Rates	$0	$60	$60	$60	$60	$60	$60	$360
	Total	$0	$60	$60	$60	$60	$60	$60	$360
Upriver Dam Spillway Rehabilitation	Utility Rates	$200	$1,000	$0	$0	$0	$0	$0	$1,000
	Total	$200	$1,000	$0	$0	$0	$0	$0	$1,000
Category Total		$200	$1,590	$890	$890	$890	$690	$660	$5,610

Costs in Thousands of Dollars

8.7 Summary of Capital 6-Year Program

Table 8.7.1 is a summary of the catagories and providing the total the costs of the Water Capital 6-Year Program.

Table 8.7.1
6-Year Totals

Improvements	To Date	2015	2016	2017	2018	2019	2020	Project Total
Source Improvements	$75	$2,205	$700	$225	$2,850	$10,000	$0	$15,980
Booster Pump Stations	$0	$280	$330	$3,150	$1,800	$0	$0	$5,560
Storage System Improvements	$660	$6,040	$650	$2,550	$3,300	$700	$3,500	$16,740
Transmission Mains	$30	$5,369	$6,674	$3,838	$0	$150	$2,400	$18,431
Distribution Mains	$0	$325	$850	$850	$850	$850	$850	$4,575
Facilities and Operation	$200	$1,590	$890	$890	$890	$690	$660	$5,610
Totals	$965	$15,809	$10,094	$11,503	$9,690	$12,390	$7,410	$66,896

Costs in Thousands of Dollars

Chapter 9

Financial Program

CHAPTER 9

Financial Program

This chapter addresses the financial condition for the City of Spokane Water Department and future financial plans to provide for future operations. The City of Spokane is a municipal corporation of the State of Washington designated as a First-Class City. As such, the City is governed by State statutes relative to budgeting. Elected officials must review and approve the City's budget annually. For planning purposes, costs and needed revenues are projected over a multi-year span and are presented in this Plan. However, the adoption of this Comprehensive Water System Plan by the current elected officials does not limit the deliberation on the Department's annual budgets by future elected officials.

9.1 Financial Status

Overview

The City combined its water and wastewater utility funds into a single financial unit in 2013, called the Water-Wastewater Fund, to support integrated planning for water, wastewater, and stormwater needs. The City maintains separate operating departments for its water and wastewater services.

With the creation of the joint fund, the City has reprioritized capital dollars and has increased the capital program for the water system. Planned projects for the water system total about $35 million over the next three years.

Ultimately, this financial change has resulted in improved responsiveness, greater flexibility to address emergent issues, and the opportunity to leverage revenues to increase capital capacity. Management of all portions of the combined system is conducted to protect and conserve the water supply of the Spokane Valley-Rathdrum Prairie Aquifer, the health of the Spokane River, and the quality of the City's drinking water.

Rates

The City is committed to maintaining affordable and predictable utility rates for its customers. The City's long-term goal is to limit rate increases to the cost of inflation, using a 25-year average of the consumer price index, which currently stands at 2.9%. In November 2014, the Spokane City Council approved three years of utility rates--for 2015, 2016, and 2017--with an annual increase equal to 2.9%.

For water services, customers currently pay a base charge and a water consumption charge. The consumption charge is based on a four-tier block structure that charges more for higher amounts of water used. Additionally, monthly bills include what's called an "integrated capital" charge that pays for capital improvements within the Water-Wastewater System.

Customers receive a single monthly bill from the City that includes charges for the City's water, wastewater, stormwater, and solid waste services. The City applies partial payments to the water utility last and has the authority to shut off water for non-payment.

Green Bonds

Also in November 2014, the Water-Wastewater Fund sold $200 million in revenue bonds to pay for needed capital improvements for the City's water, wastewater, and stormwater systems. The revenue bonds were designated "green" because they will finance environmentally beneficial projects. The projects will deliver positive outcomes with respect to water quality, water quantity, energy use, and climate resilience.

The City is facing significant capital expenses to meet Clean Water Act requirements and other demands on the wastewater system. Although the bond proceeds primarily will pay for these wastewater and stormwater projects, they can be used to pay for capital needs within the water system as well. And since the wastewater projects will help to protect the water quality in the Spokane River and the aquifer, they will also help to protect drinking water quality.

The 20-year bonds were sold at a very favorable interest rate of 3.08%.

Integrated Streets

The City is moving to integrated infrastructure planning which takes into consideration all uses for the City's right-of-way as projects are planned. The goal is to gain greater value for the dollar and to reduce inconveniences to the public.

This approach has been supported by City voters, who approved the City's Street Levy proposal with a 77% positive vote in the November 2014 election. That levy was predicated on using an integrated approach to streets. That means utility needs, including the replacement and upgrades to the water distribution system, will be integrated into transportation projects as needed into the future.

General Facility Charges & Developer Improvements

General Facility Charges ("GFC") also provide some funding for new infrastructure needed to accommodate economic growth, primarily improvements to well stations, booster stations, reservoirs/tanks, and transmission mains that are needed to accommodate particular projects. Developers pay for the distribution facilities, and if a developer requires an infrastructure improvement earlier than the Department's plans anticipate, the developer can proceed and pay for that infrastructure as well. Depending on the Department's long-term budget and priorities, the developer may have to pay for all or a portion of the cost.

The current GFC for water is $1,232 per Equivalent Residential Unit (ERU). In the last five years, GFCs have accounted for less than 1.53 percent of total Water-Wastewater Fund revenues.

Historic Financial Results

A summary of the past financial condition for the years 2006 through 2012 is shown in **Table 9.1.1**. As shown in the table, the Water Department has maintained stable rates for our customers over the last six years.

Future Financial Projections

Table 9.1.2 shows the present and projected revenues/expenditures for the Water Department for the years 2013 through 2019. The projections in **Table 9.1.2** consider the following information:

Operating Revenues

1. Water sales are the primary source of revenue for the Department, and this revenue source will increase mainly as a result of anticipated rate increases of 2.9%per year. It is anticipated that customer growth will not increase revenue as much as past years because there will be little or no increase in water sales due to conservation measures addressed in Chapter 4.
2. The other smaller sources of revenue available to the Department as listed below are estimated as shown in the table and as a whole are also important for the overall operations, maintenance, and capital needs of the Department.
3. Power sales income will fluctuate due to yearly weather patterns but is based on average expected returns as anticipated through the Department's contract with Avista. A new contract with Avista was signed in 2011, solidifying the Water Department's revenue stream from this source. Jobbing and contracting revenue is anticipated to increase at 1% per year.
4. Rental income of some Water Department properties to other City departments is shown only through 2014 because other departments are moving to new facilities of their own.
5. Water Department grounds crews do grounds maintenance for other City departments. As such there is a revenue source for "Right of Way Landscape Maintenance," which is anticipated to increase at 2.9% per year.

Operating Expenses

1. Operation, maintenance, administration, operating capital, right of way landscape maintenance, and emergency reserve costs are assumed to increase at 2.9% per year.
2. City utility taxes and State taxes on qualifying "Operating Revenue" are anticipated to remain at the present 20% and 5.029%, respectively.
3. City interfund charges for computer services, payroll, legal services, billing, accounting, and the like are expected to increase at 2.9% per year.

Infrastructure Revenue

1. Interest income from investing "Cash Available" is based on an annual interest rate of 0.5%.
2. Amounts from sales of assets are anticipated to increase at 2% per year.
3. Public Works Trust Fund ("PWTF") and Drinking Water State Revolving Fund ("DWSRF") loans are shown as a source of capital funding.

4. Contributed capital includes those facilities paid for by others and then turned over to the Water Department as assets to be owned and operated by the Department. The primary examples of this are the distribution mains built by developers to serve new homes in subdivisions, although as referred to earlier other infrastructure items can be included as well. The amounts shown are based on past experience plus projected needs.

Infrastructure Expenses

1. The debt service is as shown and is discussed in more detail later in this section.
2. A very large capital program as reflected in Chapter 8 is shown.
3. Contributed Infrastructure is as shown and reflects the "Contributed Capital" addressed in "5" immediately above.

The Department has a number of low interest loans through the State's Public Works Trust Fund and Drinking Water State Revolving Fund. The debt service for these PWTF and DWSRF loans is labeled as such in **Table 9.1.2**. The current PWTF_and DWSRF loan payments will continue until 2041 and have either a 1.0% or 0.5% interest rate. The Department may seek additional PWTF and DWSRF loans for major capital projects in the future.

The Water-Wastewater Fund added $200 million in revenue bonds in November 2014. The revenues of the combined fund are pledged as the repayment source for this 20-year debt. This is the first time the City has issued significant indebtedness for these utilities. Additional bonding is not anticipated at this time. Debt service for these bonds is not shown in Table 9.1.2.

Going forward, major capital infrastructure projects for water and wastewater will be managed through the separate Integrated Capital Management Department. These expenditures aren't shown in Table 9.1.2, as a result. Table 9.1.2, instead, displays the Water Department's operating budget and small operations-related capital items. As discussed above, the City's capital plans include $35 million in water infrastructure improvements over the next three years. The Six-Year Capital Plan for Water is attached as Appendix 8.1.1.A 20-year proforma for the Water-Wastewater Integrated Capital Fund is attached as **Appendix 9.1.1**.

9.2 Assessment of Rates

The current water rates are addressed in Municipal Code Title 13, Chapter 13.04. The water consumption rate structure is an increasing block rate structure and includes higher rates for water provided outside the City boundaries. The current block-rate tiers were established in the spring of 2012.

The City Council established principles for setting utility rates in 2012. These principles include balancing sustainability (environmental protection and water convervation), equity and affordability, financial stability for the utilities, and simplicity for the customer.

In 2013 and 2014, the City Council adopted several changes to the wastewater rates to promote and reward conservation and rebate low-water users in support of greater rate

equity. Council also adopted a three-year rate structure, which provides stable funding for the utilities.

In order to cover the higher costs of service and maintenance, out-of-city customers are charged at a higher rate than in-city customers. Utility taxes are applied to all Water Department gross revenues at the rate of 20%. Higher out-of-city rates with increased utility tax revenue to the City's general fund could affect rate-setting in opposition to the City's principles of sustainability or the City's water conservation goals. The City Council is committed to continually reviewing utility rates and has the option of revising its rate structure and/or utility tax framework to ensure consistency with rate principles and conservation goals, as well as allow greater resource focus on areas such as leak elimination, consistent with this Plan and the City's Comprehensive Plan.

9.3 Program Justification

Table 9.1.1 reflects on the Department's ability to manage its funds and accomplish it objectives. This experience is carried over into **Table 9.1.2** which clearly shows that the Department is prepared to meet its future needs.

Water Department
Fund Balance
2006-2013

	2006	2007	2008	2009	2010	2011	2012	2013	
Operating Revenues									
Water Sales	25,723,196	26,334,481	25,062,769	26,199,056	24,943,539	29,667,798	28,969,105	31,976,938	
Power Sales	1,842,427	1,341,843	1,040,284	1,071,295	20,546,289	2,405,703	2,290,269	2,373,622	
Jobbing & Contracting	1,696,831	1,830,358	2,223,791	1,694,204	1,767,196	1,733,024	2,007,421	2,177,952	
Cell Towers	353,776	377,175	387,110	412,312	461,906	516,694	505,386	496,345	
Rental Income	144,293	126,430	156,538	131,116	111,285	125,041	125,639	88,950	
Right of Way Landscaping Maint	103,858	134,925	180,675	172,787	246,126	256,854	178,620	189,338	
Other Misc Operating Rev	116,459	2,975,974	21,383	89,805	239,949	184,745	292,117	0	
Total Operating Revenues	29,980,840	33,121,186	29,072,550	29,770,575	48,316,290	34,889,859	34,368,557	37,303,145	
Operating Expenses									
Operation and Maintenance	13,833,216	15,938,366	13,217,026	14,937,155	15,462,421	15,948,249	17,072,251	15,851,084	
Administration	776,658	807,294	805,478	882,965	1,254,345	811,616	535,703	468,225	
City Taxes	6,065,740	6,305,594	6,153,779	6,352,712	6,147,158	6,350,961	6,456,297	6,817,514	
State Taxes	1,341,138	1,775,745	1,417,985	1,478,904	1,462,730	1,547,951	1,298,931	1,403,661	
Interfund	5,217,741	4,973,102	5,159,695	5,368,126	5,560,154	5,672,872	6,035,227	5,101,011	
Operating Capital	811,193	751,894	359,278	2,400,048	2,291,484	305,290	427,398	657,588	Vehicles - equipment - other operating capital
Right of Way Landscape Maint	165,141	201,621	267,985	256,588	363,454	379,295	263,767	279,595	
Total Operating Expenses	28,210,827	30,753,616	27,381,226	31,676,498	32,541,746	31,016,234	32,089,574	30,578,678	
Operating Income (loss)	1,770,013	2,367,570	1,691,324	(1,905,923)	15,774,544	3,873,625	2,278,983	6,724,467	
Infrastructure Revenue									
Rate Sabilization Fee	3,515,515	3,426,231	3,442,964	3,380,261	3,622,934	0	0	0	
General Facilities Charge	1,388,200	1,196,856	968,628	704,550	608,101	608,862	651,228	782,722	
Interest Income	1,734,510	2,015,282	1,549,509	342,038	122,642	62,401	65,654	9,488	
Sale of Assets	141,594	129,651	151,235	(85,759)	208,965	65,060	505,953	64,877	
Public Works Trust Fund Loans	0	2,590,481	129,674	558,237	889,982	0	0	0	
Contributed Capital	5,834,254	684,881	2,805,219	3,263,268	677,998	762,552	833,007	34,957	non-cash contribution
Total Infrastructure Revenue	12,614,073	10,043,382	9,047,229	8,162,595	6,130,622	1,498,875	2,055,842	892,044	
Infrastructure Expenses									
Infrastructure Debt	1,089,691	1,508,905	1,102,311	1,109,139	1,072,699	1,103,595	1,040,306	1,027,335	
Capital Six-Year Plan	4,366,698	6954893	3483894	16987130	8,564,612	3,856,017	3,445,031	9,730,483	
Other Infrastructure	7,724,809	2917270	2484244	935140	1,876,918	1,276,528	849,058	633,253	(TAPS, Hydrants, other not in 6-yr plan)
Total Infrastructure Expenses	13,181,198	11,381,068	7,070,449	19,031,409	11,514,229	6,236,140	5,334,395	11,391,071	
Infrastructure Fund Gain (Loss)	(567,125)	(1,337,686)	1,976,780	(10,868,814)	(5,383,607)	(4,737,265)	(3,278,553)	(10,499,027)	
Total Revenue	42,594,913	43,164,568	38,119,779	37,933,170	54,446,912	36,388,734	36,424,399	38,195,190	
Total Expenses	41,392,025	42,134,684	34,451,675	50,707,907	44,055,975	37,252,374	37,423,969	41,969,749	
Cash & Investments - Beginning	38,288,995	37,248,775	39,329,215	39,314,741	25,182,192	15,871,384	13,583,985	12,883,446	
Cash & Investments - Increase (Decrease)	(1,040,220)	2,080,440	(14,474)	(14,132,549)	(9,310,808)	(2,287,399)	(700,539)	(3,478,066)	
Cash & Investments - Ending	37,248,775	39,329,215	39,314,741	25,182,192	15,871,384	13,583,985	12,883,446	9,405,380	
	37,248,775	39,329,215	39,314,741	25,182,192	15,871,384	13,583,985	12,883,446	12,883,446	

Water Department
Fund Balance
2013-2019

	Actual 2013	Budget 2014	Budget 2015	Estimated 2016	Estimated 2017	Estimated 2018	Estimated 2019	Estimated 2020
Operating Revenues								
Water Sales	31,976,938	30,555,087	33,858,003	34,839,885	35,850,242	36,889,899	37,959,706	39,060,537
Power Sales	2,373,622	2,500,000	2,400,000	2,469,600	2,541,218	2,614,914	2,690,746	2,768,778
Jobbing & Contracting	2,177,952	2,084,111	2,452,631	2,477,157	2,501,929	2,526,948	2,552,218	2,577,740
Cell Towers	496,345	875	550,875	567,401	584,423	601,956	620,015	638,615
Rental Income	88,950	100,000	5,000	-	-	-	-	-
Right of Way Landscaping Maint	189,338	264,611	190,000	195,510	201,180	207,014	213,017	219,195
Other Misc Operating Revenue	-	250,000	100	250,000	250,000	250,000	250,000	250,000
Total Operating Revenues	37,303,145	35,754,684	39,456,609	40,799,554	41,928,992	43,090,731	44,285,702	45,514,865
Operating Expenses								
Operation and Maintenance	15,851,084	19,676,747	19,879,328	20,455,829	21,049,048	21,659,470	22,287,595	22,933,935
Administration	468,225	605,793	633,767	652,146	671,058	690,519	710,544	731,150
City Taxes	6,817,514	6,469,750	6,993,814	7,196,635	7,405,337	7,620,092	7,841,074	8,068,466
State Taxes	1,403,661	1,500,950	1,521,601	1,565,727	1,611,134	1,657,856	1,705,934	1,755,406
Interfund	5,101,011	6,091,632	6,310,922	6,493,939	6,682,263	6,876,049	7,075,454	7,280,642
Operating Capital	657,588	516,700	1,342,900	1,381,844	1,421,918	1,463,153	1,505,585	1,549,247
Right of Way Landscape Maint	279,595	280,000	280,000	288,120	296,475	305,073	313,920	323,024
Total Operating Expenses	30,578,678	35,141,572	36,962,332	38,034,240	39,137,233	40,272,212	41,440,106	42,641,870
Operating Income (loss)	6,724,467	613,112	2,494,277	2,765,314	2,791,760	2,818,518	2,845,595	2,872,995
Infrastructure Revenue								
Enterprise Fund Rates				-	-	-	-	-
Water Rates				-	-	-	-	-
General Facilities Charge	782,722	500,000	800,000	823,200	847,073	871,638	896,915	922,926
Interest Income	9,488	20,894	16,000	43,696	(403,102)	(1,075,783)	(1,678,214)	(1,891,348)
Sale of Assets	64,877	140,856	135,000	135,675	136,353	137,035	137,720	138,409
Loans	-				-	-	-	-
Contributed Capital	34,957	-	-	-	-	-	-	-
Total Infrastructure Revenue	892,044	661,750	951,000	1,002,571	580,324	(67,110)	(643,578)	(830,014)
Infrastructure Debt	1,027,335	1,069,165	1,000,000	1,283,318	1,283,318	1,120,771	1,120,771	1,120,771
Capital Six-Year Plan	9,730,483	12,605,412	280,000	90,376,836	135,115,064	120,563,147	42,109,436	19,125,000
Other Infrastructure	633,253	366,000	1,426,000	1,467,354	1,509,907	1,553,695	1,598,752	1,645,116
Total Infrastructure Expenses	11,391,071	14,040,577	2,706,000	93,127,508	137,908,289	123,237,613	44,828,959	21,890,887
Infrastructure Fund Gain (Loss)	(10,499,027)	(13,378,827)	(1,755,000)	(92,124,937)	(137,327,965)	(123,304,722)	(45,472,537)	(22,720,900)
Total Revenue	38,195,189	36,416,434	40,407,609	41,802,125	42,509,317	43,023,621	43,642,124	44,684,851
Total Expenses	41,969,749	49,182,149	39,668,332	131,161,748	177,045,522	163,509,825	86,269,065	64,532,756
Cash & Investments - Beginning	12,883,446	9,405,380	8,000,000	8,739,277	(80,620,346)	(215,156,551)	(335,642,755)	(378,269,696)
Cash & Investments - Increase (Decrease)	(3,478,066)	(1,405,380)	739,277	(89,359,623)	(134,536,205)	(120,486,204)	(42,626,941)	(19,847,905)
Cash & Investments - Ending	9,405,380	8,000,000	8,739,277	(80,620,346)	(215,156,551)	(335,642,755)	(378,269,696)	(398,117,601)

6-Year Capital Plan	2014	2015	2016	2017	2018	2019
Central Ave	75,000	1,500,000				
Enterprise rates	9,558,000	3,872,000	7,690,000	6,860,000	3,710,000	1,910,000
PWTF	1,251,990	150,000	2,350,000			
water rates	1,297,010	5,340,000	225,000	3,625,000	4,450,000	12,800,000
	12,182,000	10,862,000	10,265,000	10,485,000	8,160,000	14,710,000

OPR-2013-0214	**Water Loan**	**300,000**	**Plains System Second Reservoir - Pre Construction loan**
OPR-2012-0942	**DWSRF**	**365,486**	**Sundance Estates - Kendick Ave Water System**
OPR-2013-0443	**Water Loan**	**921,990**	**Garden Park Booster Station-construction loan**
OPR-2013-0644	**DWSRF**	**1,221,090**	**Central Avenue Wells 1 & 2 Rehabilitation**
OPR-2013-0645	**DWSRF**	**3,357,240**	**Steel Transmission Main Replacements**
OPR-2013-0646	**DWSRF**	**5,604,490**	**Top System Transmission Main Replacement**
		11,770,296	

	Amt	1/24
2014	1,126,481	46,937
2015	3,082,453.0	**128,436**
2016	7,283,110	**303,463**
2017		
2018		
2019		