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BEFORE THE IDAHO DEPARTMENT OF WATER RESOURCES

IN THE MATTER OF INTEGRATED MUNICIPAL APPLICATION PACKAGE ("IMAP") OF SUEZ WATER IDAHO INC., BEING A COLLECTION OF INDIVIDUAL APPLICATIONS FOR TRANSFERS OF WATER RIGHTS AND APPLICATIONS FOR AMENDMENT OF PERMITS.	**FIFTH AFFIDAVIT OF JACK W. RELF IN (MERIDIAN MASTER WATER PLAN)**

State of Idaho)
) ss.
County of Ada)

JACK W. RELF, being first duly sworn upon oath, deposes and states:

1. I am one of the attorneys representing SUEZ Water Idaho Inc. in the above-entitled action and am duly licensed to practice law in the state of Idaho.

2. I make this affidavit based upon my personal knowledge of the facts set forth in this affidavit and to the best of my information and belief.

3. A true and accurate copy of the City of Meridian, Idaho – Final – Water Master Plan (April 2012), as obtained from Kyle Radek, Assistant City Engineer for the City of Merdian, is attached hereto as Exhibit A.

DATED this 4th day of April, 2018.

GIVENS PURSLEY LLP

By ______________________
Jack W. Relf

Subscribed and sworn to before me this 4th day April, 2018.

LISA A. HUGHES
NOTARY PUBLIC
STATE OF IDAHO

____
Notary Public for Idaho
Residing at: Boise Idaho
My Commission Expires: 3·22·2019

Certificate of Service

I HEREBY CERTIFY that on this 4th day of April, 2018, the foregoing was filed, served, and copied as shown below. Service by email is authorized by the Hearing Officer's Order of September 11, 2017 at page 3. Due to the size of the exhibit, a courtesy copy of the foregoing without the exhibit attached was emailed to all parties noted below, and a physical copy of the same with the exhibit has been placed on a disk and mailed as indicated below.

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Jack W. Relf

<u>Exhibit A</u> **MERIDIAN MASTER WATER PLAN**

City of Meridian, Idaho

FINAL - WATER MASTER PLAN

Murray, Smith & Associates, Inc.
Engineers/Planners

April 2012

FINAL - WATER MASTER PLAN

FOR

THE CITY OF MERIDIAN, IDAHO

APRIL 2012

MURRAY, SMITH & ASSOCIATES, INC.
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Appreciation is expressed to all who contributed to the completion of this plan.

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SECTION 1
EXECUTIVE SUMMARY

Introduction

The purpose of this Water Master Plan (WMP) is to provide the City of Meridian (City) a comprehensive planning document that provides basic information and the guidance necessary for the sound stewardship of the potable water system. This WMP is important because it:

- Compiles basic information relevant to the water system.
- Describes the basic functional parameters of the system.
- Presents planning and analysis criteria for system improvements and expansions.
- Highlights known system deficiencies.
- Describes and graphically illustrates recommended improvements.
- Presents basic cost information for general budgeting and the development of an adoptable capital improvements program (CIP).
- Provides a physical tool for informing customers and other interested parties of the existing system and proposed improvements.
- Serves as an invaluable resource for gaining public support for needed improvements.
- Facilitates logical planning decisions relative to other City programs.

How This Plan Should Be Used

This WMP should be used in the following manner:

- It should be viewed as a dynamic working document.
- It should be reviewed annually for the purpose of prioritizing and budgeting for needed improvements.
- Plan mapping should be updated periodically to reflect current development and constructed system upgrades.
- Specific recommendations should be considered as conceptual only. Additional details and potential alternatives should be investigated and analyzed in the preliminary engineering phase of final project designs.
- Cost estimates should be considered as planning level only, and should be updated and refined with preliminary engineering and final project designs.
- It should be used as the guiding document for future water system improvements.

Authorization

In 2010, the firm of Murray, Smith & Associates, Inc. (MSA) was authorized by the City of Meridian to prepare this WMP.

Compliance

This WMP complies with water system master planning requirements established under the Idaho Administrative Code (IDAPA) 58.01.08, administered by the Idaho Department of Environmental Quality (IDEQ).

Planning Period

This WMP focuses on improvements required over the next 20 years (2030). However, longer-term evaluations were conducted on the City's water supply system that include projections through build-out.

Study Area

The study area for the WMP includes the existing City limits out to the extent of the adopted Future Impact Boundary.

Existing Water System

General

This plan assumes that groundwater will continue to be a viable source of supply for the City in the near-term and long-term. Additional water supply planning is being conducted as a follow up study to this project. That study is evaluating how to address the City's water supply needs beyond the IDEQ focused 20-year horizon.

Water Requirements

- The City's current and projected population and water demands are summarized in Table 1-1.
- The City's 10-year historical average day demand (ADD) for the years 1999 through 2009 averaged 169 gallons per capita per day (gpcpd). Since 2005, the City's per capita water usage has averaged 138 gpcpd, with the 2008 and 2009 average down to 130 gpcpd.
- The City has an average non-revenue water rate of 3 percent of total production. This is very low compared with other utilities.
- The City is in the process of adopting their first formal water conservation plan. The conservation plan was developed by City staff, with involvement from a citizen based

focus group. The plan focuses on education and awareness of water conservation issues, with later updates to include more formalized water reduction efforts and programs.

- The population projections developed in the WMP are based on the Community Planning Association of Southwest Idaho (COMPASS) data. The projections are considered conservative and, while they show growth that is higher than what has been experienced since 2007, they are not as high as the actual growth that occurred between 2000 and 2007.

Table 1-1
Population and Water Demand Summary

Year	Service Area Population	Average Daily Demand (mgd)	Maximum Daily Demand (mgd)	Peak Hourly Demand (mgd)
2010	66,000	8.6	17.2	25.7
2020	104,000	13.5	27.0	40.6
2030	140,000	18.2	36.4	54.6
Build-out	345,000	44.9	89.7	134.6

Note: Service area population differs from city limit population and populations have been rounded to the nearest 1,000

Supply

- Meridian currently utilizes groundwater as its sole source of potable water. The groundwater is supplied by 20 water supply wells dispersed throughout the City's service area. Total pumping capacity of the 20 production wells and two booster pump stations is estimated at 37,200 gpm, or 53.6 mgd. The current firm capacity (largest pump out of service in each pressure zone) is 30,100 gpm or 43.4 mgd.
- The current firm well and booster capacity of 43.4 mgd can supply the estimated 2010 peak hour demand (PHD) of 25.7 mgd and the estimated maximum day demand (MDD) plus fire flow of 24.3 mgd.
- It is expected that three additional wells will be needed by 2030 (assuming the construction of a new reservoir and booster station) in order to meet the anticipated firm capacity requirements and maintain a two well buffer beyond IDEQ requirements.

Storage

- The City's water system has storage with a nominal capacity of 2.5 million gallons (MG).
- The City will need to construct one additional 2 MG storage facility (including booster station) within the next three years in order to meet the storage requirements for peak demand and firefighting.

Distribution

- A computer model of the distribution system was developed and calibrated. Both existing and future (2015 and 2030) demand conditions were evaluated using this model.
- The City has done an excellent job of maintaining, expanding and completing loops in the distribution system to accommodate the unprecedented growth that has occurred during the past 20 years.
- The distribution system is composed of a primary grid of mostly 12-inch mains, with some 10- and 16-inch mains. Future expansions should continue the 12-inch by 12-inch grid pattern to provide adequate water transmission capabilities throughout the distribution system.
- The City has implemented an infrastructure replacement program to address mains that do not meet existing City size standards, are of substandard materials or are apparently approaching their end of service life. The project is initially targeting substandard size pipe that do not meet City standards. This WMP identifies approximately $40 million in substandard size main replacements to be made over the next 20 to 50 years. A smaller number of fire flow related improvements were also identified that will be addressed in the next 5 to 10 years.
- The City's first interconnection with another utility is recommended in Zone 3, with United Water Idaho (UWI), to address specific fire flow deficiencies, provided that the cost/benefit of the interconnection compares favorably with other options. This will be a two-way metered connection that would benefit both utilities under emergency conditions.
- Pressure Zone 1 will be fully implemented in the near future through the installation of five Pressure Reducing Valves (PRVs).

Water Quality and Regulations

- Currently, all of the City's potable water is supplied by wells. The general quality of the water is good, meeting current federal and state regulatory limits for inorganic compounds (IOCs), synthetic organic compounds (SOCs), volatile organic compounds (VOCs), lead and copper, coliform, and fluoride.
- The City currently disinfects its water supply at the wellhead, prior to its entry into the distribution system. Sodium hypochlorite is added at a sufficient rate to maintain a residual chlorine level of 0.3 mg/L in the distribution system.
- One major area of concern is the elevated uranium levels measured in Wells 16, 20B and 23. In these wells, uranium has been detected at levels that approach or exceed the 30 μg/L maximum concentration level (MCL). For wells that are affected by uranium levels that exceed the MCL, the City will need to consider either abandoning the wells, modifying the wells, placing them on standby status or implementing treatment in order to reduce the uranium content to acceptable levels. The City is currently evaluating

options for all these wells, which includes treatment or redrilling the wells to withdraw water from a different aquifer.

- Although not a health issue, the City has elevated levels of iron and manganese in several wells that cause aesthetic issues, such as taste, smell and odor complaints. The City historically managed iron and manganese by regularly flushing the water lines and keeping the chlorine levels low; however, chlorine management is becoming less feasible. The City will begin the design and construction of treatment systems to address iron and manganese at two wells prior to 2017.

Operations and Maintenance

- The City meets all requirements for operator certification.
- No major reoccurring maintenance problems have been identified.
- The City is currently implementing new maintenance management software for the water system. The integration of this software with the GIS and hydraulic model is planned.
- The City will be migrating their existing automated meter reading (AMR) system to advanced metering infrastructure (AMI) in the near future, which will include the installation of centralized towers to remotely collect customer water usage.
- The City plans to begin the process to more formally document facility manuals (particularly for wells) that will be updated as changes occur.
- The City compares favorably with other regional water utilities in terms of the number of staff assigned to the O&M department and the dollars spent to maintain the system.

Capital Improvements Program

- An estimated $10.7 million worth of water system improvements are identified over the next five years (2012-2016) in the master plan (2011 dollars).
- $670,000 in pipeline improvements address fire flow deficiencies and are included for construction through 2016.
- Approximately $42.7 million in total pipeline replacements have been identified, though not all within the 20-year planning period.
- An interconnection in Zone 3, with UWI, to address specific fire flow deficiencies has been identified. This would be a two-way metered connection that would benefit both utilities under emergency conditions. Other interconnections with UWI may be considered to create additional redundancy.
- The City plans to install five PRVs to serve Zone 1.
- $4.4 million to treat iron and manganese at four wells is included for implementation by 2020.
- The City is transitioning from the nearly exclusive use of wells to meet peak domestic and fire flow demands, to an operational system that will utilize both wells and ground

level storage with booster stations to meet peak demands. This will ultimately eliminate the need to construct a significant number of wells as demand increases. A summary of the recommendations to implement this scenario over the 20-year planning period is provided in Table 1-2.

- One of the recommendations from the water supply section is for the City to continue to maintain a two well buffer beyond strict IDEQ requirements into the future. This requires that, in addition to the ground reservoir, three additional wells be constructed between 2020 and 2030. It is recommended that the wells be spaced throughout this period to have the supply buffer remain ahead of projected increases in demand.
- Due to demand and supply forecasts, it is recommended that the City acquire an additional piece of property in Zone 2 for the eventual construction of an additional storage and booster facility in the near-term. This property will initially serve as the site of a new production well prior to 2030. Two well sites have also been identified for acquisition prior to 2020.
- The City should also consider evaluating property for a reservoir site in Zone 5 while property values are low, though this reservoir will likely not be required in the next 20 years.

Table 1-2
Summary of Estimated Water Supply Projects

Improvements[1]					Cost				
2010	**2015**	**2020**	**2030**	**Total**	**2010**	**2015**	**2020**	**2030**	**Total**
-	1 tank/ Booster[2]	-	3 wells+ booster upgrade[3]	3 wells + 1 tank/ Booster[2,3]	-	$3.7M	-	$4.2M[4]	$7.9M

[1] *Requirements to have supply in place to meet IDEQ requirements and maintain a two well buffer*
[2] *Assumes one tank will be built to meet storage requirement with an initial 4,500 gpm of pumping capacity*
[3] *Booster station upgrade of 1,500 gpm to tank/booster required by 2030 to allow service to Zone 5*
[4] *Includes $630,000 for booster upgrade to be paid for by developer*

Financial

The City has been proactive in their financial planning, maintaining healthy fund balances in recent years. The un-designated fund balance in FY2012 is approximately $6 million. The City has identified over $10 million in water infrastructure improvements in this planning effort in addition to almost $5 million in other water system capital projects between FY2012 and FY2016. Based on the City's financial model, which does not account for any rate increases in the next five years, the ending fund balance in FY2016 will be over $11 million. This provides the City with the flexibility to deal with unexpected capital, personnel or operations related costs if they should arise in the next five years. Overall, the City's water utility is in good financial condition.

Summary

Overall, the City has been proactive in addressing any needs identified in the previous master plans, (2001 and 2006), which is clear by their ability to stay ahead of the extreme growth that occurred between the early 1990s and 2007. The City is also fortunate to have an abundant groundwater aquifer of generally high quality that has allowed them to drill high producing wells, when and where required, in the system. Current groundwater quality challenges, due to uranium, iron and manganese, will require the City to be proactive in their future water supply planning.

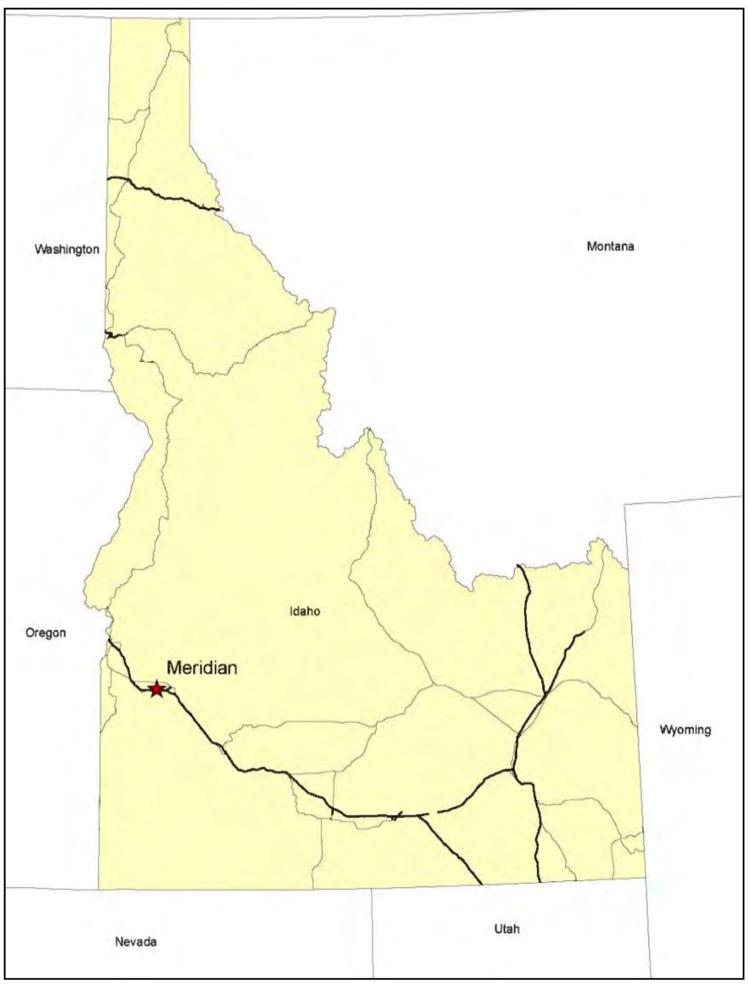
The Public Works Department's leadership is evident through the development of the City's first conservation plan, work to formalize their design and construction standards, and current long-term water supply planning efforts that look beyond the 20-year horizon required by IDEQ. In addition, the City already has their next Water Master Plan Update identified in their budget for 2015.

SECTION 2
EXISTING WATER SYSTEM

Introduction

The City of Meridian (City) is located in southwestern Idaho, approximately 32 miles east of the Idaho-Oregon border and approximately 110 miles north of the Idaho-Nevada border. The City, incorporated in August 1903, is located in Ada County and in the center of the Boise Metropolitan Area, which consists of six cities. The metropolitan area surrounding the City is home to many world-renowned hi-tech companies, a number of colleges and an award winning school system. The City has a business friendly government that encourages economic growth and is one of the fastest-growing cities in Idaho. Elevation within the City ranges from approximately 2,550 to 2,700 feet above mean sea level. The City covers an area of approximately 27 square miles.

Figure 2-1
Location of Meridian



Meridian's water system is a public system under the direction of the city government. The Water Division is directed by a water superintendent and assistant water superintendent, and employs operations and maintenance staff. The water superintendent works closely with management from other City divisions and reports to the utility operations manager, who in turn reports to the public works director. The system (PWS #4010097) provides service to approximately 27,000 accounts. The system has over 400 miles of pipe and approximately 4,400 active fire hydrants. The City's system includes four pressure zones with an additional zone planned for implementation in 2012. The system has 20 existing or currently planned groundwater wells, 22 pressure control valves, 2 booster stations and 2 storage tanks. The current service area encompasses approximately 22 square miles and the planned impact area at build-out encompasses 62 square miles. Each of the major hydraulic elements is summarized in the following section and the locations of the facilities throughout the service boundary are illustrated in Figure 2-2.

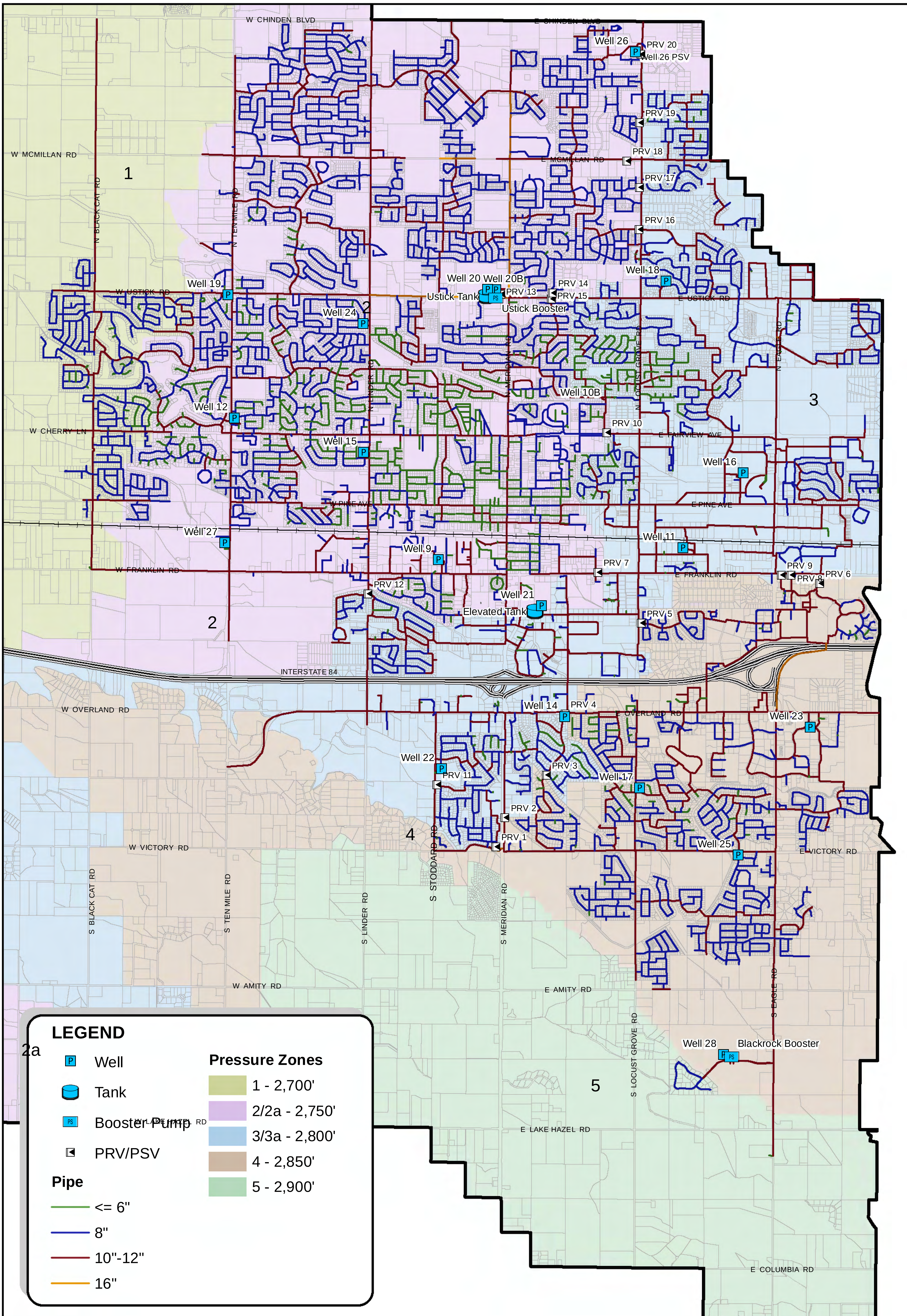
Pressure Zones

The distribution system is currently separated into four pressure zones (2-5). The zones were designed to deliver water at an operating pressure of 55 to 80 pounds per square inch (psi). Due to the relatively small hydraulic grade differences between pressure zones, the City has the ability to feed a higher pressure zone from a lower zone under emergency conditions while still maintaining pressures greater than 20 psi. Table 2-1 summarizes the pressure zone hydraulic grade lines. These zones correspond to the zone boundaries shown in Figure 2-2. Pressure Zone 1 has been designed, but not yet implemented. It will be served entirely by pressure reducing valves (PRVs) from Zone 2 and its implementation is dependent on development in the northwest section of the service area. Zone 1 is currently scheduled for implementation in 2012. Currently customers within Zone 1 boundaries are served as part of Zone 2.

Table 2-1
Pressure Zone Summary

Pressure Zone	Hydraulic Grade Line* (ft MSL)
Zone 1 (proposed)	2,700
Zone 2	2,750
Zone 3	2,800
Zone 4	2,850
Zone 5	2,900

**Approximate*



MSA	City of Meridian Water Master Plan	Figure 2-2 Existing Water System	1 in=3,500 ft	MERIDIAN IDAHO

Supply Wells

The potable water for the Meridian system is supplied solely by groundwater sources derived from 20 water wells situated throughout the City's service boundary. The well depths range from 400 to 800 feet below ground surface. The total capacity of all wells in the Meridian water system is 35,900 gpm (51.7 mgd). During a power outage, wells with backup power generation on site can provide a capacity of 25,350 gpm (36.5 mgd). Table 2-2 presents the location and capacity of each well. The locations of the wells are shown in Figure 2-2.

Table 2-2
Summary Well Pump Production Capacity

Well	Location	Pressure Zone	Pumping Capacity (gpm)	Status	Backup Power
Zone 2					
9	Franklin Road & SW 7th Street	2	1,500	Active	No
12	Ten Mile Road & Cherry Lane	2	1,800	Active	No
15	Sunnyslope Drive & Linder Road	2	1,900	Active	Yes
19	W Niemann Road & Ustick Road	2	1,900	Active	No
20[1]	Ustick Road & Meridian Road	2	2,000	Active	Yes
21	Water Tower Lane & Main Street	2	2,000	Active	Yes
24	Tumble Creek Drive & Blue Springs Avenue	2	1,800	Active	Yes
27	Ten Mile Road & Franklin Road	2	2,300	Active	Yes
		Zone 2 Total	15,200		
Zone 3					
10B[2]	Jericho Road & Willowbrook Drive	3	1,500	Planned	No
11	Lanark Street & Locust Grove Road	3	750	Active	No
16	Rosario Street & State Avenue	3	1,000	Backup	Yes
18	Summerfield Way & Summerfalls Drive	3	2,000	Active	No
22	Stoddard Road (Bear Creek Park)	3	2,000	Active	Yes
20B[3]	Ustick Road & Meridian Road	3	2,000	Backup	Yes
26	Locust Grove Road & E Commander Street	3	2,500	Active	Yes
		Zone 3 Total	11,750		
Zone 4					
14	SE 5th Street & Overland Road	4	1,400	Active	Yes
17	Locust Grove Road & Time Zone Drive	4	1,100	Active	No
23[3]	Silverstone Way & S Cobalt Point Way	4	2,000	Backup	Yes
25	Victory Road & Brandys Jewel Way	4	2,250	Active	Yes
		Zone 4 Total	6,750		
Zone 5					
28	Taconic Drive	5	2,200	Active	Yes
		Zone 5 Total	2,200		

[1] *Well 20 cannot pump directly to the system when the Ustick Booster is in operation*
[2] *Well 10 was taken offline in September 2008 due to elevated Uranium. Well 10B should be constructed by Spring 2012 at the site of Well 10*
[3] *Well 20B and Well 23 are used under emergency conditions and serve as redundant pumps for Zone 3 and Zone 4 respectively. Well 23 is set to come on automatically if the system pressure drops significantly.*

Treatment

Disinfection is the only process applied to source water in the system. All of the well discharge points are equipped with bulk 12.5 percent strength sodium hypochlorite feed systems. The sodium hypochlorite is dosed to provide a target chlorine residual concentration of 0.3 mg/L in the distribution system.

Booster Stations

There are currently two booster pump stations within the water system, the Ustick Booster Station and Blackrock Booster Station. The Ustick Booster Station is located in Zone 2, adjacent to Well 20 and the Ustick Reservoir. The Ustick Booster Station is supplied by water from the Ustick Reservoir and contains two constant-speed vertical turbine pumps rated at 800 gpm, and one variable-speed vertical turbine pump rated at 1,500 gpm. The Blackrock Booster Station is located at the southern end of pressure Zone 4, near Eagle Road. It boosts water from Zone 4 to Zone 5, and contains two variable-speed vertical turbine pumps rated at 2,200 gpm each. Due to piping restrictions downstream of the booster station, the combined operating capacity is approximately 2,500 gpm.

Pressure Reducing Valves

The regulation of flow and pressure between adjacent pressure zones in the water system is accomplished with PRVs. The water system currently has 21 active PRVs and one pressure sustaining valve (PSV) situated at pressure zone boundaries. Table 2-3 presents a list of PRVs in the City's water system and provides the PRV flow direction, diameter and pressure setting for each valve. The location of the existing PRVs is provided in Figure 2-2. The PRVs allow for the supply of water from lower to higher pressure zones under emergency conditions, due to the relatively small difference in the pressure zones' hydraulic grade lines.

Table 2-3
Pressure Reducing Valves

PRV No.	PRV Location	Pressure Zone Flow Direction	Pipe Diameter (in)	Setting (psi)	Elevation (ft MSL)	Hydraulic Grade Line (ft MSL)
7	Franklin & Baltic	3→2	10	48	2,623	2,733
10	Fairview & Jericho	3→2	10	55	2,601	2,727
12	Linder & Greenhead	3→2	12	55	2,586	2,713
13	Well 20	3→2	10	61	2,583	2,723
14	Ustick & Arrowwood (North)	3→2	8	60	2,590	2,728
15	Ustick & Arrowwood (South)	3→2	8	55	2,590	2,716
16	Locust Grove & Leighfield	3→2	10	55	2,603	2,730
17	Locust Grove & Red Rock	3→2	8	55	2,602	2,728
18	Locust Grove & McMillan	3→2	10	55	2,598	2,725
19	Locust Grove & Comisky	3→2	8	58	2,601	2,734
20	Well 26	3→2	10	58	2,601	2,735
	Well 26 PSV	3→2	10	84	2,601	2,794
1	Meridian & Victory	4→3	8	50	2,653	2,768
2	Meridian & Maestra	4→3	8	52	2,638	2,758
3	5th & Jamaica	4→3	8	62	2,628	2,770
4	Well 14	4→3	10	55	2,634	2,760
5	Locust Grove & Woodbridge	4→3	4	49	2,631	2,744
6	Franklin & Touchmark	4→3	10	45	2,657	2,761
8	Franklin & Brooklyn (Portico E)	4→3	8	50	2,655	2,770
9	Franklin & Brooklyn (Portico W)	4→3	8	50	2,658	2,773
11	Stoddard & Kodiak	4→3	10	62	2,619	2,762
21	Blackspur & Lake Creek	4→3	8	54	2,645	2,769
22	Taconic Drive	5→4	10	55	2,690	2,817

Note: Elevations are shown in feet measured from mean sea level (MSL)

Storage

The water system contains two storage facilities, which include the 0.5 million gallon (MG) elevated storage tank and the 2 MG Ustick Reservoir. The elevated storage tank is a 117 foot tall steel reservoir that was built in 1976. The static pressure delivered at the base of the storage tank ranges from 49 to 53 psi. The tank floats on Zone 2 with an overflow elevation of approximately 2,750 feet. The Ustick Reservoir is a concrete structure that was constructed in 2000 and supplies Zone 2 through the Ustick Booster Station. In Zone 4, a new 2 MG ground storage tank with booster station is currently under design and planned for construction in 2013.

SCADA System

The status of the water system is monitored and controlled through a Supervisory Control and Data Acquisition (SCADA) system. The SCADA system continuously monitors flow, pressure and various status conditions at each well and booster station and displays the information on the operator workstations. The SCADA system also monitors reservoir levels and alarm conditions at the reservoirs as well as the status of the PRVs. The City is currently doing a SCADA master plan to evaluate and identify ways to improve their SCADA system.

Distribution Pipe

The City's water distribution piping includes over 400 miles of pipe. These pipes vary from 4 to 16 inches in diameter and are composed of cast iron (CI), ductile iron (DI), polyvinyl chloride (PVC), and asbestos cement (AC). New pipelines are typically constructed using PVC. A map of the existing distribution piping is provided in Figure 2-2.

SECTION 3
POPULATION AND DEMAND PROJECTIONS

Introduction

Water infrastructure planning requires the development of future water demands. This information is used for two primary purposes in water master planning: identifying the amount of water supply required, and within a hydraulic model to size piping and related water facilities. There are several possible methods for the development of future demands, depending on what forecasting information is available. For the City of Meridian (City), which is predominantly residential in nature, the use of population projections provides a valuable tool for performing the calculations. Existing water demand can be described by developing a per capita usage rate by identifying the total existing demand and dividing that by the number of people served. Future population projections can then be multiplied by the per capita water usage, yielding future water demand. In the City's case, Community Planning Association of Southwest Idaho (COMPASS) information is available by Traffic Analysis Zone (TAZ), providing location specific population growth that can be used to determine future water demand and size infrastructure within specific areas of the system. The purpose of this section is to first present historical population and water use information, and then calculate future water demands. Demand projections have been developed on a system-wide basis, as well as for each pressure zone.

Definition of Terms

Demand

Demand refers to the total system production, which is the quantity of water, obtained from the water supply source(s) during a given time period, required to meet the needs of domestic, commercial, industrial, and public use and for fire fighting, system losses, and other miscellaneous applications. Demands are normally discussed and quantified in terms of flow rates, such as million gallons per day (mgd) or gallons per minute (gpm).

Flow rates can be described in any terms involving a volume of water delivered during a specific period. Flow rates pertinent to the analysis and design of water systems are as follows:

- Average Day Demand (ADD): the total volume of water delivered to the system in a year, divided by 365 days.
- Maximum Month Demand (MMD): the maximum volume of water delivered to the system during any single month, divided by 30 days.
- Maximum Day Demand (MDD): the maximum volume of water delivered to the system during any single day.

- Peak Hour Demand (PHD): the maximum volume of water delivered to the system during any single hour.

As noted, these demands are typically quantified in units of million gallons per day (mgd) or gallons per minute (gpm). The following conversion factors determine flow rates in other units:

- 1 mgd = 694 gpm = 1.55 cubic feet per second (cfs)
- 1 gpm = 60 gallons per hour (gph) = 1,440 gallons per day (gpd)
- 1 cfs = 450 gpm = 0.648 mgd

Volumetric conversions are:

- 1 cubic foot (cf) = 7.481 gallons (gal)
- 1 gal = 0.134 cf

The concept of per capita demand provides a convenient method of comparing the water use of different water systems or areas served by the system. The per capita demand is obtained by dividing the total system demand by the total population served. Differences in climate, type of development and water use trends influence the per capita demand for different water systems. In the City's case, there is considerable difference in per capita consumption across the system depending on where independent, non-potable irrigation systems exist.

Consumption

Consumption refers to the actual volume of water used by (and typically billed to) customers, measured at their connections to the water distribution system. Consumption is typically measured in units of hundred cubic feet (ccf) or thousands of gallons.

Peaking Factors

The relationships between the ADD and other demand parameters, such as the MDD, MMD, and PHD, are expressed as peaking factors (PF). As an example, the MDD may have a peaking factor of 2.2 (i.e., MDD = 2.2 x ADD).

Sources of Existing Data

City staff supplied existing water production and customer billing record data. Population data were obtained from the U.S. Census Bureau and COMPASS.

Water Production

A summary of monthly water production records for the years 2005 through 2009 is presented in Table 3-1. The volume of water produced is the amount pumped from the aquifer, treated by chlorination and put into the distribution system. ADD, MDD and the associated peaking factors for each year are shown in Table 3-2. The average peaking factors for the five-year period are used in the report to calculate future MDD and PHD from ADD values.

Water production in the City has increased steadily over the past 10 years, peaking in 2007, which coincides with the last of the boom construction years. Since 2007, water production has fallen somewhat; however, total production remains higher than volumes measured prior to 2007.

Table 3-1
Historical Water Production (MG)

Month	2005	2006	2007	2008	2009
January	127.54	145.75	173.17	146.14	155.07
February	105.90	129.45	145.43	149.81	144.49
March	142.59	147.48	174.54	175.26	168.92
April	169.73	144.95	270.09	213.53	214.21
May	211.29	335.91	333.77	320.63	275.66
June	286.62	337.16	374.61	373.74	371.12
July	378.91	452.98	482.63	441.13	444.02
August	464.79	428.61	476.17	410.34	407.60
September	308.31	314.58	449.17	348.54	347.63
October	235.16	260.93	282.60	228.48	206.06
November	141.89	149.00	158.02	150.01	165.64
December	138.92	144.34	156.87	181.60	146.31
Total	**2,712**	**2,991**	**3,477**	**3,139**	**3,047**

Table 3-2
Historical Average and Maximum Demands

Year	ADD (mgd)	MDD (mgd)	PF_{MDD} (MDD/ADD)	PF_{PHD} (PHD/ADD)
2005	7.43	14.38	1.94	3.21
2006	8.20	15.55	1.90	2.92
2007	9.53	19.08	2.00	3.13
2008	8.60	15.17	1.76	2.80
2009	8.35	15.86	1.90	2.97
		Averages	**2.0**	**3.0**

Per Capita Demand

ADD and MDD per capita demand estimates for the years 2005 through 2009 are shown in Table 3-3. The per capita demands were determined from the historical demand and service area population estimates. There are segments of the population within city limits that are not served by the City's water system and as such, the service area population is smaller than the City population. To increase the accuracy of per capita demands, the service area population, not the City limit population, estimates were used. COMPASS provides City population estimates for each year from 2005 through 2009 and more detailed TAZ data for benchmark years. The TAZ data were used to determine the ratio of the service area population to the entire City population to obtain service area population estimates.

As noted, the year 2007 represents the peak in demand between 2005 and 2009. Overall, total water production has gone up over the five-year period as the population has increased, however, the per capita water potable water consumption has generally trended downward over the same period.

Table 3-3
Historical Per Capita Demand

Year	Service Area Population[1]	ADD (gpcpd[2])	MDD (gpcpd)
2005	50,449	147	285
2006	59,851	137	260
2007	64,617	147	295
2008	64,969[3]	132	233
2009	65,321[3]	128	243
	Averages	**138**	**263**

[1] *Population figures are based on COMPASS city populations and service area ratios*
[2] *Gallons per capita per day*
[3] *Population is linearly interpolated using COMPASS 2010 benchmark population*

An interesting trend is also taking place in the City, where all new residential construction is required to utilize non-potable irrigation from surface water providers, when available. As agriculture land is converted to development, the overall per capita potable water usage continues to decline as summer irrigation use is eliminated from most new customer's potable consumption. In addition, there is a national trend of declining per capita water use as new, higher efficiency fixtures and appliances are installed and more people embrace a "conservation" culture.

The overall transition to non-potable irrigation and increased conservation measures are reflected in the City's large reductions in per capita potable water use observed over the past 10 years. Per capita demands were determined using COMPASS service area population estimates and historical production data. The ADD per capita demand has dramatically declined from a high of 224 gpcpd in 1999 to 128 gpcpd in 2009. This decline is further reflected in the difference in the 10-year average ADD of 169 gpcpd compared with the most recent five-year average of 138 gpcpd.

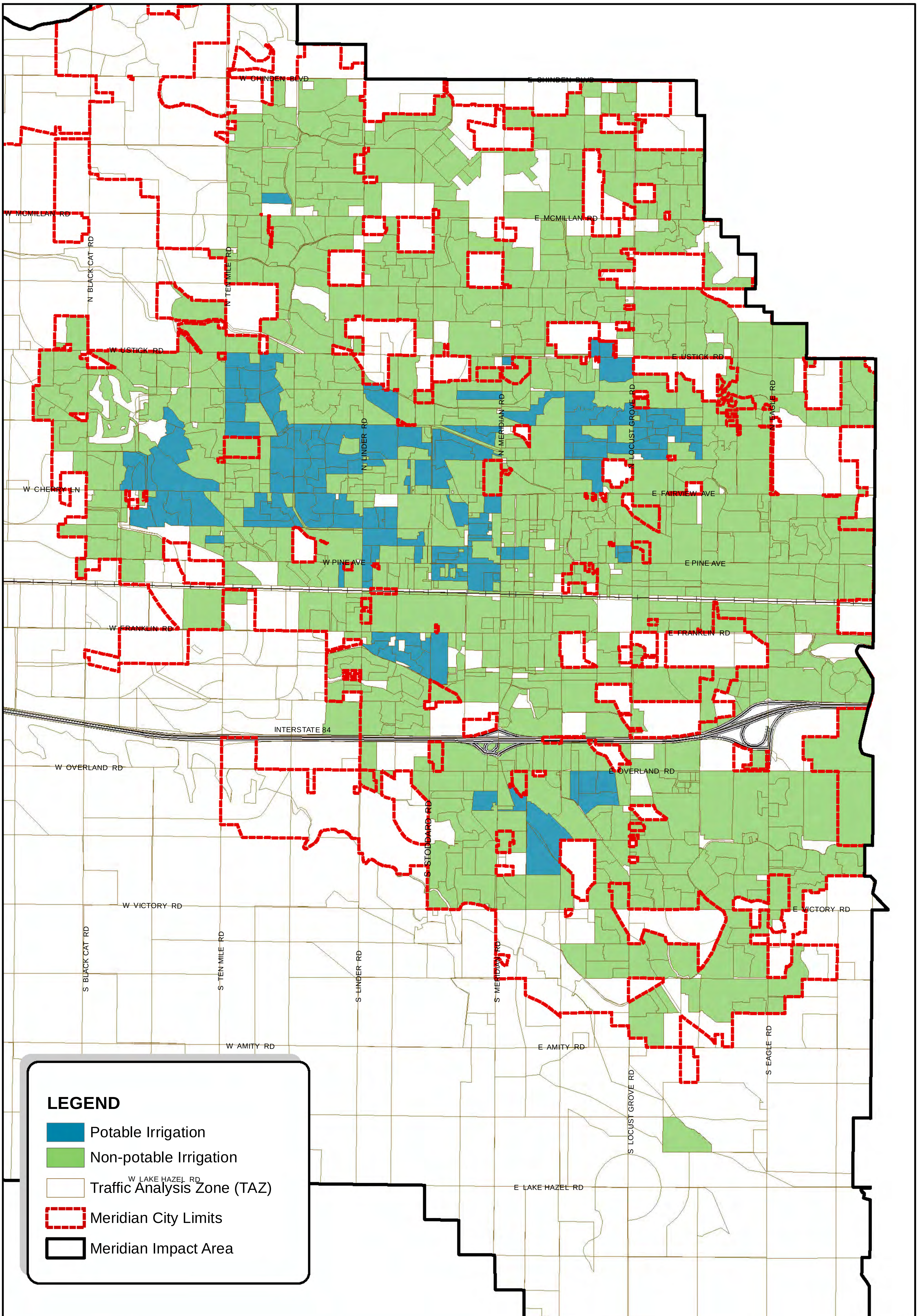
An analysis of 2008 and 2009 consumption data showed customers who use potable water for irriation used 215 gpcpd on average, while those with non-potable irrigation used 112 gpcpd. Currently, approximately 20% of the service area, from a population perspective, uses potable irrigation. Figure 3-1 depicts the approximate areas with potable and non-potable irrigation systems. Historically, the percent of potable irrigation customers and per capita demand have been higher; however, as service has extended to new customers with non-potable irrigation, the potable per capita demand has dramatically lowered. As this trend continues, and the service area population expands with most new customers using non-potable irrigation, future potable per capita demand is expected to continue to decline, but more slowly than it has historically. Consequently, a conservative per capita water use factor of 130 gpcpd, based on the most recent two-year average, is employed for future projections.

Water Consumption by Customer Class

The majority of the City's water customers are residential. However, the City does provide water for non-residential accounts as well. The City's non-residential accounts with the largest demand for 2009 are listed in Table 3-4. The demand quantities are indexed to population equivalents (PE) using the two-year average per capita demand of 130 gpcpd for ADD and five-year average per capita demand of 263 gpcpd for MDD.

The largest non-residential users, those in Table 3-4, account for only 2.9 percent of the total water demand on an average annual basis and contribute the equivalent of an additional 1,860 people consuming at the average of 130 gpcpd. The largest user, St. Luke's Regional Medical Center, accounts for 0.6 percent of average annual demand amounting to a population equivalent of 371 additional residents.

Residential use comprises the vast majority of water demand and drives both the average annual and the peak usage. The non-residential use in the system primarily supports commercial, governmental and institutional users that have water use trends similar to residential users. Little heavy industry exists in the City, limiting the tendency for flatter overall water usage or peaks at different times than typical residential users. As a result, future water demand has been calculated based on population growth and a per capita average of all system demand, including residential and non-residential use. The percent of use contributed by non-residential accounts has increased as the City has grown and should be revisited with each update of the water system plan to ensure the current strategy continues to makes sense.



City of Meridian
Water Master Plan

Figure 3-1
Potable and Non-potable Irrigation

1 in=3,500 ft

Table 3-4
Largest Non-Residential Users (2009)

Customer	ADD (gpd)	ADD PE	MMD (gallons)	Month
St. Luke's Regional Medical Center	48,230	370	2,459,000	August
Metro Express Car Wash	42,266	325	1,646,000	August
Roaring Springs	35,479	273	3,120,000	August
Nampa Meridian Irrigation—Cabella Creek (Sprinkler)	28,405	219	2,792,000	August
SL Phys Realty-Louise LLC	16,082	124	750,000	August
Sunbridge Care and Rehabilitation Center	16,027	123	645,000	August
Computrol (Sprinkler)	14,781	114	1,096,000	August
City of Meridian WWTP	14,101	108	682,000	October
Bodily RV	13,718	106	1,300,000	August
Church of Jesus Christ of LDS	12,721	98	1,036,000	September
Total	**241,811**	**1,860**		

Non-Revenue Water

The International Water Association (IWA) and the American Water Works Association (AWWA) have published and promoted a water audit methodology that has been widely recognized and adopted throughout the water industry. This method provides definitions and classifications for annual water production and consumption, shown in Table 3-5. As seen in Column E, "non-revenue" water in a system is the unbilled component of production. It is the difference between the volume of water produced and the volume of water sold to customers. As Column C indicates, non-revenue water is comprised of authorized and unauthorized consumption. Unbilled authorized consumption includes water used for flushing mains, fighting fires and park irrigation. Non-revenue water can also result from inaccurate meters (both customer and production meters), unmetered connections, theft and leaks in the system.

Table 3-5
Components of the IWA/AWWA Water Balance

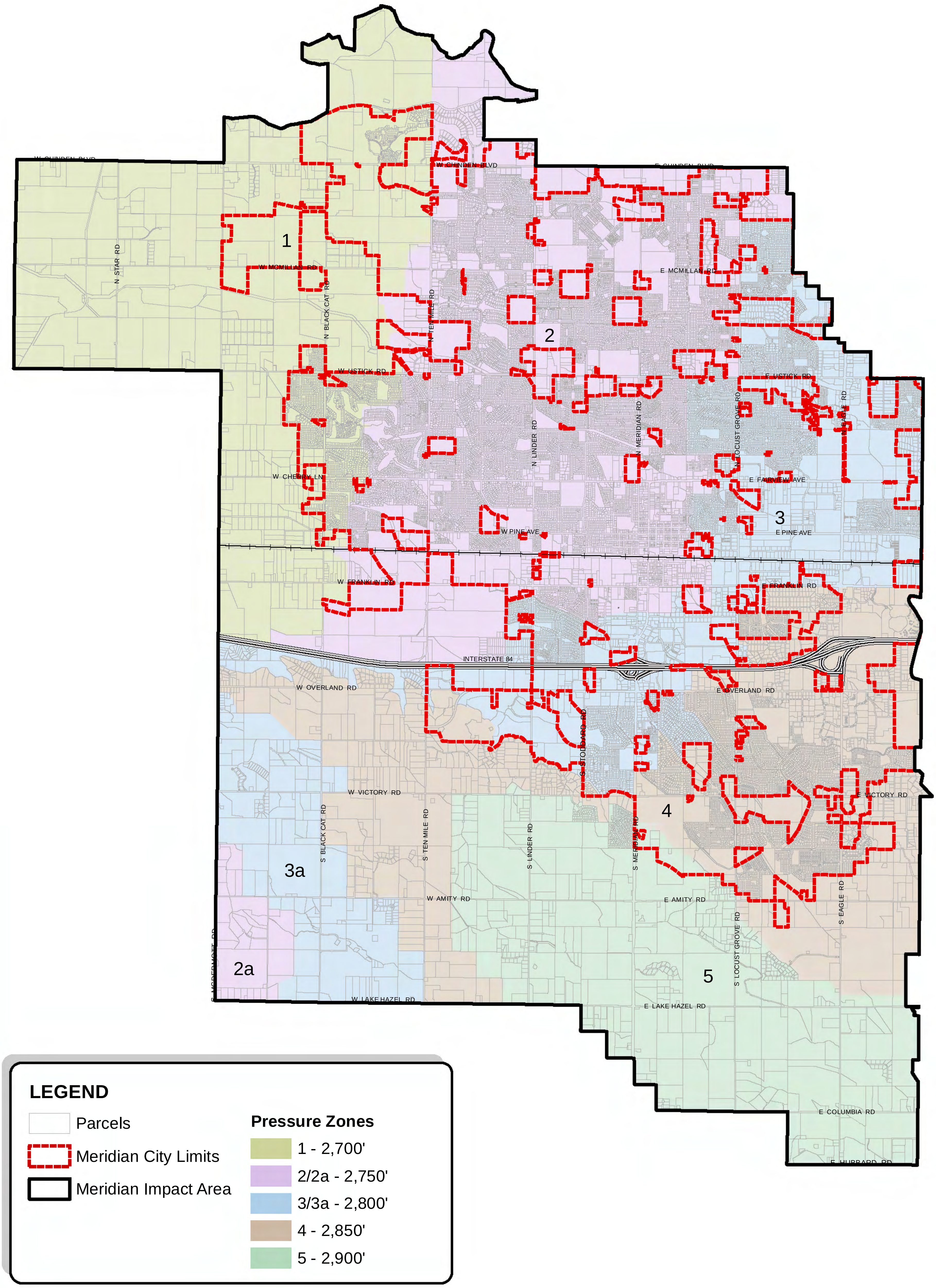
A	B	C	D	E
System Input Volume = Production = System Demand	**Authorized Consumption**	Billed Authorized Consumption	• Billed metered consumption (including water exported to another system) • Billed unmetered consumption	**Revenue Water**
		Unbilled Authorized Consumption	• Unbilled metered consumption • Unbilled unmetered consumption	**Non-Revenue Water**
	Water Losses	Apparent Losses	• Unauthorized consumption • Data handling error • Metering Inaccuracies	
		Real Losses	• Leakage from transmission and/or distribution mains • Leakage and overflows at storage tanks • Leakage from service connections up to a point of customer metering	

AWWA. Manual of Water Supply Practices M36. *Water Audits and Loss Control Programs, Third Edition*, 2009.

Water production and sales records for 2008 and 2009 indicate that the City has very low non-revenue water, averaging just 3 percent of water produced. The City is beginning a proactive meter replacement program, in conjunction with waterline replacement projects, which will likely further reduce non-revenue water. As part of this master planning effort, the City is undertaking their first water conservation plan, which also addresses some factors contributing to non-revenue water.

Current and Future Service Area Boundaries

The City has historically been agriculturally oriented, but as the population has increased in the recent past, farmland has been replaced with residential and commercial development. The current area served by the water distribution system is shown in the previous section of this facility plan on Figure 2-2. The future impact area is shown in Figure 3-2 and depicts a likely build-out boundary for the City. The proposed pressure zone boundaries required to serve the impact area are also shown on this figure and are based primarily on contour information for areas where no development currently exists. These boundaries will likely change to some degree in the future, depending on the location of specific development.



MSA	City of Meridian Water Master Plan	Figure 3-2 Impact Area Boundary	N W E S 1 in=5,000 ft	MERIDIAN IDAHO

Population Projections

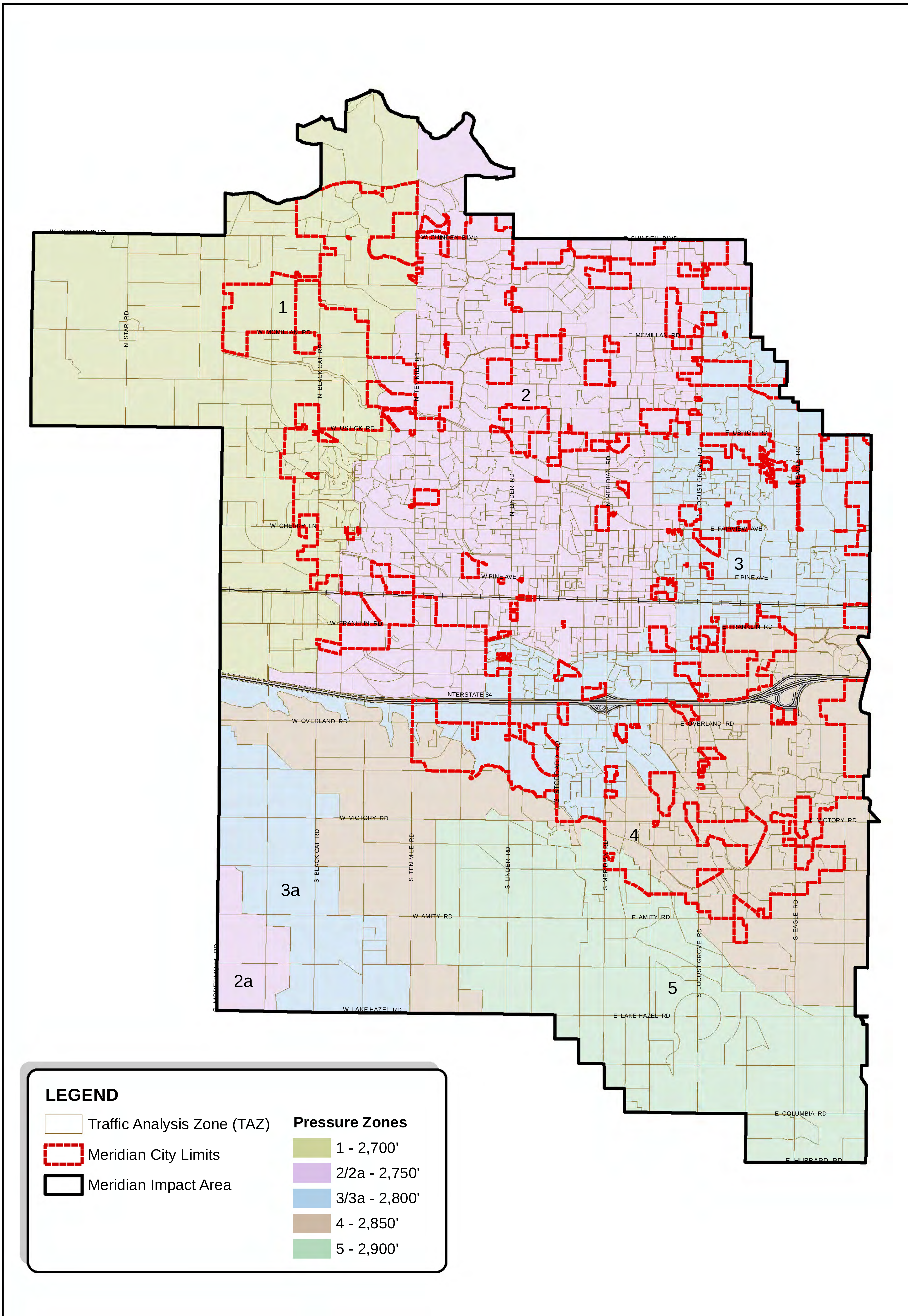
The population of the City and the surrounding area saw relatively slow growth until 1990. From 1990 through 2007, the population estimates reflect extremely rapid growth. The yearly growth rate from 2000-2007 ranged from 6.5% to 21.8%, with an overall yearly average of 12.3%. With the economic decline starting in 2008, growth has dramatically decreased. A summary of historical City population is shown in Table 3-6.

Table 3-6
City Historical Population Estimate

Year	Meridian City Population Estimate
1940	1,465
1950	1,810
1960	2,081
1970	2,616
1980	6,658
1990	9,596
1999	28,679
2000	34,919
2001	37,332
2002	39,744
2003	42,481
2004	47,690
2005	56,108
2006	66,565
2007	71,866
2008	73,040
2009	75,290

Note: Populations for each decade from 1940-2000 are based on US Census Data

The population for years without US Census data is based on COMPASS estimates. COMPASS also uses TAZ data to develop regional population projections for at least a 20-year period to assist in regional transportation and land use planning. Figure 3-3 presents the TAZ map for the City. For this plan, it is important to predict not only how much growth will occur, but also where that growth will occur within the existing City limits and impact boundary. City planning department staff estimated a geographic boundary and associated timeline for the expansion of the City's current service area to its full impact area boundary at build-out. The service boundary expansion is illustrated in Figure 3-4. The COMPASS population estimates associated with these geographic service boundaries were used to predict the service area populations shown in Table 3-7. For a 20-year horizon, Table 3-8 illustrates the estimates for how the service area population will be dispersed throughout the pressure zones within the service area. As shown in Table 3-8, significant growth is projected in all major zones prior to 2030.

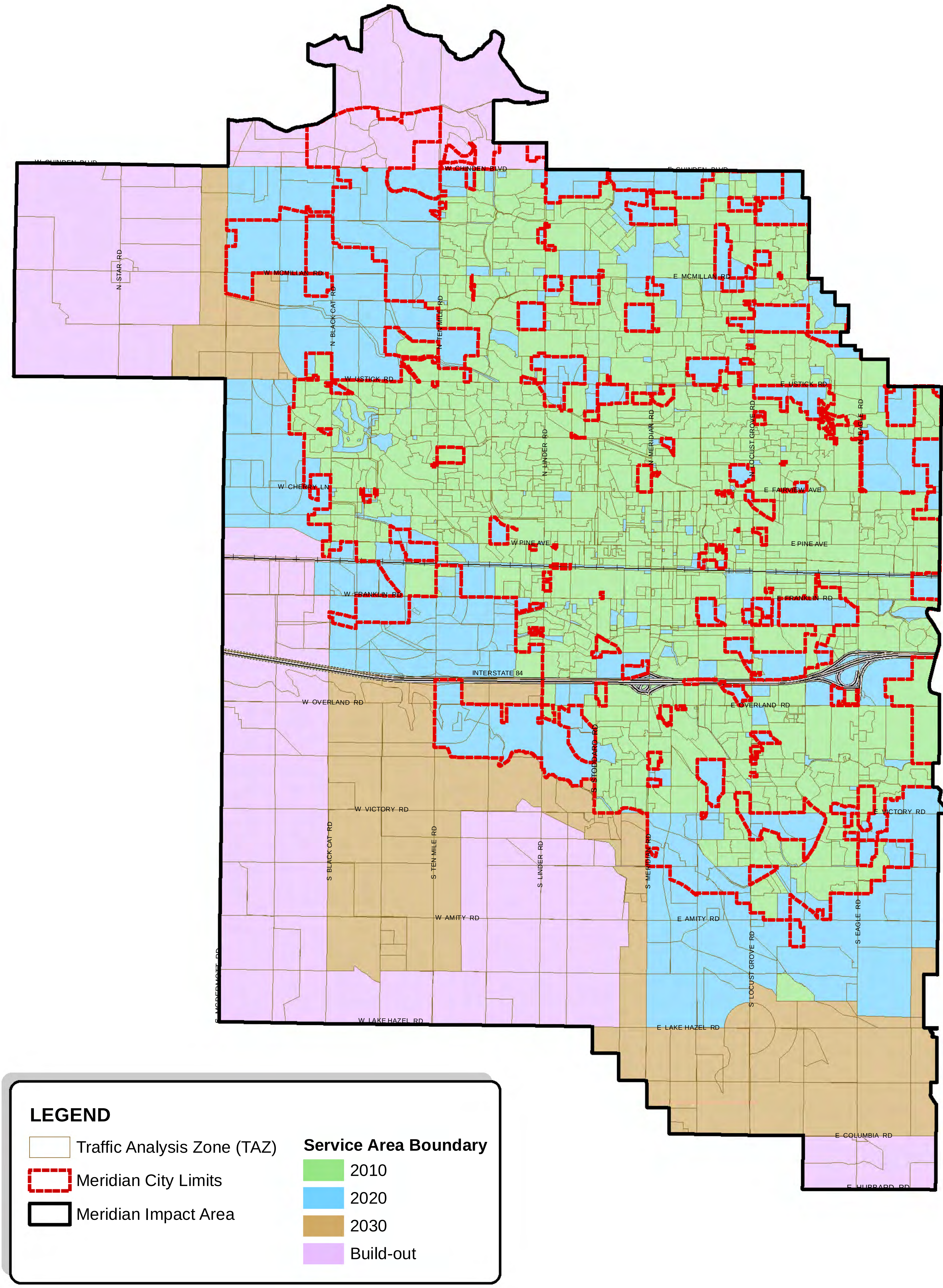


MSA

City of Meridian Water Master Plan

Figure 3-3 Traffic Analysis Zones (TAZ)

1 in=5,000 ft



MSA	City of Meridian Water Master Plan	Figure 3-4 Service Area Boundary Timeline	N W E S 1 in=5,000 ft	MERIDIAN IDAHO

Table 3-7
Service Area Population Projections

Year	Service Area Population Estimate
2010	66,000
2015	85,000
2020	104,000
2030	140,000
2060	252,000
Build-out	345,000

Note: Service area population differs from city limit population and populations have been rounded to nearest 1,000

Table 3-8
Service Area Population Projections by Pressure Zone

Zone	2010	2015	2020	2030
1	-	6,339	9,881	16,865
2	40,083	45,947	54,611	65,808
2a[1]	-	-	-	-
3	16,586	19,094	21,601	24,204
3a[2]	-	-	-	278
4	8,971	12,620	16,270	23,380
5	10	741	1,472	9,379
Total	65,650	84,741	103,835	139,914

[1] *All growth in Zone 2a is projected to occur beyond 2030*
[2] *Existing and future populations exclude Bittercreek Meadow Subdivision, which is not served by the City*

Future Water Demand Projections

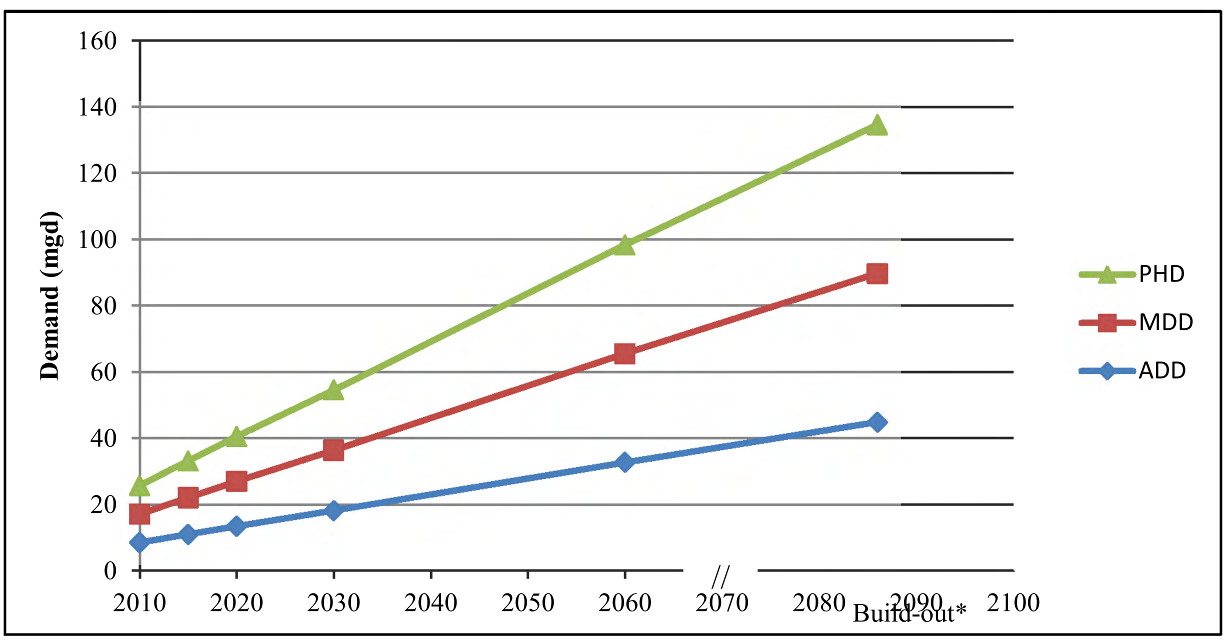
As described above, a per capita demand of 130 gpcpd will be employed as the primary demand forecasting value. System projections for ADD, MDD and PHD water demands are in Table 3-9. Figure 3-5 graphically represents the demand projections through build-out. These values were calculated using population projections, average per capita demand and average peaking factors. The demand within each pressure zone is identified in Table 3-10.

Table 3-9
Service Area Demand Projections

Year	Service Area Population Estimate	ADD (mgd)	MDD (mgd)	PHD (mgd)
2010	66,000	8.6	17.2	25.7
2015	85,000	11.0	22.1	33.2
2020	104,000	13.5	27.0	40.6
2030	140,000	18.2	36.4	54.6
2060	252,000	32.8	65.5	98.3
Build-out	345,000	44.9	89.7	134.6

Note: Existing and future demands exclude Bittercreek Meadow Subdivision, which is not served by the City

Figure 3-5
Service Area Demand Projections



** No specific date is associated with Build-out*

Table 3-10
Service Area Demand Projections by Pressure Zone

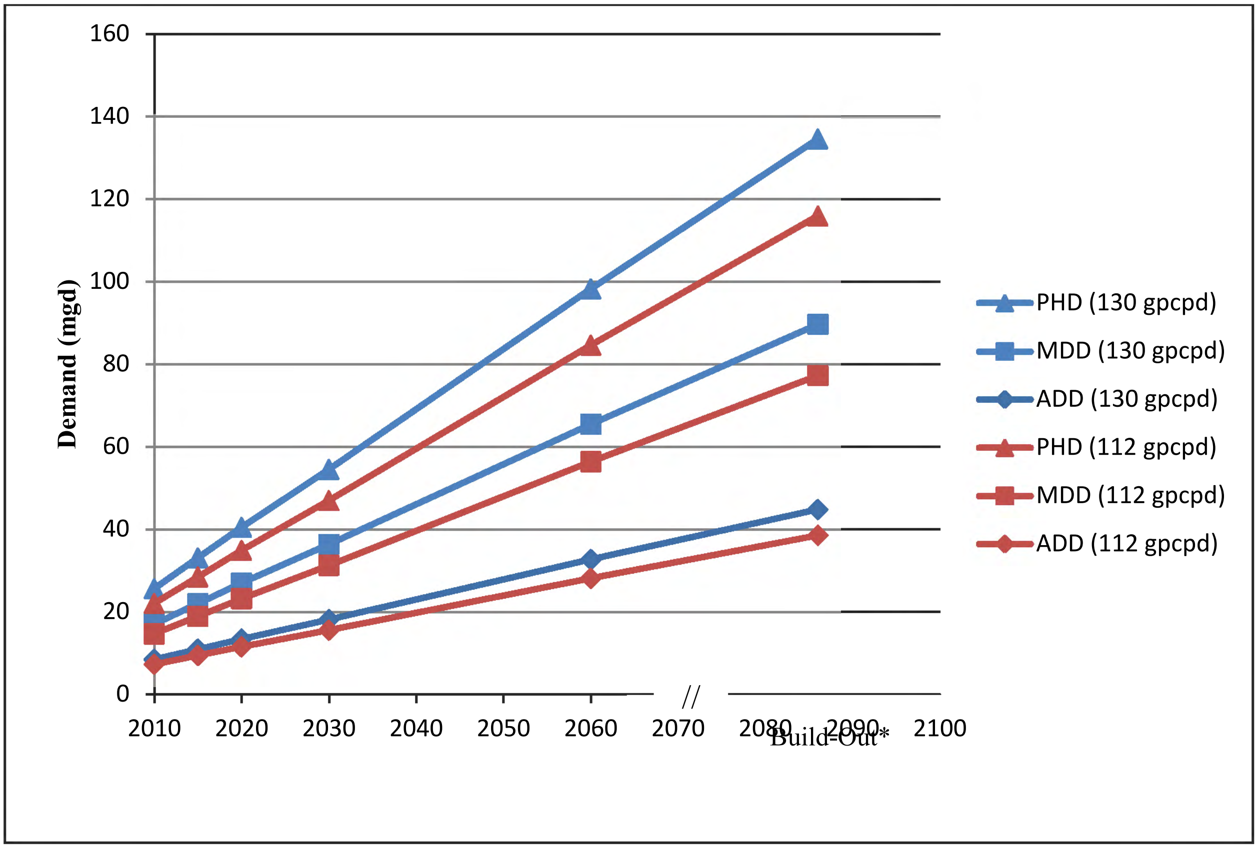
Zone	Demand (mgd)	2010	2015	2020	2030
1	ADD	-	0.8	1.3	2.2
	MDD	-	1.6	2.6	4.4
	PHD	-	2.5	3.9	6.6
2	ADD	5.2	6.0	7.1	8.6
	MDD	10.4	11.9	14.2	17.1
	PHD	15.6	17.9	21.3	25.7
3	ADD	2.2	2.5	2.8	3.1
	MDD	4.3	5.0	5.6	6.3
	PHD	6.5	7.4	8.4	9.4
3a*	ADD	-	-	-	0.04
	MDD	-	-	-	.08
	PHD	-	-	-	.12
4	ADD	1.2	1.6	2.1	3.0
	MDD	2.3	3.3	4.2	6.1
	PHD	3.5	4.9	6.3	9.1
5	ADD	0.001	0.1	0.2	1.2
	MDD	0.003	0.2	0.4	2.4
	PHD	0.004	0.3	0.6	3.7

** Existing and future demands exclude Bittercreek Meadow Subdivision, which is not served by the City*

Impact of Conservation on Future Water Demands

It should be noted that the continued decline in per capita water usage will also have a significant impact on the future water supply needs of the system. A second calculation showing the amount of water required using a per capita demand of 112 gpcpd has also been performed. As noted above, 112 gpcpd is the current average yearly water use for customers with a separate non-potable irrigation source. It is reasonable to assume that the City could attain an overall value of 112 gpcpd over the next 20 years as more customers come on line with separate irrigation systems and additional conservation measures are employed. Figure 3-6 depicts the difference between the demand requirements to build-out using a per capita demand of 130 gpcpd versus 112 gpcpd.

Figure 3-6
Demand Projections Varying Per Capita Demand



** No specific date is associated with Build-out*

Population and Demand Summary

Population growth and corresponding demands have been projected in this section. These projections produce what would be considered "conservative" future water demands based on projected population growth. The extremely high growth rates experienced between 2000 and 2007 are unlikely to be seen again, however the exceptionally slow growth between 2007 and 2010 is also unlikely. It is important to note that projecting population and corresponding water demand can be difficult where historical data varies greatly and per capita usage is also changing, both of which are factors in the City. While the projected demands for the next 20 years will be used to evaluate the hydraulic capacity of the system and identify improvements, the actual timing of those improvements should be scrutinized. In particular, the City will construct additional supply improvements, based primarily on when the system reaches certain demand thresholds versus specific predetermined timelines, which will be discussed in later sections of the WMP.

SECTION 4
WATER SUPPLY PLANNING

Introduction

To adequately plan for future water supply needs, multiple factors must be considered. Water supply planning is driven by the demand for water and the availability of water and/or water rights. As such, the purpose of this section is to present an analysis of sources of supply, and their availability and adequacy to meet current and future demands. Supply planning requires preparation for emergencies through interties with surrounding systems and consideration of water rights and long-term supply options to meet demand on a system-wide and zone-by-zone basis.

As discussed in previous planning documents, the City of Meridian (City) has a fundamental question that must be answered in terms of future supply. Will future sources of supply have a capacity that is equal to or greater than **any** instantaneous demand, (peak hour or max day plus fire flow) as is currently available? Or will future supply planning provide for sources that can meet maximum day demand with any peak hour demand or fire flow requirements being provided by storage? The analysis to follow will show, particularly beyond 20 years, that the number of wells that are required will vary significantly depending on which criteria is applied.

Water Supply

Water Rights and Long-term Supply

Table 4-1 contains water right information for the 20 wells that supply water to the City's water system. A water rights permit is the authorization necessary from the Idaho Department of Water Resources (IDWR), to begin construction of withdrawal facilities and begin using water. A license is only issued once water has been used and documentation of use is submitted and approved by IDWR. A water rights permit does not guarantee water for the appropriator. Under the prior-appropriation doctrine, the water right authorizes diversions of water only to the extent that water is available. The City is actively assessing its water rights through reinforcement of the current water rights portfolio and planning for future water rights needs. To fully utilize existing water rights, efforts are focused on extending the utility of post-1987 water rights by transferring the respective points of diversion to all of the City’s wells. This will allow the necessary flexibility to leverage water rights within the system where they are most needed. In addition, an examination of water rights compared to demands will determine proof of beneficial use. Water use within the system as a whole and within each pressure zone will identify how existing water rights are being used and ultimately lead to an evaluation of whether applications should be submitted to convert existing permits to licenses. In addition to these steps to fully utilize existing water rights, projected demands must be considered to determine the need for future water rights, and plans and applications made to accommodate growth within the community.

Table 4-1
Water Rights

Source	Pressure Zone	Priority Date	Right No.	Stage	Diversion Rate (gpm)
Well 9	2	6/28/76	63-8331	License	848
Well 10B	3	6/28/76	63-10105; 63-08332	License	1,257; 898
Well 11*	3	-	-	-	-
Well 12	2	7/6/89; 12/22/99	63-10840; 63-12162	License	601; 898
Well 14	4	3/20/92	63-11737	License	1,346
Well 15	2	8/20/92 2/14/95	63-11922; 63-12173	License	1,346; 655
Well 16	3	6/27/93	63-12039	License	1,346
Well 17	4	11/9/95	63-12295	License	2,020
Well 18	3	5/20/95	63-12181	License	2,020
Well 19	2	4/23/97	63-12378	License	2,020
Well 20	2	9/10/97	63-12416	License	2,020
Well 20B	3	4/18/03	63-31677	License	2,244
Well 21	2	1/5/00	63-12560	License	2,020
Well 22	4	3/20/01	63-31138	License	2,244
Well 23	4	8/10/01	63-31281	Permit	2,244
Well 24	2	8/29/01	63-31318	Permit	2,244
Well 25 & Well 28	4 & 5	3/11/03	63-31630	Permit	2,244
Well 26	3	2/23/04	63-31858	Permit	2,199
Well 27	2	2/10/05	63-32083	Permit	2,199

** Well 11 is not an original point of diversion, but is an alternate point of diversion for all decreed water rights including approximately 4,100 gpm not shown on this table.*

Emergency Interties

Water supplies and their associated rights are necessary to meet the long-term requirements of the system; however, at times, emergency conditions may require additional or varied short-term supply sources. The City has developed a very robust grid structured water system, which provides good transmission capability and redundancy. However, in the event of an emergency it is important to have alternate sources and means of transferring water throughout the system. The City has identified sixteen locations where opportunities exist to create emergency interties with the adjacent water purveyor, United Water Idaho (UWI). These locations are along the north and east side of the impact area as shown in Figure 4-1. The interties would allow two-way flow, providing benefit to both systems in the event of emergencies. Initial discussions with UWI indicate that under emergency conditions the intertie locations would have similar enough pressure to not require pumping. Additional discussion and formal agreements with UWI will be required prior to implementing the design, construction, and operation of the interties.

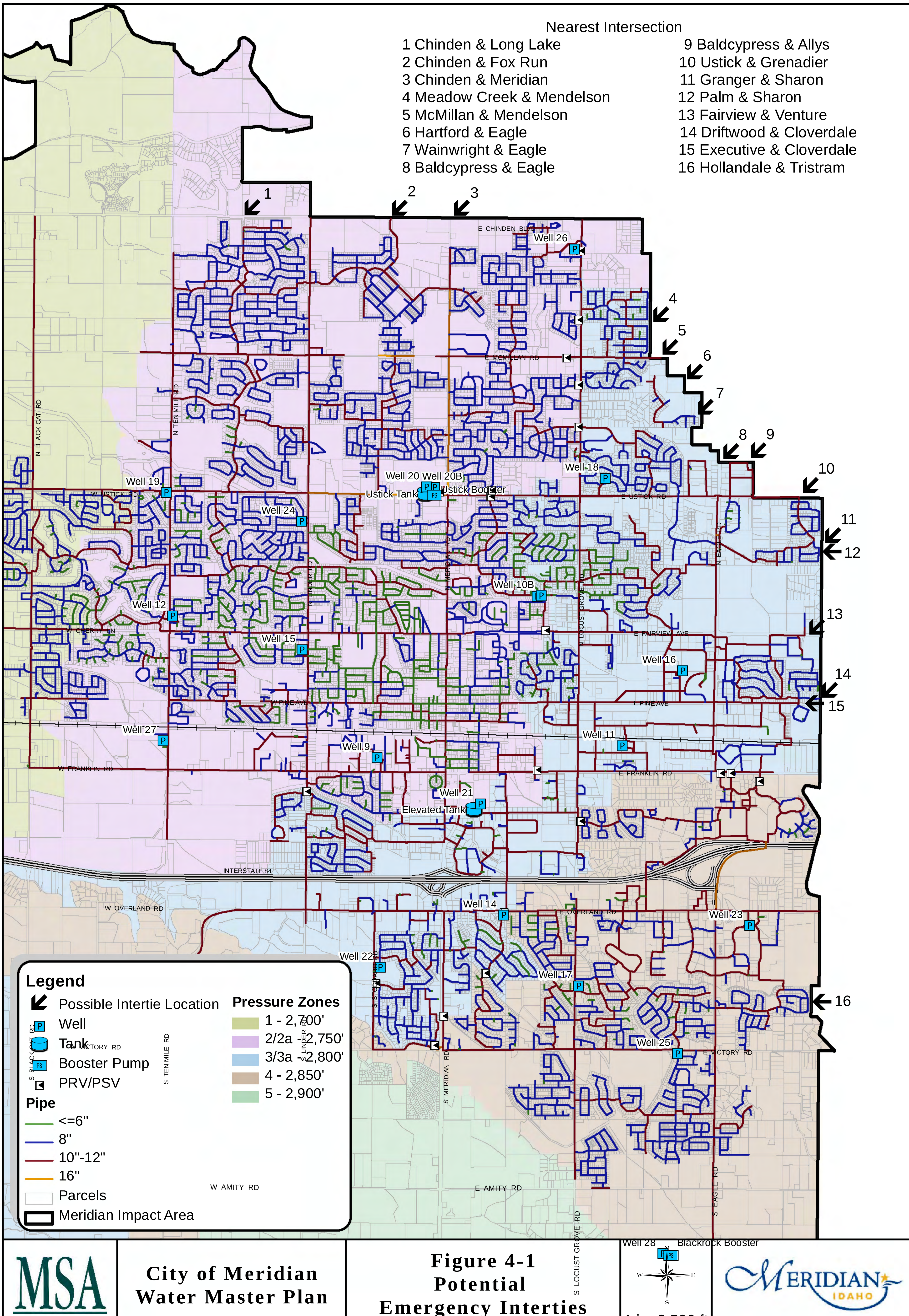
Water Demand

Conservation

While the City is taking steps to secure water rights to have the necessary supply available, it is also taking steps to decrease the amount of water required through conservation measures. The City's first formal conservation plan has been completed. It addresses many conservation related issues, including how conservation could impact demand projections, the impact of the City's reclaimed water program and how to manage non-revenue water. The plan includes an evaluation of the cost and benefit of specific conservation measures and outlines how the City will move forward on the measures listed as part of the plan. The quantitative impact of the City's conservation plan on future water demand is unknown at this time. The timeline associated with the demand projections outlined within this facility plan will vary based upon a number of factors, including overall system growth, where in the system that growth occurs and the success of the City's conservation program. As such, the supply and infrastructure requirements to accommodate increased demand should be triggered by specific demand thresholds, rather than the specific date associated with that projection.

Projected Demand

Table 4-2 contains water demand projections for the service area for current, 5-, 10- and 20-year planning periods. The demands are based on projected service area populations and a per capita average day demand (ADD) of 130 gpcpd, maximum day demand (MDD) of 260 gpcpd, and peak hour demand (PHD) of 390 gpcpd, as described previously in the Population and Demand Projections (Section 3).



City of Meridian Water Master Plan

Figure 4-1 Potential Emergency Interties

Table 4-2
Service Area Demand Projections

Year	Service Area Population Estimate	ADD (mgd)	MDD (mgd)	PHD (mgd)
2010	66,000	8.6	17.2	25.7
2015	85,000	11.0	22.1	33.2
2020	104,000	13.5	27.0	40.6
2030	140,000	18.2	36.4	54.6

Note: Service area population differs from city limit population and populations have been rounded to the nearest 1,000

To determine system supply and storage requirements, the existing supply and projected demand will be evaluated on a system-wide and zone-by-zone basis for the 5- and 20-year horizons.

Water Demand and Supply Requirements

Water Supply Criteria

To remain in compliance with the Idaho Department of Environmental Quality (IDEQ), Idaho Administrative Procedures Act (IDAPA) and provide adequate service to its customers, the following criteria are used to determine the adequacy of supply and storage, as well as emergency power for the Meridian water system.

1. Sufficient backup power to meet ADD plus fire flow
2. Sufficient supply and/or storage to meet either PHD or MDD plus fire flow (whichever is greatest) with the largest pump in each pressure zone out of service

The existing and future conditions are analyzed to determine any deficiencies in meeting the above criteria. The following analysis uses projected demands and timelines. It should be noted that the timelines associated with system deficiencies are based on COMPASS population forecasts. Ultimately, supply planning should be triggered by predetermined demand thresholds, not specific dates, as demand forecasts will vary depending on the actual rate of development within the City. Additionally, because the City has developed a robust pipe grid with many pressure reducing valves (PRVs) between each zone, water can be conveyed across the system. This can even be accomplished under emergency conditions from a lower pressure zone to a higher one, due to the hydraulic grades between zones only varying by 25-50 feet.

Existing and Future ADD Analysis

The ADD for each zone was summarized previously in Table 3-10, while the existing standby power capacity for each zone appears in Table 2-2. A summary of overall standby power along with the demand and fire flow for each zone appears in Table 4-3.

For all of the IDAPA supply calculations, including this one, it is assumed that only one fire must be fought in the City at any given time. The largest fire flow requirement within the City is 7.2 mgd (5,000 gpm) located at Plum Creek Mfg. or Dynamite Feed, both in Zone 2. The 2030 ADD plus fire flow results in an overall system standby power requirement of 25.4 mgd, which is less than the current available standby power capacity of 36.5 mgd. Each pressure zone is analyzed on a zone-by-zone basis; however, due to the robust nature of the City's distribution grid and numerous PRVs, it is assumed that water can currently be transferred between Zones 2 and 5 to meet any zone specific deficiencies; assuming additional supply is available upgradient. The same principle will extend to Zone 1 when it is implemented.

Zone 1 has not yet been implemented and customers within Zone 1 boundaries are currently served directly from Zone 2. When Zone 1 is implemented, it will continue to be served from Zone 2 through PRVs. As such, the available standby power in Zone 2 should be sufficient to serve the total demand in Zones 1 and 2. New standby power can be implemented in Zone 2, when the requirement exceeds 14.4 mgd, or water from Zones 3 and 4 can be utilized if available. By 2030, current Zone 2 standby power supply is 3.6 mgd short of meeting demand; however, there is adequate supply from Zone 3 to overcome this deficit assuming the single largest fire flow requirement in the system (7.2 mgd) in Zone 2.

Zone 3 currently has adequate standby power to meet the ADD plus fire flow requirement. Zone 3a does not have an existing supply source and one will need to be implemented by 2030 to meet demand. The ADD is rather insignificant; however, the fire flow demand is larger. To eliminate this deficiency, an additional source of supply within Zone 3a, or a connection to another pressure zone within the system is required when Zone 3a is projected to come into the system in 2030.

Zone 4 has sufficient standby power to meet the existing and projected demand through 2015. Excess supply in Zone 5 can supplement Zone 4 through 2030 without deficiencies. In addition, assuming only a single fire in the system at a time, Zone 4 has sufficient excess supply to supplement the rest of the system, including Zone 5, through the backup power capability of the booster station.

Historically, Zone 5 has been served solely through booster pumps drawing from Zone 4. Recently, Well 28 was drilled and backup power installed within Zone 5 to provide the required supply redundancy (each zone must have at least two sources of supply). The combined capacity of the well and the booster station provides adequate capacity through 2030 to meet ADD plus fire flow in Zone 5. The booster station has standby power to operate the two 3.2 mgd pumps, for 6.4 mgd of total capacity. However, the current booster station discharge piping limits the capacity to approximately 3.6 mgd. Although demand projections through 2030 do not require flows beyond the current well and booster capacity, it is anticipated that the piping from the booster station will be upgraded, as development continues, to allow the full 6.4 mgd capacity of the booster pumps, which will accommodate growth beyond 2030.

Where zone deficiencies have been identified in the following tables, requirements are shown in red. This does not infer an overall system-wide deficiency however, just a zone deficiency, which may or may not be able to be addressed by supply from other higher zones through PRVs.

Table 4-3
ADD, Fire Flow and Available Standby Power

Pressure Zone	Fire Flow (mgd)	ADD (mgd)				Total Requirement (mgd)				2010 Standby Power Pumping Capacity (mgd)
		2010	2015	2020	2030	2010	2015	2020	2030	
1	3.6	-	0.8	1.3	2.2	-	4.4	4.9	5.8	-[1]
2	7.2	5.2	6.0	7.1	8.6	12.4	13.2	14.3	15.8	14.4
1 & 2	7.2	5.2	6.8	8.4	10.8	12.4	14.0	15.6	18.0	14.4
3	4.3	2.2	2.5	2.8	3.1	6.5	6.8	7.1	7.5	10.8
3a	2.2	-	-	-	0.04	-	-	-	2.2	-
4	6.1	1.2	1.6	2.1	3.0	7.3	7.8	8.2	9.2	8.1
5	3.6	0.001	0.1	0.2	1.2	3.6	3.7	3.8	4.8	6.8[2]
System-wide	**7.2**	**8.6**	**11.0**	**13.5**	**18.2**	**15.8**	**18.2**	**20.7**	**25.4**	**36.5[3]**

[1] Zone 1 has no supply and will be served from Zone 2 through PRVs.
[2] Includes booster pumps (3.6 mgd) and well capacity (3.2 mgd)
[3] Only includes 3.2 mgd of Zone 5 since other supply is boosted from Zone 4, which was already included

In summary, by 2030 a 3.6 mgd deficiency in standby power will exist in Zones 1 and 2 based on current projections. This deficiency could be supplied by leveraging excess capacity in Zones 3-5; however, it is recommended that some additional standby power be evaluated in Zone 2 by 2030. By 2030, Zone 3a will require supply through a well and/or interconnection with the system. Zone 4 is also 1.1 mgd short of standby power supply by 2030, but supply from Zone 5 is sufficient to supplement Zone 4.

Existing and Future MDD plus Fire Flow and PHD Analysis

Currently the City has two storage tanks with a combined volume of 2.5 million gallons (MG), of which approximately 2 MG would be considered "usable" storage; both are located in Zone 2. Existing well capacity is adequate to supply all domestic and fire demands including standby requirements directly from wells and booster stations, eliminating the need to rely on storage to meet any supply requirements. However, as the following analysis shows, the existing supply is insufficient to meet PHD or MDD plus fire flow over the 20-year planning horizon. This deficiency will require the construction of additional wells, storage, or a combination of both. The following evaluation considers two different strategies: an all-well scenario, and a well and storage scenario.

In order to implement a storage and booster station scenario, the system must be able to provide MDD in all zones with firm capacity. The firm capacity is calculated by assuming the largest pump within each zone is out of service. A summary of the number of wells required for each zone to meet MDD over the next 20 years is shown in Table 4-4. The required number of wells assumes that a deficiency will first be met by any excess supply in an adjacent, higher hydraulic grade zone (except Zone 5, which can boost from Zone 4). If the zones higher than the zone with the deficiency do not have adequate excess supply, in emergency conditions lower zones could serve higher zones through the reverse capability of the PRVs; however, this is not a preferred operating condition. Based on recent well drilling and groundwater availability, future wells are assumed to produce 3 mgd. As Table 4-4 shows, by 2030 Zones 1 and 2 will not have adequate firm supply to meet MDD. However, from an overall perspective there is a system-wide surplus of firm capacity compared with MDD. This will allow excess supply to be transferred from Zones 3 and 4 to Zone 2. The City may choose to construct additional wells in Zone 2; however, due to the robust nature of the transmission/distribution system and number of PRVs between zones, it is not required.

Table 4-4
Wells Required to meet MDD through 2030

Pressure Zone	MDD (mgd)				2010 Firm Capacity (mgd)	Additional Number of Wells[1]			
	2010	2015	2020	2030		2010	2015	2020	2030
1	-	1.6	2.6	4.4	-	0	0	0	0
2	10.4	11.9	14.2	17.1	18.6[2]	0	0	0	0
1 & 2	10.4	13.6	16.8	21.5	18.6[2]	0	0	0	0[3]
3	4.3	5.0	5.6	6.3	13.3	0	0	0	0
3a	-	-	-	0.08	-	0	0	0	0
4	2.3	3.3	4.2	6.1	6.5	0	0	0	0
5	0.003	0.2	0.4	2.4	6.4[4]	0	0	0	0
System-wide	**17.1**	**22.0**	**27.0**	**36.4**	**41.5[5]**	**0**	**0**	**0**	**0**

[1] *Assumes average new well capacity of 3 mgd*
[2] *Because MDD is assumed to be met first by wells, includes well capacity for Well 20 (2,000 gpm), rather than booster pump capacity of the Ustick tank (3,300 gpm)*
[3] *Assumes surplus from Zone 3 is used to provide additional, required supply*
[4] *Includes one booster pump (3.2 mgd) and well capacity (3.2 mgd)*
[5] *Only includes 3.2 mgd of Zone 5 since other capacity is boosted from excess Zone 4 supply, which is already included*

IDAPA requires that each zone have adequate firm capacity to meet the larger of PHD or MDD plus fire flow. Total and firm pumping capacities along with PHD for each zone are summarized in Table 4-5.

Table 4-5
PHD and Firm Capacity

Pressure Zone	PHD (mgd)				2010 Total Pumping Capacity (mgd)	2010 Firm Capacity (mgd)
	2010	2015	2020	2030		
1	-	2.5	3.9	6.6	-	-
2	15.6	17.9	21.3	25.7	23.8[1]	20.4[1]
1 & 2	15.6	20.4	25.2	32.2	23.8[1]	20.4[1]
3	6.5	7.4	8.4	9.4	16.9	13.3
3a	-	-	-	0.1	-	-
4	3.5	4.9	6.3	9.1	9.7	6.5
5	0.004	0.3	0.6	3.7	6.8[2]	6.4[3]
System-wide	**25.6**	**33.0**	**40.5**	**54.5**	**53.6[4]**	**43.4[4]**

[1] *Because peak demands are assumed to be met first through storage, where available, includes booster pump capacity of the Ustick tank (3,300 gpm), rather than well capacity for Well 20 (2,000 gpm)*
[2] *Includes booster station (3.6 mgd) and well (3.2 mgd) capacity*
[3] *Includes one booster pump (3.2 mgd) and well capacity (3.2 mgd)*
[4] *Only includes 3.2 mgd of Zone 5 since other capacity is boosted from excess Zone 4 supply, which is already included*

As shown in Table 4-5, the system as a whole has adequate firm capacity through 2020. At 2030, a deficiency is noted and 11.1 mgd (4 new wells at 3 mgd each) of additional supply will be required to meet the overall system demand. Due to the robust nature of the City's system, the needed system supply could be constructed in Zones 2, 3 or 4; however, as noted, the deficiency is primarily located in Zones 1 and 2. It is recommended that three of the four new wells be sited in Zone 2 to eliminate any potential distribution system constraints that might develop. The other new well should be sited in Zone 4, prior to 2030, to supplement Zones 4 and 5 through the booster station. The system deficiency could also be eliminated by increasing the capacity of existing storage and/or constructing additional storage, reducing the number of needed wells, as discussed in greater detail below.

In addition to checking if supply is adequate to meet PHD, it must also be able to meet MDD plus fire flow. A summary of MDD plus fire flow and firm capacity is in Table 4-6.

Table 4-6
MDD Plus Fire Flow and Firm Capacity

Pressure Zone	Fire Flow (mgd)	MDD (mgd)				Total Requirement (mgd)				2010 Firm Capacity (mgd)
		2010	2015	2020	2030	2010	2015	2020	2030	
1	3.6	-	1.6	2.6	4.4	-	5.2	6.2	8.0	-
2	7.2	10.4	11.9	14.2	17.1	17.6	19.1	21.4	24.3	20.4[1]
1 & 2	7.2	10.4	13.6	16.8	21.5	17.6	20.8	24.0	28.7	20.4[1]
3	4.3	4.3	5.0	5.6	6.3	8.6	9.3	9.9	10.6	13.3
3a	2.2	-	-	-	0.08	-	-	-	2.2	-
4	6.1	2.3	3.3	4.2	6.1	8.5	9.4	10.4	12.2	6.5
5	3.6	0.003	0.2	0.4	2.4	3.6	3.8	4.0	6.0	6.4[2]
System-wide	**7.2**	**17.1**	**22.0**	**27.0**	**36.4**	**24.3**	**29.2**	**34.2**	**43.6**	**43.4[3]**

[1] *Because peak demands are assumed to be met first through storage, where available, includes booster pump capacity of the Ustick tank (3,300 gpm), rather than well capacity (2,000 gpm) for Well 20*
[2] *Includes one booster pump (3.2 mgd) and well capacity (3.2 mgd)*
[3] *Only includes 3.2 mgd of Zone 5 since other supply comes from Zone 4, which was already included*

A very small amount of additional system-wide supply will be required by 2030 when comparing firm capacity to MDD plus fire flow. Due primarily to the 7.2 mgd (5,000 gpm) fire flow requirement within Zone 2, deficiencies exist in that zone starting in 2015 and increase due to the significant growth that is projected in Zones 1 and 2. At 2030, 8.3 mgd of additional supply is required in Zones 1 and 2. Deficiencies in Zone 4 are also evident under existing conditions, once again due to large fire flow requirements. Assuming only one fire in the system, adequate supply is available from Zones 3 and 4 to meet Zone 2 requirements through 2020; however, at least one additional source of supply is necessary prior to 2030. Adequate excess supply is available from Zone 5 to meet Zone 4 requirements through 2015. By 2030, a 5.7 mgd deficiency exists in Zone 4, which will require additional supply; however, due to the close hydraulic grade of the zones and the reverse capability of the PRVs, under emergency conditions, Zone 4 could receive supplemental supply from Zone 3, eliminating any deficiency through 2020.

Ultimately, the system will require additional supply in Zone 2 by 2030 and Zone 4 just after 2015. This second source of supply could be postponed until after 2020 if Zone 4 received excess supply from Zone 3. However, the City has expressed a preference to eliminate the need for a lower zone to serve a higher zone, so additional supply in the form of a well or storage is recommended for Zone 4 sometime shortly after 2015. With these new supplies in place, and assuming that the system can still distribute water effectively between zones, firm capacity would meet or exceed MDD plus fire flow requirements.

Using the more stringent criteria system wide, PHD, the improvements outlined in Table 4-7 are recommended to increase the firm capacity of the system to 55.4 mgd by 2030 to meet IDEQ requirements. The well in 2020, in Zone 4, is not necessary for PHD, but recommended to supply MDD plus fire flow to avoid the need for Zone 3 to supplement Zone 4. The timeline is also sometime between 2015 and 2020, so the implementation should be demand driven rather based on a specific timeline.

Table 4-7
Number of Wells for All-well Scenario

Pressure Zone	Required Number of Additional Wells[1, 2]				Total Number of Additional Wells through 2030
	2010	2015	2020	2030	
1	0	0	0	0	0
2	0	0	0	3	3
1 & 2	0	0	0	3	3
3	0	0	0	0	0
3a	0	0	0	0	0
4	0	0	1	0	1
5	0	0	0	0	0
System wide	**0**	**0**	**1**	**3**	**4**

[1] *Assumes average new well capacity of 3 mgd*
[2] *Minimum to meet IDEQ requirements under all-well scenario*

The other scenario that could be used to meet PHD or MDD plus fire flow, involves a combination of wells and storage. It has been shown that there is enough firm well capacity to satisfy MDD requirements through 2030. The well and storage plus booster scenario assumes that any demand greater than MDD will be provided by storage through a booster station. Through previous conversations with City staff, it has been determined that new elevated storage tanks that would not require boosting, are not aesthetically acceptable or economical. To calculate the required storage, the following assumptions were used:

- No operational storage is required, due to pumps maintaining constant system pressure
- Equalizing storage is calculated as the difference between PHD and MDD over 4 hours
- A single, 5,000 gpm fire with a 4-hour duration can be fought with storage, resulting in a storage volume of 1.2 MG
- No standby storage is required due to adequate well generator capacity to meet ADD plus fire (assumes new generators are installed as needed)
- Total storage is peaked by 10% to account for dead storage volume

The calculated storage requirements are shown in Table 4-8. As shown in the all-well scenario, to meet IDEQ requirements, no additional wells are required until shortly after 2015, so even though a storage volume is shown under 2010 and 2015, no additional storage is actually required until shortly after 2015 to supplement Zone 4. With the existing 2 MG of usable storage, an additional 1.8 MG of storage is needed to meet peak demands by 2020 and 2.6 MG by 2030. In addition to the volume of water stored, the system must have appropriate booster pump capacity and pipe capacity to convey the stored water during peak demand periods.

Table 4-8
Required Tank Volumes for Well and Storage Scenario

Year	Operational Storage Required[1] (MG)	Equalizing Storage Required[2] (MG)	Fire Flow Storage Required[3] (MG)	Standby Storage Required[4] (MG)	Total Storage Required[5] (MG)
2010	-	1.4	1.2	-	2.9[6]
2015	-	1.8	1.2	-	3.3[6]
2020	-	2.3	1.2	-	3.8
2030	-	3.0	1.2	-	4.6

[1] *Pumps maintain constant pressure in zones, no operational component*
[2] *Based on difference between PHD and MDD for 4-hour duration*
[3] *Based on 5,000 gpm fire flow for 4-hour duration*
[4] *Assumes adequate standby power is available at wells, therefore no standby storage is required*
[5] *Assumes 10% overall storage volume is dead storage (rounded to nearest 0.1 mg)*
[6] *Not required under 2010 or 2015 conditions due to adequate well capacity to meet peak demands*

The required storage in Table 4-9 is based on the assumption that new booster stations at tanks have a 4,500 gpm capacity and piping is sized to convey at least 4,500 gpm of water, while meeting design criteria. In addition, it is assumed that the currently proposed tank design for Zone 4 will be implemented as designed, with the ability to serve 4,500 gpm each to Zones 4 and 5. The full capacity for Zone 4 and at least 1,500 gpm to Zone 5 will be necessary to meet peak demand by 2030. Because of its location in Zone 4, the proposed tank will also require additional piping to serve Zone 5, which will likely be a 16-inch pipe running parallel to existing pipe south along Locust Grove Rd. In addition to building storage in Zone 4, a well will need to be built in Zone 2 to meet PHD.

To properly evaluate the all-well versus well and storage options, a general cost comparison is provided. In this comparison, the cost used for engineering and construction of a 3 mgd water supply well is $1.2 million. The cost for a 2 MG ground-level storage tank with a 4,500 gpm booster pumping station is $3.7 million. This value is based on cost estimates recently obtained by the City and developed as part of the proposed Victory and Locust Grove Facility. The cost of land is not included. Table 4-9 contains a cost matrix for each scenario, outlining the minimum supply needs to meet IDEQ requirements. All costs are in 2011 dollars.

Table 4-9
Cost Comparison for All-well and Well and Storage Scenarios

Scenario	Required Improvements[1]					Cost				
	2010	2015	2020	2030	Total	2010	2015	2020	2030	Total
All-well	-	-	1 well	3 wells	4 wells	-	-	$1.2M	$3.6M	$4.8M
Well and Storage	-	-	1 tank/ booster[2]	1 well+ booster upgrade[3]	1 well + 1 tank/ booster[2,3]	-	-	$3.7M	$1.8M[4]	$5.5M

[1] Minimum to meet IDEQ requirements
[2] Assumes one tank will be built to meet storage requirement with an initial 4,500 gpm of boosting capacity
[3] Booster station upgrade of 1,500 gpm to tank/booster required by 2030 to allow service to Zone 5
[4] Includes $630,000 for booster upgrade to be paid for by developer

In summary, additional water rights and supplies will be necessary to meet projected system demand over the next 20 years. The growth in demand should be monitored rather than relying on a predefined timeline to address potential deficiencies. To address the deficiencies, additional supply can be provided through an all-well scenario or through wells and pumped storage. Given the current excess capacity of wells and the low rate of development, the City could choose to wait until just after 2015 before building any additional wells or tank and booster facilities. It should be noted however, that the City has recently experienced a number of water quality related issues at wells that have required the abandonment of those wells, required significant modification to those wells or the reclassification of those facilities for emergency use only. A two well buffer beyond firm capacity will allow the City flexibility in adapting to growth and water quality concerns and it is recommended that that City maintain this buffer in the future. Implementing storage, in addition to wells, provides the additional benefit of mitigating water quality issues. Storage allows for wells with water quality issues to be blended with water from wells without any quality concerns and/or water from wells without any quality issues can be stored and leveraged to meet peak demands. The level of excess supply capacity and combination of wells and storage that the City chooses should not be based solely on the calculations and tables within this chapter, but also on historical experience and other non-quantifiable factors.

Build-Out Analysis

Although IDEQ only requires water master plans to address growth and associated improvements through 20 years, the City has decided it is important to consider long-term planning, particularly concerning water rights and supply. As provided in the Population and Demand Projections (Section 3), 50-year and build-out demand projections have been provided for the impact area shown in Figure 3-2. The projected ADD, MDD, PHD, and largest required fire flow, in addition to the present firm capacity for the system, are shown in Table 4-10. As expected, the demands far exceed existing firm capacity. The number of wells required to meet IDEQ requirements for MDD and the larger of MDD plus fire flow or PHD for the entire system appear in Table 4-11. Figure 4-2 illustrates the number of wells required, during each period, to supply MDD and the larger of MDD plus fire flow or PHD demand projections for the system through 50 years and build-out assuming an all-well scenario.

Table 4-10
Build-Out Demand and Firm Capacity

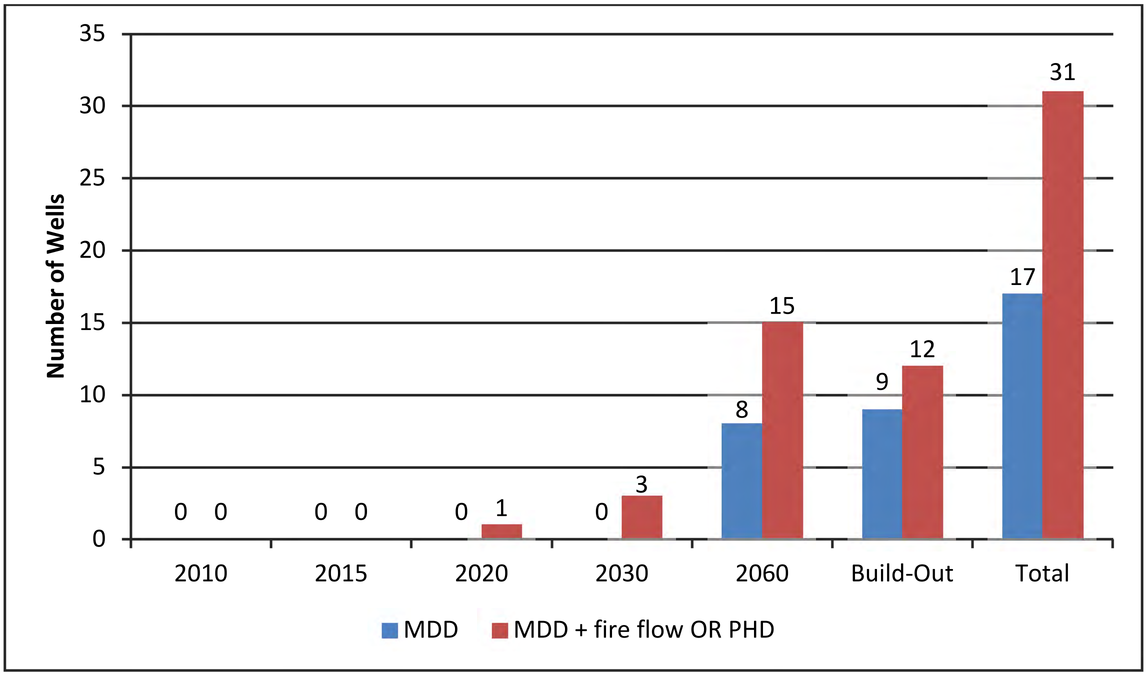
Timeframe	Fire Flow Requirement (mgd)	ADD (mgd)	MDD (mgd)	PHD (mgd)	2010 Firm Capacity (mgd)
2060	7.2	32.8	65.5	98.8	43.4
Build-out	7.2	44.9	89.7	134.6	

Table 4-11
Build-Out Requirements

Timeframe	Additional Number of Wells to meet MDD[1,2]	Additional Number of Wells to meet MDD + Fire Flow[1,2]	Additional Number of Wells to meet PHD[1,2]
2060	8	10	19
Build-out	17	18	31

[1] *Assumes average well capacity of 3 mgd*
[2] *Includes wells required to meet previous year's demand*

Figure 4-2
Number of Required Wells during Each Period



Using the same assumptions as those used above to calculate storage requirements, the needed storage for 2060 and build-out are shown in Table 4-12.

Table 4-12
Required Storage for Well and Storage Scenario

Year	Operational Storage Required[1] (MG)	Equalizing Storage Required[2] (MG)	Fire Flow Storage Required[3] (MG)	Standby Storage Required [4] (MG)	Total Storage Required[5] (MG)
2060	-	5.6	1.2	-	7.5
Build-out	-	7.5	1.2	-	9.6

[1] *Pumps maintain constant pressure in zones, no operational component required*
[2] *Based on PHD-MDD for 4-hour duration*
[3] *Based on 5,000 gpm fire flow for 4-hour duration*
[4] *Assumes adequate standby power is available at wells, eliminating the standby storage requirement*
[5] *Assumes 10% overall storage volume is dead storage (rounded to nearest 0.1 mg)*

If PHD is supplied from wells rather than having wells supply MDD and peak supply through storage, an additional 15 wells will be required by 2060 and 12 more wells by Build-out. This is a substantial number of wells that could be eliminated or reduced if the system increases its reliance on storage to serve peak demand. The other factor that must be evaluated is the ability for the City to continue to obtain water rights for supply equaling PHD in the future. Historically it has been relatively easy for municipalities to acquire new permits and water rights. This may not be the case in the future and as shown, transitioning to a well plus storage tank scenario could greatly reduce the number of new wells and associated water rights that the City would need.

Conclusions

As shown in the near-term analysis that runs through 2020, the City has done a good job of staying ahead of growth in terms of their supply capacity. Based on peak demands, only one well or an additional tank would be required in that timeframe. However, as previously mentioned, the City has experienced water quality issues in a number of wells over the past few years, requiring their abandonment, reconstruction, change of status to emergency use only, or redrilling of the wells to other aquifers. Through meetings with the City, it has been determined that a buffer of at least two wells will be maintained beyond the requirements identified in the IDAPA code to allow flexibility in meeting supply requirements, acknowledging the potential for continued water quality issues. If the City maintained an all-well scenario, this would result in the City requiring three new wells prior to 2020 to meet IDEQ requirements and maintain a two well buffer, with three more wells needed between 2020 and 2030. The City may decide as the overall number of wells increases over the next 20 to 50 years, that they want to increase the size of the well buffer, particularly if the number of water quality issues increase at existing well sites.

It is recommended, and the City prefers, to move to a well and storage scenario. Although the cost is somewhat higher through 2030, growth beyond 2030 requires a substantial number of wells that make the storage and well scenario more affordable in the long-term and ultimately, this allows the City greater predictability and flexibility in their water supply. Under the well and storage scenario, the new booster and tank in Zone 4 would be required between 2015 and 2020 (assuming 4,500 gpm booster capacity to serve Zone 4). In addition, three wells and a minimum 1,500 gpm booster upgrade to serve Zone 5 from storage are required between 2020 and 2030 to meet IDEQ requirements and maintain a two well buffer. While a potential location has been determined for the storage tank, the exact sites for the wells have not been determined; however, due to the City's ability to transfer water both directions between zones, a great deal of flexibility exists in terms of location. At least two wells are recommended to be constructed in Zones 1 and 2. The third well should be located based on growth in demand throughout the service area over the next twenty years.

Moving to a well and storage approach will allow the City to construct and maintain fewer well sites, in addition to providing a dependable source of emergency water. Additional reservoirs could also be used to blend multiple water sources to reduce contaminants to levels below the federal maximum contaminant levels. Considering these factors and demand growth, construction is recommended, within the next three years, of the proposed water reservoir and booster station located near the intersection of Victory and Locust Grove in Zone 4. While property values are low, and prior to all larger lots being developed or subdivided, the City should also consider the purchase of additional reservoir sites. Sites that are large enough to accommodate a well and reservoir should be considered. The next site would likely be located on the west edge of Zone 2. A site in Zone 5 should also be considered to support growth to the south. Based on build-out projections, and the assumption that the City transitions to a reservoir and booster scenario, an additional two to three reservoir sites beyond the Elevated, Ustick and proposed Victory/Locust Grove tanks would be required to meet build-out demands (assuming each reservoir is approximately 2 MG). It is recommended that a site evaluation project be undertaken to identify candidate locations well in advance of the actual reservoir construction.

Due to the increase in demand and related increase in needed supply, a related property acquisition evaluation should be considered at many of the existing well sites that have historically exhibited water quality concerns. Most well sites do not include adequate space to construct treatment systems that will likely be required in the future. The acquisition of one or two residential lots surrounding these locations should be considered.

SECTION 5
WATER SYSTEM ANALYSIS

Introduction

This section describes the hydraulic analysis and overall assessment of the City of Meridian's (City's) water distribution system. The analysis and overall assessment is based on the existing and future water demand criteria developed in the Population and Demand Projections (Section 3) and the analysis criteria outlined below. The findings and recommendations that result from the water system analysis are further developed into an overall improvement program, presented in the Capital Improvements Program (CIP) (Section 8).

Distribution System Analysis

A detailed system analysis was performed to assess the ability of the City's existing distribution system to provide water for domestic demands and emergency fire suppression. The analysis was also conducted to determine system improvements needed to supply anticipated future water demands and recommended fire flows for the 20-year planning horizon. A description of the analysis procedure and a discussion of the general findings and resulting recommendations follows. Recommended system improvements identified in this section are described further in the CIP (Section 8).

Regulations and Analysis Criteria

The Idaho Department of Environmental Quality (IDEQ) has regulatory authority over public and private potable water systems in the state. IDEQ also regulates and reviews water master plans. In general, IDEQ rules govern the quality of water distributed, not the manner in which it is distributed. However, some basic standards applicable for the distribution system analysis are set by IDEQ and listed below.

- Maintain minimum pressure of 40 pounds per square inch (psi) at service connections under peak hour demand conditions, excluding fire flow
- Maintain a minimum service pressure of 20 psi under maximum day demand (MDD) conditions plus fire flow; keep static pressure within the distribution system below 100 psi and where possible, below 80 psi

Although no velocity criteria are regulated by IDEQ, the City has elected to analyze the system to maintain velocities below 5 feet per second (ft/s) under demand conditions without fire flow and below 10 ft/s under fire flow conditions. The velocity criteria, in most cases, have been used as an indicator of areas where piping is undersized and does not typically dictate a system improvement on its own. These criteria serve as guidelines during the analysis and in prioritizing system improvement.

Computerized Hydraulic Network Analysis Model

A computerized hydraulic model was utilized to help evaluate the performance of the existing distribution system and to aid in the development of proposed system improvement recommendations. The model was migrated to the InfoWater software (Innovyze) from the current model, a custom-developed interface between Microsoft Access and AutoCAD, which uses an EPANet hydraulic engine. InfoWater also uses the EPANet hydraulic engine. The purpose of computer modeling is to analytically determine pressure and flow relationships throughout the distribution system for a variety of critical hydraulic conditions. System performance and adequacy is then evaluated based on the previously listed criteria.

The model was also updated with new piping and facilities, based on information available in the City's geographic information system (GIS). The model was calibrated to match field data and an analysis of the existing system was conducted to determine present hydraulic deficiencies. The system was then analyzed under future demand conditions and, when necessary, the model was expanded to include proposed improvements needed to correct existing deficiencies and provide for future development.

Calibration

Model calibration typically involves adjusting the model parameters to improve the accuracy in matching field data. It often requires the collection of additional field data concerning pump settings, valve status and retesting of hydrants. The required level of model accuracy can vary according to the intended use of the model, the type of system and the available boundary condition data as well as the size of the system and the way the system is controlled and operated. The first calibration exercise for any system is to match field-measured pressures and fire flows with model simulated system pressures and flows. This calibration process will test model pipeline friction factors, valve status, network configuration as well as facilities, such as tank elevations and pump controls and curves.

The accuracy of the model depends on the accuracy of the data; of foremost importance is correct input data describing the pipe system. Accurately modeling a system assumes correct pipe connectivity, diameter and length. Knowing the status of system facilities, including pumps, reservoirs and valves is also of critical importance during calibration. A guideline for relative data importance in obtaining an accurate model is outlined in Table 5-1.

Table 5-1
Relative Priority of System Data

Level of Importance	Input Data
1	Pipe lengths and diameters, and pipe connectivity
	Valve status
2	Reservoir water surface elevations
	Large source and booster pump flows
	Large PRV pressure settings (assuming valve elevations are known)
3	Pipe roughness factors (lining type, installation date, etc.)
4	Average day nodal demand distribution
5	Small source pumps
	Small booster pumps
	Small PRV flow information
6	Pressure information

Field Data

For the collection of field data, a plan was developed for static pressure and fire flow tests to be performed by the City in July 2010. To verify pressure gage calibration, some additional static pressure testing occurred in February 2011. Fire flow testing consists of taking an original static pressure at a hydrant and then measuring the residual pressure to obtain the pressure drop that occurs when the system is "stressed" by flowing an adjacent hydrant. The calibration accuracy involves comparing the similarity of the static pressures and the change in pressure obtained in the field with those produced by the model.

A steady state model provides a "snap-shot" in time of the system. Boundary condition data, such as reservoir levels and pump on/off status, must also be known to accurately portray the system conditions during the time of field pressure and flow data collection so that the same conditions can be replicated in the model. The time of testing was recorded for each hydrant flow test and boundary condition data during testing was collected from available system SCADA data. In the case of the City, the settings of the numerous pressure reducing valves (PRVs) between zones was also critical to accurately calibrate the model.

Steady State Calibration Results

For any system, a portion of the data describing the distribution system will be missing, or inaccurate, and assumptions will be required. This does not necessarily mean that the accuracy of the hydraulic model will be compromised. Depending on the accuracy and completeness of the available information, some pressure zones may achieve a higher degree of calibration than others. Models that do not meet the highest degree of calibration are still useful for planning purposes. Due to the uncertainty of the pressure that the pumps were set to maintain in the field, each modeled pump setting was adjusted to match the hydraulic grade line (HGL) of the pressure zone it served. The status of the pumps was set to correspond with the SCADA values from the fire flow test dates. The City's PRVs had recently been added to the City's SCADA, allowing for the valve flow and status during each test to be verified. The model was then run and the resulting model pressures were compared to the values obtained in the field. The level of confidence in the calibration was then evaluated using the predetermined criteria shown in Table 5-2.

Table 5-2
Calibration Confidence

Confidence Level	Static Pressure Difference	Residual Fire Flow Pressure Difference
High	±5 psi	≤10 psi
Medium	± 5-10 psi	10-20 psi
Low	>10 psi	>20 psi

The overall confidence level of each zone was determined by the number of low, medium and high confidence results, which is summarized in Table 5-3 and shown in Figure 5-1. More detailed test results are listed in Table 5-4.

Table 5-3
Calibration Confidence Results

Pressure Zone	Overall Confidence
2	High
3	High
4	High
5	Low

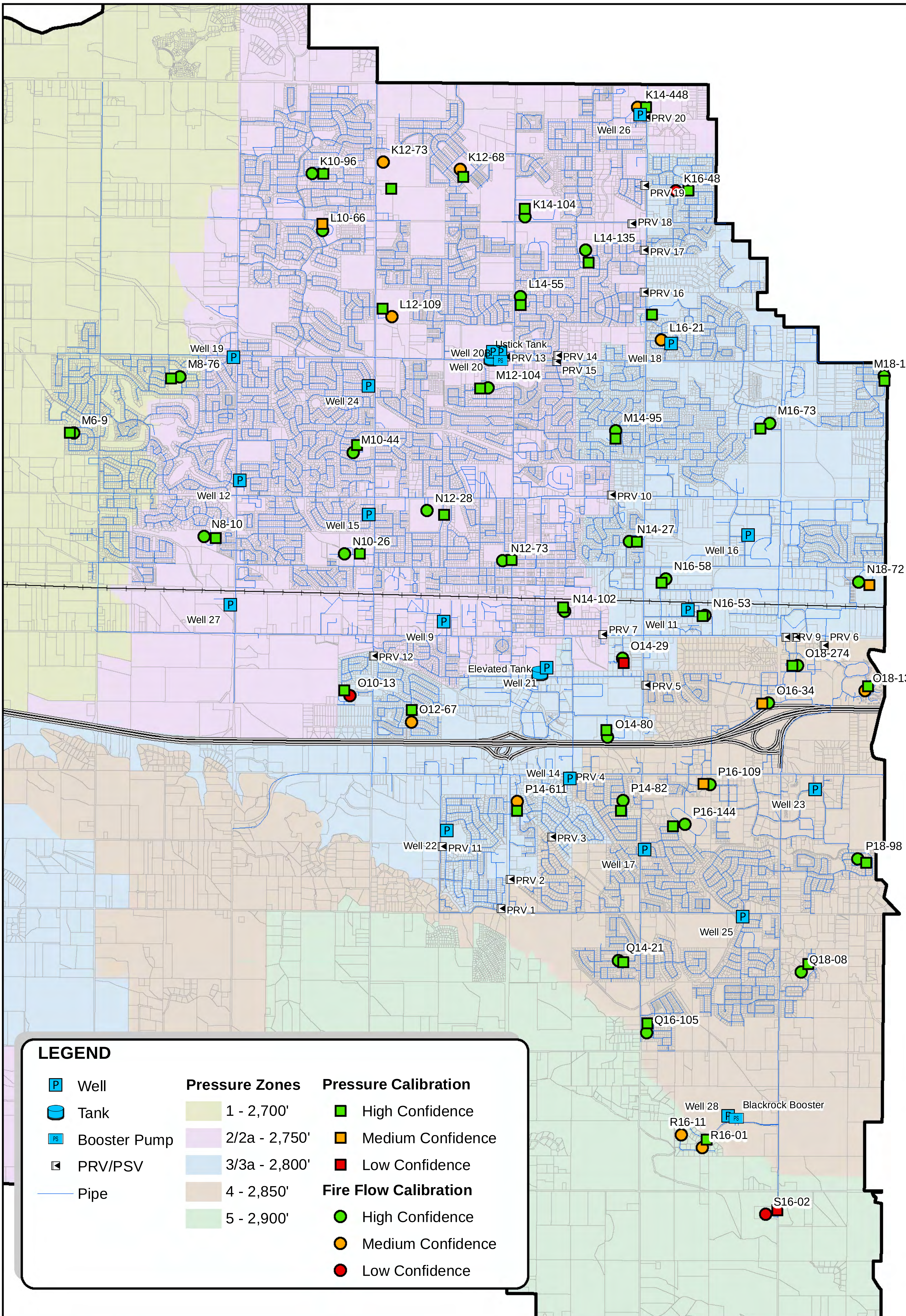
Table 5-4
Individual Fire Flow Test Results

Pressure Zone	Flow Hydrant Number	Static Delta* (absolute) psi	Flow Delta* (absolute) psi
2	N10-26	2	2
2	N12-28	1	3
2	M10-44	3	2
2	N8-10	3	1
2	M8-76	3	3
2	L12-109	2	11
2	K10-96	1	1
2	N14-102	1	7
2	M6-9	1	3
2	K12-73	1	18
2	K12-68	3	11
2	K14-104	1	6
2	L14-135	2	1
2	L14-55	3	8
2	L10-66	6	1
2	N12-73	1	0
2	K14-448	1	19
2	M12-104	2	8
3	P14-611	1	10
3	O12-67	1	10
3	O10-13	1	21
3	O14-29	11	8
3	N16-53	1	8
3	N16-58	2	7
3	N14-27	2	1
3	M14-95	4	6
3	M16-73	1	3
3	N18-72	9	2
3	M18-16	1	3
3	K16-48	1	22
3	L16-21	2	12
3	O14-80	3	2
4	Q16-105	4	2
4	Q18-8	1	9
4	Q14-21	4	2
4	P16-144	1	3
4	P14-82	1	1
4	P16-109	5	2
4	O16-34	5	3
4	O18-274	4	1
4	O18-13	4	17
4	P18-98	3	6
5	R16-01	1	20
5	R16-11	1	11
5	S16-2	27	23

** Delta = the absolute difference between model and field flow pressure*

Overall calibration confidence was considered high with a few areas of lower confidence. The City was in the process of changing the supply settings for Zone 5 during the testing, which introduced some uncertainty to how the system was actually operated during the testing. In addition, Zone 5 is currently a very small zone in terms of piping and demand, with approximately 100 gpm under MDD conditions served by the Blackrock Booster Station and Well 28. It is recommended that additional pressure and flow tests be conducted as Zone 5 continues to develop.

Although results were high overall for most zones, model calibration is an ongoing process. Any changes in demand, infrastructure or settings must be updated within the model, and additional tests should be done each year to validate the results obtained within the model.



MSA

City of Meridian
Water Master Plan

Figure 5-1
Calibration Results

1 in = 3,500 ft

MERIDIAN IDAHO

Modeling Conditions

Demand

The analysis of the existing and proposed system was performed to assess the distribution system's ability to provide peak water demands while maintaining system pressures at acceptable levels and provide recommended fire flows throughout the system during MDD periods. Existing demand was allocated throughout the system by linking geocoded customer billing records to the nearest demand node within the model. The billing records were then scaled to match production records to include the small volume of non-revenue water within the system. As noted the non-revenue water in the City's system is very low (< 5%), which is not surprising, since the majority of the system has been constructed in the last 20 years. Future demand was allocated using Traffic Analysis Zone (TAZ) data provided by COMPASS, as described in the Population and Demand Projections (Section 3). The TAZ data contained information on population for each five-, 10- and 20-year horizon. Existing per capita water usage rates were then applied to the projected population within each TAZ. The 2015 and 2030 projected demand was then allocated by spatially joining each TAZ with the nearest eligible demand node within the model.

Fire Flow

Fire flow requirements throughout the system were identified through communication with the Meridian Fire Department. The 29 locations in Table 5-5 had individual fire flow needs specified by the Fire Department and all other demand locations were assumed to have a fire flow of 1,500 gpm, unless the location was designated as a school without a fire prevention sprinkler system, in which case, the fire flow requirement was set at 2,500 gpm. Where possible, fire flow adequacy was determined using the batch processing functionality of the model.

The analysis of the existing system was performed under existing MDD plus fire flow as well as MDD and PHD conditions. The system was also analyzed under projected five- and 20-year MDD plus fire flow and MDD and PHD conditions. The system was evaluated based on the pressure and velocity criteria previously mentioned. A summary of the model analysis conditions and criteria is shown in Table 5-6. Where the pressure criteria cannot be met, deficiencies were identified and used to develop the improvement projects outlined in the CIP (Section 8). The velocity criteria are used to help assess system conditions, particularly pipeline sizing, and assist in prioritizing annual pipeline replacement projects that are currently focused on undersized mains and mains constructed with non-standard materials.

Table 5-5
Specific Fire Flow Requirements

Facility	Address	Fire Flow Demand (gpm)
Plum Creek MFG	240 W Taylor Avenue	5,000
Zamzows Feed Factory	611 N Main Street	5,000
RV Baptist Church	1300 S Teare Avenue	4,250
Meridian High School	1900 W Pine Street	3,500
Andon Company	880 E Franklin Road	3,500
Assembly of God Church	1830 Linder Road	3,250
Cherry Lane Christian Church	2511 W Cherry Lane	3,000
Cintas Document Management	575 E Bower Street	3,000
Kimberly West/Direct Buy	272 SW 5th Avenue	3,000
Bower Street Corporation	283 E 5th Street	3,000
The Cover Shop	205 E 5th Street	3,000
Idaho Truss Co	611 E 3rd Street	3,000
Snake River Yamaha	2957 E Fairview Avenue	3,000
Linder Elementary School	1825 Chateau Street	3,000
Andon Company	910 E Franklin Road	3,000
St. Luke's Hospital	520 S Eagle Road	3,000
Shoshoni Building	2040 E Fairview Avenue	2,500
Church of the Nazarene	831 N Main Street	2,500
YMC Inc	2975 Lanark Street	2,500
RGT Investments	519 E Fairview Avenue	2,500
Idaho Tank & Culvert	724 W Taylor Avenue	2,250
Whitewater Pizza & Pasta	1500 N Eagle Road	2,250
Office Value	1300 Kalispell Street	2,250
Elm Tree Plaza	2053 E Fairview Avenue	2,250
Commercial Tire	2095 E Commercial Street	2,250
Avest Plaza	189 E Fairview Avenue	2,250
Rocky Mountain Market Place	710 W Ustick Road	2,250
Matrix Xtreme Inc	621 E King Street	2,250
Martin Artis/Famco	649 N Ralstin Place	2250

Table 5-6
Model Analysis Information

Demand	2010	2015	2030
MDD (mgd)	17.2	22.1	36.4
PHD (mgd)	25.7	33.2	54.6
Fire Flow	• 29 Fire Department specified values • 2,500 gpm for schools (without sprinklers) • 1,500 gpm for all other locations		
Criteria	**Same for any year**		
Minimum pressure during MDD+fire flow	20 psi		
Minimum pressure during MDD, PHD	40 psi		
Maximum pressuring during ADD, MDD, PHD	100 psi		
Maximum velocity during MDD, PHD	5 ft/s		
Maximum velocity during MDD+fire flow	10 ft/s		

Note: Pressures indicated are at service connections. Minimal deviation may be acceptable at facilities.

Modeling Results

Existing Conditions

Under existing MDD and PHD system conditions, there are no pressure or velocity criteria violations within the system and pressures ranged from 42 to 94 psi. There were three locations with pressures below 40 psi; however, these occurred within the facility piping upstream of the Ustick Booster and do not affect customer service. It should also be noted that some of the well pump discharges exhibited velocities greater than 5 ft/s, but are not considered excessive and were not identified for improvements.

Future Conditions

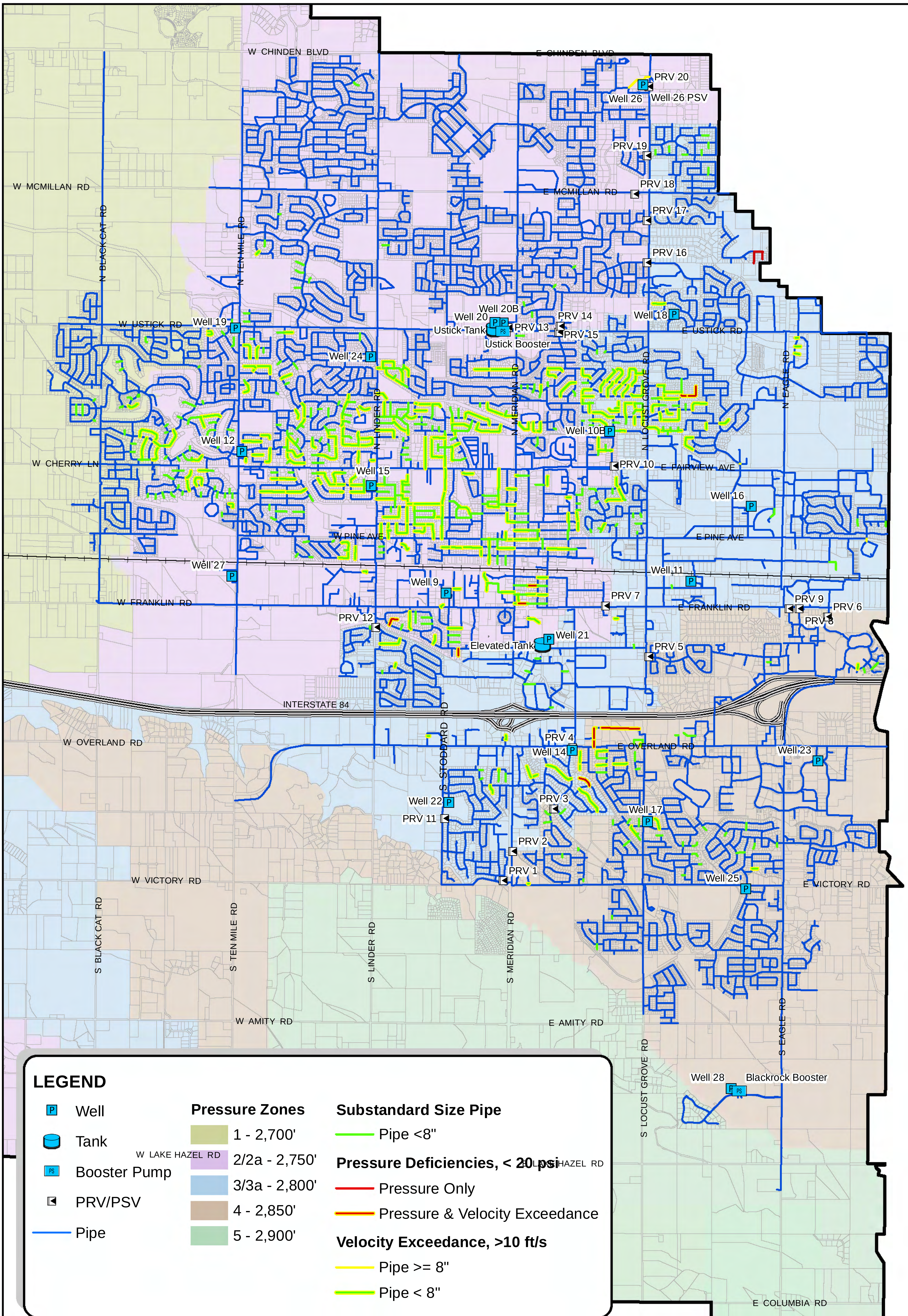
Without modifications to the existing system, 2015 and 2030 MDD and 2015 PHD result in similar velocity and pressure results as those for 2010 MDD and PHD, respectively. The pressures range from 43 to 94 psi and, similar to the 2010 results, some deviations in pressure and velocity exist around facilities. The 2030 PHD and certain 2030 MDD plus fire flow conditions exceed existing system supply capacity, so two additional sources of supply were added to the model; a well in the northwest section of Zone 2 with an assumed 2,000 gpm pumping capacity and a reservoir in Zone 4 with pumping capacity of 4,500 gpm to Zone 4 and 1,500 gpm to Zone 5. Additional information on these supply sources is provided in the CIP (Section 8). These additional supplies were identified from Water Supply Planning (Section 4) as being required prior to 2030. A proposed site for the reservoir and booster in Zone 4 has been purchased and a design has been developed, with construction of that facility occurring prior to 2015. The supply analysis also identified a supply deficiency in Zone 2 that will need to be addressed between 2020 and 2030, with the construction of one new well to meet requirements and two additional wells to maintain a two well buffer. Although the existing supply and distribution is adequate to serve future Zone 1, the City is planning to create a unique hydraulic grade line in Zone 1 through the installation of three PRVs in 2012. As demand is projected to grow in that zone, two additional PRVs are recommended to further establish the unique HGL for that zone. Additional information about this project is explained in the CIP (Section 8).

Fire Flow Analysis

Fire flow conditions were simulated under MDD at service locations throughout the system. The results of the fire flow analysis identified that, under 2010 MDD conditions, the system is currently able to supply the recommended fire flow with adequate pressure to all but a dozen areas in the system shown in Figure 5-2. Some of the locations with pressure deficiencies also exceeded the City recommendation of 10 ft/s maximum velocity under fire flow conditions. A number of additional pipes that had no pressure deficiencies did exceed the recommended maximum velocity under fire flow conditions and are also shown in Figure 5-2. However those will not be included in the CIP and will be replaced as the pipe reaches the end of its useful life, as part of the City's ongoing yearly replacement program. With the exception of the supply requirement mentioned previously, which will first become necessary between 2015 and 2020, the 2015 and 2030 analysis did not result in any additional deficiencies not identified under the 2010 MDD analysis.

The pipelines that were unable to deliver fire flow volumes with adequate pressure require improvements. To address the deficiencies, most of the pipes can be upgraded in diameter to provide adequate pressure and meet velocity recommendations. Several 8-inch pipes identified as providing deficient fire flow are located in the northeast corner of Zone 3 along Wainright Drive, just west of Eagle Road. These pipes serve a dead-end area and instead of upsizing, an interconnection with the existing system or an intertie with the United Water Idaho (UWI) system that serves customers just to the east of this area, is recommended. The City has expressed a preference to establish an intertie with UWI because of the additional benefit of having an emergency source of supply. According to the City, initial discussions with UWI indicate that the two systems have similar enough pressures to facilitate a two-way flowing PRV, which would allow the intertie to benefit both service providers. Based on discussion with the City, this intertie should have adequate supply to solve the fire flow deficiencies in the area. However, an additional study should be done prior to implementation to ensure feasibility and that adequate flow is available from the UWI system. A 4,250 gpm fire flow requirement at Teare Avenue should also be addressed by creating an interconnection to the east, in lieu of upsizing dead-end pipes that could result in water quality issues. Additional details on each recommended improvement are provided in the CIP (Section 8).

In addition to the results of the hydraulic analysis, the system has a number of pipes that are less than 8 inches that do not result in specific deficiencies, but do not comply with current City design standards. As a result, the City has requested these pipes be identified for inclusion in the City's yearly pipeline replacement program. As such, the substandard size pipes that did not result in pressure deficiencies or a velocity exceedance, are also shown in Figure 5-2. These pipeline improvements are not separated into specific capital improvement projects, but should assist in planning and budgeting annual system improvements.



City of Meridian
Water Master Plan

Figure 5-2
System Analysis Results

1 in=3,500 ft

SECTION 6
WATER QUALITY AND REGULATIONS

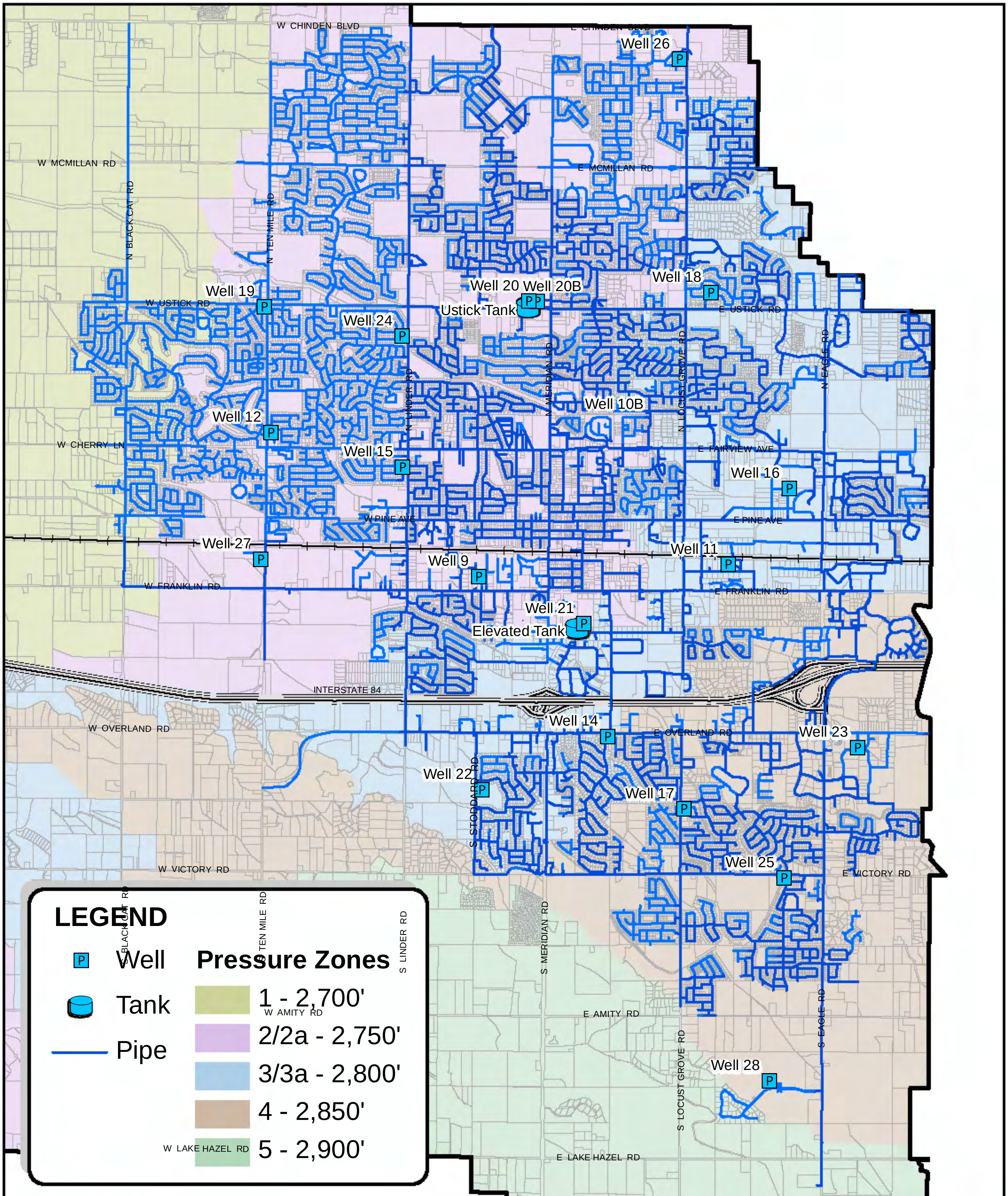
Introduction

The City of Meridian's (City's) water system relies solely on groundwater as its source of supply. Generally, the quality of the groundwater is good. According to sampling results, all wells under current usage are not in violation for radionuclides, lead and copper, bacteria, arsenic, fluoride, disinfection byproducts, inorganic compounds, volatile organic compounds, or synthetic organic compounds. The most significant issue that the City has dealt with over the past decade is radionuclides from what appears to be naturally occurring uranium detected in several wells. Well 10 was taken offline due to uranium in 2008. Well 23 has elevated uranium levels and currently serves as an emergency backup source. Wells 20B and 16 have recently returned elevated uranium levels and are currently being evaluated for corrective measures or use as emergency backup sources. Figure 6-1 presents a map of the City's wells.

Regulatory Review

This section summarizes the regulatory compliance issues that pertain to the City of Meridian groundwater supply sources. This regulatory review includes a summary of recently enacted and proposed legislation that pertains to the 1996 Safe Drinking Water Act Amendments. In some cases, discussion of regulations relative to surface water sources is provided for an informational perspective, in the event that the City were to consider a surface water source.

The Safe Drinking Water Act (SDWA) was passed by Congress in 1974 and amended twice, once in 1986 and again in 1996. The intent of these amendments was to strengthen the 1974 SDWA, primarily in the area of setting regulations to ensure public water supplies are safe. The Environmental Protection Agency (EPA) was mandated by Congress to establish rules and regulations relating to the SDWA and subsequent Amendments.



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Water Master Plan

Figure 6-1
Well Locations

MERIDIAN IDAHO

Since 1986, a number of rules and regulations have been promulgated and/or proposed by theEPA for the purpose of implementing amendments to the SDWA, including:

- National Primary Drinking Water Regulations (NPDWR)
- National Secondary Drinking Water Regulations (NSDWR)
- Drinking Water Contaminant Candidate List (CCL)
- Groundwater Rule
- Disinfectants and Byproducts Rule
    - Stage 1 Disinfectant/Disinfectant Byproducts (Stage 1 D/DBP) Rules
    - Stage 2 Disinfectant/Disinfectant Byproducts (Stage 2 D/DBP) Rules
- Total Coliform Rule (TCR)
- Radionuclide Rule
- Lead and Copper Rule (LCR)
- Arsenic Rule
- Radon Rule
- Chemical Phase Rules
    - Phase I Rule
    - Phase II and IIB Rules
- Phase V Rule
- Surface Water Treatment Rule (SWTR)
- Enhanced Surface Water Treatment Rules (ESWTRs)
    - Interim Enhanced Surface Water Treatment Rule (IESWTR)
    - Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR)
    - Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)

A detailed discussion of these rules and their impact on the City is provided in Appendix A.

Summary of Regulatory Requirements

The SDWA was originally passed to protect public health by regulating the nation's drinking water supply. The amendments add many actions to protect drinking water and its source, as well as strengthen the 1974 SDWA.

There are two basic mechanisms for regulation: 1) National Primary Drinking Water Regulations, also known as primary drinking water standards, and 2) National Secondary Drinking Water Regulations, also known as secondary drinking water standards.

Primary drinking water standards establish absolute concentration limits called Maximum Contaminant Levels (MCL) and Maximum Contaminant Goal Levels (MCGL), established concentration goals for contaminants that contain no known or expected risk to health. MCLs are enforceable standards, while MCLGs are non-enforceable public health goals. Types of contaminants include microorganisms, disinfectants, disinfection byproducts, inorganic chemicals, organic chemicals and radionuclides.

The City currently meets all of the primary drinking water standards. However, concentrations of uranium that exceed the MCL have been tested in Well 23, Well 20B and Well 16. The City, through coordination with Idaho Department of Environmental Quality (IDEQ), has reclassified Well 23 as “emergency backup,” allowing the continued use of the well under specified conditions. The City has also performed a preliminary study of a number of options, including blending and treatment, which would allow Well 23 to be used on a regular basis. The City is currently evaluating Wells 20B and 16 to determine appropriate correction or mitigation alternatives.

Secondary drinking water standards establish recommended controls for water aesthetics, not health effects. Secondary contaminants do not pose a health risk at the recommended concentration limits. Rather, secondary standards specify maximum levels of constituents for color, taste, odor and cosmetic impacts. Secondary standards are not enforceable by federal law. The City generally has high quality water in regard to secondary water standards. However, a few wells have shown increased iron and manganese, and sulfur concentrations leading to odor, color and taste issues. These problems are not uncommon for drinking water derived from groundwater sources. A list of secondary standards is given in Table 6-1.

Table 6-1
Secondary Drinking Water Standards

Contaminant	Secondary MCL	Noticeable Effects above the Secondary MCL
Aluminum	0.05 to 0.2 mg/L	colored water
Chloride	250 mg/L	salty taste
Color	15 color units	visible tint
Copper	1.0 mg/L	metallic taste; blue-green staining
Corrosivity	Non-corrosive	metallic taste; corroded pipes/fixtures staining
Fluoride	2.0 mg/L	tooth discoloration
Foaming agents	0.5 mg/L	frothy, cloudy; bitter taste; odor
Iron	0.3 mg/L	rusty color; sediment; metallic taste; reddish or orange staining
Manganese	0.05 mg/L	black to brown color; black staining; bitter metallic taste
Odor	3 TON (threshold odor number)	"rotten-egg", musty or chemical smell
pH	6.5 - 8.5	*low pH:* bitter metallic taste; corrosion *high pH:* slippery feel; soda taste; deposits
Silver	0.1 mg/L	skin discoloration; graying of the white part of the eye
Sulfate	250 mg/L	salty taste
Total Dissolved Solids (TDS)	500 mg/L	hardness; deposits; colored water; staining; salty taste
Zinc	5 mg/L	metallic taste

Areas of Concern

As previously mentioned, one area of concern for the City water supply is radionuclides. In Wells 23, 20B and 16, radionuclides have been detected at levels that exceed the uranium MCL, 30 µg/L. Sample results did not show a trend up or down for the years tested. Well 23 had uranium concentrations from 35 to 40 µg/L in 2004, 2005 and 2007, with no trend up or down. Well 23 is currently used only for emergency status and as such, only operates when the system pressure falls below a predefined emergency threshold. If this occurs, the City must take a series of steps to notify customers of the potential for elevated levels of uranium in the drinking water in the yearly consumer confidence report. Well 20B has historically shown levels of uranium around 20 µg/L, but was recently tested at 33 µg/L. Uranium levels in Well 16 test typically just below the MCL. Uranium has also been detected in Well 25, but this well has not approached the MCL.

The City has had secondary water quality issues, mainly revolving around iron, manganese and odor. Iron causes rusty color, sediment, metallic taste and reddish or orange staining and has caused customer complaints in the area surrounding Wells 18 and 22. Manganese causes black to brown color staining and a bitter, metallic taste and has caused customer complaints near Well 15. Odor from hydrogen sulfide and other forms of sulfur has caused customer complaints in the area surrounding Wells 12 and 27.

Potential Mitigation Solutions

Several methods are available for mitigating or removing uranium in well water. These include aquifer storage and recovery (ASR), reverse osmosis, anion exchange, and deepening or abandoning the affected well.

- ASR has proved effective for other Treasure Valley water providers in mitigating high levels of uranium; however, each aquifer's geology is different. Before pursuing ASR, MSA recommends conducting an evaluation of ASR at the prospective well site. ASR is affected by a number of variables, including hydrogeology, water chemistry and impact on adjacent wells.
- Reverse osmosis is very expensive and side waste stream disposal is an issue with this treatment technology.
- Ion exchange may be an economically feasible means of treatment to remove Uranium from wells; however, side stream waste disposal is a significant issue associated with this treatment technology.
- Well abandonment may be feasible by drilling replacement wells to a different aquifer. A detailed study will be necessary for specific facilities to develop costs for the available alternatives.

Plans are in place to drill a new well at the Well 10 site to create Well 10B and tap into a different aquifer. Well 10B should have a capacity of at least 1,500 gpm based on the preliminary hydrogeology and engineering work completed to date. Well 23 will continue to be used as an emergency well and will only be used under specific conditions. Well 16 and Well 20B are currently being evaluated to determine the best alternatives for correcting the uranium problems. Solutions include installing packer assemblies to occlude portions of the well screens, blending with existing or new sources on site, and designating the wells as emergency sources.

Some wells in the system have issues with odor, which the City handles in various ways. Well 12 is only used as a backup supply due to odor issues and will only be used under fire flow conditions. Well 27 also experiences some odor issues, but after chlorination any odor issues are generally mild.

For wells in the City's system that have concentrations of iron or manganese above the secondary MCL, oxidation of the iron and manganese is an option. Oxidation can occur with either aeration or chlorination. Oxidation of manganese occurs more slowly than oxidation of iron. Chlorination is faster than aeration because chlorine is a stronger oxidant. Another option is filtration through a media, such as greensand. ASR is also an option. Under ASR, chlorinated/oxygenated water is injected into the aquifer causing iron and manganese to oxidize in the aquifer and precipitate out of solution. The City currently controls secondary issues from iron and manganese by regularly flushing the water lines and keeping the chlorine levels low; however, chlorine management is becoming less feasible. The City is planning to install treatment for iron and manganese at multiple well sites over the next several years, as detailed in the Capital Improvements Program (Section 8).

SECTION 7
OPERATIONS AND MAINTENANCE

This section describes State Operations and Maintenance (O&M) program requirements and summarizes the City of Meridian's (City's) distribution system O&M program based on interviews and information supplied by City staff. O&M practices of several similar sized utilities were gathered through a survey and these results are summarized in this section in order to provide a benchmark for comparison to the City's O&M program. Recommendations to improve the efficiency and effectiveness of the City's O&M program are given at the end of this section based on requirements of state and federal regulations, City code and benchmarking with other utilities.

O&M Regulations and Guidelines

Requirements for drinking water O&M programs are provided in the following sections of the Idaho Administrative code (IDAPA) 58.01.08 – Public Drinking Water Systems and 24.05.01 – Rules of the Board of Drinking Water and Wastewater Professionals:

- *501.07 Facility and Design Standards: General Design Requirements for Public Drinking Water Systems, Reliability and Emergency Operation.* New community water systems constructed [or substantially modified] after April 15, 2007 are required to have sufficient dedicated on-site standby power, with automatic switch-over capability, or standby storage so that water may be treated and supplied to pressurize the entire distribution system during power outages. During a power outage, the water system shall be able to meet the operating pressure requirements of Subsection 552.01.b. for a minimum of eight (8) hours at average day demand plus fire flow where provided. A minimum of eight (8) hours of fuel storage shall be located on site unless an equivalent plan is authorized by the Department. Standby power provided in a public drinking water system shall be coordinated with the standby power that is provided in the wastewater collection and treatment system.
- *501.12 Facility and Design Standards: General Design Requirements for Public Drinking Water Systems, Operation and Maintenance Manual.* An operation and maintenance manual or manuals shall be provided for all public water systems. The manual shall include, but is not limited to, the following contents: daily operating instructions, operator safety procedures, location of valves and other key system features, parts list and parts order form, and information for contacting the water system operator. An operational trouble-shooting section shall be supplied to the water works as part of any proprietary unit installed in system facilities.
- *554.01 Licensed Operator Required.* Owners of all community and non-transient non-community public drinking water systems must place the direct supervision of their drinking water system, including each treatment facility and/or distribution system, under the responsible charge of a properly licensed operator.

A public community water system serves at least 15 service connections or 25 people year-round in their primary residences (e.g., most cities and towns, apartments, and mobile home parks with their own water supplies). Public community water distribution systems are classified based on system complexity, population served and type of source water. The classifications are as follows:

- Very Small Public Drinking Water System - 500 people or less and has no treatment other than disinfection, or has only treatment which does not require any chemical treatment, process adjustment, backwashing or media regeneration by an operator
- Class I – 501 to 1,500
- Class II – 1,501 to 15,000
- Class III – 15,001 to 50,000
- Class IV – 50,001 and greater

Two operator licenses exist, one for distribution and one for treatment. Both water distribution and water treatment operators must receive certification in accordance with the classification of the system being operated. In the City's case, which is a Class IV system, a licensed treatment operator is not required because only chlorination occurs and IDAPA allows chlorination to be considered as a function of distribution. The system is under the direct supervision of a Class IV licensed distribution operator.

In addition to the IDAPA regulations summarized above, the American Public Works Association (APWA) provides the following water distribution system O&M guidance in the Public Works Management Practices Manual, 6th Edition:

- Maintenance practices should be developed for the water distribution system to include installation, testing and preventative maintenance activities for all elements of the system. The level and frequency of maintenance provided for the various elements of the water distribution system should be preplanned so that the overall system is properly and adequately managed. Maintenance practices should include installation, testing, and preventative maintenance for water meters, fire hydrants, valves and pipes, as well as a program for leak detection and elimination.

The Recommended Standards for Water Works, 2007 Edition, also known as the "Ten States Standards" recommends the following regarding water system O&M:

- An operation and maintenance manual including a parts list and parts order form, operator safety procedures and an operational trouble-shooting section shall be supplied to the water works as part of any proprietary unit installed.

The City has established ordinances regarding connection to the water system and well construction. The operations and maintenance procedures used to maintain the system are set within the Water Division and City ordinances do not directly address O&M procedures.

O&M Staff and Budget

The City's water system is a Class IV System. The water distribution system has the following characteristics:

- System serves approximately 70,000 people
- Service Area: 30 square miles
- Volume of water produced (approximate 2010 values):
  - Average Daily Demand (ADD): 9 mgd
  - Maximum Daily Demand (MDD): 17 mgd
  - Peak Hourly Demand (PHD): 26 mgd
- Total length of water line: 454 miles
- Number of wells: 20
- Number of booster pumping stations: 2
- Number of finished water tanks: 2
- Number of pressure zones: 4 (proposed increase to 5 in 2012)
- Number of pressure reducing valve (PRV) stations: 21
- Average residential customer consumption: 130 gallons per capita per day (gpcd)
- Size of most residential meters: 3/4-inch

Staff from the City's Water Division are responsible for the maintenance and operation of the distribution system. The Water Division is structured, and currently operated with 20 full-time equivalent employees (FTEs). Of these 20 FTEs, three are Class I, eight are Class II, two are Class III, and five are Class IV certified distribution system operators. Two staff members hold water treatment certifications, one is Class III and one is Class IV. The staff averages approximately 400 overtime hours annually.

The City's O&M budget of approximately $3.8 million per year is allocated as shown in Table 7-1. Employee training includes participation in professional societies. The City's professional society memberships include Water Environment Federation/Pacific Northwest Clean Water Association (WEF/PNCWA), American Public Works Association (APWA), and American Water Works Association (AWWA).

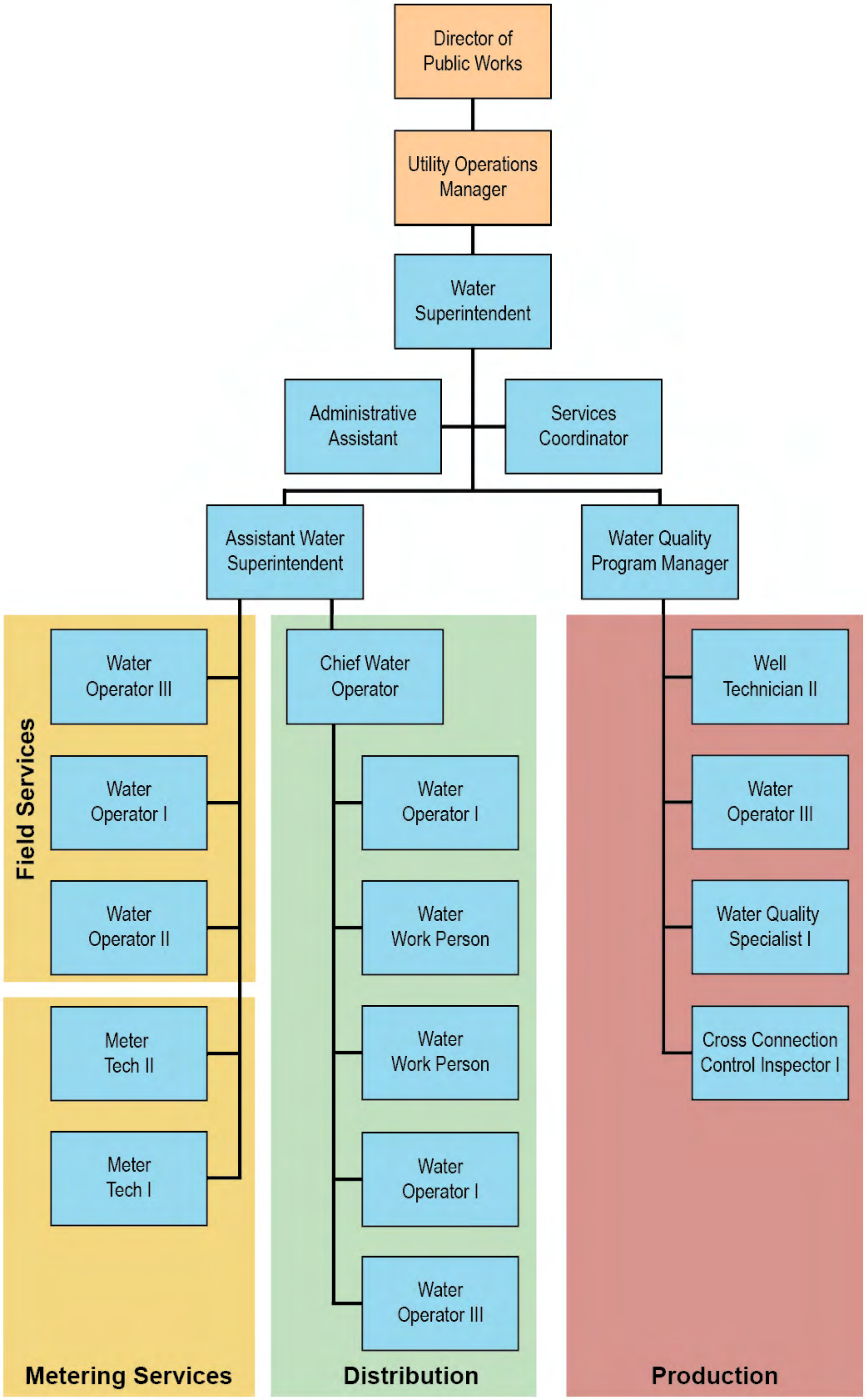
Table 7-1
Budget Allocation

Description	Percentage of Total Budget
Employee Salaries	34%
Miscellaneous Equipment and Material	34%
Other	13%
Contracted Services (Water Main Repairs)	9%
Energy	8%
Employee Training	1%
Chemicals	1%

Funding for the O&M budget comes from water rates. The City's average water rates are approximately $24 per month, while connection fees are $1,794 (2010). A portion of rates and all connection fees are used to finance the capital projects budget.

The water system O&M occurs under the direction of the Water Superintendent, who reports to the Director of Public Works through the Utility Operations Manager position. There are currently nineteen employees working under the direction of the Water Superintendent. These employees are each involved in the operation or maintenance of the system in some capacity. The organizational structure of the Water Division is outlined in Figure 7-1.

Figure 7-1
Water Division Organizational Chart



Distribution O&M

Records are kept of the O&M procedures performed through internal data tracking, Hansen, Caselle and Tokay software. The City has recently purchased the Hansen software, and it will become the main tool through which the City will track:

- Asset management for all water system facilities
- O&M procedures
- Work orders for repair and installation

The Hansen software will be linked to the City's existing GIS database. The City is currently implementing the Hansen software in phases by asset (e.g., wells, backflow devises, valves, pipelines).

Nearly every facility in the system is connected to the supervisory control and data acquisition (SCADA) system. The City is currently doing a SCADA master plan to assess the status of their SCADA system.

The summary of major O&M tasks, how often the task is performed, detailed procedure description (if necessary), and the personnel generally responsible for completing the procedure is outlined in Table 7-2. Each responsible employee performs the assigned tasks under the direction of their supervisor, as outlined in Figure 7-1. The construction plans and details for most facilities are used by personnel when needed to complete O&M tasks and records are kept of when tasks are performed; however, most procedures are not written in a manual. The City is currently working to develop written standards for O&M tasks.

Table 7-2
Maintenance Tasks

Programs	Frequency	Detailed Procedure Description	Personnel
Disconnects/Non-Payment	Bi-monthly	-	Water Operators
Disconnects/Notifications/ Backflow Prevention	Monthly	-	Cross Connection Control Inspector
Cross Connection Control/ Surveys	Account Sequence Change & as determined by hazard classification	-	Cross Connection Control Inspector
Work Orders	Daily	-	Water Operators/ Water Work Person
Customer Complaints	As Needed	-	Water Operators/ Water Quality Specialist
Zero Reads/Inactive accounts with usage	Bi-Monthly	-	Water Operators/ Meter Readers
Line Locating Program	Daily	-	Water Operators
Flushing (Entire System, Hydrants and Blowoffs)	Annually (March)	-	Water Operators/ Water Work Person
Flushing (Blowoffs)	Bi-Annually (March & September)	-	Water Operators/ Water Work Person
Flushing (Flush Lines)	Monthly	-	Water Operators/ Water Work Person
Discharge Monitoring/ Flushing	Daily/As needed	-	Water Operators
Meter Reading	2 Cycles Monthly	-	Meter Readers
Meter Replacement	Daily	-	Water Operators/Meter Reader/Water Work Person
Meter Transceiver Unit (MXU) Replacement	Daily	-	Water Operators/Meter Reader/Water Work Person
Water Service Replacement	Ongoing	-	In-House/Contractor
Valve Exercising	Daily	-	Water Operators
Water Quality Testing/ Compliance/Colilert	Monthly	-	Water Quality Specialist
Water Quality Testing/ Compliance Wells	As needed	-	Water Quality Specialist
Water Quality Testing/ Lead and Copper Rule	Every three years	-	Water Quality Specialist
Water Quality Testing Wells/Special/Colilert	Quarterly	-	Water Quality Specialist
Water Quality Testing Wells/Special/Residual	Daily	-	Water Quality Specialist
Well Drawdown Testing	Bi Annually/ Oct - April	-	Well Technician

Facility Checks/Maintenance	Frequency	Detailed Procedure Description	Personnel
Tools/Inventory Program	Annual	-	Management
Water Main Repair	As Needed	-	In-House/Contractor
Water Service Repair	As Needed	-	In-House/Contractor
Booster Pumps/Grease	Quarterly	-	Well Technician
Booster Pumps/Change oil	Bi-annual/As Needed	-	Well Technician
AC Inspections/Pump Houses	Annual	-	Contractor
Sodium Hypo Tank Cleaning	Annual	-	Well Technician/ Water Quality Specialist
Chlorine Generation System Inspection	3-6 Months	-	Well Technician/ Contractor
Chlorine Generation Drain Softener Cleaning	Monthly	-	Well Technician/ Water Quality Specialist
Chlorine Generation System Cell Cleaning	As Needed	-	Well Technician/ Water Quality Specialist
Chlorine Generation Drain Tank Cleaning	Bi-annually	-	Well Technician/ Water Quality Specialist
Hydrant Inspection/ Repairs	Continuous	-	Water Operators/ Water Work Person
Reservoir Inspection/ Cleaning	3 Years	Report and video of inspection	Contractor/ Well Technician
Reservoir Repairs and Re-Coating	As needed	Report and video of inspection	Contractor/ Well Technician
Turn Isolation Valves (all)	1-3 Years	-	Water Operators
Turn Isolation Valves (between zones)	2 years	-	Water Operators
PRV Inspection	Monthly	Record total flow/ pressures	Water Operators
PRV Overhaul	Annually	Clean, inspect and replace as needed	Water Operators
Well Pumps	Daily	Inspection, flow, production readings, hour readings, chlorine levels, feed pump settings, amperage, temperature	Well Technician
Well Casing and Pumps	10 years	Evaluate/rehabilitation and replacement	Water Superintendent
All Pumps	Bi-monthly or Daily through SCADA	Compare and trend ampere draw to flow output	SCADA/ Well Technician
All pumps	10 years or as needed	Motor and pump inspection and rebuild	Contractor

Facility Checks/Maintenance	Frequency	Detailed Procedure Description	Personnel
Service Entrances	Continuous	Line voltage by leg/ SCADA monitor and trend	SCADA
All Electrical panels, Service Entrances and Transformers	Annual	Thermal photo evaluation	Contractor
All Electrical panels, Service Entrances	Annual	Cleaning and connection checks	Contractor
Emergency Generators/ Servicing	Annually	Change oil, filters	Contractor
Emergency Generators/ inspections	Weekly	Fuel level, charger level, leaks, hours	Well Technician
Emergency Generators/ ATS Testing	Monthly	Simulate power failure	Well Technician
Emergency Generators/ Operation, cycling	Weekly	Run automatically via SCADA Control/ monitor and trend voltage	SCADA
Vehicle Inspections	Bi-Monthly	Safety and maintenance inspections	Water Operators
IDOT Commercial Inspections	Annual	Inspect Class A CDL combination truck and trailer	Contractor
Equipment Inspections	Bi-Monthly	Inspect for damage, repairs needed, safety items	Water Operators
Fire Extinguisher Inspection/Certification	Annual	Inspect/Pressure test/ recharge/intl tag	Contractor
Fire Extinguisher Inspections	Monthly	Inspect gauge, damage, intl tag	Water Operators
Eye Wash Inspections	Monthly	Flow, inspect, clean	Water Operators
Ladder Inspections	Monthly	Inspect for damage	Water Operators
First Aid Kit Inspections	Monthly	Inspect for expired product, inventory and re-fill if needed	Water Operators

The City maintains and operates all facilities and appurtenances within the system up to, and including, the customer meter. The customer is responsible for the line after the meter. As seen in Table 7-2, the O&M of the system focuses on three primary areas: customer connections and interaction, water quality, and facilities. City staff handle the majority of these O&M duties; however, a few tasks are sourced to outside contractors such as water main repairs.

All of the City's supply comes from groundwater wells and currently the only treatment required involves sodium hypochlorite disinfection. The City has identified the need for chlorine analyzers on every well and plans to add them over the next couple of years. While typically the water quality from these wells is very good, the City has historically had some problems with sediment and color from oxidation of iron and manganese during the disinfection process, along with odor caused from elevated sulfide levels. The City had 95 quality complaints (mainly color and odor) in 2009. Personnel responded to each of these complaints, and the typical response for water and/or odor issues is to flush the nearby lines. The City has an agreement with the irrigation districts to allow flushing into canals. The agreement does place limits on the volume of flushing water that can be discharged into irrigation canals.

The City has had water quality samples above the Maximum Contaminant Level (MCL) for uranium in a few wells. The MCL is 30 micrograms per liter (µg/L) for uranium. When wells exceed the MCL, they are removed from active service and taken offline or used under emergency conditions only until the quality can be improved. The City is currently developing a water supply study to evaluate long-term supply needs and resources, including the impact of continued water quality concerns.

In addition to regularly scheduled maintenance, personnel deal with service complaints and interruptions. The City records an average of eight quality or pressure customer complaints monthly, and only three customer complaints regarding service interruptions annually. The City reports the following estimates of service disruptions annually:

- 12 planned service disruptions lasting less than 4 hours
- 2 planned service disruptions lasting between 4-12 hours
- 12 unplanned service disruptions lasting less than 4 hours
- 1 unplanned service disruption lasting between 4-12 hours

The City targets a one-hour response time for emergency and non-emergency calls during both work and non-work hours. An emergency call is defined as something assessed to pose immediate threat to life, health or property. Non-emergency calls typically involve administrative issues, inconveniences and non-threatening concerns for property or safety.

The City had approximately 25 well and booster pump failures in the past 5 years due to electrical and other mechanical problems. This is substantially higher than the other utilities surveyed, but is likely due to the how the failures are defined by each entity. The City's number includes everything from power outages and small switch repairs to motor failures. Thirteen of the City's wells are equipped with onsite backup generators. Some of the facilities are designed for portable generators; however, the Water Division does not currently own any portable generators.

In the event of larger scale emergencies (e.g., facility security breach, loss of power or SCADA, introduction of contaminants into the system or natural disasters), the City Water Division has an Emergency Response Plan. This plan outlines the organization structure and responsibilities in the event of an emergency.

Automated Meter Reading

The City owns and maintains meters that are used to measure water usage by residential, commercial, public and industrial customers. Automated meter reading (AMR) technologies are currently used throughout the City to obtain data from the meters for billing. A technical memorandum completed by MSA, dated September 30, 2011, recommends upgrades to the City's current AMR systems. This technical memorandum recommended installation of a fixed base advanced metering infrastructure (AMI) system to replace the mobile AMR system. The City has budgeted the installation of the data collectors, and hardware and software of the AMI infrastructure in 2013 or 2014, depending on the timing of other capital projects, as described in the Capital Improvements Program (CIP) (Section 8). This includes converting all meters to fixed base AMI over the timeframe of the current meter and endpoint replacement cycle (approximately 15 years). A priority replacement program is necessary for installing an AMI system over a 15-year time frame and may be accomplished using several different methods:

- Replacement of meters and endpoints along current meter reading routes to limit operations impact: data collectors would be constructed as necessary for the focus coverage area. Meter read routes must be considered while upgrading the system from mobile AMR technology to fixed base AMI. During the transition to AMI, it is beneficial to manage both the existing and new systems if AMI is installed along existing meter read routes. This will limit interruptions to staff procedures and efficient drive routes until the new AMI system is fully operational.

- Replacement of oldest meters first to maximize water fund revenues: data collectors would be constructed for the entire system early in the project, as the oldest meters are likely spread throughout the City.

Additional recommendations from the AMI technical memorandum:

- The City should consider extending the useful life of the meters and endpoints to 20 years after completing the implementation schedule. The meters that are being installed are magnetic meters that do not have the same meter degradation rate as older, positive displacement meter technology. Additionally, the battery life of the endpoints (and new meters) is rated and warranted to 20 years. Extending the life of the meter and endpoint can delay capital expenditures on this system, once installed.

- The City should adjust meter and AMR standards to accommodate the new AMI system.

Benchmarking

Three other utilities in the region were surveyed in order to compare their O&M practices to the City's current program. The utilities that were surveyed and provided responses are listed below. Not all of the listed utilities provided responses to every question. Where a utility did not respond to a question, "NR" will be indicated.

1. Asotin County Public Utility District (PUD), Washington
2. City of Lewiston, Idaho
3. City of Nampa, Idaho

Because each surveyed system has unique attributes, a number of the system characteristics were calculated on a unit basis for means of comparison. The results of these performance indicators are summarized in Table 7-3. Secondary performance indicators were also calculated and are summarized in Table 7-4. Tables 7-5 to 7-14 highlight the responses to specific survey questions.

Table 7-3
Benchmarking – Performance Indicators

Utility Name	Annual Budget/ Population Served ($/person)	Annual Budget/ Average Day Flow ($/mgd)	Annual Budget/ System Pipe Length ($/lf)	Average Day Flow/ FTEs (gal/FTE)	Feet of Pipe/ FTEs (lf/FTE)	Annual Budget/ FTEs ($/FTE)
Meridian	***54***	***442,000***	***9,000***	***430,000***	***23***	***190,000***
Asotin PUD	53	246,000	10,000	643,000	16	158,000
Lewiston	225	878,000	31,000	293,000	8	257,000
Nampa	14	176,000	5,000	236,000	9	41,000

Note: Large numbers have been rounded for ease of comparison

Table 7-4
Benchmarking – Secondary Performance Indicators[1]

Utility Name	Annual Budget/ Pressure Zone ($/zone)	Annual Budget/ Reservoir ($/tank)	Annual Budget/ Pumping Systems[2] ($/pump)	FTEs/ Reservoirs (FTE/tank)	FTEs/ Pumping Systems[2] (FTE/pump)
Meridian	***950,000***	***1,900,000***	***173,000***	***10***	***1***
Asotin PUD	123,000	158,000	138,000	1	1
Lewiston	450,000	514,000	240,000	2	1
Nampa	580,000	580,000	68,000	14	2

[1] *Large Numbers have been rounded for ease of comparison*
[2] *Includes well and booster facilities*

Table 7-5
Benchmarking – Service Areas

Rank (population served)	Utility Name	Population Served	Number of Service Connections	Service Area (sq. miles)
2	***Meridian***	***66,000***	***27,250***	***30***
1	Nampa	81,000	28,000	35
3	Asotin PUD	21,000	7,000	20
4	Lewiston	16,000	5,980	17

Table 7-6
Benchmarking – Flow Rates

Rank (ADD)	Utility Name	Volume of Water Produced (mgd)			Non-Revenue Water (%)
		ADD	MDD	PHD	
1	***Meridian***	***8.6***	***17.2***	***25.7***	***3***
2	Nampa	6.6	7.5	13	18
3	Asotin PUD	4.5	12	18	4
4	Lewiston	4.1	10.5	2.6	6

Table 7-7
Benchmarking – Distribution Pipe

Rank (Length of Distribution Pipe)	Utility Name	Total Length of Distribution Pipe (miles)	Range of Pipe Sizes (inches)	Number of Hydrants
1	***Meridian***	***450***	***2-16***	***4,380***
2	Nampa	250	0.5-24	4,457
3	Lewiston	116	2-12	864
4	Asotin PUD	110	2-24	1,000

Table 7-8
Benchmarking – PRVs

Rank	Utility Name	Number of PRVs	Number of Pressure Zones
3	***Meridian***	***21***	***4***
1	Lewiston	28	8
2	Asotin PUD	25	9
4	Nampa	6	2

Table 7-9
Benchmarking – Wells

Rank	Utility Name	Number of Wells	Largest Well Pump (hp)	Smallest Well Pump (hp)	Number of Wells with Backup Power
1	***Meridian***	***20***	***200***	***50***	***13***
2	Nampa	14	250	30	14
3	Asotin PUD	7	900	500	1
4	Lewiston	6	350	75	0

Table 7-10
Benchmarking – Booster Stations

Rank	Utility Name	Number of Booster Stations	Largest Pump (hp)	Smallest Pump (hp)	Number of Booster Stations with Backup Power
3	***Meridian***	***2***	***250***	***5***	***2***
1	Lewiston	9	400	1.5	6
2	Nampa	3	1,100	60	3
2	Asotin PUD	3	500	50	2

Table 7-11
Benchmarking – Reservoirs

Rank	Utility Name	Number of Reservoirs	Tank Types				
			Pre-stressed Concrete	Cast In Place Concrete	Welded Steel	Bolted Steel	Other
2	***Meridian***	***2***	***x***	**-**	***x***	**-**	**-**
1	Lewiston	7	-	x	x	-	x
1	Asotin PUD	7	x	-	x	x	x
2	Nampa	2	x	-	x	-	-

Table 7-12
Benchmarking – Staff

Rank	Utility Name	Number of FTEs on Staff	Number of Certified Distribution Operators			
			Class I	Class II	Class III	Class IV
2	***Meridian***	***20***	***3***	***8***	***2***	***5***
1	Nampa	28	7	8	5	2
3	Lewiston	14	2	3	2	1
4	Asotin PUD	7	3	3	2	0

Table 7-13
Benchmarking – Budget

Rank	Utility Name	Total O&M Budget (2009-2010)
1	***Meridian***	***$3,800,000***
2	Lewiston	$3,600,000
3	Nampa	$1,160,000
4	Asotin PUD	$1,105,000

Note: Utilities were not consistent with items included in O&M Budget

Table 7-14
Benchmarking – Financing

Utility Name	Residential Water Fees (2009-2010)		Source of Budget (%)			
	Connection Fee	Average Monthly Water Rate	Connection Fee	Water Rates	General Fund	Loans
Meridian	***$1,794***	***$24.24***	***0***	***100***	***0***	***0***
Asotin PUD	$1,650	$30	2	98	0	0
Lewiston	$1,500	$70	5	95	0	0
Nampa	$3,696	NR	18	82	0	0

The following is a summary of observations from other questions in the benchmarking survey. Note that not all questions were filled out by all surveyed utilities.

- *System Age*: The oldest part of the system is approximately 80 years old. However, most of the system is between 10-20 years old and is relatively new compared to the other systems.
- *Surface Water Sources*: Of the surveyed utilities, only Lewiston has a surface water source. Across the state, less than 5% of drinking water comes from a surface water source.
- *Budget Allocation*: Only one other utility reported on budget allocation, but Meridian's spending was comparable to this utility with two exceptions. On a percentage basis, Meridian spent about half of what the other utility spent on energy costs and double what the other reporting utility spent on equipment and materials.
- *Professional Memberships*: The City's involvement with professional societies (WEF/PNCWA, AMSA, and APWA) is comparable to the other reporting utilities.
- *Overtime Hours:* The number of overtime hours varies among the utilities with Meridian somewhat higher than the other reported hours.
- *System Flushing:* Meridian's program to flush 100% of the system each year is comparable to a majority of the responses from other utilities.
- *Valve Exercising:* All but one utility reported having a valve exercising program.
- *Cathodic Protection:* Including Meridian, half of utilities reported not employing cathodic protection.
- *Cross Connection Program:* All utilities reported having a connection control program.
- *Leak Detection:* Meridian was only one of two utilities responding that did not have a leak detection program in place. The other utility without a leak detection program is

in the process of starting one. However, Meridian also had the lowest percent of non-revenue water of any of the surveyed utilities.

- *Well Head Protection Plan:* Meridian was the sole utility of those reporting to not have a wellhead protection plan in place.
- *Drawdown Tests:* The City was only one of two utilities reporting drawdown testing more than once a year, with the other utilities reporting drawdown pumping test frequencies between two and 10+ years.
- *Service Response Time*: The City's target emergency and non-emergency response time of one hour during and after work hours was the same as the response time of the other reporting utility.

Conclusions and Recommendations

This report makes the following conclusions and recommendations based on a review of the City O&M practices and benchmarking of other water systems:

General

1. Current system operator licensing of City staff meets requirements.
2. No major recurring maintenance problems have been reported by the City.
3. The City should routinely update the 2009 Water Department Emergency Response Plan annually, or as changes require.

Distribution System

1. The City has a high number of PRVs for the number of pressure zones. It also has a high number of PRVs and pressure zones for the elevation relief across the service area.
2. The City should consider acquiring portable generators or upgrading sites with portable generator capability to permanent generators.
3. The City should continue with the process of implementing a chlorine residual monitoring plan.
4. Develop a leak detection plan per the recommendations of the APWA Public Works Management Practices Manual

System Mapping, Maintenance Management and Hydraulic Model

1. The City updated the system model as part of this project. Ultimately, the City plans to integrate the model directly with the GIS and update it on an annual basis.
2. Yearly or bi-yearly calibration, through hydrant flow testing, should be done to ensure continued accuracy of the model.

3. The City has recently purchased Hansen maintenance management software that will be linked to the GIS. When fully deployed, this system will be a significant source of information on inventory and facilities, including the number and type of maintenance issues and procedures that are addressed by the O&M crews, and will be extremely useful in tracking O&M procedures and forecasting future investment requirements.
4. The City is currently doing a SCADA master plan and should implement the action steps that come out of that plan to maximize the use of its SCADA system.

Wells

1. The City has stated they would implement bi-annual pump drawdown tests and continuous monitoring through SCADA.
2. The City should maintain a record of existing pump settings to ensure the order of pump operation is known, and consider operation based on of the spatial allocation of demand within the system.

The City maintains a relatively comprehensive O&M protocol, and procedures and operations were generally consistent with other surveyed utilities. The O&M tasks address issues with customer interaction, water quality and infrastructure maintenance. However, few of these procedures are formally documented. To become more compliant with state and industry recommendations, the O&M procedures outlined in Table 7-2 should be documented in a manual, or manuals, and in the Hansen software. These manuals should be updated and improved annually, or more frequently as needed. In addition, operation manuals should be required from each manufacturer of proprietary units installed in the system.

SECTION 8
CAPITAL IMPROVEMENTS PROGRAM

Previous sections have outlined an overview of the existing system, projections of future growth, water demand and an analysis of existing and future water system requirements including supply, storage and distribution components. This section summarizes the previously identified system improvement needs. The recommended improvement projects are shown in Figure 8-1 and summarized in Tables 8-1, 8-5 and Table 8-6.

All project descriptions and cost estimates represent planning level accuracy and opinions of costs (+50%, -30%). During the design phase of each improvement project, recommended lengths should be verified and elevations should be surveyed. Recommended pipeline diameters will vary based on final design requirements. The final cost of projects will vary depending on actual labor and material costs, site conditions, competitive market conditions, regulatory requirements, project schedule, and other factors. Because of these factors, project feasibility and risks should be carefully reviewed prior to making specific financial decisions or establishing project budgets to help ensure proper project evaluation and adequate funding.

Project Descriptions

The City of Meridian (City) has developed a very robust water system, which provides good supply, transmission and distribution capability and redundancy. As a result, there were relatively few deficiencies identified in the Water Supply and System Analysis (Sections 4 and 5, respectively) that are required to meet minimum IDEQ requirements. Projects recommended to meet minimum IDEQ requirements include:

- Pipeline improvements to meet specific fire flow requirements
- Intertie with United Water Idaho (UWI)
- Tank and booster station in Zone 4
- New well in Zone 2

Additional projects are recommended to maintain the existing level of redundancy and flexibility in the water system, particularly in terms of supply. Projects can be seen on Figure 8-1 and are explained in detail below. As the City reviews its system and budget each year the list of projects may vary and the timeline shift somewhat from the recommendations in Table 8-1.

Pipeline

Approximately four miles of pipeline improvements have been identified as priorities by the City and organized into capital improvement projects. With the exception of two projects, the overall implementation period occurs over the next five years. The projects are identified primarily due to hydraulic deficiencies or because they are undersized 4-inch and 6-inch pipelines that should be upsized to 8-inch in order to conform to existing City standards. In addition, nearly 40 miles of 4-inch and 6-inch pipeline have been slated for replacement beyond five years. They have not been assigned separate project labels at this time as the timing of many of the projects will coincide with the end of their useful life as they currently do not pose any hydraulic deficiency in the system. As the Hansen database is updated and used for maintenance and asset management purposes, a plan will be developed for scheduling the replacement of these pipes. Much of the City's system was developed within a period of less than 20 years, which poses financial challenges to ensuring the overall system is being replaced in a reasonable timeframe (i.e. less than 100 years). The City has acknowledged that their current rate of pipe replacement will not be adequate to ensure the reasonable replacement of all piping and will be accelerated as needed once the maintenance management information is fully populated and an overall plan is agreed upon. As noted in the financial section, the City maintains a healthy water system fund balance which can be used to accelerate the replacement program. The locations of pipeline improvements can be seen on Figure 8-1 and are summarized in Table 8-1.

Table 8-1
Pipeline Project Descriptions

Project	Location Description	Timeline	Primary Reason for Project	Existing Diameter (inches)	Build-out Diameter (inches)	Length (feet)
P-1	West 2nd Street & Maple Avenue	2012	Substandard Size Pipe Replacement	4 and 6	8	1,108
P-2	West 11th Street, Washington Drive & Carlton Avenue	2012	Substandard Size Pipe Replacement	4 and 6	8	2,561
P-3	King St between Meridian Road & Main Street	2012	Substandard Size Pipe Replacement	6	8	470
P-4	Williams Street between Meridian Road & Main Street	2012	Pressure Deficiency Pipe Replacement	4	8	494
P-5	West 1st Street, North of Pine Avenue	2012	Substandard Size Pipe Replacement	6	8	269
P-6	West 1st Street, South of Broadway Avenue	2012	Substandard Size Pipe Replacement	4	8	344
P-7	East 5th Street between Carlton Avenue & Pine Avenue	2013	Substandard Size Pipe Replacement	6	8	657
P-8[1]	Meridian Road between Franklin Road & Cherry Lane and Ada Street between Meridian Road & Main Street	2013	Split Corridor Pipe Replacement	4 and 12	8 and 12	5,875
P-9	Heidi Place	2014	Pressure Deficiency Pipe Replacement	6	8	461
P-10	Lynhurst Place	2014	Pressure Deficiency Pipe Replacement	4	8	270
P-11	Ada Street between Main Street & East 3rd Street	2014	Pressure Deficiency Pipe Replacement	4	8	748

Project	Location Description	Timeline	Primary Reason for Project	Existing Diameter (inches)	Build-out Diameter (inches)	Length (feet)
P-12	Williams Street between Main Street & East 3rd Street	2014	Substandard Size Pipe Replacement	4	8	753
P-13	Antilles Court	2015	Pressure Deficiency Pipe Replacement	6	8	535
P-14	Lochmeadow Court	2015	Pressure Deficiency Pipe Replacement	6	8	921
P-15	Willowbrook Court	2015	Substandard Size Pipe Replacement	4 and 6	8	467
P-16	Lark Place	2015	Substandard Size Pipe Replacement	2	8	71
P-17[2]	Between Teare Avenue & Locust Grove Road	2016-2020	Pressure Deficiency Pipe Replacement	New Pipeline	12	1,448
P-18[2]	Locust Grove Road between Victory Road & Amity Road	2030	New Transmission Pipeline	New Pipeline	16	4,043
Substandard Size Pipe – Looped	Various Locations	End of Service Life or Replacement Schedule	Substandard Size Pipe Replacement	4 and 6	8	130,387
Substandard Size Pipe – Dead End	Various Locations	End of Service Life or Replacement Schedule	Substandard Size Pipe Replacement	4 and 6	8	65,597

[1]*Part of ACHD "Split Corridor" project*
[2]*Paid for by developers*

Projects P-4, P-9, P-10, P-11, P-13, P-14 and P-17 are required to overcome existing and future modeled pressure criteria deficiencies. With the exception of P-17 and P-18, each project is scheduled to occur over the next five years. Project P-17 involves building a new pipeline to connect from Teare Avenue to Locust Grove Road. This project will go through a currently undeveloped piece of property and will be scheduled in conjunction with the development of this area, with cost to be paid for by the developer and construction and alignment to be determined in conjunction with the developer.

Project P-18 is a necessary improvement to meet projected demand in Zone 5 over the 20-year planning period. This pipeline will transmit water from the proposed storage facility in Zone 4 through separate Zone 5 boosters, located at the pump station, to serve growth in Zone 5. The cost and timing of this pipeline will be determined in conjunction with development in Zone 5. Developers will provide funding for the booster facility, as well as for the transmission pipeline to Zone 5.

Project P-8 is being constructed along Meridian Road and Ada Street in conjunction with the Ada County Highway District (ACHD) Split Corridor project. The existing 12-inch pipeline along Meridian Road will be replaced with new 12-inch pipeline and the 4-inch line along Ada Street will be upsized to 8-inch piping.

All other labeled pipeline projects shown in Figure 8-1 are located in Zone 2 and are scheduled for construction in the next five years. As noted, these projects involve upsizing 4-inch and 6-inch piping. Priority was given to projects that:

- Upsize the smaller, 4-inch lines that are part of the looped transmission system located in the downtown area, and/or
- Need to be completed prior to the roadways being “chip sealed” by ACHD, which is scheduled for this area in 2014.

The remaining undersized pipelines without labels are also shown in Figure 8-1. These pipes have been grouped according to whether they are part of a looped system or are dead-end lines. Although many of these pipelines exceed the City’s recommended maximum velocities under fire flow conditions, upsizing these pipelines is not necessary to overcome pressure deficiencies and they have not been specifically separated into projects. These pipes should be part of future annual pipeline replacement schedules and/or replaced when they reach the end of their useful life.

Facilities

Pressure Reducing Valve (PRV) Stations

As mentioned in the description of the Existing Water System (Section 2), the City currently has four pressure zones that are designed to deliver water at an operating pressure of 55 to 80 pounds per square inch (psi). Boundaries for Zone 1 have been identified based on elevations in the western portion of the system to deliver pressures within the 55 to 80 psi range. Currently customers within the area designated to be Zone 1 are served from Zone 2 without any reduction in pressure, so typical pressures often exceed the 80 psi target. As a result, the City is scheduled to install three PRVs in 2012 to create Zone 1 with a hydraulic grade of approximately 2,700 feet. The PRVs would be installed to allow two-way flow, because while Zone 1 currently does not have a source of supply to allow emergency service to Zone 2, a future well site has been identified by the City in Zone 1. Due to the close hydraulic grade of the City's pressure zones, once a source of supply is located in Zone 1, the two-way PRVs will allow flow from Zone 1 to serve Zone 2, if necessary, under emergency conditions. The three PRVs scheduled for 2012 installation are identified as project V-1, V-2 and V-3 and are located on Ustick Road, Moon Lake Street and Harbor Point Drive, respectively. The two additional projects, V-4 and V-5, located on Cherry Lane and Pine Avenue, will be constructed as development occurs. Each PRV project location can be seen in Figure 8-1.

Interties

Water Supply Planning (Section 4) describes 16 potential locations for emergency intertie connections with United Water Idaho (UWI). These interties would benefit both systems by having the option of two-way flow, where pressures are comparable. The City has identified the location near Wainwright Drive and Eagle Road as the first location for an intertie project because the dead-end line on Wainwright Drive cannot provide adequate pressures under fire flow conditions. The City is interested in exploring the development of additional interties with UWI and would like to utilize this initial location to develop an overall standard. Interties can offer both systems additional supply redundancy at reasonable cost. The location of this project, identified as I-1, is shown in Figure 8-1.

Reservoir and Booster Stations

Based upon existing supply capacity, projected demand growth and the recommendation to move to a well and booster supply scenario, the City will require a new reservoir and booster station sometime shortly after 2015. Because of recent water quality issues, the flexibility and predictability provided by a reservoir, and the City's desire to maintain a supply buffer, the project is planned for construction prior to 2015. R-1 and BP-1 are scheduled for construction to begin in 2013. R-1 is a 2 MG reservoir and BP-1 would initially include three 1,500 gpm pumps for a 4,500 gpm capacity, with space for additional pumps to serve Zone 5 as part of BP-2. Located in Zone 4, as can be seen in Figure 8-1, this project will allow service to meet the supply deficiency in Zone 4, but also provide the flexibility of serving Zones 3, 2 and 1 through PRVs. Project BP-2 calls for a second set of booster pumps, with an initial 1,500 gpm pump and the potential for two additional 1,500 gpm pumps to serve Zone 5 from the reservoir. The first pump in BP-2 is not needed until sometime between 2020 and 2030, based on when and where demand occurs in Zone 5. BP-2 will need to be constructed in conjunction with pipeline project P-18, which would transmit the boosted water to Zone 5. As noted previously, BP-2 will be paid for by developers.

Water Supply Wells

Three new water supply wells have been identified in this analysis. One well, identified as project W-1, is necessary between 2020 and 2030 to meet minimum IDEQ requirements. To maintain a two well buffer, projects W-2 and W-3 are also recommended by 2030. While locations for W-1 and W-2, as seen in Figure 8-1, have been tentatively selected based on demand projections, the location for W-3 should be determined based upon the location of demand growth in the system. Each well is assumed to have a capacity of approximately 2,000 gpm and will require a test well be drilled prior to overall construction of the facility. It is recommended that any well sites identified in Zones 2 and 5 consider property large enough to also accommodate the construction of a reservoir.

Water Treatment Systems

As described in Water Quality and Regulations (Section 6), the City currently meets all Maximum Contaminant Level (MCL) requirements at its active supplies. However, the City has recently encountered some issues with uranium that have required wells to be used as backup or under emergency conditions only. In addition, there are a number of wells in the system that have iron and manganese issues, which are not primary MCL issues, but do contribute to odor, color and taste issues that the City would like to address. As a result, the CIP includes costs for at least four water treatment projects to address iron and manganese issues. Noted as T-1, T-2, T-3 and T-4, they are scheduled to occur in 2014, 2016, 2018 and 2020, respectively. The implementation of the treatment systems may change in terms of timing and the ultimate number that are constructed, based on the success of the initial projects. Any future well sites should also provide adequate space to accommodate any water treatment systems that may be required.

Land Acquisition

As the City continues to grow both outwardly and from an infill standpoint, it will become increasingly challenging to acquire parcels in the best locations that are large enough to accommodate reservoirs. Therefore, it is recommended that the City acquire three strategically located parcels in the near-term; one large enough for the construction of a well, booster and reservoir in Zone 2, and the other two capable of accommodating a well with space for potential treatment. Current land prices also support the near-term acquisition of these parcels. These are noted in figure 8-1 as projects L-1, L-2 and L-3, which correspond with projects W-1, W-2 and W-3.

Automated Metering Infrastructure

The City plans to migrate their current mobile automated meter reading (AMR) system to fixed base advanced metering infrastructure (AMI) in the next few years. This includes the installation of two to three data collectors mounted on reservoirs and/or towers, along with the associated hardware and software, allowing for the centralized collection of customer usage records. The City has budgeted the installation of AMI components in fiscal year 2013, which is noted as project AMI-1. The timeline for this project may be shifted based on the need to implement other capital projects, however the City is committed to completing it in the next five years. The costs associated with the continued installation and replacement of meters and endpoints are included in the City's existing Operations and Maintenance budget.

Cost Estimating

The costs that were developed for each improvement are based on average costs developed by the 2011 RSMeans Heavy Construction Cost Data (RSMeans), recent City project bid tabs, City input, and local contractor and supplier costs. All costs were developed in 2011 dollars.

The project costs presented in this plan include estimated construction costs and allowance for contingencies, permitting, legal, administrative and engineering fees. Construction costs are based on the preliminary concepts and layouts of the water system components developed during the system modeling. The cost basis for each type of project is summarized in the following sections.

Pipeline Costs

The estimates for water system piping include the costs for pipe, fittings, valves, water service connections, installation and restoration of the surface of the excavated area back to pre-existing conditions.

The pipe material assumed for new waterlines is DR18 C900 PVC for 4- to 12-inch and DR18 C905 PVC for 14- and 16-inch. For estimating purposes, it was assumed that all water pipes would be PVC.

The two classes of installation are new transmission main and waterline replacement. New transmission main is designated for areas currently without pipe and waterline replacement is for areas where there is existing waterline that will be replaced.

For all new transmission main installations, the cost is assumed to include excavation, waste of the material associated with the trenching (which includes haul, load and dump fees), bedding and zone material, native backfill (which includes minimal haul and compaction of material), fittings and valves (as a percentage of pipe costs), and testing and disinfection (as a percentage of total cost). Depth of cover is assumed to be 5 feet for section roads and 4 feet for other roads.

For waterline replacements that required upsizing of the existing line, some additional assumptions were made to develop a cost estimate. These include:

- Additional costs required to abandon existing pipe
- Additional costs required to replace water service lines (cost added as a percentage of pipe costs)
- Other materials and installation costs were assumed to be the same for replacement and capacity upgrades of existing waterlines as those for new pipelines.

As the diameter of pipe, depth of cover and the trench width increases for larger pipes, the costs also increase. Therefore, a specific cost has been identified for each pipe diameter and for each pipe depth. See Table 8-2 for linear feet (LF) costs for both new pipe and replacement of existing pipe.

Table 8-2
Water Pipeline Costs per Unit Length

Pipe Diameter	Waterline Replacement		New Transmission Main	
	4-foot cover	5-foot cover	4-foot cover	5-foot cover
8-inch	$38	$42	$37	$41
10-inch	$47	$52	$46	$50
12-inch	$51	$55	$51	$55
14-inch	$80	$85	$79	$84
16-inch	$97	$102	$95	$101

Special Pipe Crossings

Several areas have been designated as "special pipe crossings" in the cost estimate. These are areas where proposed waterline improvements cross canals and creeks. It was assumed that construction involving these crossings will require additional costs for alternative construction methods (e.g., trenchless technologies), dewatering and/or traffic control. A contingency factor of 200 percent was applied to the pipe cost to address these special construction requirements.

Surface Restoration

All projects are required to restore the surface where the construction occurred back to pre-existing conditions to complete the project. The costs to restore paved surfaces are calculated based on whether they are "local" or "section" roads, with section roads requiring a thicker layer of asphalt, as shown in Table 8-3.

As with the installation costs, surface restoration costs increase as pipe diameter increases due to the need for excavation of a larger trench. Therefore, a linear foot surface restoration cost including construction and materials has been used for each pipe size. See Table 8-3 for unit costs for surface restoration.

Table 8-3
Surface Restoration Cost per Unit Length

Pipe Diameter	Local: 3-inch asphalt and 8-inch rock base (3/4-inch minus)	Section: 4-inch asphalt and 8-inch rock base (3/4-inch minus)
	4-foot cover	5-foot cover
8-inch	$38	$63
10-inch	$41	$67
12-inch	$43	$70
14-inch	$45	$73
16-inch	$48	$77

Traffic Control

Traffic control will be required for all projects that occur in a roadway. The cost and level of effort for traffic control should be evaluated for each project as scope, size of project and local conditions at the time of construction dictate. For planning purposes, the cost of traffic control is estimated at 2 percent of the pipeline construction costs for projects in section roads and 0.5 percent of construction costs for projects in local streets.

Erosion Control

Erosion control is required for all projects. The cost and level of effort for erosion control should be evaluated for each project as scope and size of project are determined. For planning purposes, the cost of erosion control is estimated at 1 percent of the pipeline construction costs.

Facility Costs

PRV Stations

PRV project costs assume the PRVs will allow flow in two directions and contain the following major components for construction:

- 8-inch mainline Cla-Val PRV

- 3-inch low flow Cla-Val bypass PRV
- 8-inch ductile iron pipe for mainline PRV piping
- 4-inch bypass PRV piping
- Concrete valve vault
- 4- and 8-inch flow meters
- SCADA, electrical and controls
- Surface repair to preconstruction condition

United Water Idaho Intertie Project

The intertie PRV project consists of the necessary water piping to connect the two systems and a two-way PRV station (the intertie will have the ability to convey water from UWI to the City, and from the City to UWI). Cost for the intertie PRV project includes the 850-foot, 8-inch connecting waterline and assumes the same materials and installation as the PRV station costs described above with the exception of a low flow bypass, which is not needed. The costs for this project may be shared between the City and UWI.

Reservoir and Booster Station

The City is currently designing the reservoir and booster station project (R-1 and BP-1). The costs presented in this report are based on the design construction cost estimates. Those costs were also used to estimate the costs to add additional booster pumps to serve Zone 5 (BP-2). BP-2 assumes the following components will be added to the booster station constructed as part of the BP-1 project:

- Three (3) new vertical turbine pumps
- New valves and piping to connect to the existing discharge piping in the booster pumping facility
- Variable Frequency Drive (VFD) motors
- Connection to SCADA

Water Supply Wells

Costs for water supply wells are based on recent City construction and include the following:

- Drilling of test and production wells
- Masonry block well house
- Vertical turbine pump
- VFD motor
- Emergency generator
- Connection to SCADA
- The contingency includes land acquisition

Water Treatment Systems

Costs included for iron and manganese treatment are based on conceptual level estimates provided by the City.

Materials and Labor

The materials and labor cost is the sum of materials, labor and equipment for each project.

Construction Cost

The construction cost is the sum of materials, labor, equipment, mobilization, contractor's overhead and profit, tax, and contingency for each project. Mobilization and demobilization costs are the cost for the contractor to mobilize and demobilize the personnel and equipment necessary for performing the work required under the project.

At the planning level of an engineering project, a contingency is applied to cover the cost of uncertainties in the estimate. These uncertainties include unknown details of the project not covered in the unit costs, changes in site conditions and variability in the bidding climate. A state sales tax was also included as part of the contingency cost.

Total Cost

The total cost is the sum of construction cost with additional cost allowances for engineering, legal and administration. Table 8-4, shown below, presents the allowances associated with the total cost.

The engineering costs include design and surveying. Construction administration is the cost associated with managing the construction of the project. The administration and legal costs are those associated with the City providing financial and legal oversight of the contract.

Table 8-4
Costs Allowance

Factor	Allowance
Mobilization and Demobilization	10%
Contractors Overhead and Profit	15%
Administration and Legal	10%
Engineering	15%
Construction Administration	5%
Contingency	30%

Summary

The City has developed a very robust water system, which provides good supply, transmission, and distribution capability and redundancy. As a result there are relatively few areas that do not meet IDEQ requirements over the 20-year planning horizon. This allows the City to also focus on projects to upsize substandard size pipe and do projects that will continue to maintain redundancy and flexibility within the system, particularly in terms of supply. Approximately $11 million in projects are scheduled between 2012 and 2016. Recommended pipeline and facility projects and costs are summarized in Table 8-5 and Table 8-6.

Table 8-5
Summary of Required Pipeline Improvements

Project	Timeline	Project Type	Existing Diameter (inches)	Build-out Diameter (inches)	Length (feet)	Subtotal: Material and Labor	Subtotal: Construction Cost	Total Cost
P-1	2012	Replacement	6	8	1,108	$102,000	$166,000	$215,000
P-2	2012	Replacement	4 and 6	8	2,561	$236,000	$382,000	$497,000
P-3	2012	Replacement	6	8	470	$44,000	$71,000	$92,000
P-4	2012	Replacement	4	8	494	$46,000	$74,000	$96,000
P-5	2012	Replacement	6	8	269	$25,000	$41,000	$53,000
P-6	2012	Replacement	4	8	344	$32,000	$52,000	$67,000
P-7	2013	Replacement	6	8	657	$61,000	$98,000	$128,000
P-8[1]	2013	Replacement	4 and 12	8 and 12	5,875	$441,000	$716,000	$930,000
P-9	2014	Replacement	6	8	461	$43,000	$69,000	$90,000
P-10	2014	Replacement	4	8	270	$25,000	$41,000	$53,000
P-11	2014	Replacement	4	8	748	$69,000	$112,000	$146,000
P-12	2014	Replacement	4	8	753	$72,000	$117,000	$152,000
P-13	2015	Replacement	6	8	535	$50,000	$80,000	$104,000
P-14	2015	Replacement	6	8	921	$85,000	$138,000	$179,000
P-15	2015	Replacement	4 and 6	8	467	$43,000	$70,000	$91,000
P-16	2015	Replacement	2	8	71	$7,000	$11,000	$14,000

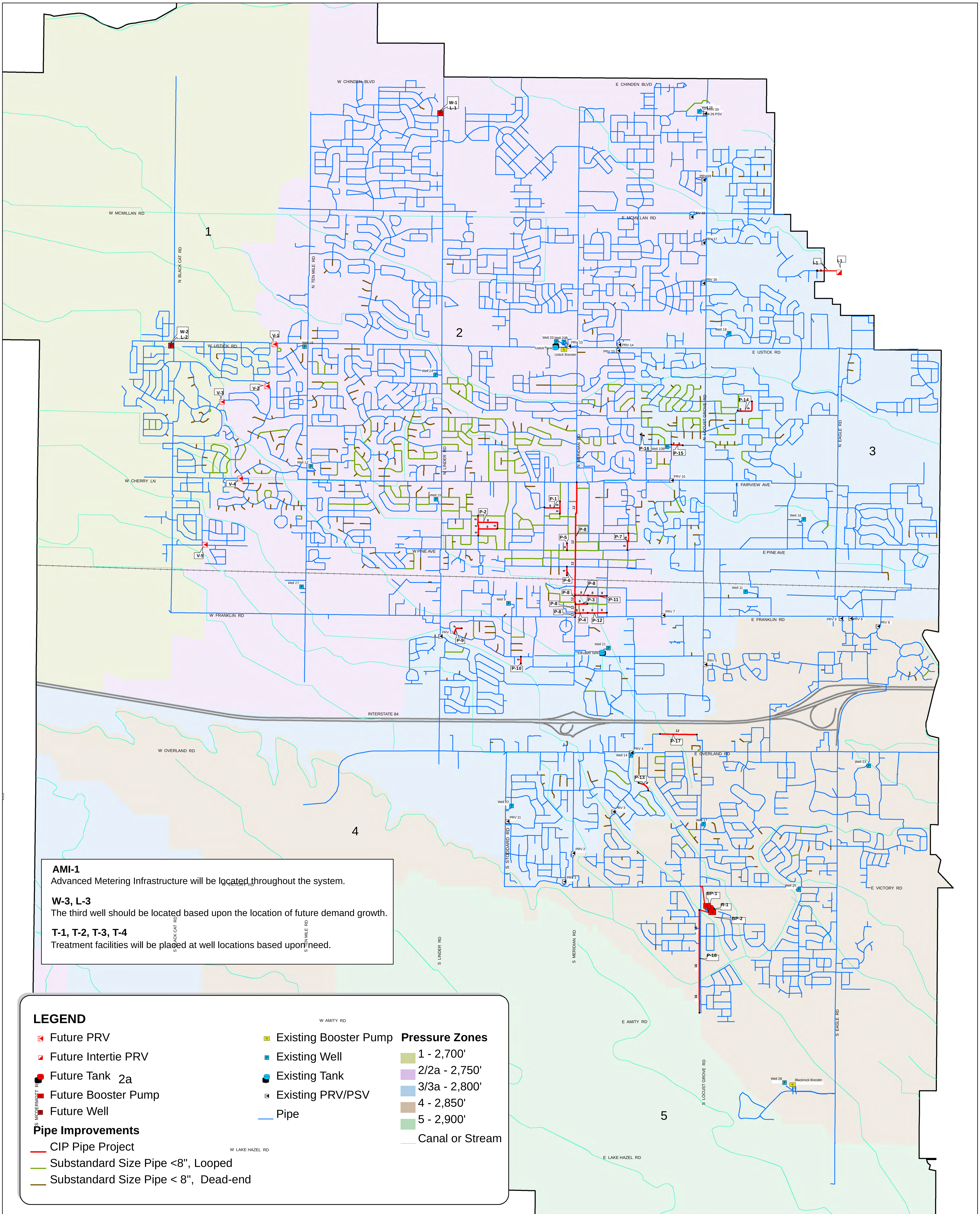
Project	Timeline	Project Type	Existing Diameter (inches)	Build-out Diameter (inches)	Length (feet)	Subtotal: Material and Labor	Subtotal: Construction Cost	Total Cost
P-17[2]	2016-2020	New	-	12	1,448	$171,000	$277,000	$360,000
P-18[2]	2030	New	-	16	4,043	$599,000	$973,000	$1,265,000
Substandard Size Pipe - Looped	End of Service Life or Replacement Schedule	Replacement	4 and 6	8	130,387	$12,027,000	$19,544,000	$25,407,000
Substandard Size Pipe - Dead End	End of Service Life or Replacement Schedule	Replacement	4 and 6	8	65,597	$6,034,000	$9,805,000	$12,746,000

[1]*Part of ACHD "Split Corridor" project*
[2]*Paid for by developers*

Table 8-6
Summary of Required Facility Improvements

Project	Description	Timeline	Subtotal: Construction Cost	Total Cost
V-1	Zone 1 PRV	2012	$100,000	$130,000
V-2	Zone 1 PRV	2012	$100,000	$130,000
V-3	Zone 1 PRV	2012	$100,000	$130,000
V-4	Zone 1 PRV	2014[1]	$100,000	$130,000
V-5	Zone 1 PRV	2014[1]	$100,000	$130,000
I-1[2]	Intertie	2015	$256,000	$333,000
R-1	Reservoir	2013	$3,400,000[3]	$3,740,000[4]
BP-1	Booster Station	2013	See footnote 3	See footnote 3
BP-2[5]	Booster Station	2020-2030	$484,000	$629,000
AMI-1	Automated Meter Infrastructure	2013	$288,000	$374,000
L-1[6]	Reservoir/Booster/ Well Site Land Acquisition	2013	-	$400,000
L-2[6]	Well Site Land Acquisition	2015	-	$50,000
L-3[6]	Well Site Land Acquisition	2017	-	$50,000
W-1	Well	2020-2030	$923,000	$1,200,000
W-2	Well	2020-2030	$923,000	$1,200,000
W-3	Well	2020-2030	$923,000	$1,200,000
T-1	Treatment at TBD Well Facility	2014	$850,000	$1,105,000
T-2	Treatment at TBD Well Facility	2016	$850,000	$1,105,000
T-3	Treatment at TBD Well Facility	2018	$850,000	$1,105,000
T-4	Treatment at TBD Well Facility	2020	$850,000	$1,105,000

[1] Dates will depend on development in the area
[2] Costs to be negotiated with United Water Idaho
[3] Cost for BP-1 are included in R-1
[4] Design currently under contract. Total cost includes addition of 10% for construction administration and remaining legal/administration costs
[5] Paid for by developers
[6] Corresponds with projects W-1, W-2 and W-3, respectively



MSA

City of Meridian
Water Master Plan

Figure 8-1
Capital Improvement Projects

N
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1 in=1,200 ft

MERIDIAN IDAHO

SECTION 9
FINANCIAL REVIEW

One of the most critical elements in the development of a Water Master Plan (WMP) is ensuring that the identified capital plan can be funded and implemented on the proposed schedule. This section provides a review of the City's ability to implement the projects identified in the Capital Improvement Program (CIP) (Section 8).

As part of the WMP, the City has identified a CIP that includes over $10 million (2011 dollars) worth of projects for implementation between FY2012 and FY2016. The City is proposing to utilize "pay as you go" financing for the project funding requirements. Alternatives to the pay as you go option would include debt financing, such as municipal bonds or state revolving loan funding. A review of the City's current rate model and fund balance has been conducted to ensure the projects identified in the CIP have adequate funding.

The City has implemented a number of incremental water rate increases over the past 10 years, which enabled them to generate an un-designated fund balance of $6 million at the beginning of FY2012 (October 1, 2011).

Table 9-1 has been developed to provide a summary of the City's forecasted un-designated fund balance. The ending fund balance is a result of adding the beginning fund balance to that year's revenue and subtracting the personnel, operations, CIP project costs and the CIP carry forward estimate, for that year. The "CIP Carry Forward Estimate" is the portion of the previous year's CIP that was not executed, and is assumed to be implemented during the following year. It is assumed that during each year, 80% of the CIP is executed.

Table 9-1
FY2012 – FY2016 Un-designated Fund Balance

	FY2012	FY2013	FY2014	FY2015	FY2016
Beginning Un-designated Fund Balance	$6,058,887	$7,138,574	$5,538,102	$6,566,199	$9,271,678
Yearly Revenue	$8,326,700	$8,409,967	$8,494,067	$8,579,007	$8,664,797
Personnel and Operating Costs	$3,801,093	$4,123,439	$4,190,970	$4,260,528	$4,332,173
CIP Projects @ 80% Execution Rate	$2,392,800	$5,288,800	$1,952,800	$1,124,800	$1,708,000
CIP Carry Forward Estimate	$1,053,120	$598,200	$1,322,200	$488,200	$281,200
Ending Fund Balance	$7,138,574	$5,538,102	$6,566,199	$9,271,678	$11,615,102

Table 9-1 shows the City's water system fund balance increasing by the end of FY2016. Increasing the system fund balance will place the City in a good position to accelerate replacement of the nearly 40 miles of small diameter pipe that does not meet existing construction standards. Because much of this pipe was installed between the mid 1990s and 2007, it will reach its end of service life in a short time period. The City will be required to execute a replacement program that starts the construction before some of the pipe reaches its service life in order to ensure overall implementation is complete. The proposed capital improvements, particularly the ground level reservoir proposed for construction in FY2013, require the use of a significant amount of the fund balance. Two well treatment projects that were not on the City's budget until recently, totaling approximately $2.2 million are also scheduled before FY2017. It should be noted that the calculations in Table 9-1 are considered conservative and should leave the projected fund balance in a better ending position than the one shown. The overall healthy projected fund balance will provide the City with a great deal of flexibility to cover unanticipated project costs or to accelerate other projects such as the replacement of the small mains. The fund balance could be significantly impacted by the following factors:

- Actual construction costs
- Rate modifications implemented between FY2012 and FY2016
- Actual CIP implementation rates
- Rates of growth different than the assumed 1% per year
- Unanticipated capital projects
- Unanticipated reduction in revenue due to reductions in consumption

The costs included in the WMP are "planning level" and are considered conservative, meaning that construction bids are expected to come in lower than those identified. On a large project, such as the ground level reservoir, potential differences between the actual project costs and those estimated in the WMP could be several hundred thousand dollars.

The second major factor is that the figures shown in Table 9-1 do not include any rate increases over the next 5 years. Any rate increases that are implemented will increase the available funds beyond what is shown.

Customer growth and associated rate revenue growth was assumed to be 1% per year as part of this calculation, which is conservative. Though population growth has been relatively low since 2008, the customer base has continued to grow, providing additional rate funding to the City. Operations and personnel costs have also been assumed to increase at a similar rate to the revenue growth.

The City also conducts a yearly review of their budget, rate model and actual operating and capital expenditures. Many of the capital projects identified in the CIP could be delayed by a year or two without an impact on the level of service provided to City customers. The City has also implemented approximately 75% of their yearly CIP budget in the past. As noted, a conservative 80% implementation rate for the CIP has been assumed.

FY2013 shows a slight degradation of the fund balance due to the costs associated with the ground level reservoir.

Overall, as noted in several WMP sections, the City has been extremely proactive in maintaining their water system and consistently provides a high level of service to their customers. The City has also proactively managed the finances of the system, which is supported by the existence of the $6 million available in the fund balance, allowing for the construction of the proposed capital projects. From a planning and regulatory review perspective, it is intended that the City evaluate their finances from a conservative standpoint. The numbers in Table 9-1 do exactly that, by using higher project costs, no rate increases and only a 1% revenue growth per year. Given that the assumptions used are conservative, this analysis shows that the City will have sufficient funds for the required improvements.

Appendix

APPENDIX A
PRIMARY DRINKING WATER REGULATIONS

Periodic Review of NPDWR

The 1996 amendment to the Safe Drinking Water Act (SDWA) requires the Environmental Protection Agency (EPA) to list unregulated contaminants that are known, or anticipated to occur in public water systems and may require regulation under SDWA. Every five years, the EPA must publish this list of contaminants called the Contaminant Candidate List. After publishing, EPA must also review at least five contaminants from the list and determine if they will be regulated (Regulatory Determinations).

The first Contaminant Candidate List, published in 1998, contained 50 chemicals and 10 microbiological contaminants. The second list, published in 2005, contained 42 chemical and 9 microbiological contaminants. The third list, published in 2009, contains 104 chemical and 12 microbiological contaminants.

Impact of Contaminant Candidate Lists on the Meridian System

The Contaminant Candidate List does not have a direct impact on the City's water system, since they do not currently impose any requirement on public water systems. However, the EPA may promulgate future regulations based on the listed contaminants.

Groundwater Rule

The final Groundwater Rule was published in November 2006. In writing the rule, EPA was particularly concerned about groundwater systems that are susceptible to fecal contamination. The rule reduces the risk of illness caused by microbial contamination and includes treatment technique requirements, compliance monitoring and source water monitoring. Treatment technique requirements include providing treatment that reliably achieves 4-log treatment of viruses and correcting all significant deficiencies. Compliance monitoring is composed of testing for minimum disinfectant residual concentrations. Source water monitoring adds fecal indicator bacterial testing of the water source, as well as regulatory steps, should a source water test return positive for fecal indicators.

Impact of Groundwater Rule on the City's System

The City's water system complies with all provisions of the Groundwater Rule and no corrective actions are required by the City.

Disinfectants and Byproducts Rule

Stage 1 Disinfectants/Disinfection Byproduct Rule

Stage 1 of the Disinfectants/Disinfection Byproducts Rule (Stage 1 D/DBP) was finalized in December 1998. The rule applies to all water systems that treat with a chemical disinfectant, such as chlorine, for either primary or residual treatment. Large systems, including the City, serving greater than 10,000 people, were required to comply with the rule by January 1, 2002.

The Stage 1 D/DBP Rule is the first of a staged set of rules that reduced the allowable levels of disinfection byproducts (DBPs) in drinking water. The rule established seven new standards and a treatment technique of enhanced coagulation or enhanced softening to further reduce DBP exposure.

Historically, the first regulated DBPs were total trihalomethanes (TTHM). The EPA first established requirements on total trihalomethanes in 1979 when an interim primary Maximum Contaminant Level (MCL) of 100 µg/L was set.

This rule establishes Maximum Contaminant Goal Levels (MCLGs) and MCLs for total trihalomethanes, haloacetic acids, chlorite and bromate. It also establishes maximum residual disinfectant level goals (MRDLGs) and maximum residual disinfectant levels (MRDLs) for three chemical disinfectants: chlorine, chloramines and chlorine dioxide.

The Stage 1 D/DBP Rule establishes MCLs of 80 µg/L for TTHMs, 60 µg/L for Five Haloacetic Acids (HAA5), 10 µg/L for Bromate and 1.0 mg/L for Chlorite. The MRDLs for regulated disinfectants are 4.0 mg/L chlorine as Cl_2, 4.0 mg/L chloramines as CL_2, and 0.8 mg/L chlorine dioxide. The MRDLGs are the same concentration as the MRDLs. For most systems, DBP sampling consists of at least four (4) quarterly samples taken from the distribution system. Under certain conditions, these sampling requirements can be reduced. Compliance for TTHM and HAA5 under the Stage 1 D/DBP Rule is based on a running annual average of the quarterly values. Daily testing for chlorite and chlorine dioxide is required at the entrance to the distribution system.

In addition to the DBP requirements stated above, the Stage 1 D/DBP Rule attempts to reduce general DBP formation by requiring specific levels of total organic carbon (TOC) removal by coagulation (“enhanced coagulation”).

Impact of the Stage 1 D/DBP Rule on the Meridian Water System

The Meridian water system is currently in compliance with all provisions set forth in the Stage 1 D/DBP Rule. The City currently collects quarterly samples for TTHM and HAA5 analysis from 17 locations in the distribution system. Recent results of DBP monitoring indicate the concentrations for both TTHMs and HAA5 are well below the respective MCLs for all locations sampled.

Stage 2 Disinfectants/Disinfection Byproduct Rule

The Stage 2 Disinfectants and Disinfection Byproduct Rule (Stage 2 D/DBP) was passed in January 2006 with the purpose of increasing public health by reducing the potential risk of adverse health effects associated with DBPs throughout the distribution system. The Stage 2 D/DBP Rule builds on the Stage 1 D/DBP Rule by requiring different monitoring and reducing some MCLs for DBPs. The rule applies to all community water systems that add either a primary or a residual disinfectant other than ultraviolet light.

MCL Determination and Monitoring Requirements

The MCLs are unchanged from Stage 1 D/DBP for total TTHM and HAA5. The Stage 2 D/DBP Rule MCLG revisions to the Stage 1 D/DBP Rule are as follows:

- Chloroform: MCLG = 0.07 mg/L
- Dibromochloromehtan: MCLG = 0.6 mg/L
- Trichloroacetic acid: MCLG = 0.02 mg/L
- Monochloroacetic acid: MCLG = 0.03 mg/L

The Stage 2 D/DBP Rule requires the use of running annual averages, by location, to determine compliance with the MCLs for TTHMs and HAA5. The running annual averages are calculated for each monitoring location in the distribution system. This differs from the running annual average approach outlined in Stage 1 D/DBP, where compliance was determined by calculating the running annual average of samples from all monitoring locations across the system. As shown in Table A-1, Meridian must sample four (4) locations quarterly.

Table A-1
Population Served and Monitoring Frequency Summary

Source Water Type	Population Size Category	Monitoring Frequency	Total Distribution System Monitoring Locations Per Monitoring Period
Subpart H	<500	per year	2
	500 to 3,300	per quarter	2
	3,301 to 9,999	per quarter	2
	10,000 to 49,999		4
	50,000 to 249,999		8
	250,000 to 999,999		12
	1,000,000 to 4,999,999		16
	≥ 500,000		20
Groundwater	<500	per year	2
	500 to 9,999		2
	10,000 to 99,999	per quarter	4
	100,000 to 499,999		6
	≥ 500,000		8

Initial Distribution System Evaluation

An Initial Distribution System Evaluation must be completed as part of the Stage 2 D/DBP Rule. An evaluation can include standard monitoring, a system specific study or 40/30 certification. Standard monitoring is one year of increased monitoring for TTHM and HAA5 in addition to data collected under Stage 1 D/DBP. This data will be used to select Stage 2 D/DBP compliance monitoring locations. Those systems that have extensive TTHM and HAA5 data or technical expertise to prepare a hydraulic model may choose to conduct a system specific study to select Stage 2 D/DBP compliance monitoring locations. 40/30 certification refers to a system that, during several years of historical records, has all individual Stage 1 D/DBP compliance samples less than, or equal to 40 µg/L for TTHM and 30 µg/L for HAA5, and has no monitoring violations during the same time period. These systems have no distribution system monitoring requirements, but will need to conduct Stage 2 D/DBP compliance monitoring.

Stage 2 D/DBP Compliance Schedule

Critical deadlines and requirements schedules are dependent on population size. The schedules breakdown as follows:

- Schedule 1 serving 100,000 or more people
- **Schedule 2 serving 50,000 to 99,999 people**
- Schedule 3 serving 10,000 to 49,999 people
- Schedule 4 serving fewer than 10,000 people

Full compliance with Stage 2D/DBP MCLs is required by 2013 or 2014 depending on the size of the population served.

Impact of Surface Water Treatment Rule on the Meridian System

The Meridian water system is currently in compliance with all provisions set forth in the Stage 1 and 2 D/DBP Rules. The City submitted a 40/30 Certification Letter on February 14, 2007, receiving confirmation by EPA on February 15, 2007. As a result of the 40/30 certification, the City will continue with annual monitoring to represent each full time well house until final compliance monitoring implementation for Stage 2 D/DBPR on October 1, 2012. After that date, the City must sample four (4) locations every quarter to test for DBPs.

Total Coliform Rule

The Total Coliform Rule (TCR) was published in 1989, becoming effective in 1990, with the primary goal to set both health goals (MCGLs) and legal limits (MCLs) regarding microbial presence in finished and distributed drinking water supplies. Compliance with the rule was required in June 1993. The MCL for total coliform is zero. The MCL is based on the presence or absence of total coliform, not on the coliform density or concentration. Presence of total coliforms indicates that the water may be contaminated with human or animal wastes. The TCR also sets sampling requirement and compliance determinations.

The required number of samples taken each month depends on the population served by the water system. A water system may choose to collect fewer than the required samples; however, different criteria would then apply in the event of a positive test for total coliform. Table A-2 provides a summary of the sampling requirements for various populations served. The City must collect at least 70 samples each month.

Table A-2
Population and Sampling Requirements

Population Served	Minimum Number of Samples per Month
25 to 1,000	1
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4
4,101 to 4,900	5
4,901 to 5,800	6
5,801 to 6,700	7
6,701 to 7,600	8
7,601 to 8,500	9
8,501 to 12,900	10
12,901 to 17,200	15
17,201 to 21,500	20
21,501 to 25,000	25
25,001 to 33,000	30
33,001 to 41,000	40
41,001 to 50,000	50
50,001 to 59,000	60
59,001 to 70,000	**70**
70,001 to 83,000	80
83,001 to 96,000	90
96,001 to 130,000	100
130,001 to 220,000	120
220,001 to 320,000	150

For systems that collect fewer than 40 samples per month, a monthly MCL violation is triggered if more than one sample per month is total coliform-positive. For systems that collect more than 40 samples per month, a monthly MCL violation is triggered if more than five percent of samples per month are total coliform-positive. If one sample tests positive for total coliform, the system must perform additional tests. The presence of either fecal coliform or *E. coli,* results in one set of 3-4 repeat samples at sites located within five or fewer sampling sites adjacent to the location of the routine positive sample. This repeat sample must be done within 24 hours and at least five routine samples must be collected the next month of operation. An acute MCL violation is triggered if a sample has any fecal coliform or *E. coli*-positive repeat samples or has a fecal coliform or *E. coli*-positive routine sample followed by a total coliform-positive repeat sample.

As part of the required review by EPA Administrators every six years, the rule was revised in 2003. The Microbial and Disinfection Byproducts Federal Advisory Committee agreed, in principle, that valid health concerns from distribution systems exist and that EPA should review available data and research on distribution system risks and work with stakeholders. As part of these efforts, the EPA and AWWA developed a series of 11 TCR Issue Papers. A TCR update was signed by the EPA on June 17, 2010 and the EPA is submitting it to the Federal Register for publication. The proposed rule update establishes an MCLG and an MCL of zero for *E. coli*, a more specific indicator of fecal contamination and potential harmful pathogens than total coliform. Under the proposed treatment technique for coliform, total coliform serves as an indicator of a potential pathway of contamination into the distribution system. A public water system that exceeds a specified frequency of total coliform occurrence must conduct an assessment to determine if any sanitary defects exist and, if found, correct them.

Impact of the Total Coliform Rule on the City's Water System

The City's water system is currently in compliance with the TCR. The City currently collects monthly samples for total coliform analysis from 95 locations in the distribution system, which means that the City currently samples more locations than required under the TCR. Additional samples are taken from the well sites to be proactive and insure the sources are free of bacteria. A few extra samples are taken in case a regular sample site cannot be used in a particular month. When the service population exceeds 96,000, the number of monthly samples will need to increase from the 95 that are currently sampled to at least 100. When the proposed 2010 TCR update comes into effect, the City should continue testing in accordance with the rule update.

Radionuclide Rule

The EPA's its final rule for radionuclides, other than radon, was issued and became effective December 8, 2003. The rule sets an MCL for combined radium-226 and radium-228, gross alpha particle radioactivity, beta photon emitter radioactivity, and uranium. The current MCL standards are combined radium of 5.0 pCi/L, gross alpha of 15.0 pCi/L (not including radon and uranium) and uranium of 30.0 μg/L. The MCL of beta photon emitters is 4 millirems (a traditional unit of radiation dose equivalent) per year.

Impact of Radionuclide Rule on the City's Water System

The City's water system complies with each portion of the radionuclide rule except the MCL for uranium. Concentrations of uranium that exceed the MCL have been tested in Well 10 (abandoned), and Well 23; however, the City has taken steps to avoid a violation of the Rule. Well 16 recently tested uranium concentrations near the MCL and the City is tracking the uranium concentration and is evaluating corrective measures. Well 15 recently began having uranium concentration is the low 20's and the City is watching the concentration in the event it continues to rise. Table A-3 presents the City's historical uranium concentrations.

Table A-3
Uranium Concentration in Well 23, 20B, 25 and 16

	Well 23	Well 20B	Well 25	Well 16
Sample Date	12/20/2004	11/1/2005	8/12/2005	4/25/2003
Concentration (µg /L)	40	20	17	32
Sample Date	3/14/2005	5/17/2006	10/12/2005	6/16/2010
Concentration (µg /L)	35	21	20	33
Sample Date	6/8/2005	6/16/2010	2/28/2006	-
Concentration (µg /L)	37	33	20.2	-
Sample Date	10/18/2007	-	5/17/2006	-
Concentration (µg /L)	38	-	21	-

Lead and Copper Rule

The Lead and Copper Rule was published June 7, 1991 and went into effect December 1992. The rule received minor revisions in April 2000. The purpose of the Lead/Copper Rule is to protect public health by minimizing lead and copper levels in drinking water. The rule has been relatively controversial due to the major difference between this regulation and most others, in that the water is monitored at the customer's tap instead of the treatment plant discharge point. Most lead and copper content in finished water comes from piping, soldering, fixtures and appliances within customer's premises. In order for a water system to comply with the lead/copper rule, the samples at the customers tap must not exceed the following action levels:

- Lead concentration of 0.015 mg/L based on 90th percentile level of all water samples
- Copper concentration of 1.3 mg/L based on 90th percentile level of all water samples

If the action levels are exceeded for either lead or copper, the water system is not in violation, but must collect source water samples and submit all data to the state with a treatment recommendation to reduce concentrations below the action level. Also, a public education program must be provided to customers within 60 days of the action level exceedance and must continue as long as the water system exceeds the action levels. A corrosion control treatment study must compare the effectiveness of pH and alkalinity adjustment, calcium adjustment and the addition of a phosphate- or silica-based corrosion inhibitor. After a corrosion control study is completed, the water system must develop a corrosion control program and submit it for approval to the primacy agency. Once approval of the program is received, water systems have 24 months to install and implement the treatment methods for corrosion control and 12 additional months to collect follow-up sampling.

Impact of Lead and Cooper Rule on the City's Water System

Monitoring for Lead and Copper Rule compliance was last conducted by the City during 2009 when 55 samples were collected from various locations in the City's service area. During this study, there were no action level exceedances for lead or copper. The water system is in compliance with the provisions set forth, and no corrective actions are required for corrosion control. The City currently does not have a corrosion control study or program in place.

Arsenic Rule

The Arsenic Rule was adopted in January of 2001 and became effective February 2002, with a compliance date of January 2006. The new Arsenic Rule reduced the old MCL standard of 50 µg/L to 10 µg/L. The MCLG for arsenic is zero. Consumer Confidence Reports must also be generated if any arsenic concentration exceeding 5 µg/L is observed.

Impact of Arsenic Rule on the City's System

The City is in compliance will all provisions in the Arsenic Rule. During the last round of sampling, conducted in 2009, only 6 of 11 samples had detectable levels of arsenic and all of the detectable concentrations were below 2.5 µg/L, which is below the MCL of 10 µg/L. Because the detectable samples were below 5 µg/L, the City was not required to report arsenic levels in its annual Consumer Confidence Report. The maximum concentration that has historically been seen in the City was 9 µg/L at Well 11 in 2003, still lower than the MCL.

Radon Rule

Radon is a naturally occurring radioactive gas that may be found in drinking water. Radon in drinking water increases the risk of stomach cancer, from drinking contaminated water, and lung cancer, from breathing in gas released during showers.

In 1996, SDWA required EPA to establish a new Radon Rule by August 2000. However, the EPA missed the deadline and a proposed rule is still under review. The proposed regulation has two options for radon concentration:

- Option One: States can choose to have water systems reduce radon levels to 4,000 pCi/L (picoCuries per liter, a standard unit of radiation) or lower as part of a mitigation program.
- Option Two: States choose not to develop a mitigation program and water systems must reduce radon to 300 pCi/L or develop individual mitigation programs and reduce radon levels to 4,000 pCi/L.

It is not known when the final rule will be promulgated.

Impact of Radon Rule on the City's Water System

When the final Radon rule is promulgated, the City must comply with the requirements of the rule. It is recommended that the City conduct an evaluation of the Radon Rule after promulgation to determine what will be required.

Chemical Phase Rules

Chemical contaminants have been regulated in phases, which are referred to as the Chemical Phase Rules. The chemicals regulated fall in three categories: Inorganic Chemicals (IOC), Synthetic Organic Chemicals (SOC) and Volatile Organic Chemicals (VOC). The Chemical Phase rules provide public health protection through the reduction of chronic risks from cancer, organ damage and circulatory, nervous and reproductive system disorders. The rules also help to reduce the occurrence of Methemoglobineamia, or "blue baby syndrome", by regulating nitrite and nitrate levels in water.

Phase I Rule

The Phase I Volatile Organic Chemical (VOC) Rule established MCLGs and MCLs for eight VOCs. The rule was promulgated in July 1987 and became effective January 1989. Monitoring requirements include sampling at each entry point to the distribution system. If no VOCs were detected during the initial monitoring, repeat monitoring is required every three to five years, depending on the vulnerability of the source. If VOCs are detected, quarterly samples must be analyzed. Compliance requires that VOC levels be lower than the MCLs, based on the annual average of quarterly samples.

The Phase I VOC Rule also requires monitoring of 51 additional, unregulated VOCs with monitoring required every five years. The EPA can revise the list of unregulated contaminants, thereby changing the constituents to be monitored.

Impact of Phase I Rule on the City's Water System

In the most recent round of VOC sampling, conducted during 2009, there were no water samples with detectable levels of VOCs regulated under the Phase I VOC Rule. Therefore, the City is in full compliance with provisions set forth in the Phase I Rule. The City should monitor the list of contaminants that require testing to ensure continued compliance with the rule.

Phase II and IIB Rules

The Phase II Rules apply to all public water systems. The rules were promulgated in June 1991 (32 contaminants) and July 1991 (2 contaminants), and added the categories SOC and IOC alongside the VOC category. These rules established MCLs and treatment techniques for 34 synthetic and inorganic contaminants. The rule established an MCL for nitrate and nitrite of 10 mg/L as nitrogen and 1 mg/L as nitrogen, respectively. Nitrate and nitrite are a concern because infants younger than six months who drink water containing these constituents could become seriously ill. Nitrate and nitrite can enter drinking water from runoff due to fertilizer use, leaching from septic tanks, sewage or erosion of natural deposits.

The rule also establishes an MCL of 4 mg/L for fluoride. The primary purpose of the fluoride MCL is to protect the public from fluorosis. Monitoring of fluoride concentration is required yearly for surface water sources and every three years for groundwater sources. For systems practicing fluoridation, daily monitoring of fluoride at the entrance to the distribution system is recommended. The highest fluoride concentration in the water system was 0.67 mg/L in Well 23 observed in 2002.

The Standardized Monitoring Framework (SMF) for Phase II contaminants occurs in a three-year cycle, which began in January 1993. Compliance with the Phase II MCLs is based on the average of quarterly samples. The SMF goal is to standardize, simplify and consolidate drinking water monitoring requirements across contaminant groups. The monitoring framework is divided into nine-year compliance cycles divided into 3 three-year compliance periods. The second and third compliance cycles are shown in Table A-4.

Table A-4
Compliance Cycles for Phase II Monitoring

2nd Compliance Cycle			3rd Compliance Cycle		
1st Period	2nd Period	3rd Period	1st Period	2nd Period	3rd Period
2002	2005	2008	2011	2014	2017
2003	2006	2009	2012	2015	2018
2004	2007	2010	2013	2016	2019

Impact of the Phase II Rules on the City's Water System

In the most recent round of sampling conducted during 2009, none of the samples had contaminant levels that exceeded the MCLs established in the Phase II Rules. Therefore, the City is in full compliance with the provisions set forth in the Phase II Rules.

Phase V Rule

The Phase V Rule was promulgated on July 1992 and set MCLGs and MCLs for 23 contaminants. Compliance monitoring for these contaminants follows the same SMF introduced with the Phase II Rule. Some of the Phase V contaminants were previously on the unregulated contaminants monitoring lists under other rules. To eliminate duplication, these contaminants were withdrawn from the other lists. Nickel was remanded from the Phase V Rule list in 1995.

Impact of the Phase V Rule on the City's Water System

In the most recent round of IOC and SOC sampling, conducted during 2009, none of the samples had contaminant levels that exceeded the MCLs established in the Phase V Rule. Therefore, the City is in full compliance with the Phase V Rule. The EPA announced stricter regulations in March 2010 for four (4) organic chemical compounds: tetrachloroethylene, trichloroethylene, acrylamide and epichlorohydrin. To ensure continued compliance, the City should monitor potential changes to regulations and act accordingly.

Surface Water Treatment Rule

The Surface Water Treatment Rule (SWTR), promulgated in June 1989, set MCLGs for *giardia*, viruses and *legionella*. The rule applies to all public water systems using surface water sources or groundwater sources under direct influence of surface water (GWUDI). The MCLGs for all three contaminants is zero. The rule also established treatment techniques for filtration, disinfection and turbidity performance standards. More specifically, the rule addresses:

- Criteria under which filtration is required
- Performance criteria for filtration
- Disinfection requirements for both filtered and unfiltered systems
- Monitoring requirements for all surface water supplies

Enhanced Surface Water Treatment Rule

In 1992, the EPA initiated the Enhanced Surface Water Treatment Rule (ESWTR) to provide additional microbial and disinfection controls for systems using surface water or GWUDI.

Interim Enhanced Surface Water Treatment Rule

The Interim Enhanced Surface Water Treatment Rule (IESWTR) was issued in December 1998 and provided improved control of microbial pathogens in drinking water. The rule builds on the provisions contained in SWTR and further reduced the possibility of *cryptosporidium*, *giardia* and other waterborne bacteria or viruses in finished drinking water supplies.

Long-Term 1 Enhanced Surface Water Treatment Rule

The purpose of the Long-Term 1 Enhanced Surface Water Treatment Rule is to increase protection of finished water from contamination by *cryptosporidium* and other microbial pathogens. The final rule was published in January 2001 and is intended to extend IESWTR to small systems serving less than 10,000 people.

Long-Term 2 Enhanced Surface Water Treatment Rule

The purpose of the Long-Term 2 Enhanced Surface Water Treatment Rule is to provide increased public health protection against microbial pathogens in public water systems. The rule, published in January 2006, supplements previous regulations and targets additional *cryptosporidium* treatment requirements to higher risk systems.

Impact of Enhanced Surface Water Treatment Rule on the City's System

The regulations have no direct or indirect impact on the City's water system because none of the City's water supply is obtained from surface water or GWUDI sources. The rule summary is only included for informational purposes in the event that the City considers the use of surface water or GWUDI sources in the future.