Deschutes Valley Water District

Water Management and Conservation Plan 2022

Joel Gehrett PE, General Manager
jgehrett@dvwd.org
Website: dvwd.org

TABLE OF CONTENTS

Chapter 1: Introduction

Brief description of water system and community served

Deschutes Valley Water District (DVWD) was formed in 1919 from a private water system, Jefferson Water Company. This private company could not achieve a profitable return, so they chartered the District we have today under Oregon Revised Statutes, Chapter 264. The signatures on the original charter are a "who's who" of the pioneers of the Culver and Metolius area.

The original service area included the District of Culver, the District of Metolius, and the surrounding agricultural areas from South of Juniper Butte to the North end of Metolius. The Opal Springs aquifer has been the sole source of domestic water since the inception of the District. However, Opal Springs was privately owned until the District purchased it in 1958.

The distribution of water throughout the rural area was not feasible in the 1920's because of the sparse population. Instead, the District installed a wooden mainline to a standpipe in the District of Culver. There, residents from outlying areas could fill tanks to transport home. A single 3" pipeline also served the District of Metolius and its outlying areas.

With the formation and completion of the North Unit Irrigation project, the Culver/Metolius/Madras areas were broken into 80 to 160 acre parcels and a massive influx of farmers began in the mid 1940's. This sudden population growth required the District to install many new mainlines to distribute domestic water to many of the newly formed farms. During this same period, the area North of Madras (called The Plains) formed a water district to accomplish the same tasks in that area.

In 1948, the Plains Water District and Deschutes Valley Water District merged to form the approximate District boundaries we have today. The conveyance of water over such a great distance (23.6 miles), presented many problems which required long District Board meetings to solve. The District has been fortunate to have faithful and responsible Board members over the years. For many years, the District strived and strained within its budget at times, to deliver water to each service with undersized and leaky mainlines.

The most important milestone in District history was the purchase of Opal Springs in 1958. Previously, the purchase of water and the poor condition of the pumps at Opal Springs had kept the District poor and without water at times. The purchase, modifications, new pumphouse and discharge lines began a cycle that has been repeated over and over. The process includes installing pumping capacity, discharge lines, storage, and then distribution lines. By the time a cycle is finished, new and improved

facilities are required and the cycle begins anew. Historically, whenever possible, new construction is done by District crews.

Hydro-electricity powers our District literally and financially. In 1985, the District's hydro-electric plant was completed near Opal Springs. Since then, revenues from that plant have paid annual principal and interest on two water bonds for a savings of over $4 million in property taxes. Hydro-electric revenues have also financed approximately $16 million of our new construction. The District levies no taxes and has no plans to levy taxes in the future, thanks to the hydro-electric revenue.

Due in large part to this hydro-electric revenue, the District has not had to issue new bonds, water rates have been fairly constant with minimal rate increases, and new service hook-up fees have remain some of the lowest in the area.

The District's cash flow relies upon two main sources of revenue; water sales and power sales. The Hydro revenue, through power sales, has been subsidizing the water distribution system capital expenses since construction in 1985. However, a new fifteen (15) year power sales agreement effective January 2020 has substantially reduced hydro revenue for the next few years. The new power sales agreement will not allow the Hydro Fund to continue to cover all of the expenses and the District will rely on water sales and savings to cover these expenses. The District will consider modest water rate increases in the future.

The District has been preparing for this time by saving and making strategic capital improvements over the years. The District is in a solid financial position to make well thought out decisions regarding future expenditures and capital improvements.

Reason for submittal of the WMCP

The purpose for the submittal of this water management and conservation plan (WMCP) is to satisfy the requirements stipulated in OAR Chapter 690, Division 086 and to update the District's WMCP approved in 2012.

Plan History

The District's original Plan was submitted to the Oregon Water Resources Department (OWRD) in the year 2001. Review comments were provided by the OWRD to the District in a letter dated September 24, 2004. Comments included some information deficiencies in the 2001 Plan relative to: 1) projected water demand relative to current and future capacity; 2) peak season and peak daily water use; 3)

leak detection program; and 4) fixture retrofitting program. The Final Order approving the original Plan with condition for the District to submit an updated Plan before October 1, 2009 was approved on December 6, 2004.

The District acknowledged the deficiencies and proceeded with a work plan for responding to them. Although delayed, this updated Plan responds to deficiencies of the original Plan, conditions in the Final Order and the condition in the District's water right permit G-16548 to submit a water management and conservation plan within two years of permit issuance. This permit was issued on July 16, 2009. The Plan was put on Administrative Hold until September 1, 2012 in order to complete additional revisions.

The District received a final order approving the WMCP on October 9, 2012 to remain in effect until October 10, 2022. The order also stipulated a progress report containing information required under OAR 690-086-0120(4) by October 10, 2017. The Progress report was submitted to July 25, 2018 and was accepted by the OWRD on September 4, 2018. The latest progress report is included in Appendix A.

Documentation of notice of draft WMCP to all affected local governments

An “affected local government” includes any local government (i.e., any city, county, metropolitan service district formed under ORS Chapter 268 or an association of local governments performing land use planning functions under ORS 197.190) within whose jurisdiction the supplier’s diversion, conveyance, and/or use of water is established or proposed within the context of the WMCP. This includes any interconnection (emergency or otherwise) between suppliers.

The following is a list of the local government agencies that may be affected by the Plan. The draft plan was made available to these agencies for review and input. Copies of letters sent by the District to these agencies and agency inputs are included in Appendix B.

City of Madras
125 SW E Street
Madras, Oregon 97741

City of Culver
P.O. Box 256
Culver, Oregon 97734

City of Metolius
636 Jefferson Avenue
Metolius, Oregon 97741

Confederated Tribes of Warm Springs
1233 Veterans Street
PO Box C
Warm Springs, OR 97761

Jefferson County Building and Planning Services
66 SE D Street
Madras, OR 97741

Proposed date of next progress report and next WMCP update

The District anticipates submitting an updated WMCP Plan to the OWRD within ten years after the date this Plan is approved. The progress report required by OAR 690-086 will be submitted to the OWRD within five years after the date of approval for this Plan.

WMCP summary Checklist of required content

		Items and Tasks	OAR Reference	Page No.
		WMCP Plan Elements		
✓		Notice to affected local government(s)	690-086-0125(5)	4
✓		Proposed WMCP update schedule	690-086-0125(6)	5
		Additional time to implement conservation benchmarks	690-086-0125(7)	
		Water Supplier Description		
✓		Supplier's source(s)	690-086-0140(1)	7
✓		Current service area and population served	690-086-0140(2)	10
✓		Assessment of adequacy and reliability of existing water supplies	690-086-0140(3)	10
✓		Present and historic water use	690-086-0140(4)	15
✓		Water rights inventory table and environmental resource issues	690-086-0140(5)	18
✓		Customers served and water use summary	690-086-0140(6)	20
✓		Interconnections with other systems	690-086-0140(7)	21
✓		System schematic	690-086-0140(8)	23
✓		Quantification of system leakage	690-086-0140(9)	23
		Water Conservation Element		
		Progress report on implementation of conservation measures scheduled in a previously approved WMCP (*N/A if 1st WMCP*)	690-086-0150(1)	25
✓		Water use measurement and reporting program	690-086-0150(2)	27
✓		Currently implemented conservation measures	690-086-0150(3)	25
✓		Annual water audit	690-086-0150(4)(a)	27
✓		Full metering of system	690-086-0150(4)(b)	28
✓		Meter testing and maintenance program	690-086-0150(4)(c)	28
✓		Rate structure based on quantity of water metered	690-086-0150(4)(d)	29
		Leak detection program	690-086-0150(4)(e)	29
✓		Public education program	690-086-0150(4)(f)	30
		System leakage reduction program <15%	690-086-0150(5)	
		System leakage reduction program <10%	690-086-0150(6)(a)	
		Technical and financial assistance programs	690-086-0150(6)(b)	30
		Retrofit/replacement of inefficient fixtures	690-086-0150(6)(c)	30
		Rate structure and billing practices to encourage conservation	690-086-0150(6)(d)	30
		Reuse, recycling, and non-potable opportunities	690-086-0150(6)(e)	31
		Other proposed conservation measures	690-086-0150(6)(f)	31
		Water Curtailment Element		
✓		Water supply assessment and description of past deficiencies	690-086-0160(1)	34
✓		Stages of alert	690-086-0160(2)	36
✓		Triggers for each stage of alert	690-086-0160(3)	38
✓		Curtailment actions	690-086-0160(4)	38
		Water Supply Element		
✓		Future service area and population projections	690-086-0170(1)	40
✓		Schedule to fully exercise each permit (*i.e., certification*)	690-086-0170(2)	40
✓		Demand forecast	690-086-0170(3)	42
✓		Comparison of projected need and available sources	690-086-0170(4)	42
		Analysis of alternative sources	690-086-0170(5) and (8)	
		Maximum rate and monthly volume quantification	690-086-0170(6)	
		Mitigation actions under state and federal laws	690-086-0170(7)	44
		Greenlight Water Request – Conservation measure schedule and cost effectiveness	690-086-0130(7)(a)	
		Greenlight Water Request – Justification that selected source is most feasible and appropriate	690-086-0130(7)(b)	
		Greenlight Water Request – Mitigation requirements	690-086-0130(7)(c)	

Chapter 2: Water Supplier Description

Source of supply

The Opal Springs aquifer is the sole source of supply of domestic water for DVWD. The District is also the sole supplier of domestic water to the City of Madras. The artesian spring and three artesian wells are located 5 miles southwest of Culver at the bottom of the 850 foot deep Crooked River canyon, less than 150 feet from the river.

Lower Opal Springs. The lower Opal Springs is the original source of supply for the District and continues to supply water for the District's approximately 4,800 service connections. The spring is located in Section 33, Township 12 South, Range 12 East, Jefferson County, 5 miles southwest of Culver, near the bottom of the approximately 800-feet deep Crooked River canyon. Locations of Opal Springs and District water supply facilities are shown on Figure 2-1.

The spring is on the east side of the canyon, above river level, discharging into the river at an approximate rate of 240 cubic feet per second (cfs). This flow rate applies to the surface discharge carried in a short natural flow channel to the Crooked River and does not account for subsurface spring discharge to the river. The current permitted allowances for diversion from lower Opal Spring is 3.48 cfs. A summary of District water rights is found in Appendix C.

Upper Opal Springs. The District also holds a 1918 water right to divert water from a spring located higher up on the east canyon wall, about 100 feet above the lower Opal Springs. Discharge from this spring is relatively minor. The water right allows a maximum diversion of 3.0 cfs for domestic and power uses. Water from the upper springs is used at the District's facilities and is not included in water supply to District customers.

Opal Springs Water Collection. The current water collection system at the lower Opal Springs consists of a subsurface water collection gallery. The gallery is a 16-feet deep, 42-inch diameter, vertical steel pipe chamber equipped with a pump and valve-controlled flow-gate system. The gallery intercepts some of the spring water that flows to the Crooked River through talus deposits at the base of the nearby canyon wall. Closing the flow gate on the side of the gallery causes water to collect in the gallery, submerging the pump intake and allowing withdrawal of the water. Leaving the flow gate open allows the spring to discharge by gravity flow to the Crooked River. Water is conveyed from the gallery by pipeline to the pump house located on the east side of the Crooked River.

Figure 2-1

Opal Springs Project Area

Source of Supply Facilities

DESCHUTES VALLEY WATER DISTRICT

OPAL SPRINGS PROJECT AREA

Wells. Beginning in 1997, the District drilled three production wells all within 750 ft. of Opal Springs. These wells were the result of an investigation into how to increase flow capture from Opal Springs. Even though there is a considerable amount of water surfacing from the Opal Springs vicinity, the sheet wall containment system capturing water for the pumphouse was proving marginal at peak pumping demand. Numerous alternatives were investigated and weighed by the District Board. An initial 12" test well was drilled 500 ft. and produced static artesian pressure of 48 psi and a free flow of over 4000 gpm. Since then, two more 16" wells were drilled with comparable artesian pressures and free flows of 5,360 gpm and 4,000 gpm.

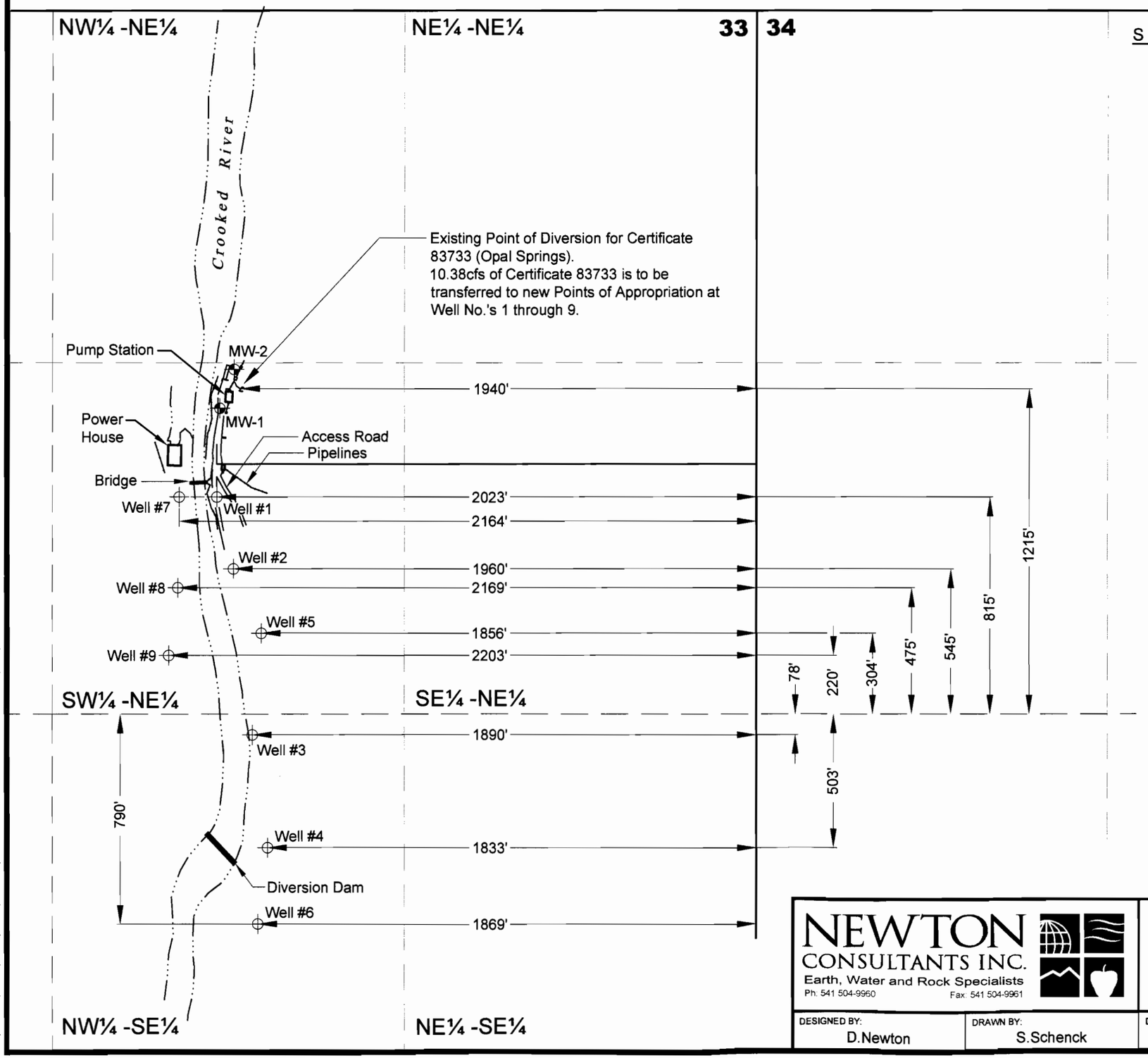
The three artesian wells have been an advantage to the District. The existing pumps have an expanded capacity due to the inlet pressure going from 3 psi to about 43 psi (depending on how many pumps are running). Pumping costs out of the canyon were reduced by about 10%. Another benefit was the increased ability to capture water without risk from external contamination. The Oregon Water Resources Department has determined that the water from the three artesian wells and water from and Opal Springs comes from the same aquifer. This has been determined geologically, from water quality testing comparisons, and flow test results.

Three wells (No.s 1, 2 and 3) supply the District with water in conjunction with lower Opal Springs. Nine wells are permitted but only three were constructed and are currently in use. The remaining 6 are reserved as future demand requires. Figure 2-1.1 shows the permitted well location. The wells are located on the east side of the Crooked River at distances ranging from approximately 300 to 1300 feet south of the lower Opal Springs (Figure 2-1). District water rights allow appropriation of ground water from wells pursuant to permit G-16548 and S-36515. Permit G-16548 allows water use between June 15 and August 31 at a maximum rate and annual volume of 16.7 cfs and 2,312 acre-feet. These ground water rights are subject to mitigation under OAR Chapter 690 Division 505. Permit S-36515 allows water use from the wells at a maximum rate of 10.38 cfs. All District water rights are summarized in Appendix C and are detailed in the “Water Rights” section of this chapter.

Operations. Water is pumped out of the canyon to four Main Reservoir tanks located on top of the canyon rim, West of Culver, Oregon. Water is pumped out of the canyon through one of three pipes exiting the canyon. 12-inch, 20-inch and 24-inch diameter steel pipelines. These reservoirs are approximately 825 feet above the pump facilities. Water is distributed from the reservoirs to customers within the 130-square-mile area served by the District.

Figure 2-1.1

Permitted Well Locations



SURFACE WATER TO GROUND WATER TRANSFER APPLICATION MAP

Deschutes Valley Water District
SEC 33, T.12S., R.12E., W.M. TAX LOT 2800

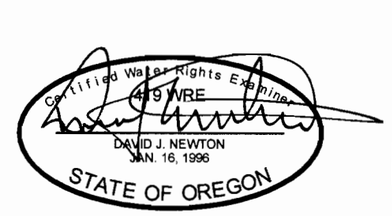
EXPLANATION

Section Lines

Quarter - Quarter Section Lines

NOTES

1. Horizontal distances from section corner to proposed wells are based on March 17, 1998 survey data by Dejarnatt Land Surveys, Inc. And are rounded to the nearest 10 feet.
2. This map was prepared for the purpose of identifying the location of proposed point of diversion transfer only and is not intended to provide legal dimensions or locations of property ownership lines.
3. Partial transfer - 10.38 cfs Certificate 83733 from existing point of diversion at Opal Springs to new points of appropriation at well numbers 1-9.
4. Existing point of diversion for Certificate 83733 is at Opal Springs 1215 feet north, 1940 feet west from east 1/4 corner of section 33.



400' 0' 400' 800'

SCALE: 1" = 400'

NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists
Ph: 541 504-9960 Fax: 541 504-9961

Surface Water to Ground Water
Point of Diversion Transfer Application Map
Deschutes Valley Water District
Jefferson County, Oregon

DESIGNED BY:	DRAWN BY:	DATE:	PROJECT NO.	
D.Newton	S.Schenck	FEB 2009	450-109	FIGURE 1

G:\0400\450\109\Cad\Water\W450109_F1_POD 08:48 02/25/2009 SS

Water is continually pumped from the lower Opal Springs 24-hours a day. The original pump house contains six pumps. Three pumps are rated at 150 horsepower, two at 500 horsepower, and one at 400 horsepower. A seventh 400 horsepower pump is located in the turbine house on the west side of the Crooked River. By monitoring the level of the Main Reservoirs, one or any combination of these pumps is manually operated to meet demands of the water being used.

The 'new' pump house provides the capacity for eight 500 horsepower pumps; however, the District presently uses only two 500 horsepower pumps and one 400 horsepower pump. The redundancy of the three pump houses and their transformers provides more reliability to District customers. If one fails, the District has a backup system.

Current service area and population served

The current District service area is shown on Figure 2-2. The service area boundaries extend from Juniper Butte on the south to Agency Plains and Gateway, west of Warm Springs, on the north. The communities of Culver, Madras and Metolius are within the service area and are supplied with water by the District. The District water conveyance distance between the southwest and northeast service area boundaries is roughly 23 miles.

The District's boundaries encompass a broad area for a relatively small water community. The District currently supplies 4,646 active services. Based on U.S. Census Bureau 2014-2018, the persons per household statistics for Jefferson County is 2.81. Estimated population served by the District is 13,055 based on persons per household multiplied by active services.

Assessment of adequacy and reliability of sources

The adequacy and reliability of the District's existing water supply are sufficient to meet present demand and demand in the foreseeable future. This conclusion is based on the following considerations.

Redundancy. Water supply is presently obtained directly from the lower Opal Springs and from three wells. The dual sources combined with backup pumping capability allow the District to continue water supply in the event of mechanical problems, maintenance needs, or other situations, enhancing adequacy and reliability of the water supply system. In addition, in 2021 the District installed a water turbine driven 400 HP pump capable of delivering the District's average winter day demand. This pump does not rely on electricity and can operate even in the case of a prolonged power outage.

Figure 2-2

System Service Area

Deschutes Valley Water District
Service Area

Legend
- wMains
- District Boundary

N
W E
S

0 ½ 1 2 3 4 Miles

Gateway
Warm Springs
Madras
Metolius
Culver
Opal Springs
Opal City
Lake Simtustus
Crooked River National Grassland
The Cove Palisades State Park
Deschutes Canyon-Steelhead Falls WSA
Madras City-County Airport
NW Highway 26
SE Highway 26
NW Fir Ln
SE Laurel Ln
97
26

The District's current pumping capacity is 15.2 MDG which is more than 1.5 times max day demand even without the largest pump running. There is adequate pumping capacity for current and foreseeable future development.

Consistent Aquifer Pressure Head. The static pressure on the ground water ranges from 43 to 50 pounds per square inch measured in each well at the wellhead. This pressure equates to approximately 100 to 121 feet of head above the wellhead. These aquifer confining pressures result in flow rates of approximately 3,000 to more than 5,000 gallons per minute from each well when the wellhead valves are opened (no pumps are required).

Static pressures in the wells have maintained consistency since the wells were installed in 1998 and 2000. Without a change to head pressure from the wells we can reasonably assume that the capacity of the aquifer system to supply the District is unchanged from a hydrologic standpoint over this period. There is no compelling reason to suspect the hydrologic capacity of the system to supply present needs, and needs of the foreseeable future, will change to the point of significant adverse impact on adequacy and reliability of supply.

Principal Discharge Area for Regional Aquifer System. The lower Opal Springs is located in the major area of ground water discharge from the upper Deschutes Basin as shown on Figure 2-3. The confluence of the Crooked, Deschutes and Metolius Rivers is located within this ground water discharge area. Downcutting by the rivers in this area has intersected aquifer systems that convey ground water from recharge areas in the High Cascade Mountain Range to the west and southwest to the discharge areas near the river confluence. Ground water discharge to the three rivers in the confluence area is described in terms of river flow gains per mile in the report "Ground-Water Hydrology of the Upper Deschutes Basin, Oregon," Marshall W. Gannett, Kenneth E. Lite Jr., David S. Morgan, and Charles A. Collins; U.S.G.S. Water-Resources Investigations Report 00- 4162; 2001). Flow gains from ground water discharge into Crooked River between Osborne Canyon and Lake Billy Chinook are reported up to 1,006 cfs per mile; flow gains from ground water discharge into the Deschutes River between Lower Bridge and Lake Billy Chinook are reported up to 305 cfs per mile; flow gains from ground water discharge into the Metolius River between Jefferson River and Lake Billy Chinook are reported up to 724 cfs per mile; and flow gains from ground water discharge into the lower reach of Whychus Creek are reported up to 94 cfs per mile. Stream flow gains due to ground water discharge are shown on Figure 2-4.

Figure 2-3

USGS Ground Water Flow

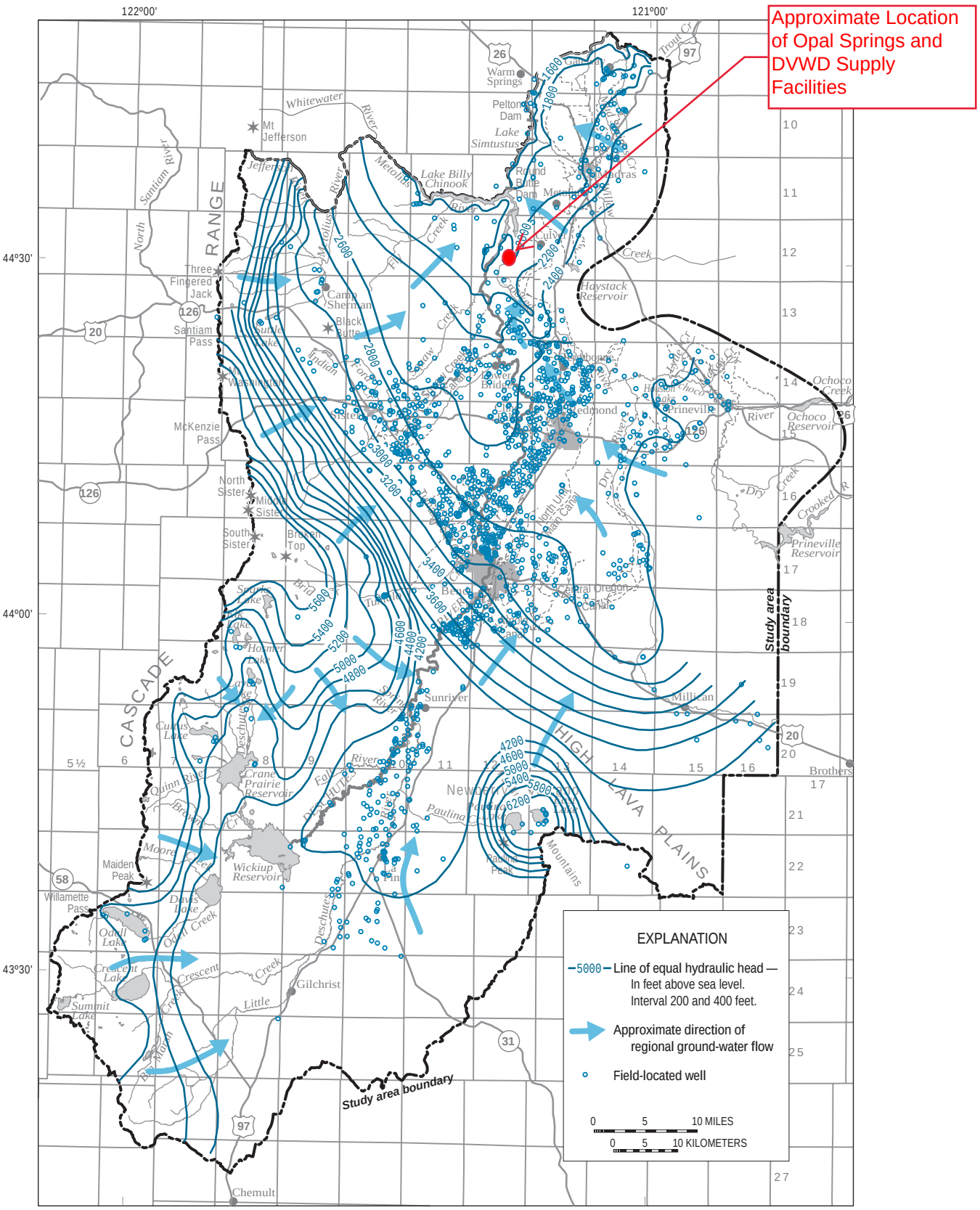


Figure 28. Generalized lines of equal hydraulic head and ground-water flow directions in the upper Deschutes Basin, Oregon. (This map does not reflect shallow, local saturated zones caused by canal and stream leakage. Arrows show approximate direction of regional ground-water flow.)

Figure 2-4

USGS Stream Gain Flux Rates

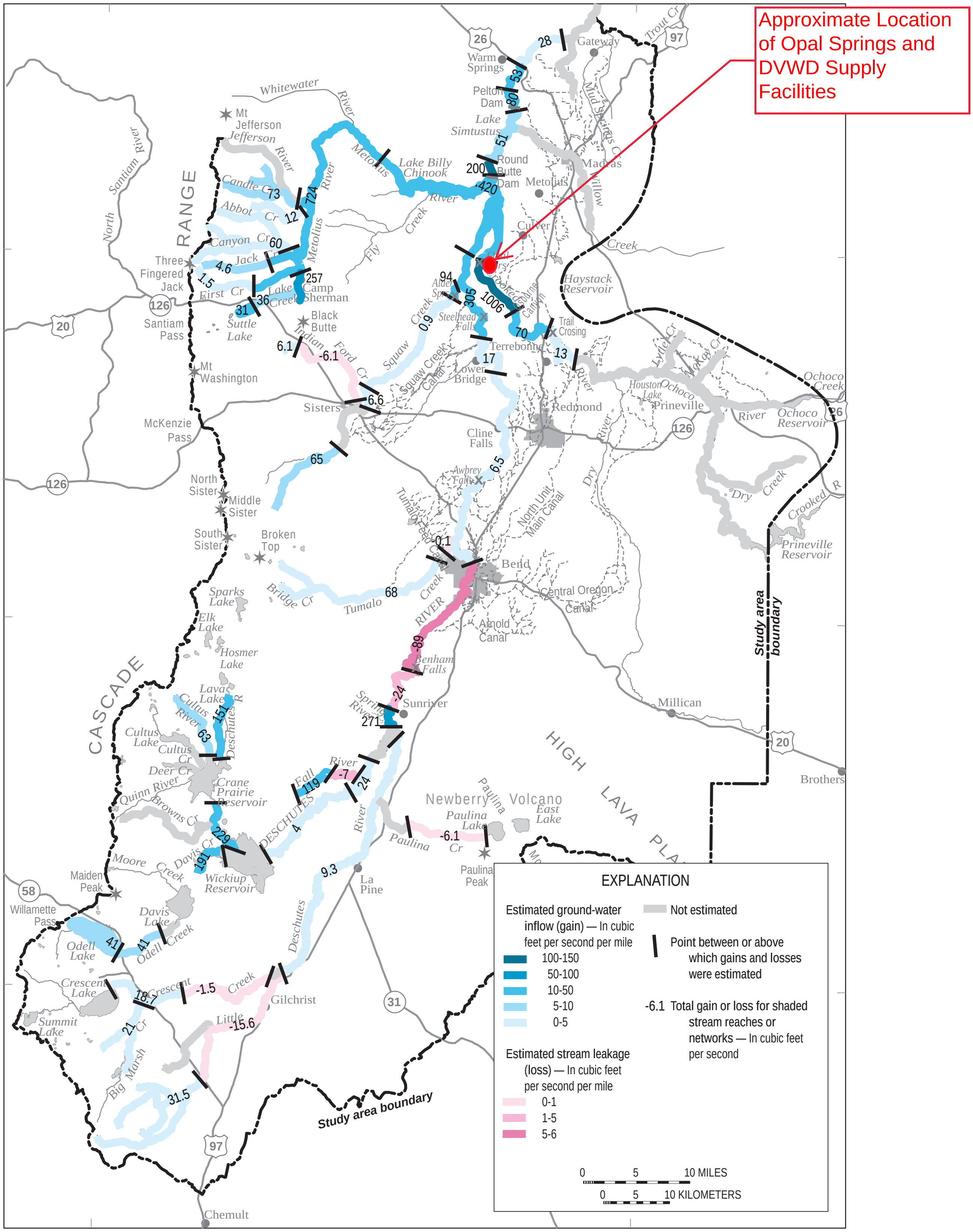


Figure 12. Estimated gain and loss flux rates and net gains and losses for selected stream reaches in the upper Deschutes Basin, Oregon.

Downcutting by the Crooked River at the main Opal Springs does not appear to have directly intersected the aquifer that supplies the springs or the wells. It is likely that the aquifer is intersected by the river some distance downstream, considering river gradient and depth to the aquifer system at the location of the springs.

Ground water discharge in the area of river confluence occurs at substantially high rates, reflecting a rather robust condition of annual recharge and storage capacity for the ground water system at the present time. Ground water recharge is relatively efficient due to annual snowpack and precipitation in the High Cascade Range upon very permeable, unweathered volcanic materials. Much of the snowpack and precipitation water percolates into the ground, annually recharging the aquifer system. Average annual recharge is estimated at 3,500 cfs ("Ground-Water Hydrology of the Upper Deschutes Basin, Oregon"). Although roughly one-half of the annual recharge discharges to springs and streams on the lower flanks of the High Cascade Mountains, the remaining component of recharge is quite significant relative to supply from ground water sources, including the District's sources.

Hydraulic Connectivity - Opal Springs and Aquifer System. Well flow testing and pressure response monitoring indicate that the confined aquifer system is hydraulically connected to the lower Opal Springs. It was concluded from the investigations and testing that the confined aquifer is the source of water for the springs.

The lower Opal Springs discharges very clean water through a surface channel to the Crooked River at an approximate rate of 240 cfs. Although no measurement device for flow or head is present at the spring diversion works, District personnel with many years of experience with the system report that seasonal or long term flow changes in spring discharge have not been noted since 1925. Although this input is based on visual observation and discharge variations could have occurred, the inputs reflect consistency in discharge of large amounts of water from the lower Opal Springs over 96-year period.

Present and Historic Water Use

Yearly water use in MG from 2018 to 2022 is summarized in table 2-1.

Year	Historic Usage (MG)
2018	1,170
2019	1,070
2020	1,259

2021	1,641
2022	1,304

2021 Month	Water Production (MG)
Jan	62.35
Feb	56.68
Mar	66.25
Apr	114.92
May	155.77
Jun	233.56
Jul	300.45
Aug	246.20
Sep	193.85
Oct	89.77
Nov	61.40
Dec	60.11
Total	1641.33

Table 2-1 – 2018-2022 Water Production

System demand conditions for 2018 to 2021 are summarized in Table 2-2. The year 2020 is more representative of current demand conditions for the District. With the Governors official Drought Declaration for Jefferson County in June 2021 the District elected to provide supplemental water to North Unit Irrigation District (NUID). The supplemental irrigation water was provided for two (2) months in June and July and resulted in over 200 MG being delivered to NUID. The District will not be providing additional supplemental water in the future. The max day peaking factor for 2021 was 2.81 while the max day peaking factor for 2020 is a more reasonable 2.38. Figures 2-5 and 2-6 represent District daily pumping and daily tank levels for 2020 and 2021

System Demand Conditions (MGD)	2018	2019	2020	2021
Average Annual Demand (AAD)	3.65	3.39	3.84	4.50
Average Daily Winter Demand (Nov - Feb)	1.97	1.90	2.00	2.00
Maximum Day Demand (MDD)	8.41	8.75	9.13	12.65
Average Monthly Demand (AMD)	111.06	103.19	116.87	136.78
Maximum Monthly Demand (MMD)	219.53	195.66	222.83	300.45
Seasonal Demand (April - Sept)	943.77	871.27	992.96	1244.76
Peak Hour Demand (PHD)	12.78	11.87	13.44	15.75
Max Day Peaking Factor	2.30	2.58	2.38	2.81

Table 2-2 – 2018- 2021 System Demand Conditions

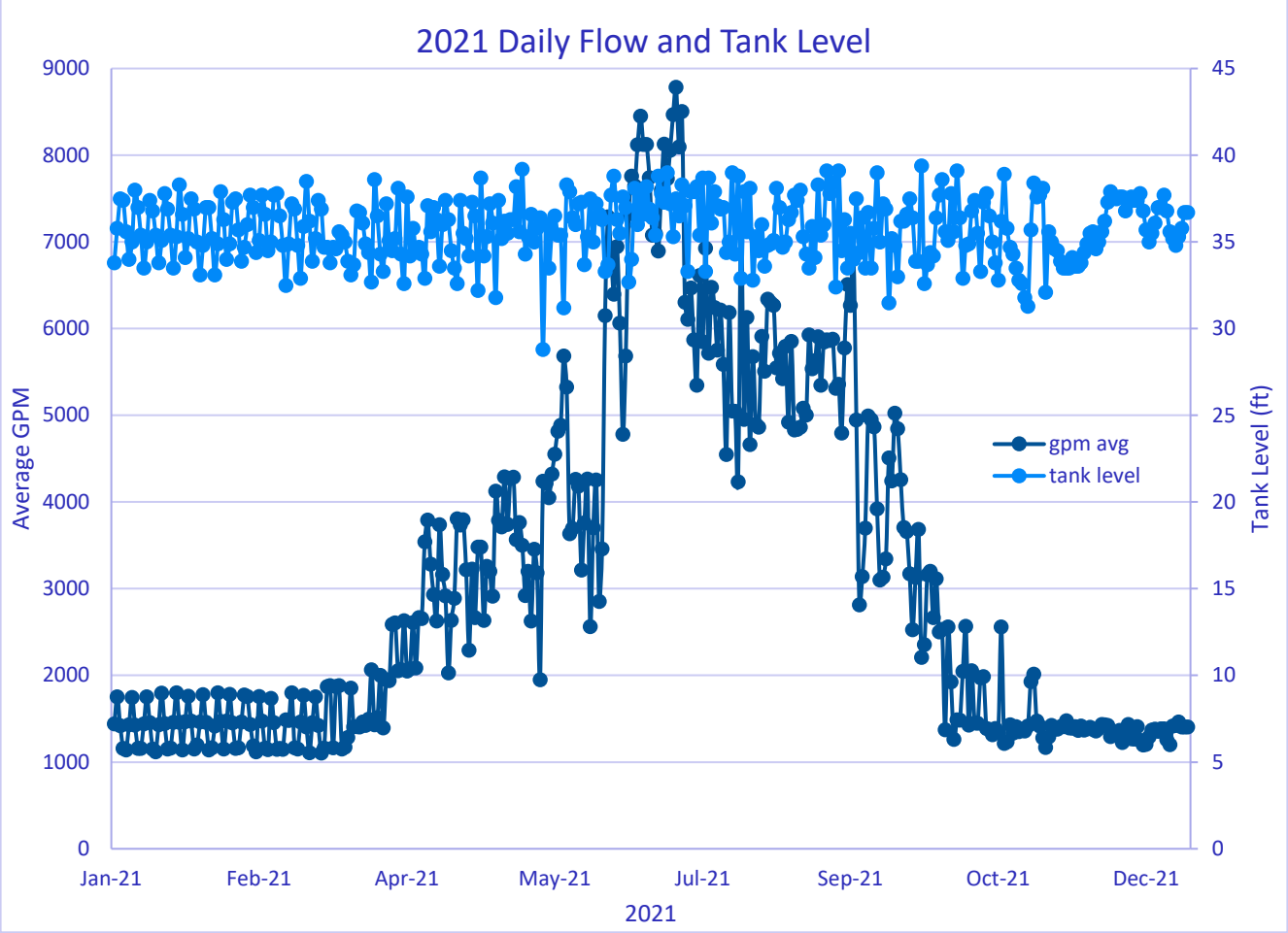


Figure 2-5 – 2021 Daily Flow and Tank Level

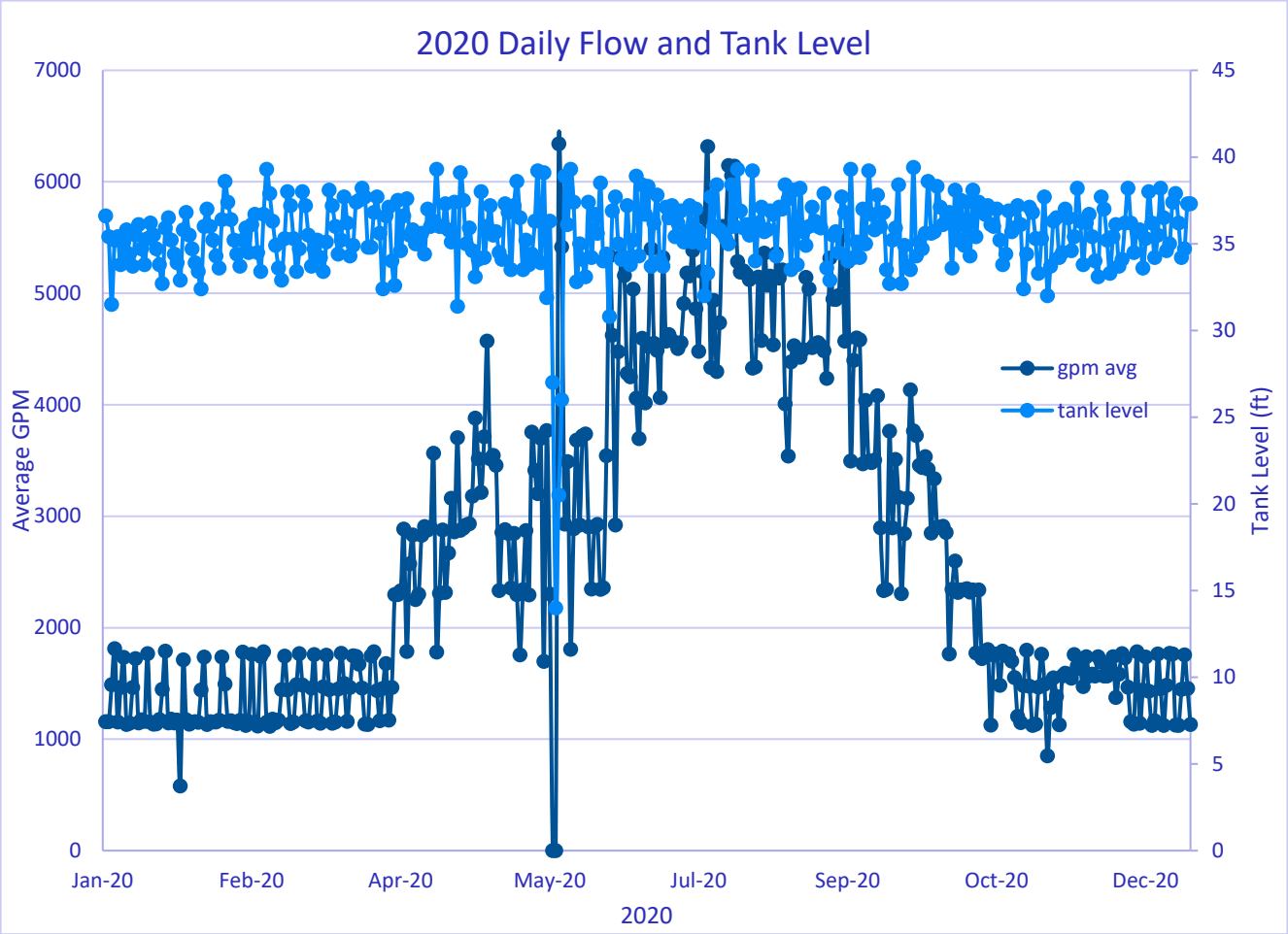


Figure 2-6 – 2020 Daily Flow and Tank Level

Water Rights

There are three instream water rights on the Crooked River that begin upstream of the District's points of diversion and appropriation and extend downstream past these points to Lake Billy Chinook. A summary of pertinent information relative to these water rights is below.

Certificate 81584

Instream transfer of an irrigation right.
Maximum rate #1: 0.431 cfs within Reach #1; 1904/1910 priority date.
Maximum rate #2: 1.296 cfs within Reach #2, being 0.865 cfs, 1898 priority date and 0.431 cfs, 1904/1910 priority date.
Total maximum rate (Reach #1 & #2): 1.727 cfs.
Total volume transferred instream: 416.4 acre-feet.

Period of Use: May 23 through October 31.

Certificate 83650

Instream transfer of an irrigation right.
Maximum rate #1: 0.206 cfs within Reach #1, 1903 priority date;
Maximum rate #2: 0.093 cfs within Reach #2, 1903 priority date. Total maximum rate (Reach #1 & #2): 0.299 cfs.
Total volume transferred instream: 66.84 acre-feet.
Period of Use: May 21 through October 31.

Certificate 80966

Instream transfer of water right from conservation project CW24. Maximum rate: 0.54 cfs, September 18, 1968 priority.
Total volume transferred instream: 149.2 acre-feet.
Period of use: May 1 through September 16.
River reach: From North Unit Irrigation District point of diversion on the Crooked River to Lake Billy Chinook.

The three instream water rights protect a total combined flow rate of 2.566 cfs and a total combined volume of 632.44 acre-feet in the Crooked River beginning upstream of the District's points of diversion at Opal Springs and points of appropriation near Opal Springs, extending to Lake Billy Chinook. The priority dates for Certificate 81584 and 83650 are senior to all of the District's water right certificates and permits. Certificate 80966 (1968) is senior to the District's Permit 36515 (quasi-municipal, 1971), Certificate 83733 (inchoate) (quasi-municipal, 1971), Certificate 65840 (power, 1977), and Permit 47591 (power, 1982).

Although the instream transfers have some seniority over District certificates and permits, the instream certificates contain Findings of Fact that state they will not result in injury to other water rights.

A tabular list of all the District’s water rights is found in Appendix C.

All of the Districts quasi municipal, municipal and domestic water rights associated with water use within the Districts are sourced from Opal Springs or ground water which feeds Opal Springs. Neither the spring nor the ground water source for the spring are part of a critical ground water designated by the Oregon Water Resources Commission. In addition, Opal Springs or the ground water which feeds Opal Springs is not listed in Oregon's Water Quality Assessment Database - 2022 Draft Report.

Water from the spring and the ground water not captured by DVWD, does flow into the Crooked River at about River Mile 7. The Crooked River, however, is not the source of water for DVWD. Ground water use is restricted administratively only by provision of mitigation water prior to appropriation of ground water under permit G-16548. The Deschutes Basin is not designated by the OWRD as a Critical Ground Water Area or a Ground Water Limited Area. Threatened and endangered species restrictions on the Crooked River are not an obvious, clear and likely event that would affect the Districts ability to fully exercise its ground water and surface water rights in the foreseeable future for reasons including those above relative to substantial interference.

The other water instream water rights maintained by the District (Permits C-10851, C-27796, and C-65840) are used for power generation. The Districts operates and maintains a power generation unit which is a run of the river style hydroelectric plant with a Kaplan style turbine. This project is licensed with the Federal Energy Regulatory Commission (FERC) No. 5891. The section of the Crooked River to which the project corresponds is Identified as the Lower Crooked - 17070305 and is located approximately at River Mile 7.

The 2021 Oregon Department of Fish and Wildlife sensitive species list identified two (2) sensitive species including Bull Trout and Fall Chinook Salmon. In addition, Bull Trout is listed as Threatened and subject to Critical Habitat designation under the Federally listed species of concern under the jurisdiction of the Fish and Wildlife Service. No other sensitive or threatened species have been identified in this section of the Crooked River.

Water Quality parameters that are monitored for this section of the Crooked River are; Dissolved Oxygen, Temperature, Turbidity and PH.

Customers Served and Water Use Summary

Figure 2-7 illustrates the District's customer base by category. The master meter category includes sales for resale customers specifically related to mobile home parks. Hydrant use is very small percentage of the overall use but we have separated this as a category in order to track usage that includes construction or bulk water delivery.

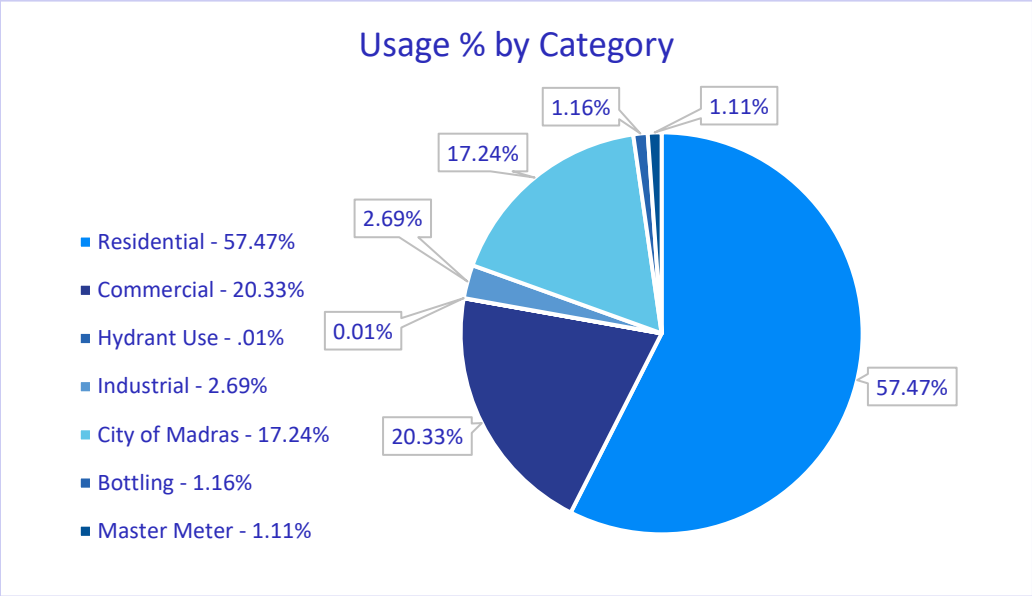


Figure 2-7 – Water Usage by Customer Category

Table 2-3 shows the District's customer category and the average daily usage for each. Again we are using 2020 usage numbers for analysis due to abnormal usage during 2021.

Category	MG Adjusted	Average Usage MGD
Residential	806.00	2.21
Commercial	285.04	0.78
Hydrant Use	0.14	0.00
Industrial	37.74	0.10
City of Madras	241.71	0.66
Bottling	16.20	0.04
Master Meter	15.54	0.04
Total	**1402.38**	**3.84**

Table 2-3 – Average Daily Water Use for Each Customer Category

In comparing 2010 to 2020 over all water usage, the District's Average Daily Demand in 2010 was 256 gallons per capita per day (gpcd) compared to 294 gpcd in 2020. Average daily demand increased from 2.69 MGD to 3.84 MGD representing a 30% increase in average demand. In the same time period, the number of customers increased from 3967 to 4439 or an 11% increase in connections served.

Water use for residential customers increased from 48% to 57%. The category to experience the largest increase in water use was commercial, increasing from 8% to 20%. We also added a new category of water use for bottled water since reporting in 2012. We have also categorized water use more discretely eliminating the “Miscellaneous” water use category that was reported in 2012.

Interconnection with Other Systems

The City of Madras is the only interconnection the District has with another municipal supply system. Water is supplied from the District to the City through three interconnections; therefore, future plans of the District include water demand for the City of Madras.

The south interconnection is located at South Adams Drive and Bard Lane. This is the primary interconnection supplying up to approximately 1,000 gpm during summer periods. The north interconnection is located at Kinkade and 'A' Street, supplying approximately 400 to 500 gpm during summer periods. The third interconnection is sited at Lincoln and 'I' Street and is used primarily for fire backup flows. Two interconnections are through 6-inch meters and the connection at Kinkade and ‘A’ Street is an 8” meter. The interconnection locations are shown on Figure 2-8.

The interconnections are established under a "Water Sale Agreement" (Agreement) between the District and the City of Madras. The Agreement is renewable on a three-year cycle and provides for basis of payment by the City, metering by the District, interconnection maintenance by the District and continuity of service (considering potential curtailment, interruption or reduction in deliveries). A copy of the current agreement is included in Appendix D.

- Map or schematic of major system features: sources, transmission lines, pump stations, treatment facilities, interconnections, existing and planned service area, major distribution system features

System schematic

The updated schematic of the District’s system is shown in Figure 2-8.

Quantification of System Leakage

The past four (4) years of system leakage is given in Table 2-4.

Year	Production (MG)	Metered Consumption (MG)	Unmetered Authorized Usage (MG)	System Leakage %
2018	1291.59	1169.92	3.89	10.04%
2019	1173.49	1070.22	4.52	9.65%
2020	1402.38	1259.48	3.89	9.91%
2021	1641.33	1493.05	4.52	8.76%

Table 2-4 – 2020 and 2021 Quantification of System Leakage

Figure 2-8

System Overview and Schematic

N

Gateway

Gateway Tank

Warm Springs

Agency Plains

Dry Hollow

Dry Hollow

Plains Tank

Madras Municipal Airport

City of Madras Interconnects

Prison Tank

Prison Pump

Round Butte Tanks 16 & 17

Round Butte Booster

Metolius

Metolius Tanks 8, 10 & 11

Lake Billy Chinook

Canadian Bench

The Cove Palisades State Park

Wells #1, #2, #3

Opal Springs

Juniper Booster

Jericho Booster

KOA Tank

Juniper Butte

Juniper Butte Tank

LaSalle Tanks 2, 4, 6 & 7

Future Potential Wells #4, #5, #6, #7, #8, #9

Green Drive Pump

Haystack Butte

Legend

- Production Well
- Storage Basin
- Pump Station
- Pumps

Mains

- 6" & Smaller
- 8" & Larger
- District Boundary

0 0.5 1 2 Miles

Chapter 3: Water Conservation Element

Progress by the District on Conservation Measures

The District continues to direct time and attention to conservation measures identified in the 2001 WMCP and updated in 2012 and has included other measures that address conservation and promotes good water stewardship.

Measure No. 1 - Public Education. Public education is the mainstay of every conservation measure and is an essential factor in measuring its success. The District utilizes several avenues to promote conservation and to educate its customers. The District newsletter promotes conservation with articles ranging from lawn watering, weatherizing homes for winter, to Xeriscaping.

The District website at DVWD.org provides customers with information relative to water saving tips and winterizing. Customers can find information about District rates and service charges as well as policies and time of operation. There are links available to government agencies such as DHS Drinking Water Program, EPA, and the Oregon Energy Department. The District has posted its Consumer Confidence Report to the website.

In-person opportunities such as the Jefferson County Fair have not been utilized especially with the COVID pandemic. Lobby hours were restricted and in person visits discontinued and the District pivoted to customer contact through direct mailings, social media and updates to the District's website. Fliers in monthly bills and the District newsletters have been used more recently for direct to customer messaging regarding irrigation and winterizing tips.

Measure No. 2 - Customer Landscaping Workshops. The District has maintained all Xeriscaping at the main office as other District facilities. This conservation measure focuses mostly on good irrigation practices. The District regularly updates the Website with information which conform to industry best practices as it relates to landscape watering. Irrigation is highly dependent on environmental conditions and soil type. The District and employees are not experts with irrigation and landscaping and we refer customers to competent landscaping companies and Oregon State University extension classes taught locally that educate participates about irrigation best practices and native vegetation options specific to Central Oregon.

Measure No. 3 - Residential Water Self-Audits. The District no longer performs residential self-audits. The District currently employs new meter technology to inform customers of potential leaks. See "Other Implemented Conservation Measures" in this chapter for specific steps the District uses to help customers identify and fix leaks.

Measure No. 4 - Incentives. The District is focused on customer leak detection and repairs. There are incentives for customers with leaks that show they have repaired those leaks to receive a credit to their bill in the amount of ½ of the measures leak for the previous month.

The District also provides information on any incentive that may be available through other parties. Energy Trust of Oregon has provided incentives in the past for energy and water saving appliances. When these incentives become available the District will make those incentives known through the Website, newsletters or bill flyers.

Measure No. 5 - System Leak Detection. This measure focuses on the unaccounted-for-water (UAW) and outlines a program for reducing it. This measure can be fully implemented by the District without action from the public. UAW is the difference between the amount of water taken from natural resources and the amount delivered. The usual method used to estimate UAW includes reviewing production amounts and delivery data, then computing the difference and determining the relative amount of use of water sold, back flushing waste lines, supply meter inaccuracies, fire hydrant testing, street cleaning, customer inaccuracies, and leaks.

Generally, the industry accepts UAW levels of 10 percent and lower as acceptable; however, others have declared these values arbitrary. The largest water wholesaler in the country, the Metropolitan Water District of Southern California, indicates that a UAW of 7 to 8 percent is a reasonable maximum. Oregon State rule requires that systems that have a UAW exceeding 15 percent develop and implement a systems leak detection program to bring leaks down to no more than 10%.

The District actively identifies and repairs leaks in efforts to maintain UAW at low levels. Old pipelines with multiple reported leaks are replaced with new pipe. The District has embarked on a major pipe replacement program beginning in 2001. Since that time, 68,431 feet of old pipe has been abandoned and/or replaced. In addition, the District has installed over 33 miles of new distribution pipeline and almost 18 miles of transmission pipeline.

The geological make-up of the District's service area consists of shallow soil overlying hard pan or rock of relatively low permeability. Accordingly, water from most leaks shows itself on the ground surface. Customers and employees are diligent at reporting wet areas. The District's servicemen investigate all reports and make the necessary repairs. The cost of repairing leaks varies according to the degree of the damage; costs range from $150 on up.

Measure No. 6 - Support of Plumbing Codes. The State of Oregon has required that new construction include water efficient plumbing fixtures since 2021 as stated in ORS 447.145. The current and previous standards are shown in Table 3-1 below:

Fixture	Pre-1992 Code	1992 Code	2021 Code
Toilet	3.5 gal/flush	1.6 gal/flush	1.5 gal/flush
Showerhead	3.5 gal/min	2.5 gal/min	2.0 gal/min
Faucet aerator	3.5 gal/min	2.5 gal/min	
Kitchen Faucet			1.8 gal/min
Lavatory Faucet (Residential)			1.5 gal/min
Lavatory Faucet (Public)			.5 gal/min

Table 3-1 – Plumbing Code changes

Because interior water consumption is not significantly influenced by peak season factors, projected reductions in interior water use would be sustained throughout the year. Peak season demand would therefore be reduced by the same amount as base year (non-peak demand) figures. Existing dwellings would not be affected under this measure. This limits the effects of this measure to any additions, remodels, individual new homes or new subdivisions that might be proposed. Since the code was initiated in 2021, the District has had approximately 175 new services installed.

Measure No. 7 - Participation in Collaborative Water Resources Planning. The District is a member of The Deschutes Water Alliance (DWA). The District joined the DWA to participate in collaborative development of water supply solutions and water resources management programs.

Water Use Measurement and Reporting Program

The District's water use measurement and reporting program complies with OAR 690-85. Water use is measured by a flow meter at each point of diversion on a monthly basis and reports are submitted by December 31 of each year.

Annual Water Audit

The District performs annual water audits. DVWD uses the AWWA water software v6 worksheet and AWWA M-36 standards for determining unaccounted-for water loss. See Appendix E for detailed audit analysis.

Five Year Benchmark: Improve Water Audit Validity Score from III to IV

Full Metering of System

The District meters all water sources and all customer connections. Starting in 2020 the District began a full water meter change out program to replace older positive displacement meters with new ultrasonic radio read meters. 98% of the District's older style meters have been replaced with the new ultrasonic meter. The few remaining old meters will be changed in the next few months. The ultrasonic meters are more accurate and also provide for the additional benefit of remote read capabilities. The meter computer program system currently in place will notify the District of potential leaks after the meter and other meter related issues.

Meter Testing and Maintenance Program

The recently replaced new customer meters come certified from the factory for accuracy within ± 3 % in extended low flow range and ± 1.5 % in normal flow range based on AWWA C-708 standards. The accuracy of ultrasonic meters is not supposed to change over time. The District will continue to evaluate if there is a need to implement a customer meter testing program. The District's policy is to test meters if there is a customer complaint.

For the District's large source water supply meters we have a system of checks and redundancy in flow monitoring. Meters at each of the wellheads and then secondary meters on the three main transmission mains measure the flow leaving the canyon to the distribution system. The wellhead meters are insertion turbine meters with one meter at each of the three wells. The meters measuring flow leaving the canyon through the three transmission mains are strap-on style ultrasonic meters. These two meter system work in tandem to verify and validate flow from source to the distribution system. We evaluate the flow monthly at the beginning of each month for the previous month's flows.

Currently there is no way to calibrate or verify strap-on style ultrasonic meters while in place. The meters are instead evaluated on repeatability, meaning that the given the same flow, water temperature, pipeline characteristics and other criteria they produce the same results. The ultrasonic meters currently in use have demonstrated a high degree of repeatability and is used as a check for the insertion flow meters at the wells. There have been two occasions in the last 3 years where discrepancies in the ultrasonic meter readings and the wellhead meter readings resulted in replacing the wellhead insertion meters due to meter inaccuracies and failures.

Rate Structure

The District currently meters water usage and employs a rate structure to assess charges to its customers. The current rate structure has been in effective since April 1, 2017.

Current water rates as of May 2022	
Base Rate (includes usage up to 700 cubic ft.)	$20.00
Excess Rate (Each additional 100 cubic ft.)	$1.30

Leak Detection Program

The District's leak detection program focuses on several points of inspection at different times of the year. A large majority of the District's pipeline is PVC which is not favorable to traditional acoustic leak detection and leak correlation methodologies. The district employs several other methodologies for leak detection.

Visual inspection is utilized every fall at each meter connection. The connection is checked and evaluated for leaks in the meter box. Leaks after the meter are detected on an ongoing basis. The District uses the technology inherent in the new ultrasonic meters to detect leaks. Letters are sent to the customers to notify them of a potential leak. Customer leaks after the meter are quantifiable and are not counted in water loss calculations.

Hydrant inspections and testing is done in the spring. Testing ensures that when the hydrant is closed there is no leaking and that the hydrant drains through weep holes.

The District also focuses on asset management strategy of replacing old mains and service lines specifically targeting galvanized mains. A breakdown of the pipe materials and length of main existing in the system is shown in Table 3-2.

Material Type	Miles of Main
Galvanized Pipe	12.92
PEX	0.44
PVC	221.62
Steel Pipe	117.66

Table 3-2 – District Distribution System Mainline Breakdown of Pipeline Material

Public Education Program

The District presently implements a public education program. Several avenues are utilized to promote conservation and to educate its customers. These educational activities are regularly scheduled throughout the year to promote conservation and best practices for topics such as irrigation, weatherizing homes for winter to prevent leaks or xeriscaping.

The District website at DVWD.org provides customers with information relative to water saving tips and winterizing. The website is updated on a regular basis with new information or updated in a way to present existing information in a new way. In addition to water conservation information, customers can find information about District rates and service charges as well as policies and time of operation. There are links available to government agencies such as DHS Drinking Water Program, EPA, and the Oregon Energy Department. The Consumer Confidence Reports is also available on the website. The District also makes available faucet aerators in the office that we hand out to customers.

Fliers in monthly bills and the District newsletters have been used more recently for direct to customer messaging regarding irrigation and winterizing tips. Recent fliers are shown in Appendix F.

Technical and Financial Assistance Program.

As describe earlier (Progress Report on Conservation Measures; Measure No. 4), the District engaged in providing customers with information on water and energy saving appliances as well as providing them with a link to the Oregon Office of Energy so that they could respond to tax credit opportunities. This program is ongoing and the information is available to District customers on its website in several places. Most of the savings are available for premium-efficiency clothes washers and dishwashers. The tax credit varies from brand to brand of this equipment.

Supplier Financed Retrofitting

The District supplies water conservation kits to customers free of charge. These kits are available to any customer and include water saving faucet aerators, leak detection tablets for toilets and information on saving water in their home. It also includes other resources available to the customer for upgrading appliances and fixtures.

Adoption of Rate Structures Encouraging Conservation

All District customers receive metered water. Customers pay for water use according to the volume of their water use and the rate schedule presented in the “Rate Structure” section presented earlier

in this Chapter. The District is also compensated for water supplied to the City of Madras per the terms of the Water Sale Agreement between the District and the City of Madras. Compensation includes a fixed rate monthly payment plus payments based on a rate per 100 cubic feet of water use. Water use is determined by volumetric metering at the interconnections with the City water system. The District has included additional items on customer bills starting in 2020 promoting water conservation. Firstly meter reading is done at the first of every Month for the previous month's consumption. Billing then reflects previous month's usage so customers receive a timely price signal with regard to water used for the previous month. Also, information is added to each bill comparing current month usage to previous month and previous year usage.

The District shift in focus toward more conservation includes evaluation of rate structures with more potential incentive for customers to reduce water use. Some options for evaluating rate structures could include, but are not limited to, the following:

- An increasing block rate structure
- A rate structure with a base fee and commodity charge using a seasonal differential that charges more per unit of water consumed in the dry season (on-peak), compared with the wet season (off-peak)
- Water conservation messages included on each water bill
- Information included with each bill to show the customer how water savings could decrease the amount billed (including reduced sewer charges, if sewer charges are based on water consumption)

Reuse, Recycling, and Non-Potable Opportunities

While the District does not own or operate any wastewater facilities, the District serves three (3) communities that manage their own wastewater operations. These communities are the Cities of Culver, Metolius and Madras. Each community has some facet of water reuse associated with their wastewater effluent. The City of Madras uses wastewater effluent to provide outdoor irrigation to the municipal golf course. The Cities of Culver and Metolius incorporate water reuse for irrigation purposes for at least one land application location and are investigating more options to expand wastewater effluent uses. The District supports these measures and assists in planning and project coordination.

In addition, the District promotes water reuse and recycling practices. The District's website promotes practices for water reuse including incorporating xeriscaping and using rainwater for outdoor watering. The District serves one car wash within the service boundary. This car wash

incorporates water reuse. The District also models this practice with its own truck wash bay. The water is collected in the underdrain, filtered, and is then reused in nearby landscaping.
The District will expand the website to include other reuse options such as incorporating the use of grey water systems and reusing cooking water for plants.

Other Implemented Conservation Measures

This report has already made mention of customer leak detection capabilities of the newly installed ultrasonic meters. These meters record water usage on an hourly basis and the leak info code is activated when there is water use above .25 gpm during any given 24 hour period. The system software notifies the District through email of the leak info code for any given meter connection which then allows District employees to review the account. The employee then determines the best corrective action for any situation. For small leaks the customer receives a letter stating that there is a potential leak along with a list of corrective actions they can take to discover and eliminate any potential leak. For larger leaks or pipe burst scenarios, an employee is dispatched to physically inspect the service connection. The employee then leaves information with the customer on corrective actions to address the leak or in more serious leak conditions, the water is shut off at the meter until the leak is addressed. Figure 3-1 represents a customer account with a small background leak while Figure 3-2 represents a customer leak condition that would instigate an on-site investigation by a District employee.

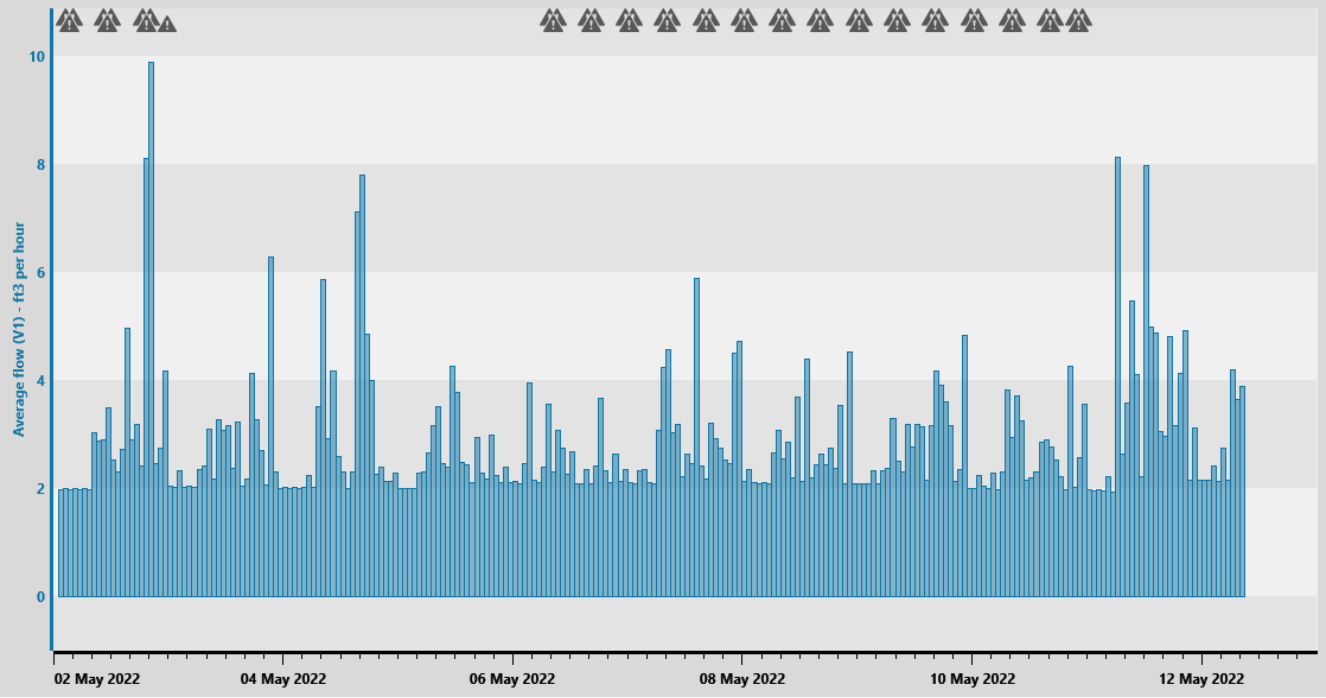


Figure 3-1 – Customer Small Background Leak

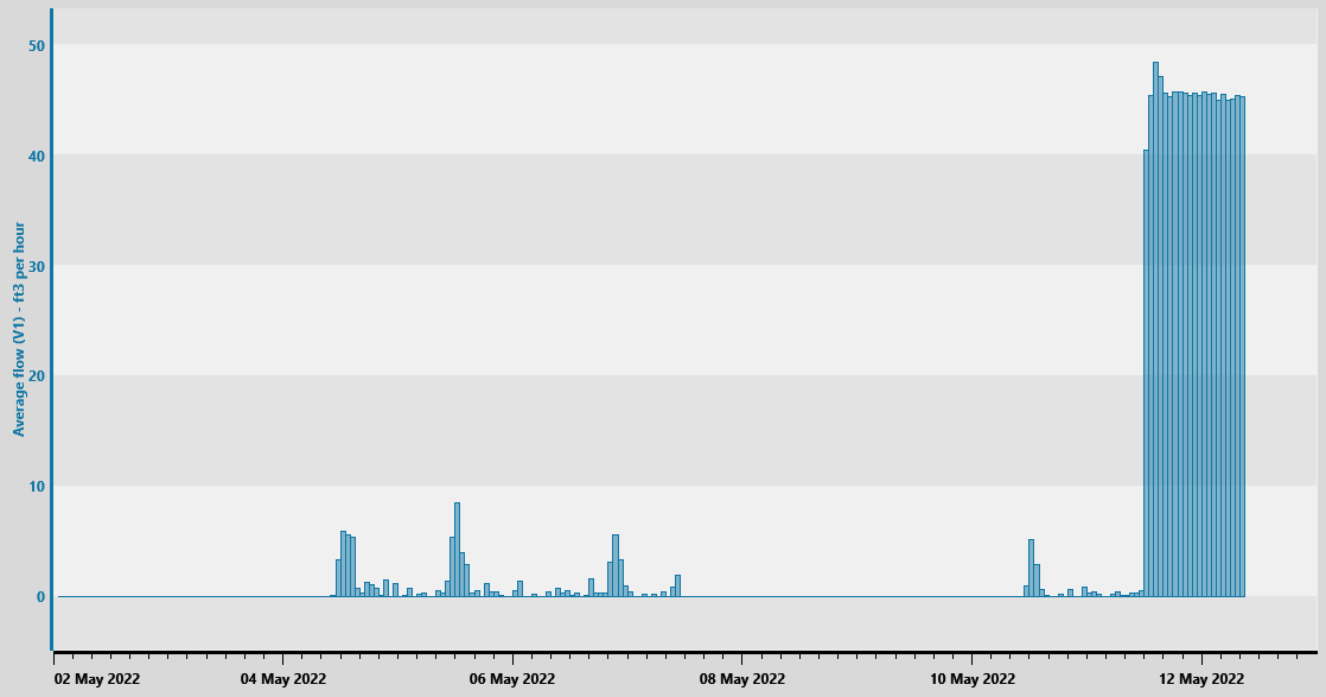


Figure 3-2 – Customer Large Leak or Pipe Burst

Addressing customer leaks and promoting irrigation best practices represent some of the greatest opportunity for conservation. The US EPA Water Sense website states the following:

- Bathrooms are the largest use of water in the home, using more than 50 percent of all indoor water.
- Approximately 5 to 10 percent of US homes have easy-to-fix leaks that drip away 90 gallons a day or more.
- Residential outdoor water use across the US accounts for nearly 8 billion gallons of water each day, mainly for landscape irrigation.

Chapter 4: Water Curtailment

Introduction

Water curtailment plans are designed to minimize the impacts of a short-term emergency water shortage by reducing demand and finding alternative supply. The two most important tools water suppliers can use to immediately reduce and meet demand are conservation measures and secondary water source. Curtailment plans usually contain voluntary and mandatory water use restrictions. The restrictions become progressively severe as the shortage becomes increasingly dire. In the early stages of a shortage, curtailment plans call for customers to take voluntary curtailment actions. As more severe stages of shortage occur, curtailment plans require more restrictive curtailment actions of its customers.

Short-term emergency water supply shortages can come in the form of sudden interruptions, such as loss of power or mechanical problems resulting in major water treatment and distribution equipment failure, contamination of water supply, and earthquakes, floods and other natural and man-made disasters. Or, supply shortages may be more gradual, and offer some lead-time to prepare. This would be the case during a drought. In the case of an immediate shortage, more severe restrictions on water usage may be used right from the start. Water shortages that allow time to prepare may provide an opportunity to gradually ramp up restrictions.

This section details the Districts water curtailment plans which includes the following:

- Assessment of current capacity limitations and the ability to maintain water delivery during long-term supply shortages
- Description of water supply deficiencies experienced within the past 10 years
- Stages of alert
- Pre-determined situations which trigger each stage of alert
- List of curtailment actions to be enacted under each stage of alert

Water Supply Assessment

The District has been very fortunate that drought conditions have never been severe enough to adversely affect its water supply. The District's water source is a relatively robust spring and aquifer system as described earlier. The hydrogeologic character of this system and performance during historic drought cycles suggests that the District will maintain its ability to deliver water to its customers during droughts in the foreseeable future. Long-term droughts could have some limiting effects; however, such potential effects cannot be definitively quantified with available information.

Potential for source contamination locally is low based on control of access to the springs by the District and hydrogeologic character of the confined aquifer supplying District wells and the springs. Local contamination is not likely to curtail the District's ability to maintain water deliveries. Contamination at locations remote from the District's source could have some impact which would likely manifest itself over time of travel and attenuation in the source aquifer system.

Other limiting factors relative to natural disasters include seismic activity with related ground shaking and rock fall conditions. These conditions could damage District pumping infrastructure and supply pipelines anchored to the Crooked River canyon wall that convey water from pumps to the Main Reservoirs at the top of the canyon. Although seismic activity is very infrequent in the area, rock fall events are possible due to other factors, including freezing of precipitation water in rock cracks and crevices. Two of District's three main transmission pipelines from the canyon floor to the main tank site are exposed and anchored the canyon wall and are more susceptible to interference with rock fall. The recently completed 24 inch transmission main is buried under the access road and is more secure from a rock fall event.

District capacity to deliver water to its customers is restricted to its present infrastructure. The present infrastructure is adequate to meet existing demand and new demands within the foreseeable future. There is no defined and imminent limit to the District's source of supply at the present time, or in the foreseeable future.

Description of Past Deficiencies

On March 30, 2020 a severe storm event with 60-100 mph winds hit the Culver area. The winds uprooted trees and downed power lines, cutting electricity to some 10,000 customers in Jefferson County and beyond including the District. Power to the Districts supply pumps was interrupted and the District could no longer pump water to the distribution system.

DVWD in conjunction with the cities of Madras, Culver, and Metolius asked all customers to stop all outdoor watering for the next 24-48 hours. The water that was held in the distribution system reservoirs at the time of the power outage had enough water to support customer average domestic demand for up to five days. Power was restored to the pumps in two days and the District resumed normal pumping operations.

Storage capacity for the District is 16.2 MG. If the District is unable to pump water and the system relies solely on water stored in the reservoirs then the District would be able to supply water to

customers for four (4) days based on average day consumption and up to eight (8) days if conservation measures are implemented such as no outdoor watering.

As was mentioned in the paragraph regarding “assessment of adequacy and reliability of sources” in Section 2 of this report, in March 2021 the District installed a hydro powered mechanical pump capable of delivering average winter day demand without electricity. The District operated from November 2021 to March 2022 without turning on an electric powered pump to deliver water to the distribution system. This addition to the Districts supply pumping capacity creates resiliency in similar power outage situations.

No other unplanned outages have occurred in the last 10 years.

Stages of Alert

Level I

The District has the capability of separating its service territory into three areas. Once the problem area or areas is determined, it will be isolated. The General Manager will issue a request of a voluntary 10-20% reduction in the affected area/areas. The request will be made at a time when there is a strong indication that the District's water supply is insufficient to provide adequate service and fire protection for all water customers.

The request will include a summary of the current water situation, the reason for the requested cutback in use, and a warning that mandatory cutbacks will be required if the voluntary measures do not sufficiently reduce water usage. Voluntary cutback measures should not exceed 20% and are normally not to be used for extended periods of time. Variances may be applied for on a case by case basis for daily watering of new plantings of lawns and shrubs. Variances must be approved by the General Manager or the Assistant Manager in his absence.

Customers affected by this request may initially by notified by door hangers and/or community emergency texts. Local radio and TV stations, as well as newspapers will be asked to run periodic announcements of the request. Leaflets or mailers could be distributed to banks, stores, supermarkets, public buildings, etc. Water conservation suggestions will be included with the announcements and leaflets.

Level II

Level II will be enacted when the request for voluntary cutbacks is not met satisfactorily or for short term, minor water shortages and equipment failures causing shortages in excess of those under the voluntary restrictions. At this level, outside water usage would be prohibited for car washing, washing down sidewalks or driveways, filling swimming pools or hot tubs, for dust control, and for other uses. A lawn-watering schedule would be determined. (Example, odd numbered residences could water on odd days and even numbered on even days). For the "Moderate Alert" condition, the target water-use reduction is 25 %.

Customers affected by this request for prohibition may initially be notified by door hangers and/or community emergency texts. Local radio and TV stations, as well as newspapers will be asked to run periodic announcements of the request and of the warnings and penalties that will be imposed for violation of the restrictions. Leaflets or mailers could be distributed house to house, or to banks, stores, supermarkets, public buildings, etc. Water conservation suggestions will be included with the announcements and leaflets.

Level III

In addition to the measures already included in Level II, Level ill will restrict all outside water usage, including watering lawns, gardens, or other landscaped areas based on a water-use reduction target of 25 to 35%. Exceptions to this measure would be licensed businesses that would be directly and adversely impacted such as landscaping shrub inventory or green houses. Failure to comply with this order can lead to monetary penalties and/or disconnection of water service. Note: Persons being disconnected for such violations must be advised of the conditions under which water service can be reinstated. For the "Sub-Critical Alert" condition, the water-use reduction target is increased to the range of 35 to 40%.

Customers affected by this prohibition may initially be notified by door hangers and/or community emergency texts. Local radio and TV stations, as well as newspapers will be asked to run periodic announcements of the request and of the warnings and penalties that will be imposed for violation of the restrictions. Leaflets or mailers could be distributed house to house, or to banks, stores, supermarkets, public buildings, etc. Water conservation suggestions will be included with the announcements and leaflets.

Level IV

This level of concern would require the disconnection of the City of Madras from the District's tie-ins (after a 24-hour notification). No new connections would be allowed to the system during this

reduction. Depending on the degree of severity of the shortage, the District may impose a maximum daily allotment of water per residence. Residences exceeding their allotment could have water service disconnected or be fined. Commercial water users would be set at 75% of the water used at the same time period of the previous year. Enforcement of this measure would require additional service personnel to monitor meters and consumption.

Level V

Under Level V the District is to assume that a natural disaster or some other force has caused severe damage to the water system, or that power and fuel sufficient to properly run the system will be unavailable for extended periods of time. This fifth level of concern would be coordinated with the City, County and State disaster plans. Communication with disaster plan incident commanders would help to establish available water sources and quantities. Fire protection will probably be unavailable at this level. Large areas of the distribution system would likely be unusable. Under these conditions, water customers will be directed to locations where containers for potable use may be filled, until such time as service can be restored. Service to individual houses would likely be terminated for the duration of the emergency(s).

Trigger for Stages of Alert and Curtailment Actions

Level I. Potential Alert (water shortage of 5-10%)

1. Determine problem area.
2. Notify customers with door hangers and through media of potential shortage and ask for voluntary cutbacks on water usage.
3. Provide leaflets on methods of conservation at banks, post office, and our office.

Level II. Mild/Moderate Alert (water shortage of 11-20%)

1. Determine problem area.
2. Notify customers with door hangers and through media of potential shortage and curtail outdoor usage for washing cars, dust control, washing down sidewalks and driveways, filling pools or hot tubs etc. Establish lawn watering schedule.
3. Distribute leaflets on conservation methods to customers affected.

Level III. Serious/Subcritical Alert (water shortage of 21-40%)

1. Determine problem area.
2. Notify customers with door hangers and through media of shortage and restrict all outside water usage, except for exceptions noted above.

3. Impose fines or disconnection of service for violations of compliance.
4. Distribute leaflets on conservation methods to customers affected.

Level IV. Critical Alert (water shortage of 41-75%)

1. All outside usage would be curtailed.
2. City of Madras would be required to disconnect from District tie-ins (after 24 hour notice).
3. Depending on severity, may impose household allotments.
4. Commercial business curtailed to 75% of previous years usage for the same period.
5. Would require additional personnel for enforcement.

Level V. System-wide Failure (water shortage over 75%)

1. Isolate each pressure zone within the District by closing intake valves at the Metolius and Plains Reservoirs.
2. Notify the City of Madras to switch sources from the District supply to its own wells.
3. Issue public notice to limit water consumption.
4. Notify large industrial water users that water supply from the District may or will be curtailed.
5. Notify Jefferson County Fire District.
6. Coordinate with Local and or State emergency operations to setup and supply water fill stations.

When the water supply from Opal Springs has been reestablished, the District will implement the following recovery steps:

1. Fill main reservoirs.
2. Open intake valves at Metolius and Plains reservoirs.
3. Monitor main reservoir level.
4. As water system returns to normal conditions notify public, City of Madras, and any other water users with curtailed service.

Chapter 5: Water Supply Element

Future Service Area

Considering the present size of the service area and its inclusion of the main community areas, there is no present plan to expand the boundaries in the foreseeable future to include larger area or acquire additional service connections outside of natural growth.

Population Projections

The present population served by the District is approximately 13,055 persons or about 55% of the Jefferson County. The projected future population in the year 2035 is estimated to be about 15,000 persons. This projection is based on population trend analysis, produced by the Population Research Center, Portland State University, June 2018. Jefferson County is forecast to grow at a rate of about .8% per year through 2035. The cities of Culver, Madras and Metolius are estimated to grow at a slightly higher rate of 1%. The district is assuming a growth rate of 1% for population served even for areas outside of the Urban Growth Boundaries (UGB). Table 5-1 presents population growth projections for the Jefferson County area through 2035

Forecasts for Total Population				
Area / Year	**2020**	**2025**	**2030**	**2035**
Jefferson County	24,139	25,273	26,375	27,323
Culver UGB	1,511	1,572	1,678	1,768
Madras UGB	7,302	7,683	8,249	8,689
Metolius UGB	1,158	1,200	1,249	1,289
Outside UGB Area	14,168	14,818	15,199	15,577

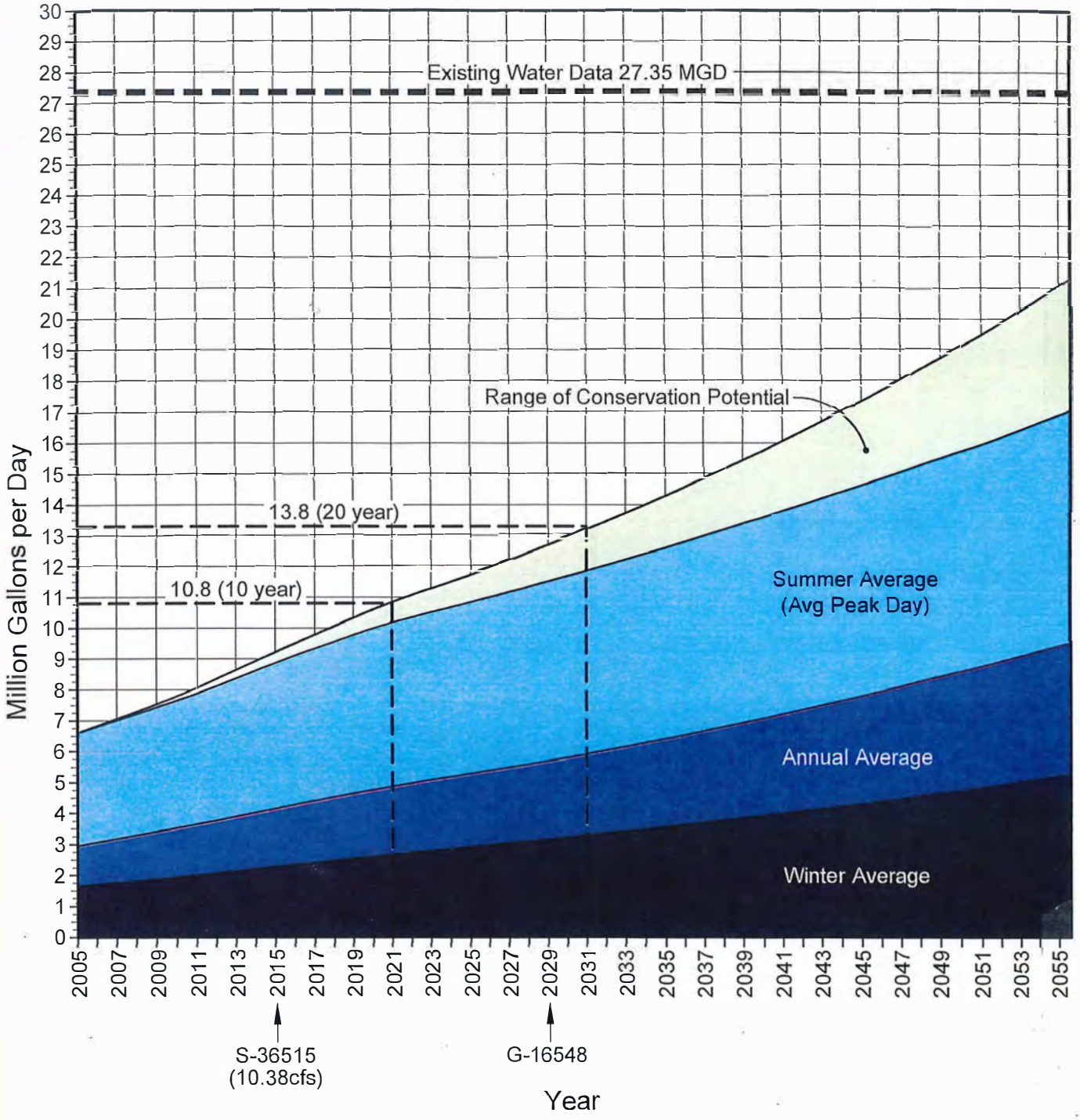
- Final Population Forecasts prepared by: Population Research Center, Portland State University, June 30th, 2018.
- Final forecasts represent populations as of July 1 of each year

Table 5-1 – Area Population Growth Projection

Figure 5-1

District Full Water Use Projections

Deschutes Valley Water District
~ Future Demand Projections ~



COCO Water Supply Report - DVWD Data Package

NEWTON CONSULTANTS INC.
Earth, Water and Rock Specialists
Ph: 541 504-9960 Fax: 541 504-9961

Future Demand Projections
Deschutes Valley Water District

DESIGNED BY:	DRAWN BY:	DATE:	PROJECT NO.	
D. Newton	S.Schenck	AUG 2012	450-112	FIGURE 5-1

G:\0400\450\112\Cad\Water\DVWD Future Growth Projection 14:05 08/30/2012 SS

Water Demand Forecast

Demand has grown at a higher rate than anticipated according to the projection included in the 2012 WMCP. As shown in Table 2-2, 2021 maximum day demand was 12.65 mg, exceeding the projected 2021 maximum demand of 10.8 mgd shown in Figure 5-1. However, anomalous conditions in 2021 may have elevated the maximum day demand above typical levels, as reflected in the elevated peaking factor of 2.81, compared to 2.34 in 2020. The 2020 maximum day demand of 9.13 mgd is below the projected demand without conservation shown in Figure 5-1. Conservation measures have minimized the overall impact of water demand on the system, though not to the maximum possible extent shown in Figure 5-1.

The District anticipates that demand will continue to grow consistent with the projections from the District's 2012 WMCP trajectory shown in Figure 5-1. As shown in Figure 5-1, the forecast maximum day demand is 13.8 mgd in 2031 and approximately 16 mgd in 2041.

Schedule to Fully Exercise Water Rights & Water Use Permits and Projected Water Needs Compared to Sources

In 2009, OWRD approved a surface water to groundwater transfer, T-9720, to change the authorized point of diversion under Certificate 87333 to nine separate groundwater well locations in the immediate vicinity of the Spring. (Certificate 87333 was a partial perfection of a 10.38 cfs portion of permit S-36515). An order approving an extension of time to develop the remaining 11.92 cfs under permit S-36515 was issued on January 23, 2015. The order includes a condition limiting the use of water beyond 1.28 cfs until approval of a WMCP authorizing access to the remaining undeveloped portion of the permit.

The projected future maximum day demand rates described above correspond to flow rates of 21.35 and 24.76 cubic feet per second (cfs) for the years 2031 and 2041, respectively. Water for future demand will be supplied primarily by the District's wells, with Opal Springs used as a supplemental source. The District intends to submit a new surface water to groundwater permit amendment for the remaining portion of Permit S-36515 to change the authorized points of appropriation to the District's authorized wells. This change would allow the District to produce up to 22.3 cfs from its wells. As described in section 2, the District's wells already have the capacity to produce a combined rate in excess of 22.3 cfs at artesian pressure, so there is no need for expansion of water supply infrastructure to use this amount of water from the wells.

Expansion of Diversion of Water Allocated Under Existing Permits.

A claim of beneficial use was already submitted for the use of 10.38 cfs from Wells 1, 2, and 3 under transfer T-9720. The district also holds permit G-16548, which authorizes the use of up to 16.7 cfs from the same wells. However, this water right requires the District to provide mitigation credits to offset the volume of water pumped annually. The supply of permanent mitigation credits throughout the Deschutes basin remains low, and what credits are available are very expensive. There are not sufficient temporary or permanent credits available to reliably provide mitigation for G-16548. This creates a challenge for the District in obtaining long-term water supply under permit G-16548.

Furthermore, the Deschutes Basin Mitigation Program is scheduled to sunset in early 2029. HB 3623, which authorized the extension of the mitigation program rules through 2029, states that the rules shall be repealed on January 2, 2029. While ground water permits and mitigation projects approved before the repeal will remain valid and effective, the temporary credits the District obtains from the Deschutes River Conservancy are authorized by mitigation projects tied to instream leases that are renewed on a five-year, every other year, or annual basis. It has been OWRD's practice to terminate temporary mitigation projects when the instream leases associated with those projects are modified or cancelled. Therefore, it is not clear whether temporary mitigation credits will be available after 2029 without a renewal of the mitigation program. It's not exactly clear what would happen if DVWD couldn't provide the number of mitigation credits it had previously provided and used as the basis of making proof. OWRD has suggested that it may be necessary to diminish the authorized volume of the permit if temporary mitigation is provided in one year and not available in future years. As a result, purchasing and supplying additional mitigation credits for Permit G-16548 is not advisable, and may create a risk for the use of the permit over the long-term. To summarize DVWD's concerns:

- Temporary mitigation credits are inherently unreliable.
- It's risky to assign more temporary credits to a permit than are known to be available in perpetuity.
- There aren't sufficient temporary or permanent credits available for purchase for DVWD to make proof on Permit G-16548.
- Even if there were sufficient credits available, it's not clear that any temporary mitigation credits will still exist by 2029, which could potentially lead to the cancellation of DVWD's permit, *if* DVWD invests preferentially in purchasing temporary credits at this time. If DVWD holds off on purchasing more temporary credits now, it may still be possible to incrementally acquire permanent mitigation credits in the future.
- The current cost of temporary and permanent mitigation credits is high. Discussions amongst stakeholders in the Upper Deschutes Basin may lead to the development of a permanent

mitigation bank to increase supply and facilitate more efficient transactions of permanent mitigation credits.

While DVWD has preferred to preserve the authorization to use S-36515 for use of the springs directly in case that is desirable in the future, the current landscape of the mitigation program suggests an alternate path is more prudent. Given the uncertainty regarding the future of the mitigation program, DVWD is prioritizing the use of water from the wells under a pending surface water to groundwater permit amendment for Permit S-36515. The permit amendment application requests to change the authorized point of appropriation from Opal Springs to the District's existing Wells 1, 2, and 3. This will allow the District to address concerns regarding the ability to provide mitigation for Permit G-16548 over the long term, as well as the cost of temporary mitigation credits. The District's wells have the capacity to use this additional water under artesian flow, and the demand projections shown in Figure 5-1 demonstrate a maximum day demand of 24.76 cfs in 2041. Therefore, the District is requesting access to the full rate of 11.92 cfs under the undeveloped portion of extended permit S-36515.

Although the District has previously received approval for an identical transfer under T-9720, the District also requests access to 14.38 cfs under permit G-16548 as a contingency for the possibility that OWRD does not approve the permit amendment to change the point of diversion from Opal Springs to Wells 1, 2, and 3. The rate requested is equal to the 24.76 cfs projected maximum day demand in 2041, less the 10.38 cfs rate already authorized under T-9720. The timeline for making full beneficial use of permit G-16548 is beyond 20 years and may be longer if OWRD approves a surface water to groundwater permit amendment for S-36515.

Opal Springs discharges to a surface flow of approximately 240 cfs. The underground component of spring discharge is unknown. Hydraulic head in the aquifer reflected in wellhead pressure gages is unchanged since well construction in 1998 and 2000. The District is the only user of Opal Springs water and the principal user of ground water in the general river confluence and ground water discharge area. Madras relies on wells; however, significant supply is provided to Madras by the District through an intertie system. There is no present information compelling the District to believe that the capacity of the sources is inadequate for the springs to continue to be used in a supplemental capacity.

Mitigation Actions

As described above, the District must provide mitigation credits to offset the impacts to surface water from use of groundwater under Permit G-16548. The District has an approved incremental mitigation plan on file with OWRD and will continue to use water under the permit in compliance with the mitigation plan.

The District is not currently required to take any mitigation actions under federal law.

Alternative Sources

Implementation of Conservation Measures

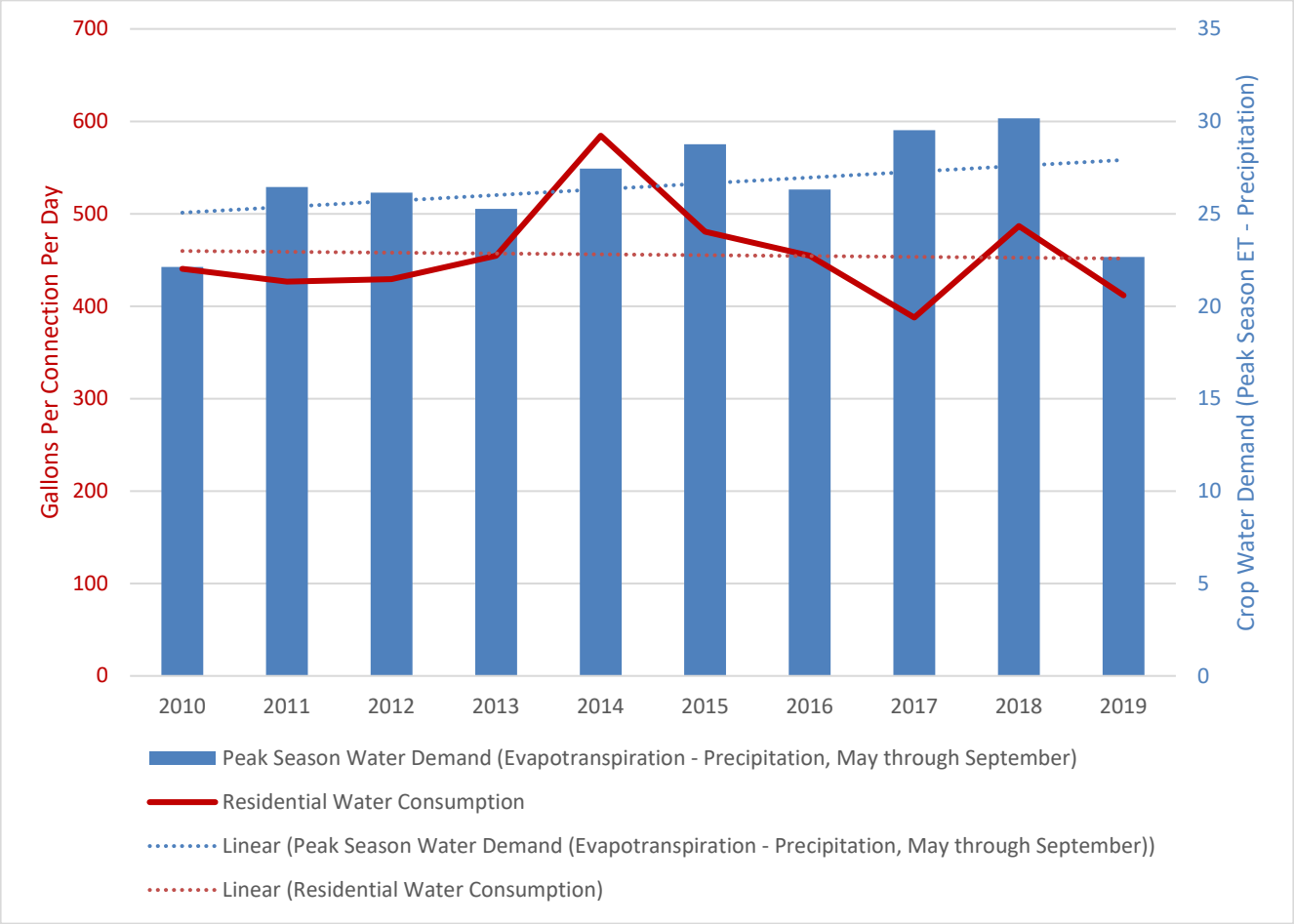
As shown in Figure 5-1, the District's demand projections include a range of conservation potential. Projections anticipated a maximum potential reduction of demand from approximately 16 mgd to 14 mgd (21.66 cfs). This would reduce the District's future need for water under Permits S-36515 and G-16458 from a combined total of to 14.38 cfs to 11.28 cfs. The original projected demand of 16.71 cfs in 2021 was exceeded by 2.86 cfs, despite continued implementation of the District's water conservation measures described in Section 3.

As shown in Table 2-4, the District's calculated water loss rates remain below 10 percent, a testament to the effectiveness of the District's water audit and systematic leak detection and repair programs implemented since completion of the District's prior WMCP in 2012. As a result, the continuation of these efforts offers minimal opportunity for reducing the District's maximum day demand. Conservation measures targeted at District customers may offer greater potential for further reducing water demands. The projections shown in Figure 5-1 incorporate results from conservation efforts implemented by other municipalities in the Western U.S, including programs similar to those already implemented by the District, as well as new water conservation measures, such as supplier financed retrofitting or replacement of inefficient fixtures or wastewater reuse.

From 2010 through 2019, the District's residential water use per account decreased by 1.8 percent. Due to declining precipitation and increased temperatures, estimated water demands for irrigation, based on evapotranspiration and precipitation data during the peak demand season of May through September, increased by over 11 percent.[1] The District's conservation measures, including

[1] Precipitation and estimated reference evapotranspiration based on data from Madras Agrimet facility.

educational outreach, support of plumbing codes, xeriscaping demonstration garden, and work to identify customer-side water leaks likely contributed to limiting increases in water use.



The District experienced a significant increase in 2020 and 2021 residential water demands. While drought and extreme heat likely played a role in increased water demands, another possible factor is that some residential customers may be replacing a portion of lost water supplies from North Unit Irrigation District (NUID) using their potable water supply connection to DVWD. NUID's primary source of water is Wickiup Reservoir, which has been at historic lows due to drought and obligations to release water to meet the ecological needs of the threatened Oregon Spotted Frog during the winter and spring. NUID's patrons generally consist of large-scale agricultural operations. While DVWD provided water to a large operation in 2021, DVWD does not generally have the capacity to provide a meaningful amount of water to replace lost supplies for such operations, nor would this be considered residential water use. However, NUID also provides water for irrigation to some smaller

accounts (<5 acres), primarily in the vicinity of Madras, to which DVWD supplies potable water. Such smaller operations likely replaced a portion of lost water supplies using their potable water connection to DVWD. The impact of these increased demands has exceeded DVWD's water conservation gains.

Although the current drought is likely to be temporary, NUID's water supply shortages may continue, as Wickiup release obligations are scheduled to increase in the coming years. As a result, 2020 and 2021 are likely representative of future water demand conditions for DVWD during dry years. Further investment in water conservation measures, particularly those aimed at reducing outdoor water use among patrons who may be using their DVWD connection to replace other irrigation supplies, may reduce the need for access to water under Permits S-36515 and G-16548. However, such measures cannot eliminate the need to access water under these water rights entirely.

Interconnection with Other Municipal Supply Systems and Cooperative Regional Water Management

The District has an interconnection with the City of Madras that provides nearly all of the City's water demand. The District also supplies water to the cities of Culver and Metolius. The next closest municipal water supplier that would potentially have the capacity to supply water to the District is the City of Redmond, which would require installation of infrastructure over a distance of nearly fifteen miles. The District's wells and the City of Redmond's wells both draw water from the same source, the Deschutes Regional Aquifer, only the District's wells are under artesian pressure due to the lower elevation of the District's wells. Because the District already has well capacity to provide water under Permits S-36515 and G-16548 it is more cost effective than any interconnection with Redmond or another distant water supplier that draws from the same source.

Other Conservation Measures

The District will continue to evaluate other water conservation measures. With improvements in the District's auditing and leak detection capabilities described in Section 3, the District has also moved to replace all older positive displacement meters with new ultrasonic radio read meters. These meters enable the use of software to automatically detect customer leaks. These meters may also provide the District with an opportunity to proactively identify water users with high irrigation water demands and conduct appropriate outreach regarding irrigation best practices. While the District is exploring these possibilities, the scale of potential water savings is not sufficient to preclude the need for water under Permit S-36515 and G-16548. Furthermore, because the District already has the

capacity to supply additional water from Wells 1 through 3 to meet its projected demands, additional conservation measures, while important, cannot provide water at a cost that is equal to or less than expansion of water under Permits S-36515 (with a surface water to groundwater permit amendment) or G-16548 (based on the current cost of temporary mitigation credits).

Acquisition Of Water Rights

As described above, the District's existing water rights are sufficient to meet projected demands through 2041. Assuming OWRD approves a surface water to groundwater permit amendment for Permit S-36515, the District projects a need to develop a portion, but not all, of the maximum authorized rate of G-16458.

Appendices

Appendix A

2018 WMCP Progress Report

H.A. McCOY
ENGINEERING & SURVEYING, LLC
1180 SW Lake Road, Redmond, OR 541-923-7554 www.ham-engr.com

PROGRESS REPORT

DESCHUTES VALLEY WATER DISTRICT

WATER MANAGEMENT & CONSERVATION PLAN – IMPLEMENTATION OF REQUIRED CONSERVATION MEASURES (OAR 690-086-0150(4)

June 5, 2018

PURPOSE

This progress report responds to the provisions for such report stipulated in item No. 3 of the Orders in the Final Order approving the Deschutes Valley Water District (DVWD)' Water Management and Conservation Plan (WMCP) on October 15, 2012. The WMCP was prepared in connection with conditions of permit G-16548.

BENCHMARKS FOR PROGRESS REPORTING

This progress report responds to OAR 690-086-0120(4)(a): A list of benchmarks established under OAR 690-086-0150 and a description of the progress of the municipal water supplier in implementing the associated conservation or other measure. Benchmarks subject to this progress report include the following:

1. Annual water audit;
2. Program to install meters;
3. Meter testing and maintenance program;
4. Rate structure based, at least in part, on quantity of water metered at service connections;
5. Regularly scheduled and systematic leak detection program; and
6. Public education program.

Progress Summary

Annual Water Audit
Evaluation of water flow/volume data in follow-up to replacement of several meters indicates reduction in estimated range of 15 to 20 percent unaccounted for water and/or leakage down to 12 percent. Consistent with WMCP benchmark time frame.

Program to Install Meters
The DVWD has replaced 3,926 of its older Trident T-8 meters with more modern and improved Trident T-10 meters. The remaining T-8 meters to be replaced total 271. Consistent with WMCP benchmark time frame.

Meter Testing and Maintenance Program
This program is being developed in conjunction with meter replacements and evaluations of new data on water flow/volume records for new meters. DVWD priority is to establish accurate accounting of water then determine need and method for leak detection program. Timing scheduled for completion by April 1, 2020 following evaluations of water flow/volume data for replaced meters.

Rate Structure
The DVWD rate structure is based, in part, on quantity of water metered at service connections. The rate structure was modified in 2017 with a modest rate increase and change to the rate structure. Consistent with WMCP.

Regularly Scheduled and Systematic Leak Detection Program
This program will be evaluated after meter replacements and evaluation of data on water flow/volume records for the new meters. DVWD priority is to establish accurate accounting of water then determine need and method for leak detection program. Timing scheduled for completion by April 1, 2020 following evaluations of water flow/volume data for replaced meters.

Public Education Program
DVWD continues its existing program as described in the WMCP.

A more descriptive summary of progress in implementing measures for each benchmark by the DVWD is presented below.

PROGRESS REPORT

Annual Water Audit

An annual water audit is to be conducted by the DVWD that includes a systematic and documented methodology for estimating any un-metered authorized and un-authorized uses.

Authorized water uses are all metered by the DVWD. The DVWD is unaware of any un-authorized water uses.

The WMCP includes a section on Quantification of System Leakage. This section states that water loss data presented in the original 2001 WMCP was found to be inconsistent by the OWRD. The OWRD also concluded that the data did not support the DVWD's estimate of water loss at less than 10 percent. Follow-up evaluations since that time suggest that water losses could be in the 15 to 20 percent range. This range of water losses is not consistent with the DVWD's expectations considering its infrastructure knowledge maintenance efforts.

As part of a water audit process and related concern about the potential range of losses described above, the DVWD conducted recent evaluations of un-accounted for water and/or leakage. The evaluation focus was on metering systems considering that water losses could be reflected in malfunctioning meters rather than actual losses from leakage. These evaluations revealed potential performance issues with one or both of the main meters on supply pipelines that may result in unreliable water production data.

Since the above evaluations were completed, the DVWD has installed new backflow valves at each of the three wells at its Opal Springs water supply facilities on the Crooked River. These improvements included installation of a saddle meter on the main diversion from Opal Springs. These installations improved meter performance.

Evaluations of meter data since the installations reveal un-accounted for water use at 12 percent. These improvements suggest that the new meters are providing more accurate data on the amount of un-accounted water. The DVWD contends that 12 percent is still high and continues to investigate this item. It is possible that older meters in the DVWD distribution system are generating erroneous data, leading to apparent higher amounts of un-accounted for water. The DVWD is actively implementing a program to install new meters as described below.

Program to Install Meters

The DVWD WMCP includes provisions *(Review and Adjustment of Basic Meter Program)* for reviewing its meter performance, testing and maintenance program. The four five-year benchmarks include: 1) review of testing and maintenance program; 2) evaluate improved meter technology and applicability to the DVWD; 3) adapt testing and maintenance program to accommodate modifications found to be necessary; and 4) implement modified testing and maintenance program, and installation of replacement meters and improved technology. These benchmarks were planned to be completed in the year 2017. Much of this benchmark work has been completed by the DVWD by 2017, primarily evaluations of improved meter technology and applicability to the DVWD, and installation of replacement meters. Other benchmark work is rescheduled to follow completion of additional meter replacements and evaluation of water flow/volume data to gain improved understanding of unaccounted for water and/or leakage water quantities. Modifications to the meter testing and maintenance program will follow.

Currently, the DVWD has 4,200 water meters in service. In 2009, the DVWD upgraded its billing software from a very old and obsolete operating system. As a consequence, the DVWD thought it lost its ability to sort customer meters by the latest date of their installation. Older meters were being replaced according to age sorting; however, the updated system showed all meters prior to 2009 as installed in 1980; therefore, the order of older meter replacements was lost. The DVWD financial staff ultimately discovered that the meter installation dates were available in the data base, but were not in a sortable format for maintaining the meter replacements schedules according to meter age. Accordingly, DVWD financial staff began correcting the age sorting system for all 4,200 meters and expects to have this completed in spring to early summer 2018. In the sorting process, they found 50 meters that were installed before 1990. Maintenance crew time was devoted to replacing these older meters in 2017. The re-established age sorting allows the DVWD to replace meters in a logical manner with focus on the oldest meters first

The DVWD maintenance crew and meter service personnel have replaced all gear-drive (old technology) meters that were in its water distribution system. There is presently a mix of Trident T-8 meters and Trident T-10 meters in the distribution system. The T-8 meters are the older style of meter. T-10 meters are the new style and replacements of the T-8 meters with the T-10 meters began 15 to 20 years ago. Presently, 3,929 of the older T-8 meters have been replaced with the new T-10 meters. There remain 271 of the older T-8 meters which are being replaced under the meter installation program. Concurrent with the meter replacements, the DVWD continues to evaluate unaccounted for water and/or water losses.

Meter Testing and Maintenance Programs

Measures taken by the DVWD in the above water audit and meter installation program included meter testing. DVWD focus is on replacement of older meters with new meters of more advanced technology. Flow/volume data collected since meters have been installed indicate reduced amounts of unaccounted for water and/or leakage than estimated in the WMCP. Accordingly, the DVWD priority at this time is improving its ability to measure water to better understand its situation of unaccounted for water and/or leakage. A meter testing and maintenance program will be restructured according to the updated meter status.

Capital Improvements Priorities

Over the last few years, the DVWD focused capital and resources on construction of major water system infrastructure projects. With these relatively large, capital and resource-intensive projects complete, the DVWD will shift more focus to meter testing and maintenance programs. Priority capital and resource expenditures between 2012 and 2017 were for the following projects:

2012: Installation of 110,000 gallon storage tank at Round Butte site:	$ 275,000
2013: Installation of 4,000,000 gallon storage tank at Main Tank site:	$1,500,000
2013: Installation of 3,735 feet of steel water pipe; Main Tanks to Canyon Rim	$ 500,000

2016: Installation of 5,300 feet of steel water pipe; Opal Springs to Canyon Rim	$1,750,000
TOTAL CAPITAL INVESTMENT	$4,025,000

Rate Structure

The DVWD evaluated its rate structure for water use and made changes in its rate structure effective April 1, 2017. Prior to the change, the DVWD rate structure was as listed below:

0-700 cubic feet of winter water use:	$18.00
0-6000 cubic feet of summer water use:	$78.60
Next 2500 cubic feet of water use:	$ 1.15 per 100 cubic foot
Next 2500 cubic feet of water use:	$ 1.25 per 100 cubic foot
Next 2500 cubic feet of water use:	$ 1.35 per 100 cubic foot
8300 cubic feet plus:	$ 1.15 per 100 cubic foot

The changed rate structure now in effect is as follows:

0-700 cubic feet of winter water use:	$20.00
700 plus cubic feet of water use:	$ 1.30 per 100 cubic feet

The DVWD water rate structure for the 6,000 cubic foot summer volume is generally consistent with rate structures for other Central Oregon municipal and major private water suppliers. The DVWD rate for the 700 cubic foot winter volume is at the low end of the range for the other municipal and major private water suppliers.

It is important to note that the DVWD can supplement its operating budget with electric power revenues it generates from its hydropower plant at Opal Springs. Accordingly, the DVWD rate structure could be somewhat lower than other water providers for winter water, when river flows are higher with higher rates of power generation.

System Leakage – Regular and Systematic Leak Detection Program Required

The DVWD suspects that the above (Annual Water Audit) range of 15 to 20 percent for unaccounted for water and/or leakage is too high. Meter improvements and follow-up readings indicate a reduction in unaccounted for water and/or leakage down to 12 percent, which the DVWD believes is still too high. The DVWD has investigated meter function and replaced two older meters on the main supply pipelines at Opal Springs. Meter function and reliability has improved.

The DVWD continues to replace older meters in its distribution system as discussed above in an effort to account for apparent water losses that may be related to meter errors. When this effort is complete, the DVWD will shift its efforts to more concerted leak detection efforts. The DVWD process to date in this regard is a systematic approach.

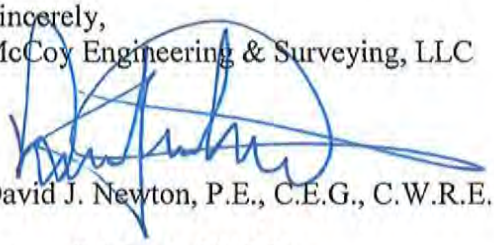
Public Education Program

Public education is an important part of programs to improve efficiency of water use and water conservation. The DVWD gives out water saver sink valve/aerators at the DVWD office and provides tips for water savings on its website at http://www.dvwd.org/watersavingstips.html.

CLOSURE

This progress report is submitted to the Oregon Water Resources Department by David J. Newton, P.E., C.E.G., C.W.R.E., on behalf of the Deschutes Valley Water District. Please contact David at (541) 325-3905, or by e-mail at david@ham-engr.com if there are any questions regarding this report.

Sincerely,
McCoy Engineering & Surveying, LLC



David J. Newton, P.E., C.E.G., C.W.R.E.

cc: Ed Pugh, DVWD

Appendix B

Notice to Affected Local Governments

DESCHUTES VALLEY WATER DISTRICT

April 18, 2022

Confederated Tribes of Warm Springs
1233 Veterans Street
PO Box C
Warm Springs, OR 97761

RE: Deschutes Valley Water District Water Management and Conservation Plan

The Deschutes Valley Water District (DVWD) in accordance with OAR 690-086 has completed an updated draft of its Water Management and Conservation Plan (WMCP). As an affected local government within the District's jurisdiction you are given this notice and the opportunity to review and comment. An electronic version of the draft WMCP can be accessed through the following download link:

https://tinyurl.com/3am9d6p6

The document will be available for 30 days. Any input received in the next 30 days will be included in the draft submittal to the Oregon Water Resource Department (OWRD).

Respectfully,

Joel Gehrett, P.E.
General Manager
jgehrett@dvwd.org
541.475.3849

DESCHUTES VALLEY WATER DISTRICT

April 18, 2022

City of Culver
P.O. Box 256
Culver, Oregon 97734

RE: Deschutes Valley Water District Water Management and Conservation Plan

The Deschutes Valley Water District (DVWD) in accordance with OAR 690-086 has completed an updated draft of its Water Management and Conservation Plan (WMCP). As an affected local government within the District's jurisdiction you are given this notice and the opportunity to review and comment. An electronic version of the draft WMCP can be accessed through the following download link:

https://tinyurl.com/3am9d6p6

The document will be available for 30 days. Any input received in the next 30 days will be included in the draft submittal to the Oregon Water Resource Department (OWRD).

Respectfully,

Joel Gehrett, P.E.
General Manager
jgehrett@dvwd.org
541.475.3849

DESCHUTES VALLEY WATER DISTRICT

April 18, 2022

City of Metolius
636 Jefferson Avenue
Metolius, Oregon 97741

RE: Deschutes Valley Water District Water Management and Conservation Plan

The Deschutes Valley Water District (DVWD) in accordance with OAR 690-086 has completed an updated draft of its Water Management and Conservation Plan (WMCP). As an affected local government within the District's jurisdiction you are given this notice and the opportunity to review and comment. An electronic version of the draft WMCP can be accessed through the following download link:

https://tinyurl.com/3am9d6p6

The document will be available for 30 days. Any input received in the next 30 days will be included in the draft submittal to the Oregon Water Resource Department (OWRD).

Respectfully,

Joel Gehrett, P.E.
General Manager
jgehrett@dvwd.org
541.475.3849

DESCHUTES VALLEY WATER DISTRICT

April 18, 2022

City of Madras
125 SW E Street
Madras, Oregon 97741
541-475-2344

RE: Deschutes Valley Water District Water Management and Conservation Plan

The Deschutes Valley Water District (DVWD) in accordance with OAR 690-086 has completed an updated draft of its Water Management and Conservation Plan (WMCP). As an affected local government within the District's jurisdiction you are given this notice and the opportunity to review and comment. An electronic version of the draft WMCP can be accessed through the following download link:

https://tinyurl.com/3am9d6p6

The document will be available for 30 days. Any input received in the next 30 days will be included in the draft submittal to the Oregon Water Resource Department (OWRD).

Respectfully,

Joel Gehrett, P.E.
General Manager
jgehrett@dvwd.org
541.475.3849

DESCHUTES VALLEY WATER DISTRICT

April 18, 2022

Jefferson County Building and Planning Services
66 SE D Street
Madras, OR 97741
541-475-2449

RE: Deschutes Valley Water District Water Management and Conservation Plan

The Deschutes Valley Water District (DVWD) in accordance with OAR 690-086 has completed an updated draft of its Water Management and Conservation Plan (WMCP). As an affected local government within the District's jurisdiction you are given this notice and the opportunity to review and comment. An electronic version of the draft WMCP can be accessed through the following download link:

https://tinyurl.com/3am9d6p6

The document will be available for 30 days. Any input received in the next 30 days will be included in the draft submittal to the Oregon Water Resource Department (OWRD).

Respectfully,

Joel Gehrett, P.E.
General Manager
jgehrett@dvwd.org
541.475.3849

Appendix C

Water Rights Summary

Deschutes Valley Water District - Water Rights Summary

Appl. No.	Permit No.	Certificate No.	Priority Date	Source	Use	Allowed Rate (cfs)	Actual Diversion				Authorized Completion Date	Notes *(Facility Name, Resource Issues or Problems, Etc.)*
							* Maximum Instantaneous Rate Diverted to Date (cfs)	* Maximum Annual Quantity Diverted to Date (MG)	* Average Monthly Diversion (MG)	* Average Daily Diversion (Gallons)		
S-48909	S-36515	N/A	12/29/1971	Opal Springs	Quasi Municipal	11.92	1.28	87.6	.35	11,628	1-Oct-2003 Extension Application Proposes 1-Oct-2028	Certificate C-83733 for 10.38 cfs issued as a partial perfection of permit S-36515, leaving 11.92 cfs under the permit. Once this remainder is fully developed, file Claim of Beneficial Use to obtain certificate. extension Needed
S-48909	S-36515	T-9720	12/29/1971	Opal Springs	Quasi Municipal	10.38	10.38	1641	116	3,842,147	1-Oct-2015	T-9720 transferred 10.38 cfs partial perfection of S-36515 to District Wells
S-32724	S-26113	C-35632	10/24/1958	Opal Springs	MUNI	2.2	2.2	150	12.5	412,000		
G-14721	G16548		4/13/1998	Groundwater (Well #1, #2, #3)	MUNI	16.7 or 2,312 ac/ft annually	1.547	77	6.41	210,000	16- Jul-2029	Max rate diversion based on mitigation – 128.4 temp credits through Deschutes River Conservancy for 214 ac/ft
S-6261	S-3903	C-7931	9/5/1918 9/5/1918	A Spring A Spring	Domestic Power	3.0 3.0**	3.0	205	17.1	563,000		**Not to exceed a Maximum rate of 3.0 cfs at any one time
S-43228	S-32674	C-46049	3/6/1967 1/25/1967	Opal Springs Crooked Rivr	Domestic Power	1.11 60.0	1.11 *	76	6.33	208,000		In Good Standing In Good Standing
S-63249	S-47591		2/10/1982 6/10/1982	Crooked Rivr Crooked Rivr	Power Power	1,500 272.5	*	*	*	*	1-Oct-1986	In Good Standing
S-7852	S-5436	C-10851	4/25/1921	Crooked Rivr	Power	48.2	*	*	*	*		In Good Standing
S-23473	S-18802	C-27796	10/8/1948	Crooked Rivr	Power	21.3	*	*	*	*		In Good Standing
S-56774	S-43521	C-65840	10/20/1977	Crooked Rivr	Power	140.0	*	*	*	*		In Good Standing
R-84628			12/5/2000	Deschutes River	GW Rechrge	200.0	0	0	0	0	Not Assigned	Application Withdrawn April 2022

- The District diverts water for hydropower up to the maximum combined allowable rate without exceeding, however, flow rate fluctuates based on allowable diversion flows available.
- * Actual Diversion annual values based on 2020 water year.

Appendix D

Water Sales Agreement Between DVWD and City of Madras

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

THIS AGREEMENT is made and entered into this 22nd day of June 2021, 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 24, 2016, which expired June 30, 2019, and was extended through June 30, 2021 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, 2021 and extend through June 30, 2024. The District shall make available to the City subject to the provisions of this agreement domestic water at the District's three points of interconnection with the City water system.

WATER RIGHTS: The City shall pay to the District according to the following rate schedule:

Effective Date	Monthly Delivery Charge	Usage Charge per Unit[1]
July 1, 2021 through June 30, 2022	$11,769.00	$0.35
July 1, 2022 through June 30, 2023	$12,004.00	$0.36
July 1, 2023 through June 30, 2024	$12,244.00	$0.37

1. One (1) Unit is equal to 100 cubic feet of water

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

The District shall provide the City with monthly computations 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 the Delivery Charge 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 one year period at the current rate schedule. The renewal shall be automatic and shall commence on July 1st of the succeeding period and shall expire on June 30th of the succeeding period. 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 Council 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: _____
Joel Gehrett, General Manager

ATTEST:

By: _____
~~Gary Dinkel~~, Chairman, Board of Commissioners
of Deschutes Valley Water District
Kathy Marston

CITY OF MADRAS ("CITY")

By: _____
Richard Ladeby, Mayor of the City of Madras

ATTEST:

By: _____
Lysa Vattimo, City Recorder of the City of Madras

Appendix E

AWWA Water Audit

AWWA Free Water Audit Software v6.0

FWAS v6.0

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format and is not meant to take the place of a full-scale, comprehensive water audit format. Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targeting loss reduction levels. This tool contains several separate worksheets. Sheets can be accessed using the tabs at the bottom of the screen, or by clicking the TOC links below.

Table of Contents (TOC)

AWWA Web Resources for Water Loss Control

https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control

Items referenced in the Free Water Audit Software v6.0 on the web:

- Data Grading Matrix v6.0
- Example Water Audit v6.0
- Water Audit Compiler v6.0
- AWWA Reports on Performance Indicators
- M36 Manual

Enter Basic Information

Name of Utility:	Deschutes Valley Water District
Name of Contact Person:	Joel Gehrett
Email:	jgehrett@dvwd.org
Telephone | Ext.:	541.475.3849
City/Town/Municipality:	Madras
State / Province:	Oregon (OR)
Country:	
Audit Preparation Date:	
Audit Year:	2021
Audit Year Label:	2021 (Fiscal, Calendar, etc)
Audit Period Start Date:	Jan 01 2021
Audit Period End Date:	Dec 31 2021
Volume Reporting Units:	Million gallons (US)
Water System Structure:	Retail
Water Type:	Potable Water
System ID Number:	
Validator Name/ID:	
Validator Email:	
Estimated Total Population Served by Water Utility:	

Key of Input Acronyms

In order of appearance in the Worksheet

VOS	Volume from Own Sources
VOSEA	VOS Error Adjustment
WI	Water Imported
WIEA	WI Error Adjustment
WE	Water Exported
WEEA	WE Error Adjustment
BMAC	Billed Metered Authorized Consumption
BUAC	Billed Unmetered Authorized Consumption
UMAC	Unbilled Metered Authorized Consumption
UUAC	Unbilled Unmetered Authorized Consumption
SDHE	Systematic Data Handling Errors
CMI	Customer Metering Inaccuracies
UC	Unauthorized Consumption
Lm	Length of mains
Nc	Number of service connections
Lp	Average length of (private) customer service line
AOP	Average Operating Pressure
CRUC	Customer Retail Unit Charge
VPC	Variable Production Cost

Color Key User input | Calculated | Optional default

Guidance for the Worksheet

Choosing to enter unit of **percent** or **volume** (applies to VOSEA, WIEA, WEEA, CMI) choose entry option:

1.00%	percent	*or*
	volume	25.000

Choosing to enter **default** or **custom input** (applies to UUAC, SDHE, UC) choose entry option:

0.25%	default	*or*
	custom	75.000

Guidance for the Interactive Data Grading

Use acronym buttons in IDG header to navigate among inputs. Acronym Key above. White = needs answers, orange = complete, clear = not required. Example below.

VOS	VOSEA	WI	WIEA	WE	WEEA	BMAC	BUAC	UMAC	UUAC
SDHE	CMI	UC	Lm	Nc	Lp	AOP	CRUC	VPC	

After clicking an acronym button, answer all visible questions in the order they're presented, choosing best-fit answer

Grade will populate when all visible questions are complete for an input: **7**

The limiting criteria will be labeled along the right. If only 1 limiting criterion is shown, improving on that criterion will achieve a higher data grade. If multiple limiting criteria are shown, improving on *each* limiting criterion is necessary to achieve a higher data grade. A complete inventory of data grading criteria is available in the Data Grading Matrix v6.0 (see web resources)

Limiting

If you have questions or comments regarding this software please contact us at: wlc@awwa.org

AWWA Free Water Audit Software: Worksheet

FWAS v6.0

Water Audit Report for: Deschutes Valley Water District
Audit Year: 2021 | Jan 01 2021 - Dec 31 2021 | 2021

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments

							choose entry option:				
VOS	Volume from Own Sources:	n	g	6	1,641.326	MG/Yr	n	g	4	percent	VOSEA
WI	Water Imported:	n	g	n/a	0.000	MG/Yr					WIEA
WE	Water Exported:	n	g	n/a	0.000	MG/Yr					WEEA
	WATER SUPPLIED:				1,641.326	MG/Yr					

AUTHORIZED CONSUMPTION

										choose entry option:	
BMAC	Billed Metered:	n	g	7	1,493.051	MG/Yr					
BUAC	Billed Unmetered:	n	g	8	33.818	MG/Yr					
UMAC	Unbilled Metered:	n	g	n/a		MG/Yr					
UUAC	Unbilled Unmetered:	n	g	3	3.817	MG/Yr				0.25% default	

Default option selected for Unbilled Unmetered, with automatic data grading of 3

AUTHORIZED CONSUMPTION: 1,530.686 MG/Yr

WATER LOSSES

110.640 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

										choose entry option:	
SDHE	Systematic Data Handling Errors:	n	g	3	3.817	MG/Yr				0.25% default	
CMI	Customer Metering Inaccuracies:	n	g	1	38.283	MG/Yr				2.50% percent	under-registration
UC	Unauthorized Consumption:	n	g	3	3.817	MG/Yr				0.25% default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 45.918 MG/Yr

Real Losses

Real Losses: 64.722 MG/Yr

WATER LOSSES: 110.640 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 114.457 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	8	354.6	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	8	4,646		(active *and* inactive)
	Service connection density:				13	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				Yes		
Lp		n	g	10			

Average length of customer service line has been set to zero and a data grading of 10 has been applied

AOP	Average Operating Pressure:	n	g	7	150.0	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	1	$25.37	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	3	$50.00	$/Million gallons		$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier III (51-70). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Volume from Own Sources (VOS)
2: Customer Metering Inaccuracies (CMI)
3: Customer Retail Unit Charge (CRUC)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

VOSEA WI 3 UUAC

White = incomplete

3 VPC

Use acronyms for navigation

details)

go to input

Volume from Own Sources (VOS) - Data Grading Criteria

go to notes

vos	Criteria Question	Select Best-Fit Answers to All Visible Questions	
vos.0	Did the water utility supply any water from its own sources during the audit year?	Yes	
vos.1	What percent of own supply volume is metered?	>99%	

For questions 2-10 below: Choose the answer that applies for those meters that measure >90% of the finished water volume.
In-situ flow accuracy testing = a test process that confirms the flow measuring accuracy of the primary device (the flowmeter), in its installed location, using an independent reference volume.
Electronic calibration = a process that checks for error in the metering secondary device(s) and/or the tertiary device(s).
Secondary device can include conversion to mA, meter transmitter or similar instrumentation.
Tertiary device can include SCADA, historian or other computerized archival system.

vos.2	What is the frequency of electronic calibration?	At least semi-annually	
vos.3	What level of data transfer errors are checked as part of the electronic calibration process?	Data transfer errors are checked at secondary device(s), but no tertiary device(s) exist	
vos.4	Is the most recent electronic calibration documentation available for review?	Yes	
vos.5	What is the frequency of in-situ flow accuracy testing?	Less than annual but within last 5 years	
vos.6	Is the most recent in-situ flow accuracy testing documentation available for review?	Yes	
vos.7	What are the total volume-weighted average results of in-situ flow accuracy testing (during or closest to audit year)?	Between ±3% to ±6%	
vos.8	Have testing and calibration procedures been closely scrutinized for compliance with procedures described in the AWWA M36 and/or M33 Manual(s)?	Yes	
vos.9	Which best describes the frequency of finished water meter readings?	Once per month	Limiting
vos.10	Which best describes the frequency of data review for anomalies/errors? These can include numbers that are outside of typical patterns, and zero or 'null' values that may reflect a gap in data recording.	Once per month	Limiting
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**6**	

go to input

Volume from Own Sources Error Adjustment (VOSEA) - Data Grading Criteria

go to notes

vosea	Criteria Question	Select Best-Fit Answers to All Visible Questions	
vosea.1	Are tank levels monitored automatically & recorded daily?	Yes	
vosea.2	Are daily changes of stored water volumes in distribution system tanks included in the tabulation of the daily "Volume from Own Sources" quantity?	Yes	
vosea.3	Is the annual net distribution storage change included in either the VOS input or the VOSEA input?	No	
vosea.4	Are the flow accuracy test and/or electronic calibration results included in the VOSEA input in the water audit?	Results are available but not analyzed	Limiting
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**4**	

go to input

Water Imported (WI) - Data Grading Criteria

go to notes

wi	Criteria Question	Select Best-Fit Answers to All Visible Questions
wi.0	Did the water utility import any water during the audit year?	No
wi.1		

For questions 2-10 below: Choose the answer that applies for those meters that measure >90% of the water imported volume.
In-situ flow accuracy testing = a test process that confirms the flow measuring accuracy of the primary device (the flowmeter), in its installed location, using an independent reference volume.
Electronic calibration = a process that checks for error in the metering secondary device(s) and/or the tertiary device(s).
Secondary device can include conversion to mA, meter transmitter or similar instrumentation.
Tertiary device can include SCADA, historian or other computerized archival system.

wi.2		
wi.3		
wi.4		
wi.5		
wi.6		
wi.7		
wi.8		
wi.9		
wi.10		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**n/a**

go to input

Water Imported Error Adjustment (WIEA) - Data Grading Criteria

go to notes

wiea	Criteria Question	Select Best-Fit Answers to All Visible Questions
wiea.1		
wiea.2		
wiea.3		
wiea.4		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**n/a**

go to input

Water Exported (WE) - Data Grading Criteria

go to notes

we	Criteria Question	Select Best-Fit Answers to All Visible Questions
we.0	Did the water utility export any water during the audit year?	No
we.1		

For questions 2-10 below: Choose the answer that applies for those meters that measure >90% of the water exported volume.
In-situ flow accuracy testing = a test process that confirms the flow measuring accuracy of the primary device (the flowmeter), in its installed location, using an independent reference volume.
Electronic calibration = a process that checks for error in the metering secondary device(s) and/or the tertiary device(s).
Secondary device can include conversion to mA, meter transmitter or similar instrumentation.
Tertiary device can include SCADA, historian or other computerized archival system.

we.2		
we.3		
we.4		
we.5		
we.6		
we.7		
we.8		
we.9		
we.10		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**n/a**

go to input

Water Exported Error Adjustment (WEEA) - Data Grading Criteria

go to notes

weea	Criteria Question	Select Best-Fit Answers to All Visible Questions
weea.1		
weea.2		
weea.3		
weea.4		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**n/a**

go to input

Billed Metered Authorized Consumption (BMAC) - Data Grading Criteria

go to notes

bmac	Criteria Question	Select Best-Fit Answers to All Visible Questions	
bmac.0	Were any customers metered in the audit year?	Yes	
bmac.1	For billed metered accounts, what % of bills are estimated in a typical billing cycle?	5% or less	
bmac.2	How often does the utility read its customer meters? For systems with multiple read frequencies, select the reading frequency that describes the majority of your customers.	Monthly	
bmac.3	Is the BMAC volume pro-rated to represent consumption occuring exactly during the audit period?	Yes	
bmac.4	How frequently does internal review by utility staff of the BMAC volumes occur?	More frequently than annually but less than every billing cycle	
bmac.5	What level of detail is examined in the internal review of BMAC volumes?	Sum total only	Limiting
bmac.6	When was the most recent billing data review by someone who is independent of the utility billing process?	More than 5 years ago, or not sure	
bmac.7			
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**7**	

go to input

Billed Unmetered Authorized Consumption (BUAC) - Data Grading Criteria

go to notes

buac	Criteria Question	Select Best-Fit Answers to All Visible Questions	
buac.0	Was there any billed consumption on unmetered accounts in the audit year?	Yes	
buac.1	What portion of billed accounts are unmetered (% by number of accounts)?	5% or less	
buac.2	Methodology to quantify consumption for unmetered accounts?	Estimated for each unmetered customer OR derived from representative statistical samples of the system	
buac.3	How frequently is unmetered customer consumption estimated?	Bi-monthly	Limiting
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**8**	

go to input

Unbilled Metered Authorized Consumption (UMAC) - Data Grading Criteria

go to notes

umac	Criteria Question	Select Best-Fit Answers to All Visible Questions
umac.0	Did the water utility have any unbilled-metered consumption in the audit year?	No
umac.1		
umac.2		
umac.3		
umac.4		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**n/a**

go to input

Unbilled Unmetered Authorized Consumption (UUAC) - Data Grading Criteria

go to notes

This Data Grading Criteria is hidden when the 'default' input is used on the Worksheet

FINAL DATA GRADE FOR THIS AUDIT INPUT:	3

go to input

Systematic Data Handling Error (SDHE) - Data Grading Criteria

go to notes

This Data Grading Criteria is hidden when the 'default' input is used on the Worksheet

FINAL DATA GRADE FOR THIS AUDIT INPUT: **3**

go to input

Customer Metering Inaccuracies (CMI) - Data Grading Criteria

go to notes

cmi	Criteria Question	Select Best-Fit Answers to All Visible Questions	
cmi.0	Was there any metered customer usage during the audit period?	Yes	
cmi.1	Do you test meters reactively (when triggered by customer complaint or billing/consumption flag)?	No reactive testing conducted	Limiting
cmi.2	For small size customer meters, which best describes the frequency of proactive testing (effort beyond when triggered by customer complaint or billing/consumption flags)?	Recurring, within 5 years prior to audit period	
cmi.3	Which best describes what meters are included in the proactive small size customer meter testing activities?	Testing targeted to subsets of meters ie oldest meters	
cmi.4	For mid and large size customer meters, which best describes the frequency of the proactive testing program?	Recurring, within 5 years prior to audit period, but less frequently than annually	
cmi.5	Which best describes what meters are included in the proactive mid- and large customer meter testing activities?	Proactive - all large meters are on a testing schedule	
cmi.6	Which best describes how the input was derived?	No test results were used, but at least 50% of meter stock has been replaced within two years of the audit period	
cmi.7	Has the input derivation been reviewed by someone with expert knowledge in the M36 methodology?	Yes	
cmi.8	To what extent does meter replacement occur and for which meters?	Proactive replacement informed by meter accuracy testing and study of meter performance trends	
cmi.9	Which best describes the reliability of meter installation records?	Records are kept for meter installations, and they include data on installation date, type, size, and manufacturer	
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**1**	

go to input

Unauthorized Consumption (UC) - Data Grading Criteria

go to notes

This Data Grading Criteria is hidden when the 'default' input is used on the Worksheet

FINAL DATA GRADE FOR THIS AUDIT INPUT:	3

go to input

Length of Mains (Lm) - Data Grading Criteria

go to notes

Lm	Criteria Question	Select Best-Fit Answers to All Visible Questions	
Lm.1	How was the input derived?	Derived directly from Mains inventory (GIS, ledger, etc)	
Lm.2	Are hydrant laterals included in the input derivation?	No	Limiting
Lm.3	Which best describes how the Mains inventory (GIS, ledger, etc) is kept up to date?	Additions or subtractions are updated in the mains inventory (GIS, ledger, etc), at least annually	
Lm.4	Which best describes how the Mains inventory (GIS, ledger, etc) is field validated to confirm field conditions match the inventory?	Field validation is accomplished (i.e. in daily operations or specific validation projects)	
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**8**	

go to input

Number of Service Connections (Nc) - Data Grading Criteria

go to notes

Nc	Criteria Question	Select Best-Fit Answers to All Visible Questions	
Nc.1	How was the input derived?	Extracted from Services inventory (GIS, billing system, etc)	
Nc.2	What is the count of services based on?	Non-premise based, i.e. meter count, customer count	Limiting
Nc.3	Are inactive (but still pressurized) service lines included in the input? These may be metered or unmetered.	Yes	
Nc.4	Which best describes how the inventory of service connections (GIS, billing system, etc) is kept up to date?	Additions or subtractions are updated in the service line inventory (GIS, billing system, etc), at least annually	
Nc.5	Which best describes how the inventory of service connections (GIS, billing system, etc) is field validated to confirm field conditions match the inventory?	Field validation is accomplished for the entire system (i.e. in daily operations or specific validation projects)	
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**8**	

go to input

Average Length of (Private) Customer Service Line (Lp) - Data Grading Criteria

go to notes

Lp	Criteria Question	Select Best-Fit Answers to All Visible Questions
Lp.0	Are customer meters typically located at the curbstop or property line?	Yes
Lp.1		
Lp.2		
Lp.3		
Lp.4		
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**10**

go to input

Average Operating Pressure (AOP) - Data Grading Criteria

go to notes

aop	Criteria Question	Select Best-Fit Answers to All Visible Questions	
aop.1	Which best describes checks on the boundary integrity for the system's pressure zone(s)?	Normally-closed boundary valves between zones have been confirmed within the past 3 years to be fully closed	
aop.2	Which best describes how one-time pressure readings (i.e. from hydrants) are collected?	Collected annually during routine system flushing and/or hydrant testing	
aop.3	Which best describes where continuous pressure data (via temporary data loggers or permanent telemetry) is collected?	At zone boundary conditions only (i.e. supply entry points, PRVs, booster stations)	
aop.4	Which best describes how continuous pressure data is collected?	Temporary data logger(s) deployed, but limited and not capturing seasonal variation during the year	Limiting
aop.5	How was the input derived?	Calculated from field data as a simple average	Limiting
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**7**	

go to input

Customer Retail Unit Charge (CRUC) - Data Grading Criteria

go to notes

cruc	Criteria Question	Select Best-Fit Answers to All Visible Questions	
cruc.0	Was any metered consumption billed on a volumetric basis in the audit period?	Yes	
cruc.1	Which best describes the use and reliability of the current rate structure?	Customer bill calculations have not been checked to confirm the rate structure is correctly implemented	Limiting
cruc.2	Choose the option that best describes how the input was derived	Rate structure has multiple volumetric rates, but only one rate was selected for this input	
cruc.3	Is there any additional volumetric revenue the utility receives that depends on water meter readings, such as sewer?	No	
cruc.4	Has the input derivation been reviewed by someone with expert knowledge in the M36 methodology?	No	
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**1**	

go to input

Variable Production Cost (VPC) - Data Grading Criteria

go to notes

vpc	Criteria Question	Select Best-Fit Answers to All Visible Questions	
vpc.1	Choose the option that best describes how the input was derived	Only one source of water exists, which was the basis for the input derivation	
vpc.2	Choose the option that best describes which short-run marginal costs have been included in the input, using the definitions below for reference. Short-run marginal costs can include the following: - chemicals + power for treatment, typically applicable if the utility is producing/treating water - power for distribution, typically applicable if pumps exist in the distribution network - water acquisition costs, typically applicable if the utility is purchasing water or incurs any extraction costs for withdrawing from a source Some short-run marginal costs may not be applicable. The auditor should analyze the system characteristics to determine which costs are applicable for inclusion in the VPC input derivation. See also the latest AWWA M36 Manual for further guidance.	Some but not all applicable short-run marginal costs are included	Limiting
vpc.3	Choose the option that best describes which long-run marginal costs have been included in the input, using the definitions below for reference. Long-run marginal costs can include the following: - water treatment residuals management, typically applicable if solids are produced from water treatment process - accelerated wear & tear on dynamic equipment, typically applicable if pumps exist for treatment and/or distribution, or any other equipment exists that wears out as a function of use instead of time (i.e. filter media, chemical dosing pumps, uv disinfection bulbs, etc) - payouts for damage claims from main and service line breaks, typically applicable if damage claims are paid by the utility - accelerated expansion of supply capacity, typically applicable if the utility is at or nearing supply capacity, or scarecity costs in water scarce areas - full cost pricing that includes all lifecycle costs and externalities (internalized or not) Some long-run marginal costs may not be applicable. The auditor should analyze the system characteristics to determine which costs are applicable for inclusion in the VPC input derivation. See also the latest AWWA M36 Manual for further guidance.	Long-run marginal costs have been evaluated for applicability, and some but not all applicable costs are included	
vpc.4	Has the input derivation been reviewed by someone with expert knowledge in the M36 methodology?	No	
	FINAL DATA GRADE FOR THIS AUDIT INPUT:	**3**	

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

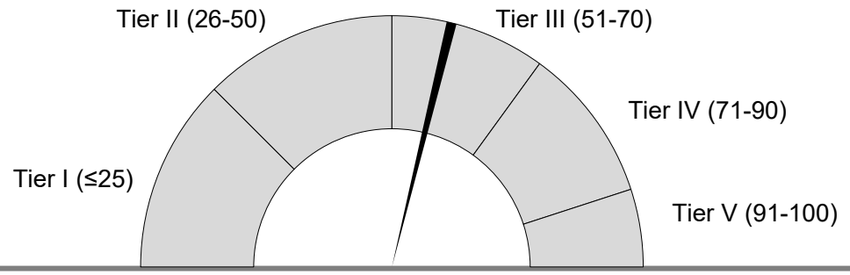
go to worksheet | go to grading | go to references

Water Audit Report for: Deschutes Valley Water District **Audit Year:** 2021 ## **Jan 01 2021 - Dec 31 2021**

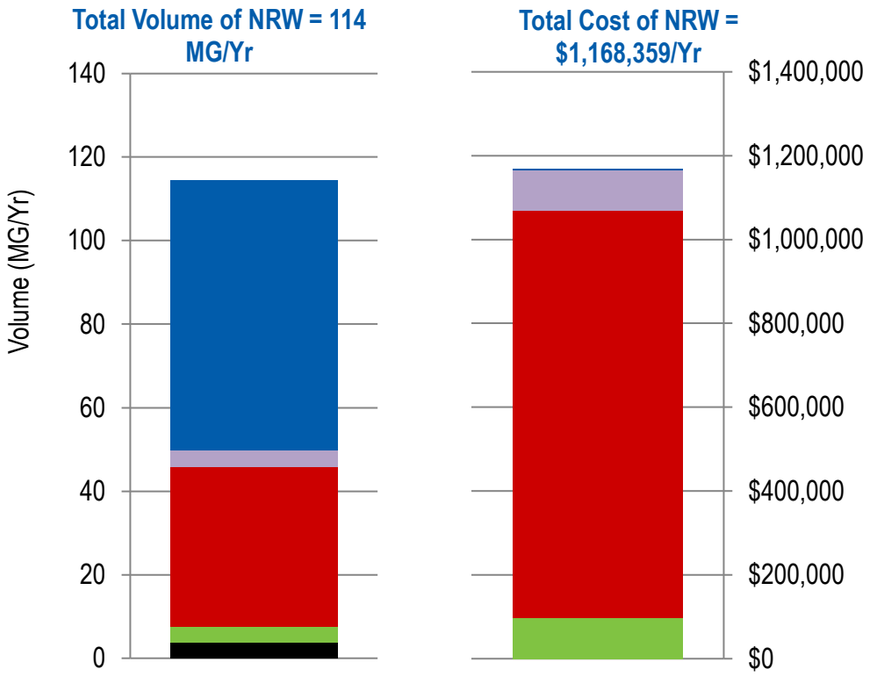
Data Validity

Data Validity Score: 57 **Data Validity Tier:** Tier III (51-70)

See Loss Control Planning for Tier Details



NRW Components Summary

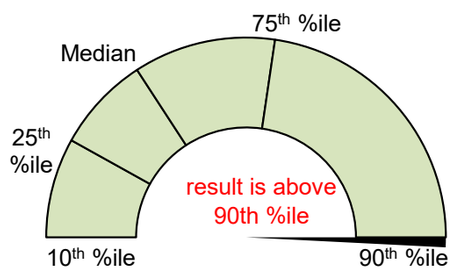


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	45.9	$1,164,932	CRUC
Real Losses	64.7	$3,236	VPC
Unbilled Authorized Cons	3.8	$191	VPC
Non-Revenue Water	114.5	$1,168,359	Blended

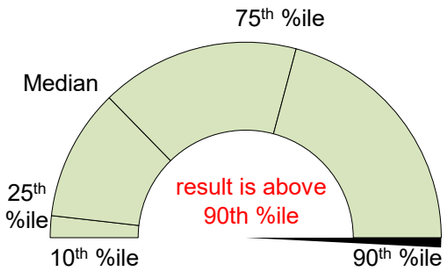
Actual KPI result — Target (see Worksheet)

Key Performance Indicators

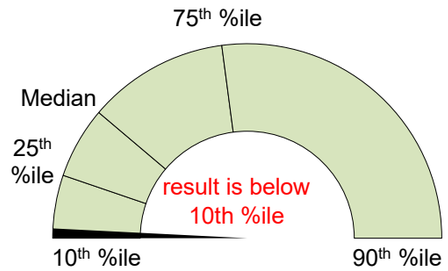
gauge %iles per validated industry ranges[2]



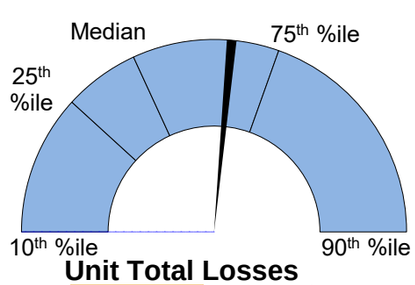
Total Loss Cost Rate
251.44 $/conn/year



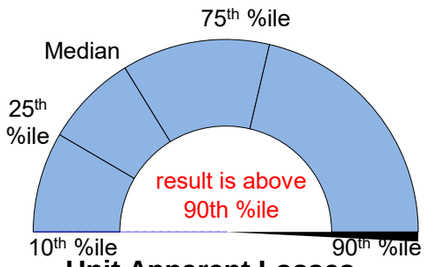
Apparent Loss Cost Rate
250.74 $/conn/year



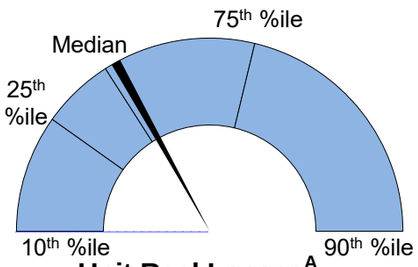
Real Loss Cost Rate
0.70 $/conn/year



Unit Total Losses
65.2 gal/conn/day

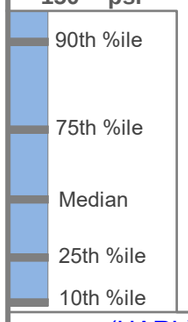


Unit Apparent Losses
27.1 gal/conn/day

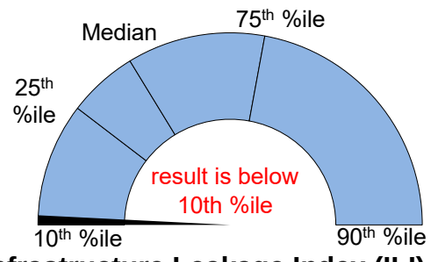


Unit Real Losses[A]
38.2 gal/conn/day

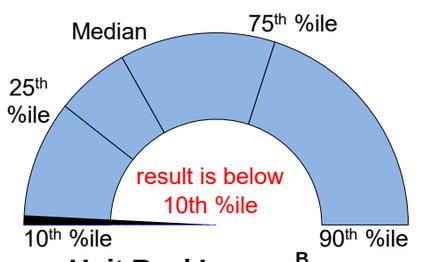
Average Operating Pressure
150 psi



AOP is above 90th %ile



Infrastructure Leakage Index (ILI)
0.5 dimensionless



Unit Real Losses[B]
500 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	143.2 MG/Yr	84.4 gal/conn/day

Guidance Information for Key Performance

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[5].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes					Uses and Limitations	Principal Users
			Assessment	Bench-Marking	Target-Setting	Planning	Tracking		
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with “low” connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software
Water Balance

Water Audit Report for: Deschutes Valley Water District
Audit Year: 2021 Jan 01 2021 - Dec 31 2021
Data Validity Tier: Tier III (51-70)

FWAS v6.0

Volume from Own Sources (VOS)
(corrected for known errors)
1,641.326

Water Imported (WI)
(corrected for known errors)
0.000

System Input Volume
1,641.326

Water Exported (WE)
(corrected for known errors)
0.000

Water Supplied
1,641.326

Billed Water Exported

Revenue Water (Exported)
0.000

Authorized Consumption
1,530.686

Billed Authorized Consumption
1,526.869

Billed Metered Consumption (BMAC)
(water exported is removed)
1,493.051

Billed Unmetered Consumption (BUAC)
33.818

Revenue Water
1,526.869

Unbilled Authorized Consumption
3.817

Unbilled Metered Consumption (UMAC)
0.000

Unbilled Unmetered Consumption (UUAC)
3.817

Non-Revenue Water (NRW)
114.457

Water Losses
110.640

Apparent Losses
45.918

Systematic Data Handling Errors (SDHE)
3.817

Customer Metering Inaccuracies (CMI)
38.283

Unauthorized Consumption (UC)
3.817

Real Losses
64.722

Leakage on Transmission and/or Distribution Mains
Not broken down

Leakage and Overflows at Utility's Storage Tanks
Not broken down

Leakage on Service Connections
Not broken down

AWWA Free Water Audit Software: Determining Water Loss Standing

FWAS v6.0

Water Audit Report for: Deschutes Valley Water District
Audit Year: 2021 Jan 01 2021 - Dec 31 2021
Data Validity Tier: Tier III (51-70)

Water Loss Control Planning Guide

Functional Focus Area	Water Audit Data Validity Tier (Score Range)				
	Tier I (1-25)	**Tier II (26-50)**	**Tier III (51-70)**	**Tier IV (71-90)**	**Tier V (91-100)**
Audit Data Collection	Launch auditing and loss control team; address supply metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations; Identify data gaps; improve supply metering	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs; Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or AMR/AMI system	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon with PIs for performance comparisons for real losses	Performance Benchmarking with PIs is meaningful in comparing real loss standing	Identify Best Practices/ Best in class; PIs are very reliable as real loss performance indicators for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.

Appendix F

Customer Bill Inserts

CYCLE & SOAK: Watering Tips: How long *should I water?*

Grass and plants have different watering needs

Sprinklers ***Cycle & Soak***

- **3 cycles** per watering day
- **1 hour** between each cycle
- **5 minutes** for fixed spray or **10 minutes** for a rotating spray head

Drip Irrigation ***Low & Slow***

- **1 cycle** per watering day
- **20-30** minutes for high-flow emitters
- **30-90** minutes for low-flow emitters

Additional Tips

- Monitor your landscape and adjust this schedule if needed
- Avoid watering between 10 am and 8 pm
- Avoid grass on slopes or in narrow areas that are difficult to water
- Trim around sprinkler heads
- Adjust sprinkler heads so they don't spray walls, driveways or sidewalks
- Check irrigation system regularly and replace broken or missing parts

YOU MAY BE SURPRISED THAT YOUR LAWN & GARDEN ARE HEALTHIER WHEN WATERED LESS FREQUENTLY & MORE DEEPLY!

GET WINTERIZED!

Some helpful tips to prevent your pipes from freezing

- **Insulate your meter** - Wood chips/shaved animal bedding, pre-made meter insulation pillows from the hardware store or household insulation work well. Make sure the register of the meter is showing and if you have a new radio read meter, make sure the antenna is above the insulation.
- **Insulate outside faucets/hose bibs** - Use molded styrofoam covers for faucets - Don't forget to disconnect & drain your garden hoses.
- **Cover foundation vents and close off all crawl spaces** - Hardware stores carry styrofoam vent covers. Wrap all pipes in unheated areas such as crawl spaces, garages, attics or basements. Caulk around pipes where they enter the house, if needed.

Check our webpage at www.dvwd.org for more winterizing tips!