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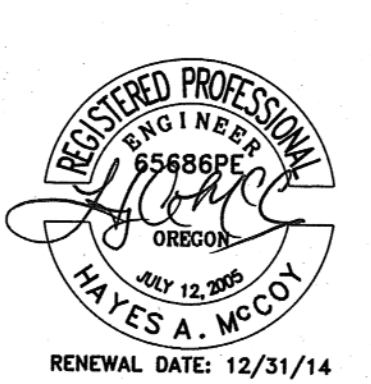
City of Madras

Water Master Plan



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EXECUTIVE SUMMARY

Executive Summary

1. Introduction

Madras is the largest city and county seat of Jefferson County (population 6,046). The municipality is served by two water suppliers, the City of Madras and the Deschutes Valley Water District (DVWD). Each supplier serves approximately half of the City's population. DVWD's water comes from three artesian wells at Opal Springs. The City of Madras' separate water system purchases all of its water from DVWD since 2008 and has approximately 900 services.

The last water master plan for the City's water system was completed in 1980 by Century West Engineering and must be updated. This report's goals are as follows:

- Evaluate the City's existing water system and determine any present deficiencies
- Estimate future water system demands
- Evaluate the capacity and the capability of the existing system to meet future needs and regulations.
- Provide recommendations for needed improvements for future and present needs.
- Discuss potential financing options to pay more needed improvements.

2. System Planning and Study Area

The City's water system is entirely surrounded by DVWD water service area. In 1993, a water service boundary was prepared between both water suppliers, but actual water development and service has not occurred according to the boundary. Development near the boundary between both suppliers has allowed the customer to choose their water service provider. An updated map representing the current service area is included in this report.

In twenty years, this report estimates the City's population to be 9,914. Over half of the City's commercial properties are served by the City's water service, but nearly all industrial lands are served by DVWD and are outside of the City's water service boundary.

Presently, the City's water system boundary encompasses 411 acres. Future growth will be limited to redevelopment and infill development. An inventory of developed and undeveloped lands reveals a maximum potential for 25% residential growth and 68% commercial growth. The future growth of the City of Madras is predicted, but the distribution between development within and outside of the water system boundary is difficult to ascertain. Assuming maximum development within the water system boundary is a conservative estimate and a reasonable basis for future planning.

This water master plan intends to serve the City for the next 20 years and should be reviewed every five years.

3. Regulatory Conditions

Congress passed the original Title XIV of the Public Health Service Act, commonly known as the Safe Drinking Water Act, in 1974, and amended it in 1986 and 1996. The Safe Drinking Water Act (SDWA) and the 1986 and 1996 amendments are federal water quality regulations affecting all

public water purveyors. In Oregon, water treatment and distribution regulations under the SDWA are promulgated by the US Environmental Protection Agency (USEPA) administered by the Oregon Health Division (OHD).

In addition to OHD, the Oregon Water Resources Department (OWRD) regulates the use of surface and groundwater in the State of Oregon. Over the years as greater demand is placed on limited water resources, OWRD has been exercising greater control over this water use.

Water regulations are divided into two categories:

- Water Treatment, Distribution, and Storage
- Water Use and Supply (Water Rights)

4. Existing Water System

The City's water system consists of the following:

- 19.7 miles of distribution piping (2" to 12" diameter)
- Two active wells for emergency and supplemental use and one inactive well
- Three tie-ins for water supply from DVWD
- 1 million gallon steel storage tank (built in 1950)
- 95 Fire Hydrants

In the past, water was primarily supplied by the City's domestic wells and a now-defunct connection to the North Unit Irrigation Canal. DVWD has supplied water to the City's system since 1950; however since 2008, has supplied all domestic water to the City. City wells are tested, maintained, and available for emergency use to supply 685 gallons per minute.

Well #2 has a sandfilter treatment system used to remove fine sediments from water pumped from the well. The masonry block building that houses the sandfilter treatment system requires repair. The sandfilter system could be removed if Well #2 was relined and fitted with a screen; however this improvement is cost-prohibitive unless Well #2 is used substantially more.

The distribution system has some older piping (2" galvanized, 4" and 6" steel piping) that is still serviceable. Newer, larger piping (8"-12") consists of PVC and Ductile Iron piping.

The three DVWD Tie-ins are located near the City's storage tank on Adams (South Tie-in), at the intersection of Kinkade and A Street (North Tie-In), and at the intersection of Lincoln and I (3rd Tie-in). Approximately 85% of the City's water supply comes from the South Tie-In. The remainder is supplied by the North Tie-In. The 3rd Tie-in has not supplied water in over five years.

5. Water Use and Projected Demand

The City's water usage is as follows:

	Volume (gallons)	
AAD	232,419,514 gallons/year OR	442 gpm(2007-2012)
ADD	636,766 gallons/day OR	442 gpm(2007-2012)
MMD	1,236,261 gallons/day OR	859 gpm(2007-2012)
MDD	1,655,592 gallons/day OR	1,150 gpm(Factor of 2.6 used with ADD)
PHD	3,183,830 gallons/day OR	2,211 gpm(Factor of 5.0 used with ADD)

In terms of gallons per capita per day (gpcd), the following values are used:

ADD	212 gpcd
MDD	551 gpcd
PHD	1,060 gpcd

The above data is based off of water sold by DVWD to the City of Madras. No water was produced by the City's wells during this time period. Maximum use occurs in July or August and minimum use generally occurs in February or March. Use during peak months in the summer are 4.3 times the volume used during winter months.

During 2012, the City sold 150,790,763 gallons. This is only 70.5% of the water purchased from DVWD. City buildings and parks are unmetered, but are estimated to account for 0.8% and 6.1% of water use, respectively. Additional water use for street cleaning accounts for 0.2% of water use. Assuming the municipal estimates are accurate, total unaccounted water equals 22.4% of water purchased from DVWD.

Of the accounted water sold by the City, 77% is for residential use and 23% is for commercial, municipal, or institutional use (collectively referred to as commercial for simplicity). Assuming growth rates as described above and the distribution of use, the overall increase in water use for the next 20 years is assumed to increase by 35%. In terms of gallons per capita per day, the following values are used for target design values:

2033	Gallons per Minute	Gallons per Capita per Day (pop. 3918)
ADD	597 gpm	286 gpcd
MDD	1,553 gpm	744 gpcd
PHD	2,985 gpm	1,430 gpcd

6. Design Criteria and Level of Service

The City's goals for level of service are designed to meet or exceed State requirements.

- Deliver water that meets or exceeds State water quality requirements
- Maintain 42 psi in water system during Maximum Day Demand (MDD)
- Maintain 20 psi residual pressure when a fire hydrant is in use
- Maximum velocity in pipes to not exceed 4.5 fps under Maximum Day Demand (MDD)
- Maximum velocity in pipes in commercial zones to not exceed 7.5 fps under fire flow conditions
- Maintain tank storage that equals the Maximum Day Demand (MDD) plus the volume required for the highest demand fire flow.
- Minimum distribution pipe size to be 8" for residential (with exceptions for 6" pipe) and 12" for commercial
- Fire hydrants to be distributed within 500 feet of all properties
- Maintain water system in a serviceable condition.

7. Financial Analysis

The City's water system draws in revenues by two methods – fees for water service and System Development Charges (SDC's). Fees for water service cover the day-to-day costs of the water system (service, personnel, maintenance, and repairs). Replacement costs of the water system are not covered. Some components of the system are beyond their service life, but still function adequately. There is a SDC water fund, but it is small and is limited to the amount of development within the water system boundary.

The City's water use fees are 50% more than DVWD, but 11% cheaper than the City of Prineville's rates. Recently, DVWD has increased their water delivery price by over 20% to the City. The City has also raised their water use rates by 4.5%.

SDC fees by the City are almost always substantially more than DVWD (the exception being a 3/4"x5/8" meter) but substantially less than the City of Prineville. Assuming complete infill development with similar development characteristics, the future SDC revenue potential is $500,000.

Most small municipalities have significant challenges to meet State requirements and to keep their water system updated. There are a number of loans and grants available for small municipalities to assist with water system improvements.

8. Analysis, Conclusions, and Recommendations

The water system was modeled and analyzed under Peak Hourly Demand (PHD). For domestic use, the system performs well. The most recent fire flow analysis and water system modeling demonstrates substandard residual pressure, excessive pipe velocities, and low flow capacity

under fire flow conditions. Most all of these deficiencies are caused by insufficient pipe diameter.

The City delivers water with good quality and has ample supply. DVWD's water supply is adequate for the City's growth over the next 20 years. Necessary water storage is sufficient for the City when combined with DVWD's storage.

Unaccounted water needs to be minimized to the state standard of 15%. Municipal water use should be metered and monitored to identify leaks in park irrigation systems and ensure accurate use. There is potential reasonable savings in this regard.

Recommended improvements in this report focus on improving fire flow in the City and service to the Madras - St. Charles Hospital.

SECTION 1 - INTRODUCTION

Section 1 – Introduction

1.1 Background Information

Madras is the county seat of Jefferson County, Oregon and was incorporated in 1910. Elevations range from 2,400 to 2,242 feet and it is located where U.S. Highways 26 and 97 intersect. Willow Creek flows intermittently though the city limits.

Madras has an arid climate and averages 9.5" of precipitation annually. In January, the average minimum and maximum temperatures are 22.1 and 41.7 degrees Fahrenheit, respectively. In July, the average minimum and maximum temperatures are 45.1 and 87.1 degrees Fahrenheit, respectively.

The 2010 U.S. census counted a population of 6,046 for the City of Madras. For further information about demographic, economic, and other characteristics, please refer to the City's "Madras Comprehensive Plan".

There are two domestic water suppliers within Madras' city limits: City of Madras Public Works and the Deschutes Valley Water District (DVWD). The City of Madras' water system has approximately900 services within the city limits.

DVWD is a supplier of domestic water to the Cities of Madras, Culver, and Metolius, as well as parts of unincorporated Jefferson County. Their water is supplied by Opal Springs and three nearby artesian wells. DVWD's water source is exceptionally pure and was estimated by the USGS to be 1,000-4,000 years old. Further studies indicate the Opal Springs aquifer is not influenced by surface water. DVWD does not filter or treat its water source because it is very pure. Occasional chlorination is necessary in DVWD's storage tanks and piping to prevent coliforms from building up.

City of Madras Public Works supplies water to approximately half of the city – the remainder being supplied by DVWD. Historically, water from the City has been supplied by City wells, the North Unit Irrigation Canal, and DVWD. Water is no longer supplied by the North Unit Irrigation Canal and the filtration plant that treated the water was demolished. The City currently has three wells (noted as #1, #2, and #3), two of which are capable to serve the City (#2 and #3). Wells #2 and #3 are a supplemental source of water for the City and only used during high demand or emergency situations. Well #1 is inactive and not connected to the City's system. The City also has a million gallon storage tank located on SE Adams Street.

Water is supplied to the City's services through three connections to DVWD's transmission lines. DVWD's water sources are more than adequate to supply peak water demand required by the City's system.

The previous approved water master plan was prepared by Century West Engineering in 1980.

1.2 Purpose of Master Plan

The purpose of this Water Master Plan is to adequately assess the existing water system and outline a plan to provide adequate water service over the next 20 years. This plan satisfies requirements by the Oregon Health Division for water master plans.

The specific goals of this water master plan are:

- Evaluate the City's existing water system and determine any present deficiencies
- Estimate future water system demands
- Evaluate the capacity and the capability of the existing system to meet future needs and regulations.
- Provide recommendations for needed improvements for future and present needs.
- Discuss potential financing options to pay for needed improvements.

This master plan includes system improvements that may be required to comply with the Environmental Protection Agency (EPA), the Oregon Health Division (OHD), and the Oregon Water Resource Department (OWRD).

Specific elements of this water master plan include:

- Study area characteristics including land use and population trends and projections
- Description of the existing water system including sources, storage, and distribution
- Existing regulations, rules, and plan requirements
- Present water usage quantities
- Projected water demands
- Evaluation of the existing water system
- Improvement alternatives and recommendations with associated costs
- Summary of recommendations
- Development of a financing program for capital improvements and on-going operation and maintenance requirements.
- Maps of the existing water distribution system and recommended improvements.

1.3 Authorization

In December, 2012, the City of Madras retained Devco Engineering, Inc. to prepare an updated Water System Master Plan that meets the requirements of OAR 333-061-0060 and the Oregon Health Division for an approved master plan.

SECTION 2 - SYSTEM PLANNING AND STUDY AREA

Section 2 – System Planning and Study Area

2.1 Planning Period

The planning period for this Water System Master Plan is 20 years, ending in 2033. A twenty year planning period is consistent with current State requirements.

Projections for future growth and demands are made with the best available information. This report recommends a cursory review of this report every five years by City staff. Amendments to the report shall be necessary if future growth and demand varies substantially with this report's projections.

2.2 Planning and Study Area

The Planning and Study Area consists of the City's Water System Service Area, which is approximately 411 acres. The City's Water Service Area is completely surrounded by the DVWD service area.

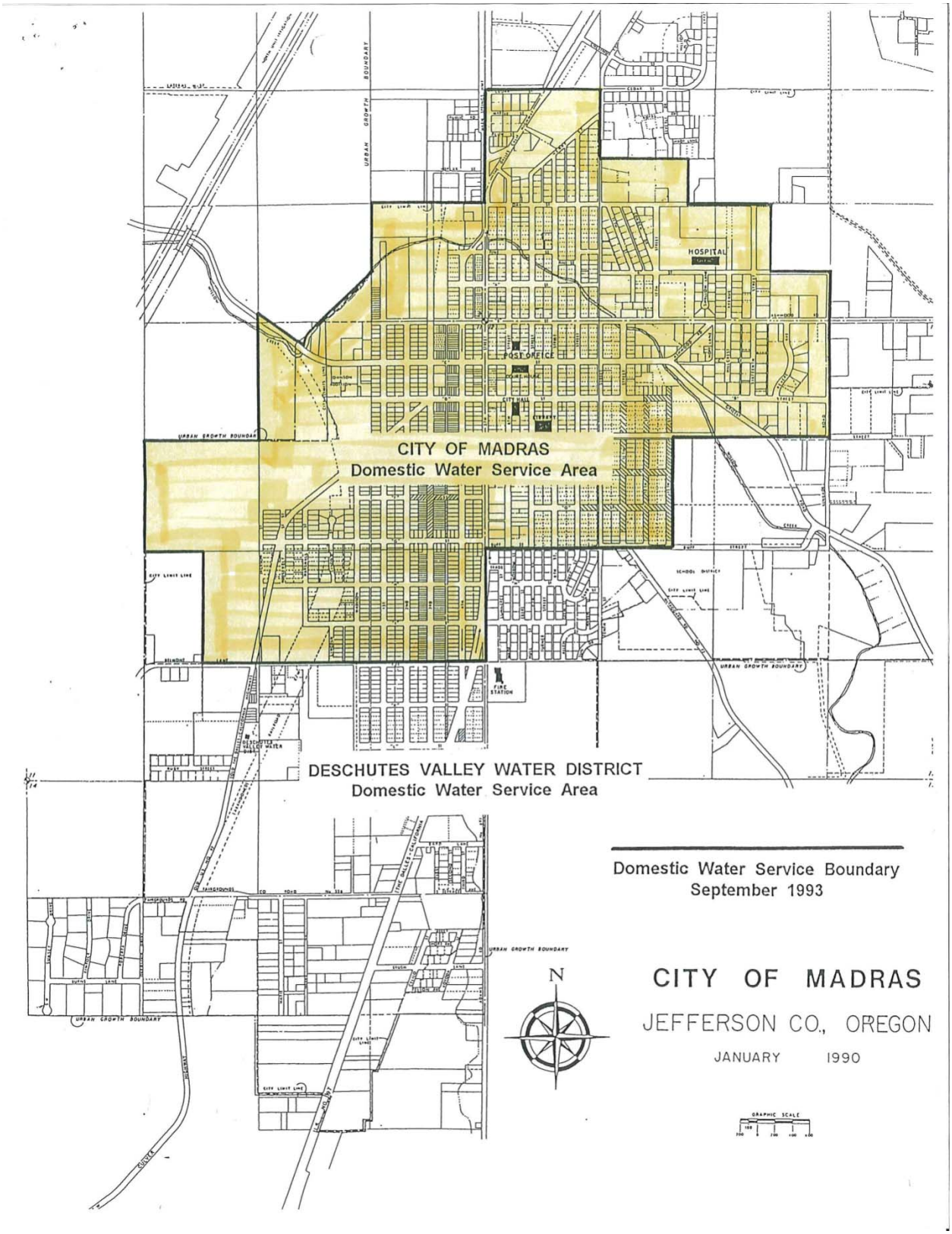
The Water System Service Area has changed over time. In 1993, the City of Madras and DVWD prepared a map delineating the boundaries between the service areas (see next sheet). This area included roughly460 acres for City water service. Over the past 20 years, the City has grown and actual service has not always been provided according to the 1993 map. Developers along the City's water service boundary generally have been able to choose between either water service provider. As part of this Water Master Plan, a new City Water Service map was prepared, which reflects the 411 acre boundary. Right-of-ways are not included in the area.

2.3 Land Use

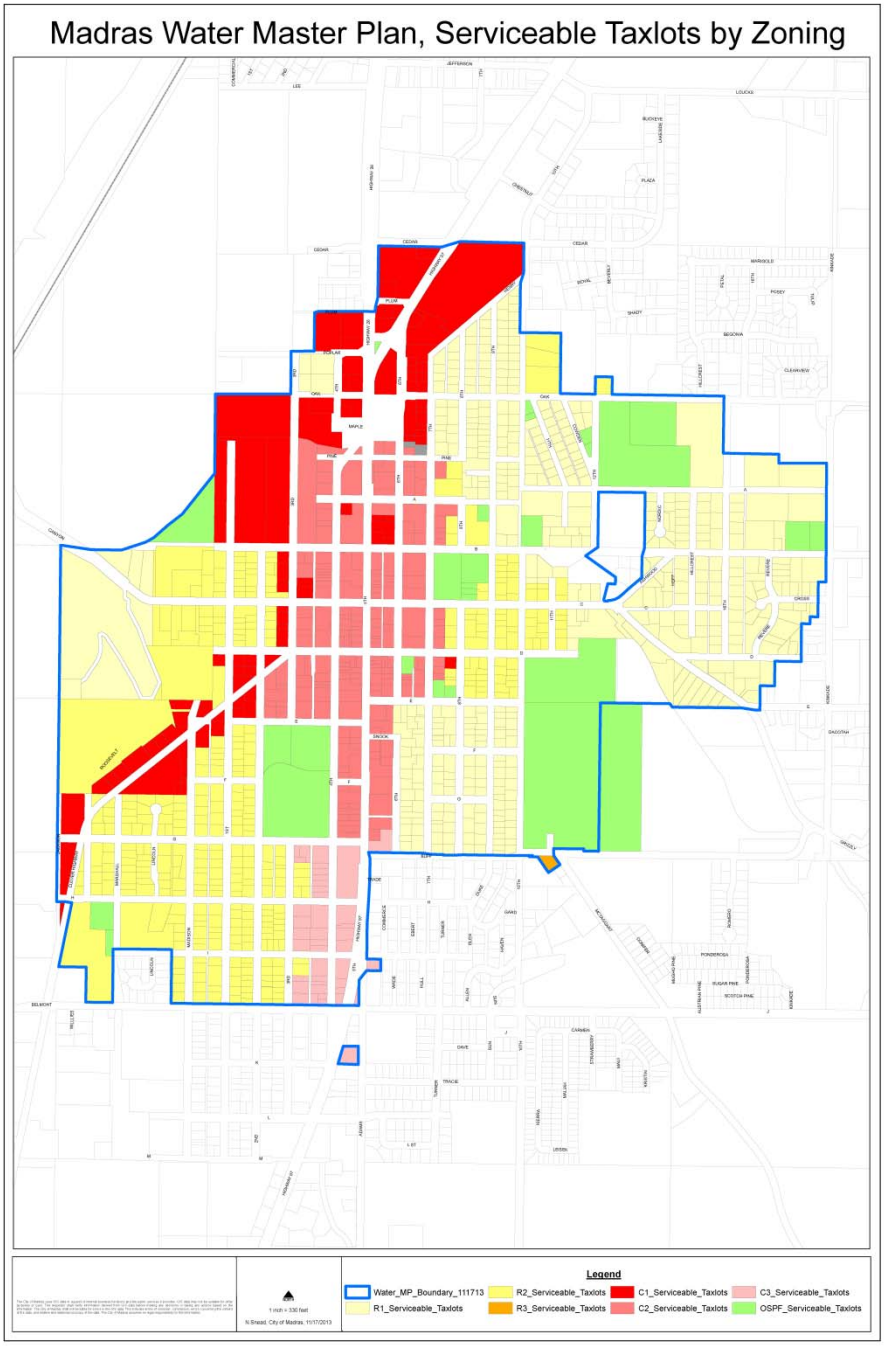
The City of Madras Water System Service Area is entirely within the City's Urban Growth Boundary (UGB). The Service Area includes residential, commercial, and institutional lands, some of which are vacant. Institutional lands are included as commercial services for simplicity and to be consistent with the City's meter designation. Future system demands are limited to infill development. The breakdown of land use for the Service Area is as follows:

	Area	Services (2012)
Residential	191 ac.	721
Commercial	187 ac.	156
Open Space/Parks	33 ac.	*

*- The City considers all meters either as residential or commercial. There is no distinction for meters for parks. City properties are not metered.



Previous water service boundary – 1993



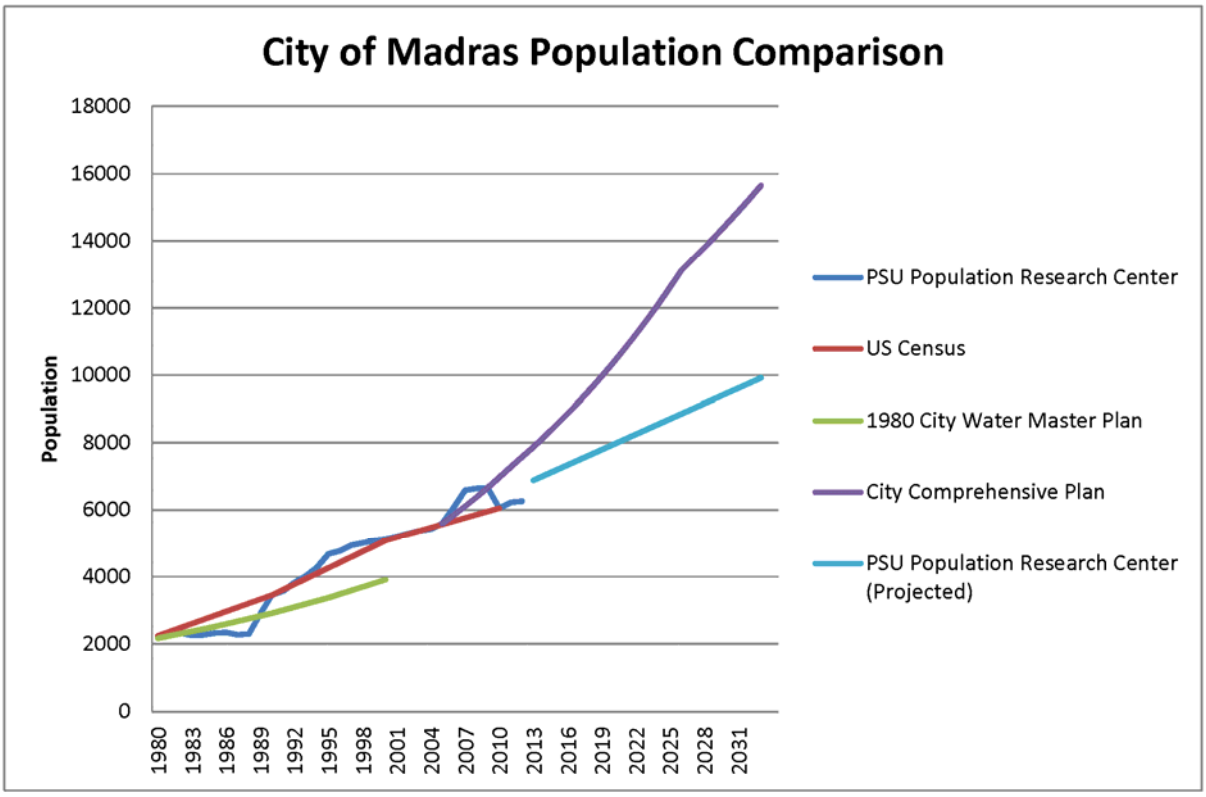
Present Water Service Boundary

2.4 Population

The 2010 U.S. Census reported a population of 6,046 people for the City of Madras and the Portland State University Population Research Centerestimated a 2012 population of 6,260. In 2003, the revised Madras Comprehensive Plan estimated a city population of 7,574 in 2012. The following is a table summarizing historical and projected population data.

City of Madras Population Comparison

Year	PSU Population Research Center	US Census	PSU Population Research Center (Projected)	1980 City Water Master Plan	City Comprehensive Plan
1980	2235	2235		2163	
1981	2290				
1982	2320				
1983	2250				
1984	2260				
1985	2320			2508	
1986	2340				
1987	2270				
1988	2295				
1989	2895				
1990	3443	3443		2906	
1991	3570				
1992	3820				
1993	4020				
1994	4290				
1995	4675			3370	
1996	4770				
1997	4940				
1998	5005				
1999	5080				
2000	5130	5078		3907	
2001	5200				
2002	5290				
2003	5370				
2004	5430				
2005	5600				5592
2006	6070				5844
2007	6585				6107
2008	6640				6381
2009	6650				6669
2010	6050	6046			6969
2011	6225				7282
2012	6260				7574
2013			6882.81		7876
2014			7034.40		8192
2015			7186.00		8519
2016			7337.59		8860
2017			7489.19		9214
2018			7640.78		9583
2019			7792.38		9966
2020			7943.98		10365
2021			8095.57		10779
2022			8247.17		11211
2023			8398.76		11659
2024			8550.36		12125
2025			8701.95		12610
2026			8853.55		13115
2027			9005.14		13451
2028			9156.74		13795
2029			9308.34		14148
2030			9459.93		14510
2031			9611.53		14882
2032			9763.12		15263
2033			9914.72		15653



The Water Master Plan is intended to serve a 20-year period. In 2033, the City's Comprehensive Plan estimates a population of 15,653. A comparison from 2005-2012 indicates the Comprehensive Plan has overestimated population substantially. Projecting the PSU Population Research Center data estimates a City population of 9,914. This will be the projected population used for this report.

The 2010 Census determined the average population per household was 2.69 persons. An inventory of residential meter services estimates a total of 1,165 households served within the water service boundary. This calculates to a water service population of 3,134 people, which is 50% of the 2012 PSU Population Research Estimate of 6,260 people.

The 2033 estimate of 9,914 people is a population 58% increase. Using this factor can estimate the 2033 water service boundary population, which calculates to 4,963. However, future growth within the water system boundary will be limited to redevelopment and infill growth. An inventory of properties within water system boundary reveals a number of properties that can still be developed.

Residential	Commercial	
Developed	154 ac. (80%)	112 ac. (60%)
Undeveloped	38 ac. (20%)	75 ac. (40%)

Assuming complete development of residential and commercial areas would assume a growth of 25% for residential and 68% for commercial. These increases are what will be used for modeling the water system over the next 20 years.

SECTION 3 - REGULATORY CONDITIONS

Section 3 – Regulatory Conditions

3.1 Responsibilities as a Water Supplier

Per OAR 333-061-0025, water suppliers are responsible for taking all reasonable precautions to assure the water delivered to water users does not exceed maximum contaminant levels, to assure that water system facilities are free of public health hazards, and to assure that water system operation and maintenance are performed as required by these rules. This includes the following:

- Routinely collect and submit water samples for laboratory analyses at the frequencies and sampling points prescribed by OAR 333-061-0036;
- Take immediate corrective action when the results of the analyses or measurements indicate that maximum contaminant levels have been exceeded and report the results of these analyses as prescribed by OAR 333-061-0040;
- Continue to report as prescribed by OAR 333-061-0040, the results of analyses or measurements which indicate that maximum contaminant levels have not been exceeded;
- Notify all customers of the system, as well as the general public in the service area, when the maximum contaminant levels have been exceeded;
- Notify all customers served by the system when the reporting requirements are not being met, when public health hazards are found to exist in the system, or when the operation of the system is subject to a permit or a variance;
- Maintain monitoring and operating records and make these records available for review when the system is inspected;
- Maintain a pressure of at least 20 pounds per square inch (psi) at all service connections at all times;
- Follow-up on complaints relating to water quality from users and maintain records and reports on actions undertaken;
- Conduct an active program for systematically identifying and controlling cross connections;
- Submit, to the Department, plans prepared by a professional engineer registered in the State of Oregon for review and approval before undertaking the construction of new water systems or major modifications to existing water systems, unless exempted from the requirement;
- Assure the water system is in compliance with OAR 333-061-0205 relating to certification of water system operators;

3.2 Regulating Agencies

Water use regulations considered include the Safe Drinking Water Act (SDWA) and amendments as administered by the Oregon Health Authority (OHA) under OAR 333, as well as water rights and water use regulations administered by the Oregon Water Resources Department (OWRD). A brief overview of regulator considerations and their applicability to the City is presented as follows.

The following are a brief summary of the regulatory requirements and standards which form the basis of the facility planning effort. The requirements under Federal and State water treatment

regulations are summarized first, followed by a discussion of issues relating to the water system design standards proposed for adoption by the City.

1. Water Treatment and Distribution Regulations and Standards

Congress passed the original Title XIV of the Public Health Service Act, commonly known as the Safe Drinking Water Act (SDWA), in 1974, and amended it in 1986 and 1996. The SDWA and the 1986 and 1996 amendments are federal water quality regulations affecting all public water purveyors. Regulations under the SDWA are promulgated by the US Environmental Protection Agency (USEPA) and administered by the Oregon Health Division (OHA). Some of the general applicable requirements of the SDWA amendments are considered in order to reduce the possibility that implementation of the water master plan will be in conflict with any known or upcoming provisions of the act. However, this does not include all provisions of requirements of the SWDA or OHA, but is limited to those items which are most applicable to the City's current system or which must be considered in the evaluation of alternatives.

The Oregon Health Authority, Drinking Water Program (OHA) is the primary regulating authority for public drinking water systems. The requirements of the Federal Safe Drinking Water Act and amendments are implemented by Oregon under the Oregon Drinking Water Quality Act of 1981 (ORS 448 as amended). The State of Oregon, through OHA, has exercised primary responsibility for the administration of the drinking water programs in the State, and arrangement called Primacy. The Oregon Drinking Water Quality Act is regulated by the administrative rules outlined under OAR 333-61, Public Drinking Water Systems. In practice, the Oregon Drinking Water Standards match the national standards established under the Safe Drinking Water Act. OHA, under the Primacy Agreement with the USEPA, has up to two years to adopt each federal rule after it is finalized.

As shown in Section 3.1, OAR 333-61 outlines the responsibilities of the water suppliers, maximum contaminant levels and treatment requirements, sampling reporting and public notice requirements, operation and maintenance requirements, and cross connection/backflow standards. It also contains the minimum construction standards and plan review requirements for construction of new public water systems and to major additions or modifications to existing public water systems (OAR 333-61-050 & 060). OAR 333-61-060 also outlines the minimum requirements for water system plans adopted by the community.

The above is a brief overview of some of the applicable current and future drinking water quality standards and other applicable regulatory requirements. This overview is for reference only and does not include all requirements. Future standards described are still under development and are subject to change.

2. Drinking Water Contaminants

Drinking water contaminants are any substances present in drinking water which are known to adversely impact human health. Drinking water contaminants can be grouped into five general categories as follows:

- *Microbial Contaminants* – such as viruses, bacteria, and parasites which can come from sewage treatment plants, septic systems, agricultural, and livestock operations, and wildlife. It also includes turbidity.
- *Disinfectants and disinfection byproducts* – chemical disinfectants used in water treatment to kill harmful microbes, and the chemical byproducts formed from the reaction of disinfection treatment chemicals with natural substances in the water.
- *Inorganic Chemicals* – salts or metals, which can be naturally occurring or can result from urban stormwater runoff, industrial, or domestic wastewater discharges, oil and gas production, mining, or farming. Also includes lead and copper leached into the water from household plumbing and fixtures.
- *Organic Chemicals* – pesticides and herbicides may come from a variety of sources, such as agriculture, urban stormwater runoff, and residential uses. Also includes synthetic and volatile chemicals which are used in industrial processes and petroleum production and can also come from gas stations, urban stormwater runoff, and septic systems.
- *Radiological Contaminants* – which can be naturally occurring or result from oil and gas production and mining operations.

Every drinking water system is vulnerable to microbial or chemical contaminants of one type or another from a variety of sources. Disease-causing microorganisms (bacteria, viruses, protozoa) can be present in surface water (lakes and streams) or from groundwater (wells or springs) from human or animal feces. Microorganisms can also enter the water system through pipe breaks or cross connections. Organic chemicals (industrial solvents, pesticides) are generally man-made and can enter drinking water supplies as a consequence of chemical production, storage, use, or disposal in the water source area. Inorganic chemicals can be introduced by human activities (nitrate from fertilizer) but more often result from natural occurrence in rocks, soils, and mineral deposits (radon, arsenic). Drinking water treatment which is essential to remove microbes and chemicals can also add or form contaminants in drinking water, such as disinfectant chemicals themselves, byproducts of disinfectants with other materials in the water, and treatment chemicals used in filtering water. Finally, water storage tanks, pipes, and household plumbing that are in direct contact with water can contribute contaminants from either the material used in the tanks and pipes or from internal coatings used to protect the materials from contact with the water (lead and copper, organics)

There are now national drinking water quality standards for over 91 different contaminants. Many of the provisions of the drinking water standards apply to the water system regardless of whether it has a surface water source or a groundwater source. However, a number of current and anticipated future requirements are more specifically related to the type of water source utilized. For an overview of other current requirements common to all water systems, consult the OHAwebsite at http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater.

3. Groundwater

Historically, the majority of the drinking water quality standards did not specifically address groundwater, since groundwater was viewed as less susceptible to some types of contamination than surface water. However, groundwater quality and treatment has come under increased scrutiny as the regulatory agencies have developed a greater understanding of the potential for contamination. Once a groundwater aquifer is contaminated, it is far less practical to clean up than a surface water source.

a. Groundwater Disinfection

On October 11, 2006, the USEPA finalized the Ground Water Rule (GWR). The rule targets utilities that provide water from underground sources and required greater vigilance for potential contamination by disease-causing microorganisms. This rule took effect on December 1, 2009. In Appendix B-1 is an article from the Pipeline newsletter that highlights requirements of this rule

4. Surface Water

Regulations for surface water treatment are not applicable because the City of Madras either purchases water from the Deschutes Valley Water District or pumps groundwater from their own wells.

5. Consumer Confidence Reports

On August 19, 1998, the USEPA published the final rule requiring every community water system to prepare and provide customers an annual consumer confidence report (CCR). This rule was mandated by the 1996 amendments to the Safe Drinking Water Act and became effective as of September 18, 1998. A CCR is a report card for customers on the quality of water delivered by the water system.

Community water systems must prepare an annual consumer confidence report on source water and the levels of contaminants found in drinking water. The report must be mailed to all customers; however the Governor may allow a system serving fewer than 10,000 people to publish the report in a local newspaper rather than mailing it. Governors may allow systems serving fewer than 500 to notify customers that a report is available.The most recently issued Consumer Confidence Report issued by the City is included in Appendix B-2.

Section 3.3 City Regulations

Current City water system development standards are found in the *Public Improvement Design & Construction Standards* (Adopted by Ordinance No. 848 on December 11, 2012). Refer to this document for the most current standards. The City's policy for administering their domestic water system is found under Ordinance No. 484. Copies of these can be found in Appendices B-3 and B-4.

SECTION 4 - EXISTING WATER SYSTEM

Section 4 – Existing Water System

4.1 Background

The City of Madras was incorporated in 1910. Domestic water supply for the City has been provided by wells, DVWD, and the North Unit Irrigation District in the past. Most of the distribution system was originally constructed in 1930 and many of these pipes have been replaced at least once. The City has three wells, of which only two are operational.

4.2 Water Sources

Deschutes Valley Water District Supply

DVWD is the primary source of water to the City of Madras via three tie-ins:

- City Reservoir on Adams Street (South Tie-In)
- Intersection of Kinkade and A Street (North Tie-In)
- Intersection of Lincoln and I (3rd Tie In)

The City of Madras has been receiving water from DVWD since 1950. DVWD's water originates from Opal Springs and three artesian wells which produce 121,000 gpm. Their current water rights for the Opal Springs area allows them to pump 11,539 gpm, which exceeds the combined capacity of all pumps operated by DVWD (7,750 gpm). The current DVWD water system master plan states DVWD intends to increase their water rights by 8,976 gpm by 2020 for future population growth.

Between 2006-2012,the distribution of water supplied to the City is as follows:

South Tie-in:	86%
North Tie-in:	14%
Well #3:	~0% (Minimal use between 2006-08, no use since 2008)
Well #2 & 3rd Tie-in:	0% (No use reported)

During months where irrigation is used (May through October), the distribution of supply does not vary much:

South Tie-in:	84%
North Tie-in:	16%
Well #3:	~0% (Minimal use between 2006-08, no use since 2008)
Well #2 & 3rd Tie-in:	0% (No use reported)

As shown, the primary water supply to the City is through the South Tie-In. The North Tie-in supplies supplemental water, but limits water pressure to 45psi with a pressure reducing valve. Increasing the pressure to 50-60psi will cause leaks within the City's pipes.

The most recent purchase agreement between the City and DVWD was approved in May, 2013 (See Appendix A-4)

Well #1

Well #1 was drilled in 1910 and is no longer operationalnor connected to the water system. It is located near the intersection of 7th and Jefferson Streets. This well is not connected to the City's water distribution system, but has an 8" casing installed to a depth of 392 feet. In 1953, the static water level is at 343 feet below ground surface and a drawdown of 37 feet was observed at a pumping rate of 150 gpm. The Water Right for this well was registered with the State in 1958 for 150 gpm(See Appendix A-1).

Well #2

Well #2 was drilled in 1966 and is connected to the water distribution system. It is also located outside the City limits near the intersection of 7th and Jefferson Streets. The well has 12" and 16" casings installed throughout with perforations from 424 to 400 feet depth. The total depth of Well #2 is 800 feet. At the time it was drilled, the static water level was 326 feet below ground surface. Drawdowns of 47, 38, and 27 feet were observed at pumping rates of 470, 345, and 218 gpm when the well was tested in 1966.

Well #2 discharges through a 6" steel pipe to a sandfilter treatment system. After treatment, the water is discharged through a 5" pipe to an 8" steel transmission line and then into the City's distribution system.

Well #2 is used by the City for emergency water supply, but has not supplied water to the City in over eight years. Public Works staff tests and operates regularly to ensure it can be used as needed. The Water Right for this well was registered with the State in 1977 for 386 gpm (see Appendix A-2).

Well #2 has a concrete block well house which houses a Berkley model well 100 hp well pump. Pressure at the well-head is approximately 100 psi and has a discharge rate of 385 gpm under normal flow conditions. Well #2 is controlled manually by the hand position of the selector switch.

Well #2 is equipped with a sandfilter filtration system in a masonry block building that requires repair.

Well #3

Well #3 was drilled in 1972 to a depth of 477 feet and has 12" and 16" casings installed with perforations from 404 to 408 feet, and 421 to 471 feet. The static water level for the well is 216 feet below ground surface. The well is located west of the City's Public Works buildings near the intersection of 1st and B Streets. Water rights for this well were registered with the State in 1979 for 404 gpm under Certificate G-5547(See Appendix A-3).

Well #3 has a concrete block well house and a Berkley 75hp well pump that can deliver 300 gpm into the water system at 100 psi. This well automatically turns on if the pressure in the City's water distribution system drops below 88 psi and turns off once the pressure reaches 92 psi. Meter readings for Well #3 are read regularly and reported to the Oregon Water Resource Department. The well last supplied water to July, 2008.

4.3 Current Water Storage

The City of Madras has a 1 million gallon welded steel storage tank that was installed in 1950 on Adams Street. In 1979, there was a blowout 25 feet above ground level that was sealed. In 2009, the storage tank was cleaned and inspected. This storage tank is supplied by a DVWD tie-in and gravity feeds the City's distribution system. The height of the tank is 40 feet tall, but a transducer senses pressure and maintains the storage in the tank to 32.5 feet.

Deschutes Valley Water District also has numerous storage tanks that can provide emergency water supply to the City of Madras. The combined capacity of the DVWD's storage 16,171,000 gallons, of which 100,000 gallons is below the City's elevation. Combining DVWD's storage capacity and the City's equates to 3,367 gallons of storage per water service.

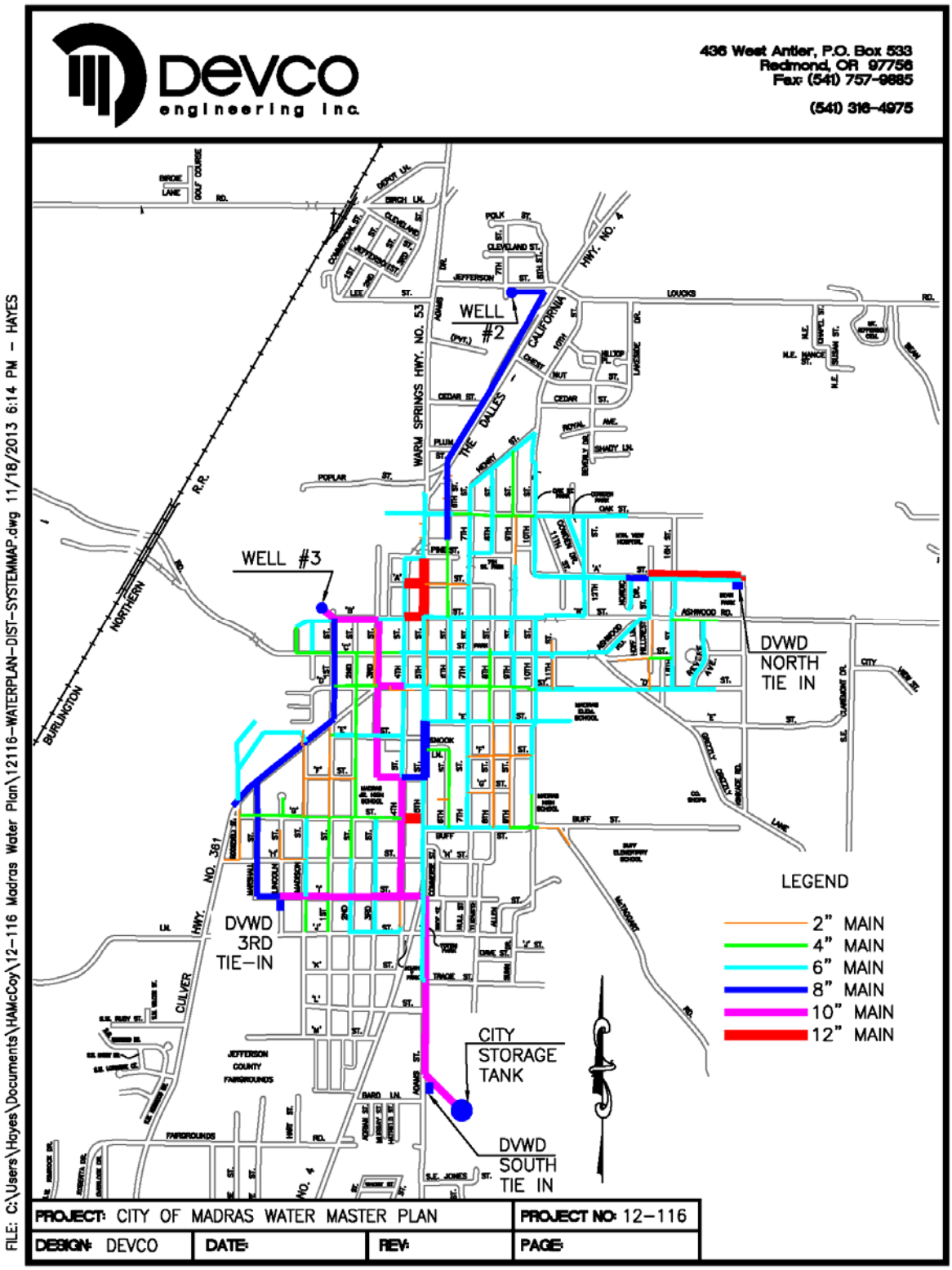
4.4 Current Distribution System

The City of Madras owns nearly 20 miles of water main ranging from 2" to 12" diameter as summarized below:

Size	Length	Material (Generally)
2"	13,962'	Galvanized
4"	16,937'	Steel
6"	50,729'	Steel or PVC
8"	10,442'	Steel or PVC
10"	9,394'	PVC or Ductile Iron
12"	2,684'	PVC or Ductile Iron
TOTAL	104,148'	

4.5 Fire Hydrants

The City also owns and maintains 95 fire hydrants, eleven of which are not equipped with a steamer fitting. Jefferson County Fire District #1 tests the fire flow of fire hydrants within their district generally on an annual basis.


DEVCO
engineering inc.
436 West Antler, P.O. Box 533
Redmond, OR 97756
Fax: (541) 757-9885
(541) 316-4975
WELL #2
WELL #3
DVWD NORTH TIE IN
DVWD 3RD TIE-IN
CITY STORAGE TANK
DVWD SOUTH TIE IN
LEGEND
2" MAIN
4" MAIN
6" MAIN
8" MAIN
10" MAIN
12" MAIN
PROJECT: CITY OF MADRAS WATER MASTER PLAN
PROJECT NO: 12-116
DESIGN: DEVCO
DATE:
REV:
PAGE:
FILE: C:\Users\Hayes\Documents\HAMcCoy\12-116 Madras Water Plan\12116-WATERPLAN-DIST-SYSTEMMAP.dwg 11/18/2013 6:14 PM - HAYES

SECTION 5 - WATER USE AND PROJECTED DEMAND

Section 5 – Water Use and Projected Demand

5.1 Description and Definitions

Water demand is the quantity of water delivered to the system over a period of time to meet the needs of consumers and to supply the needs for firefighting. Virtually all water systems have some amount of leakage in the system that cannot be economically removed and total demand includes some leakage. Demand varies seasonally with the lowest usage in winter months and the highest usage during the summer months. Variations in demand also occur with respect to time of day with higher usage occurring during the morning and early evening periods and lower usage during night hours.

Water demand is described below in the following terminology:

- *Average Annual Demand* (AAD) – The total volume of water delivered to the system in a full year expressed in gallons. When demand fluctuates up and down over several years, an average is used.
- *Average Daily Demand* (ADD) – The total volume of water delivered to the system over a year divided by 365 days. The average use in a single day expressed in gallons per day.
- *Maximum Daily Demand* (MMD) - The gallons per day average during the month with the highest water demand. The highest monthly usage typically occurs during the summer months.
- *Maximum Day Demand* (MDD) – The largest volume of water delivered to the system in a single day expressed in gallons per day. The water supply, treatment plant, and transmission lines should be designed to handle the maximum day demand. The value is not measurable, but is estimated with a factor of 2.6.
- *Peak Hourly Demand* (PHD) –The maximum volume of water delivered to the system in a single hour expressed in gallons per day. Distribution systems should be designed to adequately handle the peak hourly demand. During this peak usage, storage reservoirs supply the demand in excess of the maximum day demand. This value is not measurable, but is estimated with a factor of 5.0.

Demands described above are expressed in gallons per day (gpd). The demands can be divided by the population served to determine a demand per person per day or demand per capita per day which is expressed in gallons per capita per day (gpcd). Per capita demands can be multiplied by future population projections to determine future water demands.

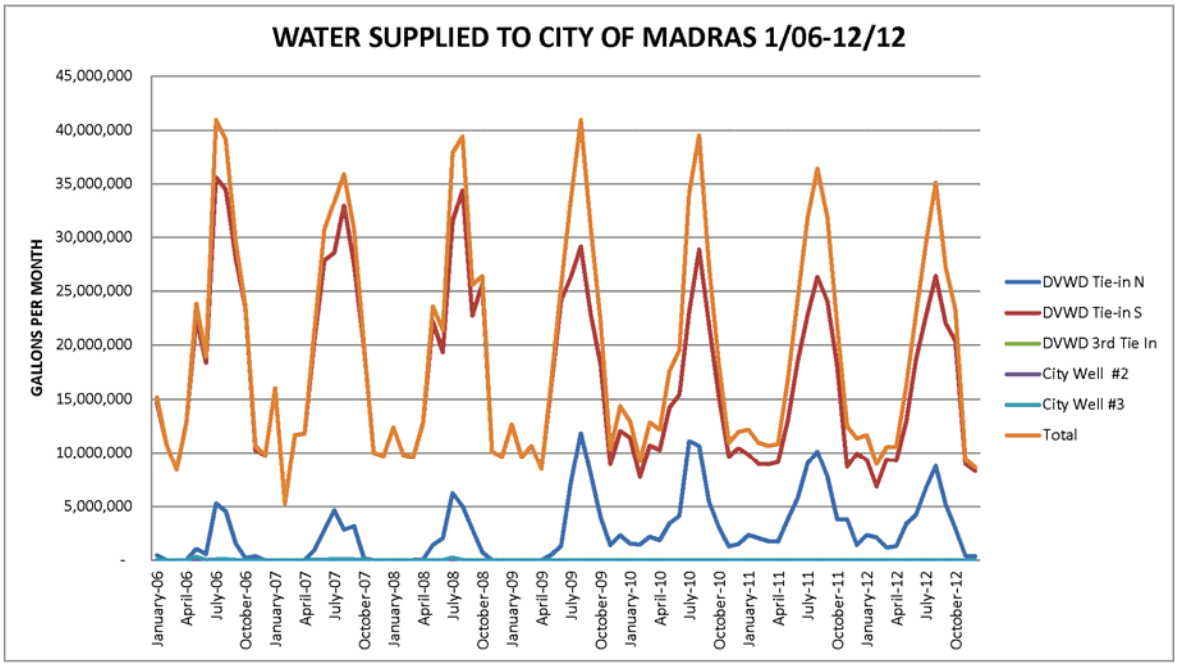
Section 5.2 Current Water Demand

Water Supply & Consumption

The analysis of water supply consumption is based on DVWD billings to the City of Madras and City well records beginning in January 2006 and ending in December 2012. Also available are City billing records from 2009-2012.The billings and well records allow for the calculation of unaccounted water (water loss) when compared with billings by the City of Madras to city residents. Water, in the City's water system, is consumed by residential, commercial, and municipal users. All known connections are metered and meter services are read once per

month. Water use by the City is not recorded. As of December 2012, there are a total of 877 connections.

The following graph and tables show the month by month water delivered by DVWD, produced in the City's wells, and average annual demand from 2006 to 2012.



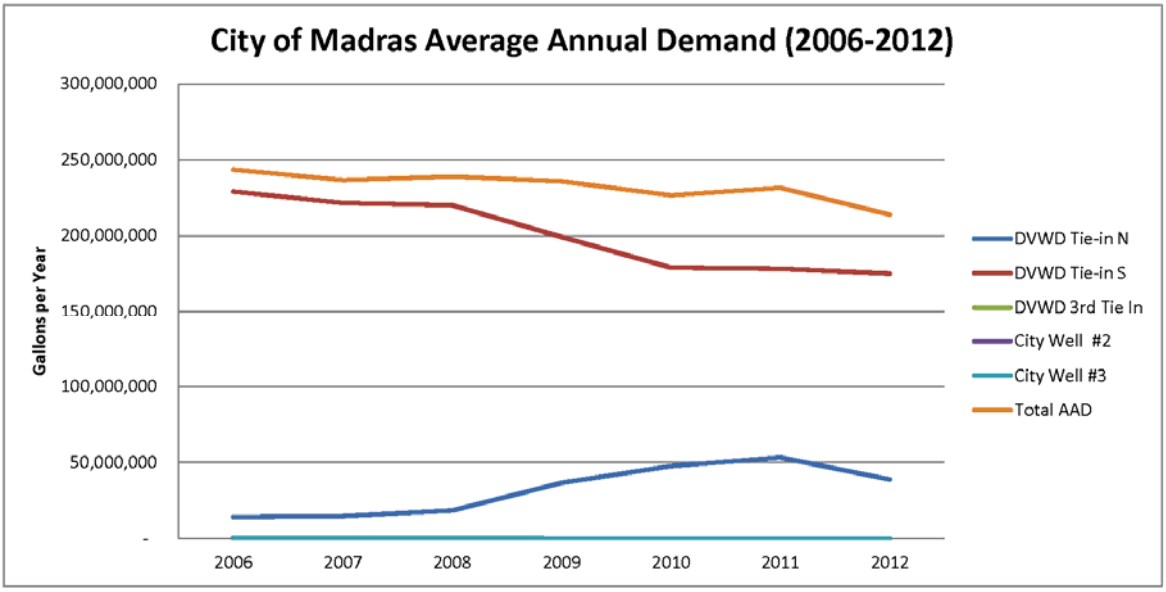
City of Madras Water Supply (January, 2006 to December 2012) in Gallons

Month	DVWD Tie-in N	DVWD Tie-in S	DVWD 3rd Tie In	City Well #2	City Well #3	Total	
January-06	472,767	14,702,164	-	-	-	15,174,931	
February-06	2,244	10,768,920	-	-	-	10,771,164	
March-06	2,244	8,399,847	-	-	-	8,402,092	*<Min.*
April-06	14,213	12,806,607	-	-	-	12,820,820	
May-06	1,045,773	22,464,673	-	-	320,000	23,830,447	
June-06	555,801	18,375,835	-	-	-	18,931,636	
July-06	5,261,032	35,609,398	-	-	80,000	40,950,430	*<Max.*
August-06	4,515,227	34,488,820	-	-	90,000	39,094,047	
September-06	1,552,203	28,019,689	-	-	10,000	29,581,891	
October-06	196,737	23,404,972	-	-	-	23,601,709	
November-06	371,781	10,258,002	-	-	-	10,629,783	
December-06	1,496	9,777,755	-	-	-	9,779,251	
January-07	-	16,006,762	-	-	-	16,006,762	
February-07	1,496	5,259,536	-	-	-	5,261,032	*<Min.*
March-07	3,665	11,653,863	-	-	-	11,657,528	
April-07	11,969	11,813,197	-	-	-	11,825,166	
May-07	952,267	20,534,706	-	-	40,000	21,526,973	
June-07	2,802,941	27,834,172	-	-	20,000	30,657,114	
July-07	4,623,694	28,533,599	-	-	130,000	33,287,292	
August-07	2,824,635	32,977,012	-	-	90,000	35,891,647	*<Max.*
September-07	3,169,486	27,442,194	-	-	80,000	30,691,680	
October-07	172,799	19,799,373	-	-	40,000	20,012,173	
November-07	3,740	10,009,650	-	-	-	10,013,390	
December-07	2,992	9,721,651	-	-	20,000	9,744,643	
January-08	748	12,356,281	-	-	-	12,357,029	
February-08	2,244	9,796,456	-	-	-	9,798,700	
March-08	8,229	9,578,025	-	-	-	9,586,254	*<Min.*
April-08	65,080	12,812,591	-	-	-	12,877,671	
May-08	1,410,073	22,169,942	-	-	-	23,580,015	
June-08	2,036,939	19,344,559	-	-	-	21,381,498	
July-08	6,217,787	31,438,275	-	-	240,000	37,896,062	
August-08	4,993,978	34,401,299	-	-	-	39,395,277	*<Max.*
September-08	2,863,533	22,725,743	-	-	-	25,589,276	
October-08	742,065	25,634,907	-	-	-	26,376,972	
November-08	5,236	10,138,314	-	-	-	10,143,551	
December-08	1,496	9,630,389	-	-	-	9,631,885	
January-09	3,740	12,643,532	-	-	-	12,647,272	
February-09	2,244	9,589,994	-	-	-	9,592,238	
March-09	1,496	10,666,437	-	-	-	10,667,933	
April-09	11,969	8,454,455	-	-	-	8,466,424	*<Min.*
May-09	483,988	16,109,993	-	-	-	16,593,981	
June-09	1,324,048	24,135,068	-	-	-	25,459,115	
July-09	7,235,134	26,319,372	-	-	-	33,554,507	
August-09	11,842,371	29,111,841	-	-	-	40,954,212	*<Max.*
September-09	8,040,036	22,943,425	-	-	-	30,983,461	
October-09	3,998,324	18,216,500	-	-	-	22,214,825	
November-09	1,386,136	8,941,435	-	-	-	10,327,571	
December-09	2,288,283	12,052,573	-	-	-	14,340,856	
January-10	1,549,958	11,418,975	-	-	-	12,968,934	
February-10	1,445,232	7,749,792	-	-	-	9,195,024	*<Min.*

City of Madras Water Supply (January, 2006 to December 2012) in Gallons

Month	DVWD Tie-in N	DVWD Tie-in S	DVWD 3rd Tie In	City Well #2	City Well #3	Total	
March-10	2,164,855	10,688,131	-	-	-	12,852,986	
April-10	1,868,628	10,281,192	-	-	-	12,149,819	
May-10	3,417,090	14,186,758	-	-	-	17,603,848	
June-10	4,112,776	15,403,835	-	-	-	19,516,610	
July-10	11,110,779	23,069,097	-	-	-	34,179,876	
August-10	10,658,957	28,848,527	-	-	-	39,507,484	*<Max.*
September-10	5,451,784	21,985,174	-	-	-	27,436,958	
October-10	3,046,057	15,218,318	-	-	-	18,264,376	
November-10	1,277,668	9,665,547	-	-	-	10,943,216	
December-10	1,502,831	10,467,456	-	-	-	11,970,287	
January-11	2,324,938	9,845,827	-	-	-	12,170,765	
February-11	2,051,152	8,924,230	-	-	-	10,975,382	
March-11	1,763,153	8,898,048	-	-	-	10,661,201	*<Min.*
April-11	1,714,529	9,120,219	-	-	-	10,834,748	
May-11	3,805,328	13,073,660	-	-	-	16,878,988	
June-11	5,759,981	18,494,775	-	-	-	24,254,756	
July-11	9,010,256	22,808,776	-	-	-	31,819,032	
August-11	10,121,857	26,307,403	-	-	-	36,429,261	*<Max.*
September-11	7,762,509	24,062,507	-	-	-	31,825,016	
October-11	3,812,808	18,078,859	-	-	-	21,891,667	
November-11	3,812,808	8,669,145	-	-	-	12,481,953	
December-11	1,415,310	9,938,585	-	-	-	11,353,895	
January-12	2,333,166	9,330,421	-	-	-	11,663,587	
February-12	2,105,011	6,849,141	-	-	-	8,954,152	
March-12	1,163,965	9,364,083	-	-	-	10,528,048	
April-12	1,299,362	9,266,837	-	-	-	10,566,199	
May-12	3,366,223	12,907,593	-	-	-	16,273,816	
June-12	4,192,069	18,675,803	-	-	-	22,867,872	
July-12	6,706,263	22,704,049	-	-	-	29,410,313	
August-12	8,743,950	26,396,421	-	-	-	35,140,371	*<Max.*
September-12	5,186,975	22,009,111	-	-	-	27,196,086	
October-12	2,909,912	20,351,434	-	-	-	23,261,346	
November-12	419,656	8,949,664	-	-	-	9,369,319	
December-12	375,521	8,263,702	-	-	-	8,639,223	*<Min.*

	DVWD Tie-in N	DVWD Tie-in S	DVWD 3rd Tie In	City Well #2	City Well #3	Total AAD	ADD
2006	13,991,517	229,076,683	-	-	500,000	243,568,200	667,310
2007	14,569,685	221,585,715	-	-	500,000	236,655,400	648,371
2008	18,347,409	220,026,780	-	-	500,000	238,874,189	652,662
2009	36,617,769	199,184,626	-	-	-	235,802,395	646,034
2010	47,606,616	178,982,802	-	-	-	226,589,418	620,793
2011	53,354,628	178,222,036	-	-	-	231,576,664	634,457
2012	38,802,074	175,068,260	-	-	-	213,870,333	584,345
AVERAGES	31,898,528	200,306,700			214,286	232,419,514	636,766



As shown in the above table, the annual consumption ranges approximately from 214 to 245 million gallons per year. This is equivalent to 584 to 667 thousand gallons per day (average).

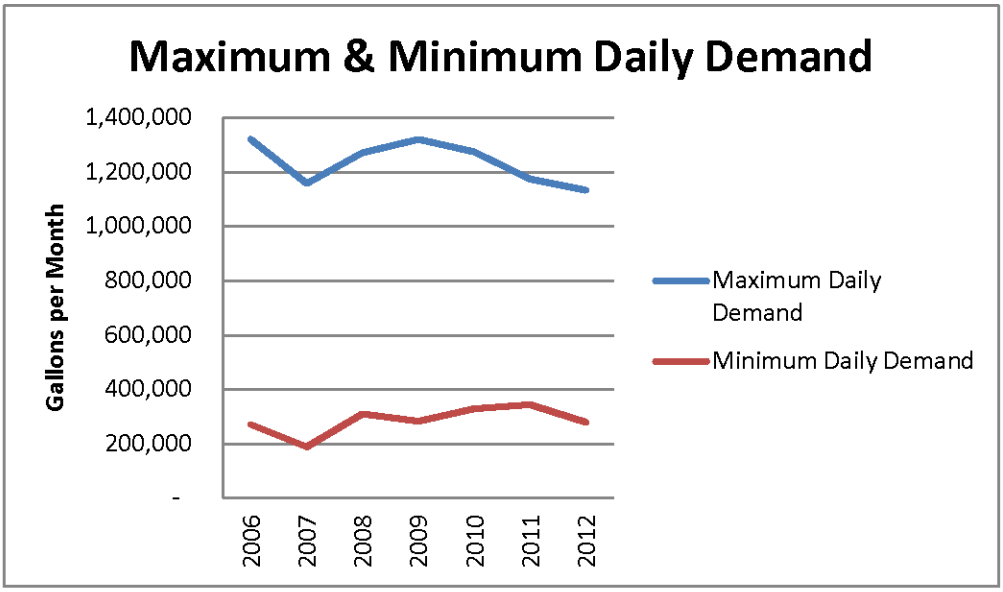
The average annual demand from 2006-2012 (AAD) is 232,370,943 gallons per year. The average daily demand from 2006-2012 (ADD) is 636,766 gallons per day.

The average annual consumption has decreased 12% between 2006 and 2012. Between 2006 and 2011, the average annual consumption has decreased 5%.

Monthly consumption averages 19.4 million gallons between 2006 and 2012. The highest average monthly consumption occurs in July or August and is 38.3 million gallons. The lowest average monthly consumption occurs generally in February or March and is 8.6 million gallons. The following table and chart show the Maximum Daily Demand (MMD) and Minimum Daily Demand.

City of Madras Maximum and Minimum Daily Demands (2006-2012) in Gallons

Year	Month	Maximum Daily Demand	Month	Minimum Daily Demand
2006	Jul-06	1,320,982	Mar-06	271,035
2007	Aug-07	1,157,795	Feb-07	187,894
2008	Aug-08	1,270,815	Mar-08	309,234
2009	Aug-09	1,321,104	Apr-09	282,214
2010	Aug-10	1,274,435	Feb-10	328,394
2011	Aug-11	1,175,137	Mar-11	343,910
2012	Aug-12	1,133,560	Dec-12	278,685
Average		**1,236,261**		**285,909**

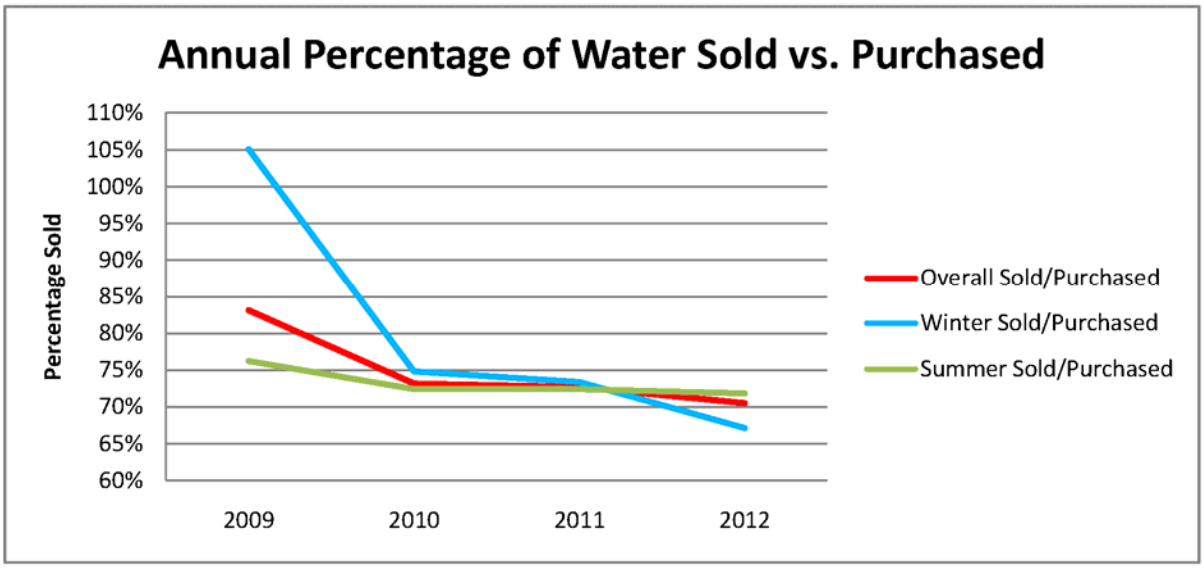


5.3 City Water Sales

Water is purchased from DVWD and then sold to private entities and other public agencies. Water used by the City of Madras for their buildings, parks, and other uses is not metered.

There is a substantial difference between the water purchased and produced by the City of Madras, and the water the City of Madras sells. We can estimate the usage of water by the City and the amount of water the City uses for irrigating its parks and planter strips. The remainder is considered unaccounted water. Unaccounted water is lost due to leakage in the distribution system, water used for system flushing, fire-fighting, and unauthorized use.

According to State standards, municipalities should take efforts to minimize unaccounted water to 15%. If 15% is achieved, then measures should be taken to reduce the loss to below 10%.



As shown in the chart above and the table on the following page, the City of Madras has substantial unaccounted for water. Between 2009-2012, unaccounted for water and municipal use makes up 25% of water purchased; however the trend has been increasing since 2009. Unaccounted and municipal use water makes up nearly 30% of water purchased from DVWD in 2012.

Water use for municipal buildings and parks within the City's water system is unmetered. The City has two municipal buildings (City Hall and Public Works) and we can assume municipal building usage is comparable to a C2 water connection. Average water use by two C2 water connections equal 228,128 cubic feet, or 0.8% of water purchased from DVWD in 2012.

Per the City Streets Supervisor's estimates, the City uses 352,850 gallons or 47,172 cubic feet annually. This equals 0.2% of water purchased from DVWD in 2012.

Some City parks are irrigated through City water and are unmetered. Other City Parks are irrigated through DVWD water and are metered. The City Parks Supervisor provided an estimate of areas irrigated by City Water and DVWD water. Applying the same rate of irrigation from DVWD irrigated parks to City watered parks gives a reasonable estimate of municipal water use for parks. The City is estimated to use 1,753,500 cubic feet of water for park irrigation during a year. This accounts for 6.1% of all water purchased from DVWD in 2012.

Adding up municipal water use equals 7.1% of water purchased from DVWD. Water sold by the City equals 70.5% of water purchased; therefore unaccounted water equals 22.4%. The state standard is 15%.

City of Madras Water Sales and Purchase Summary (2009-2012)

Month	Cubic Feet Sold	Cubic Feet Purch.	Percentage Sold/Purchased
Jan-09	*Not Avail.*	1,690,700	*Not. Avail.*
Feb-09	2,945,102	1,282,300	230%
Mar-09	1,042,598	1,426,100	73%
Apr-09	1,471,562	1,131,800	130%
May-09	1,641,818	2,218,300	74%
Jun-09	2,824,074	3,403,400	83%
Jul-09	4,161,792	4,485,600	93%
Aug-09	4,026,718	5,474,800	74%
Sep-09	2,935,945	4,141,900	71%
Oct-09	1,708,112	2,969,700	58%
Nov-09	860,351	1,380,600	62%
Dec-09	1,183,362	1,917,100	62%
Jan-10	2,043,693	1,733,700	118%
Feb-10	963,585	1,229,200	78%
Mar-10	1,061,853	1,718,200	62%
Apr-10	1,026,552	1,624,200	63%
May-10	1,636,584	2,353,300	70%
Jun-10	2,176,671	2,609,000	83%
Jul-10	3,807,014	4,569,200	83%
Aug-10	3,405,475	5,281,400	64%
Sep-10	2,536,580	3,667,800	69%
Oct-10	1,588,598	2,441,600	65%
Nov-10	925,236	1,462,900	63%
Dec-10	987,369	1,600,200	62%
Jan-11	1,986,907	1,627,000	122%
Feb-11	797,498	1,467,200	54%
Mar-11	1,079,632	1,425,200	76%
Apr-11	1,034,658	1,448,400	71%
May-11	1,508,858	2,256,400	67%
Jun-11	2,779,059	3,242,400	86%
Jul-11	3,281,750	4,253,600	77%
Aug-11	3,495,775	4,869,900	72%
Sep-11	3,091,483	4,254,400	73%
Oct-11	1,630,746	2,926,500	56%
Nov-11	923,820	1,668,600	55%
Dec-11	894,495	1,517,800	59%
Jan-12	923,446	1,559,200	59%
Feb-12	834,808	1,197,000	70%
Mar-12	929,095	1,407,400	66%
Apr-12	979,921	1,412,500	69%
May-12	1,967,873	2,175,500	90%
Jun-12	1,954,999	3,057,000	64%
Jul-12	2,931,172	3,931,600	75%
Aug-12	3,960,308	4,697,600	84%
Sep-12	2,387,909	3,635,600	66%
Oct-12	1,596,908	3,109,600	51%
Nov-12	991,677	1,252,500	79%
Dec-12	699,744	1,154,900	61%
Overall	***89,623,185***	***119,670,100***	***75%***
Nov.-April	***26,586,964***	***33,644,000***	***79%***
May-Oct.	***63,036,221***	***86,026,100***	***73%***

5.4 Target Design Values

In 2012, the City of Madras had 645 single family residential meter services. The estimated number of persons per household for the City of Madras is 2.69 (based off of the 2010 census). In 2012, these 645 residences consumed an average of 314.8 gallons/day/meter. This calculates to an average of 117 gallons/day/capita. Including all residences (multifamily and single family, total = 1116) reduces the average to 110 gpcd. Taking all water usage (residential, commercial, and unaccounted for water) and dividing by the estimated population yields an average of 212gpcd. Average per capita water use for Oregon was calculated to be 207 gpcd according to the 2000 US Geological Survey (Circa 1268), when including all water use.

Data is not available from the City of Madras for the Maximum Day Demand (MDD) or the Peak Hourly Demand (PHD). Factors of 2.6 and 5.0 will be applied to the Average Daily Demand (ADD) to determine the MDD and PHD, respectively.

As calculated in the previous section, the ADD is 212gpcd (including unaccounted water). The ratio of MMD to ADD is 1.94 and the MDD to ADD ratio is 2.6. A peaking factor of 5.0 is used to estimate the Peak Hourly Demand (PHD).

2012	GPCD
ADD	212
MDD	551
PHD	1,060

Projected Water Demand

Using the previous sections calculations for growth (an overall increase of35%), this factor will be applied to the MDD and PHD for estimated 2033 values. Projected water demand also assumed per capita usage will remain constant. The general trend over the past six years is reduced water use per capita. Assuming constant per capita use will provide a more conservative result.

2033	GPCD
ADD	286
MDD	744
PHD	1,430

SECTION 6 - DESIGN CRITERIA AND LEVEL OF SERVICE

Section 6 – Design Criteria and Level of Service

6.1 Design Life of Improvements

The design life of a water system component is generally referred to its service life. The selection of a design life is an estimate based on several factors including type and intensity of use, type, and quality of materials used in construction, and quality of workmanship during installation. Estimated service life and actual service life will vary based on above factors. The establishment of a design life provides a realistic projection of service upon which to base an economic analysis of new capital improvements.

The planning period for this Water System Master Plan is 20 years, ending in 2033. The planning period is the timeframe during which the recommended water system is expected to provide sufficient capacity to meet the needs of all anticipated users. The required system capacity is based on population, water demand projections, and land-use considerations.

The typical design life for system components are discussed below.

Pumping Equipment and Structures

Major structures and buildings have a service life of 50 years. Pump equipment is anticipated to have a service life of 20 years. Well #2 has a pump that is 46 years old and Well #3 has a pump that is 36 years old and both are serviceable. However, these pumps are generally used just for testing.

Water Distribution Piping

Water distribution piping has a service life of at least 50 years, but PVC and ductile iron piping can have a service life up to 100 years. Steel pipes can exhibit corrosion and leakage within 30 years. There are very few records on the age of the City's distribution system; however it is holding up well. The service life for distribution piping used will be 80 years.

Water Storage

Steel tanks generally have a service life of at least 60 years and can be extended by frequent maintenance and painting. The City's current storage tank has been in service for 63 years and has proved serviceable during that timeframe. In 1979, a leak was repaired. The tank was cleaned and inspected in November, 2009. Because of frequent maintenance, a service life of 100 years will be used for the City's storage tank.

6.2 Sizing and Capacity Criteria

Demand projections presented in the previous chapter are used to plan water system improvements for the next 20 years. The various components of the water system demand are used to size different improvements.

Connections to DVWD

DVWD provides water to the City via three tie-ins. Two of the tie-ins have provided adequate water service to the City for over five years. The third tie-in is supplemental. These three tie-ins are able to distribute the Maximum Day Demand (MDD) of the water system over the 20 year planning period. This amount was calculated to be 1,655,592 gallons/day (1,150 gpm) in 2012 and is projected to be 2,235,049 (1,552 gpm) gallons/day in 2033.

DVWD has the capacity to pump 7,750 gpm presently, which is five times the 2033 MDD.

Well Pumps

The City's well pumps are supplementary to the City's water system. Well #2 can contribute 385 gpm and Well #3 can contribute 300 gpm to the City's water system.This is adequate to supply the 2012 ADD (442 gpm) and the 2033 ADD (597 gpm) under emergency circumstances.

Water Storage

Storage reservoirs within the distribution system provide at least five important services:

1. Provide a reservoir supply of water to draw upon during short term peak system consumption.
2. Allow parts of the system to be shutdown for repairs or maintenance.
3. Assist keeping the system pressures reasonably constant throughout the system.
4. Provide a reserve supply of water to meet fire demands.
5. Add to system reliability and operational flexibility.

Total storage capacity must include reserve storage for equalization, emergency, and fire suppression.

- Equalization storage should typically be set at 25% of the MDD to balance the difference between peak hourly demand and the supply capacity so these variations in demand are not imposed on the water supply source.

- Emergency storage is required to protect against a total loss of water supply, which would occur with a broken transmission line, equipment breakdown, or natural disaster. At a minimum, the emergency storage volume should be equal to 75% of the MDD assuming water use is restricted during times of emergencies.

- Fire reserve storage is needed to supply fire flows throughout the water system to fight major fires. The fire reserve storage is based on the maximum flow and duration of flow to suppress a major fire. The guidelines published in the "Fire Suppression Rating Schedule" by the Insurance Services Office (ISO) are typically used to determine the required fire flow and fire reserve storage. Generally, fire flows of 1,000 to 1,500 gpm are sufficient for one to two dwelling units not exceeding two stories in heights. Commercial, industrial, and institutional buildings require higher flows. Determination of these flows is unique to each building under consideration and involves detailed surveys of construction (type and area),

occupancy (combustibility), exposure (construction type, distance, length/height of wall), and communications (opening).

The ISO also classifies fire protection capabilities on a numerical basis, called the Public Protection Classification (PPC) with Class 1 representing exemplary protection and Class 10 indicating less than minimum protection. The Public Protection Classification is determined from a complex analysis of the City's capabilities to receive and handle fire alarms, the strength of the fire district, and the adequacy of the fire supply. Analysis of the water supply system is further divided into equal parts of: 1) supply capabilities, 2) hydrant size, type, and installation, and 3) inspection and condition of the hydrants. For a PPC Class 8 rating or better, fire storage should be adequate to support needed fire flows as follows: 2 hours when less than 3,000 gpm is needed, 3 hours when fire flows of 3,000 to 3,500 gpm are needed, or 4-hours when flows greater than 3,500 gpm are needed.

For residential areas, the minimum recommended fire storage is 180,000 gallons to provide fire flows up to 1,500 gpm for a duration of 2 hours. When significant non-residential structures exist with fire-fighting requirements greater than typical residential requirements, additional fire protection storage is justified.

The largest building the City of Madras serves is Madras High School. The estimated required fire flow (from the 2010 Oregon Fire Code) is 4,250 gpm for a period of 4 hours. This building will govern the needed fire storage requirements

The most resent PPC for the City of Madras was 5/8B (see Appendix C-1).

Existing Required Storage Capacity

The 2012 MDD as previously defined is 1,591,914 gallons/day.

Equalization storage (MDD*0.25) =	397,979 gallons
Emergency storage (MDD*0.75) =	1,193,935 gallons
Fire storage (4,250gpm*60min/hr*4 hours) =	1,020,000 gallons
TOTAL:	2,611,914 gallons

Projected Required Storage Capacity

The 2033 MDD as previously defined is 2,547,063 gallons/day.

Equalization storage (MDD*0.25) =	636,766 gallons
Emergency storage (MDD*0.75) =	1,910,297 gallons
Fire storage (4,250gpm*60min/hr*4 hours) =	1,020,000 gallons
TOTAL:	3,567,063 gallons

Presently, the City has a one million gallon storage tank. This is inadequate by itself. However, including DVWD's available storage (16,171,000 gallons) can supplement the needed storage by the City presently and in the future.

The 2012 MDD for DVWD's demands is calculated as 6,952,813 gallons/day.

Equalization storage (MDD*0.25) =	1,738,203 gallons
Emergency storage (MDD*0.75) =	5,214,610 gallons
Fire storage (4,250gpm*60min/hr*4 hours) =	1,020,000 gallons
TOTAL:	7,972,813 gallons

This available present storage for DVWD is over 16,000,000 gallons. Assuming a 60% growth rate would yield the following:

The 2033 MDD for DVWD is calculated to be 11,124,500 gallons/day

Equalization storage (MDD*0.25) =	2,781,125 gallons
Emergency storage (MDD*0.75) =	8,343,375 gallons
Fire storage (4,250gpm*60min/hr*4 hours) =	1,020,000 gallons
TOTAL:	12,144,500 gallons

For the purposes of the City of Madras' water system, there is adequate storage for the next twenty years.

Distribution System

The distribution system is to be sized for fire flows and the 20-year population demand. All pipelines should be large enough to sustain a minimum residual pressure of 20 psi under fire flow conditions and or 42 psi during normal usage (City requirements). Velocity in distribution lines shall be less than 4.5 feet per second during peak usage hour for residential areas. Distribution lines in commercial areas shall have velocities under7.5 feet per second for peak hourly flows under fire flow conditions. Minimum pressure should be 20psi at all times even under fire flow conditions.

Minimum main size should be 8" for residential (6" with no hydrant connections) and 12" for commercial areas. Many of the existing City water lines are 2" and 4" diameter. As water mains are replaced over time, these should be upsized to a minimum 8" diameter.

Distribution laterals mains should be looped where possible.

Fire Flows

Requirements for firefighting at any point will vary between 500 gpm (min.) to 12,000 gpm for a single fire. General single family dwellings are estimated to require a fire flow of 1,500 gpm. Multiple fires will place a greater demand on the distribution system. A municipality must

continue to serve its domestic, commercial, and institutional customers during a fire event. The Insurance Services Office (ISO) recommends the fire system be able to operate with the remainder of the potable water system operating at the MDD.

Fire hydrants should be spaced at a maximum distance of 500 feet.

6.3 Level of Service Summary

Goals for the level of service for the City Of Madras Water System are summarized as follows:

- Deliver water that meets or exceeds State water quality requirements
- Maintain 42 psi in water system during Maximum Day Demand (MDD)
- Maintain 20 psi residual pressure when a fire hydrant is in use
- Maximum velocity in pipes to not exceed 4.5 fps under Maximum Day Demand (MDD)
- Maximum velocity in pipes in commercial zones to not exceed 7.5 fps under fire flow conditions
- Maintain tank storage that equals the Maximum Day Demand (MDD) plus the volume required for the highest demand fire flow.
- Minimum distribution pipe size to be 8” for residential (with exceptions for 6” pipe) and 12” for commercial
- Fire hydrants to be distributed within 500 feet of all properties
- Maintain water system in a serviceable condition.

SECTION 7 - FINANCIAL ANALYSIS

Section 7 – Financial Analysis

This section will analyze the existing financial characteristics of the City's water system. The City's 2013-14 budget anticipates $502,128 in revenues and $496,033 in expenditures. No capital improvement plans are included in this budget. Relevant portions of the budget are included in Appendix E for reference.

7.1 Revenues

Over 90% of revenue for the water system comes from sales. The 2013-14 budget anticipates over $450,000 in water sales. In 2012, the City had $428,451.34 in water sales. The increase in anticipated sales is due to the 4.5% increase in water sales.

For 2013-14, water sales are charged as follows: $24.45 for the first 500 cubic feet, then $1.25 for each 100 cubic feet thereafter. DVWD charges $18.00 for the first 700 cubic feet, then has a rate progression that starts with $0.80 for each 100 cubic feet up to 2,500 cubic feet. The City of Prineville has a variety of different water charge classifications, but a ¾" meter costs $16.24/month plus $1.69 per 100 cubic feet thereafter.

Cost Comparison Estimate - City of Madras vs. DVWD & Prineville

METER SIZE	# SERVICES	GAL/DAY/METER	Average CF/Month	Madras	DVWD	Prineville
SF 0.75	645	314.7736217	1262.461	$ 33.98	$ 22.50	$ 37.58
MR 0.75	50	532.3949268	2135.2738	$ 44.89	$ 29.48	$ 52.33
MR 1	8	611.7812295	2453.668	$ 48.87	$ 32.03	$ 60.89
MR 1.5	8	6100.783033	24468.381	$ 324.05	$ 214.85	$ 447.42
MR 2	9	3236.548767	12980.811	$ 180.46	$ 122.95	$ 271.83
MR 3	1	4097.24153	16432.787	$ 223.61	$ 150.56	$ 349.75
C 0.75	126	264.2380232	1059.7782	$ 31.45	$ 20.88	$ 24.73
C 1	14	1271.994145	5101.5808	$ 81.97	$ 55.11	$ 87.86
C 1.5	4	3085.602186	12375.41	$ 172.89	$ 118.10	$ 209.49
C 2	10	2331.144044	9349.5082	$ 135.07	$ 93.90	$ 159.17
C 3	2	3826.367432	15346.393	$ 210.03	$ 141.87	$ 261.05
Monthly Sales				$ 36,565.54	$ 24,315.87	$ 41,012.90
					-34%	12%
					Cheaper	Costlier

Based off of 2012 water sales by the City using 11/13 water rates

7.2 Costs

The 2013-14 budget anticipates $496,033 in expenditures. Of this amount, water purchases from DVWD ($149,865) and compensating public works staff ($137,003) are the largest expenses. Also of note is a $30,000 operating contingency and $16,000 dedicated to repairs and maintenance.

In 2012, the City of Madras paid $133,451.77 to DVWD for water purchases. This was based on the 2010 agreement of $5,000 per month and $0.223/100 cubic feet. In May, 2013, the City and DVWD agreed to a new purchase agreement at $6,000/month and $0.283/100 cubic feet. Using 2012 quantities, this would equate to a yearly purchase of $152,916.18 or a 24% increase in cost.

System Development Charges

In the 2013-14 budget, the City had $50,000 from previous collected system development charges (SDC's). This fund is for capital water improvement projects that will benefit the whole system.

SDC's are collected for residential and commercial improvements. Present SDC charges are based on the meter size for the development. Below is a table comparing the City of Madras with DVWD and the City of Prineville SDC Rates and are as follows:

SDC Comparison - City of Madras vs. DVWD & Prineville

Meter Size	Madras	DVWD	Prineville
3/4"x5/8"	$ 790.00	$ 1,200.00	
3/4"	$ 1,185.00		$ 2,808.70
1"	$ 1,975.00	$ 1,350.00	$ 7,021.75
1.5"	$ 3,950.00		$ 14,043.50
2"	$ 6,320.00	$ 1,480.00	$ 22,469.60
3"	$13,825.00		$ 44,939.20
4"	$23,700.00	$ 2,100.00	$ 70,217.50
5"	$49,375.00		
6"	$71,100.00		$ 140,435.00

Future growth within the City's water system boundary will generate additional system development charges. Assuming growth rates from Section 2within the water system, the estimated income from System Development Charges at the current rate would generateabout $500,000 over the next 20 years.

7.3 Replacement of Existing System

The following table provides an estimated annual cost of existing water system replacement. These are the costs that must be set aside to replace components of the system when their service life is exhausted.

Item	Quantity	Unit	Unit Value	Total Value	Service Life (yrs.)	
2" Wateline	13962	LF	$ 55.00	$ 767,910.00	80	$ 9,598.88
4" Waterline	16937	LF	$ 55.00	$ 931,535.00	80	$ 11,644.19
6" PVC Waterline	50729	LF	$ 55.00	$ 2,790,095.00	80	$ 34,876.19
8" PVC Waterline	10442	LF	$ 60.00	$ 626,520.00	80	$ 7,831.50
10" DI Waterline	9394	LF	$ 78.00	$ 732,732.00	80	$ 9,159.15
12" DI Waterline	2684	LF	$ 80.00	$ 214,720.00	80	$ 2,684.00
Fire Hydrants	95	EA	$ 4,000.00	$ 380,000.00	80	$ 4,750.00
Well Pumps & Structures	2	EA	$ 40,000.00	$ 80,000.00	50	$ 1,600.00
Storage Tank	1	EA	$ 1,200,000.00	$ 1,200,000.00	100	$ 12,000.00
				$ 7,723,512.00		$ 94,143.90
						Cost/year

Valves Assumed to be Included in Infrastructure
2" and 4" lines assumed to be replaced as 6" lines

The above costs include labor to replace the component – which can be estimated to be 20-40% of the above cost.

7.4 Financing Options

Most communities are unable to finance major infrastructure improvements without some of governmental funding assistance, such as low interest loans or grants.In this section, a number of major Federal and State funding programs appropriate for the recommended improvements are discussed.Projects are usually funding by a combination of grant, loan and local funds.

A brief description of the major Federal and State funding programs that are typically utilized to assist qualifying communities in the financing of infrastructure improvement programs is given below. Each of the government assistance programs has its own particular prerequisites and requirements. These assistance programs promote such goals as aiding economic development, benefiting areas of low to moderate-income families, and providing for specific community improvement projects. Not all communities or projects may qualify for each of these programs because of their unique requirements.

Oregon Community Development Block Grant (OCDBG) Program

The Oregon Economic and Community Development Department (OECDD) administers the State's annual federal allocation of CDBG funds. Funds for the program come from the U.S. Department of Housing and Urban Development. OCDBG funds under the Public Works category are targeted to water and wastewater systems.

The national objective of the program is the development of viable urban communities by providing decent housing and a suitable living environment and expanding economic

opportunities - principally for persons of low and moderate income. "Low income" means income that is equal to or less than 50% of the area median, adjusted by family size. "Moderate income" means income that is equal to or less than 80% of the area median, adjusted by family size. The State of Oregon has the following objectives for the funds it administers:

- Improving the availability and adequacy of public facilities and infrastructure
- Conserving the existing housing supply and improving housing conditions
- Increasing the supply of housing affordable to low and moderate income persons - particularly those with the lowest incomes
- Supporting projects that will lead to increased business and employment opportunities

Only non-metropolitan cities and counties in rural Oregon can apply for and receive grants. Cities and counties may undertake projects to improve existing facilities owned by other public bodies, such as water or sanitary districts. A city or county can only have one CDBG application under consideration by the State at any one time. Applications are not accepted when a jurisdiction has three or more administratively open CDGB projects. Applications may be submitted year around. Eligible activities include the following:

- Community Facilities
- Housing Rehabilitation
- Public Works Water and Sewer Improvements
- Public Works Off-Site Infrastructure for New Affordable Rental Housing
- Emergency Projects
- Section 108 Loan Guarantees
- Grants for Float Loans

In 2014, Oregon expects approximately $12 million dollars in federal funds to provide improvement grants to qualified applicants. OCDBG grants are available for each of three phases necessary to complete water and/or wastewater system improvements; preliminary engineering and planning, final engineering, and construction. Engineering costs are limited to 20% of the total budget. Total public works project grants are limited to $3,000,000 for the combined total of all phases. Final engineering and construction costs may be combined in one grant if the project period is 36 months or less. Construction of new water and sewer facilities in areas outside the Urban Growth Boundaries (UGBs) is subject to the State Planning Goal 11 and the DLCD requirements in OAR Chapter 660, Divisions 11, 4, and 22. Applicants for projects, outside UGB's must include verification from their county that the proposed activities are allowed under current state law.

Grants awarded may be used for the following public works projects:

A. Projects which are necessary to bring municipal water and sewer systems into compliance with:

- The requirements of the Safe Drinking Water Act or the Clean Water Act administered by the Oregon Health Authority (OHA)

- The requirements of water quality statutes, rules or permits administered by the Oregon Department of Environmental Quality (DEQ) or the Environmental Quality Commission

B. Projects where the municipal system has not been issued a notice of non-compliance from the OHA or DEQ, the department may determine that a project is eligible for assistance upon finding that:

- A recent letter, within the previous 12 months, from OHA or DEQ, which indicates a high probability that within 2 years the system will be notified of non-compliance, and department staff deems it reasonable and prudent that program funding will assist in bringing the water or sewer system into compliance with current regulations or requirements proposed to take affect within the next 2 years.

Eligible projects must meet the national objective of benefiting low and moderate-income persons. This typically means that at least 51% of residents must have low or moderate incomes based on the 2000 Census data or local survey. In addition, the average residential water/sewer service rate (fee) should be approximately equal to 1.75% of the community median household income (MHI), taking into account any increases necessary for the intended project. This average water/sewer rate may include monthly use fees, and other local fees used specifically to finance the system, including any special levies on taxable property within the system's service area being used to pay for the system.

Projects eligible for funding must be to solve problems faced by current residents, not projects intended to provide capacity for population and economic growth. CDBG funds may be used in projects that are needed to benefit current residents but which will be built with capacity for future development. In these cases, the CDBG participation is limited to that portion of the project cost that is necessary to serve the current population.

For additional information on the OCDBG programs, call 1-800-233-3306 or visit the OECDD website at http://www.orinfrastructure.org/.

Water/Wastewater Financing Program

The 1993 legislature created the Water/Wastewater Financing Program for communities that must meet Federal and State mandates to provide safe drinking water and adequate treatment and disposal of wastewater. The legislation was intended to assist local governments in meeting the Safe Drinking Water Act and the Clean Water Act. The fund is capitalized with lottery funds appropriated each biennium and with the sale of state revenue bonds. The Oregon Economic and Community Development Department (OECDD) administers the program.

Program eligibility is limited to projects necessary to ensure compliance with the Safe Drinking Water Act or the Clean Water Act where a Notice of Non-Compliance has been issued. Cities, counties, districts and other public entities may apply to the program. Eligible activities include the following:

- Water source, treatment, storage, and distribution improvements
- Wastewater collection and capacity
- Storm system
- Purchase of rights of way and easements necessary for infrastructure development
- Design and construction engineering

The grant/loan amounts are determined by a financial analysis based on demonstrated need and the applicant's ability or inability to afford additional loans (debt capacity, repayment sources and other factors). The programs guidelines, project administration, loan terms, and interest rates are similar to the Special Public Works Fund program. The maximum loan term is 25 years; however, loans are generally made for 20-year terms. Loans are generally repaid with utility revenues, general funds, or voter approved bond issues. Borrowers that are "Credit worthy" may be funded through sale of state revenue bonds.

The limitations on the eligible projects and related funding assistance are summarized below:

- Projects
  - Loan - max. $10 million
  - Grant - max. $750,000
- Technical Assistance (for eligible applicants under 15,000 population)
  - Loan - max. $50,000
  - Grant- max. $20,000

Interested applicants should contact OECDD prior to submitting an application. Applications are accepted year around. For additional information on this and other OECDD programs, call 1-800-233-3306 or visit the OECDD website at http://www.orinfrastructure.org/.

Oregon Special Public Works Fund

The Special Public Works Fund (SPWF) program provides financing to municipalities (cities, districts, tribal councils, etc.) to construct, improve, and repair infrastructure in order to support local economic development and create new jobs locally, especially family wage jobs. In order to be eligible, the following conditions must be satisfied.

- The existing infrastructure must be insufficient to support current or future industrial or eligible commercial development; and

- There must be a high probability that family wage jobs will be created or retained within: 1) the boundary to be served by the proposed infrastructure project or 2) industrial or eligible commercial development of the properties served by the proposed infrastructure project

The SPWF program is capitalized through biennial appropriations from the Oregon Lottery Economic Development Fund by the Oregon State Legislature, through bond sales for dedicated project funds, through loan repayments and other interest earnings. The Oregon Economic and Community Development Department (OECDD) administers the fund. The following criteria are used to determine project eligibility.

1. Firm Business Commitment

In addition to creating or retaining permanent jobs as a result of the project, there must be private and/or public investment in the project equal to at least twice the SPWF funding. Firm business commitment can be characterized by the following:

- Specific industrial/manufacturing and eligible commercial businesses committing to create permanent, full-time-equivalent jobs.
- Up to $10,000 in grant funds may be awarded for each full-time-equivalent job created (based on demonstrated financial need).
    - Of jobs created, 30% must be "family wage" jobs.
    - Public and/or private investment equal to at least twice the infrastructure cost.

2. Capacity Building

Capacity building efforts can be characterized by the following:

- Build infrastructure capacity to support industrial/manufacturing development.
- Must document recent interest by eligible businesses in locating within the municipality.
- Must demonstrate ongoing marketing efforts of industrial lands.
- No grant funds unless distressed communities. Grant funds of up to $250,000 per project may be awarded to distressed communities without a firm business commitment.

All projects must principally benefit industrial or eligible commercial users. The SPWF is primarily a loan program. Grant funds are available based upon economic need of the municipality. The maximum loan term is 25 years, though loans are generally made for 20-year terms. The grant/loan amounts are determined by a financial analysis based on a demonstrated need and the applicant's ability or inability to afford additional loans (debt capacity, repayment sources and other factors). Borrowers that are "credit worthy" may be funded through the sale of state revenue bonds. Loans are generally repaid with utility revenues, local improvement districts (LID's), general funds, or voter approved bond issues.

Determination of the final amount of financing and the loan/grant/bond mix will be based on the financial feasibility of the project, the individual credit strength of an applicant, the ability to assess specially benefited property owners, the ability of the applicant to afford annual payments on loans from enterprise funds or other sources, future beneficiaries of the project, and six other applicable issues.

The maximum SPWF loan per project is $10 million, if funded from SPWF revenue bond proceeds. Projects financed directly from the SPWF may receive up to $1 million. The maximum SPWF grant is $500,000 for a construction project and cannot exceed 85% of the total project cost. Grants are made only when loans are not feasible.

Technical Assistance grants and loans may finance preliminary planning and engineering studies and economic investigations to determine infrastructure feasibility. Up to $10,000 in grant funds and $20,000 in additional loan funds may be awarded to eligible applicants with fewer than 5,000 persons living within the City.

For additional information on the OCDBG and other OECDD programs, call 1-800-233-3306 or visit the OECDD website at http://www.orinfrastructure.org/

Safe Drinking Water Revolving Loan Fund

The Safe Drinking Water Revolving Loan Fund provides funding to drinking water systems to comply with the Safe Drinking Water Act (SDWA) to protect the public health. It is intended to assist community and nonprofit, non-community water systems plan, design and construct drinking water facilities needed to correct non-compliance issues and to further the public health protection goals of the SDWA. Funds may be used for the following types of activities:

- All drinking water facilities necessary for source of supply, filtration, treatment, storage, transmission and metering.
- The acquisition of real property necessary for the project
- Preliminary and final engineering, surveying, legal review and other support activities necessary for the construction of the project
- Construction contingencies in approved change orders.
- Cost necessary for recipients to contract environmental review services
- A reasonable amount of community growth may be accommodated in the project.

Growth may not be the primary purpose for constructing the facilities; public health improvement must be the main goal.

While many activities are eligible for DWSRF financing, the following activities are considered ineligible activities:

- Dams or rehabilitation of dams.

- Purchase of water rights, except if the water rights are owned on a system that is being purchased through a consolidation project.
- Reservoirs, except for finished water reservoirs and those reservoirs that are part of the treatment process.
- Administrative costs.
- Operation and maintenance expenses.
- Projects primarily intended to supply or attract future growth.

The Oregon Health Division and the Oregon Economic and Community Development Department (OECDD) rate proposed projects. The applicant must submit a "Letter of Interest" which is used to rank projects in a Project Priority List. Projects must be on the Priority List to receive funding. Highest ratings are given to projects that present the following:

- Project addresses the most serious risk to human health.
- Project is necessary to ensure Safe Drinking Water Act compliance.
- Applicant has the greatest financial need, on a per household basis, according to affordability criteria.

Special consideration is given to projects at small water systems that serve 10,000 or fewer people, consolidating or merging with another system as a solution to a compliance problem and which have an innovative solution to the stated problem.

Additional consideration will be given to disadvantaged communities. A disadvantaged community is defined as one whose average water cost for a residential customer in the service area of the water system is at least the state average for like systems (which have recently undergone a construction project) after the proposed project improvements are completed and currently meets at least two of the three criteria listed below:

- Community water system debt is at least $250 per capita (for sewer and water systems combined $500 per capita).
- The water system includes at least 51% low and moderate-income persons.
- The residents of the community water system have documented financial burden due to a recent (within the past two years) national or state declared disaster with documented unreimbursable expenses (minimum of $25 per capita).

Applicants with 300 or more service connections are eligible for assistance with final design and construction projects only if they maintain a current, approved master plan that evaluates the needs of the water system for at least a twenty-year period and includes the major elements outlined in OAR 333-061-0060(5). Systems with less than 300 service connections may receive funding for an engineering feasibility analysis instead of a master plan.

One-Stop Finance meetings are encouraged. OECDD will structure a financing package that may include a Safe Drinking Water direct loan as well as loans and grants from other department programs. The loan interest rate is 80% of the "State and Local Bonds Rate" for the last week of the preceding quarter. For loans to Disadvantaged Communities, which also demonstrate financial need, the interest rate is 1%. Maximum loan terms are 20 years, except that loans to disadvantaged communities may be as long as 30 years. The loan limit per project is $2 million.

Interested parties should contact the OECDD for details. For additional information on the DWSRF programs, call 1-800-233-3306 or visit the OECDD website at http://www.econ.state.or.uslsafewtr.htm.

Drinking Water Protection Loan Fund

For communities and municipalities needing improvements to protect source water, loan funds are available through OHA under the new Drinking Water Protection Loan Fund. There is less competition for funds under this program since only improvements related to source protection are eligible.

Water and Waste Disposal Loans and Grants (RUS)

The Rural Utilities Service (RUS) is one of three entities that comprise the USDA's Rural Development mission area. Administered by the USDA Rural Development office, the RUS supports various programs that provide financial and technical assistance for development and operation of safe and affordable water supply systems and sewer and other forms of waste disposal facilities.

RDA has the authority to make loans to public bodies and non-profit corporations to construct or improve essential community facilities. Grants are also available to applicants who meet the median household income (MHI) requirements. Eligible applicants must have a population less than 10,000. Priority is given to public entities in areas smaller than 5,500 people to restore a deteriorating water supply, or to improve, enlarge, or modify a water facility and/or inadequate waste facility. Preference is given to requests that involve the merging of small facilities and those serving low-income communities.

In addition, borrowers must meet the following stipulations:

- Be unable to obtain needed funds from other sources at reasonable rates and terms.
- Have legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities.
- Be financially sound and able to manage the facility effectively.
- Have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including operation and maintenance, and to retire the indebtedness and maintain a reserve.

- Water and waste disposal systems must be consistent with any development plans of State, multi-jurisdictional area, counties, or municipalities in which the proposed project is located. All facilities must comply with Federal, State, and local laws including those concerned with zoning regulations, health and sanitation standards, and the control of water pollution.

Loan and grant funds may be used for the following types of improvements:

- Construct, repair, improve, expand, or otherwise improve water supply and distribution facilities including reservoirs, pipelines, wells, pumping stations, water supplies, or water rights.
- Construct, repair, improve, expand, or otherwise improve waste collection, pumping, treatment, or other disposal facilities. Facilities to be financed may include such items as sewer lines, treatment plants, including stabilization ponds, storm sewer facilities, sanitary landfills, incinerators, and necessary equipment.
- Acquire needed land, water supply or water rights.
- Legal and engineering costs connected with the development of facilities.
- Other costs related to the development of the facility including the acquisition of right-of-way and easements, and the relocation of roads and utilities.
- Finance facilities in conjunction with funds from other agencies or those provided by the applicant.

Interim commercial financing will normally be used during construction and Rural Development funds will be available when the project is completed. If interim financing is not available, the project cost is less than $50,000, multiple advances of Rural Development funds may be made as construction progresses. The maximum term on all loans is 40 years. However, no repayment period will exceed any statutory limitation on the organizations borrowing authority or the useful life of the improvement facility to be financed. Interest rates are set quarterly and are based on current market yields for municipal obligations. Current interest rates may be obtained from any Rural Development office.

Applications for financial assistance are made at area offices of the RDA. For additional information on RDA loans and grant programs visit the RUS website at http://www.rurdev.usda.gov/UWP-dispdirectloansgrants.htm.

Emergency Community Water Assistance Grants (ECWAO)

Available through the USDA Rural Utilities Service (RUS) as part of the Water and Waste Disposal programs, ECWAC is available to communities when disaster strikes. Congress may appropriate funds for the program after a flood, earthquake, or other disaster if Federal assistance is warranted.

In order to receive assistance through an ECWAC grant, applicant must fulfill the following requirements:

- Demonstrate that a significant decline in quantity or quality of water occurred within two years of the date the application was filed with RUS
- Public bodies and nonprofit corporations serving rural areas, including cities or towns whose population does not exceed 10,000 people may be eligible

Projects that are eligible for assistance include the following:

- Extend, repair or perform significant maintenance on existing water systems
- Construct new water lines, wells, or other sources of water, reservoirs, and treatment plants
- Replace equipment and pay costs associated with connection or tap fees
- Pay related expenses such as legal and engineering fees and environmental impact analyses, or acquire rights associated with developing sources of treating, storing, or distributing water
- Achieve compliance with the requirements of the Federal Water Pollution Control Act (33 U.S.C et seq.) or with the Safe Drinking Water Act when noncompliance is directly related to a recent decline in potable water quality

The maximum grant available through ECWAC is $500,000. Grants for repairs, partial replacement, or significant maintenance on an established system cannot exceed $150,000. Otherwise, grants may be made for 100% of eligible project costs.

Applications are filed with any USDA Rural Development office. For additional information on RDA loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.rurdev.usda.gov/UWP-ecwag.htm.

Rural Community Assistance Corporation (RCAQ Financial Services)

The mission of RCACs Financial Services is to manage resources, develop programs and participate in collaborative efforts, enabling RCAC to provide suitable and innovative solutions to the financial needs of rural communities and disadvantaged populations. In 1996, RCAC was designated a Community Development Financial Institution by the US Treasury to help address the capital needs of rural communities and has since added other loan programs. These programs include community facilities (housing, educational centers, public buildings, etc.) as well as lending for water and wastewater improvements.

Long-term loans are made in communities with a population of 20,000 or fewer. The Community Facility Loan Guarantee Program from USDA Rural Development enables RCAC to make low interest loans with amortization periods of up to 25 years. The primary goal of Financial Services is to serve low and very-low income rural residents. The primary borrowers are nonprofit organizations and municipalities.

The loan fund has received support from The California Endowment, Ford Foundation, USDA RI), Bank of America and many other agencies. This support enables Financial Services to leverage both public and private funds.Additional information can be found at http://www.rcac.org.

Economic Development Administration (EDA) Public Works Grant Program

The EDA Public Works Grant Program, administered by the U.S. Department of Commerce, is aimed at projects which directly create permanent jobs or remove impediments to job creation in the project area. Thus, to be eligible for this grant, a community must be able to demonstrate the potential to create jobs from the project. Potential job creation is assessed with a survey of businesses to demonstrate the prospective number of jobs that might be created if the proposed project was completed.

Proposed projects must be located within an EDA designated Economic Development District. Priority consideration is given to projects that improve opportunities for the establishment or expansion of industry and that create or retain private sector jobs in both the near term and long-term.

Communities, which can demonstrate that their existing system is at capacity (i.e. moratorium on new connections), have a greater chance of being awarded this type of grant EDA grants are usually in the range of the 50 to 80% of the project cost; therefore some type of local funding is also required. Grants typically do not exceed 1 million dollars.

Technical Assistance and Training Grants (TAT)

Available through the USDA Rural Utilities Service (RUS) as part of the Water and Waste Disposal programs, TAT grants are intended to provide technical assistance and training to associations on a wide range of issues relating to the delivery of water and waste disposal services.

Rural communities with populations of less than 10,000 persons are eligible along with private, nonprofit organizations that have been granted tax-exempt status by the IRS.

TAT funds may be used for the following activities:

- Identify and evaluate solutions to water and/or waste related problems of associations in rural areas.
- Assist entities with preparation of applications for Water and Waste Disposal loans and grants.
- Provide training to association personnel in order to improve the management, operation and maintenance of water and/or waste disposal facilities.
- Pay expenses related to providing the technical assistance and/or training.

Grants may be made for up to 100% of the eligible project costs. Applications are filed with any USDA Rural Development office. For additional information on RDA loans and grant programs, visit the RUS website at http://www.rurdev.usda.gov/UWP-wwtat.htm.

Department of Environmental Quality Clean Water State Revolving Fund (CWSRF)

The Clean Water State Revolving Fund (CWSRF) Program is administered by the Department of Environmental Quality (DEQ) and was developed to replace the EPA Construction Grants Program. The CWSRF is a loan program that provides low interest rate loans, instead of grants, for the planning, design, and construction of water pollution control facilities.

Interest rates on all design and/or construction loans are two-thirds of the current municipal bond rate during the quarter that the loan agreement is signed. In addition, an initiation fee (1.5% of the loan amount) and a servicing fee (0.5% of the outstanding balance) are also assessed to cover program administration by DEQ. Loans can be in the form of general obligation bonds or other rated debt obligations, revenue secured loan, or a discretionary loan.

An applicant must follow three steps in applying for a CWSRF Loan:

- Submit a preliminary application within 30 days of receipt from DEQ
- Secure placement on the Intended Use Plan Priority List. Prospective projects are ranked, and only those on the Priority List are eligible for loans
- Submit a final application

CWSRF funds are allocated based on a prioritization process. Based on the preliminary applications, projects are assigned points and ranked in priority order based on:

- Severity of water quality/health hazard problem
- Receiving water body sensitivity
- Population served by the project

The Intended Use Plan is one part of Oregon's annual SRF capitalization grant application. This plan includes lists of eligible projects ranked in priority order. When projects have been allocated funds, they are placed on the Funded List. Project that are not funded remain on the Planning List to receive funds if any of the funded list projects do not complete the loan process. Projects identified on the funded list from prior years, which have not been initiated, are placed on a Supplemental List.

For additional information on this and other DEQ programs, call 1-800-452-4011 or visit the DEQ website at http://waterquality.deq.state.or.us.

State Water Resources Department: Water Development Loan Fund

The Water Development Loan Fund (WDLF) may grant loans to individuals, cities, local governments, and other public and private entities. The goal of the fund is to provide low-cost, long-term, fixed-rate financing incentives that promote projects that achieve the state's long-term water management goals.

Eligible projects include:

- Drainage projects: facilities installed to provide for the removal of excess water to increase soil versatility and productivity
- Irrigation projects: facilities designed to provide water to land for the purpose of irrigation
- Community water supply project: an undertaking, in whole or in part, in Oregon for the purpose of providing water for municipal use. A community is an incorporated or unincorporated town or locality with more than three service connections and a population of less than 30,000 people.
- Fish protection project: an undertaking, in whole or in part, in Oregon for the purpose of watershed protecting fish or fish habitat.
- Watershed project: a water development project in Oregon that provides more than one use. The primary use of the project must be one of the uses listed above.

Secondary uses may include other water uses that are compatible with the primary use.

Funds to finance a water development project are obtained through the issuance and sale of self-liquidating bonds. The bonds are repaid by participants in the program and at no cost to the state or the Oregon taxpayer. The amount and type of loan security required depends on the borrower and the type of project. A first lien on real estate is required security for all loans. Other security may also be required. Interested parties should contact the Water Resources Department for details. For additional information on the WOLF programs, call 1-800-624-3199 or visit the WRD website at http://www.wrd.state.or.us.

Oregon Department of Energy Small Scale Energy Loan Program (SELP)

The SELP program was created by voters in 1980 and offers loans to projects whose purpose is to promote energy conservation and renewable energy resource development. Eligible applicants include cities, counties, special districts, individuals, and non-profit groups. Loans will cover up to 100% of construction costs, including engineering, fees, and studies. The finished project must at least break even in power costs.

The program offers low-interest loans for projects that:

- conserve natural gas, electricity, oil, or other source of energy
- produce energy from renewable resources such as water, wind, geothermal, solar, biomass, waste materials or waste heat
- utilize recycled materials to create products.

Interested parties should contact the Oregon Office of Energy for details. For additional information on the Office of Energy programs, call 1-503-378-4040 or visit the Office of Energy website at http://www.energy.state.or.us.

SECTION 8 - ANALYSIS, CONCLUSIONS, AND RECOMMENDATIONS

Section 8 – Analysis, Conclusions, and Recommendations

8.1 Analysis

The City's water system was modeled using Haestad Method's WaterCAD with skeletonization. The existing system was modeled using the Peak-Hourly Demand as a conservative analysis measure that would determine substandard performing components of the system. Modeling results were compared with the most recent fire flow analysis. Many of the results matched closely, others were generally the same. Overall, the model's performance was indicative of tendencies of how the actual system would perform. Results of the analysis are in Appendix F.

8.2 Conclusions

- The City has adequate water supply presently and for the next 20 years. The three DVWD tie-ins are more than adequate for City water service under maximum flow conditions.
- The City's water quality meets all requirements and is monitored per state regulations.
- When combined with DVWD's storage system, the existing available water storage is adequate for emergency conditions presently and for the study period. Further development and changes in fire-fighting requirements may modify this conclusion
- The most recent fire flow analysis demonstrates poor performing fire hydrants that do not allow adequate residual pressure (20 psi). The model also demonstrates inadequate pressure for these fire flows. The inadequate fire hydrants are at the following locations:

K13-022, 10th&A	K14-026, 6th&Trade
J14-016, Roosevelt & G	J14-087, Sunrise Mobile (Space 44/45)
J14-017, Madison & G	J14-088, Sunrise Mobile (Space 4)

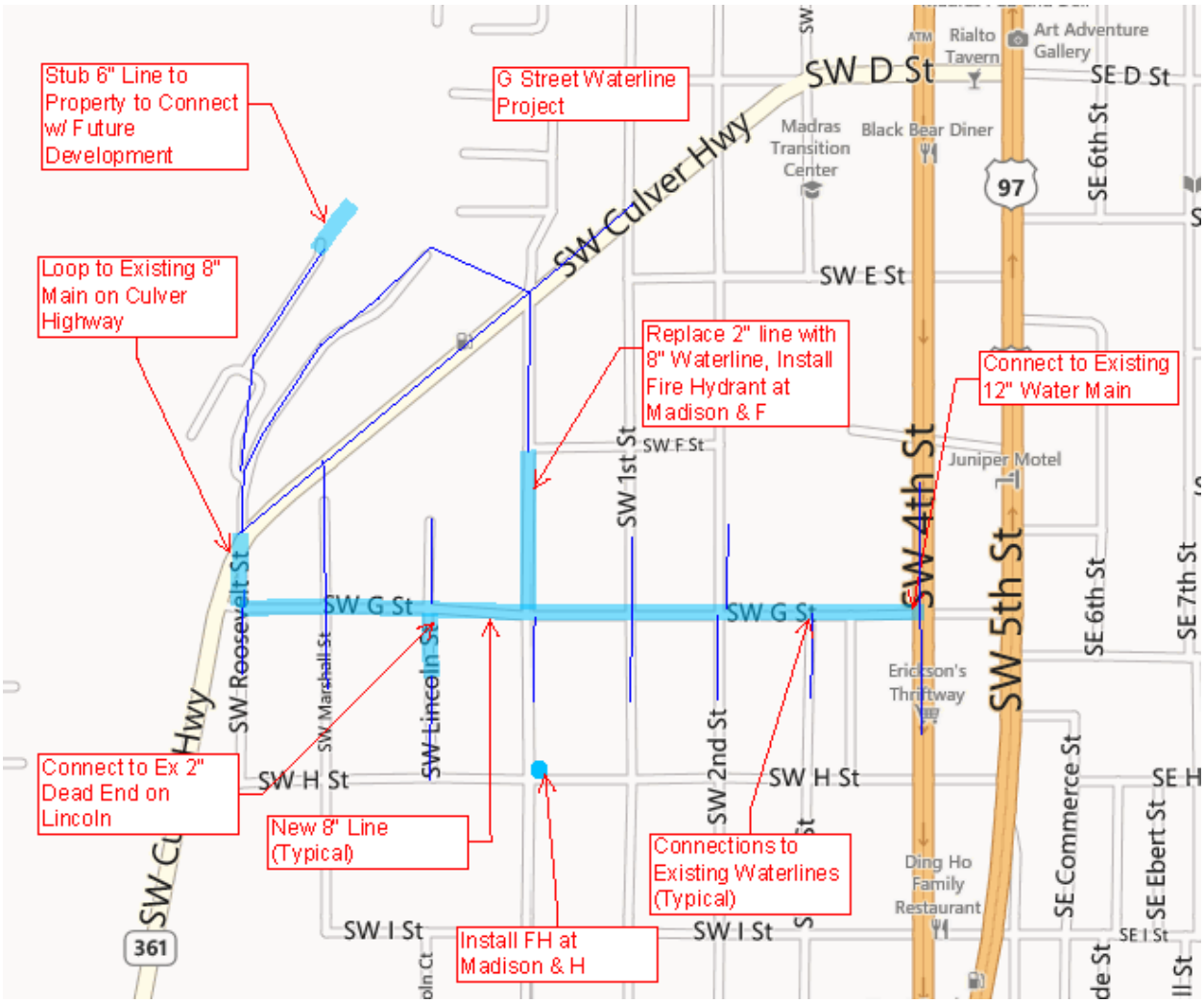
- The distribution of fire hydrants within the City's water system boundary does not meet the minimum spacing of 500 feet.
- Water pressure is almost entirely adequate (42 psi minimum) according to the model. The worst water pressure was found to be at the intersection of 7th Street and Buff Street under peak hour flow conditions (40.2 psi). Normal flow conditions would increase the pressure slightly. Through conversations with City staff and DVWD, the northeast portion of the City's water system has lower pressure. Increasing the pressure at the Kinkade Tie-in causes the City's distribution piping to leak excessively at 50-60 psi.
- The distribution system is generally undersized according to City standards. Modeling demonstrates excessive flow velocity in the 6" pipe located on A Street between Kinkade and 16th. Furthermore, modeling fire flows in the downtown commercial area reveals excessive pipe velocity in 4" and 6" diameter piping. The distribution system is adequate for domestic water use, but is inadequate for present fire flow requirements.
- The 2012 comparison between DVWD purchases and City Sales reveal that 30% of the water the City purchases are unaccounted for. This amount must be reduced to 10% and has the potential savings of $16,000/year.
- According to the budget, the water system fund is able to meet yearly expenditures. However, there is concern that as the water system ages, there will not be adequate funding to replace existing infrastructure.
- There are limited SDC funds available presently for capital water improvements. Other funding sources will need to be explored.

- As mentioned above, there is more than adequate storage capacity for the City's water system with DVWD's storage capacity. The City presently has two domestic wells connected to the system but have not been used in seven years. Considering the 24% increase in DVWD's rates, the City should consider utilizing their own wells to reduce expenditures and improve funding for infrastructure improvements.

8.3 Recommendations

- Immediately implement measures to determine the inconsistencies between water purchased and water sold. Begin by reviewing meter reading, data entry, and so forth to ensure the information being presented is accurate. Review the policies for new and discontinued service to ensure changes in water service are being implemented accurately. Coordinate with DVWD to ensure tie-ins are calibrated and also randomly check meters to ensure proper calibration.
- Running Well #3 for five hours per workday can supply the City with 10% of its water needs (according to 2006-2012 AAD usage). This corresponds to a savings of over $5,000/year to the City and can cover the replacement costs of both wells. Running Well #2 during high demand summer months can also improve savings and cover the costs of the infrastructure.
- Perform fire flow tests on the City's fire hydrants. Verify the information matches the 2011 fire flow analysis.
- Perform leak tests on older piping in the northeast section of the water boundary. Replace piping and repair as necessary.
- Inventory existing isolation valves. Prepare a list of serviceable and non-serviceable valves.
- Improve security around Well #2 sandfilter.

Project A - G Street Waterline Project



The G Street waterline project replaces the existing 4" waterline in G Street, loops the waterline to the 8" line on the Culver Highway, and loops to the dead end on Lincoln. Existing fire flow tests reveal failing hydrants in this area. Furthermore, this area does not have adequate fire hydrant distribution. Presently, the pavement on G Street is deteriorated, so there is an opportunity to combine utility work with resurfacing as well.

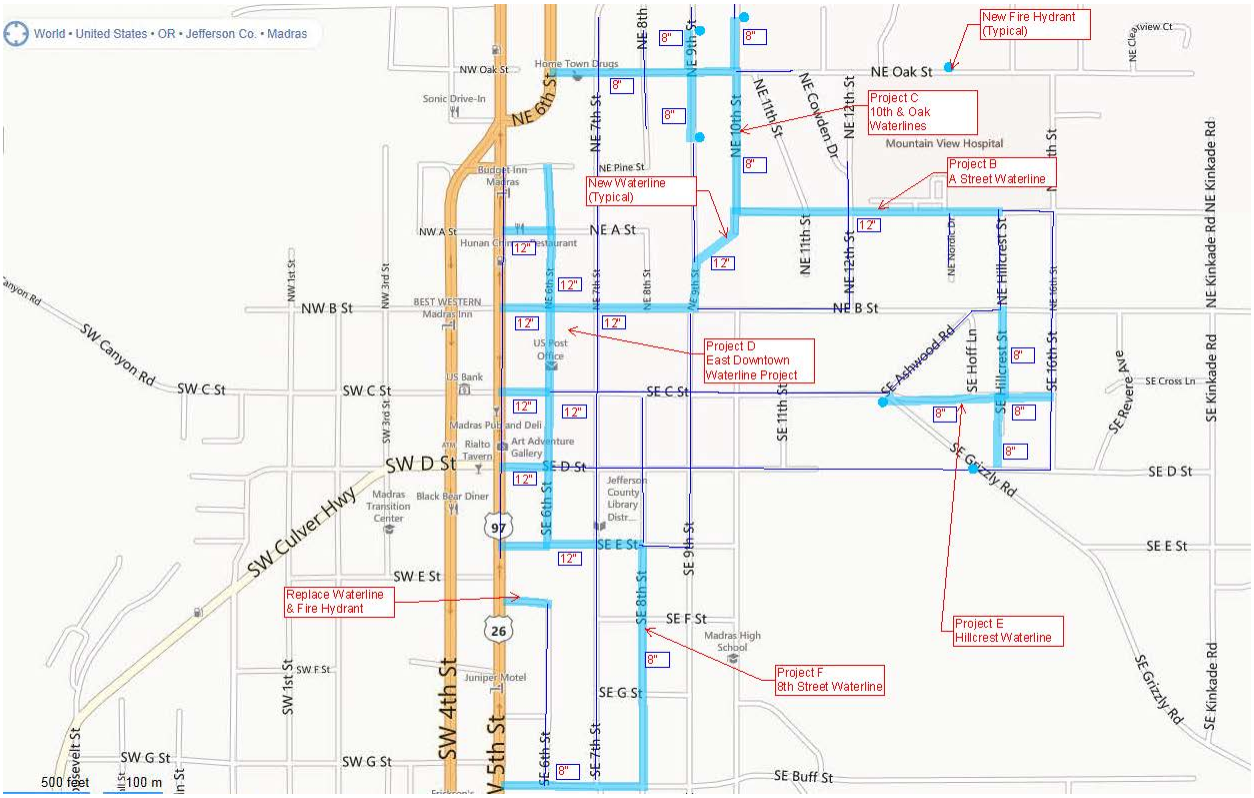
This project benefits the water system as follows:

- Remedies failing Fire Hydrants
- Improves Fire Hydrant Distribution
- Improves water distribution, circulation, and pressure
- Replaces old waterlines
- Opportunity to combine with street improvement to resurface G Street and other adjacent streets

Project A - G Street Waterline	QUANTITY	UNIT	UNIT PRICE	COST
Mobilization	1	L.S.	$ 10,000.00	$ 10,000.00
Traffic Control	1	L.S.	$ 10,000.00	$ 10,000.00
Construction Staking	1	L.S.	$ 5,000.00	$ 5,000.00
8" PVC C900 Waterline (w/ valves)	3000	L.F.	$ 55.00	$ 165,000.00
6" PVC C900 Waterline	90	L.F.	$ 45.00	$ 4,050.00
Fire Hydrants	6	EA.	$ 3,000.00	$ 18,000.00
Connections	15	EA.	$ 2,000.00	$ 30,000.00
Resurfacing	1	L.S.	$ 75,000.00	$ 75,000.00
			Total Const.	$ 317,050.00
Engineering, Surveying, Administration	1	L.S.		$ 45,000.00
			Total Project	**$ 362,050.00**

A possible alternative to the G Street waterline project would be to place a new waterline in H Street. Half of H Street is gravel and there are much fewer service connections. This alternative would save on resurfacing, traffic control, and the challenge of maintaining water service. However, more waterlines would be required to improve fire hydrant flow. This improvement would do less to improve water pressure, circulation, and distribution.

Madras Eastside Waterline Projects



The Madras Eastside Waterline projects (five total) are a series of water improvements with the following goals

- Fix failing fire hydrants
- Improve fire hydrant distribution
- Better utilize the East DVWD Tie-In at Kinkade
- Improve water pressures, circulation, and distribution
- Increase substandard waterline sizes

The routes of the proposed waterlines were evaluated and preference was given to the route with better flow distribution. Each project is summarized on the following sheets:

Project B – A Street Waterline

This project extends a 12" waterline along A Street from Hillcrest to 10th Street. This project does not substantially improve the water system, but sets up future projects that will improve fire flow, water pressure, and distribution. Of importance, the failing fire hydrant at 10th and A is replaced and a line able to provide adequate fire flow connects to this intersection. Additionally, a new fire hydrant is placed at the blowoff on Oak Street to improve distribution.

Project B - A Street Waterline	QUANTITY	UNIT	UNIT PRICE	COST
Mobilization	1	L.S.	$ 5,000.00	$ 5,000.00
Traffic Control	1	L.S.	$ 2,500.00	$ 2,500.00
Construction Staking	1	L.S.	$ 3,500.00	$ 3,500.00
12" PVC C900 Waterline (w/ valves)	1500	L.F.	$ 75.00	$ 112,500.00
8" PVC C900 Waterline	50	L.F.	$ 55.00	$ 2,750.00
Fire Hydrants	2	EA.	$ 3,000.00	$ 6,000.00
Connections	5	EA.	$ 2,000.00	$ 10,000.00
Resurfacing	1	L.S.	$ 30,000.00	$ 30,000.00
			Total Const.	$ 172,250.00
Engineering, Surveying, Administration	1	L.S.		$ 22,000.00
			Total Project	**$ 194,250.00**

Project C – 10th& Oak Waterlines

A new 8" waterline extends from 10th& A where Project B finished to the intersection of 10th& Oak. Then a new 8" waterline is placed to the intersection of 6th& Oak. Additional extensions to the north up 10th and 9thStreets, and to the South along 9th street end with fire hydrants to improve fire hydrant distribution. The completion of this project allows the Tie-In at Kinkade to adequately supply the northernmost part of the boundary as well as allow Well #2 to supply the eastern portion of the water system boundary under emergency situations.

Project C - 10th & Oak Waterlines	QUANTITY	UNIT	UNIT PRICE	COST
Mobilization	1	L.S.	$ 10,000.00	$ 10,000.00
Traffic Control	1	L.S.	$ 8,000.00	$ 8,000.00
Construction Staking	1	L.S.	$ 5,000.00	$ 5,000.00
8" PVC C900 Waterline (w/ valves)	3100	L.F.	$ 55.00	$ 170,500.00
Fire Hydrants	7	EA.	$ 3,000.00	$ 21,000.00
Connections	11	EA.	$ 2,000.00	$ 22,000.00
Resurfacing	1	L.S.	$ 35,000.00	$ 35,000.00
			Total Const.	$ 271,500.00
Engineering, Surveying, Administration	1	L.S.		$ 35,000.00
			Total Project	**$ 306,500.00**

Project D – East Downtown Commercial Waterlines

This project substantially improves availability of fire flow and reduces fire flow velocities to the downtown area east of US97/26. Additionally, this water allows the East DVWD Tie-In to better distribute to the commercial area. The project begins with a new 12" waterline where Project B ended, crosses under Willow Creek, south on 9th Street, and then extends west on C Street. 6th Street gets a new 12" waterline from Pine to E Street. Opportunities to connect 12" lines across 5th Street should happen if at all possible.

This project is the most expensive project recommended, but has the most potential to provide adequate water supply for downtown commercial development.

Project D - East Downtown Waterlines	QUANTITY	UNIT	UNIT PRICE	COST
Mobilization	1	L.S.	$ 15,000.00	$ 15,000.00
Traffic Control	1	L.S.	$ 15,000.00	$ 15,000.00
Construction Staking	1	L.S.	$ 9,000.00	$ 9,000.00
12" PVC C900 Waterline (w/ valves)	5000	L.F.	$ 75.00	$ 375,000.00
Fire Hydrants	5	EA.	$ 3,000.00	$ 15,000.00
Connections	18	EA.	$ 2,000.00	$ 36,000.00
Resurfacing	1	L.S.	$ 110,000.00	$ 110,000.00
			Total Const.	$ 575,000.00
Engineering, Surveying, Administration	1	L.S.		$ 80,000.00
			Total Project	**$ 655,000.00**

Project E – Hillcrest Waterline

This water improvement replaces undersized waterlines, loops existing systems, and improves fire hydrant distribution through this residential area. The existing water service in this area is primarily fed through a 6" waterline in NE 16th and a 2" waterline that extends from the deadend in Hillcrest. The improvements would allow the new water system to loop through to Ashwood Road. Additionally, fire hydrants are places at the intersections of Ashwood, Grizzly & C, and Grizzly & D to improve fire hydrant distribution.

Improvements are primarily replacement of the C Street waterline between Grizzly and 16th and the Hillcrest waterline between D Street and B Street.

Project E - Hillcrest Waterline	QUANTITY	UNIT	UNIT PRICE	COST
Mobilization	1	L.S.	$ 5,000.00	$ 5,000.00
Traffic Control	1	L.S.	$ 3,000.00	$ 3,000.00
Construction Staking	1	L.S.	$ 4,000.00	$ 4,000.00
8" PVC C900 Waterline (w/ valves)	1900	L.F.	$ 55.00	$ 104,500.00
Fire Hydrants	4	EA.	$ 3,000.00	$ 12,000.00
Connections	6	EA.	$ 2,000.00	$ 12,000.00
Resurfacing	1	L.S.	$ 40,000.00	$ 40,000.00
			Total Const.	$ 180,500.00
Engineering, Surveying, Administration	1	L.S.		$ 22,000.00
			Total Project	**$ 202,500.00**

Project F – 8th Street Waterline

This project replaces an undersized 2" waterline in 8th Street and loops the waterline to the connection at 5th and Buff Streets. The new waterline is sized to 8" to improve pressure, circulation, and distribution. Additionally, connecting the new 8" line to the 12" waterline at 6" Street provides an additional means of providing water to the downtown area.

The waterline on Snook Lane between 5th and 6th Streets and the fire hydrant at 6th and Snook Lane are replaced to improve the fire flow capacity in this area.

Project F - 8th Street Waterline	QUANTITY	UNIT	UNIT PRICE	COST
Mobilization	1	L.S.	$ 5,000.00	$ 5,000.00
Traffic Control	1	L.S.	$ 3,000.00	$ 3,000.00
Construction Staking	1	L.S.	$ 4,000.00	$ 4,000.00
8" PVC C900 Waterline (w/ valves)	3000	L.F.	$ 55.00	$ 165,000.00
Fire Hydrants	5	EA.	$ 3,000.00	$ 15,000.00
Connections	11	EA.	$ 2,000.00	$ 22,000.00
Resurfacing	1	L.S.	$ 50,000.00	$ 50,000.00
			Total Const.	$ 264,000.00
Engineering, Surveying, Administration	1	L.S.		$ 32,000.00
			Total Project	**$ 296,000.00**

As an alternative, replacing the waterline in 7th Street was evaluated as well. Length of the project would be reduced by replacing the 7th Street waterline; however, the existing waterline in 7th Street is 6" and the existing waterline in 8th Street is 2". The replacement of a 2" residential line has more potential to improve the system overall.

Project G – 3rd Street Waterline

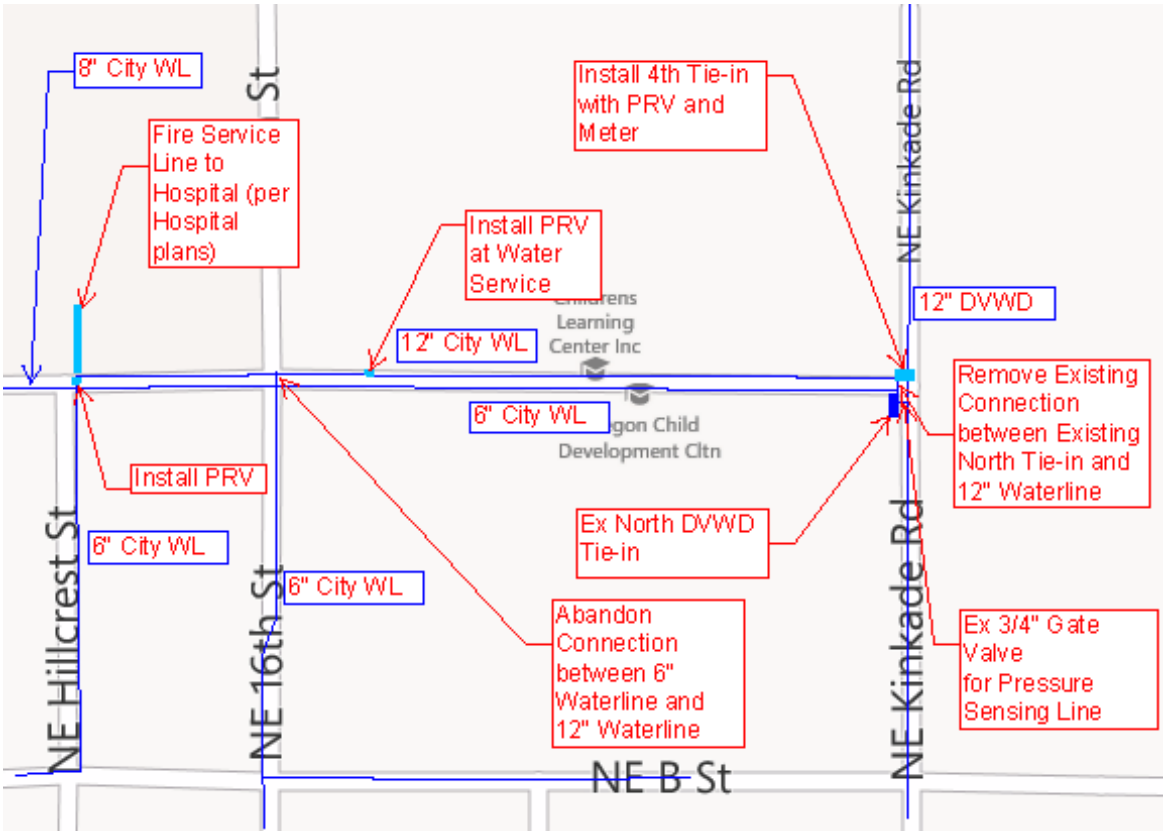
This project extends an 8" waterline from 3rd and B north 390 feet and ends with a fire hydrant to improve fire hydrant distribution in this area. 3rd Street is along a tightly packed trailer park that would benefit greatly from improved fire hydrant access. Extending the 8" waterline more than 390 feet is recommended, funding permitting.

Project G - 3rd Street Waterline	QUANTITY	UNIT	UNIT PRICE	COST
Mobilization	1	L.S.	$ 5,000.00	$ 5,000.00
Traffic Control	1	L.S.	$ 1,500.00	$ 1,500.00
Construction Staking	1	L.S.	$ 3,000.00	$ 3,000.00
8" PVC C900 Waterline (w/ valves)	390	L.F.	$ 55.00	$ 21,450.00
Fire Hydrants	1	EA.	$ 3,000.00	$ 3,000.00
Connections	1	EA.	$ 2,000.00	$ 2,000.00
Resurfacing	1	L.S.	$ 8,000.00	$ 8,000.00
			Total Const.	$ 43,950.00
Engineering, Surveying, Administration	1	L.S.		$ 6,500.00
			Total Project	**$ 50,450.00**

Project H – St. Charles Madras offsite Water Improvements

This project reconfigures the North Tie-in at Kinkade and adds a new DVWD Tie-in dedicated for the City's 12" waterline. The 12" waterline serves St. Charles Madras hospital, and will provide additional fire flow for future hospital expansions. Presently, there are pressure limitations on the City's distribution system. Reconfiguring the connections allows higher pressure to serve the hospital, but maintains acceptable pressure for the adjacent area.

The specifics of this configuration are very preliminary. Further analysis would be necessary before implementing these measures.



Project H - St. Charles Madras	QUANTITY	UNIT	UNIT PRICE	COST
Mobilization	1	L.S.	$ 5,000.00	$ 5,000.00
Traffic Control	1	L.S.	$ 500.00	$ 500.00
12" DVWD Connection, PRV, and Meter	1	EA.	$ 50,000.00	$ 50,000.00
Pressure Reducing Valves	2	L.F.	$ 2,000.00	$ 4,000.00
Abandon connections	2	EA.	$ 2,000.00	$ 4,000.00
Resurfacing	1	L.S.	$ 3,000.00	$ 3,000.00
			Total Const.	$ 66,500.00
Engineering, Administration	1	L.S.		$ 6,000.00
			Total Project	**$ 72,500.00**

8.4 Financing for System and Improvements

System Costs

Section 7.3 determined the total worth of the water system and estimated an annual replacement cost for components. The amount ($94,143.90) is calculated as the cost to hire a private contractor to perform replacement work for the City. However, most of this work is performed by City staff – which presently performs this work. With this in mind, equipment and labor can be estimated to constitute ~50% of that amount, which we will set at $47,000/year.

The current City budget allots $16,000 for maintenance of the water system. This is far less than the estimated $47,000 per year. Furthermore, historical data demonstrates the water system fund breaks even. Additional funds must be found elsewhere.

The projects in the previous subsection include replacement of 16,000 lineal feet of water line and replacement of 19 fire hydrants. These improvements can offset a portion of the anticipated maintenance costs. These improvements equal a maintenance value of $5,975/year when maintained by City staff.

Minimizing unaccounted water to 10% has the potential to provide $16,000 in savings per year. Additionally, running Wells #2 and #3 can provide savings of $7,500/year. These measures are combined with the reduced maintenance value ($5,975/year) to reduce the shortfall to $1,525/year.

Increasing water rates by 0.5% ($2,200/year) will cover the remaining portion of the maintenance amount.

Improvement Costs

The above recommended projects totaled together equal $2,066,750 in improvements. The present City budget and revenue sources are not adequate to construct these improvements. Construction of these improvements will need to be accomplished through a combination of SDC funds, utilizing public works staff, raising water rates, and outside loans and/or grants.

Section 7 contains a number of possible public funding sources for these improvements. The City should pursue these funding sources. Many of the grants and loans favor low or moderate income areas which the City may qualify for.

This report estimates the maximum revenue generated by SDC's for water to be $500,000. This amounts to ~25% of the estimated cost of recommended improvements.

Additionally, 17% of the recommended improvements include street resurfacing (paving). Many of the recommended improvements are located on streets with deteriorated pavement. Every year, the City paves some of their streets and there is opportunity to schedule the water system improvement with street resurfacing. Most grants and loans require the local municipality to provide a portion of the funding for the improvement. A combination of available SDC funds and transportation improvement funds can help the City obtain a grant or loan.

8.5 Project Timeline

Below is a recommended schedule for recommendations and improvements:

2014-2018 (1-5 years)

- Minimize unaccounted water to 10%
- Begin using local water supply (Wells #2 and #3)
- Perform Project G (3rd Street Waterline)
- Perform Snook Lane portion of Project F (8th Street Waterline)
- Perform Project A (G Street Waterline)

2019-2023 (5-10 years)

- Perform Project B (A Street Waterline)
- Perform Project C (10th& Oak Waterlines)

2024-2028 (11-15 years)

- Perform Project D (East Downtown Waterlines)

2029-2033 (16-20 years)

- Perform Project E (Hillcrest Waterline)
- Perform remainder of Project F (8th Street Waterline)

APPENDIX A-1 - RECORDS FOR WELL #1

Registration No. GR 3822

Certificate No. GR 3483

RECEIVED
AUG 1 1958
STATE ENGINEER
SALEM, OREGON

Registration Statement

OF CLAIMANT OF RIGHT TO APPROPRIATE GROUND WATER

TO THE STATE ENGINEER OF OREGON:

I, the City of Madras,

of Madras (Mailing address) County of Jefferson

State of Oregon, do hereby make application for a certificate of registration as evidence of a right to appropriate ground water.

1. **Source** from which water is withdrawn is pump well (Flowing well, pump well, infiltration trench, or tunnel)

2. **Location** is: 1/2 mile north of Madras, Oregon (Approximate distance and direction from nearest city or town);

and is more particularly described as follows:

(a) N. 0°-04' E. 3967.6' & East 1297.2' from the S.W. corner of Sec. 1, T. 11 S., R. 13E. (Give distance and bearing to corner of section or other legal subdivision)

being within Govt. Lot 4 NW¼ of NW¼ (Smallest legal subdivision) of Sec. 1, Twp. 11 S. (N. or S.), Rge. 13 E. (E. or W.)

or (b) within limits of recorded platted property, town or city:

in Lot ....., Block ..... of ..... (Name of plat or addition)

..... (If within city or town, give name) County of .....

3. **Construction Work** was begun on approx. 1910 (Date); was completed on 1910 (Date)

and the ground water claimed was first used for the purposes set out below on ? Unknown ? (Date),

since which time the water has been used See attached letter. (Continuously or intermittently)

from ..... (Date) to ..... (Date).

4. **Quantity** of water claimed and used is 150 gallons per minute; 100 acre feet per year.

5. **Purpose or Purposes** for which water is used Municipal water supply

..... (Domestic, irrigation, municipal, manufacturing, industrial, etc.)

6. **Description of Well:** Depth 404 feet. Type Drilled (Dug or drilled)

diameter 8 inches. Elevation of ground at well site 2260 (As near as known) feet, mean sea level.

Depth to water table 343 feet.

7. **Capacity of Well:** 150 g.p.m. with 37 feet drawdown.

..... g.p.m. with ..... feet drawdown.

Date of test 1953 - nearest known date

If Flowing Well: Measured discharge ..... g.p.m. on ..... (Date)

Shut-in pressure at ground surface ..... lbs. per sq. in. on ..... (Date)

Water is controlled by ..... (Cap, valve, etc.)

8. **Casing:** (Give diameter, commercial specifications and depth below ground surface of each casing size.)

8 inch diameter from surface to 392 feet

_____ inch diameter from _____ to _____ feet

_____ inch diameter from _____ to _____ feet

_____ inch diameter from _____ to _____ feet

Describe and show depth of shoe, plug, adapter, liner or other details:

Not known

9. **Perforated Casings or Screens:**

Not known (Number per foot and size of perforations, or describe screen) from _____ to _____

from _____ to _____

from _____ to _____

from _____ to _____

10. **Log of Well:** (Describe each stratum or formation clearly, indicate if water bearing, and give thickness and depth as indicated.)

MATERIAL	Thickness (Feet)	Depth to Bottom (Feet)
Not known. Log of well not available.		

GR 3483

If log of well is not available, give name and address of driller. .....

Not known

11. **Infiltration Trench:** Covered or open None

Dimensions: Length ..... ft. Minimum depth ..... ft. Maximum depth ..... ft.

Bottom width ..... ft. Discharge ..... g.p.m. Date of test .....

12. **Tunnel:** Type of lining None

Dimensions: ..... (Length, course, and cross sectional size)

Position of water bearing stratum with reference to portal of tunnel .....

Log of tunnel: (Preceding table for log of well may be used, if desired. Give footage from portal and character of materials, as pertinent.)

13. **Pumping Equipment:**

(a) Pump a) 25 h.p. Peerless 21 Stage Turbine 150
b) Booster-Fairbanks-Morse Motor & Centrifugal Pump Combination (Make, type and size) Capacity ..... g.p.m.

(b) Motor a) 25 h.p. 3 phase 60 cycle 1760 r.p.m.
b) 20 h.p. 240 volt 3 phase 60 cycle 3500 r.p.m. (Type and horsepower)

14. Location of area irrigated or to be irrigated, or place of use if for purposes other than irrigation.

Township North or South	Range E. or W. of Willamette Meridian	Section	Forty-acre Tract	Number Acres To Be Irrigated	Date of Reclamation
11 S.	13 E.	1	SW¼ of SW¼	Municipal uses	1948
		"	NW¼ of SW¼	Industrial uses	1910
		"	W½ of SE¼ of SW¼		
		2	SE¼ of SE¼		
		"	SW¼ of SE¼		
		11	NE¼ of NE¼		
		"	NW¼ of NE¼		
		"	SW¼ of NE¼		
		"	SE¼ of NE¼		
		"	NE¼ of NW¼		
		"	SE¼ of NW¼		
		"	NE¼ of SW¼		
		"	NW¼ of SE¼		
		"	NE¼ of SE¼		
		12	NE¼ of NW¼		
		"	NW¼ of NW¼		
		"	SW¼ of NW¼		
		"	SE¼ of NW¼		
		"	NW¼ of SE¼		
		"	SW¼ of NE¼		
		"	NE¼ of SW¼		
		"	NW¼ of NE¼		

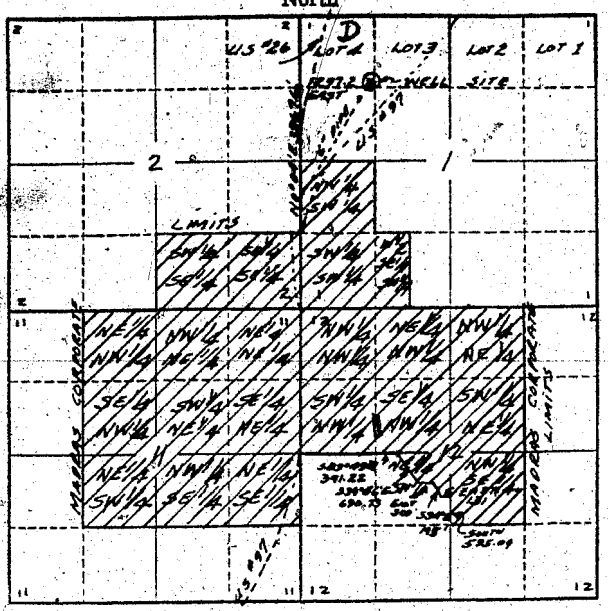
15. If the ground water supply is supplemental to an existing water supply, identification of any application for a permit, permit, certificate or adjudicated right to appropriate water made or held by the registrant.

None held by applicant. However, water is supplied from the North Unit Irrigation District during summer months on their permit from the Deschutes River to City's treatment plant.

GR 3483

Township 11 S Range 13 E, W.M.

North



Locate well and acreage of irrigated land on plat.

Scale: 2" = 1 Mile

STATE OF OREGON }
County of Jefferson } ss.

I, Donald J. Branton, being first duly sworn, do hereby certify that I have read the foregoing Registration Statement and that all of the items therein contained are true to the best of my knowledge and belief.

Donald J. Branton
(Signature of Registrant)

CONSULTING ENGINEER Madras, Oregon

Subscribed and sworn to before me this 28th day of July, 1958.

My commission expires Nov 18, 1960

(Notary Public)

(SEAL)

REGISTERED PROFESSIONAL ENGINEER OREGON DONALD J. BRANTON MAY 10, 1957

CERTIFICATE OF REGISTRATION

STATE OF OREGON }
County of Marion } ss.

This is to certify that the foregoing Registration Statement was received in the office of the State Engineer on the 1 day of August, 1958, at 8:00 o'clock A. M. and has been duly recorded in said office in Book No. 14 of Registration Statements on page GR-3483

Witness my hand this 15th day of September 19 59

Lewis A. Stanley
(State Engineer)

$20.00

By
(Deputy)

GR 3483

Jeff
424

GR-3822 appr.
GR-3483 ck.

File Original and First Copy with the STATE ENGINEER, SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON

State Well No. 11/13-1D(1)

State ~~Permit~~ No. GR3483

(1) OWNER:
Name City of Madras

Address Formerly Oregon Trunk Railway
well 2 WSP 637-D

(2) LOCATION OF WELL:
County Jefferson Owner's number, if any—

NW ¼ NW ¼ Section 1 T. 11S R. 13E W.M.

Bearing and distance from section or subdivision corner

3968' N & 1297' E from
SW Corner Section 1

(3) TYPE OF WORK (check):
New Well ☐ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 11.

PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☒

Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:
Rotary ☐ Driven ☐

Cable ☐ Jetted ☐

Dug ☐ Bored ☐

(6) CASING INSTALLED:
Threaded ☐ Welded ☐

8 " Diam. from 0 ft. to 392 ft. Gage .....

..... " Diam. from ..... ft. to ..... ft. Gage .....

..... " Diam. from ..... ft. to ..... ft. Gage .....

(7) PERFORATIONS:
Perforated? ☐ Yes ☐ No

Type of perforator used

SIZE of perforations ..... in. by ..... in.

..... perforations from ..... ft. to ..... ft.

..... perforations from ..... ft. to ..... ft.

..... perforations from ..... ft. to ..... ft.

..... perforations from ..... ft. to ..... ft.

..... perforations from ..... ft. to ..... ft.

(8) SCREENS:
Well screen installed ☐ Yes ☐ No

Manufacturer's Name .....

Type ..... Model No. .....

..... Slot size ..... Set from ..... ft. to ..... ft.

..... Slot size ..... Set from ..... ft. to ..... ft.

(9) CONSTRUCTION:
Was well gravel packed? ☐ Yes ☐ No Size of gravel: .....

Gravel placed from ..... ft. to ..... ft.

Was a surface seal provided? ☐ Yes ☐ No To what depth? ..... ft.

Material used in seal—

Did any strata contain unusable water? ☐ Yes ☐ No

Type of water? Depth of strata

Method of sealing strata off

(10) WATER LEVELS:
Static level 343 ft. below land surface Date 1953

Artesian pressure lbs. per square inch Date

Log Accepted by:

[Signed] ..... Date ....., 19.....
(Owner)

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☐ No If yes, by whom?

Yield: gal./min. with ft. drawdown after hrs.

" " " "

" " " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m. Date

Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG:
Diameter of well ..... inches.

Depth drilled ft. Depth of completed well ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Sand and Silt	0	112
Fine gravel	112	121
Lava (basalt)	121	137
Volcanic ash	137	148
Lava (basalt)	148	187
Pumice	187	198
Red basalt	198	206
Trap rock (Dense basalt)	206	220
volcanic ash	220	228
White ash or diatomite and lava	228	265
White ash or diatomite	265	293
Volcanic ash	293	300
Lava and volcanic ash	300	330
Volcanic ash	330	355
Mixed rock and gravel	355	390
Gravel, water bearing	390	415
Alt. 2375±		

Work started 19 . Completed 1910

(13) PUMP:
Manufacturer's Name .....

Type: ..... H.P. .....

Well Driller's Statement:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME .....
(Person, firm, or corporation) (Type or print)

Address .....

Driller's well number .....

[Signed] .....
(Well Driller)

License No. ..... Date ....., 19.....

(USE ADDITIONAL SHEETS IF NECESSARY)

STATE ENGINEER
Salem, Oregon

Jeff
823

OBSERVATION WELL

Well Record

STATE WELL NO. 11/13-1D
COUNTY Jefferson
APPLICATION NO. GR-3822

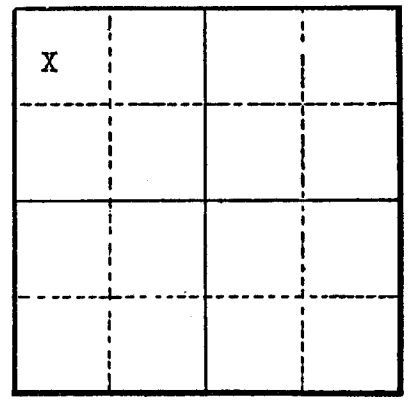
OWNER: City of Madras
MAILING ADDRESS:
CITY AND STATE: Madras, Oregon

LOCATION OF WELL: Owner's No.

NW ¼ NW ¼ Sec. 1 T. 11 ~~N.~~ S., R. 13 ~~W.~~ E., W.M.

Bearing and distance from section or subdivision corner N. 0° 04' E. 3967.6 ft. & E. 1297.2ft. from SW Cor. Sec. 1

Altitude at well



TYPE OF WELL: Drilled Date Constructed 1910
Depth drilled 404 feet Depth cased 392 feet

Section 1

CASING RECORD:

8 inch casing set to 392 feet

FINISH:

AQUIFERS:

WATER LEVEL:

343 feet below surface

PUMPING EQUIPMENT: Type Peerless 21 stage turbine Booster - ~~Fairbanks Morse Motor~~ cent. H.P. 25/20
Capacity 150 G.P.M.

WELL TESTS:
Drawdown 37 ft. after hours 150 G.P.M.
Drawdown ft. after hours G.P.M.

USE OF WATER Municipal Temp. °F., 19
SOURCE OF INFORMATION Well Registration Statement
DRILLER or DIGGER
ADDITIONAL DATA:
Log Water Level Measurements Chemical Analysis Aquifer Test

REMARKS:

State Printing 89316

3483

APPENDIX A-2 - RECORDS FOR WELL #2

Permit A.-5M.-1-76 SP*32956-690

STATE OF OREGON

COUNTY OF JEFFERSON

CERTIFICATE OF WATER RIGHT

This Is to Certify, *That* CITY OF MADRAS

of Madras, *State of* Oregon 97741, *has made proof to the satisfaction of the Water Resources Director, of a right to the use of the waters of* Well #2

a tributary of Willow Creek *for the purpose of* municipal use

under Permit No. G-3058 *and that said right to the use of said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from* October 18, 1965

that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 0.86 cubic foot per second

or its equivalent in case of rotation, measured at the point of diversion from the stream. The point of diversion is located in the SW¼ NW¼, Section 1, T. 11 S., R. 13 E., W.M., 1260 feet North and 1040 feet East from W¼ Corner, Section 1.

The amount of water used for irrigation, together with the amount secured under any other right existing for the same lands, shall be limited to ———— *of one cubic foot per second per acre,*

and shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use under the right hereby confirmed, and to which such right is appurtenant, is as follows:

NW¼ SW¼
S½ SW¼
SW¼ SE¼
Section 1

E½ SE¼
Section 2

NE¼
N½ SW¼
N½ SE¼
SE¼ SE¼
Section 11

NW¼ NE¼
NW¼
NW¼ SW¼
Section 12

T. 11 S., R. 13 E., W.M.

The right to the use of the water for the purposes aforesaid is restricted to the lands or place of use herein described. and is subject to the existing minimum flow policies established by the Water Policy Review Board.

WITNESS the signature of the Water Resources Director, affixed this date. May 24, 1977

James E. Sexson
Water Resources Director

Recorded in State Record of Water Right Certificates, Volume 36 *, page* 44384

Permit No. G- G 3058

APPLICATION FOR A PERMIT CERTIFICATE NO. 44384

To Appropriate the Ground Waters of the State of Oregon

I, The City of Madras
(Name of applicant)

of Madras (Postoffice Address), *county of* Jefferson,

state of Oregon, *do hereby make application for a permit to appropriate the following described ground waters of the state of Oregon, SUBJECT TO EXISTING RIGHTS:*

If the applicant is a corporation, give date and place of incorporation

March 2, 1910 - Madras

1. *Give name of nearest stream to which the well, tunnel or other source of water development is situated* Willow Creek
(Name of stream)
tributary of Deschutes River

2. *The amount of water which the applicant intends to apply to beneficial use is* ~~1.0~~ 1.3 *cubic feet per second or* 450 *gallons per minute.*

3. *The use to which the water is to be applied is* Municipal Water Supply

4. *The well or other source is located* 3933.8 *ft.* North (N. or S.) *and* 1052.8 *ft.* East (E. or W.) *from the* S.W. *corner of* Section 1, Township 11 South, Range 13 East of the Willamette Meridian
(Section or subdivision)
(If preferable, give distance and bearing to section corner)
(If there is more than one well, each must be described. Use separate sheet if necessary)

being within the S.W. ¼ of N.W. ¼ *of Sec.* 1, *Twp.* 11 S., *R.* 13 E., *W. M., in the county of* Jefferson.

5. *The* not applicable Municipal Distribution System (Canal or pipe line) *to be* ..... *miles in length, terminating in the* ..... (Smallest legal subdivision) *of Sec.* ....., *Twp.* ....., *R.* ....., *W. M., the proposed location being shown throughout on the accompanying map.*

6. *The name of the well or other works is* City of Madras Well No. 2

DESCRIPTION OF WORKS

7. *If the flow to be utilized is artesian, the works to be used for the control and conservation of the supply when not in use must be described.*

8. *The development will consist of* one (1) well (Give number of wells, tunnels, etc.) *having a diameter of* 12 *inches and an estimated depth of* 425 *feet. It is estimated that* 425 *feet of the well will require* steel (Kind) *casing. Depth to water table is estimated* 375 (Feet)

CANAL SYSTEM OR PIPE LINE—

G 3058

9. (a) Give dimensions at each point of canal where materially changed in size, stating miles from headgate. At headgate: width on top (at water line) ..... feet; width on bottom ..... feet; depth of water ..... feet; grade ..... feet fall per one thousand feet.

(b) At ..... miles from headgate: width on top (at water line) ..... feet; width on bottom ..... feet; depth of water ..... feet; grade ..... feet fall per one thousand feet.

(c) Length of pipe, ... ft.; size at intake, ... in.; in size at ..... ft. from intake ..... in.; size at place of use ..... in.; difference in elevation between intake and place of use, ... ft. Is grade uniform? ..... Estimated capacity, ... sec. ft.

10. If pumps are to be used, give size and type Pump size and type to be definite after test pump of well

Give horsepower and type of motor or engine to be used .....

11. If the location of the well, tunnel, or other development work is less than one-fourth mile from a natural stream or stream channel, give the distance to the nearest point on each of such channels and the difference in elevation between the stream bed and the ground surface at the source of development

not applicable

12. Location of area to be irrigated, or place of use .....

Township N. or S.	Range E. or W. of Willamette Meridian	Section	Forty-acre Tract	Number Acres To Be Irrigated
		1	SW¼ of SW¼	
11 S.	13 E.	1	NW¼ of SW¼	
		1	W½ of SE¼ of SW¼	
		2	SE¼ of SE¼	
		11	NE¼ of NE¼	
		11	E½ of NW¼ of NE¼	
		11	SW¼ of NE¼	
		11	SE¼ of NE¼	
		11	NE¼ of SW¼	
		11	NW¼ of SE¼	
		11	NE¼ of SE¼	
		12	NE¼ of NW¼	
		12	NW¼ of NW¼	
		12	SW¼ of NW¼	
		12	SE¼ of NW¼	
		12	NW¼ of NE¼	
		12	SW¼ of NE¼	
		12	NE¼ of SW¼	
		12	NW¼ of SE¼	

(If more space required, attach separate sheet)

Character of soil .....

Kind of crops raised .....

MUNICIPAL SUPPLY—

G 3058

13. *To supply the city of* Madras

in Jefferson *county, having a present population of* 1,840

and an estimated population of ..... *in 19*.....

ANSWER QUESTIONS 14, 15, 16, 17 AND 18 IN ALL CASES

14. *Estimated cost of proposed works, $* 17,000.00

15. *Construction work will begin on or before* November 15, 1965

16. *Construction work will be completed on or before* January 15, 1966

17. *The water will be completely applied to the proposed use on or before* July 15, 1966

18. *If the ground water supply is supplemental to an existing water supply, identify any application for permit, permit, certificate or adjudicated right to appropriate water, made or held by the applicant.* .....

A P Mullen

(Signature of applicant)

Remarks: .....

STATE OF OREGON,
County of Marion, } *ss.*

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for correction

In order to retain its priority, this application must be returned to the State Engineer, with corrections on or before January 12, *19* 66

WITNESS my hand this 12th *day of* November, *19* 65

CHRIS L. WHEELER

STATE ENGINEER

By Harry W Jelousek

ASSISTANT

STATE OF OREGON, } ss.
County of Marion, }

PERMIT

This is to certify that I have examined the foregoing application and do hereby grant the same, SUBJECT TO EXISTING RIGHTS and the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 1.3 cubic feet per second measured at the point of diversion from the well or source of appropriation, or its equivalent in case of rotation with other water users, from Well #2

The use to which this water is to be applied is municipal

If for irrigation, this appropriation shall be limited to ---------- of one cubic foot per second or its equivalent for each acre irrigated and shall be further limited to a diversion of not to exceed ..... acre feet per acre for each acre irrigated during the irrigation season of each year; .....

and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The well shall be cased as necessary in accordance with good practice and if the flow is artesian the works shall include proper capping and control valve to prevent the waste of ground water.

The works constructed shall include an air line and pressure gauge or an access port for measuring line, adequate to determine water level elevation in the well at all times.

The permittee shall install and maintain a weir, meter, or other suitable measuring device, and shall keep a complete record of the amount of ground water withdrawn.

The priority date of this permit is October 18, 1965 for 1.0 cfs
March 21, 1966 for 0.3 cfs

Actual construction work shall begin on or before May 19, 1967 and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19 67

Complete application of the water to the proposed use shall be made on or before October 1, 19 68

WITNESS my hand this 19th day of May, 1966

Chris L. Wheeler
STATE ENGINEER

Application No. G- 3260
G 3058
Permit No. G-

PERMIT
TO APPROPRIATE THE GROUND WATERS OF THE STATE OF OREGON

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 18th day of October, 1965, at 8:00 o'clock A. M.

Returned to applicant:

Approved:
May 19, 1966

Recorded in book No. ..... of Ground Water Permits on page G 3058

CHRIS L. WHEELER
STATE ENGINEER

Drainage Basin No. 5 page 45

State Printing

NOTICE TO WATER WELL CONTRACTOR: The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED
FEB 13 1979
WATER RESOURCES DEPT.
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print) (Do not write above this line)

Jeff
426

State Well No. 11S/13E-2d

State Permit No.

(1) OWNER:
Name CITY OF MADRAS
Address CITY HALL, MADRAS, ORE. 97741

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

CASING INSTALLED:
Threaded ☐ Welded ☒

16" Diam. from +2 ft. to 207 ft. Gage .312
12" Diam. from 170 ft. to 437 ft. Gage .330
10" Diam. from 412 ft. to 480 ft. Gage .279

PERFORATIONS:
Perforated? ☒ Yes ☐ No

Type of perforator used STAR AND TORCH
Size of perforations 3/8 in. by 1/4 in. 361 - 375
3/16 6 - 440-460
520 perforations from 361 ft. to 375 ft.
188 perforations from 440 ft. to 460 ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☒ No

Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? STRASSER
Yield: 85 gal./min. with 60 ft. drawdown after 7 hrs.
" " "
" " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used CEMENT GROUT
Well sealed from land surface to 20 AND 185-207 ft.
Diameter of well bore to bottom of seal 24 AND 20 in.
Diameter of well bore below seal 12 in.
Number of sacks of cement used in well seal 121 sacks
Number of sacks of bentonite used in well seal sacks
Brand name of bentonite
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☒ Yes ☐ No Size of gravel: 1/4 MINUS
Gravel placed from 412 ft. to 480 ft.

(10) LOCATION OF WELL:
County JEFFERSON Driller's well number 5545
NE ¼ SE ¼ Section 2 T. 11S R. 13E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 361 ft.
Static level 340 ft. below land surface. Date 1/10/79
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 8
Depth drilled 800 ft. Depth of completed well 800 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
SEE ATTACHED SHEET			

Work started JULY 20 1978 Completed JAN 11 1979
Date well drilling machine moved off of well JAN 11 1979

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Paul O Pyfman (Drilling Machine Operator) Date FEB 9, 1979
Drilling Machine Operator's License No. 53

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name R.V. STRASSER DRILLING CO (Person, firm or corporation) (Type or print)
Address 8110 SE SUNSET LANE PORTLAND ORE
[Signed] Robert L Strasser (Water Well Contractor)
Contractor's License No. 10 Date FEB. 9, 1979

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

Phone: 771-2355

R. J. Strasser Drilling Co.

8110 S. E. Sunset Lane
Portland, Oregon 97206

February 9, 1979

Log of Madras well

top soil	0 - 3
dry sand and gravel	3 - 9
sandstone	9 - 31
sandstone and broken rock	31 - 55
brown sandstone	55 - 111
broken rock and clay	111 - 115
broken black rock	115 - 120
black lava rock	120 - 141
hard black basalt	141 - 147
red and black lava	147 - 155
porous red lava	155 - 157
red and black lava	157 - 195
black basalt	195 - 210
black lava and silt	210 - 218
porous black lava	218 - 225
black and red lava	225 - 253
black and red lava with clay	253 - 270
black basalt	270 - 376
congomerate	376 - 430
red and brown lava	430 - 437
slightly cemented gravel	437 - 468
grey rock	468 - 480
broken rock and clay	480 - 514
dry brown sand	514 - 544
tan sticky shale	544 - 554
brown shale	554 - 775
broken brown rock and clay	775 - 800

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED MAR 1 1966 STATE ENGINEER SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

Jeff 427

State Well No. 11/13-2J

State Permit No. .....

(1) OWNER:
Name CITY OF MADRAS
Address MADRAS, OREGON

(2) LOCATION OF WELL:
County JEFFERSON Driller's well number 4720
NE ¼ SE ¼ Section 2 T. 11S R. 13E W.M.
Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):
New Well [X] Deepening [ ] Reconditioning [ ] Abandon [ ]
If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):
Domestic [ ] Industrial [ ] Municipal [X]
Irrigation [ ] Test Well [ ] Other [ ]

(5) TYPE OF WELL:
Rotary [ ] Driven [ ]
Cable [X] Jetted [ ]
Dug [ ] Bored [ ]

(6) CASING INSTALLED:
Threaded [ ] Welded [ ]
16" Diam. from 0 ft. to 195 ft. Gage .375
12" Diam. from 164 ft. to 451 ft. Gage .330
" Diam. from ft. to ft. Gage

(7) PERFORATIONS:
Perforated? [X] Yes [ ] No
Type of perforator used STAR
Size of perforations 3/8 in. by 1 1/4 in.
960 perforations from 424 ft. to 440 ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(8) SCREENS:
Well screen installed? [ ] Yes [X] No
Manufacturer's Name
Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:
Well seal—Material used in seal CEMENT GROUT
Depth of seal 158-215 ft. Was a packer used? YES
Diameter of well bore to bottom of seal 20 in.
Were any loose strata cemented off? [ ] Yes [X] No Depth
Was a drive shoe used? [X] Yes [ ] No
Was well gravel packed? [X] Yes [ ] No Size of gravel: 5/8 MINUS
Gravel placed from 215 ft. to 440 ft.
Did any strata contain unusable water? [ ] Yes [X] No
Type of water? depth of strata
Method of sealing strata off

(10) WATER LEVELS:
Static level 326 ft. below land surface Date 1/31/66
Artesian pressure lbs. per square inch Date

(11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? [X] Yes [ ] No If yes, by whom? STRASSER
Yield: 470 gal./min. with 47 ft. drawdown after 12 hrs.
" 345 " 38 " 1½ "
" 218 " 27 " ½ "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 64 Was a chemical analysis made? [X] Yes [ ] No

(12) WELL LOG:
Diameter of well below casing
Depth drilled 451 ft. Depth of completed well 451 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
BROWN SAND	0	31
SANDSTONE	31	109
SANDY CLAY	109	121
ASH	121	138
BLACK LAVA	138	156
BROKEN LAVA	156	161
RED AND BLACK LAVA	161	172
HARD BLACK LAVA	172	177
PUMICE	177	183
RED LAVA	183	187
BLACK LAVA	187	190
HARD BLACK LAVA	190	207
RED LAVA	207	239
HARD BLACK LAVA	239	250
RED AND BLACK LAVA	250	288
BLACK LAVA	288	322
HARD BLACK LAVA	322	363
CONGLOMERATE	363	371
RED AND BROWN ROCK	371	398
SAND AND GRAVEL	398	420
WATER BEARING SAND AND GRAVEL	420	451

Work started NOV 18 1965 Completed FEB 11 1966
Date well drilling machine moved off of well FEB 11 1966

(13) PUMP:
Manufacturer's Name
Type: H.P.

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME R J STRASSER DRILLING Co
(Person, firm or corporation) (Type or print)
Address 8110 SE SUNSET LANE PORTLAND ORE.

Drilling Machine Operator's License No. 57
[Signed] Robert J. Strasser (Water Well Contractor)
Contractor's License No. 10 Date FEB 23, 1966

(USE ADDITIONAL SHEETS IF NECESSARY)

APPENDIX A-3 - RECORDS FOR WELL #3

STATE OF OREGON

COUNTY OF JEFFERSON

CERTIFICATE OF WATER RIGHT

This Is to Certify, *That* THE CITY OF MADRAS

of 416 6th St., Madras, , *State of* Oregon, 97741 , *has made proof to the satisfaction of the Water Resources Director, of a right to the use of the waters of* Well No. 3

a tributary of Willow Creek *for the purpose of* municipal use

under Permit No. G-5547 *and that said right to the use of said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from* April 5, 1972
that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 0.9 cubic foot per second

or its equivalent in case of rotation, measured at the point of diversion from the well. The well is located in the SE¼ SE¼, Section 2, T. 11 S., R. 13 E., W.M., 200 feet North and 1295 feet West from the SE Corner, Section 2

The amount of water used for irrigation, together with the amount secured under any other right existing for the same lands, shall be limited to ---------- of one cubic foot per second per acre,

and shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use under the right hereby confirmed, and to which such right is appurtenant, is as follows:

NW¼ SW¼
S½ SW¼
SW¼ SE¼
Section 1
E½ SE¼
Section 2
NE¼
N½ SW¼
Section 11
N½ SE¼
SE¼ SE¼
Section 11
NW¼ NE¼
NW¼
NW¼ SW¼
Section 12
T. 11 S., R. 13 E., W.M.

The right to the use of the water for the purposes aforesaid is restricted to the lands or place of use herein described.

WITNESS the signature of the Water Resources Director, affixed this date. April 30, 1979

James E. Sexson
Water Resources Director

Recorded in State Record of Water Right Certificates, Volume 41 *, page* 47906

RECEIVED
APR 5 1972
STATE ENGINEER
SALEM, OREGON

Permit No. G- G 5547

CERTIFICATE NO. 47906

APPLICATION FOR A PERMIT

To Appropriate the Ground Waters of the State of Oregon

I, THE CITY OF MADRAS
(Name of applicant)

of Madras (Postoffice Address), county of Jefferson,

state of Oregon, *do hereby make application for a permit to appropriate the following described ground waters of the state of Oregon, SUBJECT TO EXISTING RIGHTS:*

If the applicant is a corporation, give date and place of incorporation

1. *Give name of nearest stream to which the well, tunnel or other source of water development is situated* Willow Creek (Name of stream) *tributary of* Deschutes River

2. *The amount of water which the applicant intends to apply to beneficial use is* 1.5 *cubic feet per second or* 675 *gallons per minute.*

3. *The use to which the water is to be applied is* Municipal Water Supply

4. *The well or other source is located* 200 *ft.* North (N. or S.) *and* 1295 *ft.* West (E. or W.) *from the* SE *corner of* Sec. 2, T. 11 S., R. 13 E., W.M. (Section or subdivision)

(If preferable, give distance and bearing to section corner)

(If there is more than one well, each must be described. Use separate sheet if necessary)

being within the S.E. 1/4 of the S.E. 1/4 *of Sec.* 2, *Twp.* 11 S., *R.* 13 E., W.M. *W. M., in the county of* Jefferson.

5. *The* NOT APPLICABLE. Municipal Distribution System (Canal or pipe line) *to be* ..... *miles in length, terminating in the* ..... (Smallest legal subdivision) *of Sec.* ....., *Twp.* ....., *R.* ....., *W. M., the proposed location being shown throughout on the accompanying map.*

6. *The name of the well or other works is* City of Madras Well No. 3

DESCRIPTION OF WORKS

7. *If the flow to be utilized is artesian, the works to be used for the control and conservation of the supply when not in use must be described.*

8. *The development will consist of* one (1) well (Give number of wells, tunnels, etc.) *having a diameter of* 12 *inches and an estimated depth of* 400 *feet. It is estimated that* 400 *feet of the well will require* steel (Kind) *casing. Depth to water table is estimated* 350 (Feet)

G 5547

CANAL SYSTEM OR PIPE LINE—

9. (a) Give dimensions at each point of canal where materially changed in size, stating miles from headgate. At headgate: width on top (at water line) ..... *feet; width on bottom* ..... *feet; depth of water* ..... *feet; grade* ..... *feet fall per one thousand feet.*

(b) At ..... *miles from headgate: width on top (at water line)* ..... *feet; width on bottom* ..... *feet; depth of water* ..... *feet; grade* ..... *feet fall per one thousand feet.*

(c) Length of pipe, ... *ft.; size at intake,* ..... *in.; in size at* ..... *ft. from intake* ..... *in.; size at place of use* ..... *in.; difference in elevation between intake and place of use,* ..... *ft. Is grade uniform?* ..... *Estimated capacity,* ..... *sec. ft.*

10. If pumps are to be used, give size and type Pump size and type to be definite after test pump of well.

Give horsepower and type of motor or engine to be used .....

11. If the location of the well, tunnel, or other development work is less than one-fourth mile from a natural stream or stream channel, give the distance to the nearest point on each of such channels and the difference in elevation between the stream bed and the ground surface at the source of development

Willow Creek 1000 feet Elevation of creek 2220 feet

Ground elevation at well site 2234 feet.

12. Location of area to be irrigated, or place of use .....

Township N. or S.	Range E. or W. of Willamette Meridian	Section	Forty-acre Tract	Number Acres To Be Irrigated
11 S.	13 E	1	S.W. 1/4 of S.W. 1/4	
		1	N.W. 1/4 of S.W. 1/4	
		1	S.E. 1/4 of S.W. 1/4	
		1	W. 1/2 of S.W. 1/4 of S.E. 1/4	
		2	S.E. 1/4 of S.E. 1/4	
		11	N.E. 1/4 of N.E. 1/4	
		11	E. 1/2 of N.W. 1/4 of N.E. 1/4	
		11	S.W. 1/4 of N.E. 1/4	
		11	S.E. 1/4 of N.E. 1/4	
		11	N.E. 1/4 of S.W. 1/4	
		11	S.E. 1/4 of S.W. 1/4	
		11	N.W. 1/4 of S.E. 1/4	
		11	N.E. 1/4 of S.E. 1/4	
		12	N.E. 1/4 of N.W. 1/4	
		12	N.W. 1/4 of N.W. 1/4	
		12	S.W. 1/4 of N.W. 1/4	
		12	S.E. 1/4 of N.W. 1/4	
		12	N.W. 1/4 of N.E. 1/4	
		12	S.W. 1/4 of N.E. 1/4	
		12	N.E. 1/4 of S.W. 1/4	
		12	N.W. 1/4 of S.E. 1/4	

(If more space required, attach separate sheet)

Character of soil .....

Kind of crops raised .....

G 5547

MUNICIPAL SUPPLY—

13. To supply the city of Madras

in Jefferson county, having a present population of 2000

and an estimated population of ..... in 19.....

ANSWER QUESTIONS 14, 15, 16, 17 AND 18 IN ALL CASES

14. Estimated cost of proposed works, $16,000.00

15. Construction work will begin on or before June 1, 1972

16. Construction work will be completed on or before August 1, 1972

17. The water will be completely applied to the proposed use on or before April 1, 1973

18. If the ground water supply is supplemental to an existing water supply, identify any application for permit, permit, certificate or adjudicated right to appropriate water, made or held by the applicant. .....

x A P Miller, City Recorder
(Signature of applicant)

Remarks: .....

STATE OF OREGON, }
County of Marion, } ss.

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for .....

In order to retain its priority, this application must be returned to the State Engineer, with corrections on or before ....., 19.....

WITNESS my hand this ..... day of ....., 19.....

.....
STATE ENGINEER

By .....
ASSISTANT

STATE OF OREGON, }
County of Marion, } *ss.*

PERMIT

This is to certify that I have examined the foregoing application and do hereby grant the same, SUBJECT TO EXISTING RIGHTS and the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 1.5 *cubic feet per second measured at the point of diversion from the well or source of appropriation, or its equivalent in case of rotation with other water users, from* well #3

The use to which this water is to be applied is municipal

If for irrigation, this appropriation shall be limited to ..... *of one cubic foot per second or its equivalent for each acre irrigated and shall be further limited to a diversion of not to exceed* ..... *acre feet per acre for each acre irrigated during the irrigation season of each year;* .....

and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The well shall be cased as necessary in accordance with good practice and if the flow is artesian the works shall include proper capping and control valve to prevent the waste of ground water.

The works constructed shall include an air line and pressure gauge or an access port for measuring line, adequate to determine water level elevation in the well at all times.

The permittee shall install and maintain a weir, meter, or other suitable measuring device, and shall keep a complete record of the amount of ground water withdrawn.

The priority date of this permit is April 5, 1972

Actual construction work shall begin on or before March 21, 1976 *and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19*76

*Complete application of the water to the proposed use shall be made on or before October 1, 19*77

WITNESS my hand this 21st *day of* March, *19*75.

STATE ENGINEER

Application No. G-5747

Permit No. G-5542

PERMIT

TO APPROPRIATE THE GROUND WATERS OF THE STATE OF OREGON

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 5th *day of* April, *19*72, *at* 8:00 *o'clock* A *M.*

Returned to applicant: .....

.....

Approved:

March 21, 1975

Recorded in book No. ..... *of Ground Water Permits on page* G-5542

CHRIS L. WHEELER
STATE ENGINEER

Drainage Basin No. 5 *page* 47

State Printing

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the

STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED OCT 5 1972 STATE ENGINEER SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

Jeff 428

State Well No. 11S/13E-2 11
State Permit No.

(1) OWNER:
Name CITY OF MADRAS
Address CITY HALL, MADRAS, ORE.

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED: Threaded ☐ Welded ☒
16" Diam. from 0 ft. to 165 ft. Gage .375
12" Diam. from 155 ft. to 477 ft. Gage .330
" Diam. from ft. to ft. Gage

(6) PERFORATIONS: Perforated? ☒ Yes ☐ No.
Type of perforator used STAR
Size of perforations 3/8 in. by 1 1/4 in.
160 perforations from 404 ft. to 408 ft.
1580 perforations from 421 ft. to 471 ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom? STRASSER
Yield: 329 gal./min. with 130 ft. drawdown after 12 hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water 57° Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used CEMENT GROUT AND READY MIX
Well sealed from land surface to 21 AND 155-170 ft.
Diameter of well bore to bottom of seal 20 AND 16
Diameter of well bore below seal 16 AND 12
Number of sacks of cement used in well seal 0-21-5705 10 SK. MIX 155-170 18 SACKS GROUT sacks
Number of sacks of bentonite used in well seal sacks
Brand name of bentonite
Number of pounds of bentonite per 100 gallons of water lbs./100 gals.
Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County JEFFERSON Driller's well number 5420
SE ¼ SE ¼ Section 2 T. 11S R. 13E W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found 404 ft.
Static level 216 ft. below land surface. Date 9/13/72
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing —
Depth drilled 477 ft. Depth of completed well 477 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
SEE ATTACHED SHEET			

Work started JUNE 19 1972 Completed SEPT 22 1972
Date well drilling machine moved off of well SEPT 25 1972

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] [signature] (Drilling Machine Operator) Date 9/27, 1972
Drilling Machine Operator's License No. 54

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name R.J. STRASSER DRILLING Co (Person, firm or corporation) (Type or print)
Address 8110 SE SUNSET LANE PORTLAND ORE
[Signed] Robert L. Strasser (Water Well Contractor)
Contractor's License No. 10 Date SEPT 27, 1972

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

Phone: 771-2355

R. J. Strasser Drilling Co.

8110 S. E. Sunset Lane
Portland, Oregon 97206

September 30, 1972

LOG OF MADRAS WELL #3

fill	0 - 5
sand, gravel and clay	5 - 14
brown clay	14 - 18
sand, gravel and clay	18 - 41
brown sandy silt	41 - 63
brown sandy clay and rock	63 - 87
gray sandstone	87 - 108
black basalt	108 - 113
broken black basalt	113 - 132
black basalt	132 - 143
broken black basalt	143 - 151
black basalt	151 - 177
brown and black basalt	177 - 256
dark brown basalt	256 - 264
black porous basalt	264 - 288
hard, dark grey basalt	288 - 293
porous black basalt	293 - 313
dark grey basalt, grey clay	313 - 329
black basalt	329 - 335
porous black basalt, tan clay	335 - 358
sticky brown clay, broken rock	358 - 366
brown and red rock layers of clay	366 - 404
sand, gravel and clay	404 - 408
sticky brown clay	408 - 417
clay and gravel	417 - 423
sand, gravel and brown silt	423 - 461
dirty brown sand, some gravel	461 - 467
brown ash	467 - 477

APPENDIX A-4 - WATER SALE AGREEMENT BETWEEN CITY OF MADRAS AND DVWD (5/28/13)

WATER SALE AGREEMENT
between
DESCHUTES VALLEY WATER DISTRICT
and
CITY OF MADRAS

THIS AGREEMENT is made and entered into this 28th day of May 2013, by and between DESCHUTES VALLEY WATER DISTRICT, hereinafter referred to as "District" and the CITY OF MADRAS, hereinafter referred to as "City".

RECITALS

WHEREAS, the District owns and operates a domestic water district under ORS Chapter 264 for the purpose of supplying domestic water;

AND WHEREAS, the City wishes to purchase domestic water from the District for the purpose of providing for the entire water needs for the City of Madras except in situations of emergency where the District is unable to provide for the entire needs of the City in which case the City will utilize it's own wells during the period of the inability of the District to provide sufficient water for the needs of the residents of the City of Madras;

AND WHEREAS, the District and the City have previously operated under a Water Sale Agreement dated May 11, 2010, which expires June 30, 2013, and this Agreement shall replace the previous Agreement and the previous Agreement upon expiration shall be null and void and have no effect;

AND WHEREAS, the District and the City are authorized pursuant to ORS 190.010 to enter into an intergovernmental contractual agreement;

AND WHEREAS, the District is authorized specifically pursuant to ORS 264.310 to contract and enter into an intergovernmental agreement to supply and sell surplus water on such terms and conditions and at such rates as the District's Board shall consider advisable;

NOW THEREFORE, the parties hereby mutually agree as follows:

TERM OF AGREEMENT: This agreement shall commence on July 1, 2013 and extend through June 30, 2016. The District shall make available to the City subject to the provisions of this agreement domestic water at the Districts three points of interconnection with the City water system.

WATER RIGHTS: The City shall pay to the District the sum of SIX THOUSAND AND 00/100 DOLLARS ($6,000.00) per month. In addition the City shall pay to the District the sum of $0.283 per 100 cubic feet, which shall be a "UNIT". The $0.283 rate shall commence upon the first unit of water delivered. The water rates shall be adjusted when the electric pumping cost per unit has increased or decreased by 10% calculated from the following formula: The electric pumping cost divided by the number of units sold, determined from the District's annual audit report, plus 10.25%.

When the rates are adjusted as provided by this paragraph, the rate charge shall be the rate computed pursuant to this formula. The new rate shall become effective on July 1 of the following fiscal year during the term of this contract.

METERING AND PAYMENTS: The District shall meter the amount of water delivered to the City by the District at the District's point of delivery to the City. The parties acknowledge that there are three points of delivery existing. The point of delivery is the location currently existing where the District and City's water facilities are connected and metering by the District shall be conducted at those points.

The District shall provide the City with monthly computations and invoice of metered use and the City shall make monthly payments within thirty (30) days of the City receiving the invoice. The City shall, in addition, pay monthly the SIX THOUSAND AND 00/100 DOLLARS ($6,000.00) each month during the term of this contract.

RENEWAL OF CONTRACT: Unless notice is given by either party to this contract in writing, no later than ninety (90) days of the expiration date of this contract, that the contract shall not be renewed, then the contract shall automatically be renewed for an additional three year period. The renewal shall be automatic and shall commence on July 1st of the succeeding period and shall expire on June 30th on the third year of the renewal. For each renewal period the parties reserve the right to notify the other party of their intent to terminate the contract ninety (90) days before the next contract expiration date. During any renewal contract period the District shall be able to negotiate a different monthly charge for the provision of domestic water services.

POINT OF DELIVERY AND MAINTENANCE: The parties agree that there are three points of delivery located within the City. The District is responsible for the maintenance of the valve house locations at the point of delivery. The point of delivery is where the District shall meter the water delivered to the City. The District will maintain all equipment and installation of valve house metering equipment at the point of delivery. The valve housing and equipment shall belong to the District. The District shall maintain all necessary repairs, maintenance and replacement of equipment at the point of delivery.

SUPPLY OF WATER: The District shall supply to the City all the water needs that the City shall require during the period of this agreement. The water shall be used by the City for domestic water purposes including the City's irrigation of parks and green spaces. The District shall supply water to the City pursuant to this agreement so long as available to the District a surplus supply of water existing over and above all demands of the District's domestic water users.

CONTINUITY OF SERVICE: The District may be required to curtail, interrupt or reduce deliveries of water in order to construct, install, maintain, repair, replace, remove, investigate or inspect any of the District's equipment or any part of its system. In such circumstances, the District shall use its best efforts to keep all curtailments, interruptions or reductions to a minimum. The District shall notify the City in advance when the District is required to temporarily curtail water delivery service and shall notify the City as to the period of time in which said service may be temporarily discontinued for the needs of the District to make necessary repairs, improvements or

testing.

In the event that the City shall need to make repairs, construction, maintenance or inspect any of the City's domestic water delivery system, the City shall notify the District of the need for the District to shut down a supply of water to the City on a temporary basis to allow the City to construct or maintain the City's water delivery system to it's citizens. The District agrees to cease service for a period of time to allow the City to make any necessary repairs, inspection, replacement or construction. Notices shall be given by the parties to the appropriate representative of the City and District as designated from time to time by the City or District.

LIABILITY: Neither party, its directors, officers and employees, shall be liable to the other party for any loss or damage to the water system of the other caused by or arising out of an interruption of water service, whether or not such interruption of water service resulted from gross negligence, negligence, wrongful act or omission of the other party. An interruption of water service caused by the design, construction, operation, maintenance or use of one parties' water system shall not be the liability of the other party. Each party releases the other party, its directors, officers and employees from any such liability.

WARRANTIES: The District warrants to the City that the District shall supply domestic water to the City of the same quality as the domestic water being supplied to the District's domestic water users.

The District neither warrants nor guarantees the quality or quantity of the domestic water delivered to the City at or beyond the point of delivery, which is the point at which the District delivers water to the City and meters the water from the District's point of delivery at the valve houses at the point of delivery. The City shall assume all responsibility for water quality from the point of delivery by the District to the City and the City shall assume responsibility for water quality to the City's own domestic water service users. The City warrants that the water delivered by the District to the City shall be used for domestic water purposes only.

NON-DEDICATION: Nothing in this Agreement shall be construed to create any duty to, any standard of care with reference to, or any liability to any person not a party to this Agreement. No undertaking by one party to the other under any provisions of this Agreement shall constitute the dedication of that party's system of domestic water supply or any portion thereof to the other party or to the public.

COMPLETENESS OF AGREEMENT: The provisions embodied in this Agreement contain all covenants, agreements, obligations and stipulations agreed upon between the parties and on execution hereof, any and all previous and existing agreements and/or contracts entered into between the parties are hereby declared by mutual consent to be null and void.

ASSIGNMENT: No assignment of this Agreement shall be valid.

ENTIRE AGREEMENT: This Agreement contains the entire agreement between the parties and no modification of this Agreement shall be binding upon the parties unless evidence by an

agreement in writing signed by the District and the City by and through their authorized representatives after the date hereof.

BREACH: A breach of contract by either party shall constitute grounds for cancellation of this Agreement by the other party. However, the party who commits the breach shall have thirty (30) days after mailing a written notice of such breach from the other party in which to correct or abate the breach and avoid cancellation. If the party committing the breach fails, refuses or neglects to correct or abate the breach within such thirty day period, then the other party, at its option, shall immediately terminate this Agreement by giving written notice of termination to the party in default. Any written notice provided for herein shall be deemed properly mailed and delivered when the same is deposited in the United States Mail, postage prepaid and properly addressed to the party to whom such notice is directed. Proper addresses of the two parties shall be as follows: Deschutes Valley Water District, 881 SW Culver Highway, Madras, Oregon 97741 and City of Madras, 125 SW "E" Street, Madras, Oregon 97741.

RATIFICATION: The signatures by the parties' agents as hereinafter contained do hereby certify that this contract has been ratified on behalf of the City of Madras by the City Counsel of the City of Madras and on behalf of Deschutes Valley Water District by the Board of Directors of Deschutes Valley Water District and the undersigned have authority to enter into this contract as referenced by the signing of the parties' agents.

DESCHUTES VALLEY WATER DISTRICT ("DISTRICT")

By: Edson Pugh
Edson Pugh, General Manager

ATTEST:

By: Eldon Barker
Eldon Barker, Chairman, Board of Commissioners
of Deschutes Valley Water District

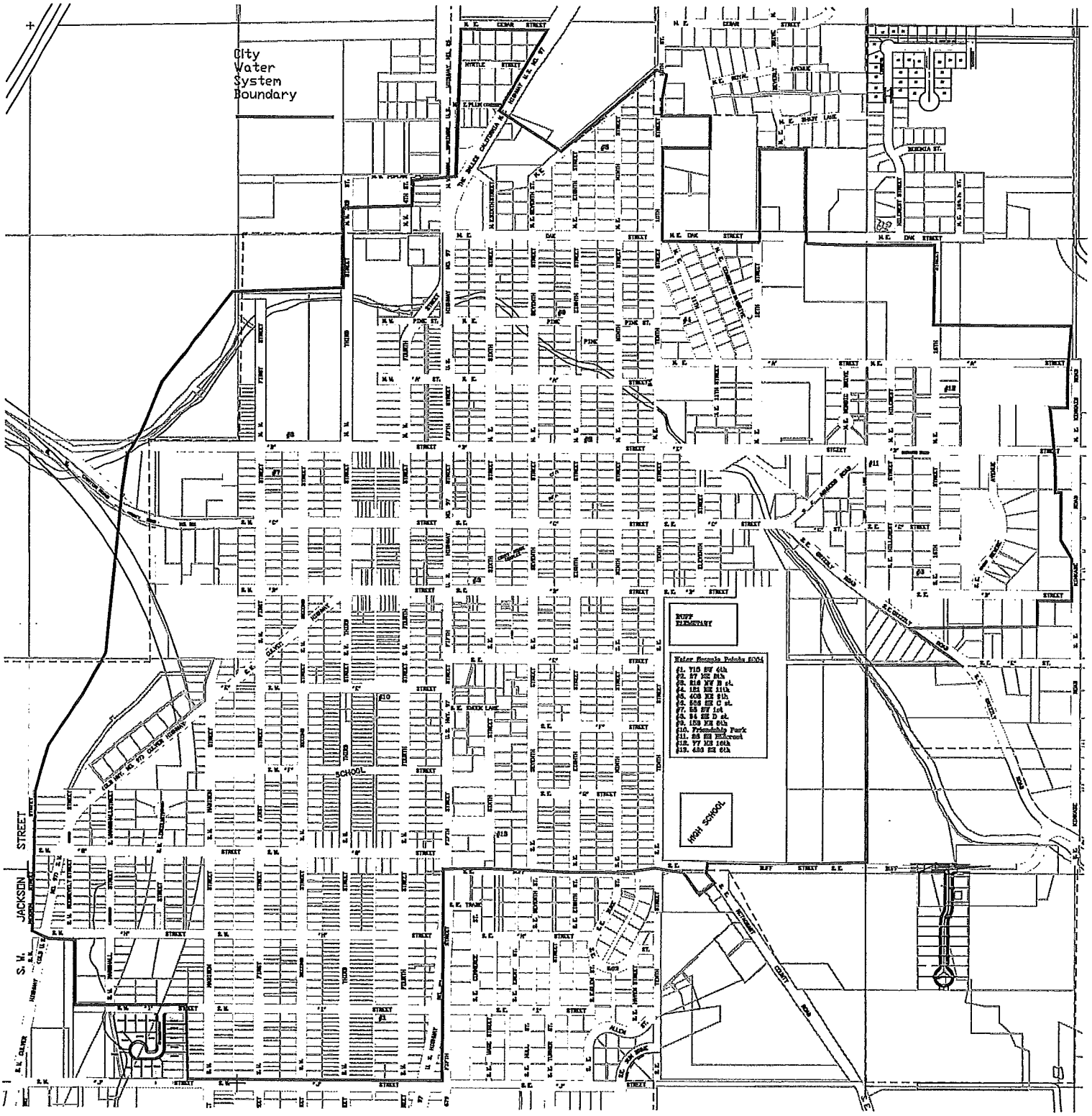
CITY OF MADRAS ("CITY")

By: Melanie Widmer
Melanie Widmer, Mayor

ATTEST:

By: Karen J. Coleman 5-28-2013
Karen Coleman, City Recorder of the City of Madras

Madras Water Service Boundary Map



Oregon Association of Water Utilities names Deschutes Valley Water District

With the Best Groundwater and Best Overall Water of the Year for 2013

SUNRIVER, OREGON – The Oregon Association of Water Utilities 35th Annual Technical and Management Conference, held each March at the Sunriver Resort, proved to be successful for all attendees. At the annual awards banquet Deschutes Valley Water District was named as the Best Groundwater and Best Overall Water in Oregon for the 2013 year. Water from Deschutes Valley Water District will be entered to represent Oregon in the National Best Water Contest at the annual National Rural Water Association's Rural Water Rally in Washington D.C. at the end of this year.

Deschutes Valley Water District has excellent water which was proven this year by an unbiased panel of five judges who blind taste tested drinking water from around Oregon, judging it on clarity, bouquet, and taste.

Deschutes Valley Water District has been a member of the Oregon Association of Water Utilities (OAWU) since November of 1979. OAWU is a non-profit organization with over 700 members and serves Oregon's water and wastewater utilities in hands-on training and technical services. The association serves as a legislative liaison and is active in supporting legislation that improves the utilities that serve Oregon's residents. For more information about OAWU, visit their website at www.oawu.net or contact the office at 503-837-1212.

APPENDIX B-1 - PIPELINE NEWSLETTER, FALL 2009

DHS: PUBLIC HEALTH DIVISION

DRINKING WATER PROGRAM

Pipeline

Vol. 24 Issue 1 Winter 2009 OREGON DRINKING WATER NEWS www.oregon.gov/DHS/ph/dwp/

Program update

by Dave Leland

2009 has been a swirl of activity! Oregon applied for and received additional moneys for the Drinking Water Revolving Fund under federal stimulus provisions, which will enable us to begin awarding funds to communities for safe drinking water construction projects. We completed state adoption of three remaining EPA drinking water regulations. And, to top it off, the Legislature is deliberating, among other issues this session, state budget concerns as well as water-related bills.

Stimulus funds awarded

The 2009 federal American Recovery and Reinvestment Act (ARRA) included $2 billion for safe drinking water infrastructure to be distributed

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OAWU to deliver small water system operator training

by Ronald Hall

The Drinking Water Program is happy to announce that we have contracted with the Oregon Association of Water Utilities (OAWU) for the delivery of our Small Water System Training Course. The course is free and is sponsored by a grant from the U.S. EPA. This is the same course that Drinking Water Program staff members have been delivering around the state for a number of years.

All water system operators are welcome to attend; however, the course targets small systems with fewer than 150 connections that use groundwater as a source or purchase water without adding any treatment. It is the course you need to take to receive small water system operator certification. Training materials have been updated to reflect industry standards and are based on a need-to-know document developed by an industry task force.

The courses will be offered in the same areas as in the past, but we want to limit attendance to 40

Continued on page 3

Update ...continued from page 1

through the states via the Drinking Water Revolving Loan Fund. Oregon's share is $28,515,000, which compares to the current annual capitalization grant of about $12 million per year. This stimulus funding is subject to the following:

1. All drinking water infrastructure projects must be under contract or under construction by Feb. 17, 2010. "Readiness to proceed" is crucial!

2. Fifty percent of the funding must be used for loan subsidies.

3. Twenty percent of the funding must be used for "green" projects.

4. "Buy American" provisions for materials are part of the ARRA.

5. Prevailing wages are required in compliance with Davis-Bacon.

Together with our partners at the Oregon Economic and Community Development Department (OECDD), we prepared early to receive stimulus funding. Communities across Oregon responded to our solicitation for safe drinking water projects. Nearly 150 communities submitted projects with a total estimated cost of $335 million! More than 100 of these communities submitted financial applications and certified their readiness to proceed. We received the federal capitalization grant on April 9, and the staffs of DHS and OECDD are focused on reviewing the applications and conducting required on-site assessments of technical/financial/managerial capacity as top priorities. We expect to begin awarding funds by mid-June.

EPA rules adopted

We held hearings around the state in March for public comment on our adoption of the three remaining EPA drinking water regulations: the Long-term 2 Enhanced Surface Water Treatment Rule; the Stage 2 Disinfection By-products Rule; and the Ground Water Rule. The rule adoption was a major effort by Drinking Water Program staff, and we appreciate the comments we received from the three participating water suppliers and from EPA Region X. The state rules were filed with the Secretary of State on May 15. Our next step is to apply to EPA for primacy for these three rules, and we expect to complete that process and take over rule implementation from EPA by fall 2009!

2009 Legislature in session

In a typical legislative session, about 3,000 bills are introduced. The Public Health Division usually reviews about 600 of these, and then tracks about 50 as top priority bills. This year, the Drinking Water Program is involved with top priority bills on the following topics:

1. Pharmaceutical take-back programs to keep unused drugs out of the water (SB 598);

2. Arsenic testing requirements for private wells upon sale of property (SB 739);

3. DEQ capacity to test water for cyanotoxins from algae (HB 2945).

Other bills in play include: establishment of drinking water overlay zones (SB 482); mobile home park submetering (SB 929); other bills related to pharmaceuticals (HB 2918, HB 2535); landlord water utility charges (HB 2613); continuing education units for water and wastewater training (HB 3247); municipal water use reduction (HB 3442); limited license for backflow testers to repair backflow devices (SB 930); and fluoridation of large water systems (HB 3156).

The state budget picture occupies center stage. The May revenue forecast is expected to show a shortfall for the 2009–11 state General Fund budget of more than $4 billion. In April, all state agencies submitted General Fund budget reduction options of up to 30 percent. The Joint Committee on Ways and Means then held a series of public hearings in different communities in Oregon to take public comments on the agency-proposed reduction lists. The Drinking Water Program currently is funded at $15 million for two years, with about one-third in General Fund moneys

and fees, and about two-thirds in Federal Funds. The DHS reduction options list contains a drinking water General Fund reduction of $800,000 for 2009–11. This reduction option represents a portion of the program capacity that was added by the 2007 Legislature. Should this occur, the program will not be able effectively to oversee the 900 known very small non-EPA public water systems in Oregon, serving 10–24 people or 4–14 connections.

Stay tuned!

Dave Leland is manager of the Drinking Water Program 971-673-0415 or david.e.leland@state.or.us

OAWU ...continued from page 1

persons to improve the quality of the training. We have added additional courses this year in areas where prior attendance shows a greater need.

We will soon offer this same training online so check our Web site or future issues of Pipeline for announcements.

While we will continue to post the training schedule on our Web site, registration will be handled directly by the OAWU. You can reach them at www.OAWU.net or call them at 503-873-8353.

Ron Hall is unit manager for the Protection, Planning and Certification Unit of the Drinking Water Program 971-673-0409 or ronald.a.hall@state.or.us

Get ready for the Ground Water Rule

by Bill Goss

The Drinking Water Program (DWP) will take primacy for the Ground Water Rule (GWR) after the current rule adoption package is complete. The DWP has long advised that public water systems take many of the actions included in the GWR, but taking those actions will soon become required. Provisions of the GWR take effect **Dec. 1, 2009**. Are you ready?

Which water systems does the GWR apply to?

- Systems relying 100 percent on ground water (GW);
- Consecutive (or purchasing) systems receiving GW from wholesalers;
- Mixed surface and GW systems, except where all GW goes through treatment equivalent to surface water or ground water under the direct influence of surface water.

What does the GWR consist of?

The GWR is designed to reduce the risk of illness caused by microbial contamination in public GW systems. *E. coli* will be used as an indicator of fecal contamination. The GWR consists of four main elements:

1. **Water system (sanitary) surveys.** The DWP has been conducting water system surveys for many years, but the GWR will affect the process. The survey frequency for community systems will change from every five years to every three years except for those GW systems that demonstrate outstanding performance. Significant deficiencies identified during the survey will need to be corrected within 120 days of notification, or be on an approved plan and schedule for correction.

2. **Source water monitoring.** Source water samples will need to be collected from raw water sample taps at the wellhead or springbox in three possible scenarios:

Provisions of the GWR take effect Dec. 1, 2009

- **Triggered monitoring.** Following a total coliform positive (TC+) sample result in the distribution system, the GW system must collect one untreated source sample within 24 hours from every source in use at the time the TC+ sample was collected. For systems with <1,000 population, the triggered source sample(s) will count as one of the four repeat samples required under the Total Coliform Rule. Representative sampling may be allowed for larger systems with multiple GW sources and distribution system pressure zones if DWP approves the system's sampling plan.

- **Additional monitoring.** After an *E. coli*-positive result from the source, five additional source samples must be collected within 24 hours unless corrective action is taken immediately.

- **Assessment monitoring.** Twelve monthly source samples will be required for GW sources that are determined by the DWP to be at higher risk of fecal contamination. Systems will be notified individually if assessment monitoring will be required. All systems that treat with chlorine or ultraviolet and do not achieve 4-log treatment of viruses will be required to collect at least one source sample per year.

3. **Compliance monitoring.** If a GW system provides 4-log treatment (99.99 percent inactivation or removal) of viruses, compliance monitoring of the treatment process can replace the triggered source water monitoring requirements if the system desires. If chlorinating, the chlorine residual will need to be monitored daily, or continuously if >3,300 population, at the entry point to ensure the minimum required chlorine residual is maintained. If a system decides to perform

compliance monitoring instead of triggered source monitoring, a request must be submitted to DWP by Dec. 1, 2009, with engineering calculations that demonstrate 4-log virus treatment before the first user. A minimum chlorine residual that must be maintained at the entry point will be assigned by DWP.

4. **Corrective actions.** A GW system will be required to take corrective actions if a source water sample tests positive for *E. coli*, or if the system is notified of a significant deficiency. The action must be agreed upon during consultation with DWP staff, and be one or more of the following to:

    - Correct all significant deficiencies;
    - Provide an alternative source of water;
    - Eliminate the source of contamination;
    - Provide 4-log treatment of viruses and conduct compliance monitoring.

What else do I need to know?

- An *E.coli*-positive source sample will require issuing a Tier 1 (Boil Water) Notice within 24 hours.
- EPA GWR guidance manuals and Quick Reference Guides are available online at: *www.epa.gov/ogwdw/disinfection/gwr/compliancehelp.html.*

What should I do now?

- Update your coliform sampling plan to include the required triggered source water sample sites. Identify which source or sources contribute water to the location of each coliform sampling site in the distribution system. A revised template for small GW systems is available on the DWP Web site.
- Install or confirm the presence of a raw water sample tap at each GW source. Source samples for springs may be collected from the overflow pipe outlet if it flows year-round; otherwise a sampling point will need to be installed as close as possible to the source, and prior to any treatment.
- Correct all deficiencies noted in your most recent survey report.
- Consider the pros/cons of triggered monitoring vs. compliance monitoring.
- Consider installing an injection port on the well discharge line so a chlorination system could be placed into operation quickly if needed. Determine if the system is able to provide 4-log treatment for viruses. Review the emergency disinfection and public notice procedures in your Emergency Response Plan.
- Consider wholesale/purchasing GW system communication and sampling requirements if they apply to your system. If a purchasing system has a TC+ sample, the wholesale GW system is required to collect the triggered source sample(s). Distribution of any required public notices to customers will also need to be coordinated.

The job of complying with the GWR will vary from system to system. Find out what it will take for your system and get ready!

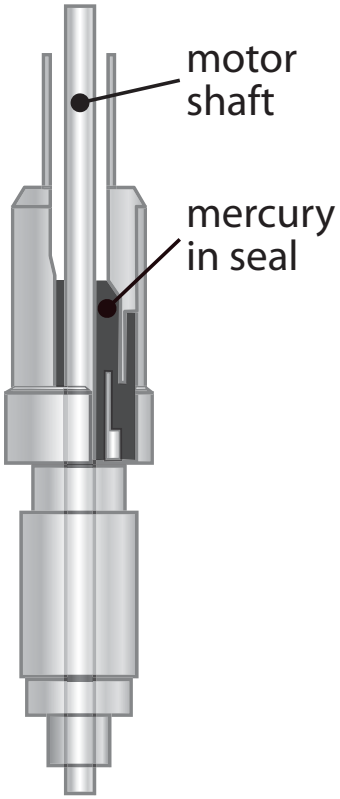
Bill Goss, PE, is a civil engineer in the Technical Services Unit of the Drinking Water Program
541-966-0900 or william.h.goss@state.or.us

Mercury in pumps: Addressing the risk of contamination

by Carrie Gentry

Several water systems around the nation have experienced mercury leaks at wells from the failure of seals in submersible pumps resulting in increased sampling, cleanup costs, the need to switch to emergency water sources, and in some cases, installation of treatment systems.

Submersible pumps are widely used at water systems in Oregon for pulling water from wells. In a submersible pump, the pump assembly and motor are submerged in water and the motor is typically mounted below the pump assembly. All submersible pumps use a seal to separate the electrical parts of the motor from the water intake area of the pump. Mechanical seals are common; however, some older pumps use mercury seals. At least one pump manufacturer (Flowserve Byron Jackson) still produces submersible pumps with optional mercury seals.[1]



Mercury is a liquid metal and has a high surface tension, which makes it a tempting choice for use in submersible pump seals. A submersible pump with a mercury seal may contain approximately 12 pounds of mercury, which is about 5,400,000 milligrams.[2] The maximum contaminant level (MCL) for mercury is 0.002 mg/L.

A mercury spill on the ground at a wellhead — which could happen when a pump is being pulled for maintenance — could release mercury vapor. Health effects associated with inhalation of mercury vapor over time include tremors, insomnia and neuromuscular changes.[3] Cleanup costs of surrounding soils can be significant.

The financial impacts on a water system due to a leak of mercury in a well also can be significant. This might include the cost of removing the mercury from the well, which may be found in both the water and the sediment at the bottom of the well.

It may also include the cost of supplying an alternative source of water, and increased monitoring and testing costs.

In order to mitigate the risk of mercury leaks from submersible pumps, operators should develop and implement best management practices.[2,4] These may include:

1. **Awareness of mercury seals.** If a submersible pump was installed prior to 1990, it may contain a mercury seal. Operators should check the pump manual or contact the manufacturer to determine whether the submersible pump has a mercury seal. If the operator is unable to make a determination, then the assumption should be made that the pump has a mercury seal.

2. **Replace seals or pumps.** Some seals can be retrofitted with mechanical seals. If a seal cannot be replaced, consider putting pump replacement projects higher on the priority list.

3. **Consider more frequent monitoring of mercury.** If pump replacement is not a feasible option, consider increased monitoring of mercury.

4. **Read instructions before pulling a pump for maintenance.** Incorrectly disassembling a pump can lead to a leak. An operations manual should have instructions for proper pump disassembly and removal.

5. **Use a cover or other barrier if working over the wellhead.** An impermeable barrier can protect the soil around the wellhead and the wellhead itself.

6. **Have a spill kit handy.** Train staff on safe cleanup procedures for mercury spills and safe disposal. DEQ has disposal guidelines for mercury. See *www.deq.state.or.us/lq/mercurydisposal.htm* for more information.

We recommend that water systems determine whether any submersible pumps currently in use contain mercury seals. If mercury seals do exist in your water system, then best management practices can help reduce the risk of contamination. Over the long term, phasing out mercury seals by replacing the seals or pumps is highly recommended.

Carrie Gentry is the regional engineer assistant in the Technical Services Unit of the Drinking Water Program 971-673-0191 or carrie.l.gentry@state.or.us

1. Hawaii Safe Drinking Water Branch of the Hawaii State Department of Health, September 2006. Mercury In Your Water Source. The Water Spot 2006. *http://hawaii.gov/health/environmental/water/sdwb/environmental/water/sdwb/newsletter/pdf/10spot07.pdf* (accessed 4/2/2009).

2. Massachusetts Department of Environmental Protection Drinking Water Program, December 2007. Identification and Best Management Practices of Mercury-Containing Equipment at Public Water Systems. *www.mass.gov/dep/water/drinking/mercbmp.pdf* (accessed 4/2/2009).

3. U.S. Environmental Protection Agency, February 2009. Health Effects. *www.epa.gov/ mercury/effects.htm* (accessed 4/2/2009).

4. Idaho Department of Environmental Quality. Drinking water, submersible pumps, and mercury seals: A potential problem. *www.deq.idaho.gov/WATER/assist_business/pws/mercury_seals_fs.pdf* (accessed 4/2/2009).

Renewing backflow tester and specialist certifications for 2009–11

by Michael Perry

It is time for the backflow assembly testers and cross connection specialists biennial certification renewal. The renewal is for July 1, 2009, through June 30, 2011. Applications were mailed April 27, 2009. If you have not received your renewal application, call 971-673-1220. Renewal forms are *not* available online.

Most renewals will require evidence of having taken the approved Tester or Specialist Update courses along with gauge calibrations. Renewal requirements are on the back of the renewal form or online at: *www.oregon.gov/DHS/ph/crossconnection/docs/RenewalRequirements.pdf.*

If testers want to be on the Public List of Certified Testers, in addition to the renewal requirements of certification, the tester, or his or her employer, must have either a Construction Contractors Board license or a Landscaper Contractors Board license.

Michael Perry is the Cross Connection Program coordinator 971-673-1220 or michael.perry@state.or.us

Attention Lane County public water systems

The DHS Drinking Water Program (DWP) is pleased to announce that after 10 years of direct state service to public water systems (PWS) in Lane County, Lane County Environmental Health has contracted with the DWP to provide local service again! This means that more than 300 PWS in Lane County will now receive assistance from the Lane County Environmental Health Program beginning in March 2009. For assistance, please see the information below:

For PWS serving > 3,300 population and all community PWS using surface water in Lane County contact:

Casey Lyon
DHS Drinking Water Program
444 A Street
Springfield, OR 97477
541-726-2587, ext. 31
Fax: 541-726-2596
casey.lyon@state.or.us

For all other Lane County PWS contact:
Katrinka Danielson
Lane County Environmental Health
125 E. 8th Avenue
Eugene, OR 97401
541-682-7462
Fax: 541-682-7459
katrinka.danielson@co.lane.or.us

Operator certification corner:

Applying for small water system operator certification

by Dottie Reynolds

This is a reminder that if your system is required to have a level "S" ("small system") operator, the small water system operator **and** the owner must complete the small water system (SWS) operator designation application. This form designates the operator as the individual in direct responsible charge (DRC) of the system. The training certificate received for attending the training course is *not* the SWS operator certification. The SWS is not considered to be in compliance until the SWS operator application is received and certification is issued. Re-certification is due no later than July 31, every three years.

The owner or legal representative (president, owner, secretary, superintendent, mayor, etc.) of the system must complete the application designating the operator as the DRC for the drinking water system, and send it, along with a copy of the operator's training certificate, to the address at the bottom of the form. The only time the designated DRC may sign the application is if he or she owns the system. If you cannot locate the training certificate, indicate the training date and location on the application and we will verify the date.

You may request a small water system operator application by calling the Department of Human Services Public Health Division Drinking Water Program (DWP) at 971-673-0413 or you can print the form from the Operator Certification Program Web site at *www.oregon.gov/DHS/ph/dwp/certif.shtml*. The Web site also offers training schedules, rules, requirements, contracting for services information, FAQ sheets, and more, about small water systems. To ensure that the address, phone number and contacts are correct, click on the side bar ("Data Online") and type in the name of your system, or its PWS ID number. If the information is incorrect or there are any changes to be made on this screen, please call the DWP immediately.

If your DRC is a contract operator certified at level 1–4 in distribution or treatment, this application still must be completed and signed by the owner every three years. The DWP must also have a copy of the most current contract. This ensures that we have the most current owner (legal representative) and operator information on record.

Note that the SWO free training course, formerly offered by Drinking Water Program staff is now being conducted by the Oregon Association of Water Utilities (OAWU) personnel. Look for information on our Web page, this Pipeline issue, or go to www.OAWU.net for the full calendar and locations of training.

Dottie Reynolds is the Operator Certification Program coordinator in the Drinking Water Program 971-673-0426 or dottie.e.reynolds@state.or.us

Meeting calendar

Drinking Water Advisory Committee

Department of Human Services
Diane Weis, 971-673-0427

July 15, 2009
October 21, 2009

All meetings are held at the Public Utility Commission Office, 550 Capitol St. N.E., Salem, OR 97310

Cross Connection Advisory Board

Go to:
www.oregon.gov/DHS/ph/crossconnection/docs/AdvisoryBoardSchedule.pdf

Training calendar

CEUs for Water System Operators

Check *www.oesac.com* for new offerings approved for drinking water

OAWU

503-873-8353

June 10	Source Water Protection Planning
June 17	Safe Drinking Water Act Update
June 17	Water Conservation Management Planning
July 15	Safe Drinking Water Act Update
July 15	Water Conservation Management Planning
Aug. 4	Control Valves by GC Systems
Aug. 17–20	Summer Classic XV
Sept. 8–10	Water Treatment/Distribution Certification Review
Sept. 22–24	Water Treatment/Distribution Certification Review

OCT Academy

1-866-266-0028

June 22–23	Two-Day Pump Theory
June 24–25	Two-Day Pump Repair and Maintenance
June 26	One-Day Pump Control Systems
Sept. 15	Ponds and Lagoons
Sept. 18	Collections Certification Review
Sept. 21–22	Two-Day Mathematics for Collections Operators

Cross Connection/Backflow Courses

Backflow Management Inc. (B)
503-255-1619
Clackamas Community College (C)
503-675-6958 ext. 2388

Backflow Assembly Tester Course

June 1–5	Portland (B)
June 8–12	Clackamas (C)
Aug.31–Sept.4	Portland (B)

Backflow Assembly Tester Recertification

June 5	Clackamas (C)
June 12	Portland (B)
June 18	Portland (B)
June 23	Redmond (B)
June 26	Portland (B)

Cross Connection Inspector Course

Sept.28–Oct.1	Portland (B)

Water System Training Course

OAWU
503-873-8353

June 23	Coos Bay
June 25	Springfield
July 22	Pendleton
September *	Newport, Klamath Falls, Bend, Eagle Point

* Dates to be announced

Department of Human Services
Drinking Water Program
P.O. Box 14450
Portland, OR 97293-0450

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Upon request this publication can be furnished in an alternate format for individuals with disabilities by contacting Diane Weis, 971-673-0427. Available formats are: large print, Braille, audio tape recording, electronic format and oral presentation.

DHS 8302

DHS

APPENDIX B-2 - CITY OF MADRAS 2012 WATER QUALITY REPORT

City of Madras 2012
Annual Drinking Water Quality Report

We're pleased to present to you this year's Annual Water Quality Report. This report is designed to inform you about the quality of water and services we deliver to you every day. Our constant goal is to provide you with a safe and dependable supply of drinking water. We want you to understand the efforts we make to continually improve the water treatment process and protect our water resources. We are committed to ensuring the quality of your water.

The City has three sources for our water. Deschutes Valley Water District is the main supplier of our water. We also have two wells in the City limits that are used for backup and emergencies. The wells draw water from the Lower Deschutes Drainage Basin.

We are pleased to report that our drinking water is safe and meets Federal and State requirements.

If you have any questions about this report or concerning your water utility, please contact Keith Bedell at (541) 475-7259. We want our valued customers to be informed about their water utility. If you want to learn more, please attend any of our regularly scheduled Council meetings. They are held on the 2nd and 4th Tuesdays of each month at 7:00 pm in the City Hall Council Chambers.

The City of Madras routinely monitors for constituents in your drinking water according to Federal and State laws. The following table shows the results of our monitoring for the period of January 1 to December 31, 2012. All drinking water, including bottled drinking water, may be reasonably expected to contain at least small amounts of some constituents. It's important to remember that the presence of these constituents does not necessarily pose a health risk.

In the following tables you will find many terms and abbreviations you might not be familiar with. To help you better understand these terms we've provided the following definitions:

Parts per million (ppm) or Milligrams per liter (mg/l) -one part per million corresponds to one minute in two years or a single penny in $10,000.

Parts per billion (ppb) or Micrograms per liter -one part per billion corresponds to one minute in 2,000 years, or a single penny in $10,000,000.

Action Level -the concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

Maximum Contaminant Level -The "Maximum Allowed" (MCL) is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology. ***Maximum Contaminant Level Goal*** -The "Goal" (MCLG) is the level of a contaminant in drinking water below which there is no known or expected **risk** to health. MCLGs allow for a margin of safety.

(9) Arsenic. Some people who drink water containing arsenic in excess of the MCL over many years could experience skin damage or problems with their circulatory system, and may have an increased **risk** of getting cancer.

(15) Copper. Copper is an essential nutrient, but some people who drink water containing copper in excess of the action level over a relatively short amount of time could experience gastrointestinal distress. Some people who drink water containing copper in excess of the action level over many years could suffer liver or kidney damage. People with Wilson's disease should consult their personal doctor.

(17) Lead. Infants and children who drink water containing lead in excess of the action level could experience delays in their physical or mental development. Children could show slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure.

(20) Nitrate. Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.

City of Madras

Contaminant	MCLG	MCL	Your Water	Sample Date	Violation	Typical Source
Arsenic [ppb]	50	10	0.0065	2012	No	Erosion of natural deposits; runoff from orchards; Runoff from glass and electronics production wastes
Copper[ppb]	AL = 1.35	0	0.0032		No	Corrosion of household plumbing systems, erosion of natural deposits
Nitrate (measured as Nitrogen) [ppm]	10	10	ND	2012	No	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits, Naturally Occurring

Deschutes Valley Water District

Contaminant	MCLG	MCL	Your Water	Sample Date	Violation	Typical Source
Inorganic Contaminants						
Arsenic (ppb)	0	10	3	2009	No	Erosion of natural deposits; Runoff from orchards; Runoff from glass and electronics production wastes
Fluoride (ppm)	4	4	0.175	2009	No	Erosion of natural deposits; Water additive which promotes strong teeth; Discharge from fertilizer and aluminum factories

Contaminants	**MCLG**	**AL**	**Your Water**		**Sample Date**	**# Samples Exceeding AL**	**Exceeds AL**	**Typical Source**
Inorganic Contaminants								
Copper – action level at consumer taps (ppm)	1.3	1.3	0.027		2010	0	No	Corrosion of household plumbing systems; Erosion of natural deposits

We constantly monitor for various constituents in the water supply to meet all regulatory requirements.

All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline at 1-800-426-4791.

MCLs are set at very stringent levels. To understand the possible health effects described for many regulated constituents, **a** person would have to drink 2 liters of water every day at the MCL level for a lifetime to have a one-in-a-million chance of having the described health effect.

Lead: Lead in drinking water is rarely the sole cause of lead poisoning, but it can add to a person's total lead exposure. All potential sources of lead in the household should be identified and removed, replaced or reduced.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by cryptosporidium and other microbiological contaminants are available from the Safe Drinking Water Hotline (800-426-4791).

Please call our office if you have guestions.

We at the City of Madras work around the clock to provide top quality water to every tap. We ask that all our customers help us protect our water sources, which are the heart of our community, our way of life and our children's future. **Este informe contiene información muy importante sobre su aqua beber. Tradúzcalo ó hable con alguien que lo etienda bien.**

APPENDIX B-3 - CITY ORDINANCE 484

ORDINANCE NO. 484

AN ORDINANCE PROVIDING RULES, REGULATIONS, RATES AND CHARGES FOR SERVICE, FOR THE MANAGEMENT OF THE WATER SYSTEM OF THE CITY OF MADRAS, OREGON, PROVIDING FOR DEPOSITS, ESTABLISHING PROCEDURES FOR EXTENSION OF WATER MAINS, REPEALING ORDINANCES NO. 135, 202, AND 452, PROVIDING FOR COLLECTION AND PENALTIES FOR VIOLATIONS; AND DECLARING AN EMERGENCY.

The City of Madras ordains as follows:

SECTION 1. [REPEAL]

City of Madras Ordinances No. 135, 202, and 452 are hereby repealed.

SECTION 2. APPLICATION FOR SERVICE

It shall be unlawful to obtain or provide water service to any premises within the City of Madras or from any water facility owned or operated by the City of Madras except upon written application of the legal owner of the premises, or his/her duly authorized agent, upon the printed forms of the city.

Such application shall not be valid until approved by the city administrator or designated agent. The applicant shall be responsible for all rates and charges for service to said premises.

SECTION 3. DEPOSIT REQUIRED

Whenever an applicant shall apply for service the applicant shall deposit, with the city, such funds as may be established by resolution for new service deposit.

The City Treasurer shall keep the total of such deposits in a separate account known as "Water Deposit Accounts" and shall keep records showing the source of all receipts and purposes of withdrawals from said account. From this account the City Treasurer shall satisfy any delinquent account immediately following the disconnection of service for

delinquency of payment, giving the depositor credit upon his/her water account. The treasurer shall thereupon require the depositor to immediately restore his/her deposit to the original amount.

When a depositor terminates his/her account and said account is fully satisfied, the treasurer shall return any unused portion of the deposit, plus interest, to the depositor.

In the event that such deposit is not applied for within sixty (60) days from the date that water service is discontinued, then such deposit shall be forfeited to the City of Madras, unless otherwise specified by the Council.

SECTION 4. USE OF WATER

Water will be furnished for ordinary domestic, business and community purposes and fire protection only. No water will be furnished for the direct operation of steam boilers or machinery, and the city will assume no responsibility therein. Where water subject to backflow may be contaminated, the applicant shall install suitable backflow devices.

SECTION 5. SERVICE CONNECTIONS

A standard service connection shall be 3/4 inch with a 5/8 X 3/4 meter. Such service shall be installed from the main to the street, curb, or property line within the right-of-way where such main exists.

The cost for providing such standard service shall be established from time to time by resolution. Larger services may be provided only upon special application at the cost which may be established by resolution. No service shall be installed until the regular established or estimated cost thereof has been paid.

SECTION 6. JURISDICTION

All service connections, meters, mains, and parts of the system through which water is served from the city's system, except the pipes beyond the meter to the private property owner's building, are the property of the city and under its exclusive control. No person other than city personnel shall install any service, make any extension, turn the water on or off, or otherwise tamper or interfere with the water or the system.

SECTION 7. SEPARATE CONNECTION

A separate service connection will be required for each dwelling, place of business, institution and premises served. All outlying buildings and premises used as a part of such dwelling, place of business, or institution may be served from such connection, as well as all buildings on such premises operated under the one management.

No user shall furnish water to any family, business, institution or premises other than those occupied and operated by user, provided however, that the Council may permit a user to supply others through the user's service connection, in which event such user will be charged an additional monthly fee for each additional user so supplied.

Such permit may be revoked and separate service connections required at any time.

SECTION 8. MAINTENANCE OF CONNECTIONS

Each user must protect the service and the meter from damage from hot water, freezing, traffic and so forth. Standard service connections belonging to the city will be maintained and replaced by the city without cost to the user, except where user is at fault. Larger services and services owned by individuals will be maintained and replaced at the cost of the user.

SECTION 9. METER STOPPAGE - REQUEST FOR TEST

(1) If a meter shall fail to record usage, the charge shall be the average for the past six (6) months.

(2) When any water customer shall make a complaint that the water bill for any period is excessive, the water department shall, upon request of the consumer, have such meter reread and the service inspected for leaks.

(3) Should such customer desire that the meter be tested or changed, such test or change shall be made by the water department and the cost of said test or change shall be charged to the account of the consumer as established in the rate resolution. However, should the test of the meter show a registration in excess of three percent (3%) in favor of the city the amount charged to said account for such test will be canceled or credited as the case may be, and the

bill adjusted accordingly. The excess registration, not to exceed the three (3) previous readings, shall be credited to the account. Where no such error is found, the amount charged for such test will be retained to cover the expense of such test or charge.

SECTION 10. ALTERATION OF SERVICE

When any property owner or owner's agent being served water by the city shall request a relocation or alteration of the service or meter location, either vertically or horizontally, a determination of advisability of such relocation or alteration shall be made by the agent of the water department. The decision of the water department shall prevail, subject to the order of the Council.

In no event shall the meter or service be relocated onto private property beyond the property line, except by order of the Council. The cost of such relocation or alteration shall be charged to the account of said owner or agent as established in the rate resolution. However, should a service or meter relocation or alteration be deemed beneficial to the city by the water department, such relocation or alteration may be done by the water department, whether desired by the property owner or not, and such relocation or alteration shall be at the expense of the city.

SECTION 11. DAMAGE TO CITY FACILITIES

(1) Whenever a city owned meter is harmed by hot water or damaged by carelessness or negligence of the owner or occupant of the premises, the water department shall repair the damage and charge the account of said owner or occupant as established in the rate resolution.

(2) When a service pipe, curb stop, meter, meter box, valve, main or other water equipment owned by the city by contractors or others in the performance of construction, excavation, hauling or other work, or by vandalism or where service pipes are destroyed by electrolysis, the person, contractors, or company responsible for such damage or destruction shall be billed by the city for the cost of repair or replacement of such damaged equipment.

SECTION 12. PRIVATE SERVICE PIPES

The user shall, at user's expense, install pipes from the property line or downstream meter outlet to the facilities as desired on user's premises, subject always to building, plumbing and sanitation codes.

All pipes from meter to the premises must be installed in accordance with good engineering practice, and maintained in good order by the user. Pipes must be laid at least twenty-four inches (24") deep and provided with stop and waste for drainage, and all standpipes or fittings of any kind must be so located, anchored and installed so as not to interfere with or endanger the meter. All pipes must be well protected from freezing.

Before the pipe is covered, the Water Department must be notified that connection with the meter is desired, and after this connection is made by the Water Department, the user shall see that all joints between the meter and the premises are tight. No meter shall be connected with the private service pipe until all of the requirements herein provided have been complied with.

All service pipes must have a shut-off valve installed on the downstream side of the meter and upstream of the building.

All service pipes that are changed by the user shall be inspected and approved by the Public Works Department of the City of Madras.

SECTION 13. MAINTENANCE OF CUSTOMER PLUMBING

The owner of the premises or authorized agent shall maintain the plumbing system in good repair. Water will not be furnished to premises where it is allowed to run to waste through defective plumbing, or otherwise.

Where the pressure from the city system exceeds the pressure allowable within a building, the owner shall install a pressure regulator as required by the Plumbing Code.

No water user or any person shall cause or suffer water from the system to run, drain, or flow from property having the water connection onto any other property or onto any street or way, and the city shall in no case be liable for damage occasioned from water running from open or faulty fixtures or from broken or damaged pipes beyond the property line.

SECTION 14. READINGS - BILLINGS

Meters will be read on or about the twenty-fifth day of each calendar month for the preceding month. Over fifteen (15) days will be billed as a full month. Fifteen (15) days or less will be billed as a half month.

Charges for water will be as established from time to time by resolution.

SECTION 15. PAYMENT - DELINQUENCY

All bills are due on the tenth day of the calendar month following service. Bills are payable to the City of Madras or agent as may be authorized by the common Council of the City of Madras. Unpaid bills become delinquent on the tenth day of such month. When a bill is not paid before it becomes delinquent, or a rule is violated, the water may be shut off and service discontinued until payment in full, together with a charge for re-establishing service as established in the rate resolution, and full compliance of this ordinance is obtained.

SECTION 16. DISCONTINUANCE OF SERVICE

Discontinuance of service for thirty (30) days or more will be made upon written application and shall be re-established upon receipt of payment for such service according to charges established in the rate resolution.

SECTION 17. INTERRUPTION OF SERVICE

The city reserves the right to interrupt service at any time for repairs or other necessary purpose without notice, and will not be responsible for damages arising thereby. The city will make reasonable effort to notify water users of pending outages when possible.

Water users which require an uninterruptable supply shall obtain additional service from another part of the system and/or shall provide emergency storage. Damage to city facilities arising from a backflow of hot water, steam, or other reason will be charged to the user from which such backflow occurred.

SECTION 18. SERVICE OUTSIDE THE CITY

Property outside the city boundaries may, at the option of the Council, be supplied with water service. The Council may fix rates for such out-of-city service, and specify terms and conditions regarding use of deliveries.

SECTION 19. TEMPORARY OR TRANSIENT SERVICE

Temporary or transient service for construction work, water haulers, or other purpose may be rendered upon special application and permit, and upon deposit in advance on amount as set by resolution. Such bulk sales or transient service shall be subject to such terms and conditions as may be set by the water department. Rates for delivery of water for such bulk sales or transient service shall be as established by resolution.

SECTION 20. LIMITATION OF WATER USE

The City Council reserves the right to limit the use of water as to hours, purpose or manner as it may deem necessary for conservation, and the preservation of the health and safety of the people and the community.

SECTION 21. ACCESS TO PREMISES FOR INSPECTION

Officials, agents and employees of the city shall at all reasonable times have access to any premises served by the city system for the purpose of inspection, repair, or enforcement of any of the provisions of this ordinance; and in the event that any inspection discloses excessive leaks or any undue waste of water, or violations of city ordinances, then the city shall have the right to discontinue water service to such premises until such violations have been corrected.

SECTION 22. EXTENSION OF MAINS

(1) Water mains within the city may only be extended upon approval of the city. Where a parcel to be served water does not lie adjacent to a city water main

capable of providing adequate flows for the intended use as well as for fire protection, the property owner shall request that a city water main be extended to the property to be served.

(2) Any person requiring an extension of the city's water mains shall make application therefore to the Public Works Department, and shall deposit with the City of Madras such sum of money as the city shall estimate is sufficient to cover the cost of such water main extension, together with fifteen percent (15%) for overhead, supervision, and engineering.

(3) The size of such extensions, type of materials, location of mains, valves, appurtenant fixtures, fire hydrants, and other fittings shall be under City of Madras specifications and subject to city approval. The minimum size for main extensions shall be six inches (6") unless the city determines that the city's best interest would be served by a smaller size.

Should the city determine that it would be in the city's best interest to install a main of a larger size than required by this ordinance or the needs of the proposed development, the city may cause the larger main to be installed and pay the difference in cost between the required main size and the larger main installed.

No lines or laterals shall be installed until the estimated cost thereof, as hereinabove set forth, shall have been deposited with the City of Madras, and all such extensions of mains and laterals and installation of fire hydrants shall be the sole property of the City of Madras, without right of refund on the part of the person or persons paying for such extension and on the part of any person or persons whomsoever.

(4) When any person shall hereafter be required to pay the cost of extending a water main adjacent to property other than his/her own so that water service for domestic use is provided for such other property, without further extension of such water main, the City of Madras may establish charges for connections to such main(s) and provide a reimbursement agreement to repay the persons extending such main a portion of their costs.

The agreement shall be valid for a period of ten (10) years. Connection charges established by the city for such mains collected after ten (10) years shall be deposited into the city water funds.

The city makes no guarantee that future connections will be made subject to reimbursement. The right to receive refunds shall run with the land, and charges subject to reimbursement will be paid to the owners of the land at the time such reimbursements are made.

(5) Whenever the city may install a main line extension on its own volition which may provide availability of service to property not previously served, the city may establish charges for connections to that main. Such charges shall be in addition to any regularly set connection fees.

SECTION 23. SYSTEMS DEVELOPMENT CHARGES

All developers requesting new service installations within the city shall be charged a fee established by resolution for Water System Development.

Such charges shall be independent from all other connection fees and shall be deposited in an account to be used only for increasing water storage facilities, enlargement of mains, replacement of mains, extension of mains, and development of additional supply as may be necessary to accommodate the additional demands placed on the water system as a result of the development.

The fee may vary depending on the cost of system maintenance and shall be specifically assessed to cover the type of service being provided and volume of water to be used by the new development.

SECTION 24. PENALTIES

Any person, firm or corporation who shall violate, fail, neglect or refuse to comply with any of the provisions of this ordinance shall be guilty of a misdemeanor and, upon conviction thereof, shall be punished by a fine not to exceed $300.

SECTION 25. SEPARATE VIOLATION

Each day that a violation of this ordinance continues shall constitute a separate violation.

SECTION 26. APPEAL

Any person aggrieved by any decision or action of the city made or taken pursuant to these rules and regulations may appeal to the City Administrator for a review of such decision or action. Where warranted, arrangements may be made for billing adjustment, delay in discontinuing service, or other remedies. Notwithstanding the above, any person may request that the Council of the city hear his or her complaint or grievance.

[Section 26, Appeal, added by Ordinance No. 844, passed by Council on April 24, 2012]

SECTION 27. APPEAL TO COUNCIL

Any local government agency or person feeling himself or herself aggrieved by any decision or action of the city made or taken pursuant to these rules and regulations may appeal to the Council by filing written notice of appeal with the City Recorder within forty-five (45) days following such decision or action. Such notice of appeal shall set forth in reasonable detail the action or decision appealed from and the appellant's ground for reversal or modification thereof. Within twenty (20) days following receipt of such notice, the Council shall set a time for hearing upon such appeal, which shall not be less than ten (10) nor more than forty (40) days following receipt of the notice. The action of the Council upon such appeal shall be conclusive, subject to appeal in the manner required by law.

[Section 27, Appeal to Council, added by Ordinance no. 844, passed by Council on April 24, 2012]

SECTION 28. CONSTITUTIONALITY AND SAVING CLAUSE

If any clause, sentence, paragraph, section, article or portion of this ordinance shall, for any reason, be adjudged invalid or unenforceable by a court of competent jurisdiction, the remainder of the ordinance shall remain in full force and effect.

[Numbering of this section amended by Ordinance No. 844, passed by Council on April 24, 2012]

SECTION 29. EMERGENCY CLAUSE

It is necessary for the preservation of public health, peace and safety that uniform rules and equitable rates be prescribed for the furnishing and use of water; therefore, an emergency is hereby declared and this ordinance shall go into full force and effect as of its date of passage.

[Numbering of this section amended by Ordinance No. 844, passed by Council on April 24, 2012]

Passed by the Council and approved by the Mayor March 26, 1991.

APPENDIX B-4 - PUBLC WORKS STANDARDS, SECTION 6

Public Improvement Design & Construction Standards

City of Madras, Oregon

Adopted by Ordinance No. 848 on December 11, 2012

SECTION 6 WATER FACILITIES

6-1 Purpose

The City owns and operates its water system as a public utility. As such, the City is responsible for ensuring the safe and reliable production and distribution of potable water to its customers.

The standards provided herein are intended to protect the integrity of the existing system and ensure that the future system operates efficiently. The City reserves the right to approve or reject any materials and devices proposed to be incorporated into the water system. The City also reserves the right to require that any proposed addition(s) to the water system comply with reliability, redundancy, construction and capacity requirements as outlined in these standards.

6-2 Summary

These standards represent the minimum requirements for the design and construction of water production and distribution facilities within the City's water system.

For non-City water utility suppliers (i.e. Deschutes Valley Water District), the utility grid alignment, trenching, pipe bedding, backfilling, and trench surface repair are to follow the City of Madras standards. The installation and testing of the actual water system will be according to the standards and specifications established by the water utility provider.

All improvements and additions to the potable water system will comply with the current and applicable requirements of the following standards:

1) The current Oregon Revised Statutes.

2) The Oregon Health Division, Drinking Water Section, of the Oregon Administrative Rules.

3) The current American Water Works Association (AWWA) Standards for the design and construction of public water systems.

4) All applicable City of Madras Ordinances.

5) Oregon Standard Specifications for Construction.

Refer to the requirements outlined in the current Oregon Standard Specifications for Construction, Part 1100 as well as applicable Oregon Standard Drawings and the approved engineered plans for installation details and requirements. In case of a conflict between standards, the design criteria of the City as presented herein shall govern.

6-2.1 Site Plan Review

A water system concept (preliminary utility plan) will be submitted to the City with the Site Plan Application for all proposed development that will result in water supply demands. If the City requires it, the site plan shall include preliminary demand calculations and/or modeling reports that estimate initial, phased, and ultimate domestic and fire demand required by the development. The site plan shall include general locations of any proposed connection to the existing water system,

identification of proposed pressure zones, and preliminary locations of any booster station(s) and/or reservoir(s) required to ensure adequate domestic and fire service pressures to the development.

This information will assist the City, Fire District, and Building Department in confirming that adequate water capacity is available at the proposed connection point(s). In addition, the information will be used in conjunction with actual flow tests to determine if capacity improvements are required by the new development or redevelopment project. The City reserves the right to require a more comprehensive (larger design review and flow test study area) system capacity analysis if, in the City's opinion, the proposed development has the potential of operational, supply or hydraulic impact on the current water production or distribution system.

6-2.2 Requirements Prior to Construction Plan Approval

Prior to the City's issuance of construction plan approval, design calculations and construction documents shall be submitted to the City for review and approval for any proposed connection or water system improvements regardless of development size. The plans will be revised according to the City's review comments and re-reviewed for compliance with review comments and the land use decision. Final construction plans will not receive approval from the City until compliance occurs with City review comments and land use decision requirements.

The submittal shall include a design stamped by an Engineer licensed by the State of Oregon and include all information necessary for the City to verify that the proposed facilities meet all design criteria defined in these standards. The plan will include detailed notes describing all pertinent construction phases, areas of responsibility, standard references and specific instructions that will affect the successful completion of the project. The plan shall meet the City's design and drafting standards.

The approval of construction plans will not be granted until the City has been satisfied that all requested design modifications have been addressed by the applicant and that all required easements and deeds of dedication have been granted to the City. The design submittal shall include all drawings, specifications and supporting calculations needed to verify that the proposed water system improvements and/or connections align with the water system concept (utility plan) approved during the City's site plan review process (land use findings and decision) and that the design meets the City's standards as specified herein. All proposed agreements between the applicant and the City regarding cost sharing, advance financing, utilization of SDC credits, etc. shall be signed by all parties prior to the issuance of the approval of construction plans. The City will not accept water system improvements that an applicant intends to dedicate to the public unless the improvements are reviewed and approved by the City prior to the start of construction.

6-3 Production Facilities

These will be reviewed and approved per the City Engineer's requirements on a case-by-case basis.

6-4 Distribution Systems

6-4.1 Location and Depth

Refer to Section 1.11 and current Oregon DEQ standards.

6-4.2 Water Mains - Potable Water

All new water mains will be either Class 50 Ductile Iron Pipe, according to AWWA Standards section C100 or Class 200 Polyvinyl Chloride (PVC) Pipe, according to AWWA Standards section C900. C900 PVC mains will be colored blue, throughout the entire composition of the pipe. The City, at its discretion, may entertain or direct changes to these material standards where pressure considerations or ground conditions warrant modification.

The City has standardized three nominal pipe sizes for mains; 6, 8, and 12 inch diameter pipe. Other sizes approved on a case-by-case basis as approved by the City Engineer. Pipe selection shall be based on this standardization and these velocity limitations.

Water mains will be sized to meet the following flow criteria:

1) In residential areas, velocity shall be less than four and one-half (4.5') feet per second, during the peak usage hour, calculated using the saturation build-out EDUs.

2) In commercial/ industrial areas, velocity shall be less than four and one-half (7.5') feet per second, during fire flow on the peak usage day (at saturation build out EDUs).

3) Water mains in residential areas will be a minimum of eight-inch (8") nominal diameter.

4) Water mains in areas serving commercial/industrial zonings will be a minimum of twelve-inch (12") nominal diameter.

5) Pipe size selection will not decrease the residual pressure within the existing distribution system below 20 pounds per square inch, during a fire situation or 42 pounds per square inch during normal usage periods.

Water main extensions that will be dedicated to the City will be installed so that the main extends a minimum of twenty lineal feet past the development to be served.

Mains will be placed and constructed as indicated on the approved engineered plan. Back filling, compaction and surface restoration will be as required by the Agency having jurisdiction of the right-of-way.

6-4.2.1 Tapping Main Lines

When tapping existing water main lines, the contractor shall use a Romac SST Tapping Tee or approved equivalent. Ductile Iron tapping sleeves are not acceptable for use, except on Ductile Iron pipe.

When tapping existing water main lines, the contractor shall make provisions to continuously flush and purge water through the non-pressurized side of the tapping valve (toward the bottom), or through the tapping machine. Using a corporation stop on the testing tap on the tapping sleeve is not acceptable.

The purpose of this procedure is to prevent the fouling of valves, regulators, meters and other equipment with chips and other debris to drinking water.

City personnel must be present any time a tap is made on the City's existing water main lines.

6-4.3 Valves

All water mains twelve-inch and smaller will be fitted with resilient wedge epoxy lined and coated gate valves, according to AWWA Standards section C500. Substitution of butterfly valves will only be permitted when field conditions require the main to be installed with "minimum cover." In these cases gate valves may not allow adequate "surface to operator nut" clearance.

Water mains larger than twelve-inch will be fitted with either gate or butterfly valves, with resilient valve seats and epoxy lining and coating, according to AWWA Standards section C500**.**

Isolation valves will be installed on all City mains at intervals no greater than 500 linear feet. At water main intersections, valves will be installed as detailed on the engineered plan.

Submittal data will be required for all valves installed in the City system.

6-4.4 Services

All water, fire and irrigation services will be installed by the developer at the time of original construction. See Oregon Standard Drawings and the approved engineered plans for installation details and requirements.

Where existing mains are in place, a City approved contractor will establish individual services (i.e. tapping the main). The materials for services larger than two inch shall correspond to requirements for mains and appurtenances.

6-4.5 Fire Hydrants

All fire hydrants will be installed by the developer at the time of original construction. All fire hydrants will be Kennedy K-81 D or Mueller Centurion fitted with a 5¼" valve.

6-4.6 Pressure Zone Control

If a pressure reducing valve (PRV) is required within a development to provide appropriate residential pressure, the developer will design and install an approved PRV station as part of the water facilities provided. PRV station design and hydraulic capabilities are specific to the distribution area to be served. The PRV station design shall be submitted to the City for approval prior to the issuance of the Site Construction Permit. The submittal shall include all engineering calculations necessary for the City to verify that the station meets the City's hydraulic and material requirements. In addition, the submittal should address any anticipated hydraulic impacts on the existing water system.

Flow modeling may be required when a PRV station is necessary. The modeling effort will evaluate both existing system characteristics and system characteristics after the proposed PRV installation. If the additional flow volumes created by any proposed development result in velocities that exceed those stated in Section 4, the developer will be required to provide larger or additional water distribution facilities.

6-4.7 Air-Vacuum Control

An air-vacuum control (AVC) device is required on any City Water main where a "high spot" exists at any point between lower portions of the main. A "high spot" is any location at which the main rises more than one-half (.5) times the nominal pipe diameter, and then descends to the previous elevation.

6-4.8 Flush Outs/ Fire Hydrants

A fire hydrant is required on all dead end portions of City mains.

6-4.9 Backflow Control

All services that present a potential for cross contamination risk to the public water supply must be equipped with a backflow prevention assembly approved by the Oregon Health Division. Designers are to refer to the current edition of the current Oregon Standard Specifications for Construction, Part 1100.

6-4.10 Appurtenances

All fittings needed to provide a fully functional water distribution system, not specifically covered in these specifications are to be manufactured and installed according to the latest edition of the AWWA Standards.

6-4.11 Disinfection of Facilities

Following completion of new facilities, including wells, valves, pumps, water mains and service connections, which will be in contact with the water delivered to users, said facilities shall be disinfected before they are placed into service. Disinfection shall be by chlorination according to Oregon Administrative Rules 333-061-0050(10) and AWWA Standards C651 through C654, and also refer to the current Oregon Standard Specifications for Construction, Part 1100.

Disinfection shall include but not be limited to the introduction of a chlorine solution with an initial concentration of 25mg/l into the facility in a manner that will result in a thorough wetting of all surfaces. The solution shall remain in place for 24 hours. After the 24-hour period, the free chlorine residual must be checked and found to be 10 mg/l or greater. The chlorine solution shall be drained and the facility flushed with potable water. A minimum of one sample shall be collected from the facility for microbiological analysis. Should any test fail, the facility shall be flushed, rechlorinated and rechecked until a sample free of coliform organisms is obtained. Other disinfectants may be used if demonstrated that they can also achieve the same results.

6-5 Facilities, Infrastructure and Property

6-5.1 Site Enclosures

All City Water wells, reservoirs, pump stations and buildings will be contained within a limited access enclosure. Enclosures will be (minimum) six-foot tall, nine-gauge, chain link fencing with a heavy-duty top rail and 12.5-gauge stranded bottom tension wire. Enclosures will be equipped with at least one 16-foot “drive through” double gate and one 36-inch “walk through” gate. When appropriate, enclosures will include three-wire “anti-climb” top barrier. Fences (or other enclosures) will be positioned so that a service truck, with a standard 160-inch wheel base, can travel around all buildings or facilities without reversing direction.

Site enclosure requirements may be altered depending on the specific usage or location of the property or facility. Additional costs associated with requirements that are more stringent will be the responsibility of the developer.

6-5.2 Buildings

All City water buildings and structures that house mechanical, electrical, electronic or other temperature and humidity sensitive equipment shall contain central climatic control apparatus. Atmospheric conditions inside the structures shall be maintained according to the recommendations of the equipment manufacturers. No climatic control equipment will be installed without approval of the City.

6-5.3 Access

All City water properties and facilities shall be accessible by way of an improved roadway connecting to a public right-of-way. The minimum requirements for access driveways outside the City limits include: a minimum width of 20 feet; base course of at least eight inches of ¾ inch minus compacted to 95% of AASHTO T-99; over the top of subgrade geotextile, and drainage that meets the requirements of Section 4 of these Standards. The minimum requirements for access driveways within the City limits include a minimum width of 20 feet; base course of at least 8 inches of ¾ inch minus, compacted to 95% of AASHTO T-99, asphalt paving level II or III, ½ inch dense HMAC with PG64-28 oil (3 inch thickness, minimum, placed in two lifts), and drainage that meets the requirements of Section 4 of these Standards.

All access driveways shall be located in areas wholly controlled by the City through a dedicated easement. Shared usage will be permitted, but the access needs and requirements of the City will have precedence over all others. All easements or private

usage agreements will be recorded with the appropriate governmental authority and will be non-revocable.

6-5.4 Property

All City water buildings or other structures (not located in right-of-way) will be located on property deeded to the City. Easements or private usage agreements will not be considered as viable alternatives to City ownership. Water system improvements required as a condition of public dedication of infrastructure will be constructed on property that is deeded to the City. Property will be free of encumbrances, as reported in a title search provided by the developer and approved by the City attorney.

APPENDIX C-1 - ISO LETTER

4 B Eves Drive, Suite 200
P.O. Box 961
Marlton, NJ 08053-3112

t 856.985.5600
f 856.810.9065

January 28, 2013

Mr. Evan Thomas, Board Chairman
Jefferson Co FD 1
P. O. Box 30
Madras, OR 97741

RE: Jefferson Co FD 1, Jefferson County, OR
Public Protection Classification: 5/8B
Effective Date: May 1, 2013

Dear Chairman Thomas:

We wish to thank you, Fire Chief Brian Huff, Mr. Edson Pugh and Mr. Jeff Hurd for your cooperation during our recent Public Protection Classification (PPC) survey. ISO has completed its analysis of the structural fire suppression delivery system provided in your community. The resulting classification is indicated above.

Enclosed is a summary of the ISO analysis of your fire suppression services. If you would like to know more about your community's PPC classification, or if you would like to learn about the potential effect of proposed changes to your fire suppression delivery system, please call us at the phone number listed below.

ISO's Public Protection Classification Program (PPC) plays an important role in the underwriting process at insurance companies. In fact, most U.S. insurers – including the largest ones – use PPC information as part of their decision- making when deciding what business to write, coverage's to offer or prices to charge for personal or commercial property insurance.

Each insurance company independently determines the premiums it charges its policyholders. The way an insurer uses ISO's information on public fire protection may depend on several things – the company's fire-loss experience, ratemaking methodology, underwriting guidelines, and its marketing strategy.

PPC is important to communities and fire departments as well. Communities whose PPC improves may get lower insurance prices. PPC also provides fire departments with a valuable benchmark, and is used by many departments as a valuable tool when planning, budgeting and justifying fire protection improvements.

ISO appreciates the high level of cooperation extended by local officials during the entire PPC survey process. The community protection baseline information gathered by ISO is an essential foundation upon which determination of the relative level of fire protection is made using the Fire Suppression Rating Schedule.

The classification is a direct result of the information gathered, and is dependent on the resource levels devoted to fire protection in existence at the time of survey. Material changes in those resources that occur after the survey is completed may affect the classification. Although ISO maintains a pro-active process to keep baseline information as current as possible, in the event of changes please call us at 1-800-444-4554, option 2 to expedite the update activity.

ISO is the leading supplier of data and analytics for the property/casualty insurance industry. Most insurers use PPC classifications for underwriting and calculating premiums for residential, commercial and industrial properties. The PPC program is not intended to analyze all aspects of a comprehensive structural fire suppression delivery system program. It is not for purposes of determining compliance with any state or local law, nor is it for making loss prevention or life safety recommendations.

If you have any questions about your classification, please let us know.

Sincerely,

Francine Yotsko

Francine Yotsko
(800) 444-4554 Option 2

nb

Encl.

cc: Chief Brian Huff, Jefferson County Fire Department 1
Mr. Edson Pugh, Manager, Deschutes Valley Water District
Mr. Jeff Hurd, Public Works Director, Madras
Mr. Gus Burril, Manager, Madras
The Honorable Shawna Clanton, Mayor, Culver
The Honorable Sandy Toms, Mayor, Metolius
Ms. April Stream, Communications Director, Jefferson County Sheriff's Office

INSURANCE SERVICES OFFICE, INC.

HYDRANT FLOW DATA SUMMARY

City Jefferson Co FD 1

County Jefferson State Oregon Witnessed by: Insurance Services Office, Inc. Date: October 17, 2012

TEST NO.	TYPE DIST.*	TEST LOCATION	SERVICE	FLOW - GPM $Q=(29.83(C(d^2)p^{0.5}))$ INDIVIDUAL HYDRANTS			TOTAL	PRESSURE PSI STATIC	RESID.	FLOW -AT 20 PSI NEEDED **	AVAIL.	REMARKS***
1	Comm	445 SE Buff St	Deschutes Valley Water District, Main	3130	0	0	3130	205	128	7000	5000	
1A	Comm	445 SE Buff St	Deschutes Valley Water District, Main	3130	0	0	3130	205	128	1250	5000	
2	Comm	410 4th St, north hyd	Madras, Main	1500	0	0	1500	70	40	3000	2000	
3	Comm	4th and G St	Madras, Main	1430	0	0	1430	64	38	3500	1900	
4	Comm	Washington & 9th	Deschutes Valley Water District, Main	2470	0	0	2470	160	110	6000	4300	
4A	Comm	Washington & 9th	Deschutes Valley Water District, Main	2470	0	0	2470	160	110	1500	4300	
5	Comm	2579 SW Bear Dr	Deschutes Valley Water District, Main	1280	0	0	1280	105	90	3000	3300	(A)-(250 gpm)
6	Comm	6th Ave & E St	Deschutes Valley Water District, Main	2850	0	0	2850	118	90	3500	5600	
7	Comm	500 W E St	Deschutes Valley Water District, Main	1280	0	0	1280	105	95	4000	4100	
7A	Comm	500 W E St	Deschutes Valley Water District, Main	1280	0	0	1280	105	95	3500	4100	
8	Comm	450 Fairgrounds - front hyd	Deschutes Valley Water District, Main	3130	0	0	3130	172	152	4000	9400	
8A	Comm	450 Fairgrounds - Front	Deschutes Valley Water District, Main	3130	0	0	3130	172	152	2250	9400	
9	Comm	9th and D St	Madras, Main	1430	0	0	1430	80	65	5000	3000	
9R	Res	9th and D St	Madras, Main	1430	0	0	1430	80	65	1500	3000	
10	Comm	7th Ave, W of C St	Deschutes Valley Water District, Main	2260	0	0	2260	105	85	7000	4900	
10A	Comm	7th Ave, W of C St	Deschutes Valley Water District, Main	2260	0	0	2260	105	85	3500	4900	

THE ABOVE LISTED NEEDED FIRE FLOWS ARE FOR PROPERTY INSURANCE PREMIUM CALCULATIONS ONLY AND ARE *NOT* INTENDED TO PREDICT THE MAXIMUM AMOUNT OF WATER REQUIRED FOR A LARGE SCALE FIRE CONDITION.

THE AVAILABLE FLOWS ONLY INDICATE THE CONDITIONS THAT EXISTED AT THE TIME AND AT THE LOCATION WHERE TESTS WERE WITNESSED.

***Comm = Commercial; Res = Residential.**

****Needed is the rate of flow for a specific duration for a full credit condition. Needed Fire Flows greater than 3,500 gpm are not considered in determining the classification of the city when using the Fire Suppression Rating Schedule.**

***** (A)-Limited by available hydrants to gpm shown. Available facilities limit flow to gpm shown plus consumption for the needed duration of (B)-2 hours, (C)-3 hours or (D)-4 hours.**

APPENDIX C-2 - DVWD WATER STORAGE CAPACITY

DVWD – DOMESTIC WATER STORAGE FACILITIES

Tank I.D. #	Name/ Location	Capacity (gal.)	Year Installed	HGL Elevation	Height/ Type
2	Main Tanks 13-12-3	1 million	1954	2,910 ft.	40 ft./ Steel
4	"	1 million	1970	2,910 ft.	"
6	"	2.5 million	1982	2,910 ft.	"
7	"	4 million	2013	2,910 ft.	"
8	Metolius Tanks 11-13-27	1 million	1964	2,740 ft	"
10	"	1.5 million	1982	2,740 ft.	"
11	"	3 million	2007	2,740 ft.	"
14	Plains Tank 10-13-25	1 million	1987	2,590 ft.	"
24	Prison Tank 11-14-9	500,000	2006	2,742 ft.	24 ft./ Steel
17	Round Butte 11-12-24	110,000	1993	3,079 ft.	20 ft./ Steel
18	"	110,000	2012	3,079 ft.	"
19	Juniper Butte 12-12-36	150,000	1995	3,128 ft.	24 ft./ Steel
20	KOA Tank 12-13-28	201,000	2000	2,964 ft.	32 ft./ Steel
22	Gateway Tank 9-14-29	100,000	1995	2,196 ft.	16 ft./ Steel

T O T A L C A P A C I T Y 16,171,000 gallons

DVWD System Storage Estimates 12-31-13

The whole District	16,171,000 gallons / 4,200 services
	3,850 gallons/service
Round Butte area	220,000 gallons / 46 services
	4,783 gallons/service
Juniper Butte area	150,000 gallons / 57 services
	2,631 gallons/service
Plains area	1,000,000 gallons / 290 services
	3,448 gallons/service
KOA area	201,000 gallons / 60 services
	3,350 gallons/service
Gateway area	100,000 gallons / 40 services
	2,500 gallons/service
City of Madras	1,000,000 gallons / 900 services
	1,111 gallons/service
DVWD + Madras	17,171,000 gallons / 5,100 services
	3,367 gallons/service

APPENDIX D - 2011 FIRE FLOW ANALYSIS, JCFD#1

Hydrant Number	Location of Hydrant	Static Pressure	Residual Pressure	(day-month-	Q20	OwnedBy
J14-001	5th & B St	82	65	17-Sep-10	1813.16	City
K13-013	Henry and 8th Street	55	25	18-Aug-11	773.68	City
K13-014	12th St. and Oak St.	55	25	18-Aug-11	631.71	City
K13-015	10th St. and Oak St.	55	25	18-Aug-11	1078.85	City
K13-016	SE corner of 7th and Oak	50	25	18-Aug-11	712.66	City
K13-017	Oak and 6th Street	65	45	18-Aug-11	1162.70	City
K13-018	Henry and 10th St.	55	25	18-Aug-11	657.50	City
K13-020	8th St. and Pine St.	55	30	18-Aug-11	697.07	City
K13-021	A St. and 7th St.	75	50	18-Aug-11	1148.68	City
K13-022	10th St. and A St.	65	15	18-Aug-11	672.52	City
K13-023	12th St. and Cowden Dr.	55	35	18-Aug-11	1039.92	City
K13-025	6th and B St.	75	45	18-Aug-11	1163.85	City
K13-026	7th and B St.	75	55	18-Aug-11	1448.72	City
K13-029	162 Ft. W. of Nordic on A St.	55	45	18-Aug-11	1335.93	City
K13-030	Nordic and A St.	50	45	18-Aug-11	2071.04	City
K13-031	Hillcrest and B St.	55	45	18-Aug-11	1476.00	City
K13-032	Hillcrest and A St.	55	45	18-Aug-11	1650.22	City
K13-035	Corner of A st and Kincade	40	35	18-Aug-11	1343.08	City
K13-039	8th and B Street	65	50	18-Aug-11	1606.94	City
K13-040	10th and B Street	65	55	18-Aug-11	2070.48	City
K13-048	"A" St. & OCDC	45	40	18-Aug-11	1789.51	City
K13-058	Parking lot of Early Childhood Development	45	40	18-Aug-11	1697.68	City
J13-015	6th & Poplar St	65	45	29-Aug-11	1246.86	City
J13-016	6th & Oak St	65	45	29-Aug-11	1191.42	City
K13-024	Les Schwab parking lot East end	65	40	29-Aug-11	1056.17	City
K13-027	6th & Plum St	65	40	29-Aug-11	1105.32	City
J13-005	5th & A St	85	55	06-Sep-11	1395.29	City
J13-006	4th & A St	85	60	06-Sep-11	1539.65	City
J13-010	5th & Oak St	85	60	06-Sep-11	1257.12	City
J13-013	4th & Maple St	80	60	06-Sep-11	1663.34	City
J13-014	4th & Oak St	75	55	06-Sep-11	1587.00	City
K14-002	W corner of 16th and B St.	51	50	20-Jul-12	3757.09	City

K14-007	11th St. and C St.	65	60	20-Jul-12	2748.13	City
K14-008	10th and C St.	57	55	20-Jul-12	3441.00	City
K14-009	9th St. and B St.	65	50	20-Jul-12	1358.11	City
K14-014	6th and C Street	68	65	20-Jul-12	3353.63	City
K14-015	7th and C Street	70	60	20-Jul-12	2000.74	City
K14-016	8th and C Street	68	65	20-Jul-12	3353.63	City
K14-017	9th St. and D St.	65	60	20-Jul-12	2331.86	City
K14-018	8th and D Street	65	50	20-Jul-12	803.47	City
K14-019	Corner of 10th and D St.	65	60	20-Jul-12	2331.86	City
K14-020	Corner of 10th and E St.	65	60	20-Jul-12	2458.00	City
K14-022	7th and E Street	70	50	20-Jul-12	1230.77	City
K14-027	F & 10th St.	65	50	20-Jul-12	673.27	City
K14-037	6th and D Street	68	65	20-Jul-12	3353.63	City
K14-041	9th St. and C St.	65	60	20-Jul-12	2577.97	City
K14-044	Hoff and B st.	52	50	20-Jul-12	2146.33	City
K14-050	D & Revere	50	45	20-Jul-12	987.33	City
K14-057	Intersection of B & revere, 200' south on revere	50	45	20-Jul-12	1396.30	City
K14-028	7th and G Street	70	45	23-Jul-12	378.03	City
K14-031	10th St between F St & Buff	65	45	23-Jul-12	822.16	City
K14-001	H st. between comerce and Ebert	195	140	24-Jul-12	2238.75	City
K14-026	6th and Snook Lane	60	10	24-Jul-12	366.41	City
K14-029	6th and Buff Street	70	55	24-Jul-12	718.81	City
K14-030	8th and Buff Street	55	45	24-Jul-12	660.09	City
J14-010	HWY 361 and Madison St	70	45	09-Aug-12	1542.99	City
J14-011	HWY 361 by Brads bait and Tackel	65	40	09-Aug-12	1030.71	City
J14-012	2nd and E St.	65	45	09-Aug-12	1424.02	City
J14-013	4th and E St.	60	53	09-Aug-12	2432.82	City
J14-015	F and 4th St.	60	40	09-Aug-12	1380.09	City
J14-016	Roosevelt and G Street	55	4	09-Aug-12	193.64	City
J14-017	Madison and G Street	50	6	09-Aug-12	305.10	City
J14-018	1st and G Street	60	30	09-Aug-12	480.09	City
J14-022	Marshall and H Street	60	40	09-Aug-12	1118.00	City
J14-023	2nd and H Street	60	35	09-Aug-12	967.20	City

J14-025	1st and I street	55	35	09-Aug-12	1015.15	City
J14-026	4th and I Street	45	35	09-Aug-12	615.39	City
J14-028	3rd and J Street	45	35	09-Aug-12	1319.86	City
J14-037	SE corner of City Hall	65	55	09-Aug-12	2138.38	City
J14-038	NW corner of City Hall	70	50	09-Aug-12	1230.77	City
J14-083	200 ft S of H st on SW Marshal St	65	40	09-Aug-12	977.82	City
J14-084	Lincon ct 100' South of I(718 SW lincon ct)	180	160	09-Aug-12	5458.25	City
J14-087	Sunrise Mobile next to Space 44/45	45	12	09-Aug-12	456.74	City
J14-088	Sunrise Mobile next to Space 4	65	20	09-Aug-12	530.61	City
J14-002	4th & B St	80	60	10-Aug-12	1606.94	City
J14-003	2nd & B St	80	60	10-Aug-12	1872.03	City
J14-004	1st & C St	80	40	10-Aug-12	934.07	City
J14-005	D St and 2nd St	75	60	10-Aug-12	1513.55	City
J14-006	D St, 3rd St, and Hwy 361	75	60	10-Aug-12	1725.71	City
J14-007	D and 4th St.	80	55	10-Aug-12	1474.52	City
J14-008	D and 5th St.	65	45	10-Aug-12	1246.86	City
J14-009	E St. and 2nd St.	60	40	10-Aug-12	1063.43	City
J14-019	2nd St. and G St.	65	30	10-Aug-12	429.73	City
J14-020	G and 4th St.	55	35	10-Aug-12	1112.04	City
J14-034	Entrance to Canyon Villa Apts on C St	75	35	10-Aug-12	1091.49	City
J14-035	N end of SW enterence into Canyon Villa	77	50	10-Aug-12	1375.85	City
J14-036	D St. and 1st	60	40	10-Aug-12	1091.06	City
J14-075	3rd & C St	80	50	10-Aug-12	1463.80	City
J14-076	North of NW Canyon Rd/NW of Cannon Via Apt	85	45	10-Aug-12	1344.40	City
J14-077	C St. and 5th St	80	55	10-Aug-12	1291.08	City
J14-078	5th & F St	60	45	10-Aug-12	1209.02	City
J14-079	4th & C St	75	60	10-Aug-12	829.01	City
J14-089	Harriman Building parking lot	65	55	10-Aug-12	2330.25	City
K14-025	5th and Snook Lane	65	45	10-Aug-12	1191.42	City
K14-081	Between G St & Buff on 5th St	55	45	10-Aug-12	1616.88	City
J14-042	100 ft West of Lincoln CT on I st	192	175	09-Sep-13	5706.64	City
K14-021	Corner of E St. and 9th St.	90	62	09-Sep-13	863.48	City

APPENDIX E - 2013-14 CITY OF MADRAS BUDGET

City of Madras
Annual Budget
2013-2014

SDC WATER IMPROVEMENT FUND

SDC Water Improvement Fund

Program: This fund provides for capital improvement projects for the City's Water System.

Planned Project -

1. Once the City updates its Water Master Plan, there will be a list of projects identified for improvement in the water system. The available budget funds are designated for use on the highest priority projects of the capital improvement list.

2. The Water Master Plan is expected to be complete by October 2013. Approximate $12,750 FY 2012-13; $18,450 remaining for FY 2013-14.

City of Madras

2013-2014 Budget Document

SDC Water Improvement Fund

Resources	Historcial Data 2010-11	Historcial Data 2011-12	Adopted 2012-13	2013-14 Budget Proposed	2013-14 Budget Approved	2013-14 Budget Adopted
Beginning Cash	49,419	49,612	49,770	49,986	49,986	49,986
Current Year Resources						
SDCs - Water	0	0	0	0	0	0
Interest	193	154	100	200	200	200
Total Current Year Resources	193	154	100	200	200	200
Total Resources	49,612	49,766	49,870	50,186	50,186	50,186

Expenditures	Historcial Data 2010-11	Historcial Data 2011-12	Adopted 2012-13	2013-14 Budget Proposed	2013-14 Budget Approved	2013-14 Budget Adopted
Materials & Services	0	0	0	0	0	0
Capital Outlay						
Water Lines	0	0	40,000	25,000	25,000	25,000
Total Expenditures	0	0	40,000	25,000	25,000	25,000
Ending Cash Balance	49,612	49,766	9,870	25,186	25,186	25,186

City of Madras

2013-2014 Budget Document

SDC Water Improvement Fund

Revenues

Historical Data 2010-11	Historical Data 2011-12	Adopted 2012-13	Line Item	Description	2013-14 Budget Proposed	2013-14 Budget Approved	2013-14 Budget Adopted
			405-405				
				Beginning Cash			
49,419	49,612	49,770	301-0101	Beginning Cash	49,986	49,986	49,986
49,419	49,612	49,770		Total Beginning Cash	49,986	49,986	49,986
				System Development Fees			
0	0	0	370-6501	SDC - Water	0	0	0
0	0	0		Total System Development Fees	0	0	0
				Use of Money & Property			
193	154	100	380-8101	Interest	200	200	200
193	154	100		Total Use of Money & Property	200	200	200
7 49,612	49,766	49,870		**Total Revenues**	50,186	50,186	50,186

City of Madras

2013-2014 Budget Document

SDC Water Improvement Fund

Expenditures

Historical Data 2010-11	Historical Data 2011-12	Adopted 2012-13	Line Item	Description	2013-14 Budget Proposed	2013-14 Budget Approved	2013-14 Budget Adopted
			405-405				
				Materials & Services			
0	0	0	520-4017	Internal Services Central Services Fund	0	0	0
0	0	0	520-4018	Internal Services Public Works Staff Fund	0	0	0
0	0	0		Totals Materials & Services	0	0	0
				Capital Outlay			
0	0	40,000	540-3201	Water Lines	25,000	25,000	25,000
0	0	40,000		Total Capital Outlay	25,000	25,000	25,000
				Ending Cash Balance			
49,612	49,766	9,870	595-1010	Ending Cash Balance	25,186	25,186	25,186
49,612	49,766	9,870		Total Ending Cash Balance	25,186	25,186	25,186
49,612	49,766	49,870		**Total Expenditures**	50,186	50,186	50,186
49,612	49,766	49,870		**Total SDC Water Improv. Revenues**	50,186	50,186	50,186
49,612	49,766	49,870		**Total SDC Water Imp. Expenditures**	50,186	50,186	50,186

WATER OPERATIONS FUND

Water Operations Fund

Program: This fund provides for maintenance & capital improvement projects for the City's Water System. Consistent with the economic analysis for the City's Water Operations Fund, the City will increase its water charges by 4.5% effectively July 1, 2013.

Current Inventory of Water Facilities:

- 19.7 miles of water main varying from 2" to 12" in size.
- 1 – 1 million gallon water tank
- 3 Water Wells

Planned Projects -

1. No planned projects for FY 2013-14

City of Madras

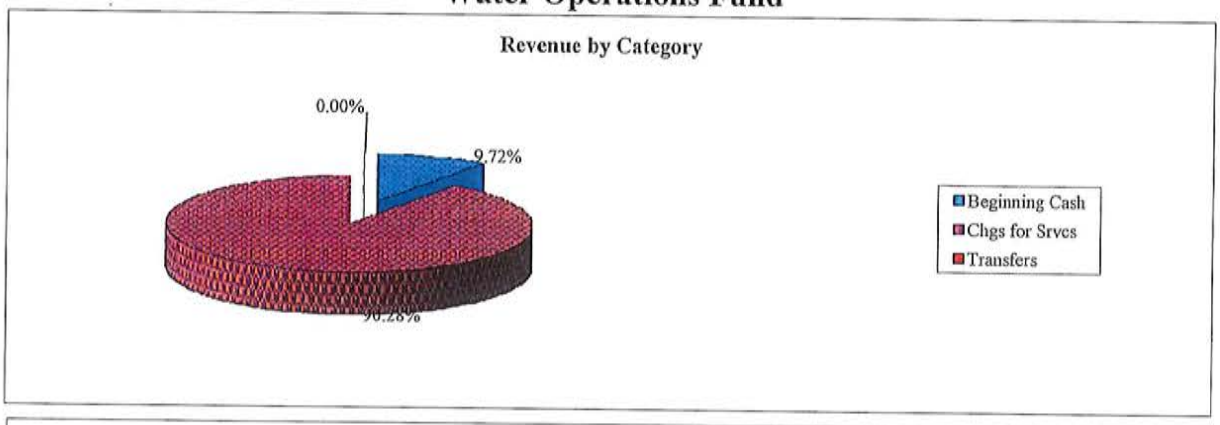
2013-2014 Budget Document

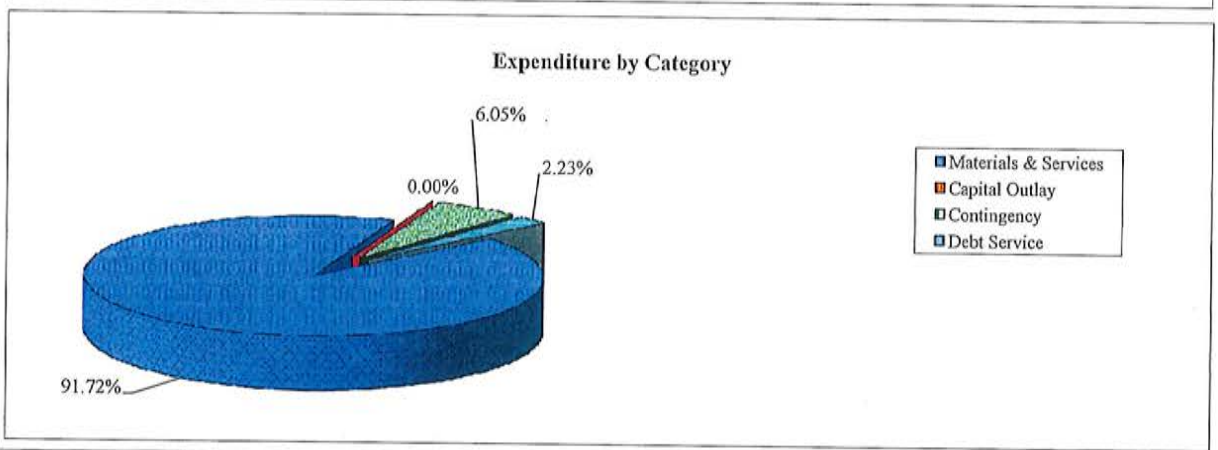
Water Operations Fund

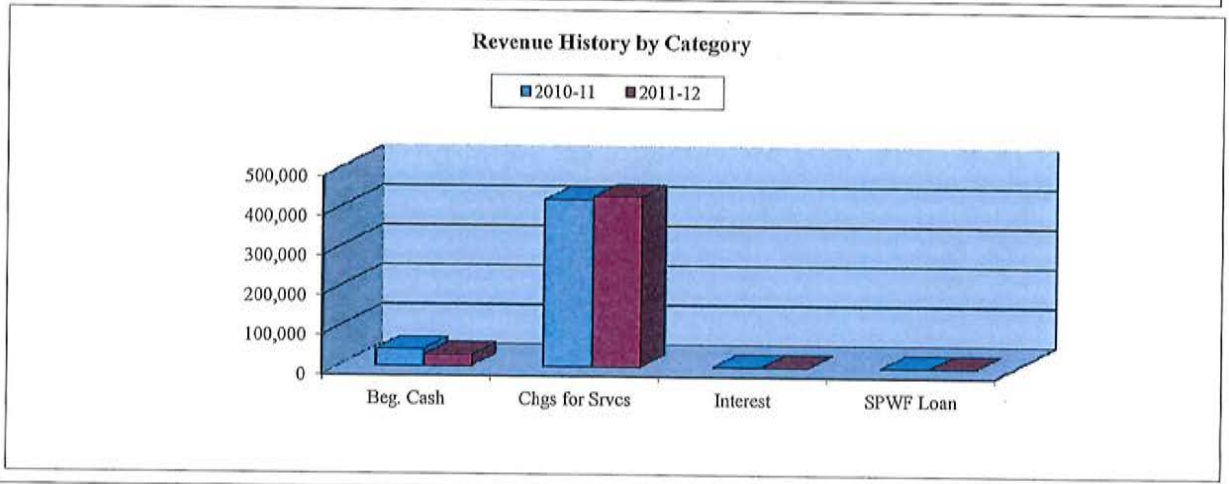
Resources	Historical Data 2010-11	Historical Data 2011-12	Adopted 2012-13	2013-14 Budget Proposed	2013-14 Budget Approved	2013-14 Budget Adopted
Beginning Cash	42,131	28,400	18,573	48,760	48,760	48,760
Current year resources						
Revenues from Other Agencies	0	0	0	0	0	0
Miscellaneous	76	1,349	0	500	500	500
Charges for Services	421,297	428,444	428,010	452,568	452,568	452,568
Interest	40	98	0	300	300	300
Interfund Transfers	0	0	60,000	0	0	0
Total Current Year Resources	421,414	429,891	488,010	453,368	453,368	453,368
Total Resources	463,545	458,291	506,583	502,128	502,128	502,128

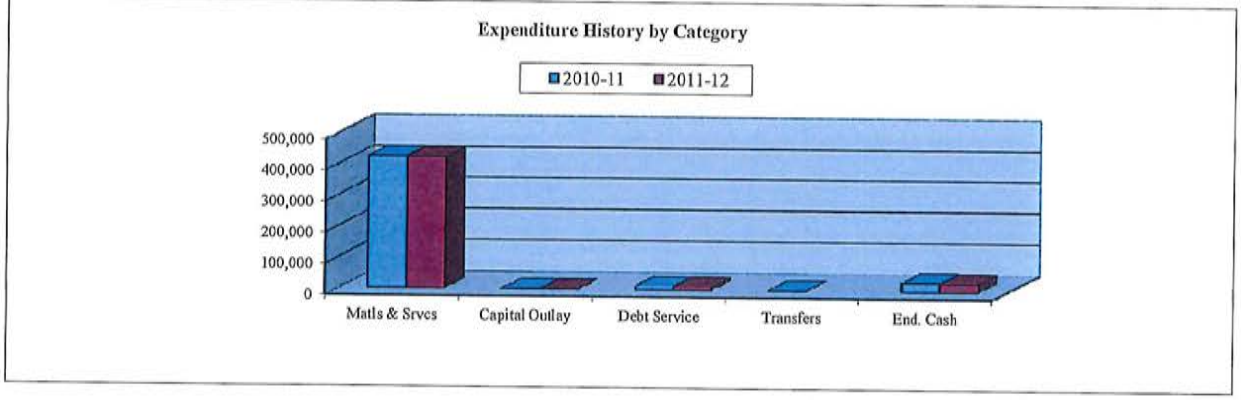
Expenditures	Historical Data 2010-11	Historical Data 2011-12	Adopted 2012-13	2013-14 Budget Proposed	2013-14 Budget Approved	2013-14 Budget Adopted
Materials and Services	424,070	420,761	443,713	454,959	454,959	454,959
Capital Outlay	0	0	43,000	0	0	18,450
Interfund Transfers	0	0	0	0	0	0
Debt Service						
OEDD North Y - Principal (Dec)	4,199	4,218	4,427	4,647	4,647	4,647
OEDD North Y - Interest (Dec)	6,876	6,857	6,647	6,427	6,427	6,427
Contingency	0	0	8,796	30,000	30,000	11,550
Total Expenditures	435,145	431,836	506,583	496,033	496,033	496,033
Ending Cash Balance	28,400	26,455	0	6,095	6,095	6,095

Water Operations Fund









City of Madras

2013-2014 Budget Document

Water Operations Fund

Revenues

Historical Data 2010-11	Historical Data 2011-12	Adopted 2012-13	Line Item	Description	2013-14 Budget Proposed	2013-14 Budget Approved	2013-14 Budget Adopted
			502-020				
				Beginning Cash			
42,131	28,400	18,573	301-0101	Beginning Cash	48,760	48,760	48,760
42,131	28,400	18,573		Total Beginning Cash	48,760	48,760	48,760
				Revenues from Other Agencies			
0	0	0	340-4121	SPWF Loan - North Y Project	0	0	0
0	0	0		Total Revenues from Other Agencies	0	0	0
				Charges for Services			
76	1,349	0	350-5401	Miscellaneous Revenue	500	500	500
76	1,349	0		Total Charges for Services	500	500	500
				Charges for Services for Current Services			
419,532	425,751	426,360	370-6101	Water Sales	450,918	450,918	450,918
1,765	2,693	1,500	370-6202	Turn Off Fee	1,500	1,500	1,500
0	0	150	370-6301	Installation Inspection Fees	150	150	150
421,297	428,444	428,010		Total System Development Fees	452,568	452,568	452,568
				Use of Money and Property			
40	98	0	380-8101	Interest on Investments	300	300	300
40	98	0		Total Use of Money & Property	300	300	300
				Interfund Transfers - In			
0	0	60,000	390-9504	Internal Services Public Works Staff Fund	0	0	0
0	0	60,000		Total Interfund Transfers - In	0	0	0
463,545	458,291	506,583		**Total Revenues**	502,128	502,128	502,128

City of Madras

2013-2014 Budget Document

Water Operations Fund

Expenditures

Historical Data 2010-11	Historical Data 2011-12	Adopted 2012-13	Line Item	Description	2013-14 Budget Proposed	2013-14 Budget Approved	2013-14 Budget Adopted
			502-020				
				Materials & Services			
4,790	2,359	4,000	520-1206	Chemicals/Testing	4,000	4,000	4,000
878	0	1,000	520-1221	Contract Services	1,000	1,000	1,000
3,426	3,509	4,200	520-1401	Electricity	4,200	4,200	4,200
0	49	0	520-1403	Equipment Repairs	0	0	0
3,732	4,688	4,400	520-1801	Insurance & Surety Bonds	5,000	5,000	5,000
40	1,366	1,000	520-2102	Legal Fees	1,000	1,000	1,000
0	0	500	520-2204	Miscellaneous Expense	500	500	500
720	0	0	520-2505	Permits	0	0	0
34,651	16,215	16,000	520-2702	Repairs & Maintenance	16,000	16,000	16,000
666	4,127	2,000	520-3203	Water Meters	2,000	2,000	2,000
127,992	127,069	148,000	520-3204	Water Purchases	149,865	149,865	149,865
0	0	1,000	520-3205	Water Rights	5,000	5,000	5,000
-2	0	0	520-3206	Bad Debt Expense	0	0	0
75,042	64,005	68,017	520-4017	Internal Services Central Services Fund	72,799	72,799	72,799
110,743	143,643	139,666	520-4018	Internal Services Public Works Staff Fund	137,003	137,003	137,003
27,785	45,345	38,766	520-4019	Internal Services Buildings Fund	39,592	39,592	39,592
33,607	8,386	15,164	520-4020	Internal Services Fleet Fund	17,000	17,000	17,000
424,070	420,761	443,713		Total Materials & Services	454,959	454,959	454,959
				Capital Outlay			
0	0	8,000	540-3201	Water Lines	0	0	0
0	0	35,000	540-3203	Water Master Plan	0	0	18,450
0	0	43,000		Total Capital Outlay	0	0	18,450
				Interfund Transfers - Out			
0	0	0	550-4022	SDC Park Improvement Fund	0	0	0
0	0	0		Total Interfund Transfers - Out	0	0	0
				Debt Service			
4,199	4,218	4,427	570-7414	OEDD - North Y Principal	4,647	4,647	4,647
6,876	6,857	6,647	570-7415	OEDD - North Y Interest	6,427	6,427	6,427
11,075	11,075	11,074		Total Debt Service	11,074	11,074	11,074
				Operating Contingency			
0	0	8,796	590-1010	Operating Contingency	30,000	30,000	11,550
0	0	8,796		Total Operating Contingency	30,000	30,000	11,550
				Ending Cash Balance			
28,400	26,455	0	595-1010	Ending Cash Balance	6,095	6,095	6,095
28,400	26,455	0		Total Ending Cash Balance	6,095	6,095	6,095
463,545	458,291	506,583		**Total Expenditures**	502,128	502,128	502,128
463,545	458,291	506,583		**Total Water Operations Revenues**	502,128	502,128	502,128
463,545	458,291	506,583		**Total Water Operations Expenditures**	502,128	502,128	502,128

City of Madras
Amortization Schedule
2013-2014

North Y Project

Oregon Economic & Community Development Department
Special Public Works Fund Loan
Loan No. JO4006

Loan Amount	161,000
Issue Date	12/23/04
Maturity Date	12/01/30
Term	25 years
Interest Rate	4.97%

Water Operations Fund Portion

Year	Payment	Interest	Prinicpal	Balance
Balance July 1, 2013				129,323
12/1/2013	11,074	6,427	4,647	124,676
12/1/2014	11,074	6,196	4,878	119,798
12/1/2015	11,075	5,954	5,121	114,677
12/1/2016	11,074	5,699	5,375	109,302
12/1/2017	11,075	5,432	5,643	103,659
12/1/2018	11,075	5,152	5,923	97,736
12/1/2019	11,074	4,857	6,217	91,519
12/1/2020	11,074	4,548	6,526	84,993
12/1/2021	11,075	4,224	6,851	78,142
12/1/2022	11,075	3,884	7,191	70,951
12/1/2023	11,075	3,526	7,549	63,402
12/1/2024	11,075	3,151	7,924	55,478
12/1/2025	11,075	2,757	8,318	47,160
12/1/2026	11,075	2,344	8,731	38,429
12/1/2027	11,075	1,910	9,165	29,264
12/1/2028	11,074	1,454	9,620	19,644
12/1/2029	11,075	976	10,099	9,545
12/1/2030	10,019	474	9,545	0

Payments Due Dates:
December - Principal & Interest

City of Madras
Amortization Schedule
2013-2014

North Y Project

Oregon Economic & Community Development Department
Special Public Works Fund Loan
Loan No. JO4006

Loan Amount	230,000
Issue Date	12/23/04
Maturity Date	12/01/30
Term	25 years
Interest Rate	4.97%

Total Loan Amount

Year	Payment	Interest	Prinicpal	Balance
Balance July 1, 2013				186,987
12/1/2013	16,004	9,293	6,711	180,276
12/1/2014	16,004	8,959	7,045	173,231
12/1/2015	16,005	8,609	7,396	165,835
12/1/2016	16,004	8,241	7,763	158,072
12/1/2017	16,005	7,856	8,149	149,923
12/1/2018	16,005	7,451	8,554	141,369
12/1/2019	16,004	7,025	8,979	132,390
12/1/2020	16,004	6,579	9,425	122,965
12/1/2021	16,005	6,111	9,894	113,071
12/1/2022	16,005	5,620	10,385	102,686
12/1/2023	16,005	5,103	10,902	91,784
12/1/2024	16,005	4,561	11,444	80,340
12/1/2025	16,005	3,992	12,013	68,327
12/1/2026	16,005	3,396	12,609	55,718
12/1/2027	16,005	2,769	13,236	42,482
12/1/2028	16,004	2,111	13,893	28,589
12/1/2029	16,005	1,420	14,585	14,004
12/1/2030	14,700	696	14,004	0

Payments Due Dates:
December - Principal & Interest

APPENDIX F - WATER SYSTEM ANALYSIS SUMMARY

2012 Peak Hour Flow Modeling (based off DVWD sales to City of Madras)

Label	Location	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1*	Elbow at Adams	2381.14	0	2426.7	19.7
J-2*	Adams & Tracie	2325.71	0	2413.59	38
J-3	Adams & I	2298	1.3	2409.53	48.3
J-4	4th & I	2294.23	91.53	2408.32	49.4
J-5	Lincoln & I	2304.22	206.23	2408.27	45
J-5A	Madison & J	2304.45	13.95	2408.24	44.9
J-5B	Madison & I	2300.38	48.05	2408.26	46.7
J-5C	Madison & G	2286.86	49.6	2406.81	51.9
J-5D	Marshall & G	2261.87	34.1	2406.45	62.6
J-6	4th & G	2272.67	147.98	2405.84	57.6
J-7	4th & F	2261.54	28.47	2405.34	62.2
J-8	Elbow SW City Hall	2259.52	0	2405.17	63
J-9	3rd & D	2242	15.58	2404.52	70.3
J-10	3rd & B	2232	64.14	2404.27	74.5
J-11	1st & B	2231	154	2404.27	75
J-12	1st & Culver Hwy	2244.52	60.88	2404.86	69.4
J-13	Madison & Culver Hwy	2258	53.46	2405.91	64
J-14	Marshall & I	2283.49	0	2407.87	53.8
J-15	5th & Buff	2284.27	0	2405.81	52.6
J-16	5th & G	2281	10.18	2405.82	54
J-17	4th & D	2241.49	46.12	2404.51	70.5
J-18	4th & B	2232.6	14.33	2402.83	73.6
J-19	4th & A	2228.06	5.2	2402.78	75.6
J-20	4th & Pine	2225.27	1.3	2402.77	76.8
J-21	5th & Oak	2250.53	15.91	2401.72	65.4
J-22	5th & Pine	2225.86	2.85	2402.77	76.5
J-23	5th & A	2228.28	20.39	2402.78	75.5
J-24	5th & Buff	2233	3.9	2402.79	73.5
J-25	6th & Oak	2255.86	15.91	2401.33	62.9
J-26	US97 & Plum	2258	10.18	2401.32	62
J-27	US97 & Jefferson	2280.92	0	2401.32	52.1
J-28	7th & Oak	2270.69	33.47	2399.8	55.9
J-29	7th & Henry	2271.2	29.45	2399.07	55.3
J-30	10th & Henry	2293.43	106.35	2397.76	45.1
J-31	7th & B	2234.63	63.52	2401.37	72.1
J-32	10th & A	2266.83	132.3	2397.94	56.7
J-33	Hillcrest & A (6")	2286.93	59.54	2403.33	50.4
J-34	Kinkade & A (N. Tie in)	2329.2	0	2433.25	45
J-35	Kinkade & A (12")	2332.34	0	2433.25	43.7
J-36	Hillcrest & A (12")	2289.38	63.36	2433.23	62.2
J-37	Hillcrest & B	2285.82	0	2402.93	50.7
J-38	Ashwood & B	2282.47	3.1	2402.79	52.1
J-39	Ashwood & C	2260.62	23.61	2402.09	61.2
J-40	16th & A	2302.78	23.91	2407.58	45.3
J-41	16th & D	2269.35	115.78	2402.13	57.4
J-42	10th & D	2248.81	32.13	2401.55	66.1
J-43	10th & C	2246	50.82	2401.52	67.3
J-44	10th & E	2252.14	62.14	2401.56	64.6
J-45	7th & C	2240.45	56.34	2401.41	69.6
J-46	7th & E	2243.35	69.69	2401.85	68.6
J-47	5th & E	2250.34	27.89	2402.68	65.9
J-48	7th & Buff	2309.92	25.88	2402.91	*40.2*
J-49	10th & Buff	2278.32	34.93	2401.74	53.4
J-50	Madras High School	2264	29.27	2401.7	59.6
J-51*	Elbow at Tracie	2324.65	6.28	2413.4	38.4
J-52*	Connection at Tank	2400	0	2432.1	13.9

* Denotes Junction out of pressure zone, pressure requirements not necessary.

2012 Peak Hour Flow Modeling (based off DVWD sales to City of Madras)

Label	Scaled Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Wil	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
P-284	1176.06	J-1	J-2	10	Steel	100	1059.55	4.33	0.011	FALSE	0
P-289	1055.72	J-2	J-3	10	PVC	150	894.94	3.66	0.004	FALSE	0
P-290	316.51	J-3	J-4	10	PVC	150	893.64	3.65	0.004	FALSE	0
P-291	976.46	J-4	J-6	10	PVC	150	714.42	2.92	0.003	FALSE	0
P-292	511.92	J-6	J-7	10	PVC	150	427.63	1.75	0.001	FALSE	0
P-293	311.58	J-7	J-8	10	PVC	150	316.8	1.29	0.001	FALSE	0
P-294	1142.7	J-8	J-9	10	PVC	150	316.8	1.29	0.001	FALSE	0
P-295	830.71	J-9	J-10	10	PVC	150	227.49	0.93	0	FALSE	0
P-296	542.07	J-10	J-11	10	PVC	150	-5.85	0.02	0	FALSE	0
P-297	173.76	J-11	PMP-1	6	Steel	100	0.01	0	0	FALSE	0
P-298	44.92	J-2	J-51	6	Steel	100	164.61	1.87	0.004	FALSE	0
P-300	269.22	J-16	J-6	12	PVC	150	-162.05	0.46	0	FALSE	0
P-302	1912.95	J-51	J-15	6	Steel	100	158.33	1.8	0.004	FALSE	0
P-304	118.32	J-16	J-15	6	Steel	100	25.86	0.29	0	FALSE	0
P-305	1140.28	J-7	J-17	6	Ductile Iron	130	82.35	0.93	0.001	FALSE	0
P-306	832.79	J-17	J-18	6	Steel	100	109.96	1.25	0.002	FALSE	0
P-307	321.31	J-18	J-10	6	Steel	100	-169.2	1.92	0.004	FALSE	0
P-308	323.2	J-17	J-9	10	PVC	150	-73.73	0.3	0	FALSE	0
P-309	452.32	J-18	J-19	6	Steel	100	22.44	0.25	0	FALSE	0
P-310	313.23	J-19	J-20	6	Ductile Iron	130	13.56	0.15	0	FALSE	0
P-311	242.31	J-18	J-24	12	PVC	150	242.4	0.69	0	FALSE	0
P-312	406.67	J-24	J-23	12	PVC	150	113.37	0.32	0	FALSE	0
P-313	319.19	J-23	J-22	12	PVC	150	96.65	0.27	0	FALSE	0
P-314	554.5	J-22	J-21	6	Steel	100	106.06	1.2	0.002	FALSE	0
P-315	283.73	J-21	J-25	6	Steel	100	90.15	1.02	0.001	FALSE	0
P-316	672.86	J-25	J-26	8	Ductile Iron	130	10.19	0.07	0	FALSE	0
P-317	2420.11	J-26	J-27	8	Ductile Iron	130	0.01	0	0	FALSE	0
P-318	242.96	J-20	J-22	12	PVC	150	12.26	0.03	0	FALSE	0
P-319	240.65	J-19	J-23	12	PVC	150	3.68	0.01	0	FALSE	0
P-320	555.95	J-24	J-31	6	Steel	100	125.13	1.42	0.003	FALSE	0
P-321	1291.18	J-31	J-28	6	Steel	100	83.42	0.95	0.001	FALSE	0
P-322	335.74	J-28	J-29	6	Steel	100	114	1.29	0.002	FALSE	0
P-323	1055.09	J-29	J-30	6	Steel	100	84.55	0.96	0.001	FALSE	0
P-324	1787.68	J-30	J-32	6	Steel	100	-21.8	0.25	0	FALSE	0
P-325	284.81	J-25	J-28	4	Steel	100	64.05	1.64	0.005	FALSE	0
P-326	1427.13	J-32	J-33	6	Steel	100	-154.1	1.75	0.004	FALSE	0
P-327	329.44	J-33	J-40	6	Steel	100	-299.16	3.39	0.013	FALSE	0
P-328	826.36	J-40	J-34	6	Steel	100	-480.74	*5.45*	0.031	FALSE	0
P-329	48.42	J-34	J-35	12	PVC	150	63.36	0.18	0	FALSE	0
P-330	1155.88	J-35	J-36	12	PVC	150	63.36	0.18	0	FALSE	0
P-331	511.92	J-33	J-37	6	Ductile Iron	130	85.52	0.97	0.001	FALSE	0
P-332	109.77	J-37	J-38	6	Steel	100	85.52	0.97	0.001	FALSE	0
P-333	592.53	J-38	J-39	6	Steel	100	82.42	0.94	0.001	FALSE	0
P-334	1383.74	J-40	J-41	6	Steel	100	157.67	1.79	0.004	FALSE	0
P-335	1704.84	J-41	J-42	6	Steel	100	41.89	0.48	0	FALSE	0
P-336	453.97	J-42	J-43	6	Steel	100	17.5	0.2	0	FALSE	0
P-337	894.53	J-43	J-39	6	Steel	100	-58.81	0.67	0.001	FALSE	0
P-338	393.43	J-42	J-44	6	Steel	100	-7.74	0.09	0	FALSE	0
P-339	841.99	J-43	J-45	6	Steel	100	25.49	0.29	0	FALSE	0
P-340	853.42	J-45	J-46	6	Steel	100	-52.66	0.6	0.001	FALSE	0
P-341	508.3	J-46	J-47	6	Steel	100	-98.12	1.11	0.002	FALSE	0
P-342	1206.95	J-47	J-16	6	Steel	100	-126.01	1.43	0.003	FALSE	0
P-344	452.77	J-31	J-45	6	Steel	100	-21.81	0.25	0	FALSE	0
P-345	847.45	J-46	J-44	6	Steel	100	42.24	0.48	0	FALSE	0
P-346	552.16	J-15	J-48	6	Steel	100	184.19	2.09	0.005	FALSE	0
P-347	805.48	J-48	J-49	6	Steel	100	91.84	1.04	0.001	FALSE	0
P-348	440.64	J-49	J-50	8	Ductile Iron	130	56.91	0.36	0	FALSE	0
P-349	888.44	J-50	J-44	6	Steel	100	27.64	0.31	0	FALSE	0
P-350	1325.41	J-46	J-48	6	Steel	100	-66.46	0.75	0.001	FALSE	0
P-353	483.89	J-52	J-1	10	Steel	100	1059.55	4.33	0.011	FALSE	0
P-354	76.57	R-3	J-52	10	PVC	150	1059.55	4.33	0.005	FALSE	0
P-355	61.57	J-34	PRV-2	12	PVC	150	-544.1	1.54	0.001	TRUE	1
P-356	82.26	PRV-2	R-4	12	PVC	150	-544.07	1.54	0.001	TRUE	1
P-357	70	J-5	PRV-3	12	PVC	150	-561.68	1.59	0.001	TRUE	1
P-358	105.03	PRV-3	R-5	10	PVC	150	-561.71	2.29	0.002	TRUE	1
P-359	283.85	J-5	J-14	8	PVC	150	288.87	1.84	0.001	FALSE	0
P-361	1225.79	J-13	J-12	8	PVC	150	220.74	1.41	0.001	FALSE	0
P-362	1254.61	J-12	J-11	8	PVC	150	159.86	1.02	0	FALSE	0
P-363	1179.13	J-4	J-5B	10	PVC	150	87.68	0.36	0	FALSE	0
P-364	322.11	J-5B	J-5	10	PVC	150	-66.58	0.27	0	FALSE	0
P-365	988.57	J-5B	J-5C	6	Steel	100	92.26	1.05	0.001	FALSE	0
P-366	1007.33	J-14	J-5D	8	PVC	150	288.87	1.84	0.001	FALSE	0
P-367	427.81	J-5D	J-13	8	PVC	150	274.2	1.75	0.001	FALSE	0
P-368	615.83	J-5C	J-5D	4	Steel	100	19.43	0.5	0.001	FALSE	0
P-369	1186.03	J-5C	J-6	4	Steel	100	23.23	0.59	0.001	FALSE	0
P-370	447.39	J-5B	J-5A	6	Ductile Iron	130	13.95	0.16	0	FALSE	0

2012 Peak Hour Flow Modeling (based off DVWD sales to City of Madras) - Fire Flow at J-5C

Label	Location	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	Elbow at Adams	2381.14	0	2426.12	19.5
J-2	Adams & Tracie	2325.71	0	2411.69	37.2
J-3	Adams & I	2298	1.3	2407.38	47.3
J-4	4th & I	2294.23	91.53	2406.09	48.4
J-5	Lincoln & I	2304.22	206.23	2408.26	45
J-5A	Madison & J	2304.45	13.95	2406.31	44.1
J-5B	Madison & I	2300.38	48.05	2406.32	45.8
J-5C	**Madison & G**	**2286.86**	**1549.6**	**2309.45**	**9.8**
J-5D	Marshall & G	2260	34.1	2400.55	60.8
J-5E	Roosevelt & G	2261.87	0	2400.55	60
J-6	4th & G	2272.67	147.98	2401.35	55.7
J-7	4th & F	2261.54	28.47	2400.75	60.2
J-8	Elbow SW City Hall	2259.52	0	2400.54	61
J-9	3rd & D	2242	15.58	2399.77	68.3
J-10	3rd & B	2232	64.14	2399.41	72.4
J-11	1st & B	2231	154	2399.4	72.9
J-12	1st & Culver Hwy	2244.52	60.88	2399.64	67.1
J-13	Madison & Culver Hwy	2258	53.46	2400.21	61.5
J-14	Marshall & I	2283.49	0	2406.56	53.2
J-15	5th & Buff	2284.27	0	2401.34	50.7
J-16	5th & G	2281	10.18	2401.34	52.1
J-17	4th & D	2241.49	46.12	2399.76	68.5
J-18	4th & B	2232.6	14.33	2398.2	71.6
J-19	4th & A	2228.06	5.2	2398.16	73.6
J-20	4th & Pine	2225.27	1.3	2398.15	74.8
J-21	5th & Oak	2250.53	15.91	2397.19	63.5
J-22	5th & Pine	2225.86	2.85	2398.15	74.5
J-23	5th & A	2228.28	20.39	2398.16	73.5
J-24	5th & Buff	2233	3.9	2398.17	71.5
J-25	6th & Oak	2255.86	15.91	2396.83	61
J-26	US97 & Plum	2258	10.18	2396.83	60.1
J-27	US97 & Jefferson	2280.92	0	2396.83	50.1
J-28	7th & Oak	2270.69	33.47	2395.52	54
J-29	7th & Henry	2271.2	29.45	2394.86	53.5
J-30	10th & Henry	2293.43	106.35	2393.72	43.4
J-31	7th & B	2234.63	63.52	2397.04	70.3
J-32	10th & A	2266.83	132.3	2394	55
J-33	Hillcrest & A (6")	2286.93	59.54	2399.79	48.8
J-34	Kinkade & A (N. Tie in)	2329.2	0	2433.25	45
J-35	Kinkade & A (12")	2332.34	0	2433.25	43.7
J-36	Hillcrest & A (12")	2289.38	63.36	2433.23	62.2
J-37	Hillcrest & B	2285.82	0	2399.28	49.1
J-38	Ashwood & B	2282.47	3.1	2399.1	50.5
J-39	Ashwood & C	2260.62	23.61	2398.19	59.5
J-40	16th & A	2302.78	23.91	2404.54	44
J-41	16th & D	2269.35	115.78	2398.32	55.8
J-42	10th & D	2248.81	32.13	2397.42	64.3
J-43	10th & C	2246	50.82	2397.39	65.5
J-44	10th & E	2252.14	62.14	2397.41	62.9
J-45	7th & C	2240.45	56.34	2397.15	67.8
J-46	7th & E	2243.35	69.69	2397.62	66.7
J-47	5th & E	2250.34	27.89	2398.39	64.1
J-48	7th & Buff	2309.92	25.88	2398.62	38.4
J-49	10th & Buff	2278.32	34.93	2397.55	51.6
J-50	Madras High School	2264	29.27	2397.52	57.8
J-51	Elbow at Tracie	2324.65	6.28	2411.44	37.6
J-52	Connection at Tank	2400	0	2432.06	13.9

2012 Peak Hour Flow Modeling (based off DVWD sales to City of Madras) - Fire Flow at J-5E

Label	Location	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	Elbow at Adams	2381.14	0	2426.22	19.5
J-2	Adams & Tracie	2325.71	0	2412.03	37.3
J-3	Adams & I	2298	1.3	2407.9	47.5
J-4	4th & I	2294.23	91.53	2406.67	48.6
J-5	Lincoln & I	2304.22	206.23	2408.26	45
J-5A	Madison & J	2304.45	13.95	2407.57	44.6
J-5B	Madison & I	2300.38	48.05	2407.58	46.4
J-5C	Madison & G	2286.86	49.6	2400.93	49.4
J-5D	Marshall & G	2260	34.1	2386.34	54.7
J-5E	**Roosevelt & G**	**2261.87**	**1500**	**1973.8**	**-124.6**
J-6	4th & G	2272.67	147.98	2400.34	55.2
J-7	4th & F	2261.54	28.47	2398.43	59.2
J-8	Elbow SW City Hall	2259.52	0	2397.71	59.8
J-9	3rd & D	2242	15.58	2395.08	66.2
J-10	3rd & B	2232	64.14	2393.21	69.7
J-11	1st & B	2231	154	2392.36	69.8
J-12	1st & Culver Hwy	2244.52	60.88	2389.19	62.6
J-13	Madison & Culver Hwy	2258	53.46	2386.92	55.8
J-14	Marshall & I	2283.49	0	2403.44	51.9
J-15	5th & Buff	2284.27	0	2400.31	50.2
J-16	5th & G	2281	10.18	2400.32	51.6
J-17	4th & D	2241.49	46.12	2395.08	66.4
J-18	4th & B	2232.6	14.33	2393.03	69.4
J-19	4th & A	2228.06	5.2	2393.01	71.4
J-20	4th & Pine	2225.27	1.3	2393	72.6
J-21	5th & Oak	2250.53	15.91	2392.28	61.3
J-22	5th & Pine	2225.86	2.85	2393	72.3
J-23	5th & A	2228.28	20.39	2393.01	71.3
J-24	5th & Buff	2233	3.9	2393.02	69.2
J-25	6th & Oak	2255.86	15.91	2392.02	58.9
J-26	US97 & Plum	2258	10.18	2392.02	58
J-27	US97 & Jefferson	2280.92	0	2392.02	48.1
J-28	7th & Oak	2270.69	33.47	2391.23	52.2
J-29	7th & Henry	2271.2	29.45	2390.71	51.7
J-30	10th & Henry	2293.43	106.35	2389.87	41.7
J-31	7th & B	2234.63	63.52	2392.83	68.4
J-32	10th & A	2266.83	132.3	2390.43	53.5
J-33	Hillcrest & A (6")	2286.93	59.54	2397.06	47.6
J-34	Kinkade & A (N. Tie in)	2329.2	0	2433.25	45
J-35	Kinkade & A (12")	2332.34	0	2433.25	43.7
J-36	Hillcrest & A (12")	2289.38	63.36	2433.23	62.2
J-37	Hillcrest & B	2285.82	0	2396.5	47.9
J-38	Ashwood & B	2282.47	3.1	2396.31	49.3
J-39	Ashwood & C	2260.62	23.61	2395.33	58.3
J-40	16th & A	2302.78	23.91	2402.27	43
J-41	16th & D	2269.35	115.78	2395.69	54.7
J-42	10th & D	2248.81	32.13	2394.62	63.1
J-43	10th & C	2246	50.82	2394.43	64.2
J-44	10th & E	2252.14	62.14	2394.65	61.7
J-45	7th & C	2240.45	56.34	2393.69	66.3
J-46	7th & E	2243.35	69.69	2394.92	65.6
J-47	5th & E	2250.34	27.89	2396.12	63.1
J-48	7th & Buff	2309.92	25.88	2396.5	37.5
J-49	10th & Buff	2278.32	34.93	2395	50.5
J-50	Madras High School	2264	29.27	2394.94	56.7
J-51	Elbow at Tracie	2324.65	6.28	2411.74	37.7
J-52	Connection at Tank	2400	0	2432.06	13.9

2012 Peak Hour Flow Modeling (based off DVWD sales to City of Madras) - Fire Flow at J-32

Label	Location	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	Elbow at Adams	2381.14	0	2425.73	19.3
J-2	Adams & Tracie	2325.71	0	2410.4	36.6
J-3	Adams & I	2298	1.3	2406.18	46.8
J-4	4th & I	2294.23	91.53	2404.91	47.9
J-5	Lincoln & I	2304.22	206.23	2408.26	45
J-5A	Madison & J	2304.45	13.95	2407.17	44.4
J-5B	Madison & I	2300.38	48.05	2407.18	46.2
J-5C	Madison & G	2286.86	49.6	2403.37	50.4
J-5D	Marshall & G	2260	34.1	2402.23	61.5
J-5E	Roosevelt & G	2261.87	0	2402.23	60.7
J-6	4th & G	2272.67	147.98	2395.88	53.3
J-7	4th & F	2261.54	28.47	2394.4	57.5
J-8	Elbow SW City Hall	2259.52	0	2393.85	58.1
J-9	3rd & D	2242	15.58	2391.85	64.8
J-10	3rd & B	2232	64.14	2391.32	68.9
J-11	1st & B	2231	154	2391.58	69.5
J-12	1st & Culver Hwy	2244.52	60.88	2395.43	65.3
J-13	Madison & Culver Hwy	2258	53.46	2400.21	61.5
J-14	Marshall & I	2283.49	0	2406.94	53.4
J-15	5th & Buff	2284.27	0	2394.63	47.7
J-16	5th & G	2281	10.18	2395.69	49.6
J-17	4th & D	2241.49	46.12	2391.75	65
J-18	4th & B	2232.6	14.33	2378.09	62.9
J-19	4th & A	2228.06	5.2	2377.67	64.7
J-20	4th & Pine	2225.27	1.3	2377.58	65.9
J-21	5th & Oak	2250.53	15.91	2366.38	50.1
J-22	5th & Pine	2225.86	2.85	2377.58	65.6
J-23	5th & A	2228.28	20.39	2377.67	64.6
J-24	5th & Buff	2233	3.9	2377.77	62.6
J-25	6th & Oak	2255.86	15.91	2361.09	45.5
J-26	US97 & Plum	2258	10.18	2361.08	44.6
J-27	US97 & Jefferson	2280.92	0	2361.08	34.7
J-28	7th & Oak	2270.69	33.47	2327.69	24.7
J-29	7th & Henry	2271.2	29.45	2304.44	14.4
J-30	10th & Henry	2293.43	106.35	2236.63	-24.6
J-31	7th & B	2234.63	63.52	2361.13	54.7
J-32	**10th & A**	**2266.83**	**1632.3**	**2151.49**	**-49.9**
J-33	Hillcrest & A (6")	2286.93	59.54	2332.16	19.6
J-34	Kinkade & A (N. Tie in)	2329.2	0	2433.25	45
J-35	Kinkade & A (12")	2332.34	0	2433.24	43.7
J-36	Hillcrest & A (12")	2289.38	63.36	2433.23	62.2
J-37	Hillcrest & B	2285.82	0	2335.96	21.7
J-38	Ashwood & B	2282.47	3.1	2337.28	23.7
J-39	Ashwood & C	2260.62	23.61	2344.57	36.3
J-40	16th & A	2302.78	23.91	2358.31	24
J-41	16th & D	2269.35	115.78	2357.96	38.3
J-42	10th & D	2248.81	32.13	2359.88	48.1
J-43	10th & C	2246	50.82	2357.27	48.1
J-44	10th & E	2252.14	62.14	2365.15	48.9
J-45	7th & C	2240.45	56.34	2361.2	52.2
J-46	7th & E	2243.35	69.69	2369.52	54.6
J-47	5th & E	2250.34	27.89	2376.43	54.6
J-48	7th & Buff	2309.92	25.88	2377.75	29.3
J-49	10th & Buff	2278.32	34.93	2370.33	39.8
J-50	Madras High School	2264	29.27	2369.86	45.8
J-51	Elbow at Tracie	2324.65	6.28	2410.02	36.9
J-52	Connection at Tank	2400	0	2432.03	13.9

2012 Peak Hour Flow Modeling (based off DVWD sales to City of Madras) - Fire Flow at J-47

Label	Location	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	Elbow at Adams	2381.14	0	2425.38	19.1
J-2	Adams & Tracie	2325.71	0	2409.29	36.2
J-3	Adams & I	2298	1.3	2404.95	46.3
J-4	4th & I	2294.23	91.53	2403.66	47.3
J-5	Lincoln & I	2304.22	206.23	2408.26	45
J-5A	Madison & J	2304.45	13.95	2406.83	44.3
J-5B	Madison & I	2300.38	48.05	2406.84	46.1
J-5C	Madison & G	2286.86	49.6	2402.83	50.2
J-5D	Marshall & G	2260	34.1	2402.05	61.5
J-5E	Roosevelt & G	2261.87	0	2402.05	60.6
J-6	4th & G	2272.67	147.98	2392.97	52
J-7	4th & F	2261.54	28.47	2392.31	56.6
J-8	Elbow SW City Hall	2259.52	0	2392.08	57.4
J-9	3rd & D	2242	15.58	2391.22	64.6
J-10	3rd & B	2232	64.14	2391.07	68.8
J-11	1st & B	2231	154	2391.33	69.4
J-12	1st & Culver Hwy	2244.52	60.88	2395.21	65.2
J-13	Madison & Culver Hwy	2258	53.46	2400.03	61.4
J-14	Marshall & I	2283.49	0	2406.9	53.4
J-15	5th & Buff	2284.27	0	2391.11	46.2
J-16	5th & G	2281	10.18	2392.44	48.2
J-17	4th & D	2241.49	46.12	2391.15	64.8
J-18	4th & B	2232.6	14.33	2384.18	65.6
J-19	4th & A	2228.06	5.2	2383.98	67.5
J-20	4th & Pine	2225.27	1.3	2383.96	68.7
J-21	5th & Oak	2250.53	15.91	2380.84	56.4
J-22	5th & Pine	2225.86	2.85	2383.96	68.4
J-23	5th & A	2228.28	20.39	2383.98	67.4
J-24	5th & Buff	2233	3.9	2384.01	65.3
J-25	6th & Oak	2255.86	15.91	2379.48	53.5
J-26	US97 & Plum	2258	10.18	2379.48	52.6
J-27	US97 & Jefferson	2280.92	0	2379.48	42.6
J-28	7th & Oak	2270.69	33.47	2372.2	43.9
J-29	7th & Henry	2271.2	29.45	2371.46	43.4
J-30	10th & Henry	2293.43	106.35	2370.12	33.2
J-31	7th & B	2234.63	63.52	2372.2	59.5
J-32	**10th & A**	2266.83	132.3	2370.29	44.8
J-33	Hillcrest & A (6")	2286.93	59.54	2375.61	38.4
J-34	Kinkade & A (N. Tie in)	2329.2	0	2433.25	45
J-35	Kinkade & A (12")	2332.34	0	2433.25	43.7
J-36	Hillcrest & A (12")	2289.38	63.36	2433.23	62.2
J-37	Hillcrest & B	2285.82	0	2373.71	38
J-38	Ashwood & B	2282.47	3.1	2373.05	39.2
J-39	Ashwood & C	2260.62	23.61	2369.58	47.1
J-40	16th & A	2302.78	23.91	2383.27	34.8
J-41	16th & D	2269.35	115.78	2370.11	43.6
J-42	10th & D	2248.81	32.13	2364.86	50.2
J-43	10th & C	2246	50.82	2365.44	51.7
J-44	10th & E	2252.14	62.14	2362.62	47.8
J-45	7th & C	2240.45	56.34	2365.24	54
J-46	7th & E	2243.35	69.69	2353.67	47.7
J-47	5th & E	2250.34	1527.89	2312.66	27
J-48	7th & Buff	2309.92	25.88	2370.74	26.3
J-49	10th & Buff	2278.32	34.93	2365.68	37.8
J-50	Madras High School	2264	29.27	2365.38	43.9
J-51	Elbow at Tracie	2324.65	6.28	2408.85	36.4
J-52	Connection at Tank	2400	0	2432.01	13.8

2012 Peak Hour Flow Modeling (based off DVWD sales to City of Madras) - Fire Flow at J2€

Label	Scaled Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Wil	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
P-284	1176.06	J-1	J-2	10	Steel	100	1168.28	4.77	0.013	FALSE	0
P-289	1055.72	J-2	J-3	10	PVC	150	927.16	3.79	0.004	FALSE	0
P-290	316.51	J-3	J-4	10	PVC	150	925.86	3.78	0.004	FALSE	0
P-291	976.46	J-4	J-6	10	PVC	150	1518.41	6.2	0.01	FALSE	0
P-292	511.92	J-6	J-7	10	PVC	150	1017.58	4.16	0.005	FALSE	0
P-293	311.58	J-7	J-8	10	PVC	150	783.02	3.2	0.003	FALSE	0
P-294	1142.7	J-8	J-9	10	PVC	150	783.02	3.2	0.003	FALSE	0
P-295	830.71	J-9	J-10	10	PVC	150	463.23	1.89	0.001	FALSE	0
P-296	542.07	J-10	J-11	10	PVC	150	-363.66	1.49	0.001	FALSE	0
P-297	173.76	J-11	PMP-1	6	Steel	100	0.01	0	0	FALSE	0
P-298	44.92	J-2	J-51	6	Steel	100	241.11	2.74	0.009	FALSE	0
P-300	269.22	J-16	J-6	12	PVC	150	-426.98	1.21	0	FALSE	0
P-302	1912.95	J-51	J-15	6	Steel	100	234.83	2.66	0.008	FALSE	0
P-304	118.32	J-16	J-15	6	Steel	100	146.26	1.66	0.003	FALSE	0
P-305	1140.28	J-7	J-17	6	Ductile Iron	130	206.09	2.34	0.004	FALSE	0
P-306	832.79	J-17	J-18	6	Steel	100	464.17	5.27	0.029	FALSE	0
P-307	321.31	J-18	J-10	6	Steel	100	-762.76	8.66	0.073	FALSE	0
P-308	323.2	J-17	J-9	10	PVC	150	-304.21	1.24	0.001	FALSE	0
P-309	452.32	J-18	J-19	6	Steel	100	129.63	1.47	0.003	FALSE	0
P-310	313.23	J-19	J-20	6	Ductile Iron	130	127.15	1.44	0.002	FALSE	0
P-311	242.31	J-18	J-24	12	PVC	150	1082.97	3.07	0.002	FALSE	0
P-312	406.67	J-24	J-23	12	PVC	150	931.82	2.64	0.002	FALSE	0
P-313	319.19	J-23	J-22	12	PVC	150	908.71	2.58	0.002	FALSE	0
P-314	**554.5**	**J-22**	**J-21**	**6**	**Steel**	**100**	**1031.71**	**11.71**	**0.128**	**FALSE**	**0**
P-315	**283.73**	**J-21**	**J-25**	**6**	**Steel**	**100**	**1015.8**	**11.53**	**0.124**	**FALSE**	**0**
P-316	**672.86**	**J-25**	**J-26**	**8**	**Ductile Iron**	**130**	**1510.19**	**9.64**	**0.039**	**FALSE**	**0**
P-317	2420.11	J-26	J-27	8	Ductile Iron	130	0.01	0	0	FALSE	0
P-318	242.96	J-20	J-22	12	PVC	150	125.85	0.36	0	FALSE	0
P-319	240.65	J-19	J-23	12	PVC	150	-2.72	0.01	0	FALSE	0
P-320	555.95	J-24	J-31	6	Steel	100	147.25	1.67	0.003	FALSE	0
P-321	1291.18	J-31	J-28	6	Steel	100	440.77	5	0.026	FALSE	0
P-322	335.74	J-28	J-29	6	Steel	100	-103.01	1.17	0.002	FALSE	0
P-323	1055.09	J-29	J-30	6	Steel	100	-132.46	1.5	0.003	FALSE	0
P-324	1787.68	J-30	J-32	6	Steel	100	-238.81	2.71	0.008	FALSE	0
P-325	**284.81**	**J-25**	**J-28**	**4**	**Steel**	**100**	**-510.3**	**13.03**	**0.25**	**FALSE**	**0**
P-326	1427.13	J-32	J-33	6	Steel	100	-371.11	4.21	0.019	FALSE	0
P-327	329.44	J-33	J-40	6	Steel	100	-484	5.49	0.031	FALSE	0
P-328	826.36	J-40	J-34	6	Steel	100	-691.54	7.85	0.061	FALSE	0
P-329	48.42	J-34	J-35	12	PVC	150	63.36	0.18	0	FALSE	0
P-330	1155.88	J-35	J-36	12	PVC	150	63.36	0.18	0	FALSE	0
P-331	511.92	J-33	J-37	6	Ductile Iron	130	53.35	0.61	0	FALSE	0
P-332	109.77	J-37	J-38	6	Steel	100	53.35	0.61	0.001	FALSE	0
P-333	592.53	J-38	J-39	6	Steel	100	50.25	0.57	0	FALSE	0
P-334	1383.74	J-40	J-41	6	Steel	100	183.63	2.08	0.005	FALSE	0
P-335	1704.84	J-41	J-42	6	Steel	100	67.85	0.77	0.001	FALSE	0
P-336	453.97	J-42	J-43	6	Steel	100	183.02	2.08	0.005	FALSE	0
P-337	894.53	J-43	J-39	6	Steel	100	-26.64	0.3	0	FALSE	0
P-338	393.43	J-42	J-44	6	Steel	100	-147.3	1.67	0.003	FALSE	0
P-339	841.99	J-43	J-45	6	Steel	100	158.84	1.8	0.004	FALSE	0
P-340	853.42	J-45	J-46	6	Steel	100	-254.53	2.89	0.01	FALSE	0
P-341	508.3	J-46	J-47	6	Steel	100	-242.64	2.75	0.009	FALSE	0
P-342	1206.95	J-47	J-16	6	Steel	100	-270.53	3.07	0.011	FALSE	0
P-344	452.77	J-31	J-45	6	Steel	100	-357.03	4.05	0.018	FALSE	0
P-345	847.45	J-46	J-44	6	Steel	100	85.53	0.97	0.001	FALSE	0
P-346	552.16	J-15	J-48	6	Steel	100	381.1	4.32	0.02	FALSE	0
P-347	805.48	J-48	J-49	6	Steel	100	188.12	2.13	0.005	FALSE	0
P-348	440.64	J-49	J-50	8	Ductile Iron	130	153.19	0.98	0.001	FALSE	0
P-349	888.44	J-50	J-44	6	Steel	100	123.92	1.41	0.003	FALSE	0
P-350	1325.41	J-46	J-48	6	Steel	100	-167.1	1.9	0.004	FALSE	0
P-353	483.89	J-52	J-1	10	Steel	100	1168.28	4.77	0.013	FALSE	0
P-354	76.57	R-3	J-52	10	PVC	150	1168.28	4.77	0.006	FALSE	0
P-355	61.57	J-34	PRV-2	12	PVC	150	-754.9	2.14	0.001	TRUE	1
P-356	82.26	PRV-2	R-4	12	PVC	150	-754.88	2.14	0.001	TRUE	1
P-357	70	J-5	PRV-3	12	PVC	150	-1742.15	4.94	0.005	TRUE	1
P-358	105.03	PRV-3	R-5	10	PVC	150	-1742.2	7.12	0.013	TRUE	1
P-359	283.85	J-5	J-14	8	PVC	150	620.64	3.96	0.006	FALSE	0
P-361	1225.79	J-13	J-12	8	PVC	150	578.56	3.69	0.005	FALSE	0
P-362	1254.61	J-12	J-11	8	PVC	150	517.68	3.3	0.004	FALSE	0
P-363	1179.13	J-4	J-5B	10	PVC	150	-684.08	2.79	0.002	FALSE	0
P-364	322.11	J-5B	J-5	10	PVC	150	-915.28	3.74	0.004	FALSE	0
P-365	988.57	J-5B	J-5C	6	Steel	100	169.2	1.92	0.004	FALSE	0
P-366	1007.33	J-14	J-5D	8	PVC	150	620.64	3.96	0.006	FALSE	0
P-367	427.81	J-5D	J-13	8	PVC	150	632.02	4.03	0.006	FALSE	0
P-368	615.83	J-5C	J-5D	4	Steel	100	45.48	1.16	0.003	FALSE	0
P-369	1186.03	J-5C	J-6	4	Steel	100	74.12	1.89	0.007	FALSE	0
P-370	447.39	J-5B	J-5A	6	Ductile Iron	130	13.95	0.16	0	FALSE	0
P-371	224.06	J-5D	J-5E	6	Ductile Iron	130	0	0	0	FALSE	0

2012 Peak Hour Flow Modeling (based off DVWD sales to City of Madras) - Fire Flow at J31

Label	Scaled Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Wil	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
P-284	1176.06	J-1	J-2	10	Steel	100	1168.2	4.77	0.013	FALSE	0
P-289	1055.72	J-2	J-3	10	PVC	150	924.04	3.77	0.004	FALSE	0
P-290	316.51	J-3	J-4	10	PVC	150	922.74	3.77	0.004	FALSE	0
P-291	976.46	J-4	J-6	10	PVC	150	1512.63	6.18	0.01	FALSE	0
P-292	511.92	J-6	J-7	10	PVC	150	885.59	3.62	0.004	FALSE	0
P-293	311.58	J-7	J-8	10	PVC	150	678.4	2.77	0.002	FALSE	0
P-294	1142.7	J-8	J-9	10	PVC	150	678.4	2.77	0.002	FALSE	0
P-295	830.71	J-9	J-10	10	PVC	150	392.7	1.6	0.001	FALSE	0
P-296	542.07	J-10	J-11	10	PVC	150	-333.93	1.36	0.001	FALSE	0
P-297	173.76	J-11	PMP-1	6	Steel	100	0.01	0	0	FALSE	0
P-298	44.92	J-2	J-51	6	Steel	100	244.16	2.77	0.009	FALSE	0
P-300	269.22	J-16	J-6	12	PVC	150	-553.77	1.57	0.001	FALSE	0
P-302	1912.95	J-51	J-15	6	Steel	100	237.88	2.7	0.008	FALSE	0
P-304	118.32	J-16	J-15	6	Steel	100	215.84	2.45	0.007	FALSE	0
P-305	1140.28	J-7	J-17	6	Ductile Iron	130	178.72	2.03	0.003	FALSE	0
P-306	832.79	J-17	J-18	6	Steel	100	402.72	4.57	0.022	FALSE	0
P-307	321.31	J-18	J-10	6	Steel	100	-662.49	7.52	0.056	FALSE	0
P-308	323.2	J-17	J-9	10	PVC	150	-270.12	1.1	0	FALSE	0
P-309	452.32	J-18	J-19	6	Steel	100	79.31	0.9	0.001	FALSE	0
P-310	313.23	J-19	J-20	6	Ductile Iron	130	35.7	0.41	0	FALSE	0
P-311	242.31	J-18	J-24	12	PVC	150	971.57	2.76	0.002	FALSE	0
P-312	406.67	J-24	J-23	12	PVC	150	233.89	0.66	0	FALSE	0
P-313	319.19	J-23	J-22	12	PVC	150	251.9	0.71	0	FALSE	0
P-314	554.5	J-22	J-21	6	Steel	100	283.46	3.22	0.012	FALSE	0
P-315	283.73	J-21	J-25	6	Steel	100	267.55	3.04	0.01	FALSE	0
P-316	672.86	J-25	J-26	8	Ductile Iron	130	10.19	0.07	0	FALSE	0
P-317	2420.11	J-26	J-27	8	Ductile Iron	130	0.01	0	0	FALSE	0
P-318	242.96	J-20	J-22	12	PVC	150	34.4	0.1	0	FALSE	0
P-319	240.65	J-19	J-23	12	PVC	150	38.41	0.11	0	FALSE	0
P-320	555.95	J-24	J-31	6	Steel	100	733.79	8.33	0.068	FALSE	0
P-321	1291.18	J-31	J-28	6	Steel	100	-232.32	2.64	0.008	FALSE	0
P-322	335.74	J-28	J-29	6	Steel	100	-24.34	0.28	0	FALSE	0
P-323	1055.09	J-29	J-30	6	Steel	100	-53.79	0.61	0.001	FALSE	0
P-324	1787.68	J-30	J-32	6	Steel	100	-160.14	1.82	0.004	FALSE	0
P-325	284.81	J-25	J-28	4	Steel	100	241.45	6.16	0.063	FALSE	0
P-326	1427.13	J-32	J-33	6	Steel	100	-292.44	3.32	0.012	FALSE	0
P-327	329.44	J-33	J-40	6	Steel	100	-489.22	5.55	0.032	FALSE	0
P-328	826.36	J-40	J-34	6	Steel	100	-723.42	8.21	0.066	FALSE	0
P-329	48.42	J-34	J-35	12	PVC	150	63.36	0.18	0	FALSE	0
P-330	1155.88	J-35	J-36	12	PVC	150	63.36	0.18	0	FALSE	0
P-331	511.92	J-33	J-37	6	Ductile Iron	130	137.24	1.56	0.002	FALSE	0
P-332	109.77	J-37	J-38	6	Steel	100	137.24	1.56	0.003	FALSE	0
P-333	592.53	J-38	J-39	6	Steel	100	134.14	1.52	0.003	FALSE	0
P-334	1383.74	J-40	J-41	6	Steel	100	210.29	2.39	0.007	FALSE	0
P-335	1704.84	J-41	J-42	6	Steel	100	94.51	1.07	0.002	FALSE	0
P-336	453.97	J-42	J-43	6	Steel	100	227.32	2.58	0.008	FALSE	0
P-337	894.53	J-43	J-39	6	Steel	100	-110.53	1.25	0.002	FALSE	0
P-338	393.43	J-42	J-44	6	Steel	100	-164.94	1.87	0.004	FALSE	0
P-339	841.99	J-43	J-45	6	Steel	100	287.03	3.26	0.012	FALSE	0
P-340	853.42	J-45	J-46	6	Steel	100	-366.73	4.16	0.019	FALSE	0
P-341	508.3	J-46	J-47	6	Steel	100	-299.86	3.4	0.013	FALSE	0
P-342	1206.95	J-47	J-16	6	Steel	100	-327.75	3.72	0.015	FALSE	0
P-344	452.77	J-31	J-45	6	Steel	100	-597.42	6.78	0.046	FALSE	0
P-345	847.45	J-46	J-44	6	Steel	100	72.22	0.82	0.001	FALSE	0
P-346	552.16	J-15	J-48	6	Steel	100	453.72	5.15	0.028	FALSE	0
P-347	805.48	J-48	J-49	6	Steel	100	219.05	2.49	0.007	FALSE	0
P-348	440.64	J-49	J-50	8	Ductile Iron	130	184.12	1.18	0.001	FALSE	0
P-349	888.44	J-50	J-44	6	Steel	100	154.85	1.76	0.004	FALSE	0
P-350	1325.41	J-46	J-48	6	Steel	100	-208.79	2.37	0.007	FALSE	0
P-353	483.89	J-52	J-1	10	Steel	100	1168.2	4.77	0.013	FALSE	0
P-354	76.57	R-3	J-52	10	PVC	150	1168.2	4.77	0.006	FALSE	0
P-355	61.57	J-34	PRV-2	12	PVC	150	-786.78	2.23	0.001	TRUE	1
P-356	82.26	PRV-2	R-4	12	PVC	150	-786.64	2.23	0.001	TRUE	1
P-357	70	J-5	PRV-3	12	PVC	150	-1710.34	4.85	0.005	TRUE	1
P-358	105.03	PRV-3	R-5	10	PVC	150	-1710.83	6.99	0.013	TRUE	1
P-359	283.85	J-5	J-14	8	PVC	150	595.7	3.8	0.005	FALSE	0
P-361	1225.79	J-13	J-12	8	PVC	150	548.82	3.5	0.005	FALSE	0
P-362	1254.61	J-12	J-11	8	PVC	150	487.94	3.11	0.004	FALSE	0
P-363	1179.13	J-4	J-5B	10	PVC	150	-681.42	2.78	0.002	FALSE	0
P-364	322.11	J-5B	J-5	10	PVC	150	-908.42	3.71	0.004	FALSE	0
P-365	988.57	J-5B	J-5C	6	Steel	100	165	1.87	0.004	FALSE	0
P-366	1007.33	J-14	J-5D	8	PVC	150	595.7	3.8	0.005	FALSE	0
P-367	427.81	J-5D	J-13	8	PVC	150	602.28	3.84	0.005	FALSE	0
P-368	615.83	J-5C	J-5D	4	Steel	100	40.68	1.04	0.002	FALSE	0
P-369	1186.03	J-5C	J-6	4	Steel	100	74.71	1.91	0.007	FALSE	0
P-370	447.39	J-5B	J-5A	6	Ductile Iron	130	13.95	0.16	0	FALSE	0
P-371	224.06	J-5D	J-5E	6	Ductile Iron	130	0	0	0	FALSE	0

2033 Peak Hour Flow Modeling

Label	Location	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1*	Elbow at Adams	2381.14	0	2426.67	19.7
J-2*	Adams & Tracie	2325.71	0	2413.49	38
J-3	Adams & I	2298	1.71	2409.45	48.2
J-4	4th & I	2294.23	93.21	2408.24	49.3
J-5	Lincoln & I	2304.22	204.67	2408.27	45
J-5A	Madison & J	2304.45	13.68	2408.22	44.9
J-5B	Madison & I	2300.38	47.12	2408.23	46.7
J-5C	Madison & G	2286.86	48.64	2406.66	51.8
J-5D	Marshall & G	2260	33.44	2406.24	63.3
J-5E	Roosevelt & G	2261.87	0	2406.24	62.5
J-6	4th & G	2272.67	159.45	2405.4	57.4
J-7	4th & F	2261.54	35.46	2404.83	62
J-8	Elbow SW City Hall	2259.52	0	2404.64	62.8
J-9	3rd & D	2242	17.01	2403.93	70.1
J-10	3rd & B	2232	63.97	2403.69	74.3
J-11	1st & B	2231	150.67	2403.69	74.7
J-12	1st & Culver Hwy	2244.52	59.95	2404.41	69.2
J-13	Madison & Culver Hwy	2258	55.35	2405.62	63.9
J-14	Marshall & I	2283.49	0	2407.82	53.8
J-15	5th & Buff	2284.27	0	2405.35	52.4
J-16	5th & G	2281	13.37	2405.37	53.8
J-17	4th & D	2241.49	58.53	2403.92	70.3
J-18	4th & B	2232.6	18.31	2401.93	73.3
J-19	4th & A	2228.06	6.84	2401.87	75.2
J-20	4th & Pine	2225.27	1.71	2401.86	76.4
J-21	5th & Oak	2250.53	19.86	2400.65	65
J-22	5th & Pine	2225.86	3.23	2401.86	76.1
J-23	5th & A	2228.28	26.77	2401.87	75.1
J-24	5th & Buff	2233	5.13	2401.89	73.1
J-25	6th & Oak	2255.86	19.86	2400.22	62.5
J-26	US97 & Plum	2258	13.37	2400.21	61.5
J-27	US97 & Jefferson	2280.92	0	2400.21	51.6
J-28	7th & Oak	2270.69	32.79	2398.8	55.4
J-29	7th & Henry	2271.2	28.88	2398.11	54.9
J-30	10th & Henry	2293.43	104.49	2396.88	44.8
J-31	7th & B	2234.63	69.73	2400.32	71.7
J-32	10th & A	2266.83	131.48	2397.07	56.3
J-33	Hillcrest & A (6")	2286.93	60.36	2402.46	50
J-34	Kinkade & A (N. Tie in)	2329.2	0	2433.25	45
J-35	Kinkade & A (12")	2332.34	0	2433.25	43.7
J-36	Hillcrest & A (12")	2289.38	77.3	2433.23	62.2
J-37	Hillcrest & B	2285.82	0	2402.04	50.3
J-38	Ashwood & B	2282.47	3.04	2401.89	51.7
J-39	Ashwood & C	2260.62	23.57	2401.15	60.8
J-40	16th & A	2302.78	27.27	2406.8	45
J-41	16th & D	2269.35	113.53	2401.26	57.1
J-42	10th & D	2248.81	34.46	2400.59	65.7
J-43	10th & C	2246	50.26	2400.54	66.9
J-44	10th & E	2252.14	60.91	2400.6	64.2
J-45	7th & C	2240.45	71.97	2400.36	69.2
J-46	7th & E	2243.35	71.36	2400.9	68.2
J-47	5th & E	2250.34	33.33	2401.79	65.5
J-48	**7th & Buff**	**2309.92**	**25.37**	**2402.11**	**39.9**
J-49	10th & Buff	2278.32	34.68	2400.79	53
J-50	Madras High School	2264	34.97	2400.75	59.2
J-51*	Elbow at Tracie	2324.65	8.24	2413.28	38.3
J-52*	Connection at Tank	2400	0	2432.09	13.9

* Denotes Junction out of pressure zone, pressure requirements not necessary.

2033 Peak Hour Flow Modeling

Label	Scaled Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Wil	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
P-284	1176.06	J-1	J-2	10	Steel	100	1062.79	4.34	0.011	FALSE	0
P-289	1055.72	J-2	J-3	10	PVC	150	892.43	3.65	0.004	FALSE	0
P-290	316.51	J-3	J-4	10	PVC	150	890.72	3.64	0.004	FALSE	0
P-291	976.46	J-4	J-6	10	PVC	150	769.85	3.14	0.003	FALSE	0
P-292	511.92	J-6	J-7	10	PVC	150	455.47	1.86	0.001	FALSE	0
P-293	311.58	J-7	J-8	10	PVC	150	333.16	1.36	0.001	FALSE	0
P-294	1142.7	J-8	J-9	10	PVC	150	333.16	1.36	0.001	FALSE	0
P-295	830.71	J-9	J-10	10	PVC	150	224.27	0.92	0	FALSE	0
P-296	542.07	J-10	J-11	10	PVC	150	-27.9	0.11	0	FALSE	0
P-297	173.76	J-11	PMP-1	6	Steel	100	0.01	0	0	FALSE	0
P-298	44.92	J-2	J-51	6	Steel	100	170.36	1.93	0.005	FALSE	0
P-300	269.22	J-16	J-6	12	PVC	150	-181.75	0.52	0	FALSE	0
P-302	1912.95	J-51	J-15	6	Steel	100	162.12	1.84	0.004	FALSE	0
P-304	118.32	J-16	J-15	6	Steel	100	33.14	0.38	0	FALSE	0
P-305	1140.28	J-7	J-17	6	Ductile Iron	130	86.86	0.99	0.001	FALSE	0
P-306	832.79	J-17	J-18	6	Steel	100	120.2	1.36	0.002	FALSE	0
P-307	321.31	J-18	J-10	6	Steel	100	-188.2	2.14	0.005	FALSE	0
P-308	323.2	J-17	J-9	10	PVC	150	-91.87	0.38	0	FALSE	0
P-309	452.32	J-18	J-19	6	Steel	100	24.81	0.28	0	FALSE	0
P-310	313.23	J-19	J-20	6	Ductile Iron	130	14.71	0.17	0	FALSE	0
P-311	242.31	J-18	J-24	12	PVC	150	265.28	0.75	0	FALSE	0
P-312	406.67	J-24	J-23	12	PVC	150	128.36	0.36	0	FALSE	0
P-313	319.19	J-23	J-22	12	PVC	150	104.85	0.3	0	FALSE	0
P-314	554.5	J-22	J-21	6	Steel	100	114.62	1.3	0.002	FALSE	0
P-315	283.73	J-21	J-25	6	Steel	100	94.76	1.08	0.002	FALSE	0
P-316	672.86	J-25	J-26	8	Ductile Iron	130	13.38	0.09	0	FALSE	0
P-317	2420.11	J-26	J-27	8	Ductile Iron	130	0.01	0	0	FALSE	0
P-318	242.96	J-20	J-22	12	PVC	150	13	0.04	0	FALSE	0
P-319	240.65	J-19	J-23	12	PVC	150	3.26	0.01	0	FALSE	0
P-320	555.95	J-24	J-31	6	Steel	100	131.79	1.5	0.003	FALSE	0
P-321	1291.18	J-31	J-28	6	Steel	100	82.03	0.93	0.001	FALSE	0
P-322	335.74	J-28	J-29	6	Steel	100	110.76	1.26	0.002	FALSE	0
P-323	1055.09	J-29	J-30	6	Steel	100	81.88	0.93	0.001	FALSE	0
P-324	1787.68	J-30	J-32	6	Steel	100	-22.61	0.26	0	FALSE	0
P-325	284.81	J-25	J-28	4	Steel	100	61.52	1.57	0.005	FALSE	0
P-326	1427.13	J-32	J-33	6	Steel	100	-154.09	1.75	0.004	FALSE	0
P-327	329.44	J-33	J-40	6	Steel	100	-302.36	3.43	0.013	FALSE	0
P-328	**826.36**	**J-40**	**J-34**	**6**	**Steel**	**100**	**-488.64**	**5.54**	**0.032**	**FALSE**	**0**
P-329	48.42	J-34	J-35	12	PVC	150	77.3	0.22	0	FALSE	0
P-330	1155.88	J-35	J-36	12	PVC	150	77.3	0.22	0	FALSE	0
P-331	511.92	J-33	J-37	6	Ductile Iron	130	87.91	1	0.001	FALSE	0
P-332	109.77	J-37	J-38	6	Steel	100	87.91	1	0.001	FALSE	0
P-333	592.53	J-38	J-39	6	Steel	100	84.87	0.96	0.001	FALSE	0
P-334	1383.74	J-40	J-41	6	Steel	100	159.01	1.8	0.004	FALSE	0
P-335	1704.84	J-41	J-42	6	Steel	100	45.48	0.52	0	FALSE	0
P-336	453.97	J-42	J-43	6	Steel	100	21.92	0.25	0	FALSE	0
P-337	894.53	J-43	J-39	6	Steel	100	-61.3	0.7	0.001	FALSE	0
P-338	393.43	J-42	J-44	6	Steel	100	-10.9	0.12	0	FALSE	0
P-339	841.99	J-43	J-45	6	Steel	100	32.95	0.37	0	FALSE	0
P-340	853.42	J-45	J-46	6	Steel	100	-58.98	0.67	0.001	FALSE	0
P-341	508.3	J-46	J-47	6	Steel	100	-101.91	1.16	0.002	FALSE	0
P-342	1206.95	J-47	J-16	6	Steel	100	-135.24	1.53	0.003	FALSE	0
P-344	452.77	J-31	J-45	6	Steel	100	-19.97	0.23	0	FALSE	0
P-345	847.45	J-46	J-44	6	Steel	100	43.25	0.49	0	FALSE	0
P-346	552.16	J-15	J-48	6	Steel	100	195.26	2.22	0.006	FALSE	0
P-347	805.48	J-48	J-49	6	Steel	100	98.21	1.11	0.002	FALSE	0
P-348	440.64	J-49	J-50	8	Ductile Iron	130	63.53	0.41	0	FALSE	0
P-349	888.44	J-50	J-44	6	Steel	100	28.56	0.32	0	FALSE	0
P-350	1325.41	J-46	J-48	6	Steel	100	-71.68	0.81	0.001	FALSE	0
P-353	483.89	J-52	J-1	10	Steel	100	1062.79	4.34	0.011	FALSE	0
P-354	76.57	R-3	J-52	10	PVC	150	1062.79	4.34	0.005	FALSE	0
P-355	61.57	J-34	PRV-2	12	PVC	150	-565.94	1.61	0.001	TRUE	1
P-356	82.26	PRV-2	R-4	12	PVC	150	-565.94	1.61	0.001	TRUE	1
P-357	70	J-5	PRV-3	12	PVC	150	-640.59	1.82	0.001	TRUE	1
P-358	105.03	PRV-3	R-5	10	PVC	150	-640.59	2.62	0.002	TRUE	1
P-359	283.85	J-5	J-14	8	PVC	150	306.29	1.95	0.002	FALSE	0
P-361	1225.79	J-13	J-12	8	PVC	150	238.53	1.52	0.001	FALSE	0
P-362	1254.61	J-12	J-11	8	PVC	150	178.58	1.14	0.001	FALSE	0
P-363	1179.13	J-4	J-5B	10	PVC	150	27.66	0.11	0	FALSE	0
P-364	322.11	J-5B	J-5	10	PVC	150	-129.63	0.53	0	FALSE	0
P-365	988.57	J-5B	J-5C	6	Steel	100	96.49	1.09	0.002	FALSE	0
P-366	1007.33	J-14	J-5D	8	PVC	150	306.29	1.95	0.002	FALSE	0
P-367	427.81	J-5D	J-13	8	PVC	150	293.88	1.88	0.001	FALSE	0
P-368	615.83	J-5C	J-5D	4	Steel	100	21.03	0.54	0.001	FALSE	0
P-369	1186.03	J-5C	J-6	4	Steel	100	26.83	0.68	0.001	FALSE	0
P-370	447.39	J-5B	J-5A	6	Ductile Iron	130	13.68	0.16	0	FALSE	0
P-371	224.06	J-5D	J-5E	4	Steel	100	0	0	0	FALSE	0

2033 Peak Hour Flow Modeling - with Solutions

Label	Location	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	Elbow at Adams	2381.14	0	2426.67	19.7
J-2	Adams & Tracie	2325.71	0	2413.48	38
J-3	Adams & I	2298	1.71	2409.44	48.2
J-4	4th & I	2294.23	93.21	2408.24	49.3
J-5	Lincoln & I	2304.22	204.67	2408.27	45
J-5A	Madison & J	2304.45	13.68	2408.21	44.9
J-5B	Madison & I	2300.38	47.12	2408.22	46.7
J-5C	Madison & G	2286.86	48.64	2405.89	51.5
J-5D	Marshall & G	2260	33.44	2405.95	63.1
J-5E	Roosevelt & G	2261.87	0	2405.95	62.3
J-6	4th & G	2272.67	159.45	2405.46	57.5
J-7	4th & F	2261.54	35.46	2405.16	62.1
J-8	Elbow SW City Hall	2259.52	0	2405.06	63
J-9	3rd & D	2242	17.01	2404.71	70.4
J-10	3rd & B	2232	63.97	2404.58	74.7
J-11	1st & B	2231	150.67	2404.57	75.1
J-12	1st & Culver Hwy	2244.52	59.95	2404.88	69.4
J-13	Madison & Culver Hwy	2258	55.35	2405.55	63.8
J-14	Marshall & I	2283.49	0	2407.76	53.8
J-15	5th & Buff	2284.27	0	2405.31	52.4
J-16	5th & G	2281	13.37	2405.36	53.8
J-17	4th & D	2241.49	58.53	2404.71	70.6
J-18	4th & B	2232.6	18.31	2404.35	74.3
J-19	4th & A	2228.06	6.84	2404.34	76.3
J-20	4th & Pine	2225.27	1.71	2404.33	77.5
J-21	5th & Oak	2250.53	19.86	2404.21	66.5
J-22	5th & Pine	2225.86	3.23	2404.33	77.2
J-23	5th & A	2228.28	26.77	2404.34	76.2
J-24	5th & Buff	2233	5.13	2404.34	74.1
J-25	6th & Oak	2255.86	19.86	2404.2	64.2
J-26	US97 & Plum	2258	13.37	2404.2	63.3
J-27	US97 & Jefferson	2280.92	0	2404.2	53.3
J-28	7th & Oak	2270.69	32.79	2404.2	57.8
J-29	7th & Henry	2271.2	28.88	2403.87	57.4
J-30	10th & Henry	2293.43	104.49	2403.45	47.6
J-31	7th & B	2234.63	69.73	2404.34	73.4
J-32	10th & A	2266.83	131.48	2404.09	59.4
J-33	Hillcrest & A (6")	2286.93	60.36	2406.97	51.9
J-34	Kinkade & A (N. Tie in)	2329.2	0	2433.25	45
J-35	Kinkade & A (12")	2332.34	0	2433.25	43.7
J-36	Hillcrest & A (12")	2289.38	77.3	2433.23	62.2
J-37	Hillcrest & B	2285.82	0	2406.46	52.2
J-38	Ashwood & B	2282.47	3.04	2406.28	53.6
J-39	Ashwood & C	2260.62	23.57	2405.36	62.6
J-40	16th & A	2302.78	27.27	2410.44	46.6
J-41	16th & D	2269.35	113.53	2405.13	58.7
J-42	10th & D	2248.81	34.46	2404.55	67.4
J-43	10th & C	2246	50.26	2404.55	68.6
J-44	10th & E	2252.14	60.91	2404.55	65.9
J-45	7th & C	2240.45	71.97	2404.41	70.9
J-46	7th & E	2243.35	71.36	2404.6	69.8
J-47	5th & E	2250.34	33.33	2404.65	66.8
J-48	**7th & Buff**	2309.92	25.37	2405.01	41.1
J-49	10th & Buff	2278.32	34.68	2404.98	54.8
J-50	Madras High School	2264	34.97	2404.9	61
J-51	Elbow at Tracie	2324.65	8.24	2413.28	38.3
J-52	Connection at Tank	2400	0	2432.09	13.9

2033 Peak Hour Flow Modeling - with Solutions

Label	Scaled Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Wil	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
P-284	1176.06	J-1	J-2	10	Steel	100	1062.92	4.34	0.011	FALSE	0
P-289	1055.72	J-2	J-3	10	PVC	150	892.23	3.64	0.004	FALSE	0
P-290	316.51	J-3	J-4	10	PVC	150	890.52	3.64	0.004	FALSE	0
P-291	976.46	J-4	J-6	10	PVC	150	760.31	3.11	0.003	FALSE	0
P-292	511.92	J-6	J-7	10	PVC	150	323.04	1.32	0.001	FALSE	0
P-293	311.58	J-7	J-8	10	PVC	150	228.32	0.93	0	FALSE	0
P-294	1142.7	J-8	J-9	10	PVC	150	228.32	0.93	0	FALSE	0
P-295	830.71	J-9	J-10	10	PVC	150	163.97	0.67	0	FALSE	0
P-296	542.07	J-10	J-11	10	PVC	150	37.06	0.15	0	FALSE	0
P-298	44.92	J-2	J-51	6	Steel	100	170.69	1.94	0.005	FALSE	0
P-300	269.22	J-16	J-6	12	PVC	150	-416.44	1.18	0	FALSE	0
P-302	1912.95	J-51	J-15	6	Steel	100	162.45	1.84	0.004	FALSE	0
P-304	118.32	J-16	J-15	12	Ductile Iron	130	346.97	0.98	0	FALSE	0
P-305	1140.28	J-7	J-17	6	Ductile Iron	130	59.26	0.67	0	FALSE	0
P-306	832.79	J-17	J-18	6	Steel	100	48.07	0.55	0	FALSE	0
P-307	321.31	J-18	J-10	6	Steel	100	-62.93	0.71	0.001	FALSE	0
P-308	323.2	J-17	J-9	10	PVC	150	-47.34	0.19	0	FALSE	0
P-309	452.32	J-18	J-19	6	Steel	100	9.31	0.11	0	FALSE	0
P-310	313.23	J-19	J-20	6	Ductile Iron	130	4.68	0.05	0	FALSE	0
P-311	242.31	J-18	J-24	12	PVC	150	83.38	0.24	0	FALSE	0
P-312	406.67	J-24	J-23	12	PVC	150	62.25	0.18	0	FALSE	0
P-313	319.19	J-23	J-22	12	PVC	150	33.28	0.09	0	FALSE	0
P-314	554.5	J-22	J-21	6	Steel	100	33.02	0.37	0	FALSE	0
P-315	283.73	J-21	J-25	6	Steel	100	13.16	0.15	0	FALSE	0
P-316	672.86	J-25	J-26	8	Ductile Iron	130	13.38	0.09	0	FALSE	0
P-317	2420.11	J-26	J-27	8	Ductile Iron	130	0.01	0	0	FALSE	0
P-318	242.96	J-20	J-22	12	PVC	150	2.97	0.01	0	FALSE	0
P-319	240.65	J-19	J-23	12	PVC	150	-2.2	0.01	0	FALSE	0
P-320	555.95	J-24	J-31	12	PVC	150	16	0.05	0	FALSE	0
P-321	1291.18	J-31	J-28	12	PVC	150	207.84	0.59	0	FALSE	0
P-322	335.74	J-28	J-29	6	Steel	100	74.86	0.85	0.001	FALSE	0
P-323	1055.09	J-29	J-30	6	Steel	100	45.98	0.52	0	FALSE	0
P-325	284.81	J-25	J-28	12	PVC	150	-20.08	0.06	0	FALSE	0
P-326	1427.13	J-32	J-33	6	Steel	100	-109.89	1.25	0.002	FALSE	0
P-327	329.44	J-33	J-40	6	Steel	100	-268.29	3.04	0.011	FALSE	0
P-328	826.36	J-40	J-34	6	Steel	100	-451.02	5.12	0.028	FALSE	0
P-329	48.42	J-34	J-35	12	PVC	150	77.3	0.22	0	FALSE	0
P-330	1155.88	J-35	J-36	12	PVC	150	77.3	0.22	0	FALSE	0
P-331	511.92	J-33	J-37	6	Ductile Iron	130	98.04	1.11	0.001	FALSE	0
P-332	109.77	J-37	J-38	6	Steel	100	98.04	1.11	0.002	FALSE	0
P-333	592.53	J-38	J-39	6	Steel	100	95	1.08	0.002	FALSE	0
P-334	1383.74	J-40	J-41	6	Steel	100	155.46	1.76	0.004	FALSE	0
P-335	1704.84	J-41	J-42	6	Steel	100	41.93	0.48	0	FALSE	0
P-336	453.97	J-42	J-43	6	Steel	100	6.91	0.08	0	FALSE	0
P-337	894.53	J-43	J-39	6	Steel	100	-71.43	0.81	0.001	FALSE	0
P-338	393.43	J-42	J-44	6	Steel	100	0.57	0.01	0	FALSE	0
P-339	841.99	J-43	J-45	6	Steel	100	28.08	0.32	0	FALSE	0
P-340	853.42	J-45	J-46	12	PVC	150	-305.46	0.87	0	FALSE	0
P-341	508.3	J-46	J-47	6	Steel	100	-22.77	0.26	0	FALSE	0
P-342	1206.95	J-47	J-16	6	Steel	100	-56.1	0.64	0.001	FALSE	0
P-344	452.77	J-31	J-45	12	PVC	150	-261.57	0.74	0	FALSE	0
P-345	847.45	J-46	J-44	6	Steel	100	15.1	0.17	0	FALSE	0
P-346	552.16	J-15	J-48	12	PVC	150	509.42	1.45	0.001	FALSE	0
P-347	805.48	J-48	J-49	12	PVC	150	114.89	0.33	0	FALSE	0
P-348	440.64	J-49	J-50	8	Ductile Iron	130	80.21	0.51	0	FALSE	0
P-349	888.44	J-50	J-44	6	Steel	100	45.24	0.51	0	FALSE	0
P-350	1325.41	J-46	J-48	12	PVC	150	-369.15	1.05	0	FALSE	0
P-353	483.89	J-52	J-1	10	Steel	100	1062.92	4.34	0.011	FALSE	0
P-354	76.57	R-3	J-52	10	PVC	150	1062.92	4.34	0.005	FALSE	0
P-355	61.57	J-34	PRV-2	12	PVC	150	-528.32	1.5	0	TRUE	1
P-356	82.26	PRV-2	R-4	12	PVC	150	-528.32	1.5	0	TRUE	1
P-357	70	J-5	PRV-3	12	PVC	150	-678.09	1.92	0.001	TRUE	1
P-358	105.03	PRV-3	R-5	10	PVC	150	-678.09	2.77	0.002	TRUE	1
P-359	283.85	J-5	J-14	8	PVC	150	329.93	2.11	0.002	FALSE	0
P-361	1225.79	J-13	J-12	8	PVC	150	173.57	1.11	0.001	FALSE	0
P-362	1254.61	J-12	J-11	8	PVC	150	113.62	0.73	0	FALSE	0
P-363	1179.13	J-4	J-5B	10	PVC	150	37	0.15	0	FALSE	0
P-364	322.11	J-5B	J-5	10	PVC	150	-143.49	0.59	0	FALSE	0
P-365	988.57	J-5B	J-5C	6	Steel	100	119.69	1.36	0.002	FALSE	0
P-366	1007.33	J-14	J-5D	8	PVC	150	329.93	2.11	0.002	FALSE	0
P-367	427.81	J-5D	J-13	8	PVC	150	228.92	1.46	0.001	FALSE	0
P-368	615.83	J-5C	J-5D	8	PVC	150	-67.57	0.43	0	FALSE	0
P-369	1186.03	J-5C	J-6	8	PVC	150	138.62	0.88	0	FALSE	0
P-370	447.39	J-5B	J-5A	6	Ductile Iron	130	13.68	0.16	0	FALSE	0
P-371	224.06	J-5D	J-5E	8	PVC	150	0	0	0	FALSE	0
P-372	1037.46	J-30	J-248	6	Steel	100	-58.51	0.66	0.001	FALSE	0
P-373	750.23	J-248	J-32	8	PVC	150	21.59	0.14	0	FALSE	0
P-374	806.88	J-28	J-248	8	PVC	150	80.1	0.51	0	FALSE	0

2033 Peak Hour Flow Modeling - with Solutions

Label	Scaled Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Wil	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
P-284	1176.06	J-1	J-2	10	Steel	100	1062.92	4.34	0.011	FALSE	0
P-289	1055.72	J-2	J-3	10	PVC	150	892.23	3.64	0.004	FALSE	0
P-290	316.51	J-3	J-4	10	PVC	150	890.52	3.64	0.004	FALSE	0
P-291	976.46	J-4	J-6	10	PVC	150	760.31	3.11	0.003	FALSE	0
P-292	511.92	J-6	J-7	10	PVC	150	323.04	1.32	0.001	FALSE	0
P-293	311.58	J-7	J-8	10	PVC	150	228.32	0.93	0	FALSE	0
P-294	1142.7	J-8	J-9	10	PVC	150	228.32	0.93	0	FALSE	0
P-295	830.71	J-9	J-10	10	PVC	150	163.97	0.67	0	FALSE	0
P-296	542.07	J-10	J-11	10	PVC	150	37.06	0.15	0	FALSE	0
P-298	44.92	J-2	J-51	6	Steel	100	170.69	1.94	0.005	FALSE	0
P-300	269.22	J-16	J-6	12	PVC	150	-416.44	1.18	0	FALSE	0
P-302	1912.95	J-51	J-15	6	Steel	100	162.45	1.84	0.004	FALSE	0
P-304	118.32	J-16	J-15	12	Ductile Iron	130	346.97	0.98	0	FALSE	0
P-305	1140.28	J-7	J-17	6	Ductile Iron	130	59.26	0.67	0	FALSE	0
P-306	832.79	J-17	J-18	6	Steel	100	48.07	0.55	0	FALSE	0
P-307	321.31	J-18	J-10	6	Steel	100	-62.93	0.71	0.001	FALSE	0
P-308	323.2	J-17	J-9	10	PVC	150	-47.34	0.19	0	FALSE	0
P-309	452.32	J-18	J-19	6	Steel	100	9.31	0.11	0	FALSE	0
P-310	313.23	J-19	J-20	6	Ductile Iron	130	4.68	0.05	0	FALSE	0
P-311	242.31	J-18	J-24	12	PVC	150	83.38	0.24	0	FALSE	0
P-312	406.67	J-24	J-23	12	PVC	150	62.25	0.18	0	FALSE	0
P-313	319.19	J-23	J-22	12	PVC	150	33.28	0.09	0	FALSE	0
P-314	554.5	J-22	J-21	6	Steel	100	33.02	0.37	0	FALSE	0
P-315	283.73	J-21	J-25	6	Steel	100	13.16	0.15	0	FALSE	0
P-316	672.86	J-25	J-26	8	Ductile Iron	130	13.38	0.09	0	FALSE	0
P-317	2420.11	J-26	J-27	8	Ductile Iron	130	0.01	0	0	FALSE	0
P-318	242.96	J-20	J-22	12	PVC	150	2.97	0.01	0	FALSE	0
P-319	240.65	J-19	J-23	12	PVC	150	-2.2	0.01	0	FALSE	0
P-320	555.95	J-24	J-31	12	PVC	150	16	0.05	0	FALSE	0
P-321	1291.18	J-31	J-28	12	PVC	150	207.84	0.59	0	FALSE	0
P-322	335.74	J-28	J-29	6	Steel	100	74.86	0.85	0.001	FALSE	0
P-323	1055.09	J-29	J-30	6	Steel	100	45.98	0.52	0	FALSE	0
P-325	284.81	J-25	J-28	12	PVC	150	-20.08	0.06	0	FALSE	0
P-326	1427.13	J-32	J-33	6	Steel	100	-109.89	1.25	0.002	FALSE	0
P-327	329.44	J-33	J-40	6	Steel	100	-268.29	3.04	0.011	FALSE	0
P-328	826.36	J-40	J-34	6	Steel	100	-451.02	5.12	0.028	FALSE	0
P-329	48.42	J-34	J-35	12	PVC	150	77.3	0.22	0	FALSE	0
P-330	1155.88	J-35	J-36	12	PVC	150	77.3	0.22	0	FALSE	0
P-331	511.92	J-33	J-37	6	Ductile Iron	130	98.04	1.11	0.001	FALSE	0
P-332	109.77	J-37	J-38	6	Steel	100	98.04	1.11	0.002	FALSE	0
P-333	592.53	J-38	J-39	6	Steel	100	95	1.08	0.002	FALSE	0
P-334	1383.74	J-40	J-41	6	Steel	100	155.46	1.76	0.004	FALSE	0
P-335	1704.84	J-41	J-42	6	Steel	100	41.93	0.48	0	FALSE	0
P-336	453.97	J-42	J-43	6	Steel	100	6.91	0.08	0	FALSE	0
P-337	894.53	J-43	J-39	6	Steel	100	-71.43	0.81	0.001	FALSE	0
P-338	393.43	J-42	J-44	6	Steel	100	0.57	0.01	0	FALSE	0
P-339	841.99	J-43	J-45	6	Steel	100	28.08	0.32	0	FALSE	0
P-340	853.42	J-45	J-46	12	PVC	150	-305.46	0.87	0	FALSE	0
P-341	508.3	J-46	J-47	6	Steel	100	-22.77	0.26	0	FALSE	0
P-342	1206.95	J-47	J-16	6	Steel	100	-56.1	0.64	0.001	FALSE	0
P-344	452.77	J-31	J-45	12	PVC	150	-261.57	0.74	0	FALSE	0
P-345	847.45	J-46	J-44	6	Steel	100	15.1	0.17	0	FALSE	0
P-346	552.16	J-15	J-48	12	PVC	150	509.42	1.45	0.001	FALSE	0
P-347	805.48	J-48	J-49	12	PVC	150	114.89	0.33	0	FALSE	0
P-348	440.64	J-49	J-50	8	Ductile Iron	130	80.21	0.51	0	FALSE	0
P-349	888.44	J-50	J-44	6	Steel	100	45.24	0.51	0	FALSE	0
P-350	1325.41	J-46	J-48	12	PVC	150	-369.15	1.05	0	FALSE	0
P-353	483.89	J-52	J-1	10	Steel	100	1062.92	4.34	0.011	FALSE	0
P-354	76.57	R-3	J-52	10	PVC	150	1062.92	4.34	0.005	FALSE	0
P-355	61.57	J-34	PRV-2	12	PVC	150	-528.32	1.5	0	TRUE	1
P-356	82.26	PRV-2	R-4	12	PVC	150	-528.32	1.5	0	TRUE	1
P-357	70	J-5	PRV-3	12	PVC	150	-678.09	1.92	0.001	TRUE	1
P-358	105.03	PRV-3	R-5	10	PVC	150	-678.09	2.77	0.002	TRUE	1
P-359	283.85	J-5	J-14	8	PVC	150	329.93	2.11	0.002	FALSE	0
P-361	1225.79	J-13	J-12	8	PVC	150	173.57	1.11	0.001	FALSE	0
P-362	1254.61	J-12	J-11	8	PVC	150	113.62	0.73	0	FALSE	0
P-363	1179.13	J-4	J-5B	10	PVC	150	37	0.15	0	FALSE	0
P-364	322.11	J-5B	J-5	10	PVC	150	-143.49	0.59	0	FALSE	0
P-365	988.57	J-5B	J-5C	6	Steel	100	119.69	1.36	0.002	FALSE	0
P-366	1007.33	J-14	J-5D	8	PVC	150	329.93	2.11	0.002	FALSE	0
P-367	427.81	J-5D	J-13	8	PVC	150	228.92	1.46	0.001	FALSE	0
P-368	615.83	J-5C	J-5D	8	PVC	150	-67.57	0.43	0	FALSE	0
P-369	1186.03	J-5C	J-6	8	PVC	150	138.62	0.88	0	FALSE	0
P-370	447.39	J-5B	J-5A	6	Ductile Iron	130	13.68	0.16	0	FALSE	0
P-371	224.06	J-5D	J-5E	8	PVC	150	0	0	0	FALSE	0
P-372	1037.46	J-30	J-248	6	Steel	100	-58.51	0.66	0.001	FALSE	0
P-373	750.23	J-248	J-32	8	PVC	150	21.59	0.14	0	FALSE	0
P-374	806.88	J-28	J-248	8	PVC	150	80.1	0.51	0	FALSE	0

2033 Peak Hour Flow Modeling - with Solutions - Fire Flow at J-5E

Label	Location	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	Elbow at Adams	2381.14	0	2425.81	19.3
J-2	Adams & Tracie	2325.71	0	2410.67	36.8
J-3	Adams & I	2298	1.71	2406.41	46.9
J-4	4th & I	2294.23	93.21	2405.13	48
J-5	Lincoln & I	2304.22	204.67	2408.26	45
J-5A	Madison & J	2304.45	13.68	2406.99	44.4
J-5B	Madison & I	2300.38	47.12	2407	46.1
J-5C	Madison & G	2286.86	48.64	2395.22	46.9
J-5D	Marshall & G	2260	33.44	2392.68	57.4
J-5E	**Roosevelt & G**	**2261.87**	**1500**	**2386.03**	**53.7**
J-6	4th & G	2272.67	159.45	2396.77	53.7
J-7	4th & F	2261.54	35.46	2396.16	58.2
J-8	Elbow SW City Hall	2259.52	0	2395.95	59
J-9	3rd & D	2242	17.01	2395.17	66.3
J-10	3rd & B	2232	63.97	2394.64	70.4
J-11	1st & B	2231	150.67	2394.25	70.6
J-12	1st & Culver Hwy	2244.52	59.95	2393.27	64.4
J-13	Madison & Culver Hwy	2258	55.35	2392.76	58.3
J-14	Marshall & I	2283.49	0	2404.83	52.5
J-15	5th & Buff	2284.27	0	2396.6	48.6
J-16	5th & G	2281	13.37	2396.65	50
J-17	4th & D	2241.49	58.53	2395.17	66.5
J-18	4th & B	2232.6	18.31	2395.04	70.3
J-19	4th & A	2228.06	6.84	2395.04	72.2
J-20	4th & Pine	2225.27	1.71	2395.04	73.5
J-21	5th & Oak	2250.53	19.86	2394.96	62.5
J-22	5th & Pine	2225.86	3.23	2395.04	73.2
J-23	5th & A	2228.28	26.77	2395.04	72.1
J-24	5th & Buff	2233	5.13	2395.04	70.1
J-25	6th & Oak	2255.86	19.86	2394.96	60.2
J-26	US97 & Plum	2258	13.37	2394.95	59.3
J-27	US97 & Jefferson	2280.92	0	2394.95	49.3
J-28	7th & Oak	2270.69	32.79	2394.96	53.8
J-29	7th & Henry	2271.2	28.88	2394.64	53.4
J-30	10th & Henry	2293.43	104.49	2394.23	43.6
J-31	7th & B	2234.63	69.73	2395.07	69.4
J-32	10th & A	2266.83	131.48	2394.91	55.4
J-33	Hillcrest & A (6")	2286.93	60.36	2399.14	48.5
J-34	Kinkade & A (N. Tie in)	2329.2	0	2433.25	45
J-35	Kinkade & A (12")	2332.34	0	2433.25	43.7
J-36	Hillcrest & A (12")	2289.38	77.3	2433.23	62.2
J-37	Hillcrest & B	2285.82	0	2398.43	48.7
J-38	Ashwood & B	2282.47	3.04	2398.18	50.1
J-39	Ashwood & C	2260.62	23.57	2396.9	59
J-40	16th & A	2302.78	27.27	2403.76	43.7
J-41	16th & D	2269.35	113.53	2396.93	55.2
J-42	10th & D	2248.81	34.46	2395.64	63.5
J-43	10th & C	2246	50.26	2395.63	64.7
J-44	10th & E	2252.14	60.91	2395.61	62.1
J-45	7th & C	2240.45	71.97	2395.24	67
J-46	7th & E	2243.35	71.36	2395.58	65.9
J-47	5th & E	2250.34	33.33	2395.69	62.9
J-48	**7th & Buff**	2309.92	25.37	2396.18	37.3
J-49	10th & Buff	2278.32	34.68	2396.15	51
J-50	Madras High School	2264	34.97	2396.06	57.1
J-51	Elbow at Tracie	2324.65	8.24	2410.33	37.1
J-52	Connection at Tank	2400	0	2432.03	13.9

2033 Peak Hour Flow Modeling - with Solutions - Fire Flow at J-32

Label	Location	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	Elbow at Adams	2381.14	0	2425.51	19.2
J-2	Adams & Tracie	2325.71	0	2409.69	36.3
J-3	Adams & I	2298	1.71	2405.36	46.4
J-4	4th & I	2294.23	93.21	2404.07	47.5
J-5	Lincoln & I	2304.22	204.67	2408.26	45
J-5A	Madison & J	2304.45	13.68	2406.77	44.3
J-5B	Madison & I	2300.38	47.12	2406.78	46
J-5C	Madison & G	2286.86	48.64	2397.8	48
J-5D	Marshall & G	2260	33.44	2398.41	59.9
J-5E	Roosevelt & G	2261.87	0	2398.41	59.1
J-6	4th & G	2272.67	159.45	2394.18	52.6
J-7	4th & F	2261.54	35.46	2393.33	57
J-8	Elbow SW City Hall	2259.52	0	2393.03	57.8
J-9	3rd & D	2242	17.01	2391.94	64.9
J-10	3rd & B	2232	63.97	2391.66	69.1
J-11	1st & B	2231	150.67	2391.77	69.6
J-12	1st & Culver Hwy	2244.52	59.95	2394.04	64.7
J-13	Madison & Culver Hwy	2258	55.35	2397.06	60.2
J-14	Marshall & I	2283.49	0	2406.1	53
J-15	5th & Buff	2284.27	0	2393.09	47.1
J-16	5th & G	2281	13.37	2393.43	48.6
J-17	4th & D	2241.49	58.53	2391.88	65.1
J-18	4th & B	2232.6	18.31	2385.92	66.3
J-19	4th & A	2228.06	6.84	2385.75	68.2
J-20	4th & Pine	2225.27	1.71	2385.73	69.4
J-21	5th & Oak	2250.53	19.86	2382.93	57.3
J-22	5th & Pine	2225.86	3.23	2385.73	69.2
J-23	5th & A	2228.28	26.77	2385.75	68.1
J-24	5th & Buff	2233	5.13	2385.78	66.1
J-25	6th & Oak	2255.86	19.86	2381.78	54.5
J-26	US97 & Plum	2258	13.37	2381.77	53.6
J-27	US97 & Jefferson	2280.92	0	2381.77	43.6
J-28	7th & Oak	2270.69	32.79	2381.76	48.1
J-29	7th & Henry	2271.2	28.88	2378.59	46.5
J-30	10th & Henry	2293.43	104.49	2370.61	33.4
J-31	7th & B	2234.63	69.73	2385.64	65.3
J-32	**10th & A**	**2266.83**	**1631.48**	**2352.86**	**37.2**
J-33	Hillcrest & A (6")	2286.93	60.36	2385.38	42.6
J-34	Kinkade & A (N. Tie in)	2329.2	0	2433.25	45
J-35	Kinkade & A (12")	2332.34	0	2433.25	43.7
J-36	Hillcrest & A (12")	2289.38	77.3	2433.23	62.2
J-37	Hillcrest & B	2285.82	0	2385.49	43.1
J-38	Ashwood & B	2282.47	3.04	2385.52	44.6
J-39	Ashwood & C	2260.62	23.57	2385.76	54.1
J-40	16th & A	2302.78	27.27	2393.51	39.3
J-41	16th & D	2269.35	113.53	2388.12	51.4
J-42	10th & D	2248.81	34.46	2387.52	60
J-43	10th & C	2246	50.26	2386.52	60.8
J-44	10th & E	2252.14	60.91	2388.26	58.9
J-45	7th & C	2240.45	71.97	2386.52	63.2
J-46	7th & E	2243.35	71.36	2388.42	62.8
J-47	5th & E	2250.34	33.33	2389.45	60.2
J-48	7th & Buff	2309.92	25.37	2391.34	35.2
J-49	10th & Buff	2278.32	34.68	2391.26	48.9
J-50	Madras High School	2264	34.97	2390.95	54.9
J-51	Elbow at Tracie	2324.65	8.24	2409.28	36.6
J-52	Connection at Tank	2400	0	2432.01	13.9

2033 Peak Hour Flow Modeling - with Solutions - Fire Flow at J-47

Label	Location	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	Elbow at Adams	2381.14	0	2425.42	19.2
J-2	Adams & Tracie	2325.71	0	2409.39	36.2
J-3	Adams & I	2298	1.71	2405.03	46.3
J-4	4th & I	2294.23	93.21	2403.73	47.4
J-5	Lincoln & I	2304.22	204.67	2408.26	45
J-5A	Madison & J	2304.45	13.68	2406.67	44.2
J-5B	Madison & I	2300.38	47.12	2406.68	46
J-5C	Madison & G	2286.86	48.64	2397.49	47.9
J-5D	Marshall & G	2260	33.44	2398.23	59.8
J-5E	Roosevelt & G	2261.87	0	2398.23	59
J-6	4th & G	2272.67	159.45	2393.42	52.2
J-7	4th & F	2261.54	35.46	2392.95	56.9
J-8	Elbow SW City Hall	2259.52	0	2392.79	57.7
J-9	3rd & D	2242	17.01	2392.22	65
J-10	3rd & B	2232	63.97	2392.1	69.3
J-11	1st & B	2231	150.67	2392.19	69.7
J-12	1st & Culver Hwy	2244.52	59.95	2394.23	64.8
J-13	Madison & Culver Hwy	2258	55.35	2396.99	60.1
J-14	Marshall & I	2283.49	0	2406.06	53
J-15	5th & Buff	2284.27	0	2392.19	46.7
J-16	5th & G	2281	13.37	2392.39	48.2
J-17	4th & D	2241.49	58.53	2392.18	65.2
J-18	4th & B	2232.6	18.31	2389.14	67.7
J-19	4th & A	2228.06	6.84	2389.07	69.7
J-20	4th & Pine	2225.27	1.71	2389.07	70.9
J-21	5th & Oak	2250.53	19.86	2388.9	59.9
J-22	5th & Pine	2225.86	3.23	2389.07	70.6
J-23	5th & A	2228.28	26.77	2389.07	69.6
J-24	5th & Buff	2233	5.13	2389.07	67.5
J-25	6th & Oak	2255.86	19.86	2388.87	57.5
J-26	US97 & Plum	2258	13.37	2388.87	56.6
J-27	US97 & Jefferson	2280.92	0	2388.87	46.7
J-28	7th & Oak	2270.69	32.79	2388.87	51.1
J-29	7th & Henry	2271.2	28.88	2388.55	50.8
J-30	10th & Henry	2293.43	104.49	2388.16	41
J-31	7th & B	2234.63	69.73	2388.96	66.8
J-32	10th & A	2266.83	131.48	2388.85	52.8
J-33	Hillcrest & A (6")	2286.93	60.36	2393.93	46.3
J-34	Kinkade & A (N. Tie in)	2329.2	0	2433.25	45
J-35	Kinkade & A (12")	2332.34	0	2433.25	43.7
J-36	Hillcrest & A (12")	2289.38	77.3	2433.23	62.2
J-37	Hillcrest & B	2285.82	0	2393.07	46.4
J-38	Ashwood & B	2282.47	3.04	2392.76	47.7
J-39	Ashwood & C	2260.62	23.57	2391.2	56.5
J-40	16th & A	2302.78	27.27	2399.31	41.8
J-41	16th & D	2269.35	113.53	2391.45	52.8
J-42	10th & D	2248.81	34.46	2389.61	60.9
J-43	10th & C	2246	50.26	2389.59	62.1
J-44	10th & E	2252.14	60.91	2389.52	59.4
J-45	7th & C	2240.45	71.97	2388.95	64.3
J-46	7th & E	2243.35	71.36	2388.94	63
J-47	**5th & E**	**2250.34**	**1533.33**	**2335.34**	**36.8**
J-48	7th & Buff	2309.92	25.37	2390.98	35.1
J-49	10th & Buff	2278.32	34.68	2390.93	48.7
J-50	Madras High School	2264	34.97	2390.76	54.8
J-51	Elbow at Tracie	2324.65	8.24	2408.97	36.5
J-52	Connection at Tank	2400	0	2432.01	13.8

2033 Peak Hour Flow Modeling - with Solutions - Fireflow at J-26

Label	Scaled Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Wil	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
P-284	1176.06	J-1	J-2	10	Steel	100	1175.6	4.8	0.014	FALSE	0
P-289	1055.72	J-2	J-3	10	PVC	150	927.69	3.79	0.004	FALSE	0
P-290	316.51	J-3	J-4	10	PVC	150	925.98	3.78	0.004	FALSE	0
P-291	976.46	J-4	J-6	10	PVC	150	1521.83	6.22	0.01	FALSE	0
P-292	511.92	J-6	J-7	10	PVC	150	584.76	2.39	0.002	FALSE	0
P-293	311.58	J-7	J-8	10	PVC	150	434.82	1.78	0.001	FALSE	0
P-294	1142.7	J-8	J-9	10	PVC	150	434.82	1.78	0.001	FALSE	0
P-295	830.71	J-9	J-10	10	PVC	150	247.55	1.01	0	FALSE	0
P-296	542.07	J-10	J-11	10	PVC	150	-187.05	0.76	0	FALSE	0
P-298	44.92	J-2	J-51	6	Steel	100	247.91	2.81	0.009	FALSE	0
P-300	269.22	J-16	J-6	12	PVC	150	-1220.87	3.46	0.003	FALSE	0
P-302	1912.95	J-51	J-15	6	Steel	100	239.67	2.72	0.009	FALSE	0
P-304	118.32	J-16	J-15	12	Ductile Iron	130	1063.68	3.02	0.003	FALSE	0
P-305	1140.28	J-7	J-17	6	Ductile Iron	130	114.48	1.3	0.001	FALSE	0
P-306	832.79	J-17	J-18	6	Steel	100	226.21	2.57	0.008	FALSE	0
P-307	321.31	J-18	J-10	6	Steel	100	-370.63	4.21	0.019	FALSE	0
P-308	323.2	J-17	J-9	10	PVC	150	-170.26	0.7	0	FALSE	0
P-309	452.32	J-18	J-19	6	Steel	100	47.15	0.54	0	FALSE	0
P-310	313.23	J-19	J-20	6	Ductile Iron	130	27.68	0.31	0	FALSE	0
P-311	242.31	J-18	J-24	12	PVC	150	531.38	1.51	0.001	FALSE	0
P-312	406.67	J-24	J-23	12	PVC	150	211.27	0.6	0	FALSE	0
P-313	319.19	J-23	J-22	12	PVC	150	197.13	0.56	0	FALSE	0
P-314	554.5	J-22	J-21	6	Steel	100	219.87	2.49	0.007	FALSE	0
P-315	283.73	J-21	J-25	6	Steel	100	200.01	2.27	0.006	FALSE	0
P-316	672.86	J-25	J-26	8	Ductile Iron	130	1513.38	9.66	0.039	FALSE	0
P-317	2420.11	J-26	J-27	8	Ductile Iron	130	0.01	0	0	FALSE	0
P-318	242.96	J-20	J-22	12	PVC	150	25.97	0.07	0	FALSE	0
P-319	240.65	J-19	J-23	12	PVC	150	12.63	0.04	0	FALSE	0
P-320	555.95	J-24	J-31	12	PVC	150	314.97	0.89	0	FALSE	0
P-321	1291.18	J-31	J-28	12	PVC	150	1416.63	4.02	0.004	FALSE	0
P-322	335.74	J-28	J-29	6	Steel	100	72.35	0.82	0.001	FALSE	0
P-323	1055.09	J-29	J-30	6	Steel	100	43.47	0.49	0	FALSE	0
P-325	284.81	J-25	J-28	12	PVC	150	-1333.23	3.78	0.003	FALSE	0
P-326	1427.13	J-32	J-33	6	Steel	100	-214.24	2.43	0.007	FALSE	0
P-327	329.44	J-33	J-40	6	Steel	100	-374.87	4.25	0.02	FALSE	0
P-328	826.36	J-40	J-34	6	Steel	100	-583.54	6.62	0.044	FALSE	0
P-329	48.42	J-34	J-35	12	PVC	150	77.3	0.22	0	FALSE	0
P-330	1155.88	J-35	J-36	12	PVC	150	77.3	0.22	0	FALSE	0
P-331	511.92	J-33	J-37	6	Ductile Iron	130	100.27	1.14	0.001	FALSE	0
P-332	109.77	J-37	J-38	6	Steel	100	100.27	1.14	0.002	FALSE	0
P-333	592.53	J-38	J-39	6	Steel	100	97.23	1.1	0.002	FALSE	0
P-334	1383.74	J-40	J-41	6	Steel	100	181.4	2.06	0.005	FALSE	0
P-335	1704.84	J-41	J-42	6	Steel	100	67.87	0.77	0.001	FALSE	0
P-336	453.97	J-42	J-43	6	Steel	100	80.45	0.91	0.001	FALSE	0
P-337	894.53	J-43	J-39	6	Steel	100	-73.66	0.84	0.001	FALSE	0
P-338	393.43	J-42	J-44	6	Steel	100	-47.04	0.53	0	FALSE	0
P-339	841.99	J-43	J-45	6	Steel	100	103.84	1.18	0.002	FALSE	0
P-340	853.42	J-45	J-46	12	PVC	150	-1139.51	3.23	0.002	FALSE	0
P-341	508.3	J-46	J-47	6	Steel	100	-110.49	1.25	0.002	FALSE	0
P-342	1206.95	J-47	J-16	6	Steel	100	-143.82	1.63	0.003	FALSE	0
P-344	452.77	J-31	J-45	12	PVC	150	-1171.38	3.32	0.003	FALSE	0
P-345	847.45	J-46	J-44	6	Steel	100	-23.26	0.26	0	FALSE	0
P-346	552.16	J-15	J-48	12	PVC	150	1303.34	3.7	0.003	FALSE	0
P-347	805.48	J-48	J-49	12	PVC	150	200.86	0.57	0	FALSE	0
P-348	440.64	J-49	J-50	8	Ductile Iron	130	166.18	1.06	0.001	FALSE	0
P-349	888.44	J-50	J-44	6	Steel	100	131.21	1.49	0.003	FALSE	0
P-350	1325.41	J-46	J-48	12	PVC	150	-1077.11	3.06	0.002	FALSE	0
P-353	483.89	J-52	J-1	10	Steel	100	1175.6	4.8	0.014	FALSE	0
P-354	76.57	R-3	J-52	10	PVC	150	1175.6	4.8	0.006	FALSE	0
P-355	61.57	J-34	PRV-2	12	PVC	150	-660.84	1.87	0.001	TRUE	1
P-356	82.26	PRV-2	R-4	12	PVC	150	-660.84	1.87	0.001	TRUE	1
P-357	70	J-5	PRV-3	12	PVC	150	-1932.88	5.48	0.007	TRUE	1
P-358	105.03	PRV-3	R-5	10	PVC	150	-1932.89	7.9	0.016	TRUE	1
P-359	283.85	J-5	J-14	8	PVC	150	728.21	4.65	0.008	FALSE	0
P-361	1225.79	J-13	J-12	8	PVC	150	397.68	2.54	0.003	FALSE	0
P-362	1254.61	J-12	J-11	8	PVC	150	337.73	2.16	0.002	FALSE	0
P-363	1179.13	J-4	J-5B	10	PVC	150	-689.05	2.81	0.002	FALSE	0
P-364	322.11	J-5B	J-5	10	PVC	150	-1000	4.08	0.005	FALSE	0
P-365	988.57	J-5B	J-5C	6	Steel	100	250.15	2.84	0.009	FALSE	0
P-366	1007.33	J-14	J-5D	8	PVC	150	728.21	4.65	0.008	FALSE	0
P-367	427.81	J-5D	J-13	8	PVC	150	453.03	2.89	0.003	FALSE	0
P-368	615.83	J-5C	J-5D	8	PVC	150	-241.74	1.54	0.001	FALSE	0
P-369	1186.03	J-5C	J-6	8	PVC	150	443.25	2.83	0.003	FALSE	0
P-370	447.39	J-5B	J-5A	6	Ductile Iron	130	13.68	0.16	0	FALSE	0
P-371	224.06	J-5D	J-5E	8	PVC	150	0	0	0	FALSE	0
P-372	1037.46	J-30	J-248	6	Steel	100	-61.02	0.69	0.001	FALSE	0
P-373	750.23	J-248	J-32	8	PVC	150	-82.76	0.53	0	FALSE	0
P-374	806.88	J-28	J-248	8	PVC	150	-21.75	0.14	0	FALSE	0

2033 Peak Hour Flow Modeling - with Solutions - Fireflow at J-31

Label	Scaled Length (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Wil	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Has User Defined Length?	Length (User Defined) (ft)
P-284	1176.06	J-1	J-2	10	Steel	100	1176.61	4.81	0.014	FALSE	0
P-289	1055.72	J-2	J-3	10	PVC	150	928.18	3.79	0.004	FALSE	0
P-290	316.51	J-3	J-4	10	PVC	150	926.47	3.78	0.004	FALSE	0
P-291	976.46	J-4	J-6	10	PVC	150	1526.16	6.23	0.01	FALSE	0
P-292	511.92	J-6	J-7	10	PVC	150	585.48	2.39	0.002	FALSE	0
P-293	311.58	J-7	J-8	10	PVC	150	435.39	1.78	0.001	FALSE	0
P-294	1142.7	J-8	J-9	10	PVC	150	435.39	1.78	0.001	FALSE	0
P-295	830.71	J-9	J-10	10	PVC	150	247.57	1.01	0	FALSE	0
P-296	542.07	J-10	J-11	10	PVC	150	-188.24	0.77	0	FALSE	0
P-298	44.92	J-2	J-51	6	Steel	100	248.43	2.82	0.009	FALSE	0
P-300	269.22	J-16	J-6	12	PVC	150	-1226.41	3.48	0.003	FALSE	0
P-302	1912.95	J-51	J-15	6	Steel	100	240.19	2.73	0.009	FALSE	0
P-304	118.32	J-16	J-15	12	Ductile Iron	130	1068.43	3.03	0.003	FALSE	0
P-305	1140.28	J-7	J-17	6	Ductile Iron	130	114.63	1.3	0.001	FALSE	0
P-306	832.79	J-17	J-18	6	Steel	100	226.91	2.57	0.008	FALSE	0
P-307	321.31	J-18	J-10	6	Steel	100	-371.84	4.22	0.019	FALSE	0
P-308	323.2	J-17	J-9	10	PVC	150	-170.81	0.7	0	FALSE	0
P-309	452.32	J-18	J-19	6	Steel	100	41.75	0.47	0	FALSE	0
P-310	313.23	J-19	J-20	6	Ductile Iron	130	7.72	0.09	0	FALSE	0
P-311	242.31	J-18	J-24	12	PVC	150	538.69	1.53	0.001	FALSE	0
P-312	406.67	J-24	J-23	12	PVC	150	48.1	0.14	0	FALSE	0
P-313	319.19	J-23	J-22	12	PVC	150	48.53	0.14	0	FALSE	0
P-314	554.5	J-22	J-21	6	Steel	100	51.31	0.58	0	FALSE	0
P-315	283.73	J-21	J-25	6	Steel	100	31.45	0.36	0	FALSE	0
P-316	672.86	J-25	J-26	8	Ductile Iron	130	13.38	0.09	0	FALSE	0
P-317	2420.11	J-26	J-27	8	Ductile Iron	130	0.01	0	0	FALSE	0
P-318	242.96	J-20	J-22	12	PVC	150	6.01	0.02	0	FALSE	0
P-319	240.65	J-19	J-23	12	PVC	150	27.2	0.08	0	FALSE	0
P-320	555.95	J-24	J-31	12	PVC	150	485.45	1.38	0.001	FALSE	0
P-321	1291.18	J-31	J-28	12	PVC	150	122.24	0.35	0	FALSE	0
P-322	335.74	J-28	J-29	6	Steel	100	72.66	0.82	0.001	FALSE	0
P-323	1055.09	J-29	J-30	6	Steel	100	43.78	0.5	0	FALSE	0
P-325	284.81	J-25	J-28	12	PVC	150	-1.8	0.01	0	FALSE	0
P-326	1427.13	J-32	J-33	6	Steel	100	-177.2	2.01	0.005	FALSE	0
P-327	329.44	J-33	J-40	6	Steel	100	-359.29	4.08	0.018	FALSE	0
P-328	826.36	J-40	J-34	6	Steel	100	-575.57	6.53	0.043	FALSE	0
P-329	48.42	J-34	J-35	12	PVC	150	77.3	0.22	0	FALSE	0
P-330	1155.88	J-35	J-36	12	PVC	150	77.3	0.22	0	FALSE	0
P-331	511.92	J-33	J-37	6	Ductile Iron	130	121.73	1.38	0.002	FALSE	0
P-332	109.77	J-37	J-38	6	Steel	100	121.73	1.38	0.002	FALSE	0
P-333	592.53	J-38	J-39	6	Steel	100	118.69	1.35	0.002	FALSE	0
P-334	1383.74	J-40	J-41	6	Steel	100	189	2.14	0.006	FALSE	0
P-335	1704.84	J-41	J-42	6	Steel	100	75.47	0.86	0.001	FALSE	0
P-336	453.97	J-42	J-43	6	Steel	100	72.3	0.82	0.001	FALSE	0
P-337	894.53	J-43	J-39	6	Steel	100	-95.12	1.08	0.002	FALSE	0
P-338	393.43	J-42	J-44	6	Steel	100	-31.29	0.36	0	FALSE	0
P-339	841.99	J-43	J-45	6	Steel	100	117.16	1.33	0.002	FALSE	0
P-340	853.42	J-45	J-46	12	PVC	150	-1161.32	3.29	0.003	FALSE	0
P-341	508.3	J-46	J-47	6	Steel	100	-111.28	1.26	0.002	FALSE	0
P-342	1206.95	J-47	J-16	6	Steel	100	-144.61	1.64	0.003	FALSE	0
P-344	452.77	J-31	J-45	12	PVC	150	-1206.51	3.42	0.003	FALSE	0
P-345	847.45	J-46	J-44	6	Steel	100	-36.71	0.42	0	FALSE	0
P-346	552.16	J-15	J-48	12	PVC	150	1308.62	3.71	0.003	FALSE	0
P-347	805.48	J-48	J-49	12	PVC	150	198.56	0.56	0	FALSE	0
P-348	440.64	J-49	J-50	8	Ductile Iron	130	163.88	1.05	0.001	FALSE	0
P-349	888.44	J-50	J-44	6	Steel	100	128.91	1.46	0.003	FALSE	0
P-350	1325.41	J-46	J-48	12	PVC	150	-1084.69	3.08	0.002	FALSE	0
P-353	483.89	J-52	J-1	10	Steel	100	1176.61	4.81	0.014	FALSE	0
P-354	76.57	R-3	J-52	10	PVC	150	1176.61	4.81	0.006	FALSE	0
P-355	61.57	J-34	PRV-2	12	PVC	150	-652.87	1.85	0.001	TRUE	1
P-356	82.26	PRV-2	R-4	12	PVC	150	-652.87	1.85	0.001	TRUE	1
P-357	70	J-5	PRV-3	12	PVC	150	-1939.84	5.5	0.007	TRUE	1
P-358	105.03	PRV-3	R-5	10	PVC	150	-1939.85	7.92	0.016	TRUE	1
P-359	283.85	J-5	J-14	8	PVC	150	730.55	4.66	0.008	FALSE	0
P-361	1225.79	J-13	J-12	8	PVC	150	398.87	2.55	0.003	FALSE	0
P-362	1254.61	J-12	J-11	8	PVC	150	338.92	2.16	0.002	FALSE	0
P-363	1179.13	J-4	J-5B	10	PVC	150	-692.9	2.83	0.002	FALSE	0
P-364	322.11	J-5B	J-5	10	PVC	150	-1004.62	4.1	0.005	FALSE	0
P-365	988.57	J-5B	J-5C	6	Steel	100	250.92	2.85	0.009	FALSE	0
P-366	1007.33	J-14	J-5D	8	PVC	150	730.55	4.66	0.008	FALSE	0
P-367	427.81	J-5D	J-13	8	PVC	150	454.22	2.9	0.003	FALSE	0
P-368	615.83	J-5C	J-5D	8	PVC	150	-242.89	1.55	0.001	FALSE	0
P-369	1186.03	J-5C	J-6	8	PVC	150	445.17	2.84	0.003	FALSE	0
P-370	447.39	J-5B	J-5A	6	Ductile Iron	130	13.68	0.16	0	FALSE	0
P-371	224.06	J-5D	J-5E	8	PVC	150	0	0	0	FALSE	0
P-372	1037.46	J-30	J-248	6	Steel	100	-60.71	0.69	0.001	FALSE	0
P-373	750.23	J-248	J-32	8	PVC	150	-45.72	0.29	0	FALSE	0
P-374	806.88	J-28	J-248	8	PVC	150	14.99	0.1	0	FALSE	0