# UPPER GRANDE RONDE RIVER WATERSHED PARTNERSHIP
# PLACE-BASED INTEGRATED WATER RESOURCES PLANNING

## UNION COUNTY, OREGON

## INTEGRATED WATER RESOURCES NEEDS AND VULNERABILITIES REPORT

**April 2019**

This project is funded through the Oregon Water Resources Department
Place-Based Integrated Water Resources Planning Grant

# Table of Contents

**TABLES**



**FIGURES**

**APPENDICES**



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# Acronyms and Definitions

This list includes acronyms and defined terms used in this report in alphabetical order. Definitions appear in parenthesis following the acronym. More detailed definitions of key terms are included in Section 2.0 Analysis Framework. Acronyms are also defined in their first instance of use in each section of this report.

**AF** - acre-feet.

**Agricultural demand** - amount of water needed to meet irrigation requirements in the Upper Grande Ronde River Watershed.

**Agrimet** - weather station.

**Annual demand** - total water volume delivered in a year (acre-feet).

**ADD** - Average daily demand is the total annual volume delivered divided by 365 days.

**BIR** - Basin Investigation Report.

**Bi-weekly** - two-week period.

**Crop consumptive demand** - demand based on evapotranspiration.

**CTUIR** - Confederated Tribes of the Umatilla Indian Reservation.

**Current demand** - estimated demand as of 2018.

**CFS** - cubic feet per second.

**CWPP** - Community Wildfire Protection Plan.

**Demand** - this report does not distinguish between a “need” and a “demand” but refers to all uses of water as demands. Need is included in the title of this report as recommended by the Oregon Water Resources Department for this planning step.

**DEQ** - Oregon Department of Environmental Quality.

**Effective precipitation** - the portion of rainfall that contributes to meeting the water needs of growing crops.  Precipitation that either runs off the surface or percolates below the root zone cannot be utilized by the crop and is not considered effective precipitation.

**EOP** - Union County Emergency Operations Plan.

**ESA** - Endangered Species Act.

**ET** - evapotranspiration.

**Future demand** - estimated demand as of 2068 (50-year planning horizon).

**FSA/OAIN** - Farm Service Agency/Oregon Agriculture Information Network.

**FWT** - The Freshwater Trust.

**Gallons per capita per day** - the average daily demand divided by population.

**GIRW** - gross irrigation water requirement: net irrigation water requirement adjusted for losses due to conveyance/application inefficiencies.

**GIS** - Geographic Information Systems.

**gpd** - gallons per day.

**Groundwater** - alluvial and basalt aquifers in the Upper Grande Ronde River Watershed.

**GRMW** - Grande Ronde Model Watershed.

**IMBO** - Agrimet Imbler weather station.

**Instream Demand** - water quality and quantity needed to support instream functions including recreation and aquatic life. This is also defined as non-consumptive use.

**Irrigated acres** - agricultural land with water rights that is irrigated.

**ISWR** - instream water right (legal water rights for instantaneous streamflow levels that need to remain instream and carry a priority date. These are established through Oregon's Instream Water Right Act [1987]. These rights can be requested by the Oregon Department of Fish and Wildlife, the Oregon Department of Environmental Quality, or Oregon Parks and Recreation Department).

**IWM** - irrigation water management.

**Kimberly-Penman** - evapotranspiration equation.

**LOCA downscaling** - localized constructed analogs are statistically downscaled climate projections for North America.

**Maximum daily demand** - largest volume delivered in a single day.

**Municipal demand** - this is composed of three components municipal (city demand), unincorporated demand, and self-supplied industrial demand (self-supplied industrial use demand).

**Municipal "city" demand** - (demand for water by entities connected to the municipal water system including commercial businesses, residences, schools, parks, industry, etc.).

**NCAR** - National Center for Atmospheric Research.

**NRC** - National Research Council.

**NWS** - National Weather Service.

**Natural Hazards Mitigation Plan** - Oregon's statewide hazards plan.

**Natural Stream Flow** - gauged data minus consumptive use.

**Need** - this report does not distinguish between a "need" and a "demand" but refers to all uses of water as demands. Need is included in the title of this report as recommended by the Oregon Water Resources Department for this planning step.

**NIWR** - net irrigation water requirement was calculated by taking the composite evapotranspiration and subtracting the portion of the crop water use supplied by effective precipitation (Pe): NIWR = ET – Pe.

**NRCS** - Natural Resources Conservation Service.

**ODA** - Oregon Department of Agriculture.

**OHA** - Oregon Health Authority.

**ODFW** - Oregon Department of Fish and Wildlife.

**OPRD** - Oregon Parks and Recreation Department.

**OSU** - Oregon State University Extension Office.

**Out-of-stream demand** - water quality and quantity needed to support agricultural use, municipal use, and industrial use. This is also defined generally as a consumptive use, although there are some exceptions such as the use of stream flow to generate hydropower for municipal use.

**Oregon Method** - A method developed by ODFW to calculate instream water rights.

**OWRD** - Oregon Water Resources Department.

**Perman-Montieth** - model used in agricultural demand calculations.

**PCD** - per capita demand.

**POU** - point of use.

**Pour point** - the location in each subwatershed where water first flows into the watershed and from which demand quantities and qualities are calculated from.

**PRISM** - spatial and temporal climate model.

**PSU** - Portland State University.

**QQ** - quarter-quarter.

**RCP 8.5** - representative concentration pathway 8.5 (climate model).

**ROS** - rain-on-snow event.

**SCS** - Soil Conservation Service.

**SSIU** - self-supplied industrial use demand (demand for water by industrial users that are not connected to the municipal water supply system).

**Stakeholder Committee** - all members of the Upper Grande Ronde River Watershed Partnership that have signed on to the governance agreement.

**Steering Committee** - smaller group with representatives from each demand group that conducts planning and administrative work that is approved and reviewed by the Stakeholder Committee.

**Step 1** - convene a group (outcome of this step was a signed governance agreement that described the way the group would work during this process).

**Step 2** - estimate water supply.

**Step 3** - estimate water demand.

**Step 4** - consider solutions to balance supply and demand.

**Step 5** - develop an action plan to implement solutions.

**Subwatershed** - the Upper Grande Ronde River Watershed is broken into eight subwatersheds that are assessed in this report.

**SW** - surface water.

**SWE** - snow water equivalent.

**TMDL** - total maximum daily load is a regulatory term in the Clean Water Act describing a plan to restore impaired waterbodies. It is the maximum amount of a given pollutant that the waterbody can receive while still meeting water quality standards.

**TAF** - thousand acre-feet.

**TDS -** total dissolved solids.

**TRSQQ** - township range section quarter quarter.

**UGRRW** - Upper Grande Ronde River Watershed.

**UGRRW Partnership** - Upper Grande Ronde River Watershed Partnership.

**Unaccounted for water** - or "leakage" or "system loss:" the difference between metered production and metered consumption (Oregon Water Resources Department, 2017b).

**Unincorporated demand** - demand for water by residences and others located outside of the city limits and not connected to the municipal water supply system.

**Union County** - convener of the Place-Based Planning effort.

**Union County Farm Bureau** - farming advocacy group.

**USFS** - U.S. Forest Service.

**USGS** - U.S. Geological Survey.

**USDA** - U.S. Department of Agriculture.

**VIC -** Variable Infiltration Capacity.

**Vulnerability** - level of risk for each demand group in each subwatershed (how likely that demands are not met).

**Water Availability** - water supply minus consumptive uses.

**Water Balance** - water supply, minus water demand on a bi-weekly period in each subwatershed.

**Water Demand Technical Committee** - technical partners conducting work and analysis on water demand topics for review by the Stakeholder committee.

**Water Rights** - legal ownership of water.

**WMCP** - Water Management and Conservation Plan is a document prepared by a water supplier to describe its current and projected utilization, management, and conservation of water resources.

**Working Groups** - agricultural demand, municipal demand, instream demand, and natural hazards/climate change.

**WSMP** - Water System Master Plan is a document describing water facility and processes especially as they related to satisfying regulations associated with the Safe Water Drinking Act.

**WY** - water year.

# Acknowledgements

In a Stakeholder Committee meeting, including the entire Upper Grande Ronde River Watershed (UGRRW) Partnership, Step 3 tasks were explained and membership in the Water Demand Technical Committee for Step 3 was solicited. Members of the Partnership volunteered to assist on the Water Demand Technical Committee. There were also four working groups that met frequently to complete analysis for agricultural demand, municipal demand, instream demand, and natural hazards/climate change. These teams worked to compile data, draft reports, and determine the most relevant and useful information to help describe the water supply (quantity and quality) and ecological issues in the UGRRW. The members of these teams include:

### *Water Demand Technical Committee*

- Smita Mehta and John Dadoly (Oregon Department of Environmental Quality)
- Steve Parrett, Rachel LovellFord, Jordan Beamer, Shad Hattan, and Phillip Marcy (Oregon Water Resources Department [OWRD])
- Connar Stone (Grande Ronde Model Watershed [GRMW])
- Donna Beverage, Darcy Carreiro, and Scott Hartell (Union County)
- Timothy Bailey, Adrienne Averett, and Nick Myatt (Oregon Department of Fish and Wildlife [ODFW])
- Allen Childs and Anton Chiono (Confederated Tribes of the Umatilla Indian Reservation [CTUIR])
- Margaret Matter (Oregon Department of Agriculture [ODA])
- Brett Moore and Dana Kurtz (Anderson Perry & Associates, Inc.)
- Jed Hassinger (Union County Farm Bureau)
- Kyle Carpenter (City of La Grande)
- Maren Peterson (Eastern Oregon University)
- Rod McKee (City of Union)

### *Agricultural Demand*

- Jed Hassinger (Union County Farm Bureau)
- Darrin Walenta (Oregon State University Extension Office)
- Margaret Matter (ODA)
- Darrell Dyke (Bureau of Reclamation)
- Mike Burton and Nick Vora (Natural Resources Conservation Service)
- Shad Hattan (OWRD)
- Spencer Sawaske (The Freshwater Trust [FWT])

### *Municipal Demand*

- Steve Parrett (OWRD)
- Kyle Carpenter (City of La Grande)
- Rod McKee (City of Union)

### Instream Demand

- Tim Bailey (ODFW)
- Jeff Oveson (GRMW)
- Tony Malmberg (FWT)
- Anton Chiono (CTUIR)

### Natural Hazards/Climate Change

- J.B. Brock (Union County)
- Bill Gamble (U.S. Forest Service)
- Margaret Matter (ODA)
- Connar Stone (GRMW)

# Executive Summary

## Section 1.0: Introduction

The Upper Grande Ronde River Watershed (UGRRW) Partnership brings together a variety of stakeholders to help communities plan for future water needs. The UGRRW Partnership identified eight subwatersheds within the planning area. This report identifies estimated demands on current and future water resources and discusses vulnerabilities to water systems as a result of these analysis. By understanding these demands, partners may identify existing challenges, project future challenges, and work together to develop long-term solutions. It is critical that these solutions balance environmental, social, and economic needs. This report will be used to assist with focusing the research of Step 4 "Develop Integrated Solutions for Meeting Long-Term Water Needs" on priority areas in the UGRRW in combination with Step 2 "Characterizing Water Resources."

## Section 2.0: Analysis Framework

This section of the report provides the framework for evaluating current and future instream and out-of-stream demands for water in the UGRRW. These values are calculated to determine how well current demands are being met and how well future demands can expect to be met. Definitions, assumptions, limitations, and data gaps are provided in this section.

The goal of this report is to quantify demand for water based on best available data and to assess vulnerabilities to ecological, agricultural, and municipal interests associated with these demands.

Quantitative attribute assessments have measured attributes at their foundation but may include estimates to fill data gaps and/or some reliance on professional opinion.

Qualitative attribute assessments are based on limited measured data and rely heavily on condition estimates, professional opinion, and agency policy.

## Section 3.0: Municipal Needs/Demands

Seven cities are located within the UGRRW; each City has unique water supply and infrastructure challenges, but all share a similar demand profile with increased water use in the summer months. The cities exclusively use groundwater for their municipal potable water supply needs. Two other groups of users are analyzed in this section: unincorporated users (those outside city limits) and self-supplied industrial users (SSIU) (industrial users located outside city limits and have their own water rights and supply). Water rights and well locations for each city and SSIU are described in this section.

Current water use for cities was first calculated using the formula from the 2015 Oregon Water Resources Department (OWRD) long-term forecast (OWRD, 2015) and then compared to actual water use records (with outlier data removed) as reported on the OWRD water use reporting site (OWRD, 2018c). The results from the actual use calculation is that cities, unincorporated users, and SSIU use approximately 2,060 acre-feet (AF) per year of surface water and 8,190 AF per year of groundwater. Bi-weekly estimates were calculated using actual water use reporting records (which are reported monthly and were divided in half for bi-weekly use estimates). Bi-weekly estimates are described in the subwatershed summary section.

Future water use was calculated by taking all current estimates for cities and unincorporated users and forecasting a 6 percent increase in population (as estimated by the Portland State University population report). SSIU usage was increased based on assumptions of some industrial growth (increased work shifts from 1 to 2 per day). This results in a projected total of 8,240 AF per year of surface water needed and 13,550 AF per year of groundwater needed in 2068.

Vulnerabilities to municipal city water systems as defined as all water controlled by a city and used by city residents appear to generally be **low** for water quantity, as none of the cities are approaching their total water right capacity. Some vulnerabilities exist in terms of redundancy of supply, and the potential for contamination of aquifers. Municipal demand data are included in Appendix A, Municipal Demand Calculations.

## Section 4.0: Agricultural Needs/Demands

Agricultural demand was calculated in two ways, 1) water rights assessment and 2) crop consumptive demand using calculations of evapotranspiration (ET) of crops raised in the UGRRW.

To determine the current demand for irrigation water use based on water rights in the UGRRW (for surface and groundwater) the following steps were used:

- Determine an estimate of the number of irrigated acres in each subwatershed.
- Determine an estimate of the amount of different types of irrigation systems present in each subwatershed.
- Use results in calculations to estimate demand.

The method above describes how agricultural demand was calculated based exclusively on water rights; however, this method was thought to overestimate current use. The second method was to calculate agricultural water demand based on ET. Crop distribution was determined for Union County. After crops were established, Agrimet crop coefficients were used to estimate ET using a Kimberly-Penman model. The ET estimates for each crop were weighted based on the percentage of that crop compared to the total agricultural output for the basin. Next, water rights were distributed on this basis to determine the bi-weekly period when they would be most likely to be used during the irrigation season. Demand was determined based on 1994 to 2017 Agrimet Imbler (IMBO) station data (precipitation, temperature, and ET crop coefficients); 2011 to 2017 Farm Service Agency/Oregon Agriculture Information Network acreage data; and OWRD primary irrigation water right acreage. Annual estimates of crop demands are commonly available yet are not useful to farmers who require crop demands at time scales of bi-weekly or shorter to monitor crop water use (i.e., ET) over the growing season, and to capture deficits between crop water demand and water supply that become increasingly likely since demands typically peak when supply is low.

Future demand was calculated using estimated future ET based on precipitation and temperatures projected by the Representative Concentration Pathways (RCP) 8.5 climate scenario. Water quality was not considered a vulnerability for agricultural use. Future demand was calculated in two ways: the first assumed no changes in water use, and the second assumed irrigation efficiencies. The Natural Resources Conservation Service water savings estimator was used to estimate water savings for irrigation system planning. Current and potential consumption estimates were calculated based on changes to agricultural irrigation practices. Each subwatershed had different benefits to implementing irrigation improvements.

Total agricultural water use per year was estimated to be 211,130 AF per year (surface water) and 86,830 AF per year (groundwater) using water rights, and 193,730 AF per year (surface water) and 77,970 AF per year (groundwater) using estimated ET. Future demand with irrigation efficiency implemented to the level suited to field conditions and with projected increases in future temperature was estimated to be 211,130 AF per year (surface water) and 86,830 AF per year (groundwater) using water rights, and 284,530 AF per year (surface water) and 114,520 AF per year (groundwater) using estimated ET. Estimates assume that no additional water rights are issued, and that no expansion of irrigated acres occur.

Overall, vulnerabilities to agricultural systems in terms of water quantity appear to be **high** on a bi-weekly basis. Water quality issues were not identified as a limiting factor for agriculture. Agricultural demand data are included in Appendix B, Agricultural Demand Calculations.

## Section 5.0: Instream Needs/Demands

Instream demand is complex, and numerous processes contribute to the amount of water available for instream use. Instream demand for aquatic life is driven by several factors: species, water needs, stream variables, and future changes. Instream demand is also important for other uses that are important to Tribal culture. For instream demand, the group quantified species and water needs, and qualified stream and future demands. This was accomplished through using calculations based on instream water rights (ISWR) and qualitative analysis.

To determine how often existing needs (as described by ISWR only) are met, data from the OWRD Water Availability Reporting System were used to evaluate how much water was left for instream uses when consumptive uses (municipal and agricultural) were removed. Water availability for an ISWR at the 80 percent and 50 percent exceedances was calculated.

Determining whether future demands can be met is dependent on many issues such as the severity of climate change impacts and whether conservation measures are implemented. For this planning effort, temperatures from the climate model RCP 8.5 were considered for future planning efforts.

Water quality is essential for instream aquatic life and ecological function. Water quality in each subwatershed is analyzed in this report.

Overall, instream demand vulnerabilities are **high.** Instream demand data are included in Appendix C, Instream Demand Calculations

## Section 6.0: Climate Change and Natural Hazards

The planning group evaluated the potential impacts of climate change and natural hazards on demand estimates. It was decided that to model future climate change, RCP 8.5 temperature and precipitation data would be used for the 2068 (50 years in the future) scenario. These are the values discussed in each demand section, and the rational for selection is explained in this section. It was decided that natural hazards would be evaluated in a qualitative manner and information would primarily be obtained from the County-wide hazards vulnerability analysis, Emergency Operations Plan, Natural Hazards Mitigation Plan, and Community Wildfire Protection Plan.

Overall, climate change is likely to increase likelihood of some natural hazards, for example increases in temperature increase the likelihood of lightning strikes which, in turn, increases the probability of wildfires. Wildfires increase the likelihood of landslides, mudslides; impaired water quality due to inputs to ash, erosion, etc. Increased sediment and/or ash load to surface water sources, and increased potential for toxic algal blooms due to ash-mediated fertilization of water sources, may render some water unusable for irrigation, human consumption, and for fisheries, livestock, and other animals.

## Section 7.0: Subwatershed Demand Summaries

Surface water and groundwater demand vary by subwatershed, demand category, and time of year. For example, municipal demand is exclusively reliant on groundwater sources, while instream demand is exclusively reliant on surface water sources (although data are not available to help the Partnership understand surface water/groundwater interactions and interdependencies). Agricultural demand encompasses both surface water and groundwater.

In Appendix D, Water Balance Calculations, each bi-weekly summary for current and future demand is provided for each subwatershed. Figure ES-1 shows subwatershed boundaries, as defined in the Step 2 report. The annual summary for current and future demand is shown on Tables ES-1 and ES-2. Table ES-3 shows qualitative rankings for each demand group by subwatershed. Additional information is located in Appendix E, Additional Information.

**Figure ES-1**
**Subwatershed Map**

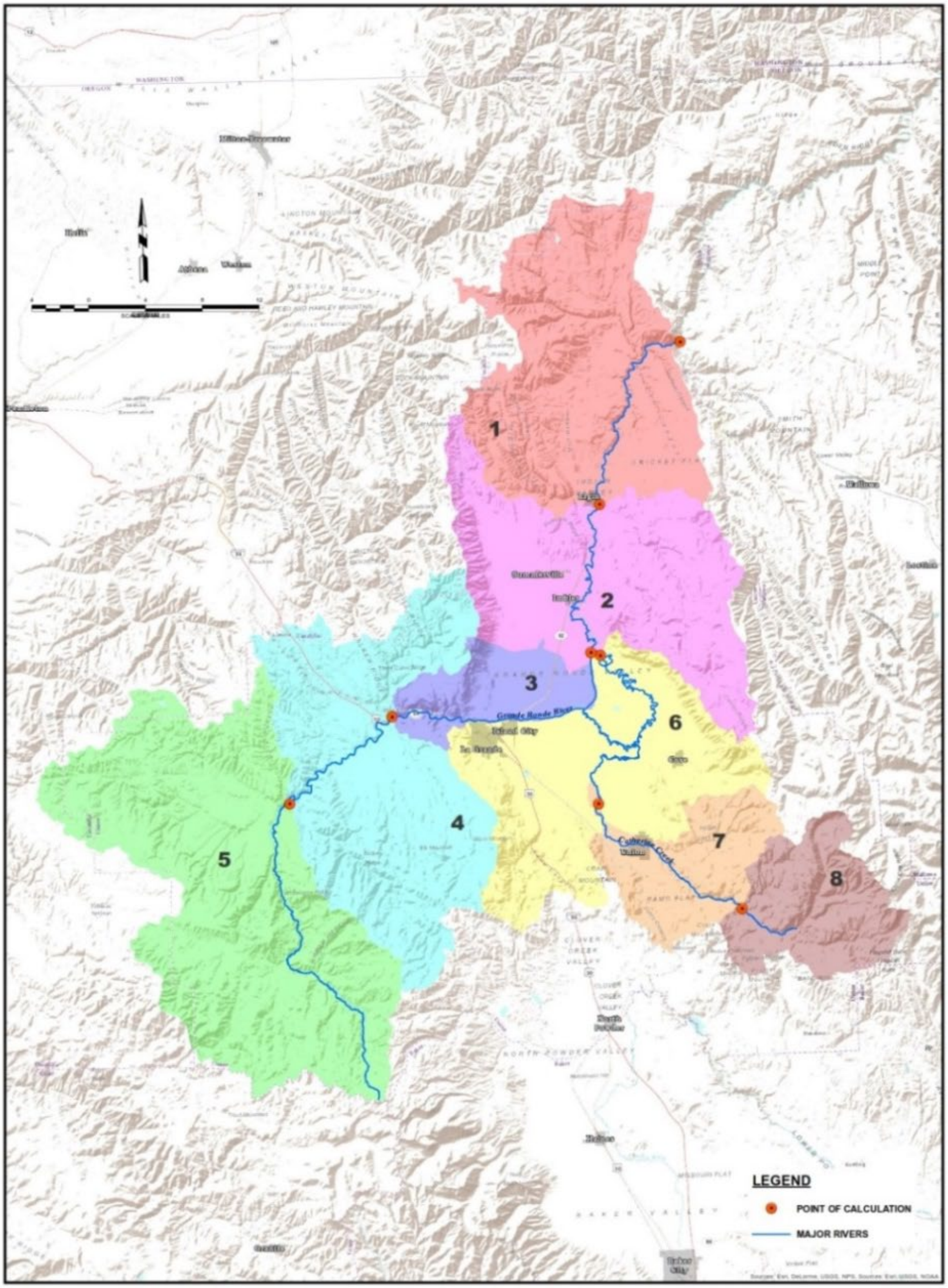


**Table ES-1**
**Annual Water Balance (Current Demand)**

| Subwatershed | Name | Surface Water Quantity (Natural Stream Flow) (from Step 2 Report) AF per Year (50th Percentile) | Groundwater Used (from Step 2 Report) AF per Year | Agricultural Demand Surface Water (AF per year) (Water Rights Only) | Agricultural Demand Groundwater (AF per Year) (Water Rights Only) | Agricultural Demand Surface Water (AF per Year) (ET Estimate) | Agricultural Demand Groundwater (AF per Year) (ET Estimate) | Municipal Demand Surface Water (AF per Year) | Municipal Demand Groundwater (AF per Year) 2013 Totals | Instream Demand (AF per Year) (Water Rights Only) | Surface Water Balance (ag ET) | Groundwater Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Lookingglass Creek/Cabin Creek | 644,600 | - | 3,470 | 230 | 3,410 | 220 | 383 | 810 | 173,750 | 467,440 | (1,030) |
| 2 | Willow Creek/Indian Creek | 523,380 | 29,400 | 51,890 | 14,440 | 46,630 | 12,980 | - | 810 | 141,820 | 334,930 | 15,620 |
| 3 | Lower Five Points Creek | 234,120 | 25,720 | 23,780 | 23,490 | 20,770 | 20,520 | 1,393 | 500 | 85,610 | 127,740 | 4,700 |
| 4 | Beaver Creek, Upper Five Points Creek | 219,830 | 1,960 | 750 | 2,040 | 710 | 1,932 | 170 | 160 | 85,610 | 133,510 | (120) |
| 5 | Meadow Creek Upper Grande Ronde River | 127,840 | 190 | 520 | - | 510 | - | - | 50 | 46,840 | 80,490 | 140 |
| 6 | Ladd Creek Lower Catherine | 153,740 | 71,720 | 106,330 | 46,100 | 96,350 | 41,774 | 110 | 5,500 | 57,550 | (160) | 24,450 |
| 7 | Upper Catherine Creek 1 | 116,240 | 9,280 | 24,030 | 530 | 24,870 | 550 | - | 370 | 57,550 | 33,820 | 8,360 |
| 8 | Upper Catherine Creek 2 | 71,600 | - | 360 | - | 470 | - | - | 10 | 32,500 | 38,620 | (10) |
| | Total | 644,600* | 138,270 | 211,130 | 86,830 | 193,730 | 77,973 | 2,060 | 8,190 | 173,750* | 277,130 | 52,110 |

**Total natural stream flow and instream demand are expressed as the total from subwatershed 1 (the most upstream section of the watershed) to prevent "double counting."*

**Table ES-2**
**Annual Water Balance (Future Demand)**

| Subwatershed | Name | 2068 Temperature Change from Current (degrees F from Annual Mean*) | Surface Water Quantity (Natural Stream Flow) (from Step 2 Report) AF per Year | Groundwater Used (from Step 2 Report) AF per Year | Agricultural Demand Surface Water (AF per Year) (Water Rights Only) | Agricultural Demand Groundwater (AF per Year) (Water Rights Only) | Agricultural Demand Surface Water (AF per Year) (ET Estimate) | Agricultural Demand Groundwater (AF per Year) (ET Estimate) | Municipal Demand Surface Water (AF per Year) | Municipal Demand Groundwater (AF per Year) | Instream Demand AF per Year (Water Rights Only) | Surface Water Balance (ag ET) | Groundwater Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Lookingglass Creek/Cabin Creek | 1.6 | 593,040 | - | 3,470 | 230 | 5,010 | 330 | 60 | 30 | 173,750 | 414,210 | (2,090) |
| 2 | Willow Creek/Indian Creek | 1.6 | 481,510 | 29,400 | 51,890 | 14,440 | 68,490 | 19,060 | - | 860 | 141,820 | 271,210 | 9,490 |
| 3 | Lower Five Points Creek | 1.6 | 215,390 | 25,720 | 23,780 | 23,490 | 30,510 | 30,140 | 5,570 | 1,240 | 85,610 | 93,700 | (5,660) |
| 4 | Beaver Creek, Upper Five Points Creek | 1.6 | 202,250 | 1,960 | 750 | 2,040 | 1,050 | 2,840 | 690 | 360 | 85,610 | 114,910 | (1,230) |
| 5 | Meadow Creek Upper Grande Ronde River | 1.6 | 117,610 | 71,720 | 520 | - | 750 | 0 | - | 50 | 46,840 | 70,020 | 140 |
| 6 | Ladd Creek Lower Catherine | 1.6 | 141,440 | 9,280 | 106,330 | 46,100 | 141,510 | 61,360 | 460 | 8,870 | 57,550 | (58,070) | 1,490 |
| 7 | Upper Catherine Creek 1 | 1.6 | 106,940 | - | 24,030 | 530 | 36,530 | 810 | - | 390 | 57,550 | 12,870 | 8,080 |
| 8 | Upper Catherine Creek 2 | 1.6 | 65,870 | 190 | 360 | - | 690 | 0 | - | 10 | 32,500 | 32,680 | (10) |
| **Total** | | **1.6** | 593,040* | 138,270 | 211,130 | 86,830 | 284,530 | 114,520 | 6,780 | 11,810 | 173,570* | 126,510 | 10,200 |

** All future estimates have a high degree of uncertainty associated with them because of the inherent difficulty in making estimates and predictions 50 years into the future.*

Vulnerabilities for each subwatershed were examined and resulted in the following rankings:

**Table ES-3**
**Water Demand**
**Vulnerabilities by Subwatershed**

| Name | Overall* | Agricultural+ | Municipal+ | Instream* | Water Quality* |
|---|---|---|---|---|---|
| 1 Lookingglass Creek/Cabin Creek | Low | Low | Low | High | High |
| 2 Willow Creek/Indian Creek | Moderate | High | Low | High | High |
| 3 Lower Five Points Creek | Moderate | High | Low | High | High |
| 4 Beaver Creek, Upper Five Points Creek | Moderate | Low | Low | High | Moderate |
| 5 Meadow Creek Upper Grande Ronde River | Low | Low | Low | High | Low |
| 6 Ladd Creek Lower Catherine | High | High | Moderate | High | High |
| 7 Upper Catherine Creek 1 | High | High | Low | High | Moderate |
| 8 Upper Catherine Creek 2 | Low | Low | Low | High | Low |

**Qualitative attribute assessments are based on limited measured data and rely heavily on condition estimates, professional opinion, and agency policy.*

*+ Quantitative attribute assessments have measured attributes at their foundation but may include estimates to fill data gaps and/or some reliance on professional opinion.*

## Section 8.0: Public Participation and Outreach

Monthly meetings engaging all stakeholders were held in Union County and conducted from late 2017 to early 2019. Numerous ad-hoc meetings were held with relevant stakeholders (organized into working groups related to different demand categories) as needed over the same period of time. A comprehensive list of meeting types and dates is included in this section.

## Section 9.0: References

Documents referenced in this report are included in this section.

# 1.0 - Introduction

## Background and Purpose

Helping communities plan for their water future through place-based integrated water resources planning is a recommended action in Oregon's 2012 Integrated Water Resources Strategy. In 2015, the Upper Grande Ronde River Watershed (UGRRW) Partnership was selected by the Oregon Water Resources Department as one of four funded pilot projects across the state to complete the five steps of place-based planning.

In late 2016, the UGRRW Partnership began meeting as a diverse stakeholder group. In early 2017, the UGRRW Partnership completed Step 1 (convene a group and complete a governance document). In early 2018, the UGRRW Partnership completed Step 2 (water supply availability analysis). Both completed documents can be viewed on the Union County website (Union County, 2018a).

This report represents the completion of Step 3. The purpose of Step 3 is to identify demands on current and future water resources. By understanding these demands, partners may identify existing challenges, project future challenges, and work together to develop long-term solutions for the UGRRW. This report characterizes demand for three major demand groups (municipal, agricultural, instream) in each of the eight subwatersheds (identified in Step 2) as well as reviews vulnerabilities due to climate change and natural hazards for the area. By comparing supply and demand (of water in terms of both quality and quantity), this report allows for consensus on areas where improvement is needed. This report represents the UGRRW Partnership's groundwork to analyze potential solutions to problem areas in Step 4 and create an action plan in Step 5.

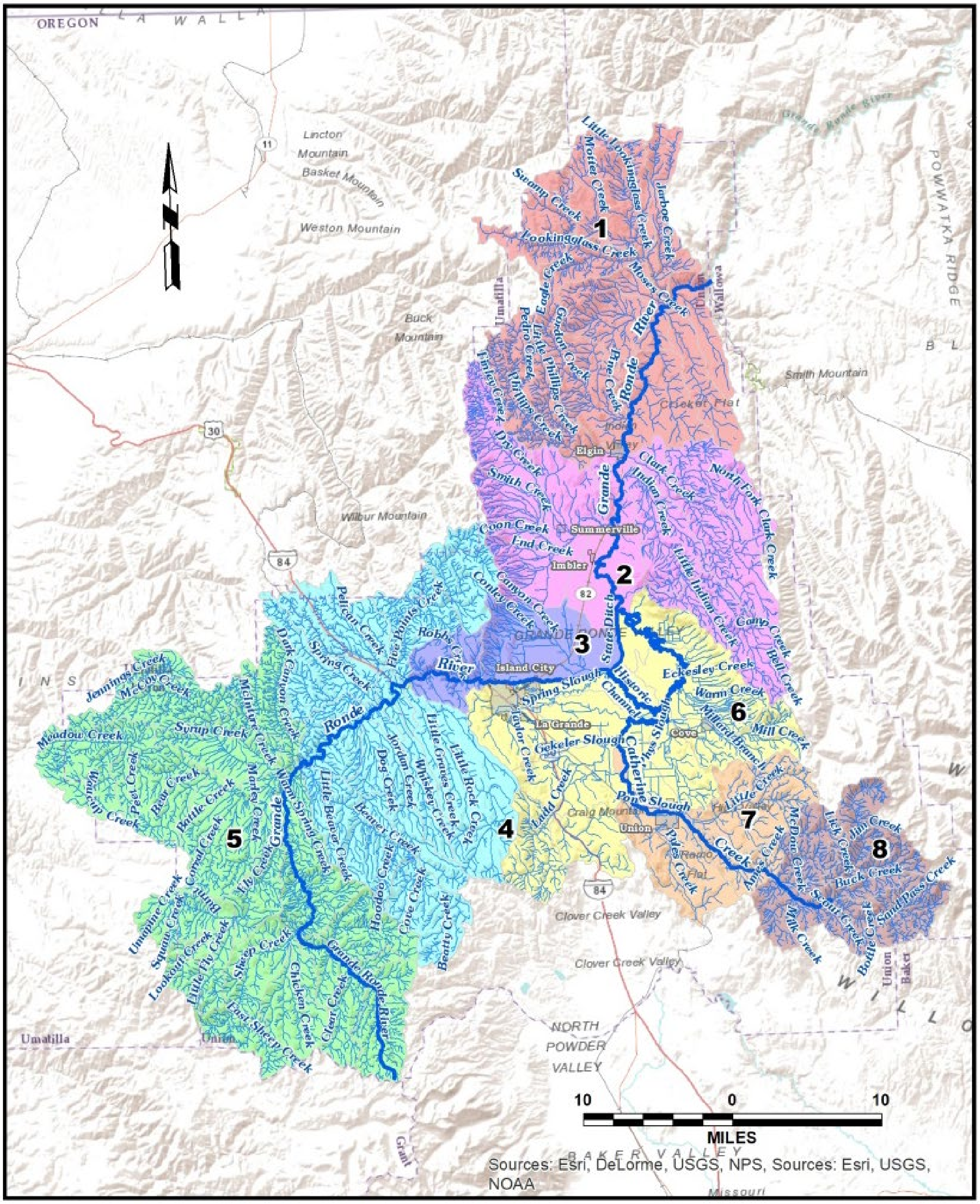
This document is organized into nine sections. Section 1 introduces the report. Section 2 introduces the framework used for analysis, definitions throughout the report, and assumptions made throughout the report. Section 3 discusses current and future municipal water demands. Section 4 discusses current and future agricultural demands. Section 5 discusses current and future instream water demands. Section 6 describes climate change and natural factors affected by water demands. Section 7 summarizes overall findings of the report by subwatershed. Section 8 details public participation and outreach activities. Section 9 includes references.

See Figure 1-1 for the planning area of the UGRRW Partnership.

**Figure 1-1**
**Planning Area**

The UGRRW is divided into eight subwatersheds that are analyzed in this report. For more information on the methodology to develop these subwatersheds, see the State of Water Resources Report (UGRRW Partnership, 2018). See the subwatershed boundaries below (Figure 1-2).

**Figure 1-2**
**Subwatersheds of the Upper Grande Ronde River Watershed**



# 2.0 - Analysis Framework

The purpose of this section is to provide definitions of key terms, assumptions used in calculations, limitations of data, and data gaps identified in the report.

## Definitions, Assumptions, and Limitations

Please refer to this section to understand terms used throughout this report and assumptions and limitations associated with them.

### *General*

- Demand: this report does not distinguish between a “need” and a “demand” but refers to all uses of water as demands.
- Instream demand: water quality and quantity needed to support instream functions including recreation and aquatic life. This is also defined as non-consumptive use.
- Out-of-stream demand: water quality and quantity needed to support agricultural use, municipal use, and industrial use. This is also defined generally as a consumptive use, although there are some exceptions such as the use of stream flow to generate hydropower for municipal use.
- Current demand: this is demand as of 2018, or as close to that date as data are available. Most calculations use several years of data to estimate current demand. See details in each section.
- Future demand: this is estimated demand as of 2068 (50 years from 2018).
- Current supply (surface water natural stream flow calculated using gauged/observed data minus consumptive use (upstream out-of-stream uses, diversions into/out of stream, and reservoir storage, regulation, etc.) (Copper, 2002). Naturalized flows are computed using the Oregon Water Resources Department’s (OWRD) flow statistics based on the 1958 to 1987 period of record.
- Current supply (groundwater): groundwater supply is estimated using groundwater allocations to estimate the maximum, legal groundwater uses within a subwatershed. This analysis included primary and supplemental irrigation water rights as well as municipal water rights. These values should be considered a gross estimate of groundwater use. For more information on these calculations see the Step 2 report (Upper Grande Ronde River Watershed [UGRRW] Partnership, 2018). Because of a lack of available data, groundwater supply is considered equivalent to current groundwater demand (maximum use if each water right was fully utilized). For a description of key information gaps regarding groundwater supply, see the Groundwater memo (Appendix E, Additional Information).
- Future supply: this assumes that surface water supply changes as a function of temperature and precipitation changes (as predicted by the Representative Concentration Pathway [RCP] 8.5 climate model) and that groundwater supply remains constant due to the assumption that aquifers are operating at a sustainable pumping rate. This assumption is made because

of a lack of data about groundwater recharge and pumping rates. However, it is acknowledged that: (a) if the system is recharged from the surface, anticipated changes in precipitation type (less snow/more rain), timing, intensity, and other factors will all contribute to lower recharge, thus the groundwater supply will decrease; and (b) if groundwater is withdrawn from a source not recharged from the surface, or perhaps not recharged at all. In that case, regardless of the rate of extraction, the supply is likely decreasing at an unknown level. The UGRRW Partnership is not using groundwater graphs/data for Step 3 because there is no accurate way to estimate the supply. All groundwater discussions in the report are heavily caveated because of this substantial data gap. The assumption that groundwater demand equals supply is a significant assumption that carries a large risk.  OWRD has a proposal to better document understanding of the groundwater supply.

- Water quality: included in current and future water supply and demand is the water quality associated with each water volume at different times of the year, as well as for different demands. See the State of Water Resources (UGRRW Partnership, 2018) for additional details on water quality.
- Water Balance: this describes the entire water supply minus the demand on a bi-weekly basis throughout the year. The water balance is used to determine locations and times of year when vulnerabilities (i.e., deficiencies or unmet needs are likely to exist) and opportunities exist. For more information about the water balance, see Appendix D, Water Balance Calculations.
    - Current groundwater use was assumed to be at a sustainable level that will be continued into the future.
    - The 50th percentile exceedance probability was used for the baseline surface water supply when analyzing the surface water balance. The Step 2 report also included 10th and 90th percentile exceedance probabilities, which could be analyzed as related to a water balance at a later date.
    - Although annual and bi-weekly totals graphs are shown in this report, these aggregates of data may misrepresent actual demands because they combine effects over time and location.
    - Instream demand requirement are shown at the pour points in each subwatershed. There is potential that some of these values may overlap between subwatersheds.
- Data accuracy and precision: this report contains calculated and collected data. Original reported and calculated values are retained throughout the body of the document and are presented with uniform significant digits in the summary sections of the report (Executive Summary and Section 7, Subwatershed Summaries. Numbers presented in this report may contain artifacts of calculation and exceed the significant digits of the original data.

### *Municipal*

Total municipal demand is defined of the sum of three terms: municipal "city" demand, unincorporated demand, and self-supplied industrial user (SSIU) demand. Each term is defined below:

- Municipal "city" demand is generally residential, commercial, and industrial potable water demand within the service area of a municipal water provider and also includes demands from parks, schools, ballfields, etc., within the city.
- Unincorporated demand is residential and commercial uses outside of cities and not served by a municipal water provider. These are primarily rural residences with their own water well, but also includes some commercial uses like resorts, RV parks, etc., that have their own water system.
- SSIU demand is industry served by their own water rights and water supply system, not by a city or municipal water provider.

**Current Municipal Demand** is defined as total demand as of 2018.

**Future Municipal Demand** is defined as total demand as of 2068. To calculate future municipal demand, the following assumptions were made to each term in the equation:

- Municipal demand - it was assumed that cities grew by 6 percent over that time period, based on Portland State University (PSU) calculations
- Unincorporated demand - it was assumed that the amount of people living outside of cities grew by 23 percent based on PSU calculations
- SSIU demand - it was assumed that SSIU demand doubled (that each user added an additional 8-hour shift to their day, utilizing half of their maximum water right)

For additional information on municipal demand, see Appendix A, Municipal Demand Calculations.

### *Agriculture*

Agricultural demand is calculated two ways:

- Water rights methods calculates the maximum demand based on water rights in each area
- Evapotranspiration (ET) method calculates the use based on crop consumptive use

**Current Agricultural Demand** - demand estimated based on water rights and ET as of 2018.

**Future Agricultural Demand** - demand estimated as of 2068 (including RCP 8.5 climate projections and modeled with two efficiency scenarios (no change in irrigation efficiency and reduced water consumption through water management strategies).

For additional information on agricultural demand, see Appendix B, Agricultural Demand Calculations.

### *Instream*

- Instream water right (ISWR) - legal water rights for instantaneous streamflow levels that need to remain instream and carry a priority date. These are established through Oregon's Instream Water Right Act (1987). These rights can be requested by the Oregon Department of Fish and Wildlife, the Oregon Department of Environmental Quality (DEQ), or the Oregon Parks and Recreation Department.

- Additional concerns with determining whether ISWRs are met include if there are priority areas not protected with ISWRs. This means that even if existing ISWRs are met, it does not indicate that the ecosystem is functioning at a healthy level.
- Instream demand was calculated based on water rights only. This is a limited approach because it does not consider items such as peak and channel-forming flows or that because of the junior nature of ISWRs, there are many places in the UGRRW where ecological demand exists but is not represented through ISWRs because studies have not been completed yet, and water rights are already allocated. However, based on information available, this was the approach selected by the UGRRW Partnership.

**Current instream demand** - demand based on water rights only as of 2018.

**Future instream demand** - demand based on water rights only for 2068 (no change from 2018).

For additional information on instream demand, see Appendix C, Instream Demand Calculations

### *Water Quality*

Demand values consist of both water quantity and water quality needs. Water rights are critical to describe quantity demand, but there is a water quality component to each demand. See Appendix E, Additional Information, for an overview of water rights. It is necessary to discuss water quality of each demand in Step 3 so solutions can be identified that provide water at the right quality in Step 4. The focus of each section of this report is on the calculation of water quantity demand; therefore, a general introduction of water quality demand parameters is described below. See Appendix E, Additional Information, for a description of water quality parameters.

- In general, local municipal concerns include microbes, salts, metals, pesticides, herbicides, organics, radioactive contaminants, and arsenic.
- Local agricultural concerns include sediment/turbidity, invasive seeds, bacteria, and weed and algae growth from excessive nutrients.
- Local instream concerns include temperature, dissolved oxygen, pH, sediment, bacteria, ammonia, and channel and flow regime alterations.

Numerous waterbodies in the UGRRW have been identified as water quality limited by the DEQ, based on limited data sets available to meet agency deadlines. The water quality impairments can be for one or multiple parameters over portions of the year or all year long. The primary parameters of concern are temperature, pH, dissolved oxygen, and bacteria (*E. coli*). Temperature is a limiting factor for aquatic life beneficial uses in many of the summer months, especially in the southern and central part of the UGRRW. In most subwatersheds, pH is also a concern during the summer months. The downstream portions of the UGRRW (subwatersheds 1 through 3 and 6) have more water quality impairments than upstream areas (Meadow Creek and Catherine Creek areas and subwatersheds 4, 5, 7, and 8) due to reductions in flow, the accumulation of pollutants downstream and increasing land management impacts.

A set of total maximum daily limits (TMDLs) and associated implementation plans has been developed for the Upper Grande Ronde River. The TMDLs address five point sources in the UGRRW that discharge to surface water bodies under National Pollutant Discharge Elimination System Permits that may be contributing to pH and dissolved oxygen issues. Non-point sources of water pollution addressed by the TMDLs can include human-caused and natural sources. Human causes of non-point sources of water pollution include timber harvesting, livestock grazing, crop production, road construction and maintenance, rural residential development, and urban runoff. Landscape changes that alter the hydrology of the basin, such as channelization of streams, changes in vegetation, and a lowered water table also contribute to water quality impairments. Natural causes of water quality impairment include wildfire, drought, severe floods, insects, and disease infestation of forests. The impacts of these natural forces can also be affected by land management activities, making a complex interaction of factors affecting water quality.

When developing solutions for water quantity needs in the UGRRW, water quality must also be considered. Water from one use may not be able to be traded for another use if it does not have sufficient quality to support the designated beneficial uses of the receiving waterbody.

Water quality parameters are described in detail in Appendix E, Additional Information.

### *Groundwater Uncertainty*

Three of OWRD's five observation wells in Union County, and two of La Grande's city wells (UNIO 940 and UNIO 2098) show significant declines from the time they were drilled. The basalt wells in the La Grande and Elgin areas show steeper declines (75 to 100 feet over multiple decades) compared to the alluvial wells (maximum 20 to 30 feet over multiple decades). In addition, many wells with records spanning many years show little or no observable trend, especially in the alluvial system. The magnitude and timing of changes in groundwater elevation vary greatly in different areas within the basin, and broad trends are not conclusive with the limited data available.

The periods of record of well water levels present challenges for detecting trends and forming generalizations, for example, the periods of record:

(a) are short in some cases

(b) differ among the wells

(c) are not current

(d) lack measurements at consistent intervals

(e) exhibit periods of relatively persistent conditions (i.e., higher or lower), suggesting connectivity with surface conditions, but may be lagged

See the groundwater memo (Appendix E, Additional Information) for a summary of data gaps regarding groundwater levels and proposals for improving key data sets.

## *Data Set Limitations*

Because this project is limited to the analysis of existing data sets, results are subject to the limitations imposed by each data set. This includes the uncertainty associated with the lack of uniform sampling techniques, instrument accuracy, and the data sets generated from their usage.

The Step 2 report and this Step 3 report use the 30-year base period of annual flow (1958 to 1987). Subwatershed flows are based on data sets from La Grande, Elgin, Union, and Hilgard. Of these, the only data set covering the flow period is La Grande. Elgin and Union cover 80 percent of the period and Hilgard covers 53 percent. Data gaps in these data sets were filled with estimates that introduce error to the analysis.

Precipitation data does not exist for the subwatersheds for the base period of flow. The precipitation data set was generated using the PRISM model, which yields a single estimate for specific locations within each subwatershed.

The PRISM model is reported to generate errors greater than 15 percent, which is known to increase within the elevation range of 4,000 to 8,000 feet. An area-precipitation ratio was used to generate estimates of annual flow on the subwatersheds, which was subdivided to yield monthly estimates of flow. Runoff is a function of aspect, elevation, slope, water travel distance, temperature patterns and the time, and duration and intensity of precipitation events. The area-precipitation ratio does not utilize these factors and is insensitive to their impact. Furthermore, these factors increase in importance as monthly estimates are generated. Errors reported for annual flow estimates using the area-precipitation ratio are reported to range from 15 to 30 percent. The step 2 report identifies a ratio range of 0.5 to 1.5 as being desired. This acceptable range can be further partitioned to indicate that the most effective ratio would be between 0.85 and 1.15, moderate effectiveness would range from 0.65 to 0.85 and 1.15 to 1.35 and least effective between 0.45 to 0.65 and 1.35 to 1.55. The area-precipitation ratios for the subwatersheds contain one ratio that is outside the range, two ratios that are least acceptable, one in the moderate range, and four in the most effective range.

It is important to be aware of and understand strengths and weaknesses of PRISM precipitation data. PRISM is a gridded dataset often used in geologic information system (GIS) spatial representation and analyses. The PRISM model interpolates at regular intervals temperature and precipitation values between points where weather stations are located. The two basic types of PRISM data are:

1) Long-term, temporally consistent; based on data records greater than or equal to 20 years long

2) Best estimates, based on all network data from weather stations, regardless of the length of the data records

The National Center for Atmospheric Research (NCAR), expressed the following key limitations of PRISM data on their website:

"Utility (of PRISM data) for climate change studies is not well-known; the heterogeneous station network could cause temporal discontinuities" (NCAR, 2017).

Due to the mix of lengths of period of records and the specific intervals involved, PRISM is more useful for spatial representation and analysis that does not involve investigating changes in or relationships with precipitation and temperature over time. To detect effects of climate on precipitation and water resources, Chen and Grasby (2009) recommend that the length of data record be at least as long as the longest mode of climate variability known to influence climate and water resources in a region. In the Western U.S., the longest mode is the Atlantic Multidecadal Oscillation (AMO), which evolves over 60 to 80 years. Since precipitation and streamflow are not random processes, but rather exhibit patterns associated with multi-decadal climate conditions, it becomes understandable that mixing data sets of different lengths and for different periods of time, as is done for PRISM data, may create temporal discontinuities.

Each of these identified sources of error are present within the numbers presented in this report, and the magnitude of the combined error is unknown. These results are suitable for relative comparison (within the report) but have an unknown level of accuracy and should not be used for other purposes.

Characteristics of data dictate whether and to what level of confidence the data will inform and answer questions. Some key points learned about data in the place-based planning process include:

- Knowing what data are available for the project area
- What is the source of the data (e.g., measured/observed data; remotely sensed; output or results from computer model simulations; developed from regressions with related observed data; and gridded spatial data for GIS applications)
- Assumptions underlying the collection or development of the data, as well as fundamental assumptions of models to which the data will be applied

Often, the required type and quality of data are not available and there is not sufficient time and money to assemble the perfect data set. As a result, options include moving forward with imperfect data or halting the project and doing nothing. In the case of the UGRRW, the Partnership opted to move forward with the awareness of imperfect data, which tempers the Partnership's expectations and confidence in the results. In addition, realizing the significance of data gaps raises the priority for collecting/developing more fitting data to improve subsequent studies.

The 1958 to 1987 "natural flow" data set, the basis for water resources administration and rights, presents challenges to obtain meaningful information from several place-based planning steps. The challenges are not unique to the UGRRW, or even to Oregon. All 11 western states wrestle with similar challenges since prior appropriation is practiced, in one form or another, in administering the states' water resources.

### *Limitations with Assuming Static Conditions for the Water Balance Computation*

Conducting an accurate water balance for the UGRRW is limited by the availability and accuracy of both water supply and demand data. Though a standard practice in water supply planning for establishing an understanding of long-term historical baseline conditions, stationary water supply estimates, such as those used in this report, do not capture the variability of the timing and quantity of actual water availability. Although other errors were introduced through the water balance computation through the use of data sets with different periods of record, this section explains the limitation of using stationary conditions to describe water supply and suggests approaches for addressing issues of non-stationary during future planning.

### Surface Water Estimates

Estimations of how much surface water was available for use, during what times, and in what locations was based primarily on gauged flows for the time period of 1958 through 1987. This data was provided by OWRD during Step 2 and is the best available set of naturalized streamflow data for the basin. Additionally, the 1958-1987 gage flow records were adjusted to remove effects of human use and management of water in the watershed (e.g., irrigation and municipal diversions, consumptive uses, storage effects). The adjusted flows were considered representative of “natural” or pre-development flows, or the total amount of water available and what streamflow may have looked like prior to effects of human activities in the watershed. Although the approach and methods used to create the “natural flows” datasets are standard practices for watershed planning, more recent science and longer data records show that the patterns in climate, hydrology, and other physical processes are not stationary. An example of this would be more recent observed hydrologic information (i.e., temperature, snowpack, streamflows) that fall outside the ranges of variation in the historic 1958 through 1987 base period.

Physical processes are inherently more variable than previously anticipated, as are the human activities (e.g., changes in land use, land cover, water use, and climate) that compound and/or confound natural variability. Accurate, representative water balance for year-to-year conditions is not feasible with the available data. Additionally, an accurate accounting of this would require near real-time data and distributed hydrologic modeling. Nonetheless, quantifying changes in streamflow, temperature, precipitation, and other factors that have occurred since the base period, 1958 through 1987, and estimating future changes may be useful in developing options and strategies that will promote sustainable, resilient water resources in the UGRRW.

### Evapotranspiration Estimates

Similar to streamflow variability, estimated variations in ET were also assumed to remain stationary over time. ET, especially from crops, may change from year to year, depending largely on the amount of irrigated land and irrigation methods. A more accurate understanding of the interannual variability in ET will allow for more informed flow naturalization computations, crop rotation planning, and more information for within-year crop management decisions.

### Groundwater Estimates

The assumption that groundwater is being used at a sustainable level (i.e., supply will be the same in 2018 as 2068) has an impact on the overall certainty of water balance calculations. The lack of data and information about groundwater use, water levels, and rates of recharge, let alone how these values might change over time, precludes much certainty about the groundwater supply. It is recommended that more work be done on computing groundwater supply values (see Appendix E, Additional Information).

#### Instream, Climate Change, and Natural Hazards Estimates

Instream, climate change, and natural hazard estimates are dynamic multivariate assessments that are impacted by political decisions, regulatory requirements, and biological assumptions. In addition, issues relating to the quantity and quality of data sets (including data gaps) and the difficulty of verifying modeling outputs are compounded when output from previous decisions are transferred into current assessments without verification. Attempts have been made to identify individual estimate assumptions and can be found interspersed throughout Sections 5 and 6 of this report.

### *Risk/Vulnerability Evaluation*

The following categorizations are used throughout this report to qualitatively describe the vulnerability of subwatersheds in terms of the risk that a demand group will be faced with a water quality or quantity deficit. This evaluation was qualitative in nature and utilized consensus-based decision making and best professional judgment.

#### High

High risk: The problem is already occurring and has a high probability of occurring in the future and/or becoming worse.

High magnitude: The problem is and/or will require changes from standard water use practices and will create tradeoffs for water users.

#### Moderate

Moderate risk: The problem is not occurring yet but is likely (greater than 50 percent probability) to occur in the future.

Moderate magnitude: The problem may impact standard water use practices and is likely (greater than 50 percent probability) to create tradeoffs with water users.

#### Low

Low risk: The problem is not occurring at the time and has a low potential (less than 50 percent probability) to occur.

Low magnitude: The problem may become worse in the future but not in a significant way; the problem is unlikely to become so significant that standard water use practices will be impacted.

### *Data Gaps and Recommended Actions*

In summary, the following major data gaps and uncertainty elements are present within this report:

- Surface water volume.
- Groundwater volume. Lack of information on whether groundwater pumping rates are sustainable. Groundwater balance graphs are not included in this report because of lack of certainty about supply (see Appendix E, Additional Information).
- Uncertainty in the models used to estimate future temperatures, precipitation, and other climate variabilities. The uncertainty resides more in the question "when" will the projections be realized. For precipitation, seasonal and average annual projections are more certain than daily or monthly; however, those, similar to annual demand estimates, annual or seasonal precipitation projections are not that helpful in practice.
- Uncertainty in estimated population growth.
- Uncertainty in quality of future water supply, which may limit the volume of water that is usable by municipal, agricultural, and instream uses.
- Uncertainty in the UGRRW's response to precipitation, as well as temperature regime, resulting in available water supply (timing, amount, intensity and frequency).
- Uncertainty related to how aquatic species will react to temperature changes (adaptation potential has not been explored).

There are several recommended actions to be explored in Step 4 to potentially improve the data gaps identified in this report. These include:

- Groundwater monitoring
- Stream flow gauging
- Uncertainty analysis

# 3.0 - Municipal Needs/Demands

## Introduction

This section will provide an overview of the water quality and quantity components of municipal demand, describe elements of the municipal, unincorporated, and industrial infrastructure, present demand calculations for current and future demand, provide a vulnerability assessment, and recommend actions for improvement.

The Upper Grande Ronde River Watershed (UGRRW) is located within the approximate boundaries of Union County. Union County is in northeast Oregon and has a population of 25,790 (U.S. Census Bureau, 2016). This section describes the municipal demands within Union County and seeks to document current demands and forecast future demand for municipal, domestic, industrial, and commercial water needs.

For this report, three components make up total “municipal” demand: municipal (or city) demand, unincorporated demand, and self-supplied industrial use (SSIU) demand.

## Overview of Municipal User Demands

### *Municipal Water Quality Demands*

According to the Oregon Department of Environmental Quality, in general, local municipal concerns include microbes, salts, metals, pesticides, herbicides, organics, radioactive contaminants, and arsenic. Municipalities in the UGRRW currently rely exclusively on groundwater for their treated potable supply. This water is treated and tested on a regular basis to ensure it meets drinking water standards. The Step 2 report describes some localized areas with high nitrates and areas in cities with potential contamination as possible risks to municipal water supplies.

### *Municipal Water Quantity Demands*

The primary demand is for potable water for each city that serves residences, businesses, schools, industry, parks, and ballfields within a city’s service boundaries.

### *System Components*

#### Water Rights

Each municipal user described above has water rights for their water use. Table 3-1, below, shows rights, priority dates, and whether the right applies to surface water or groundwater for each community (Oregon Water Resources Department [OWRD], 2017a).

**Table 3-1**
**Municipal Water Rights**

| City | Permit | Certificate | Priority Date | Union County Well Log ID's | Surface CFS | Alluvial GW CFS | Basalt GW CFS |
|---|---|---|---|---|---|---|---|
| **La Grande** | | 6201 | 1892 | | 0.75 | | |
| | | 3200 | 1909 | | 7.00 | | |
| | G 1962 | 31715 | 1961 | 0912 | | | 1.11 |
| | G 4296 | 42678 | 1968 | 0778 | | 3.33 | |
| | G 4542 | 42679 | 1969 | 0932, 0993 | | | 1.33 |
| | R 8345 | 61437 | 1977 | | 510 AF Storage | | |
| | G 8327 | 58995 | 1977 | 0999 | | 3.34 | |
| | G 10438 | 64137 | 1984 | 0940 | | | 4.46 |
| | G 11661 | 89556 | 1992 | 2098 | | | 5.80 |
| | G 13681 | | 1998 | 50520 | | 4.46 | |
| | G 15159 | | 2001 | | | 0.07 | |
| SUM = --> | | | | | **7.75** | **11.20** | **12.70** |
| **Island City** | G 7224 | | 1977 | 2496 | | 1.00 | |
| | G 11683 | | 1993 | 2496 | | 2.67 | |
| | G 14999 | | 2000 | 0770 | | 0.31 | |
| SUM = --> | | | | | | **3.98** | |
| **Union** | T-8255 | Inchoate | 1874 | | 0.85 | | |
| | | 31124 | 1893 | | 3.00 | | |
| | G 2541 | 60411 | 1963 | 1471, 1472 | | | 0.45 |
| | G 10139 | 60412 | 1983 | 1484 | | | 4.01 |
| | G 11206 | | 1989 | 2377 | | | 5.57 |
| SUM = --> | | | | | **3.85** | | **10.03** |
| **Cove** | 2295 | 7759 | 1914 | | 0.10 | | |
| | G 9580 | 65692 | 1981 | 1364 | | | 1.11 |
| | G 15314 | | 2001 | 51591, 51639 | | | 1.67 |
| | S 48505 | 82203 | 1981 | | *6.00 | | |
| SUM = --> | | | | | **6.10** | | **2.78** |
| **Elgin** | S 3453 | 88842 | 1917 | | **0.75 | | |
| | U 296 | 20584 | 1949 | 1713, 1743 | | | 5.00 |
| | G-3612 | 46834 | 1967 | 1731 | | | 3.30 |
| SUM = --> | | | | | **0.75** | | **8.30** |
| **Imbler** | G 10825 | | 1988 | 0208 | | | 1.11 |
| | G 10825 | | 1988 | 0208 | | | *** 4.46 |
| SUM = --> | | | | | | | **5.57** |

*Note: It is unknown whether Elgin currently uses their 0.75 water right.*
**Power*
***Irrigation*
****Fire system maintenance*
*AF = acre-feet*
*cfs = cubic feet per second*
*GW = groundwater*
***Total legal diversion (not actual use): Surface Water Sum: 12.45 Groundwater Alluvial Sum: 15.18 Groundwater Basalt Sum: 33.86***

## Infrastructure

### *Union County Drinking Water Systems*

There are 31 active Union County public drinking water systems in the Oregon Health Authority (OHA) inventory (OHA, 2018). All are groundwater systems. Several are located outside the planning area. These systems are listed below on Table 3-2.

**Table 3-2**
**Union County Public Drinking Water Systems**

| PWS ID | PWS Name | Owner Type | Connections | Population Served | City |
|---|---|---|---|---|---|
| OR4192832 | Anthony Lakes Mountain Resort | Federal Government | 25 | 150 | North Powder |
| OR4190251 | Camp Elkanah | Private | 2 | 22 | La Grande |
| OR4195538 | Catherine Creek Lodge | Private | 6 | 250 | Ontario |
| OR4195073 | Cove Christian Camp | Private | 1 | 20 | Cove |
| OR4101243 | Cove, City of | Local Government | 306 | 550 | Cove |
| OR4105803 | Eagles Hot Lake RV Park | Private | 14 | 24 | La Grande |
| OR4100273 | Elgin Water Department | Local Government | 720 | 1,725 | Elgin |
| OR4100455 | Flying K Trailer Ranch | Private | 64 | 96 | La Grande |
| OR4105529 | Hot Lake Resort | Private | 3 | 10 | La Grande |
| OR4101418 | Imbler, City of | Local Government | 140 | 305 | Imbler |
| OR4100454 | Island City, City of | Local Government | 421 | 1,015 | Island City |
| OR4100453 | La Grande, City of | Local Government | 5,396 | 13,152 | La Grande |
| OR4101140 | Mt Emily Water Association | Private | 13 | 24 | La Grande |
| OR4100577 | North Powder, City of | Local Government | 201 | 445 | North Powder |
| OR4105907 | ODF/WL Lookingglass Hatchery | State Government | 5 | 24 | Elgin |
| OR4195340 | OPRD Catherine Creek SP-CG | State Government | 1 | 25 | Meacham |
| OR4191074 | OPRD Catherine Creek SP-Day Use | State Government | 1 | 25 | Meacham |
| OR4191075 | OPRD Hilgard Junction State Park | State Government | 1 | 30 | Meacham |
| OR4191076 | OPRD Red Bridge State Park | State Government | 1 | 30 | Meacham |
| OR4101486 | OR Youth Authority - River Bend | State Government | 3 | 75 | La Grande |
| OR4191123 | OTE Charles Reynolds I84 | State Government | 2 | 200 | Salem |
| OR4101375 | Sacajawea Mobile Home Park | Private | 42 | 90 | Hailey |
| OR4191251 | Spout Springs Lodge & Ski Area | Private | 1 | 20 | Weston |
| OR4193453 | Spout Springs Water Board | Private | 45 | 100 | Hermiston |
| OR4105731 | Summerville Store/Tavern | Private | 1 | 20 | Summerville |
| OR4101344 | Sundowner Mobile Home Park | Private | 80 | 160 | La Grande |
| OR4105674 | Union Co Pks-Pilcher Creek CG | Local Government | 1 | 20 | La Grande |
| OR4106260 | Union Pacific RR Telocaset | Private | 6 | 12 | Hermiston |
| OR4100915 | Union, City of | Local Government | 980 | 2,150 | Union |
| OR4192755 | USFS Jubilee Lake CG | Federal Government | 1 | 40 | Pendleton |
| OR4194877 | USFS Oregon Trail Blue Mtn Crossing | Federal Government | 2 | 25 | La Grande |

Of these systems, seven are incorporated cities located within Union County and the UGRRW boundary. Some of the cities manage municipal water supplies through existing Water System Master Plans (WSMP) and Water Management and Conservation Plans (WMCP). See Table 3-3 below.

**Table 3-3**
**Union County Water System Master Plans and**
**Water Management and Conservation Plans (Year Published)**

| City | WSMP | WMCP |
|---|---|---|
| La Grande | 2013 | 2010 |
| Island City | 2011 | 2011 |
| Elgin | 2011 | None |
| Union | 2010 | 2011 |
| Cove | 2001 | None |
| Summerville* | None | None |
| Imbler | None | None |

**Summerville has no municipal water system but is included in this report for informational purposes as it is shown on maps of the area.*

Those cities with a required WMCP submit an update every 10 years to the OWRD reporting on:

- Water right inventory (if any changes)
- Water usage over the past 10 years (records of water use, historic and current)
- Population
- Service population area (if any changes)
- Non-revenue water for past 10 years
- Conservation measure benchmark progress
- Curtailment plan (only if any changes or supply issues)
- Demand forecast (projected need and available sources)

A discussion of each city's water supply sources and current plans is located in the Step 2 report.

## *Municipal Wells in Union County*

The following three maps (Figures 3-1, 3-2, and 3-3) show the locations of municipal wells from which much of the water on Table 3-2, above, is drawn in Union County (OWRD, 2017b).

**Figure 3-1**
**Municipal Wells for Cove and Union**

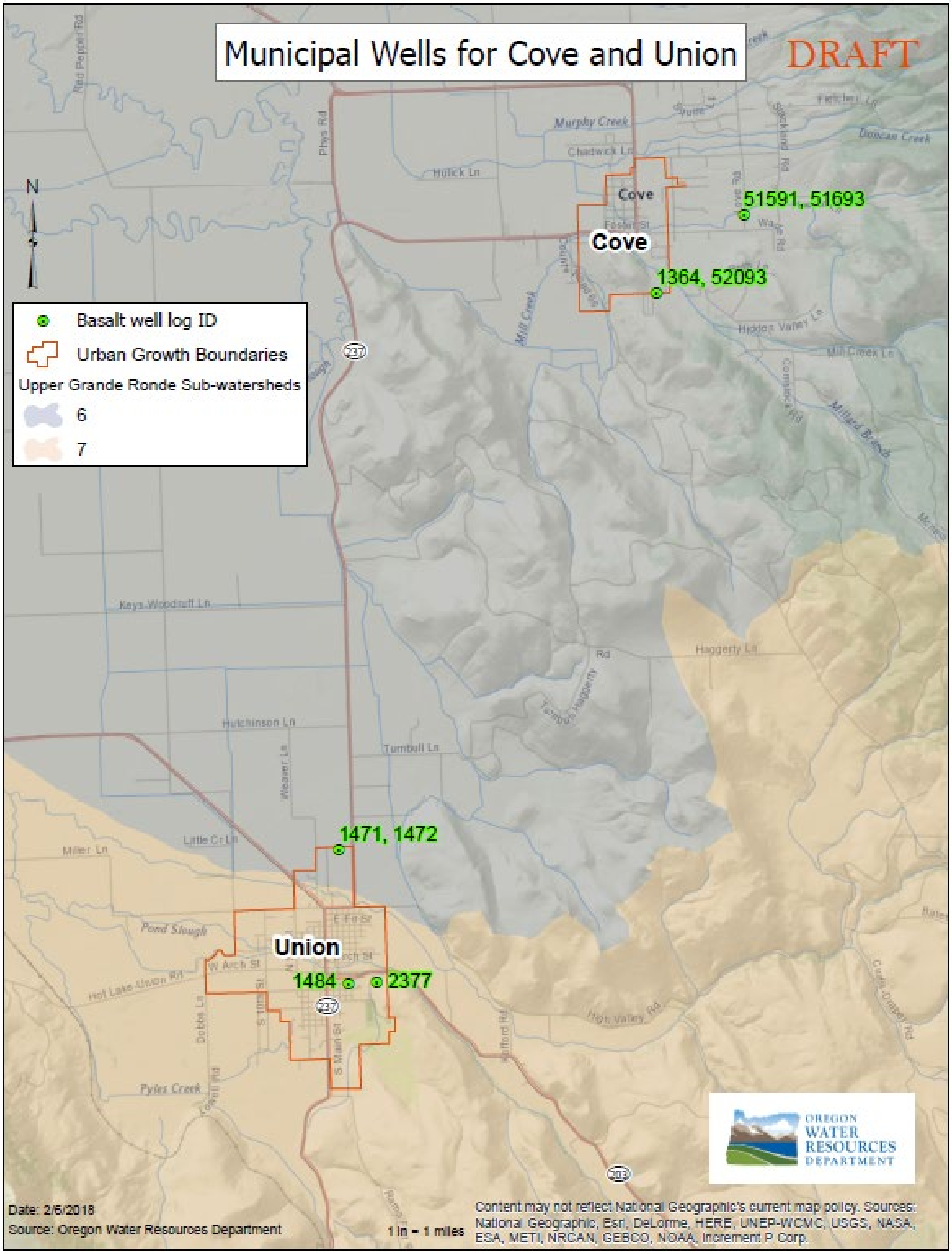


**Figure 3-2**
**Municipal Wells for Elgin and Imbler**

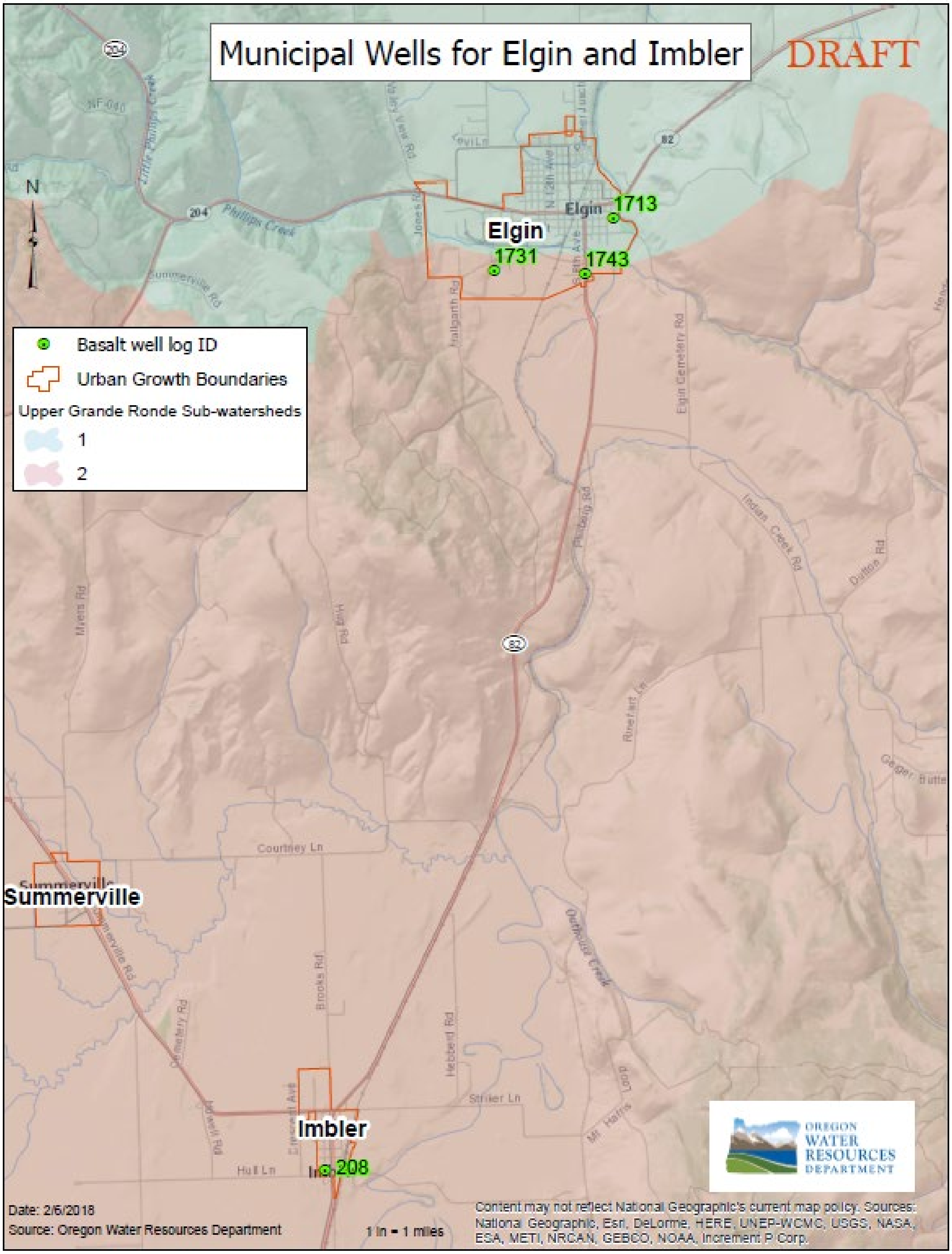
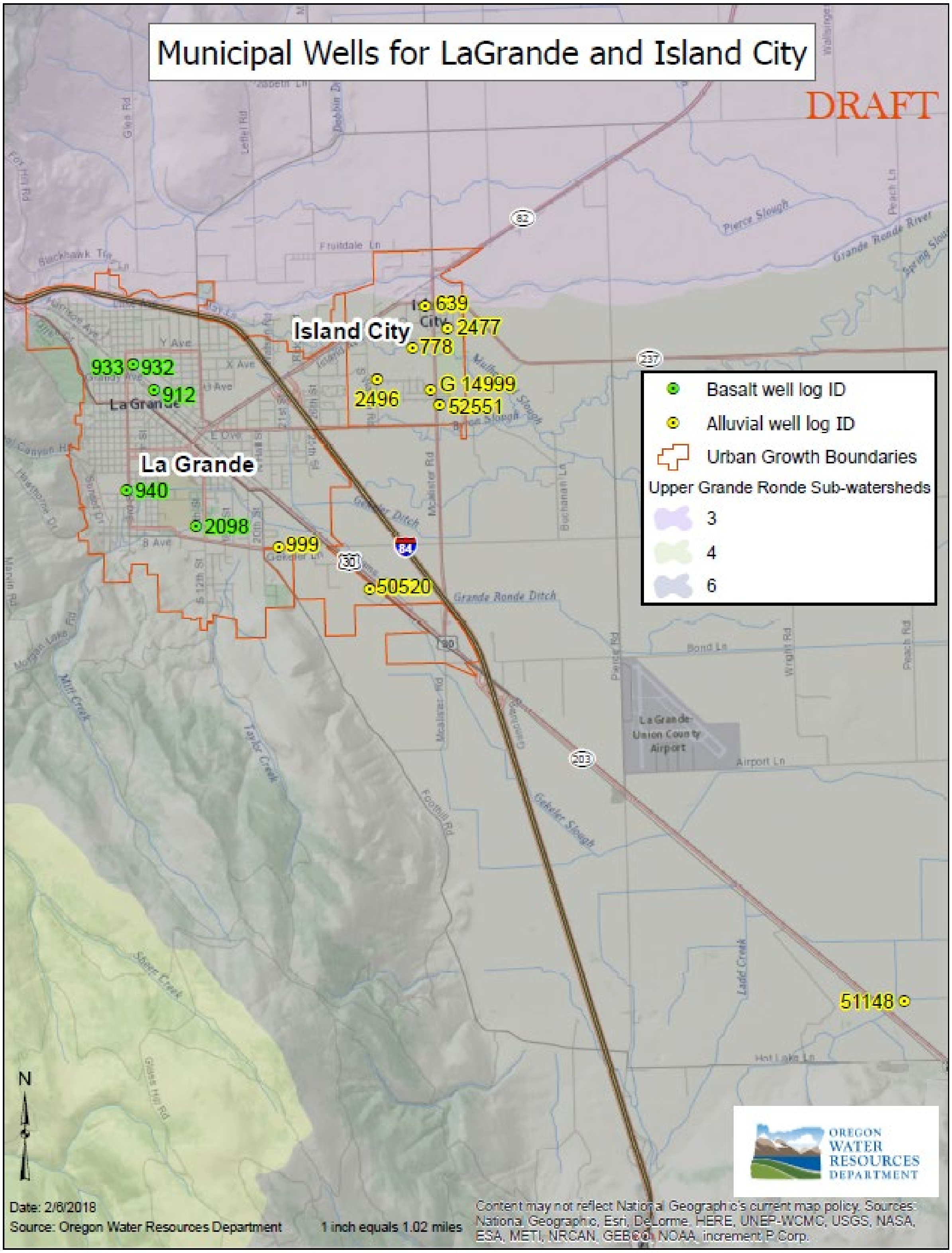


**Figure 3-3**
**Municipal Wells for La Grande and Island City**



## *Self-Supplied Industrial Use Water Rights*

Table 3-4 shows all SSIU water rights in the UGRRW. Table 3-5 shows the largest of those water rights.

**Table 3-4**
**Self-Supplied Industrial Use Water Rights**

| Permit | Report Use? | Certificate or Transfer | Priority Date | Water Right Holder Name | Use | Source | CFS |
|---|---|---|---|---|---|---|---|
| 27696 | No | 34636 | 8/9/1961 | A.J./FERN ROTH | Commercial | SPRING 4 | 0.39 |
| 396 | No | 30896 | 6/22/1951 | BAKER UNION COOPERATIVE CREAMERY | Industrial | A WELL | 0.10 |
| 2035 | No | 36553 | 1/12/1962 | BOISE CASCADE CORP. | Industrial | Boise WELL | 0.25 |
| 2930 | No | 34393 | 6/2/1965 | BOISE CASCADE CORP. | Industrial | A WELL | 0.34 |
| 920 | No | 27000 | 6/3/1958 | BOISE CASCADE CORP. | Industrial | WELLS 1 & 2 | 0.50 |
| 2550 | No | 36554 | 12/9/1963 | BOISE CASCADE CORP. | Industrial | A WELL | 1.56 |
| 40678 | No | 58877 | 8/18/1976 | BOISE CASCADE CORP. | Log Deck | SPRINGS/WASTE WATE | 3.00 |
| 11745 | No | | 7/6/1992 | BOISE CASCADE; NORTHEAST OREGON REGION | Industrial | A WELL | 1.11 |
| 3321 | No | 41154 | 6/6/1966 | BORDEN CO. CHEMICAL DIVISION | Industrial | A WELL | 0.89 |
| | No | T8905 | 12/31/1872 | DON HAMPTON | Commercial | GRANDE RONDE RIVER | 0.03 |
| 7361 | No | T8905 | 5/26/1926 | DON HAMPTON | Commercial | PIERCE SLOUGH | 0.03 |
| 3755 | No | 41269 | 7/20/1967 | DONNOVAN F HAMPTON; ROGERS ASPHALT PAVING | Industrial | A WELL | 0.22 |
| 54414 | No | 90948 | 3/30/2006 | EAGLES HOT LAKE RV PARK | Commercial | A SPRING | 0.09 |
| 16213 | No | 92277 | 4/3/2006 | EAGLES HOT LAKE RV PARK | Commercial | A WELL | 0.10 |
| 15261 | No | | 8/14/2001 | FIRST CHURCH OF THE NAZARENE | Commercial | A WELL | 0.05 |
| 54644 | YES | | 9/13/2007 | HOT LAKE SPRINGS RESORT | Commercial | A SPRING | 0.49 |
| 13513 | YES | | 2/2/1998 | KENNETH DALE KNOTT | Industrial | A WELL | 2.23 |
| 3490 | No | 41044 | 9/28/1966 | LA GRANDE CONCRETE PIPE CO. INC. | Industrial | A WELL | 0.13 |
| 2969 | No | 88818 | 7/2/1965 | LA GRANDE COUNTRY CLUB | Commercial | A WELL | 0.81 |
| 15877 | No | 15322 | 7/27/1944 | MT EMILY LUMBER CO. | Industrial | GRANDE RONDE RIVER | 1.00 |
| 6414 | No | 7216 | 3/22/1924 | MT EMILY TIMBER CO. | Industrial | GRANDE RONDE RIVER | 10.00 |
| 16268 | YES | | 7/18/2006 | OREGON STATE PARKS AND RECREATION DEPARTMI | Commercial | A WELL | 0.12 |
| 16267 | YES | | 1/8/2007 | OREGON STATE PARKS AND RECREATION DEPARTMI | Commercial | A WELL | 0.14 |
| 16266 | YES | | 1/8/2007 | OREGON STATE PARKS AND RECREATION DEPARTMI | Commercial | A WELL | 0.19 |
| 10056 | No | | 3/16/1983 | OREGON WASHINGTON RAILROAD & NAVIGATION C | Industrial | WELLS several | 0.09 |
| 8797 | No | 8112 | 11/5/1928 | OREGON WASHINGTON RAILROAD AND NAVIGATIOI | Industrial | MOSES CREEK | 0.13 |
| 16988 | No | 16941 | 5/6/1946 | OREGON WASHINGTON RAILROAD AND NAVIGATIOI | Industrial | FIVE POINTS CREEK | 0.50 |
| 8798 | No | 8113 | 11/5/1928 | OREGON WASHINGTON RAILROAD AND NAVIGATIOI | Industrial | FIVE POINTS CREEK | 0.50 |
| 1855 | No | 1172 | 1/3/1914 | OREGON WASHINGTON RAILROAD AND NAVIGATIOI | Industrial | DRY CREEK | 0.51 |
| | No | T7008 | 12/31/1872 | ORODELL DITCH ASSOCIATION | Industrial | GRANDE RONDE R | 0.38 |
| 15979 | YES | | 1/22/2004 | ROVEY FARMS | Commercial | A WELL | 1.34 |
| | No | CI4185 | 12/31/1905 | UNION PACIFIC RAILROAD CO. | Industrial | A WELL | 0.45 |
| | | | | | | CFS Rate Total | 27.622 |

**Table 3-5**
**Big Seven Industrial Rights 1 cfs or Greater**

| Stakeholder | Use | Source | Stream | CFS |
|---|---|---|---|---|
| Mt. Emily Timber Co. | Industrial Manufacturing | Grande Ronde River | Grande Ronde River > Snake River | 10.00 |
| Boise Cascade Corp. | Log Deck | Springs/Wastewater | Phillips Creek > Grande Ronde River | 3.00 |
| Kenneth Dale Knott | Industrial Manufacturing | A Well | Duncan Creek > Murphy Creek | 2.23 |
| Boise Cascade Corp. | Industrial Manufacturing | A Well | Phillips Creek > Grande Ronde River | 1.56 |
| Rovey Farms | Commercial Use | A Well | Unnamed Stream > Little Creek | 1.34 |
| Boise Cascade; Northeast Oregon Region | Industrial Manufacturing | A Well | Grande Ronde River > Snake River | 1.11 |
| Mt. Emily Lumber Co. | Industrial Manufacturing | Grande Ronde River | Grande Ronde River > Snake River | 1.00 |

Figures 3-4, 3-5, 3-6, and 3-7 show the locations of industrial water rights throughout the UGRRW.

**Figure 3-4**
**Industrial Water Rights in the Central Portion of the Upper Grande Ronde River Watershed (3 and 6)**

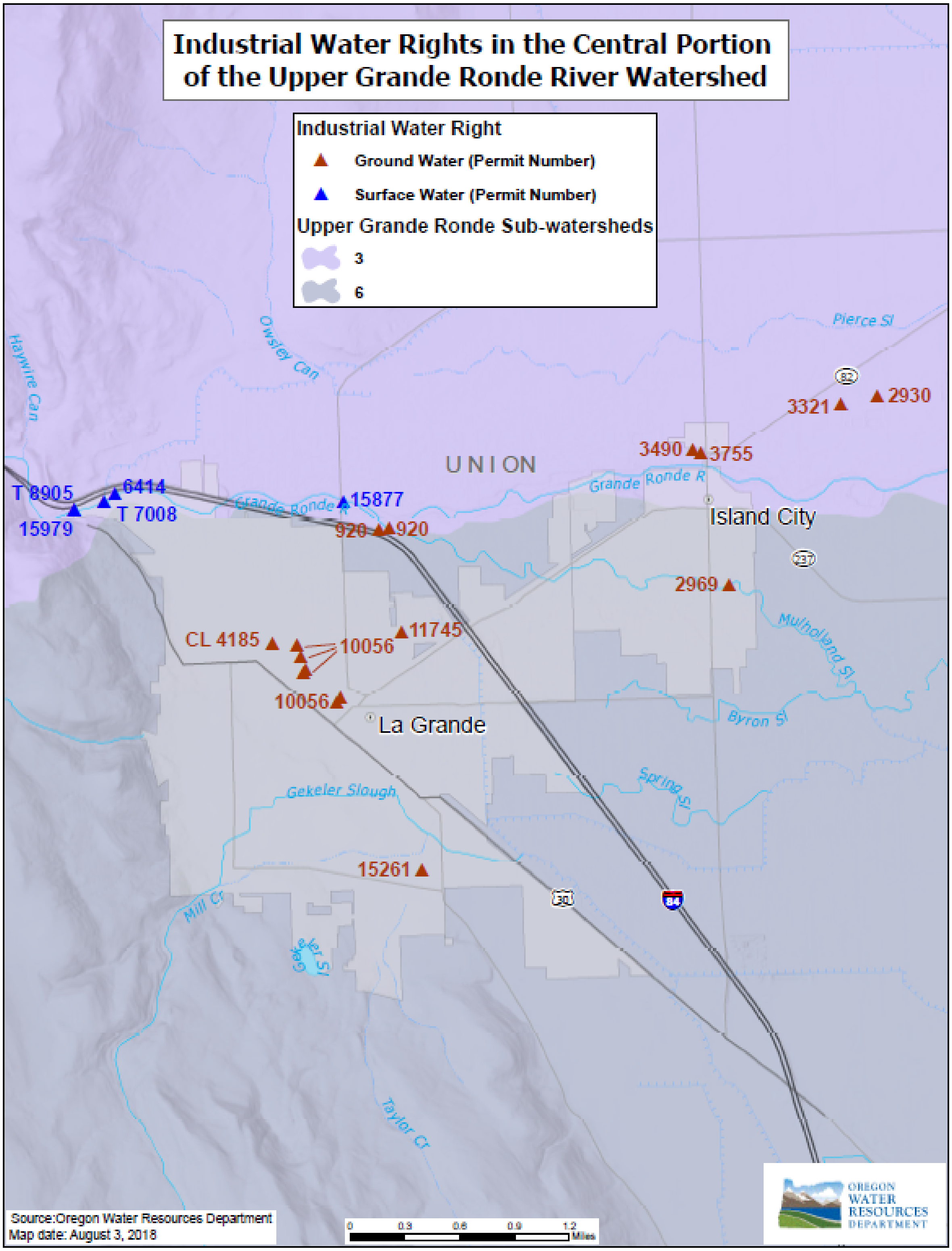


**Figure 3-5**
**Industrial Water Rights in the Northern Portion of the Upper Grande Ronde River Watershed (1 and 2)**

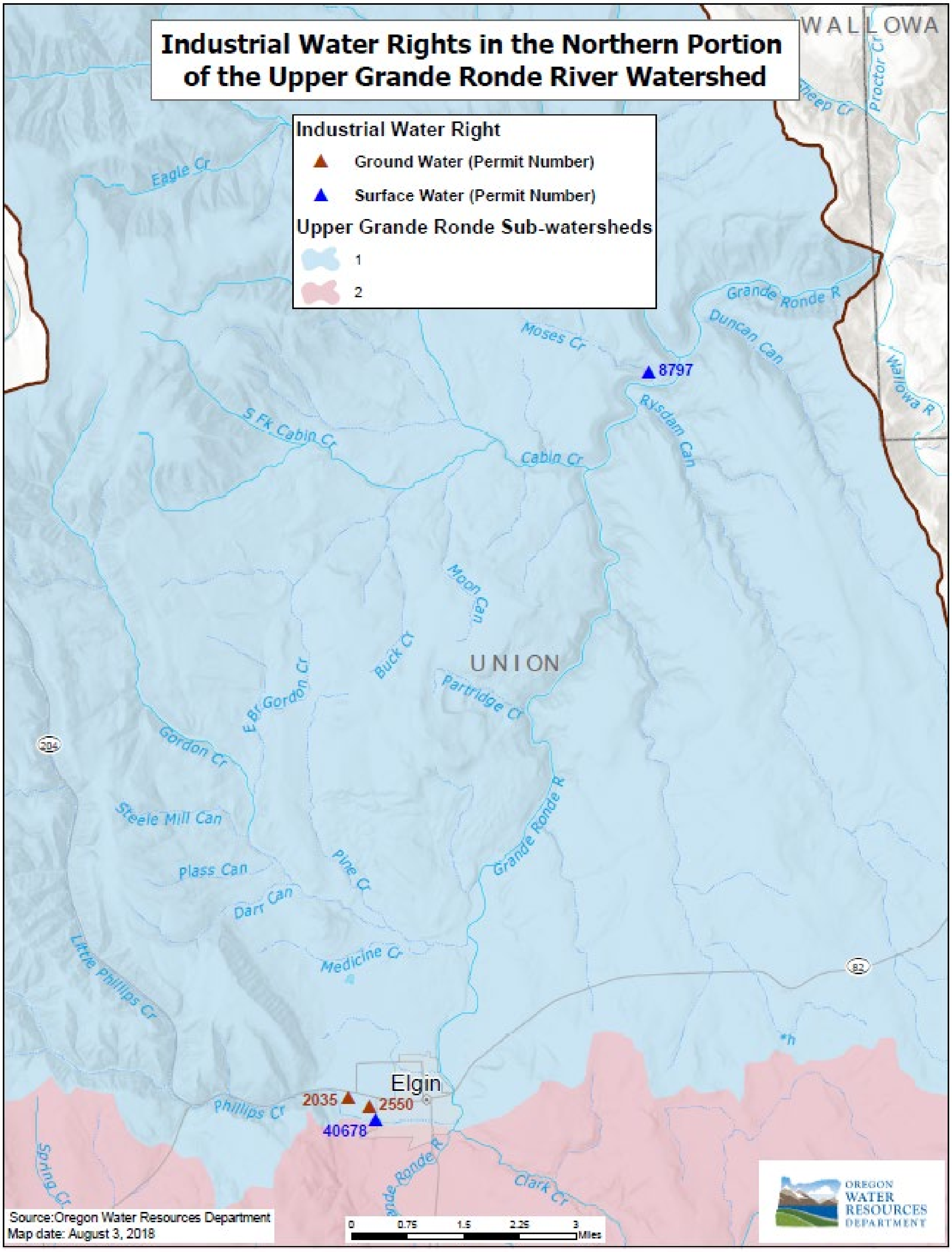


**Figure 3-6**
**Industrial Water Rights in the Southern Portion of the Upper Grande Ronde River Watershed (6 and 7)**

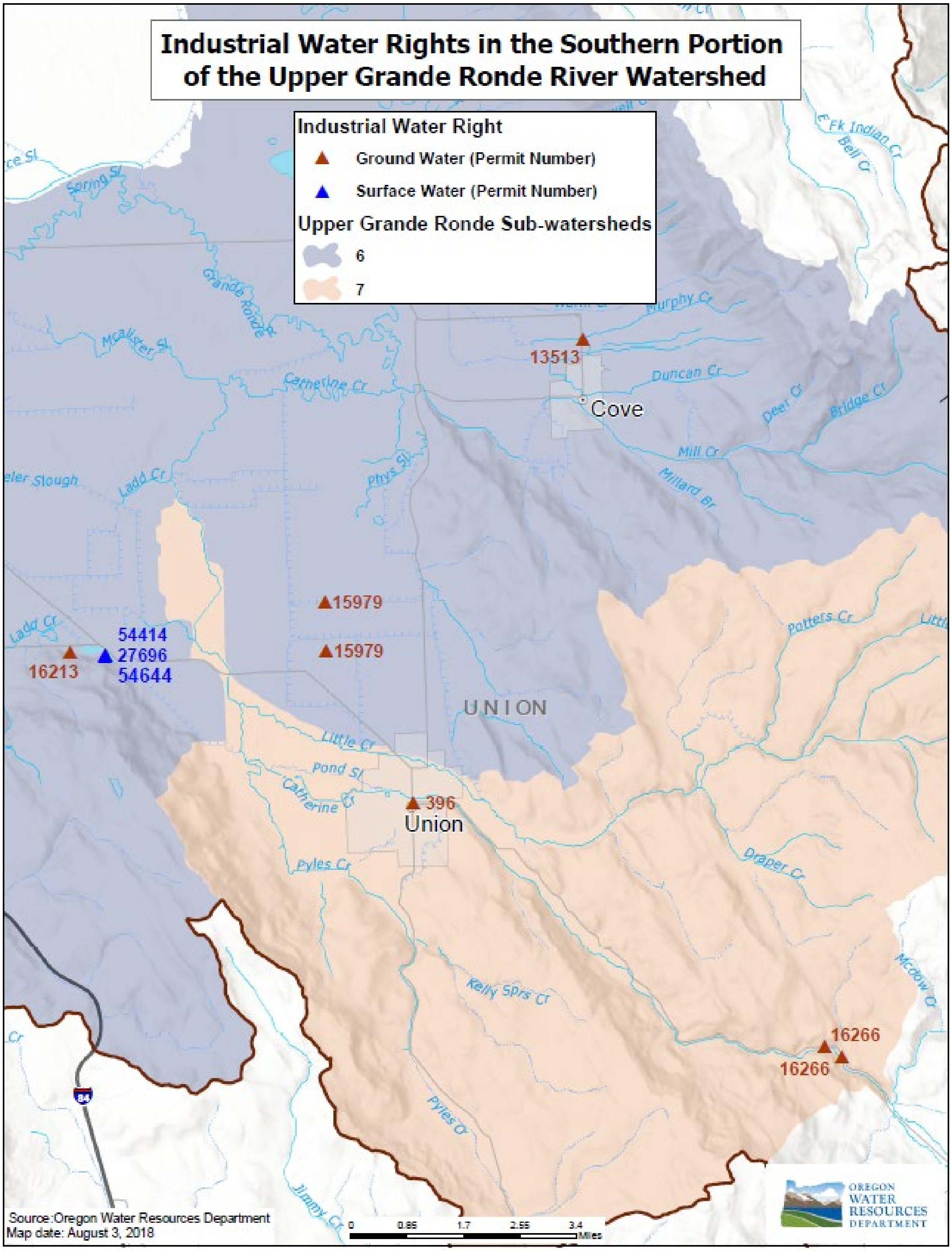
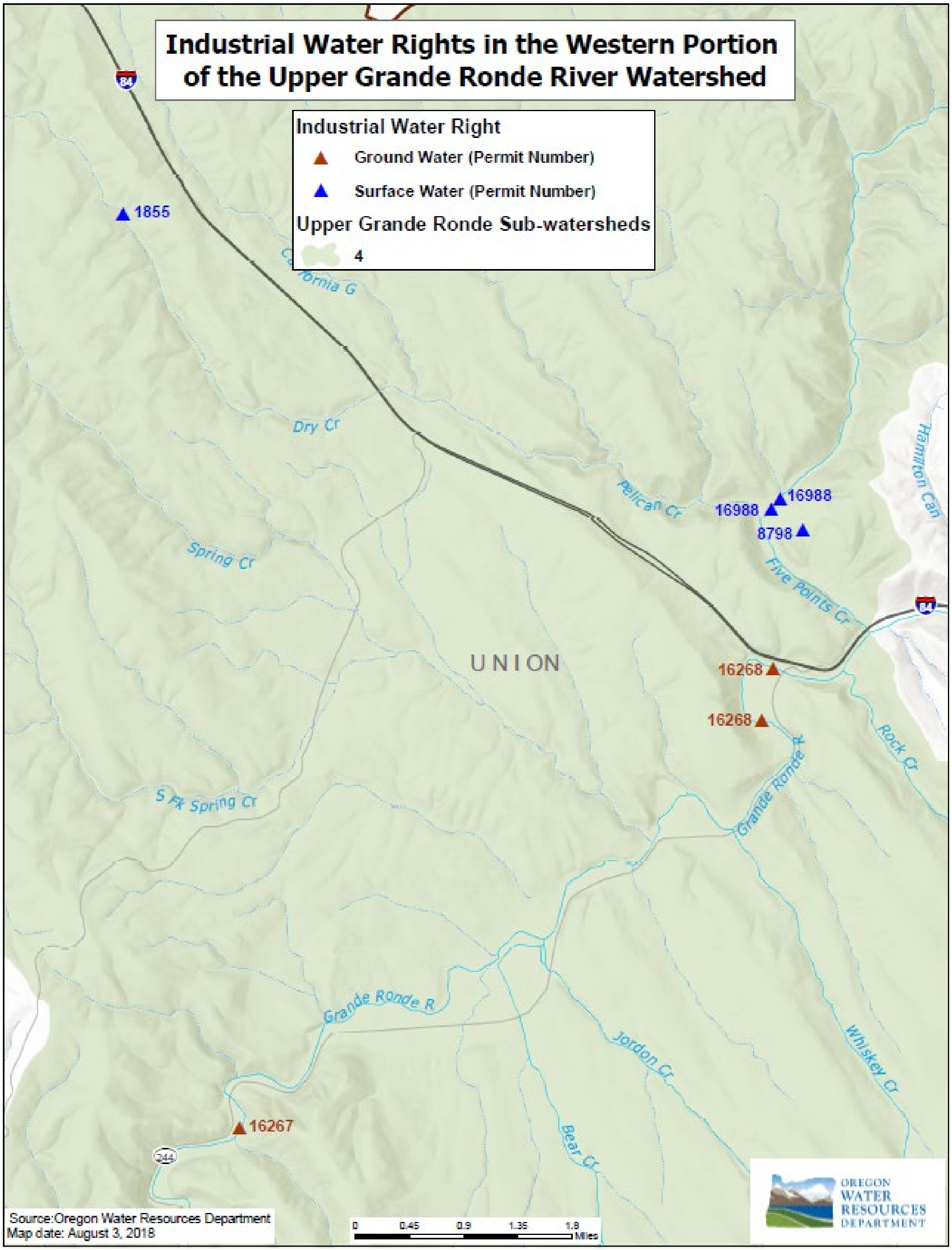


**Figure 3-7**
**Industrial Water Rights in the Western Portion of the Upper Grande Ronde River Watershed (4)**



# Demand Calculations (Current and Future)

This section describes Union County demand as calculated by the 2015 Statewide Forecast. The 2015 Statewide Forecast contains County-scale 2015 agriculture and municipal demand estimates and projections to 2050. These methods are compared to the UGRRW Partnership calculations to provide refined estimates based on local knowledge and additional review of municipal water use reporting data.

## *Municipal Demand*

For current municipal demand, the 2015 Statewide Forecast used existing WMCP data extrapolated to other municipalities without WMCPs. The La Grande and Island City WMCP were used for Union County, and the City of Echo in Umatilla County was used to estimate per capita demand (PCD) for smaller cities and rural residents in northeastern Oregon (OWRD, 2015).

### Actual Water Use by City

To refine the 2015 Statewide Forecast estimates, actual reported water use from each city was evaluated following this general process: 1) downloaded reported current municipal water use data since 2001 from OWRD's website, 2) excluded outliers from the dataset, 3) divided the monthly data to a bi-weekly basis, and 4) apportioned the reported use to each of the eight subwatersheds where the municipal well is located. Data that appeared to be far from normal was discarded (i.e., well meter down or mis-recording) and was replaced with an average for that month to arrive at a reasonable estimate of current demand.

Spreadsheets containing these data can be found in Appendix A, Municipal Demand Calculations.

Figure 3-8, below, shows the total combined water demand for all cities in Union County for 2013, which was the last year that all cities simultaneously submitted complete reports to the OWRD. Data used in this figure are located in Appendix A. Figures showing each City's individual water demands are included in Appendix A. Table 3-6, below, shows municipal demand in gallons per day (City of La Grande, 2018).

**Figure 3-8**
**2013 Water Year Total Municipal Consumption**

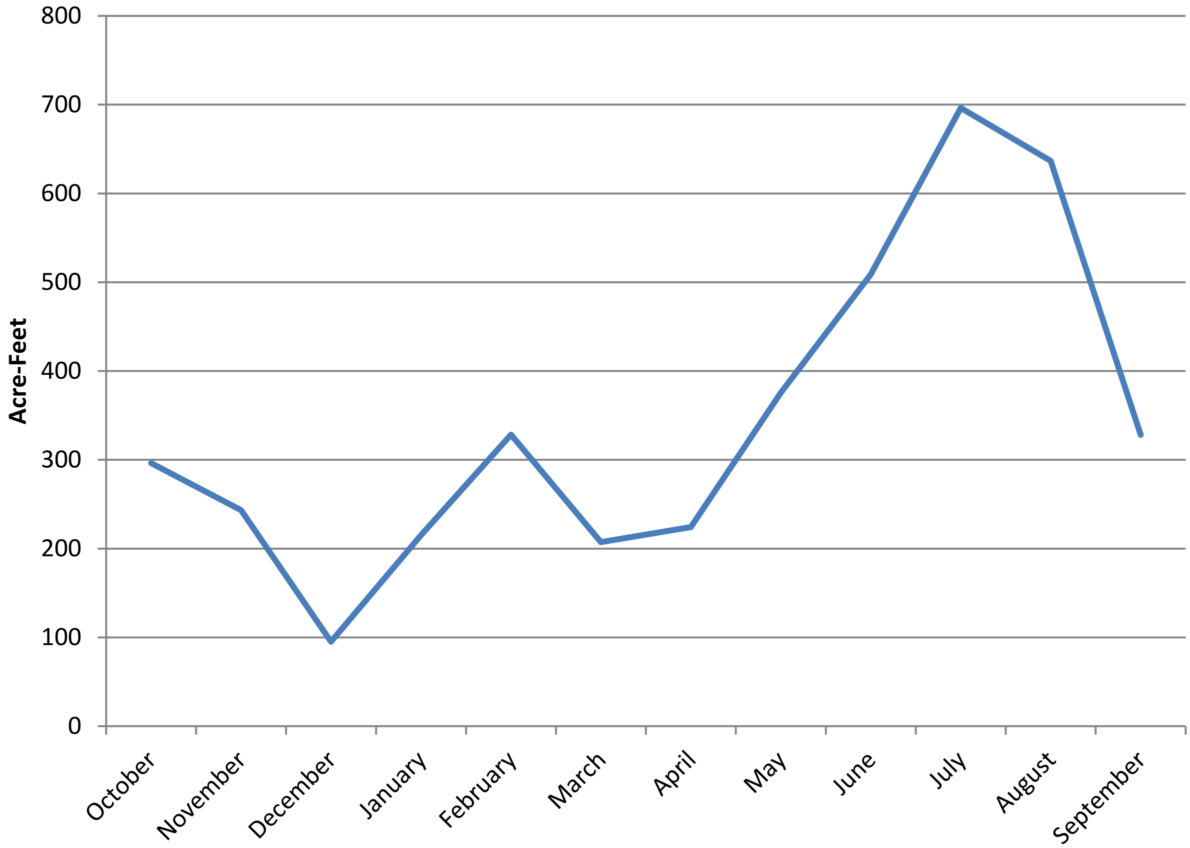


**Table 3-6**
**Municipal Demand Gallons per Day Estimate Sources**

| County | City/Identifier | Per Capita Reference | PCD per Day 2010 to 2050 (2015 Statewide Forecast) | PCD per Day 2001 to 2016 Averaged Reported Use Data |
|---|---|---|---|---|
| Union | Cove | Cove - 2012 | 215 | 201 |
| Union | Elgin | Echo - 2012 | 161 | 374 |
| Union | Imbler | Echo - 2012 | 161 | 313 |
| Union | Island City | Island City - 2011 | 260 | 365 |
| Union | La Grande | La Grande - 2010 | 195 | 183 |
| Union | Summerville* | Echo - 2012 | 161 | 218 |
| Union | Union | La Grande - 2010 | 195 | 201 |

**Summerville has no municipal water system but is included in this report for informational purposes as it is shown on maps of the area.*

For future municipal city demand both the 2015 Statewide Forecast and the UGRRW Partnership assumed a less than 1 percent population growth across the County (see Table 3-7, below). It assumes that PCD will not change between now and 2050.

**Table 3-7**
**Municipal Demand Population Estimates (2015 Statewide Forecast)**

| City/ Identifier | Forecasted Population | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
| Cove | 552 | 577 | 577 | 603 | 629 | 653 | 675 | 697 | 732 |
| Elgin | 1,711 | 1,788 | 1,788 | 1,871 | 1,950 | 2,024 | 2,091 | 2,159 | 2,268 |
| Imbler | 306 | 320 | 320 | 335 | 349 | 362 | 374 | 386 | 406 |
| Island City | 989 | 1,033 | 1,033 | 1,081 | 1,127 | 1,170 | 1,209 | 1,248 | 1,311 |
| La Grande | 13,082 | 13,667 | 13,667 | 14,302 | 14,911 | 15,475 | 15,990 | 16,510 | 17,340 |
| Summerville | 135 | 141 | 141 | 148 | 154 | 160 | 165 | 170 | 179 |
| Union | 2,121 | 2,216 | 2,216 | 2,319 | 2,418 | 2,509 | 2,593 | 2,677 | 2,811 |

The water use data reported by the cities to the OWRD (2001 to 2017) were used to calculate per capita demand figures that are more accurate since they are based on actual water use reported by each city in the planning area rather than extrapolated from nearby WMCPs as was done for the statewide forecast.

To estimate the unincorporated demand, the municipal per capita demand figures for all the cities in the planning area was averaged 221.9 gallons per capita day (gpcd), and applied to the estimate of the population outside the cities, 6,353 people. This produced an estimate of total annual use volume in AF for the unincorporated demand. The total annual volume was then apportioned by month in a similar pattern as the monthly city use pattern to reflect typical higher use in the summer months. Unincorporated use is estimated to be a substantial volume of annual water use, more than half of La Grande's use, if 221.9 gpcd is assumed. See Appendix A to review the calculations used in this assessment.

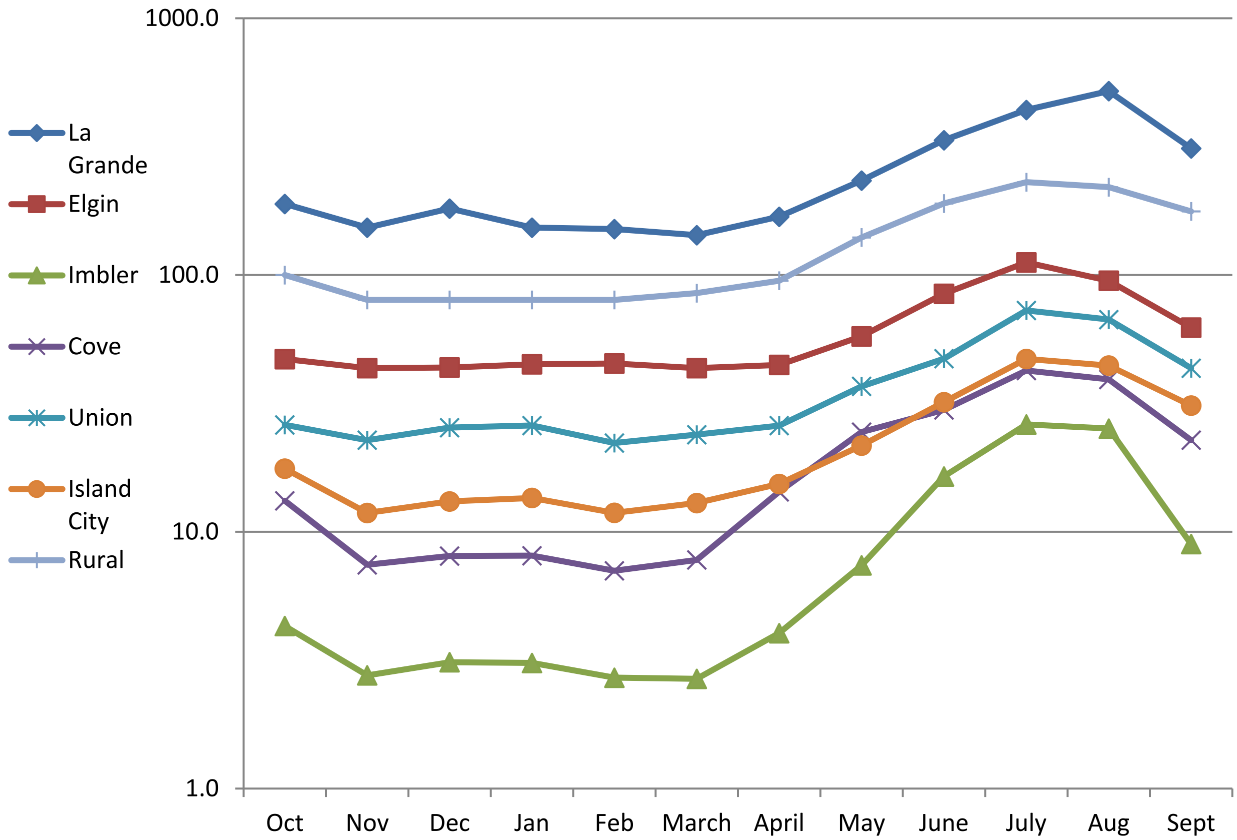
Table 3-8 shows the monthly summary data for each city and unincorporated areas.

**Table 3-8**
**Current Municipal Demand Cities and Unincorporated Areas in Acre-Feet**

| | La Grande | Elgin | Imbler | Cove | Union | Island City | Unincorporated |
|---|---|---|---|---|---|---|---|
| **October** | 189.2 | 47.1 | 4.3 | 13.2 | 26.1 | 17.6 | 100.0 |
| **November** | 152.9 | 43.4 | 2.8 | 7.4 | 22.8 | 11.8 | 80.0 |
| **December** | 181.4 | 43.6 | 3.1 | 8.0 | 25.5 | 13.1 | 80.0 |
| **January** | 152.9 | 44.9 | 3.1 | 8.1 | 25.9 | 13.5 | 80.0 |
| **February** | 151.0 | 45.2 | 2.7 | 7.1 | 22.2 | 11.8 | 80.0 |
| **March** | 143.0 | 43.4 | 2.7 | 7.8 | 23.9 | 12.9 | 85.0 |
| **April** | 168.7 | 44.7 | 4.0 | 14.3 | 25.9 | 15.4 | 95.0 |
| **May** | 233.3 | 57.7 | 7.4 | 24.5 | 36.8 | 21.7 | 140.0 |
| **June** | 334.9 | 84.5 | 16.4 | 29.8 | 47.2 | 32.0 | 190.0 |
| **July** | 439.5 | 112.0 | 26.2 | 42.5 | 72.8 | 47.1 | 230.0 |
| **August** | 520.3 | 95.0 | 25.2 | 39.2 | 67.1 | 44.4 | 220.0 |
| **September** | 311.3 | 62.4 | 9.0 | 22.7 | 43.4 | 31.0 | 177.0 |
| **Annual Avg AF** | 2,978.3 | 724.0 | 106.9 | 224.6 | 439.6 | 272.5 | 1,557.5 |
| **Daily Avg AF** | 8.2 | 2.0 | 0.3 | 0.6 | 1.2 | 0.8 | 4.3 |
| **Source Formation** | Alluvial/Basalt | Basalt | Basalt | Basalt | Basalt | Alluvial | Alluvial |
| **Subwatershed** | 6 | 1 and 2 | 2 | 6 | 6 and 7 | 6 | all |

Figure 3-9 is a graph of all the cities and of unincorporated water use by month (average of 2001 through 2016 monthly data) (log scale).

**Figure 3-9**
**City and Unincorporated Water Use by Month (Log Scale) in Acre-feet**




The ratio of highest month usage to lowest month usage for each city is shown below on Table 3-9. Imbler and Cove have very high summer usage relative to winter, which likely indicates substantial irrigation or seasonal industrial use served by the cities. This ratio is useful to explore the variability in demand between municipal users and may be further considered when working through potential water conservation solutions in Step 4.

**Table 3-9**
**Ratio of Highest Month to Lowest Month Usage by City**

| City | Ratio High/low |
|---|---|
| La Grande | 3.6 |
| Elgin | 2.6 |
| Imbler | 9.7 |
| Cove | 6.0 |
| Union | 3.3 |
| Island City | 4.0 |

### *Unincorporated Demand*

In addition to municipal city demand, unincorporated demand was calculated. Unincorporated demand was defined as rural households who are generally using exempt wells for household water and yard irrigation. For current unincorporated demand, the 2015 Statewide Forecast used the total number of people outside city limits and multiplied it by the PCD usage from the City of Echo (161 gallons per day [GPD]). The Partnership used the GPD based on the average for the actual municipal per capita per day calculations (221.9 gallons PCD) and applied this to the total number people estimated outside city limits (6,353 people) to reflect local actual water use information. This quantity was distributed between the months similar to city use patterns and then apportioned between the eight subwatersheds based on the percentage of tax lots outside city limits within each subwatershed.

This unincorporated rural demand is approximately half of La Grande's demand and is dispersed across the County. No attempt was made to subtract North Powder area unincorporated use from the Union County total for this category, but it would be a relatively small figure.

Table 3-10 below shows the total water demand (obtained by applying per capita demand to the unincorporated population) from tax lots outside city boundaries (obtained from the Oregon map) within Union County.

**Table 3-10**
**Current Unincorporated Demand by Subwatershed in Acre-Feet**

| Subwatershed | 1 (Lookingglass Creek/Cabin Creek) | 2 (Willow Creek/Indian Creek) | 3 (Lower Five Points Creek) | 4 (Beaver Creek, Upper Five Points Creek) | 5 (Meadow Creek Upper Grande Ronde River) | 6 (Ladd Creek Lower Catherine) | 7 (Upper Catherine Creek 1) | 8 (Upper Catherine Creek 2) | Total |
|---|---|---|---|---|---|---|---|---|---|
| Tax Lots | 972 | 1,448 | 1,075 | 380 | 203 | 2,102 | 399 | 51 | 6,630 |
| Percent of Total Tax Lots | 15% | 22% | 16% | 6% | 3% | 32% | 6% | 1% | 100% |
| October | 14.7 | 21.8 | 16.2 | 5.7 | 3.1 | 31.7 | 6.0 | 0.8 | 100 |
| November | 11.7 | 17.5 | 13.0 | 4.6 | 2.4 | 25.4 | 4.8 | 0.6 | 80 |
| December | 11.7 | 17.5 | 13.0 | 4.6 | 2.4 | 25.4 | 4.8 | 0.6 | 80 |
| January | 11.7 | 17.5 | 13.0 | 4.6 | 2.4 | 25.4 | 4.8 | 0.6 | 80 |
| February | 11.7 | 17.5 | 13.0 | 4.6 | 2.4 | 25.4 | 4.8 | 0.6 | 80 |
| March | 12.5 | 18.6 | 13.8 | 4.9 | 2.6 | 26.9 | 5.1 | 0.7 | 85 |
| April | 13.9 | 20.7 | 15.4 | 5.4 | 2.9 | 30.1 | 5.7 | 0.7 | 95 |
| May | 20.5 | 30.6 | 22.7 | 8.0 | 4.3 | 44.4 | 8.4 | 1.1 | 140 |
| June | 27.9 | 41.5 | 30.8 | 10.9 | 5.8 | 60.2 | 11.4 | 1.5 | 190 |
| July | 33.7 | 50.2 | 37.3 | 13.2 | 7.0 | 72.9 | 13.8 | 1.8 | 230 |
| August | 32.3 | 48.0 | 35.7 | 12.6 | 6.7 | 69.7 | 13.2 | 1.7 | 220 |
| September | 25.9 | 38.7 | 28.7 | 10.1 | 5.4 | 56.1 | 10.7 | 1.4 | 177 |

For future unincorporated demand, the 2015 Statewide Forecast assumed no change in PCD from 2015 to 2050. The 2050 forecast was based on population projections that estimate 6,764 rural people in 2015 to 8,582 in 2050 (26 percent increase).

### *Self-supplied Industrial Use Demand*

SSIU was calculated next. These water uses are often located outside city limits and provide their own water through groundwater or surface water rights (although some are located within city limits and have their own water source). Different industrial users have different water quality demands depending on the process used at the facility.

For the 2015 Statewide Forecast, the assumptions used to calculate SSIU demand were:

1. Based on “industrial” water rights in the water right database
2. The instantaneous diversion rate was used
3. Assumed facilities, on average, use one-half that diversion rate
4. Assumed facilities operate 16 hours every day of the year

Table 3-4 (above) shows all SSIU water rights and Table 3-5 (above) shows the seven rights with a maximum diversion rate of 1 cfs or greater that account for 73 percent of diversion demand of SSIU rights. The use or non-use of these seven industrial rights could have a large impact on the SSIU demand at any given time.

The UGRRW Partnership used SSIU water rights and half the full water right rate multiplied by one shift a day (8 hours) to calculate current demand, since some rights are believed by the planning group’s participants to be not in use or operating at a reduced rate).

For future SSIU demand, the 2015 Statewide Forecast assumed demand would be the same as 2015. In this report, the UGRRW Partnership used SSIU water rights and used half the full water right rate multiplied by two shifts a day (16 hours) to recognize that future use could increase within the limits of the rights.

For this analysis, SSIU water rights were assigned to their subwatershed location and source (groundwater or surface water). These water rights were then multiplied by an estimate of current use and the end of the planning period estimated use.

The current use was estimated using half the maximum rate for one 8-hour shift a day and converted to 15-day AF sums to put in the water balance tables. The statewide forecast used half rate times two shifts a day but this seemed high based on the local feedback, so a lower figure was used.

The projected future use (2068) could have been estimated in as wide a range as equal to current use to eight times current use. No industry data were available or used for this estimation. Based on a general idea that growth could occur in Union County, projected future use was estimated using the full maximum rate for two 8-hour shifts a day (2/3 day) and then converted to 15-day AF sums to put in the water balance tables. This estimate using the full maximum rate for two shifts may be high, but it makes allowance for some industries to maximize use of these permits, which is a future possibility. See Table 3-11 for Self-sustained Industrial Use Demand by Subwatershed (Current and Future).

**Table 3-11**
**Self-sustained Industrial Use Demand by Subwatershed (Current and Future)**

| Subwatershed/Source | Current (AF per 15 Days) | Future (2068) (AF per 15 Days) |
|---|---|---|
| 1 (Lookingglass Creek/Cabin Creek)/GW | 9.0 | 47.4 |
| 1 (Lookingglass Creek/Cabin Creek)/SW | 16.0 | 63.8 |
| 3 (Lower Five Points Creek)/GW | 10.2 | 40.7 |
| 3 (Lower Five Points Creek)/SW | 58.1 | 232.2 |
| 4 (Beaver Creek, Upper Five Points Creek)/GW | 2.7 | 11.0 |
| 4 (Beaver Creek, Upper Five Points Creek)/SW | 7.1 | 28.6 |
| 6 (Ladd Creek Lower Catherine)/GW | 43.2 | 172.7 |
| 6 (Ladd Creek Lower Catherine)/SW | 4.7 | 19.0 |
| 7 (Upper Catherine Creek 1)/GW | 2.3 | 9.2 |
| **TOTAL** | **153.3** | **624.6** |

## *Total Municipal Demand*

Total municipal demand (sum of municipal, unincorporated, and SSIU demand) for Union County was calculated by the 2015 Statewide Forecast to be 14.5 thousand acre feet (TAF) per year for 2015 and 16.0 TAF per year in 2050. It was calculated by the UGRRW Partnership to be 10.3 TAF per year for 2018 and 22.3 TAF per year in 2068. See Table 3-12, below, for a comparison of the 2015 Statewide Forecast versus the Partnership's estimates for municipal demand.

**Table 3-12**
**Comparison of 2015 Statewide Forecast and Partnership Municipal Demand Estimates**

| 2015 Statewide Forecast | | Partnership Calculations | |
|---|---|---|---|
| **2015 Demand TAF per Year** | | **2018 Demand TAF per Year** | |
| Municipal | 4.4 | Municipal | 5.0 |
| Unincorporated | 1.2 | Unincorporated | 1.6 |
| SSIU | 8.9 | SSIU | 3.7 |
| **Total** | **14.5** | **Total** | **10.3** |
| **2050 Demand TAF per Year** | | **2068 Demand TAF per Year** | |
| Municipal | 5.6 | Municipal | 5.3 |
| Unincorporated | 1.5 | Unincorporated | 2.0 |
| SSIU | 8.9 | SSIU | 15.0 |
| **Total** | **16.0** | **Total** | **22.3** |

## Vulnerability Assessment and Indicators of Resilience

### *Qualitative Review of Municipal Demand - City Surveys*

To evaluate municipal concerns related to water use that were not quantifiable, qualitative surveys were sent to all cities within Union County to determine the status of systems and future needs. Responses were received by Union, Island City, Imbler, La Grande, and Cove (but not Elgin). Responses are summarized on Table 3-13, below:

**Table 3-13**
**Municipal Response Summary**

| Question | Union | Island City | Imbler | La Grande | Cove |
|---|---|---|---|---|---|
| **How does the amount of water used by the City change throughout the year?** | High in summer, low in winter | High in summer, low in winter | High in summer, low in winter | High in summer, low in winter | High in summer, low in winter |
| **Are there any water quality concerns for the City's water supply?** | No | No | No | No | No |
| **What has been the trend in annual use over the past 10 or 20 years?** | Stable | Increasing | Increasing, but poor data quality | Stable | Decreasing |
| **Approximately how is the city's use/demand divided between industrial, commercial, and domestic uses?** | 0 percent industrial, 85 percent domestic, 15 percent commercial | No industrial, majority domestic, some commercial | No industrial, 100 percent domestic, no commercial | 45 percent industrial/ commercial, 55 percent domestic | No industrial, 92.5 percent domestic, 7.5 percent commercial |
| **Do you feel the City's water rights/supply sources adequate for the next 30 to 50 years?** | Yes | Yes | Yes | Unknown. Dependent on population changes. | 30 years - Yes<br>50 years - Unknown |
| **What is the condition of wells, treatment system, and distribution system?** | Good | Good | Aging | Good | Good |

| Question | Union | Island City | Imbler | La Grande | Cove |
|---|---|---|---|---|---|
| **How active is the City at promoting citizen conservation and reducing system leakage?** | Moderate-poor | Moderate-poor | Moderate-poor | Very active | Very active |
| **Are there any serious issues the City is facing with their water system or supply?** | No | No | No | No | No |
| **What SSIU have water rights in the area?** | Unknown | Unknown | Unknown | Unknown | Artesian Blue Water Plant, Blue Mountain Bottled Water |

All survey respondents indicated that water use peaks in the summer and is at a minimum in the winter. All responded that water supply was adequate to serve the City's needs for the next 30 to 50 years (except La Grande and Cove indicated unknown), and none indicated any serious imminent water issues. Water is primarily allocated for domestic use, with a limited amount of commercial use and no industrial use among the respondents, with the exception of La Grande, which reported industrial/commercial use at 45 percent. Three questions were asked regarding activities outside of city systems related to SSIU use and unincorporated demand. All cities responded with "unknown," so these questions were omitted from the summary table above.

Future water demands can be presumed to be tied to population forecasts, all of which were expected to either remain stable or increase. Four respondents reported the condition of their water system as "good" and one reported the system as "aging."

Table 3-14, below, shows how the forecasted supply compares to the total value of municipal rights that can be perfected by the cities. It appears that cities could use significantly more water in the future if population increases occur.

**Table 3-14**
**Table of Municipal Groundwater Rights Compared to Reported Use**

| City | Maximum Groundwater Rights Rate, cfs* | Maximum Legal Annual Volume of Groundwater Rights in AF | Current Reported Annual Use in AF** | Percent of Groundwater Rights Maximum Legal Annual Volume Currently Used | Ratio of Groundwater Rights Maximum Legal Annual Volume to Current Annual Reported Use |
|---|---|---|---|---|---|
| La Grande | 23.9 | 17,298.7 | 2,978.0 | 17 | 5.8 |
| Island City | 4.0 | 2,880.7 | 272.5 | 9 | 10.6 |
| Union | 10.0 | 7,259.7 | 439.6 | 6 | 16.5 |
| Cove | 2.8 | 2,012.2 | 224.6 | 11 | 9.0 |
| Elgin | 8.3 | 6,007.5 | 724.0 | 12 | 8.3 |
| Imbler | 1.1 | 803.4 | 106.9 | 13 | 7.5 |

**This information comes from Table 3-1 in this report and is for the water rights used for municipal purposes within a city.*
***This information comes from Table 3-8 in this report of GW use reporting.*
*Notes: Analysis does not consider the reliability of the source or water rights to serve at the maximum rate year-round.*
*Some of the groundwater rights are not fully developed or perfected.*

## Future Demand Analysis

Based on the assumptions in the report, future municipal demands also appear to be met. There are uncertainties that may impact this, including unexpected population increases or decreases, industrial use increases, climate change, system leakage, and water saving conservation practices.

Future groundwater quality was not identified as an issue of concern because of the lack of new contaminants (such as nitrates) being introduced to groundwater. If cities use surface water rights in the future, water quality could be a much more serious concern.

This report assumes that groundwater levels are stable in the UGRRW. However, if groundwater levels were to decline, water quality could become a concern if wells are deepened and water quality deteriorates at depth. A warmer future climate could result in increased pumping that will lower groundwater levels at a faster rate.

Additional future concerns for municipal use were identified by the Stakeholder Group, including whether a state of emergency/drought could impact water use and whether city water use would take priority over industrial and agricultural users. Some cities in the watershed have drought or emergency curtailment plans to address these issues. Additional concerns related to water storage and municipal system redundancy were also discussed.

## Municipal Demand Summary and Vulnerability Assessment

### *Overall Water Quality Vulnerabilities*

- Municipal supplies are primarily supplied by groundwater and appear to have a low risk of being impacted by water quality problems.
- Drinking water supplies are frequently tested for quality, but there is little groundwater quality data from surrounding areas.
- The supplies are assumed to be pumped at a sustainable rate, and it is also assumed that they are relatively safe from contamination. There is a lack of data to support these assumptions.
- Lack of regional groundwater water quality data is a critical uncertainty.

### *Overall Water Quantity Vulnerabilities*

Table 3-15 shows the municipal portion of current and future annual demand in the UGRRW. Bi-weekly demand can be seen in Section 7, Subwatershed Demand Summaries.

**Table 3-15**
**Municipal Demand Summary**

| Subwatershed | Name | Groundwater Used (from Step 2 Report) AF per Year | Current Municipal Demand Surface Water (AF per Year) | Municipal Demand Ground Water (AF per Year) | Future Municipal Demand Surface Water (AF per Year) | Future Municipal Demand Ground Water (AF per Year) | Water Quality Comments | Vulnerabilities |
|---|---|---|---|---|---|---|---|---|
| 1 (Elgin) | Lookingglass Creek/Cabin Creek | - | 383 | 805 | 1,532 | 1,762 | | |
| 2 (Imbler and Summerville) | Willow Creek/Indian Creek | 29,404 | - | 809 | - | 857 | | Aging infrastructure |
| 3 (Island City) | Lower Five Points Creek | 25,721 | 1,393 | 497 | 5,573 | 1,244 | Drinking water source is groundwater; high density population | Increasing water use |
| 4 (None) | Beaver Creek, Upper Five Points Creek | 1,964 | 171 | 155 | 686 | 360 | | |
| 5 (None) | Meadow Creek Upper Grande Ronde River | 187 | - | 48 | - | 51 | | |
| 6 (La Grande and Cove) | Ladd Creek Lower Catherine | 71,716 | 114 | 5,498 | 456 | 8,873 | Drinking water source is groundwater; high density population | |
| 7 (Union) | Upper Catherine Creek 1 | 9,279 | - | 369 | - | 388 | | |
| 8 (None) | Upper Catherine Creek 2 | - | - | 12 | - | 13 | | |
| Total | | 138,271 | 2,062 | 8,192 | 8,246 | 13,548 | | |

Overall, vulnerabilities to municipal systems appear to be **low.** Vulnerabilities include a slight potential increase in use in 2068 as infrastructure ages. Another vulnerability related to infrastructure is that many systems lack system redundancy and storage to support municipal demand if groundwater pumps fail. The cities, except for Imbler, have multiple wells, so there is some redundancy in terms of source water extraction. The City of La Grande has a surface water reservoir as a redundant raw water back-up source but currently does not have the means to treat that source and does not use it in the system.

All residents within the cities rely on groundwater for potable water supply, and this could be a vulnerability in the event of aquifer contamination or depletion. One assumption that may understate the vulnerabilities of using groundwater is that groundwater is assumed to be stable in this report. If that is not the case, declining aquifers could create concerns in the future.

### *Main Issues*

Based on research to date, the main issues facing municipalities are: 1) the long-term stability/viability of the groundwater aquifers from which the municipalities extract water, 2) the possibility for contamination of those aquifers, 3) the ability of small cities to finance continuous infrastructure maintenance, and 4) a lack of system redundancy as the municipalities are largely isolated from each other and are dependent on groundwater wells (though La Grande has a back-up reservoir). SSIU have a combination of groundwater and surface water supply and their surface water rights are subject to regulation by priority date in times of shortage. There have not been reported concerns from rural homeowners supplied from exempt wells, but possible future declines in the groundwater aquifers or contamination could affect their supply.

### *Being Addressed Currently*

The cities supply water only as needed by their customers, and some cities have reported additional opportunities for conservation efforts. The extent of potential contamination was identified in the Step 2 report and the risks to aquifers and municipal wells are recognized by the cities. Generally, risk from contamination from nitrates and cleanup sites are highest in the areas with the highest population (such as subwatershed 6) The cities reported no dire funding shortfall in meeting their maintenance costs but were not explicitly asked that question. A review of past regulation by priority date of the SSIU surface water rights has not been performed.

### *Critical Assumptions*

A critical assumption for the cities is that their future population growth will be fairly slow and stable, so they can expand their water systems at a reasonable pace, implement conservation, and not exceed supply. Another assumption is that per capita demand will not change greatly from current calculated values. For SSIU, a critical assumption is that current use of their water rights is modest, or in some cases is not occurring, but that use may increase substantially in the future as new industry or economic conditions cause increases in industrial production. A critical assumption for rural well users is that growth and density will increase roughly equal to city population growth, and the dispersed nature of these many wells will not lead to substantial groundwater decline or localized interference between wells.

### *Critical Uncertainties*

An overall critical uncertainty is the rate of population growth; however, history shows a somewhat slow and steady increase.

## Recommended Actions to Improve Understanding of Municipal Water Uses/Needs

### *Main Opportunities*

The cities have an opportunity for closer cooperation, perhaps, and to mitigate risk to their groundwater supply through additional conservation. Rural well use and per capita demand is not well understood, so a voluntary program of water use metering of a small network of wells could provide the community a great deal of useful information.

A mutual aid agreement between cities may be appropriate specific to water so they are ready to help each other in an emergency.

One additional opportunity is for the OWRD to provide information to better clarify knowledge of groundwater supply. This will inform data gaps and help the UGRRW Partnership identify measures to improve data.

# 4.0 - Agricultural Needs/Demands

## Introduction

This section provides a discussion of agricultural user demands on water in terms of quality and quantity, describe components of demand (water rights and systems using water), show current and future demand calculations (and clarify assumptions and methods used), assess overall vulnerability of agricultural demand and discuss recommended actions to improve understanding of agricultural demand.

## Overview of Agricultural Demands

Agricultural demand includes irrigation as well as other agricultural uses, including stock water, dairy barn, nursery uses and greenhouses, temperature control, frost protection, mint still, cranberries, supplemental flood harvesting, dust control, fire control, or animal waste management (Oregon Department of Agriculture [ODA], 2017). All of these are beneficial uses of water for agriculture. Within the Upper Grande Ronde River Watershed (UGRRW), demand for agricultural uses is focused on irrigation needs because that is how the vast majority of water is used. Only three agricultural water rights for uses other than irrigation were found in the Oregon Water Resources Department (OWRD) database and are described below.

The water quality and water quantity components of agricultural demand are described in the next two subsections.

### *Water Quality for Agricultural Demands*

Crops have different water quantity and quality demands. For example, some crops may be particularly sensitive to water quality (bacteria concentrations), and irrigation methods may have water quality limitations (e.g., sediment/turbidity in nozzles). Most often, the concern with presence of bacteria is food safety-related. For farms located downstream in the UGRRW, if water is not of a certain quality, the systems may require filtration to remove sediment and bacteria.

Sediment in supply water is a problem for many efficient means of irrigation because it clogs nozzles, tape, etc. Sediment can also reduce the quality of soil by clogging soil pores, leading to reduced infiltration. Salts (i.e., total dissolved solids) and other elements can reduce plant vigor and productivity.

This demand parameter was not quantitatively analyzed in this report but is discussed as related to vulnerabilities and demand.

### *Water Quantity for Agricultural Demands*

The simplest method to discuss agricultural demand is by reviewing the water right for each portion of land and using that right to describe the maximum value. That method is described below; however, it is also useful to look at current and future demands in terms of what crops are actually using (consumptive use). This looks at water needed for each crop based on time of year, evapotranspiration (ET), and location. This is a more accurate picture of what is actually being used.

## System Components

### *Water Rights*

Water rights for agricultural users were obtained from the OWRD's database. Calculations and assumptions are described in the following sections.

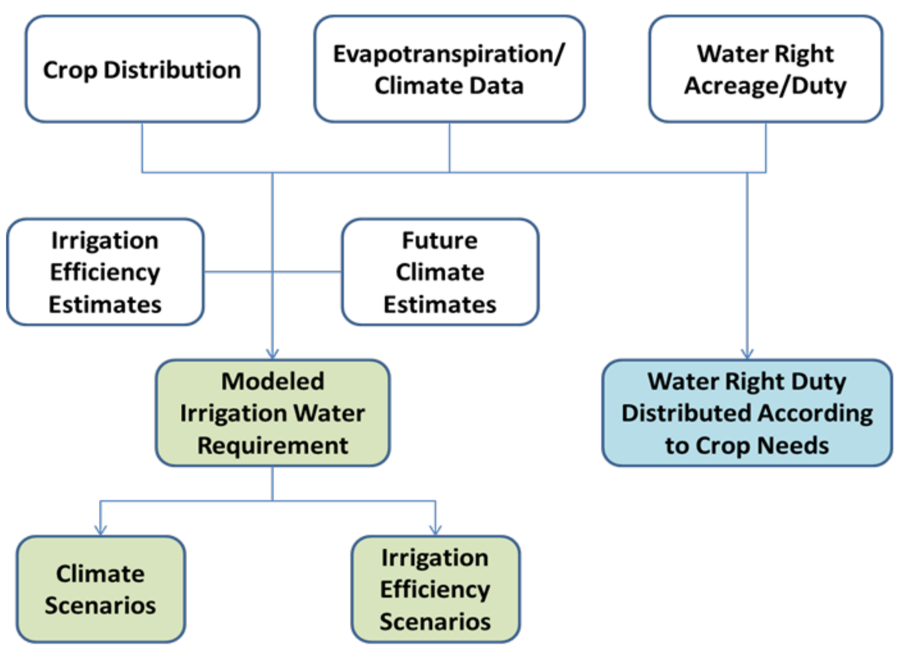
### *Infrastructure*

Components of agricultural demand infrastructure are primarily described below in terms of methods of irrigation. See descriptions in sections below.

## Demand Calculations (Current and Future)

Figure 4-10, below, presents the methods by which agricultural use was estimated. Two approaches for estimating agricultural demand were utilized: one with demands defined by water right duty (blue box in the flow chart), and the other defined by crop water use based on the basin's irrigated area, crop distribution, and an evapotranspiration model (green boxes in the flow chart). The first approach calculates the irrigated area, multiplies it by the water right duty, and then distributes this amount over the irrigation season according to a curve derived from a weighted average bi-weekly crop water use for crops grown in the basin. The second approach takes the total irrigated cropland area and estimates crop water use with an evapotranspiration model that uses the basin's crop distribution and climate data. Future scenarios build on this approach by varying the irrigation efficiency or climate data used by the evapotranspiration model.

**Figure 4-10**
**Upper Grande Ronde River Watershed Agricultural (Irrigation) Use Estimation Methodology - Current and Future Demands**



## Methods and Assumptions

This section describes the current and future demand calculations. Agricultural demand was calculated in two ways: based on water rights and based on ET demand of each crop type. All spreadsheets are included in Appendix B, Agricultural Demand Calculations.

The 2015 Statewide Forecast demand section on agriculture was reviewed, and some methods were taken from this document as detailed below (OWRD, 2015).

Early in Step 3 planning, the Stakeholder Group reviewed the following data considerations to help assess what methods would work for this analysis (ODA, 2017):

- Purpose or stage/phase of planning (concept, reconnaissance, feasibility, design) influence
- Levels of detail and confidence required
- Scale of project/study
    - Spatial scale (for example, Union County or Snake River Basin)
    - Temporal scale (for example daily or annual)
- Resources available (what and quantity - time, funds, staff)
- Type of model or techniques needed
- Data required
- Data characteristics (measured/observed, interpolated, model output - original purpose for creating the data)
- Further alterations to model output (downscaling, bias-correction)
- Calibration and verification/validation
- Updates and new advances (even for tools that have been around a long time)
- Unnecessary complexity (e.g., needless creation of new terms in place of established terms; using a data-intensive model for which there is little or no measured/observed input data; no useful user's manual)

With the above considerations in mind, the following techniques were used to calculate agricultural water demand.

## Grande Ronde Valley Irrigation Water Use Based on Water Rights

Estimating agricultural demand based on existing water rights and potential legal volume or "duty" was chosen for the study area because it defines the upper limit to the amount of water allocated for irrigating agricultural crops in the area. To determine the current demand for irrigation water use in the UGRRW (for surface and groundwater), the following steps were used (Natural Resources Conservation Service [NRCS], 2018a):

- Determine the number of irrigated acres in each subwatershed.
- Determine the amount of different types of irrigation systems present in each subwatershed.
- Use results in calculations to estimate demand (next step).

To estimate irrigated acres, the following assumptions were used:

- All irrigated acres have a primary water right.
- All primary water rights are used on the full acreage and at the full duty of the right.
- All primary water rights are contained in the tabular (spreadsheet) data maintained by the OWRD (OWRD, 2018a).

To estimate irrigated acres, the following methodology was used:

- The tabular dataset of all primary irrigation water rights in Union County was downloaded. (OWRD, 2018a)
- Each water right was then linked to quarter-quarters (QQ) of sections to allow for spatial analysis.
- The QQ with their center inside a subwatershed were selected to obtain a subset of the water rights within that area, then acreage from that area.

The following challenges (potential sources of error) were encountered when estimating irrigated acres:

- The OWRD spatial dataset included uncertainties, specifically "polypoints," which represent un-mappable irrigation rights. The solution was the creation of a unique spatial dataset from tabular data that utilized the OWRD point of use (POU) data set and the Public Land Survey Township Range Section QQ plats to identify the number of irrigated acres by QQ.
- To do this, a spatial dataset of QQ was used and linked to the tabular dataset from the OWRD.
- Acreages did not match between the OWRD spatial data and the customized dataset. Also, the sum of the subwatersheds from the customized dataset was slightly different than the OWRD dataset (OWRD spatial data set = 100,415 acres versus customized data set = 99,165 acres versus OWRD tabular data set = 99,332 acres).
- Another known error is related to the quality of some maps in the water right files used to digitize the data into Geographic Information Systems (GIS).
- The difference between acreages within our dataset is likely due to some QQs that are being double-counted because of GIS summing errors. The difference is small, and the Stakeholder Group determined the difference to be acceptable for this planning effort.
- It is known that that not all water rights are used to their full acreage, if at all, but the process of removing rights from the dataset would be time consuming to verify, and it was determined to be too detailed of a step for this planning-level effort. According to the OWRD, for Union County, the 2015 U.S. Geological Survey Water Use Report for Oregon indicates that 75,000 acres were irrigated, based on comparing irrigated POU with the 2015 Crop Data Layer. So approximately 75 percent of the land was irrigated in 2015 (Dieter et al., 2018).
- In addition, three non-irrigation agricultural water rights were retrieved from the OWRD's database but are not currently included in the demand calculations. Permit G13534 is a groundwater right sourced from a well in Owsley Canyon, a tributary of the Grande Ronde

River, for temperature control with a maximum rate of 0.414 cubic feet per second (cfs). Certificate 46523 is sourced from Mill Creek, a tributary to Catherine Creek, for temperature control with a maximum rate of 0.78 cfs. Certificate 74954 is a storage right to runoff in the Phillips Creek area, for agricultural uses, with a maximum volume of 4.8 acre-feet.

Figures 4-1 and 4-2 show UGRRW irrigation water rights by source (surface water or groundwater) and by acres (in each subwatershed by source), respectively.

**Figure 4-1**
**Upper Grande Ronde River Watershed Irrigation Water Rights by Source**

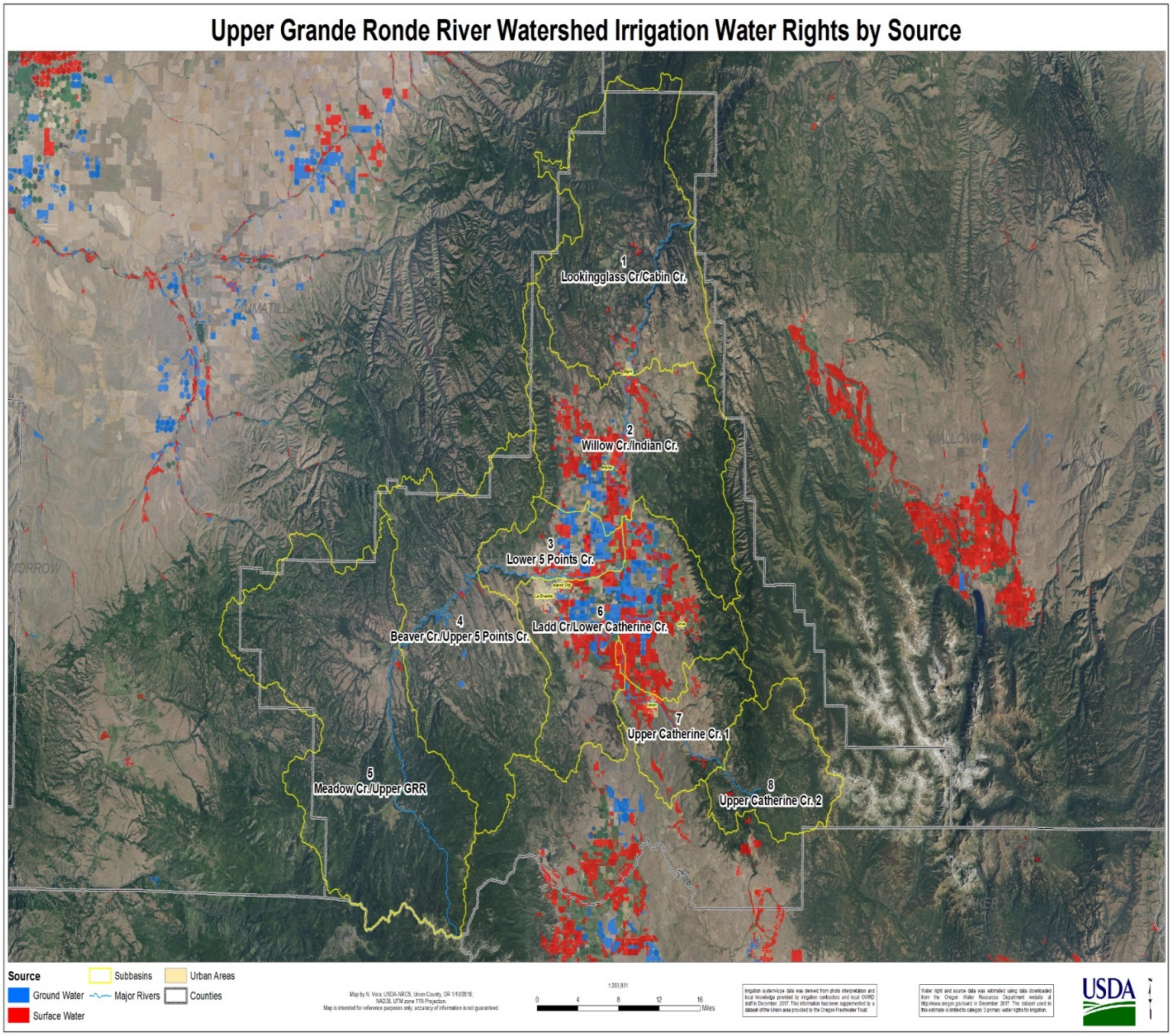
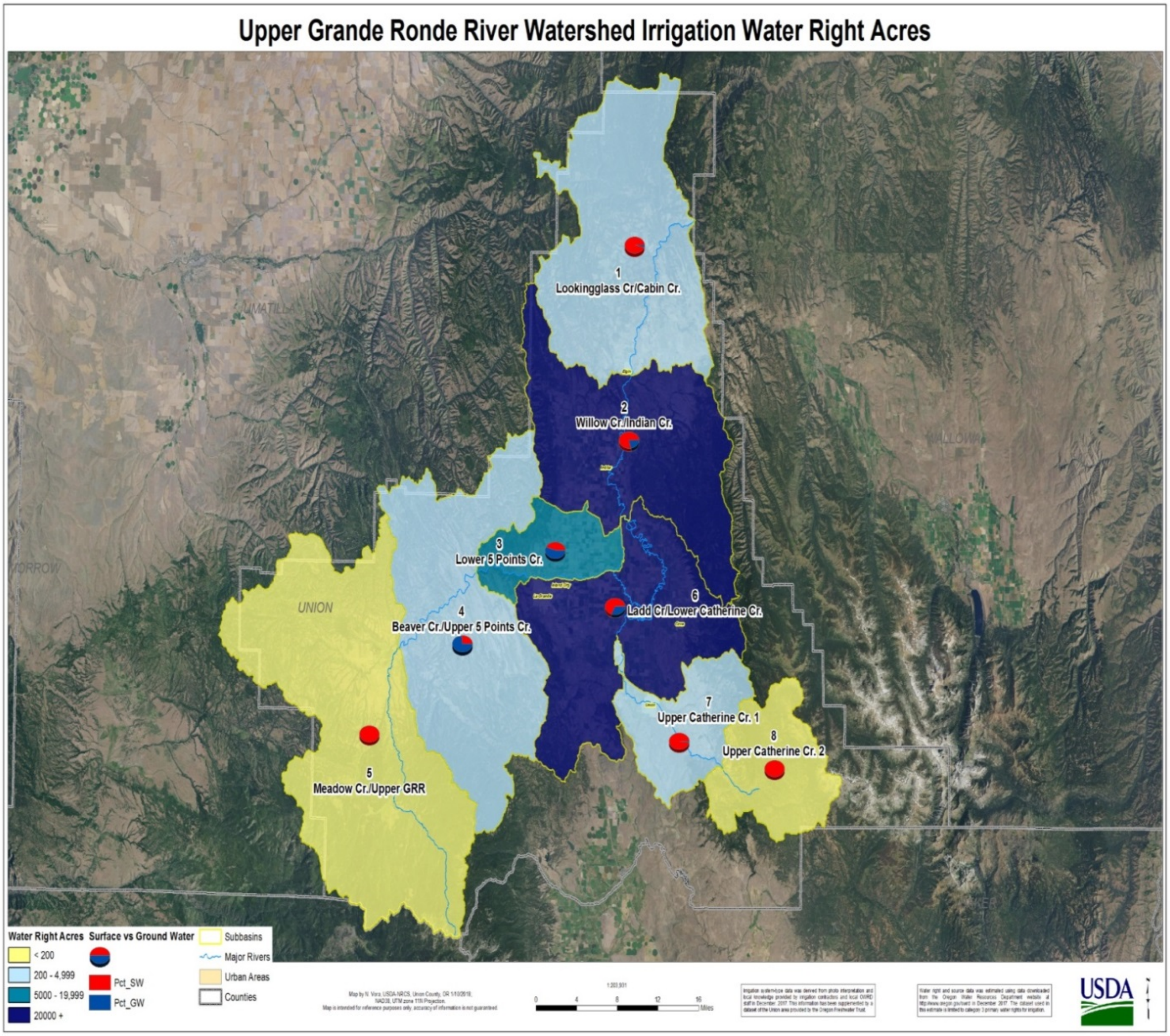
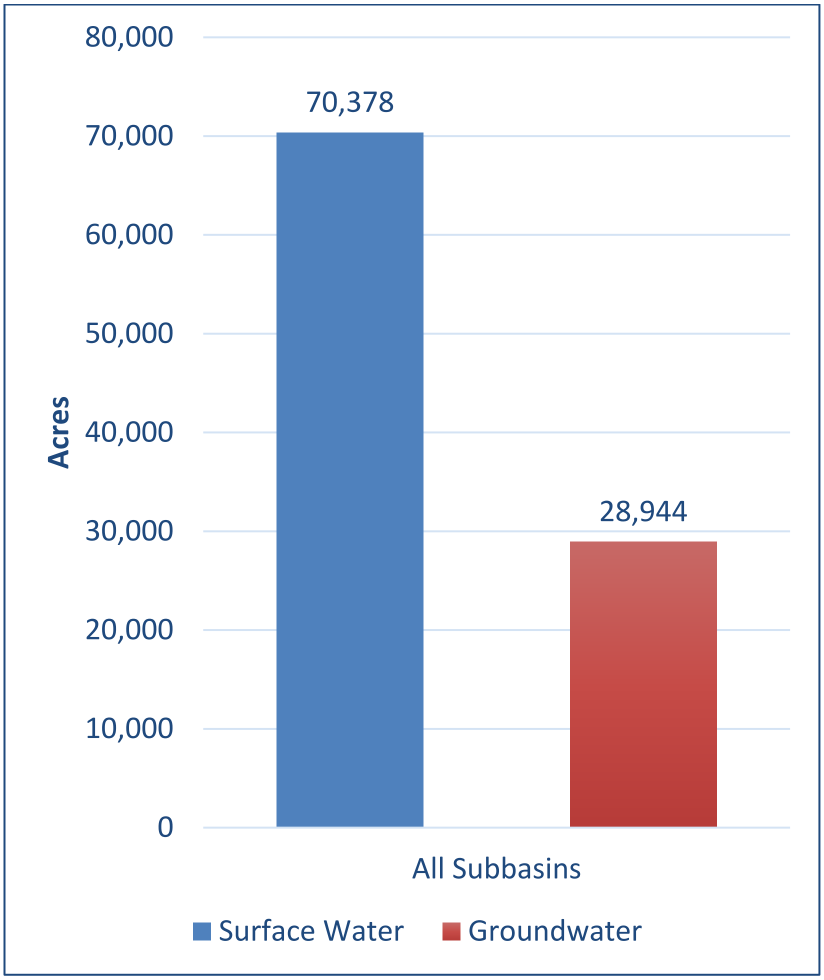


**Figure 4-2**
**Upper Grande Ronde River Watershed Irrigation Water Right Acres**



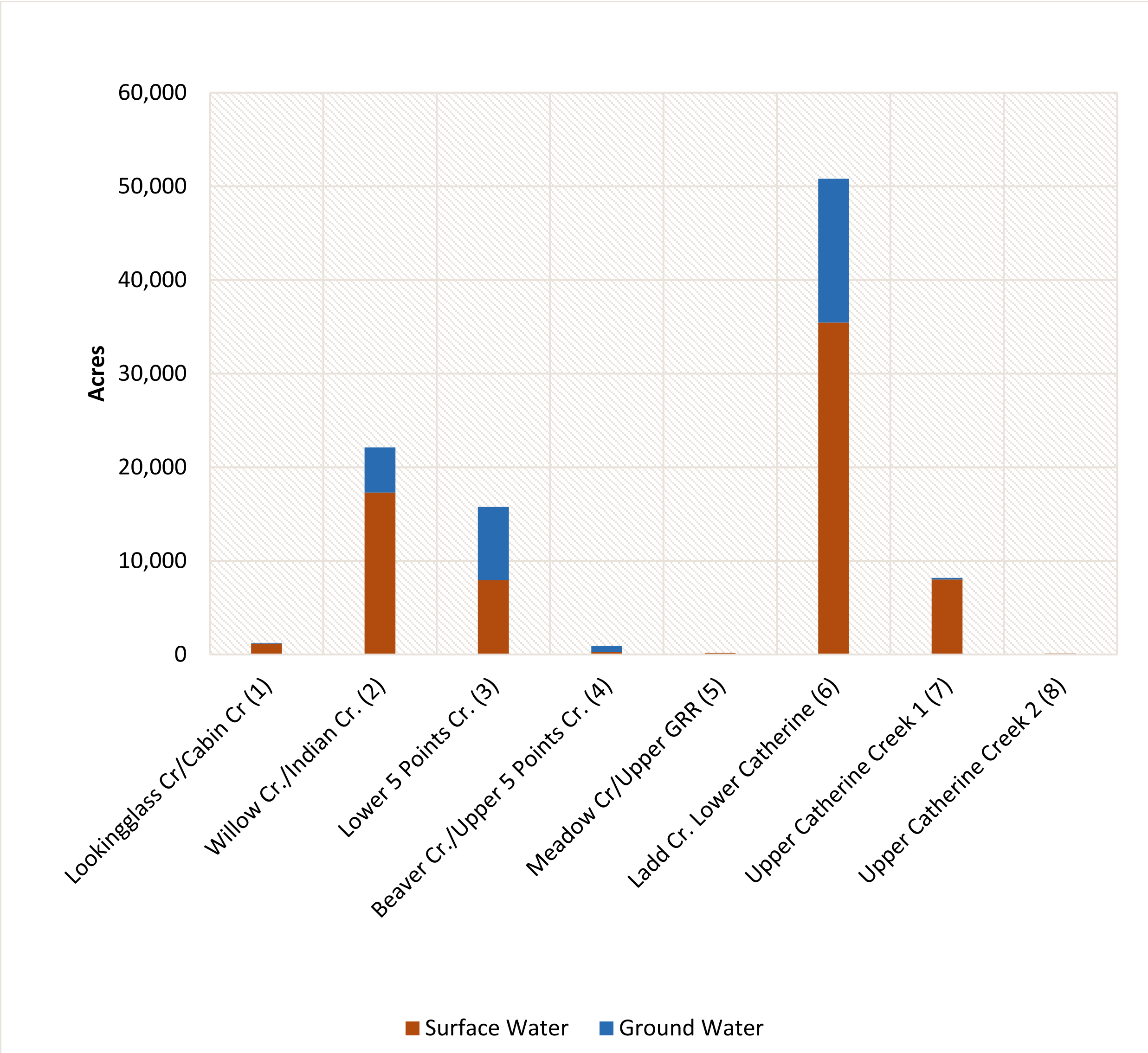

Surface water comprises approximately 70 percent of the water used for irrigation in the entire UGRRW. Figure 4-3, below, shows UGRRW irrigated acres by source.

**Figure 4-3**
**Upper Grande Ronde River Watershed Irrigated Acres by Source**



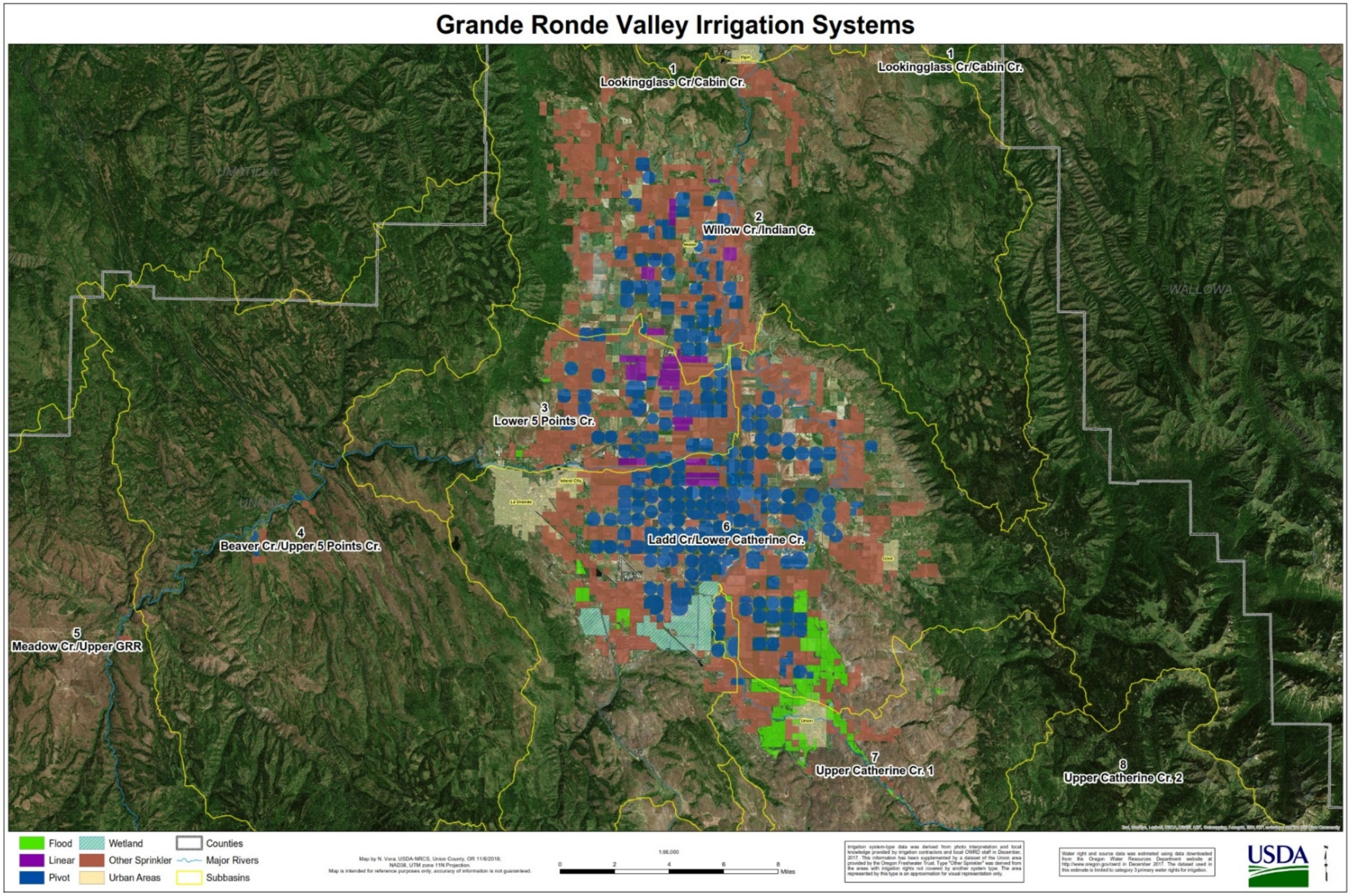

Legal irrigation only occurs in certain subwatersheds; Subwatersheds 2 (Willow Creek/Indian Creek), 3 (Lower Five Points Creek), 6 (Ladd Creek Lower Catherine), and 7 (Upper Catherine Creek 1) have the most significant water uses (see Figure 4-4 below).

**Figure 4-4**
**Upper Grande Ronde River Watershed Irrigated Acres by Subwatershed**



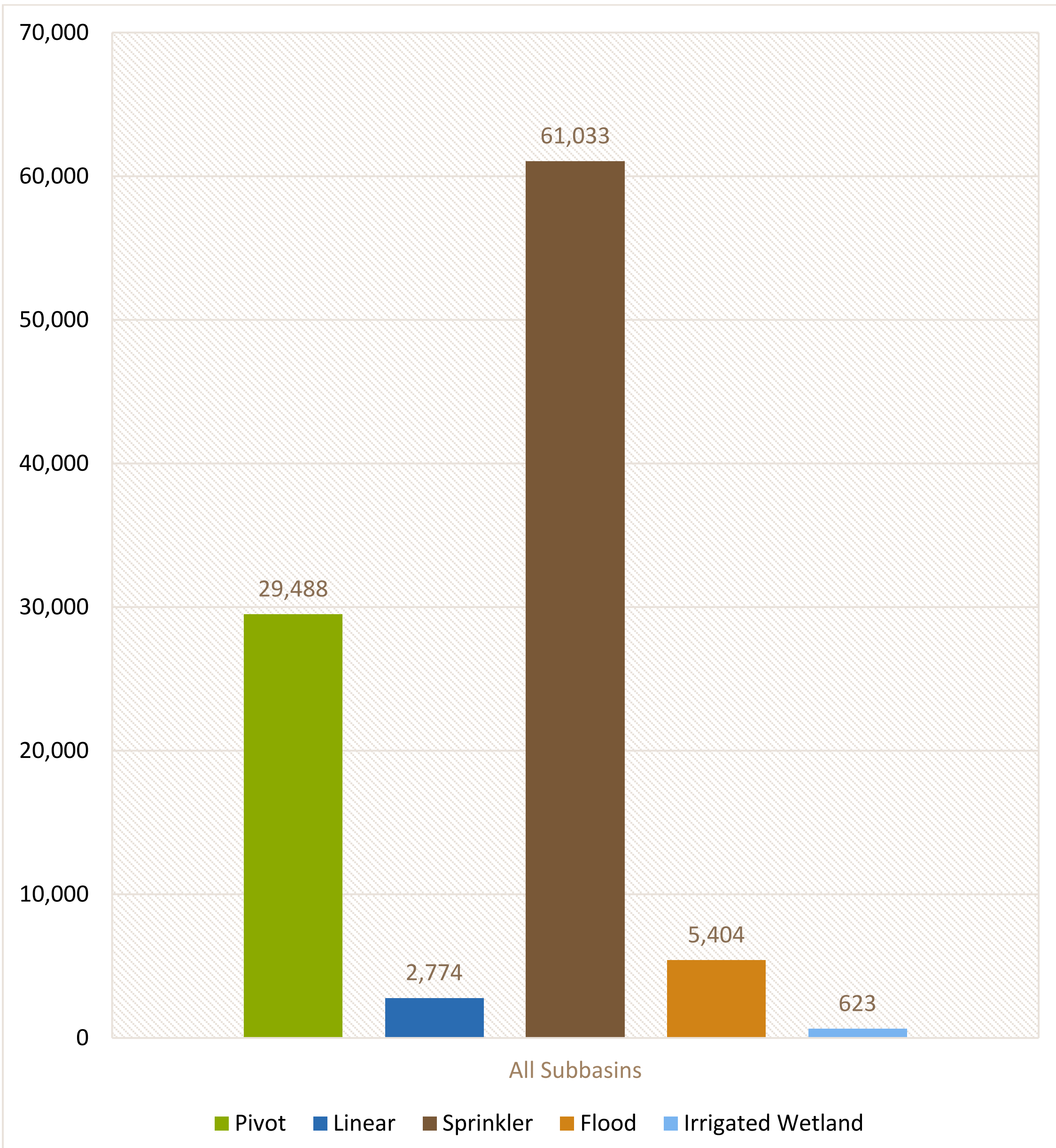

Once total irrigated acres were estimated, system acreages were estimated starting with a dataset provided by The Freshwater Trust. This dataset provided irrigation system types in the Catherine Creek Watershed near Union. Using aerial photos, the agricultural demand group built on this and drew-in the different irrigation system types and calculated actual acreages for the entire valley for the following systems: sprinkler, flood, pivot, linear, and "irrigated wetland." The remaining acres of primary water rights in each subwatershed were wheel line or hand line. The far upper portion of Catherine Creek was considered to be all flood irrigation. Figure 4-5 shows all UGRRW irrigation systems by type.

**Figure 4-5**
**Upper Grande Ronde River Watershed Irrigation Systems**



Sprinkler irrigation using wheel-line and hand-line systems is most common in the UGRRW, comprising 61 percent of the total irrigated acres, and represents all irrigated area not defined by another system type (shown in brown) on Figure 4-5, above. Center pivot and linear systems have similar application efficiencies and are the next most popular system type in the UGRRW, with 32 percent of irrigated acres. This can be seen on Figure 4-6, below.

**Figure 4-6**
**Upper Grande Ronde River Watershed Irrigated Acres by System**




Not all subwatersheds are irrigated in a significant way. Use is concentrated in the central part of the UGRRW (see Figure 4-7, below).

**Figure 4-7**
**Upper Grande Ronde River Watershed Irrigated Acres by System and Subwatershed**

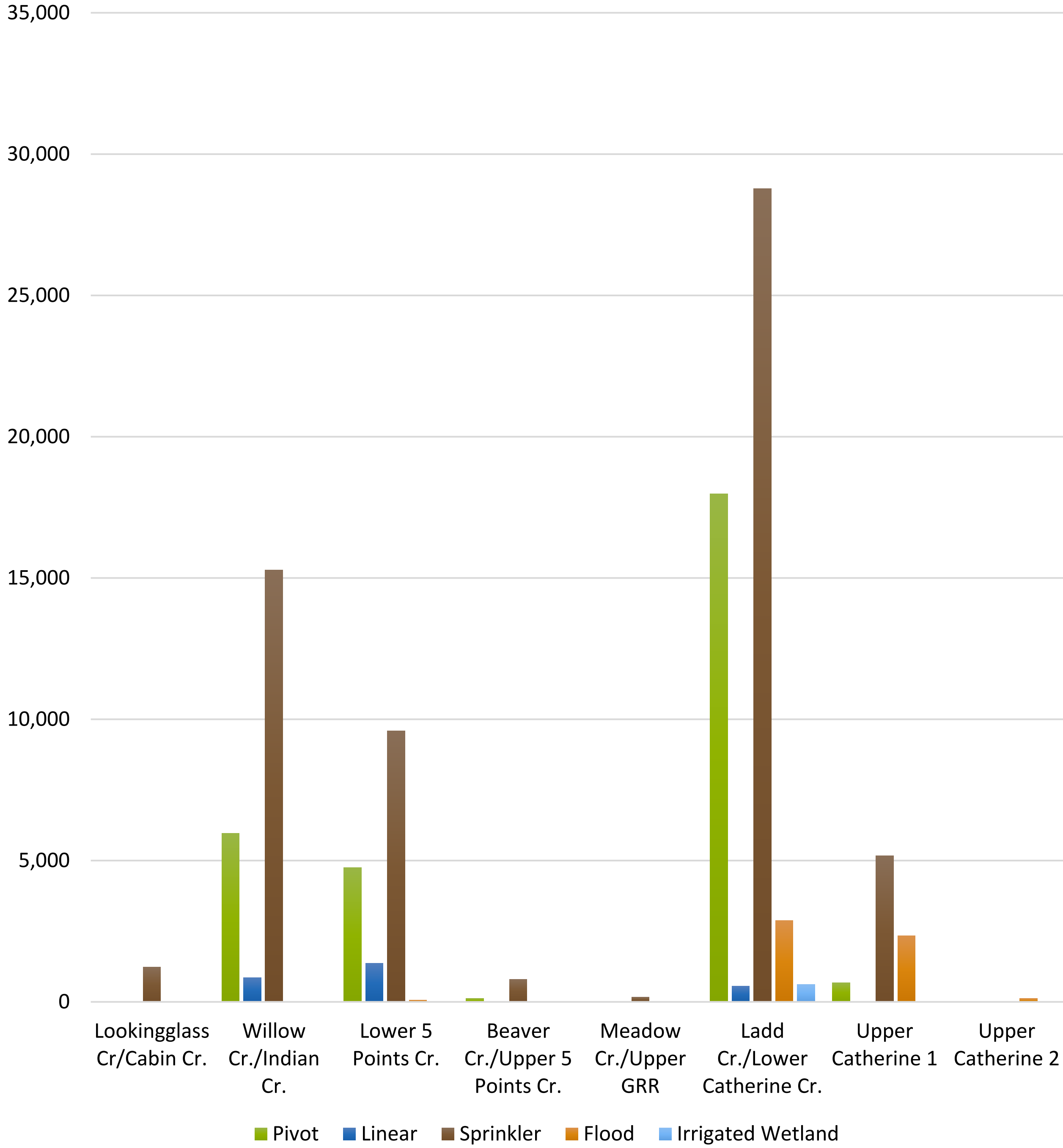



Table 4-1 provides a summary of water rights data, system data, and potential demand based on these values. This information will be compared to the second estimation method (described in the next section).

**Table 4-1**
**Subwatershed Summary of Water Rights and Systems**

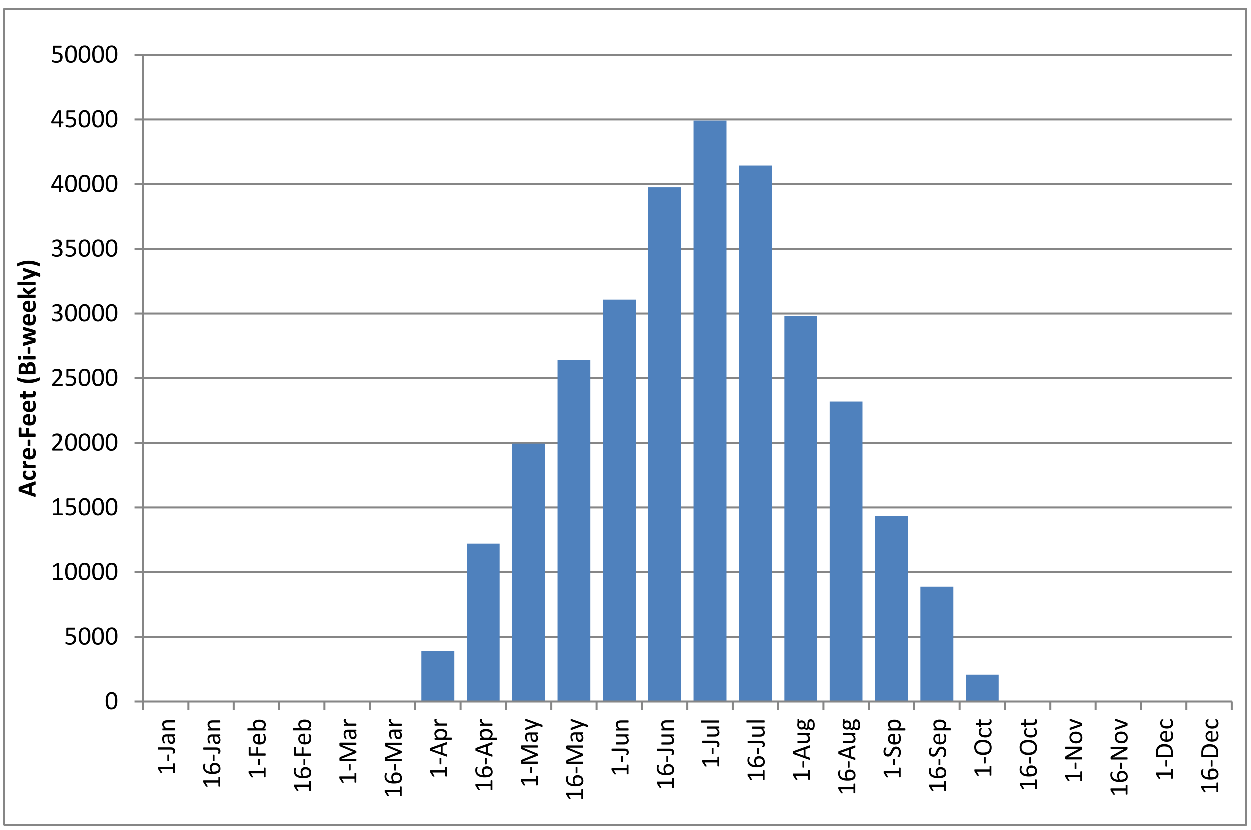
| Subwatershed Number | Subwatershed Name | Total Acres | Primary Water Right Acres | Percent Water Rights | Percent Surface Water Irrigation | Percent Groundwater Irrigation | Surface Water Acres | Groundwater Acres | Pivot Acres | Linear Acres | Percent Pivot and Linear | Pivot/ Linear to Sprinkler Ratio | Flood Acres | Sprinkler Acres | Irrigated Wetland | Potential AF Demand | Potential Surface Water Demand | Potential Groundwater Demand |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Lookingglass Creek/Cabin Creek | 168,992 | 1,233 | 0.7 | 94 | 6 | 1,158 | 75 | 0 | 0 | 0 | 0 | 0 | 1,233 | 0 | 3,699 | 3,474 | 225 |
| 7 | Upper Catherine Creek 1 | 55,494 | 8,186 | 14.8 | 98 | 2 | 8,009 | 177 | 676 | 0 | 8 | 0.13 | 2,341 | 5,169 | 0 | 24,558 | 24,027 | 531 |
| 2 | Willow Creek/Indian Creek | 149,800 | 22,109 | 14.8 | 78 | 22 | 17,296 | 4,813 | 5,963 | 857 | 31 | 0.45 | 0 | 15,289 | 0 | 66,327 | 51,888 | 14,439 |
| 3 | Lower Five Points Creek | 41,005 | 15,759 | 38.4 | 50 | 50 | 7,928 | 7,831 | 4,749 | 1,362 | 39 | 0.64 | 64 | 9,584 | 0 | 47,277 | 23,784 | 23,493 |
| 4 | Beaver Creek, Upper Five Points Creek | 178,051 | 931 | 0.5 | 27 | 73 | 251 | 680 | 127 | 0 | 14 | 0.16 | 0 | 805 | 0 | 2,793 | 753 | 2,040 |
| 5 | Meadow Creek Upper Grande Ronde River | 249,739 | 173 | 0.1 | 100 | 0 | 173 | 0 | 0 | 0 | 0 | 0 | 0 | 173 | 0 | 519 | 519 | 0 |
| 6 | Ladd Creek Lower Catherine | 142,259 | 50,812 | 35.7 | 70 | 30 | 35,444 | 15,368 | 17,974 | 554 | 36 | 0.64 | 2,881 | 28,780 | 623 | 152,436 | 106,332 | 46,104 |
| 8 | Upper Catherine Creek 2 | 61,818 | 119 | 0.2 | 100 | 0 | 119 | 0 | 0 | 0 | 0 | 0 | 119 | 0 | 0 | 357 | 357 | 0 |
| | **Total** | **1,047,158** | **99,322** | **105** | **617** | **183** | **70,378** | **28,944** | **29,489** | **2,773** | **128** | **2** | **5,405** | **61,033** | **623** | **297,966** | **211,134** | **86,832** |

## *Temporal Distribution of Agricultural Water Use Based on Water Rights*

The timing of agricultural water demand is an extremely important factor to consider; perhaps as important as the total volume used. While the volume of water allowed by a water right might be assumed to be used uniformly over the specified irrigation season, this is not the way irrigation water is used over time in practice. During the cool early parts of the irrigation season, crops grow slowly and much of the crop water requirement is met by spring precipitation. As solar radiation and temperatures rise in summer, crop growth and metabolism increase, causing ET to peak in early July. In fall, after harvest, crop water requirements drop off as the irrigation season ends.

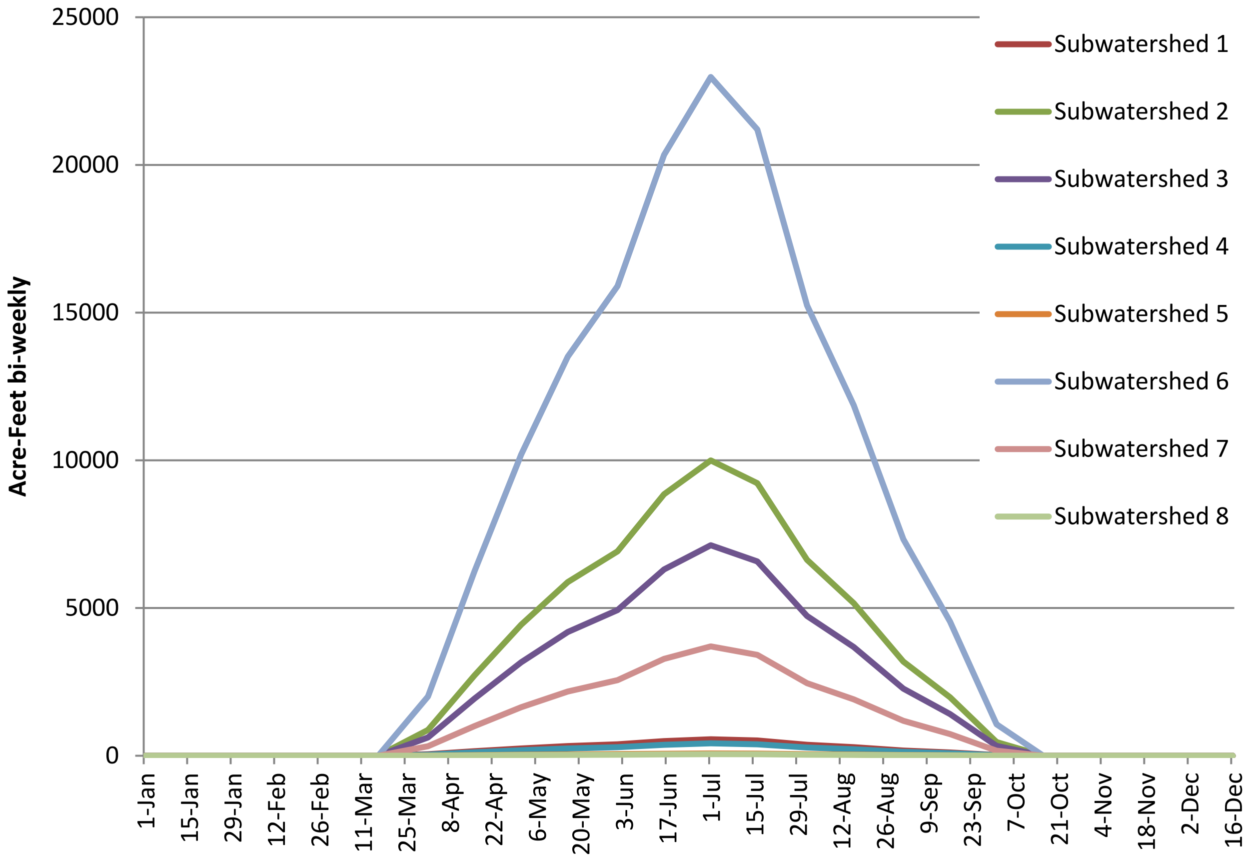
The UGRRW Partnership sought to estimate the timing of irrigation water right demand by distributing the total volume (3 AF for each primary water right acre) according to crop water use, as defined by modeled ET. To accomplish this, total primary water right duty for the UGRRW was taken and distributed across bi-weekly periods according to the modeled net irrigation water requirement. The resulting plot is shown on Figure 4-8, below.

**Figure 4-8**
**Grande Ronde Basin Total Irrigation Water Rights,**
**Distributed by Bi-weekly Net Irrigation Water Requirement**




Demand was further distributed by subwatershed. This distribution is shown on Figure 4-9.

**Figure 4-9**
**Upper Grande Ronde River Watershed Irrigation Water Rights by Subwatershed, Distributed by Bi-Weekly Net Irrigation Water Requirement**



### *Grande Ronde Valley Agricultural (Irrigation) Water Use Based on Evapotranspiration*

This section describes the method that the UGRRW Partnership used to calculate agricultural (irrigation) demand based on ET. Current estimated demand is presented, as well as estimated demand for two future scenarios for 2068: one scenario where no agricultural practices are changed and one where water management and conservation measures are implemented. Both scenarios assume the Representative Climate Pathway (RCP) 8.5 climate scenario for temperature and precipitation changes.

The second method used is shown on Figure 4-10 for irrigated agricultural water demand based on ET. One advantage of using ET to characterize irrigation demand is that parameters such as climate or irrigation efficiency can be changed and the effect on demands under different future scenarios can be estimated.

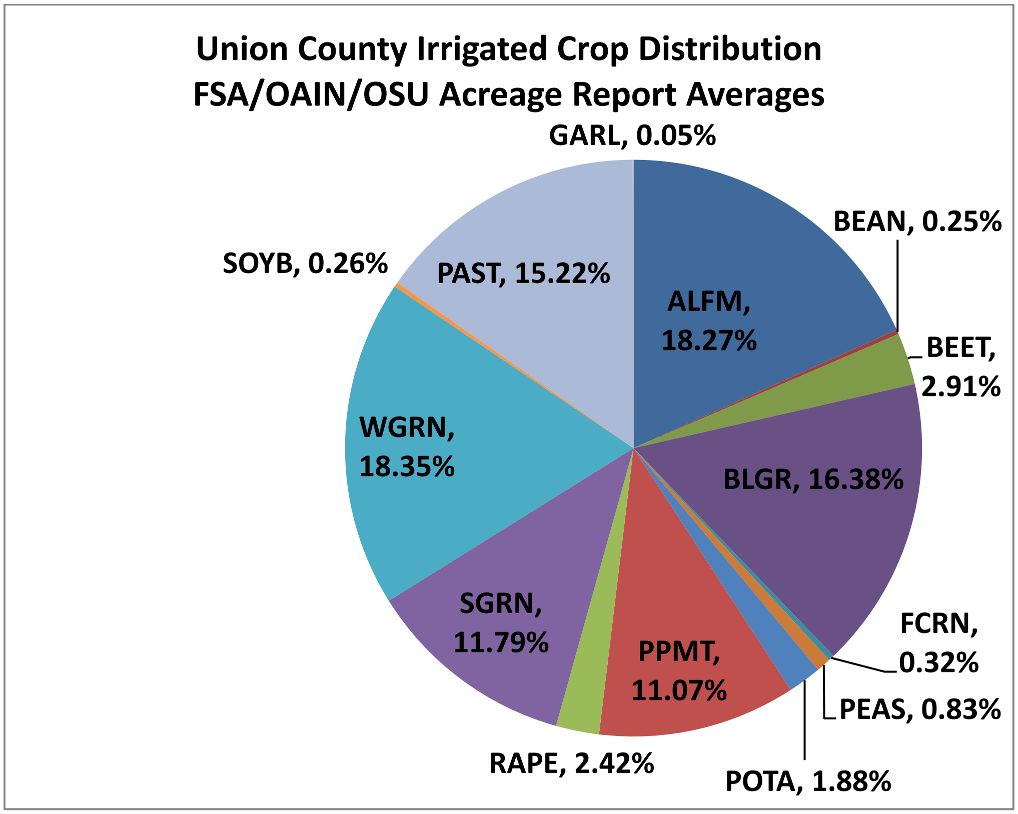
#### Union County Crop Data Sources

The following data sources were evaluated for use in this estimate. Benefits and drawbacks of each data source are listed below:

- U.S. Department of Agriculture (USDA) Census of Agriculture
  - This is a voluntary census that occurs every five years; 2012 is the most recent
  - It distinguishes between irrigated and dryland acres
- USDA Cropland Data Layer
  - This estimates crop acreage using satellite imagery
  - It does not distinguish between irrigated and dryland acres
- Farm Service Agency (FSA) County Acreage Reports
  - Data is reported to FSA by program participants
  - It distinguishes between irrigated and dryland acres
- Oregon Agriculture Information Network (OAIN)/Oregon State University (OSU) Extension County Acreage Data
  - Obtained directly from local industry
  - Does not distinguish irrigated versus dryland

Based on this analysis, the Stakeholder Group decided to use FSA acreage data used for all crops except beets, mint, and potatoes. For these three crops, OAIN/OSU data were considered more accurate and were used with the assumption that these crops are always grown under irrigation in Union County. Crops from acreage data were assigned to a corresponding Agrimet crop code to estimate a weighted average, or composite, ET for crops grown in the basin (Union County Farm Bureau, 2018). Based on this information, the following crops and their distribution are shown on Figure 4-11.

**Figure 4-11**
**Union County Irrigated Crop Distribution**




*See Table 4-2 for definition of acronyms.*

Table 4-2 below shows from which data source each crop was obtained:

**Table 4-2**
**Union County Crop Distribution and Data Source**

| Crop | Acres | Percent | Data Source |
|---|---|---|---|
| Alfalfa (ALFM) | 12,386 | 18.27 | FSA |
| Beans (BEAN) | 169 | 0.25 | FSA |
| Beet (BEET) | 1,970 | 2.91 | OAIN |
| Grass Seed (BLGR) | 11,105 | 16.38 | FSA |
| Corn (FCRN) | 216 | 0.32 | FSA |
| Peas (PEAS) | 559 | 0.83 | FSA |
| Potato (POTA) | 1,277 | 1.88 | OAIN |
| Peppermint (PPMT) | 7,505 | 11.07 | OAIN |
| Canola, Cilantro, Quinoa (RAPE) | 1,642 | 2.42 | FSA |
| Spring Grain (SGRN) | 7,991 | 11.79 | FSA |
| Winter Grain (WGRN) | 12,438 | 18.35 | FSA |
| Soybean (SOYB) | 179 | 0.26 | FSA |
| Pasture, Grass Forage, Mixed Forage (PAST) | 10,315 | 15.22 | FSA |
| Garlic (GARL) | 34 | 0.05 | FSA |

After crops were established, the next step was to model crop water use using the following assumptions:

- Agrimet Imbler (IMBO) station reference ET were estimated using Penman-Montieth model. The ET model assumes that crops are well-watered.
- It was assumed that the Imbler (IMBO) weather is representative of the Grande Ronde Valley.
- It was assumed that Agrimet planting dates/crop curves are representative of Grande Ronde Valley practices.

### Post-Harvest Water Requirements

Some irrigation demands in the UGRRW are not represented in the Agrimet modeled crop water use data. One example is the post-harvest irrigation of perennial crops such as grass seed or peppermint. These crops require irrigation after harvest to grow healthy root systems in preparation for winter dormancy and the subsequent production season. Another post-harvest demand is irrigation to promote germination of fall-seeded crops. This is a customary practice in the Grande Ronde Valley for fall-seeded alfalfa, grass-seed, oilseed crops, and winter grains.

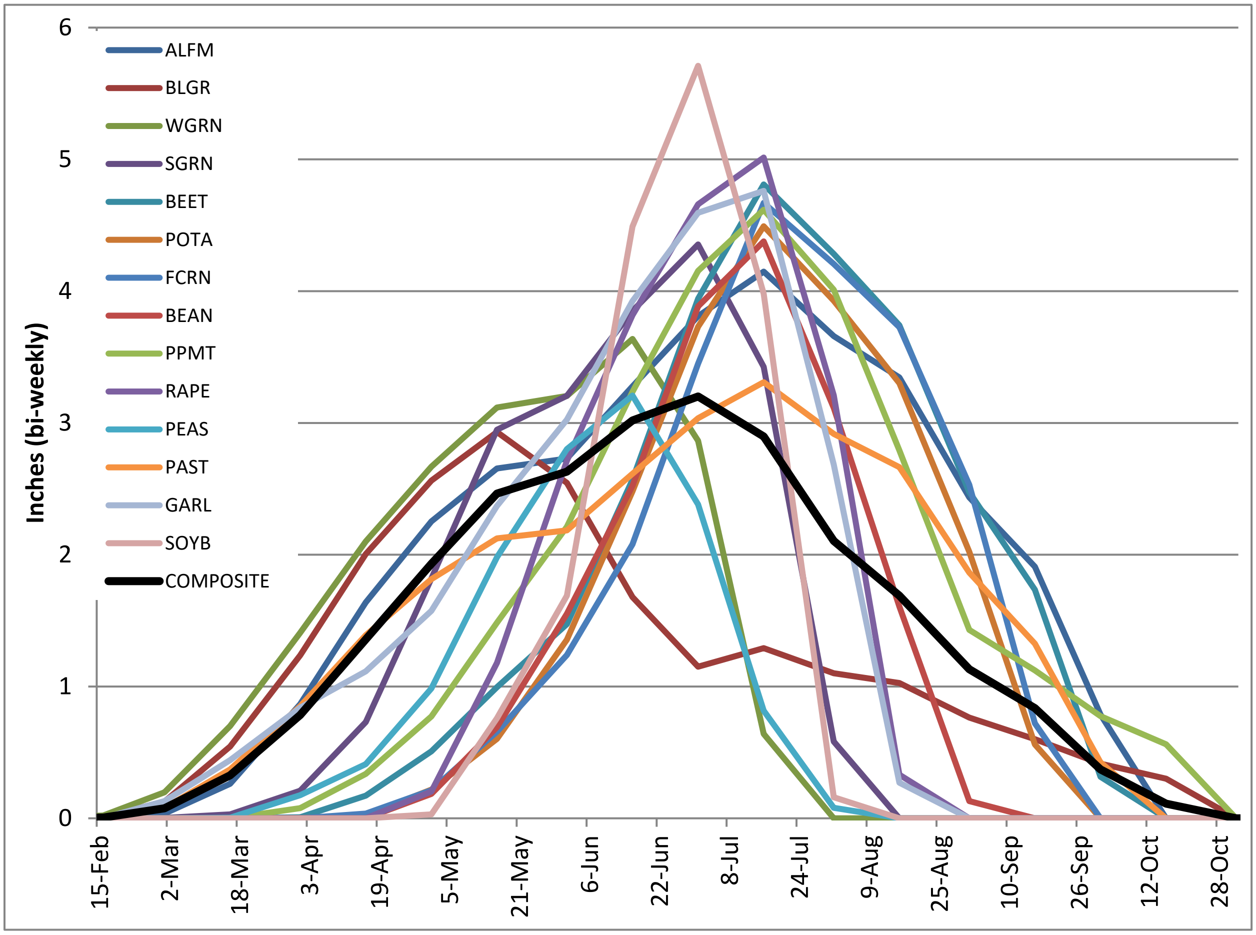
Post-harvest irrigation requirements were estimated for grass seed and peppermint, two prominent basins perennial crops, in this analysis. Post-harvest irrigation guidelines from OSU extension bulletins em8807 and em8662 for Kentucky Bluegrass and Peppermint, respectively, were obtained. The total suggested post-harvest water requirement for each crop was converted into a static crop coefficient spanning the time period from harvest (July 15 for Kentucky bluegrass, and September 1 for peppermint) to the end of the irrigation season. These coefficients were added to the crop curves from Agrimet, extending them from harvest to the end of the irrigation season.

### Composite Evapotranspiration

A composite ET for the UGRRW was generated by weighting the ET for each crop according to the portion of the total irrigated acres that crop represents in the UGRRW.

Figure 4-12 shows bi-weekly ET values for each crop, as well as the basin composite ET, derived from the Agrimet 1994 to 2017 average daily values.

**Figure 4-12**
**Evapotranspiration by Crop**
**Agrimet Imbler (IMBO) 1994 through 2017 Bi-weekly Averages**




### *Effective Precipitation and Net Irrigation Water Requirement (NIWR)*

The net irrigation water requirement (NIWR) was calculated by taking the composite ET and subtracting the portion of the crop water use supplied by effective precipitation ($P_e$):

$NIWR = ET - P_e$

Effective precipitation is defined as the portion of rainfall that contributes to meeting the water needs of growing crops. Precipitation that either runs off the surface or percolates below the root zone cannot be utilized by the crop and is not considered effective precipitation. The USDA Soil Conservation Service (SCS) method was used to estimate effective precipitation (USDA, 1993):

$P_e = SF(0.70917P_t^{0.82416} - 0.11556)(10^{0.02426ETc})$

where:

$P_e$ = average monthly effective monthly precipitation (inches)

$P_t$ = monthly mean precipitation (inches)

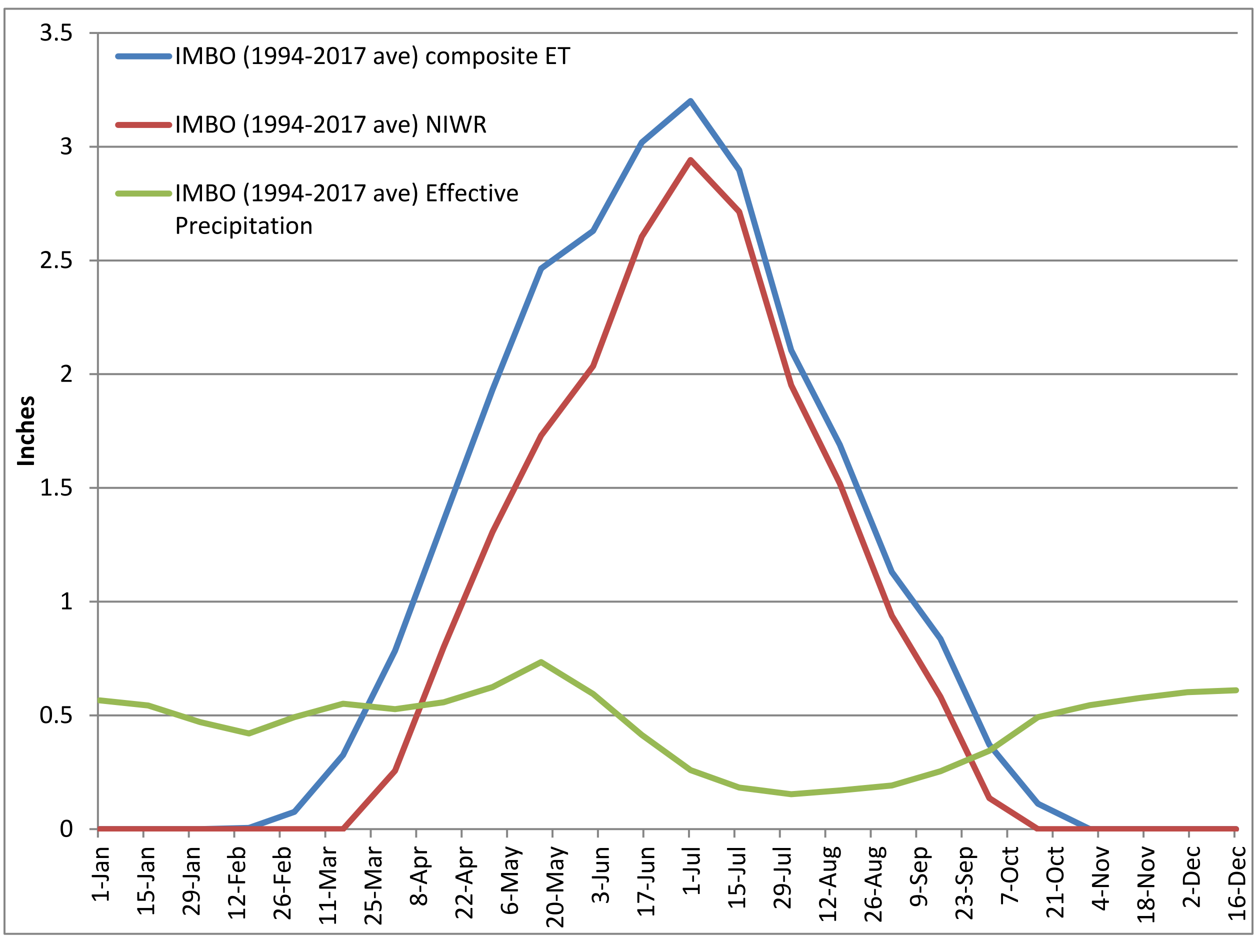
$ET_c$ = average monthly crop evapotranspiration (inches)

SF = soil water storage factor

While this method is intended to estimate monthly averages, it was used to estimate $P_e$ on a daily basis by using a 30-day moving average for $P_t$ and ET.

Figure 4-13 shows the composite ET, net irrigation water requirement, and precipitation from the Imbler (IMBO) weather station.

**Figure 4-13**
**Agrimet Imbler (IMBO) (1994 to 2017 average) Bi-weekly Evapotranspiration, Net Irrigation Water Requirement, and Effective Precipitation**



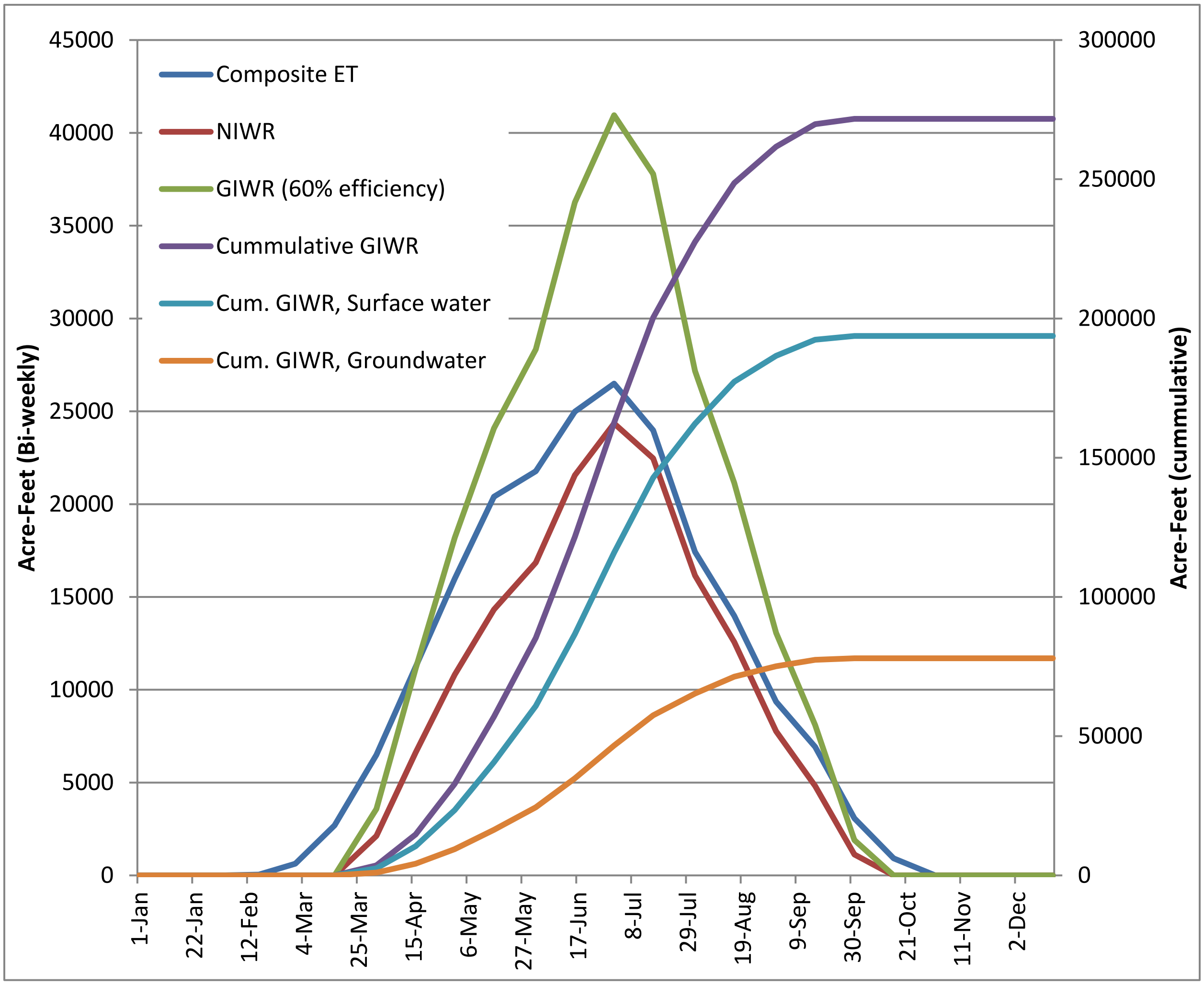
## Irrigation Efficiency and Gross Irrigation Water Requirement

An estimate of irrigation efficiency is required to calculate the gross irrigation water requirement (GIWR) from the NIWR. While the NIWR describes the water requirements necessary for crop growth, additional water is required to account for losses due to irrigation and diversion system inefficiencies. The total volume of water used for irrigation, supplying crop water needs and accounting for system losses, is the GIWR. It is calculated by dividing the NIWR by the overall irrigation efficiency.

Overall irrigation efficiency is affected by many factors. Irrigation water management decisions, such as the timing, frequency, and amount applied have a large impact on efficiency. Conveyance losses due to leaky pipes or ditches also contribute to overall efficiency. Losses from application by the sprinkler irrigation method, the most common method in the basin, arise from non-uniform application, where some areas of a field receive more irrigation water than others, and evaporation of water from droplets, the wetted crop canopy, and the soil surface. Wind and humidity during the time of application also affect the application efficiency. Finally, non-uniform soils, with varying water holding capacities and/or infiltration rates, as well as uneven topography, which exacerbates surface runoff, are factors influencing efficiency.

The current irrigation efficiency for each subwatershed was estimated using the NRCS "water savings estimator" tool, based on system types present in each area. Efficiencies range from 41 percent (subwatershed 8 [Upper Catherine Creek 2]) to 62 percent (subwatershed 3 [Lower Five Points Creek]), with an average of 60 percent for the entire UGRRW. Applying this efficiency to the UGRRW NIWR gives an annual GIWR of approximately 270,000 AF. This is shown on Figure 4-14, below.

**Figure 4-14**
**Upper Grande Ronde River Watershed Modeled Current Irrigation Water Demand**




## Vulnerability Assessment and Indicators of Resilience

Generally, when total annual water supply and irrigation demand are compared, it may appear as though water supply is sufficient to meet demands. However, on time scales more relevant to irrigation operation, such as bi-weekly, changes in timing and quantity of available water supply, it is increasingly possible that irrigation demands may not be met. See Table 4-3, Annual Agricultural Demand (Current), below.

**Table 4-3**
**Annual Agricultural Demand (Current)**

| Subwatershed | Name | Surface Water Quantity (Natural Stream Flow) (from Step 2 Report) AF per Year (50th Percentile) | Groundwater Used (from Step 2 Report) AF per Year | Agricultural Demand Surface Water (AF per Year) (Water Rights Only) | Agricultural Demand Groundwater (AF per Year) (Water Rights Only) | Agricultural Demand Surface Water (AF per Year) (ET Estimate) | Agricultural Demand Groundwater (AF per Year) (ET Estimate) |
|---|---|---|---|---|---|---|---|
| 1 | Lookingglass Creek/ Cabin Creek | 644,604 | - | 3,474 | 225 | 3,412 | 221 |
| 2 | Willow Creek/Indian Creek | 523,382 | 29,404 | 51,888 | 14,439 | 46,630 | 12,976 |
| 3 | Lower Five Points Creek | 234,118 | 25,721 | 23,784 | 23,493 | 20,774 | 20,520 |
| 4 | Beaver Creek, Upper Five Points Creek | 219,834 | 1,964 | 753 | 2,040 | 713 | 1,932 |
| 5 | Meadow Creek Upper Grande Ronde River | 127,836 | 187 | 519 | - | 510 | - |
| 6 | Ladd Creek Lower Catherine | 153,738 | 71,716 | 106,332 | 46,104 | 96,345 | 41,774 |
| 7 | Upper Catherine Creek 1 | 116,238 | 9,279 | 24,027 | 531 | 24,868 | 550 |
| 8 | Upper Catherine Creek 2 | 71,598 | - | 357 | - | 472 | - |
| | **Total** | **644,604** | **138,271** | **211,134** | **86,832** | **193,725** | **77,973** |

### *Future Demands Analysis*

To forecast future demand for this planning effort, the Stakeholder Group determined that the Representative Concentration Pathways (RCP) 8.5 climate scenario would be used to evaluate the effect of climate trends on ET. In addition, the Stakeholder Group determined that the effects of anticipated efficiency improvements (application efficiency and more intensive irrigation water management) would be evaluated. This results in two future scenarios for irrigation water demand: future climate with existing efficiency and future climate with increased efficiency. These scenarios can then be compared to current demands (with existing efficiency).

While water rights are likely to remain static over the next 50 years, actual crop water demand may change significantly. There are multiple items the Stakeholder Group identified that could affect water demand for agriculture in the future. These include:

- Differences in cropping schemes - farmers are at the mercy of global markets (for example, currently wheat prices are down, so half the valley is growing canola instead). Cropping regimes may change based on markets.
- Crops could change with consolidation of small farms to large farms.
- Political mandates are not predictable, trade policies influence crop profitability.
- Improvements in efficiency (i.e., technology, no till drilling) can be made.
- Better irrigation/application methods (e.g., buried drip tape).
- Cost of electricity.
- Changes in tillage regimes (more organic matter retains water better).
- In 50 years, better soil amendments and technologies could improve crop productivity and use less water.
- More agricultural lands could become irrigated.
- Changes to local climate, including a decrease in snow pack, shifting hydrograph, and worse droughts (1°F increase in temperature may cause up to a 5 percent increase in ET [National Research Council, 2011]). These changes could result in potential increases in water quality issues such as weeds, algae, and invasive species in irrigation ditches.

### *Effect of Projected Future Climate on Evapotranspiration, Net Irrigation Water Requirement, and Gross Irrigation Water Requirement*

Future irrigation water use was calculated using estimated future ET based on precipitation and temperatures projected by the RCP 8.5 climate scenario. Localized constructed analogs (LOCA) downscaling was applied to RCP 8.5 scenario outputs from 28 global climate models. Daily temperature and precipitation projections from the 28 models were averaged for the year 2068. The Penman-Montieth reference ET was calculated as before for current demands, but using the 2068 temperature data along with the following estimation methods for missing weather parameters:

- Total solar radiation was estimated using Hargraves' radiation formula (Allen et al., 1998):

$R_s = k_{Rs}(T_{max} - T_{min})^{0.5}R_a$

where,

$R_a$ = extraterrestrial radiation [MJ $m^{-2}$ $d^{-1}$],

$T_{max}$ = maximum air temperature [°C],

$T_{min}$ = minimum air temperature [°C],

$k_{Rs}$ = adjustment coefficient (0.16) [$°C^{-0.5}$]

- Daily mean wind speed was assumed to be the same as historic (1994 to 2017 IMBO average).
- Vapor pressure derived from relative humidity was estimated by assuming that the dewpoint temperature is near the daily minimum temperature, and can be corrected by applying an offset, $K_0$: $T_{dew} = T_{min} - K_0$. Monthly $K_0$ values were taken from Allen and Robison, 2007.

The calculation of composite ET for the year 2068 was done using crop curves derived from the Agrimet IMBO 1994-2017 averages. The UGRRW crop distribution and total irrigated acreage was also assumed to be the same as at present.

Future effective precipitation was calculated by the USDA-SCS method, as above for current $P_e$, but used the LOCA-downscaled mean global climate model projected precipitation for 2068. 2068 projected effective precipitation was subtracted from the composite ET to calculate future NIWR.

A comparison of current and projected precipitation is shown on Table 4-4.

**Table 4-4**
**Annual Agricultural Demand (2068)**

| Subwatershed | Name | Agricultural Demand Surface Water (AF per Year) (Water Rights Only) | Agricultural Demand Groundwater (AF per Year) (Water Rights Only) | 2068 Agricultural Demand Surface Water (AF per Year) (Modeled GIWR) | 2068 Agricultural Demand Groundwater (AF per Year) (Modeled GIWR) |
|---|---|---|---|---|---|
| 1 | Lookingglass Creek/ Cabin Creek | 3,474 | 225 | 5,011 | 325 |
| 2 | Willow Creek/Indian Creek | 51,888 | 14,439 | 68,488 | 19,058 |
| 3 | Lower Five Points Creek | 23,784 | 23,493 | 30,512 | 30,139 |
| 4 | Beaver Creek, Upper Five Points Creek | 753 | 2,040 | 1,047 | 2,838 |
| 5 | Meadow Creek Upper Grande Ronde River | 519 | - | 749 | 0 |
| 6 | Ladd Creek Lower Catherine | 106,332 | 46,104 | 141,507 | 61,355 |
| 7 | Upper Catherine Creek 1 | 24,027 | 531 | 36,524 | 807 |
| 8 | Upper Catherine Creek 2 | 357 | - | 693 | 0 |
| | **Total** | **211,134** | **86,832** | **284,532** | **114,522** |

*2068 scenario includes climate change effects as described by RCP 8.5.*

## Increased Irrigation Efficiency Scenario

NRCS uses a water saving estimator for irrigation system planning and ranking. This spreadsheet calculates current efficiency levels and determines what potential actions would translate to water saving advantages. Typically, this is used on individual farms; however, for this project, estimates were made for the entire UGRRW by subwatershed (NRCS, 2018b). This spreadsheet is in Appendix B, Agriculture Demand Calculations.

Intensive irrigation water management leads to less use of water in the field. Relative efficiency by subwatershed was estimated, and this will allow the Stakeholder Group to identify relative efficiency of each subwatershed and compare areas of potential improvement. A large opportunity for improvement is to transition from a wheel line to a pivot. NRCS offers educational outreach and incentive programs for water management programs. Management is usually linked to new sprinklers. Variable rate irrigation can give further improvement.

### *Method for Estimating System Efficiencies and Opportunities for Improvement*

Irrigated acreage data are useful, but the efficiencies of the different systems differ considerably making the actual volume of water diverted highly variable. System efficiency dictates overall water requirements and is a factor in determining where the most water can be saved through system improvements. The group estimated current and potential future irrigation system efficiencies and gross irrigation water requirements using previously collected data and the NRCS Water Savings Estimator worksheet.

#### Estimating System Efficiencies: The Analysis

- Efficiencies were derived from NRCS Water Savings Estimator worksheet
  - Background data from the NRCS Farm Irrigation Rating Index (NRCS, 2018c) and OSU Extension "Blue Book" on crop ET values (OSU Extension, 2018).
- Several assumptions meant to characterize current conditions were made in the estimations:
  - Crop is alfalfa with 5-year rotation, including an annual grain
  - Soil is silt loam
  - Flood irrigation uses unlined ditch delivery, all other systems use pipeline
  - Currently, no irrigation water management (IWM) is used
  - 10 percent of pivots and other sprinkler systems have efficient (new) nozzles
- The future "improved" scenario made several assumptions as well
  - Crop and soil remain unchanged
  - 90 percent of flood irrigation can be converted to a sprinkler of some kind
  - 33 percent of wheel lines can be converted to pivots
  - 75 percent of unconverted wheel lines will be upgraded to new nozzles, drains, etc.
  - 75 percent of pivots that are not new (90 percent of total) can be upgraded with new sprinkler packages
  - Most linear systems are fairly new, so their efficiency remains unchanged
  - Intensive IWM is used on all converted/upgraded systems

Figure 4-15, below, shows the current and potential future efficiency estimates.

## Estimating Irrigation System Efficiencies: Results

The section below shows current and improved irrigation efficiency estimates based on the calculations above.

**Figure 4-15**
**Current and Potential (Improved) Efficiency Estimates**

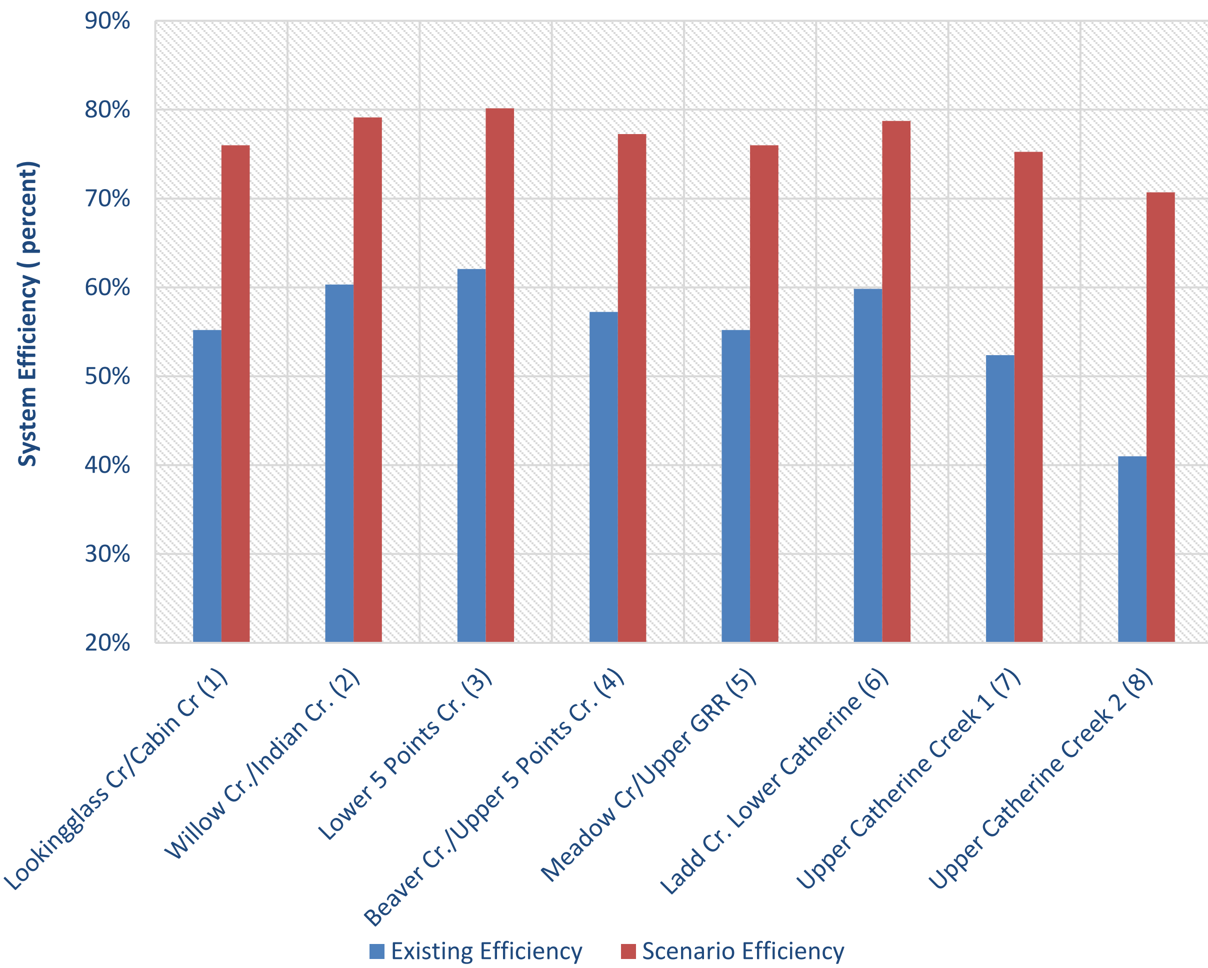



Figure 4-16 shows current and potential consumption estimates.

**Figure 4-16**
**Current and Potential Water Use (Diverted) Estimates**

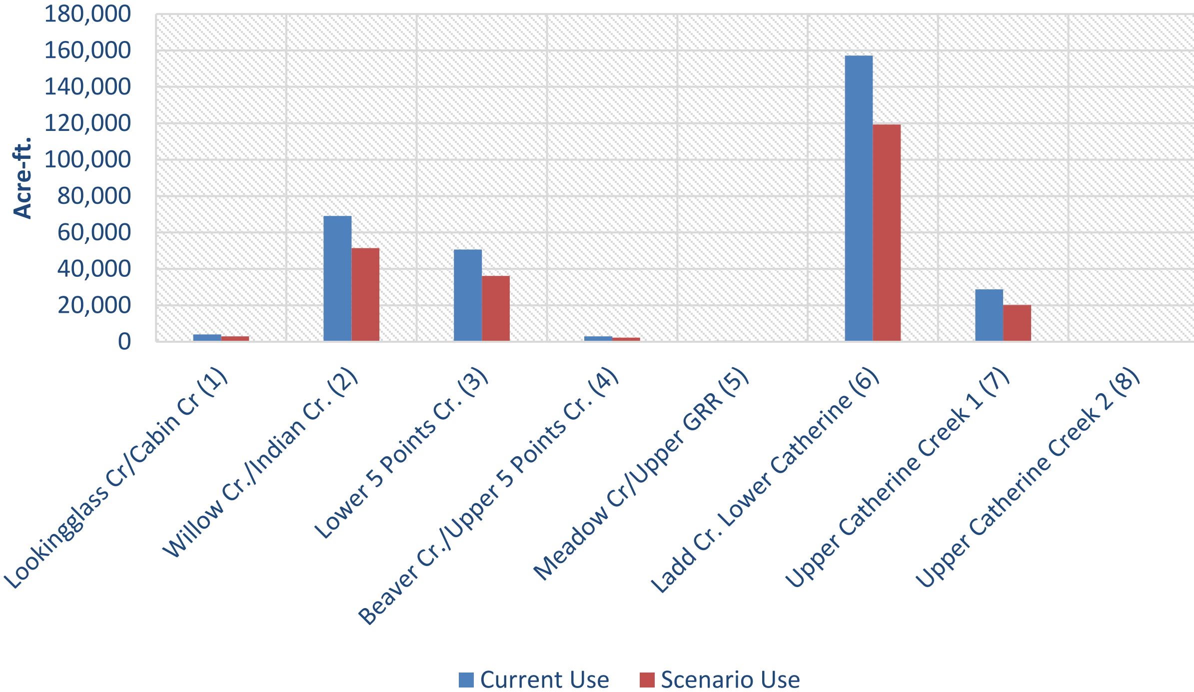



Table 4-5, below, shows the summary of bi-weekly agricultural demand.

**Table 4-5**
**Bi-weekly Agricultural Demand**

| Month | Days | Surface Water Supply | | | Annual Groundwater/24 | Surface Water Rights by Subwatershed Distributed According to Irrigation Demand | Groundwater Rights by Subwatershed Distributed According to Irrigation Demand | GIWR; Surface Water | GIWR; Groundwater |
|---|---|---|---|---|---|---|---|---|---|
| | | Median Water Volume (50 Percent Exceedance) | Low Water Volume (90 Percent Exceedance) | High Water Volume (10 Percent Exceedance) | | | | | |
| October | 1st to 15th | 5,573 | 3,488 | 9,188 | 5,761 | 1,474 | 607 | 1,353 | 545 |
| | 16th to 31st | 5,573 | 3,488 | 9,188 | 5,761 | - | - | - | - |
| November | 1st to 15th | 5,763 | 3,664 | 14,450 | 5,761 | - | - | - | - |
| | 16th to 30th | 5,763 | 3,664 | 14,450 | 5,761 | - | - | - | - |
| December | 1st to 15th | 9,316 | 4,126 | 32,968 | 5,761 | - | - | - | - |
| | 16th to 31st | 9,316 | 4,126 | 32,968 | 5,761 | - | - | - | - |
| January | 1st to 15th | 12,506 | 5,020 | 59,129 | 5,761 | - | - | - | - |
| | 16th to 31st | 12,506 | 5,020 | 59,129 | 5,761 | - | - | - | - |
| February | 1st to 15th | 26,089 | 7,055 | 73,266 | 5,761 | - | - | - | - |
| | 16th to 28th | 26,089 | 7,055 | 73,266 | 5,761 | - | - | - | - |
| March | 1st to 15th | 39,774 | 15,484 | 111,877 | 5,761 | - | - | - | - |
| | 16th to 31st | 39,774 | 15,484 | 111,877 | 5,761 | - | - | - | - |
| April | 1st to 15th | 69,572 | 30,834 | 128,028 | 5,761 | 2,778 | 1,143 | 2,549 | 1,026 |
| | 16th to 30th | 69,572 | 30,834 | 128,028 | 5,761 | 8,654 | 3,559 | 7,941 | 3,196 |
| May | 1st to 15th | 78,697 | 31,394 | 131,445 | 5,761 | 14,133 | 5,812 | 12,968 | 5,219 |
| | 16th to 31st | 78,697 | 31,394 | 131,445 | 5,761 | 18,716 | 7,697 | 17,173 | 6,912 |
| June | 1st to 15th | 44,048 | 14,861 | 87,685 | 5,761 | 22,022 | 9,057 | 20,206 | 8,133 |
| | 16th to 30th | 44,048 | 14,861 | 87,685 | 5,761 | 28,174 | 11,587 | 25,850 | 10,405 |
| July | 1st to 15th | 14,804 | 11,060 | 31,436 | 5,761 | 31,823 | 13,088 | 29,199 | 11,752 |
| | 16th to 31st | 14,804 | 11,060 | 31,436 | 5,761 | 29,365 | 12,077 | 26,944 | 10,845 |
| August | 1st to 15th | 9,614 | 8,550 | 12,719 | 5,761 | 21,115 | 8,684 | 19,374 | 7,798 |
| | 16th to 31st | 9,614 | 8,550 | 12,719 | 5,761 | 16,432 | 6,758 | 15,077 | 6,069 |
| September | 1st to 15th | 6,546 | 5,228 | 10,086 | 5,761 | 10,153 | 4,176 | 9,316 | 3,750 |
| | 16th to 30th | 6,546 | 5,228 | 10,086 | 5,761 | 6,293 | 2,588 | 5,774 | 2,324 |
| **Total** | **-** | **644,604** | **281,528** | **1,404,554** | **138,271** | **211,134** | **86,832** | **193,725** | **77,973** |

Total agricultural water use on an annual basis was estimated to be 211,134 AF per year (surface water) and 86,832 AF per year (groundwater) using water rights, and 193,725 AF per year (surface water) and 77,973 AF per year (groundwater) using estimated ET. Future GIWR was estimated to be 284,532 AF per year (surface water) and 114,522 AF per year (groundwater) with existing irrigation efficiency and 214,169 AF per year (surface water) and 87,396 AF per year (groundwater) under the increased efficiency scenario. These figures are shown on Figure 4-17, below.

**Figure 4-17**
**Current and Scenario Agricultural Demand Estimates**

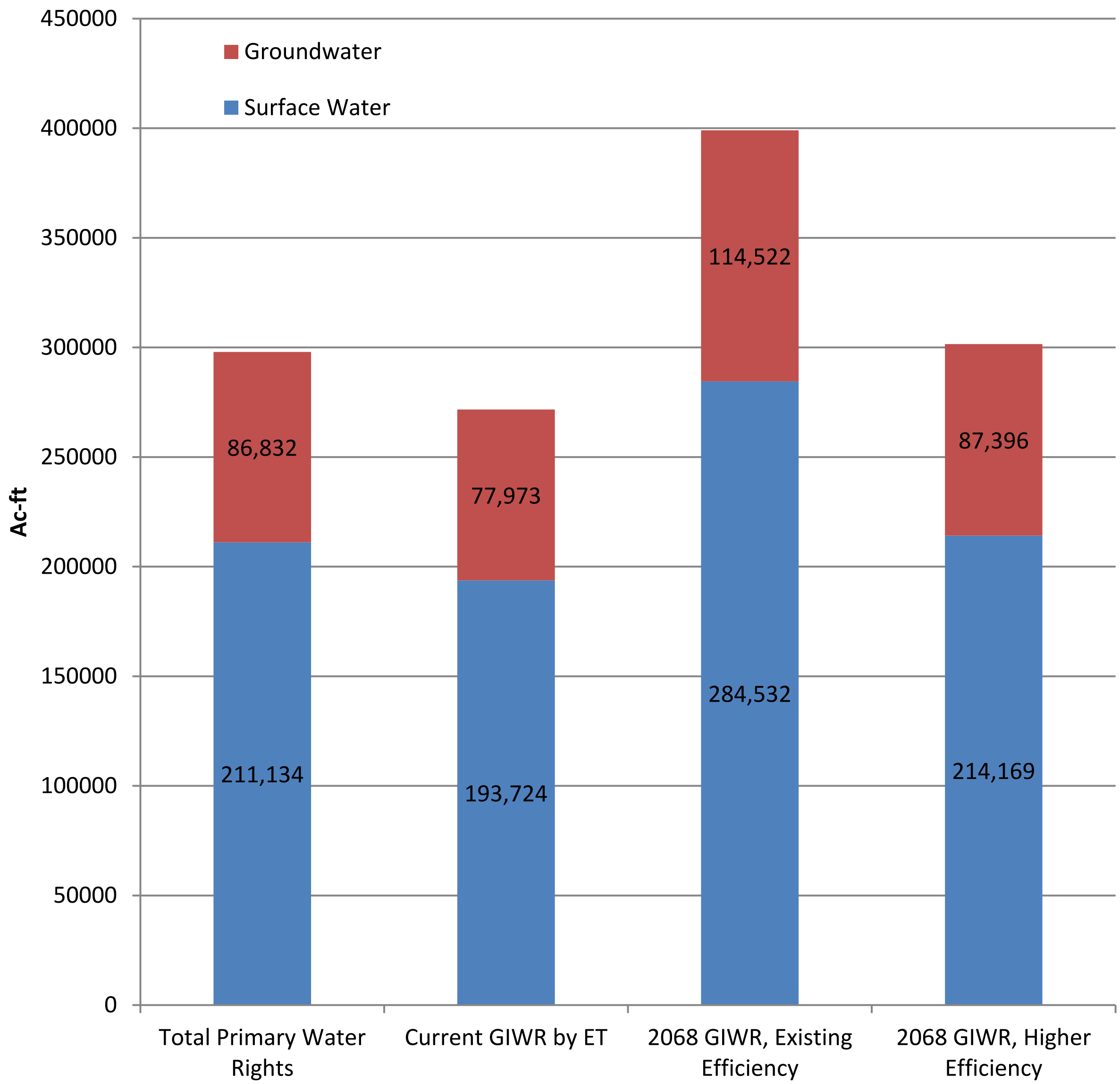



Figure 4-18, below, shows the current and future scenario GIWR on a bi-weekly temporal scale.

**Figure 4-18**
**Current and Scenario Bi-Weekly GIWR Estimates**

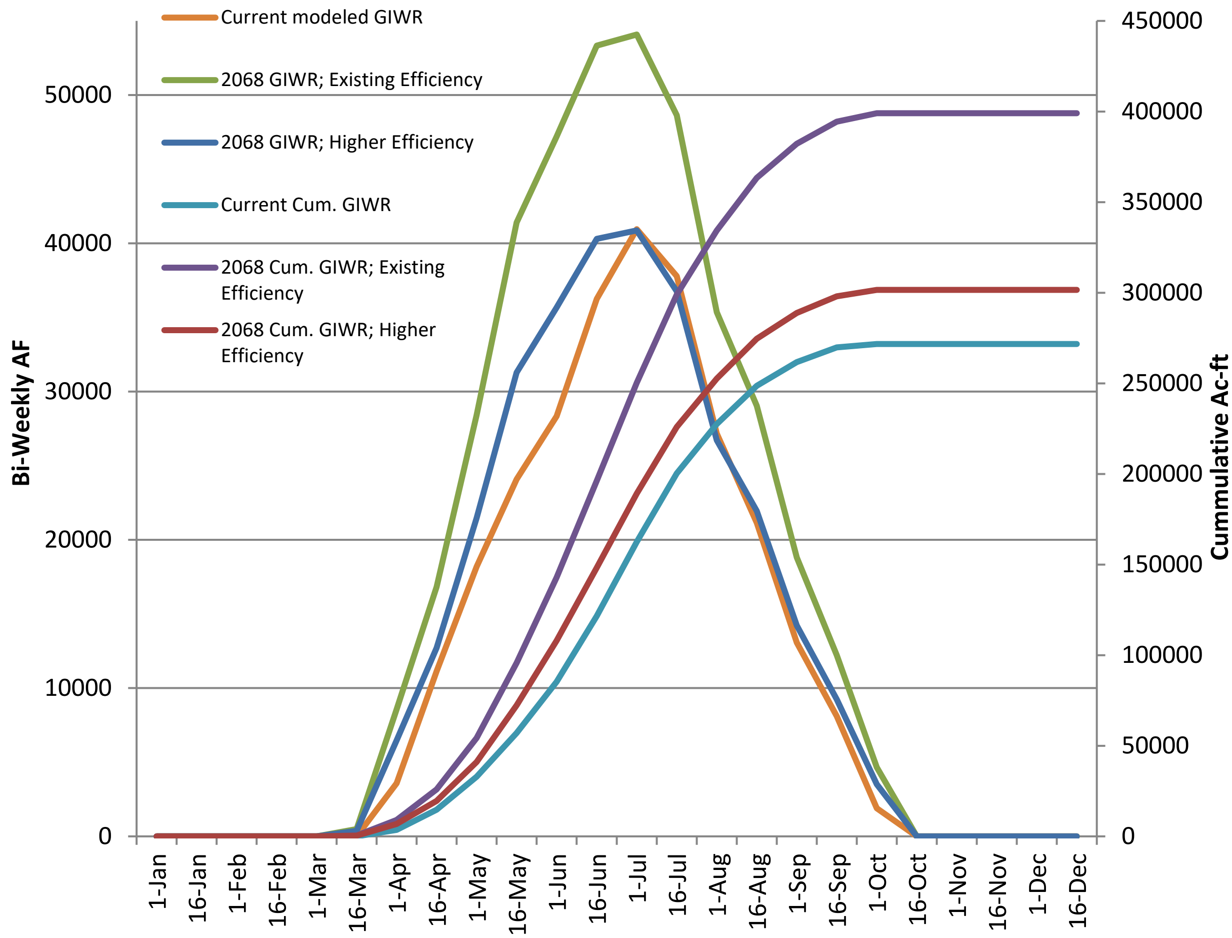



Figure 4-19 shows current and future average daily evapotranspiration.

**Figure 4-19**
**Current and Future Average Daily Evapotranspiration**

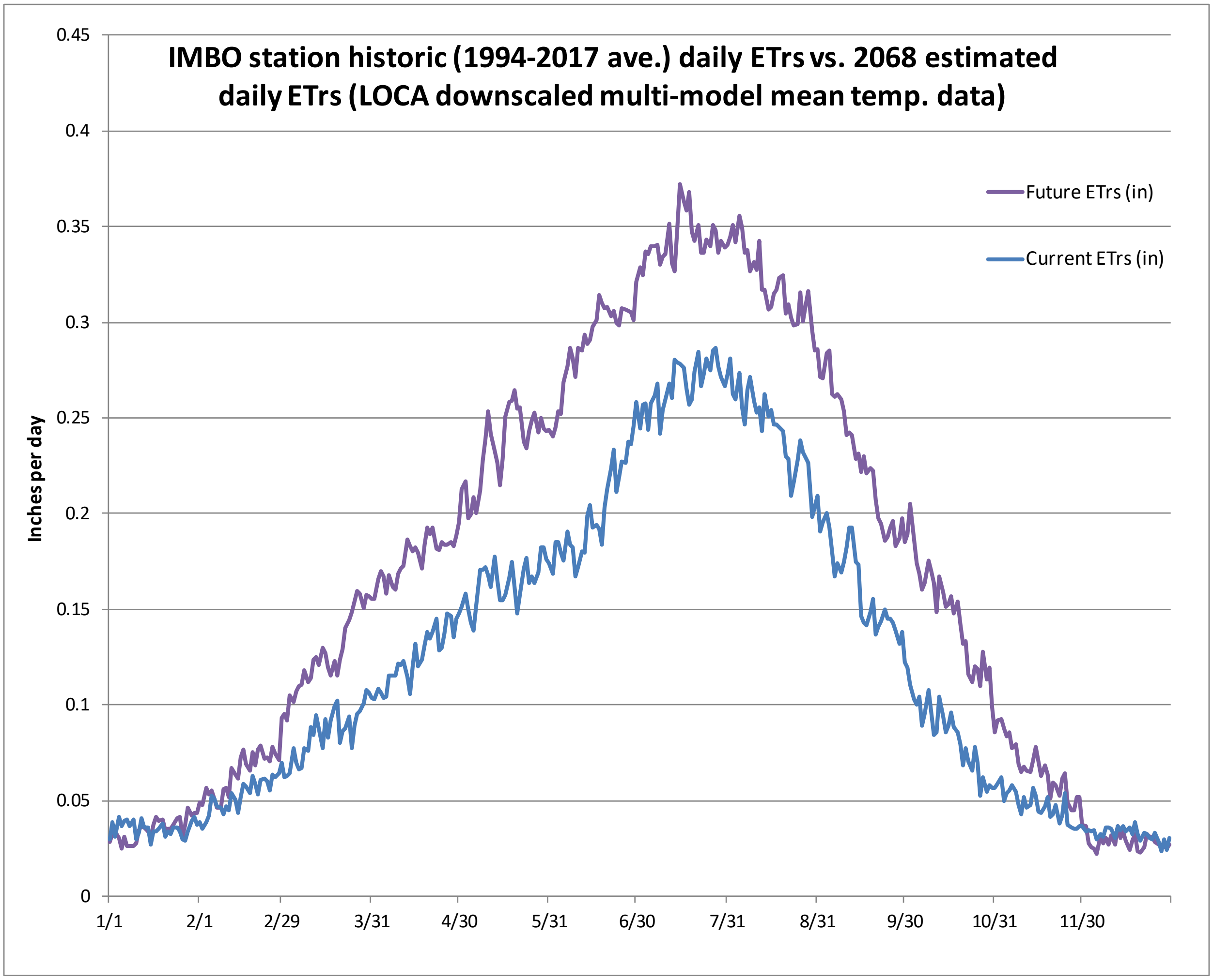
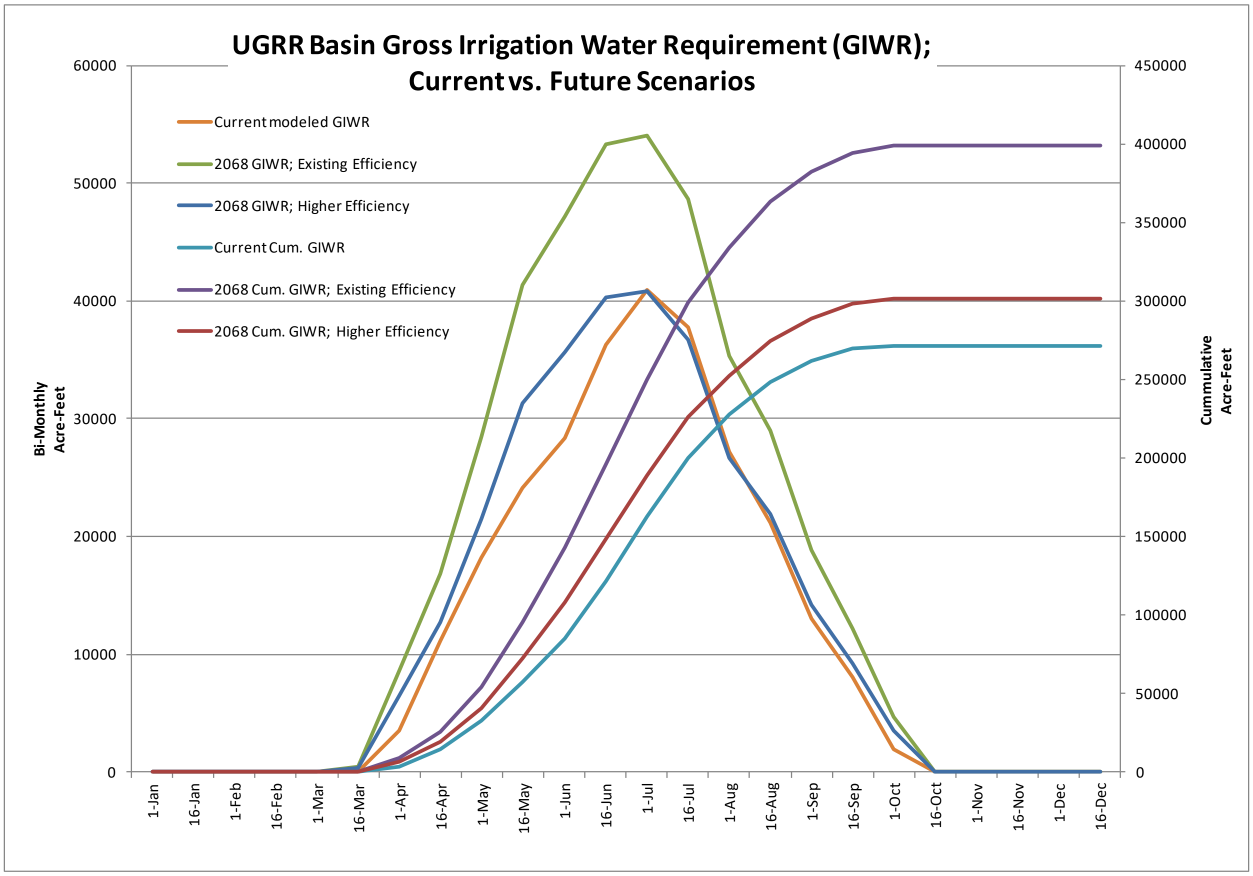



Figure 4-20, below, shows current and future gross irrigation water requirements.

**Figure 4-20**
**Current and Future Gross Irrigation Water Requirements**




# Agricultural Demand Summary and Vulnerability Assessment

## *Overall Water Quality Vulnerabilities*

- Irrigation water appears to have a low risk of not having sufficient quality for agricultural purposes.
- There is limited testing of surface water in the area.
- The Step 3 report assumes that water quality will continue to be of sufficient quality to meet agricultural needs.
- The lack of consistent surface water quality data across the UGRRW is a critical uncertainty.
- There are opportunities for partnerships between the many stakeholder groups and agencies to share data and coordinate monitoring activities.

## *Overall Water Quantity Vulnerabilities*

As shown on Table 4-4, demand is less vulnerable on an annual basis than on a bi-weekly basis. Table 4-5 shows bi-weekly agricultural demand compared to water supply. At certain times of the year when demand is high, and supply is low (late summer/early fall) there is not enough water to meet agricultural demand. Based on increasing temperatures and projected decreases in growing season precipitation and snowpack, as well as earlier snowmelt of the RCP 8.5 climate model, it is estimated that this gap in supply and demand will grow worse in the future. See Section 6 for details on this change.

The main issues affecting agricultural water use in the UGRRW involve the characterization of water resources and the adequacy of the quantity of surface water available, especially in the future, as changes in climate shift the balance of supply and demand.

Surface water users routinely experience curtailment of their supply from July through the end of the season, limiting the viability of producing crops that require water during this part of the season. While this fact is well known among surface water irrigators, it is difficult to quantify because there are currently no gauging stations throughout the major irrigated areas of the basin, creating a critical uncertainty. Surface water inadequacy will be exacerbated in the future, when warmer temperatures increase ET while simultaneously shifting the surface water supply, which is largely derived from snowmelt runoff. Surface storage has been investigated in the past as a potential solution, but this issue is currently not being addressed through any significant infrastructure projects that would store spring runoff for use later in the season. Some surface water irrigators have supplemental groundwater rights that can be used when the surface water supply dwindles, but this is no longer an option for others, as further groundwater appropriations were precluded by the 1988 scenic waterway designation. If the surface water supply is not augmented with some type of storage, there is a high risk that users will have insufficient water to meet crop needs, which will create a high degree of impact on the viability of farming operations and the local economy.

Agricultural use of groundwater in the UGRRW also faces critical supply uncertainties. While nearly 30 percent of the UGRRW's primary irrigation water rights are from a groundwater source, the sustainable yields from groundwater aquifers are unknown. Therefore, the sustainability of groundwater resources currently, and in the face of additional pressure on them in the future from increased ET is unknown and is a critical uncertainty. Though the groundwater resource has not been quantified very accurately, demands on it are expected to increase in the future, resulting in a moderate risk of supply shortage, which will result in a high magnitude impact on the viability of operations that depend on groundwater sources, as well as the local economy.

Several critical assumptions affect the risk levels estimated for agricultural water use. The future climate scenario assumes a relatively high emission (RCP 8.5) scenario, driving temperature change. Deviations from the assumed pathway would affect the risks derived from increased temperature. Another noteworthy assumption is that in the selected ET model, the distribution of crops remains constant in the future. A variety of factors could affect the crops types grown in the basin and could change the irrigation demand.

Overall, the risks to agricultural demand in terms of water quantity are considered **high** because the problem is already occurring and has a high probability of occurring in the future and/or becoming worse, requiring changes to current irrigation practices**.**

## Recommended Actions to Improve Understanding of Agricultural Water Uses/Needs

Opportunities for addressing agricultural demand issues include infrastructure projects that would capture spring runoff for use later in the season as well as increased irrigation efficiency. Our increased efficiency scenario estimates that efficiency improvements can reduce overall future irrigation demands by 24 percent. However, these improvements do not address the problem of surface water availability when stream flows dwindle in the summer months. With a warmer climate predicted for the future, and the accompanying reduction in snowpack that surface water users depend on, water storage infrastructure would seem the most obvious opportunity for improving the prospects for meeting future agricultural demand.

# 5.0 - Instream Needs/Demands

## Introduction

This section describes elements of instream demand, which includes both variables needed to sustain aquatic life as well as the downstream scenic waterway as a recreational demand. Instream demands are described in terms of water quality and quantity elements. System components are described. Next, demand calculations are presented (current and future). Vulnerabilities are described for current demand and future demand and then recommended actions to improve understanding are described.

## Overview of Instream Demands

### *Water Quality Demands*

Temperature and flow are the primary components of instream demand in the Upper Grande Ronde River Watershed (UGRRW). See the Step 2 report for additional water quality analysis.

### *Water Quantity Demands*

Instream demand for aquatic life is driven by several factors: species, water needs, stream variables, and future changes (Oregon Department of Fish and Wildlife [ODFW], 2017).

- Species: the first step is determining what species are present, their life history, distribution, protection status, and priority areas.
- Water Needs and Streams: these needs are site-specific and are dependent on micro habitats. Important data on micro habitats include depth, velocity, substrate, and cover. The other information that is important is the presence, timing, and specific habitat requirements of a life stage. These components lead to a biological flow recommendation. Components of streams that affect instream demand include geomorphology, stream size, hydrograph (flow and timing), and level of anthropogenic development.
- Future: 2.5 to 3.4°C century average warming is anticipated (Mote et al., 2013). This is projected to lead to an approximately 5 percent decrease in stream flow (National Research Council [NRC], 2011) and a shift in the hydrograph. This is predicted to cause species to migrate with the thermal envelopes they have evolved to tolerate (Isaak et al., 2017).
- Water Quality Needs: include the chemical (temperature, pH, dissolved oxygen), biological (macroinvertebrates), and physical characteristics of the waterbody (channel morphology, flow regime).

Instream demand is complex and may require the specific timing and quality of available instream flows. Instream demand includes needs for aquatic life as well as recreational use. Numerous processes contribute to the amount of water available for instream use, though consumptive uses may play the largest role in whether water is available instream during the summer period. For example, vegetation management in the UGRRW impacts the flow regime and amount of sediment and nutrients in the water and can affect the timing of runoff and water quality. Examples of vegetation management include commercial and non-commercial thinning, prescribed fire, and grazing. Different vegetation species have different associated evapotranspiration demands. Roads, climate change, and wildfires all impact the hydrologic process (U.S. Forest Service, 2018).

Instream needs and demands are not only related to aquatic life. There are no instream rights for recreation uses within the UGRRW; however, water needs for recreational uses must be protected. Recreation uses (swimming, fishing, boating) are designated beneficial uses for waterbodies in the UGRRW. Ladd Marsh and wetlands in the region are other examples of instream needs that are not directly related to aquatic life but must be protected.

Instream water rights have a priority date based on the date of application to the Oregon Water Resources Department (OWRD), just like all other water rights. Most instream water rights (ISWR) in the planning area have junior priority dates relative to most other rights since many instream rights were applied for after the 1987 Instream Water Rights Act. However, in cases where an existing senior water right is *converted* to an instream right, the instream right retains the priority of the original water right. Additionally, the downstream Scenic Waterway represents downstream recreational demand that has additional demands on water, although not in a quantified way.

## Drivers of Instream Needs

### *Endangered Species Considerations*

The Endangered Species Act (ESA) lists multiple species in the basin that are legally required to be protected. All actions taken in the basin are required to avoid ESA jeopardy. These include Chinook and steelhead salmonid species and bull trout. These species can be affected by a lack of instream flow.

### *Tribal Cultural Practices and Treaty Rights*

Meeting in-stream demand is also important to maintaining the fisheries that are central to tribal culture and subsistence (Confederated Tribes of the Umatilla Indian Reservation [CTUIR], 2018). Treaties between the United States government and Native American tribes have guaranteed rights to certain subsistence practices and the aquatic species necessary to effectuate them. The Treaty of 1855 was a treaty signed between the United States government and Umatilla, Cayuse, and Walla Walla Tribes. This treaty guaranteed members of the Umatilla, Cayuse, and Walla Walla tribes the right to fish, hunt, and gather at all “usual and accustomed” stations (Treaty with the Walla Walla, Cayuse, etc., 1855). These practices require water. While formal water needs are difficult to quantify, the United States has recognized that water quantity and quality must be sufficient to sustain rights (not adjudicated water rights as described in previous sections, but a legal right to water) reserved to tribes through a treaty with the United States (Winters v. United States, 207 U.S. 564 [1908]).

The CTUIR’s “First Foods” policy links tribal identity and cultural continuity and also guides CTUIR natural resource management today. CTUIR cultural First Foods include water, salmon, deer, cous, and huckleberry. These principles are also applied to water resources management via the CTUIR’s “River Vision” management approach.

The River Vision mission statement is "the Umatilla basin includes a healthy river capable of providing 'First Foods' that sustain the continuity of the Tribe's culture. This vision requires a river that is dynamic, and shaped not only by physical and biological processes, but the interactions and interconnections between those processes." River Vision is applied to fisheries habitat through hydrology, geomorphology, connectivity riparian vegetation, and aquatic biota.

## System Components

### *Water Rights*

Instream water rights place protection of instream flows on the same legal standing as consumptive water rights. They are based on "Basin Investigation Report (BIR)" using the Oregon Method (ODFW, 1975). The report is titled "Fish and Wildlife Resources of the Grande Ronde Basin, Oregon, and their Water Requirements." The basin study is currently the basis for all ISWR, except in some limited cases such as those instream rights created by temporary leases by The Freshwater Trust (FTW) and others.

The BIR developed specific criteria such as listed on Table 5-1 and shown on Figure 5-1, below:

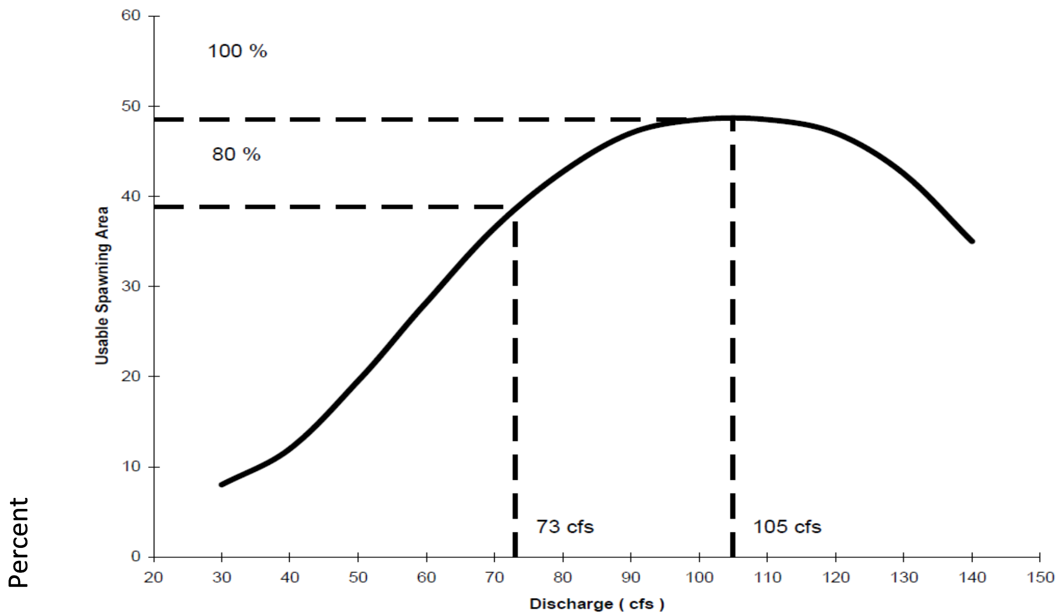
**Table 5-1**
**Salmonid Spawning Criteria**

SALMONID SPAWNING CRITERIA

| | ChF | ChS | Co | CS | St | Br | K | Other trout |
|---|---|---|---|---|---|---|---|---|
| Water Velocity (fps) | 1.0 to 3.0 | 1.0 to 3.0 | 1.0 to 3.0 | 1.5 to 3.2 | 1.0 to 3.0 | 0.7 to 2.1 | 0.8 to 2.1 | 1.0 to 3.0 |
| Water Depth (ft) | 0.8 | 0.8 | 0.6 | 0.6 | 0.6 | 0.8 | 0.4 or 0.6 | 0.4 or 0.6 |
| Sample | 440 | 158 | 251 | 177 | 363 | 115 | 106 | |

*ChF = fall chinook salmon, ChS = spring chinook salmon, Co = Coho salmon, CS = cutthroat trout (sea-run), st = steelhead, Br = brown trout, k = kokanee Sample=number of samples, fps=feet per second.*

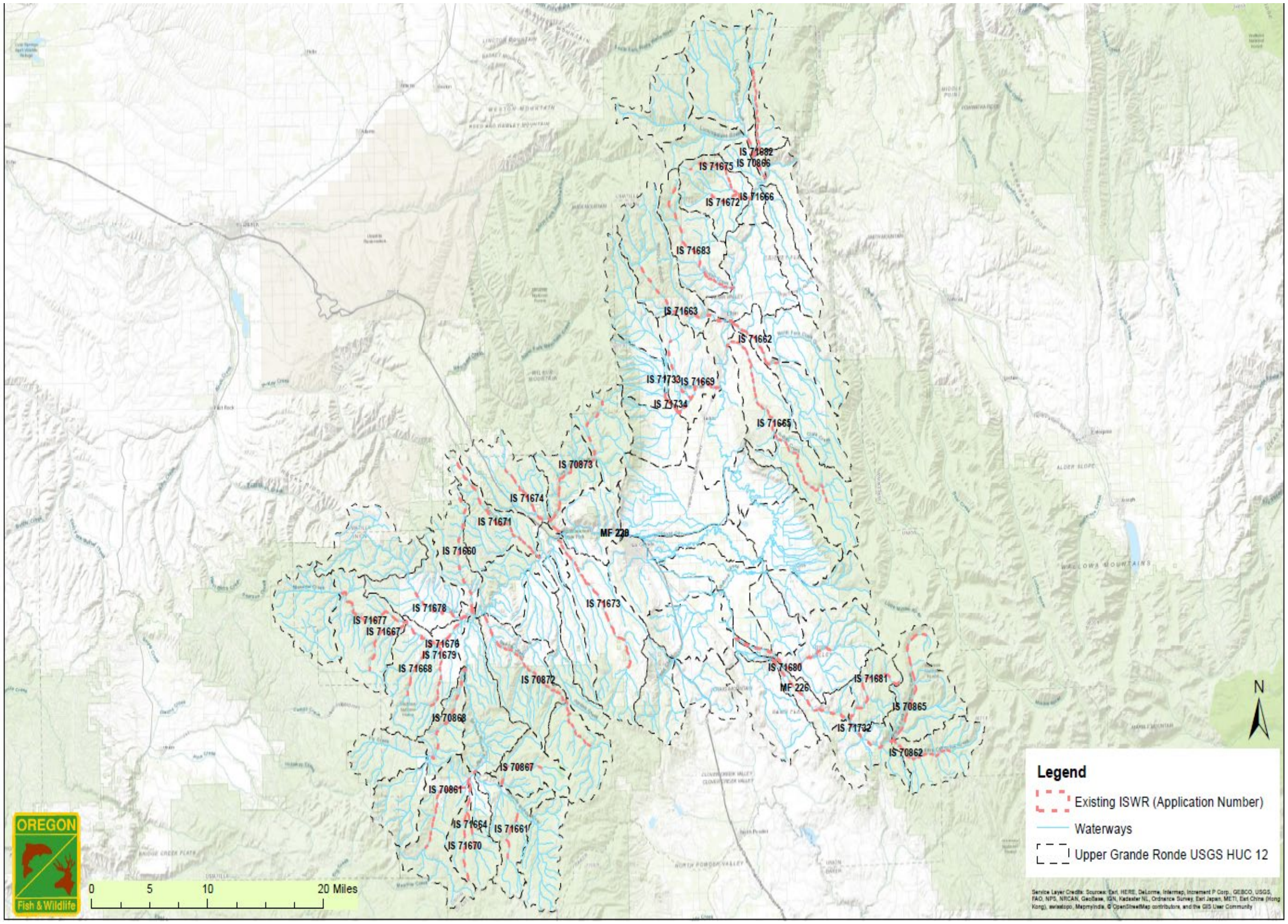
**Figure 5-1**
**Spawning Areas as a Function of Discharge**




*(Graph from Thompson, 1972)*

The water right certificate holder for ISWR is OWRD (in trust for the people of Oregon) and can be requested by ODFW, the Oregon Department of Environmental Quality, or the Oregon Parks and Recreation Department. Each right has a specified purpose such as migration, spawning, egg incubation, fry emergence, or juvenile rearing and is linked to a specific stream reach. Priority dates of these water rights are the early 1990s. Rights are described as an instantaneous rate (cubic feet per second) per month (ODFW, 2018a). Existing ISWR are shown on Figure 5-2.

**Figure 5-2**
**Upper Grande Ronde River Watershed Existing Instream Water Rights**




These water rights (certificate numbers) are enumerated on Table 5-2 on a bi-weekly basis.

**Table 5-2**
**Upper Grande Ronde River Watershed Water Rights**

| | | Cubic Feet Per Second | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| StreamName | Priority Date | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
| BEAR CR > MEADOW CR | 6/7/1991 | 1.5 | 1.5 | 4.7 | 4.7 | 9.3 | 9.3 | 15.2 | 15.2 | 8.2 | 8.2 | 1.3 | 1.3 | 0.4 | 0.4 | 0.2 | 0.2 | 0.1 | 0.1 | 0.2 | 0.2 | 0.4 | 0.4 | 1.1 | 1.1 |
| BEAVER CR > GRANDE RONDE R | 11/8/1990 | 11.3 | 11.3 | 16.6 | 16.6 | 31.1 | 31.1 | 68.0 | 68.0 | 68.0 | 68.0 | 40.0 | 40.0 | 13.6 | 13.6 | 5.9 | 5.9 | 5.4 | 5.4 | 6.6 | 6.6 | 9.2 | 9.2 | 10.0 | 10.0 |
| BURNT CORRAL CR > MEADOW CR | 6/7/1991 | 1.1 | 1.1 | 2.8 | 2.8 | 5.6 | 5.6 | 10.5 | 10.5 | 7.4 | 7.4 | 1.3 | 1.3 | 0.4 | 0.4 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.4 | 0.4 | 0.9 | 0.9 |
| CABIN CR > GRANDE RONDE R | 6/7/1991 | 20.0 | 20.0 | 20.0 | 20.0 | 30.0 | 30.0 | 30.0 | 50.0 | 50.0 | 50.0 | 20.9 | 20.9 | 12.4 | 12.4 | 10.5 | 10.5 | 11.4 | 11.4 | 18.6 | 18.6 | 20.0 | 20.0 | 20.0 | 20.0 |
| CATHERINE CR > GRANDE RONDE R | 7/1/1991 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 | 60.0 | 60.0 | 60.0 | 70.0 | 70.0 | 70.0 | 70.0 | 70.0 | 70.0 | 37.8 | 37.8 | 31.0 | 31.0 | 29.5 | 29.5 | 34.0 | 34.0 | 30.0 | 30.0 |
| CHICKEN CR > SHEEP CR | 6/7/1991 | 3.7 | 3.7 | 5.7 | 5.7 | 11.3 | 11.3 | 26.0 | 26.0 | 26.0 | 26.0 | 15.8 | 15.8 | 3.6 | 3.6 | 1.5 | 1.5 | 1.2 | 1.2 | 1.6 | 1.6 | 2.6 | 2.6 | 3.2 | 3.2 |
| CLARK CR > GRANDE RONDE R | 6/7/1991 | 13.1 | 13.1 | 20.0 | 20.0 | 30.0 | 30.0 | 30.0 | 43.0 | 43.0 | 43.0 | 14.6 | 14.6 | 2.6 | 2.6 | 1.1 | 1.1 | 0.4 | 0.4 | 1.5 | 1.5 | 4.7 | 4.7 | 9.8 | 9.8 |
| CLEAR CR > GRANDE RONDE R | 6/7/1991 | 2.4 | 2.4 | 3.2 | 3.2 | 6.2 | 6.2 | 19.5 | 19.5 | 34.0 | 34.0 | 20.0 | 20.0 | 5.8 | 5.8 | 2.0 | 2.0 | 1.8 | 1.8 | 2.1 | 2.1 | 2.2 | 2.2 | 2.0 | 2.0 |
| DARK CAN CR > MEADOW CR | 6/7/1991 | 3.1 | 3.1 | 9.3 | 9.3 | 17.1 | 17.1 | 26.6 | 26.6 | 13.7 | 13.7 | 2.1 | 2.1 | 0.6 | 0.6 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 1.0 | 1.0 | 2.5 | 2.5 |
| FIVE POINTS CR > GRANDE RONDE R | 11/8/1990 | 17.0 | 17.0 | 17.0 | 17.0 | 30.0 | 30.0 | 43.0 | 43.0 | 43.0 | 43.0 | 30.0 | 30.0 | 6.5 | 6.5 | 3.7 | 3.7 | 4.0 | 4.0 | 4.3 | 4.3 | 8.4 | 8.4 | 12.8 | 12.8 |
| FLY CR > GRANDE RONDE R | 11/8/1990 | 9.6 | 9.6 | 13.0 | 13.0 | 20.0 | 20.0 | 34.0 | 34.0 | 34.0 | 34.0 | 20.0 | 20.0 | 6.5 | 6.5 | 4.2 | 4.2 | 3.8 | 3.8 | 4.7 | 4.7 | 6.2 | 6.2 | 8.4 | 8.4 |
| GORDON CR > GRANDE RONDE R | 6/7/1991 | 13.0 | 13.0 | 13.0 | 13.0 | 20.0 | 20.0 | 20.0 | 34.0 | 34.0 | 34.0 | 20.0 | 20.0 | 17.7 | 17.7 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 |
| INDIAN CR > GRANDE RONDE R | 6/7/1991 | 14.6 | 14.6 | 22.5 | 22.5 | 36.7 | 36.7 | 50.0 | 68.0 | 68.0 | 68.0 | 50.0 | 50.0 | 22.3 | 22.3 | 7.9 | 7.9 | 5.4 | 5.4 | 5.5 | 5.5 | 8.3 | 8.3 | 11.2 | 11.2 |
| JARBOE CR > LOOKINGGLASS CR | 6/7/1991 | 12.9 | 12.9 | 13.0 | 13.0 | 20.0 | 20.0 | 20.0 | 34.0 | 34.0 | 34.0 | 20.0 | 20.0 | 13.5 | 13.5 | 10.6 | 10.6 | 10.6 | 10.6 | 10.6 | 10.6 | 13.0 | 13.0 | 13.0 | 13.0 |
| LIMBER JIM CR > GRANDE RONDE R | 11/8/1990 | 3.7 | 3.7 | 5.5 | 5.5 | 10.7 | 10.7 | 26.0 | 26.0 | 26.0 | 26.0 | 19.6 | 19.6 | 4.2 | 4.2 | 1.6 | 1.6 | 1.5 | 1.5 | 1.8 | 1.8 | 2.8 | 2.8 | 3.2 | 3.2 |
| LITTLE CATHERINE CR | 6/7/1991 | 5.0 | 5.0 | 7.1 | 7.1 | 10.7 | 10.7 | 20.0 | 20.0 | 20.0 | 20.0 | 13.0 | 13.0 | 11.6 | 11.6 | 5.0 | 5.0 | 4.4 | 4.4 | 4.2 | 4.2 | 4.8 | 4.8 | 5.0 | 5.0 |

| | | Cubic Feet Per Second | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Priority Date** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** |
| > CATHERINE CR | | | | | | | | | | | | | | | | | | | | | | | | | |
| LITTLE CR > CATHERINE CR | 6/7/1991 | 12.5 | 12.5 | 20.0 | 20.0 | 20.0 | 26.5 | 34.0 | 34.0 | 34.0 | 34.0 | 20.0 | 20.0 | 12.9 | 12.9 | 7.4 | 7.4 | 5.8 | 5.8 | 7.4 | 7.4 | 6.8 | 6.8 | 9.7 | 9.7 |
| LITTLE LOOKINGGLASS CR > LOOKINGGLASS CR | 11/8/1990 | 65.0 | 65.0 | 65.0 | 65.0 | 65.0 | 65.0 | 65.0 | 100.0 | 100.0 | 100.0 | 80.0 | 80.0 | 80.0 | 80.0 | 64.1 | 64.1 | 64.2 | 64.2 | 64.4 | 64.4 | 80.0 | 80.0 | 65.0 | 65.0 |
| MARLEY CR > MEADOW CR | 6/7/1991 | 1.2 | 1.2 | 3.4 | 3.4 | 6.8 | 6.8 | 11.4 | 11.4 | 6.5 | 6.5 | 1.4 | 1.4 | 0.4 | 0.4 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.4 | 0.4 | 1.0 | 1.0 |
| MCCOY CR > MEADOW CR | 6/7/1991 | 8.5 | 8.5 | 13.0 | 13.0 | 20.0 | 20.0 | 34.0 | 34.0 | 34.0 | 34.0 | 6.0 | 6.0 | 1.9 | 1.9 | 1.1 | 1.1 | 1.1 | 1.1 | 1.4 | 1.4 | 2.7 | 2.7 | 6.7 | 6.7 |
| MEADOW CR > GRANDE RONDE R | 6/7/1991 | 25.8 | 25.8 | 27.0 | 27.0 | 40.0 | 40.0 | 68.0 | 68.0 | 68.0 | 68.0 | 24.1 | 24.1 | 6.9 | 6.9 | 4.2 | 4.2 | 3.8 | 3.8 | 5.1 | 5.1 | 8.5 | 8.5 | 20.2 | 20.2 |
| MEADOW CR > GRANDE RONDE R | 6/7/1991 | 7.0 | 7.0 | 10.0 | 10.0 | 15.0 | 15.0 | 26.0 | 26.0 | 26.0 | 26.0 | 6.9 | 6.9 | 2.2 | 2.2 | 0.9 | 0.9 | 0.9 | 0.9 | 1.2 | 1.2 | 2.8 | 2.8 | 5.5 | 5.5 |
| MILL CR > WILLOW CR | 7/1/1991 | 1.6 | 1.6 | 4.0 | 4.0 | 6.9 | 6.9 | 10.0 | 10.0 | 6.9 | 6.9 | 1.6 | 1.6 | 0.2 | 0.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.2 | 0.2 | 1.0 | 1.0 |
| N FK CABIN CR > CABIN CR | 6/7/1991 | 10.0 | 10.0 | 10.0 | 10.0 | 15.0 | 15.0 | 15.0 | 26.0 | 20.3 | 20.3 | 8.3 | 8.3 | 4.9 | 4.9 | 4.5 | 4.5 | 4.9 | 4.9 | 7.9 | 7.9 | 10.0 | 10.0 | 10.0 | 10.0 |
| N FK CATHERINE CR > CATHERINE CR | 11/8/1990 | 15.4 | 15.4 | 19.2 | 19.2 | 29.0 | 29.0 | 50.0 | 50.0 | 50.0 | 50.0 | 34.0 | 34.0 | 31.4 | 31.4 | 14.5 | 14.5 | 11.8 | 11.8 | 11.3 | 11.3 | 13.0 | 13.0 | 14.0 | 14.0 |
| PELICAN CR > FIVE POINTS CR | 6/7/1991 | 7.0 | 7.0 | 7.0 | 7.0 | 12.0 | 12.0 | 17.0 | 17.0 | 17.0 | 17.0 | 5.3 | 5.3 | 1.1 | 1.1 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 1.4 | 1.4 | 3.4 | 3.4 |
| PHILLIPS CR > GRANDE RONDE R | 6/7/1991 | 17.0 | 17.0 | 17.0 | 17.0 | 30.0 | 30.0 | 30.0 | 43.0 | 43.0 | 43.0 | 30.0 | 30.0 | 26.6 | 26.6 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 | 17.0 |
| ROCK CR > GRANDE RONDE R | 6/7/1991 | 13.5 | 13.5 | 17.0 | 17.0 | 30.0 | 30.0 | 43.0 | 43.0 | 43.0 | 43.0 | 29.8 | 29.8 | 4.8 | 4.8 | 2.2 | 2.2 | 2.1 | 2.1 | 2.4 | 2.4 | 4.0 | 4.0 | 6.3 | 6.3 |
| S FK CABIN CR > CABIN CR | 6/7/1991 | 13.0 | 13.0 | 13.0 | 13.0 | 20.0 | 20.0 | 20.0 | 34.0 | 28.0 | 28.0 | 12.3 | 12.3 | 7.4 | 7.4 | 6.0 | 6.0 | 6.5 | 6.5 | 10.5 | 10.5 | 12.7 | 12.7 | 13.0 | 13.0 |
| S FK CATHERINE CR > CATHERINE CR | 11/8/1990 | 11.9 | 11.9 | 14.8 | 14.8 | 20.0 | 22.4 | 34.0 | 34.0 | 34.0 | 34.0 | 20.0 | 20.0 | 20.0 | 20.0 | 11.2 | 11.2 | 9.2 | 9.2 | 8.7 | 8.7 | 10.0 | 10.0 | 10.9 | 10.9 |
| SHEEP CR > GRANDE RONDE R | 11/8/1990 | 10.4 | 10.4 | 18.3 | 18.3 | 20.0 | 34.0 | 34.0 | 34.0 | 34.0 | 34.0 | 25.0 | 25.0 | 8.1 | 8.1 | 3.5 | 3.5 | 3.1 | 3.1 | 4.0 | 4.0 | 6.7 | 6.7 | 8.9 | 8.9 |
| SPRING CR > GRANDE RONDE R | 6/7/1991 | 7.0 | 7.0 | 10.0 | 10.0 | 15.0 | 15.0 | 26.0 | 26.0 | 25.9 | 25.9 | 4.3 | 4.3 | 0.9 | 0.9 | 0.5 | 0.5 | 0.4 | 0.4 | 0.5 | 0.5 | 1.3 | 1.3 | 3.1 | 3.1 |

| | | Cubic Feet Per Second | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Priority Date** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** |
| W CHICKEN CR > CHICKEN CR | 6/7/1991 | 1.4 | 1.4 | 2.2 | 2.2 | 4.5 | 4.5 | 10.4 | 10.4 | 11.4 | 11.4 | 3.9 | 3.9 | 0.9 | 0.9 | 0.4 | 0.4 | 0.3 | 0.3 | 0.4 | 0.4 | 0.9 | 0.9 | 1.2 | 1.2 |
| WILLOW CR > GRANDE RONDE R | 6/7/1991 | 13.0 | 13.0 | 13.0 | 13.0 | 20.0 | 20.0 | 34.0 | 34.0 | 34.0 | 34.0 | 20.0 | 20.0 | 8.0 | 8.0 | 7.3 | 7.3 | 5.3 | 5.3 | 6.9 | 6.9 | 11.2 | 11.2 | 13.0 | 13.0 |
| WILLOW CR > GRANDE RONDE R | 7/1/1991 | 4.0 | 4.0 | 4.0 | 4.0 | 7.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | 7.0 | 7.0 | 6.4 | 6.4 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| CATHERINE CR > GRANDE RONDE R | 11/3/1983 | 30.0 | 30.0 | 30.0 | 30.0 | 100.0 | 100.0 | 200.0 | 200.0 | 200.0 | 200.0 | 200.0 | 125.0 | 80.0 | 80.0 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 |
| GRANDE RONDE R > SNAKE R | 5/9/1961 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| GRANDE RONDE R > SNAKE R | 11/3/1983 | 70.0 | 70.0 | 70.0 | 70.0 | 100.0 | 100.0 | 300.0 | 300.0 | 300.0 | 300.0 | 300.0 | 200.0 | 100.0 | 100.0 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 | 30.0 | 70.0 | 70.0 | 70.0 | 70.0 |

### *Infrastructure*

Infrastructure related to instream demand can be characterized as streambed conditions, impediments to flow, and diversions in the system.

## Demand Calculations (Current and Future)

### *Overview of Ideal Methods*

Determining instream demands requires strategic planning. Understanding what instream functions or species are targeted for protection, and identifying the streams, springs, rivers, wetlands, and lakes of interest ultimately helps determine what methods may be selected for any analysis. ODFW provided a summary document for potential methods to determine instream demand. The guidance includes a description of key desktop and field methods that may be used to address questions, along with brief descriptions about which methods are best for answering what types of questions. This document may be found in Appendix C, Instream Demand Calculations (ODFW, 2018b). The UGRRW Partnership lacked data to conduct these evaluations; therefore, much of this guidance can be described as future work to be considered in the UGRRW.

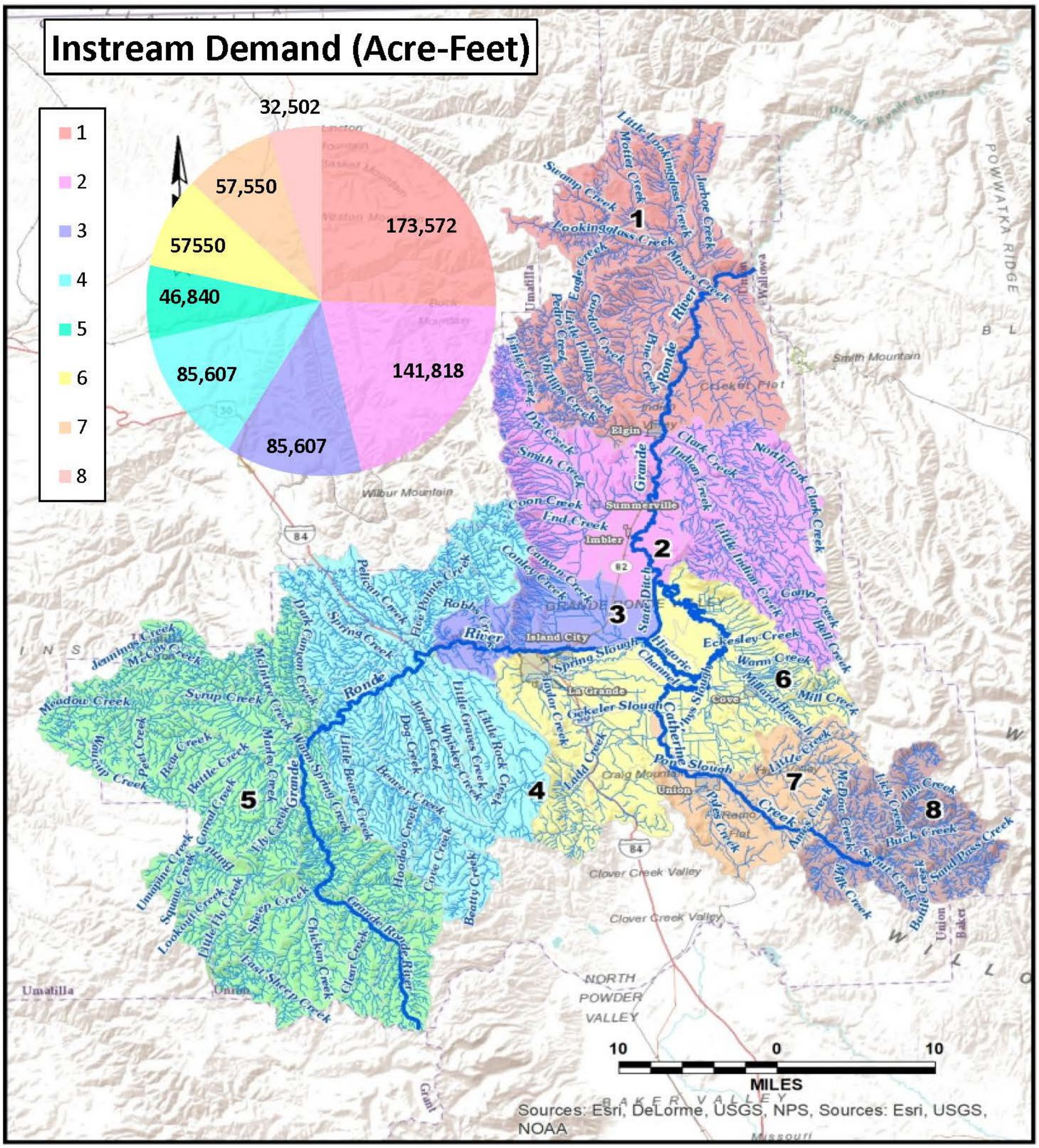
## Methods and Assumptions

For instream demand, the group quantified species and water needs, and qualified stream and future demands. This was accomplished through using water rights and qualitative analysis.

## Instream Demand Calculations

When considering water needs for aquatic species, multiple variables were considered. Aquatic species, such as the salmonid species of elevated concern in the UGRRW, are highly reliant on water flow, temperature, volume, velocity, depth, water quality, and timing/seasonality. Water rights based on flow needs for salmonid spawning, incubation, passage, and rearing were studied in the late 1960s and used to compile a map of water demand for aquatic species per region (see Figure 5-3). Based on the historical data, the greatest demand has come from northern Union County (subwatershed 1, north of Elgin), central Union County (subwatershed 3, near Island City), southeastern Union County (near Medical Springs), and southeastern Union County (subwatershed 7, near Union). There were no rights for the south-central area (subwatershed 6) that includes La Grande or Cove. Full detail of the rights may be found in Appendix C, Instream Demand Calculations (ODFW, 2018b). This approach is limited, as it does not take into account items such as peak and channel forming flows or that because of the generally junior nature of most ISWRs. There are many places in the UGRRW where ecological demands exist, but are not represented through ISWRs because flow studies have not been completed yet and applications for instream rights have not been made.

**Figure 5-3**
**Aquatic Species Instream Demand**



The data above have been and are currently being used as a baseline for calculating water rights based on migration patterns and salmonid needs. They do not consider climate changes, shifts in habitat, or surrounding land use. Also, this approach only considers minimum habitat need and does not reflect higher flows specifically needed by fish.

Water quality is important for instream needs, which include species needs as well as recreational needs. Water must be of a certain temperature and relatively free of chemicals and sediment content for aquatic life to function properly. See the Step 2 report for more discussion on water quality requirements on a biweekly basis throughout the year in each subwatershed.

### *Species Needs*

The range of steelhead and Chinook (the two endangered aquatic species) in the Grande Ronde Basin are shown on Figures 5-4 and 5-5, respectively:

**Figure 5-4**
**Grande Ronde Basin Range of Steelhead**

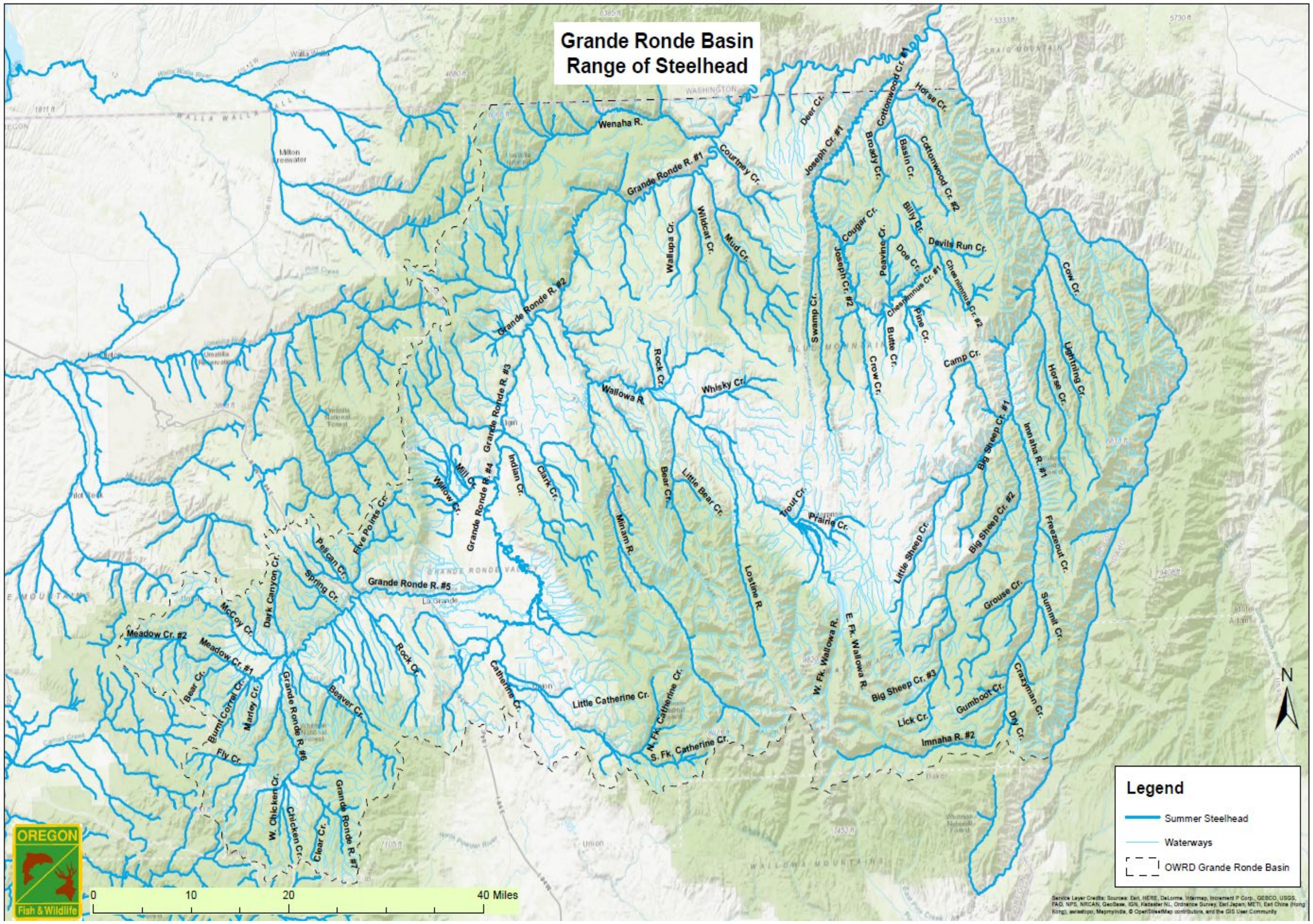
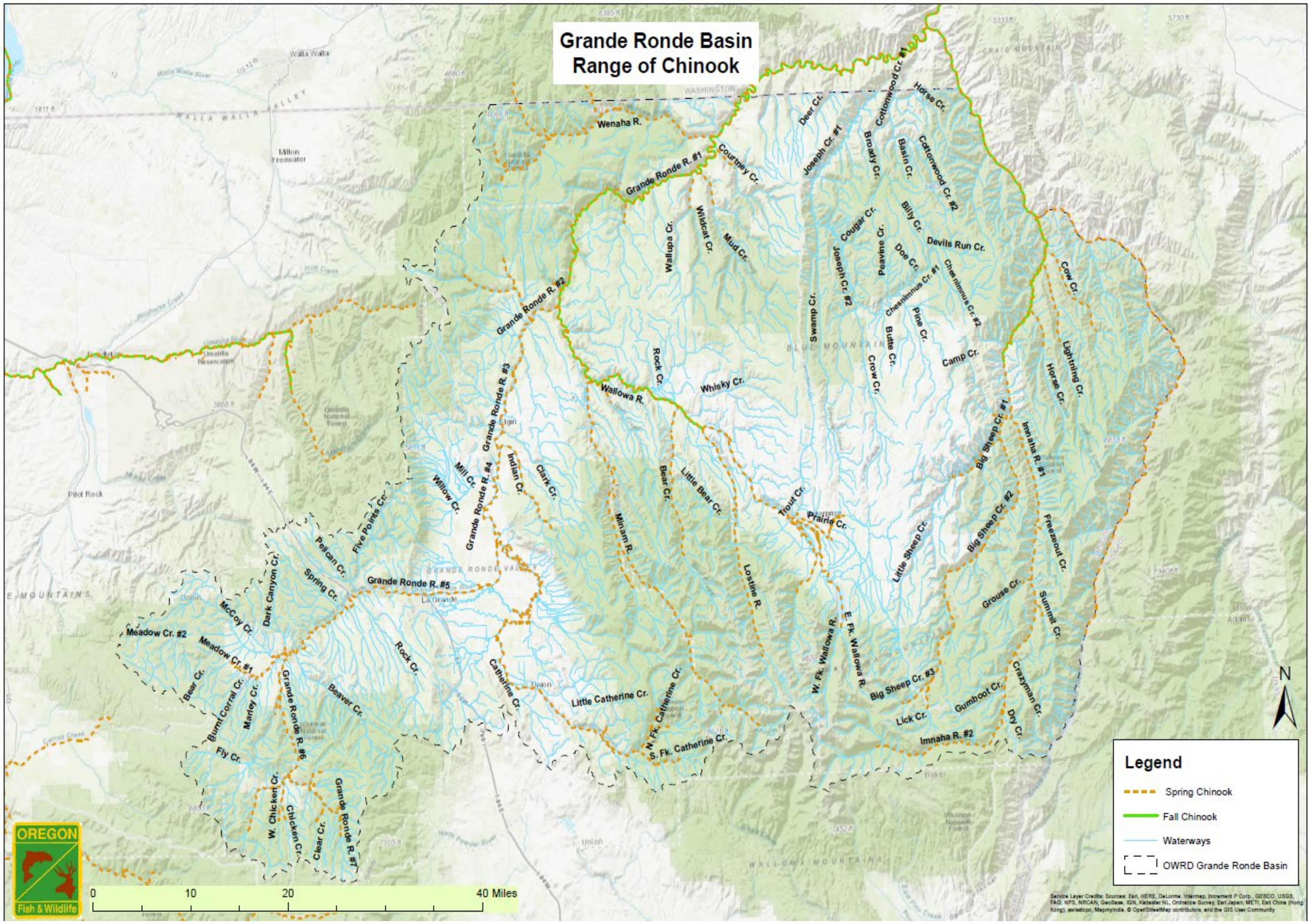


**Figure 5-5**
**Grande Ronde Basin Range of Chinook**



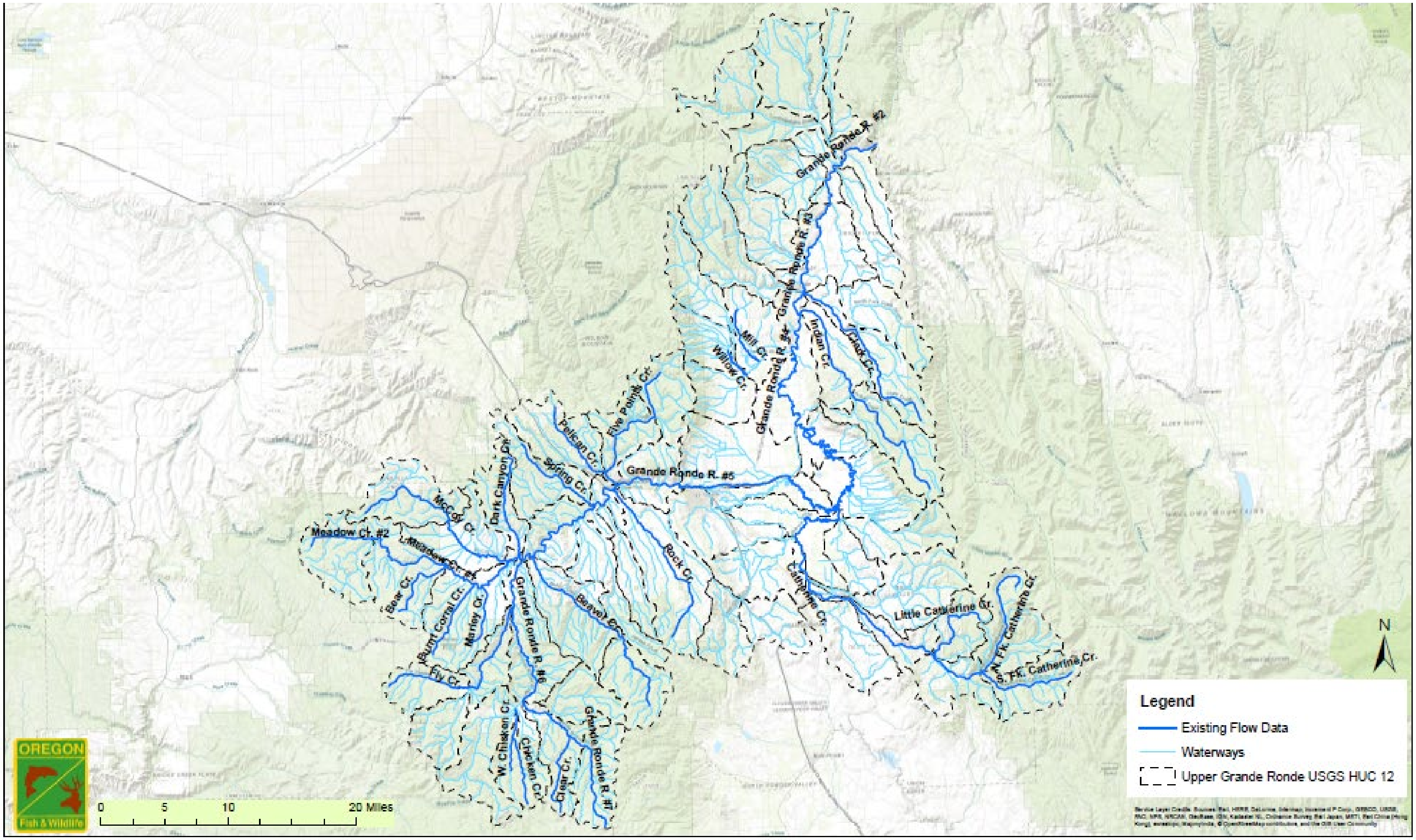
### *Ecological Needs*

Characterizing ecological needs is more difficult, as these are difficult to measure. Peak and channel-forming flows are important for habitat creation and maintenance. In addition, flows that initiate fish migration are essential to trigger these species to move to the next stage of their lives. Water quality limits where fish can live, and future demand, including climate change concerns, will impact species habitat ranges. Additional future work, as described in Appendix C, may be considered as a part of Step 4.

Existing flow data (and the studies associated with these data) provide a snapshot in time of where there is information to determine water rights and consider ecological needs and where data gaps exist.

Ecological needs during the irrigation season could potentially be met with instream leases (FWT, 2018). Figure 5-6, below, shows UGRRW areas were ISWR are present (and existing flow data are present). However, there is concern that instream leases may have detrimental impacts on other water users, and this potential solution will need to be reviewed carefully so as not to negatively impact those water users. Additionally, instream leases are unlikely to be effective in meeting ecological needs such as peak and channel-forming flows.

**Figure 5-6**
**Upper Grande Ronde River Watershed Existing Flow Data**



## Vulnerability Assessment and Indicators of Resilience

To determine how often existing ecological baseflow needs are met, data from the OWRD Water Availability Calculator was used to evaluate how much water was left for instream uses when consumptive uses (municipal and agricultural) were removed from the stream. Figure 5-7 is an example of this calculation:

**Figure 5-7**
**Example Water Availability Calculation Report**

WsID_71669_WaterAvailabiltyCalculation.txt - Notepad

File Edit Format View Help

DETAILED REPORT ON THE WATER AVAILABILITY CALCULATION

WILLOW CR > GRANDE RONDE R - AT MOUTH

Watershed ID #: 71669 Basin: GRANDE RONDE Exceedance Level: 80
Time: 3:44 PM Date: 09/29/2017

Monthly values are in cfs.
Storage is the annual amount at 50% exceedance in ac-ft.

| Month | Natural Stream Flow | Consumptive Use and Storage | Expected Stream Flow | Reserved Stream Flow | Instream Requirements | Net Water Available |
|---|---|---|---|---|---|---|
| JAN | 11.60 | 0.25 | 11.30 | 0.00 | 13.00 | -1.65 |
| FEB | 41.60 | 0.34 | 41.30 | 0.00 | 13.00 | 28.30 |
| MAR | 79.20 | 0.43 | 78.80 | 0.00 | 20.00 | 58.80 |
| APR | 72.40 | 8.54 | 63.90 | 0.00 | 34.00 | 29.90 |
| MAY | 54.80 | 51.30 | 3.50 | 0.00 | 34.00 | -30.50 |
| JUN | 14.90 | 61.10 | -46.20 | 0.00 | 20.00 | -66.20 |
| JUL | 5.86 | 27.70 | -21.80 | 0.00 | 8.03 | -29.80 |
| AUG | 4.78 | 8.01 | -3.23 | 0.00 | 7.34 | -10.60 |
| SEP | 4.95 | 4.21 | 0.74 | 0.00 | 5.25 | -4.51 |
| OCT | 5.05 | 0.15 | 4.90 | 0.00 | 6.89 | -1.99 |
| NOV | 6.25 | 0.16 | 6.09 | 0.00 | 11.20 | -5.11 |
| DEC | 9.52 | 0.22 | 9.30 | 0.00 | 13.00 | -3.70 |
| ANN | 35,700 | 9,830 | 28,600 | 0 | 11,200 | 19,900 |

Using these reports, water availability for ISWR at the 80 percent and 50 percent exceedances was calculated on Tables 5-3 and 5-4. Green indicates the months in which enough water to meet instream demand is likely to be available. Table 5-5 shows current monthly instream demand, and Table 5-6 shows current annual instream demand.

These tables show that there are many times of the year when the 50 percent exceedance flows are met (less so in late fall); however, there are very few times of the year when the 80 percent exceedance flows are met. In practice, this means that fish migration can be threatened in the fall in reaches where there are inadequate flows.

**Table 5-3**
**Water Available for Instream Water Rights 80 Percent Exceedance**

| Stream | 80 Percent Exceedance | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
| Bear Creek | -0.8 | -2.9 | -6.4 | -9.2 | -5.9 | -0.8 | 0.0 | -0.1 | -0.1 | -0.1 | -0.3 | -0.7 |
| Beaver Creek | -11.7 | -16.5 | -23.4 | -25.2 | -19.7 | -22.3 | -13.5 | -8.9 | -8.8 | -9.5 | -11.6 | -11.4 |
| Burnt Corrall Creek | 0.0 | -0.5 | -1.7 | -3.0 | -3.7 | -0.3 | 0.3 | 0.1 | 0.1 | 0.0 | -0.1 | -0.2 |
| Cabin Creek | -17.3 | -6.6 | -0.5 | -22.2 | -29.1 | -17.3 | -11.8 | -10.0 | -10.8 | -17.9 | -19.0 | -18.1 |
| Catherine ab Brinker | -8.6 | -6.6 | -12.1 | 47.8 | 88.3 | 43.2 | -23.3 | -9.6 | -6.4 | -5.3 | -7.3 | -7.4 |
| Catherine ab Pond SL | -11.0 | -8.2 | -53.3 | -93.6 | -45.2 | -91.7 | -37.4 | -5.1 | -8.5 | -8.7 | -6.2 | -10.1 |
| Chicken Creek | -1.8 | -3.5 | -6.9 | -9.8 | -9.2 | -8.3 | -1.2 | -0.2 | -0.3 | -0.6 | -1.4 | -1.6 |
| Clark Creek | -10.1 | -13.1 | -9.3 | -1.5 | 1.4 | -8.3 | -2.5 | -0.7 | 0.4 | -0.2 | -3.4 | -7.6 |
| Clear Creek | -0.2 | -0.2 | -3.3 | -11.8 | -10.1 | -8.6 | -2.8 | -0.6 | -0.4 | -0.8 | -0.7 | -0.2 |
| Dark Canyon Creek | -1.3 | -5.1 | -10.2 | -15.3 | -9.5 | -1.1 | 0.1 | -0.1 | -0.1 | -0.2 | -0.6 | -1.4 |
| Five Points Creek | -10.7 | 16.4 | 53.3 | 48.5 | 27.5 | -16.4 | -4.0 | -2.0 | -2.1 | -2.2 | -5.9 | -7.5 |
| Fly Creek | -3.1 | -5.7 | -5.1 | 11.3 | 13.2 | 1.3 | 0.2 | -0.7 | -0.4 | -1.0 | -1.8 | -3.0 |
| Gordon Creek | -9.9 | 4.3 | 18.8 | 1.0 | -10.9 | -18.2 | -18.1 | -12.8 | -12.5 | -12.2 | -11.9 | -10.6 |
| Grande Ronde ab Haywire | -35.6 | -26.8 | 27.4 | 159.0 | 154.0 | -144.0 | -66.8 | -14.5 | -15.3 | -9.7 | -37.9 | -40.7 |
| Indian Creek | -8.9 | -13.6 | -19.3 | -34.8 | 18.3 | 3.8 | -14.2 | -3.6 | -1.2 | -1.2 | -3.2 | -6.8 |
| Jarboe Creek | -11.3 | -9.8 | -10.6 | -14.5 | -11.0 | -14.5 | -12.4 | -10.0 | -9.9 | -9.7 | -12.2 | -11.8 |
| Limber Jim Creek | -1.8 | -3.4 | -6.1 | -8.4 | -8.3 | -12.0 | -1.7 | -0.3 | -0.4 | -0.8 | -1.7 | -1.6 |
| Little Creek | -9.7 | -14.7 | -16.3 | -16.1 | -21.4 | -26.0 | -17.5 | -8.8 | -5.9 | -6.3 | -4.5 | -7.3 |
| Little Catherine Creek | -3.0 | -3.8 | -5.0 | -7.6 | 0.3 | -2.4 | -8.3 | -4.0 | -3.3 | -3.1 | -2.8 | -3.2 |
| Little Lookingglass Creek | -5.5 | 5.0 | 29.2 | 127.0 | 162.0 | 12.1 | -24.2 | -11.9 | -7.1 | -11.4 | -27.0 | -6.3 |
| Marley | -0.5 | -1.9 | -4.4 | -7.0 | -3.9 | -0.7 | 0.2 | -0.1 | 0.0 | -0.1 | -0.2 | -0.5 |
| McCoy Creek | -3.4 | -1.2 | 0.8 | 3.7 | -22.4 | -3.5 | 0.0 | -0.5 | -0.4 | -0.7 | -1.5 | -3.6 |
| Meadow ab Bear | -2.1 | 9.2 | 16.2 | 19.5 | -9.3 | -4.4 | -0.6 | -0.1 | 0.5 | 0.9 | -0.7 | 0.8 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Meadow at Mouth | -26.8 | -21.5 | -56.8 | -43.5 | -46.8 | -14.1 | -2.0 | -1.7 | -0.9 | -2.6 | -4.1 | -18.8 |
| Mill Creek | 1.5 | -0.3 | -2.4 | -5.4 | -13.2 | -10.1 | -2.4 | 1.4 | 2.2 | 2.9 | 2.8 | 2.0 |
| North Fork Cabin Creek | -8.8 | -3.5 | -1.4 | -14.3 | -11.0 | -6.3 | -4.5 | -4.3 | -4.6 | -7.6 | -9.6 | -9.1 |
| North Fork Catherine Creek | 0.2 | -0.8 | -8.0 | -1.3 | 84.0 | 67.0 | -2.7 | 5.7 | 4.5 | 4.0 | 2.1 | 1.5 |
| Pelican Creek | -6.3 | 1.5 | 17.1 | 15.9 | -3.7 | -3.8 | -0.8 | -0.3 | -0.3 | -0.3 | -1.0 | -2.6 |
| Phillips Creek | -11.8 | 13.1 | 31.8 | 11.7 | 1.6 | -21.7 | -25.5 | -16.2 | -16.0 | -15.9 | -15.2 | -12.6 |
| Rock Creek | -8.7 | -11.6 | -18.0 | -7.4 | -10.8 | -17.8 | -1.4 | -0.5 | -0.4 | -0.4 | -1.3 | -2.5 |
| South Fork Cabin Creek | -11.8 | -6.5 | -4.8 | -19.2 | -16.8 | -10.4 | -7.1 | -5.7 | -6.2 | -10.2 | -12.2 | -12.1 |
| South Fork Catherine Creek | -4.6 | -7.7 | -10.4 | -2.3 | 39.8 | 29.1 | -5.9 | -4.3 | -2.2 | -0.9 | -1.5 | -4.6 |
| Sheep Creek | -4.8 | -11.6 | -19.6 | 15.2 | 8.3 | -8.1 | -2.6 | -0.6 | -0.7 | -1.3 | -3.5 | -4.2 |
| Spring Creek | -5.1 | -7.3 | -8.2 | -6.6 | -19.2 | -2.9 | -0.4 | -0.1 | -0.1 | -0.1 | -0.7 | -1.6 |
| West Fork Chicken Creek | -0.7 | -1.4 | -2.8 | -4.5 | -6.1 | -1.8 | -0.3 | 0.0 | 0.0 | -0.1 | -0.5 | -0.6 |
| Willow Creek at Mouth | -1.7 | 28.3 | 58.8 | 29.9 | -30.5 | -66.2 | -29.8 | -10.6 | -4.5 | -2.0 | -5.1 | -3.7 |
| Willow Creek ab Mill | 2.0 | 28.5 | 58.9 | 40.1 | 11.0 | -25.2 | -16.9 | -6.3 | -4.4 | -2.5 | -1.8 | 0.9 |

*Ab=above; SL=slough*

**Table 5-4**
**Water Available for Instream Water Rights 50 Percent Exceedance**

| | 50 Percent Exceedance | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stream** | **JAN** | **FEB** | **MAR** | **APR** | **MAY** | **JUN** | **JUL** | **AUG** | **SEP** | **OCT** | **NOV** | **DEC** |
| Bear Creek | 0.5 | -1.9 | 2.7 | 1.1 | -2.9 | -0.7 | 0.0 | 0.0 | 0.0 | -0.1 | -0.1 | 0.5 |
| Beaver Creek | -7.4 | -4.8 | -8.3 | -3.6 | 4.4 | -2.3 | -9.0 | -7.7 | -8.2 | -8.6 | -9.2 | -9.4 |
| Burnt Corrall Creek | 1.6 | 0.7 | 8.6 | 9.2 | 0.9 | -0.1 | 0.4 | 0.1 | 0.1 | 0.0 | 0.2 | 1.4 |
| Cabin Creek | -8.2 | 10.2 | 24.2 | 11.3 | -8.7 | -6.9 | -10.9 | -9.2 | -10.5 | -17.5 | -18.0 | -13.3 |
| Catherine ab Brinker | 5.1 | 9.4 | 16.0 | 115.0 | 199.0 | 175.0 | 4.9 | -0.8 | -0.3 | -0.4 | 0.0 | 3.8 |
| Catherine ab Pond SL | 4.0 | 9.2 | -23.1 | -23.6 | 67.8 | 40.3 | -9.0 | 3.8 | -2.4 | -3.7 | 1.5 | 2.0 |
| Chicken Creek | -0.4 | 0.0 | -1.7 | -2.4 | -1.2 | -2.9 | 0.1 | 0.1 | -0.1 | -0.3 | -0.7 | -1.0 |
| Clark Creek | 0.6 | 6.5 | 20.0 | 41.3 | 31.4 | 3.9 | -0.4 | 0.0 | 0.4 | 1.2 | 1.6 | -0.1 |
| Clear Creek | 0.5 | 0.9 | -0.2 | -5.3 | 4.0 | 5.1 | -1.4 | 0.1 | -0.1 | -0.1 | 0.5 | 1.2 |
| Dark Canyon Creek | 2.0 | -2.9 | 5.9 | 1.5 | -4.3 | -0.9 | 0.2 | -0.1 | -0.1 | -0.2 | 0.0 | 1.5 |
| Five Points Creek | 11.3 | 57.3 | 109.0 | 146.0 | 83.8 | 15.9 | -1.1 | 0.2 | -1.3 | -1.3 | -3.7 | 3.5 |
| Fly Creek | 1.3 | 6.6 | 10.8 | 30.2 | 32.4 | 16.0 | 3.4 | 0.2 | 0.2 | -0.1 | 0.3 | -1.1 |
| Gordon Creek | 1.7 | 25.1 | 46.2 | 41.3 | 10.9 | -6.8 | -17.1 | -11.9 | -12.2 | -11.8 | -10.8 | -4.8 |
| Grande Ronde ab Haywire | 42.8 | 171.0 | 311.0 | 527.0 | 560.0 | 55.2 | -30.5 | -4.3 | -6.8 | 0.3 | -16.1 | 6.5 |
| Indian Creek | 0.2 | 1.2 | 2.8 | 10.8 | 97.7 | 98.3 | -3.8 | -1.1 | -0.4 | 0.4 | 0.6 | -0.3 |
| Jarboe Creek | -6.2 | -1.4 | 0.9 | 2.2 | 3.0 | -7.8 | -11.0 | -9.4 | -9.9 | -8.8 | -9.4 | -7.9 |
| Limber Jim Creek | -0.5 | 0.1 | -1.0 | -0.8 | -0.2 | -6.3 | -0.4 | 0.0 | -0.2 | -0.5 | -1.0 | -0.9 |
| Little Creek | -6.7 | -9.9 | -6.2 | 5.9 | -7.1 | -17.2 | -16.4 | -7.8 | -5.1 | -5.3 | -3.4 | -5.5 |
| Little Catherine Creek | -1.3 | -1.7 | -0.7 | 4.6 | 11.6 | 5.8 | -7.0 | -2.9 | -2.6 | -2.2 | -2.0 | -2.0 |
| Little Lookingglass Creek | 9.7 | 41.9 | 103.0 | 236.0 | 282.0 | 78.9 | -12.9 | -6.2 | -3.5 | -6.6 | -15.9 | 11.8 |
| Marley | 0.5 | -1.2 | 2.1 | 0.6 | -0.6 | -0.5 | 0.2 | -0.1 | 0.0 | -0.1 | 0.1 | 0.5 |
| McCoy Creek | 5.0 | 5.6 | 51.0 | 53.1 | -9.2 | -2.9 | 0.1 | -0.4 | -0.3 | -0.6 | -0.2 | 3.9 |
| Meadow ab Bear | 9.6 | 19.6 | 67.2 | 46.7 | 2.4 | 0.2 | 0.0 | 0.3 | 0.6 | 1.8 | 1.2 | 9.9 |
| Meadow at Mouth | 1.4 | 14.7 | 47.1 | 48.5 | -5.2 | -2.9 | -0.2 | -0.3 | -0.2 | -0.5 | 0.3 | 1.0 |
| Mill Creek | 2.2 | 1.2 | 1.3 | -1.7 | -12.4 | -10.0 | -2.4 | 1.5 | 2.2 | 3.0 | 2.9 | 2.4 |
| North Fork Cabin Creek | -4.4 | 4.1 | 8.9 | -0.1 | -2.3 | -1.8 | -4.1 | -3.9 | -4.4 | -7.5 | -9.1 | -6.9 |
| North Fork Catherine Creek | 6.3 | 5.8 | 2.5 | 15.9 | 145.0 | 149.0 | 14.6 | 6.8 | 6.1 | 5.2 | 5.8 | 7.3 |
| Pelican Creek | 0.3 | 16.4 | 42.1 | 53.7 | 9.6 | 0.5 | -0.5 | 0.0 | -0.2 | -0.2 | -0.7 | 0.4 |
| Phillips Creek | 8.9 | 42.8 | 62.3 | 70.8 | 38.3 | 0.7 | -23.4 | -14.5 | -15.4 | -15.2 | -13.1 | -2.3 |
| Rock Creek | -5.3 | -0.5 | -2.4 | 9.4 | 2.9 | -8.9 | 0.3 | 0.0 | 0.0 | 0.2 | 0.2 | -1.1 |
| South Fork Cabin Creek | -7.4 | 1.9 | 7.9 | -1.4 | -6.0 | -4.9 | -6.6 | -5.3 | -6.0 | -10.0 | -11.8 | -9.8 |
| South Fork Catherine Creek | -3.0 | -4.3 | -4.6 | 18.6 | 71.2 | 68.1 | 3.3 | 1.9 | 1.3 | 1.4 | 0.4 | -2.3 |
| Sheep Creek | -0.1 | 0.2 | -2.9 | 36.7 | 27.9 | 4.2 | 0.0 | 0.2 | -0.2 | -0.5 | -1.5 | -2.2 |
| Spring Creek | -2.6 | -0.2 | 2.6 | 2.5 | -15.6 | -1.8 | -0.2 | 0.0 | 0.0 | 0.1 | -0.2 | -0.8 |
| West Fork Chicken Creek | -0.1 | 0.0 | -0.8 | -1.8 | -3.4 | -0.3 | 0.1 | 0.1 | 0.0 | 0.0 | -0.2 | -0.3 |

| | 50 Percent Exceedance | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stream** | **JAN** | **FEB** | **MAR** | **APR** | **MAY** | **JUN** | **JUL** | **AUG** | **SEP** | **OCT** | **NOV** | **DEC** |
| Willow Creek at Mouth | 24.2 | 70.9 | 113.0 | 104.0 | 11.5 | -43.7 | -27.6 | -8.8 | -3.8 | -0.9 | -2.0 | 10.0 |
| Willow Creek ab Mill | 23.4 | 62.5 | 95.6 | 98.0 | 44.6 | -4.9 | -15.0 | -4.8 | -3.8 | -1.8 | 0.4 | 11.5 |

Annual instream demand was calculated based on which ISWRs occurred in each subwatershed. Instream demand was calculated to include just those ISWRs or recommended flows that apply to the specific pour points for each subwatershed. A pour point is defined as the location in each subwatershed where water flows out of the watershed and where demand quantities and qualities are calculated. When existing ISWR were present at these locations, they were used. Where ISWRs do not apply at the pour points, either the instream right from the upstream reach or flows recommended in the Grande Ronde Basin Investigation Report were used (see Table 5-7). It should be noted that the recommended flows from the Grande Ronde Basin Investigation Report for the Grande Ronde in subwatersheds 1 and 2 are relatively high in the fall. This has not been addressed in this report.

**Table 5-5**
**Monthly Instream Demand (Current)**

| | Acre-Feet/Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subwatershed | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | **Total** |
| 1 | 14757 | 13329 | 14757 | 14281 | 14757 | 14281 | 14757 | 14757 | 14281 | 14757 | 14281 | 14757 | **173752** |
| 2 | 10760 | 9719 | 10760 | 17851 | 18446 | 10413 | 10760 | 10760 | 10413 | 10760 | 10413 | 10760 | **141818** |
| 3 | 4304 | 3888 | 6149 | 17851 | 18446 | 14876 | 6149 | 1845 | 1785 | 1845 | 4165 | 4304 | **85607** |
| 4 | 4304 | 3888 | 6149 | 17851 | 18446 | 14876 | 6149 | 1845 | 1785 | 1845 | 4165 | 4304 | **85607** |
| 5 | 2460 | 2499 | 3074 | 4463 | 4612 | 4463 | 4612 | 5405 | 5950 | 2380 | 4463 | 2460 | **46840** |
| 6 | 1845 | 1666 | 6149 | 11901 | 12298 | 9669 | 4919 | 1845 | 1785 | 1845 | 1785 | 1845 | **57550** |
| 7 | 1845 | 1666 | 6149 | 11901 | 12298 | 9669 | 4919 | 1845 | 1785 | 1845 | 1785 | 1845 | **57550** |
| 8 | 1845 | 1666 | 2797 | 3570 | 4304 | 4165 | 4304 | 2324 | 1845 | 1814 | 2023 | 1845 | **32502** |
| **Total** | 14757 | 13329 | 14757 | 14281 | 14757 | 14281 | 14757 | 14757 | 14281 | 14757 | 14281 | 14757 | **173752** |

**Table 5-6**
**Annual Instream Demand (Current)**

| Subwatershed | Name | Surface Water Quantity (Natural Stream Flow) (from Step 2 Report) AF per Year (50th Percentile) | Instream Demand (AF per Year) (Water Rights Only) * |
|---|---|---|---|
| 1 | Lookingglass Creek/Cabin Creek | 644,604 | 173,752 |
| 2 | Willow Creek/Indian Creek | 523,382 | 141,818 |
| 3 | Lower Five Points Creek | 234,118 | 85,607 |
| 4 | Beaver Creek, Upper Five Points Creek | 219,834 | 85,607 |
| 5 | Meadow Creek Upper Grande Ronde River | 127,836 | 46,840 |
| 6 | Ladd Creek Lower Catherine | 153,738 | 57,550 |
| 7 | Upper Catherine Creek 1 | 116,238 | 57,550 |
| 8 | Upper Catherine Creek 2 | 71,598 | 32,502 |
| | **Total** | **644,604** | **173,752** |

*AF = acre-feet*

**Total natural stream flow and instream demand are expressed as the total from subwatershed 1 (the most upstream section of the watershed) to prevent "double counting."*

**Table 5-7**
**Source for Flow Values**

| Subwatershed | Name | Source for Flow Values |
|---|---|---|
| 1 | Lookingglass Creek/Cabin Creek | Grande Ronde Basin Investigation |
| 2 | Willow Creek/Indian Creek | Grande Ronde Basin Investigation |
| 3 | Lower Five Points Creek | Certificate 59539 |
| 4 | Beaver Cree, Upper Five Points Creek | Certificate 59539 |
| 5 | Meadow Creek Upper Grande Ronde River | Grande Ronde Basin Investigation |
| 6 | Ladd Creek Lower Catherine | Certificate 59537 (Note that this legally only applies upstream of the Swackhammer diversion) |
| 7 | Upper Catherine Creek 1 | Certificate 59537 |
| 8 | Upper Catherine Creek 2 | Certificate 73316 |

## Problems Meeting Existing Demands

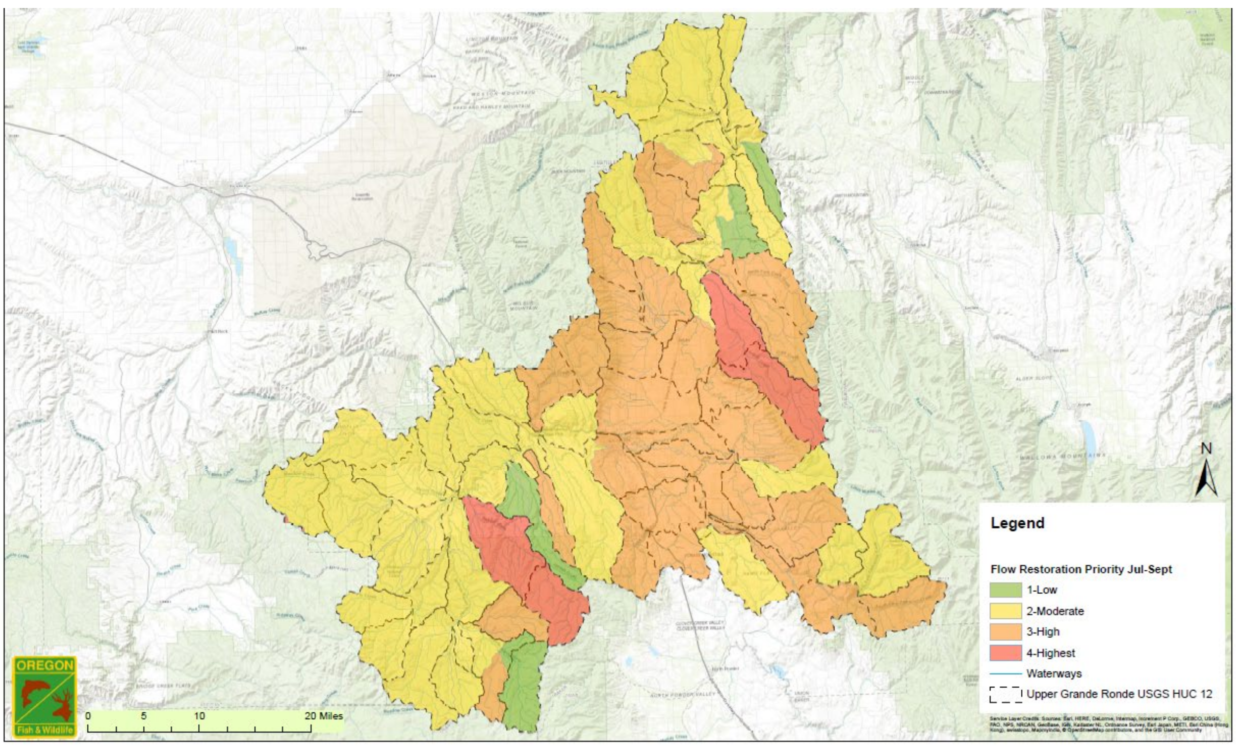
ISWR represent the minimum flows needed for aquatic life. Currently, there are several issues with meeting instream demands, including current beneficial uses that require the out of stream diversion of surface water, human interference with things like creating unauthorized diversions and hunting beavers (which reduce natural floodplain connectivity). When Lewis and Clark explored the Pacific Northwest in 1805, salmon and beavers coexisted in very high densities. By 1900, beaver were almost extirpated from this basin. Restoring floodplains, storing water, and other methods (such as these implemented on the Limber Jim Creek project) may invite/allow beavers to populate their former habitat (Grande Ronde Model Watershed, 2018).

Additional concerns with determining whether ISWRs are met are that there are priority areas not protected with ISWRs. This means that even if existing ISWRs are met, it does not indicate that the ecosystem is functioning at a healthy level.

## Flow Restoration Priorities

Based on information collected in the 1975 Basin Study, ODFW has determined that certain areas are higher priority for flow restoration for salmonids (see Figure 5-8, below).

**Figure 5-8**
**Upper Grande Ronde River Watershed Stream Flow Restoration Priorities for Recovery of Salmonids**




**OWRD, 1975 basin study*

## Future Demands Analysis

Determining whether future demands can be met is dependent on many issues such as the severity of climate change impacts and whether conservation measures are implemented. For this planning effort, temperatures from Representative Concentration Pathways (RCP) 8.5 were considered for future planning efforts. For every 1°F increase in temperature, it was estimated that there would be a 5 percent decrease in stream flow (NRC, 2011). This made it more difficult to meet instream demand in future forecasted scenarios.

**Table 5-8**
**Annual Instream Demand (Future)**

| Subwatershed | Name | 2068 Temperature Change from Current | Surface Water Quantity (Natural Stream Flow) (Values from Step 2 Report, with Climate Change Factor included) AF per Year | Instream Demand AF per Year (Water Rights Only) |
|---|---|---|---|---|
| 1 | Lookingglass Creek/Cabin Creek | 1.6 | 593,036 | 173,752 |
| 2 | Willow Creek/Indian Creek | 1.6 | 481,511 | 141,818 |
| 3 | Lower Five Points Creek | 1.6 | 215,389 | 85,607 |
| 4 | Beaver Creek, Upper Five Points Creek | 1.6 | 202,247 | 85,607 |
| 5 | Meadow Creek Upper Grande Ronde River | 1.6 | 117,609 | 46,840 |
| 6 | Ladd Creek Lower Catherine | 1.6 | 141,439 | 57,550 |
| 7 | Upper Catherine Creek 1 | 1.6 | 106,939 | 57,550 |
| 8 | Upper Catherine Creek 2 | 1.6 | 65,870 | 32,502 |
| **Total** | | **1.6** | **593,036** | **173,752** |

Even before municipal and agricultural water use is considered, instream demand does not appear to be met on an annual basis in the future.

## Instream Demand Summary and Vulnerability Assessment

### *Water Quality Overall Vulnerabilities*

- Instream beneficial uses of surface water such as fisheries and other aquatic organisms are at a high risk of being impacted by poor water quality conditions in many areas of the UGRRW.

- Many resources have been used to counteract the water quality issues particularly in subwatersheds in or near headwater areas (4 [Beaver Creek, Upper Five Points Creek], 5 [Meadow Creek Upper Grande Ronde River], 7 [Upper Catherine Creek 1], and 8 [Upper Catherine Creek 2]). However, water quality issues relating to low flows, high water temperatures, bacteria, and nutrients remain a significant problem subwatersheds 1, 2, 3, and 6, which are at lower elevations with more significant water withdrawals and land use impacts.
- A critical assumption may be that the water quality issues can be addressed sufficiently in a changing climate.
- A critical uncertainty throughout the UGRRW is the effect of climate change over time.
- Opportunities for cooperative projects that address agricultural water use efficiency and low stream flows.

### *Instream Water Demand Summary*

Instream flow demand recognizes the value and importance of suitable flows and water elevations throughout a basin's drainage network to sustain and enhance fish and wildlife populations and their habitats, support ecological functions, maintain and improve water quality, meet recreational needs, and contribute to the cultural needs and sustainable socioeconomics of local communities.

An instream flow that mimics the natural hydrologic cycle provides the best assurance that the habitat needs of aquatic dependent fish and wildlife species will be met. However, this assessment finds that instream flow demand is vulnerable to not being met both currently and in the future. The lack of instream water available to meet instream demand directly affects the viability of ESA-listed fish species and their habitats, Native American cultural practices and treaty rights, and water contact recreational opportunities.

Determining instream water demand is complex, involving factors such as the biological needs of specific aquatic species; processes that influence the quantity, quality, and diversity of instream habitat; the influence of flow volume on water quality and the occurrence of hydrologic events as important cues triggering life history events of aquatic species. The constraints of the planning process do not allow for adequate time and resources to calculate a complete instream water demand.

For this planning process, the Technical Committee utilized ISWR and past flow studies (ODFW, 1975) to calculate the instream flow demand to meet the specific biological needs of sensitive fish species. It should be noted here that ISWRs were used because the flow volumes are based on specific flow studies (ODFW, 1975), not because of their administrative/legal status as water rights. This analysis provides a good understanding of how current instream flows meet the biological needs of sensitive fish species.

A quantitative assessment of future demand is not included. Qualitatively, RCP 8.5 were considered for future planning efforts. For every 1°F increase in temperature, it was estimated that there would be a 5 percent decrease in stream flow (NRC, 2011). This exacerbated the ability to meet instream demand in future forecasted scenarios.

In addition to calculating instream demand at the pour point of each subwatershed, the OWRD water availability tables were utilized to provide an understanding as to what degree instream water rights are being met, per the methods and assumptions of OWRD's water availability calculations, at both 50 and 80 percent exceedance levels. The results of this exercise show that flows are not available to meet the instream need throughout the year at many locations, particularly at the 80 percent exceedance level.

Opportunities for improving instream flows include watershed restoration such as thinning vegetation to historically appropriate levels and improving the form and function of floodplains and wet meadows, water conservation to reduce out-of-stream use, and short- and long-term agreements to return out-of-stream uses to instream.

### *Water Quantity Overall Vulnerabilities*

As shown on Tables 5-7 and 5-8, above, on an annual basis, instream demand is vulnerable to not being met both currently and in the future. On a bi-weekly basis these issues are exacerbated. Table 5-9, below, shows current bi-weekly instream demand compared to water supply. At certain times of the year when demand is high, and supply is low (late summer/early fall), there not enough water to meet instream demand. It is estimated based on increasing temperatures and decreasing precipitation of the RCP 8.5 climate model that this gap in supply and demand will grow worse in the future.

**Table 5-9**
**Bi-weekly Instream Demand Summary**

| | | Water Supply | | | Instream Demand |
|---|---|---|---|---|---|
| **Month** | **Days** | **Median Water Volume (50 Percent Exceedance)** | **Low Water Volume (90 Percent Exceedance)** | **High Water Volume (10 Percent Exceedance)** | **ISWR** |
| October | 1st to 15th | 5,573 | 3,488 | 9,188 | 77,140 |
| | 16th to 31st | 5,573 | 3,488 | 9,188 | 77,617 |
| November | 1st to 15th | 5,763 | 3,664 | 14,450 | 77,140 |
| | 16th to 30th | 5,763 | 3,664 | 14,450 | 77,140 |
| December | 1st to 15th | 9,316 | 4,126 | 32,968 | 77,140 |
| | 16th to 31st | 9,316 | 4,126 | 32,968 | 77,617 |
| January | 1st to 15th | 12,506 | 5,020 | 59,129 | 77,140 |
| | 16th to 31st | 12,506 | 5,020 | 59,129 | 77,617 |
| February | 1st to 15th | 26,089 | 7,055 | 73,266 | 66,664 |
| | 16th to 28th | 26,089 | 7,055 | 73,266 | 66,664 |
| March | 1st to 15th | 39,774 | 15,484 | 111,877 | 77,140 |
| | 16th to 31st | 39,774 | 15,484 | 111,877 | 77,617 |
| April | 1st to 15th | 69,572 | 30,834 | 128,028 | 77,140 |
| | 16th to 30th | 69,572 | 30,834 | 128,028 | 77,140 |

| | | Water Supply | | | Instream Demand |
|---|---|---|---|---|---|
| **Month** | **Days** | **Median Water Volume (50 Percent Exceedance)** | **Low Water Volume (90 Percent Exceedance)** | **High Water Volume (10 Percent Exceedance)** | **ISWR** |
| May | 1st to 15th | 78,697 | 31,394 | 131,445 | 77,140 |
| | 16th to 31st | 78,697 | 31,394 | 131,445 | 77,617 |
| June | 1st to 15th | 44,048 | 14,861 | 87,685 | 77,140 |
| | 16th to 30th | 44,048 | 14,861 | 87,685 | 77,140 |
| July | 1st to 15th | 14,804 | 11,060 | 31,436 | 77,140 |
| | 16th to 31st | 14,804 | 11,060 | 31,436 | 77,617 |
| August | 1st to 15th | 9,614 | 8,550 | 12,719 | 77,140 |
| | 16th to 31st | 9,614 | 8,550 | 12,719 | 77,617 |
| September | 1st to 15th | 6,546 | 5,228 | 10,086 | 77,140 |
| | 16th to 30th | 6,546 | 5,228 | 10,086 | 77,140 |
| **Total** | **-** | **644,604** | **281,528** | **1,404,554** | 173,752 |

Overall, instream demand vulnerabilities are **high.**

### *Recommended Actions to Improve Instream Water Uses/Needs*

See the ODFW paper in Appendix C describing the next steps to more accurately characterize instream demand.

# 6.0 - Climate Change and Natural Hazards

## Introduction

The Upper Grande Ronde River Watershed (UGRRW) Partnership evaluated the potential impacts of climate change and natural hazards on demand estimates. It was decided that to model future climate change, Representative Climate Pathway (RCP) 8.5 temperature and precipitation data would be used for the 2068 (50 years in the future) scenario. These are the values discussed in each demand section, and the rational for selection is explained here. It was decided that natural hazards would be evaluated in a qualitative manner and information would primarily be obtained from the County-wide hazards vulnerability analysis, Emergency Operations Plan, Natural Hazards Mitigation Plan, and Community Wildfire Protection Plan (CWPP), along with information from the Pacific Northwest Research Station general technical report publication Climate Change Vulnerability and Adaptation in the Blue Mountains Region (Halofsky, J.E.; Peterson, D.L., eds. 2016).

## Climate Change and Natural Hazards Overview

Overall, natural hazards and climate change increase vulnerabilities associated with each demand type due to predicted changes in air temperatures, precipitation patterns (form, amount, timing) and associated timing and magnitude of stream flow, and impacts on natural disturbances (wildfire, floods, drought induced insect activity).

### *Climate Change*

There are many climate models available. RCP is the latest generation of climate model scenarios. It models four greenhouse gas concentration (not emissions) trajectories used in the Intergovernmental Panel on Climate Change 5th Assessment Report in 2014.

Researchers developed a new approach with RCP in response to the needs of policy makers, including:

- Increasing interest in exploring approaches to achieve specific climate change targets (e.g., temperature increase equal to or less than 2°C), and
- Interest in “risk management,” combining emissions reductions and adaptation to reduce adverse impacts.

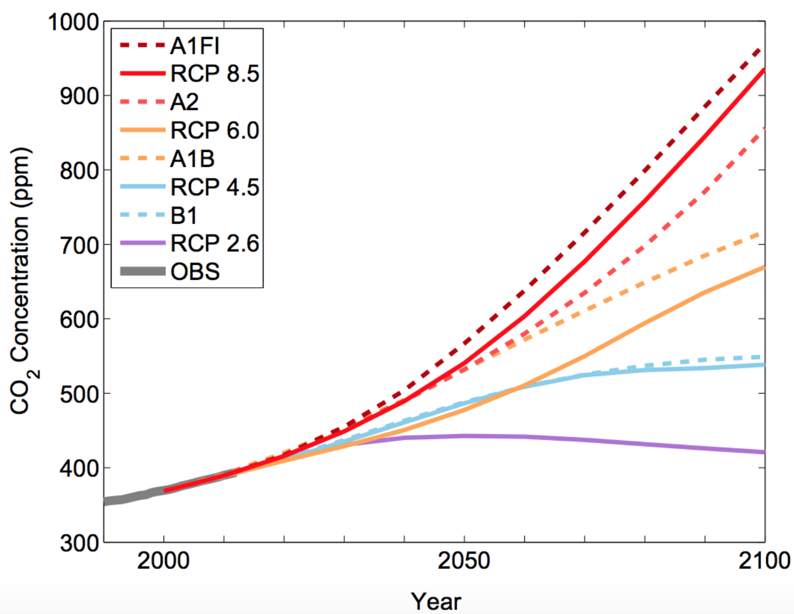
Figure 6-1 is from the RCP report and lists the scenario characteristics.

**Figure 6-1**
**Representative Concentration Pathways Scenarios**

| *New scenarios* | *Scenario characteristics* | *Comparison to old scenarios* | *Description used in this report* |
|---|---|---|---|
| *RCP 2.6* | An extremely low scenario that reflects aggressive greenhouse gas reduction and sequestration efforts | No analogue in previous scenarios | "Very Low" |
| *RCP 4.5* | A low scenario in which greenhouse gas emissions stabilize by mid-century and fall sharply thereafter | Very close to B1 by 2100, but higher emissions at mid-century | "Low" |
| *RCP 6.0* | A medium scenario in which greenhouse gas emissions increase gradually until stabilizing in the final decades of the 21st century | Similar to A1B by 2100, but closer to B1 at mid-century | "Medium" |
| *RCP 8.5* | A high scenario that assumes continued increases in greenhouse gas emissions until the end of the 21st century | Nearly identical to A1FI[B] | "High" |

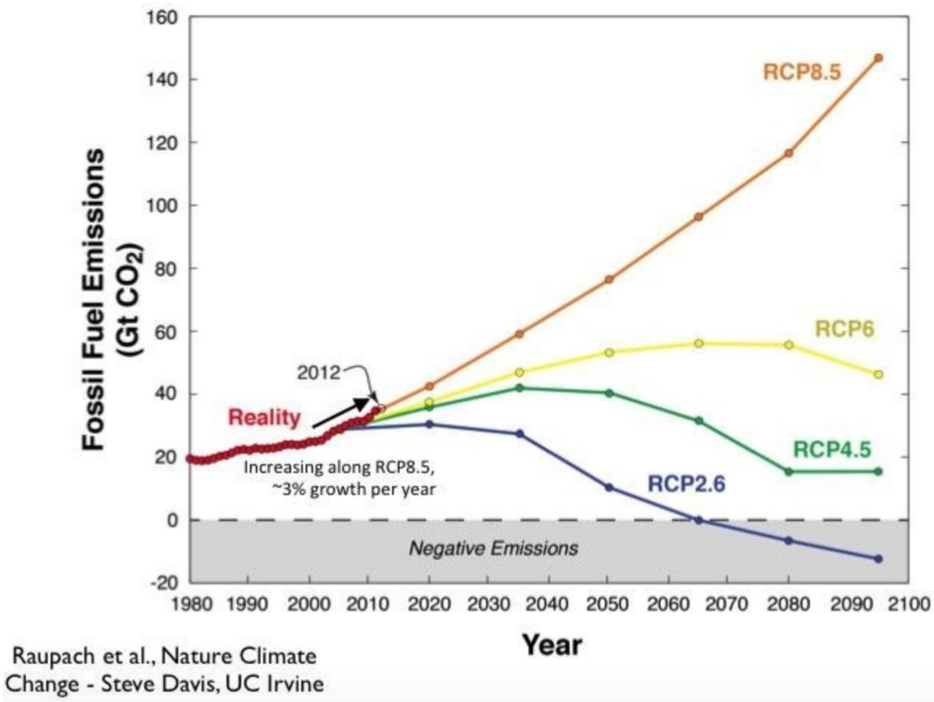
Figure 6-2 shows a comparison of RCP and Special Report on Emissions Scenarios climate scenarios. The planning group determined that the most likely and highest impact scenario (RCP 8.5) would be the scenario used for future planning in the 50-year time frame.

**Figure 6-2**
**Comparison of Representative Concentration Pathways (CMIP 5) and Special Report on Emissions Scenarios Climate Scenarios (CMIP 3)**




This RCP 8.5 scenario was chosen by the UGRRW Partnership because it represents the most likely (path that emissions are currently on) and most drastic scenarios. The UGRRW Partnership determined that this worst-case analysis for 2068 (50 years from 2018) would be helpful to understand the largest impacts to demand and supply that could occur. The UGRRW Partnership determined that if it planned for the worst-case scenario, then if a less severe scenario occurred, fewer adaptations may be needed (Oregon Department of Agriculture, 2018). For the past 15 to 20 years, observed greenhouse gas concentrations were consistent with RCP 8.5 and are anticipated likely to remain on that trajectory. Scenarios are shown below on Figure 6-3.

**Figure 6-3**
**Fossil Fuel Emissions Scenarios**




In addition to this analysis, The Climate Impacts Research Consortium at Oregon State University is conducting an external review of climate-related threats and adaptation strategies for the UGRRW. This report is forthcoming and is being prepared under a separate title.

## *Climate Changes in Streamflow, Temperature, and Precipitation in the Upper Grande Ronde River Watershed Since the Early to Mid-1900s*

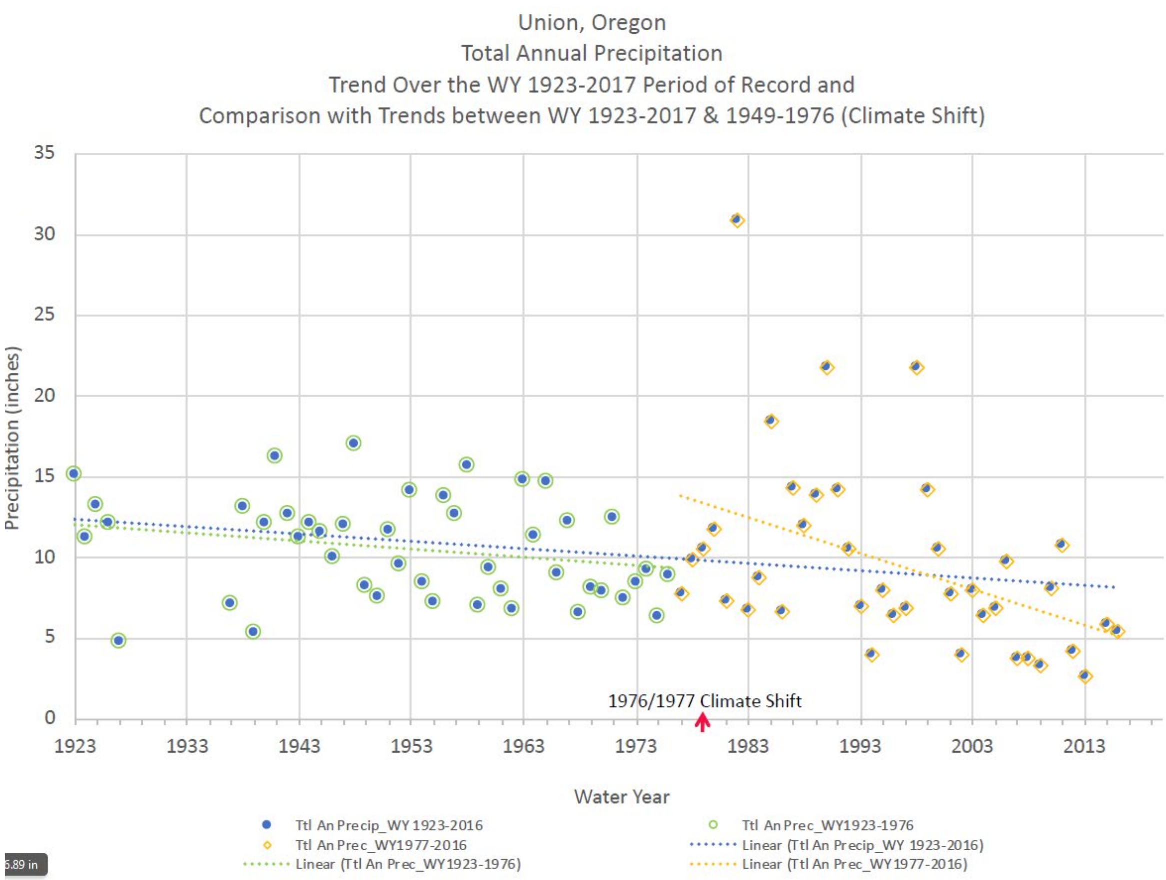
Streamflow, temperature and precipitation data records since the early to mid-1900s in the UGRRW exhibit different types of change (i.e., nonstationarities), including periods of persistent conditions (e.g., alternating cycles of prevailing higher and lower streamflows); step-changes (e.g., relatively abrupt shift in climate conditions); and trends. The longer data record (i.e., at least 60 to 80 years) is recommended (Chen and Grasby, 2009) to detect effects of changes in climate because it is the length of time necessary for the longest mode of climate variability that influences water resources in a region (e.g., Western United States), in this case, the Atlantic Multidecadal Oscillation Western U.S., to complete one full cycle.

The U.S. Geological Survey (USGS) gauge, Grande Ronde River at Troy, Oregon, has the longest period of streamflow record, 1945 to the present, that meets the record length criteria for detecting effects of changes in climate. In addition to evaluating changes over the entire period of record, there are two reasons to suggest dividing the period of into two sections to compare conditions before and after the break:

- The base period for water rights and administration in Oregon, 1958 to 1987, and the record since that time, 1988 to the present; and
- The strong El Nino event in 1976/1977 involved a step-change, or a relatively abrupt shift in the climate system. This had immediate chemical, biological, and physical effects in the Pacific Ocean. With at least 40 additional years of data, changes in streamflow, temperature, and precipitation, including snow, have also been detected in different locations in the U.S., including in the UGRRW as a result of this step-change.

The USGS gauge at Troy, Oregon, is affected by land use changes and water development, so all changes at this location may not be solely attributed to climate change. See Figure 6-4, below, for precipitation shift.

**Figure 6-4**
**Precipitation Shift**



The Grande Ronde River stream gauge at Troy is downstream of the UGRRW, and, consequently, integrates as well as amplifies changes in basin climate and land use, land cover, and water use conditions. Total annual flow volumes were 10 percent lower between water years (WY) 1958 to 1987 and 1988 to 2016; and 13 percent lower between 1945 to 1976 and 1977 to 2016. Median monthly flows exhibited even greater decreases; 20 percent between 1958 to 1987 and 1988 to 2016; and 24 percent between 1945 to 1976 and 1977 to 2016. Most of the decreases in monthly flows were evident in low (80 percent exceedance), middle (50 percent exceedance), and high (20 percent exceedance) flows, and occurred primarily during the winter and summer. March was the only month where flows were higher (approximately 15 to 30 percent) since WY 1945. These changes in monthly flow could indicate a shift in the flow regime. Table 6-1 shows summaries of monthly flow volumes and changes in flow.

**Table 6-1**
**Summaries of Monthly Flow Volumes and Changes in Flow**

**Summaries of Monthly Flow Volumes and Changes in Flow (ac-ft): Grande Ronde River at Troy (USGS 13333000)**

**I (A) Comparison of Flow Volumes between 1988-2016 and 1958-1987 ( (Base Period for Water Availability and Water Rights Administration)**

| 1958-1987 | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 57,167 | 74,806 | 124,463 | 145,651 | 182,134 | 248,083 | 341,279 | 415,447 | 344,056 | 133,826 | 53,036 | 48,890 |
| Min | 38,846 | 44,600 | 44,295 | 43,160 | 42,686 | 54,607 | 134,320 | 145,586 | 128,449 | 31,981 | 27,570 | 34,181 |
| Max | 157,328 | 179,894 | 387,072 | 386,120 | 410,199 | 708,055 | 597,279 | 618,819 | 690,561 | 304,401 | 85,160 | 76,845 |
| 80% Exceedence (20th Percentile) | 46,166 | 52,068 | 55,433 | 65,090 | 92,322 | 158,725 | 217,054 | 310,146 | 257,179 | 69,030 | 40,231 | 40,792 |
| 50% Exceedance (Median) | 53,025 | 63,498 | 96,176 | 128,191 | 167,771 | 207,510 | 353,978 | 405,806 | 337,198 | 113,248 | 50,888 | 47,420 |
| 20% Exceedance (80th Percentile ) | 60,122 | 93,257 | 153,881 | 194,343 | 276,926 | 316,148 | 470,564 | 558,566 | 435,829 | 193,518 | 65,460 | 55,206 |

| 1988-2016 | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 45,943 | 65,346 | 98,450 | 125,661 | 168,865 | 283,572 | 367,061 | 423,016 | 302,814 | 111,990 | 43,003 | 37,533 |
| Min | 32,439 | 36,777 | 41,397 | 49,267 | 49,852 | 103,497 | 160,978 | 158,280 | 89,315 | 37,741 | 25,049 | 24,341 |
| Max | 68,273 | 224,097 | 443,442 | 383,720 | 827,618 | 584,585 | 677,867 | 722,316 | 616,261 | 276,038 | 68,943 | 62,033 |
| 80% Exceedence (20th Percentile) | 36,955 | 46,929 | 54,215 | 66,971 | 80,874 | 187,568 | 228,899 | 303,541 | 174,306 | 62,543 | 28,951 | 29,417 |
| 50% Exceedance (Median) | 44,904 | 54,648 | 73,723 | 93,465 | 130,155 | 266,755 | 336,871 | 391,416 | 286,154 | 98,568 | 40,806 | 36,960 |
| 20% Exceedance (80th Percentile ) | 53,168 | 73,983 | 116,599 | 179,019 | 215,562 | 378,686 | 493,255 | 568,844 | 396,815 | 147,855 | 55,869 | 44,714 |

I (B) Change in Flow Volumes (ac-ft) between 1988-2016 and 1958-1987 (Base Period for Water Availability and Water Rights Administration)

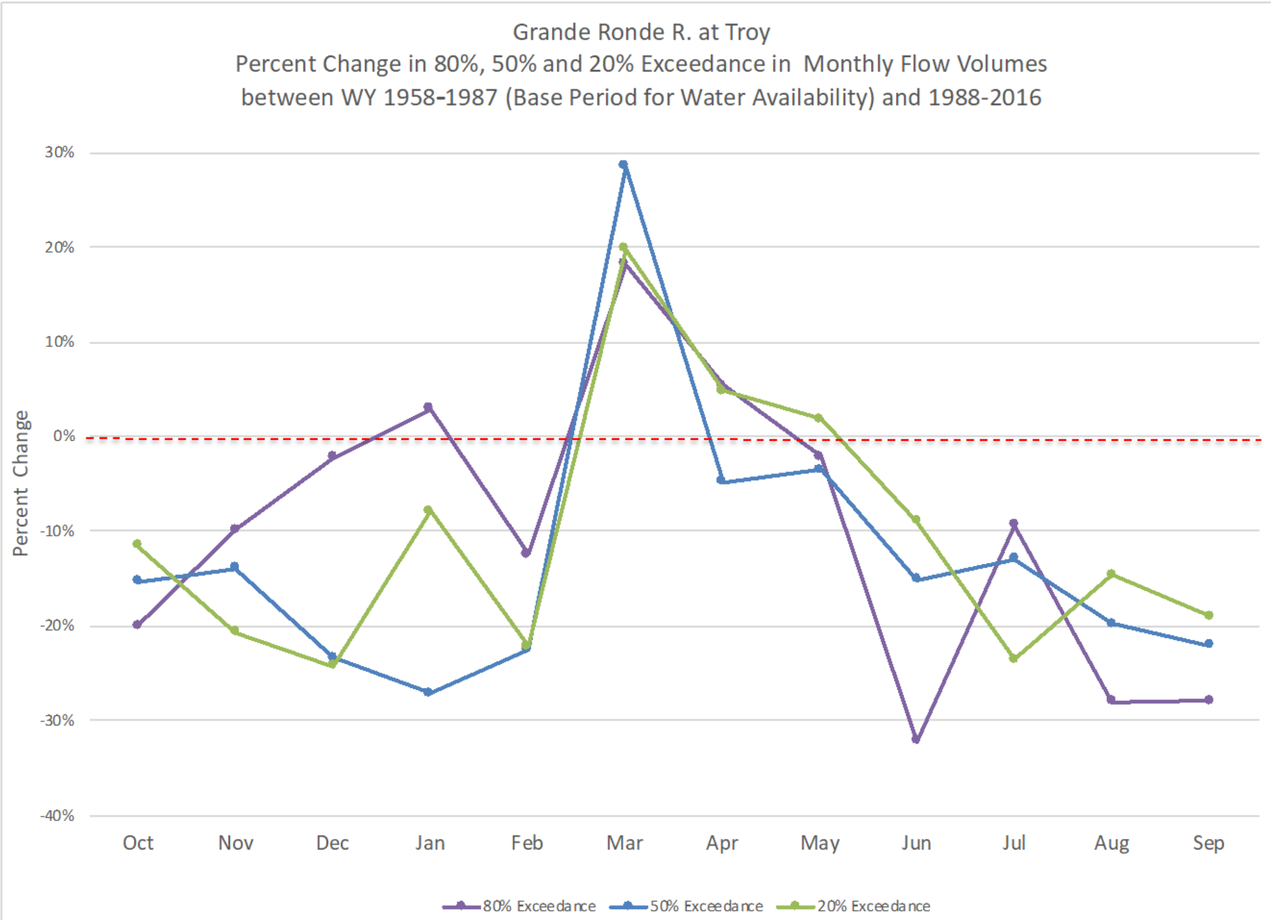
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | -11,224 | -9,460 | -26,013 | -19,990 | -13,269 | 35,489 | 25,782 | 7,568 | -41,242 | -21,836 | -10,033 | -11,357 |
| Min | -6,407 | -7,823 | -2,898 | 6,107 | 7,166 | 48,890 | 26,658 | 12,694 | -39,134 | 5,760 | -2,521 | -9,840 |
| Max | -89,055 | 44,203 | 56,370 | -2,400 | 417,419 | -123,470 | 80,588 | 103,497 | -74,300 | -28,363 | -16,217 | -14,812 |
| 80% Exceedence (20th Percentile) | -9,212 | -5,139 | -1,219 | 1,881 | -11,449 | 28,843 | 11,845 | -6,605 | -82,873 | -6,487 | -11,280 | -11,374 |
| 50% Exceedance (Median) | -8,121 | -8,850 | -22,453 | -34,726 | -37,616 | 59,246 | -17,107 | -14,390 | -51,044 | -14,680 | -10,082 | -10,460 |
| 20% Exceedance (80th Percentile ) | -6,954 | -19,274 | -37,282 | -15,324 | -61,363 | 62,538 | 22,691 | 10,278 | -39,015 | -45,663 | -9,590 | -10,491 |

I (C) Percent Change in Flow Volumes between 1988-2016 and 1958-1987 (Base Period for Water Availability and Water Rights Administration)

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | -20% | -13% | -21% | -14% | -7% | 14% | 8% | 2% | -12% | -16% | -19% | -23% |
| Min | -16% | -18% | -7% | 14% | 17% | 90% | 20% | 9% | -30% | 18% | -9% | -29% |
| Max | -57% | 25% | 15% | -1% | 102% | -17% | 13% | 17% | -11% | -9% | -19% | -19% |
| 80% Exceedence (20th Percentile) | -20% | -10% | -2% | 3% | -12% | 18% | 5% | -2% | -32% | -9% | -28% | -28% |
| 50% Exceedance (Median) | -15% | -14% | -23% | -27% | -22% | 29% | -5% | -4% | -15% | -13% | -20% | -22% |
| 20% Exceedance (80th Percentile ) | -12% | -21% | -24% | -8% | -22% | 20% | 5% | 2% | -9% | -24% | -15% | -19% |

*AF = acre-feet*

**Figure 6-5**
**Grande Ronde River at Troy Percent Change in Monthly Flows Over Time**




**Other time periods are included in Appendix E, Additional Information.*

Changes in land use, land cover, and water use in the UGRRW may have contributed in part to reductions in streamflow, for example during summer months. However, little or no water is diverted for irrigation during the winter (e.g., December through February). Total annual precipitation from National Oceanic and Atmospheric Administration National Weather Service (NWS) stations at La Grande and Union, for example, show decreasing trends over the periods of record, 1949 to 2017 and 1923 to 2017, respectively. Reductions in precipitation occurred mainly between August/September and March, and across the distribution (i.e., low [80 percent exceedance], middle [50 percent exceedance], and high [20 percent exceedance] precipitation totals) at the La Grande and Unions stations. Increases in precipitation occurred during April to July, and September at the La Grande station, and in December, July, and September at the Union station. If there is less precipitation in winter and more in spring/summer, this could potentially mean less irrigation requirements in the early part of the year, but also lower snowpack (and hence, larger requirements at the end of the year).

Warmer temperatures also contribute to lowering streamflow because of increased evaporation, sublimation, and evapotranspiration, especially if combined with winds; precipitation falling more often as rain rather than snow, and earlier snowmelt. Maximum daily (typically daytime) temperatures are often influenced by factors including irrigation, wind, and surface features, such as hills and structures, and as a result, may not be the best indicator of trends and changes. Overall, median maximum daily temperatures did not exhibit a strong warming trend. In October, March, and June the warmest (20 percent exceedance) maximum daily temperatures exhibited small increases (i.e., 1 to 3°F).

Minimum daily (typically night time) temperatures, on the other hand, are not as affected by the same factors that affect daytime temperatures, so they are often more reliable indicators. In general, minimum daily temperatures do exhibit a clearer pattern. Data for the La Grande station show small (i.e., 1 to 2°F) increases may have occurred throughout the distribution (i.e., lower, middle, and higher minimum daily temperatures) in November and February/March through August. Potential changes in minimum daily temperature are small and subtle. The lower, or coolest (i.e., 80 percent exceedance), minimum daily temperatures for October exhibit a slight negative trend over the period of record; however, the trend changes when the period of record is divided at 1976/1977. Between 1949 to 1976, minimum daily temperatures appear to have been decreasing. In contrast, after 1976, minimum daily temperatures show an increasing trend. In conclusion, for the La Grande station, the data suggest that the temperature range is narrowing, due primarily to potential increases in minimum daily temperature. In general, increases in maximum daily temperatures have not been sufficiently large to counter cooling effects of irrigation, topography, and other potential contributing factors on the landscape.

See Appendix E, Additional Information, for more detail about these changes.

### *Future Climate Change Impacts on Hydrologic Processes in the Blue Mountains*

Climate change will likely affect physical hydrological processes and resource values influenced by hydrological processes, including water use, infrastructure, and fish. Specifically, climate change will affect the amount, timing, and type of precipitation, and timing and rate of snowmelt (Luce et al., 2012, 2013; Safeeq et al., 2013), affecting snowpack volumes (Hamlet et al., 2005), streamflows (Hidalgo et al., 2009; Mantua et al., 2010), and stream temperatures (Isaak et al., 2012; Luce et al., 2014). Changes in the amount and timing of precipitation will also affect vegetation, further altering water supplies (Adams et al., 2011).

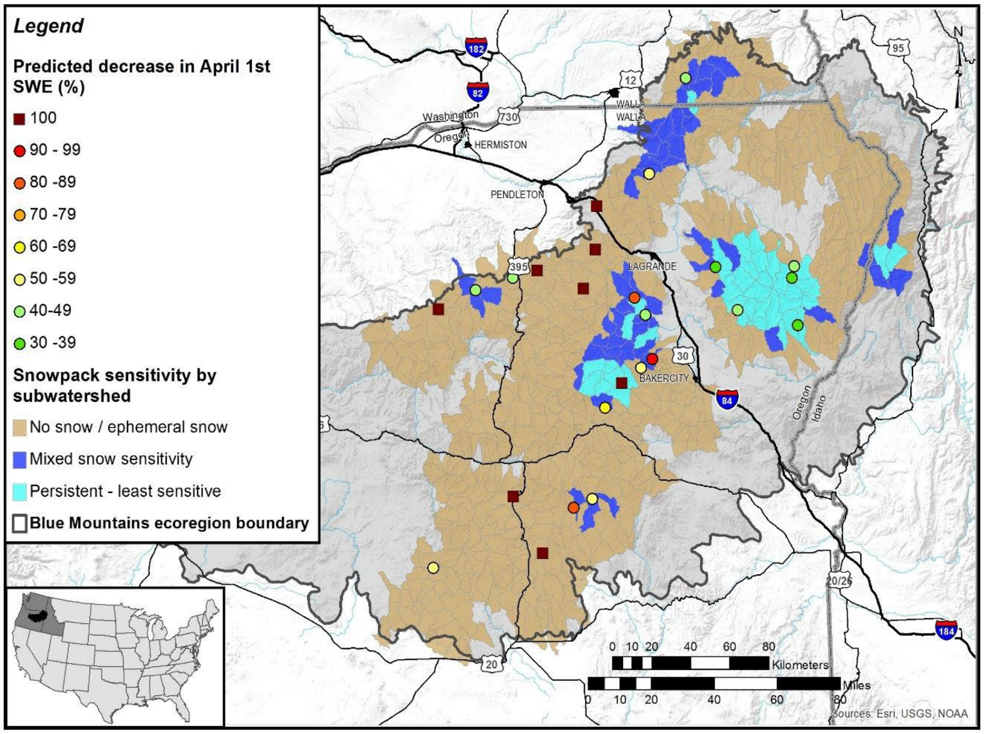
#### Snowpack

Effects of climate change on snowpack in watersheds of the Pacific Northwest can be broadly distinguished by mid-winter temperatures in each basin (Hamlet and Lettenmaier, 2007). Rain-dominated basins are above freezing most of the time in winter, and snow accumulation is minimal (less than 10 percent of October through March precipitation). At a relatively coarse time scale, rain-dominated basins typically have one broad peak in streamflows in the winter that coincides with the regional winter peak in precipitation. However, at a finer time scale, rain-dominated basins may display multiple peaks in streamflow that coincide with individual storms or rain events. Mixed rain and snow (also called “transient” or “transitional”) basins can collect substantial snowpack in winter (10 to 40 percent of October through March precipitation) but are typically only a few degrees below freezing on average in mid-winter. Mixed rain-and-snow basins typically have multiple seasonal streamflow peaks, with one primary peak in late autumn caused by rain, and another in late spring caused by snowmelt. Snowmelt-dominated basins are relatively cold in winter and capture a larger percentage (greater than 40 percent) of their October through March precipitation as snow. Snowmelt-dominated basins typically have relatively low flows through winter and a period of streamflow peaks in spring that coincides with seasonal snowmelt.

Increasing temperatures in the Pacific Northwest over the last 50 years have led to more precipitation falling as rain rather than snow, earlier snowmelt (Hamlet et al., 2007; Stewart et al., 2005), and reduced spring snowpack (Barnett et al., 2008; Hamlet et al., 2005; Mote 2003). Snowpack in the Pacific Northwest is expected to be sensitive to future temperature increases with changing climate. In response to warming, shifts from snowmelt-dominant to mixed rain-and-snow basins, and from mixed rain-and-snow to rain-dominant basins are projected by the 2040s in the Pacific Northwest (Tohver et al., 2014).

In the Blue Mountains, large areas could lose all or significant portions of April 1 snow water equivalent (SWE) under a 3°C temperature increase (expected by approximately 2050 for the RCP 8.5 scenario (see Figure 6-6). Results indicate that snowpack sensitivity is relatively high in the Strawberry Mountains, Monument Rock Wilderness, Wenaha-Tucannon Wilderness, and at mid-elevations in the North Fork John Day, Eagle Cap Wilderness, and Hells Canyon Wilderness (see Figure 6-6). Snowpack sensitivity is lower at high elevations in the Wallowa Mountains (Eagle Cap Wilderness), Greenhorn Mountains (North Fork John Day Wilderness), and Hells Canyon Wilderness Area. However, snowpack loss may still be significant (40 to 100 percent loss) in some of these areas (Luce et al., 2014a).

**Figure 6-6**
**Predicted Change in April 1st Snow Water Equivalent Percentage**




Similarly, the Variable Infiltration Capacity (VIC) model (Liang et al.,1994) was used to project up to 100 percent loss of April 1 SWE in parts of the Blue Mountains by the 2080s (Hamlet et al., 2013). This study also projected that 26 of the watersheds in the Blue Mountains that were historically classified as mixed rain and snow will become rain dominant by the 2080s. These watersheds will likely receive more rain and less snow in the winter months.

## Stream Flows

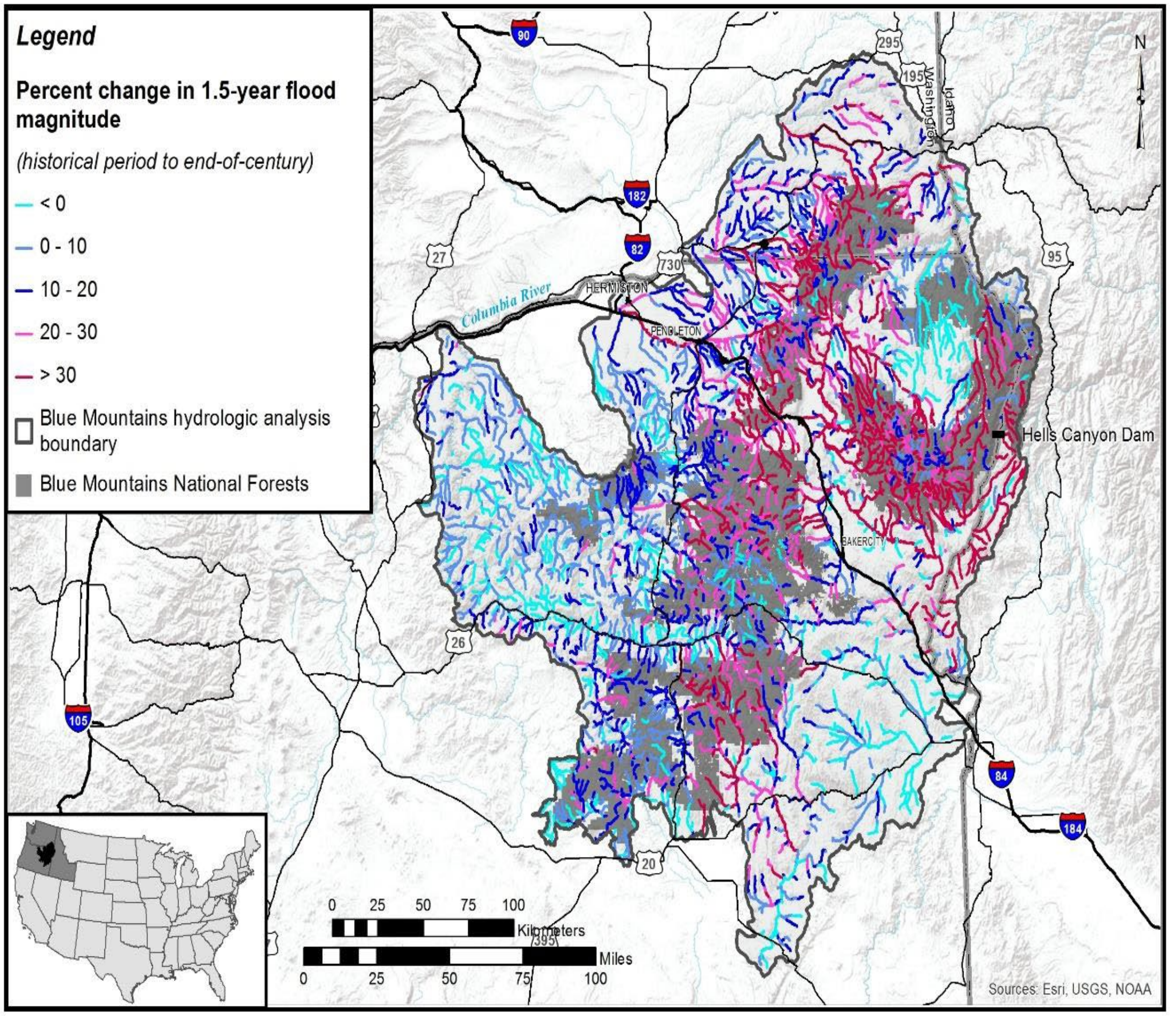
Flooding regimes in the Pacific Northwest are sensitive to precipitation intensity, temperature effects on freezing elevation (which determines whether precipitation falls as rain or snow), and the effects of temperature and precipitation change on seasonal snow dynamics (Hamlet and Lettenmaier, 2007; Tohver et al., 2014). Floods in the Pacific Northwest typically occur during the autumn and winter because of heavy rainfall (sometimes combined with melting snow) or in spring because of unusually heavy snowpack and rapid snowmelt (Hamlet and Lettenmaier, 2007; Sumioka et al., 1998). Summer thunderstorms can also cause local flooding and mass wasting, particularly after wildfire (e.g., Cannon et al., 2010; Istanbulluoglu et al., 2004; Luce et al., 2012; Moody and Martin, 2009).

Flooding can be exacerbated by rain-on-snow (ROS) events, which are contingent on the wind speed, air temperature, absolute humidity, intensity of precipitation, elevation of the freezing line, and existing snowpack when storms happen (Eiriksson et al., 2013; Harr, 1986; Marks et al., 1998; McCabe et al., 2007). Warming affects future flood risk from ROS events differently depending on the importance of these events as a driver of flooding in different basins under the current climate. As temperatures warm, the ROS zone, an elevation band below which there is rarely snow and above which there is rarely rain, will likely shift upward in elevation. This upward shift in the ROS zone will tend to strongly increase flooding in basins where the current ROS zone is low in the basin (with a large snow collection area above). In contrast, in basins in which the ROS zone is higher in the basin, the upward shift in the ROS zone may only modestly increase the fractional contributing basin area with ROS or potentially shrink the relative contribution of ROS.

In the latter half of the twentieth century, increased temperatures led to earlier runoff timing in snowmelt-dominated and mixed rain-and-snow watersheds across the western United States (Cayan et al., 2001; Hamlet et al., 2007; Stewart et al., 2005). With future increases in temperature and potentially in amount of precipitation in the winter months, extreme hydrologic events (e.g., those currently rated as having 100-year recurrence intervals) may become more frequent (Hamlet et al., 2013).

An analysis for the Blue Mountains, using VIC model output from Wenger et al. (2010), projects that flood magnitude will increase in the Wallowa Mountains, Hells Canyon Wilderness Area, and northeastern portion of the Wallowa-Whitman National Forest by the 2080s, particularly in mid-elevation areas most vulnerable to ROS (see Figure 6-7).

**Figure 6-7**
**Predicted Change in 1-1/2-Year (Bank Full) Flood Magnitude**



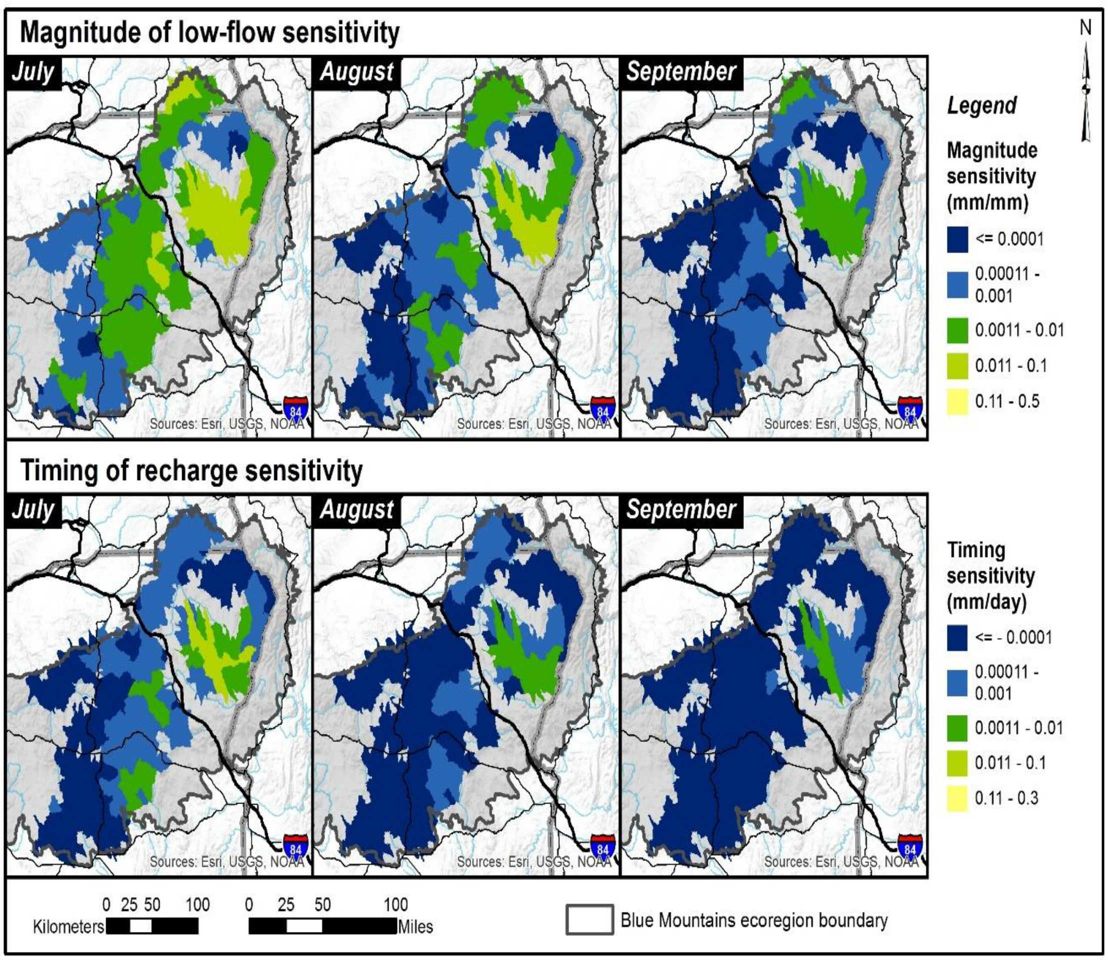

As a result of earlier snowmelt and peak streamflows over the last 50 years in the western United States, spring, early summer, and late summer flows have been decreasing, and fractions of annual flow occurring earlier in the water year have been increasing (Kormos et al., 2016; Leppi et al., 2011; Luce and Holden, 2009; Safeeq et al., 2013; Stewart et al., 2005). An analysis by Stewart et al. (2005) in eastern Oregon showed some of the largest trends toward decreasing fractional flows from March through June.

Summer low flows are influenced not only by the timing of snowmelt, but also by landscape drainage efficiency, or the inherent geologically mediated efficiency of landscapes in converting recharge (precipitation) into discharge (Safeeq et al., 2013; Tague and Grant, 2009). The Blue Mountains, which have moderate groundwater contributions, experienced reduced summer flows of 21 to 28 percent between 1949 and 2010 (Safeeq et al., 2013).

Safeeq et al. (2014) developed and applied an analytical framework for characterizing summer streamflow sensitivity to a change in the magnitude (mm mm-1) and timing (mm day-1) of recharge at broad spatial scales (assuming an initial recharge volume or 1 mm). This approach facilitates assessments of relative sensitivities in different locations in a watershed or among watersheds. Sensitivity, in this approach, has a very specific meaning: how much does summer streamflow (at some defined point during the summer [i.e., July 1 or August 1]), change in response to a change in either the amount of water that recharges the aquifer during late winter and early spring, and the timing of that recharge?

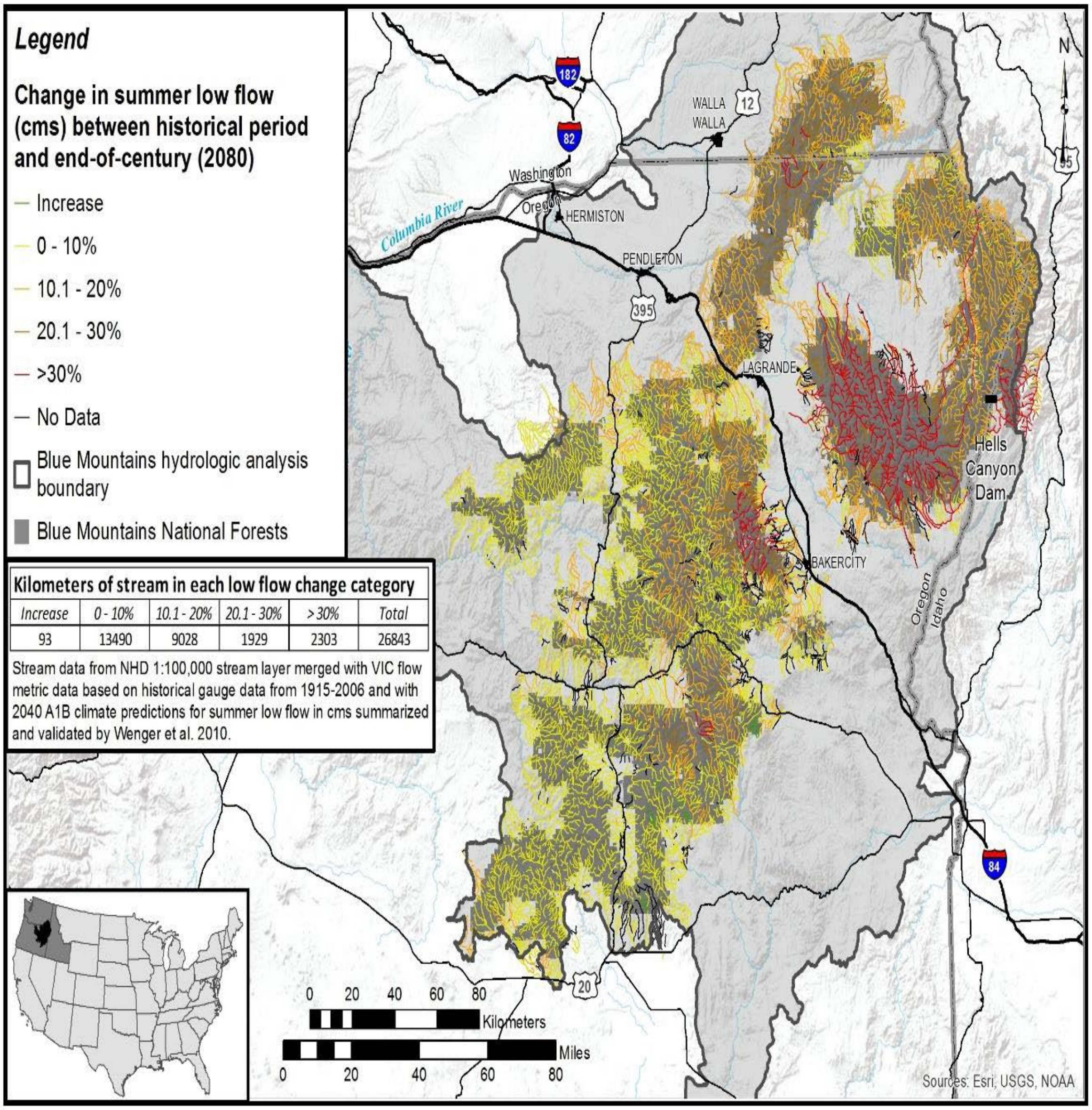
Snow-dominated regions with late snowmelt, such as the Wallowa Mountains, show relatively high sensitivity (see Figure 6-8), especially early in summer (July), although they are less sensitive than the Cascade and Olympic Mountains. The rest of the Blue Mountains region shows moderate to low sensitivity to changes in the magnitude and timing of snowmelt (see Figure 6-8), although sensitivity in the Wallowas is higher in early summer. The level and sensitivity and the spatial extent of highly sensitive areas was shown to diminish over time as summer progresses.

**Figure 6-8**
**Predicted Low-Flow and Stream Recharge Sensitivity During Summer Months**



Projections of future low flows using the VIC hydrologic model (data from Wenger et al. 2010) also show relatively minor decreases in summer streamflow (less than 10 percent decrease) for 47 percent of perennial streams across the Blue Mountains region by 2080 (see Figure 6-9). However, some portions of the region, such as the Wallowas, Greenhorn Mountains, and the Wenaha-Tucannon Wilderness show greater decreases (greater than 30 percent in streamflow by 2080; see Figure 6-9).

**Figure 6-9**
**Predicted Percentage Change in Summer Low Flows Across the Blue Mountains**



### Limitations

The results and map products discussed in this section represent our current best understanding of the likely effects of climate change on key hydrologic processes. Nevertheless, these results should be applied with caution. Key uncertainties include the specific climate trajectories that the Blue Mountains will experience in the future, critical assumptions underlying all models used, and the myriad uncertainties and errors attached to the calibration of each model. Resource managers wishing to apply the results of this analysis in forest planning are encouraged to read the primary literature in which the strengths and limitations of different modeling and forecasting approaches are described.

In general, projections of future trends in streamflow and related processes are strongest in characterizing relative sensitivities of different parts of the landscape rather than absolute changes. In other words, the spatial pattern of trends is more robust than projections associated with any particular location. Similarly, more confidence applies to the interpretation of relative as opposed to absolute magnitudes of projected changes. Differences in results between modeling approaches, such as the low-flow analysis, should be interpreted as bracketing likely potential changes. Finally, the models used here contain uncertainties related to the quantification of soil, vegetation, and other characteristics used to generate hydrologic dynamics.

## *Natural Hazards*

Union County natural hazards information was primarily obtained from the County-wide hazards vulnerability analysis, Emergency Operations Plan (EOP), Natural Hazards Mitigation Plan, and CWPP (Union County, 2018b). Potential implications of climate change on natural hazards are summarized from the Pacific Northwest Research Station general technical report publication Climate Change Vulnerability and Adaptation in the Blue Mountains Region (Halofsky, J.E.; Peterson, D.L., eds. 2016). The following sections summarize some of the bigger natural hazards challenges and associated climate change implications for the planning area.

The EOP is a document produced by Union County that outlines how the County will organize and respond to emergencies and disasters in the County, as well as the County's short-term recovery from these events. For the purposes of the EOP, emergencies and disaster include those beyond the normal limits of the County's day-to-day capabilities and resources. The EOP designates roles and responsibilities to individuals and agencies possessing the appropriate technical capabilities, resources, judgment, and expertise in an emergency situation. Based on a profile of the County, the EOP analyzes a wide range of natural and human-caused hazards and threats with the potential to disrupt community wellbeing and/or damage property and the environment.

The EOP also analyzes threats by scoring each type with a formula that incorporates four independently weighed criteria (history, vulnerability, maximum threat, probability) and three levels of severity (low, moderate, and high). Each hazard is given a score produced by multiplying the criterion's severity rating by its weight factor. These are combined to provide a total risk score for that hazard. Below is the Union County Hazard Analysis Matrix from the EOP.

**Table 6-2**
**Matrix from Emergency Operations Plan**

| Hazard | Rating Criteria with Weight Factors | | | | Total Score |
|---|---|---|---|---|---|
| | History [1] (WF=2) | Vulnerability [2] (WF=5) | Max Threat [3] (WF=10) | Probability [4] (WF=7) | |
| *Severity Rating (High = 10 points; Moderate = 5 points; Low = 1 point) X Weight Factor (WF)* | | | | | |
| Winter Storm | 20 | 50 | 100 | 70 | **240** |
| Hazmat/Transportation Incident | 14 | 50 | 100 | 70 | **234** |
| Flooding | 16 | 50 | 90 | 56 | **212** |
| Wildland/Urban Interface Fire | 20 | 25 | 50 | 70 | **165** |
| Epidemic/Health Emergency | 2 | 20 | 80 | 42 | **144** |
| Drought | 20 | 5 | 10 | 70 | **105** |
| Earthquake | 2 | 20 | 70 | 7 | **99** |
| Dust Storm | 8 | 20 | 40 | 28 | **96** |
| Windstorm | 2 | 25 | 50 | 14 | **91** |
| Land and Debris Slides | 4 | 10 | 70 | 7 | **91** |
| Terrorism | 2 | 20 | 60 | 7 | **89** |
| Dam Failure | 2 | 20 | 50 | 7 | **79** |

Notes:
1. History addresses the record of previous major emergencies or disasters. Weight Factor is 2. Rating factors: high = 4 or more events in last 100 years; moderate = 3 events in last 100 years; low = 1 or 0 events in last 100 years.
2. Vulnerability addresses the percentage of population or property likely to be affected by a major emergency or disaster. Weight Factor is 5. Rating factors: high = more than 10% affected; moderate = 1%-10% affected; low = less than 1% affected.
3. Maximum Threat addresses the percentage of population or property that could be affected in a worst case incident. Weight Factor is 10. Rating factors: high = more than 25% could be affected; moderate = 5%-25% could be affected; low = less than 5% could be affected.
4. Probability addresses the likelihood of a future major emergency or disaster within a specified period of time. Weight Factor is 7. Rating factors: high = one incident within a 10-year period; moderate = one incident within a 50-year period; low = one incident within a 100-year period.

The Oregon Natural Hazards Mitigation Plan is a document produced by the State of Oregon and approved by the Federal Emergency Management Agency in 2015 contains the most recent descriptions and probabilities of Oregon's natural hazards, the state's vulnerabilities to hazards, and the state's mitigation strategies and implementation capability. This information is presented to inform Oregon counties and aid in preparation of response plans for disasters and emergencies. This plan identifies how each type of hazard may affect the population in each region of Oregon.

The Community Wildfire Protection Plan is another document produced by Union County that uses a variety of analyses and professional sources to reduce the potential for wildfires in Union County. This plan also serves to promote coordination with wildland fire agencies and educate landowners while enhancing community safety through educated hazard and risk reduction for fire prevention.

The following sections summarize some of the larger natural hazards challenges for the planning area from these reports.

### Drought

Drought events have occurred in recent years in the UGRRW. These events may increase in frequency, intensity, and duration in the future. Because Union County does not have a backup source of water, a severe drought may require severe conservation measures. Droughts are understood to cause an adverse community impact but are not generally considered a safety concern for most of the population. However, drought can impact agriculture, fish, and wildlife, as well as have devastating effects on the control of wildfires (Union County Department of Emergency Services, 2015).

In addition to drought-related decreased summer flows, Luce and Holden (2009) showed declines in some annual streamflow quantiles in the Pacific Northwest between 1948 and 2006; they found decreases in the 25th percentile flow (drought year flows) over the study period, meaning that the driest 25 percent of years have become drier across the Pacific Northwest. This suggests that climate change is likely to result in more extreme drought conditions with associated implications on municipal and agricultural water demands, and increased potential for wildfires.

Precipitation and temperature are the main drivers of drought. They largely determine snowpack, soil moisture, and streamflow levels, which are commonly used as indicators of drought. In Oregon, many watersheds depend heavily on snowpack for their annual water supply, and the timing of peak runoff from snowmelt is critical. In the case of severe or multi-year droughts, soil moisture does not recover in time for the next growing season. Groundwater levels do not rebound and refilling above-ground reservoirs can also prove difficult. All of these factors set the stage for forest fires, fewer crops, poor grazing conditions, decreased streamflows and habitat for fish, impaired water quality, and scarce supplies. Because droughts are a slow-moving disaster where impacts develop over time, persisting even after the rain and snow returns, building drought resiliency in Oregon will require a portfolio of water management methods that are put into place long before the next drought arrives.

Drought declarations for an area typically go through a three-part process before securing a state drought declaration from the Governor. The primary benefits of a state drought declaration from the Governor are that it creates greater awareness of drought conditions, facilitates coordination between state agencies, and allows the Oregon Water Resources Department (OWRD) to provide existing water right holders with access to emergency water management tools. The OWRD has tracked Governor-declared drought declarations in a database since 1990 (https://apps.wrd.state.or.us/apps/wr/wr_drought/declaration_status_report.aspx), which shows that the Governor has declared drought in Union County in the following years: 1992, 2001, 2002, 2003, 2007, and 2015. These six declarations in the past 28 years equates to 21 percent of the years in drought, or slightly more than 1 in 5. Drought is not an uncommon occurrence in the County. For comparison, in that same period in the other three planning areas Harney County has experienced nine years of drought, Gilliam County eight, and Lincoln County just two.

## Wildfire

Wildfire affects the planning area in late summer when demand for water is the greatest for all demand groups. The topography of the region, with densely forested hills and a valley floor containing agricultural fields, can produce large fires that impact wildlife and property (Union County, 2005). Where to obtain water to contain fires is a concern, as well as the ensuing impacts that wildfire can cause to native habitat and wildlife, water quality, and local economies. In addition, ash, debris, and sediment flow into surface water sources (e.g., rivers, irrigation water storage ponds, and stock watering ponds) and may affect irrigation operations because of clogged intakes, pipes, spray nozzles, and drip equipment and limit stock water supplies.

The Natural Hazards Mitigation Plan states the increasing development of private forest lands combined with hot, dry summer months and the risk of natural or human-caused fire puts northeast Oregon at a high risk for wildfires. Additionally, fire protection is often slow in response due to the rural nature of the area (State of Oregon, 2015).

As described in the Union County Community Wildfire Protection Plan (2005) the Oregon Department of Forestry study titled, "Forest, Farms and People: Land Use Change on Non-Federal Land in Eastern Oregon, 1975-2001," six issues are noted that increase wildfire risk in the area:

"1. In parts of Central Oregon, 60 percent of forest industry land has shifted from forest industry to non-industrial ownership.

2. There are now three times as many dwellings on non-federal wildland forest in Eastern Oregon as in 1975. This may lead to increased fire hazard, impacts to wildlife and their habitat, and a decreased timber supply.

3. Dwelling density is increasing at a faster rate in Eastern Oregon's fire-prone private wildland forests than in Western Oregon's private wildland forests.

4. As the number of structures in Eastern Oregon's forests increase, the propensity to manage for timber production decreases.

5. Along with decreasing inventory volumes on timber industry lands, timber harvests in Central Oregon have decreased dramatically, and may remain depressed.

6. The remainder of Eastern Oregon's private forests may experience the rapid development and other permanent changes currently occurring in Central Oregon."

Several projects (including working with local landowners and agencies to restore habitat and reduce fuel loads) are identified to assist with reducing these threats.

In addition to the factors identified above, climate change is anticipated to affect future wildfire extent and intensity. Increased temperatures with climate change will likely lead to increased wildfire area burned (Littell et al., 2010; McKenzie et al., 2004; Westerling et al., 2006). Annual area burned by wildfire is expected to increase substantially, and fire seasons will likely lengthen. In dry forest types where fire has not occurred for several decades, crown fires may result in high tree mortality in areas historically characterized by low levels of fire-related mortality. In addition, the interaction of multiple disturbances and stressors will create or exacerbate stress complexes. For example, an extended warm and dry period may increase bark beetle activity, which would increase short-term fine fuels and associated risk of uncharacteristic wildfire.

A catastrophic fire could have a large effect on water supply (both surface water and alluvial groundwater due to the connectivity between the two). This is a vulnerability for water supply. The condition of the watershed forests are a critical water issue in some portions of the UGRRW.

## Floods

In the spring, flooding events frequently occur in the region, particularly during mountainous ROS events (State of Oregon, 2015). There is a history of flooding, especially as related to Ladd Marsh in Union County and flash flooding in County-wide creeks (Union County, 2015). Based on the climate change projections, flooding is likely to increase in the future. In addition to flooding, there are likely to be events of increased magnitude when combined with wildfires (potentially landslides). Also, due to the projected increase in intensity of rain events, flooding is particularly dangerous because precipitation is anticipated to shift out of spring and summer months into winter months.

Increased magnitude of peak stream flows will increase the likelihood of damage to roads near perennial streams, ranging from minor erosion to complete loss of the road prism, thus affecting public safety, access for resource management or emergency response, water quality, and aquatic habitat. Bridges, campgrounds, and facilities near streams and floodplains will be especially vulnerable.

The Oregon Natural Hazards Mitigation Plan states that the northeastern region of Oregon is considered moderately vulnerable for hazardous flooding. Other risk factors for flooding in the region include ice jams, spring runoff, thunderstorms, heavily vegetated stream banks, low bridge clearances, and natural stream constructions (State of Oregon, 2015).

In Section VI, Continuity of Government, the Community Wildfire Protection Plan states that all vital county and individual departmental records should be stored in safe storage facilities (not prone to flood damage) if possible (Union County, 2005).

## Seismic Events

Seismic events are not considered a significant natural hazards risk within Union County. However, La Grande and its hospital are located on a fault line, so it is possible that seismic activity could impact water distribution infrastructure in the region. Additionally, the Union County EOP states that “even a small-to moderately sized event could cause significant property damage, injury, potential death and isolate the population from the outside world.” Within the next 50 years, the Cascadia Subduction Zone has an approximate 30 percent chance of an earthquake occurrence. Though not in the immediate vicinity, such an event could have ramifications that reach Union County (such as an influx of people moving from the area of impact and putting a strain on local water resources). Furthermore, a seismic event nearer the Cascade Mountains would affect larger markets on the west side of Oregon, potentially affecting northeastern Oregon economically (State of Oregon, 2015).

Natural hazard emergency planning within Union County is prioritized based on a scale composed of four components: history, vulnerability, maximum threat, and probability. Based on the existing weighting system, the top five County priorities are winter storm, hazmat/transportation incident, flooding, wildland/urban interface fire, epidemic/health emergency.

### Vulnerabilities of Infrastructure and the Built Environment (Municipal)

Based on this analysis, primary concerns to infrastructure and the built environment include increasing pressure on surface water and overuse of groundwater. In addition, aging infrastructure is a concern for some municipalities.

Most existing communities (based on survey input) said that their existing system is sufficient to meet their current needs; however, aging systems and an abrupt failure could disrupt future water quantities, and system redundancies must be strengthened in each community.

### Vulnerabilities of Human Systems (Agriculture)

Based on this analysis, concerns in agricultural systems are increasing the need for water based on increasing temperatures and decreasing precipitation during spring and summer months (e.g., part of the growing season). Additionally, the shifting hydrograph will put more pressure on agriculture systems in the late summer/fall.

Historic or observed NWS data show a decreasing trend in precipitation since 1976/1977; as well as decreases in SWE. Phil Mote and others also reported in 2018, that over the past 60 years, SWE has decreased in the West approximately 30 percent (Mote, 2018).

Flooding is also a concern in low lying areas.

Climate change projections include a shift of precipitation into the winter months, and even though total precipitation may increase some, confidence in precipitation projections are not as high as for temperature.

Decreasing snowpack and declining summer flows associated with drought periods and shifts in precipitation from snow to rain will alter timing and availability of water supply, affecting municipal and public uses downstream from and in national forests, and other forest uses including livestock, wildlife, recreation, firefighting, road maintenance, and in-stream fishery flows. Declining summer low flows will affect water availability during late summer, the period of peak demand (e.g., for irrigation and power supply).

### Vulnerabilities of Natural Systems (Instream)

The shifting hydrograph may impact salmonid migration and could cause increasing pressure on surface water that could reduce amounts available for instream use.

Changing climate patterns can contribute to changes in runoff channels and patterns. When the existing drainage network is altered, transport and capture of water is disturbed.

Decreased snowpack associated with climate change will shift the timing of peak flows, decrease summer base flows, and, in combination with higher air temperature, increase stream temperatures, all of which will reduce the vigor of cold-water fish species. Abundance and distribution of spring Chinook salmon, redband trout/steelhead, and especially bull trout will be greatly reduced, although effects will vary by location as a function of both stream temperature and competition from non-native fish species. Increased wildfire will add sediment to streams, increase peak flows and channel scouring, and raise stream temperature by removing vegetation.

Riparian areas and wetlands will be especially vulnerable to higher air temperature, reduced snowpack, and altered hydrology. The primary effects will be decreased establishment, growth, and cover of species such as cottonwood, willow, and aspen, which may be displaced by upland forest species in some locations. However, species that propagate effectively following fire will be more resilient to climate change. Reduced groundwater discharge to groundwater-dependent ecosystems will reduce areas of saturated soil, convert perennial springs to ephemeral springs, eliminate some ephemeral springs, and alter local aquatic flora and fauna communities.

These and other elements may impact natural systems.

## Natural Hazards Vulnerability Summary and Recommended Future Work

In general, the forest dominated subwatersheds are currently at an increased/high risk of wildfire, and this will be exacerbated by climate change.

Instream vulnerability risks would likely be a bit more variable. Future work could analyze changes in SWE, flood, watershed sensitivity and low flow predictions from the assessment to rate the subwatersheds. Subwatersheds with greater predicted changes in these parameters at likely at higher risk than drainages with less predicted changes.

Agriculture vulnerability is somewhat dependent on instream/surface versus groundwater-dependent irrigation reliance. For subwatersheds with more instream/surface irrigation dependency, drainages with greatest estimated reductions in overall SWE and low flows (time of greatest irrigation demand) are likely at a higher risk than subwatershed with greater groundwater irrigation reliance.

The Step 3 infrastructure section focuses on municipal infrastructure while the assessment speaks more to roads and other infrastructure potentially at risk to changes in flows/floods, etc., anticipated with climate change. Future work could use the 1-1/2 year flood percent change predictions to do a relative assessment of risk across our subwatersheds.

# 7.0 - Subwatershed Demand Summaries

## Introduction

Surface water and groundwater demand vary by subwatershed, demand category, and time of year. Municipal city demand is almost exclusively reliant on groundwater, while instream demand is reliant on both surface water and groundwater contributions to streamflow. Agricultural demand uses both surface water and groundwater. It should be noted that there is interaction between alluvial groundwater and surface water; however, data are not available to quantitatively describe this interaction and, therefore, it is not used in analysis in this report (additional discussion of the interaction between alluvial groundwater and surface water is found in the Step 2 report).

In Appendix D, Water Balance Calculations, each bi-weekly summary for current and future demand is provided for each subwatershed.

The water balance was constructed on an annual and bi-weekly basis. The water balance spreadsheet starts October 1 and runs through September 31 of the following calendar year. It is provided as a total for the entire basin and also by each of the eight individual subwatersheds. The water balance is provided for the data currently available and also based on estimates for the year 2068 (50 years in the future from the date of this report [2018]).

Components of the water balance include:

- Subwatershed number and name
- Month and portion of month in period (i.e., October 1 through 15)
- 50, 90, 10 percent exceedance acre-feet (AF) of surface water supply
- AF of alluvial and Columbia River Basalt groundwater supply combined
- Agricultural demand in AF based on water rights
- Agricultural demand in AF based on evapotranspiration (ET)
- Municipal demand for surface water and groundwater in AF
- Instream demand in AF in bi-weekly increments by subwatershed
- Surface water balance and groundwater balance numbers
- All of the above variables in 2068 values (future scenario)

Assumptions, uncertainty, and data gaps present in the water balance are described in Section 2.0.

## Annual Whole Upper Grande Ronde River Watershed Overview

Tables 7-1 and 7-2 below summarize the annual water balance for each of the eight subwatersheds.

Table 7-1 (current demand) shows that overall there is an annual surplus of approximately 277,127 AF per year of surface water if each demand (municipal use [actual reported use], agricultural use [ET values], and instream demand values) are considered. Subwatershed 6 shows a deficit for the year. There appears to be an overall groundwater surplus for the year; however, four of the eight subwatersheds show annual deficits. This information has a high degree of uncertainty because of the unknown groundwater supply volume in the equation.

Table 7-2 (future demand) shows similar issues; only the surface water surplus is reduced to 126,505 AF per year on an annual basis.

Both tables indicate that water resources and the demands on those resources are not evenly distributed across the subwatersheds. Subwatersheds 3 (Lower Five Points Creek), 5 (Meadow Creek Upper Grand Ronde River), 6 (Ladd Creek Lower Catherine), and 7 (Upper Catherine Creek 1) have the most demand for water. Generally, the center of the Upper Grande Ronde River Watershed (UGRRW) is where population and agricultural activities are concentrated and, thus, total demand is also concentrated.

**Table 7-1**
**Annual Water Balance (Current Demand)**

| Subwatershed | Name | Surface Water Quantity (Natural Stream Flow) (from Step 2 Report) AF per Year (50th Percentile) | Groundwater Used (from Step 2 Report) AF per Year | Agricultural Demand Surface Water (AF per Year) (Water Rights Only) | Agricultural Demand Groundwater (AF per Year) (Water Rights Only) | Agricultural Demand Surface Water (AF per Year) (ET Estimate) | Agricultural Demand Groundwater (AF per Year) (ET Estimate) | Municipal Demand Surface Water (AF per Year) | Municipal Demand Ground Water (AF per Year) | Instream Demand (AF per Year) (Water Rights Only) | Surface Water Balance (ag ET) | Groundwater Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Lookingglass Creek/Cabin Creek | 644,600 | - | 3,470 | 230 | 3,410 | 220 | 383 | 810 | 173,750 | 467,440 | (1,030) |
| 2 | Willow Creek/Indian Creek | 523,380 | 29,400 | 51,890 | 14,440 | 46,630 | 12,980 | - | 810 | 141,820 | 334,930 | 15,620 |
| 3 | Lower Five Points Creek | 234,120 | 25,720 | 23,780 | 23,490 | 20,770 | 20,520 | 1,393 | 500 | 85,610 | 127,740 | 4,700 |
| 4 | Beaver Creek, Upper Five Points Creek | 219,830 | 1,960 | 750 | 2,040 | 710 | 1,932 | 170 | 160 | 85,610 | 133,510 | (120) |
| 5 | Meadow Creek Upper Grande Ronde River | 127,840 | 190 | 520 | - | 510 | - | - | 50 | 46,840 | 80,490 | 140 |
| 6 | Ladd Creek Lower Catherine | 153,740 | 71,720 | 106,330 | 46,100 | 96,350 | 41,774 | 110 | 5,500 | 57,550 | (160) | 24,450 |
| 7 | Upper Catherine Creek 1 | 116,240 | 9,280 | 24,030 | 530 | 24,870 | 550 | - | 370 | 57,550 | 33,820 | 8,360 |
| 8 | Upper Catherine Creek 2 | 71,600 | - | 360 | - | 470 | - | - | 10 | 32,500 | 38,620 | (10) |
| | **Total** | **644,600*** | **138,270** | **211,130** | **86,830** | **193,730** | **77,973** | **2,060** | **8,190** | **173,750*** | **277,130** | **52,110** |

**Total natural stream flow and instream demand are expressed as the total from subwatershed 1 (the most upstream section of the watershed) to prevent "double counting."*

**Table 7-2**
**Annual Water Balance (Future Demand)**

| Subwatershed | Name | 2068 Temperature Change from Current (°F) | Surface Water Quantity (Natural Stream Flow) (from Step 2 Report) AF per Year | Groundwater Used (from Step 2 Report) AF per Year | Agricultural Demand Surface Water (AF per Year) (Water Rights Only) | Agricultural Demand Ground Water (AF per Year) (Water Rights Only) | Agricultural Demand Surface Water (AF per Year) (ET estimate) | Agricultural Demand Groundwater (AF per Year) (ET estimate) | Municipal Demand Surface Water (AF per Year) | Municipal Demand Groundwater (AF per Year) | Instream Demand AF per Year (Water Rights Only) | Surface Water Balance (ag ET) | Groundwater Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Lookingglass Creek/Cabin Creek | 1.6 | 593,040 | - | 3,470 | 230 | 5,010 | 330 | 60 | 30 | 173,750 | 414,210 | (2,090) |
| 2 | Willow Creek/Indian Creek | 1.6 | 481,510 | 29,400 | 51,890 | 14,440 | 68,490 | 19,060 | - | 860 | 141,820 | 271,210 | 9,490 |
| 3 | Lower Five Points Creek | 1.6 | 215,390 | 25,720 | 23,780 | 23,490 | 30,510 | 30,140 | 5,570 | 1,240 | 85,610 | 93,700 | (5,660) |
| 4 | Beaver Creek, Upper Five Points Creek | 1.6 | 202,250 | 1,960 | 750 | 2,040 | 1,050 | 2,840 | 690 | 360 | 85,610 | 114,910 | (1,230) |
| 5 | Meadow Creek Upper Grande Ronde River | 1.6 | 117,610 | 71,720 | 520 | - | 750 | 0 | - | 50 | 46,840 | 70,020 | 140 |
| 6 | Ladd Creek Lower Catherine | 1.6 | 141,440 | 9,280 | 106,330 | 46,100 | 141,510 | 61,360 | 460 | 8,870 | 57,550 | (58,070) | 1,490 |
| 7 | Upper Catherine Creek 1 | 1.6 | 106,940 | - | 24,030 | 530 | 36,530 | 810 | - | 390 | 57,550 | 12,870 | 8,080 |
| 8 | Upper Catherine Creek 2 | 1.6 | 65,870 | 190 | 360 | - | 690 | 0 | - | 10 | 32,500 | 32,680 | (10) |
| **Total** | | **1.6** | **593,040*** | **138,270** | **211,130** | **86,830** | **284,530** | **114,520** | **6,780** | **11,810** | **173,570*** | **126,510** | **10,200** |

Table 7-3, below, shows shaded representations of the water balance.

**Table 7-3**
**Shaded Bi-weekly Water Balance**

## Biweekly surface water balance by subwatershed

| Subwater | Oct 1st to 15th | Oct 16th to 31st | Nov 1st to 15th | Nov 16th to 30th | Dec 1st to 15th | Dec 16th to 31st | Jan 1st to 15th | Jan 16th to 31st | Feb 1st to 15th | Feb 16th to 28th | Mar 1st to 15th | Mar 16th to 31st | Apr 1st to 15th | Apr 16th to 30th | May 1st to 15th | May 16th to 31st | Jun 1st to 15th | Jun 16th to 30th | Jul 1st to 15th | Jul 16th to 31st | Aug 1st to 15th | Aug 16th to 31st | Sep 1st to 15th | Sep 16th to 30th |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -1607 | -2059 | -1393 | -1393 | 2160 | 1684 | 5350 | 4874 | 19409 | 19409 | 32618 | 32142 | 62371 | 62276 | 71312 | 70762 | 36536 | 36436 | 7133 | 6697 | 2116 | 1716 | -775 | -712 |
| 2 | -1007 | -1029 | -528 | -528 | 2357 | 2010 | 4948 | 4601 | 16323 | 16323 | 27087 | 26740 | 46949 | 45651 | 51850 | 50243 | 25695 | 24336 | -215 | -19 | -2064 | -1377 | -2134 | -1282 |
| 3 | 345 | 431 | -33 | -33 | 1062 | 923 | 2504 | 2365 | 6960 | 6960 | 14425 | 14226 | 21029 | 20451 | 21306 | 20260 | 816 | 3185 | -3345 | -3302 | -1715 | -1314 | -772 | -392 |
| 4 | 449 | 395 | -111 | -111 | 918 | 779 | 2271 | 2132 | 6464 | 6464 | 13411 | 13212 | 19496 | 19476 | 20766 | 20156 | 2229 | 5183 | -443 | -633 | 262 | 218 | 172 | 185 |
| 5 | 842 | -1534 | -1110 | -1110 | 658 | 579 | 1260 | 1181 | 3496 | 3219 | 7866 | 7767 | 13431 | 13417 | 15529 | 15370 | 4914 | 4900 | -660 | -803 | -1547 | -2478 | -2353 | -2343 |
| 6 | -241 | 372 | 478 | 478 | 1325 | 1265 | 2086 | 2026 | 5384 | 5384 | 6506 | 6308 | 9370 | 6689 | 6365 | 3876 | -5499 | -6075 | -13376 | -12413 | -8240 | -6162 | -3969 | -2208 |
| 7 | 352 | 466 | 662 | 662 | 855 | 796 | 997 | 938 | 1320 | 1320 | 616 | 417 | 1725 | 1033 | 8971 | 8034 | 5495 | 7002 | -2206 | -2076 | -1584 | -1091 | -670 | -216 |
| 8 | -8 | -63 | -54 | -54 | 184 | 125 | 271 | 212 | 493 | 493 | 1319 | 308 | 3138 | 3125 | 8103 | 7954 | 6516 | 6502 | 262 | 129 | -66 | -130 | -72 | -63 |

## 2068 biweekly surface water balance by subwatershed

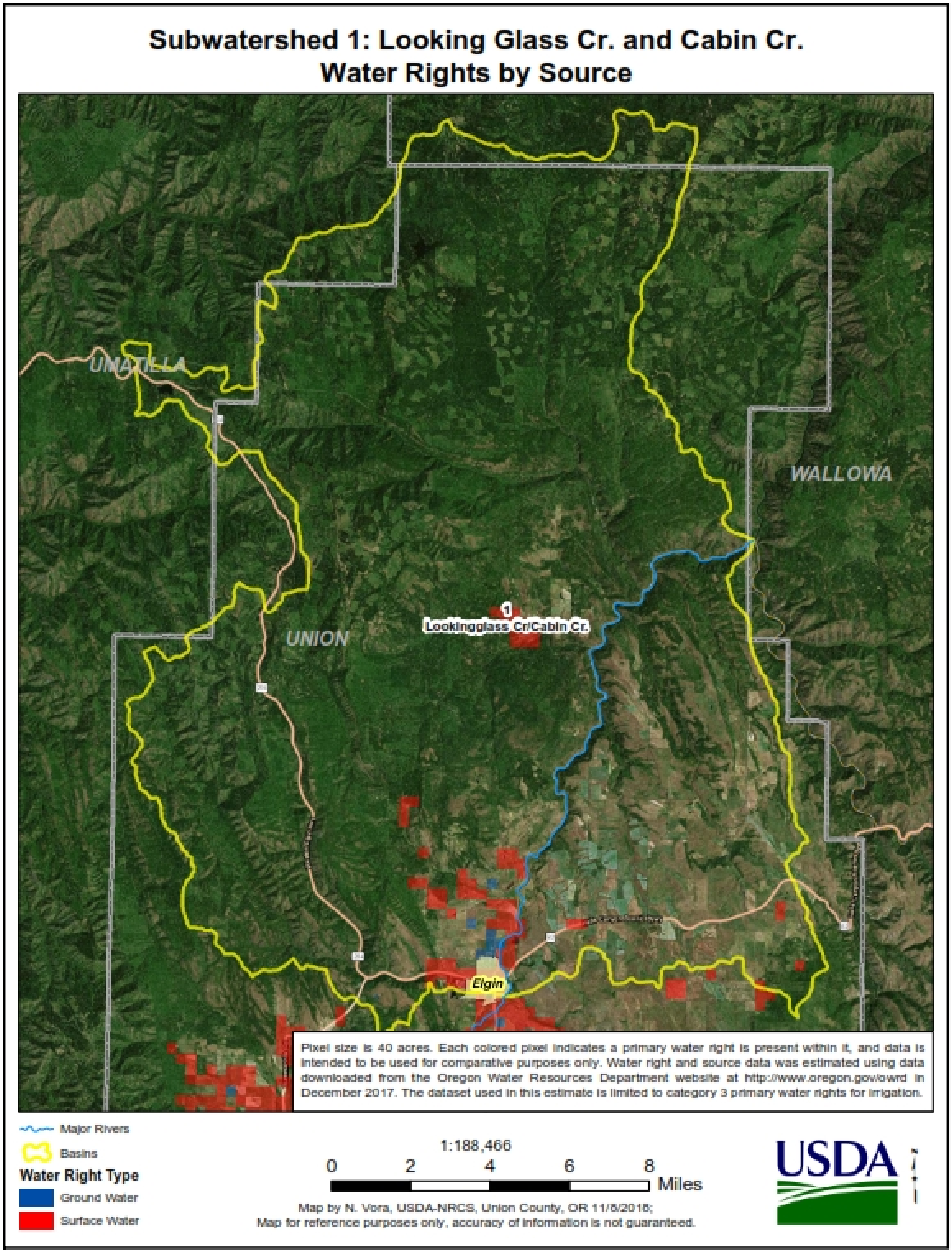
| Subwater | Oct 1st to 15th | Oct 16th to 31st | Nov 1st to 15th | Nov 16th to 30th | Dec 1st to 15th | Dec 16th to 31st | Jan 1st to 15th | Jan 16th to 31st | Feb 1st to 15th | Feb 16th to 28th | Mar 1st to 15th | Mar 16th to 31st | Apr 1st to 15th | Apr 16th to 30th | May 1st to 15th | May 16th to 31st | Jun 1st to 15th | Jun 16th to 30th | Jul 1st to 15th | Jul 16th to 31st | Aug 1st to 15th | Aug 16th to 31st | Sep 1st to 15th | Sep 16th to 30th |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -1495 | -2135 | -1557 | -1297 | 4301 | 1589 | 299 | 6076 | 20796 | 13882 | 27399 | 27911 | 39997 | 60417 | 58938 | 32329 | 21715 | 28686 | 7883 | 5032 | 1389 | 1906 | -1386 | 39 |
| 2 | -1322 | -1051 | -621 | -411 | 4135 | 1972 | 886 | 5617 | 17489 | 11875 | 22889 | 23264 | 28016 | 43262 | 40190 | 16280 | 10655 | 15326 | -1687 | -3084 | -3937 | -2458 | -3520 | -1298 |
| 3 | 11 | 250 | -249 | -154 | 1641 | 733 | 472 | 2656 | 7279 | 4904 | 11981 | 12181 | 10782 | 19084 | 15439 | 3397 | -4750 | -328 | -4340 | -4588 | -2594 | -2046 | -1474 | -728 |
| 4 | 468 | 367 | -172 | -83 | 1604 | 743 | 505 | 2547 | 6905 | 4675 | 11258 | 11468 | 10361 | 18729 | 16107 | 5662 | -1550 | 3207 | -327 | -948 | 145 | 219 | 53 | 297 |
| 5 | 867 | -1538 | -1133 | -1082 | 1092 | 569 | 280 | 1426 | 3750 | 2251 | 6650 | 6784 | 8407 | 13014 | 12752 | 6707 | 2503 | 3644 | -578 | -988 | -1607 | -2467 | -2412 | -2267 |
| 6 | -1187 | 351 | 436 | 498 | 1833 | 1240 | 878 | 2310 | 5712 | 4063 | 5259 | 5121 | 2276 | 4241 | -187 | -11382 | -15670 | -13929 | -17816 | -16628 | -11293 | -8895 | -6141 | -3481 |
| 7 | 149 | 459 | 631 | 701 | 1266 | 787 | 241 | 1127 | 1438 | 868 | 149 | -5 | -1293 | 312 | 5464 | -1595 | -865 | 3052 | -3153 | -3461 | -2440 | -1751 | -1303 | -409 |
| 8 | 18 | -68 | -73 | -30 | 438 | 120 | -194 | 328 | 566 | 214 | 1032 | 75 | 1552 | 2991 | 6501 | 2968 | 3630 | 5003 | 396 | -132 | -146 | -105 | -147 | 43 |

| | |
|---|---|
| | AF<-10000 |
| | -10000<AF<-5000 |
| | -5000<AF<-2000 |
| | -2000<AF<-1000 |
| | -1000<AF<-500 |
| | -500<AF<0 |
| | 0<AF<500 |
| | 500<AF<1000 |
| | 1000<AF<2000 |
| | 2000<AF<10000 |
| | 10000<AF<20000 |
| | 20000<AF<50000 |
| | AF>50000 |

## Subwatershed Demands and Vulnerabilities

In Appendix D, Water Balance Calculations, each bi-weekly summary for current and future demand is provided for each subwatershed. An overview of each subwatershed is provided below.

### Subwatershed 1 Lookingglass Creek/Cabin Creek



## Demand Summary

This subwatershed is 168, 990 acres in area.

This subwatershed includes the City of Elgin and has 380 AF per year of municipal surface water demand (self-sustained industrial use [SSIU] demand) and 810 AF per year of groundwater demand. Future demand in the year 2068 is estimated to increase to 1,530 AF per year (largely due to a potential increase in SSIU use of existing water rights) for surface water demand, and 1,760 AF per year for groundwater demand.

The total agricultural demand for this subwatershed includes 1,230 acres that have primary irrigation water rights. The total surface water demand is 3,410 AF per year and 220 AF per year for groundwater (based on ET values). Future demand is estimated to increase to 5,010 AF per year for surface water and 330 AF per year for groundwater (based on ET values).

The total instream demand is 173,750 AF per year.

On an annual basis, there appears to be a surplus of surface water and a deficit of groundwater in this subwatershed.

The Lookingglass Creek drainage is designated for salmon, trout, and bull trout spawning and rearing uses. Warm stream temperatures, unnaturally wide channels, lack of large woody debris, and sedimentation in this drainage result in stream segments that do not adequately support fish uses. Projects that improve shade, channel morphology, and habitat structure would be beneficial for aquatic life.

The Grande Ronde River is designated for fishing, swimming, boating, and salmon and trout rearing and migration uses, among others. However, the water quality of the Grande Ronde River in this subwatershed is poor. Summertime recreation on the Grande Ronde is impacted by high levels of aquatic weeds, algae, and pH. Reductions in nutrient inputs would improve the quality of water for recreation. Fish use is impacted by high summertime phosphorous levels, sedimentation, summer stream temperatures, spawning season low-dissolved oxygen concentrations, low summer flows that limit migration and holding, lack of complex habitat, lack of pool frequency, and lack of large woody material. Reductions in nutrient and sediment inputs and improved channel morphology and structure would be beneficial for aquatic life.

## Vulnerability Summary

### *Overall*

The risk of conflicting demands in this subwatershed is **low** due to lack of agricultural and municipal use in this area.

### *Agricultural*

This subwatershed has a **low** risk vulnerability for agricultural demand as there is very little agricultural area in this subwatershed.

### *Municipal*

The City of Elgin and some SSIUs are located in subwatershed 1 along the boundary of subwatershed 2. One of the SSIU groundwater rights, permit G2550, has a maximum diversion rate larger than 1 cubic feet per second (cfs) (1.56 cfs) and SSIU surface water right S40678 is 3 cfs. Approximately 15 percent of rural residential groundwater demand is within the subwatershed. These municipal uses appears to be at a **low** risk for vulnerabilities; however, the subwatershed is vulnerable to conditions upstream, such as a potential chemical spills.

### *Instream*

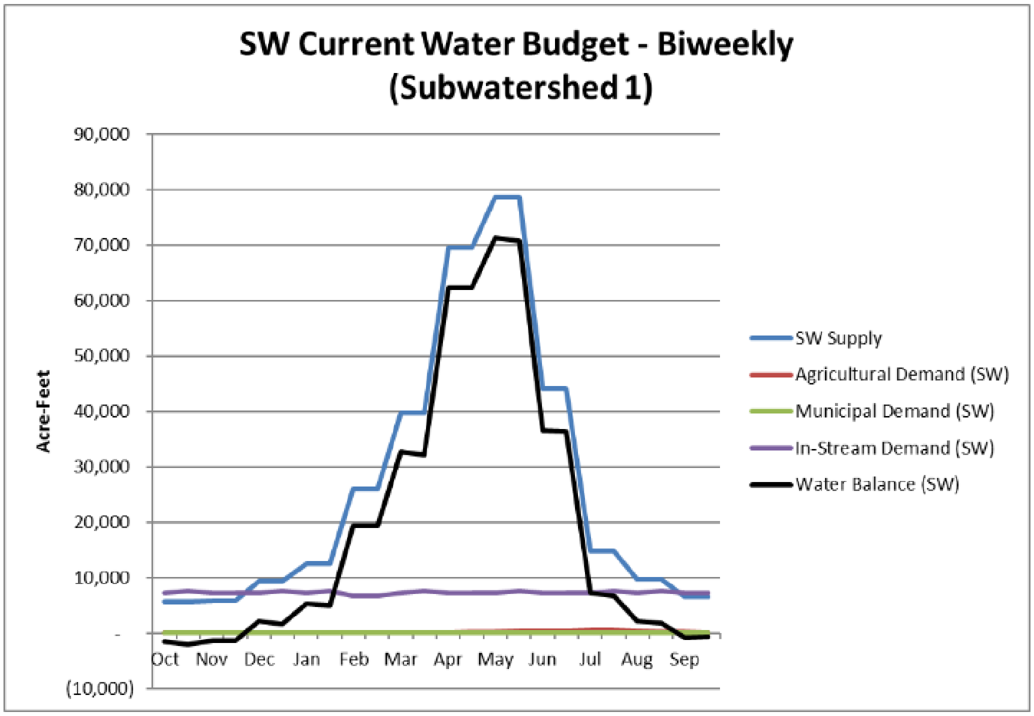
Subwatershed 1 has **high** risk vulnerability for instream demand. While total water supply at the pour point indicates that abundant water is available, there are seasonal vulnerabilities as shown by water availability analysis for instream water rights (ISWR) on tributary streams including Cabin, Gordon, Jarboe, Little Lookingglass, and Phillips Creeks. All show instream flow deficiencies during summer low flow months. Current conditions may worsen in the future due to climate change. Relatively little out-of-stream use occurs in these tributaries so magnitude is **low**. Fish habitat in the subwatershed is used for spawning, rearing, and migration.

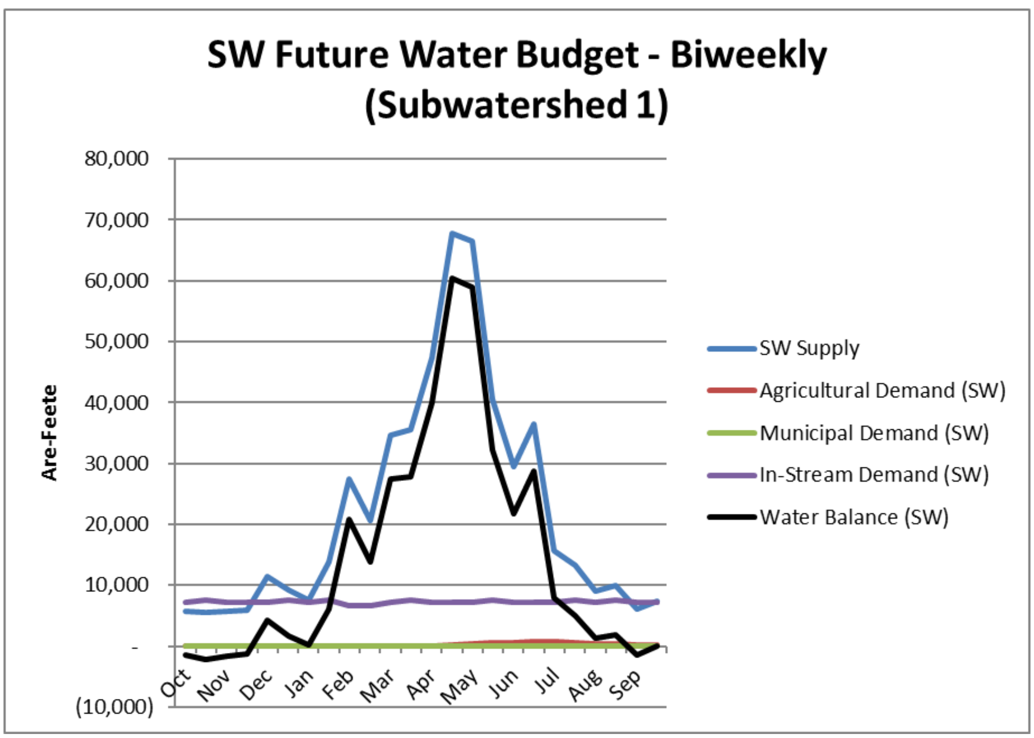
### *Water Quality*

Subwatershed 1 (Lookingglass/Cabin Creek) has a **high** risk of impact from water quality impairments caused by water withdrawals in the subwatershed and upstream. Significant changes in practices and/or efficiencies in water use will be needed to address the water quality impairments.

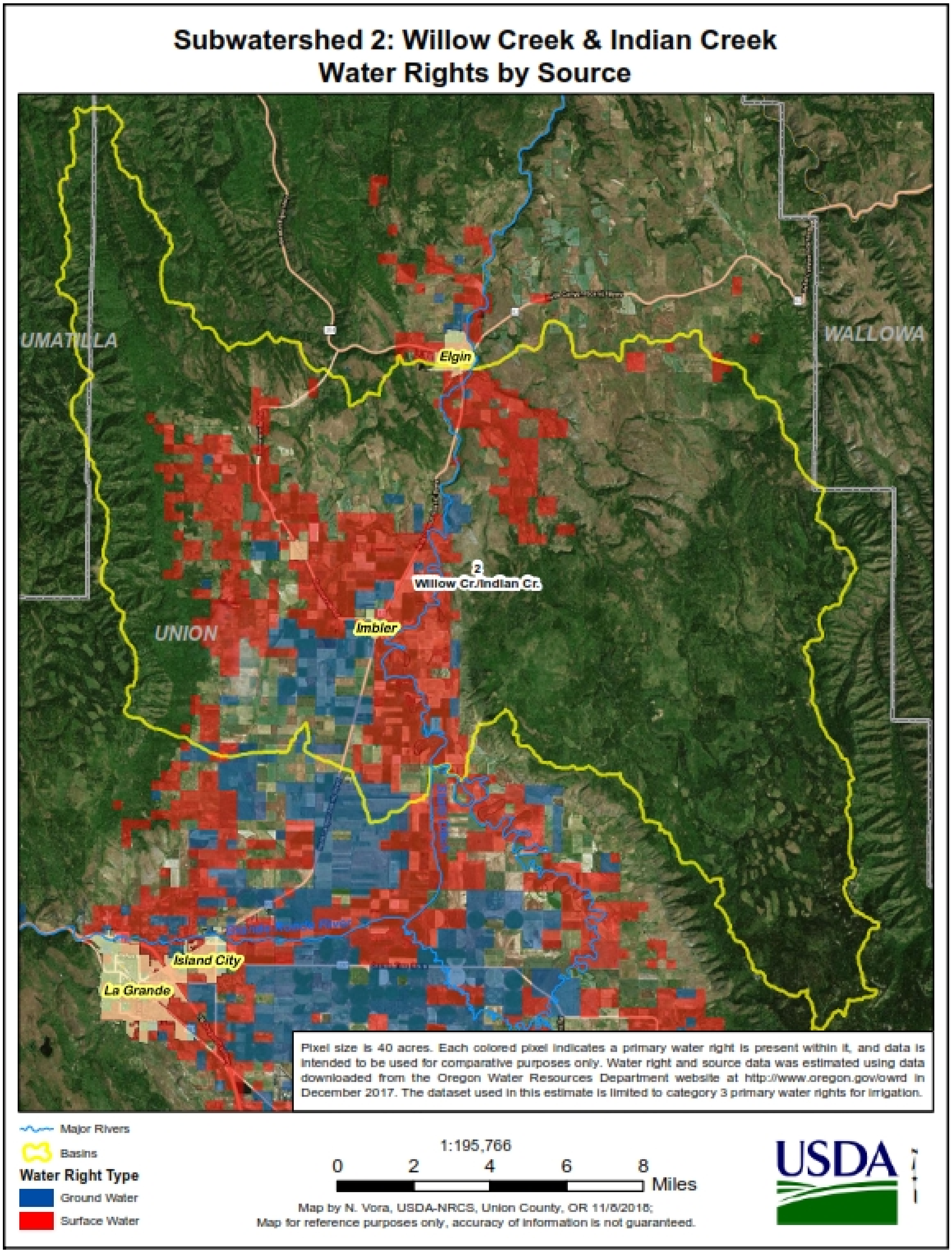
The water balance for this subwatershed is presented on Figure 7-1.

**Figure 7-1**
**Surface Water Budget - Bi-weekly (Subwatershed 1 - Lookingglass Creek/Cabin Creek)**



### *Subwatershed 2 Willow Creek/Indian Creek*



## Demand Summary

This subwatershed is 149,800 acres in area.

This subwatershed includes the Cities of Imbler and Summerville and has no municipal surface water demand and 810 AF per year of groundwater demand. Future demand for groundwater is estimated to increase to 860 AF per year.

The total agricultural demand for this subwatershed includes 22,110 acres that have primary irrigation water rights and are irrigated. The total surface water demand is 46,630 AF per year and 12,980 AF per year for groundwater (based on ET values). Future demand is estimated to increase to 68,490 AF per year for surface water and 19,058 AF per year for groundwater (based on ET values).

The total instream demand is 141,820 AF per year.

On an annual basis, there appears to be surplus of surface water and groundwater (however, the deficits of surface water on a bi-weekly basis in late summer/early fall create a strain on the resource).

Mill Creek, tributary of Willow Creek is designated by the Oregon Department of Environmental Quality (DEQ) (beneficial use designation) for swimming and fishing, but high *E. coli* concentrations in the stream make it unsafe for people to fish or swim in the creek. Mill Creek and Willow Creek areas are flood-prone agricultural areas. *E. coli* from livestock and wildlife droppings may flush into the stream after rain or flood events, increasing instream *E. coli* concentrations to levels that are unhealthy for human contact. Fencing livestock out of the creek, better agricultural waste management practices, and wider vegetative buffers along the creek would be beneficial for trapping animal waste before it reaches the stream.

The Grande Ronde River is designated for fishing, swimming, boating, and salmon and trout rearing and migration uses, among others. However, the water quality of the Grande Ronde River in this subwatershed is poor. Summertime recreation on the Grande Ronde is impacted by high levels of *E. coli*, aquatic weeds, algae, and pH. Reductions in nutrient inputs would improve the quality of water for recreation. Fish use is impacted by high summertime phosphorous levels, sedimentation, summer stream temperatures, summertime pH, spawning season dissolved oxygen concentrations, low summer flows that limit migration and holding, lack of complex habitat, lack of pool frequency, and lack of large woody material.

## Vulnerability Summary

### *Overall*

The risk of conflicting demands in this subwatershed is **moderate** due to municipal and agricultural pressure on groundwater supplies. Potential areas for improvement are finding ways to preserve groundwater supply or create groundwater storage options for late season demands.

### *Agriculture*

This subwatershed has a **high** risk vulnerability for agricultural demand. It ranks second in terms of irrigated acreage and is typically short on surface water after July, especially in the future scenario. There is a large amount of water in spring that is available, but it is mostly gone after precipitation ceases and demand is high.

### *Municipal*

Two of Elgin's groundwater wells are located along the northern edge of subwatershed 2, and the City of Imbler has one well within the subwatershed. Approximately 22 percent of rural residential groundwater demand is within the subwatershed. This municipal system appears to be at a l**ow** risk for vulnerabilities.

### *Instream*

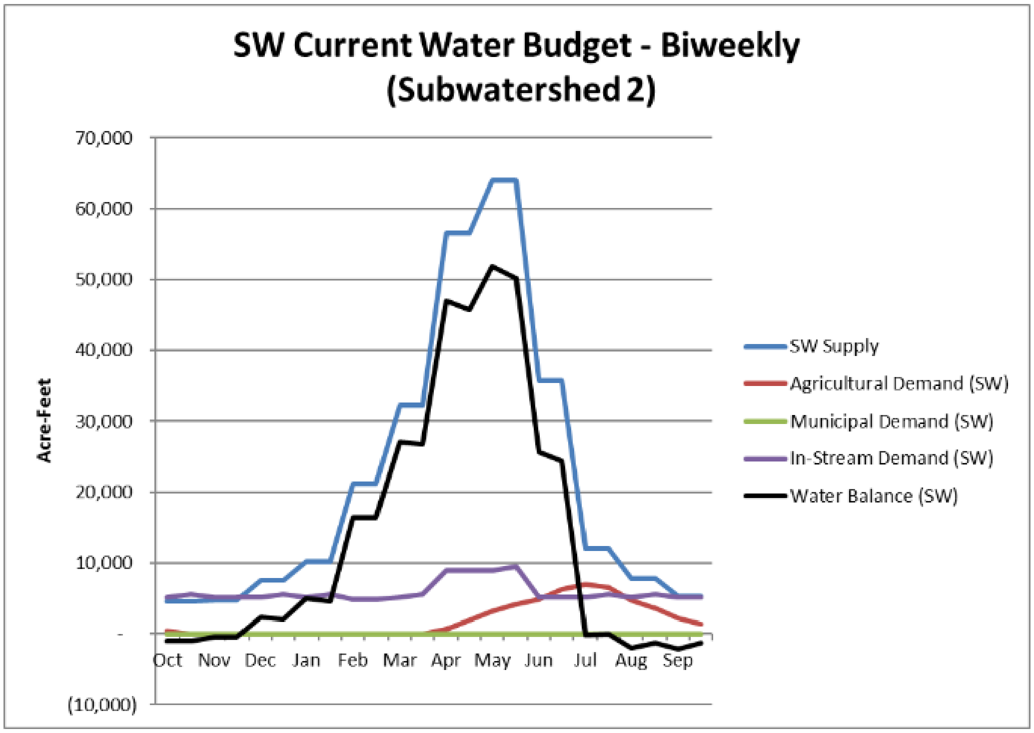
Subwatershed 2 has **high** risk vulnerability for instream demand. While total water supply at the pour point indicates that abundant water is available, there are seasonal vulnerabilities as shown by water availability analysis for ISWR's on tributary streams including Clark, Indian, Mill, and Willow Creeks. Current conditions will worsen in the future due to climate change. There is a significant amount of out-of-stream use in this subwatershed so magnitude is **high** given that significant changes would need to occur to meet instream demand. Fish habitat in the subwatershed is used for spawning, rearing and migration.

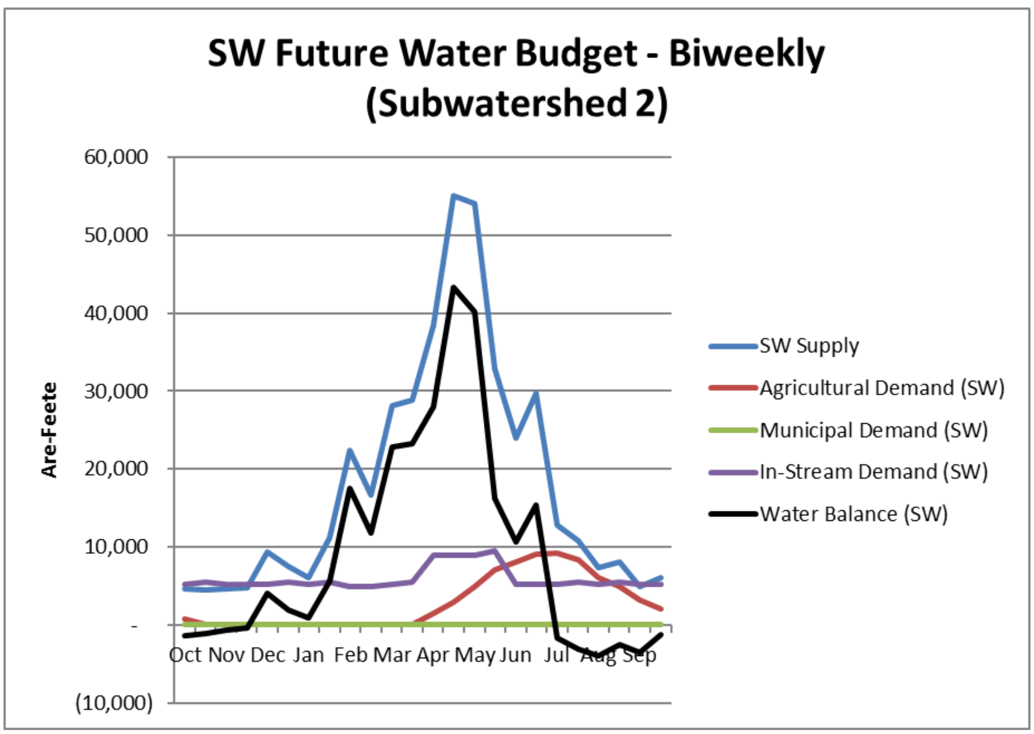
### *Water Quality*

Subwatershed 2 has a **high** risk of impact from water quality temperature impairments caused by water withdrawals in the subwatershed and upstream. Significant changes in practices and/or efficiencies in water use will be needed to address the water quality impairments.

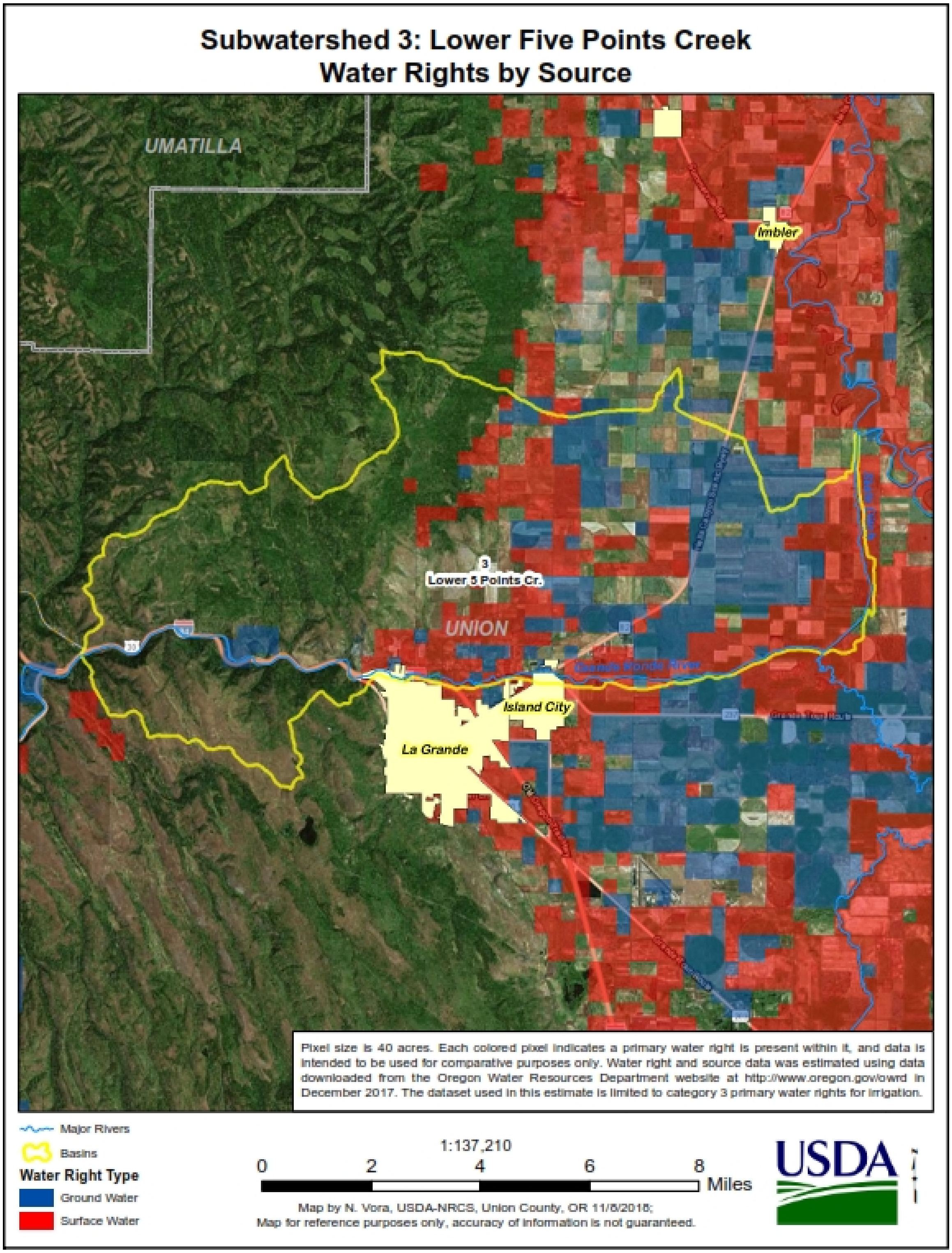
The Water Balance for this subwatershed is presented on Figure 7-2.

**Figure 7-2**
**Surface Water Budget - Bi-weekly (Subwatershed 2 - Willow Creek/Indian Creek)**



### *Subwatershed 3 Lower Five Points Creek*



## Demand Summary

This subwatershed is 41,010 acres in area.

This subwatershed includes a portion of Island City and has 1,390 AF per year of municipal surface water demand (all SSIU demand) and 500 AF per year of municipal groundwater demand. Future demand is estimated to increase to 5,570 AF per year of surface water demand and 1,240 AF per year of groundwater demand. It was noted by the OWRD watermaster that this is a four-fold potential increase in SSIU surface rights in the area, and the OWRD watermaster believes it is highly unlikely SSIU use increases that much.

The total agricultural demand for this subwatershed includes 15,760 acres that have primary water rights and are irrigated. The total surface water demand is 20,770 AF per year and 20,520 AF per year for groundwater (based on ET values); this is a fairly even split. Future demand is estimated to increase to 30,510 AF per year for surface water and 30,140 AF per year for groundwater (based on ET values).

The total instream demand is 85,610 AF per year.

On an annual basis, there appears to be a surplus of surface water and groundwater; however, there is a deficit of surface water and groundwater during late summer and fall on a bi-weekly basis. Groundwater is not regulated based by priority in the UGRRW.

Catherine Creek and the Grande Ronde River upstream of State Ditch are designated for recreation (swimming, fishing, boating) but high aquatic weeds, algae, and pH levels in the summer make it unsafe for people to recreate in the water. Reductions in nutrient inputs would improve the quality of water for recreation.

Catherine Creek and the Grande Ronde River upstream of State Ditch are also designated by the DEQ (beneficial use designation) for use by fish and aquatic life. These uses are negatively impacted by high summertime phosphorous levels, sedimentation, summer stream temperatures, summertime pH, low summer flows that limit migration and holding, lack of complex habitat, lack of pool frequency, and lack of large woody material.

## Vulnerability Summary

### *Overall*

The risk of conflicting demands in this subwatershed is **moderate** due to late season pressure on groundwater and surface water supplies.

### *Agriculture*

This subwatershed has a **high** risk of vulnerability now and in the future, as it typically exceeds supply for a large portion of the irrigation season. Approximately half of the irrigation in this subwatershed is from groundwater sources, so there is a moderate risk that these supplies will not be sustainable in the future, given that it is unknown what level of withdrawal this resource can support.

### *Municipal*

Several SSIU groundwater rights and several SSIU surface rights exist along the boundary between the southern edge of subwatershed 3 and subwatershed 4, including permit S15877 for 1 cfs and S6414 for 10 cfs. According to the watermaster, Delivery Ditch has been filled in for 10 years and has not delivered water to these rights in 20 years or more. Approximately 16 percent of the rural residential groundwater demand is within the subwatershed. There are no cities within the subwatershed. This municipal system appears to be at a **low** risk for vulnerabilities.

### *Instream*

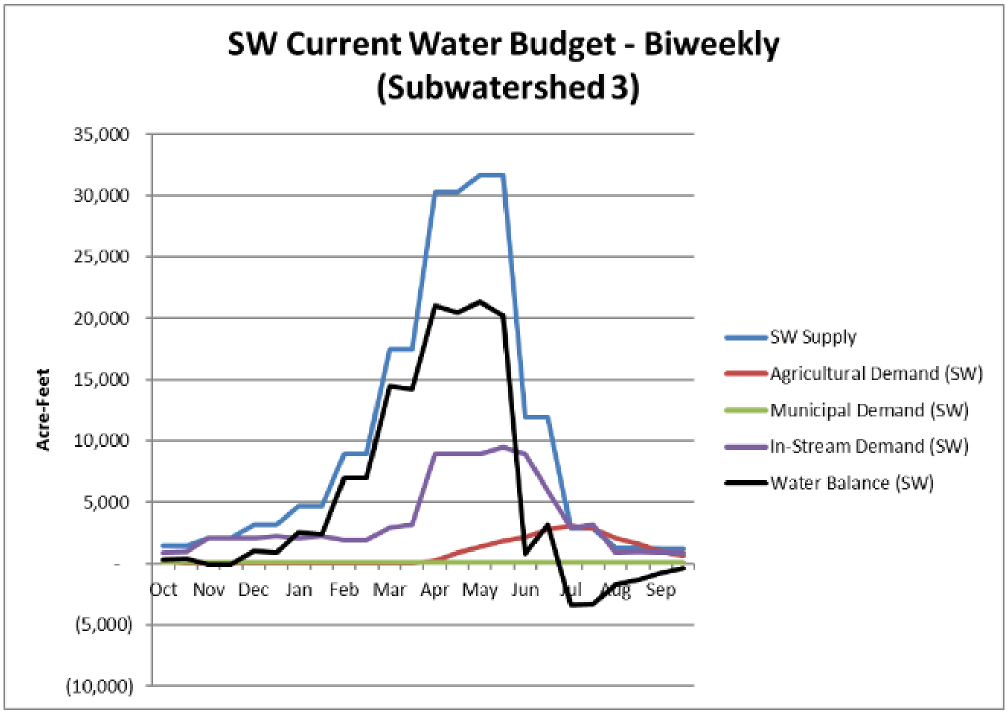
Subwatershed 3 has **high** risk vulnerability for instream demand. While total supply/demand shows a surplus, there is a flow deficit in the summer and fall so the subwatershed is high risk vulnerability for instream demand. Current conditions will worsen in the future due to climate change. There is a significant amount of out-of-stream use in this subwatershed so magnitude is **high** given that significant changes would need to occur to meet instream demand. Fish habitat in the subwatershed is used for spawning, rearing, and migration.

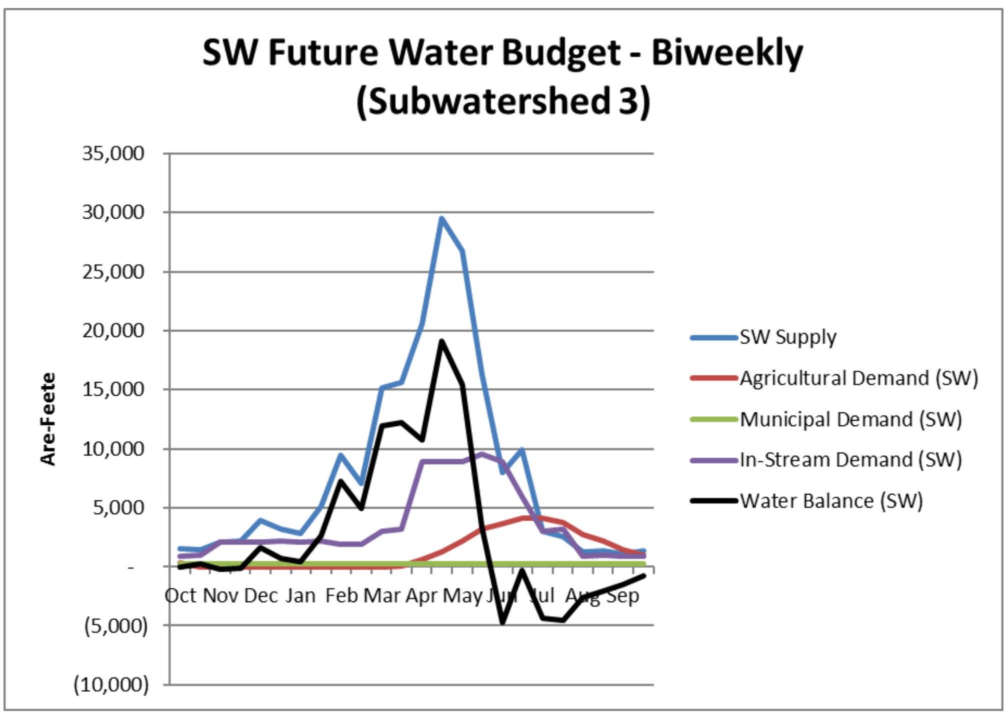
### *Water Quality*

Subwatershed 3 (Lower Five Points Creek) has a **high** risk of impact from water quality impairments caused by water withdrawals in the subwatershed and upstream. Significant changes in practices and/or efficiencies in water use will be needed to address the water quality impairments.

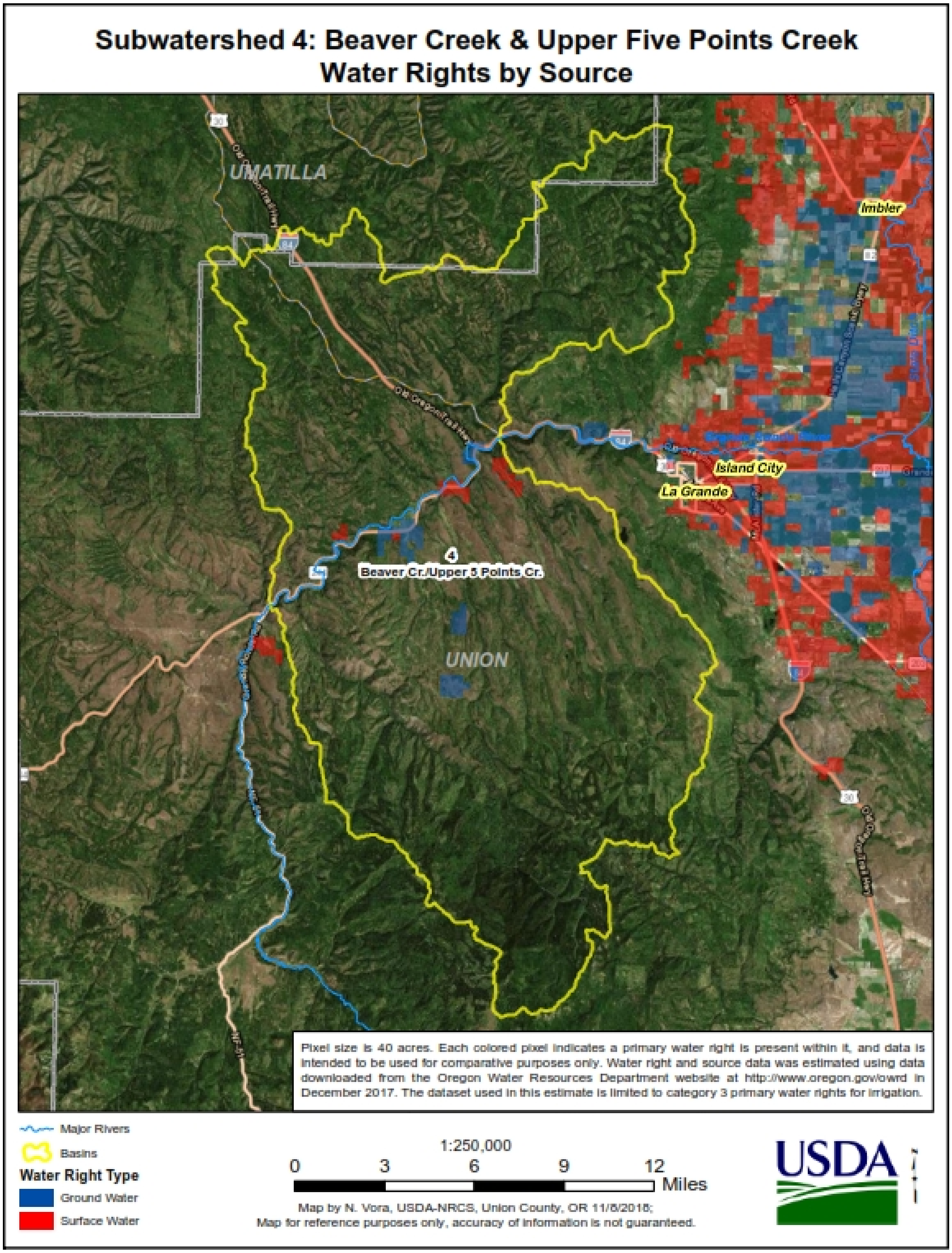
The Water Balance for this subwatershed is presented on Figure 7-3.

**Figure 7-3**
**Surface Water Budget - Bi-weekly (Subwatershed 3 - Lower Five Points Creek)**



### *Subwatershed 4 Beaver Creek, Upper Five Points Creek*



## Demand Summary

This subwatershed is 178,050 acres in area.

This subwatershed has no cities and municipal demand is 0 AF per year inside the subwatershed; however, the City of La Grande's reservoir on Beaver Creek presents a substantial future municipal demand on the subwatershed's surface water.

The total agricultural demand for this subwatershed includes 930 acres that have primary irrigation water rights. The total surface water demand is 710 AF per year and 1,930 AF per year for groundwater (based on ET values). Future demand is estimated to increase to 1,050 AF per year for surface water and 2,840 AF per year for groundwater (based on ET values).

The total instream demand is 85,607 AF per year. It includes water rights on seven stream segments.

On an annual basis, there is a surplus of surface water and deficit of groundwater. Based on water rights, there appears to be a deficit of groundwater during the months of November and July (see Appendix D, Water Balance Calculations).

Rock Creek is designated for salmonid spawning and rearing, among other uses, but summer steelhead habitat is degraded by an unnaturally wide, flat channel and a lack of large woody debris in certain reaches. Similarly, Jordan Creek summer steelhead habitat is limited by lack of large wood material. Potential solutions could be working to unconstrain the channel structure.

Beaver Creek is designated for salmonid spawning and rearing and resident fish use, but sedimentation is a detriment to fish use.

The Grande Ronde River in this subwatershed is designated for salmonid and resident fish use but fish habitat is degraded by summer pH levels, high summer temperatures, sedimentation, lack of complex habitat, inadequate pool frequency, and lack of large woody material.

## Vulnerability Summary

### *Overall*

The risk of conflicting demands in this subwatershed is **moderate** due to late season pressure on groundwater supplies. Potential areas for improvement are finding ways to improve irrigation efficiency and store water for late season demands.

### *Agriculture*

This subwatershed has a **low** risk vulnerability for agricultural demand as there is very little agricultural area in this subwatershed.

### *Municipal*

There are several SSIU surface and groundwater rights in the subwatershed, but all are less than 1 cfs. There are no cities. There are just 6 percent of rural residential wells in the subwatershed. This municipal system appears to be at a **low** risk for vulnerabilities.

### *Instream*

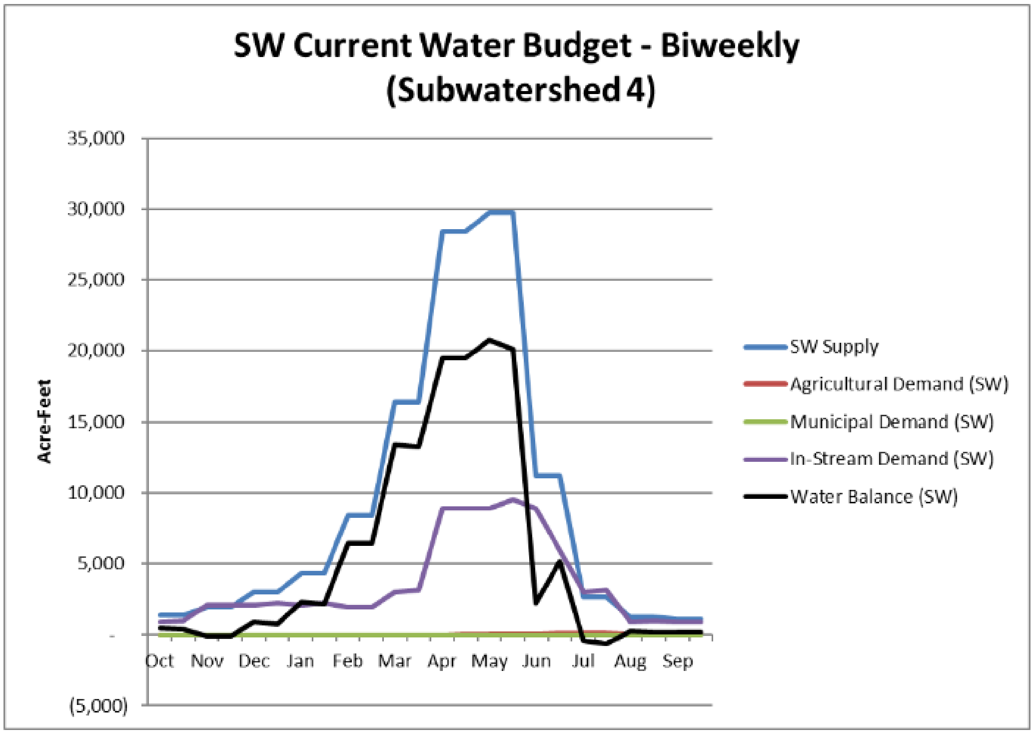
Subwatershed 4 has **high** risk vulnerability for instream demand. While total water supply at the pour point indicates that abundant water is available, there are seasonal vulnerabilities as shown by water availability analysis for ISWR's on tributary streams including Beaver Creek, Fivepoints Creek, Grande Ronde River, Pelican Creek, Rock Creek, Spring Creek, and the Grande Ronde River. Current conditions will worsen in the future due to climate change. There is limited amount of out-of-stream use in this subwatershed so magnitude is **low**. Fish habitat in the subwatershed is used for spawning, rearing, and migration.

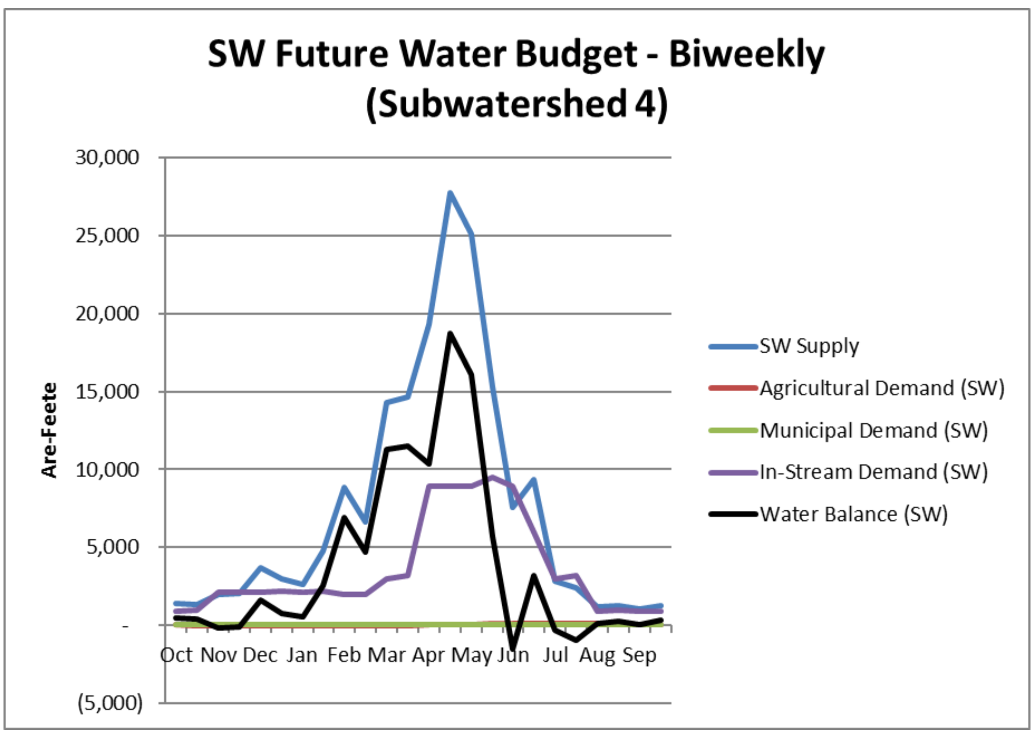
### *Water Quality*

Subwatershed 4 (Beaver Creek/Upper Five Points Creek) has a **moderate** risk of impact from water quality impairments caused by water withdrawals and land management methods in the subwatershed and upstream. Changes in practices and/or efficiencies in water use have been employed to address water quality impairments.

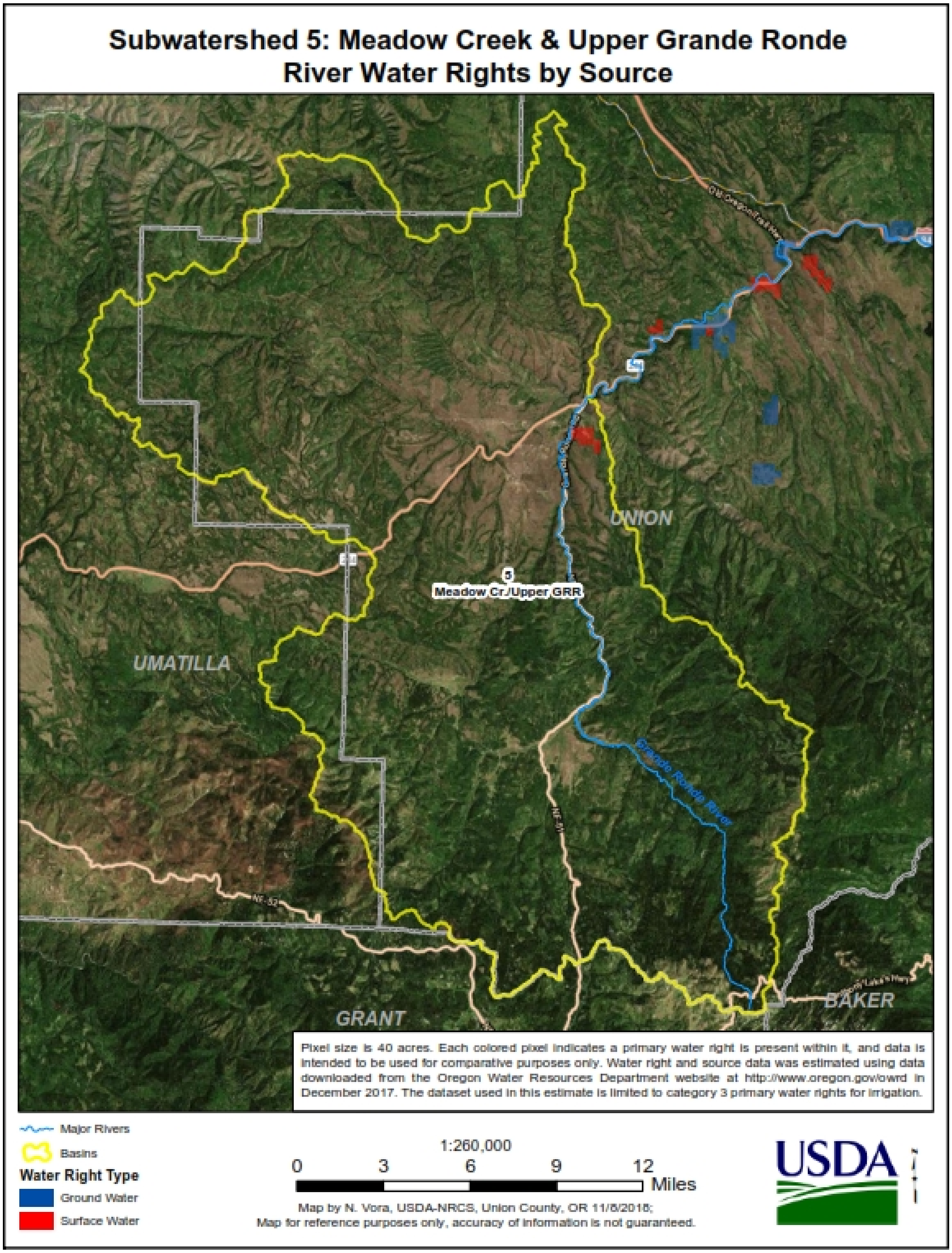
The water balance for this subwatershed is presented on Figure 7-4.

**Figure 7-4**
**Surface Water Budget - Bi-weekly (Subwatershed 4 - Beaver Creek, Upper Five Points Creek)**



## *Subwatershed 5 Meadow Creek Upper Grande Ronde River*



## Demand Summary

This subwatershed is 249,740 acres in area.

This subwatershed has no cities and municipal demand is 0 AF per year for surface water and 48 AF per year for groundwater demand. In the future, groundwater demand is anticipated to increase to 51 AF per year.

The total agricultural demand for this subwatershed includes approximately 170 acres that have primary irrigation water rights. The total surface water demand is 510 AF per year and 0 AF per year for groundwater (based on ET values). Future demand is estimated to increase to 750 AF per year for surface water and 0 AF per year for groundwater (based on ET values).

The total instream demand is 46,840 AF per year.

On an annual and bi-weekly basis, there appears to be a surplus of surface water and groundwater.

This subwatershed is designated for salmonid and resident fish uses but the Grande Ronde River and many tributaries do not adequately support fish. High summer temperatures are an issue of concern for fish in reaches of the Grande Ronde River, McCoy Creek, Meadow Creek, Sheep Creek, and Fly Creek. Sedimentation degrades fish habitat in the Grande Ronde River and all major tributaries. Forest practices that protect and restore riparian vegetation, reduce erosion inputs, and restore channel connection to floodplains would all be beneficial to fish uses. Dissolved oxygen concentrations are below levels needed for rearing and spawning in several tributaries, including Lookout Creek and Dark Canyon. Summer steelhead habitat is reduced by unnaturally wide, shallow channels, infrequent pools, and lack of large woody material in several reaches including the Grande Ronde River and most major tributaries.

## Vulnerability Summary

### *Overall*

The risk of conflicting demands in this subwatershed is **low** due to surpluses in each bi-weekly segment. Potential areas for improvement include improving stream habitat. There is no municipal city or SSIU demand and minimal agricultural demand.

### *Agriculture*

Subwatershed 5 has a **low** risk vulnerability for agricultural demand, as there is very little agricultural area in this subwatershed.

### *Municipal*

There are no cities and no SSIU rights in the subwatershed and just 3 percent of rural residential wells. This municipal system appears to be at a **low** risk for vulnerabilities.

### *Instream*

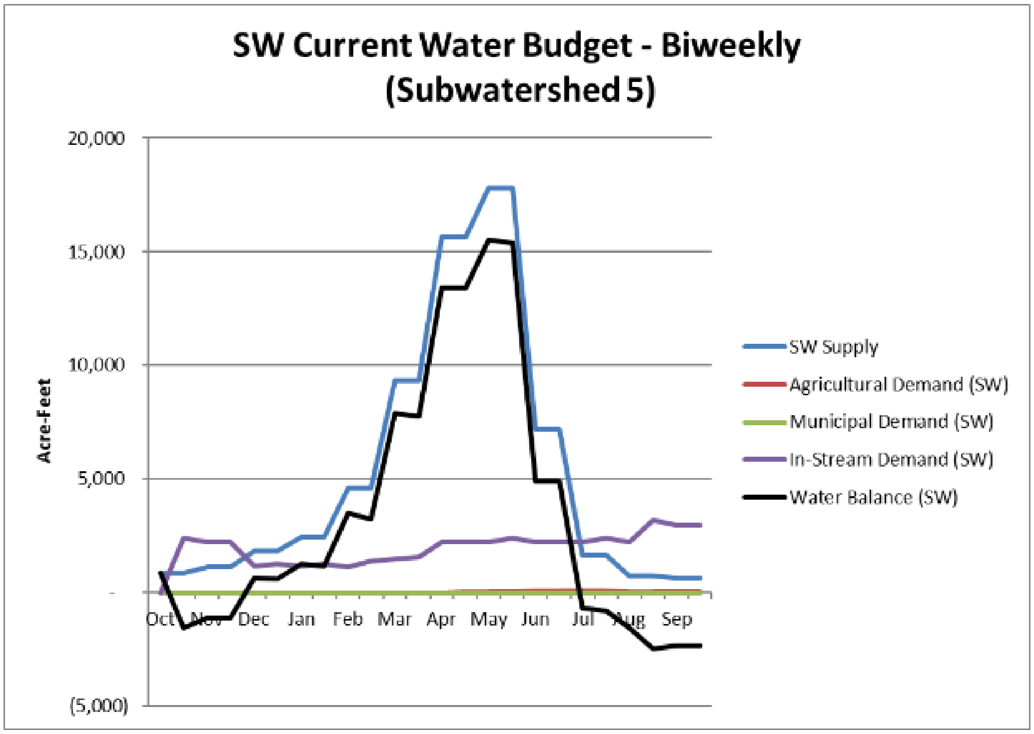
Subwatershed 5 has **high** risk vulnerability for instream demand. While total water supply at the pour point indicates that abundant water is available, there are seasonal vulnerabilities as shown by water availability analysis for ISWR's on tributary streams including Bear, Clear, Dark Canyon, Fly, Limber Jim, Marley, McCoy, Meadow, Sheep, and Chicken Creeks. Current conditions will worsen in the future due to climate change. There is limited amount of out-of-stream use in this subwatershed so magnitude is **low**. Fish habitat in the subwatershed is used for spawning, rearing and migration.

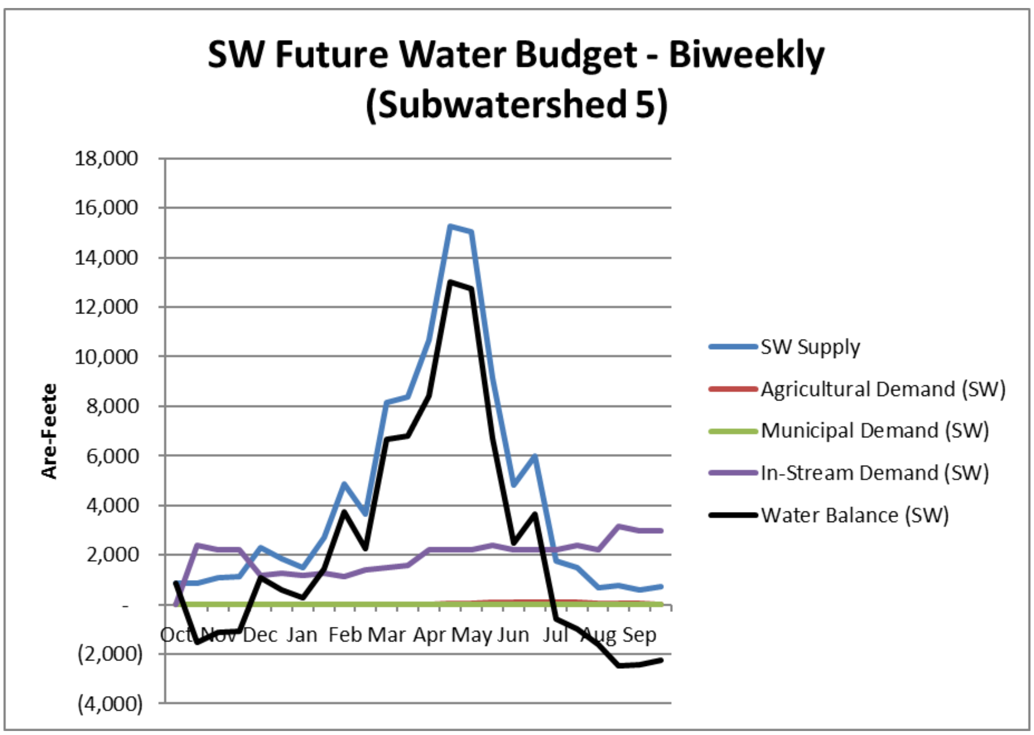
### *Water Quality*

Subwatershed 5 (Meadow Creek/Upper Grande Ronde River) has a **low** risk of impact from water quality impairments. Changes in land use practices may be needed to address climate change impacts.

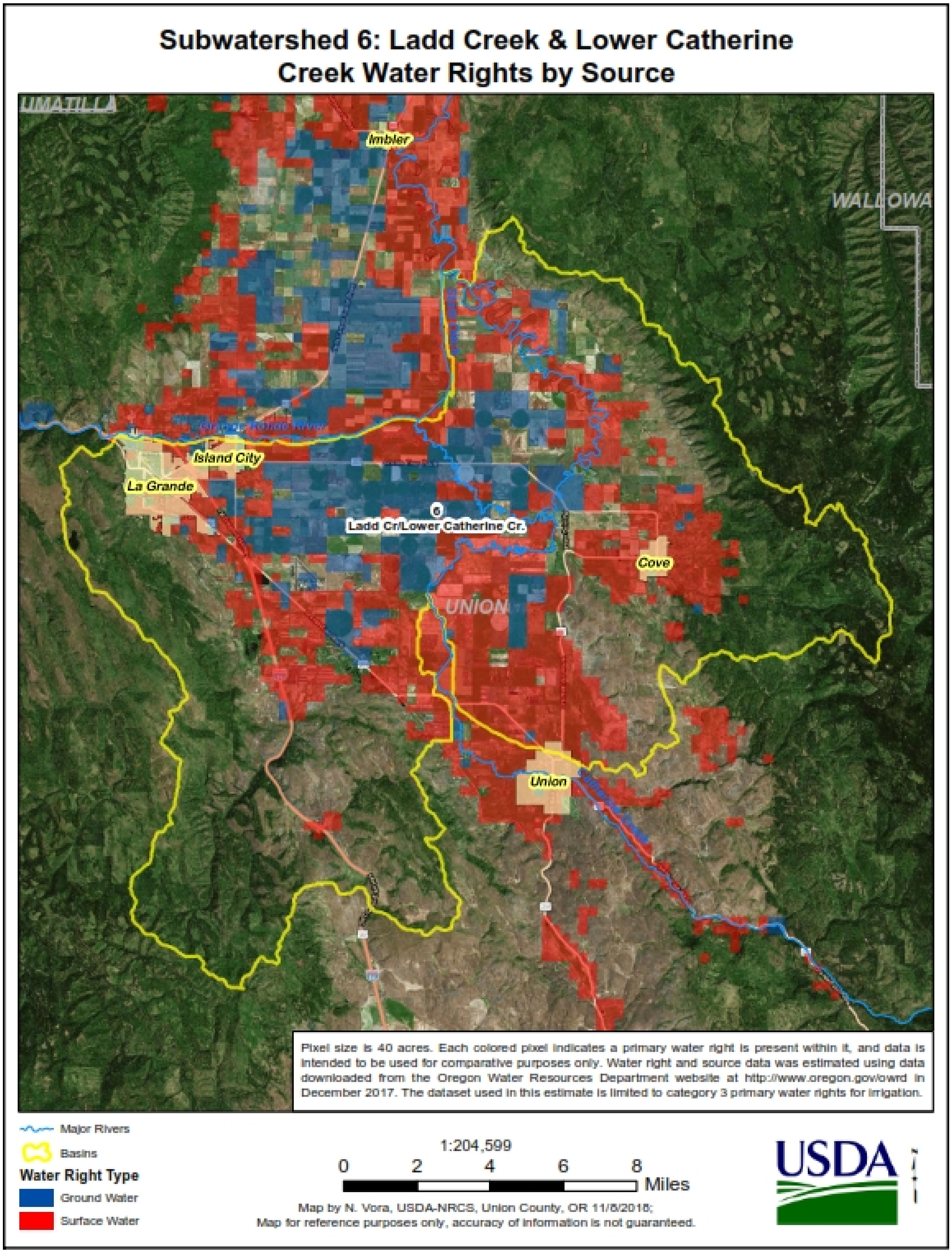
The water balance for this subwatershed is presented on Figure 7-5.

**Figure 7-5**
**Surface Water Budget - Bi-weekly (Subwatershed 5 - Meadow Creek Upper Grande Ronde River)**



### *Subwatershed 6 Ladd Creek Lower Catherine Creek*



## Demand Summary

This subwatershed is 142,260 acres in area.

This subwatershed includes the Cities of La Grande and Cove and has 110 AF per year municipal surface water demand and 5,500 AF per year of groundwater demand. Future demand is estimated to increase to 460 AF per year for surface water demand and 8,870 AF per year for groundwater municipal demand.

The total agricultural demand for this subwatershed includes 50,810 acres that have primary water rights. The total surface water demand is 96,350 AF per year and 41,770 AF per year for groundwater (based on ET values). Future demand is estimated to increase to 141,510 AF per year for surface water and 61,360 AF per year for groundwater (based on ET values).

The total instream demand is 57,550 AF per year. It does not include any water rights, but there is demand for instream flow based on Oregon Department of Fish and Wildlife area studies as described in Section 5, Instream Needs/Demands.

On an annual basis, there appears to be a deficit of surface water and surplus of groundwater. The deficit is most significant during late summer and fall on a bi-weekly basis.

Catherine Creek, State Ditch, and the Grande Ronde River are designated for recreation (swimming, fishing, boating) but high aquatic weeds, algae, and pH levels in the summer make it unsafe for people to recreate in the water. Reductions in nutrient inputs would improve the quality of water for recreation.

Catherine Creek, State Ditch, and the Grande Ronde River are also designated for use by fish and aquatic life. These uses are impacted by high summertime phosphorous levels, sedimentation, summer stream temperatures, summertime pH, low summer flows that limit migration and holding, lack of complex habitat, lack of pool frequency, and lack of large woody material. Reductions in nutrient and sediment inputs; reconnecting the floodplain by restoring meanders; and restoring riparian vegetation to buffer nutrient and sediment inputs and provide food, shade, and habitat would be beneficial for aquatic life. The actions may also need to occur in upstream subwatersheds to result in quality improvements to the Grande Ronde River reach in this subwatershed.

Mill Creek is designated for recreation, but the high summertime concentrations of *E. coli* make it unsafe for people to have contact with the water.

## Vulnerability Summary

### *Overall*

The risk of conflicting demands in this subwatershed is **high** due to late season pressure on groundwater and surface water supplies. Potential areas for improvement are finding ways to improve irrigation efficiency and store water for late season demands and working on the

Beaver Creek reservoir (located in Subwatershed 4) to make it available as a drinking water supply source for the City of La Grande.

### *Agriculture*

This subwatershed has a **high** risk of vulnerability now and in the future, as it is the highest irrigation demand subwatershed and typically exceeds supply for a large portion of the irrigation season. This subwatershed also has the highest level of groundwater withdrawal in the basin, and due to the uncertainty of supply, has a moderate risk of unsustainable withdrawal now and in the future.

### *Municipal*

La Grande, a portion of Island City, and the City of Cove are all located in subwatershed 6, as well as many SSIU surface and groundwater rights. Approximately 32 percent of the rural residential groundwater use is within the subwatershed. This municipal system appears to be at a **moderate** risk for vulnerabilities.

### *Instream*

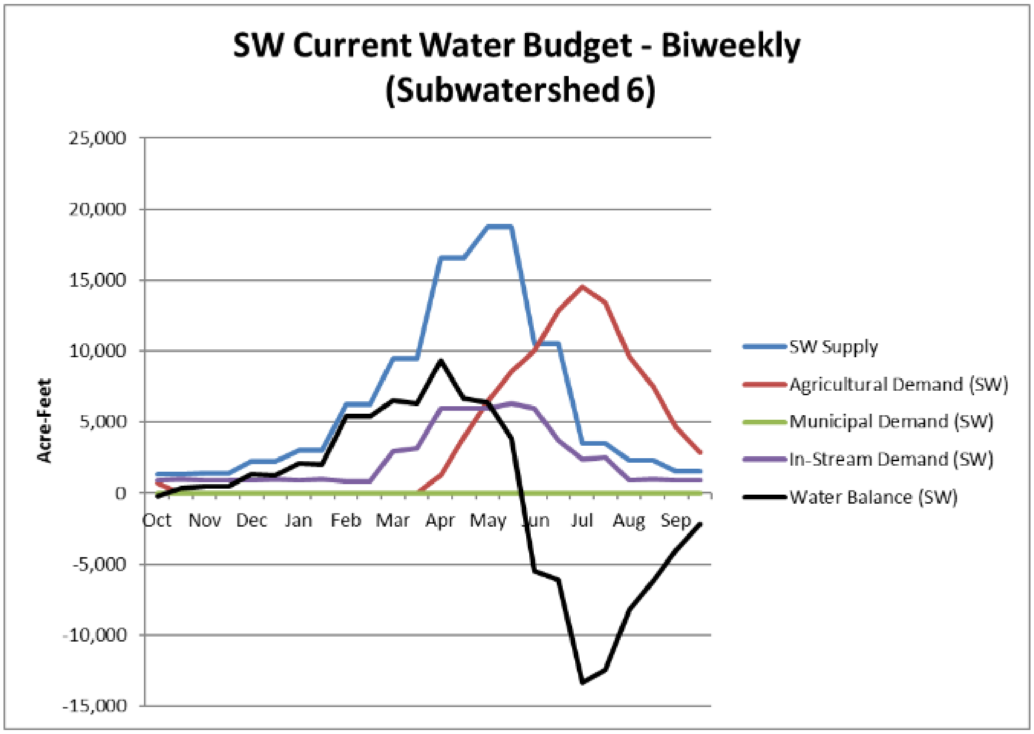
Subwatershed 6 has **very high** risk vulnerability for instream demand. Conditions in this watershed (and subwatershed 7) are the most severe of all. While total water supply at the pour point indicates that abundant water is available, there are seasonal vulnerabilities. Current conditions will worsen in the future due to climate change. There is a significant amount of out-of-stream use in this subwatershed so magnitude is **high** given that significant changes would need to occur to meet instream demand. Fish habitat in the subwatershed is used for spawning, rearing and migration.

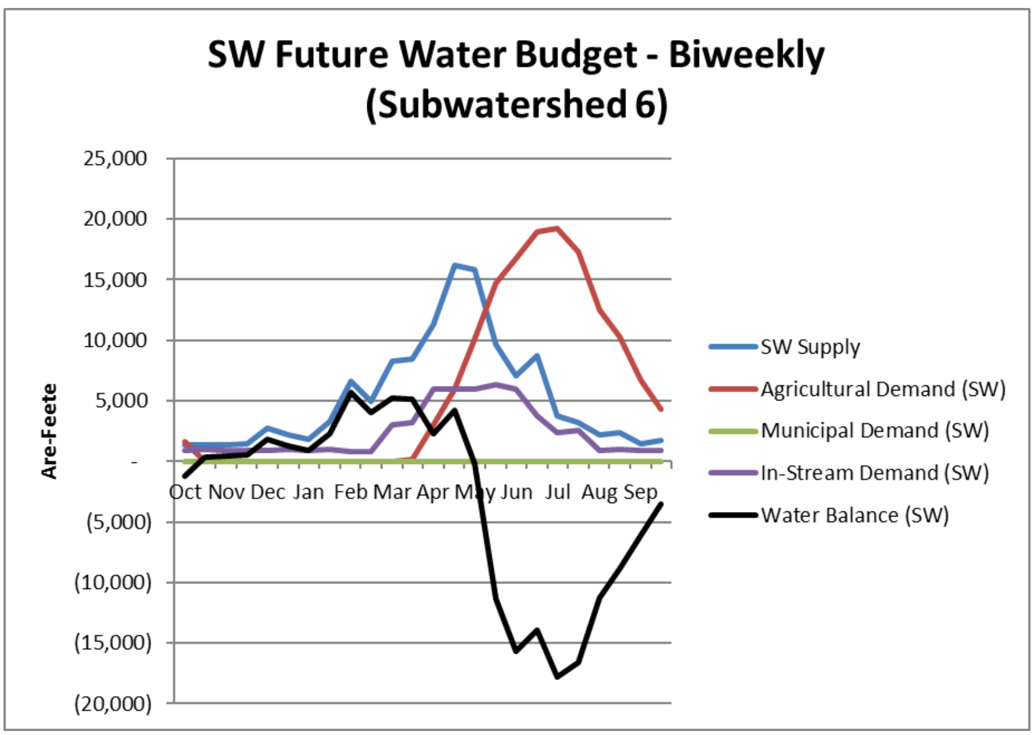
### *Water Quality*

Subwatershed 6 (Ladd Creek/Lower Catherine Creek) has a **high** risk of impact from water quality impairments caused by water withdrawals in the subwatershed and upstream. Significant changes in practices and/or efficiencies in water use will be needed to address the water quality impairments.

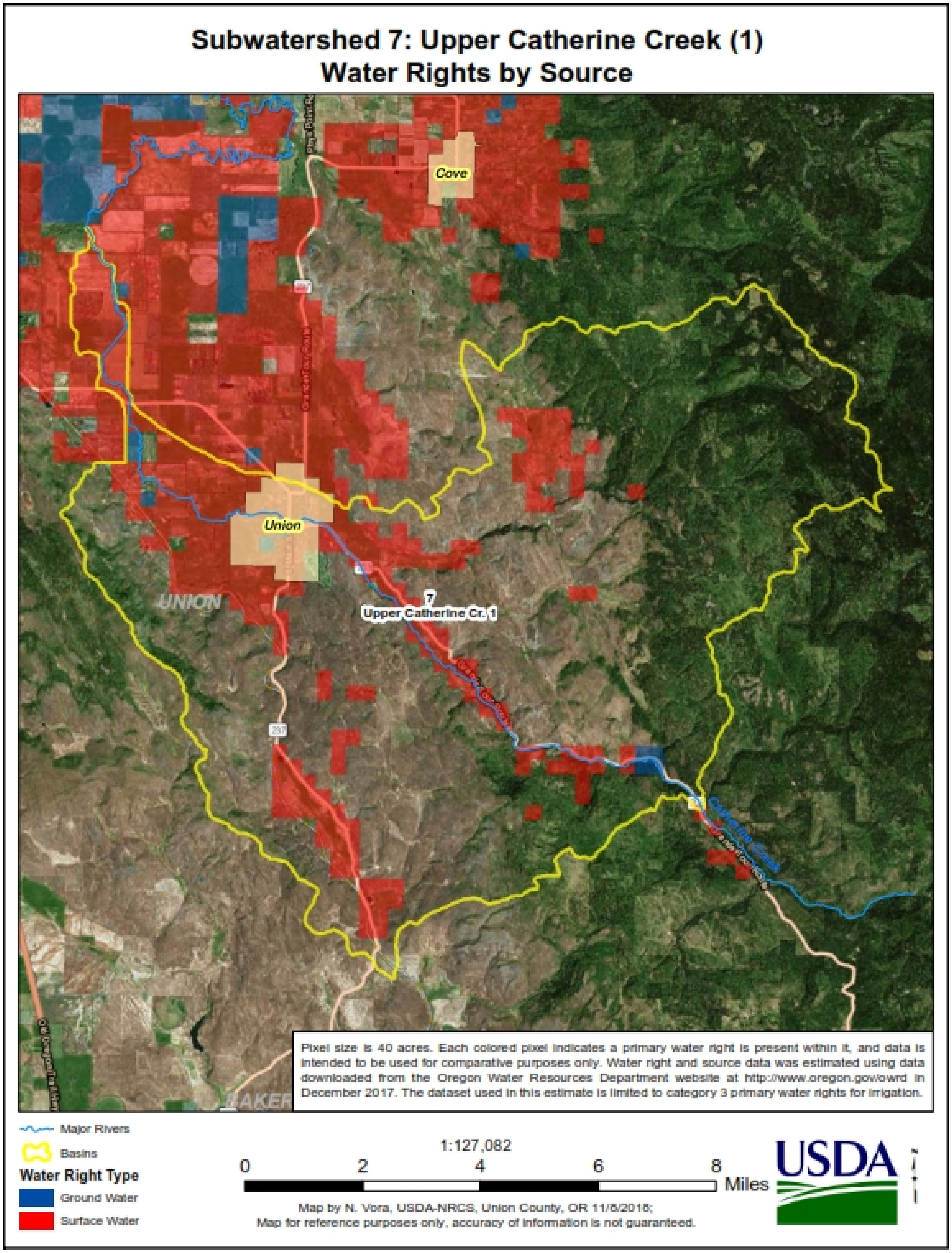
The water balance for this subwatershed is presented on Figure 7-6.

**Figure 7-6**
**Surface Water Budget - Bi-weekly (Subwatershed 6 - Ladd Creek Lower Catherine)**



## *Subwatershed 7 Upper Catherine Creek 1*



## Demand Summary

This subwatershed is 55,490 acres in area.

This subwatershed includes the City of Union and has no municipal surface water demand and 369 AF per year of groundwater demand. The City of Union has surface water rights for municipal use, they are not currently used but could be in the future. There is one municipal surface water right that is potentially available for stockwater. Future demand is estimated to increase to 2,550 AF per year for municipal demand. The OWRD watermaster indicated that this increase is likely to be too high; however, this value is used for consistency in this report.

The total agricultural demand for this subwatershed includes 8,190 acres have of primary irrigation water rights). The total surface water demand is 24,870 AF per year and 550 AF per year for groundwater (based on ET values). Future demand is estimated to increase to 36,530 AF per year for surface water and 810 AF per year for groundwater (based on ET values).

The total instream demand is 57,550 AF per year.

On an annual basis, there is a surplus of surface water and groundwater.

Catherine Creek is designated by the DEQ for bull trout use but summer stream temperatures are too high to adequately support bull trout

## Vulnerability Summary

### *Overall*

The risk of conflicting demands in this subwatershed is **high** due to consistent demand on groundwater and surface water supplies. Potential areas for improvement are finding ways to improve irrigation efficiency.

### *Agriculture*

This subwatershed has a **high** risk of vulnerability now and in the future, as it typically exceeds supply for a large portion of the irrigation season.

### *Municipal*

The City of Union is within subwatershed 7, and several small SSIU rights, but just 6 percent of rural residential well use is located within the subwatershed. This municipal system appears to be at a **low** risk for vulnerabilities.

### *Instream*

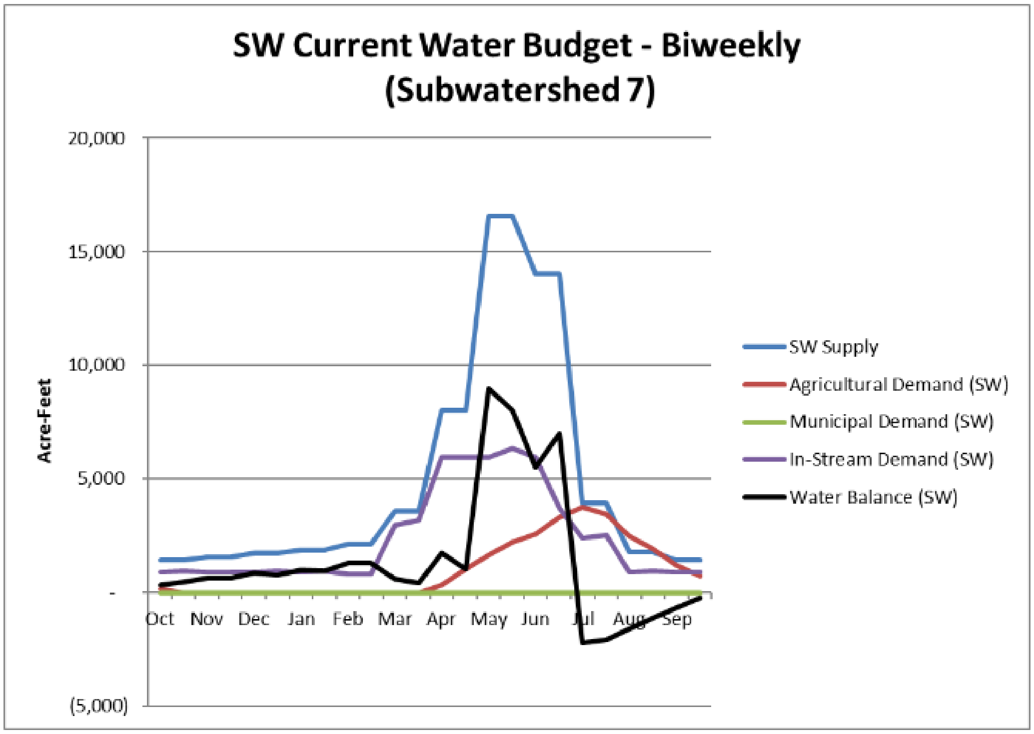
Subwatershed 7 has **very high** risk vulnerability for instream demand. Conditions in this subwatershed (and subwatershed 6) are the most severe of all. While total water supply at the pour point indicates that abundant water is available, there are seasonal vulnerabilities. Current conditions will worsen in the future due to climate change. There is a significant amount of out-of-stream use in this subwatershed so magnitude is **high** given that significant changes would need to occur to meet instream demand. Fish habitat in the subwatershed is used for spawning, rearing and migration.

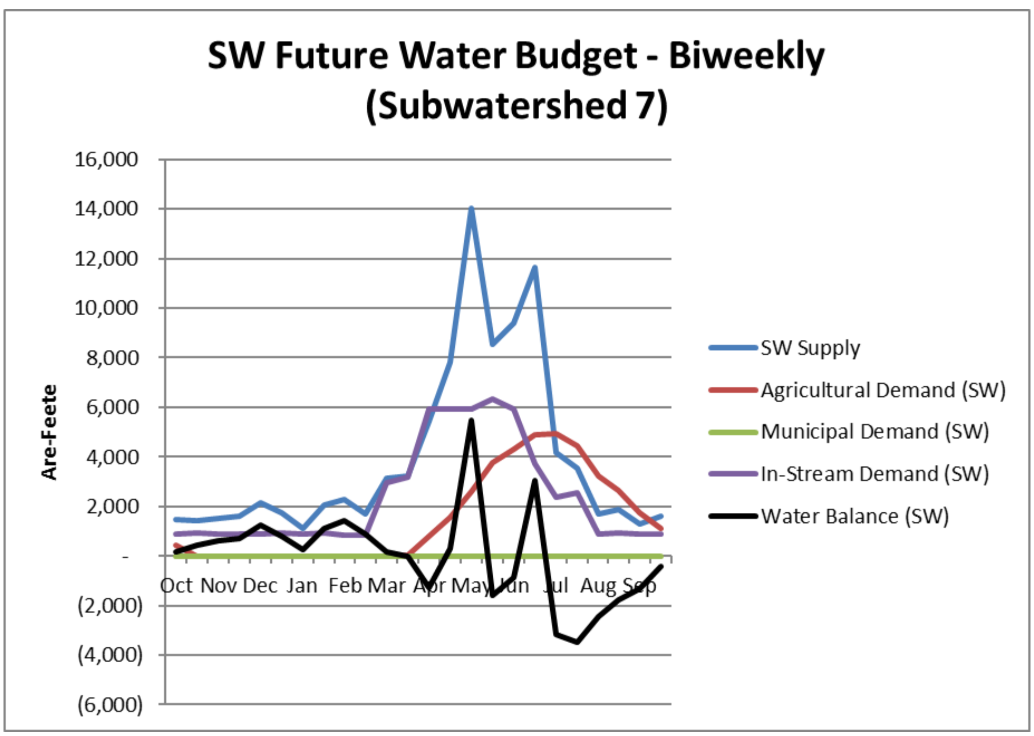
### *Water Quality*

Subwatershed 7 has a **moderate** risk of impact from water quality impairments caused by water withdrawals and land management methods in the subwatershed and upstream. Changes in practices and/or efficiencies in water use have been employed to address water quality impairments.

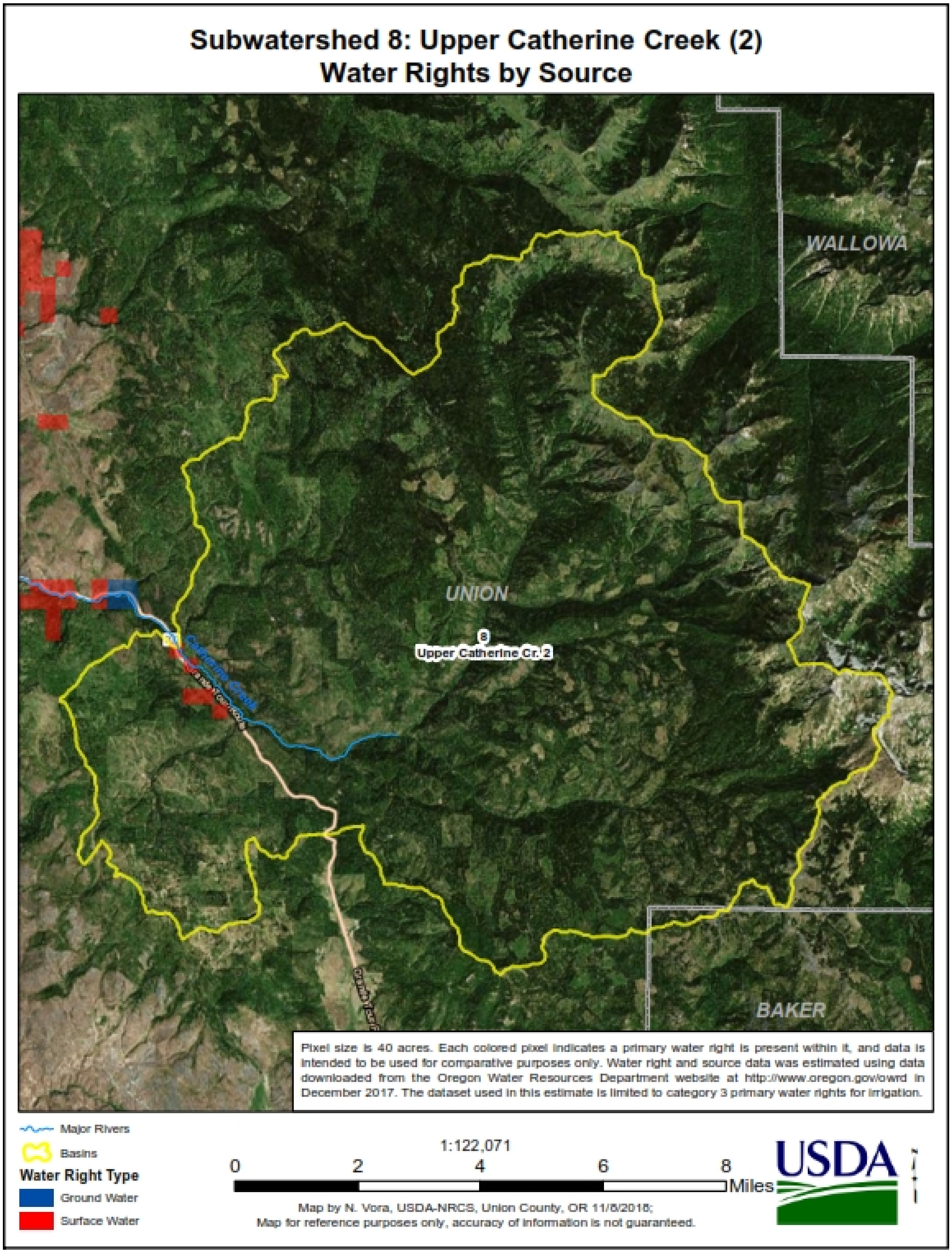
The water balance for this subwatershed is presented on Figure 7-7.

**Figure 7-7**
**Surface Water Budget - Bi-weekly (Subwatershed 7 - Upper Catherine Creek 1)**



### *Subwatershed 8 Upper Catherine Creek 2*



## Demand Summary

This subwatershed is 61,820 acres in area.

This subwatershed has no cities and municipal demand is 0 AF per year for surface water demand and 10 AF per year for groundwater demand.

The total agricultural demand for this subwatershed is 120 acres that have primary irrigation water rights. The total surface water demand is 470 AF per year and 0 AF per year for groundwater (based on ET values). Future demand is estimated to increase to 690 AF per year for surface water and 0 AF per year for groundwater (based on ET values).

The total instream demand is 32,500 AF per year.

On an annual basis, there is a surplus of surface water and slight deficit of groundwater. There is a slight deficit of surface water on a bi-weekly basis during August through November.

Catherine Creek is designated for bull trout use but summer stream temperatures are too high to adequately support bull trout. Sedimentation is also a detriment to fish habitat in South Fork Catherine Creek, North Fork Catherine Creek, and Little Catherine Creek.

## Vulnerability Summary

### *Overall*

The risk of conflicting demands in this subwatershed is **low,** although there is some late season pressure on surface water supplies. Potential areas for improvement are finding ways to improve irrigation efficiency and improve instream habitat.

### *Agriculture*

This subwatershed has a **low** risk vulnerability for agricultural demand as there is very little agricultural area in this subwatershed.

### *Municipal*

There are no cities, no SSIU rights, and just 1 percent of rural residential use in the subwatershed. This municipal system appears to be at a **low** risk for vulnerabilities.

### *Instream*

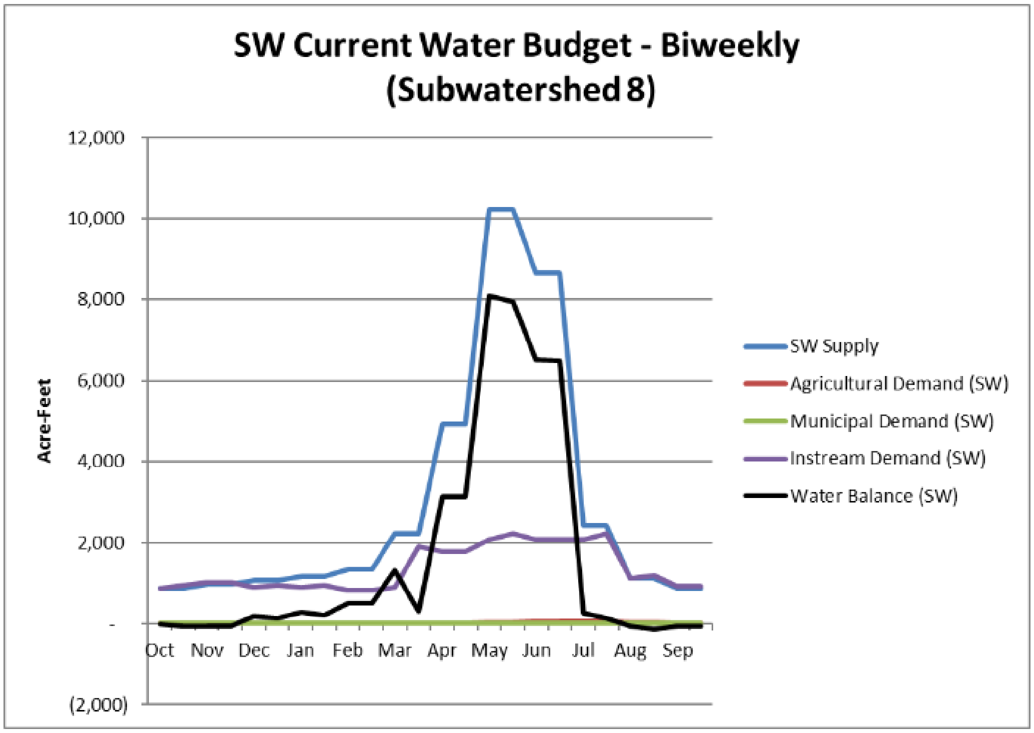
Subwatershed 8 has **high** risk vulnerability for instream demand. While total water supply at the pour point indicates that abundant water is available, there are seasonal vulnerabilities as shown by water availability analysis for ISWR's on tributary streams, including mainstem Catherine, Little Catherine, and South Fork Catherine Creeks. Current conditions will worsen in the future due to climate change. There is limited amount of out-of-stream use in this subwatershed so magnitude is **low**. Fish habitat in the subwatershed is used for spawning, rearing and migration.

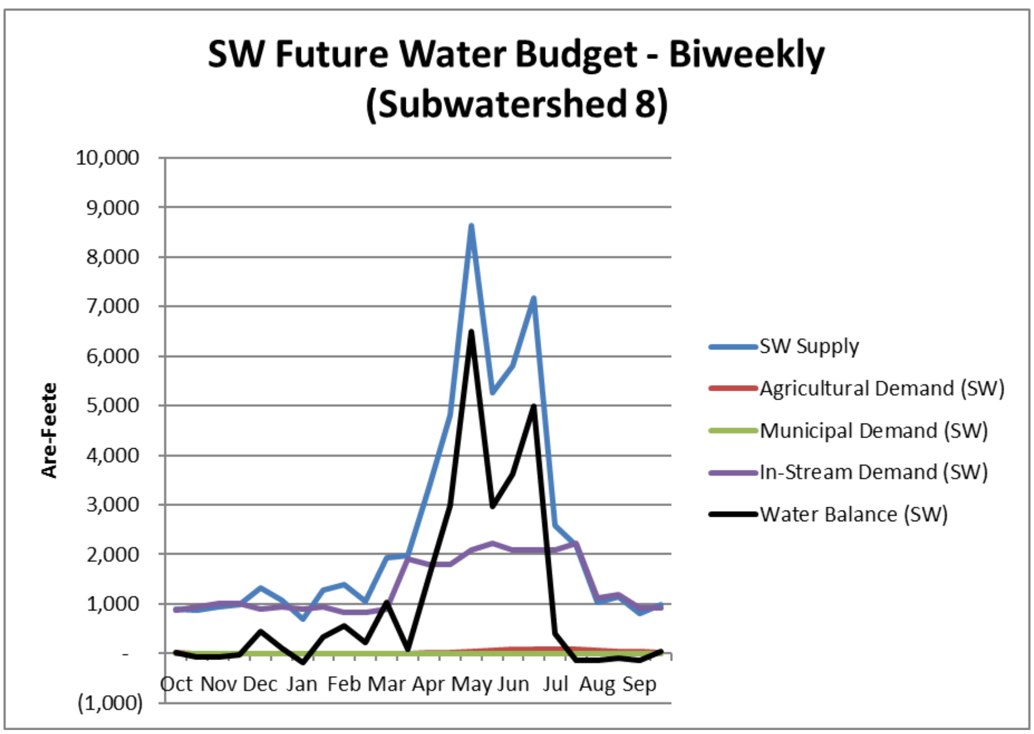
### *Water Quality*

Subwatershed 8 (Upper Catherine Creek 2) has a **low** risk of impact from water quality impairments. Changes in land use practices may be needed to address climate change impacts.

The water balance for this subwatershed is presented on Figure 7-8.

**Figure 7-8**
**Surface Water Budget - Bi-weekly (Subwatershed 8 - Upper Catherine Creek 2)**



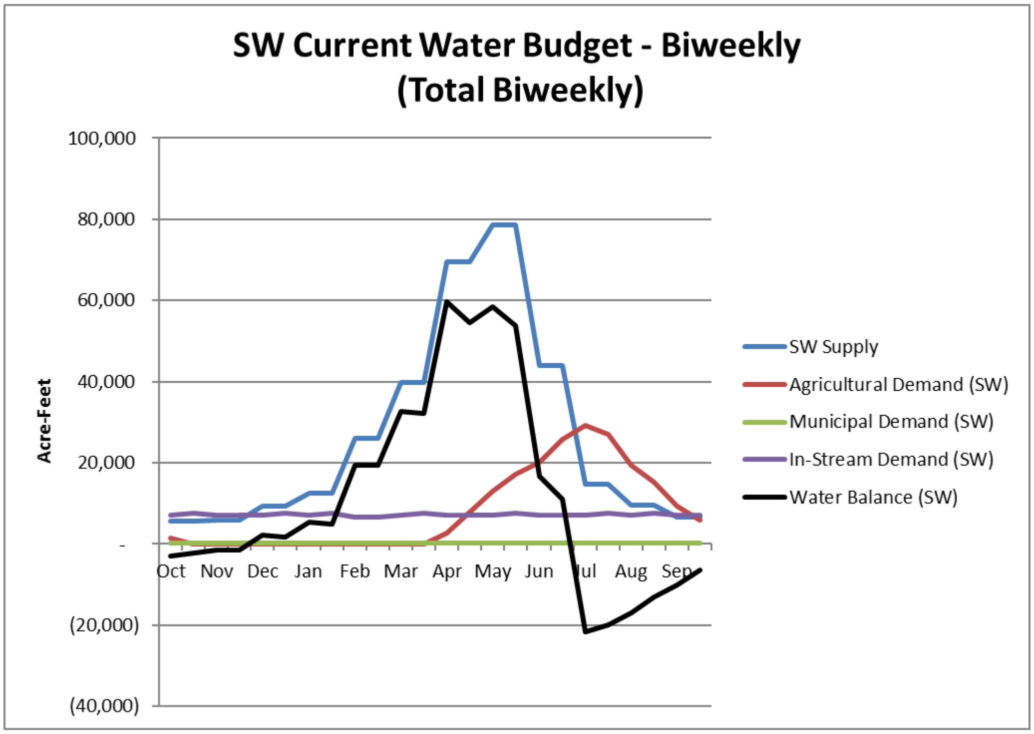



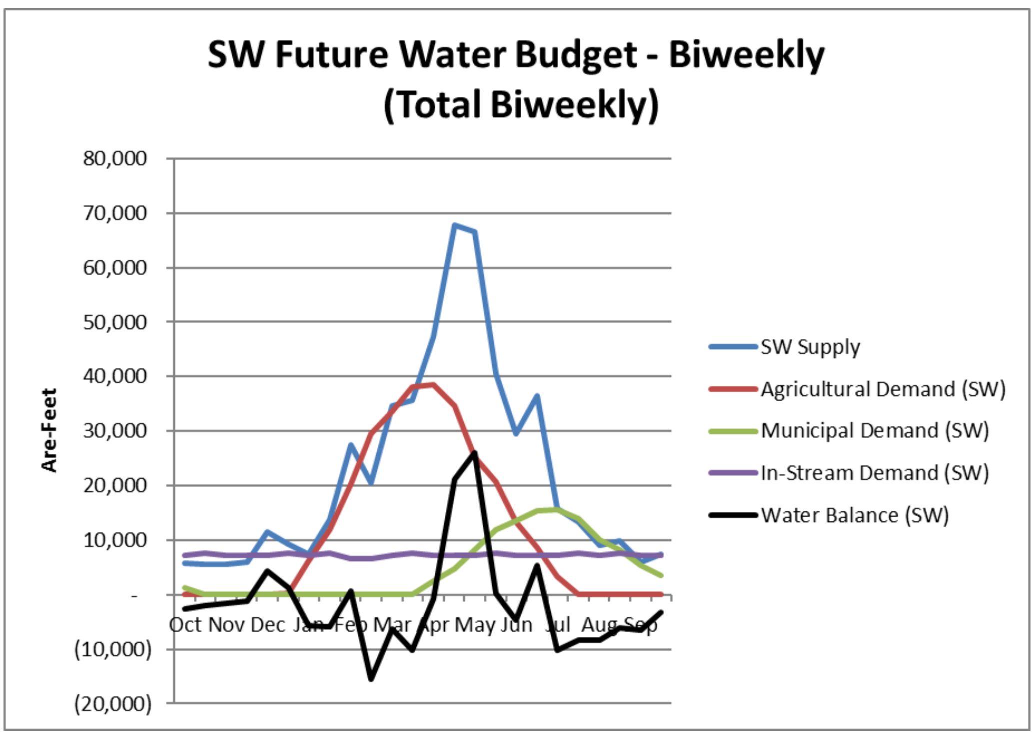
## Total Bi-weekly Summary

Figure 7-9 shows the total bi-weekly summaries for both current and future surface water demand.

Currently, there is a water surplus from February through May, and a deficit for the rest of the months. Based on these assumptions, in the future, there appears to be a deficit for all months. There could be a large shift in current versus future timing for water demand in agriculture. Based on temperature and precipitation changes there could be a shift in demand to approximately 3 months earlier in the future. This shift in demand is not evident for other demand categories because instream demand is based only on water rights and is not showing an increase in the future, although this may be underpredicting needs.

**Figure 7-9**
**Total Bi-weekly Water Budget Summary**



## Conclusion and Next Steps

Generally, areas of highest agricultural use will have the greatest potential for surface water demand conflicts because agricultural use is the highest percentage of water use in the UGRRW. Groundwater demand may not have high conflict potential if pumping rates are held constant; however, there is significant uncertainty in groundwater supply data. Stream segments with ISWR are protected and restoration opportunities exist in many areas. Municipal systems appear to have the lowest vulnerabilities of the three demand groups. See Table 7-10, below, for a summary of these demands.

**Table 7-10**
**Water Demand Vulnerabilities by Subwatershed**

| Name | Overall | Agricultural | Municipal | Instream | Water Quality |
|---|---|---|---|---|---|
| 1 Lookingglass Creek/Cabin Creek | Low | Low | Low | High | High |
| 2 Willow Creek/Indian Creek | Moderate | High | Low | High | High |
| 3 Lower Five Points Creek | Moderate | High | Low | High | High |
| 4 Beaver Creek, Upper Five Points Creek | Moderate | Low | Low | High | Moderate |
| 5 Meadow Creek Upper Grande Ronde River | Low | Low | Low | High | Low |
| 6 Ladd Creek Lower Catherine | High | High | Moderate | High | High |
| 7 Upper Catherine Creek 1 | High | High | Low | High | Moderate |
| 8 Upper Catherine Creek 2 | Low | Low | Low | High | Low |

These vulnerabilities will be further analyzed in Step 4 and the UGRRW Partnership will explore ways to improve conditions for all demand groups.

# 8.0 - Public Participation and Outreach

This section provides an overview of the total number of meetings held (broken down by work group/ committee), workshops/field trips held, associated conferences attended, and a web link to an archive of the meeting notes. It took hundreds of person hours to develop this report, with representation and participation from more than 20 diverse water interests. Meetings were publicized through newspaper advertisements, radio interviews, and on the Union County website. Project progress was presented at several meetings throughout the area.

## Step 1 Meetings

- March 22, 2016
- June 29, 2016
- June 30, 2016
- August 4, 2016
- August 30, 2016 - Steering Committee Kickoff
- September 6, 2016
- September 20, 2016 - Steering Committee Meeting
- October 6, 2016 - Stakeholder Committee Meeting
- October 18, 2016 - Steering Committee Meeting
- November 2, 2016 - Stakeholder Committee Meeting
- November 29, 2016 - Steering Committee Meeting

## Step 2 Meetings

- January 10, 2017 - Water Supply Technical Committee No. 1
- January 11, 2017 - Steering Committee Meeting
- January 24, 2017 - Water Supply Technical Committee No. 2
- February 21, 2017 - Water Supply Technical Committee No. 3
- February 22, 2017 - Stakeholder Committee Meeting No. 4
- March 14, 2017 - Water Supply Technical Committee No. 4
- March 16, 2017 - Steering Committee Meeting
- April 3, 2017 - Water Supply Technical Meeting and Steering Committee Meeting
- April 12, 2017 - Stakeholder Committee Meeting No. 5
- May 24 through 25, 2017 - Bend Meeting
- June 6, 2017 - Water Supply Technical Committee Meeting No. 6

- June 21, 2017 - Stakeholder Committee Meeting No. 6
- July 28, 2017 - Field trip
- August 8, 2017 - Technical Committee Meeting No. 7 and Steering Committee
- August 30, 2017 - Water Supply Technical Committee and Steering Committee Meeting
- September 6, 2017 - Stakeholder Meeting

## Step 3 Meetings

- September 19, 2017 - Technical and Steering Committee Meeting
- October 10, 2017 - Technical Committee Meeting
- October 25, 2017 - Technical and Steering Committee Meeting
- October 31, 2017 - Agricultural Work Group Meeting
- November 6, 2017 - Instream Work Group Meeting
- November 8, 2017 - Stakeholder Committee Meeting No. 9
- November 21, 2017 - Technical Committee Meeting
- December 13, 2017 - Natural Hazards Work Group Meeting
- December 14, 2017 - Agricultural Work Group Meeting
- January 8, 2018 - Agricultural Work Group Meeting
- January 16, 2018 - Stakeholder Committee Meeting No. 10
- January 23, 2018 - Technical Committee Meeting
- February 7, 2018 - Stakeholder Committee Meeting No. 11
- February 14, 2018 - Agricultural Work Group Meeting
- February 20, 2018 - Technical Committee Meeting
- March 13, 2018 - Stakeholder Committee Meeting No. 12
- April 18, 2018 - Stakeholder Meeting No. 13
- August 15, 2018 - Stakeholder Meeting No. 14
- September 17, 2018 - Technical Committee Meeting
- September 19, 2018 - Stakeholder Committee Meeting No. 15
- October 24, 2018 - Steering Committee Meeting
- October 25, 2018 - Technical Committee Meeting
- November 8, 2018 - Stakeholder Meeting and Field Trip No. 16
- December 21, 2018 - Technical Committee Meeting

- January 16, 2019 - Stakeholder Meeting No. 17
- March 20, 2019 - Stakeholder Meeting No.

Meeting materials and notes are available at: http://union-county.org/planning/place-based-integrated-water-resources-planning/

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# APPENDIX A
## Municipal Demand Calculations

The figures below show the variability in each water year for each city. All units are in Acre-feet.

**Figure 3-10**
**La Grande Water Demand**

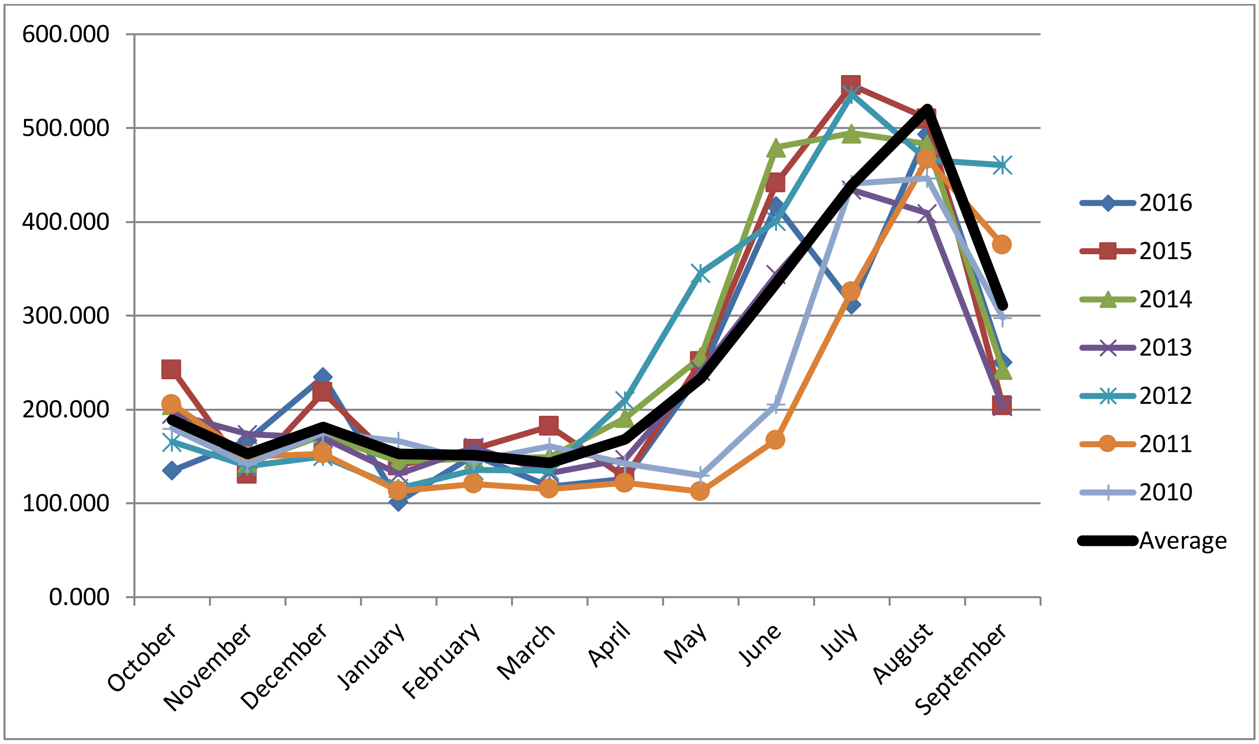



**Figure 3-11**
**Elgin Water Demand**

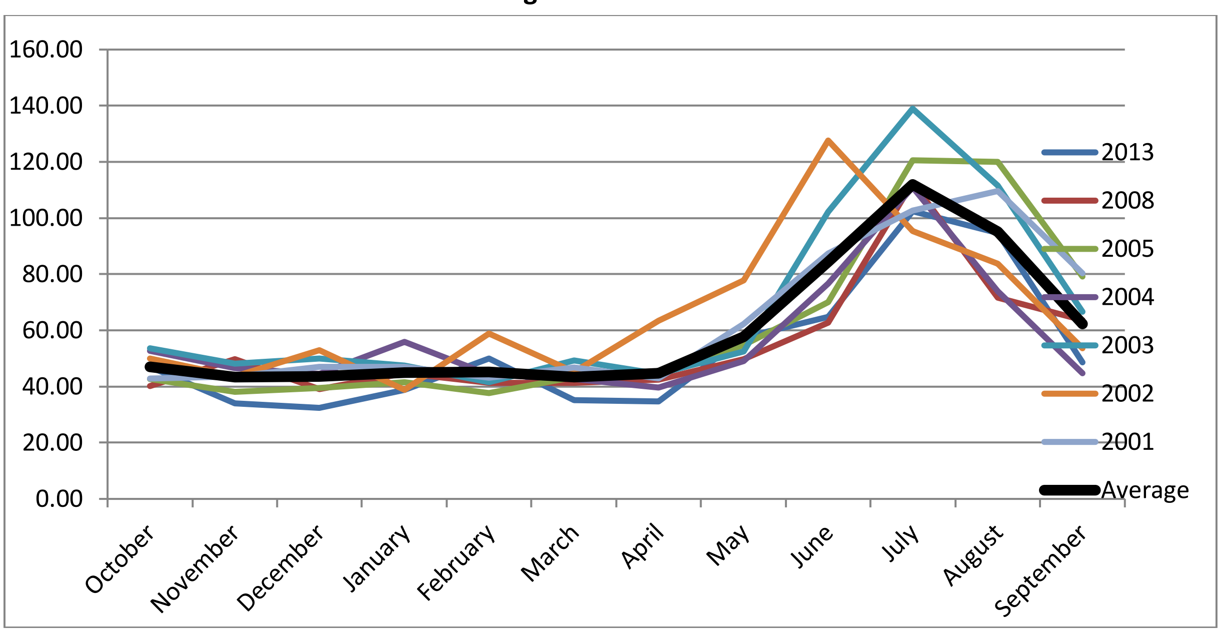



**Figure 3-12**
**Imbler Water Demand**

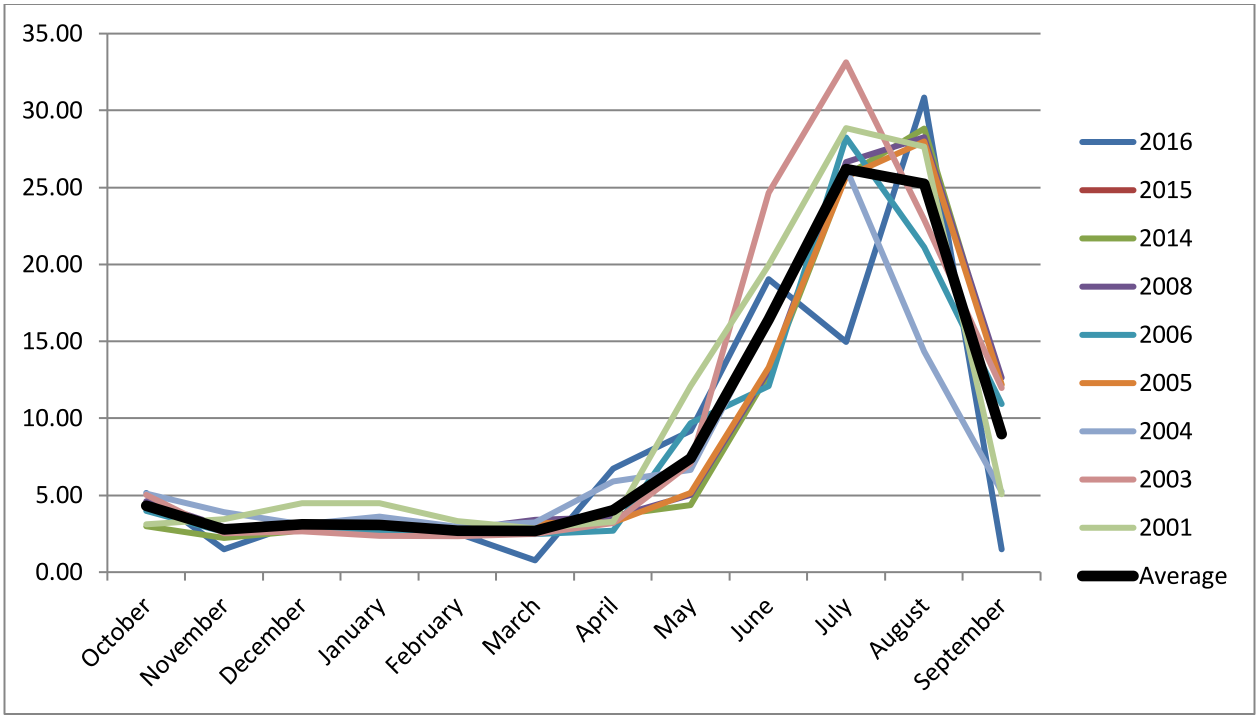



**Figure 3-13**
**Cove Water Demand**

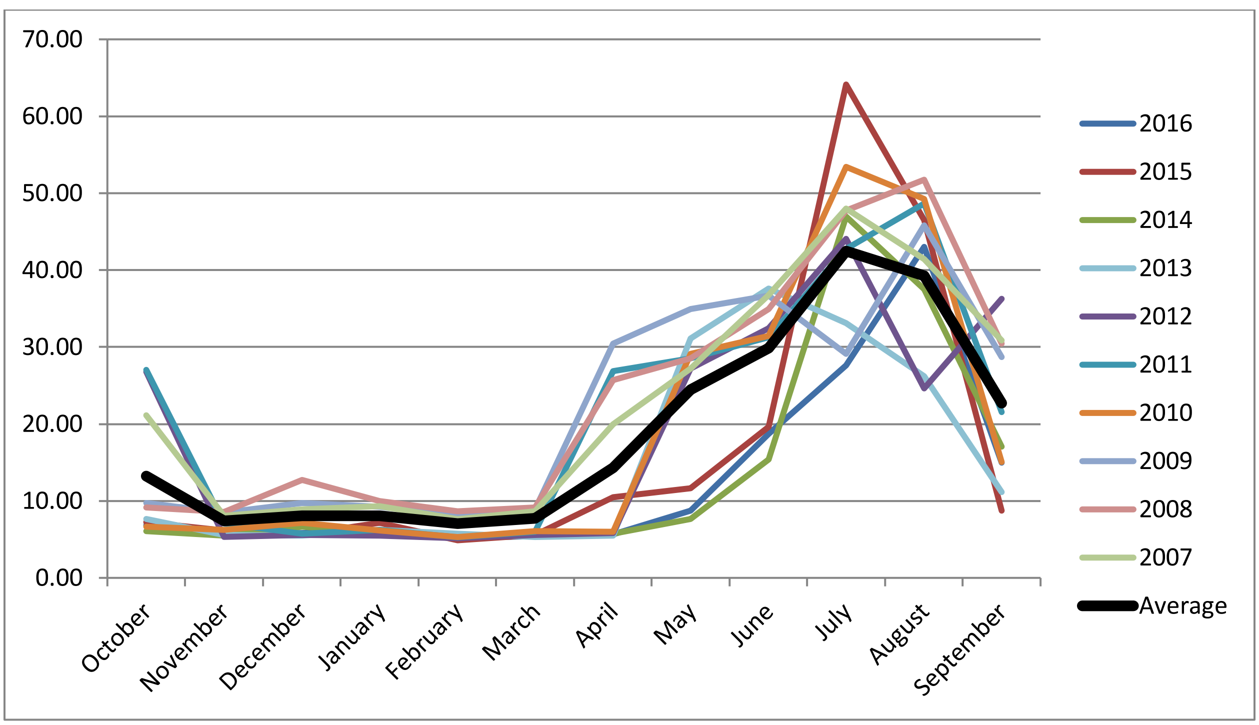



**Figure 3-14**
**Union Water Demand**

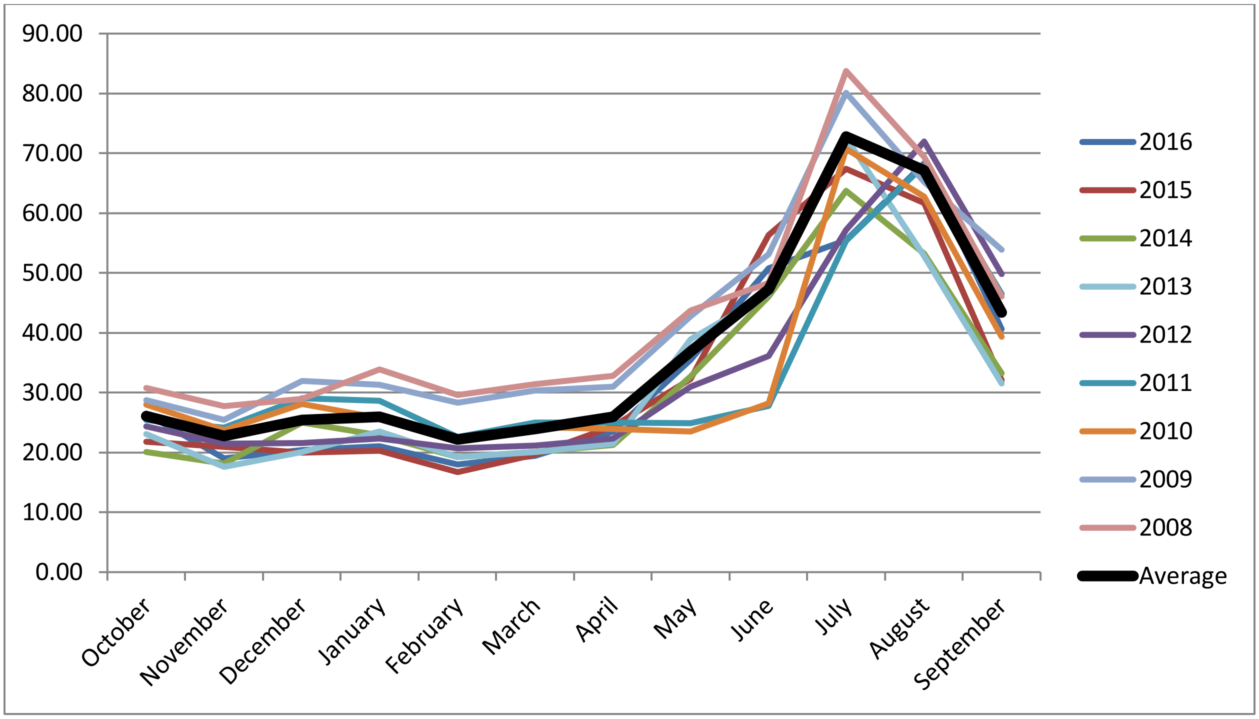
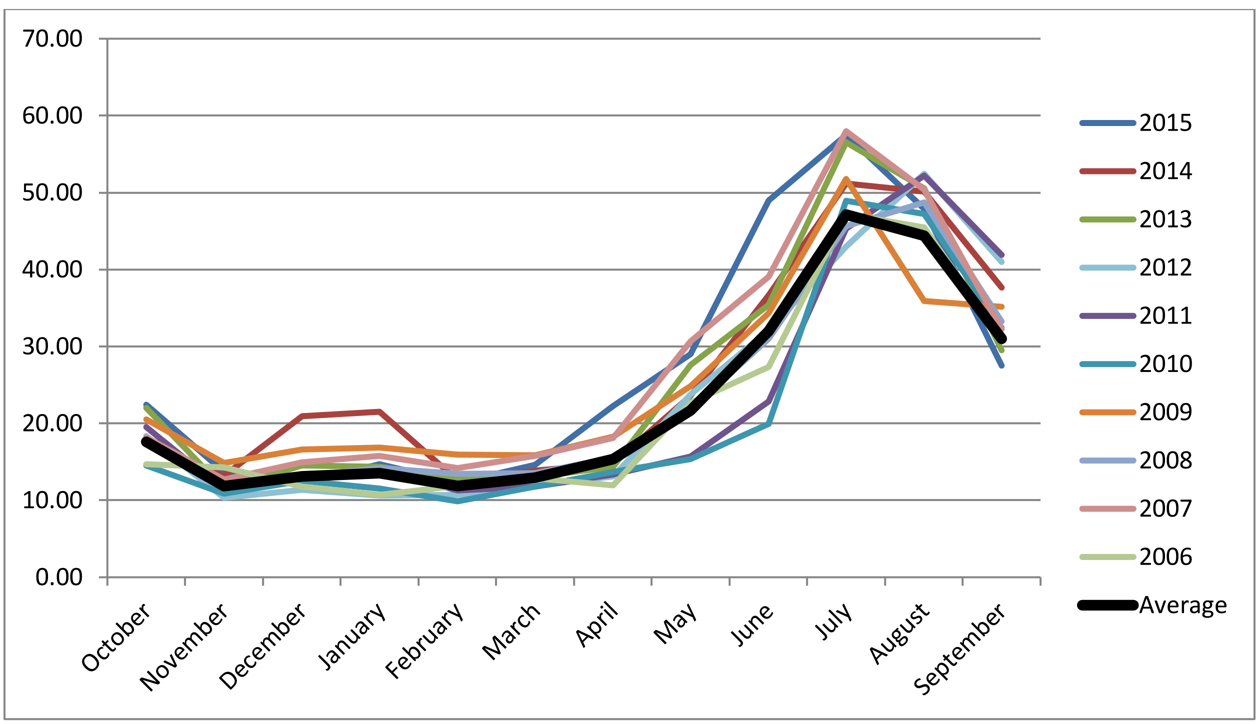



**Figure 3-15**
**Island City Water Demand**

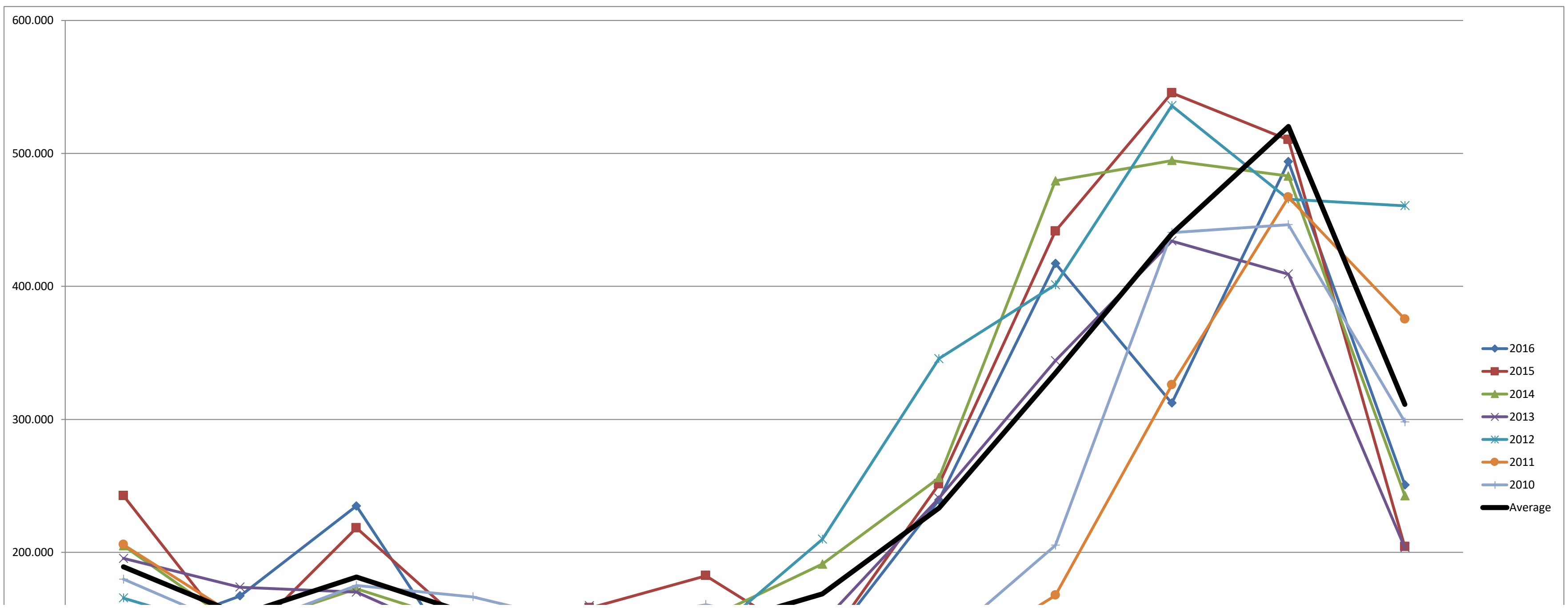


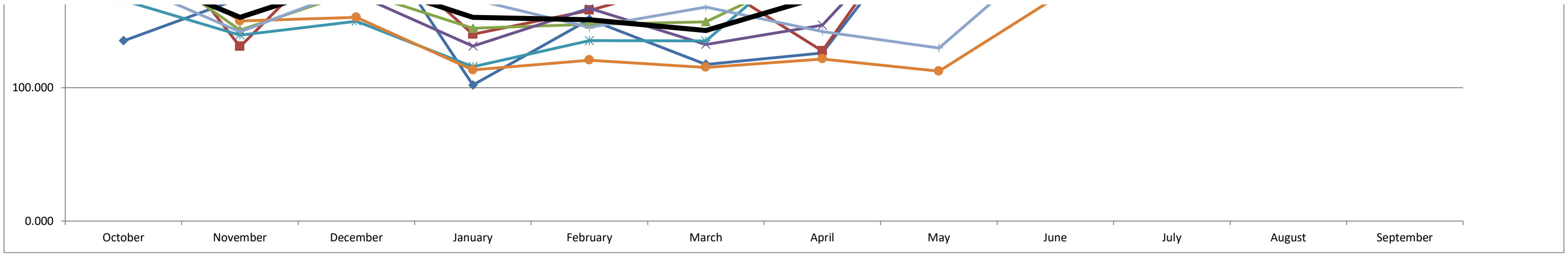
| Current GW | | 1 | | | | 2 | | | | 3 | | | | 4 | | | | 5 | | | | 6 | | | | 7 | | | | 8 | | | | bi-weekly total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Municipal | Day | Municipal Demand Ground Water | Unincorporated Demand | SSIU Demand | Total | Municipal Demand Ground Water | Unincorporated Demand | SSIU Demand | Total | Municipal Demand Ground Water | Unincorporated Demand | SSIU Demand | Total | Municipal Demand Ground Water | Unincorporated Demand | SSIU Demand | Total | Municipal Demand Ground Water | Unincorporated Demand | SSIU Demand | Total | Municipal Demand Ground Water | Unincorporated Demand | SSIU Demand | Total | Municipal Demand Ground Water | Unincorporated Demand | SSIU Demand | Total | Municipal Demand Ground Water | Unincorporated Demand | SSIU Demand | Total | Municipal Demand Ground Water | Unincorporated Demand | SSIU Demand | Total |
| Oct | 1st to 15th | 11.8 | 7.3 | 9.0 | 28.0 | 13.9 | 10.9 | 0.0 | 24.8 | 0.0 | 8.1 | 10.2 | 18.3 | 0.0 | 2.9 | 2.7 | 5.6 | 0.0 | 1.5 | 0.0 | 1.5 | 125.3 | 15.9 | 43.2 | 184.3 | 6.5 | 3.0 | 2.3 | 11.8 | 0.0 | 0.4 | 0.0 | 0.4 | | | | 274.9 |
| | 16th to 31st | 11.8 | 7.3 | 9.0 | 28.0 | 13.9 | 10.9 | 0.0 | 24.8 | 0.0 | 8.1 | 10.2 | 18.3 | 0.0 | 2.9 | 2.7 | 5.6 | 0.0 | 1.5 | 0.0 | 1.5 | 125.3 | 15.9 | 43.2 | 184.3 | 6.5 | 3.0 | 2.3 | 11.8 | 0.0 | 0.4 | 0.0 | 0.4 | | | | 274.9 |
| Nov | 1st to 15th | 10.9 | 5.9 | 9.0 | 25.7 | 12.2 | 8.7 | 0.0 | 21.0 | 0.0 | 6.5 | 10.2 | 16.7 | 0.0 | 2.3 | 2.7 | 5.0 | 0.0 | 1.2 | 0.0 | 1.2 | 97.7 | 12.7 | 43.2 | 153.6 | 5.7 | 2.4 | 2.3 | 10.4 | 0.0 | 0.3 | 0.0 | 0.3 | | | | 233.9 |
| | 16th to 30th | 10.9 | 5.9 | 9.0 | 25.7 | 12.2 | 8.7 | 0.0 | 21.0 | 0.0 | 6.5 | 10.2 | 16.7 | 0.0 | 2.3 | 2.7 | 5.0 | 0.0 | 1.2 | 0.0 | 1.2 | 97.7 | 12.7 | 43.2 | 153.6 | 5.7 | 2.4 | 2.3 | 10.4 | 0.0 | 0.3 | 0.0 | 0.3 | | | | 233.9 |
| Dec | 1st to 15th | 10.9 | 5.9 | 9.0 | 25.7 | 12.5 | 8.7 | 0.0 | 21.2 | 0.0 | 6.5 | 10.2 | 16.7 | 0.0 | 2.3 | 2.7 | 5.0 | 0.0 | 1.2 | 0.0 | 1.2 | 114.2 | 12.7 | 43.2 | 170.1 | 6.4 | 2.4 | 2.3 | 11.1 | 0.0 | 0.3 | 0.0 | 0.3 | | | | 251.3 |
| | 16th to 31st | 10.9 | 5.9 | 9.0 | 25.7 | 12.5 | 8.7 | 0.0 | 21.2 | 0.0 | 6.5 | 10.2 | 16.7 | 0.0 | 2.3 | 2.7 | 5.0 | 0.0 | 1.2 | 0.0 | 1.2 | 114.2 | 12.7 | 43.2 | 170.1 | 6.4 | 2.4 | 2.3 | 11.1 | 0.0 | 0.3 | 0.0 | 0.3 | | | | 251.3 |
| Jan | 1st to 15th | 11.2 | 5.9 | 9.0 | 26.0 | 12.8 | 8.7 | 0.0 | 21.5 | 0.0 | 6.5 | 10.2 | 16.7 | 0.0 | 2.3 | 2.7 | 5.0 | 0.0 | 1.2 | 0.0 | 1.2 | 100.5 | 12.7 | 43.2 | 156.4 | 6.5 | 2.4 | 2.3 | 11.2 | 0.0 | 0.3 | 0.0 | 0.3 | | | | 238.4 |
| | 16th to 31st | 11.2 | 5.9 | 9.0 | 26.0 | 12.8 | 8.7 | 0.0 | 21.5 | 0.0 | 6.5 | 10.2 | 16.7 | 0.0 | 2.3 | 2.7 | 5.0 | 0.0 | 1.2 | 0.0 | 1.2 | 100.5 | 12.7 | 43.2 | 156.4 | 6.5 | 2.4 | 2.3 | 11.2 | 0.0 | 0.3 | 0.0 | 0.3 | | | | 238.4 |
| Feb | 1st to 15th | 11.3 | 5.9 | 9.0 | 26.1 | 12.7 | 8.7 | 0.0 | 21.4 | 0.0 | 6.5 | 10.2 | 16.7 | 0.0 | 2.3 | 2.7 | 5.0 | 0.0 | 1.2 | 0.0 | 1.2 | 96.4 | 12.7 | 43.2 | 152.3 | 5.5 | 2.4 | 2.3 | 10.3 | 0.0 | 0.3 | 0.0 | 0.3 | | | | 233.3 |
| | 16th to 28th | 11.3 | 5.9 | 9.0 | 26.1 | 12.7 | 8.7 | 0.0 | 21.4 | 0.0 | 6.5 | 10.2 | 16.7 | 0.0 | 2.3 | 2.7 | 5.0 | 0.0 | 1.2 | 0.0 | 1.2 | 96.4 | 12.7 | 43.2 | 152.3 | 5.5 | 2.4 | 2.3 | 10.3 | 0.0 | 0.3 | 0.0 | 0.3 | | | | 233.3 |
| Mar | 1st to 15th | 10.8 | 6.2 | 9.0 | 26.0 | 12.2 | 9.3 | 0.0 | 21.5 | 0.0 | 6.9 | 10.2 | 17.1 | 0.0 | 2.4 | 2.7 | 5.2 | 0.0 | 1.3 | 0.0 | 1.3 | 94.3 | 13.5 | 43.2 | 150.9 | 6.0 | 2.6 | 2.3 | 10.8 | 0.0 | 0.3 | 0.0 | 0.3 | | | | 233.2 |
| | 16th to 31st | 10.8 | 6.2 | 9.0 | 26.0 | 12.2 | 9.3 | 0.0 | 21.5 | 0.0 | 6.9 | 10.2 | 17.1 | 0.0 | 2.4 | 2.7 | 5.2 | 0.0 | 1.3 | 0.0 | 1.3 | 94.3 | 13.5 | 43.2 | 150.9 | 6.0 | 2.6 | 2.3 | 10.8 | 0.0 | 0.3 | 0.0 | 0.3 | | | | 233.2 |
| Apr | 1st to 15th | 11.2 | 7.0 | 9.0 | 27.1 | 13.2 | 10.4 | 0.0 | 23.6 | 0.0 | 7.7 | 10.2 | 17.9 | 0.0 | 2.7 | 2.7 | 5.5 | 0.0 | 1.5 | 0.0 | 1.5 | 113.3 | 15.1 | 43.2 | 171.6 | 6.5 | 2.9 | 2.3 | 11.6 | 0.0 | 0.4 | 0.0 | 0.4 | | | | 259.0 |
| | 16th to 30th | 11.2 | 7.0 | 9.0 | 27.1 | 13.2 | 10.4 | 0.0 | 23.6 | 0.0 | 7.7 | 10.2 | 17.9 | 0.0 | 2.7 | 2.7 | 5.5 | 0.0 | 1.5 | 0.0 | 1.5 | 113.3 | 15.1 | 43.2 | 171.6 | 6.5 | 2.9 | 2.3 | 11.6 | 0.0 | 0.4 | 0.0 | 0.4 | | | | 259.0 |
| May | 1st to 15th | 14.4 | 10.3 | 9.0 | 33.6 | 18.1 | 15.3 | 0.0 | 33.4 | 0.0 | 11.3 | 10.2 | 21.5 | 0.0 | 4.0 | 2.7 | 6.8 | 0.0 | 2.1 | 0.0 | 2.1 | 159.8 | 22.2 | 43.2 | 225.1 | 9.2 | 4.2 | 2.3 | 15.7 | 0.0 | 0.5 | 0.0 | 0.5 | | | | 338.9 |
| | 16th to 31st | 14.4 | 10.3 | 9.0 | 33.6 | 18.1 | 15.3 | 0.0 | 33.4 | 0.0 | 11.3 | 10.2 | 21.5 | 0.0 | 4.0 | 2.7 | 6.8 | 0.0 | 2.1 | 0.0 | 2.1 | 159.8 | 22.2 | 43.2 | 225.1 | 9.2 | 4.2 | 2.3 | 15.7 | 0.0 | 0.5 | 0.0 | 0.5 | | | | 338.9 |
| Jun | 1st to 15th | 21.1 | 13.9 | 9.0 | 44.0 | 29.3 | 20.7 | 0.0 | 50.1 | 0.0 | 15.4 | 10.2 | 25.6 | 0.0 | 5.4 | 2.7 | 8.2 | 0.0 | 2.9 | 0.0 | 2.9 | 226.1 | 30.1 | 43.2 | 299.4 | 11.8 | 5.7 | 2.3 | 19.8 | 0.0 | 0.7 | 0.0 | 0.7 | | | | 450.8 |
| | 16th to 30th | 21.1 | 13.9 | 9.0 | 44.0 | 29.3 | 20.7 | 0.0 | 50.1 | 0.0 | 15.4 | 10.2 | 25.6 | 0.0 | 5.4 | 2.7 | 8.2 | 0.0 | 2.9 | 0.0 | 2.9 | 226.1 | 30.1 | 43.2 | 299.4 | 11.8 | 5.7 | 2.3 | 19.8 | 0.0 | 0.7 | 0.0 | 0.7 | | | | 450.8 |
| Jul | 1st to 15th | 28.0 | 16.9 | 9.0 | 53.8 | 41.1 | 25.1 | 0.0 | 66.2 | 0.0 | 18.6 | 10.2 | 28.8 | 0.0 | 6.6 | 2.7 | 9.3 | 0.0 | 3.5 | 0.0 | 3.5 | 306.3 | 36.5 | 43.2 | 385.9 | 18.2 | 6.9 | 2.3 | 27.4 | 0.0 | 0.9 | 0.0 | 0.9 | | | | 576.0 |
| | 16th to 31st | 28.0 | 16.9 | 9.0 | 53.8 | 41.1 | 25.1 | 0.0 | 66.2 | 0.0 | 18.6 | 10.2 | 28.8 | 0.0 | 6.6 | 2.7 | 9.3 | 0.0 | 3.5 | 0.0 | 3.5 | 306.3 | 36.5 | 43.2 | 385.9 | 18.2 | 6.9 | 2.3 | 27.4 | 0.0 | 0.9 | 0.0 | 0.9 | | | | 576.0 |
| Aug | 1st to 15th | 23.8 | 16.1 | 9.0 | 48.8 | 36.4 | 24.0 | 0.0 | 60.4 | 0.0 | 17.8 | 10.2 | 28.0 | 0.0 | 6.3 | 2.7 | 9.1 | 0.0 | 3.4 | 0.0 | 3.4 | 340.9 | 34.9 | 43.2 | 419.0 | 16.8 | 6.6 | 2.3 | 25.7 | 0.0 | 0.8 | 0.0 | 0.8 | | | | 595.2 |
| | 16th to 31st | 23.8 | 16.1 | 9.0 | 48.8 | 36.4 | 24.0 | 0.0 | 60.4 | 0.0 | 17.8 | 10.2 | 28.0 | 0.0 | 6.3 | 2.7 | 9.1 | 0.0 | 3.4 | 0.0 | 3.4 | 340.9 | 34.9 | 43.2 | 419.0 | 16.8 | 6.6 | 2.3 | 25.7 | 0.0 | 0.8 | 0.0 | 0.8 | | | | 595.2 |
| Sep | 1st to 15th | 15.6 | 13.0 | 9.0 | 37.5 | 20.1 | 19.3 | 0.0 | 39.4 | 0.0 | 14.3 | 10.2 | 24.5 | 0.0 | 5.1 | 2.7 | 7.8 | 0.0 | 2.7 | 0.0 | 2.7 | 208.9 | 28.1 | 43.2 | 280.1 | 10.8 | 5.3 | 2.3 | 18.5 | 0.0 | 0.7 | 0.0 | 0.7 | | | | 411.3 |
| | 16th to 30th | 15.6 | 13.0 | 9.0 | 37.5 | 20.1 | 19.3 | 0.0 | 39.4 | 0.0 | 14.3 | 10.2 | 24.5 | 0.0 | 5.1 | 2.7 | 7.8 | 0.0 | 2.7 | 0.0 | 2.7 | 208.9 | 28.1 | 43.2 | 280.1 | 10.8 | 5.3 | 2.3 | 18.5 | 0.0 | 0.7 | 0.0 | 0.7 | | | | 411.3 |
| Total | | 362 | 228 | 215 | 805 | 469 | 340 | - | 809 | - | 252 | 244 | 497 | - | 89 | 66 | 155 | - | 48 | - | 48 | 3,968 | 494 | 1,036 | 5,498 | 220 | 94 | 55 | 369 | - | 12 | - | 12 | - | - | - | 8,192 |
| | | *6% | *26% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Current GW | | 1 | | | | 2 | | | | 3 | | | | 4 | | | | 5 | | | | 6 | | | | 7 | | | | 8 | | | | bi-weekly total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Municipal | Day | Municipal Demar | Unincorporated D | SSIU Demand | Total | Municipal Demar | Unincorporated D | SSIU Demand | Total | Municipal Demar | Unincorporated D | SSIU Demand | Total | Municipal Demar | Unincorporated D | SSIU Demand | Total | Municipal Demar | Unincorporated D | SSIU Demand | Total | Municipal Demar | Unincorporated D | SSIU Demand | Total | Municipal Demar | Unincorporated D | SSIU Demand | Total | Municipal Demar | Unincorporated D | SSIU Demand | Total | Municipal Demar | Unincorporated D | SSIU Demand | Total |
| Oct | 1st to 15th | 11.76324464 | 7.330316742 | 8.9555025 | 28.0491 | 13.91147152 | 10.92006033 | 0 | 24.8315 | 0 | 8.107088989 | 10.1865122 | 18.2936 | 0 | 2.865761689 | 2.749131 | 5.61489 | 0 | 1.53092006 | 0 | 1.53092 | 125.3262214 | 15.85218703 | 43.171175 | 184.35 | 6.52347675 | 3.009049774 | 2.30730638 | 11.8398 | 0 | 0.384615385 | 0 | 0.38462 | | | | 274.894 |
| | 16th to 31st | 11.76324464 | 7.330316742 | 8.9555025 | 28.0491 | 13.91147152 | 10.92006033 | 0 | 24.8315 | 0 | 8.107088989 | 10.1865122 | 18.2936 | 0 | 2.865761689 | 2.749131 | 5.61489 | 0 | 1.53092006 | 0 | 1.53092 | 125.3262214 | 15.85218703 | 43.171175 | 184.35 | 6.52347675 | 3.009049774 | 2.30730638 | 11.8398 | 0 | 0.384615385 | 0 | 0.38462 | | | | 274.894 |
| Nov | 1st to 15th | 10.85227607 | 5.864253394 | 8.9555025 | 25.672 | 12.23231982 | 8.736048265 | 0 | 20.9684 | 0 | 6.485671192 | 10.1865122 | 16.6722 | 0 | 2.292609351 | 2.749131 | 5.04174 | 0 | 1.224736048 | 0 | 1.22474 | 97.7139674 | 12.68174962 | 43.171175 | 153.567 | 5.6880465 | 2.407239819 | 2.30730638 | 10.4026 | 0 | 0.307692308 | 0 | 0.30769 | | | | 233.856 |
| | 16th to 30th | 10.85227607 | 5.864253394 | 8.9555025 | 25.672 | 12.23231982 | 8.736048265 | 0 | 20.9684 | 0 | 6.485671192 | 10.1865122 | 16.6722 | 0 | 2.292609351 | 2.749131 | 5.04174 | 0 | 1.224736048 | 0 | 1.22474 | 97.7139674 | 12.68174962 | 43.171175 | 153.567 | 5.6880465 | 2.407239819 | 2.30730638 | 10.4026 | 0 | 0.307692308 | 0 | 0.30769 | | | | 233.856 |
| Dec | 1st to 15th | 10.9083925 | 5.864253394 | 8.9555025 | 25.7281 | 12.46125438 | 8.736048265 | 0 | 21.1973 | 0 | 6.485671192 | 10.1865122 | 16.6722 | 0 | 2.292609351 | 2.749131 | 5.04174 | 0 | 1.224736048 | 0 | 1.22474 | 114.2337184 | 12.68174962 | 43.171175 | 170.087 | 6.3648155 | 2.407239819 | 2.30730638 | 11.0794 | 0 | 0.307692308 | 0 | 0.30769 | | | | 251.338 |
| | 16th to 31st | 10.9083925 | 5.864253394 | 8.9555025 | 25.7281 | 12.46125438 | 8.736048265 | 0 | 21.1973 | 0 | 6.485671192 | 10.1865122 | 16.6722 | 0 | 2.292609351 | 2.749131 | 5.04174 | 0 | 1.224736048 | 0 | 1.22474 | 114.2337184 | 12.68174962 | 43.171175 | 170.087 | 6.3648155 | 2.407239819 | 2.30730638 | 11.0794 | 0 | 0.307692308 | 0 | 0.30769 | | | | 251.338 |
| Jan | 1st to 15th | 11.22953107 | 5.864253394 | 8.9555025 | 26.0493 | 12.77186107 | 8.736048265 | 0 | 21.5079 | 0 | 6.485671192 | 10.1865122 | 16.6722 | 0 | 2.292609351 | 2.749131 | 5.04174 | 0 | 1.224736048 | 0 | 1.22474 | 100.5188775 | 12.68174962 | 43.171175 | 156.372 | 6.482661 | 2.407239819 | 2.30730638 | 11.1972 | 0 | 0.307692308 | 0 | 0.30769 | | | | 238.373 |
| | 16th to 31st | 11.22953107 | 5.864253394 | 8.9555025 | 26.0493 | 12.77186107 | 8.736048265 | 0 | 21.5079 | 0 | 6.485671192 | 10.1865122 | 16.6722 | 0 | 2.292609351 | 2.749131 | 5.04174 | 0 | 1.224736048 | 0 | 1.22474 | 100.5188775 | 12.68174962 | 43.171175 | 156.372 | 6.482661 | 2.407239819 | 2.30730638 | 11.1972 | 0 | 0.307692308 | 0 | 0.30769 | | | | 238.373 |
| Feb | 1st to 15th | 11.30806071 | 5.864253394 | 8.9555025 | 26.1278 | 12.65971821 | 8.736048265 | 0 | 21.3958 | 0 | 6.485671192 | 10.1865122 | 16.6722 | 0 | 2.292609351 | 2.749131 | 5.04174 | 0 | 1.224736048 | 0 | 1.22474 | 96.42924319 | 12.68174962 | 43.171175 | 152.282 | 5.54281125 | 2.407239819 | 2.30730638 | 10.2574 | 0 | 0.307692308 | 0 | 0.30769 | | | | 233.309 |
| | 16th to 28th | 11.30806071 | 5.864253394 | 8.9555025 | 26.1278 | 12.65971821 | 8.736048265 | 0 | 21.3958 | 0 | 6.485671192 | 10.1865122 | 16.6722 | 0 | 2.292609351 | 2.749131 | 5.04174 | 0 | 1.224736048 | 0 | 1.22474 | 96.42924319 | 12.68174962 | 43.171175 | 152.282 | 5.54281125 | 2.407239819 | 2.30730638 | 10.2574 | 0 | 0.307692308 | 0 | 0.30769 | | | | 233.309 |
| Mar | 1st to 15th | 10.8477825 | 6.230769231 | 8.9555025 | 26.0341 | 12.18562875 | 9.282051282 | 0 | 21.4677 | 0 | 6.891025641 | 10.1865122 | 17.0775 | 0 | 2.435897436 | 2.749131 | 5.18503 | 0 | 1.301282051 | 0 | 1.30128 | 94.29448431 | 13.47435897 | 43.171175 | 150.94 | 5.97544875 | 2.557692308 | 2.30730638 | 10.8404 | 0 | 0.326923077 | 0 | 0.32692 | | | | 233.173 |
| | 16th to 31st | 10.8477825 | 6.230769231 | 8.9555025 | 26.0341 | 12.18562875 | 9.282051282 | 0 | 21.4677 | 0 | 6.891025641 | 10.1865122 | 17.0775 | 0 | 2.435897436 | 2.749131 | 5.18503 | 0 | 1.301282051 | 0 | 1.30128 | 94.29448431 | 13.47435897 | 43.171175 | 150.94 | 5.97544875 | 2.557692308 | 2.30730638 | 10.8404 | 0 | 0.326923077 | 0 | 0.32692 | | | | 233.173 |
| Apr | 1st to 15th | 11.16607036 | 6.963800905 | 8.9555025 | 27.0854 | 13.18099223 | 10.37405732 | 0 | 23.555 | 0 | 7.70173454 | 10.1865122 | 17.8882 | 0 | 2.722473605 | 2.749131 | 5.4716 | 0 | 1.454374057 | 0 | 1.45437 | 113.3393598 | 15.05957768 | 43.171175 | 171.57 | 6.480052 | 2.858597285 | 2.30730638 | 11.646 | 0 | 0.365384615 | 0 | 0.36538 | | | | 259.036 |
| | 16th to 30th | 11.16607036 | 6.963800905 | 8.9555025 | 27.0854 | 13.18099223 | 10.37405732 | 0 | 23.555 | 0 | 7.70173454 | 10.1865122 | 17.8882 | 0 | 2.722473605 | 2.749131 | 5.4716 | 0 | 1.454374057 | 0 | 1.45437 | 113.3393598 | 15.05957768 | 43.171175 | 171.57 | 6.480052 | 2.858597285 | 2.30730638 | 11.646 | 0 | 0.365384615 | 0 | 0.36538 | | | | 259.036 |
| May | 1st to 15th | 14.4246925 | 10.26244344 | 8.9555025 | 33.6426 | 18.12578188 | 15.28808446 | 0 | 33.4139 | 0 | 11.34992459 | 10.1865122 | 21.5364 | 0 | 4.012066365 | 2.749131 | 6.7612 | 0 | 2.143288084 | 0 | 2.14329 | 159.7685226 | 22.19306184 | 43.171175 | 225.133 | 9.209452 | 4.212669683 | 2.30730638 | 15.7294 | 0 | 0.538461538 | 0 | 0.53846 | | | | 338.898 |
| | 16th to 31st | 14.4246925 | 10.26244344 | 8.9555025 | 33.6426 | 18.12578188 | 15.28808446 | 0 | 33.4139 | 0 | 11.34992459 | 10.1865122 | 21.5364 | 0 | 4.012066365 | 2.749131 | 6.7612 | 0 | 2.143288084 | 0 | 2.14329 | 159.7685226 | 22.19306184 | 43.171175 | 225.133 | 9.209452 | 4.212669683 | 2.30730638 | 15.7294 | 0 | 0.538461538 | 0 | 0.53846 | | | | 338.898 |
| Jun | 1st to 15th | 21.12968214 | 13.92760181 | 8.9555025 | 44.0128 | 29.34396714 | 20.74811463 | 0 | 50.0921 | 0 | 15.40346908 | 10.1865122 | 25.59 | 0 | 5.44494721 | 2.749131 | 8.19408 | 0 | 2.908748115 | 0 | 2.90875 | 226.1456562 | 30.11915535 | 43.171175 | 299.436 | 11.80888425 | 5.71719457 | 2.30730638 | 19.8334 | 0 | 0.730769231 | 0 | 0.73077 | | | | 450.798 |
| | 16th to 30th | 21.12968214 | 13.92760181 | 8.9555025 | 44.0128 | 29.34396714 | 20.74811463 | 0 | 50.0921 | 0 | 15.40346908 | 10.1865122 | 25.59 | 0 | 5.44494721 | 2.749131 | 8.19408 | 0 | 2.908748115 | 0 | 2.90875 | 226.1456562 | 30.11915535 | 43.171175 | 299.436 | 11.80888425 | 5.71719457 | 2.30730638 | 19.8334 | 0 | 0.730769231 | 0 | 0.73077 | | | | 450.798 |
| Jul | 1st to 15th | 27.99359821 | 16.85972851 | 8.9555025 | 53.8088 | 41.09069009 | 25.11613876 | 0 | 66.2068 | 0 | 18.64630468 | 10.1865122 | 28.8328 | 0 | 6.591251885 | 2.749131 | 9.34038 | 0 | 3.521116139 | 0 | 3.52112 | 306.3069683 | 36.46003017 | 43.171175 | 385.938 | 18.197944 | 6.92081448 | 2.30730638 | 27.4261 | 0 | 0.884615385 | 0 | 0.88462 | | | | 575.959 |
| | 16th to 31st | 27.99359821 | 16.85972851 | 8.9555025 | 53.8088 | 41.09069009 | 25.11613876 | 0 | 66.2068 | 0 | 18.64630468 | 10.1865122 | 28.8328 | 0 | 6.591251885 | 2.749131 | 9.34038 | 0 | 3.521116139 | 0 | 3.52112 | 306.3069683 | 36.46003017 | 43.171175 | 385.938 | 18.197944 | 6.92081448 | 2.30730638 | 27.4261 | 0 | 0.884615385 | 0 | 0.88462 | | | | 575.959 |
| Aug | 1st to 15th | 23.76180929 | 16.12669683 | 8.9555025 | 48.844 | 36.38341366 | 24.02413273 | 0 | 60.4075 | 0 | 17.83559578 | 10.1865122 | 28.0221 | 0 | 6.304675716 | 2.749131 | 9.05381 | 0 | 3.368024133 | 0 | 3.36802 | 340.9150602 | 34.87481146 | 43.171175 | 418.961 | 16.77696775 | 6.619909502 | 2.30730638 | 25.7042 | 0 | 0.846153846 | 0 | 0.84615 | | | | 595.207 |
| | 16th to 31st | 23.76180929 | 16.12669683 | 8.9555025 | 48.844 | 36.38341366 | 24.02413273 | 0 | 60.4075 | 0 | 17.83559578 | 10.1865122 | 28.0221 | 0 | 6.304675716 | 2.749131 | 9.05381 | 0 | 3.368024133 | 0 | 3.36802 | 340.9150602 | 34.87481146 | 43.171175 | 418.961 | 16.77696775 | 6.619909502 | 2.30730638 | 25.7042 | 0 | 0.846153846 | 0 | 0.84615 | | | | 595.207 |
| Sep | 1st to 15th | 15.6030375 | 12.97466063 | 8.9555025 | 37.5332 | 20.08362625 | 19.32850679 | 0 | 39.4121 | 0 | 14.34954751 | 10.1865122 | 24.5361 | 0 | 5.07239819 | 2.749131 | 7.82153 | 0 | 2.709728507 | 0 | 2.70973 | 208.8966513 | 28.05837104 | 43.171175 | 280.126 | 10.8434865 | 5.3260181 | 2.30730638 | 18.4768 | 0 | 0.680769231 | 0 | 0.68077 | | | | 411.296 |
| | 16th to 30th | 15.6030375 | 12.97466063 | 8.9555025 | 37.5332 | 20.08362625 | 19.32850679 | 0 | 39.4121 | 0 | 14.34954751 | 10.1865122 | 24.5361 | 0 | 5.07239819 | 2.749131 | 7.82153 | 0 | 2.709728507 | 0 | 2.70973 | 208.8966513 | 28.05837104 | 43.171175 | 280.126 | 10.8434865 | 5.3260181 | 2.30730638 | 18.4768 | 0 | 0.680769231 | 0 | 0.68077 | | | | 411.296 |
| **Total** | | **361.976355** | **228.2660633** | **214.93206** | **805.174** | **468.86145** | **340.0506787** | **0** | **808.912** | **0** | **252.4547511** | **244.476293** | **496.931** | **0** | **89.239819** | **65.979144** | **155.219** | **0** | **47.67285068** | **0** | **47.6729** | **3967.777461** | **493.6371041** | **1036.1082** | **5497.52** | **219.7880925** | **93.70180995** | **55.375353** | **368.865** | **0** | **11.97692308** | **0** | **11.9769** | **0** | **0** | **0** | **8192.27** |

5018
1557
Self-supplied Industrial
**Total**

| Water Year | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | Total Water Used | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | 135.219 | 167.197 | 234.835 | 102.075 | 151.330 | 117.603 | 126.196 | 239.316 | 417.281 | 312.263 | 493.697 | 250.701 | 2747.712 | 2747.712 | 2747.712 |
| 2015 | 242.538 | 130.953 | 218.232 | 140.068 | 158.082 | 182.326 | 127.638 | 251.284 | 441.452 | 545.530 | 510.269 | 204.085 | 3152.457 | 3152.457 | 3152.457 |
| 2014 | 204.883 | 143.228 | 172.567 | 144.609 | 147.709 | 149.458 | 191.042 | 256.041 | 479.365 | 494.586 | 482.986 | 242.538 | 3109.013 | 3109.013 | 3109.013 |
| 2013 | 195.369 | 173.795 | **170.000** | 131.229 | 159.647 | 132.487 | 146.880 | 240.758 | 343.996 | 434.099 | 409.240 | 203.440 | 2740.941 | 2740.941 | 2740.941 |
| 2012 | 165.601 | 139.546 | 149.980 | 115.793 | 135.341 | 135.065 | 209.762 | 345.684 | 401.108 | 535.863 | 465.677 | 460.644 | 3260.064 | 3260.064 | 3260.064 |
| 2011 | 205.681 | 150.041 | 152.803 | 113.368 | 120.733 | 115.332 | 121.623 | 112.447 | 167.657 | 325.859 | 467.058 | 375.360 | 2427.964 | 2427.964 | 2427.964 |
| 2010 | 179.748 | 142.001 | 175.022 | 166.552 | 145.315 | 160.568 | 142.216 | 129.787 | 205.220 | 440.482 | 446.405 | 298.024 | 2631.340 | 2631.34 | 2631.34 |
| 2009 | 189.323 | 140.068 | 175.360 | 160.138 | 143.382 | 155.473 | 162.440 | 230.723 | 281.022 | 473.227 | 381.712 | 331.432 | 2824.300 | 2824.3 | 2824.3 |
| 2008 | 184.659 | 151.453 | 170.051 | 156.609 | 164.404 | 143.014 | 162.593 | 213.752 | 280.009 | 477.830 | 429.771 | 307.230 | 2841.375 | 2841.375 | 2841.375 |
| 2007 | 189.194 | 157.431 | 158.321 | 150.864 | 157.155 | 151.017 | 178.361 | 300.196 | 403.557 | 567.712 | 464.229 | 535.949 | 3413.988 | 3413.988 | 3413.988 |
| 2006 | 178.300 | 148.869 | 157.922 | 155.835 | 140.184 | 77.180 | 169.646 | 224.425 | 192.601 | 361.851 | 1724.932 | 313.607 | 3845.352 | 3845.352 | 3845.352 |
| 2004 | 216.109 | 145.708 | 193.583 | 164.643 | 186.709 | 167.160 | 210.308 | 223.566 | 321.372 | 463.707 | 290.898 | 193.736 | 2777.499 | 2777.499 | 2777.499 |
| 2003 | 210.032 | 150.281 | 282.366 | 151.631 | 149.176 | 125.423 | 185.972 | 202.513 | 357.032 | 372.438 | 435.565 | 315.786 | 2938.217 | 2938.217 | 2938.217 |
| 2002 | 212.027 | 180.267 | 188.768 | 216.572 | 167.286 | 162.222 | 184.410 | 256.284 | 370.907 | 483.505 | 429.646 | 298.419 | 3150.311 | 3150.311 | 3150.311 |
| 2001 | 128.799 | 173.021 | 121.495 | 223.566 | 138.895 | 170.321 | 211.076 | 273.098 | 360.623 | 302.989 | 371.886 | 338.803 | 2814.571 | 2814.571 | 2814.571 |
| 2000 | 231.760 | 182.535 | 202.483 | 174.648 | 184.560 | 152.153 | 200.120 | 90.069 | 272.392 | 149.882 | 303.971 | 166.607 | 2311.180 | 2311.18 | **2978.34** |
| 1999 | 188.550 | 166.884 | 178.484 | 174.771 | 158.260 | 174.249 | 187.322 | 257.846 | 378.177 | 476.842 | 396.038 | 319.500 | 3056.922 | 3056.922 | |
| 1998 | 179.497 | 158.966 | 164.244 | 169.400 | 153.012 | 154.270 | 165.871 | 225.653 | 321.034 | 467.236 | 451.493 | 296.452 | 2907.129 | 2907.129 | |
| 1997 | 227.497 | 176.032 | 177.996 | 149.271 | 143.624 | 169.649 | 189.566 | 303.944 | 361.669 | 390.548 | 443.762 | 283.136 | 3016.695 | 3016.695 | |
| 1996 | 269.633 | 261.501 | 284.241 | 268.805 | 272.610 | 261.777 | 231.855 | 274.482 | 437.870 | 556.360 | 473.009 | 362.559 | 3954.703 | 3954.703 | |
| 1995 | 258.581 | 188.304 | 194.442 | 193.214 | 185.849 | 200.272 | 213.776 | 272.852 | 356.786 | 477.394 | 447.319 | 344.204 | 3332.991 | 3332.991 | |
| 1993 | 151.079 | 0.120 | 0.120 | 26.144 | 7.025 | 99.398 | 25.315 | 127.451 | 118.303 | 192.325 | 212.978 | 155.590 | 1115.848 | 0 | |
| 1992 | 139.758 | 186.435 | 200.644 | 195.611 | 186.804 | 193.494 | 233.666 | 375.173 | 401.841 | 280.712 | 226.577 | 130.981 | 2751.696 | 2751.696 | |
| 1991 | 238.847 | 207.577 | 266.221 | 277.760 | 205.985 | 220.561 | 211.755 | 223.371 | 272.993 | 487.796 | 448.391 | 365.993 | 3427.251 | 3427.251 | |
| 1989 | 247.912 | 177.309 | 185.969 | 194.264 | 220.215 | 206.834 | 194.519 | 257.932 | 393.178 | 515.578 | 365.840 | 265.395 | 3224.944 | 3224.944 | |
| **Average** | **189.165** | **152.924** | **181.420** | **152.903** | **151.023** | **142.977** | **168.678** | **233.325** | **334.880** | **439.463** | **520.265** | **311.317** | **2978.340** | **8.159836** | |
| Std Dev | 29.794 | 14.485 | 39.188 | 33.465 | 15.612 | 26.782 | 30.839 | 57.929 | 93.263 | 85.951 | 337.803 | 94.025 | | | |





100.000
0.000
October
November
December
January
February
March
April
May
June
July
August
September

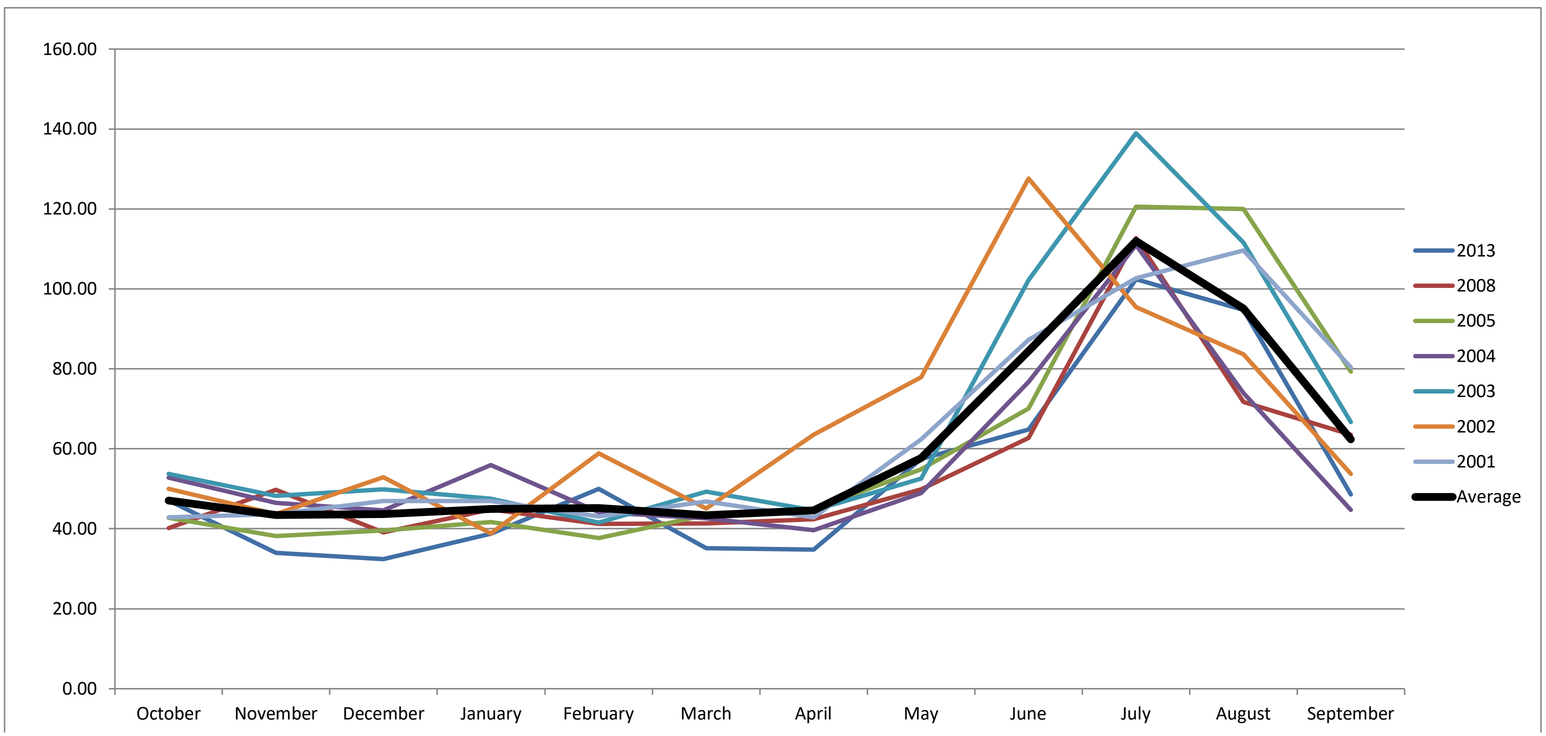
| Water Year | Report ID | Facility Name | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | Source Name | Location | TRSQQ | Water Right Holder's Name | Company Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 64.017 | 48.151 | 3.928 | 78.564 | 4.419 | 0.000 | 50.545 | 76.753 | 28.111 | 72.825 | 45.573 | 472.886 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 1.473 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 11647 | GEKELER WELL (UNIO 999) | 5.064 | 0.000 | 0.031 | 0.000 | 0.184 | 0.000 | 5.585 | 23.784 | 31.303 | 21.452 | 39.650 | 5.616 | 132.668 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 11661 | 2ND & H WELL (UNIO 940) | 12.429 | 94.215 | 95.627 | 98.021 | 72.457 | 97.376 | 101.335 | 70.247 | 111.094 | 93.693 | 147.767 | 64.385 | 1058.647 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 30206 | 12TH STREET WELL (UNIO 2098) | 73.531 | 0.000 | 65.521 | 0.000 | 0.000 | 0.000 | 18.935 | 51.557 | 142.550 | 85.285 | 178.211 | 82.983 | 698.573 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 48385 | HWY 30 WELL (UNIO 50520) | 44.069 | 8.838 | 25.380 | 0.000 | 0.000 | 15.682 | 0.215 | 43.057 | 55.455 | 83.597 | 55.117 | 52.018 | 383.428 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2016 | 61075 | | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.037 | A WELL; | 20 FEET NORTH AND 1700 FEET EAST FROM SW CORNER, SECTION 32 | (3S-39E-32-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 11641 | ISLAND CITY WELL (UNIO 778) | 40.970 | 84.609 | 48.765 | 0.000 | 38.423 | 89.090 | 25.779 | 74.574 | 85.193 | 58.033 | 54.504 | 23.815 | 623.753 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 1.473 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 11647 | GEKELER WELL (UNIO 999) | 11.263 | 20.930 | 11.754 | 0.000 | 4.972 | 1.043 | 20.040 | 27.804 | 22.280 | 29.952 | 25.963 | 32.315 | 208.317 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 44.211 | 83.996 | 42.013 | 0.000 | 170.219 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 11661 | 2ND & H WELL (UNIO 940) | 37.625 | 22.035 | 121.498 | 63.557 | 14.240 | 61.194 | 71.904 | 88.507 | 123.216 | 11.263 | 50.698 | 130.091 | 795.826 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 30206 | 12TH STREET WELL (UNIO 2098) | 79.853 | 0.000 | 11.846 | 76.385 | 71.904 | 16.511 | 5.677 | 0.000 | 106.122 | 156.790 | 185.300 | 17.217 | 727.605 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 48385 | HWY 30 WELL (UNIO 50520) | 72.702 | 3.253 | 24.244 | 0.000 | 28.418 | 14.362 | 4.112 | 60.273 | 60.304 | 205.371 | 151.665 | 0.522 | 625.226 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2015 | 61075 | | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.037 | A WELL; | 20 FEET NORTH AND 1700 FEET EAST FROM SW CORNER, SECTION 32 | (3S-39E-32-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 11641 | ISLAND CITY WELL (UNIO 778) | 49.962 | 54.780 | 44.376 | 48.918 | 33.298 | 90.563 | 104.158 | 50.821 | 51.803 | 0.000 | 77.950 | 40.970 | 647.599 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 1.473 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.369 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.369 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 12.490 | 49.747 | 17.063 | 7.335 | 20.869 | 25.288 | 0.000 | 10.097 | 19.641 | 0.675 | 11.263 | 174.467 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 11660 | MAIN BEAVER CREEK | 186.466 | 76.784 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.210 | 0.000 | 186.712 | 0.000 | 452.171 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 11661 | 2ND & H WELL (UNIO 940) | 52.938 | 21.881 | 2.056 | 27.313 | 33.267 | 0.000 | 7.365 | 93.479 | 62.483 | 120.638 | 74.421 | 37.625 | 533.466 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 30206 | 12TH STREET WELL (UNIO 2098) | 55.885 | 24.520 | 69.326 | 16.818 | 39.834 | 7.519 | 54.105 | 17.708 | 221.697 | 204.665 | 230.075 | 79.853 | 1022.004 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 48385 | HWY 30 WELL (UNIO 50520) | 45.972 | 29.431 | 6.936 | 34.372 | 33.850 | 30.382 | 0.000 | 93.908 | 133.159 | 149.517 | 99.739 | 72.702 | 729.968 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2014 | 61075 | | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.037 | A WELL; | 20 FEET NORTH AND 1700 FEET EAST FROM SW CORNER, SECTION 32 | (3S-39E-32-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 11641 | ISLAND CITY WELL (UNIO 778) | 65.674 | 59.690 | 0.000 | 0.000 | 0.000 | 0.000 | 77.612 | 47.875 | 56.836 | 72.886 | 79.607 | 58.432 | 518.613 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 1.473 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 11647 | GEKELER WELL (UNIO 999) | 15.989 | 35.354 | 0.000 | 57.327 | 4.972 | 20.838 | 1.289 | 22.188 | 38.852 | 15.590 | 20.163 | 1.749 | 234.310 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.210 | 0.000 | 0.000 | 0.000 | 2.210 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 11661 | 2ND & H WELL (UNIO 940) | 15.989 | 35.354 | 0.000 | 41.031 | 39.988 | 0.000 | 39.282 | 51.772 | 89.673 | 74.973 | 128.433 | 79.515 | 596.010 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 30206 | 12TH STREET WELL (UNIO 2098) | 72.794 | 27.098 | 1.841 | 32.745 | 53.123 | 74.298 | 10.465 | 54.473 | 99.187 | 89.980 | 68.621 | 47.322 | 631.947 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 48385 | HWY 30 WELL (UNIO 50520) | 24.797 | 16.173 | 19.610 | 0.000 | 61.439 | 37.226 | 18.106 | 64.324 | 57.112 | 180.543 | 112.291 | 16.296 | 607.918 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2013 | 61075 | | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.037 | A WELL; | 20 FEET NORTH AND 1700 FEET EAST FROM SW CORNER, SECTION 32 | (3S-39E-32-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 11641 | ISLAND CITY WELL (UNIO 778) | 63.894 | 53.583 | 38.177 | 4.020 | 0.000 | 90.931 | 101.366 | 71.843 | 49.655 | 30.934 | 111.309 | 89.919 | 705.631 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 1.473 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 11647 | GEKELER WELL (UNIO 999) | 8.255 | 10.311 | 34.402 | 25.410 | 33.144 | 0.000 | 45.727 | 112.721 | 135.400 | 198.343 | 128.556 | 120.086 | 852.355 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.210 | 0.000 | 0.000 | 0.000 | 2.210 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 11661 | 2ND & H WELL (UNIO 940) | 21.973 | 12.460 | 12.214 | 25.410 | 33.144 | 0.000 | 45.727 | 112.721 | 135.400 | 198.343 | 128.556 | 120.086 | 846.033 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 30206 | 12TH STREET WELL (UNIO 2098) | 65.061 | 22.894 | 32.530 | 29.461 | 53.153 | 0.000 | 0.000 | 0.000 | 1.719 | 26.485 | 43.578 | 62.544 | 337.425 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 48385 | HWY 30 WELL (UNIO 50520) | 6.291 | 40.172 | 32.530 | 31.364 | 15.774 | 44.008 | 16.818 | 48.274 | 76.600 | 81.633 | 53.552 | 67.884 | 514.900 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2012 | 61075 | | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.037 | A WELL; | 20 FEET NORTH AND 1700 FEET EAST FROM SW CORNER, SECTION 32 | (3S-39E-32-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 17.615 | 110.511 | 119.779 | 247.905 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 1.473 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 11647 | GEKELER WELL (UNIO 999) | 2.670 | 4.910 | 9.544 | 27.497 | 13.258 | 25.779 | 30.382 | 48.642 | 24.520 | 36.121 | 21.697 | 7.918 | 252.938 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.210 | 0.000 | 0.000 | 0.000 | 2.210 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 11661 | 2ND & H WELL (UNIO 940) | 111.094 | 17.032 | 28.909 | 33.911 | 31.518 | 27.068 | 37.348 | 14.424 | 60.549 | 93.939 | 116.465 | 27.068 | 599.325 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 30206 | 12TH STREET WELL (UNIO 2098) | 67.117 | 94.184 | 64.938 | 42.903 | 37.809 | 37.072 | 34.034 | 20.776 | 44.929 | 178.057 | 218.260 | 177.689 | 1017.769 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 48385 | HWY 30 WELL (UNIO 50520) | 24.674 | 33.789 | 49.286 | 8.930 | 38.024 | 25.288 | 19.733 | 28.479 | 35.323 | 0.000 | 0.000 | 42.780 | 306.307 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2011 | 61075 | | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.037 | A WELL; | 20 FEET NORTH AND 1700 FEET EAST FROM SW CORNER, SECTION 32 | (3S-39E-32-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 56.284 | 11.969 | 0.000 | 0.000 | 0.000 | 68.252 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 1.473 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 11647 | GEKELER WELL (UNIO 999) | 1.043 | 0.000 | 2.148 | 0.000 | 0.000 | 0.000 | 21.881 | 31.211 | 11.294 | 40.080 | 38.024 | 0.000 | 145.681 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.210 | 0.000 | 0.000 | 0.000 | 2.210 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 11661 | 2ND & H WELL (UNIO 940) | 45.788 | 63.250 | 74.850 | 115.483 | 137.026 | 17.339 | 61.746 | 3.990 | 105.325 | 101.396 | 139.052 | 130.674 | 995.918 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 30206 | 12TH STREET WELL (UNIO 2098) | 30.045 | 57.511 | 60.641 | 10.434 | 0.614 | 0.000 | 3.100 | 9.483 | 3.591 | 110.603 | 118.183 | 54.412 | 458.616 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 48385 | HWY 30 WELL (UNIO 50520) | 102.747 | 21.114 | 37.256 | 40.509 | 7.549 | 143.103 | 55.363 | 28.694 | 70.707 | 188.277 | 151.020 | 112.813 | 959.153 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2010 | 61075 | | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.037 | A WELL; | 20 FEET NORTH AND 1700 FEET EAST FROM SW CORNER, SECTION 32 | (3S-39E-32-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2009 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 13.749 | 0.000 | 0.000 | 0.000 | 0.000 | 13.442 | 84.180 | 6.168 | 5.033 | 0.000 | 122.572 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 1.473 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.197 | 11.877 | 14.178 | 9.882 | 0.049 | 37.183 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 11661 | 2ND & H WELL (UNIO 940) | 65.030 | 31.702 | 40.018 | 9.360 | 8.378 | 5.033 | 4.450 | 76.538 | 11.846 | 135.799 | 145.404 | 108.516 | 642.075 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 30206 | 12TH STREET WELL (UNIO 2098) | 121.958 | 107.473 | 120.884 | 149.731 | 125.733 | 83.566 | 117.170 | 115.667 | 134.909 | 171.306 | 30.259 | 49.041 | 1327.697 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 48385 | HWY 30 WELL (UNIO 50520) | 2.210 | 0.767 | 0.583 | 0.921 | 9.145 | 66.749 | 40.694 | 23.753 | 38.085 | 145.650 | 191.008 | 173.700 | 693.264 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2009 | 61075 | | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.037 | A WELL; | 20 FEET NORTH AND 1700 FEET EAST FROM SW CORNER, SECTION 32 | (3S-39E-32-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 36.704 | 0.031 | 0.000 | 36.735 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 0.123 | 1.473 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 38.545 | 14.240 | 0.000 | 52.785 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 11661 | 2ND & H WELL (UNIO 940) | 127.482 | 144.484 | 143.747 | 122.817 | 146.847 | 69.603 | 120.086 | 158.601 | 172.441 | 155.931 | 155.102 | 93.080 | 1610.219 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 30206 | 12TH STREET WELL (UNIO 2098) | 24.244 | 6.844 | 26.178 | 33.666 | 16.879 | 5.493 | 35.170 | 51.619 | 95.750 | 80.865 | 123.308 | 193.801 | 693.816 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 48385 | HWY 30 WELL (UNIO 50520) | 32.807 | 0.000 | 0.000 | 0.000 | 0.552 | 67.792 | 7.212 | 3.406 | 11.693 | 165.659 | 136.965 | 20.224 | 446.310 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2008 | 61075 | | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.037 | A WELL; | 20 FEET NORTH AND 1700 FEET EAST FROM SW CORNER, SECTION 32 | (3S-39E-32-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2007 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2007 | 11641 | ISLAND CITY WELL (UNIO 778) | 60.764 | 0.000 | 0.000 | 0.000 | 0.000 | 0.092 | 0.000 | 0.000 | 0.460 | 93.571 | 95.903 | 203.161 | 453.951 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2007 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 1.436 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2007 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2007 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2007 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.061 | 0.215 | 0.000 | 0.000 | 0.276 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2007 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2007 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2007 | 11661 | 2ND & H WELL (UNIO 940) | 80.374 | 105.232 | 112.414 | 121.651 | 119.257 | 60.120 | 106.153 | 36.029 | 130.367 | 140.617 | 111.094 | 99.985 | 1223.293 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2007 | 30206 | 12TH STREET WELL (UNIO 2098) | 47.384 | 44.990 | 45.788 | 29.093 | 37.778 | 7.212 | 52.386 | 110.756 | 105.355 | 144.637 | 84.333 | 55.240 | 764.953 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2007 | 48385 | HWY 30 WELL (UNIO 50520) | 0.552 | 7.089 | 0.000 | 0.000 | 0.000 | 83.474 | 19.702 | 153.291 | 167.193 | 188.553 | 172.779 | 177.444 | 970.078 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.767 | 0.000 | 0.000 | 0.000 | 0.767 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 1.436 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.460 | 0.000 | 0.031 | 1.289 | 22.096 | 11.324 | 0.000 | 35.200 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 11648 | MORGAN LAKE | 780.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 11661 | 2ND & H WELL (UNIO 940) | 136.198 | 135.031 | 142.458 | 143.133 | 131.963 | 71.505 | 122.602 | 161.363 | 123.186 | 115.912 | 122.204 | 93.816 | 1499.371 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 30206 | 12TH STREET WELL (UNIO 2098) | 41.461 | 13.718 | 15.344 | 12.582 | 8.102 | 5.094 | 46.923 | 62.912 | 67.240 | 223.723 | 190.486 | 90.625 | 778.211 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2006 | 48385 | HWY 30 WELL (UNIO 50520) | 0.522 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1400.798 | 129.047 | 1530.367 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 1.436 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 11648 | MORGAN LAKE | 780.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 11661 | 2ND & H WELL (UNIO 940) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 30206 | 12TH STREET WELL (UNIO 2098) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2005 | 48385 | HWY 30 WELL (UNIO 50520) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.657 | 75.740 | 75.740 | 47.691 | 200.829 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 1.436 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 5.493 | 6.261 | 30.934 | 42.688 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 11661 | 2ND & H WELL (UNIO 940) | 12.797 | 57.573 | 74.942 | 76.937 | 48.090 | 74.513 | 173.301 | 171.398 | 79.914 | 18.812 | 117.938 | 37.256 | 943.471 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 30206 | 12TH STREET WELL (UNIO 2098) | 74.942 | 58.861 | 63.281 | 60.826 | 57.849 | 0.000 | 0.000 | 0.092 | 167.316 | 235.139 | 34.188 | 55.179 | 807.672 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2004 | 48385 | HWY 30 WELL (UNIO 50520) | 128.249 | 29.155 | 55.240 | 26.761 | 80.651 | 92.527 | 36.888 | 51.956 | 72.365 | 128.403 | 56.652 | 22.556 | 781.402 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 10.404 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 2.885 | 0.092 | 87.003 | 128.556 | 47.691 | 276.630 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 1.436 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.061 | 14.639 | 46.340 | 6.261 | 30.934 | 98.235 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 11661 | 2ND & H WELL (UNIO 940) | 102.961 | 78.257 | 123.799 | 141.261 | 136.873 | 0.000 | 132.085 | 126.439 | 65.337 | 0.000 | 117.938 | 182.139 | 1207.089 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 30206 | 12TH STREET WELL (UNIO 2098) | 0.000 | 0.000 | 0.000 | 10.250 | 12.184 | 0.000 | 15.682 | 12.184 | 62.605 | 46.893 | 34.188 | 54.903 | 248.888 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 48385 | HWY 30 WELL (UNIO 50520) | 106.951 | 61.501 | 158.447 | 0.000 | 0.000 | 125.303 | 38.085 | 60.826 | 214.240 | 192.082 | 148.504 | 0.000 | 1105.938 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2003 | 61075 | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | A WELL; | 20 FEET NORTH AND 1700 FEET EAST FROM SW CORNER, SECTION 32 | (3S-39E-32-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2002 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.890 | 0.000 | 0.399 | 7.918 | 31.855 | 36.274 | 77.336 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2002 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.120 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.120 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER,  S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2002 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2002 | 11647 | GEKELER WELL (UNIO 999) | 2.271 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.153 | 0.031 | 15.590 | 41.062 | 14.485 | 9.820 | 83.413 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2002 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2002 | 11661 | 2ND & H WELL (UNIO 940) | 135.277 | 142.182 | 148.473 | 155.808 | 133.558 | 71.781 | 110.910 | 144.791 | 158.447 | 149.885 | 156.084 | 78.656 | 1585.852 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2002 | 30206 | 12TH STREET WELL (UNIO 2098) | 36.152 | 27.620 | 25.042 | 17.217 | 18.199 | 8.102 | 38.637 | 40.172 | 47.230 | 66.994 | 38.975 | 29.339 | 393.678 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2002 | 48385 | HWY 30 WELL (UNIO 50520) | 38.208 | 10.465 | 15.252 | 43.548 | 15.529 | 82.338 | 33.819 | 71.290 | 149.240 | 217.646 | 188.246 | 144.330 | 1009.912 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2001 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.737 | 0.000 | 0.000 | 0.000 | 1.043 | 0.246 | 0.000 | 29.461 | 11.846 | 0.000 | 43.333 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 1.436 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.565 | 22.556 | 43.271 | 10.895 | 78.288 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 11661 | 2ND & H WELL (UNIO 940) | 38.054 | 116.004 | 27.927 | 18.291 | 57.388 | 33.696 | 98.051 | 121.897 | 137.978 | 170.201 | 165.260 | 112.506 | 1097.253 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 30206 | 12TH STREET WELL (UNIO 2098) | 26.208 | 56.897 | 59.260 | 36.673 | 78.318 | 53.031 | 82.707 | 53.859 | 33.144 | 42.596 | 47.967 | 36.673 | 607.335 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2001 | 48385 | HWY 30 WELL (UNIO 50520) | 64.416 | 0.000 | 33.451 | 168.482 | 3.069 | 83.474 | 29.155 | 96.977 | 187.816 | 38.054 | 103.422 | 178.610 | 986.926 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-16-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.031 | 0.000 | 0.000 | 0.000 | 0.000 | 47.322 | 7.304 | 10.833 | 11.109 | 12.429 | 12.337 | 0.000 | 101.366 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 1.436 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 11647 | GEKELER WELL (UNIO 999) | 69.940 | 56.345 | 7.427 | 0.000 | 0.000 | 23.170 | 28.479 | 1.596 | 23.017 | 1.381 | 33.666 | 0.767 | 245.788 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 11661 | 2ND & H WELL (UNIO 940) | 147.123 | 57.573 | 86.973 | 66.073 | 95.565 | 33.205 | 70.922 | 48.734 | 162.621 | 80.190 | 190.241 | 140.893 | 1180.113 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 2000 | 30206 | 12TH STREET WELL (UNIO 2098) | 14.547 | 68.498 | 107.964 | 108.455 | 88.875 | 48.335 | 93.294 | 28.786 | 75.526 | 55.762 | 67.608 | 24.827 | 782.477 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 19.242 | 9.820 | 0.000 | 40.295 | 108.393 | 107.841 | 42.013 | 327.605 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 1.436 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 11647 | GEKELER WELL (UNIO 999) | 0.307 | 0.338 | 0.000 | 0.000 | 0.000 | 25.656 | 41.768 | 35.415 | 51.343 | 72.610 | 31.732 | 39.650 | 298.818 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 11661 | 2ND & H WELL (UNIO 940) | 124.290 | 95.627 | 77.459 | 70.523 | 57.480 | 56.805 | 75.127 | 145.588 | 193.463 | 200.829 | 189.965 | 182.262 | 1469.418 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1999 | 30206 | 12TH STREET WELL (UNIO 2098) | 63.833 | 70.799 | 100.905 | 104.128 | 100.660 | 72.426 | 60.488 | 76.722 | 92.957 | 94.890 | 66.380 | 55.455 | 959.644 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 11641 | ISLAND CITY WELL (UNIO 778) | 113.764 | 139.911 | 94.952 | 51.588 | 20.101 | 57.542 | 23.538 | 0.276 | 0.000 | 10.649 | 46.156 | 20.746 | 579.224 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 1.436 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 11644 | BEAVER CR RES STORAGE | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 11647 | GEKELER WELL (UNIO 999) | 28.019 | 17.615 | 5.401 | 27.988 | 32.807 | 0.368 | 17.431 | 0.000 | 49.992 | 129.446 | 77.152 | 31.027 | 417.247 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 11661 | 2ND & H WELL (UNIO 940) | 0.000 | 0.000 | 12.276 | 28.571 | 28.970 | 26.116 | 40.110 | 194.323 | 188.799 | 196.532 | 205.371 | 196.900 | 1117.968 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1998 | 30206 | 12TH STREET WELL (UNIO 2098) | 37.594 | 1.320 | 51.496 | 61.132 | 71.014 | 70.124 | 84.671 | 30.934 | 82.124 | 130.489 | 122.694 | 47.660 | 791.254 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 11641 | ISLAND CITY WELL (UNIO 778) | 38.668 | 2.271 | 1.596 | 0.000 | 0.000 | 0.123 | 0.031 | 0.031 | 0.031 | 0.061 | 106.798 | 154.826 | 304.434 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 6.997 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 24.306 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 0.890 | 0.031 | 0.000 | 0.000 | 66.073 | 0.000 | 23.753 | 36.428 | 82.461 | 121.989 | 56.529 | 388.154 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 11661 | 2ND & H WELL (UNIO 940) | 80.589 | 43.149 | 87.985 | 80.344 | 32.960 | 33.789 | 68.130 | 192.082 | 206.353 | 206.844 | 120.086 | 7.764 | 1160.074 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1997 | 30206 | 12TH STREET WELL (UNIO 2098) | 105.631 | 127.114 | 85.776 | 66.319 | 108.056 | 67.055 | 118.797 | 85.469 | 116.250 | 98.573 | 92.282 | 61.409 | 1132.730 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 11641 | ISLAND CITY WELL (UNIO 778) | 19.150 | 86.574 | 40.141 | 45.880 | 5.862 | 0.000 | 40.080 | 132.883 | 146.294 | 162.713 | 145.711 | 121.835 | 947.123 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 0.583 | 6.997 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 2.025 | 24.306 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 11647 | GEKELER WELL (UNIO 999) | 15.406 | 0.000 | 31.303 | 45.266 | 67.823 | 20.255 | 10.925 | 37.072 | 116.710 | 125.917 | 39.405 | 0.000 | 510.081 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 11660 | MAIN BEAVER CREEK | 80.651 | 80.651 | 80.651 | 80.651 | 80.651 | 80.651 | 80.651 | 80.651 | 80.651 | 80.651 | 80.651 | 80.651 | 967.807 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 11661 | 2ND & H WELL (UNIO 940) | 72.457 | 33.359 | 43.057 | 36.244 | 53.000 | 68.314 | 25.349 | 1.627 | 5.493 | 17.646 | 45.051 | 89.612 | 491.208 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1996 | 30206 | 12TH STREET WELL (UNIO 2098) | 79.362 | 58.309 | 86.482 | 58.156 | 62.667 | 89.949 | 72.242 | 19.641 | 86.113 | 166.825 | 159.583 | 67.853 | 1007.181 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 11641 | ISLAND CITY WELL (UNIO 778) | 34.985 | 15.038 | 0.000 | 0.000 | 0.000 | 38.668 | 0.000 | 35.599 | 102.501 | 135.645 | 141.476 | 65.981 | 569.894 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 3.683 | 3.683 | 3.683 | 3.683 | 3.683 | 3.683 | 3.683 | 3.683 | 3.683 | 3.683 | 3.683 | 3.683 | 44.192 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 9.575 | 9.575 | 9.575 | 9.575 | 9.575 | 9.575 | 9.575 | 9.575 | 9.575 | 9.575 | 9.575 | 9.575 | 114.899 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 11647 | GEKELER WELL (UNIO 999) | 144.852 | 0.000 | 0.000 | 0.000 | 0.000 | 33.451 | 3.683 | 10.588 | 86.543 | 130.735 | 125.211 | 138.100 | 673.162 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 11660 | MAIN BEAVER CREEK | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | 0.119 | 1.428 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 11661 | 2ND & H WELL (UNIO 940) | 23.937 | 63.833 | 65.368 | 71.812 | 110.480 | 75.495 | 103.729 | 89.305 | 63.526 | 88.998 | 69.971 | 69.664 | 896.118 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1995 | 30206 | 12TH STREET WELL (UNIO 2098) | 41.430 | 96.056 | 115.697 | 108.025 | 61.992 | 39.282 | 92.988 | 123.983 | 90.839 | 108.639 | 97.284 | 57.081 | 1033.297 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8-SE SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1993 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1993 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 29.062 | 0.000 | 0.000 | 15.897 | 44.192 | 45.143 | 38.238 | 172.533 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1993 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.120 | 0.000 | 0.120 | 0.120 | 0.120 | 0.120 | 1.316 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1993 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1993 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1993 | 11647 | GEKELER WELL (UNIO 999) | 6.107 | 0.000 | 0.000 | 0.000 | 0.000 | 40.049 | 0.123 | 22.311 | 6.475 | 24.551 | 35.845 | 0.000 | 135.461 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1993 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1993 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1993 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1993 | 11661 | 2ND & H WELL (UNIO 940) | 144.852 | 0.000 | 0.000 | 26.024 | 6.905 | 30.167 | 25.073 | 105.140 | 95.811 | 123.462 | 131.870 | 117.232 | 806.537 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1993 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1992 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1992 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 6.168 | 28.541 | 88.875 | 138.499 | 74.083 | 27.681 | 0.000 | 363.848 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1992 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1992 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |

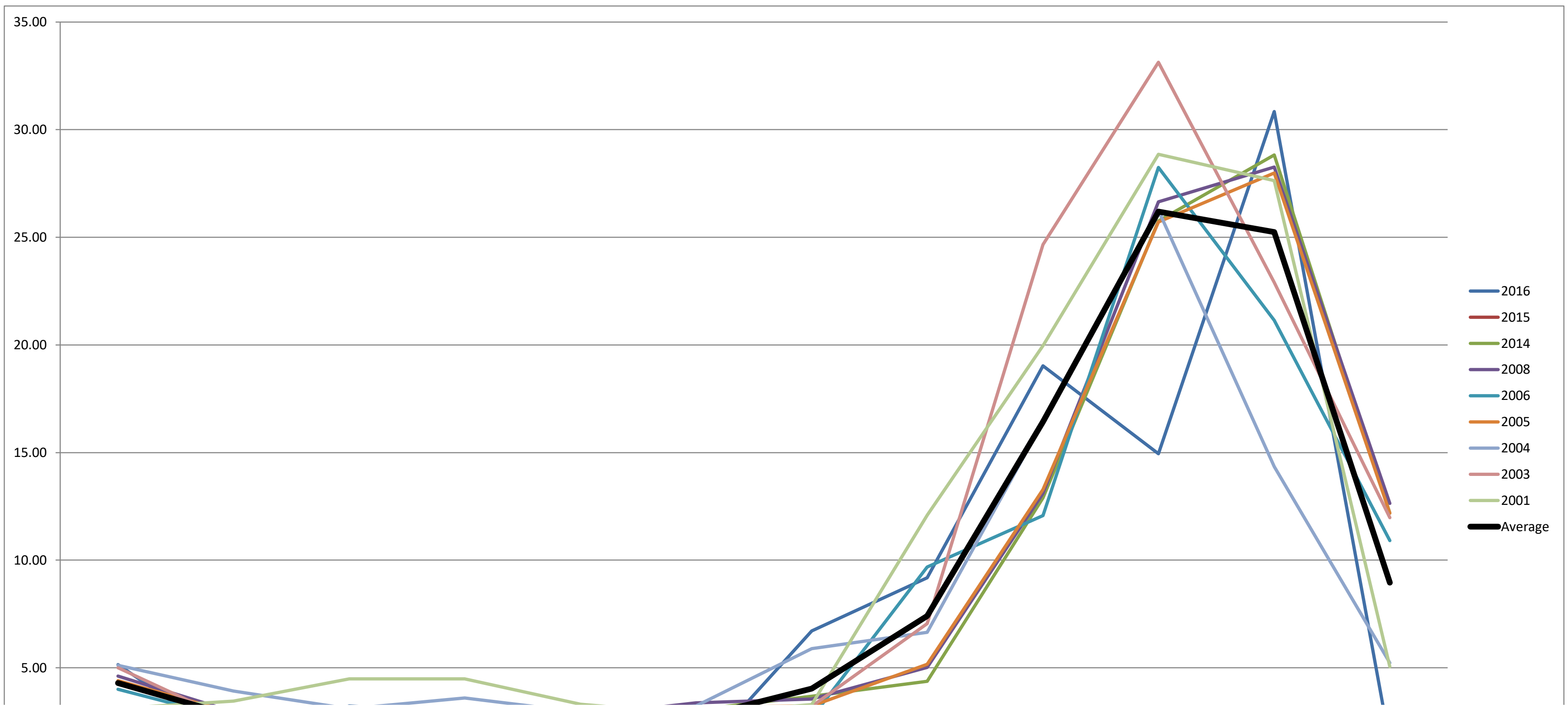
| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1992 | 11647 | GEKELER WELL (UNIO 999) | | 4.972 | 11.754 | 0.000 | 0.000 | 41.860 | 64.600 | 105.171 | 77.152 | 30.720 | 37.778 | 0.000 | 374.006 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1992 | 11648 | MORGAN LAKE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1992 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1992 | 11660 | MAIN BEAVER CREEK | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1992 | 11661 | 2ND & H WELL (UNIO 940) | 139.758 | 181.464 | 188.891 | 195.611 | 186.804 | 145.466 | 140.525 | 181.126 | 186.190 | 175.909 | 161.117 | 130.981 | 2013.841 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1992 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1991 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1991 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1991 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1991 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933) | 25.620 | 24.793 | 25.620 | 25.620 | 23.141 | 25.620 | 24.793 | 25.620 | 24.793 | 25.620 | 25.620 | 24.793 | 301.653 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1991 | 11644 | BEAVER CR RES STORAGE | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | 510.360 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1991 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 67.178 | 51.557 | 63.802 | 182.538 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1991 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1991 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.987 | 1.079 | 0.482 | 0.018 | 0.000 | 0.000 | 0.000 | 2.567 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1991 | 11660 | MAIN BEAVER CREEK | 200.921 | 182.783 | 198.189 | 177.628 | 148.105 | 174.528 | 115.268 | 129.507 | 191.929 | 250.698 | 252.877 | 200.675 | 2223.109 | BEAVER CREEK; | | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1991 | 11661 | 2ND & H WELL (UNIO 940) | 12.306 | 0.000 | 42.412 | 74.513 | 34.740 | 19.426 | 70.615 | 67.761 | 56.253 | 144.300 | 118.337 | 76.722 | 717.385 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1991 | 11662 | BEAVER CR RES USE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |
| 1989 | 11640 | GRANDE RONDE RIVER | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-   ) | LEE MANNOR | CITY OF LA GRANDE |
| 1989 | 11641 | ISLAND CITY WELL (UNIO 778) | 0.000 | 0.890 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 8.041 | 13.166 | 0.000 | 22.096 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3-SE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1989 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1989 | 11647 | GEKELER WELL (UNIO 999) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 5.094 | 12.337 | 30.198 | 82.216 | 47.200 | 0.000 | 177.045 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9-SW SW) | LEE MANNOR | CITY OF LA GRANDE |
| 1989 | 11648 | MORGAN LAKE | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | 780.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1989 | 11649 | MORGAN LAKE SOURCE | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-25-NE NW) | LEE MANNOR | CITY OF LA GRANDE |
| 1989 | 11661 | 2ND & H WELL (UNIO 940) | 99.270 | 19.193 | 21.498 | 48.111 | 80.123 | 92.101 | 86.828 | 98.208 | 138.852 | 164.413 | 100.706 | 47.378 | 996.679 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7-SE NE) | LEE MANNOR | CITY OF LA GRANDE |
| 1989 | 11662 | BEAVER CR RES USE | 148.642 | 157.226 | 164.471 | 146.153 | 140.092 | 114.734 | 102.596 | 147.387 | 224.128 | 260.908 | 204.769 | 218.017 | 2029.124 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8-SW SE) | LEE MANNOR | CITY OF LA GRANDE |

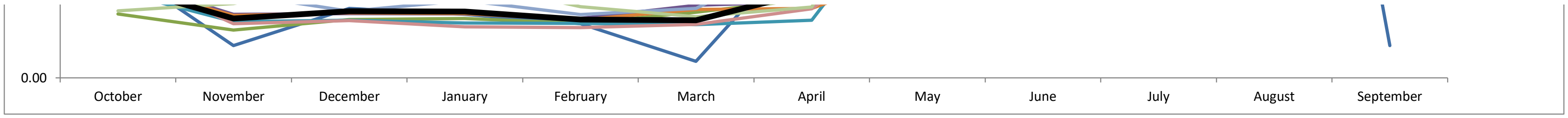
| Water Year | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | Total Water Used | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2013 | 47.05 | 33.94 | 32.42 | 38.72 | **50.00** | 35.11 | 34.75 | 57.43 | 64.82 | 102.42 | 94.80 | 48.65 | 720.01 | 720.0061 | 640.10 |
| 2008 | 40.19 | 49.70 | 39.10 | 44.82 | 41.27 | 41.37 | 42.42 | 49.82 | 62.74 | 112.70 | 71.68 | 63.57 | 659.37 | 659.3739 | 659.3739 |
| 2005 | 42.78 | 38.15 | 39.56 | 41.64 | 37.69 | 43.39 | 44.81 | 54.84 | 70.09 | 120.58 | 119.96 | 79.27 | 732.76 | 732.7605 | 732.7605 |
| 2004 | 52.82 | 46.46 | 44.62 | 55.92 | 44.19 | 42.63 | 39.65 | 48.98 | 76.75 | 110.97 | 73.99 | 44.71 | 681.69 | 681.694 | 681.694 |
| 2003 | 53.67 | 48.27 | 49.90 | 47.54 | 41.55 | 49.32 | 44.62 | 52.60 | 102.29 | 138.96 | 111.62 | 66.69 | 807.03 | 807.0276 | 807.0276 |
| 2002 | **50.00** | 43.67 | 52.86 | 38.84 | 58.84 | 45.09 | 63.49 | 77.89 | 127.62 | 95.49 | 83.66 | 53.68 | 827.83 | 827.8318 | 791.12 |
| 2001 | 42.86 | 43.67 | 46.98 | 46.95 | 43.08 | 46.83 | 42.91 | 62.32 | 87.32 | 102.71 | 109.63 | 80.33 | 755.60 | 755.5961 | 755.5961 |
| 2000 | 47.05 | 34.98 | 40.81 | 41.33 | 38.05 | 36.33 | 42.02 | 53.51 | 87.88 | 119.24 | 128.91 | 58.90 | 728.99 | 728.9888 | |
| 1999 | 36.56 | 32.48 | 41.84 | 44.76 | 35.14 | 37.48 | 36.30 | 66.89 | 106.53 | 144.13 | 103.75 | 77.92 | 763.77 | 763.7698 | |
| 1995 | 37.89 | 46.47 | 42.58 | 41.13 | 35.32 | 37.11 | 36.15 | 46.81 | 67.76 | 97.80 | 91.03 | 70.01 | 650.05 | 650.0475 | |
| 1994 | 47.87 | 50.96 | 49.10 | 44.13 | 41.31 | 44.25 | 41.42 | 55.26 | 75.55 | 117.85 | 112.82 | 66.10 | 746.62 | 746.6226 | |
| 1993 | 38.57 | 45.66 | 52.55 | 48.63 | 53.00 | 43.39 | 39.95 | 56.23 | 44.04 | 62.68 | 86.48 | 89.81 | 660.98 | 660.9758 | |
| 1992 | 26.57 | 15.24 | 16.37 | 14.70 | 13.62 | 17.62 | 19.28 | 17.20 | 17.99 | 17.33 | 20.45 | 16.95 | 213.30 | 213.3005 | **723.9527** |
| 1991 | 15.04 | 13.63 | 21.82 | 25.72 | 14.73 | 15.56 | 16.57 | 14.73 | 21.18 | 45.11 | 54.01 | 30.08 | 288.17 | 288.1694 | |
| | | | | | | | | | | | | | | 659.726 | |
| **Average** | **47.05** | **43.41** | **43.63** | **44.92** | **45.23** | **43.39** | **44.66** | **57.70** | **84.52** | **111.97** | **95.05** | **62.41** | **723.95** | | |
| Std Dev | 5.30 | 5.63 | 7.06 | 6.03 | 7.07 | 4.53 | 9.00 | 10.01 | 23.50 | 14.45 | 19.27 | 14.16 | | | |



| Water Year | Report ID | Facility Name | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | Source Name | Location | TRSQQ | Water Right Holder's Name | mpany Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2013 | 11407 | WELL 2 | 38.12 | 30.56 | 26.48 | 26.58 | 22.63 | 25.87 | 24.13 | 39.92 | 31.85 | 51.20 | 73.69 | 23.29 | 414.33 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 2013 | 11408 | WELL 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.27 | 30.72 | 46.35 | 20.89 | 25.36 | 135.58 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 2013 | 32954 | WELL 4 | 8.92 | 3.38 | 5.94 | 12.14 | 107.28 | 9.24 | 10.62 | 5.24 | 2.25 | 4.87 | 0.22 | 0.00 | 170.10 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 2008 | 11407 | WELL 2 | 7.21 | 9.17 | 25.80 | 25.67 | 22.23 | 20.64 | 13.23 | 15.48 | 18.30 | 41.12 | 29.90 | 32.98 | 261.74 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 2008 | 11408 | WELL 3 | 20.15 | 20.51 | 0.00 | 0.00 | 0.00 | 5.85 | 29.19 | 29.19 | 27.45 | 41.75 | 24.07 | 18.52 | 216.67 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 2008 | 32954 | WELL 4 | 12.83 | 20.03 | 13.30 | 19.14 | 19.04 | 14.88 | 0.00 | 5.16 | 16.99 | 29.83 | 17.71 | 12.07 | 180.97 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 2005 | 11407 | WELL 2 | 13.60 | 12.52 | 15.50 | 33.51 | 9.18 | 17.43 | 19.61 | 19.67 | 23.29 | 34.37 | 25.99 | 21.24 | 245.91 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 2005 | 11408 | WELL 3 | 19.64 | 16.88 | 15.16 | 0.12 | 9.88 | 17.25 | 9.61 | 19.92 | 30.66 | 49.90 | 37.56 | 11.11 | 237.69 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 2005 | 32954 | WELL 4 | 9.54 | 8.75 | 8.90 | 8.01 | 18.63 | 8.72 | 15.59 | 15.25 | 16.14 | 36.31 | 56.41 | 46.92 | 249.16 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 2004 | 11407 | WELL 2 | 10.19 | 29.55 | 10.93 | 40.94 | 13.23 | 24.98 | 32.35 | 38.76 | 17.95 | 40.26 | 33.88 | 14.55 | 307.56 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 2004 | 11408 | WELL 3 | 4.17 | 0.98 | 23.32 | 2.33 | 19.24 | 7.49 | 0.00 | 0.00 | 45.82 | 55.98 | 20.87 | 19.73 | 199.94 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 2004 | 32954 | WELL 4 | 38.45 | 15.93 | 10.37 | 12.64 | 11.72 | 10.16 | 7.30 | 10.22 | 12.98 | 14.73 | 19.24 | 10.43 | 174.19 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 2003 | 11407 | WELL 2 | 39.83 | 18.54 | 5.28 | 17.19 | 14.33 | 17.19 | 16.73 | 18.94 | 44.41 | 48.95 | 19.70 | 3.65 | 264.72 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 2003 | 11408 | WELL 3 | 0.00 | 18.32 | 32.38 | 18.23 | 16.51 | 18.90 | 18.01 | 15.38 | 26.58 | 0.06 | 0.00 | 0.00 | 164.37 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 2003 | 32954 | WELL 4 | 13.84 | 11.42 | 12.24 | 12.12 | 10.71 | 13.23 | 9.88 | 18.29 | 31.30 | 89.95 | 91.91 | 63.04 | 377.93 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 2002 | 11407 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 1.88 | 9.43 | 43.58 | 32.58 | 44.10 | 38.09 | 45.42 | 39.83 | 254.90 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 2002 | 11408 | WELL 3 | 0.00 | 0.00 | 0.00 | 0.00 | 31.50 | 22.40 | 3.82 | 27.07 | 29.92 | 20.39 | 22.39 | 0.00 | 157.49 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 2002 | 32954 | WELL 4 | 86.71 | 43.67 | 52.86 | 38.84 | 25.46 | 13.26 | 16.09 | 18.25 | 53.60 | 37.00 | 15.85 | 13.85 | 415.44 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 2001 | 11407 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 2001 | 11408 | WELL 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 2001 | 32954 | WELL 4 | 42.86 | 43.67 | 46.98 | 46.95 | 43.08 | 46.83 | 42.91 | 62.32 | 87.32 | 102.71 | 109.63 | 80.33 | 755.60 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 2000 | 11407 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 2000 | 11408 | WELL 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 2000 | 32954 | WELL 4 | 47.05 | 34.98 | 40.81 | 41.33 | 38.05 | 36.33 | 42.02 | 53.51 | 87.88 | 119.24 | 128.91 | 58.90 | 728.99 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 1999 | 11407 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 8.16 | 14.14 | 31.01 | 21.16 | 3.23 | 77.79 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 1999 | 11408 | WELL 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 1999 | 32954 | WELL 4 | 36.56 | 32.48 | 41.84 | 44.76 | 35.14 | 37.48 | 36.20 | 58.73 | 92.39 | 113.13 | 82.59 | 74.68 | 685.98 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 1998 | 11407 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.24 | 41.93 | 26.16 | 75.33 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 1998 | 11408 | WELL 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 1995 | 11407 | WELL 2 | 37.89 | 46.47 | 42.58 | 41.13 | 35.32 | 37.11 | 36.15 | 46.81 | 67.76 | 97.80 | 91.03 | 70.01 | 650.05 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 1994 | 11407 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 1994 | 11408 | WELL 3 | 2.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.94 | 3.21 | 6.32 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 1994 | 32954 | WELL 4 | 45.69 | 50.96 | 49.10 | 44.13 | 41.31 | 44.25 | 41.42 | 55.26 | 75.55 | 117.85 | 111.88 | 62.89 | 740.30 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 1993 | 11407 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 1993 | 11408 | WELL 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.09 | 0.00 | 3.51 | 16.89 | 21.50 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 1993 | 32954 | WELL 4 | 38.57 | 45.66 | 52.55 | 48.63 | 53.00 | 43.39 | 39.95 | 56.23 | 42.95 | 62.68 | 82.97 | 72.92 | 639.48 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 1992 | 11407 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 1992 | 11408 | WELL 3 | 26.57 | 15.24 | 16.37 | 14.70 | 13.62 | 17.62 | 19.28 | 17.20 | 17.99 | 17.33 | 20.45 | 16.95 | 213.30 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 1991 | 11407 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 1991 | 11408 | WELL 3 | 15.04 | 13.63 | 21.82 | 25.72 | 14.73 | 15.56 | 16.57 | 14.73 | 21.18 | 45.11 | 54.01 | 30.08 | 288.17 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |

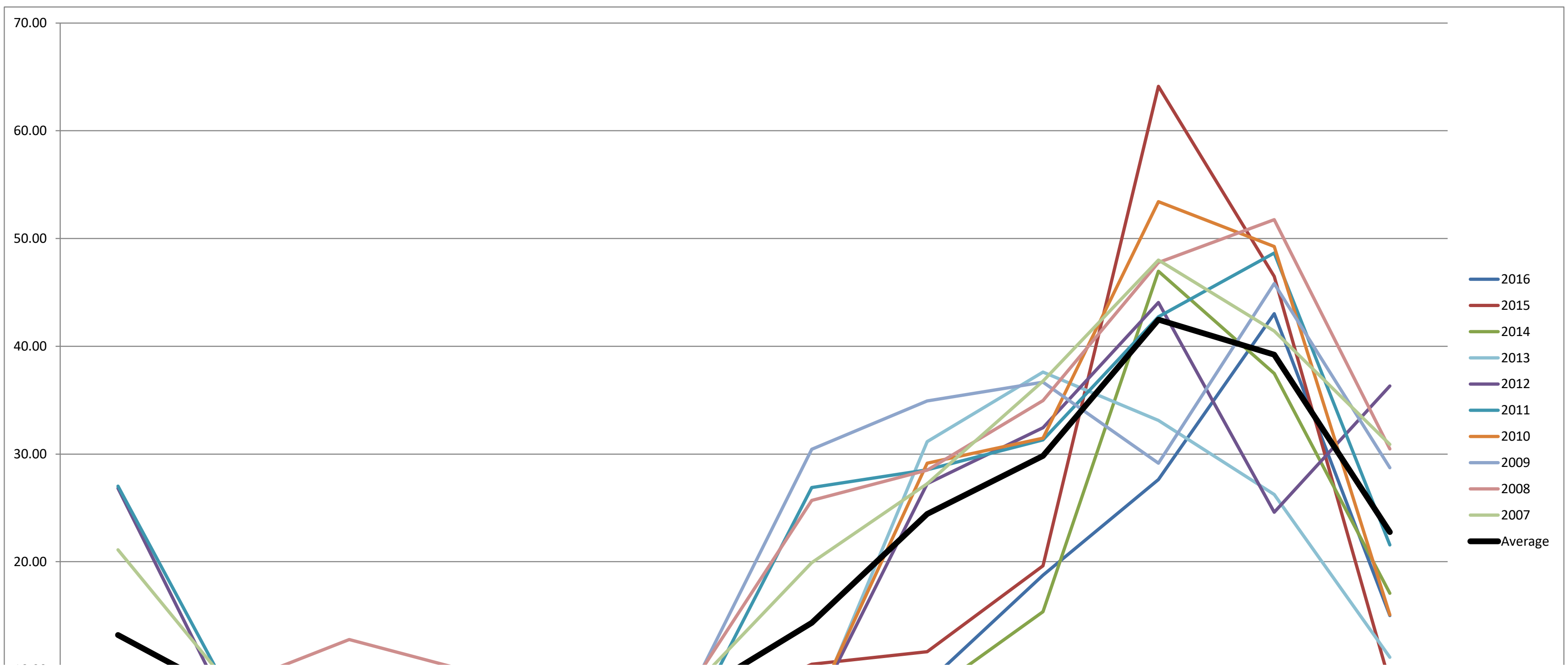
| Water Year | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | Total Water Used | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | 5.16 | 1.50 | 3.22 | 2.95 | 2.52 | 0.77 | 6.72 | 9.18 | 19.03 | 14.95 | 30.84 | 1.50 | 98.33 | 98.32745 | 98.32745 |
| 2014 | 2.97 | 2.22 | 2.70 | 2.77 | 2.53 | 3.06 | 3.68 | 4.37 | 12.89 | 25.76 | 28.83 | 12.18 | 103.96 | 103.9623 | 103.9623 |
| 2008 | 4.61 | 2.95 | 2.98 | 2.97 | 2.77 | 3.38 | 3.55 | 5.01 | 13.10 | 26.65 | 28.26 | 12.64 | 108.87 | 108.8722 | 108.8722 |
| 2006 | 4.00 | 2.61 | 2.68 | 2.55 | 2.53 | 2.47 | 2.68 | 9.69 | 12.07 | 28.25 | 21.14 | 10.92 | 101.60 | 101.5989 | 101.5989 |
| 2005 | 4.40 | 2.90 | 3.01 | 2.99 | 2.70 | 3.18 | 3.23 | 5.16 | 13.29 | 25.71 | 27.99 | 12.18 | 106.73 | 106.7301 | 106.7301 |
| 2004 | 5.11 | 3.92 | 3.10 | 3.60 | 2.94 | 3.23 | 5.89 | 6.65 | 16.43 | 26.25 | 14.35 | 5.23 | 96.71 | 96.70707 | 96.70707 |
| 2003 | 5.00 | 2.51 | 2.67 | 2.37 | 2.34 | 2.48 | 3.20 | 7.06 | 24.66 | 33.13 | 22.90 | 11.98 | 120.30 | 120.3007 | 120.3007 |
| 2001 | 3.12 | 3.46 | 4.48 | 4.48 | 3.31 | 2.84 | 3.29 | 12.09 | 19.96 | 28.86 | 27.63 | 5.06 | 118.58 | 118.5821 | 118.5821 |
| 2000 | 7.26 | 2.77 | 3.04 | 3.48 | 2.74 | 2.56 | 4.63 | 11.43 | 20.91 | 30.54 | 29.01 | 5.06 | 123.42 | 123.4187 | **106.8851** |
| 1999 | 2.77 | 2.47 | 3.08 | 2.72 | 2.33 | 2.82 | 4.51 | 11.61 | 17.57 | 27.86 | 18.60 | 13.89 | 110.23 | 110.2255 | |
| 1998 | 3.30 | 2.34 | 2.49 | 2.57 | 2.11 | 2.30 | 2.84 | 3.43 | 7.55 | 21.87 | 24.60 | 8.90 | 84.29 | 84.29025 | |
| 1997 | 4.24 | 2.19 | 2.56 | 2.61 | 2.35 | 2.65 | 2.46 | 6.41 | 11.45 | 13.14 | 19.11 | 7.74 | 76.90 | 76.90341 | |
| 1996 | 2.20 | 1.95 | 2.10 | 2.16 | 2.37 | 2.34 | 2.34 | 3.35 | 10.50 | 20.80 | 14.04 | 6.61 | 70.75 | 70.75029 | |
| 1995 | 3.80 | 2.29 | 2.28 | 2.87 | 2.43 | 2.79 | 3.67 | 7.64 | 10.80 | 20.21 | 15.61 | 10.35 | 84.77 | 84.77445 | |
| 1994 | 4.72 | 2.53 | 2.40 | 2.28 | 2.04 | 3.11 | 3.09 | 8.55 | 15.36 | 28.07 | 23.39 | 12.81 | 108.36 | 108.3566 | |
| 1993 | 3.65 | 2.45 | 2.43 | 2.35 | 2.06 | 2.19 | 2.19 | 6.29 | 5.62 | 10.26 | 15.26 | 12.05 | 66.80 | 66.80215 | |
| 1991 | 3.08 | 2.12 | 2.84 | 2.93 | 1.88 | 4.01 | 2.68 | 3.04 | 5.44 | 18.40 | 16.00 | 12.68 | 75.10 | 75.09726 | |
| 1990 | 3.67 | 1.95 | 2.03 | 2.01 | 1.73 | 2.66 | 5.38 | 4.16 | 7.76 | 20.00 | 14.68 | 11.11 | 77.14 | 77.13917 | |
| 1989 | 2.80 | 2.47 | 2.13 | 1.37 | 2.45 | 1.02 | 3.24 | 8.01 | 17.49 | 27.21 | 18.96 | 25.09 | 112.22 | 112.2189 | |
| | | | | | | | | | | | | | | 97.10829 | |
| **Average** | **4.30** | **2.76** | **3.11** | **3.08** | **2.70** | **2.68** | **4.03** | **7.40** | **16.43** | **26.19** | **25.24** | **8.96** | **106.89** | | |
| Std Dev | 0.86 | 0.55 | 0.56 | 0.66 | 0.38 | 0.75 | 1.25 | 2.86 | 5.34 | 6.19 | 5.85 | 4.96 | | | |

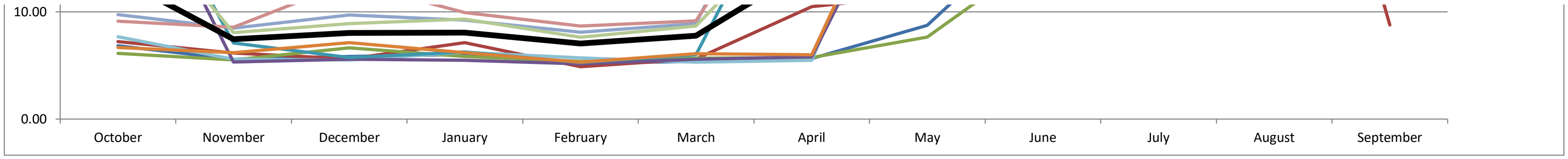



0.00
October
November
December
January
February
March
April
May
June
July
August
September

| Water Year | Report ID | Facility Name | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | Source Name | Location | TRSQQ | Water Right Holder's Name | Company Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | 11590 | ONE WELL | 5.16 | 1.50 | 3.22 | 2.95 | 2.52 | 0.77 | 6.72 | 9.18 | 19.03 | 14.95 | 30.84 | 1.50 | 98.33 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 2015 | 11590 | ONE WELL | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 0.90 | 10.84 | 20.20 | 23.12 | 50.04 | 12.65 | 171.76 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 2014 | 11590 | ONE WELL | 2.97 | 2.22 | 2.70 | 2.77 | 2.53 | 3.06 | 3.68 | 4.37 | 12.89 | 25.76 | 28.83 | 12.18 | 103.96 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 2013 | 11590 | ONE WELL | 1.04 | 0.99 | 1.03 | 1.15 | 0.98 | 1.19 | 1.20 | 1.23 | 1.60 | 2.40 | 3.08 | 3.99 | 19.89 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 2008 | 11590 | ONE WELL | 4.61 | 2.95 | 2.98 | 2.97 | 2.77 | 3.38 | 3.55 | 5.01 | 13.10 | 26.65 | 28.26 | 12.64 | 108.87 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 2006 | 11590 | ONE WELL | 4.00 | 2.61 | 2.68 | 2.55 | 2.53 | 2.47 | 2.68 | 9.69 | 12.07 | 28.25 | 21.14 | 10.92 | 101.60 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 2005 | 11590 | ONE WELL | 4.40 | 2.90 | 3.01 | 2.99 | 2.70 | 3.18 | 3.23 | 5.16 | 13.29 | 25.71 | 27.99 | 12.18 | 106.73 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 2004 | 11590 | ONE WELL | 5.11 | 3.92 | 3.10 | 3.60 | 2.94 | 3.23 | 5.89 | 6.65 | 16.43 | 26.25 | 14.35 | 5.23 | 96.71 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 2003 | 11590 | ONE WELL | 5.00 | 2.51 | 2.67 | 2.37 | 2.34 | 2.48 | 3.20 | 7.06 | 24.66 | 33.13 | 22.90 | 11.98 | 120.30 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 2001 | 11590 | ONE WELL | 3.12 | 3.46 | 4.48 | 4.48 | 3.31 | 2.84 | 3.29 | 12.09 | 19.96 | 28.86 | 27.63 | 5.06 | 118.58 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 2000 | 11590 | ONE WELL | 7.26 | 2.77 | 3.04 | 3.48 | 2.74 | 2.56 | 4.63 | 11.43 | 20.91 | 30.54 | 29.01 | 5.06 | 123.42 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 1999 | 11590 | ONE WELL | 2.77 | 2.47 | 3.08 | 2.72 | 2.33 | 2.82 | 4.51 | 11.61 | 17.57 | 27.86 | 18.60 | 13.89 | 110.23 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 1998 | 11590 | ONE WELL | 3.30 | 2.34 | 2.49 | 2.57 | 2.11 | 2.30 | 2.84 | 3.43 | 7.55 | 21.87 | 24.60 | 8.90 | 84.29 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 1997 | 11590 | ONE WELL | 4.24 | 2.19 | 2.56 | 2.61 | 2.35 | 2.65 | 2.46 | 6.41 | 11.45 | 13.14 | 19.11 | 7.74 | 76.90 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 1996 | 11590 | ONE WELL | 2.20 | 1.95 | 2.10 | 2.16 | 2.37 | 2.34 | 2.34 | 3.35 | 10.50 | 20.80 | 14.04 | 6.61 | 70.75 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 1995 | 11590 | ONE WELL | 3.80 | 2.29 | 2.28 | 2.87 | 2.43 | 2.79 | 3.67 | 7.64 | 10.80 | 20.21 | 15.61 | 10.35 | 84.77 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 1994 | 11590 | ONE WELL | 4.72 | 2.53 | 2.40 | 2.28 | 2.04 | 3.11 | 3.09 | 8.55 | 15.36 | 28.07 | 23.39 | 12.81 | 108.36 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 1993 | 11590 | ONE WELL | 3.65 | 2.45 | 2.43 | 2.35 | 2.06 | 2.19 | 2.19 | 6.29 | 5.62 | 10.26 | 15.26 | 12.05 | 66.80 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 1991 | 11590 | ONE WELL | 3.08 | 2.12 | 2.84 | 2.93 | 1.88 | 4.01 | 2.68 | 3.04 | 5.44 | 18.40 | 16.00 | 12.68 | 75.10 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 1990 | 11590 | ONE WELL | 3.67 | 1.95 | 2.03 | 2.01 | 1.73 | 2.66 | 5.38 | 4.16 | 7.76 | 20.00 | 14.68 | 11.11 | 77.14 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |
| 1989 | 11590 | ONE WELL | 2.80 | 2.47 | 2.13 | 1.37 | 2.45 | 1.02 | 3.24 | 8.01 | 17.49 | 27.21 | 18.96 | 25.09 | 112.22 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-20-SE SW) | NAN BIGEJ | CITY OF IMBLER |

| | | | | | | | | | | | | | no hydro | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water Year | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | al Water Used | |
| 2016 | 6.85 | 5.59 | 5.83 | 6.02 | 5.20 | 5.38 | 5.65 | 8.75 | 18.75 | 27.62 | 43.03 | 15.02 | 153.68 | 153.6842 | 153.68 |
| 2015 | 7.23 | 6.18 | 5.63 | 7.13 | 4.89 | 5.62 | 10.48 | 11.65 | 19.61 | 64.13 | 46.50 | 8.77 | 197.80 | 197.7965 | 197.80 |
| 2014 | 6.12 | 5.51 | 6.64 | 5.84 | 5.38 | 5.67 | 5.75 | 7.66 | 15.38 | 46.97 | 37.49 | 17.09 | 165.49 | 165.4872 | 165.49 |
| 2013 | 7.67 | 5.57 | 5.53 | 6.22 | 5.71 | 5.31 | 5.47 | 31.14 | 37.61 | 33.12 | 26.23 | 11.14 | 180.71 | 180.7089 | 180.7089 |
| 2012 | 26.82 | 5.31 | 5.58 | 5.48 | 5.15 | 5.58 | 5.81 | 27.23 | 32.45 | 44.07 | 24.60 | 36.31 | 224.39 | 224.3947 | 224.3947 |
| 2011 | 27.02 | 7.10 | 5.74 | 6.26 | 5.28 | 6.00 | 26.89 | 28.53 | 31.32 | 42.74 | 48.66 | 21.56 | 257.09 | 257.0876 | 257.0876 |
| 2010 | 6.67 | 6.21 | 7.13 | 6.18 | 5.31 | 6.10 | 6.02 | 29.15 | 31.48 | 53.42 | 49.27 | 15.07 | 222.02 | 222.0163 | 222.0163 |
| 2009 | 9.75 | 8.50 | 9.71 | 9.23 | 8.10 | 8.91 | 30.44 | 34.94 | 36.66 | 29.15 | 45.82 | 28.74 | 259.94 | 259.9448 | 259.9448 |
| 2008 | 9.15 | 8.57 | 12.77 | 9.95 | 8.67 | 9.17 | 25.69 | 28.52 | 34.95 | 47.78 | 51.75 | 30.48 | 277.43 | 277.4344 | 277.4344 |
| 2007 | 21.11 | 8.07 | 8.89 | 9.33 | 7.64 | 8.68 | 19.93 | 27.23 | 36.78 | 48.00 | 41.41 | 30.90 | 267.98 | 267.9822 | 267.9822 |
| 2006 | 16.73 | 7.57 | 9.82 | 9.53 | 7.16 | 7.97 | 23.91 | 29.90 | 31.13 | 46.98 | 40.86 | 31.02 | 262.58 | 262.5779 | 262.5779 |
| 2005 | 24.96 | 9.15 | 9.41 | 9.26 | 7.86 | 10.13 | 7.71 | 19.42 | 29.30 | 40.85 | 42.70 | 31.66 | 242.42 | 242.4152 | 242.4152 |
| 2004 | 11.51 | 10.41 | 9.30 | 9.75 | 11.23 | 11.50 | 25.67 | 33.25 | 25.50 | 40.07 | 37.01 | 25.86 | 251.07 | 251.0726 | 251.0726 |
| 2003 | 10.97 | 9.50 | 9.77 | 10.21 | 8.04 | 9.22 | 9.26 | 28.21 | 43.54 | 47.37 | 33.06 | 16.75 | 235.88 | 235.8845 | 235.8845 |
| 2002 | 12.21 | 8.82 | 9.12 | 9.24 | 8.69 | 9.80 | 10.97 | 31.96 | 35.00 | 43.95 | 36.14 | 25.78 | 241.71 | 241.7062 | 241.7062 |
| 2001 | 6.52 | 7.00 | 7.92 | 9.53 | 8.51 | 9.32 | 9.40 | 13.71 | 17.81 | 23.35 | 23.11 | 17.77 | 153.96 | 153.9573 | 153.9573 |
| 2000 | 11.07 | 7.09 | 6.96 | 7.13 | 7.04 | 7.45 | 7.27 | 14.69 | 16.22 | 24.42 | 25.24 | 8.41 | 142.99 | 142.986 | **224.63** |
| 1999 | 7.11 | 6.53 | 8.62 | 6.84 | 6.24 | 7.06 | 8.24 | 9.71 | 15.54 | 23.41 | 16.88 | 14.44 | 130.62 | 130.6214 | |
| 1998 | 8.18 | 7.43 | 9.17 | 8.04 | 6.64 | 7.46 | 7.18 | 8.46 | 10.46 | 22.17 | 19.60 | 11.81 | 126.59 | 126.5919 | |
| 1990 | 6.79 | 5.67 | 6.22 | 5.79 | 5.70 | 5.71 | 7.91 | 8.67 | 7.04 | 17.20 | 14.77 | 11.45 | 102.92 | 102.9246 | |
| 1989 | 12.42 | 10.99 | 10.44 | 7.52 | 19.44 | 13.16 | 12.03 | 12.27 | 20.11 | 25.88 | 22.41 | 17.93 | 184.60 | 184.6023 | |
| | | | | | | | | | | | | | | 203.8989 | |
| **Average** | **13.21** | **7.44** | **8.05** | **8.07** | **7.05** | **7.77** | **14.32** | **24.45** | **29.83** | **42.47** | **39.23** | **22.74** | **224.63** | | |
| Std Dev | 6.93 | 1.67 | 2.00 | 1.65 | 3.18 | 2.21 | 8.46 | 9.95 | 10.21 | 12.50 | 11.59 | 8.61 | | | |

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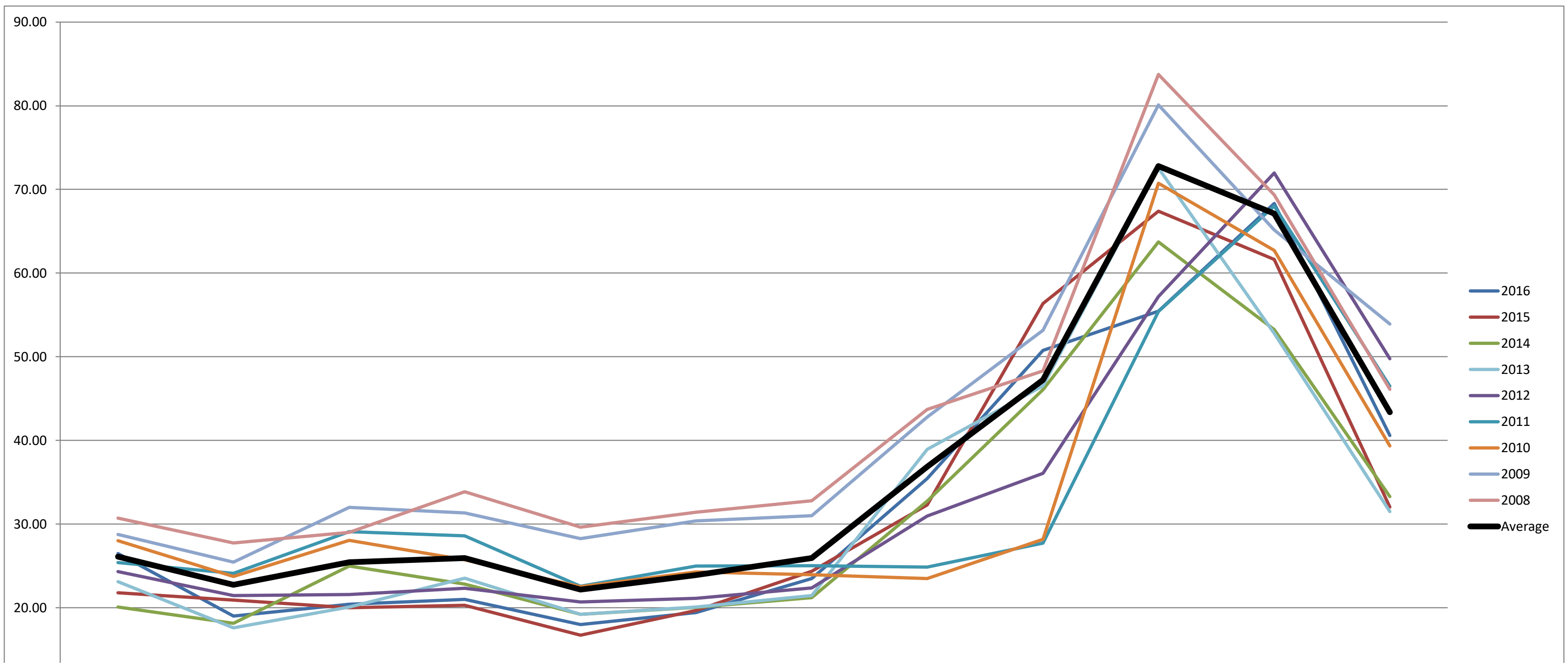
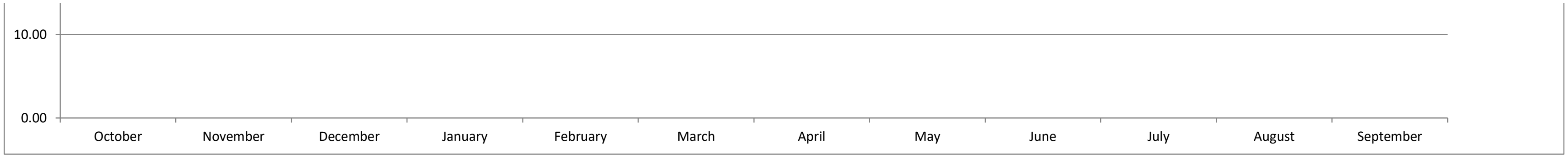
| Water Year | Report ID | Facility Name | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | Source Name | Location | TRSQQ | Water Right Holder's Name | Company Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2017 | 11323 | SEWAGE LAGOON/RES | | | | | | | | | | 20.86 | 20.63 | | 41.49 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2017 | 61041 | WELL 2 | 8.01 | 5.46 | 6.19 | 8.17 | 6.07 | 5.35 | 5.23 | 8.89 | 15.11 | 26.95 | 23.54 | 11.31 | 130.28 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2016 | 61041 | WELL 2 | 6.85 | 5.59 | 5.83 | 6.02 | 5.20 | 5.38 | 5.65 | 8.75 | 18.75 | 19.21 | 22.02 | 15.02 | 124.27 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2016 | 11323 | SEWAGE LAGOON/RES | | | | | | | | | | 8.41 | 21.00 | | 29.41 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2015 | 11323 | SEWAGE LAGOON/RES | | | | | | | | | | 36.58 | 20.64 | | 57.22 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2015 | 61041 | WELL 2 | 7.23 | 6.18 | 5.63 | 7.13 | 4.89 | 5.62 | 10.48 | 11.65 | 19.61 | 27.55 | 25.86 | 8.77 | 140.58 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2014 | 11323 | SEWAGE LAGOON/RES | | | | | | | | | | 23.37 | 17.30 | | 40.67 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2014 | 61041 | WELL 2 | 6.12 | 5.51 | 6.64 | 5.84 | 5.38 | 5.67 | 5.75 | 7.66 | 15.38 | 23.60 | 20.19 | 17.09 | 124.82 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2013 | 11323 | SEWAGE LAGOON/RES | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 21.40 | 20.93 | 4.78 | 0.00 | 0.00 | 47.10 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2013 | 61041 | WELL 2 | 7.67 | 5.57 | 5.53 | 6.22 | 5.71 | 5.31 | 5.47 | 9.74 | 16.67 | 28.34 | 26.23 | 11.14 | 133.60 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2012 | 61041 | WELL 2 | 7.14 | 5.31 | 5.58 | 5.48 | 5.15 | 5.58 | 5.81 | 7.64 | 10.62 | 22.56 | 24.60 | 19.98 | 125.45 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2012 | 11323 | SEWAGE LAGOON/RES | 19.69 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 19.59 | 21.84 | 21.50 | 0.00 | 16.33 | 98.94 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2011 | 11323 | SEWAGE LAGOON/RES | 19.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 21.32 | 21.83 | 22.17 | 20.78 | 22.71 | 0.00 | 128.40 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2011 | 61041 | WELL 2 | 7.42 | 7.10 | 5.74 | 6.26 | 5.28 | 6.00 | 5.57 | 6.70 | 9.15 | 21.96 | 25.95 | 21.56 | 128.69 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2010 | 11323 | SEWAGE LAGOON/RES | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 22.61 | 23.89 | 24.13 | 23.10 | 0.00 | 93.73 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2010 | 61041 | WELL 2 | 6.67 | 6.21 | 7.13 | 6.18 | 5.31 | 6.10 | 6.02 | 6.54 | 7.59 | 29.29 | 26.17 | 15.07 | 128.28 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2009 | 61041 | WELL 2 | 9.75 | 8.50 | 9.71 | 9.23 | 8.10 | 8.91 | 8.31 | 10.49 | 13.75 | 29.15 | 20.83 | 18.09 | 154.82 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2009 | 11323 | SEWAGE LAGOON/RES | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 22.13 | 24.45 | 22.90 | 0.00 | 25.00 | 10.65 | 105.13 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2008 | 11323 | SEWAGE LAGOON/RES | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 16.56 | 16.95 | 16.01 | 14.15 | 23.46 | 12.10 | 99.23 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2008 | 11324 | WASTE WATER | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WASTE WATER; | | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2008 | 61041 | WELL 2 | 9.15 | 8.57 | 12.77 | 9.95 | 8.67 | 9.17 | 9.12 | 11.57 | 18.94 | 33.63 | 28.30 | 18.38 | 178.20 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2007 | 61041 | WELL 2 | 9.33 | 8.07 | 8.89 | 9.33 | 7.64 | 8.68 | 8.77 | 10.58 | 20.93 | 31.59 | 24.35 | 19.39 | 167.54 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2007 | 11323 | SEWAGE LAGOON/RES | 11.79 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 11.16 | 16.65 | 15.85 | 16.42 | 17.06 | 11.51 | 100.44 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2007 | 11326 | A WELL (UNIO 1364) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 2006 | 11326 | A WELL (UNIO 1364) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 2006 | 61041 | WELL 2 | 8.24 | 7.57 | 9.82 | 9.53 | 7.16 | 7.97 | 8.39 | 12.79 | 14.98 | 30.35 | 24.92 | 15.85 | 157.57 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2006 | 11323 | SEWAGE LAGOON/RES | 8.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.52 | 17.11 | 16.15 | 16.63 | 15.94 | 15.17 | 105.01 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2005 | 11323 | SEWAGE LAGOON/RES | 14.21 | | | | | | | 10.48 | 15.90 | 15.88 | 15.94 | 15.35 | 87.76 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2005 | 11326 | A WELL (UNIO 1364) | 10.75 | 9.15 | 9.41 | 9.26 | 7.86 | 5.14 | | | | | | | 51.58 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 2005 | 61041 | WELL 2 | | | | | | 4.99 | 7.71 | 8.93 | 13.40 | 24.97 | 26.77 | 16.31 | 103.08 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-15-SE SE) | MIKE BROWN | CITY OF COVE |
| 2004 | 11323 | SEWAGE LAGOON/RES | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14.94 | 19.81 | 8.03 | 16.05 | 15.95 | 14.98 | 89.76 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2004 | 11326 | A WELL (UNIO 1364) | 11.51 | 10.41 | 9.30 | 9.75 | 11.23 | 11.50 | 10.73 | 13.44 | 17.47 | 24.02 | 21.06 | 10.88 | 161.32 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 2003 | 11323 | SEWAGE LAGOON/RES | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 18.00 | 23.45 | 18.47 | 10.81 | 3.14 | 73.87 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2003 | 11326 | A WELL (UNIO 1364) | 10.97 | 9.50 | 9.77 | 10.21 | 8.04 | 9.22 | 9.26 | 10.21 | 20.09 | 28.90 | 22.25 | 13.61 | 162.02 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 2002 | 11323 | SEWAGE LAGOON/RES | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 17.35 | 16.71 | 17.80 | 14.45 | 11.47 | 77.79 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 2002 | 11326 | A WELL (UNIO 1364) | 12.21 | 8.82 | 9.12 | 9.24 | 8.69 | 9.80 | 10.97 | 14.61 | 18.29 | 26.15 | 21.69 | 14.30 | 163.92 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 2001 | 11326 | A WELL (UNIO 1364) | 6.52 | 7.00 | 7.92 | 9.53 | 8.51 | 9.32 | 9.40 | 13.71 | 17.81 | 23.35 | 23.11 | 17.77 | 153.96 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 2000 | 11326 | A WELL (UNIO 1364) | 11.07 | 7.09 | 6.96 | 7.13 | 7.04 | 7.45 | 7.27 | 14.69 | 16.22 | 24.42 | 25.24 | 8.41 | 142.99 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 1999 | 11326 | A WELL (UNIO 1364) | 7.11 | 6.53 | 8.62 | 6.84 | 6.24 | 7.06 | 8.24 | 9.71 | 15.54 | 23.41 | 16.88 | 14.44 | 130.62 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 1998 | 11326 | A WELL (UNIO 1364) | 8.18 | 7.43 | 9.17 | 8.04 | 6.64 | 7.46 | 7.18 | 8.46 | 10.46 | 22.17 | 19.60 | 11.81 | 126.59 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 1990 | 11324 | WASTE WATER | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WASTE WATER; | | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 1990 | 11326 | A WELL (UNIO 1364) | 6.79 | 5.67 | 6.22 | 5.79 | 5.70 | 5.71 | 7.91 | 8.67 | 7.04 | 17.20 | 14.77 | 11.45 | 102.92 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 1989 | 11324 | WASTE WATER | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.84 | 4.02 | 5.06 | 6.51 | 7.18 | 7.18 | WASTE WATER; | | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |
| 1989 | 11326 | A WELL (UNIO 1364) | 6.93 | 5.34 | 6.48 | 3.53 | 13.00 | 7.36 | 6.38 | 6.96 | 11.83 | 16.12 | 11.63 | 7.31 | 102.88 | A WELL; | 60 FEET NORTH AND 740 FEET EAST FROM W1/4 CORNER, SECTION 22 | (3S-40E-22-SW NW) | MIKE BROWN | CITY OF COVE |
| 1989 | 11323 | SEWAGE LAGOON/RES | 5.49 | 5.65 | 3.96 | 3.99 | 6.44 | 5.80 | 5.65 | 3.47 | 4.27 | 4.70 | 4.27 | 3.44 | 57.11 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-17-SE SE) | MIKE BROWN | CITY OF COVE |

| Water Year | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | Total Water Used | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | 26.49 | 19.00 | 20.41 | 21.01 | 17.99 | 19.41 | 23.50 | 35.45 | 50.77 | 55.46 | 68.32 | 40.59 | 398.40 | 398.4011 | 398.4011 |
| 2015 | 21.80 | 20.92 | 20.01 | 20.31 | 16.72 | 19.66 | 24.35 | 32.29 | 56.35 | 67.40 | 61.65 | 32.04 | 393.49 | 393.4939 | 393.4939 |
| 2014 | 20.10 | 18.14 | 24.99 | 22.83 | 19.20 | 20.03 | 21.22 | 32.73 | 46.07 | 63.73 | 53.25 | 33.29 | 375.57 | 375.5685 | 375.5685 |
| 2013 | 23.11 | 17.60 | 20.08 | 23.51 | 19.20 | 20.08 | 21.45 | 38.92 | 46.53 | 72.55 | 52.79 | 31.51 | 387.33 | 387.3316 | 387.3316 |
| 2012 | 24.33 | 21.45 | 21.57 | 22.32 | 20.69 | 21.13 | 22.36 | 30.95 | 36.08 | 57.18 | 71.97 | 49.77 | 399.79 | 399.7852 | 399.7852 |
| 2011 | 25.40 | 24.11 | 29.10 | 28.61 | 22.57 | 24.97 | 25.03 | 24.86 | 27.73 | 55.42 | 68.02 | 46.49 | 402.31 | 402.3078 | 402.3078 |
| 2010 | 28.01 | 23.75 | 28.07 | 25.73 | 22.51 | 24.30 | 23.95 | 23.49 | 28.18 | 70.74 | 62.71 | 39.33 | 400.77 | 400.7734 | 400.7734 |
| 2009 | 28.77 | 25.45 | 31.99 | 31.35 | 28.26 | 30.38 | 30.99 | 42.77 | 53.17 | 80.10 | 65.17 | 53.92 | 502.34 | 502.3446 | 502.3446 |
| 2008 | 30.73 | 27.74 | 28.99 | 33.88 | 29.63 | 31.40 | 32.79 | 43.71 | 48.30 | 83.75 | 69.36 | 46.12 | 506.40 | 506.4048 | 506.4048 |
| 2007 | 32.20 | 29.37 | 29.39 | 29.75 | 24.93 | 27.66 | 33.56 | 63.20 | 79.19 | 121.59 | 97.83 | 60.68 | 629.35 | 629.3509 | 629.3509 |
| 2006 | 2.50 | 2.30 | 2.80 | 2.78 | 2.42 | 2.59 | 2.96 | 4.78 | 5.57 | 11.31 | 8.50 | 5.42 | 53.92 | 53.92421 | **439.5762** |
| 2005 | 3.21 | 2.91 | 2.41 | 2.55 | 2.22 | 2.69 | 2.49 | 3.30 | 5.32 | 8.88 | 9.69 | 5.39 | 51.07 | 51.06891 | |
| 2004 | 3.26 | 2.18 | 2.23 | 2.63 | 1.94 | 2.41 | 3.62 | 3.69 | 5.60 | 8.74 | 7.33 | 4.42 | 48.04 | 48.03958 | |
| 2003 | 2.57 | 2.13 | 2.14 | 2.08 | 1.94 | 2.16 | 2.34 | 2.79 | 6.84 | 10.40 | 8.53 | 4.63 | 48.55 | 48.55355 | |
| 2002 | 3.56 | 3.09 | 2.84 | 2.69 | 2.56 | 2.76 | 2.74 | 4.60 | 6.37 | 8.71 | 8.65 | 4.99 | 53.56 | 53.55894 | |
| 2001 | 27.03 | 27.46 | 32.24 | 33.02 | 29.95 | 31.15 | 33.00 | 52.80 | 62.48 | 81.20 | 85.61 | 80.54 | 576.47 | 576.4677 | |
| 2000 | 28.25 | 23.54 | 26.50 | 25.57 | 25.35 | 22.95 | 30.62 | 44.86 | 72.51 | 105.31 | 120.67 | 36.70 | 562.82 | 562.8172 | |
| 1994 | 13.80 | 27.00 | 23.02 | 11.19 | 15.59 | 13.85 | 15.48 | 28.94 | 18.38 | 32.20 | 33.69 | 40.47 | 273.61 | 273.6074 | |
| 1993 | 33.33 | 27.00 | 38.87 | 40.73 | 30.76 | 32.22 | 29.84 | 43.78 | 39.30 | 56.13 | 62.15 | 55.91 | 490.01 | 490.0075 | |
| 1992 | 40.18 | 32.51 | 33.50 | 34.17 | 32.21 | 31.55 | 31.83 | 59.86 | 58.52 | 51.82 | 72.63 | 42.10 | 520.87 | 520.8684 | |
| 1989 | 78.73 | 55.81 | 59.50 | 56.98 | 65.28 | 57.24 | 63.70 | 78.12 | 122.01 | 136.27 | 96.64 | 62.61 | 932.90 | 932.9016 | |
| | | | | | | | | | | | | | | | |
| **Average 07-** | **26.09** | **22.75** | **25.46** | **25.93** | **22.17** | **23.90** | **25.92** | **36.84** | **47.24** | **72.79** | **67.11** | **43.37** | **439.58** | | |
| Std Dev | 3.90 | 4.02 | 4.60 | 4.70 | 4.32 | 4.58 | 4.70 | 11.44 | 14.99 | 19.77 | 12.58 | 9.80 | | | |

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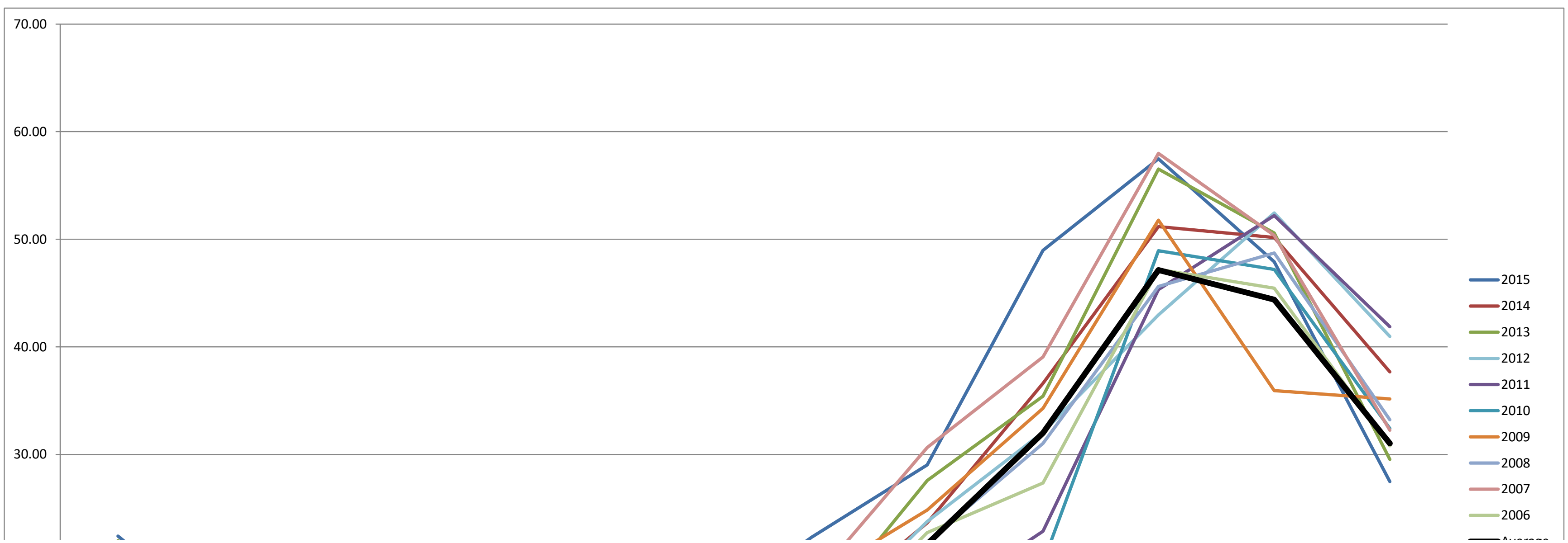
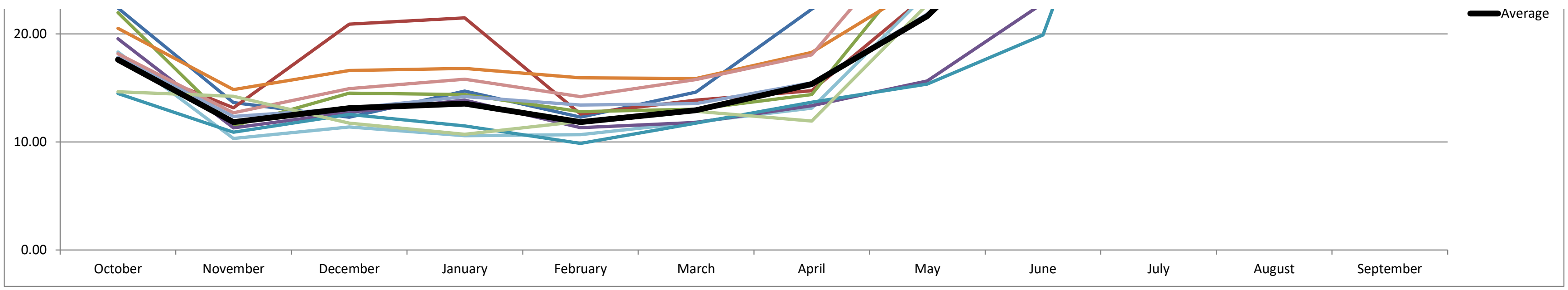
September

| Water Year | Report ID | Facility Name | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | Source Name | Location | TRSQQ | Water Right Holder's Name | Company Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2016 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2016 | 12294 | WELL 2 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 24.50 | 50.77 | 55.46 | 68.32 | 40.58 | 240.12 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2016 | 23528 | WELL 3 (UNIO 2377) | 25.99 | 19.00 | 20.41 | 21.01 | 17.99 | 19.41 | 23.50 | 10.95 | 0.00 | 0.00 | 0.00 | 0.01 | 158.28 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2015 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2015 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2015 | 12294 | WELL 2 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.46 | 0.00 | 0.77 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2015 | 23528 | WELL 3 (UNIO 2377) | 21.80 | 20.79 | 20.01 | 20.31 | 16.72 | 19.66 | 24.18 | 32.29 | 56.35 | 67.40 | 61.18 | 32.04 | 392.73 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2014 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2014 | 12294 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.48 | 0.48 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2014 | 23528 | WELL 3 (UNIO 2377) | 20.10 | 18.14 | 24.99 | 22.83 | 19.20 | 20.03 | 21.22 | 32.72 | 46.07 | 63.73 | 53.25 | 32.81 | 375.09 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2014 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2013 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2013 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2013 | 12294 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.08 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2013 | 23528 | WELL 3 (UNIO 2377) | 23.11 | 17.60 | 20.08 | 23.51 | 19.18 | 20.08 | 21.40 | 38.92 | 46.53 | 72.54 | 52.79 | 31.51 | 387.25 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2012 | 23528 | WELL 3 (UNIO 2377) | 24.33 | 21.45 | 21.57 | 22.30 | 20.69 | 21.13 | 22.33 | 30.95 | 36.08 | 57.18 | 71.97 | 49.77 | 399.73 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2012 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2012 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2012 | 12294 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2011 | 23528 | WELL 3 (UNIO 2377) | 25.40 | 24.11 | 29.10 | 28.61 | 22.57 | 24.97 | 25.03 | 24.86 | 27.73 | 55.42 | 68.02 | 46.49 | 402.31 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2011 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2011 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2011 | 12294 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2010 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2010 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2010 | 12294 | WELL 2 | 28.01 | 23.75 | 1.99 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 34.86 | 0.00 | 0.00 | 88.61 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2010 | 23528 | WELL 3 (UNIO 2377) | 0.00 | 0.00 | 26.08 | 25.73 | 22.51 | 24.30 | 23.95 | 23.49 | 28.18 | 35.88 | 62.71 | 39.33 | 312.17 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2009 | 23528 | WELL 3 (UNIO 2377) | 28.77 | 25.45 | 31.99 | 31.35 | 28.26 | 30.38 | 30.97 | 42.77 | 53.17 | 55.54 | 0.00 | 0.00 | 358.67 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2009 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2009 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2009 | 12294 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 24.56 | 65.17 | 53.92 | 143.68 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2008 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2008 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2008 | 12294 | WELL 2 | 13.04 | 0.00 | 0.00 | 31.76 | 29.63 | 31.40 | 32.79 | 9.01 | 0.00 | 0.00 | 0.00 | 0.00 | 147.64 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2008 | 23528 | WELL 3 (UNIO 2377) | 17.70 | 27.74 | 28.99 | 2.12 | 0.00 | 0.00 | 0.00 | 34.70 | 48.30 | 83.75 | 69.36 | 46.12 | 358.77 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2007 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2007 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2007 | 12294 | WELL 2 | 32.19 | 29.37 | 4.71 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 77.83 | 97.83 | 59.68 | 301.61 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2007 | 23528 | WELL 3 (UNIO 2377) | 0.02 | 0.00 | 24.68 | 29.75 | 24.93 | 27.66 | 33.56 | 63.20 | 79.19 | 43.76 | 0.00 | 1.00 | 327.74 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2006 | 23528 | WELL 3 (UNIO 2377) | 2.47 | 2.30 | 2.80 | 2.78 | 2.42 | 2.59 | 2.96 | 4.78 | 5.39 | 0.22 | 0.42 | 0.00 | 29.12 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2006 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2006 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2006 | 12294 | WELL 2 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 11.09 | 8.08 | 5.42 | 24.80 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2005 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2005 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2005 | 12294 | WELL 2 | 3.21 | 2.91 | 2.41 | 2.55 | 2.22 | 2.69 | 2.41 | 3.30 | 0.15 | 0.00 | 0.07 | 0.00 | 21.93 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2005 | 23528 | WELL 3 (UNIO 2377) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 5.17 | 8.88 | 9.62 | 5.39 | 29.14 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2004 | 23528 | WELL 3 (UNIO 2377) | 0.97 | 2.18 | 0.66 | 2.63 | 1.87 | 2.38 | 2.54 | 1.39 | 5.60 | 8.74 | 6.82 | 0.17 | 35.95 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2004 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2004 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2004 | 12294 | WELL 2 | 2.29 | 0.00 | 1.56 | 0.00 | 0.07 | 0.03 | 1.07 | 2.30 | 0.00 | 0.00 | 0.52 | 4.24 | 12.09 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2003 | 23528 | WELL 3 (UNIO 2377) | 2.57 | 2.13 | 2.14 | 2.08 | 1.94 | 0.67 | 0.00 | 1.08 | 6.84 | 7.87 | 0.00 | 0.00 | 27.33 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2003 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2003 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2003 | 12294 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.49 | 2.34 | 1.71 | 0.00 | 2.53 | 8.53 | 4.63 | 21.22 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2002 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2002 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2002 | 12294 | WELL 2 | 3.56 | 3.09 | 2.82 | 2.69 | 2.56 | 2.76 | 2.74 | 4.60 | 6.37 | 2.29 | 0.00 | 0.00 | 33.47 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2002 | 23528 | WELL 3 (UNIO 2377) | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.42 | 8.65 | 4.99 | 20.09 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2001 | 23528 | WELL 3 (UNIO 2377) | 27.03 | 11.51 | 0.00 | 0.00 | 0.00 | 0.00 | 5.00 | 52.80 | 62.48 | 81.20 | 85.61 | 15.60 | 341.22 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2001 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2001 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2001 | 12294 | WELL 2 | 0.00 | 15.96 | 32.24 | 33.02 | 29.95 | 31.15 | 28.00 | 0.00 | 0.00 | 0.00 | 0.00 | 64.94 | 235.24 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2000 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-   ) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2000 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2000 | 12294 | WELL 2 | 28.25 | 6.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 56.71 | 105.31 | 51.38 | 0.00 | 248.22 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 2000 | 23528 | WELL 3 (UNIO 2377) | 0.00 | 16.96 | 26.50 | 25.57 | 25.35 | 22.95 | 30.62 | 44.86 | 15.81 | 0.00 | 69.29 | 36.70 | 314.60 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 1994 | 23528 | WELL 3 (UNIO 2377) | 13.80 | 27.00 | 23.02 | 11.19 | 15.59 | 13.85 | 15.48 | 28.94 | 18.38 | 32.20 | 33.69 | 40.47 | 273.61 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 1993 | 23528 | WELL 3 (UNIO 2377) | 13.80 | 27.00 | 23.02 | 11.19 | 15.59 | 13.85 | 15.48 | 28.94 | 18.38 | 32.20 | 33.69 | 40.47 | 273.61 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 1993 | 12294 | WELL 2 | 19.53 | 0.00 | 15.84 | 29.55 | 15.17 | 18.36 | 14.35 | 14.84 | 20.92 | 23.93 | 28.45 | 15.44 | 216.40 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 1992 | 12294 | WELL 2 | 20.35 | 19.33 | 18.45 | 17.91 | 16.52 | 14.53 | 19.93 | 41.50 | 28.40 | 27.84 | 52.09 | 20.87 | 297.72 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 1992 | 23528 | WELL 3 (UNIO 2377) | 19.83 | 13.17 | 15.04 | 16.26 | 15.69 | 17.02 | 11.91 | 18.36 | 30.12 | 23.98 | 20.54 | 21.23 | 223.15 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NW NE) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 1989 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-18-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |
| 1989 | 12294 | WELL 2 | 78.73 | 55.81 | 59.50 | 56.98 | 65.28 | 57.24 | 63.70 | 78.12 | 122.01 | 136.27 | 96.64 | 62.61 | 932.90 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-19-NE NW) | PW SUPERINTENDENT PAUL PHILLIPS | CITY OF UNION |

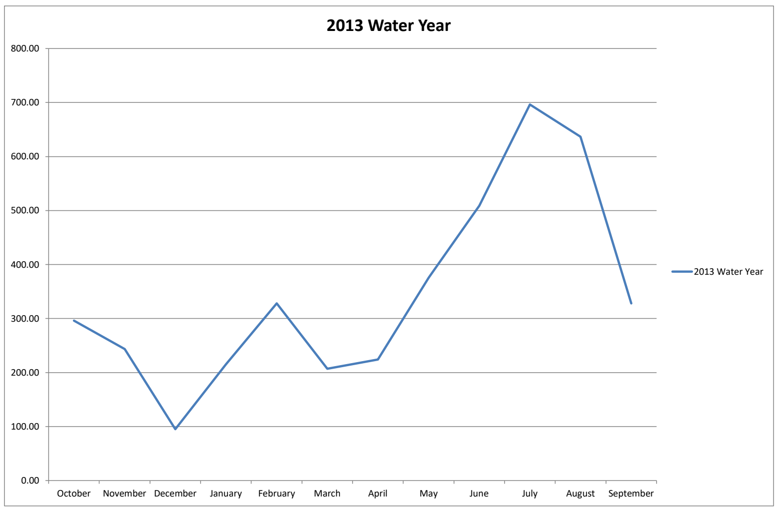
| Water Year | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | Total Water Used | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2015 | 22.41 | 13.67 | 12.31 | 14.71 | 12.30 | 14.63 | 22.30 | 29.01 | 48.98 | 57.48 | 47.91 | 27.47 | 323.19 | 323.1949 | 323.1949 |
| 2014 | 17.49 | 13.17 | 20.91 | 21.51 | 12.59 | 13.88 | 14.75 | 23.62 | 36.62 | 51.18 | 50.15 | 37.67 | 313.54 | 313.54 | 313.54 |
| 2013 | 21.99 | 11.50 | 14.51 | 14.38 | 12.82 | 13.04 | 14.40 | 27.57 | 35.42 | 56.53 | 50.58 | 29.53 | 302.27 | 302.2704 | 302.2704 |
| 2012 | 18.35 | 10.33 | 11.39 | 10.58 | 10.69 | 11.84 | 13.14 | 23.76 | 32.07 | 42.96 | 52.45 | 40.96 | 278.53 | 278.5326 | 278.5326 |
| 2011 | 19.56 | 11.31 | 12.76 | 13.89 | 11.32 | 11.80 | 13.37 | 15.65 | 22.85 | 45.32 | 52.21 | 41.86 | 271.89 | 271.8892 | 271.8892 |
| 2010 | 14.49 | 10.90 | 12.54 | 11.49 | 9.87 | 11.75 | 13.68 | 15.36 | 19.93 | 48.94 | 47.20 | 32.42 | 248.56 | 248.5615 | 248.5615 |
| 2009 | 20.53 | 14.86 | 16.62 | 16.83 | 15.96 | 15.88 | 18.30 | 24.81 | 34.30 | 51.78 | 35.91 | 35.14 | 300.92 | 300.9228 | 300.9228 |
| 2008 | 17.85 | 12.37 | 13.12 | 14.20 | 13.43 | 13.55 | 15.49 | 21.85 | 31.01 | **45.62** | 48.72 | 33.21 | 280.42 | 358.677 | **280.42** |
| 2007 | 18.18 | 12.71 | 14.95 | 15.81 | 14.20 | 15.78 | 18.08 | 30.64 | 39.07 | 57.99 | 50.36 | 32.24 | 320.00 | 319.9965 | 319.9965 |
| 2006 | 14.66 | 14.25 | 11.75 | 10.72 | 11.91 | 12.85 | 11.94 | 22.72 | 27.34 | 47.20 | 45.44 | 30.81 | 261.57 | 261.5709 | 261.5709 |
| 2005 | 17.50 | 9.84 | 9.65 | 10.04 | 9.34 | 12.01 | 11.84 | 14.04 | 24.52 | 31.04 | 46.74 | 32.15 | 228.70 | 228.7001 | 228.7001 |
| 2004 | 17.26 | 9.51 | 12.22 | 12.92 | 10.94 | 14.96 | 20.12 | 15.31 | 29.16 | 36.01 | 26.10 | 16.87 | 221.37 | 221.3675 | 221.3675 |
| 2003 | 14.76 | 10.54 | 9.09 | 10.35 | 8.74 | 8.84 | 11.51 | 14.85 | 35.88 | 49.56 | 38.59 | 24.22 | 236.94 | 236.9404 | 236.9404 |
| 2002 | 14.02 | 9.55 | 8.67 | 9.47 | 9.95 | 8.44 | 13.83 | 22.13 | 31.01 | 44.28 | 37.34 | 26.13 | 234.84 | 234.8357 | 234.8357 |
| 2001 | 15.22 | 13.14 | 16.53 | 16.33 | 13.67 | 14.92 | 17.69 | 23.73 | 31.57 | 41.24 | 36.17 | 24.65 | 264.86 | 264.8641 | 264.8641 |
| 2000 | 17.61 | 12.13 | 13.59 | 15.27 | 14.22 | 16.22 | 16.96 | 19.79 | 29.95 | 47.14 | 48.37 | 17.92 | 269.17 | 269.1741 | **272.5074** |
| 1999 | 13.26 | 163.62 | 14.96 | 13.49 | 13.34 | 15.74 | 18.15 | 22.99 | 30.94 | 43.19 | 29.35 | 27.79 | 406.81 | 406.8089 | |
| 1998 | 11.79 | 9.51 | 11.28 | 11.03 | 9.83 | 13.42 | 15.11 | 13.99 | 15.98 | 31.36 | 33.52 | 20.19 | 197.02 | 197.024 | |
| 1997 | 1.31 | 1.06 | 1.04 | 3.72 | 3.27 | 1.76 | 3.38 | 2.52 | 3.07 | 4.39 | 2.88 | 3.61 | 32.04 | 32.04449 | |
| 1996 | 1.01 | 1.04 | 3.62 | 3.95 | 10.88 | 9.10 | 7.25 | 12.66 | 18.01 | 30.31 | 24.83 | 14.33 | 136.98 | 136.9835 | |
| 1995 | 12.70 | 14.18 | 14.80 | 11.03 | 9.37 | 12.01 | 10.82 | 14.59 | 10.80 | 16.31 | 10.35 | 10.13 | 147.09 | 147.0943 | |
| 1994 | 11.66 | 11.61 | 11.28 | 12.82 | 10.74 | 11.01 | 12.23 | 14.86 | 15.51 | 21.43 | 22.27 | 18.59 | 174.02 | 174.0162 | |
| 1993 | 9.85 | 10.89 | 12.23 | 10.75 | 10.15 | 11.17 | 9.41 | 0.00 | 15.95 | 11.48 | 18.18 | 10.75 | 130.81 | 130.8135 | |
| 1992 | 9.61 | 7.70 | 7.78 | 7.90 | 7.25 | 9.05 | 9.28 | 15.33 | 19.21 | 23.13 | 30.20 | 15.98 | 162.42 | 162.421 | |
| 1991 | 10.27 | 9.94 | 8.56 | 7.71 | 7.27 | 7.53 | 7.13 | 10.27 | 10.27 | 14.56 | 29.11 | 21.54 | 144.18 | 144.1767 | |
| 1990 | 5.29 | 4.86 | 4.78 | 3.74 | 1.46 | 1.88 | 3.13 | 2.74 | 5.77 | 6.13 | 6.07 | 3.46 | 49.30 | 49.30178 | |
| 1989 | 6.82 | 4.86 | 5.55 | 6.33 | 11.00 | 7.21 | 7.59 | 8.41 | 14.34 | 32.19 | 31.28 | 5.90 | 141.49 | 141.4917 | |
| **Average** | **17.62** | **11.84** | **13.13** | **13.55** | **11.85** | **12.95** | **15.36** | **21.67** | **31.98** | **47.14** | **44.39** | **31.02** | **272.51** | | |
| Std Dev | 5.52 | 33.55 | 4.32 | 4.06 | 2.68 | 3.36 | 4.28 | 6.66 | 10.30 | 13.34 | 13.80 | 9.93 | | | |




Average
20.00
10.00
0.00
October
November
December
January
February
March
April
May
June
July
August
September

| Water Year | Report ID | Facility Name | October | November | December | January | February | March | April | May | June | July | August | September | Total Water Used | Source Name | Location | TRSQQ | Water Right Holder's Name | Company Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2015 | 30190 | WELL 4 (UNIO 2496) | 22.41 | 13.67 | 12.31 | 14.71 | 12.30 | 14.63 | 22.30 | 29.01 | 48.98 | 57.45 | 47.83 | 27.43 | 323.04 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2015 | 60722 | WELL 3 (UNIO 777) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.08 | 0.04 | 0.15 | A WELL; | 1500 FEET NORTH AND 2950 FEET WEST FROM SE CORNER, SECTION 3 | (3S-38E-3-NE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2014 | 30190 | WELL 4 (UNIO 2496) | 17.49 | 13.17 | 20.91 | 21.51 | 12.59 | 13.88 | 14.75 | 23.62 | 36.62 | 51.18 | 50.15 | 37.67 | 313.54 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2013 | 30190 | WELL 4 (UNIO 2496) | 21.99 | 11.35 | 14.51 | 14.38 | 12.82 | 13.04 | 14.35 | 27.57 | 35.36 | 56.46 | 50.52 | 29.50 | 301.85 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2013 | 60722 | WELL 3 (UNIO 777) | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.06 | 0.07 | 0.06 | 0.03 | 0.42 | A WELL; | 1500 FEET NORTH AND 2950 FEET WEST FROM SE CORNER, SECTION 3 | (3S-38E-3-NE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2012 | 60722 | WELL 3 (UNIO 777) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.24 | 0.52 | 0.00 | 0.75 | A WELL; | 1500 FEET NORTH AND 2950 FEET WEST FROM SE CORNER, SECTION 3 | (3S-38E-3-NE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2012 | 30190 | WELL 4 (UNIO 2496) | 18.35 | 10.33 | 11.39 | 10.58 | 10.69 | 11.84 | 13.14 | 23.76 | 32.07 | 42.73 | 51.93 | 40.96 | 277.78 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2011 | 30190 | WELL 4 (UNIO 2496) | 18.88 | 11.28 | 12.75 | 13.87 | 11.30 | 11.78 | 13.16 | 15.42 | 22.49 | 45.32 | 52.21 | 41.85 | 270.32 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2011 | 60722 | WELL 3 (UNIO 777) | 0.68 | 0.03 | 0.00 | 0.01 | 0.02 | 0.02 | 0.21 | 0.23 | 0.36 | 0.00 | 0.00 | 0.00 | 1.57 | A WELL; | 1500 FEET NORTH AND 2950 FEET WEST FROM SE CORNER, SECTION 3 | (3S-38E-3-NE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2010 | 30190 | WELL 4 (UNIO 2496) | 14.18 | 10.75 | 12.54 | 11.48 | 9.84 | 11.67 | 13.43 | 15.11 | 17.82 | 37.94 | 36.97 | 28.58 | 220.32 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2010 | 60722 | WELL 3 (UNIO 777) | 0.31 | 0.15 | 0.00 | 0.01 | 0.03 | 0.08 | 0.25 | 0.25 | 2.11 | 10.99 | 10.23 | 3.83 | 28.24 | A WELL; | 1500 FEET NORTH AND 2950 FEET WEST FROM SE CORNER, SECTION 3 | (3S-38E-3-NE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2009 | 30190 | WELL 4 (UNIO 2496) | 20.53 | 14.86 | 16.62 | 16.83 | 15.96 | 15.88 | 18.30 | 24.81 | 34.30 | 51.78 | 31.59 | 27.13 | 288.58 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2009 | 60722 | WELL 3 (UNIO 777) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.32 | 8.02 | 12.34 | A WELL; | 1500 FEET NORTH AND 2950 FEET WEST FROM SE CORNER, SECTION 3 | (3S-38E-3-NE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2008 | 11596 | WELL 1 | 0.51 | 0.45 | 0.45 | 0.44 | 0.40 | 0.46 | 0.46 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 3.49 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2008 | 30190 | WELL 4 (UNIO 2496) | 17.34 | 11.92 | 12.67 | 13.76 | 13.03 | 13.09 | 15.03 | 21.52 | 31.01 | 123.87 | 48.72 | 33.21 | 355.19 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2007 | 11596 | WELL 1 | 0.27 | 0.27 | 0.05 | 0.08 | 0.07 | 0.08 | 0.07 | 0.11 | 0.24 | 0.04 | 0.05 | 0.04 | 1.37 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2007 | 30190 | WELL 4 (UNIO 2496) | 17.91 | 12.44 | 14.90 | 15.73 | 14.13 | 15.71 | 18.01 | 30.53 | 38.82 | 57.94 | 50.31 | 32.20 | 318.63 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2006 | 30190 | WELL 4 (UNIO 2496) | 14.40 | 13.98 | 11.49 | 10.46 | 11.66 | 12.59 | 11.71 | 22.44 | 27.07 | 46.93 | 45.15 | 30.55 | 258.44 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2006 | 11596 | WELL 1 | 0.26 | 0.26 | 0.26 | 0.25 | 0.24 | 0.27 | 0.23 | 0.28 | 0.27 | 0.27 | 0.29 | 0.26 | 3.13 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2005 | 11596 | WELL 1 | 0.27 | 0.26 | 0.29 | 0.30 | 0.28 | 0.29 | 0.22 | 0.29 | 0.25 | 0.30 | 0.32 | 0.29 | 3.35 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2005 | 30190 | WELL 4 (UNIO 2496) | 17.23 | 9.58 | 9.36 | 9.74 | 9.06 | 11.72 | 11.62 | 13.75 | 24.27 | 30.74 | 46.42 | 31.86 | 225.35 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2004 | 11596 | WELL 1 | 0.28 | 0.19 | 0.24 | 0.04 | 0.27 | 0.30 | 0.29 | 0.25 | 0.29 | 0.31 | 0.30 | 0.30 | 3.05 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2004 | 30190 | WELL 4 (UNIO 2496) | 16.98 | 9.31 | 11.97 | 12.89 | 10.67 | 14.66 | 19.83 | 15.06 | 28.87 | 35.70 | 25.80 | 16.58 | 218.32 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2003 | 11596 | WELL 1 | 0.30 | 0.31 | 0.28 | 0.33 | 0.27 | 0.27 | 0.31 | 0.34 | 0.30 | 0.30 | 0.27 | 0.26 | 3.53 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2003 | 30190 | WELL 4 (UNIO 2496) | 14.46 | 10.23 | 8.81 | 10.02 | 8.47 | 8.57 | 11.21 | 14.51 | 35.59 | 49.26 | 38.32 | 23.96 | 233.41 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2002 | 11596 | WELL 1 | 0.30 | 0.26 | 0.30 | 0.27 | 0.23 | 0.29 | 0.28 | 0.30 | 0.28 | 0.30 | 0.29 | 0.32 | 3.43 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2002 | 30190 | WELL 4 (UNIO 2496) | 13.72 | 9.29 | 8.37 | 9.20 | 9.72 | 8.15 | 13.55 | 21.83 | 30.73 | 43.98 | 37.05 | 25.82 | 231.40 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2001 | 30190 | WELL 4 (UNIO 2496) | 14.94 | 12.89 | 16.24 | 16.06 | 13.43 | 14.65 | 17.39 | 23.44 | 31.31 | 40.92 | 35.83 | 24.32 | 261.42 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2001 | 11596 | WELL 1 | 0.28 | 0.26 | 0.29 | 0.27 | 0.24 | 0.27 | 0.30 | 0.29 | 0.27 | 0.32 | 0.34 | 0.33 | 3.44 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2000 | 11596 | WELL 1 | 0.16 | 0.17 | 0.15 | 0.23 | 0.20 | 0.20 | 0.20 | 0.22 | 0.23 | 0.28 | 0.27 | 0.25 | 2.54 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 2000 | 30190 | WELL 4 (UNIO 2496) | 17.45 | 11.97 | 13.44 | 15.04 | 14.02 | 16.02 | 16.75 | 19.57 | 29.72 | 46.86 | 48.11 | 17.67 | 266.63 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1999 | 11596 | WELL 1 | 0.40 | 0.31 | 0.62 | 2.40 | 2.43 | 2.66 | 2.66 | 2.78 | 2.46 | 0.66 | 2.71 | 2.40 | 22.51 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1999 | 30190 | WELL 4 (UNIO 2496) | 12.86 | 163.30 | 14.34 | 11.08 | 10.90 | 13.07 | 15.49 | 20.21 | 28.48 | 42.53 | 26.64 | 25.39 | 384.30 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1998 | 11596 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.38 | 0.61 | 0.44 | 0.41 | 2.37 | 1.21 | 0.53 | 5.95 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1998 | 30190 | WELL 4 (UNIO 2496) | 11.79 | 9.51 | 11.28 | 11.03 | 9.83 | 13.04 | 14.50 | 13.54 | 15.58 | 28.99 | 32.31 | 19.66 | 191.07 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1997 | 30190 | WELL 4 (UNIO 2496) | 0.99 | 0.73 | 0.74 | 0.76 | 0.68 | 0.83 | 1.11 | 2.04 | 2.37 | 2.43 | 2.88 | 1.56 | 17.11 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1997 | 11596 | WELL 1 | 0.32 | 0.33 | 0.31 | 2.96 | 2.60 | 0.94 | 2.27 | 0.49 | 0.70 | 1.96 | 0.00 | 2.06 | 14.93 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1996 | 11596 | WELL 1 | 0.40 | 0.42 | 2.95 | 3.18 | 3.17 | 2.67 | 0.18 | 3.78 | 2.79 | 3.54 | 3.29 | 2.97 | 29.34 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1996 | 30190 | WELL 4 (UNIO 2496) | 0.62 | 0.61 | 0.67 | 0.78 | 7.71 | 6.43 | 7.06 | 8.88 | 15.22 | 26.77 | 21.53 | 11.36 | 107.64 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3-NW SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1995 | 11596 | WELL 1 | 12.70 | 14.18 | 14.80 | 11.03 | 9.37 | 12.01 | 10.82 | 14.59 | 10.80 | 16.31 | 10.35 | 10.13 | 147.09 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1994 | 11596 | WELL 1 | 11.66 | 11.61 | 11.28 | 12.82 | 10.74 | 11.01 | 12.23 | 14.86 | 15.51 | 21.43 | 22.27 | 18.59 | 174.02 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1993 | 11596 | WELL 1 | 9.85 | 10.89 | 12.23 | 10.75 | 10.15 | 11.17 | 9.41 | 0.00 | 15.95 | 11.48 | 18.18 | 10.75 | 130.81 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1992 | 11596 | WELL 1 | 9.61 | 7.70 | 7.78 | 7.90 | 7.25 | 9.05 | 9.28 | 15.33 | 19.21 | 23.13 | 30.20 | 15.98 | 162.42 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1991 | 11596 | WELL 1 | 10.27 | 9.94 | 8.56 | 7.71 | 7.27 | 7.53 | 7.13 | 10.27 | 10.27 | 14.56 | 29.11 | 21.54 | 144.18 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1990 | 11596 | WELL 1 | 5.29 | 4.86 | 4.78 | 3.74 | 1.46 | 1.88 | 3.13 | 2.74 | 5.77 | 6.13 | 6.07 | 3.46 | 49.30 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |
| 1989 | 11596 | WELL 1 | 6.82 | 4.86 | 5.55 | 6.33 | 11.00 | 7.21 | 7.59 | 8.41 | 14.34 | 32.19 | 31.28 | 5.90 | 141.49 | WELL 1 (UNIO 639); | 90 FEET NORTH AND 2240 FEET EAST FROM SW CORNER, SECTION 34 | (2S-38E-34-SE SW) | CITY RECORDER JUDY RYGG | CITY OF ISLAND CITY |

| Water Year | Report ID | Facility Name | October | Novembe | December | January | February | March | April | May | June | July | August | Septembe | Total Wat | Source Name | Location | TRSQQ | Water Rig | Company Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2013 | 11640 | GRANDE RONDE RIVER | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | GRANDE RONDE RIVER; | PUMPING PLANT AND PIPE LINES | (0-0-0-&n | LEE MANN | CITY OF LA GRANDE |
| 2013 | 11641 | ISLAND CITY WELL (UNIO 778) | 65.67 | 59.69 | 0.00 | 0.00 | 0.00 | 0.00 | 77.61 | 47.87 | 56.84 | 72.89 | 79.61 | 58.43 | 518.61 | A WELL; | 1020 FEET NORTH AND 762 FEET WEST FROM CEN, S3 | (3S-38E-3 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 11642 | PUBLIC WORKS WELL 1 (UNIO 932 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 1.47 | WELL 1; | 3060 FEET NORTH AND 530 FEET WEST FROM SE CORNER, S6 | (3S-38E-6 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 11643 | PUBLIC WORKS WELL 2 (UNIO 933 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 2; | 3060 FEET NORTH AND 510 FEET WEST FROM SE CORNER, S6 | (3S-38E-6 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 11644 | BEAVER CR RES STORAGE | 510.36 | 510.36 | 510.36 | 510.36 | 510.36 | 510.36 | 510.36 | 510.36 | 510.36 | 510.36 | 510.36 | 510.36 | 510.36 | BEAVER CREEK; | ALSO SESE; SWSW, SECTION 9; NWNW, SECTION 16; N1/2NE1/4, SECTION 17 | (5S-37E-8 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 11647 | GEKELER WELL (UNIO 999) | 15.99 | 35.35 | 0.00 | 57.33 | 4.97 | 20.84 | 1.29 | 22.19 | 38.85 | 15.59 | 20.16 | 1.75 | 234.31 | A WELL; | 71 FEET NORTH AND 670.47 FEET EAST FROM SW CORNER, SECTION 9 | (3S-38E-9 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 11648 | MORGAN LAKE | 780.00 | 780.00 | 780.00 | 780.00 | 780.00 | 780.00 | 780.00 | 780.00 | 780.00 | 780.00 | 780.00 | 780.00 | 780.00 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST, 1220 FEET FROM N1/4 CORNER,M SECTION 25 | (3S-37E-2 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 11649 | MORGAN LAKE SOURCE | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | SHEEP CREEK; | SOUTH 34 DEGREES 30 MINUTES WEST 1220 FEET FROM N1/4 CORNER, SECTION 25 | (3S-37E-2 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 11660 | MAIN BEAVER CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.21 | 0.00 | 0.00 | 0.00 | 2.21 | BEAVER CREEK; | | (0-0-0-&n | LEE MANN | CITY OF LA GRANDE |
| 2013 | 11661 | 2ND & H WELL (UNIO 940) | 15.99 | 35.35 | 0.00 | 41.03 | 39.99 | 0.00 | 39.28 | 51.77 | 89.67 | 74.97 | 128.43 | 79.52 | 596.01 | A WELL; | 99.96 FEET NORTH AND 876.11 FEET WEST FROM E1/4 CORNER, SECTION 7 | (3S-38E-7 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 11662 | BEAVER CR RES USE | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | BEAVER CR RESERVOIR; | 1220 FEET NORTH AND 1900 FEET WEST FROM SE CORNER, SECTION 8 | (5S-37E-8 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 30206 | 12TH STREET WELL (UNIO 2098) | 72.79 | 27.10 | 1.84 | 32.75 | 53.12 | 74.30 | 10.46 | 54.47 | 99.19 | 89.98 | 68.62 | 47.32 | 631.95 | A WELL; | NORTH 23 DEGREES 11 MINUTES 26 SECONDS WEST, 1170.2 FEET FROM S1/4 CORNER, SECTION 8 | (3S-38E-8 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 48385 | HWY 30 WELL (UNIO 50520) | 24.80 | 16.17 | 19.61 | 0.00 | 61.44 | 37.23 | 18.11 | 64.32 | 57.11 | 180.54 | 112.29 | 16.30 | 607.92 | A WELL; | NORTH 43 DEGEES 47 MINUTES 21 SECONDS WEST, 399.62 FEET FROM E1/4 CORNER, SECTION 16 | (3S-38E-1 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 61075 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | A WELL; | 20 FEET NORTH AND 1700 FEET EAST FROM SW CORNER, SECTION 32 | (3S-39E-3 | LEE MANN | CITY OF LA GRANDE |
| 2013 | 11407 | WELL 2 | 38.12 | 30.56 | 26.48 | 26.58 | 22.63 | 25.87 | 24.13 | 39.92 | 31.85 | 51.20 | 73.69 | 23.29 | 414.33 | WELL 2; | NONE GIVEN | (1N-39E-15-NE SE) | | CITY OF ELGIN |
| 2013 | 11408 | WELL 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.27 | 30.72 | 46.35 | 20.89 | 25.36 | 135.58 | WELL 3; | NONE GIVEN | (1N-39E-22-NW NE) | | CITY OF ELGIN |
| 2013 | 32954 | WELL 4 | 8.92 | 3.38 | 5.94 | 12.14 | 107.28 | 9.24 | 10.62 | 5.24 | 2.25 | 4.87 | 0.22 | 0.00 | 170.10 | A WELL; | 267 FEET NORTH AND 55 FEET EAST FROM SE CORNER, NWSE, SECTION 16 | (1N-39E-16-NE SE) | | CITY OF ELGIN |
| 2013 | 11590 | ONE WELL | 1.04 | 0.99 | 1.03 | 1.15 | 0.98 | 1.19 | 1.20 | 1.23 | 1.60 | 2.40 | 3.08 | 3.99 | 19.89 | ONE WELL; | 290 FEET NORTH AND 260 FEET WEST FROM S1/4 CORNER, SECTION 20 | (1S-39E-2 | NAN BIGE | CITY OF IMBLER |
| 2013 | 11323 | SEWAGE LAGOON/RES | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 21.40 | 20.93 | 4.78 | 0.00 | 0.00 | 47.10 | SEWAGE LAGOON/RESERVOIR; | 690 FEET NORTH AND 300 FEET WEST FROM SE CORNER, SECTION 17 | (3S-40E-1 | MIKE BRO | CITY OF COVE |
| 2013 | 30143 | MILL CREEK | 158.40 | 197.43 | 169.88 | 126.26 | 101.01 | 234.16 | 713.96 | 713.96 | 713.96 | 635.90 | 282.37 | 181.36 | 4228.65 | MILL CREEK; | 670 FEET SOUTH AND 1560 FEET WEST FROM N1/4 CORNER, SECTION 30 | (3S-41E-3 | MIKE BRO | CITY OF COVE |
| 2013 | 61041 | WELL 2 | 7.67 | 5.57 | 5.53 | 6.22 | 5.71 | 5.31 | 5.47 | 9.74 | 16.67 | 28.34 | 26.23 | 11.14 | 133.60 | WELL 2; | 100 FEET NORTH AND 360 FEET WEST FROM SE CORNER, SECTION 15 | (3S-40E-1 | MIKE BRO | CITY OF COVE |
| 2013 | 12292 | CATHERINE CREEK | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | CATHERINE CREEK; | | (0-0-0-&n | PW SUPEF | CITY OF UNION |
| 2013 | 12293 | WELL 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | WELL 1; | 30 FEET SOUTH AND 1990 FEET EAST FROM NW CORNER, SECTION 18 | (4S-39E-1 | PW SUPEF | CITY OF UNION |
| 2013 | 12294 | WELL 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.08 | WELL 2; | 580 FEET SOUTH AND 2240 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-1 | PW SUPEF | CITY OF UNION |
| 2013 | 23528 | WELL 3 (UNIO 2377) | 23.11 | 17.60 | 20.08 | 23.51 | 19.18 | 20.08 | 21.40 | 38.92 | 46.53 | 72.54 | 52.79 | 31.51 | 387.25 | A WELL; | 528 FEET SOUTH AND 3489 FEET EAST FROM NW CORNER, SECTION 19 | (4S-40E-1 | PW SUPEF | CITY OF UNION |
| 2013 | 30190 | WELL 4 (UNIO 2496) | 21.99 | 11.35 | 14.51 | 14.38 | 12.82 | 13.04 | 14.35 | 27.57 | 35.36 | 56.46 | 50.52 | 29.50 | 301.85 | WELL 4 (UNIO 2496); | 530 FEET SOUTH AND 100 FEET EAST FROM W1/4 CORNER, SECTION 3 | (3S-38E-3 | CITY RECC | CITY OF ISLAND CITY |
| 2013 | 60722 | WELL 3 (UNIO 777) | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.06 | 0.07 | 0.06 | 0.03 | 0.42 | A WELL; | 1500 FEET NORTH AND 2950 FEET WEST FROM SE CORNER, SECTION 3 | (3S-38E-3 | CITY RECC | CITY OF ISLAND CITY |
| | | Water Use by Month | 296.23 | 243.40 | 95.14 | 215.22 | 328.26 | 207.22 | 224.15 | 375.65 | 509.03 | 696.34 | 636.72 | 328.24 | 4155.63 | Total Water Use for Municipal (AF) | | | | |
| | | | | | | | | | | | | | | | **1,354.11** | Total Water Use for Municipal (MG) | | | | |

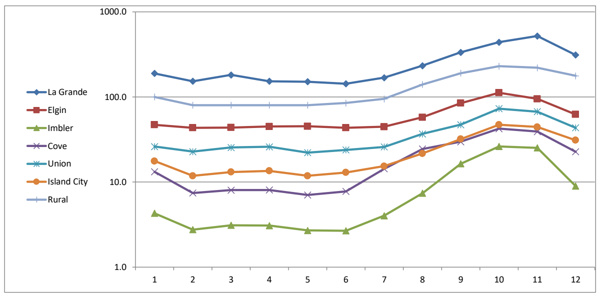


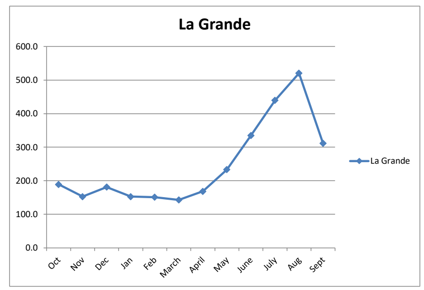
| City | Population 2013 | Population 2017 | | Percent Increase | | |
|---|---|---|---|---|---|---|
| Cove | 550 | 550 | | 0.254545 | 0.082944 | 227 |
| Union | 2,150 | 2,150 | | 0.186047 | 0.060623 | 166 |
| Island City | 1,150 | 1,115 | | 0.282609 | 0.092088 | 252 |
| Imbler | 305 | 305 | | 0.393443 | 0.128204 | 351 |
| Elgin | 1,725 | 1,730 | | 0.42029 | 0.136952 | 375 |
| La Grande | 13,125 | 13,245 | | 0.209524 | 0.068274 | 187 |
| Union County | | 26,087 | | | | 260 |
| N Powder Area | | 439 + about 200 | | | | |
| Planning Area Cities | | 19,095 | | | | |
| **Planning Area Rural** | | **6,353** | 1409730.7 | | | |
| Rural gallons/day | | 1,409,730 | | | | |

| | Rurgal/Da | per/month | AF/mth | |
|---|---|---|---|---|
| Planning Area Rural | 1409730 | 42291900 | **129.7891** | 1557.469 |

| City | Ratio High/low | Daily Avg AF | Daily Avg Gallons | 2017 Population | PCD/day |
|---|---|---|---|---|---|
| **La Grande** | 3.64 | 8.160 | 2,658,890.8 | 13,245 | 200.7 |
| **Elgin** | 2.58 | 1.983 | 646,303.3 | 1,730 | 373.6 |
| **Imbler** | 9.70 | 0.293 | 95,420.9 | 305 | 312.9 |
| **Cove** | 5.99 | 0.615 | 200,540.7 | 550 | 364.6 |
| **Union** | 3.28 | 1.204 | 392,428.3 | 2,150 | 182.5 |
| **Island City** | 3.99 | 0.747 | 243,278.9 | 1,115 | 218.2 |
| | | | 4,236,862.9 | 19,095 | 221.9 |

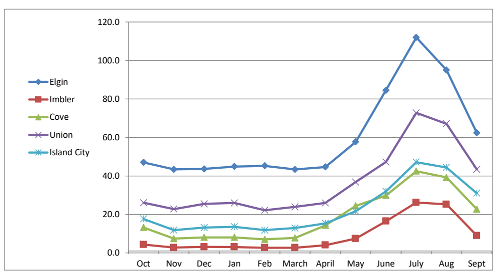
| | **2001-2016 Monthly Data** | | | **AC-FT** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **City** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **March** | **April** | **May** | **June** | **July** | **Aug** | **Sept** | **Annual Avg AF** | **Daily Avg AF** | **Source Formation** | **Sub-watershed** |
| **La Grande** | 189.2 | 152.9 | 181.4 | 152.9 | 151.0 | 143.0 | 168.7 | 233.3 | 334.9 | 439.5 | 520.3 | 311.3 | 2978.3 | 8.160 | Alluvial/Basalt | 6 |
| **Elgin** | 47.1 | 43.4 | 43.6 | 44.9 | 45.2 | 43.4 | 44.7 | 57.7 | 84.5 | 112.0 | 95.0 | 62.4 | 724.0 | 1.983 | Basalt | 1 & 2 |
| **Imbler** | 4.3 | 2.8 | 3.1 | 3.1 | 2.7 | 2.7 | 4.0 | 7.4 | 16.4 | 26.2 | 25.2 | 9.0 | 106.9 | 0.293 | Basalt | 2 |
| **Cove** | 13.2 | 7.4 | 8.0 | 8.1 | 7.1 | 7.8 | 14.3 | 24.5 | 29.8 | 42.5 | 39.2 | 22.7 | 224.6 | 0.615 | Basalt | **6** |
| **Union** | 26.1 | 22.8 | 25.5 | 25.9 | 22.2 | 23.9 | 25.9 | 36.8 | 47.2 | 72.8 | 67.1 | 43.4 | 439.6 | 1.204 | Basalt | 6 & 7 |
| **Island City** | 17.6 | 11.8 | 13.1 | 13.5 | 11.8 | 12.9 | 15.4 | 21.7 | 32.0 | 47.1 | 44.4 | 31.0 | 272.5 | 0.747 | Alluvial | 6 |
| **Rural** | 100.0 | 80.0 | 80.0 | 80.0 | 80.0 | 85.0 | 95.0 | 140.0 | 190.0 | 230.0 | 220.0 | 177.0 | 1557.469 | 4.267 | Alluvial | all |




| **City** | **La Grande** | **Elgin** | **Imbler** | **Cove** | **Union** | **Island City** | **Rural** |
|---|---|---|---|---|---|---|---|
| **Oct** | 189.2 | 47.1 | 4.3 | 13.2 | 26.1 | 17.6 | 100.0 |
| **Nov** | 152.9 | 43.4 | 2.8 | 7.4 | 22.8 | 11.8 | 80.0 |
| **Dec** | 181.4 | 43.6 | 3.1 | 8.0 | 25.5 | 13.1 | 80.0 |
| **Jan** | 152.9 | 44.9 | 3.1 | 8.1 | 25.9 | 13.5 | 80.0 |
| **Feb** | 151.0 | 45.2 | 2.7 | 7.1 | 22.2 | 11.8 | 80.0 |
| **March** | 143.0 | 43.4 | 2.7 | 7.8 | 23.9 | 12.9 | 85.0 |
| **April** | 168.7 | 44.7 | 4.0 | 14.3 | 25.9 | 15.4 | 95.0 |
| **May** | 233.3 | 57.7 | 7.4 | 24.5 | 36.8 | 21.7 | 140.0 |
| **June** | 334.9 | 84.5 | 16.4 | 29.8 | 47.2 | 32.0 | 190.0 |
| **July** | 439.5 | 112.0 | 26.2 | 42.5 | 72.8 | 47.1 | 230.0 |
| **Aug** | 520.3 | 95.0 | 25.2 | 39.2 | 67.1 | 44.4 | 220.0 |
| **Sept** | 311.3 | 62.4 | 9.0 | 22.7 | 43.4 | 31.0 | 177.0 |
| **Annual Avg A** | 2978.3 | 724.0 | 106.9 | 224.6 | 439.6 | 272.5 | 1557.469 |
| **Daily Avg AF** | 8.160 | 1.983 | 0.293 | 0.615 | 1.204 | 0.747 | 4.267 |
| **Source Forma** | Alluvial/Ba | Basalt | Basalt | Basalt | Basalt | Alluvial | Alluvial |
| **Sub-watershe** | 6 | 1 & 2 | 2 | **6** | 6 & 7 | 6 | all |

*** 2001-2016 Monthly Data (AC-FT)**



| sub-watershed/source | Current | Future |
|---|---|---|
| 1 GW | 9.0 | 47.4 |
| 1 SW | 16.0 | 63.8 |
| 3 GW | 10.2 | 40.7 |
| 3 SW | 58.1 | 232.2 |
| 4 GW | 2.7 | 11.0 |
| 4 SW | 7.1 | 28.6 |
| 6 GW | 43.2 | 172.7 |
| 6 SW | 4.7 | 19.0 |
| 7 GW | 2.3 | 9.2 |
| TOTAL AC-FT PER 15 DAYS | 153.3 | 624.6 |

| sub-watershed | Permit | Report Use? | Cert | Trx | Priority Date | Stakeholder Name | Use code | Source | Stream Name | CFS | podus e_acft | CFS .1 to .99 | CFS 1-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 27696 | No | ##### | | 8/9/1961 | A.J./FERN ROTH | Commercial Use | SPRING 4 | CATHERINE CR > GRANDE RONDE | 0.39 | | 0.39 | |
| 7 | 396 | No | ##### | | 6/22/1951 | BAKER UNION COOPERATIVE | Industrial Manufacturing | A WELL | CATHERINE CR > GRANDE RONDE | 0.10 | | 0.10 | |
| 1 | 2035 | No | ##### | | 1/12/1962 | BOISE CASCADE CORP. | Industrial Manufacturing | Boise WELL | PHILLIPS CR > GRANDE RONDE R | 0.25 | | 0.25 | |
| ? | 2930 | No | ##### | | 6/2/1965 | BOISE CASCADE CORP. | Industrial Manufacturing | A WELL | PIERCE SL > WRIGHT SL | 0.34 | | 0.34 | |
| 3 | 920 | No | ##### | | 6/3/1958 | BOISE CASCADE CORP. | Industrial Manufacturing | WELLS 1 & 2 | MAY PARK DITCH > GRANDE RON | 0.50 | | 0.50 | |
| 1 | 2550 | No | ##### | | 12/9/1963 | BOISE CASCADE CORP. | Industrial Manufacturing | A WELL | PHILLIPS CR > GRANDE RONDE R | 1.56 | | | 1.56 |
| 1 | 40678 | No | ##### | | 8/18/1976 | BOISE CASCADE CORP. | Log Deck | SPRINGS/WASTE WATE | PHILLIPS CR > GRANDE RONDE R | 3.00 | | | 3.00 |
| 6 | 11745 | No | | | 7/6/1992 | BOISE CASCADE; NORTHEAST | Industrial Manufacturing | A WELL | GRANDE RONDE R > SNAKE R | 1.11 | | | 1.11 |
| ? | 3321 | No | ##### | | 6/6/1966 | BORDEN CO. CHEMICAL DIVIS | Industrial Manufacturing | A WELL | PIERCE SL > WRIGHT SL | 0.89 | | 0.89 | |
| 3 | | No | | T 8905 | 12/31/1872 | DON HAMPTON | Commercial Use | GRANDE RONDE RIVER | GRANDE RONDE R > SNAKE R | 0.03 | | | |
| 3 | 7361 | No | | T 8905 | 5/26/1926 | DON HAMPTON | Commercial Use | PIERCE SLOUGH | PIERCE SL > WRIGHT SL | 0.03 | | | |
| 3 | 3755 | No | ##### | | 7/20/1967 | DONNOVAN F HAMPTON; RO | Industrial Manufacturing | A WELL | PIERCE SL > WRIGHT SL | 0.22 | | 0.22 | |
| 6 | 54414 | No | ##### | | 3/30/2006 | EAGLES HOT LAKE RV PARK | Commercial Use | A SPRING | LADD CR > CATHERINE CR | 0.09 | | | |
| 6 | 16213 | No | ##### | | 4/3/2006 | EAGLES HOT LAKE RV PARK | Commercial Use | A WELL | LADD CR > CATHERINE CR | 0.10 | | 0.10 | |
| 6 | 15261 | No | | | 8/14/2001 | FIRST CHURCH OF THE NAZAR | Commercial Use | A WELL | UNN STR > MILL CR | 0.05 | | | |
| 6 | 54644 | YES | | | 9/13/2007 | HOT LAKE SPRINGS RESORT | Commercial Use | A SPRING | LADD CR > CATHERINE CR | 0.49 | | 0.49 | |
| 6 | 13513 | YES | | | 2/2/1998 | KENNETH DALE KNOTT | Industrial Manufacturing | A WELL | DUNCAN CR > MURPHY CR | 2.23 | | | 2.23 |
| 3 | 3490 | No | ##### | | 9/28/1966 | LA GRANDE CONCRETE PIPE C | Industrial Manufacturing | A WELL | PIERCE SL > WRIGHT SL | 0.13 | | 0.13 | |
| ? | 2969 | No | ##### | T 1004 | 7/2/1965 | LA GRANDE COUNTRY CLUB | Commercial Use | A WELL | MULHOLLAND SL > SPRING SL | 0.81 | | 0.81 | |
| 3 | 15877 | No | ##### | | 7/27/1944 | MT EMILY LUMBER CO. | Industrial Manufacturing | GRANDE RONDE RIVER | GRANDE RONDE R > SNAKE R | 1.00 | | | 1.00 |
| 3 | 6414 | No | 7216 | | 3/22/1924 | MT EMILY TIMBER CO. | Industrial Manufacturing | GRANDE RONDE RIVER | GRANDE RONDE R > SNAKE R | 10.00 | | | 10.00 |
| 4 | 16268 | YES | | | 7/18/2006 | OREGON STATE PARKS AND R | Commercial Use | A WELL | GRANDE RONDE R > SNAKE R | 0.12 | | 0.12 | |
| 4 | 16267 | YES | | | 1/8/2007 | OREGON STATE PARKS AND R | Commercial Use | A WELL | GRANDE RONDE R > SNAKE R | 0.14 | | 0.14 | |
| 7 | 16266 | YES | | | 1/8/2007 | OREGON STATE PARKS AND R | Commercial Use | A WELL | CATHERINE CR > GRANDE RONDE | 0.19 | | 0.19 | |
| 6 | 10056 | No | | | 3/16/1983 | OREGON WASHINGTON RAILI | Industrial Manufacturing | WELLS several | GRANDE RONDE R > SNAKE R | 0.09 | | | |
| 1 | 8797 | No | 8112 | | 11/5/1928 | OREGON WASHINGTON RAILI | Industrial Manufacturing | MOSES CREEK | MOSES CR > GRANDE RONDE R | 0.13 | | 0.13 | |
| 4 | 16988 | No | ##### | | 5/6/1946 | OREGON WASHINGTON RAILI | Industrial Manufacturing | FIVE POINTS CREEK | FIVE POINTS CR > GRANDE ROND | 0.50 | | 0.50 | |
| 4 | 8798 | No | 8113 | | 11/5/1928 | OREGON WASHINGTON RAILI | Industrial Manufacturing | FIVE POINTS CREEK | FIVE POINTS CR > GRANDE ROND | 0.50 | | 0.50 | |
| 4 | 1855 | No | 1172 | | 1/3/1914 | OREGON WASHINGTON RAILI | Industrial Manufacturing | DRY CREEK | DRY CR > PELICAN CR | 0.51 | | 0.51 | |
| 3 | | No | | T 7008 | 12/31/1872 | ORODELL DITCH ASSOCIATIOI | Industrial Manufacturing | GRANDE RONDE R | GRANDE RONDE R > SNAKE R | 0.38 | | 0.38 | |
| 6 | 15979 | YES | | | 1/22/2004 | ROVEY FARMS | Commercial Use | A WELL | UNN STR > LITTLE CR | 1.34 | | | 1.34 |
| 6 | | No | | Cl 4185 | 12/31/1905 | UNION PACIFIC RAILROAD CO | Industrial Manufacturing | A WELL | GRANDE RONDE R > SNAKE R | 0.45 | | 0.45 | |
| | | | | | | | | | CFS | 27.622 | | 7.1056 | 20.24 |
| | | | | | | | | | 1/2 Rate | 13.811 | | | |
| | | | | | | | | | 2 shifts/day 16 hrs | 9.1151 | | | |
| | | | | | | | | | AF/YR | 6654 | | | |
| | | | | | | | | | **TAF/YR** | **6.8** | | | |

| | | | | STAKEHOLDER | USE | SOURCE | STREAM | CFS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 6414 | No | 7216 | 3/22/1924 | MT EMILY TIMBER CO. | Industrial Manufacturing | GRANDE RONDE RIV | GRANDE RONDE R > SNAKE F | 10.00 | 10 | 10 |
| 40678 | No | 58877 | 8/18/1976 | BOISE CASCADE CORP. | Log Deck | SPRINGS/WASTE W/ | PHILLIPS CR > GRANDE RONI | 3.00 | 3 | 3 |
| 13513 | YES | | 2/2/1998 | KENNETH DALE KNOTT | Industrial Manufacturing | A WELL | DUNCAN CR > MURPHY CR | 2.23 | 2.23 | 2.23 |
| 2550 | No | 36554 | 12/9/1963 | BOISE CASCADE CORP. | Industrial Manufacturing | A WELL | PHILLIPS CR > GRANDE RONI | 1.56 | 1.56 | 1.56 |
| 15979 | YES | | 1/22/2004 | ROVEY FARMS | Commercial Use | A WELL | UNN STR > LITTLE CR | 1.34 | 1.336 | 1.336 |
| 11745 | No | | 7/6/1992 | BOISE CASCADE; NORTHE/ | Industrial Manufacturing | A WELL | GRANDE RONDE R > SNAKE F | 1.11 | 1.114 | 1.114 |
| 15877 | No | 15322 | 7/27/1944 | MT EMILY LUMBER CO. | Industrial Manufacturing | GRANDE RONDE RIV | GRANDE RONDE R > SNAKE F | 1.00 | 1 | 1 |

| poduse_maxrate | SW/GW S( | sub-watershed | Permit | Report Use? | Cert | decree_title | claim_char | claim_nbr | Trx | township | township_char | range | Priority Date | Stakeholder Name | range_char | sctn | qtr40 | qtr160 | dlc | govt_lot | Use code | Source | tributary_to | location_description | streamcode | Stream Name | pod_maxrate | pod_ratecfs | pod_ratecfsest | pod_maxacft | pod_acft | begin_month | begin_day | end_month | end_day | pod_location_status | poduse_maxrate | CFS | poduse_ratecfsest | poduse_maxacft | poduse_acft | poduse_acftsest | CFS .1 to .99 | CFS 1-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.25 | GW | 1 | 2035 | No | 36553 | | | | | 1 | N | 39 | 1/12/1962 | BOISE CASCADE | E | 16 | SW | NE | | | Industrial | Boise WEI | PHILLIPS ( | N65.57' E/ | 08176008 | PHILLIPS ( | 0.25 | 0.25 | | | | 1 | 1 | 12 | 31 | NC | 0.25 | 0.25 | | | | | 0.39 | |
| 1.56 | GW | 1 | 2550 | No | 36554 | | | | | 1 | N | 39 | 12/9/1963 | BOISE CASCADE | E | 16 | NE | SE | | | Industrial | A WELL | PHILLIPS ( | N38.00E 1 | 08176008 | PHILLIPS ( | 1.56 | 1.56 | | | | 1 | 1 | 12 | 31 | NC | 1.56 | 1.56 | | | | | 0.1 | |
| 3.00 | SW | 1 | 40678 | No | 58877 | | | | | 1 | N | 39 | 8/18/1976 | BOISE CASCADE | E | 16 | SE | SE | | | Log Deck | SPRINGS/\ | PHILLIPS ( | 1300 FEET | 08176008 | PHILLIPS ( | 3 | 3 | | | | 1 | 1 | 12 | 31 | NC | 3 | 3 | | | | | 0.25 | |
| 0.25 | SW | 1 | 8797 | No | 8112 | | | | | 3 | N | 40 | 11/5/1928 | OREGON WASHI | E | 30 | SE | SE | | | Industrial | MOSES CR | GRANDE R | | 08176007 | MOSES CR | 0.25 | 0.25 | | | | 1 | 1 | 12 | 31 | NC | 0.25 | 0.125 | Yes | | | | 0.335 | |
| 0.50 | GW | 3 | 920 | No | 27000 | | | | | 3 | S | 38 | 6/3/1958 | BOISE CASCADE | E | 5 | NW | NE | | | Industrial | WELLS 1 8 | GRANDE R | | 0817601C | MAY PARK | 0.5 | 0.5 | | | | 1 | 1 | 12 | 31 | NC | 0.5 | 0.5 | | | | | 0.5 | |
| 0.05 | SW | 3 | | No | | Grande Rc | | | T 8905 | 2 | S | 38 | 12/31/1872 | DON HAMPTON | E | 31 | SW | SW | | | Commerci | GRANDE R | SNAKE RIV | 1858 FEET | 081760 | GRANDE R | 0.05 | 0.05 | | | | 1 | 1 | 12 | 31 | NC | 0.05 | 0.025 | Yes | | | | | 1.56 |
| 0.03 | SW | 3 | 7361 | No | | | | | T 8905 | 2 | S | 38 | 5/26/1926 | DON HAMPTON | E | 31 | SW | SW | | | Commerci | PIERCE SL( | WRIGHT S | 1858 FEET | 0817601C | PIERCE SL | 0.026 | 0.026 | | | | 1 | 1 | 12 | 31 | NC | 0.026 | 0.026 | | | | | | 3 |
| 0.22 | GW | 3 | 3755 | No | 41269 | | | | | 2 | S | 38 | 7/20/1967 | DONNOVAN F H/ | E | 34 | NE | SW | | | Industrial | A WELL | GRANDE R | 750 FEET ! | 0817601C | PIERCE SL | 0.22 | 0.22 | | | | 1 | 1 | 12 | 31 | NC | 0.22 | 0.22 | | | | | | 1.114 |
| 0.13 | GW | 3 | 3490 | No | 41044 | | | | | 2 | S | 38 | 9/28/1966 | LA GRANDE CON | E | 34 | NE | SW | | | Industrial | A WELL | GRANDE R | 840 FEET ! | 0817601C | PIERCE SL | 0.13 | 0.13 | | | | 1 | 1 | 12 | 31 | NC | 0.13 | 0.13 | | | | | 0.89 | |
| 1.00 | SW | 3 | 15877 | No | 15322 | | | | | 2 | S | 38 | 7/27/1944 | MT EMILY LUMB | E | 32 | SW | SE | | | Industrial | GRANDE R | SNAKE RIV | | 081760 | GRANDE R | 1 | 1 | | | | 1 | 1 | 12 | 31 | NC | 1 | 1 | | | | | | |
| 10.00 | SW | 3 | 6414 | No | 7216 | | | | | 3 | S | 38 | 3/22/1924 | MT EMILY TIMBE | E | 5 | SE | NE | | | Industrial | GRANDE R | SNAKE RIV | ALSO NESE | 081760 | GRANDE R | 10 | 10 | | | | 1 | 1 | 12 | 31 | NC | 10 | 10 | | | | | | |
| 0.75 | SW | 3 | | No | | Grande Rc | | | T 7008 | 2 | S | 38 | 12/31/1872 | ORODELL DITCH | E | 31 | SW | SW | | | Industrial | GRANDE R | SNAKE R | 969 FEET I | 081760 | GRANDE R | 2 | 2 | | | | 1 | 1 | 12 | 31 | NC | 0.75 | 0.375 | Yes | | | | 0.22 | |
| 0.28 | GW | 4 | 16268 | YES | | | | | | 3 | S | 37 | 7/18/2006 | OREGON STATE I | E | 6 | SW | NW | | | Commerci | A WELL | GRANDE R | 1600 FEET | 081760 | GRANDE R | 0.28 | 0.14 | Yes | | | 3 | 1 | 10 | 31 | NC | 0.28 | 0.115 | Yes | | | | | |
| 0.28 | GW | 4 | 16267 | YES | | | | | | 3 | S | 36 | 1/8/2007 | OREGON STATE I | E | 20 | SW | NE | | | Commerci | A WELL | GRANDE R | 25 FEET N | 081760 | GRANDE R | 0.28 | 0.28 | | | | 3 | 1 | 10 | 31 | NC | 0.28 | 0.14 | Yes | | | | 0.1 | |
| 0.45 | SW | 4 | 16988 | No | 16941 | | | | | 2 | S | 37 | 5/6/1946 | OREGON WASHI | E | 30 | NW | SW | | 3 | Industrial | FIVE POIN | GRANDE R | UPPER DI\ | 08176011 | FIVE POIN | 0.45 | 0.45 | | | | 1 | 1 | 12 | 31 | NC | 0.45 | 0.5 | | | | | | |
| 0.50 | SW | 4 | 8798 | No | 8113 | | | | | 2 | S | 37 | 11/5/1928 | OREGON WASHI | E | 30 | | | | 3 | Industrial | FIVE POIN | GRANDE R | | 08176011 | FIVE POIN | 0.5 | 0.5 | | | | 1 | 1 | 12 | 31 | NC | 0.5 | 0.5 | | | | | 0.49 | |
| 0.51 | SW | 4 | 1855 | No | 1172 | | | | | 2 | S | 36 | 1/3/1914 | OREGON WASHI | E | 17 | NW | SW | | | Industrial | DRY CREEK | PELICAN C | | 08176011 | DRY CR > F | 0.505 | 0.505 | | | | 1 | 1 | 12 | 31 | NC | 0.505 | 0.505 | | | | | | 2.23 |
| 0.39 | SW | 6 | 27696 | No | 34636 | | | | | 4 | S | 39 | 8/9/1961 | A.J./FERN ROTH | E | 5 | NW | SE | | 6 | Commerci | SPRING 4 | CATHERIN | 780 FEET ! | 0817601C | CATHERIN | 3.17 | 3.17 | | | | 1 | 1 | 12 | 31 | NC | 0.39 | 0.39 | | | | | 0.13 | |
| 1.11 | GW | 6 | 11745 | No | | | | | | 3 | S | 38 | 7/6/1992 | BOISE CASCADE; | E | 5 | NE | SE | | | Industrial | A WELL | GRANDE R | NORTH 27 | 081760 | GRANDE R | 1.114 | 1.114 | | | | 1 | 1 | 12 | 31 | NC | 1.114 | 1.114 | | | | | 0.81 | |
| 0.09 | SW | 6 | 54414 | No | 90948 | | | | | 4 | S | 39 | 3/30/2006 | EAGLES HOT LAK | E | 5 | NW | SE | | | Commerci | A SPRING | LADD CREI | 3381 FEET | 0817601C | LADD CR > | 0.087 | 0.087 | | | | 1 | 1 | 12 | 31 | NC | 0.087 | 0.087 | | | | | | 1 |
| 0.10 | GW | 6 | 16213 | No | 92277 | | | | | 4 | S | 39 | 4/3/2006 | EAGLES HOT LAK | E | 5 | NW | SW | | | Commerci | A WELL | LADD CREI | 3084 FEET | 0817601C | LADD CR > | 0.1 | 0.1 | | | | 1 | 1 | 3 | 31 | NC | 0.1 | 0.1 | | | | | | 10 |
| 0.05 | GW | 6 | 15261 | No | | | | | | 3 | S | 38 | 8/14/2001 | FIRST CHURCH C | E | 8 | SE | SE | | | Commerci | A WELL | MILL CREE | 550 FEET I | 08176009 | UNN STR > | 0.089 | 0.089 | | | | 1 | 1 | 12 | 31 | NC | 0.051 | 0.051 | | | | | 0.115 | |
| 0.49 | SW | 6 | 54644 | YES | | | | | | 4 | S | 39 | 9/13/2007 | HOT LAKE SPRIN | E | 5 | NW | SE | | | Commerci | A SPRING | CATHERIN | 810 FEET ! | 0817601C | LADD CR > | 0.49 | 0.49 | | | | 1 | 1 | 12 | 31 | NC | 0.49 | 0.49 | | | | | 0.14 | |
| 2.23 | GW | 6 | 13513 | YES | | | | | | 3 | S | 40 | 2/2/1998 | KENNETH DALE K | E | 15 | NW | NW | | | Industrial | A WELL | WARM CR | 664 FEET ! | 0817601C | DUNCAN ( | 2.23 | 2.23 | | | | 1 | 1 | 12 | 31 | NC | 2.23 | 2.23 | | | | | 0.185 | |
| 0.03 | GW | 6 | 10056 | No | | | | | | 3 | S | 38 | 3/16/1983 | OREGON WASHI | E | 5 | SE | SW | | | Industrial | WELLS sev | GRANDE R | 3850 FEET | 081760 | GRANDE R | 0.0334 | 0.0334 | | | | 1 | 1 | 12 | 31 | NC | 0.0334 | 0.0869 | | | | | | |
| 4.01 | GW | 6 | 15979 | YES | | | | | | 3 | S | 39 | 1/22/2004 | ROVEY FARMS | E | 36 | SW | SW | | | Commerci | A WELL | LITTLE CRE | 5100 FEET | 0817601C | UNN STR > | 4.01 | 4.01 | | | | 3 | 1 | 10 | 31 | NC | 4.01 | 1.336 | Yes | | | | 0.125 | |
| 0.45 | GW | 6 | | No | | | GR | 4185 | Cl 4185 | 3 | S | 38 | 12/31/1905 | UNION PACIFIC | E | 5 | NW | SW | | | Industrial | A WELL | GRANDE R | SOUTH 11 | 081760 | GRANDE R | 0.4456 | 0.4456 | | | | 1 | 1 | 12 | 31 | NC | 0.4456 | 0.4456 | | | | | 0.5 | |
| 0.10 | GW | 7 | 396 | No | 30896 | | | | | 4 | S | 40 | 6/22/1951 | BAKER UNION C( | E | 19 | NE | NW | | | Industrial | A WELL | CATHERIN | S83.57'E 1 | 0817601C | CATHERIN | 0.1 | 0.1 | | | | 1 | 1 | 12 | 31 | NC | 0.1 | 0.1 | | | | | 0.5 | |
| 0.37 | GW | 7 | 16266 | YES | | | | | | 5 | S | 41 | 1/8/2007 | OREGON STATE I | E | 7 | NE | NW | | | Commerci | A WELL | CATHERIN | 560 FEET ! | 0817601C | CATHERIN | 0.37 | 0.185 | Yes | | | 3 | 1 | 10 | 31 | NC | 0.37 | 0.185 | Yes | | | | 0.505 | |
| 0.34 | | ? | 2930 | No | 34393 | | | | | 2 | S | 38 | 6/2/1965 | BOISE CASCADE | E | 35 | SE | NW | | | Industrial | A WELL | PIERCE SL | 3260 FEET | 0817601C | PIERCE SL | 0.67 | 0.67 | | | | 1 | 1 | 12 | 31 | NC | 0.335 | 0.335 | | | | | 0.375 | |
| 0.89 | | ? | 3321 | No | 41154 | | | | | 2 | S | 38 | 6/6/1966 | BORDEN CO. CH | E | 35 | SW | NW | | | Industrial | A WELL | GRANDE R | 425 FEET I | 0817601C | PIERCE SL | 0.89 | 0.89 | | | | 1 | 1 | 12 | 31 | NC | 0.89 | 0.89 | | | | | | 1.336 |
| 0.81 | | ? | 2969 | No | 88818 | | | | T 10046 | 3 | S | 38 | 7/2/1965 | LA GRANDE COU | E | 3 | SW | NE | | | Commerci | A WELL | MULLHOLI | 2020 FEET | 0817601C | MULHOLL/ | 0.81 | 0.81 | | | | 3 | 1 | 10 | 31 | NC | 0.81 | 0.81 | | | | | 0.4456 | |
| 31.21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| sub-watershed/ source | POD 1/2 rate for 1/3 day | POD 1/2 rate for 1/3 day = ac-ft/15 days | poduse_max rate | POD max rate for 2/3 day = ac-ft/15 days | SW/GW So | Permit | Report Use? | Cert | decree_title | claim_char | claim_nbr | Trx | township | township_char | range | Priority Date | Stakeholder Name | range_char | sctn | qtr40 | qtr160 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | current est | | | planning period | | | | | | | | | | | | | | | | | |
| 1 | | | 0.25 | | GW | 2035 | No | 36553 | | | | | 1 | N | 39 | 1/12/1962 | BOISE CASCADE CORP. | E | 16 | SW | NE |
| 1 | | | 1.56 | | GW | 2550 | No | 36554 | | | | | 1 | N | 39 | 12/9/1963 | BOISE CASCADE CORP. | E | 16 | NE | SE |
| **1 GW** | **0.301** | **8.96** | **1.81** | **47.39** | | | | | | | | | | | | | | | | | |
| 1 | | | 3.00 | | SW | 40678 | No | 58877 | | | | | 1 | N | 39 | 8/18/1976 | BOISE CASCADE CORP. | E | 16 | SE | SE |
| 1 | | | 0.25 | | SW | 8797 | No | 8112 | | | | | 3 | N | 40 | 11/5/1928 | OREGON WASHINGTON RA | E | 30 | SE | SE |
| **1 SW** | **0.53625** | **15.95** | **3.25** | **63.82** | | | | | | | | | | | | | | | | | |
| 3 | | | 0.50 | | GW | 920 | No | 27000 | | | | | 3 | S | 38 | 6/3/1958 | BOISE CASCADE CORP. | E | 5 | NW | NE |
| 3 | | | 0.34 | | GW | 2930 | No | 34393 | | | | | 2 | S | 38 | 6/2/1965 | BOISE CASCADE CORP. | E | 35 | SE | NW |
| 3 | | | 0.89 | | GW | 3321 | No | 41154 | | | | | 2 | S | 38 | 6/6/1966 | BORDEN CO. CHEMICAL DIV | E | 35 | SW | NW |
| 3 | | | 0.13 | | GW | 3490 | No | 41044 | | | | | 2 | S | 38 | 9/28/1966 | LA GRANDE CONCRETE PIPE | E | 34 | NE | SW |
| 3 | | | 0.22 | | GW | 3755 | No | 41269 | | | | | 2 | S | 38 | 7/20/1967 | DONNOVAN F HAMPTON; R | E | 34 | NE | SW |
| **3 GW** | **0.342375** | **10.19** | **2.08** | **40.75** | | | | | | | | | | | | | | | | | |
| 3 | | | 0.05 | | SW | | No | | Grand | | | T 89 | 2 | S | 38 | 12/31/1872 | DON HAMPTON | E | 31 | SW | SW |
| 3 | | | 0.03 | | SW | 7361 | No | | | | | T 89 | 2 | S | 38 | 5/26/1926 | DON HAMPTON | E | 31 | SW | SW |
| 3 | | | 1.00 | | SW | 15877 | No | 15322 | | | | | 2 | S | 38 | 7/27/1944 | MT EMILY LUMBER CO. | E | 32 | SW | SE |
| 3 | | | 10.00 | | SW | 6414 | No | 7216 | | | | | 3 | S | 38 | 3/22/1924 | MT EMILY TIMBER CO. | E | 5 | SE | NE |
| 3 | | | 0.75 | | SW | | No | | Grand | | | T 70 | 2 | S | 38 | 12/31/1872 | ORODELL DITCH ASSOCIATI | E | 31 | SW | SW |
| **3 SW** | **1.95129** | **58.06** | **11.83** | **232.22** | | | | | | | | | | | | | | | | | |
| 4 | | | 0.28 | | GW | 16268 | YES | | | | | | 3 | S | 37 | 7/18/2006 | OREGON STATE PARKS AND | E | 6 | SW | NW |
| 4 | | | 0.28 | | GW | 16267 | YES | | | | | | 3 | S | 36 | 1/8/2007 | OREGON STATE PARKS AND | E | 20 | SW | NE |
| **4 GW** | **0.0924** | **2.75** | **0.56** | **11.00** | | | | | | | | | | | | | | | | | |
| 4 | | | 0.45 | | SW | 16988 | No | 16941 | | | | | 2 | S | 37 | 5/6/1946 | OREGON WASHINGTON RA | E | 30 | NW | SW |
| 4 | | | 0.50 | | SW | 8798 | No | 8113 | | | | | 2 | S | 37 | 11/5/1928 | OREGON WASHINGTON RA | E | 30 | | |
| 4 | | | 0.51 | | SW | 1855 | No | 1172 | | | | | 2 | S | 36 | 1/3/1914 | OREGON WASHINGTON RA | E | 17 | NW | SW |
| **4 SW** | **0.240075** | **7.14** | **1.46** | **28.57** | | | | | | | | | | | | | | | | | |
| 6 | | | 1.11 | | GW | 11745 | No | | | | | | 3 | S | 38 | 7/6/1992 | BOISE CASCADE; NORTHEAS | E | 5 | NE | SE |
| 6 | | | 0.10 | | GW | 16213 | No | 92277 | | | | | 4 | S | 39 | 4/3/2006 | EAGLES HOT LAKE RV PARK | E | 5 | NW | SW |
| 6 | | | 0.05 | | GW | 15261 | No | | | | | | 3 | S | 38 | 8/14/2001 | FIRST CHURCH OF THE NAZ | E | 8 | SE | SE |
| 6 | | | 2.23 | | GW | 13513 | YES | | | | | | 3 | S | 40 | 2/2/1998 | KENNETH DALE KNOTT | E | 15 | NW | NW |
| 6 | | | 0.03 | | GW | 10056 | No | | | | | | 3 | S | 38 | 3/16/1983 | OREGON WASHINGTON RA | E | 5 | SE | SW |
| 6 | | | 4.01 | | GW | 15979 | YES | | | | | | 3 | S | 39 | 1/22/2004 | ROVEY FARMS | E | 36 | SW | SW |
| 6 | | | 0.45 | | GW | | No | | | GR | #### | Cl 41 | 3 | S | 38 | 12/31/1905 | UNION PACIFIC RAILROAD ( | E | 5 | NW | SW |
| 6 | | | 0.81 | | GW | 2969 | No | 88818 | | | | T 10 | 3 | S | 38 | 7/2/1965 | LA GRANDE COUNTRY CLUB | E | 3 | SW | NE |
| **6 GW** | **1.45101** | **43.17** | **8.79** | **172.68** | | | | | | | | | | | | | | | | | |
| 6 | | | 0.49 | | SW | 54644 | YES | | | | | | 4 | S | 39 | 9/13/2007 | HOT LAKE SPRINGS RESORT | E | 5 | NW | SE |
| 6 | | | 0.09 | | SW | 54414 | No | 90948 | | | | | 4 | S | 39 | 3/30/2006 | EAGLES HOT LAKE RV PARK | E | 5 | NW | SE |
| 6 | | | 0.39 | | SW | 27696 | No | 34636 | | | | | 4 | S | 39 | 8/9/1961 | A.J./FERN ROTH | E | 5 | NW | SE |
| **6 SW** | **0.159555** | **4.75** | **0.97** | **18.99** | | | | | | | | | | | | | | | | | |
| 7 | | | 0.10 | | GW | 396 | No | 30896 | | | | | 4 | S | 40 | 6/22/1951 | BAKER UNION COOPERATIV | E | 19 | NE | NW |
| 7 | | | 0.37 | | GW | 16266 | YES | | | | | | 5 | S | 41 | 1/8/2007 | OREGON STATE PARKS AND | E | 7 | NE | NW |
| **7 GW** | **0.07755** | **2.31** | **0.47** | **9.23** | | | | | | | | | | | | | | | | | |
| TOTAL AC-FT PER 15 DAYS | | 153.27 | | 624.65 | | | | | | | | | | | | | | | | | |

| sub-watershed/ source | dlc | govt lot | Use code | Source | tributary to | location_description | streamcode | Stream Name | pod_maxrate | pod_ratecfs | pod_ratecfsest | pod_maxacft | pod acft | begin_month | begin_day | end_month | end day | pod_location_status | poduse_maxrate | CFS | poduse_ratecfsest | poduse_maxacft | poduse_acft | poduse_acftsest | CFS .1 to .99 | CFS 1-10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | Industrial | Boise WEL | PHILLIPS C | N65.57' EA | 08176008 | PHILLIPS C | 0.25 | 0.25 | | | | 1 | 1 | 12 | 31 | NC | 0.25 | 0.25 | | | | | 0.39 | |
| 1 | | | Industrial | A WELL | PHILLIPS C | N38.00E 1 | 08176008 | PHILLIPS C | 1.56 | 1.56 | | | | 1 | 1 | 12 | 31 | NC | 1.56 | 1.56 | | | | | 0.1 | |
| **1 GW** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | Log Deck | SPRINGS/\ | PHILLIPS C | 1300 FEET | 08176008 | PHILLIPS C | 3 | 3 | | | | 1 | 1 | 12 | 31 | NC | 3 | 3 | | | | | 0.25 | |
| 1 | | | Industrial | MOSES CR | GRANDE R | | 08176007 | MOSES CR | 0.25 | 0.25 | | | | 1 | 1 | 12 | 31 | NC | 0.25 | 0.125 | Yes | | | | 0.335 | |
| **1 SW** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | Industrial | WELLS 1 & | GRANDE R | | 08176010 | MAY PARK | 0.5 | 0.5 | | | | 1 | 1 | 12 | 31 | NC | 0.5 | 0.5 | | | | | 0.5 | |
| 3 | | | Industrial | A WELL | PIERCE SL | 3260 FEET | 08176010 | PIERCE SL | 0.67 | 0.67 | | | | 1 | 1 | 12 | 31 | NC | 0.335 | 0.335 | | | | | 0.375 | |
| 3 | | | Industrial | A WELL | GRANDE R | 425 FEET N | 08176010 | PIERCE SL | 0.89 | 0.89 | | | | 1 | 1 | 12 | 31 | NC | 0.89 | 0.89 | | | | | | 1.336 |
| 3 | | | Industrial | A WELL | GRANDE R | 840 FEET S | 08176010 | PIERCE SL | 0.13 | 0.13 | | | | 1 | 1 | 12 | 31 | NC | 0.13 | 0.13 | | | | | 0.89 | |
| 3 | | | Industrial | A WELL | GRANDE R | 750 FEET S | 08176010 | PIERCE SL | 0.22 | 0.22 | | | | 1 | 1 | 12 | 31 | NC | 0.22 | 0.22 | | | | | | 1.114 |
| **3 GW** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | Commerci | GRANDE R | SNAKE RIV | 1858 FEET | 081760 | GRANDE R | 0.05 | 0.05 | | | | 1 | 1 | 12 | 31 | NC | 0.05 | 0.025 | Yes | | | | | 1.56 |
| 3 | | | Commerci | PIERCE SLO | WRIGHT SL | 1858 FEET | 08176010 | PIERCE SL | 0.026 | 0.026 | | | | 1 | 1 | 12 | 31 | NC | 0.026 | 0.026 | | | | | | 3 |
| 3 | | | Industrial | GRANDE R | SNAKE RIV | | 081760 | GRANDE R | 1 | 1 | | | | 1 | 1 | 12 | 31 | NC | 1 | 1 | | | | | | |
| 3 | | | Industrial | GRANDE R | SNAKE RIV | ALSO NESE | 081760 | GRANDE R | 10 | 10 | | | | 1 | 1 | 12 | 31 | NC | 10 | 10 | | | | | | |
| 3 | | | Industrial | GRANDE R | SNAKE R | 969 FEET N | 081760 | GRANDE R | 2 | 2 | | | | 1 | 1 | 12 | 31 | NC | 0.75 | 0.375 | Yes | | | | 0.22 | |
| **3 SW** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | Commerci | A WELL | GRANDE R | 1600 FEET | 081760 | GRANDE R | 0.28 | 0.14 | Yes | | | 3 | 1 | 10 | 31 | NC | 0.28 | 0.115 | Yes | | | | | |
| 4 | | | Commerci | A WELL | GRANDE R | 25 FEET NO | 081760 | GRANDE R | 0.28 | 0.28 | | | | 3 | 1 | 10 | 31 | NC | 0.28 | 0.14 | Yes | | | | 0.1 | |
| **4 GW** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | 3 | Industrial | FIVE POIN | GRANDE R | UPPER DIV | 08176011 | FIVE POIN | 0.45 | 0.45 | | | | 1 | 1 | 12 | 31 | NC | 0.45 | 0.5 | | | | | | |
| 4 | | 3 | Industrial | FIVE POIN | GRANDE R | | 08176011 | FIVE POIN | 0.5 | 0.5 | | | | 1 | 1 | 12 | 31 | NC | 0.5 | 0.5 | | | | | 0.49 | |
| 4 | | | Industrial | DRY CREEK | PELICAN C | | 08176011 | DRY CR > P | 0.505 | 0.505 | | | | 1 | 1 | 12 | 31 | NC | 0.505 | 0.505 | | | | | | 2.23 |
| **4 SW** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | Industrial | A WELL | GRANDE R | NORTH 27 | 081760 | GRANDE R | 1.114 | 1.114 | | | | 1 | 1 | 12 | 31 | NC | 1.114 | 1.114 | | | | | 0.81 | |
| 6 | | | Commerci | A WELL | LADD CREE | 3084 FEET | 08176010 | LADD CR > | 0.1 | 0.1 | | | | 1 | 1 | 3 | 31 | NC | 0.1 | 0.1 | | | | | | 10 |
| 6 | | | Commerci | A WELL | MILL CREE | 550 FEET N | 08176009 | UNN STR > | 0.089 | 0.089 | | | | 1 | 1 | 12 | 31 | NC | 0.051 | 0.051 | | | | | 0.115 | |
| 6 | | | Industrial | A WELL | WARM CR | 664 FEET S | 08176010 | DUNCAN C | 2.23 | 2.23 | | | | 1 | 1 | 12 | 31 | NC | 2.23 | 2.23 | | | | | 0.185 | |
| 6 | | | Industrial | WELLS sev | GRANDE R | 3850 FEET | 081760 | GRANDE R | 0.0334 | 0.0334 | | | | 1 | 1 | 12 | 31 | NC | 0.0334 | 0.0869 | | | | | | |
| 6 | | | Commerci | A WELL | LITTLE CRE | 5100 FEET | 08176010 | UNN STR > | 4.01 | 4.01 | | | | 3 | 1 | 10 | 31 | NC | 4.01 | 1.336 | Yes | | | | 0.125 | |
| 6 | | | Industrial | A WELL | GRANDE R | SOUTH 11 | 081760 | GRANDE R | 0.4456 | 0.4456 | | | | 1 | 1 | 12 | 31 | NC | 0.4456 | 0.4456 | | | | | 0.5 | |
| 6 | | | Commerci | A WELL | MULLHOLL | 2020 FEET | 08176010 | MULHOLLA | 0.81 | 0.81 | | | | 3 | 1 | 10 | 31 | NC | 0.81 | 0.81 | | | | | 0.4456 | |
| **6 GW** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | Commerci | A SPRING | CATHERINE | 810 FEET S | 08176010 | LADD CR > | 0.49 | 0.49 | | | | 1 | 1 | 12 | 31 | NC | 0.49 | 0.49 | | | | | 0.14 | |
| 6 | | | Commerci | A SPRING | LADD CREE | 3381 FEET | 08176010 | LADD CR > | 0.087 | 0.087 | | | | 1 | 1 | 12 | 31 | NC | 0.087 | 0.087 | | | | | | 1 |
| 6 | | 6 | Commerci | SPRING 4 | CATHERINE | 780 FEET S | 08176010 | CATHERINE | 3.17 | 3.17 | | | | 1 | 1 | 12 | 31 | NC | 0.39 | 0.39 | | | | | 0.13 | |
| **6 SW** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | Industrial | A WELL | CATHERINE | S83.57'E 1 | 08176010 | CATHERINE | 0.1 | 0.1 | | | | 1 | 1 | 12 | 31 | NC | 0.1 | 0.1 | | | | | 0.5 | |
| 7 | | | Commerci | A WELL | CATHERINE | 560 FEET S | 08176010 | CATHERINE | 0.37 | 0.185 | Yes | | | 3 | 1 | 10 | 31 | NC | 0.37 | 0.185 | Yes | | | | 0.505 | |

tax lots outside city boundaries

**AF/month>>>** 100.0 80.0 80.0 80.0 80.0 85.0 95.0 140.0 190.0 230.0 220.0 177.0

x

| sub-watersheds | tax lots | % of total | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June | Jul | Aug | Sept | sub-watersheds |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 972 | 0.15 | 14.7 | 11.7 | 11.7 | 11.7 | 11.7 | 12.5 | 13.9 | 20.5 | 27.9 | 33.7 | 32.3 | 25.9 | **1** |
| **2** | 1448 | 0.22 | 21.8 | 17.5 | 17.5 | 17.5 | 17.5 | 18.6 | 20.7 | 30.6 | 41.5 | 50.2 | 48.0 | 38.7 | **2** |
| **3** | 1075 | 0.16 | 16.2 | 13.0 | 13.0 | 13.0 | 13.0 | 13.8 | 15.4 | 22.7 | 30.8 | 37.3 | 35.7 | 28.7 | **3** |
| **4** | 380 | 0.06 | 5.7 | 4.6 | 4.6 | 4.6 | 4.6 | 4.9 | 5.4 | 8.0 | 10.9 | 13.2 | 12.6 | 10.1 | **4** |
| **5** | 203 | 0.03 | 3.1 | 2.4 | 2.4 | 2.4 | 2.4 | 2.6 | 2.9 | 4.3 | 5.8 | 7.0 | 6.7 | 5.4 | **5** |
| **6** | 2102 | 0.32 | 31.7 | 25.4 | 25.4 | 25.4 | 25.4 | 26.9 | 30.1 | 44.4 | 60.2 | 72.9 | 69.7 | 56.1 | **6** |
| **7** | 399 | 0.06 | 6.0 | 4.8 | 4.8 | 4.8 | 4.8 | 5.1 | 5.7 | 8.4 | 11.4 | 13.8 | 13.2 | 10.7 | **7** |
| **8** | 51 | 0.01 | 0.8 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 | 1.1 | 1.5 | 1.8 | 1.7 | 1.4 | **8** |
| Total | 6630 | 1 | 100 | 80 | 80 | 80 | 80 | 85 | 95 | 140 | 190 | 230 | 220 | 177 | |

| Month | AF/Month |
|---|---|
| Oct | 100 |
| Nov | 80 |
| Dec | 80 |
| Jan | 80 |
| Feb | 80 |
| Mar | 85 |
| Apr | 95 |
| May | 140 |
| June | 190 |
| Jul | 230 |
| Aug | 220 |
| Sept | 177 |
| Total | **1557** |

| sub-watersheds | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **tax lots** | 972 | 1448 | 1075 | 380 | 203 | 2102 | 399 | 51 | 6630 |
| **% of total** | 0.15 | 0.22 | 0.16 | 0.06 | 0.03 | 0.32 | 0.06 | 0.01 | 1 |
| **Oct** | 14.7 | 21.8 | 16.2 | 5.7 | 3.1 | 31.7 | 6.0 | 0.8 | 100 |
| **Nov** | 11.7 | 17.5 | 13.0 | 4.6 | 2.4 | 25.4 | 4.8 | 0.6 | 80 |
| **Dec** | 11.7 | 17.5 | 13.0 | 4.6 | 2.4 | 25.4 | 4.8 | 0.6 | 80 |
| **Jan** | 11.7 | 17.5 | 13.0 | 4.6 | 2.4 | 25.4 | 4.8 | 0.6 | 80 |
| **Feb** | 11.7 | 17.5 | 13.0 | 4.6 | 2.4 | 25.4 | 4.8 | 0.6 | 80 |
| **Mar** | 12.5 | 18.6 | 13.8 | 4.9 | 2.6 | 26.9 | 5.1 | 0.7 | 85 |
| **Apr** | 13.9 | 20.7 | 15.4 | 5.4 | 2.9 | 30.1 | 5.7 | 0.7 | 95 |
| **May** | 20.5 | 30.6 | 22.7 | 8.0 | 4.3 | 44.4 | 8.4 | 1.1 | 140 |
| **June** | 27.9 | 41.5 | 30.8 | 10.9 | 5.8 | 60.2 | 11.4 | 1.5 | 190 |
| **Jul** | 33.7 | 50.2 | 37.3 | 13.2 | 7.0 | 72.9 | 13.8 | 1.8 | 230 |
| **Aug** | 32.3 | 48.0 | 35.7 | 12.6 | 6.7 | 69.7 | 13.2 | 1.7 | 220 |
| **Sept** | 25.9 | 38.7 | 28.7 | 10.1 | 5.4 | 56.1 | 10.7 | 1.4 | 177 |

# APPENDIX B
## Agricultural Demand Calculations

Yellow highlighted cells contain data used to compute basin crop distribution.

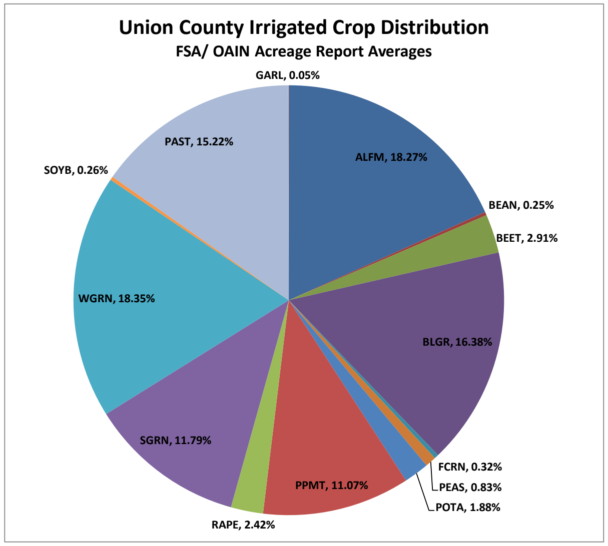
| | OAIN Acreage Data for Union County; all acres | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | 17-yr | |
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | AVG | |
| Wheat - all mrkt classe | 32100 | 29200 | 29900 | 30000 | 38000 | 34000 | 33000 | 30000 | 36000 | 34750 | 40000 | 31150 | 30000 | 31000 | 29363 | 29000 | 26469 | | 31996 | |
| Wheat - cert. seed | | | | | | | | | | | | | | | | | 3051 | | | |
| Barley | 7600 | 5600 | 4400 | 5000 | 3500 | 2500 | 2500 | 2000 | 2500 | 1500 | 2200 | 2300 | 4500 | 5500 | 3745 | 3750 | 3712 | | 3694.529 | |
| Alfalfa | 20000 | 21000 | 22000 | 22000 | 22000 | 22000 | 22000 | 22000 | 23000 | 23000 | 23000 | 23000 | 23000 | 24000 | 17700 | 18000 | 18500 | | 21541.18 | |
| Other Hay | 16000 | 15000 | 16000 | 16000 | 16000 | 16000 | 16000 | 16000 | 15000 | 15000 | 15000 | 15000 | 15000 | 15000 | 15000 | 14000 | 13900 | | 15288.24 | |
| Peppermint | 8480 | 7800 | 8200 | 6800 | 6900 | 6820 | 7200 | 8200 | 6700 | 7200 | 8000 | 7800 | 8800 | 7875 | 7500 | 6866 | 6450 | | **7505.353** | 11.07% |
| Sugarbeet | 1900 | 1800 | 2200 | 2100 | 1900 | 2100 | 2200 | 2200 | 1427 | 1670 | 2000 | 2000 | 2100 | 2040 | 1815 | 1991 | 2043 | | **1969.765** | 2.91% |
| Sunflower | 0 | 0 | 0 | 0 | 0 | 80 | 200 | 1100 | 750 | 1205 | 1015 | 523 | 1909 | 1990 | 1150 | 850 | 1446 | | 718.7059 | |
| Cert. Seed Potato | 286 | 460 | 870 | 1349 | 1719 | 1058 | 1070 | 1054 | 1150 | 1000 | 950 | 977 | 1054 | 677 | 837 | 776 | 753 | | **943.5294** | 1.39% |
| Com/Fresh Potato | 128 | 90 | 140 | 276 | 241 | 160 | 587 | 646 | 500 | 400 | 600 | 450 | 500 | 138 | 236 | 473 | 100 | | **333.2353** | 0.49% |
| Other crops | 1726 | 1350 | 1690 | 3565 | 1905 | 602 | 1193 | 1500 | 2673 | 1725 | 2035 | 1850 | 2466 | 3642 | 5000 | 5110 | 2990 | | 2413.059 | |
| K. bluegrass | 6490 | 7240 | 7700 | 6500 | 6000 | 6340 | 6100 | 6100 | 6200 | 5340 | 4500 | 4560 | 4820 | 5746 | 5990 | 8000 | 8535 | | 6244.765 | |
| Creeping Red Fescue | 3600 | 4760 | 4300 | 3900 | 3010 | 3360 | 3660 | 3200 | 2600 | 2300 | 1890 | 2090 | 1480 | 1494 | 1284 | 1750 | 2360 | | 2766.941 | |
| Chewings Fescue | 1950 | 1100 | 800 | 1300 | 330 | 630 | 820 | 600 | 750 | 650 | 340 | 140 | 200 | 325 | 1500 | 375 | 675 | | 734.4118 | |
| Hard Fescue | 460 | 726 | 500 | 150 | 100 | 170 | 380 | 350 | 430 | 300 | 180 | 140 | 0 | 0 | 140 | 70 | 60 | | 244.4706 | |
| Tall Fescue | 470 | 220 | 540 | 260 | 40 | 140 | 80 | 80 | 80 | 80 | 40 | 0 | 0 | 0 | 0 | 0 | 83 | | 124.2941 | |
| Other Grasses | 52 | 68 | 100 | 72 | 110 | 10 | 11 | 11 | 4 | 145 | 55 | 80 | 300 | 196 | 20 | 366 | 593 | | 129 | |
| Total Crop Acreage | 101242 | 96414 | 99340 | 99272 | 101755 | 95970 | 97001 | 95041 | 99764 | 96265 | 101805 | 92060 | 96129 | 99623 | 91280 | 91377 | 91720 | | 96647.47 | |

Other crops include = oilseed (crush), oilseed (certified seed), legume seed, dry beans/peas, certified small grain seed, field corn, soybean, pumpkin, sweet cherry and various specialty crops.

Misc. Grasses = Int. and Pubescent wheat grass, brome grass, canarygrass, Idaho fescue and bluebunch wheatgrass

| 2011-2017 FSA Acreage Report averages; Union County | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Agrimet Crop Code | | | | | | | | | |
| | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **average** | |
| ALFM | 10538.8 | 12541.7 | 12875 | 12687.51 | 12085.48 | 13202.1 | 12770.9 | **12386** | 18.27% |
| BEAN | 15.6 | 43.5 | 34.6 | 92.46 | 290 | 49.46 | 658.77 | **169** | 0.25% |
| BEET | 2006.4 | 2045.2 | 1922.2 | 1787.62 | 1866.78 | 2113.72 | 1960.12 | **1957** | |
| BLGR | 7714.5 | 9117.1 | 8897.3 | 9900.1 | 12565.97 | 13909.65 | 15628.59 | **11105** | 16.38% |
| FCRN | 128.8 | 252.2 | 359.1 | 54 | 99.88 | 178.35 | 437.08 | **216** | 0.32% |
| PEAS | 244.5 | 56 | 470.8 | 691.69 | 724.55 | 668.3 | 1058.77 | **559** | 0.83% |
| POTA | 1261.5 | 1747.9 | 1016.9 | 682.27 | 1194.12 | 1377.14 | 1307.76 | **1227** | |
| PPMT | 7849 | 8769.4 | 7623.5 | 6881.6 | 6099.16 | 5977.19 | 5051.85 | **6893** | |
| RAPE | 1184.6 | 1549.1 | 1488.3 | 1454.5 | 1146.63 | 2640.32 | 2029.1 | **1642** | 2.42% |
| SGRN | 9819.9 | 7820 | 7716 | 6557.62 | 6785.89 | 9131.52 | 8103.27 | **7991** | 11.79% |
| WGRN | 12519.7 | 13923.9 | 14625.4 | 14518.97 | 12984.78 | 9779.91 | 8710.3 | **12438** | 18.35% |
| SOYB | 32.4 | 0 | 10 | 114.71 | 335.22 | 421.32 | 338.58 | **179** | 0.26% |
| PAST | 9274.5 | 10217.8 | 9677.7 | 10314.16 | 10550.47 | 10735.97 | 11434.84 | **10315** | 15.22% |
| GARL | 0 | 0 | 0 | 0 | 0 | 90 | 145.01 | **34** | 0.05% |
| | 62590.2 | 68083.8 | 66716.8 | 65737.21 | 66728.93 | 70184.95 | 69489.93 | 67110 | |

| Crop | Acres | % |
|---|---|---|
| ALFM | 12386 | 18.27% |
| BEAN | 169 | 0.25% |
| BEET | 1970 | 2.91% |
| BLGR | 11105 | 16.38% |
| FCRN | 216 | 0.32% |
| PEAS | 559 | 0.83% |
| POTA | 1277 | 1.88% |
| PPMT | 7505 | 11.07% |
| RAPE | 1642 | 2.42% |
| SGRN | 7991 | 11.79% |
| WGRN | 12438 | 18.35% |
| SOYB | 179 | 0.26% |
| PAST | 10315 | 15.22% |
| GARL | 34 | 0.05% |




| Key for Correlating FSA crops to Agrimet Crop Codes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Agrimet Crop Code | State Code | County Cod | Crop Code | State | County | State Count | Crop | Crop Type |
| SGRN | 41 | 061 | 0011 | OREGON | UNION | 41061 | WHEAT | HARD RED SPRING |
| WGRN | 41 | 061 | 0011 | OREGON | UNION | 41061 | WHEAT | HARD RED WINTER |
| WGRN | 41 | 061 | 0011 | OREGON | UNION | 41061 | WHEAT | SOFT RED WINTER |
| SGRN | 41 | 061 | 0011 | OREGON | UNION | 41061 | WHEAT | SOFT WHITE SPRING |
| WGRN | 41 | 061 | 0011 | OREGON | UNION | 41061 | WHEAT | SOFT WHITE WINTER |
| SGRN | 41 | 061 | 0016 | OREGON | UNION | 41061 | OATS | SPRING |
| ALFM | 41 | 061 | 0027 | OREGON | UNION | 41061 | ALFALFA | |
| BEET | 41 | 061 | 0039 | OREGON | UNION | 41061 | SUGAR BEE | |
| FCRN | 41 | 061 | 0041 | OREGON | UNION | 41061 | CORN | SWEET |
| FCRN | 41 | 061 | 0041 | OREGON | UNION | 41061 | CORN | YELLOW |
| BEAN | 41 | 061 | 0047 | OREGON | UNION | 41061 | BEANS | GARBANZO- LARGE KABULI (CHICKP |
| PEAS | 41 | 061 | 0067 | OREGON | UNION | 41061 | PEAS | AUSTRIAN |
| PEAS | 41 | 061 | 0067 | OREGON | UNION | 41061 | PEAS | GREEN |
| RAPE | 41 | 061 | 0078 | OREGON | UNION | 41061 | SUNFLOWE | SUNFLOWER OIL |
| SOYB | 41 | 061 | 0081 | OREGON | UNION | 41061 | SOYBEANS | LSD |
| POTA | 41 | 061 | 0084 | OREGON | UNION | 41061 | POTATOES | REDS |
| POTA | 41 | 061 | 0084 | OREGON | UNION | 41061 | POTATOES | RUSSETS |
| POTA | 41 | 061 | 0084 | OREGON | UNION | 41061 | POTATOES | WHITES |
| POTA | 41 | 061 | 0084 | OREGON | UNION | 41061 | POTATOES | YELLOW |
| SGRN | 41 | 061 | 0091 | OREGON | UNION | 41061 | BARLEY | SPRING BARLEY |
| WGRN | 41 | 061 | 0091 | OREGON | UNION | 41061 | BARLEY | WINTER BARLEY |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BLGR | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | KENTUCKY BLUEGRASS |
| BLGR | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | OTHER BROME |
| BLGR | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | CANARY |
| BLGR | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | FESCUE- CHEWING |
| BLGR | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | FESCUE- RED |
| BLGR | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | FESCUE- HARD |
| BLGR | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | FESCUE- TALL |
| BLGR | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | IDAHO FESCUE |
| PAST | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | NATIVE |
| PAST | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | ORCHARD |
| PAST | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | ANNUAL RYEGRASS |
| PAST | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | SAINFOIN |
| PAST | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | TIMOTHY |
| PAST | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | BLUE BUNCH WHEAT |
| PAST | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | CRESTED WHEAT |
| PAST | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | INTERMEDIATE WHEAT |
| PAST | 41 | 061 | 0102 | OREGON | UNION | 41061 | GRASS | PUBESCENT WHEAT |
| RAPE | 41 | 061 | 0114 | OREGON | UNION | 41061 | BUCKWHEA | |
| | 41 | 061 | 0128 | OREGON | UNION | 41061 | CHERRIES | SWEET |
| WGRN | 41 | 061 | 0158 | OREGON | UNION | 41061 | TRITICALE | |
| ALFM | 41 | 061 | 0265 | OREGON | UNION | 41061 | CLOVER | RED CLOVER |
| ALFM | 41 | 061 | 0265 | OREGON | UNION | 41061 | CLOVER | WHITE CLOVER |
| ALFM | 41 | 061 | 0296 | OREGON | UNION | 41061 | MIXED FOR | ALFALFA GRASS MIXTURE |
| PAST | 41 | 061 | 0296 | OREGON | UNION | 41061 | MIXED FOR | GGV |
| PAST | 41 | 061 | 0296 | OREGON | UNION | 41061 | MIXED FOR | GRASS MIX-BELOW 25% ALFALFA |
| PAST | 41 | 061 | 0296 | OREGON | UNION | 41061 | MIXED FOR | 2 OR MORE INTERSEEDED GRASS MI |
| PAST | 41 | 061 | 0296 | OREGON | UNION | 41061 | MIXED FOR | LEGUME/SMALL GRAIN/GRASS |
| PAST | 41 | 061 | 0296 | OREGON | UNION | 41061 | MIXED FOR | LEGUME/GRASS MIXTURE |
| PAST | 41 | 061 | 0296 | OREGON | UNION | 41061 | MIXED FOR | LEGUME/SMALL GRAIN |
| PAST | 41 | 061 | 0296 | OREGON | UNION | 41061 | MIXED FOR | 2 OR MORE INTERSEEDED SMALL GR |
| PAST | 41 | 061 | 0296 | OREGON | UNION | 41061 | MIXED FOR | GRASS/SMALL GRAIN INTERSEEDING |
| GARL | 41 | 061 | 0423 | OREGON | UNION | 41061 | GARLIC | COMMON |
| RAPE | 41 | 061 | 0711 | OREGON | UNION | 41061 | CANOLA | SPRING CANOLA |
| RAPE | 41 | 061 | 0716 | OREGON | UNION | 41061 | QUINOA | |
| PAST | 41 | 061 | 0777 | OREGON | UNION | 41061 | WILDLIFE F | |
| SGRN | 41 | 061 | 1223 | OREGON | UNION | 41061 | TEFF | |
| RAPE | 41 | 061 | 4000 | OREGON | UNION | 41061 | GREENS | LEAF SPINACH |
| RAPE | 41 | 061 | 5000 | OREGON | UNION | 41061 | HERBS | CILANTRO/CORIANDER |
| PPMT | 41 | 061 | 5000 | OREGON | UNION | 41061 | HERBS | PEPPERMINT |

This worksheet contains historic daily Agrimet IMBO weather and crop water use data, averaged over the period 1994-2017.
Effective precipitation is calculated from IMBO PP using the USDA SCS method with a daily time step by using a 30 day moving average for PP and ET (column U).
The effective precipitation calculation is also done for the future scenario using the LOCA downscaled multi-model mean 2068 precipitation data (column W).
Crop coefficients for basin crops are derived from the IMBO historic averages. A composite crop coefficient is computed based on the basin crop distribution (weighted by acreage; see columns AS-BF).
Post-Harvest water requirements for peppermint and grass seed are estimated based on extension bulletin EM8807 and EM8662 recommendations by applying static crop coefficient of 0.3 for BLGR and 0.625 for PPMT (columns AP, AQ).
Current and Future ET (composite) values are calculated by applying the composite crop coefficient to the reference ET calculated in worksheets Current_ETrs and Future Etrs (see columns BH, BJ).
The net irrigation water requirement (NIWR) is caluculated by subtracting effective precipitation from the composite ET. Only positive values are reported. (Columns BI, BK)

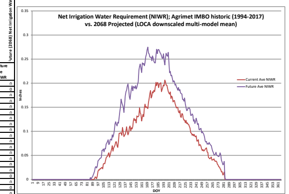
| Bi-Monthly period beginning | DOY | ET Kimberly-Penman (in) IMBO ET | ET ASCE-EWRI Alfalfa (in) IMBO ETR | ET ASCE-EWRI Grass (in) IMBO ETO | Minimum Daily Air Temperature (F) IMBO MN | Maximum Daily Air Temperature (F) IMBO MX | Mean Daily Air Temperature (F) IMBO MM | Accumulated Precipitation Since Recharge/Reset (in) IMBO PC | Daily (24 hour) Precipitation (in) IMBO PP | Accumulated Water Year Precipitation (in) IMBO PU | Daily Global Solar Radiation (langleys) IMBO SR | Mean Daily Humidity (%) IMBO TA | Growing Degree Days (base 50F) IMBO TG | Mean Daily Dewpoint Temperature (F) IMBO YM | Daily Average Wind Speed (mph) IMBO UA | Daily Average Wind Direction (deg az) IMBO UD | Daily Peak Wind Gust (mph) IMBO WG | Daily Wind Run (miles) IMBO WR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-Jan | 1 | 0.02 | 0.04 | 0.02 | 21.2 | 34.6 | 29.4 | 8.9 | 0.12 | 5.8 | 90.1 | 81.1 | 0.12 | 23.9 | 7.0 | 190.0 | 24.4 | 168.3 |
| 1-Jan | 2 | 0.03 | 0.06 | 0.03 | 23.2 | 35.9 | 30.0 | 8.9 | 0.03 | 5.8 | 114.4 | 77.6 | 0.00 | 23.4 | 8.5 | 136.8 | 27.9 | 204.0 |
| 1-Jan | 3 | 0.02 | 0.03 | 0.02 | 21.8 | 35.1 | 28.8 | 8.9 | 0.04 | 5.8 | 112.6 | 79.0 | 0.00 | 22.6 | 6.6 | 137.6 | 22.4 | 157.2 |
| 1-Jan | 4 | 0.03 | 0.05 | 0.03 | 22.2 | 36.6 | 29.8 | 9.0 | 0.04 | 5.9 | 113.9 | 75.3 | 0.02 | 22.5 | 8.0 | 177.5 | 27.0 | 192.9 |
| 1-Jan | 5 | 0.03 | 0.05 | 0.03 | 21.8 | 34.9 | 28.5 | 9.0 | 0.05 | 5.9 | 114.1 | 74.9 | 0.00 | 21.1 | 6.6 | 168.9 | 24.1 | 157.2 |
| 1-Jan | 6 | 0.02 | 0.04 | 0.03 | 23.3 | 37.3 | 30.4 | 9.1 | 0.05 | 6.0 | 113.7 | 76.7 | 0.00 | 23.6 | 7.6 | 194.3 | 24.0 | 183.0 |
| 1-Jan | 7 | 0.02 | 0.04 | 0.03 | 27.6 | 38.4 | 33.0 | 9.2 | 0.06 | 6.0 | 98.4 | 80.1 | 0.00 | 27.2 | 8.7 | 187.0 | 26.1 | 209.5 |
| 1-Jan | 8 | 0.02 | 0.04 | 0.02 | 28.0 | 40.6 | 34.4 | 9.2 | 0.05 | 6.1 | 108.9 | 80.3 | 0.06 | 28.4 | 7.0 | 178.9 | 24.3 | 168.8 |
| 1-Jan | 9 | 0.03 | 0.05 | 0.03 | 29.0 | 40.9 | 34.6 | 9.3 | 0.05 | 6.1 | 104.1 | 79.0 | 0.02 | 28.4 | 7.0 | 184.0 | 23.3 | 168.4 |
| 1-Jan | 10 | 0.02 | 0.04 | 0.03 | 27.8 | 39.2 | 33.5 | 9.3 | 0.06 | 6.2 | 86.4 | 84.2 | 0.03 | 29.0 | 6.3 | 161.8 | 22.4 | 152.2 |
| 1-Jan | 11 | 0.03 | 0.04 | 0.03 | 24.7 | 38.4 | 32.0 | 9.4 | 0.07 | 6.3 | 110.0 | 80.9 | 0.00 | 26.5 | 6.7 | 153.7 | 21.8 | 159.9 |
| 1-Jan | 12 | 0.03 | 0.05 | 0.03 | 24.3 | 37.6 | 30.8 | 9.4 | 0.05 | 6.3 | 103.0 | 77.8 | 0.00 | 24.3 | 8.0 | 199.0 | 25.6 | 192.2 |
| 1-Jan | 13 | 0.02 | 0.04 | 0.03 | 26.7 | 38.5 | 32.6 | 8.9 | 0.06 | 6.3 | 119.5 | 79.4 | 0.00 | 27.2 | 6.6 | 199.2 | 22.6 | 159.6 |
| 1-Jan | 14 | 0.03 | 0.04 | 0.03 | 26.0 | 38.5 | 32.1 | 9.0 | 0.06 | 6.3 | 116.0 | 79.9 | 0.07 | 26.3 | 6.9 | 168.9 | 20.6 | 166.2 |
| 1-Jan | 15 | 0.03 | 0.03 | 0.02 | 22.0 | 36.4 | 28.9 | 8.7 | 0.05 | 6.4 | 131.4 | 82.1 | 21714.45 | 23.8 | 5.7 | 179.7 | 18.9 | 137.6 |

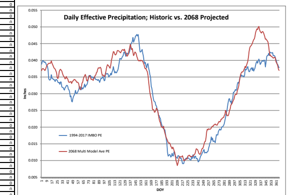
| DOY | Effective Precipitation (USDA SCS method); D=2, SF=0.921719 1994-2017 IMBO | 2068 Multi-Model Mean Daily Precipitation 2068 Multi model | FUTURE Effective Precipitation (USDA SCS method); D=2, SF=0.921719 2068 Multi Model Ave PE |
|---|---|---|---|
| 1 | 0.039 | 0.072 | 0.037 |
| 2 | 0.040 | 0.080 | 0.037 |
| 3 | 0.040 | 0.061 | 0.038 |
| 4 | 0.040 | 0.062 | 0.037 |
| 5 | 0.039 | 0.058 | 0.037 |
| 6 | 0.040 | 0.070 | 0.037 |
| 7 | 0.039 | 0.094 | 0.037 |
| 8 | 0.039 | 0.096 | 0.038 |
| 9 | 0.038 | 0.121 | 0.038 |
| 10 | 0.038 | 0.077 | 0.039 |
| 11 | 0.037 | 0.050 | 0.039 |
| 12 | 0.034 | 0.047 | 0.039 |
| 13 | 0.034 | 0.036 | 0.039 |
| 14 | 0.034 | 0.046 | 0.039 |
| 15 | 0.034 | 0.084 | 0.039 |

Average Daily Crop Water Use; all available IMBO data 1994-2017

| DOY | ETr | ALFP | ALFM | BLGR | WGRN | SGRN | BEET | POTA | FCRN | BEAN | PPMT | RAPE | PEAS | PAST | GARL | SOYB | BLGR_PH | PPMT_PH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 4 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 6 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 7 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 8 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 9 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |

Crop Coefficients Derived from IMBO Daily Crop Water Use averages 1994-2017

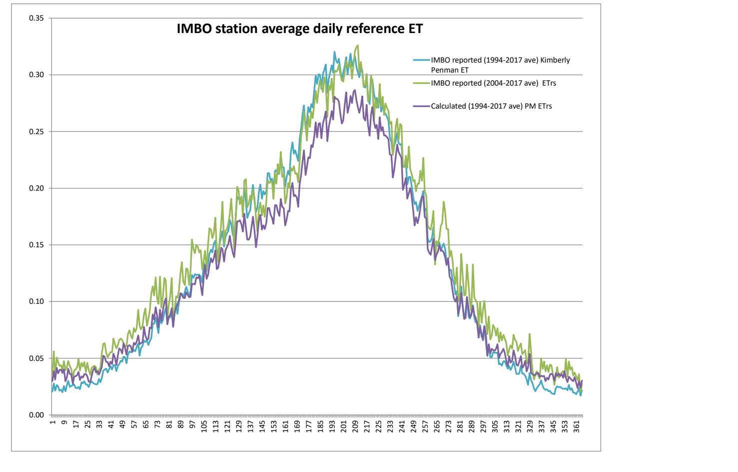


| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 16-Aug | 229 | 0.27 | 0.26 | 0.20 | 46.3 | 85.5 | 66.8 | 6.9 | 0.00 |
| 16-Aug | 230 | 0.27 | 0.27 | 0.21 | 45.9 | 86.1 | 66.9 | 6.9 | 0.01 |
| 16-Aug | 231 | 0.26 | 0.27 | 0.21 | 46.5 | 86.1 | 66.8 | 7.0 | 0.01 |
| 16-Aug | 232 | 0.26 | 0.27 | 0.20 | 47.9 | 85.9 | 67.1 | 7.0 | 0.02 |
| 16-Aug | 233 | 0.25 | 0.26 | 0.20 | 47.1 | 85.0 | 66.5 | 7.0 | 0.01 |
| 16-Aug | 234 | 0.24 | 0.26 | 0.19 | 47.8 | 83.7 | 65.9 | 7.0 | 0.01 |
| 16-Aug | 235 | 0.23 | 0.23 | 0.17 | 46.6 | 81.7 | 64.1 | 7.0 | 0.05 |
| 16-Aug | 236 | 0.24 | 0.24 | 0.18 | 44.4 | 83.3 | 63.7 | 7.1 | 0.01 |
| 16-Aug | 237 | 0.24 | 0.25 | 0.19 | 45.1 | 85.5 | 65.2 | 6.8 | 0.01 |
| 16-Aug | 238 | 0.25 | 0.26 | 0.19 | 46.3 | 86.3 | 66.0 | 6.8 | 0.01 |
| 16-Aug | 239 | 0.24 | 0.24 | 0.18 | 46.7 | 85.8 | 66.1 | 6.8 | 0.00 |
| 16-Aug | 240 | 0.24 | 0.26 | 0.19 | 47.1 | 85.9 | 66.6 | 6.8 | 0.02 |
| 16-Aug | 241 | 0.24 | 0.26 | 0.19 | 48.6 | 83.6 | 65.8 | 6.8 | 0.00 |
| 16-Aug | 242 | 0.22 | 0.22 | 0.16 | 45.6 | 81.7 | 63.4 | 6.8 | 0.01 |
| 16-Aug | 243 | 0.22 | 0.22 | 0.17 | 46.7 | 81.9 | 63.8 | 6.9 | 0.01 |
| 16-Aug | 244 | 0.22 | 0.23 | 0.17 | 44.7 | 83.6 | 63.6 | 6.9 | 0.01 |
| 1-Sep | 245 | 0.20 | 0.22 | 0.16 | 45.2 | 81.3 | 62.8 | 6.9 | 0.01 |
| 1-Sep | 246 | 0.21 | 0.24 | 0.17 | 45.2 | 80.1 | 62.1 | 6.9 | 0.05 |
| 1-Sep | 247 | 0.21 | 0.22 | 0.16 | 44.2 | 80.4 | 62.2 | 6.9 | 0.01 |
| 1-Sep | 248 | 0.20 | 0.21 | 0.16 | 45.8 | 78.6 | 61.4 | 7.0 | 0.06 |
| 1-Sep | 249 | 0.19 | 0.21 | 0.16 | 43.6 | 78.1 | 60.4 | 6.2 | 0.01 |
| 1-Sep | 250 | 0.19 | 0.21 | 0.16 | 42.9 | 76.9 | 59.4 | 6.2 | 0.03 |
| 1-Sep | 251 | 0.19 | 0.20 | 0.15 | 42.2 | 78.6 | 60.0 | 6.2 | 0.03 |
| 1-Sep | 252 | 0.18 | 0.20 | 0.15 | 42.9 | 76.9 | 59.9 | 6.2 | 0.01 |
| 1-Sep | 253 | 0.18 | 0.20 | 0.15 | 43.9 | 77.8 | 60.0 | 6.2 | 0.00 |
| 1-Sep | 254 | 0.19 | 0.22 | 0.16 | 41.7 | 79.9 | 60.5 | 6.1 | 0.02 |
| 1-Sep | 255 | 0.19 | 0.21 | 0.15 | 43.3 | 81.2 | 61.7 | 6.1 | 0.01 |
| 1-Sep | 256 | 0.20 | 0.23 | 0.16 | 43.7 | 80.8 | 61.4 | 6.2 | 0.00 |
| 1-Sep | 257 | 0.18 | 0.20 | 0.14 | 42.6 | 78.9 | 60.1 | 6.2 | 0.02 |
| 1-Sep | 258 | 0.18 | 0.19 | 0.14 | 44.0 | 78.3 | 60.4 | 6.2 | 0.02 |
| 1-Sep | 259 | 0.16 | 0.17 | 0.12 | 44.7 | 75.2 | 59.2 | 6.2 | 0.03 |
| 16-Sep | 260 | 0.15 | 0.16 | 0.12 | 44.3 | 74.0 | 58.3 | 6.2 | 0.02 |
| 16-Sep | 261 | 0.15 | 0.16 | 0.12 | 41.8 | 73.8 | 57.3 | 6.3 | 0.02 |
| 16-Sep | 262 | 0.16 | 0.17 | 0.12 | 43.6 | 73.0 | 57.6 | 6.3 | 0.04 |
| 16-Sep | 263 | 0.17 | 0.18 | 0.13 | 41.1 | 73.5 | 56.8 | 6.3 | 0.04 |
| 16-Sep | 264 | 0.15 | 0.13 | 0.10 | 39.5 | 71.3 | 54.7 | 6.4 | 0.03 |
| 16-Sep | 265 | 0.15 | 0.15 | 0.11 | 38.7 | 73.7 | 55.0 | 6.4 | 0.03 |
| 16-Sep | 266 | 0.15 | 0.15 | 0.11 | 39.0 | 73.7 | 55.3 | 6.4 | 0.01 |
| 16-Sep | 267 | 0.15 | 0.16 | 0.11 | 38.5 | 74.4 | 55.6 | 6.4 | 0.02 |
| 16-Sep | 268 | 0.14 | 0.17 | 0.12 | 40.2 | 74.2 | 56.0 | 6.4 | 0.01 |
| 16-Sep | 269 | 0.15 | 0.17 | 0.12 | 38.9 | 74.0 | 55.7 | 6.4 | 0.01 |
| 16-Sep | 270 | 0.15 | 0.19 | 0.13 | 39.8 | 73.9 | 55.9 | 6.4 | 0.02 |
| 16-Sep | 271 | 0.15 | 0.18 | 0.13 | 38.8 | 75.6 | 55.8 | 6.2 | 0.02 |
| 16-Sep | 272 | 0.13 | 0.16 | 0.12 | 40.3 | 74.6 | 56.0 | 6.2 | 0.05 |
| 16-Sep | 273 | 0.13 | 0.16 | 0.11 | 42.2 | 73.8 | 56.8 | 6.3 | 0.03 |
| 16-Sep | 274 | 0.13 | 0.14 | 0.10 | 40.2 | 72.0 | 54.8 | 6.3 | 0.06 |
| 1-Oct | 275 | 0.13 | 0.14 | 0.10 | 37.1 | 67.8 | 52.1 | 6.3 | 0.02 |
| 1-Oct | 276 | 0.12 | 0.14 | 0.10 | 37.8 | 65.6 | 50.7 | 6.4 | 0.08 |
| 1-Oct | 277 | 0.12 | 0.12 | 0.09 | 37.0 | 64.9 | 49.9 | 6.4 | 0.01 |
| 1-Oct | 278 | 0.11 | 0.12 | 0.08 | 35.2 | 64.9 | 49.1 | 6.5 | 0.04 |
| 1-Oct | 279 | 0.11 | 0.13 | 0.09 | 35.0 | 66.3 | 49.9 | 6.5 | 0.01 |
| 1-Oct | 280 | 0.09 | 0.10 | 0.07 | 37.9 | 63.8 | 50.7 | 6.5 | 0.02 |
| 1-Oct | 281 | 0.10 | 0.11 | 0.08 | 36.6 | 65.6 | 50.1 | 6.5 | 0.03 |
| 1-Oct | 282 | 0.11 | 0.14 | 0.10 | 35.5 | 66.1 | 50.0 | 6.5 | 0.01 |
| 1-Oct | 283 | 0.10 | 0.12 | 0.09 | 35.6 | 63.3 | 48.8 | 6.6 | 0.06 |
| 1-Oct | 284 | 0.09 | 0.11 | 0.07 | 36.2 | 58.8 | 47.3 | 6.7 | 0.07 |
| 1-Oct | 285 | 0.09 | 0.11 | 0.07 | 33.8 | 60.9 | 46.2 | 6.7 | 0.02 |
| 1-Oct | 286 | 0.10 | 0.13 | 0.09 | 34.8 | 64.3 | 48.7 | 6.5 | 0.01 |
| 1-Oct | 287 | 0.09 | 0.12 | 0.08 | 37.4 | 63.4 | 49.7 | 6.5 | 0.06 |
| 1-Oct | 288 | 0.09 | 0.10 | 0.07 | 35.3 | 61.8 | 48.3 | 6.6 | 0.04 |
| 1-Oct | 289 | 0.09 | 0.09 | 0.06 | 36.4 | 62.7 | 48.6 | 6.6 | 0.04 |
| 16-Oct | 290 | 0.10 | 0.13 | 0.09 | 34.8 | 63.6 | 48.4 | 6.6 | 0.02 |
| 16-Oct | 291 | 0.09 | 0.10 | 0.07 | 34.8 | 63.4 | 48.3 | 6.6 | 0.03 |
| 16-Oct | 292 | 0.08 | 0.10 | 0.07 | 36.5 | 62.4 | 48.6 | 6.7 | 0.07 |
| 16-Oct | 293 | 0.08 | 0.10 | 0.07 | 35.6 | 61.4 | 47.7 | 6.6 | 0.04 |
| 16-Oct | 294 | 0.07 | 0.08 | 0.05 | 35.0 | 59.6 | 46.1 | 6.7 | 0.05 |
| 16-Oct | 295 | 0.08 | 0.10 | 0.07 | 34.7 | 60.3 | 46.6 | 6.7 | 0.05 |
| 16-Oct | 296 | 0.07 | 0.08 | 0.06 | 33.1 | 58.2 | 45.2 | 6.8 | 0.05 |
| 16-Oct | 297 | 0.07 | 0.09 | 0.06 | 33.0 | 57.6 | 43.9 | 6.8 | 0.06 |
| 16-Oct | 298 | 0.08 | 0.10 | 0.07 | 31.5 | 59.9 | 44.7 | 6.9 | 0.07 |
| 16-Oct | 299 | 0.06 | 0.08 | 0.06 | 33.0 | 56.7 | 44.6 | 7.0 | 0.08 |
| 16-Oct | 300 | 0.05 | 0.07 | 0.05 | 32.5 | 53.8 | 42.8 | 6.7 | 0.05 |
| 16-Oct | 301 | 0.06 | 0.09 | 0.06 | 33.1 | 53.4 | 42.8 | 6.8 | 0.09 |
| 16-Oct | 302 | 0.05 | 0.07 | 0.05 | 32.2 | 51.9 | 41.6 | 6.9 | 0.09 |
| 16-Oct | 303 | 0.05 | 0.07 | 0.05 | 30.8 | 52.1 | 41.0 | 7.0 | 0.10 |
| 16-Oct | 304 | 0.06 | 0.08 | 0.05 | 30.2 | 52.4 | 40.7 | 7.1 | 0.05 |
| 16-Oct | 305 | 0.05 | 0.08 | 0.05 | 30.3 | 51.4 | 40.4 | 7.2 | 0.01 |
| 1-Nov | 306 | 0.05 | 0.07 | 0.05 | 29.8 | 51.0 | 40.4 | 7.2 | 0.03 |
| 1-Nov | 307 | 0.05 | 0.08 | 0.05 | 31.5 | 52.2 | 41.5 | 7.2 | 0.03 |
| 1-Nov | 308 | 0.04 | 0.06 | 0.04 | 31.8 | 50.7 | 41.0 | 7.3 | 0.09 |
| 1-Nov | 309 | 0.05 | 0.07 | 0.05 | 32.7 | 52.7 | 42.5 | 7.3 | 0.07 |
| 1-Nov | 310 | 0.04 | 0.07 | 0.04 | 32.8 | 51.5 | 42.5 | 7.4 | 0.12 |
| 1-Nov | 311 | 0.05 | 0.07 | 0.05 | 32.2 | 51.3 | 41.8 | 7.4 | 0.02 |
| 1-Nov | 312 | 0.05 | 0.07 | 0.04 | 32.5 | 50.1 | 41.2 | 7.3 | 0.05 |
| 1-Nov | 313 | 0.04 | 0.06 | 0.04 | 31.8 | 49.9 | 40.5 | 7.1 | 0.04 |
| 1-Nov | 314 | 0.04 | 0.05 | 0.04 | 31.2 | 48.2 | 39.3 | 7.1 | 0.05 |
| 1-Nov | 315 | 0.04 | 0.06 | 0.04 | 31.2 | 47.4 | 39.2 | 7.2 | 0.08 |
| 1-Nov | 316 | 0.04 | 0.06 | 0.04 | 32.0 | 47.5 | 39.8 | 7.3 | 0.11 |
| 1-Nov | 317 | 0.04 | 0.06 | 0.04 | 30.0 | 47.7 | 39.3 | 7.4 | 0.05 |
| 1-Nov | 318 | 0.05 | 0.07 | 0.04 | 31.4 | 47.2 | 39.1 | 7.4 | 0.04 |
| 1-Nov | 319 | 0.04 | 0.07 | 0.04 | 30.9 | 45.7 | 38.4 | 7.5 | 0.08 |
| 1-Nov | 320 | 0.04 | 0.06 | 0.04 | 31.2 | 45.8 | 38.5 | 7.6 | 0.10 |
| 16-Nov | 321 | 0.04 | 0.06 | 0.04 | 29.7 | 45.7 | 37.9 | 7.6 | 0.03 |
| 16-Nov | 322 | 0.04 | 0.06 | 0.04 | 31.1 | 44.5 | 37.8 | 7.5 | 0.06 |
| 16-Nov | 323 | 0.04 | 0.06 | 0.04 | 30.2 | 46.3 | 38.3 | 7.7 | 0.05 |
| 16-Nov | 324 | 0.04 | 0.05 | 0.03 | 27.3 | 44.5 | 35.8 | 7.8 | 0.04 |
| 16-Nov | 325 | 0.04 | 0.06 | 0.03 | 27.2 | 44.1 | 35.4 | 7.5 | 0.05 |
| 16-Nov | 326 | 0.03 | 0.06 | 0.04 | 26.5 | 42.5 | 34.9 | 7.5 | 0.03 |
| 16-Nov | 327 | 0.03 | 0.05 | 0.03 | 26.6 | 42.0 | 34.2 | 7.6 | 0.07 |
| 16-Nov | 328 | 0.03 | 0.05 | 0.03 | 28.9 | 43.5 | 36.3 | 7.8 | 0.18 |
| 16-Nov | 329 | 0.04 | 0.07 | 0.04 | 29.0 | 43.4 | 36.5 | 7.6 | 0.05 |
| 16-Nov | 330 | 0.03 | 0.06 | 0.04 | 27.7 | 41.7 | 34.7 | 7.7 | 0.08 |
| 16-Nov | 331 | 0.03 | 0.04 | 0.03 | 26.2 | 42.0 | 34.4 | 7.3 | 0.08 |
| 16-Nov | 332 | 0.02 | 0.03 | 0.02 | 26.5 | 41.0 | 34.3 | 6.8 | 0.12 |
| 16-Nov | 333 | 0.02 | 0.04 | 0.02 | 28.3 | 41.3 | 34.8 | 6.4 | 0.02 |
| 16-Nov | 334 | 0.02 | 0.04 | 0.03 | 28.6 | 43.3 | 35.8 | 6.5 | 0.08 |
| 16-Nov | 335 | 0.03 | 0.03 | 0.02 | 27.0 | 41.1 | 34.4 | 6.6 | 0.05 |
| 1-Dec | 336 | 0.03 | 0.03 | 0.02 | 25.2 | 39.2 | 32.9 | 6.6 | 0.05 |
| 1-Dec | 337 | 0.03 | 0.05 | 0.03 | 23.1 | 38.8 | 31.1 | 6.7 | 0.04 |
| 1-Dec | 338 | 0.03 | 0.04 | 0.03 | 22.4 | 37.1 | 30.5 | 6.7 | 0.05 |
| 1-Dec | 339 | 0.02 | 0.05 | 0.03 | 24.0 | 39.0 | 31.7 | 6.7 | 0.04 |
| 1-Dec | 340 | 0.02 | 0.04 | 0.02 | 21.8 | 37.0 | 30.2 | 6.9 | 0.11 |
| 1-Dec | 341 | 0.02 | 0.04 | 0.03 | 22.7 | 35.7 | 29.3 | 6.9 | 0.06 |
| 1-Dec | 342 | 0.02 | 0.04 | 0.02 | 22.5 | 36.5 | 29.8 | 7.0 | 0.05 |
| 1-Dec | 343 | 0.02 | 0.04 | 0.03 | 25.6 | 37.6 | 31.8 | 7.0 | 0.07 |
| 1-Dec | 344 | 0.02 | 0.04 | 0.03 | 27.8 | 39.3 | 33.7 | 7.1 | 0.10 |
| 1-Dec | 345 | 0.02 | 0.04 | 0.02 | 28.3 | 39.2 | 33.9 | 7.2 | 0.10 |
| 1-Dec | 346 | 0.02 | 0.03 | 0.02 | 27.1 | 39.5 | 33.8 | 7.3 | 0.10 |
| 1-Dec | 347 | 0.02 | 0.03 | 0.02 | 26.1 | 39.1 | 32.9 | 7.4 | 0.07 |
| 1-Dec | 348 | 0.03 | 0.04 | 0.03 | 25.6 | 38.5 | 32.3 | 7.5 | 0.09 |
| 1-Dec | 349 | 0.02 | 0.03 | 0.02 | 24.8 | 38.1 | 31.8 | 7.6 | 0.07 |
| 1-Dec | 350 | 0.02 | 0.04 | 0.02 | 22.3 | 37.6 | 30.5 | 7.6 | 0.05 |
| 16-Dec | 351 | 0.02 | 0.04 | 0.02 | 21.9 | 37.5 | 30.3 | 7.7 | 0.03 |
| 16-Dec | 352 | 0.02 | 0.04 | 0.03 | 22.3 | 35.5 | 29.5 | 7.7 | 0.05 |
| 16-Dec | 353 | 0.02 | 0.03 | 0.02 | 23.7 | 35.8 | 30.5 | 7.8 | 0.09 |
| 16-Dec | 354 | 0.02 | 0.05 | 0.03 | 24.2 | 37.5 | 31.2 | 7.9 | 0.07 |
| 16-Dec | 355 | 0.02 | 0.03 | 0.02 | 22.7 | 37.0 | 30.1 | 7.9 | 0.03 |
| 16-Dec | 356 | 0.03 | 0.05 | 0.03 | 24.3 | 36.9 | 30.4 | 8.0 | 0.05 |
| 16-Dec | 357 | 0.02 | 0.04 | 0.03 | 22.7 | 36.5 | 30.1 | 8.0 | 0.05 |
| 16-Dec | 358 | 0.02 | 0.04 | 0.03 | 24.0 | 36.4 | 30.5 | 8.1 | 0.07 |
| 16-Dec | 359 | 0.02 | 0.03 | 0.02 | 22.8 | 35.3 | 29.8 | 8.1 | 0.06 |
| 16-Dec | 360 | 0.02 | 0.04 | 0.02 | 24.7 | 36.2 | 30.9 | 8.3 | 0.14 |
| 16-Dec | 361 | 0.02 | 0.03 | 0.02 | 26.7 | 37.9 | 32.0 | 8.5 | 0.19 |
| 16-Dec | 362 | 0.02 | 0.03 | 0.02 | 22.6 | 37.2 | 30.0 | 8.6 | 0.10 |
| 16-Dec | 363 | 0.02 | 0.04 | 0.02 | 22.1 | 36.6 | 29.6 | 8.7 | 0.12 |
| 16-Dec | 364 | 0.02 | 0.02 | 0.01 | 21.5 | 34.2 | 28.4 | 8.7 | 0.06 |
| 16-Dec | 365 | 0.02 | 0.03 | 0.02 | 22.6 | 35.4 | 29.5 | 8.4 | 0.04 |

This worksheet takes the historic (1994-2017 average) daily weather data from the Agrimet IMBO station and calculates the tall crop reference ET (Etrs) using the Penman Montieth FAO56 model.

| | | | | | | | | | | | | | | | | | | | albedo = 0.23 | | | | | | | Cn=1600, Cd=0.38 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | daily minin | daily maxir | :ure (2068) | Total solar | daily mear | Slope of sa | psychrome | delta term | Psi term | temperatu | mean satu | vapor pres | inverse rel | solar declir | latitude (ra | sunset hou | extraterre | clear sky sc | net shortw | net outgoi | net radiati | radiation t | wind term | short crop reference E | | tall crop reference ET | |
| DOY | Tmin (C) | Tmax (C) | Tmean (C) | Rs (MJ/m2 | u2 (m/s) | Δ | γ | DT | PT | TT | es | ea | dr | δ | φ | ωs | Ra | Rso | Rns | Rnl | Rn | ETrad | ETwind | Etos (mm) | Etos (in) | ETrs (mm) | Current ETrs (in) |
| 1 | -6.02391 | 1.469082 | -2.27742 | 3.77402 | 3.135579 | 0.038333 | 0.061031 | 0.233127 | 0.37117 | 10.42403 | 0.534404 | 0.433613 | 1.032995 | -0.40101 | 0.792961 | 1.125811 | 10.48572 | 8.040075 | 2.905995 | 1.858023 | 1.047972 | 0.099679 | 0.38997 | 0.489648 | 0.019277 | 0.757685 | 0.02983 |
| 2 | -4.86304 | 2.151932 | -1.35556 | 4.788139 | 3.800246 | 0.040716 | 0.061031 | 0.22544 | 0.337928 | 12.5908 | 0.569464 | 0.441707 | 1.03298 | -0.39956 | 0.792961 | 1.127726 | 10.54088 | 8.082367 | 3.686867 | 2.97525 | 0.711616 | 0.065454 | 0.543577 | 0.609032 | 0.023978 | 0.981401 | 0.038638 |
| 3 | -5.66643 | 1.716425 | -1.975 | 4.715669 | 2.928112 | 0.039101 | 0.061031 | 0.243025 | 0.37933 | 9.72346 | 0.545891 | 0.43136 | 1.032956 | -0.398 | 0.792961 | 1.129793 | 10.60054 | 8.128111 | 3.631065 | 2.852744 | 0.778321 | 0.077174 | 0.422433 | 0.499607 | 0.01967 | 0.792937 | 0.031218 |
| 4 | -5.43889 | 2.530303 | -1.45429 | 4.770173 | 3.592576 | 0.040454 | 0.061031 | 0.22981 | 0.346702 | 11.90709 | 0.570109 | 0.429038 | 1.032922 | -0.39632 | 0.792961 | 1.132011 | 10.66469 | 8.177302 | 3.673034 | 2.906582 | 0.766452 | 0.071864 | 0.582371 | 0.654235 | 0.025757 | 1.054645 | 0.041521 |
| 5 | -5.66061 | 1.621465 | -2.01957 | 4.776815 | 2.928518 | 0.038987 | 0.061031 | 0.242476 | 0.379579 | 9.726409 | 0.543632 | 0.407385 | 1.032878 | -0.39452 | 0.792961 | 1.134377 | 10.73334 | 8.229937 | 3.678148 | 2.882829 | 0.795318 | 0.078681 | 0.503014 | 0.581695 | 0.022901 | 0.931509 | 0.036674 |
| 6 | -4.8128 | 2.959662 | -0.92657 | 4.759231 | 3.409696 | 0.041867 | 0.061031 | 0.241098 | 0.351458 | 11.27904 | 0.591401 | 0.45343 | 1.032824 | -0.39261 | 0.792961 | 1.136891 | 10.80647 | 8.286012 | 3.664608 | 2.818441 | 0.846167 | 0.083236 | 0.546933 | 0.630168 | 0.02481 | 1.007277 | 0.039657 |
| 7 | -2.43406 | 3.549275 | 0.557609 | 4.119156 | 3.901687 | 0.04607 | 0.061031 | 0.24497 | 0.324524 | 12.83649 | 0.649262 | 0.519771 | 1.032761 | -0.39058 | 0.792961 | 1.13955 | 10.88408 | 8.345522 | 3.17175 | 2.082773 | 1.088977 | 0.108841 | 0.539427 | 0.648268 | 0.025522 | 1.016347 | 0.040014 |
| 8 | -2.23961 | 4.763527 | 1.261957 | 4.558861 | 3.144246 | 0.048189 | 0.061031 | 0.276207 | 0.34982 | 10.31795 | 0.688073 | 0.55272 | 1.032688 | -0.38843 | 0.792961 | 1.142352 | 10.96617 | 8.408462 | 3.510323 | 2.507909 | 1.002414 | 0.112965 | 0.488546 | 0.601511 | 0.023682 | 0.940128 | 0.037013 |
| 9 | -1.68623 | 4.930676 | 1.622222 | 4.360334 | 3.137249 | 0.049304 | 0.061031 | 0.281038 | 0.347885 | 10.28148 | 0.703942 | 0.55583 | 1.032605 | -0.38617 | 0.792961 | 1.145295 | 11.05272 | 8.474826 | 3.357457 | 2.271461 | 1.085996 | 0.124524 | 0.529765 | 0.654289 | 0.025759 | 1.021724 | 0.040225 |
| 10 | -2.32609 | 3.980435 | 0.827174 | 3.615739 | 2.835011 | 0.046871 | 0.061031 | 0.281119 | 0.366047 | 9.317957 | 0.663479 | 0.558819 | 1.032512 | -0.38379 | 0.792961 | 1.148377 | 11.14373 | 8.544607 | 2.784119 | 1.439948 | 1.344171 | 0.154172 | 0.356973 | 0.511145 | 0.020124 | 0.757353 | 0.029817 |
| 11 | -4.06449 | 3.559903 | -0.25229 | 4.604606 | 2.978064 | 0.043734 | 0.061031 | 0.262567 | 0.366419 | 9.826875 | 0.620235 | 0.502024 | 1.03241 | -0.3813 | 0.792961 | 1.151595 | 11.23918 | 8.617798 | 3.545547 | 2.43473 | 1.110817 | 0.118999 | 0.42565 | 0.544649 | 0.021443 | 0.839085 | 0.033035 |
| 12 | -4.26329 | 3.137198 | -0.56304 | 4.312732 | 3.581179 | 0.042865 | 0.061031 | 0.240532 | 0.342473 | 11.83048 | 0.605255 | 0.471181 | 1.032298 | -0.3787 | 0.792961 | 1.154948 | 11.33907 | 8.69439 | 3.320803 | 2.113057 | 1.207746 | 0.118525 | 0.543219 | 0.661744 | 0.026053 | 1.033543 | 0.040691 |
| 13 | -2.94831 | 3.594686 | 0.323188 | 5.001569 | 2.972613 | 0.045383 | 0.061031 | 0.26998 | 0.36307 | 9.788235 | 0.640935 | 0.508719 | 1.032177 | -0.37598 | 0.792961 | 1.158433 | 11.44338 | 8.774374 | 3.851209 | 2.765616 | 1.085592 | 0.11958 | 0.469871 | 0.589451 | 0.023207 | 0.915389 | 0.036039 |
| 14 | -3.35909 | 3.601768 | 0.121338 | 4.856288 | 3.096768 | 0.044799 | 0.061031 | 0.263382 | 0.358818 | 10.20459 | 0.633701 | 0.506266 | 1.032046 | -0.37315 | 0.792961 | 1.162047 | 11.55211 | 8.85774 | 3.739342 | 2.567188 | 1.172154 | 0.125959 | 0.466613 | 0.592572 | 0.02333 | 0.914831 | 0.036017 |
| 15 | -5.56439 | 2.434596 | -1.5649 | 5.500028 | 2.562758 | 0.040164 | 0.061031 | 0.260171 | 0.395348 | 8.497363 | 0.565678 | 0.46454 | 1.031906 | -0.37022 | 0.792961 | 1.165787 | 11.66523 | 8.944477 | 4.235021 | 3.136822 | 1.098199 | 0.116574 | 0.339764 | 0.456338 | 0.017966 | 0.692533 | 0.027265 |
| 16 | -4.58551 | 2.737923 | -0.92379 | 5.502749 | 3.194507 | 0.041875 | 0.061031 | 0.247495 | 0.360718 | 10.5671 | 0.589204 | 0.47361 | 1.031756 | -0.36717 | 0.792961 | 1.169653 | 11.78273 | 9.034573 | 4.237117 | 3.102157 | 1.13496 | 0.114606 | 0.440615 | 0.555221 | 0.021859 | 0.858357 | 0.033794 |
| 17 | -3.88937 | 2.802899 | -0.54324 | 4.697153 | 3.458535 | 0.04292 | 0.061031 | 0.244253 | 0.347326 | 11.4245 | 0.602645 | 0.492966 | 1.031597 | -0.36401 | 0.792961 | 1.17364 | 11.90459 | 9.128015 | 3.616808 | 2.258286 | 1.358522 | 0.135384 | 0.435207 | 0.570591 | 0.022464 | 0.867408 | 0.03415 |
| 18 | -2.85556 | 3.948068 | 0.546256 | 5.024178 | 3.568545 | 0.046037 | 0.061031 | 0.254181 | 0.336971 | 11.74094 | 0.652612 | 0.540065 | 1.031428 | -0.36075 | 0.792961 | 1.177746 | 12.0308 | 9.224788 | 3.868617 | 2.51605 | 1.352567 | 0.140269 | 0.445277 | 0.585546 | 0.023053 | 0.889106 | 0.035004 |
| 19 | -1.97271 | 4.229469 | 1.128382 | 5.339117 | 3.362518 | 0.047781 | 0.061031 | 0.267548 | 0.341747 | 11.0396 | 0.677483 | 0.549468 | 1.031251 | -0.35738 | 0.792961 | 1.181969 | 12.16134 | 9.324876 | 4.11112 | 2.774932 | 1.336188 | 0.145858 | 0.482968 | 0.628826 | 0.024757 | 0.960326 | 0.037808 |
| 20 | -2.65652 | 4.132609 | 0.738043 | 5.350275 | 2.841231 | 0.046605 | 0.061031 | 0.279752 | 0.366348 | 9.341441 | 0.661604 | 0.553791 | 1.031063 | -0.3539 | 0.792961 | 1.186306 | 12.29618 | 9.428264 | 4.119712 | 2.710037 | 1.409675 | 0.160899 | 0.368959 | 0.529858 | 0.020861 | 0.784176 | 0.030873 |
| 21 | -3.61739 | 3.346135 | -0.13563 | 5.646391 | 3.116452 | 0.044064 | 0.061031 | 0.25956 | 0.359508 | 10.27912 | 0.62205 | 0.507252 | 1.030867 | -0.35032 | 0.792961 | 1.190754 | 12.43529 | 9.534934 | 4.347721 | 2.945101 | 1.40262 | 0.148538 | 0.424227 | 0.572765 | 0.02255 | 0.863999 | 0.034016 |
| 22 | -4.64396 | 3.173188 | -0.73539 | 5.626495 | 2.864749 | 0.042389 | 0.061031 | 0.260271 | 0.374733 | 9.469736 | 0.599917 | 0.486551 | 1.030662 | -0.34663 | 0.792961 | 1.195311 | 12.57866 | 9.644866 | 4.332401 | 2.86709 | 1.465311 | 0.155602 | 0.402294 | 0.557896 | 0.021964 | 0.834938 | 0.032872 |
| 23 | -3.8157 | 3.507488 | -0.15411 | 5.922939 | 2.983506 | 0.044011 | 0.061031 | 0.263617 | 0.365561 | 9.84129 | 0.62305 | 0.498984 | 1.030447 | -0.34285 | 0.792961 | 1.199973 | 12.72626 | 9.75804 | 4.560663 | 3.085963 | 1.4747 | 0.158612 | 0.446337 | 0.604949 | 0.023817 | 0.9123 | 0.035917 |
| 24 | -3.60749 | 3.565459 | -0.02101 | 5.614499 | 3.112008 | 0.04439 | 0.061031 | 0.261123 | 0.359012 | 10.26016 | 0.628292 | 0.507774 | 1.030224 | -0.33896 | 0.792961 | 1.204739 | 12.87806 | 9.874434 | 4.323164 | 2.740591 | 1.582573 | 0.168604 | 0.44393 | 0.612534 | 0.024116 | 0.91684 | 0.036096 |
| 25 | -2.49614 | 4.187923 | 0.845894 | 6.233799 | 2.970095 | 0.046927 | 0.061031 | 0.27671 | 0.359876 | 9.761276 | 0.666217 | 0.549725 | 1.029991 | -0.33497 | 0.792961 | 1.209606 | 13.03403 | 9.994025 | 4.800025 | 3.215073 | 1.584953 | 0.178938 | 0.40922 | 0.588158 | 0.023156 | 0.869274 | 0.034223 |
| 26 | -4.75314 | 3.702899 | -0.52512 | 5.77975 | 2.604688 | 0.04297 | 0.061031 | 0.271875 | 0.386151 | 8.603433 | 0.612775 | 0.51298 | 1.02975 | -0.33088 | 0.792961 | 1.21457 | 13.19414 | 10.11679 | 4.450407 | 2.739569 | 1.710839 | 0.189775 | 0.331539 | 0.521315 | 0.020524 | 0.749043 | 0.02949 |
| 27 | -4.94758 | 3.174155 | -0.88671 | 6.199613 | 2.742882 | 0.041976 | 0.061031 | 0.262472 | 0.381629 | 9.071934 | 0.59502 | 0.50117 | 1.029499 | -0.32669 | 0.792961 | 1.219629 | 13.35834 | 10.2427 | 4.773702 | 3.036017 | 1.737686 | 0.186087 | 0.324919 | 0.511006 | 0.020118 | 0.733029 | 0.028859 |
| 28 | -4.18865 | 3.067633 | -0.56051 | 6.196828 | 3.290603 | 0.042872 | 0.061031 | 0.248986 | 0.354452 | 10.87046 | 0.60463 | 0.498596 | 1.02924 | -0.3224 | 0.792961 | 1.224781 | 13.52662 | 10.37173 | 4.771558 | 2.984183 | 1.787375 | 0.181573 | 0.408553 | 0.590126 | 0.023233 | 0.867421 | 0.03415 |
| 29 | -3.56884 | 3.750242 | 0.0907 | 5.207542 | 3.476222 | 0.04471 | 0.061031 | 0.251358 | 0.343112 | 11.45627 | 0.634148 | 0.51294 | 1.028973 | -0.31803 | 0.792961 | 1.230022 | 13.69893 | 10.50384 | 4.009807 | 2.094567 | 1.91524 | 0.196416 | 0.476442 | 0.672857 | 0.02649 | 0.995909 | 0.039209 |
| 30 | -2.9372 | 4.216908 | 0.639855 | 6.107977 | 3.125393 | 0.046313 | 0.061031 | 0.268953 | 0.354424 | 10.2794 | 0.658844 | 0.519639 | 1.028696 | -0.31355 | 0.792961 | 1.235351 | 13.87522 | 10.63902 | 4.703142 | 2.80299 | 1.900152 | 0.208509 | 0.507162 | 0.71567 | 0.028176 | 1.063028 | 0.041852 |
| 31 | -3.29879 | 3.981884 | 0.341546 | 5.847321 | 2.84609 | 0.045437 | 0.061031 | 0.274498 | 0.368711 | 9.37099 | 0.645519 | 0.520274 | 1.028412 | -0.30898 | 0.792961 | 1.240765 | 14.05546 | 10.77722 | 4.502437 | 2.510609 | 1.991829 | 0.223075 | 0.432744 | 0.655819 | 0.02582 | 0.952419 | 0.037497 |
| 32 | -4.42174 | 3.275121 | -0.57331 | 6.379555 | 2.744048 | 0.042836 | 0.061031 | 0.266381 | 0.379528 | 9.06535 | 0.606364 | 0.474271 | 1.028119 | -0.30433 | 0.792961 | 1.24626 | 14.23961 | 10.91842 | 4.912257 | 2.896767 | 2.01549 | 0.21905 | 0.454471 | 0.673521 | 0.026517 | 0.985928 | 0.038816 |
| 33 | -4.93333 | 4.233092 | -0.35012 | 7.285615 | 2.58428 | 0.043459 | 0.061031 | 0.274853 | 0.385992 | 8.530545 | 0.625007 | 0.50428 | 1.027817 | -0.29958 | 0.792961 | 1.251835 | 14.42771 | 11.06257 | 5.609923 | 3.528247 | 2.081677 | 0.23344 | 0.397521 | 0.63096 | 0.024841 | 0.90407 | 0.035593 |
| 34 | -4.24179 | 4.510386 | 0.1343 | 6.780049 | 2.873495 | 0.044836 | 0.061031 | 0.270921 | 0.368782 | 9.468404 | 0.6445 | 0.518374 | 1.027507 | -0.29474 | 0.792961 | 1.257487 | 14.61942 | 11.20965 | 5.220638 | 3.057044 | 2.163594 | 0.239155 | 0.440404 | 0.679559 | 0.026754 | 0.980532 | 0.038604 |
| 35 | -1.96377 | 5.670773 | 1.853502 | 6.704341 | 2.897791 | 0.050032 | 0.061031 | 0.292252 | 0.356504 | 9.488735 | 0.721417 | 0.580807 | 1.027189 | -0.28981 | 0.792961 | 1.263213 | 14.81499 | 11.3596 | 5.162343 | 2.926691 | 2.235652 | 0.266576 | 0.475653 | 0.742229 | 0.029222 | 1.068046 | 0.042049 |
| 36 | -1.82754 | 5.986715 | 2.079589 | 6.991301 | 3.268057 | 0.050752 | 0.061031 | 0.282588 | 0.339822 | 10.69236 | 0.734215 | 0.559884 | 1.026864 | -0.2848 | 0.792961 | 1.269011 | 15.01427 | 11.5124 | 5.383302 | 3.113824 | 2.269477 | 0.261661 | 0.633434 | 0.895095 | 0.03524 | 1.32874 | 0.052313 |
| 37 | -1.96208 | 6.164734 | 2.101329 | 6.525273 | 3.268445 | 0.050822 | 0.061031 | 0.282853 | 0.339675 | 10.69279 | 0.73736 | 0.569422 | 1.02653 | -0.27971 | 0.792961 | 1.274879 | 15.21719 | 11.668 | 5.024461 | 2.674984 | 2.349477 | 0.27114 | 0.609966 | 0.881105 | 0.034689 | 1.297886 | 0.051098 |
| 38 | -2.46932 | 6.354348 | 1.942512 | 7.445933 | 2.789724 | 0.050314 | 0.061031 | 0.297306 | 0.360632 | 9.131915 | 0.733833 | 0.572916 | 1.026188 | -0.27453 | 0.792961 | 1.280814 | 15.42372 | 11.82635 | 5.733368 | 3.290993 | 2.442375 | 0.296262 | 0.529942 | 0.826204 | 0.032528 | 1.190473 | 0.046869 |
| 39 | -2.28043 | 5.931643 | 1.825604 | 6.368742 | 2.700122 | 0.049944 | 0.061031 | 0.299056 | 0.365448 | 8.842369 | 0.723628 | 0.562007 | 1.025838 | -0.26927 | 0.792961 | 1.286814 | 15.63378 | 11.98742 | 4.903931 | 2.423148 | 2.480783 | 0.302692 | 0.522265 | 0.824957 | 0.032479 | 1.184415 | 0.04663 |
| 40 | -2.61498 | 5.972947 | 1.678986 | 7.823691 | 2.558429 | 0.049482 | 0.061031 | 0.302452 | 0.373047 | 8.382827 | 0.71862 | 0.573174 | 1.025481 | -0.26393 | 0.792961 | 1.292877 | 15.84731 | 12.15115 | 6.024242 | 3.404012 | 2.62023 | 0.323337 | 0.454836 | 0.778173 | 0.030637 | 1.09031 | 0.042926 |
| 41 | -3.02778 | 6.135266 | 1.553744 | 8.662034 | 2.604688 | 0.04909 | 0.061031 | 0.29902 | 0.371756 | 8.53829 | 0.716257 | 0.555747 | 1.025116 | -0.25852 | 0.792961 | 1.298999 | 16.06426 | 12.3175 | 6.669766 | 3.950303 | 2.719463 | 0.331775 | 0.509484 | 0.841259 | 0.03312 | 1.19138 | 0.046905 |
| 42 | -3.00725 | 6.258213 | 1.625483 | 8.523578 | 2.302645 | 0.049314 | 0.061031 | 0.311865 | 0.385964 | 7.546205 | 0.72066 | 0.56172 | 1.024744 | -0.25302 | 0.792961 | 1.30518 | 16.28455 | 12.48641 | 6.563155 | 3.762119 | 2.801036 | 0.356406 | 0.462923 | 0.819329 | 0.032257 | 1.138893 | 0.044838 |
| 43 | -1.7785 | 6.763768 | 2.492633 | 8.062321 | 2.991669 | 0.052091 | 0.061031 | 0.297321 | 0.348349 | 9.77341 | 0.760921 | 0.582161 | 1.024365 | -0.24745 | 0.792961 | 1.311417 | 16.50813 | 12.65784 | 6.207987 | 3.370468 | 2.837519 | 0.344211 | 0.6086 | 0.952811 | 0.037512 | 1.369095 | 0.053901 |
| 44 | -2.72826 | 6.432126 | 1.851932 | 8.579281 | 2.69293 | 0.050027 | 0.061031 | 0.299673 | 0.365592 | 8.817974 | 0.731553 | 0.560846 | 1.023978 | -0.24181 | 0.792961 | 1.317708 | 16.73492 | 12.83173 | 6.606046 | 3.650572 | 2.955474 | 0.361355 | 0.55032 | 0.911675 | 0.035893 | 1.288943 | 0.050746 |
| 45 | -2.81618 | 6.286957 | 1.735386 | 7.338841 | 2.395551 | 0.049659 | 0.061031 | 0.309595 | 0.380496 | 7.847537 | 0.725118 | 0.577642 | 1.023584 | -0.2361 | 0.792961 | 1.32405 | 16.96485 | 13.00803 | 5.650908 | 2.696675 | 2.954233 | 0.373164 | 0.440358 | 0.813522 | 0.032028 | 1.115356 | 0.043912 |
| 46 | -2.15217 | 7.09372 | 2.470773 | 8.247377 | 2.978258 | 0.05202 | 0.061031 | 0.297507 | 0.349046 | 9.730369 | 0.764911 | 0.598982 | 1.023183 | -0.23031 | 0.792961 | 1.330442 | 17.19784 | 13.18669 | 6.35048 | 3.246045 | 3.104435 | 0.376825 | 0.563554 | 0.940378 | 0.037023 | 1.323658 | 0.052113 |
| 47 | -1.26957 | 7.486232 | 3.108333 | 7.906845 | 2.882047 | 0.054143 | 0.061031 | 0.309428 | 0.348792 | 9.394293 | 0.796211 | 0.597355 | 1.022776 | -0.22446 | 0.792961 | 1.336881 | 17.43383 | 13.36763 | 6.08827 | 2.973867 | 3.114403 | 0.393183 | 0.65158 | 1.044763 | 0.041132 | 1.491573 | 0.058723 |
| 48 | -1.44082 | 7.597585 | 3.078382 | 8.543238 | 2.615573 | 0.054042 | 0.061031 | 0.319118 | 0.36039 | 8.52662 | 0.796681 | 0.597037 | 1.022361 | -0.21854 | 0.792961 | 1.343367 | 17.67273 | 13.55081 | 6.578293 | 3.321974 | 3.256319 | 0.423973 | 0.61349 | 1.037463 | 0.040845 | 1.459588 | 0.057464 |
| 49 | -1.9587 | 7.966667 | 3.003986 | 8.656209 | 2.545213 | 0.053791 | 0.061031 | 0.320877 | 0.364069 | 8.299486 | 0.79968 | 0.616637 | 1.02194 | -0.21256 | 0.792961 | 1.349896 | 17.91447 | 13.73617 | 6.665281 | 3.291762 | 3.373518 | 0.441653 | 0.55308 | 0.994734 | 0.039163 | 1.37398 | 0.054094 |
| 50 | -1.56498 | 7.346135 | 2.89058 | 8.77668 | 2.929667 | 0.05341 | 0.061031 | 0.304792 | 0.348286 | 9.557051 | 0.785279 | 0.575415 | 1.021513 | -0.20651 | 0.792961 | 1.356467 | 18.15897 | 13.92364 | 6.758043 | 3.340015 | 3.418028 | 0.425049 | 0.69855 | 1.123599 | 0.044236 | 1.601549 | 0.063053 |
| 51 | -1.25314 | 7.514251 | 3.130556 | 8.68579 | 2.672716 | 0.054219 | 0.061031 | 0.317606 | 0.357513 | 8.711258 | 0.79754 | 0.599684 | 1.021079 | -0.2004 | 0.792961 | 1.363078 | 18.40614 | 14.11317 | 6.688058 | 3.186359 | 3.501699 | 0.453762 | 0.6162 | 1.069962 | 0.042124 | 1.492196 | 0.058748 |
| 52 | -1.92126 | 7.589855 | 2.8343 | 7.68549 | 2.724612 | 0.053222 | 0.061031 | 0.311619 | 0.357346 | 8.88994 | 0.78683 | 0.616793 | 1.020639 | -0.19424 | 0.792961 | 1.369728 | 18.6559 | 14.30467 | 5.917828 | 2.460672 | 3.457156 | 0.439545 | 0.540173 | 0.979718 | 0.038572 | 1.347378 | 0.053046 |
| 53 | -1.12778 | 7.042995 | 2.957609 | 8.405602 | 2.900901 | 0.053635 | 0.061031 | 0.306726 | 0.349026 | 9.460912 | 0.783635 | 0.586155 | 1.020192 | -0.18801 | 0.792961 | 1.376414 | 18.90817 | 14.4981 | 6.472313 | 2.874742 | 3.597571 | 0.450216 | 0.652098 | 1.102314 | 0.043398 | 1.546855 | 0.0609 |
| 54 | -2.01159 | 7.380918 | 2.684662 | 9.207702 | 2.841231 | 0.052724 | 0.061031 | 0.30527 | 0.353369 | 9.27548 | 0.777662 | 0.579737 | 1.01974 | -0.18173 | 0.792961 | 1.383135 | 19.16285 | 14.69339 | 7.08993 | 3.291935 | 3.797995 | 0.47304 | 0.648733 | 1.121774 | 0.044164 | 1.563552 | 0.061557 |
| 55 | -2.7215 | 7.607246 | 2.442874 | 10.35636 | 2.493706 | 0.051928 | 0.061031 | 0.315279 | 0.370548 | 8.148097 | 0.772154 | 0.574137 | 1.019282 | -0.1754 | 0.792961 | 1.38989 | 19.41987 | 14.89045 | 7.974397 | 3.905174 | 4.069222 | 0.52344 | 0.597866 | 1.121306 | 0.044146 | 1.52977 | 0.060227 |
| 56 | -3.64783 | 7.176087 | 1.76413 | 10.05775 | 2.303811 | 0.04975 | 0.061031 | 0.313706 | 0.384846 | 7.546217 | 0.740242 | 0.55925 | 1.018817 | -0.16901 | 0.792961 | 1.396676 | 19.67912 | 15.08924 | 7.744467 | 3.632372 | 4.112095 | 0.526315 | 0.525626 | 1.051941 | 0.041415 | 1.410731 | 0.055541 |
| 57 | -2.79541 | 6.668116 | 1.936353 | 9.669633 | 2.684767 | 0.050295 | 0.061031 | 0.3011 | 0.365377 | 8.788543 | 0.738205 | 0.531553 | 1.018349 | -0.16258 | 0.792961 | 1.403492 | 19.94052 | 15.28967 | 7.445617 | 3.371784 | 4.073834 | 0.500465 | 0.663588 | 1.164053 | 0.045829 | 1.616739 | 0.063651 |
| 58 | -3.21039 | 6.962802 | 1.876208 | 10.37473 | 2.799053 | 0.050104 | 0.061031 | 0.296091 | 0.360668 | 9.164664 | 0.740646 | 0.550039 | 1.017874 | -0.15609 | 0.792961 | 1.410337 | 20.20397 | 15.49168 | 7.988539 | 3.678887 | 4.309653 | 0.520629 | 0.630033 | 1.150661 | 0.045302 | 1.577006 | 0.062087 |
| 59 | -2.74952 | 7.496377 | 2.37343 | 10.0441 | 2.893709 | 0.051702 | 0.061031 | 0.299135 | 0.353233 | 9.457479 | 0.767691 | 0.565954 | 1.017394 | -0.14956 | 0.792961 | 1.417209 | 20.46939 | 15.69519 | 7.733955 | 3.410499 | 4.323456 | 0.527842 | 0.661961 | 1.189803 | 0.046843 | 1.637703 | 0.064476 |
| 60 | -2.09662 | 7.723913 | 2.813647 | 10.85488 | 2.894681 | 0.053153 | 0.061031 | 0.305036 | 0.350251 | 9.445555 | 0.788207 | 0.569671 | 1.016908 | -0.14299 | 0.792961 | 1.424106 | 20.73667 | 15.90013 | 8.358257 | 3.816867 | 4.54139 | 0.565197 | 0.722983 | 1.28818 | 0.050716 | 1.778379 | 0.070015 |
| 61 | -2.0186 | 8.256039 | 3.11872 | 8.641482 | 2.518584 | 0.054179 | 0.061031 | 0.323508 | 0.364427 | 8.209244 | 0.809152 | 0.604057 | 1.016418 | -0.13637 | 0.792961 | 1.431028 | 21.00572 | 16.10643 | 6.653941 | 2.477136 | 4.176806 | 0.551302 | 0.613577 | 1.164879 | 0.045861 | 1.583954 | 0.06236 |
| 62 | -2.13068 | 8.268116 | 3.06872 | 10.84621 | 2.171059 | 0.054009 | 0.061031 | 0.337365 | 0.381228 | 7.07778 | 0.807423 | 0.596914 | 1.015923 | -0.12971 | 0.792961 | 1.437973 | 21.27644 | 16.31401 | 8.351585 | 3.631212 | 4.720374 | 0.649736 | 0.568006 | 1.217742 | 0.047943 | 1.606343 | 0.063242 |
| 63 | -1.65773 | 8.385024 | 3.363647 | 9.870818 | 2.704009 | 0.055015 | 0.061031 | 0.319562 | 0.354512 | 8.805818 | 0.821075 | 0.623828 | 1.015423 | -0.12302 | 0.792961 | 1.444939 | 21.54873 | 16.52279 | 7.60053 | 3.008345 | 4.592185 | 0.598736 | 0.61576 | 1.214496 | 0.047815 | 1.630886 | 0.064208 |
| 64 | -1.0913 | 9.572222 | 4.240459 | 10.3716 | 2.875439 | 0.058099 | 0.061031 | 0.324941 | 0.341344 | 9.334479 | 0.878581 | 0.627796 | 1.014918 | -0.11628 | 0.792961 | 1.451925 | 21.8225 | 16.73271 | 7.986129 | 3.244606 | 4.741523 | 0.628612 | 0.799069 | 1.427681 | 0.056208 | 1.971766 | 0.077629 |
| 65 | -1.36184 | 9.605072 | 4.121618 | 10.44588 | 2.544046 | 0.057672 | 0.061031 | 0.336292 | 0.35588 | 8.262227 | 0.874346 | 0.648917 | 1.014409 | -0.10952 | 0.792961 | 1.45893 | 22.09765 | 16.94368 | 8.043331 | 3.183595 | 4.859736 | 0.66679 | 0.662844 | 1.329634 | 0.052348 | 1.780691 | 0.070106 |
| 66 | -2.67512 | 9.216908 | 3.270894 | 11.35271 | 2.11586 | 0.054697 | 0.061031 | 0.342639 | 0.382322 | 6.892777 | 0.833311 | 0.616208 | 1.013896 | -0.10272 | 0.792961 | 1.465952 | 22.37406 | 17.15563 | 8.741585 | 3.589381 | 5.152204 | 0.720261 | 0.572122 | 1.292384 | 0.050881 | 1.682912 | 0.066256 |
| 67 | -1.66184 | 8.563285 | 3.450725 | 10.04896 | 2.509061 | 0.055314 | 0.061031 | 0.32845 | 0.362397 | 8.16838 | 0.827692 | 0.617261 | 1.013379 | -0.09589 | 0.792961 | 1.472991 | 22.65166 | 17.36847 | 7.737697 | 2.851827 | 4.88587 | 0.654744 | 0.622919 | 1.277662 | 0.050302 | 1.700313 | 0.066941 |
| 68 | -0.58913 | 10.38043 | 4.895652 | 10.59087 | 2.799053 | 0.060449 | 0.061031 | 0.336829 | 0.339795 | 9.065087 | 0.922362 | 0.678634 | 1.012858 | -0.08903 | 0.792961 | 1.480045 | 22.93032 | 17.58214 | 8.154973 | 3.057083 | 5.09789 | 0.700584 | 0.750749 | 1.451333 | 0.057139 | 1.960657 | 0.077191 |
| 69 | -0.54952 | 11.10072 | 5.275604 | 10.39399 | 2.410129 | 0.061929 | 0.061031 | 0.358029 | 0.352839 | 7.794847 | 0.954165 | 0.696644 | 1.012333 | -0.08215 | 0.792961 | 1.487113 | 23.20995 | 17.79655 | 8.003369 | 2.890847 | 5.112522 | 0.746816 | 0.708266 | 1.455082 | 0.057287 | 1.939967 | 0.076377 |
| 70 | 0.04058 | 12.08502 | 6.062802 | 12.26203 | 2.516446 | 0.064985 | 0.061031 | 0.364605 | 0.342422 | 8.115742 | 1.011526 | 0.71094 | 1.011804 | -0.07524 | 0.792961 | 1.494194 | 23.49044 | 18.01163 | 9.441761 | 3.774846 | 5.666914 | 0.843003 | 0.835331 | 1.678334 | 0.066076 | 2.250468 | 0.088601 |
| 71 | -0.48043 | 11.86667 | 5.693116 | 11.98814 | 2.508283 | 0.063534 | 0.061031 | 0.359735 | 0.345563 | 8.100146 | 0.990025 | 0.712965 | 1.011272 | -0.06831 | 0.792961 | 1.501286 | 23.7717 | 18.22729 | 9.230866 | 3.547135 | 5.683731 | 0.834211 | 0.775525 | 1.609735 | 0.063375 | 2.138768 | 0.084203 |
| 72 | -0.15145 | 12.43623 | 6.142391 | 12.1129 | 2.667274 | 0.065301 | 0.061031 | 0.359429 | 0.335927 | 8.59972 | 1.023761 | 0.701521 | 1.010736 | -0.06135 | 0.792961 | 1.508389 | 24.05362 | 18.44345 | 9.326936 | 3.577268 | 5.749668 | 0.843172 | 0.930913 | 1.774085 | 0.069846 | 2.411693 | 0.094949 |
| 73 | 0.214251 | 11.48019 | 5.847222 | 10.96233 | 2.636953 | 0.064136 | 0.061031 | 0.356536 | 0.339279 | 8.51096 | 0.987799 | 0.693821 | 1.010198 | -0.05438 | 0.792961 | 1.515501 | 24.3361 | 18.66005 | 8.440998 | 2.94805 | 5.492948 | 0.79904 | 0.848886 | 1.647927 | 0.064879 | 2.228424 | 0.087733 |
| 74 | 0.336957 | 11.36184 | 5.849396 | 9.91052 | 2.550266 | 0.064144 | 0.061031 | 0.360168 | 0.34269 | 8.231108 | 0.985282 | 0.734669 | 1.009656 | -0.0474 | 0.792961 | 1.522621 | 24.61903 | 18.87699 | 7.6311 | 2.35061 | 5.28049 | 0.775959 | 0.706908 | 1.482867 | 0.058381 | 1.964026 | 0.077324 |
| 75 | 1.002415 | 10.92319 | 5.962802 | 11.99553 | 2.622376 | 0.06459 | 0.061031 | 0.358758 | 0.338993 | 8.460404 | 0.981425 | 0.67112 | 1.009111 | -0.0404 | 0.792961 | 1.529748 | 24.90231 | 19.0942 | 9.236556 | 3.346332 | 5.890225 | 0.862172 | 0.889961 | 1.752133 | 0.068982 | 2.360393 | 0.092929 |
| 76 | -0.45314 | 10.05676 | 4.801812 | 11.84633 | 2.372811 | 0.06015 | 0.061031 | 0.352953 | 0.358126 | 7.687241 | 0.911795 | 0.640381 | 1.008564 | -0.03339 | 0.792961 | 1.536882 | 25.18585 | 19.3116 | 9.121676 | 3.197067 | 5.924609 | 0.853173 | 0.747202 | 1.600375 | 0.063007 | 2.109819 | 0.083064 |
| 77 | -0.08551 | 11.13647 | 5.525483 | 12.58856 | 2.513337 | 0.062886 | 0.061031 | 0.357161 | 0.346631 | 8.12135 | 0.96584 | 0.66409 | 1.008014 | -0.02636 | 0.792961 | 1.54402 | 25.46952 | 19.52911 | 9.693192 | 3.484151 | 6.209041 | 0.904793 | 0.849457 | 1.75425 | 0.069065 | 2.333618 | 0.091875 |
| 78 | -0.64348 | 12.65725 | 6.006884 | 12.86507 | 2.707313 | 0.064764 | 0.061031 | 0.355897 | 0.335386 | 8.733053 | 1.02365 | 0.699633 | 1.007462 | -0.01934 | 0.792961 | 1.551163 | 25.75324 | 19.74666 | 9.906105 | 3.526907 | 6.379198 | 0.926296 | 0.949024 | 1.875321 | 0.073832 | 2.521858 | 0.099286 |
| 79 | -0.32246 | 12.25821 | 5.967874 | 12.98427 | 2.748324 | 0.06461 | 0.061031 | 0.353696 | 0.334106 | 8.866583 | 1.011619 | 0.675255 | 1.006907 | -0.0123 | 0.792961 | 1.558308 | 26.0369 | 19.96416 | 9.997886 | 3.545995 | 6.451891 | 0.931058 | 0.996435 | 1.927493 | 0.075886 | 2.606754 | 0.102628 |
| 80 | -0.64082 | 11.02198 | 5.19058 | 12.46327 | 2.074654 | 0.061607 | 0.061031 | 0.371822 | 0.36835 | 6.711906 | 0.948764 | 0.693831 | 1.006351 | -0.00526 | 0.792961 | 1.565455 | 26.3204 | 20.18154 | 9.596715 | 3.188639 | 6.408076 | 0.972126 | 0.630279 | 1.602405 | 0.063087 | 2.030552 | 0.079943 |
| 81 | -0.95152 | 12.67146 | 5.859975 | 13.17721 | 2.121611 | 0.064186 | 0.061031 | 0.379254 | 0.360616 | 6.847344 | 1.01783 | 0.741387 | 1.005793 | 0.001779 | 0.792961 | 1.572603 | 26.60364 | 20.39871 | 10.14645 | 3.416899 | 6.729554 | 1.041301 | 0.68261 | 1.723911 | 0.067871 | 2.187873 | 0.086137 |
| 82 | -0.17652 | 11.51742 | 5.670455 | 13.44496 | 2.139493 | 0.063446 | 0.061031 | 0.375702 | 0.361403 | 6.909751 | 0.980775 | 0.697295 | 1.005232 | 0.008819 | 0.792961 | 1.57975 | 26.88651 | 20.61561 | 10.35262 | 3.516308 | 6.836309 | 1.047915 | 0.707907 | 1.755821 | 0.069127 | 2.237221 | 0.08808 |
| 83 | 0.378744 | 11.75072 | 6.064734 | 12.48881 | 2.569119 | 0.064993 | 0.061031 | 0.36241 | 0.34032 | 8.28556 | 1.003759 | 0.704054 | 1.004671 | 0.015857 | 0.792961 | 1.586897 | 27.16893 | 20.83215 | 9.61638 | 3.053929 | 6.562452 | 0.970344 | 0.845092 | 1.815436 | 0.071474 | 2.389173 | 0.094062 |
| 84 | 0.124155 | 10.22126 | 5.172705 | 10.94198 | 2.427427 | 0.061539 | 0.061031 | 0.355837 | 0.352903 | 7.853698 | 0.931315 | 0.697437 | 1.004108 | 0.022889 | 0.792961 | 1.594041 | 27.45078 | 21.04827 | 8.425327 | 2.313856 | 6.111471 | 0.887273 | 0.648213 | 1.535486 | 0.060452 | 1.972077 | 0.077641 |
| 85 | -0.86763 | 10.7 | 4.916184 | 13.5277 | 2.525776 | 0.060575 | 0.061031 | 0.348097 | 0.350718 | 8.179439 | 0.930028 | 0.667849 | 1.003544 | 0.029915 | 0.792961 | 1.601181 | 27.73197 | 21.26388 | 10.41633 | 3.374018 | 7.042309 | 1.000174 | 0.752108 | 1.752282 | 0.068987 | 2.257272 | 0.088869 |
| 86 | -1.14614 | 11.03961 | 4.946739 | 14.8271 | 2.649198 | 0.060689 | 0.061031 | 0.343473 | 0.345408 | 8.578183 | 0.938933 | 0.664136 | 1.002978 | 0.036932 | 0.792961 | 1.608317 | 28.01241 | 21.47891 | 11.41686 | 3.866783 | 7.550082 | 1.058045 | 0.814218 | 1.872262 | 0.073711 | 2.417072 | 0.09516 |
| 87 | 0.886473 | 10.36667 | 5.62657 | 12.5794 | 2.847839 | 0.063276 | 0.061031 | 0.345013 | 0.332774 | 9.19889 | 0.954905 | 0.661085 | 1.002412 | 0.043938 | 0.792961 | 1.615448 | 28.29199 | 21.69328 | 9.686141 | 2.9044 | 6.781741 | 0.954633 | 0.899428 | 1.854061 | 0.072995 | 2.46035 | 0.096864 |
| 88 | 0.171498 | 11.4913 | 5.831401 | 14.4599 | 2.801969 | 0.064074 | 0.061031 | 0.349656 | 0.333054 | 9.044075 | 0.987335 | 0.690293 | 1.001845 | 0.050931 | 0.792961 | 1.622572 | 28.57063 | 21.90693 | 11.13412 | 3.604054 | 7.530067 | 1.074236 | 0.894739 | 1.968975 | 0.077519 | 2.568988 | 0.101141 |
| 89 | -0.4058 | 12.37319 | 5.983696 | 15.1621 | 2.604494 | 0.064672 | 0.061031 | 0.359793 | 0.339537 | 8.402084 | 1.015224 | 0.684367 | 1.001278 | 0.057909 | 0.792961 | 1.629688 | 28.84822 | 22.11977 | 11.67481 | 3.851955 | 7.822859 | 1.14836 | 0.943876 | 2.092237 | 0.082372 | 2.729802 | 0.107473 |
| 90 | -0.12343 | 12.96618 | 6.421377 | 14.18781 | 2.625291 | 0.066419 | 0.061031 | 0.365087 | 0.335471 | 8.45591 | 1.049898 | 0.718021 | 1.00071 | 0.06487 | 0.792961 | 1.636795 | 29.12467 | 22.33175 | 10.92461 | 3.37777 | 7.546843 | 1.124145 | 0.941441 | 2.065586 | 0.081322 | 2.70261 | 0.106402 |
| 91 | 0.338406 | 11.71667 | 6.027536 | 14.64736 | 2.509061 | 0.064845 | 0.061031 | 0.36442 | 0.342986 | 8.092945 | 1.001291 | 0.684121 | 1.000142 | 0.071811 | 0.792961 | 1.643893 | 29.3999 | 22.54279 | 11.27846 | 3.52958 | 7.748884 | 1.15213 | 0.880388 | 2.032519 | 0.08002 | 2.626842 | 0.103419 |
| 92 | -0.81425 | 11.12367 | 5.15471 | 16.03002 | 2.418098 | 0.061471 | 0.061031 | 0.355983 | 0.353438 | 7.82402 | 0.949542 | 0.644503 | 0.999574 | 0.078732 | 0.792961 | 1.650979 | 29.67381 | 22.75281 | 12.34311 | 4.035948 | 8.307166 | 1.20654 | 0.843523 | 2.050063 | 0.080711 | 2.616683 | 0.103019 |
| 93 | -1.03092 | 12.5087 | 5.738889 | 17.12621 | 2.240837 | 0.063712 | 0.061031 | 0.372059 | 0.356403 | 7.235276 | 1.008387 | 0.680328 | 0.999006 | 0.085629 | 0.792961 | 1.658054 | 29.94631 | 22.96175 | 13.18719 | 4.390883 | 8.796302 | 1.335279 | 0.845957 | 2.181237 | 0.085875 | 2.751311 | 0.108319 |
| 94 | -0.55 | 12.78865 | 6.119324 | 15.28482 | 2.487486 | 0.065209 | 0.061031 | 0.366638 | 0.343147 | 8.020718 | 1.031984 | 0.711849 | 0.998438 | 0.0925 | 0.792961 | 1.665115 | 30.21732 | 23.16955 | 11.76931 | 3.589926 | 8.179388 | 1.22354 | 0.881103 | 2.104643 | 0.08286 | 2.697834 | 0.106214 |
| 95 | 0.906481 | 12.52176 | 6.71412 | 15.14413 | 2.322859 | 0.06761 | 0.061031 | 0.382319 | 0.345117 | 7.473962 | 1.051922 | 0.737472 | 0.997871 | 0.099344 | 0.792961 | 1.672161 | 30.48674 | 23.37613 | 11.66098 | 3.477203 | 8.183776 | 1.276557 | 0.81109 | 2.087647 | 0.082191 | 2.634031 | 0.103702 |
| 96 | 0.87338 | 12.64329 | 6.758333 | 15.29009 | 2.284002 | 0.067792 | 0.061031 | 0.384705 | 0.346341 | 7.347776 | 1.056955 | 0.740503 | 0.997305 | 0.106159 | 0.792961 | 1.679192 | 30.75449 | 23.58144 | 11.77337 | 3.480645 | 8.292724 | 1.301622 | 0.805319 | 2.106941 | 0.08295 | 2.649466 | 0.10431 |
| 97 | 0.398611 | 14.2463 | 7.322454 | 16.7211 | 2.436554 | 0.070144 | 0.061031 | 0.385967 | 0.335826 | 7.822773 | 1.126542 | 0.778835 | 0.996739 | 0.112942 | 0.792961 | 1.686206 | 31.02049 | 23.78539 | 12.87525 | 3.948978 | 8.92627 | 1.405659 | 0.913457 | 2.319116 | 0.091304 | 2.933567 | 0.115495 |
| 98 | 0.697454 | 13.3787 | 7.038079 | 16.93726 | 2.422398 | 0.06895 | 0.061031 | 0.382527 | 0.338598 | 7.785221 | 1.088894 | 0.741909 | 0.996174 | 0.119692 | 0.792961 | 1.693202 | 31.28465 | 23.98794 | 13.04169 | 4.012148 | 9.029545 | 1.409252 | 0.914674 | 2.323926 | 0.091493 | 2.938917 | 0.115705 |
| 99 | 0.495602 | 13.59606 | 7.045833 | 17.82528 | 2.109843 | 0.068982 | 0.061031 | 0.396918 | 0.351171 | 6.780527 | 1.095182 | 0.744989 | 0.995611 | 0.126406 | 0.792961 | 1.700178 | 31.5469 | 24.18903 | 13.72547 | 4.285562 | 9.439906 | 1.528721 | 0.833855 | 2.362576 | 0.093015 | 2.924458 | 0.115136 |
| 100 | 0.530324 | 14.55231 | 7.541319 | 17.89034 | 2.210799 | 0.071075 | 0.061031 | 0.399338 | 0.342908 | 7.092428 | 1.145796 | 0.770409 | 0.995048 | 0.133083 | 0.792961 | 1.707133 | 31.80715 | 24.38858 | 13.77556 | 4.247565 | 9.527994 | 1.552394 | 0.912959 | 2.465353 | 0.097061 | 3.081974 | 0.121338 |
| 101 | 1.074074 | 14.29375 | 7.683912 | 17.26758 | 2.193663 | 0.071687 | 0.061031 | 0.402198 | 0.342414 | 7.033878 | 1.144781 | 0.764156 | 0.994487 | 0.139721 | 0.792961 | 1.714066 | 32.06532 | 24.58654 | 13.29604 | 3.983391 | 9.312649 | 1.528176 | 0.916736 | 2.444912 | 0.096256 | 3.065814 | 0.120701 |
| 102 | 0.877083 | 14.99884 | 7.937963 | 16.57915 | 2.317344 | 0.072789 | 0.061031 | 0.400145 | 0.335509 | 7.423736 | 1.178063 | 0.786818 | 0.993928 | 0.146317 | 0.792961 | 1.720976 | 32.32135 | 24.78284 | 12.76595 | 3.668058 | 9.097889 | 1.485315 | 0.974483 | 2.459798 | 0.096842 | 3.120678 | 0.122861 |
| 103 | 1.497222 | 13.54676 | 7.521991 | 15.24098 | 2.595999 | 0.070992 | 0.061031 | 0.3819 | 0.328316 | 8.328754 | 1.11642 | 0.772916 | 0.993371 | 0.152869 | 0.792961 | 1.727861 | 32.57514 | 24.97745 | 11.73556 | 3.135954 | 8.599601 | 1.339947 | 0.939298 | 2.279245 | 0.089734 | 2.910582 | 0.11459 |
| 104 | 0.643519 | 12.17014 | 6.406829 | 15.74717 | 2.370243 | 0.066361 | 0.061031 | 0.375819 | 0.345638 | 7.634813 | 1.029191 | 0.727925 | 0.992815 | 0.159377 | 0.792961 | 1.734719 | 32.82664 | 25.17029 | 12.12532 | 3.275476 | 8.849842 | 1.356982 | 0.795004 | 2.151986 | 0.084724 | 2.68242 | 0.105607 |
| 105 | 0.278472 | 12.67153 | 6.475 | 18.14065 | 2.613321 | 0.066636 | 0.061031 | 0.366343 | 0.33553 | 8.415741 | 1.044591 | 0.70842 | 0.992262 | 0.165837 | 0.792961 | 1.74155 | 33.07577 | 25.36131 | 13.9683 | 4.112524 | 9.85578 | 1.473122 | 0.949256 | 2.422378 | 0.095369 | 3.053587 | 0.12022 |



| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 106 | 1.249074 | 14.81968 | 8.034375 | 16.61418 | 2.529501 | 0.073211 | 0.061031 | 0.392067 | 0.32684 | 8.100615 | 1.177128 | 0.754951 | 0.991711 | 0.172248 | 0.792961 | 1.748351 | 33.32245 | 25.55046 | 12.79292 | 3.54544 | 9.24748 | 1.479258 | 1.117759 | 2.597017 | 0.102245 | 3.355422 | 0.132103 |
| 107 | 1.340509 | 14.69745 | 8.018981 | 17.66353 | 2.094196 | 0.073144 | 0.061031 | 0.411773 | 0.343585 | 6.706937 | 1.172717 | 0.809488 | 0.991162 | 0.178608 | 0.792961 | 1.755121 | 33.56663 | 25.73768 | 13.60092 | 3.794452 | 9.806464 | 1.64752 | 0.837028 | 2.484548 | 0.097817 | 3.047848 | 0.119994 |
| 108 | 1.290278 | 14.75833 | 8.024306 | 18.76806 | 2.034032 | 0.073167 | 0.061031 | 0.414765 | 0.345971 | 6.51413 | 1.174794 | 0.806075 | 0.990616 | 0.184915 | 0.792961 | 1.761859 | 33.80823 | 25.92293 | 14.45141 | 4.135152 | 10.31626 | 1.745761 | 0.830982 | 2.576743 | 0.101447 | 3.134821 | 0.123418 |
| 109 | 1.562037 | 15.44491 | 8.503472 | 19.65704 | 2.285678 | 0.075295 | 0.061031 | 0.409754 | 0.332134 | 7.307585 | 1.21932 | 0.839034 | 0.990073 | 0.191167 | 0.792961 | 1.768563 | 34.04718 | 26.10615 | 15.13592 | 4.371334 | 10.76459 | 1.799622 | 0.92299 | 2.722612 | 0.107189 | 3.339098 | 0.131461 |
| 110 | 1.615972 | 15.88773 | 8.751852 | 19.18594 | 2.354969 | 0.076418 | 0.061031 | 0.410151 | 0.327568 | 7.522479 | 1.245885 | 0.82326 | 0.989533 | 0.197363 | 0.792961 | 1.775231 | 34.28343 | 26.2873 | 14.77317 | 4.206187 | 10.56699 | 1.768298 | 1.041401 | 2.809699 | 0.110618 | 3.51133 | 0.138241 |
| 111 | 2.440972 | 15.84282 | 9.141898 | 18.57418 | 2.198505 | 0.078211 | 0.061031 | 0.423076 | 0.330144 | 7.012978 | 1.264168 | 0.84409 | 0.988996 | 0.2035 | 0.792961 | 1.781861 | 34.51691 | 26.46632 | 14.30212 | 3.945751 | 10.35637 | 1.787665 | 0.972603 | 2.760268 | 0.108672 | 3.417516 | 0.134548 |
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| 113 | 2.08912 | 15.98194 | 9.035532 | 20.01383 | 2.406379 | 0.077719 | 0.061031 | 0.411898 | 0.323458 | 7.678966 | 1.263173 | 0.82222 | 0.987931 | 0.215591 | 0.792961 | 1.795003 | 34.97532 | 26.81782 | 15.41065 | 4.371348 | 11.0393 | 1.855204 | 1.095249 | 2.950453 | 0.11616 | 3.687504 | 0.145177 |
| 114 | 2.024769 | 15.37778 | 8.701273 | 17.85136 | 2.283443 | 0.076188 | 0.061031 | 0.412714 | 0.33061 | 7.295312 | 1.227081 | 0.842263 | 0.987404 | 0.221542 | 0.792961 | 1.80151 | 35.20013 | 26.9902 | 13.74555 | 3.565484 | 10.18007 | 1.714195 | 0.928142 | 2.642338 | 0.104029 | 3.265614 | 0.128567 |
| 115 | 1.860417 | 14.65787 | 8.259144 | 19.46829 | 2.138155 | 0.074203 | 0.061031 | 0.413152 | 0.339813 | 6.841874 | 1.183384 | 0.807921 | 0.986881 | 0.227427 | 0.792961 | 1.807972 | 35.42195 | 27.16028 | 14.99058 | 4.080565 | 10.91002 | 1.839058 | 0.872936 | 2.711994 | 0.106771 | 3.295177 | 0.129731 |
| 116 | 1.713194 | 16.17407 | 8.943634 | 20.06294 | 2.039061 | 0.077295 | 0.061031 | 0.4279 | 0.337865 | 6.508943 | 1.264945 | 0.850834 | 0.986362 | 0.233245 | 0.792961 | 1.814388 | 35.64071 | 27.32801 | 15.44846 | 4.214401 | 11.23406 | 1.961278 | 0.91069 | 2.871969 | 0.11307 | 3.484267 | 0.137176 |
| 117 | 1.861111 | 16.72245 | 9.291782 | 20.66461 | 2.331686 | 0.07891 | 0.061031 | 0.419008 | 0.324075 | 7.43386 | 1.301283 | 0.860387 | 0.985847 | 0.238994 | 0.792961 | 1.820755 | 35.85636 | 27.49336 | 15.91175 | 4.376904 | 11.53485 | 1.971941 | 1.062175 | 3.034116 | 0.119453 | 3.746997 | 0.14752 |
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| 119 | 1.74213 | 14.91458 | 8.328356 | 18.98318 | 2.256434 | 0.074511 | 0.061031 | 0.408582 | 0.334666 | 7.218579 | 1.194358 | 0.789834 | 0.984829 | 0.250277 | 0.792961 | 1.833335 | 36.27812 | 27.81676 | 14.61705 | 3.803553 | 10.81349 | 1.802625 | 0.977255 | 2.77988 | 0.109444 | 3.436174 | 0.135282 |
| 120 | 2.01412 | 15.94236 | 8.978241 | 20.53538 | 2.118783 | 0.077454 | 0.061031 | 0.424519 | 0.334507 | 6.762596 | 1.258979 | 0.8119 | 0.984327 | 0.255808 | 0.792961 | 1.839544 | 36.48414 | 27.97473 | 15.81224 | 4.274271 | 11.53797 | 1.998422 | 1.011353 | 3.009775 | 0.118495 | 3.691723 | 0.145343 |
| 121 | 1.397917 | 16.74722 | 9.072569 | 20.6789 | 2.040179 | 0.07789 | 0.061031 | 0.429722 | 0.336713 | 6.509534 | 1.291357 | 0.824758 | 0.983829 | 0.261263 | 0.792961 | 1.845696 | 36.68685 | 28.13016 | 15.92275 | 4.272784 | 11.64997 | 2.042549 | 1.022715 | 3.065264 | 0.12068 | 3.75746 | 0.147932 |
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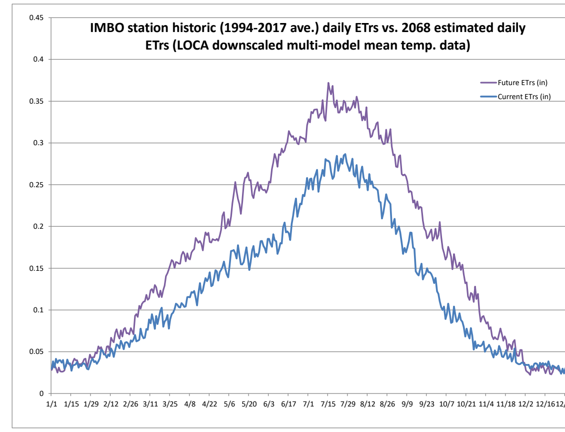
| 123 | 2.904861 | 16.89236 | 9.898611 | 21.77762 | 2.16833 | 0.081792 | 0.061031 | 0.435487 | 0.324949 | 6.898221 | 1.338608 | 0.848058 | 0.982848 | 0.27194 | 0.792961 | 1.857819 | 37.08218 | 28.43328 | 16.76877 | 4.5608 | 12.20797 | 2.169098 | 1.099603 | 3.268701 | 0.128689 | 4.010905 | 0.15791 |
| 124 | 2.990046 | 17.39398 | 10.19201 | 19.92698 | 2.332577 | 0.083218 | 0.061031 | 0.431961 | 0.316796 | 7.41306 | 1.371936 | 0.919449 | 0.982366 | 0.277159 | 0.792961 | 1.863787 | 37.27471 | 28.5809 | 15.34378 | 3.859794 | 11.48398 | 2.023938 | 1.062633 | 3.086572 | 0.121519 | 3.800723 | 0.149635 |
| 125 | 4.102083 | 16.51481 | 10.30845 | 19.72339 | 2.180996 | 0.08379 | 0.061031 | 0.440817 | 0.321085 | 6.928479 | 1.349034 | 0.923566 | 0.981888 | 0.282295 | 0.792961 | 1.869688 | 37.46375 | 28.72586 | 15.18701 | 3.76326 | 11.42375 | 2.054601 | 0.946512 | 3.001113 | 0.118154 | 3.635454 | 0.143128 |
| 126 | 2.982176 | 16.29468 | 9.638426 | 19.8911 | 2.061041 | 0.080546 | 0.061031 | 0.436929 | 0.331072 | 6.562931 | 1.304801 | 0.896496 | 0.981416 | 0.287347 | 0.792961 | 1.875521 | 37.64928 | 28.86811 | 15.31615 | 3.786906 | 11.52924 | 2.055282 | 0.887165 | 2.942447 | 0.115844 | 3.535954 | 0.139211 |
| 127 | 2.765509 | 17.17222 | 9.968866 | 22.13833 | 2.000877 | 0.082132 | 0.061031 | 0.444719 | 0.330466 | 6.363912 | 1.352113 | 0.901967 | 0.980949 | 0.292315 | 0.792961 | 1.881283 | 37.83125 | 29.00764 | 17.04652 | 4.454914 | 12.5916 | 2.284687 | 0.946684 | 3.23137 | 0.127219 | 3.865443 | 0.152183 |
| 128 | 2.46412 | 18.60995 | 10.53704 | 24.1336 | 2.087304 | 0.084922 | 0.061031 | 0.44869 | 0.322463 | 6.625497 | 1.436957 | 0.916827 | 0.980488 | 0.297196 | 0.792961 | 1.886972 | 38.00962 | 29.14441 | 18.58288 | 5.047153 | 13.53572 | 2.477925 | 1.111248 | 3.589173 | 0.141306 | 4.336719 | 0.170737 |
| 129 | 3.174306 | 18.46597 | 10.82014 | 23.23203 | 2.141135 | 0.086342 | 0.061031 | 0.450159 | 0.318198 | 6.789588 | 1.446217 | 0.912611 | 0.980033 | 0.301988 | 0.792961 | 1.892585 | 38.18435 | 29.27839 | 17.88866 | 4.76396 | 13.1247 | 2.410546 | 1.152819 | 3.563365 | 0.14029 | 4.341682 | 0.170932 |
| 130 | 3.247454 | 18.55208 | 10.89977 | 24.12837 | 2.01019 | 0.086745 | 0.061031 | 0.457784 | 0.322084 | 6.372569 | 1.453956 | 0.922772 | 0.979584 | 0.306692 | 0.792961 | 1.898121 | 38.35542 | 29.40955 | 18.57885 | 4.991793 | 13.58705 | 2.537731 | 1.090257 | 3.627988 | 0.142834 | 4.362973 | 0.171771 |
| 131 | 3.858565 | 19.29954 | 11.57905 | 21.57929 | 2.231475 | 0.090249 | 0.061031 | 0.456761 | 0.308887 | 7.057186 | 1.521997 | 0.992995 | 0.979141 | 0.311304 | 0.792961 | 1.903575 | 38.52278 | 29.53788 | 16.61605 | 4.129448 | 12.48661 | 2.326983 | 1.153155 | 3.480139 | 0.137013 | 4.259596 | 0.167701 |
| 132 | 4.104398 | 18.35208 | 11.22824 | 21.15417 | 2.212289 | 0.088425 | 0.061031 | 0.452618 | 0.312401 | 7.005146 | 1.464691 | 0.963535 | 0.978704 | 0.315824 | 0.792961 | 1.908946 | 38.6864 | 29.66334 | 16.28871 | 3.995826 | 12.29289 | 2.270107 | 1.096737 | 3.366843 | 0.132553 | 4.106342 | 0.161667 |
| 133 | 4.062963 | 19.43148 | 11.74722 | 23.34886 | 2.166095 | 0.091135 | 0.061031 | 0.462346 | 0.309624 | 6.846373 | 1.537059 | 0.976859 | 0.978273 | 0.320251 | 0.792961 | 1.914231 | 38.84626 | 29.78591 | 17.97862 | 4.633488 | 13.34513 | 2.517387 | 1.187515 | 3.704902 | 0.145862 | 4.507599 | 0.177465 |
| 134 | 4.219444 | 19.93819 | 12.07882 | 22.13575 | 1.87496 | 0.092903 | 0.061031 | 0.481761 | 0.316485 | 5.91929 | 1.577629 | 1.046639 | 0.977848 | 0.324583 | 0.792961 | 1.919427 | 39.00232 | 29.90557 | 17.04453 | 4.165331 | 12.8792 | 2.531514 | 0.994739 | 3.526253 | 0.138829 | 4.200242 | 0.165364 |
| 135 | 5.105324 | 19.94537 | 12.52535 | 20.62465 | 1.736378 | 0.095331 | 0.061031 | 0.495501 | 0.317222 | 5.47321 | 1.604565 | 1.103734 | 0.977431 | 0.328818 | 0.792961 | 1.924533 | 39.15455 | 30.0223 | 15.88098 | 3.652853 | 12.22813 | 2.472089 | 0.869554 | 3.341644 | 0.131561 | 3.931346 | 0.154777 |
| 136 | 5.847917 | 19.4787 | 12.66331 | 20.40758 | 1.781454 | 0.096092 | 0.061031 | 0.49509 | 0.314449 | 5.612583 | 1.594595 | 1.09665 | 0.97702 | 0.332956 | 0.792961 | 1.929544 | 39.30292 | 30.13606 | 15.71384 | 3.582581 | 12.13126 | 2.450476 | 0.878811 | 3.329287 | 0.131074 | 3.924861 | 0.154522 |
| 137 | 6.102778 | 19.09306 | 12.59792 | 20.73633 | 1.966231 | 0.095731 | 0.061031 | 0.484558 | 0.308922 | 6.196151 | 1.575983 | 1.087153 | 0.976615 | 0.336995 | 0.792961 | 1.934459 | 39.4474 | 30.24685 | 15.96697 | 3.662022 | 12.30495 | 2.432687 | 0.935683 | 3.36837 | 0.132613 | 3.998963 | 0.15744 |
| 138 | 5.593519 | 19.91991 | 12.75671 | 22.4375 | 2.023042 | 0.09661 | 0.061031 | 0.483967 | 0.305736 | 6.371637 | 1.617916 | 1.118431 | 0.976218 | 0.340935 | 0.792961 | 1.939275 | 39.58797 | 30.35463 | 17.27687 | 4.090009 | 13.18686 | 2.603861 | 0.973016 | 3.576877 | 0.140822 | 4.229039 | 0.166498 |
| 139 | 4.977315 | 20.12917 | 12.55324 | 23.97925 | 1.986907 | 0.095484 | 0.061031 | 0.482865 | 0.308636 | 6.262285 | 1.613987 | 1.087874 | 0.975828 | 0.344773 | 0.792961 | 1.943989 | 39.7246 | 30.45939 | 18.46402 | 4.53657 | 13.92745 | 2.743835 | 1.016853 | 3.760688 | 0.148059 | 4.4426 | 0.174906 |
| 140 | 5.212963 | 18.4919 | 11.85243 | 21.93993 | 2.021925 | 0.091693 | 0.061031 | 0.470992 | 0.313495 | 6.388333 | 1.50703 | 1.022325 | 0.975445 | 0.34851 | 0.792961 | 1.948599 | 39.85727 | 30.56112 | 16.89375 | 3.988234 | 12.90551 | 2.479982 | 0.970723 | 3.450706 | 0.135855 | 4.101716 | 0.161485 |
| 141 | 4.414352 | 18.73634 | 11.57535 | 20.4786 | 1.91091 | 0.09023 | 0.061031 | 0.47262 | 0.319681 | 6.043457 | 1.499397 | 1.068564 | 0.975069 | 0.352143 | 0.792961 | 1.953101 | 39.98595 | 30.65978 | 15.76852 | 3.485284 | 12.28324 | 2.368564 | 0.832359 | 3.200923 | 0.126021 | 3.756522 | 0.147895 |
| 142 | 5.70463 | 19.29699 | 12.50081 | 20.98749 | 1.940899 | 0.095196 | 0.061031 | 0.484453 | 0.310588 | 6.118402 | 1.577299 | 1.098825 | 0.9747 | 0.355672 | 0.792961 | 1.957493 | 40.11061 | 30.75537 | 16.16036 | 3.616305 | 12.54406 | 2.479419 | 0.909245 | 3.388664 | 0.133412 | 3.999417 | 0.157457 |
| 143 | 5.825231 | 19.89352 | 12.85938 | 22.7731 | 1.943879 | 0.097182 | 0.061031 | 0.489459 | 0.307385 | 6.120111 | 1.623384 | 1.089094 | 0.974339 | 0.359095 | 0.792961 | 1.961773 | 40.23125 | 30.84787 | 17.53529 | 4.128933 | 13.40636 | 2.677237 | 1.005121 | 3.682359 | 0.144975 | 4.359914 | 0.17165 |
| 144 | 6.321991 | 20.2956 | 13.3088 | 23.60375 | 1.791327 | 0.099721 | 0.061031 | 0.503836 | 0.308358 | 5.630962 | 1.668787 | 1.105182 | 0.973986 | 0.362412 | 0.792961 | 1.965937 | 40.34783 | 30.93726 | 18.17489 | 4.344862 | 13.83002 | 2.842968 | 0.978618 | 3.821586 | 0.150456 | 4.483667 | 0.176522 |
| 145 | 5.243981 | 19.86319 | 12.55359 | 21.87709 | 1.853167 | 0.095486 | 0.061031 | 0.489744 | 0.313026 | 5.840761 | 1.602916 | 1.097162 | 0.97364 | 0.365621 | 0.792961 | 1.969983 | 40.46033 | 31.02353 | 16.84536 | 3.817993 | 13.02737 | 2.603068 | 0.924674 | 3.527743 | 0.138888 | 4.150624 | 0.16341 |
| 146 | 5.509722 | 19.56458 | 12.53715 | 22.64938 | 1.932144 | 0.095396 | 0.061031 | 0.485425 | 0.31056 | 6.09003 | 1.589917 | 1.086675 | 0.973302 | 0.368723 | 0.792961 | 1.973909 | 40.56874 | 31.10665 | 17.44003 | 4.026898 | 13.41313 | 2.656514 | 0.95179 | 3.608304 | 0.142059 | 4.246657 | 0.167191 |
| 147 | 5.128935 | 20.40532 | 12.76713 | 22.12926 | 1.849255 | 0.096668 | 0.061031 | 0.493021 | 0.311269 | 5.824078 | 1.638896 | 1.142986 | 0.972973 | 0.371714 | 0.792961 | 1.977712 | 40.67304 | 31.18662 | 17.03953 | 3.807912 | 13.23162 | 2.661575 | 0.899013 | 3.560587 | 0.140181 | 4.163946 | 0.163935 |
| 148 | 5.848843 | 20.57477 | 13.21181 | 22.6863 | 1.721477 | 0.099168 | 0.061031 | 0.506164 | 0.311509 | 5.413225 | 1.674076 | 1.138364 | 0.972651 | 0.374596 | 0.792961 | 1.981389 | 40.7732 | 31.26343 | 17.46845 | 3.973497 | 13.49495 | 2.786907 | 0.903354 | 3.69026 | 0.145286 | 4.300619 | 0.169316 |
| 149 | 6.627083 | 21.19699 | 13.91204 | 23.58173 | 1.966417 | 0.103217 | 0.061031 | 0.503368 | 0.297637 | 6.168356 | 1.746875 | 1.172371 | 0.972337 | 0.377367 | 0.792961 | 1.984938 | 40.86922 | 31.33705 | 18.15793 | 4.193939 | 13.964 | 2.867845 | 1.054748 | 3.922594 | 0.154433 | 4.634456 | 0.182459 |
| 150 | 6.160648 | 21.88194 | 14.0213 | 24.20387 | 1.676959 | 0.103862 | 0.061031 | 0.520111 | 0.305629 | 5.258366 | 1.785263 | 1.191968 | 0.972031 | 0.380026 | 0.792961 | 1.988356 | 40.96107 | 31.40748 | 18.63698 | 4.328199 | 14.30878 | 3.036402 | 0.953491 | 3.989892 | 0.157082 | 4.636444 | 0.182537 |
| 151 | 6.718056 | 22.23657 | 14.47731 | 21.97191 | 1.713653 | 0.106588 | 0.061031 | 0.524601 | 0.300383 | 5.364903 | 1.832462 | 1.223115 | 0.971734 | 0.382572 | 0.792961 | 1.991641 | 41.04874 | 31.4747 | 16.91837 | 3.697624 | 13.22074 | 2.829731 | 0.981979 | 3.81171 | 0.150067 | 4.483162 | 0.176502 |
| 152 | 7.172454 | 22.15718 | 14.66481 | 22.22664 | 1.673979 | 0.107726 | 0.061031 | 0.529383 | 0.299918 | 5.237278 | 1.841575 | 1.265001 | 0.971445 | 0.385005 | 0.792961 | 1.994791 | 41.13222 | 31.5387 | 17.11451 | 3.708999 | 13.40551 | 2.895432 | 0.905657 | 3.801089 | 0.149649 | 4.416789 | 0.173889 |
| 153 | 6.725926 | 21.39907 | 14.0625 | 21.82879 | 1.71682 | 0.104105 | 0.061031 | 0.518551 | 0.303999 | 5.382584 | 1.765893 | 1.223742 | 0.971164 | 0.387324 | 0.792961 | 1.997803 | 41.21148 | 31.59948 | 16.80817 | 3.612902 | 13.19527 | 2.791708 | 0.887121 | 3.67883 | 0.144836 | 4.279473 | 0.168483 |
| 154 | 7.559028 | 22.7 | 15.12951 | 23.86497 | 1.589041 | 0.110592 | 0.061031 | 0.540536 | 0.2983 | 4.963521 | 1.899917 | 1.272937 | 0.970892 | 0.389528 | 0.792961 | 2.000675 | 41.28653 | 31.65702 | 18.37603 | 4.133709 | 14.24232 | 3.14098 | 0.92832 | 4.0693 | 0.160209 | 4.702171 | 0.185125 |
| 155 | 7.104398 | 22.89606 | 15.00023 | 23.36196 | 1.655538 | 0.109788 | 0.061031 | 0.5351 | 0.297463 | 5.173553 | 1.900444 | 1.264951 | 0.970629 | 0.391617 | 0.792961 | 2.003405 | 41.35734 | 31.71132 | 17.98871 | 3.995516 | 13.99319 | 3.055007 | 0.977985 | 4.032992 | 0.158779 | 4.701043 | 0.18508 |
| 156 | 7.221759 | 21.96667 | 14.59421 | 22.6897 | 1.784807 | 0.107296 | 0.061031 | 0.522469 | 0.297187 | 5.585392 | 1.827891 | 1.235052 | 0.970374 | 0.39359 | 0.792961 | 2.005991 | 41.4239 | 31.76235 | 17.47107 | 3.823749 | 13.64732 | 2.909165 | 0.984056 | 3.893222 | 0.153276 | 4.561811 | 0.179599 |
| 157 | 6.941435 | 20.80741 | 13.87442 | 22.33991 | 1.855402 | 0.102996 | 0.061031 | 0.508552 | 0.301347 | 5.820882 | 1.727786 | 1.15825 | 0.970129 | 0.395446 | 0.792961 | 2.00843 | 41.4862 | 31.81013 | 17.20173 | 3.781811 | 13.41992 | 2.784488 | 0.999027 | 3.783515 | 0.148957 | 4.460771 | 0.175621 |
| 158 | 6.626389 | 21.74954 | 14.18796 | 24.8686 | 1.801944 | 0.104851 | 0.061031 | 0.515811 | 0.300242 | 5.646996 | 1.790141 | 1.176205 | 0.969892 | 0.397185 | 0.792961 | 2.010722 | 41.54424 | 31.85463 | 19.14882 | 4.445971 | 14.70285 | 3.094228 | 1.040909 | 4.135137 | 0.162801 | 4.839991 | 0.190551 |
| 159 | 6.223611 | 21.91759 | 14.0706 | 23.56847 | 1.769161 | 0.104153 | 0.061031 | 0.515876 | 0.302291 | 5.546527 | 1.790183 | 1.186003 | 0.969664 | 0.398806 | 0.792961 | 2.012863 | 41.59801 | 31.89585 | 18.14773 | 4.070753 | 14.07697 | 2.962886 | 1.013007 | 3.975893 | 0.156531 | 4.664014 | 0.183623 |
| 160 | 6.419213 | 21.87986 | 14.14954 | 24.43406 | 1.65144 | 0.104622 | 0.061031 | 0.523315 | 0.305276 | 5.176036 | 1.793615 | 1.218754 | 0.969444 | 0.400309 | 0.792961 | 2.014854 | 41.64749 | 31.93379 | 18.81422 | 4.249574 | 14.56465 | 3.109732 | 0.90835 | 4.018082 | 0.158192 | 4.631185 | 0.18233 |
| 161 | 6.208565 | 20.48519 | 13.34688 | 21.98251 | 1.603383 | 0.099939 | 0.061031 | 0.514508 | 0.314204 | 5.0395 | 1.679069 | 1.129929 | 0.969234 | 0.401693 | 0.792961 | 2.01669 | 41.69267 | 31.96844 | 16.92654 | 3.666237 | 13.2603 | 2.78359 | 0.869524 | 3.653114 | 0.143823 | 4.24389 | 0.167082 |
| 162 | 5.949769 | 20.87454 | 13.41215 | 23.12178 | 1.727623 | 0.100313 | 0.061031 | 0.508702 | 0.3095 | 5.428754 | 1.699883 | 1.171446 | 0.969034 | 0.402958 | 0.792961 | 2.018373 | 41.73356 | 31.99979 | 17.80377 | 3.913886 | 13.88988 | 2.882852 | 0.88788 | 3.770731 | 0.148454 | 4.367884 | 0.171964 |
| 163 | 6.22963 | 21.5169 | 13.87326 | 23.61622 | 1.685713 | 0.102989 | 0.061031 | 0.517534 | 0.30669 | 5.288544 | 1.758576 | 1.174509 | 0.968842 | 0.404104 | 0.792961 | 2.019899 | 41.77015 | 32.02785 | 18.18449 | 4.061499 | 14.12299 | 2.982122 | 0.947323 | 3.929444 | 0.154703 | 4.57171 | 0.179989 |
| 164 | 6.973148 | 21.67569 | 14.32442 | 23.0372 | 1.714212 | 0.105667 | 0.061031 | 0.522407 | 0.301733 | 5.369508 | 1.796065 | 1.203962 | 0.968659 | 0.40513 | 0.792961 | 2.021268 | 41.80243 | 32.0526 | 17.73865 | 3.887075 | 13.85157 | 2.952352 | 0.959301 | 3.911653 | 0.154002 | 4.563363 | 0.17966 |
| 165 | 7.380787 | 22.6088 | 14.99479 | 25.14384 | 1.721849 | 0.109754 | 0.061031 | 0.531459 | 0.295529 | 5.380876 | 1.886001 | 1.204039 | 0.968486 | 0.406037 | 0.792961 | 2.022479 | 41.83039 | 32.07404 | 19.36076 | 4.481276 | 14.87948 | 3.226398 | 1.084461 | 4.310859 | 0.169719 | 5.051509 | 0.198878 |
| 166 | 7.04213 | 22.8831 | 14.96262 | 25.81715 | 1.735633 | 0.109555 | 0.061031 | 0.530272 | 0.295405 | 5.424557 | 1.897198 | 1.189993 | 0.968322 | 0.406822 | 0.792961 | 2.02353 | 41.85404 | 32.09217 | 19.87921 | 4.678659 | 15.20055 | 3.288651 | 1.133254 | 4.421905 | 0.174091 | 5.196747 | 0.204596 |
| 167 | 7.04537 | 22.28958 | 14.66748 | 23.82273 | 1.762269 | 0.107742 | 0.061031 | 0.524697 | 0.297218 | 5.513456 | 1.847972 | 1.173439 | 0.968168 | 0.407488 | 0.792961 | 2.024421 | 41.87337 | 32.10699 | 18.34351 | 4.147601 | 14.19591 | 3.039007 | 1.105357 | 4.144364 | 0.163164 | 4.901396 | 0.192968 |
| 168 | 6.159954 | 22.88519 | 14.52257 | 24.63644 | 1.592953 | 0.106861 | 0.061031 | 0.531787 | 0.303718 | 4.986243 | 1.867751 | 1.180528 | 0.968023 | 0.408032 | 0.792961 | 2.025151 | 41.88837 | 32.1185 | 18.97006 | 4.347372 | 14.62269 | 3.172673 | 1.040739 | 4.213412 | 0.165882 | 4.927516 | 0.193997 |
| 169 | 7.367593 | 22.31319 | 14.84039 | 24.15838 | 1.686272 | 0.108801 | 0.061031 | 0.531194 | 0.29797 | 5.272522 | 1.861128 | 1.199318 | 0.967887 | 0.408456 | 0.792961 | 2.025719 | 41.89906 | 32.12669 | 18.60195 | 4.205461 | 14.39649 | 3.120112 | 1.039737 | 4.159849 | 0.163774 | 4.870642 | 0.191758 |
| 170 | 6.600463 | 21.75486 | 14.17766 | 23.48189 | 1.754446 | 0.10479 | 0.061031 | 0.518178 | 0.301797 | 5.498343 | 1.789693 | 1.183047 | 0.967761 | 0.408758 | 0.792961 | 2.026125 | 41.90542 | 32.13157 | 18.08106 | 4.010694 | 14.07037 | 2.97471 | 1.006658 | 3.981367 | 0.156747 | 4.66551 | 0.183682 |
| 171 | 6.058102 | 23.21898 | 14.63854 | 25.98785 | 1.616981 | 0.107566 | 0.061031 | 0.532107 | 0.30191 | 5.059415 | 1.892871 | 1.175796 | 0.967645 | 0.40894 | 0.792961 | 2.026369 | 41.90746 | 32.13314 | 20.01065 | 4.720922 | 15.28972 | 3.319395 | 1.095324 | 4.41472 | 0.173808 | 5.165765 | 0.203377 |
| 172 | 7.212963 | 24.76551 | 15.98924 | 25.2765 | 1.666342 | 0.116065 | 0.061031 | 0.54832 | 0.288327 | 5.189492 | 2.070202 | 1.262659 | 0.967538 | 0.409 | 0.792961 | 2.02645 | 41.90519 | 32.13139 | 19.4629 | 4.482511 | 14.98039 | 3.351331 | 1.208302 | 4.559633 | 0.179513 | 5.395727 | 0.21243 |
| 173 | 7.056713 | 25.67176 | 16.36424 | 27.21195 | 1.596678 | 0.118524 | 0.061031 | 0.557268 | 0.286954 | 4.966094 | 2.151266 | 1.302618 | 0.96744 | 0.408939 | 0.792961 | 2.026368 | 41.89859 | 32.12633 | 20.9532 | 4.956994 | 15.99621 | 3.63698 | 1.209356 | 4.846336 | 0.190801 | 5.682798 | 0.223732 |
| 174 | 7.164352 | 25.53218 | 16.34826 | 27.64434 | 1.802875 | 0.118418 | 0.061031 | 0.546057 | 0.281432 | 5.607732 | 2.141407 | 1.267757 | 0.967353 | 0.408757 | 0.792961 | 2.026123 | 41.88769 | 32.11797 | 21.28614 | 5.131016 | 16.15513 | 3.59922 | 1.378788 | 4.978008 | 0.195985 | 5.930046 | 0.233466 |
| 175 | 7.804398 | 25.12315 | 16.46377 | 24.7708 | 1.612697 | 0.119184 | 0.061031 | 0.557768 | 0.285621 | 5.014193 | 2.124825 | 1.291663 | 0.967275 | 0.408454 | 0.792961 | 2.025716 | 41.87247 | 32.1063 | 19.07352 | 4.338713 | 14.7348 | 3.35319 | 1.19322 | 4.54641 | 0.178993 | 5.375429 | 0.211631 |
| 176 | 7.517593 | 25.20093 | 16.35926 | 26.09976 | 1.643058 | 0.118491 | 0.061031 | 0.554689 | 0.285705 | 5.110438 | 2.121958 | 1.280425 | 0.967206 | 0.408029 | 0.792961 | 2.025147 | 41.85295 | 32.09133 | 20.09682 | 4.704792 | 15.39202 | 3.483415 | 1.228704 | 4.712119 | 0.185517 | 5.563315 | 0.219028 |
| 177 | 7.695602 | 26.26481 | 16.98021 | 26.88304 | 1.696331 | 0.122658 | 0.061031 | 0.560365 | 0.278823 | 5.264833 | 2.232576 | 1.37028 | 0.967148 | 0.407484 | 0.792961 | 2.024417 | 41.82912 | 32.07307 | 20.69994 | 4.811831 | 15.88811 | 3.632481 | 1.265813 | 4.898293 | 0.192846 | 5.773584 | 0.227306 |
| 178 | 8.208796 | 26.44884 | 17.32882 | 26.50012 | 1.670626 | 0.125051 | 0.061031 | 0.566486 | 0.276474 | 5.178828 | 2.269893 | 1.394178 | 0.967099 | 0.406818 | 0.792961 | 2.023525 | 41.80101 | 32.05151 | 20.4051 | 4.70056 | 15.70454 | 3.629728 | 1.253858 | 4.883586 | 0.192267 | 5.752529 | 0.226478 |
| 179 | 8.756713 | 27.86134 | 18.30903 | 26.58599 | 1.716634 | 0.131994 | 0.061031 | 0.577284 | 0.266924 | 5.303544 | 2.439424 | 1.473443 | 0.96706 | 0.406032 | 0.792961 | 2.022473 | 41.76861 | 32.02667 | 20.47121 | 4.667553 | 15.80366 | 3.722267 | 1.367485 | 5.089752 | 0.200384 | 6.042601 | 0.237898 |
| 180 | 10.61944 | 27.39074 | 19.00509 | 25.9086 | 1.734329 | 0.137121 | 0.061031 | 0.585634 | 0.260661 | 5.345441 | 2.463883 | 1.4876 | 0.967031 | 0.405125 | 0.792961 | 2.021261 | 41.73193 | 31.99854 | 19.94962 | 4.515065 | 15.43456 | 3.687914 | 1.360303 | 5.048216 | 0.198749 | 5.997773 | 0.236133 |
| 181 | 9.271065 | 28.38935 | 18.83021 | 27.59635 | 1.619402 | 0.135817 | 0.061031 | 0.589351 | 0.264833 | 4.994213 | 2.517863 | 1.484448 | 0.967011 | 0.404098 | 0.792961 | 2.019891 | 41.69099 | 31.96715 | 21.24919 | 4.955435 | 16.29375 | 3.917916 | 1.366829 | 5.284744 | 0.208061 | 6.240774 | 0.2457 |
| 182 | 9.666435 | 28.85162 | 19.25903 | 28.12335 | 1.648087 | 0.139032 | 0.061031 | 0.593489 | 0.260525 | 5.07522 | 2.58612 | 1.443389 | 0.967001 | 0.402952 | 0.792961 | 2.018364 | 41.64578 | 31.93248 | 21.65498 | 5.200579 | 16.4544 | 3.984328 | 1.510946 | 5.495274 | 0.216349 | 6.557825 | 0.258182 |
| 183 | 9.611111 | 27.89167 | 18.75139 | 26.88969 | 1.676773 | 0.135233 | 0.061031 | 0.585276 | 0.264138 | 5.172538 | 2.47624 | 1.426747 | 0.967001 | 0.401686 | 0.792961 | 2.016681 | 41.59633 | 31.89457 | 20.70506 | 4.876497 | 15.82856 | 3.779744 | 1.433884 | 5.213628 | 0.205261 | 6.218701 | 0.244831 |
| 184 | 8.745139 | 28.58125 | 18.66319 | 28.84873 | 1.594256 | 0.134582 | 0.061031 | 0.588478 | 0.266868 | 4.919478 | 2.5191 | 1.401921 | 0.967011 | 0.400301 | 0.792961 | 2.014843 | 41.54263 | 31.8534 | 22.21352 | 5.444062 | 16.76946 | 4.026327 | 1.466688 | 5.493015 | 0.21626 | 6.522766 | 0.256802 |
| 185 | 8.79375 | 28.56829 | 18.68102 | 27.66077 | 1.698379 | 0.134713 | 0.061031 | 0.583207 | 0.26422 | 5.240456 | 2.519491 | 1.372682 | 0.967031 | 0.398797 | 0.792961 | 2.012852 | 41.48472 | 31.80899 | 21.2988 | 5.192489 | 16.10631 | 3.832471 | 1.587908 | 5.420379 | 0.213401 | 6.538062 | 0.257404 |
| 186 | 8.653472 | 27.83426 | 18.24387 | 26.66093 | 1.699497 | 0.131523 | 0.061031 | 0.577311 | 0.267893 | 5.251775 | 2.432533 | 1.381993 | 0.96706 | 0.397175 | 0.792961 | 2.01071 | 41.42259 | 31.76135 | 20.52892 | 4.88889 | 15.64003 | 3.683895 | 1.478019 | 5.161914 | 0.203225 | 6.1986 | 0.244039 |
| 187 | 9.362037 | 28.65787 | 19.00995 | 28.31461 | 1.661312 | 0.137157 | 0.061031 | 0.589513 | 0.262318 | 5.120309 | 2.5518 | 1.427116 | 0.967099 | 0.395436 | 0.792961 | 2.008417 | 41.35626 | 31.71049 | 21.80225 | 5.314308 | 16.48794 | 3.9657 | 1.510619 | 5.476319 | 0.215603 | 6.537289 | 0.257374 |
| 188 | 9.27338 | 29.21597 | 19.24468 | 28.43929 | 1.695399 | 0.138924 | 0.061031 | 0.590824 | 0.259558 | 5.22117 | 2.61269 | 1.460929 | 0.967148 | 0.393579 | 0.792961 | 2.005977 | 41.28575 | 31.65642 | 21.89826 | 5.318359 | 16.5799 | 3.996684 | 1.560862 | 5.557546 | 0.218801 | 6.654418 | 0.261985 |
| 189 | 8.900231 | 29.51181 | 19.20602 | 28.81324 | 1.692233 | 0.138632 | 0.061031 | 0.59048 | 0.259954 | 5.212108 | 2.633017 | 1.431385 | 0.967206 | 0.391606 | 0.792961 | 2.00339 | 41.21106 | 31.59916 | 22.1862 | 5.484771 | 16.70143 | 4.023635 | 1.6281 | 5.651735 | 0.222509 | 6.798409 | 0.267654 |
| 190 | 9.100926 | 29.69398 | 19.39745 | 25.44031 | 1.590904 | 0.140084 | 0.061031 | 0.598323 | 0.260676 | 4.896805 | 2.662533 | 1.545401 | 0.967275 | 0.389517 | 0.792961 | 2.000659 | 41.13222 | 31.53871 | 19.58903 | 4.437601 | 15.15143 | 3.698705 | 1.425994 | 5.124699 | 0.20176 | 6.132084 | 0.241421 |
| 191 | 9.92037 | 29.52176 | 19.72106 | 26.15356 | 1.744201 | 0.142569 | 0.061031 | 0.594548 | 0.254517 | 5.362719 | 2.674739 | 1.51154 | 0.967353 | 0.387312 | 0.792961 | 1.997787 | 41.04925 | 31.47508 | 20.13824 | 4.705514 | 15.43273 | 3.743603 | 1.587652 | 5.331255 | 0.209892 | 6.451535 | 0.253997 |
| 192 | 9.706481 | 29.52894 | 19.61771 | 27.20574 | 1.684409 | 0.141771 | 0.061031 | 0.59629 | 0.256699 | 5.180714 | 2.666888 | 1.458299 | 0.96744 | 0.384992 | 0.792961 | 1.994774 | 40.96215 | 31.4083 | 20.94842 | 5.080435 | 15.86798 | 3.860467 | 1.60728 | 5.467747 | 0.215266 | 6.603641 | 0.259986 |
| 193 | 9.917593 | 29.55787 | 19.73773 | 26.94218 | 1.800081 | 0.142698 | 0.061031 | 0.591905 | 0.253156 | 5.534213 | 2.67892 | 1.4138 | 0.967538 | 0.382559 | 0.792961 | 1.991623 | 40.87095 | 31.33837 | 20.74548 | 5.110355 | 15.63512 | 3.775841 | 1.772459 | 5.548299 | 0.218437 | 6.802875 | 0.26783 |
| 194 | 9.76713 | 29.23796 | 19.50255 | 27.03242 | 1.698193 | 0.140887 | 0.061031 | 0.594066 | 0.257346 | 5.225164 | 2.635012 | 1.407788 | 0.967645 | 0.380012 | 0.792961 | 1.988338 | 40.77566 | 31.26531 | 20.81497 | 5.145438 | 15.66953 | 3.797964 | 1.650218 | 5.448182 | 0.214495 | 6.61603 | 0.260474 |
| 195 | 9.040741 | 30.3294 | 19.68507 | 29.09788 | 1.71831 | 0.142291 | 0.061031 | 0.595413 | 0.255385 | 5.283765 | 2.737559 | 1.399223 | 0.967761 | 0.377352 | 0.792961 | 1.984919 | 40.67631 | 31.18913 | 22.40536 | 5.764652 | 16.64071 | 4.042501 | 1.805942 | 5.848443 | 0.230254 | 7.127946 | 0.280628 |
| 196 | 9.615278 | 30.58449 | 20.09988 | 27.7069 | 1.777357 | 0.145525 | 0.061031 | 0.597791 | 0.250707 | 5.457596 | 2.792033 | 1.42738 | 0.967887 | 0.374581 | 0.792961 | 1.981369 | 40.57291 | 31.10985 | 21.33431 | 5.380051 | 15.95426 | 3.891222 | 1.867195 | 5.758417 | 0.226709 | 7.084409 | 0.278914 |
| 197 | 10.55 | 30.12315 | 20.33657 | 26.70795 | 1.901783 | 0.147398 | 0.061031 | 0.594603 | 0.246201 | 5.834951 | 2.773544 | 1.413236 | 0.968023 | 0.371698 | 0.792961 | 1.977691 | 40.46549 | 31.02748 | 20.56512 | 5.162026 | 15.40309 | 3.736763 | 1.954181 | 5.690943 | 0.224053 | 7.078293 | 0.278673 |
| 198 | 9.164815 | 30.34259 | 19.7537 | 27.86783 | 1.779592 | 0.142821 | 0.061031 | 0.59316 | 0.253473 | 5.470922 | 2.744032 | 1.412936 | 0.968168 | 0.368706 | 0.792961 | 1.973888 | 40.35407 | 30.94204 | 21.45823 | 5.467419 | 15.99081 | 3.869925 | 1.845873 | 5.715798 | 0.225031 | 7.024728 | 0.276564 |
| 199 | 9.130787 | 30.42546 | 19.77813 | 26.25535 | 1.696889 | 0.143011 | 0.061031 | 0.597737 | 0.255091 | 5.216238 | 2.75298 | 1.424415 | 0.968322 | 0.365604 | 0.792961 | 1.969961 | 40.23866 | 30.85355 | 20.21662 | 5.026436 | 15.19019 | 3.70453 | 1.767807 | 5.472337 | 0.215446 | 6.730759 | 0.264991 |
| 200 | 9.88287 | 29.82778 | 19.85532 | 25.78327 | 1.722967 | 0.14361 | 0.061031 | 0.597395 | 0.25388 | 5.295004 | 2.709844 | 1.45933 | 0.968486 | 0.362394 | 0.792961 | 1.965914 | 40.11929 | 30.76203 | 19.85312 | 4.860103 | 14.99302 | 3.654354 | 1.681061 | 5.335415 | 0.210056 | 6.528674 | 0.257034 |
| 201 | 9.40787 | 30.50773 | 19.9578 | 26.36572 | 1.691949 | 0.14441 | 0.061031 | 0.600331 | 0.253716 | 5.197862 | 2.774144 | 1.513959 | 0.968659 | 0.359076 | 0.792961 | 1.961749 | 39.99599 | 30.66749 | 20.3016 | 4.95969 | 15.34191 | 3.757773 | 1.661906 | 5.419679 | 0.213373 | 6.598962 | 0.259802 |
| 202 | 9.595652 | 31.31063 | 20.45314 | 27.26701 | 1.6626 | 0.148327 | 0.061031 | 0.608251 | 0.250273 | 5.099077 | 2.883869 | 1.476516 | 0.968842 | 0.355653 | 0.792961 | 1.957469 | 39.86878 | 30.56994 | 20.9956 | 5.3308 | 15.6648 | 3.887477 | 1.796012 | 5.683489 | 0.223759 | 6.964469 | 0.274192 |
| 203 | 9.622947 | 31.9128 | 20.76787 | 27.14448 | 1.721881 | 0.150863 | 0.061031 | 0.609241 | 0.246467 | 5.275231 | 2.964338 | 1.451133 | 0.969034 | 0.352123 | 0.792961 | 1.953076 | 39.73768 | 30.46942 | 20.90125 | 5.393023 | 15.50823 | 3.854885 | 1.967426 | 5.82231 | 0.229225 | 7.229801 | 0.284638 |
| 204 | 10.37053 | 31.08981 | 20.73017 | 25.77327 | 1.718772 | 0.150557 | 0.061031 | 0.608917 | 0.246836 | 5.266379 | 2.887201 | 1.512178 | 0.969234 | 0.34849 | 0.792961 | 1.948574 | 39.60272 | 30.36594 | 19.84542 | 4.922004 | 14.92341 | 3.707544 | 1.787439 | 5.494983 | 0.216338 | 6.77032 | 0.266548 |
| 205 | 9.848611 | 30.58426 | 20.21644 | 27.47041 | 1.664293 | 0.146444 | 0.061031 | 0.605115 | 0.252184 | 5.108388 | 2.801454 | 1.405209 | 0.969444 | 0.344753 | 0.792961 | 1.943964 | 39.46393 | 30.25952 | 21.15222 | 5.576332 | 15.57589 | 3.84548 | 1.79872 | 5.644201 | 0.222213 | 6.926914 | 0.272713 |
| 206 | 9.009259 | 31.39537 | 20.20231 | 27.95765 | 1.698566 | 0.146333 | 0.061031 | 0.603159 | 0.251561 | 5.213837 | 2.871744 | 1.423009 | 0.969664 | 0.340914 | 0.792961 | 1.939249 | 39.32133 | 30.15018 | 21.52739 | 5.714942 | 15.81245 | 3.891268 | 1.900161 | 5.791429 | 0.228009 | 7.147174 | 0.281385 |
| 207 | 9.449537 | 31.80023 | 20.62488 | 26.45449 | 1.618471 | 0.149707 | 0.061031 | 0.612742 | 0.249799 | 4.960833 | 2.942379 | 1.424786 | 0.969892 | 0.336974 | 0.792961 | 1.934433 | 39.17495 | 30.03794 | 20.36996 | 5.343668 | 15.02629 | 3.756554 | 1.880615 | 5.637169 | 0.221936 | 6.98688 | 0.275074 |
| 208 | 9.825231 | 32.02407 | 20.92465 | 26.91943 | 1.715143 | 0.15214 | 0.061031 | 0.611589 | 0.245341 | 5.251785 | 2.987452 | 1.430367 | 0.970129 | 0.332934 | 0.792961 | 1.929517 | 39.02482 | 29.92283 | 20.72796 | 5.517723 | 15.21024 | 3.795384 | 2.006269 | 5.801653 | 0.228412 | 7.240219 | 0.285048 |
| 209 | 9.802083 | 32.62917 | 21.21563 | 26.61845 | 1.678449 | 0.154533 | 0.061031 | 0.617162 | 0.243742 | 5.134343 | 3.069114 | 1.444901 | 0.970374 | 0.328795 | 0.792961 | 1.924505 | 38.87098 | 29.80487 | 20.49621 | 5.458636 | 15.03757 | 3.78649 | 2.032628 | 5.819118 | 0.229099 | 7.280904 | 0.28665 |
| 210 | 10.50255 | 31.32361 | 20.91308 | 25.70681 | 1.719614 | 0.152045 | 0.061031 | 0.611213 | 0.245343 | 5.265681 | 2.92298 | 1.378063 | 0.970629 | 0.324559 | 0.792961 | 1.919399 | 38.71344 | 29.68407 | 19.79425 | 5.315432 | 14.47881 | 3.610653 | 1.995872 | 5.606525 | 0.220729 | 7.040064 | 0.277168 |
| 211 | 10.70162 | 31.00671 | 20.85417 | 25.65518 | 1.701546 | 0.151565 | 0.061031 | 0.611384 | 0.246189 | 5.211399 | 2.890607 | 1.399475 | 0.970892 | 0.320227 | 0.792961 | 1.914202 | 38.55224 | 29.56047 | 19.75448 | 5.287086 | 14.4674 | 3.608814 | 1.913108 | 5.521923 | 0.217399 | 6.894373 | 0.271432 |
| 212 | 9.968056 | 31.0625 | 20.51528 | 25.2037 | 1.653489 | 0.148825 | 0.061031 | 0.609521 | 0.249957 | 5.070061 | 2.866969 | 1.381593 | 0.971164 | 0.3158 | 0.792961 | 1.908917 | 38.38742 | 29.43409 | 19.40685 | 5.196786 | 14.21006 | 3.533821 | 1.882414 | 5.416235 | 0.213238 | 6.768438 | 0.266474 |
| 213 | 9.525463 | 31.94375 | 20.73461 | 25.72351 | 1.637284 | 0.150593 | 0.061031 | 0.613166 | 0.2485 | 5.016622 | 2.964569 | 1.422598 | 0.971445 | 0.311279 | 0.792961 | 1.903545 | 38.21901 | 29.30496 | 19.8071 | 5.330745 | 14.47636 | 3.621577 | 1.922266 | 5.543843 | 0.218262 | 6.926218 | 0.272686 |
| 214 | 10.2794 | 32.06435 | 21.17188 | 25.45735 | 1.685527 | 0.154171 | 0.061031 | 0.616245 | 0.243951 | 5.156762 | 3.011618 | 1.361101 | 0.971734 | 0.306666 | 0.792961 | 1.89809 | 38.04704 | 29.1731 | 19.60216 | 5.427248 | 14.17491 | 3.563971 | 2.076348 | 5.640319 | 0.22206 | 7.137857 | 0.281018 |
| 215 | 9.99213 | 30.72801 | 20.36007 | 23.81808 | 1.741221 | 0.147585 | 0.061031 | 0.603008 | 0.249365 | 5.341895 | 2.825404 | 1.358183 | 0.972031 | 0.301962 | 0.792961 | 1.892555 | 37.87154 | 29.03853 | 18.33992 | 4.9103 | 13.42962 | 3.30405 | 1.954455 | 5.258506 | 0.207028 | 6.662916 | 0.26232 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 216 | 9.40463 | 30.79676 | 20.10069 | 24.56366 | 1.691674 | 0.145531 | 0.061031 | 0.602199 | 0.252545 | 5.194483 | 2.810347 | 1.389154 | 0.972337 | 0.297169 | 0.792961 | 1.886941 | 37.69256 | 28.90129 | 18.91402 | 5.100575 | 13.81344 | 3.393926 | 1.864376 | 5.258302 | 0.20702 | 6.595659 | 0.259672 |
| 217 | 10.06042 | 31.57708 | 20.81875 | 24.98667 | 1.833982 | 0.151276 | 0.061031 | 0.604225 | 0.243771 | 5.617693 | 2.937629 | 1.454592 | 0.972651 | 0.292288 | 0.792961 | 1.881252 | 37.51012 | 28.76141 | 19.23973 | 5.198609 | 14.04112 | 3.461474 | 2.030913 | 5.492387 | 0.216236 | 6.947741 | 0.273533 |
| 218 | 9.693981 | 30.49144 | 20.09271 | 24.06459 | 1.698379 | 0.145468 | 0.061031 | 0.601749 | 0.252465 | 5.215215 | 2.783575 | 1.373938 | 0.972973 | 0.28732 | 0.792961 | 1.875489 | 37.32427 | 28.61891 | 18.52974 | 5.045674 | 13.48406 | 3.310522 | 1.856012 | 5.166534 | 0.203407 | 6.498639 | 0.255852 |
| 219 | 9.435417 | 29.49653 | 19.46597 | 23.6094 | 1.700801 | 0.140607 | 0.061031 | 0.593451 | 0.257591 | 5.233843 | 2.652166 | 1.32931 | 0.973302 | 0.282267 | 0.792961 | 1.869656 | 37.13505 | 28.47382 | 18.17924 | 4.974468 | 13.20477 | 3.197244 | 1.783464 | 4.980708 | 0.196091 | 6.258176 | 0.246385 |
| 220 | 9.272454 | 29.95278 | 19.61262 | 25.4133 | 1.861363 | 0.141732 | 0.061031 | 0.587154 | 0.252835 | 5.725066 | 2.700475 | 1.342372 | 0.97364 | 0.27713 | 0.792961 | 1.863754 | 36.9425 | 28.32618 | 19.56824 | 5.556909 | 14.01133 | 3.35654 | 1.965852 | 5.322393 | 0.209543 | 6.724796 | 0.264756 |
| 221 | 8.35 | 31.32384 | 19.83692 | 25.5006 | 1.78518 | 0.143467 | 0.061031 | 0.593963 | 0.252674 | 5.486541 | 2.837349 | 1.367531 | 0.973986 | 0.271911 | 0.792961 | 1.857786 | 36.74665 | 28.17601 | 19.63546 | 5.604448 | 14.03101 | 3.400233 | 2.037615 | 5.437848 | 0.214089 | 6.898197 | 0.271583 |
| 222 | 9.198611 | 31.06551 | 20.13206 | 24.09149 | 1.725947 | 0.145778 | 0.061031 | 0.600839 | 0.251547 | 5.299155 | 2.836465 | 1.399476 | 0.974339 | 0.266612 | 0.792961 | 1.851755 | 36.54755 | 28.02335 | 18.55045 | 5.170921 | 13.37953 | 3.27989 | 1.915489 | 5.195379 | 0.204542 | 6.571088 | 0.258704 |
| 223 | 9.053704 | 30.50509 | 19.7794 | 24.39277 | 1.694468 | 0.143021 | 0.061031 | 0.597879 | 0.255134 | 5.208772 | 2.759891 | 1.38297 | 0.9747 | 0.261234 | 0.792961 | 1.845662 | 36.34525 | 27.86823 | 18.78243 | 5.30787 | 13.47456 | 3.286911 | 1.829837 | 5.116748 | 0.201447 | 6.428784 | 0.253102 |
| 224 | 9.31088 | 30.78958 | 20.05023 | 23.75048 | 1.762828 | 0.145134 | 0.061031 | 0.597886 | 0.251421 | 5.413901 | 2.805725 | 1.398443 | 0.975069 | 0.255778 | 0.792961 | 1.83951 | 36.13979 | 27.71069 | 18.28787 | 5.143061 | 13.14481 | 3.206513 | 1.91555 | 5.122063 | 0.201656 | 6.496757 | 0.255778 |
| 225 | 8.96713 | 30.59977 | 19.78345 | 23.46968 | 1.614932 | 0.143052 | 0.061031 | 0.602085 | 0.256872 | 4.964211 | 2.768374 | 1.404684 | 0.975445 | 0.250246 | 0.792961 | 1.833301 | 35.93121 | 27.55076 | 18.07166 | 5.069566 | 13.00209 | 3.193972 | 1.738934 | 4.932906 | 0.194209 | 6.182817 | 0.243418 |
| 226 | 8.84213 | 31.72083 | 20.28148 | 23.96202 | 1.671743 | 0.14696 | 0.061031 | 0.605568 | 0.251488 | 5.130119 | 2.908076 | 1.357793 | 0.975828 | 0.244641 | 0.792961 | 1.827037 | 35.71956 | 27.38847 | 18.45075 | 5.392524 | 13.05823 | 3.226318 | 2.00012 | 5.226438 | 0.205765 | 6.669919 | 0.262595 |
| 227 | 9.365972 | 30.24028 | 19.80313 | 23.30164 | 1.676586 | 0.143205 | 0.061031 | 0.599117 | 0.255333 | 5.153386 | 2.739324 | 1.287174 | 0.976218 | 0.238962 | 0.792961 | 1.82072 | 35.50489 | 27.22387 | 17.94226 | 5.310667 | 12.63159 | 3.087661 | 1.910785 | 4.998446 | 0.196789 | 6.375441 | 0.251002 |
| 228 | 8.637037 | 29.80995 | 19.2235 | 24.2907 | 1.730976 | 0.138764 | 0.061031 | 0.588695 | 0.258921 | 5.33112 | 2.658622 | 1.257118 | 0.976615 | 0.233213 | 0.792961 | 1.814353 | 35.28725 | 27.05699 | 18.70384 | 5.69764 | 13.0062 | 3.123927 | 1.934553 | 5.05848 | 0.199153 | 6.447544 | 0.25384 |
| 229 | 7.931944 | 29.73889 | 18.83542 | 23.86237 | 1.679939 | 0.135856 | 0.061031 | 0.586225 | 0.263353 | 5.180815 | 2.623868 | 1.258145 | 0.97702 | 0.227395 | 0.792961 | 1.807937 | 35.0667 | 26.88788 | 18.37402 | 5.576988 | 12.79704 | 3.060791 | 1.863373 | 4.924163 | 0.193865 | 6.262626 | 0.24656 |
| 230 | 7.738194 | 30.04977 | 18.89398 | 23.63246 | 1.661685 | 0.136291 | 0.061031 | 0.58796 | 0.263289 | 5.123492 | 2.654491 | 1.263449 | 0.977431 | 0.22151 | 0.792961 | 1.801474 | 34.84327 | 26.71657 | 18.197 | 5.547662 | 12.64933 | 3.034419 | 1.876458 | 4.910877 | 0.193342 | 6.26078 | 0.246487 |
| 231 | 8.043519 | 30.08218 | 19.06285 | 23.58138 | 1.675469 | 0.137554 | 0.061031 | 0.589468 | 0.261542 | 5.163005 | 2.669529 | 1.297958 | 0.977848 | 0.215558 | 0.792961 | 1.794967 | 34.61704 | 26.5431 | 18.15767 | 5.528186 | 12.62948 | 3.037427 | 1.852091 | 4.889518 | 0.192501 | 6.22099 | 0.244921 |
| 232 | 8.813194 | 29.95046 | 19.38183 | 22.05571 | 1.762269 | 0.139965 | 0.061031 | 0.589166 | 0.256904 | 5.424557 | 2.682338 | 1.295469 | 0.978273 | 0.209543 | 0.792961 | 1.788416 | 34.38804 | 26.36751 | 16.9829 | 5.094716 | 11.88818 | 2.857678 | 1.932731 | 4.790409 | 0.188599 | 6.181697 | 0.243374 |
| 233 | 8.388194 | 29.43403 | 18.91111 | 21.93151 | 1.593325 | 0.136419 | 0.061031 | 0.591806 | 0.264763 | 4.912429 | 2.604358 | 1.264025 | 0.978704 | 0.203466 | 0.792961 | 1.781825 | 34.15635 | 26.18986 | 16.88726 | 5.124564 | 11.7627 | 2.840184 | 1.743279 | 4.583463 | 0.180451 | 5.840788 | 0.229952 |
| 234 | 8.76713 | 28.71597 | 18.74155 | 21.12867 | 1.779405 | 0.13516 | 0.061031 | 0.5798 | 0.261807 | 5.489328 | 2.53526 | 1.271655 | 0.979141 | 0.197329 | 0.792961 | 1.775194 | 33.92201 | 26.01017 | 16.26907 | 4.874379 | 11.3947 | 2.695509 | 1.815986 | 4.511496 | 0.177618 | 5.81556 | 0.228959 |
| 235 | 8.103704 | 27.60139 | 17.85255 | 21.10676 | 1.664479 | 0.128721 | 0.061031 | 0.573901 | 0.272107 | 5.150483 | 2.386725 | 1.285888 | 0.979584 | 0.191133 | 0.792961 | 1.768526 | 33.68509 | 25.82851 | 16.2522 | 4.83282 | 11.41938 | 2.673869 | 1.542804 | 4.216673 | 0.166011 | 5.320247 | 0.209459 |
| 236 | 6.900926 | 28.49329 | 17.69711 | 22.495 | 1.581963 | 0.127623 | 0.061031 | 0.576224 | 0.275561 | 4.897766 | 2.442464 | 1.289651 | 0.980033 | 0.18488 | 0.792961 | 1.761822 | 33.44564 | 25.64491 | 17.32115 | 5.342262 | 11.97889 | 2.816231 | 1.555871 | 4.372102 | 0.17213 | 5.486555 | 0.216006 |
| 237 | 7.268287 | 29.71042 | 18.48935 | 21.75854 | 1.665969 | 0.133307 | 0.061031 | 0.582359 | 0.26662 | 5.143832 | 2.59678 | 1.30789 | 0.980488 | 0.178573 | 0.792961 | 1.755084 | 33.20373 | 25.45943 | 16.75407 | 5.174685 | 11.57939 | 2.751291 | 1.767645 | 4.518936 | 0.177911 | 5.790883 | 0.227988 |
| 238 | 7.943519 | 30.14977 | 19.04664 | 21.77872 | 1.748299 | 0.137432 | 0.061031 | 0.58546 | 0.259994 | 5.387732 | 2.67415 | 1.297375 | 0.980949 | 0.172213 | 0.792961 | 1.748314 | 32.95943 | 25.27211 | 16.76962 | 5.294593 | 11.47502 | 2.741014 | 1.928554 | 4.669568 | 0.183841 | 6.059383 | 0.238558 |
| 239 | 8.154167 | 29.86204 | 19.0081 | 22.19758 | 1.618844 | 0.137143 | 0.061031 | 0.59173 | 0.263331 | 4.989448 | 2.646844 | 1.273033 | 0.981416 | 0.165801 | 0.792961 | 1.741513 | 32.7128 | 25.08299 | 17.09213 | 5.539181 | 11.55295 | 2.78918 | 1.805019 | 4.594199 | 0.180874 | 5.89754 | 0.232187 |
| 240 | 8.403009 | 29.94792 | 19.17546 | 19.93473 | 1.761338 | 0.138401 | 0.061031 | 0.586491 | 0.258628 | 5.42552 | 2.666489 | 1.306213 | 0.981888 | 0.159341 | 0.792961 | 1.734682 | 32.4639 | 24.89215 | 15.34974 | 4.75086 | 10.59888 | 2.53619 | 1.908729 | 4.444919 | 0.174997 | 5.823376 | 0.229267 |
| 241 | 9.222917 | 28.63958 | 18.93125 | 20.98707 | 1.841432 | 0.136569 | 0.061031 | 0.579145 | 0.258814 | 5.676984 | 2.544231 | 1.290837 | 0.982366 | 0.152833 | 0.792961 | 1.727823 | 32.2128 | 24.69961 | 16.16004 | 5.181342 | 10.9787 | 2.594171 | 1.841594 | 4.435765 | 0.174636 | 5.758341 | 0.226706 |
| 242 | 7.546065 | 27.6169 | 17.58148 | 19.97358 | 1.61605 | 0.126811 | 0.061031 | 0.572829 | 0.275691 | 5.00529 | 2.368239 | 1.283171 | 0.982848 | 0.146281 | 0.792961 | 1.720938 | 31.95957 | 24.50545 | 15.37966 | 4.802953 | 10.57671 | 2.471926 | 1.4973 | 3.969225 | 0.156269 | 5.043903 | 0.198579 |
| 243 | 8.155556 | 27.73171 | 17.94363 | 20.72295 | 1.604874 | 0.129369 | 0.061031 | 0.578308 | 0.272824 | 4.964488 | 2.402735 | 1.271518 | 0.983336 | 0.139684 | 0.792961 | 1.714028 | 31.70429 | 24.30971 | 15.95667 | 5.170254 | 10.78642 | 2.545051 | 1.532156 | 4.077207 | 0.16052 | 5.178194 | 0.203866 |
| 244 | 7.076157 | 28.65972 | 17.86794 | 20.92666 | 1.623873 | 0.128831 | 0.061031 | 0.576273 | 0.273 | 5.024567 | 2.467344 | 1.29807 | 0.983829 | 0.133047 | 0.792961 | 1.707095 | 31.44702 | 24.11244 | 16.11352 | 5.259101 | 10.85442 | 2.552084 | 1.6039 | 4.155984 | 0.163621 | 5.309313 | 0.209028 |
| 245 | 7.360648 | 27.36991 | 17.36528 | 19.02588 | 1.579355 | 0.125304 | 0.061031 | 0.571882 | 0.278545 | 4.895281 | 2.335195 | 1.262951 | 0.984327 | 0.12637 | 0.792961 | 1.70014 | 31.18784 | 23.91372 | 14.64993 | 4.652808 | 9.997122 | 2.332607 | 1.462064 | 3.79467 | 0.149396 | 4.846547 | 0.190809 |
| 246 | 7.35 | 26.73912 | 17.04456 | 19.06353 | 1.739544 | 0.123097 | 0.061031 | 0.558959 | 0.277132 | 5.397757 | 2.268664 | 1.210767 | 0.984829 | 0.119655 | 0.792961 | 1.693163 | 30.92683 | 23.71358 | 14.67892 | 4.786594 | 9.892324 | 2.255998 | 1.5825 | 3.838497 | 0.151122 | 4.973426 | 0.195804 |
| 247 | 6.753009 | 26.89514 | 16.82407 | 19.08267 | 1.833237 | 0.121599 | 0.061031 | 0.55104 | 0.276572 | 5.692808 | 2.264229 | 1.200909 | 0.985336 | 0.112905 | 0.792961 | 1.686168 | 30.66406 | 23.5121 | 14.69365 | 4.85852 | 9.835133 | 2.211179 | 1.674167 | 3.885346 | 0.152966 | 5.084361 | 0.200172 |
| 248 | 7.693287 | 25.89514 | 16.79421 | 18.51056 | 1.844226 | 0.121397 | 0.061031 | 0.550061 | 0.276539 | 5.727525 | 2.195612 | 1.17865 | 0.985847 | 0.106122 | 0.792961 | 1.679154 | 30.39961 | 23.30933 | 14.25313 | 4.732559 | 9.520571 | 2.136652 | 1.61075 | 3.747402 | 0.147535 | 4.900242 | 0.192923 |
| 249 | 6.443981 | 25.60486 | 16.02442 | 18.87109 | 1.607295 | 0.116294 | 0.061031 | 0.551999 | 0.28969 | 5.004994 | 2.123981 | 1.154747 | 0.986362 | 0.099307 | 0.792961 | 1.672123 | 30.13356 | 23.10533 | 14.53074 | 4.924001 | 9.606741 | 2.163589 | 1.405292 | 3.568882 | 0.140507 | 4.576648 | 0.180183 |
| 250 | 6.065278 | 24.96852 | 15.5169 | 18.37461 | 1.594815 | 0.11303 | 0.061031 | 0.545631 | 0.294617 | 4.974869 | 2.050593 | 1.197777 | 0.986881 | 0.092463 | 0.792961 | 1.665076 | 29.86598 | 22.90016 | 14.14845 | 4.693039 | 9.45541 | 2.10494 | 1.249954 | 3.354895 | 0.132082 | 4.247257 | 0.167215 |
| 251 | 5.646991 | 25.87824 | 15.76262 | 19.32718 | 1.565758 | 0.114601 | 0.061031 | 0.55064 | 0.293247 | 4.88007 | 2.124911 | 1.216078 | 0.987404 | 0.085591 | 0.792961 | 1.658015 | 29.59697 | 22.69389 | 14.88193 | 5.108822 | 9.773103 | 2.195637 | 1.300602 | 3.496239 | 0.137647 | 4.42652 | 0.174272 |
| 252 | 6.027778 | 24.92708 | 15.47743 | 17.95991 | 1.59407 | 0.11278 | 0.061031 | 0.545122 | 0.294995 | 4.973225 | 2.045477 | 1.141964 | 0.987931 | 0.078694 | 0.792961 | 1.650941 | 29.32661 | 22.48659 | 13.82913 | 4.748746 | 9.080382 | 2.019566 | 1.325524 | 3.34509 | 0.131696 | 4.29526 | 0.169105 |
| 253 | 6.583333 | 25.4294 | 16.00637 | 18.65764 | 1.623873 | 0.116177 | 0.061031 | 0.550849 | 0.289379 | 5.056932 | 2.111631 | 1.178 | 0.988462 | 0.071773 | 0.792961 | 1.643854 | 29.05497 | 22.27831 | 14.36638 | 5.064221 | 9.30216 | 2.090629 | 1.36625 | 3.456878 | 0.136098 | 4.436133 | 0.174651 |
| 254 | 5.391435 | 26.60764 | 15.99954 | 18.88503 | 1.657587 | 0.116132 | 0.061031 | 0.548934 | 0.288483 | 5.162044 | 2.190262 | 1.199606 | 0.988996 | 0.064832 | 0.792961 | 1.636756 | 28.78215 | 22.06912 | 14.54147 | 5.193746 | 9.347729 | 2.093563 | 1.475247 | 3.568811 | 0.140504 | 4.627709 | 0.182193 |
| 255 | 6.292593 | 27.3544 | 16.8235 | 19.17411 | 1.671185 | 0.121595 | 0.061031 | 0.559559 | 0.280857 | 5.189593 | 2.297183 | 1.194143 | 0.989533 | 0.057871 | 0.792961 | 1.629649 | 28.50823 | 21.85909 | 14.76407 | 5.4514 | 9.312667 | 2.126084 | 1.607718 | 3.733802 | 0.147 | 4.892396 | 0.192614 |
| 256 | 6.493056 | 27.10278 | 16.79792 | 18.807 | 1.738054 | 0.121422 | 0.061031 | 0.555658 | 0.279296 | 5.397723 | 2.277204 | 1.18556 | 0.990073 | 0.050893 | 0.792961 | 1.622533 | 28.23331 | 21.64828 | 14.48139 | 5.38929 | 9.092101 | 2.061256 | 1.645719 | 3.706975 | 0.145944 | 4.89199 | 0.192598 |
| 257 | 5.886806 | 26.04282 | 15.96481 | 16.80756 | 1.645107 | 0.115907 | 0.061031 | 0.549125 | 0.289145 | 5.123795 | 2.148883 | 1.137144 | 0.990616 | 0.0439 | 0.792961 | 1.615409 | 27.95746 | 21.43678 | 12.94182 | 4.662836 | 8.278985 | 1.854849 | 1.498912 | 3.353762 | 0.132038 | 4.435194 | 0.174614 |
| 258 | 6.649537 | 25.73472 | 16.19213 | 17.0337 | 1.681802 | 0.11739 | 0.061031 | 0.5503 | 0.286103 | 5.233965 | 2.143544 | 1.158139 | 0.991162 | 0.036894 | 0.792961 | 1.608278 | 27.68079 | 21.22463 | 13.11595 | 4.803848 | 8.3121 | 1.866253 | 1.475597 | 3.34185 | 0.131569 | 4.404759 | 0.173416 |
| 259 | 7.066667 | 24.00995 | 15.53831 | 15.10133 | 1.519936 | 0.113167 | 0.061031 | 0.550053 | 0.296647 | 4.740939 | 1.996077 | 1.166358 | 0.991711 | 0.029877 | 0.792961 | 1.601142 | 27.40338 | 21.01192 | 11.62803 | 4.009144 | 7.618883 | 1.709841 | 1.166904 | 2.876745 | 0.113258 | 3.717295 | 0.14635 |
| 260 | 6.81088 | 23.34769 | 15.07928 | 14.74837 | 1.672302 | 0.110279 | 0.061031 | 0.535305 | 0.296252 | 5.224506 | 1.928993 | 1.171879 | 0.992262 | 0.022851 | 0.792961 | 1.594002 | 27.12532 | 20.79872 | 11.35624 | 3.892168 | 7.464076 | 1.630186 | 1.171837 | 2.802023 | 0.110316 | 3.641293 | 0.143358 |
| 261 | 5.424074 | 23.23542 | 14.32975 | 15.44399 | 1.60357 | 0.105699 | 0.061031 | 0.52848 | 0.305149 | 5.022845 | 1.874082 | 1.134725 | 0.992815 | 0.015818 | 0.792961 | 1.586858 | 26.84671 | 20.58509 | 11.89187 | 4.261715 | 7.630157 | 1.645213 | 1.133223 | 2.778436 | 0.109387 | 3.589572 | 0.141322 |
| 262 | 6.47037 | 22.79306 | 14.63171 | 15.76559 | 1.842177 | 0.107524 | 0.061031 | 0.519988 | 0.295148 | 5.764175 | 1.870233 | 1.134039 | 0.993371 | 0.008781 | 0.792961 | 1.579711 | 26.56764 | 20.37111 | 12.1395 | 4.482843 | 7.656659 | 1.6244 | 1.252477 | 2.876877 | 0.113263 | 3.769054 | 0.148388 |
| 263 | 5.041667 | 23.04792 | 14.04479 | 16.82078 | 1.966231 | 0.104001 | 0.061031 | 0.505268 | 0.29651 | 6.164919 | 1.846221 | 1.106332 | 0.993928 | 0.001741 | 0.792961 | 1.572564 | 26.2882 | 20.15685 | 12.952 | 5.022778 | 7.929225 | 1.634603 | 1.352486 | 2.98709 | 0.117602 | 3.946979 | 0.155393 |
| 264 | 4.174306 | 21.84769 | 13.011 | 15.09762 | 1.721663 | 0.098032 | 0.061031 | 0.503274 | 0.31332 | 5.417612 | 1.721389 | 1.040027 | 0.994487 | -0.0053 | 0.792961 | 1.565416 | 26.0085 | 19.94238 | 11.62517 | 4.383253 | 7.241913 | 1.487023 | 1.156573 | 2.643597 | 0.104079 | 3.468317 | 0.136548 |
| 265 | 3.710185 | 23.17245 | 13.44132 | 16.33975 | 1.638402 | 0.10048 | 0.061031 | 0.51394 | 0.312166 | 5.147866 | 1.817848 | 1.096912 | 0.995048 | -0.01234 | 0.792961 | 1.558269 | 25.72863 | 19.72779 | 12.58161 | 4.947799 | 7.633812 | 1.600716 | 1.158535 | 2.759251 | 0.108632 | 3.586951 | 0.141219 |
| 266 | 3.874306 | 23.14606 | 13.51019 | 15.52479 | 1.685527 | 0.100877 | 0.061031 | 0.512367 | 0.309987 | 5.294661 | 1.820224 | 1.060334 | 0.995611 | -0.01937 | 0.792961 | 1.551124 | 25.44868 | 19.51313 | 11.95409 | 4.727216 | 7.226875 | 1.510746 | 1.247188 | 2.757935 | 0.10858 | 3.651652 | 0.143766 |
| 267 | 3.589815 | 23.5331 | 13.56146 | 16.36336 | 1.648274 | 0.101173 | 0.061031 | 0.515118 | 0.310739 | 5.176713 | 1.845695 | 1.027068 | 0.996174 | -0.0264 | 0.792961 | 1.543981 | 25.16875 | 19.29849 | 12.59979 | 5.25482 | 7.344965 | 1.543679 | 1.31685 | 2.860529 | 0.112619 | 3.806756 | 0.149872 |
| 268 | 4.577546 | 23.43981 | 14.00868 | 14.45903 | 1.723712 | 0.103787 | 0.061031 | 0.517417 | 0.304265 | 5.405204 | 1.865983 | 1.062087 | 0.996739 | -0.03342 | 0.792961 | 1.536843 | 24.88894 | 19.08395 | 11.13345 | 4.419297 | 6.714154 | 1.4174 | 1.322099 | 2.739499 | 0.107854 | 3.690379 | 0.145291 |
| 269 | 3.857176 | 23.33889 | 13.59803 | 16.03145 | 1.766553 | 0.101385 | 0.061031 | 0.509283 | 0.306578 | 5.547483 | 1.836332 | 1.084392 | 0.997305 | -0.04044 | 0.792961 | 1.529709 | 24.60935 | 18.86957 | 12.34422 | 5.166888 | 7.177328 | 1.491359 | 1.27885 | 2.770209 | 0.109063 | 3.685039 | 0.14508 |
| 270 | 4.357971 | 23.25995 | 13.80896 | 15.52539 | 1.803434 | 0.102613 | 0.061031 | 0.510342 | 0.303538 | 5.659134 | 1.843948 | 1.102089 | 0.997871 | -0.04744 | 0.792961 | 1.522582 | 24.33008 | 18.65543 | 11.95455 | 4.996841 | 6.957707 | 1.448729 | 1.274339 | 2.723068 | 0.107207 | 3.634635 | 0.143096 |
| 271 | 3.767824 | 24.22685 | 13.99734 | 15.45521 | 1.619589 | 0.10372 | 0.061031 | 0.52289 | 0.307682 | 5.078897 | 1.912428 | 1.145465 | 0.998438 | -0.05442 | 0.792961 | 1.515462 | 24.05122 | 18.44161 | 11.90051 | 4.991452 | 6.909056 | 1.473973 | 1.198521 | 2.672494 | 0.105216 | 3.534229 | 0.139143 |
| 272 | 4.606713 | 23.67894 | 14.14282 | 13.67817 | 1.613069 | 0.104582 | 0.061031 | 0.525312 | 0.306558 | 5.05589 | 1.887773 | 1.132279 | 0.999006 | -0.06139 | 0.792961 | 1.50835 | 23.77287 | 18.22818 | 10.53219 | 4.259001 | 6.273191 | 1.344516 | 1.17096 | 2.515476 | 0.099034 | 3.359766 | 0.132274 |
| 273 | 5.684028 | 23.21829 | 14.45116 | 13.24644 | 1.786856 | 0.10643 | 0.061031 | 0.520338 | 0.298384 | 5.594587 | 1.880797 | 1.100125 | 0.999574 | -0.06834 | 0.792961 | 1.501247 | 23.49513 | 18.01522 | 10.19976 | 4.187778 | 6.011983 | 1.276331 | 1.303205 | 2.579536 | 0.101557 | 3.51811 | 0.138508 |
| 274 | 4.57037 | 22.19884 | 13.38461 | 13.1106 | 1.719055 | 0.100155 | 0.061031 | 0.508767 | 0.310028 | 5.402349 | 1.761319 | 1.112647 | 1.000142 | -0.07527 | 0.792961 | 1.494155 | 23.2181 | 17.80281 | 10.09516 | 4.118482 | 5.976678 | 1.240621 | 1.086447 | 2.327068 | 0.091617 | 3.105871 | 0.122278 |
| 275 | 2.809954 | 19.89236 | 11.35116 | 14.13024 | 1.801199 | 0.08906 | 0.061031 | 0.47507 | 0.325557 | 5.700975 | 1.535176 | 0.950018 | 1.00071 | -0.08218 | 0.792961 | 1.487074 | 22.94189 | 17.59101 | 10.88029 | 4.828319 | 6.051966 | 1.173044 | 1.086048 | 2.259092 | 0.088941 | 3.032662 | 0.119396 |
| 276 | 3.234259 | 18.64977 | 10.94201 | 12.60881 | 1.959712 | 0.08696 | 0.061031 | 0.460942 | 0.323506 | 6.211622 | 1.460147 | 0.950325 | 1.001278 | -0.08907 | 0.792961 | 1.480007 | 22.66658 | 17.37992 | 9.708784 | 4.109703 | 5.599081 | 1.052987 | 1.024486 | 2.077473 | 0.08179 | 2.803209 | 0.110363 |
| 277 | 2.76412 | 18.25 | 10.50706 | 12.97432 | 1.807159 | 0.084773 | 0.061031 | 0.462471 | 0.332952 | 5.73687 | 1.420916 | 0.945844 | 1.001845 | -0.09593 | 0.792961 | 1.472953 | 22.39228 | 17.16959 | 9.990224 | 4.356076 | 5.634148 | 1.063097 | 0.907435 | 1.970532 | 0.07758 | 2.613415 | 0.10289 |
| 278 | 1.78588 | 18.29144 | 10.03866 | 13.15737 | 1.725761 | 0.08247 | 0.061031 | 0.459926 | 0.340363 | 5.487535 | 1.398508 | 0.93319 | 1.002412 | -0.10276 | 0.792961 | 1.465914 | 22.11908 | 16.96011 | 10.13117 | 4.525831 | 5.605343 | 1.05184 | 0.869102 | 1.920942 | 0.075628 | 2.537295 | 0.099894 |
| 279 | 1.677778 | 19.06528 | 10.37153 | 13.71006 | 1.707879 | 0.084101 | 0.061031 | 0.465748 | 0.337989 | 5.424296 | 1.447946 | 0.946734 | 1.002978 | -0.10955 | 0.792961 | 1.458891 | 21.84708 | 16.75155 | 10.55675 | 4.90178 | 5.654967 | 1.074585 | 0.9189 | 1.993485 | 0.078484 | 2.647065 | 0.104215 |
| 280 | 3.287731 | 17.64606 | 10.4669 | 10.74321 | 1.529994 | 0.084573 | 0.061031 | 0.476864 | 0.344124 | 4.857692 | 1.395941 | 0.934047 | 1.003544 | -0.11632 | 0.792961 | 1.451886 | 21.57638 | 16.54399 | 8.272269 | 3.433604 | 4.838665 | 0.941412 | 0.772123 | 1.713536 | 0.067462 | 2.266346 | 0.089226 |
| 281 | 2.552083 | 18.66019 | 10.60613 | 11.60099 | 1.694095 | 0.085267 | 0.061031 | 0.469914 | 0.336351 | 5.376068 | 1.442626 | 0.972768 | 1.004108 | -0.12305 | 0.792961 | 1.4449 | 21.30708 | 16.3375 | 8.932766 | 3.925707 | 5.007059 | 0.959978 | 0.849616 | 1.809594 | 0.071244 | 2.415355 | 0.095093 |
| 282 | 1.924769 | 18.96921 | 10.44699 | 12.86366 | 1.931958 | 0.084474 | 0.061031 | 0.455154 | 0.328841 | 6.134347 | 1.447514 | 0.93399 | 1.004671 | -0.12975 | 0.792961 | 1.437934 | 21.03926 | 16.13215 | 9.905021 | 4.742611 | 5.16241 | 0.958674 | 1.035894 | 1.994568 | 0.078526 | 2.730865 | 0.107514 |
| 283 | 1.991435 | 17.39884 | 9.695139 | 10.44455 | 1.870862 | 0.080816 | 0.061031 | 0.447315 | 0.337808 | 5.956155 | 1.34623 | 0.875942 | 1.005232 | -0.13641 | 0.792961 | 1.43099 | 20.77304 | 15.92802 | 8.042302 | 3.526013 | 4.516289 | 0.824243 | 0.946238 | 1.770481 | 0.069704 | 2.444644 | 0.096246 |
| 284 | 2.352315 | 14.89144 | 8.621875 | 10.10517 | 1.866765 | 0.075828 | 0.061031 | 0.431833 | 0.347566 | 5.965758 | 1.208548 | 0.818373 | 1.005793 | -0.14302 | 0.792961 | 1.424068 | 20.50849 | 15.72517 | 7.780983 | 3.423161 | 4.357822 | 0.767796 | 0.809026 | 1.576822 | 0.06208 | 2.150259 | 0.084656 |
| 285 | 0.97662 | 16.0544 | 8.515509 | 11.30269 | 1.744015 | 0.075349 | 0.061031 | 0.436628 | 0.353663 | 5.575584 | 1.240108 | 0.836742 | 1.006351 | -0.1496 | 0.792961 | 1.417171 | 20.24572 | 15.52369 | 8.703068 | 4.157958 | 4.545109 | 0.809685 | 0.795387 | 1.605072 | 0.063192 | 2.170165 | 0.08544 |
| 286 | 1.538657 | 17.92153 | 9.730093 | 11.94353 | 2.049306 | 0.080983 | 0.061031 | 0.43884 | 0.330724 | 6.523449 | 1.368254 | 0.872764 | 1.006907 | -0.15613 | 0.792961 | 1.410299 | 19.98482 | 15.32364 | 9.196516 | 4.636219 | 4.560297 | 0.816506 | 1.069 | 1.885506 | 0.074233 | 2.645238 | 0.104143 |
| 287 | 2.987963 | 17.43102 | 10.20949 | 10.43794 | 1.954496 | 0.083304 | 0.061031 | 0.450553 | 0.330092 | 6.211114 | 1.374207 | 0.915027 | 1.007462 | -0.16261 | 0.792961 | 1.403454 | 19.72587 | 15.12509 | 8.037211 | 3.804151 | 4.23306 | 0.778145 | 0.941427 | 1.719572 | 0.0677 | 2.390113 | 0.094099 |
| 288 | 1.818519 | 16.57616 | 9.197338 | 10.35952 | 1.874774 | 0.078469 | 0.061031 | 0.43984 | 0.342098 | 5.979137 | 1.29141 | 0.880747 | 1.008014 | -0.16905 | 0.792961 | 1.396638 | 19.46897 | 14.92811 | 7.976831 | 3.830892 | 4.14594 | 0.744009 | 0.839992 | 1.584001 | 0.062362 | 2.181366 | 0.085881 |
| 289 | 2.471528 | 17.03426 | 9.752894 | 10.74186 | 1.955427 | 0.081092 | 0.061031 | 0.443854 | 0.334053 | 6.224109 | 1.335876 | 0.912058 | 1.008564 | -0.17543 | 0.792961 | 1.389852 | 19.21422 | 14.73277 | 8.271235 | 4.126548 | 4.144687 | 0.750572 | 0.881193 | 1.631765 | 0.064243 | 2.258135 | 0.088903 |
| 290 | 1.552083 | 17.54838 | 9.550231 | 10.8144 | 2.018944 | 0.080127 | 0.061031 | 0.437725 | 0.333409 | 6.430892 | 1.344721 | 0.876607 | 1.009111 | -0.18177 | 0.792961 | 1.383098 | 18.96168 | 14.53914 | 8.327088 | 4.30099 | 4.026098 | 0.719028 | 1.003693 | 1.722721 | 0.067824 | 2.437733 | 0.095974 |
| 291 | 1.54838 | 17.44792 | 9.498148 | 10.79432 | 1.821129 | 0.07988 | 0.061031 | 0.447004 | 0.341528 | 5.801866 | 1.338289 | 0.891897 | 1.009656 | -0.18805 | 0.792961 | 1.376377 | 18.71147 | 14.34728 | 8.311627 | 4.349559 | 3.962068 | 0.722592 | 0.884525 | 1.607117 | 0.063272 | 2.239368 | 0.088164 |
| 292 | 2.478935 | 16.89074 | 9.684838 | 8.947122 | 1.96977 | 0.080767 | 0.061031 | 0.442141 | 0.334103 | 6.27127 | 1.327275 | 0.901767 | 1.010198 | -0.19427 | 0.792961 | 1.369691 | 18.46365 | 14.15726 | 6.889284 | 3.282051 | 3.607233 | 0.650721 | 0.891546 | 1.542267 | 0.060719 | 2.178348 | 0.085762 |
| 293 | 1.972454 | 16.35463 | 9.163542 | 10.10582 | 1.833609 | 0.078312 | 0.061031 | 0.441462 | 0.344049 | 5.848552 | 1.282068 | 0.88834 | 1.010736 | -0.20044 | 0.792961 | 1.363042 | 18.21832 | 13.96915 | 7.78148 | 4.076803 | 3.704678 | 0.667273 | 0.792255 | 1.459529 | 0.057462 | 2.024638 | 0.07971 |
| 294 | 1.644213 | 15.33681 | 8.490509 | 9.064666 | 1.770837 | 0.075236 | 0.061031 | 0.434857 | 0.352755 | 5.661837 | 1.215277 | 0.891279 | 1.011272 | -0.20655 | 0.792961 | 1.356431 | 17.97555 | 13.783 | 6.979793 | 3.46109 | 3.518703 | 0.624295 | 0.647101 | 1.271396 | 0.050055 | 1.731433 | 0.068167 |
| 295 | 1.520833 | 15.69444 | 8.607639 | 10.0019 | 2.017827 | 0.075764 | 0.061031 | 0.424052 | 0.341594 | 6.448845 | 1.232454 | 0.870708 | 1.011804 | -0.21259 | 0.792961 | 1.34986 | 17.73543 | 13.59889 | 7.701462 | 4.175684 | 3.525778 | 0.610007 | 0.796884 | 1.406891 | 0.055389 | 1.972311 | 0.07765 |
| 296 | 0.623148 | 14.58056 | 7.601852 | 8.921547 | 1.941644 | 0.071334 | 0.061031 | 0.413158 | 0.353485 | 6.227612 | 1.149449 | 0.820415 | 1.012333 | -0.21857 | 0.792961 | 1.343331 | 17.49803 | 13.41686 | 6.869592 | 3.570448 | 3.299144 | 0.556132 | 0.724327 | 1.280459 | 0.050412 | 1.794557 | 0.070652 |
| 297 | 0.555787 | 14.2287 | 7.392245 | 9.66282 | 1.799895 | 0.07044 | 0.061031 | 0.417246 | 0.361518 | 5.777283 | 1.129219 | 0.818961 | 1.012858 | -0.22449 | 0.792961 | 1.336846 | 17.26345 | 13.23699 | 7.440372 | 4.132048 | 3.308323 | 0.563198 | 0.648001 | 1.211198 | 0.047685 | 1.671689 | 0.065815 |
| 298 | -0.25532 | 15.48333 | 7.614005 | 9.382183 | 2.132567 | 0.071386 | 0.061031 | 0.404066 | 0.345454 | 6.839681 | 1.179342 | 0.816675 | 1.013379 | -0.23034 | 0.792961 | 1.330407 | 17.03174 | 13.05932 | 7.224281 | 4.051342 | 3.172939 | 0.523088 | 0.856909 | 1.379997 | 0.054331 | 1.987902 | 0.078264 |
| 299 | 0.559722 | 13.71435 | 7.137037 | 7.652563 | 2.128655 | 0.069363 | 0.061031 | 0.397347 | 0.349619 | 6.83876 | 1.102673 | 0.785351 | 1.013896 | -0.23613 | 0.792961 | 1.324015 | 16.80299 | 12.88393 | 5.892474 | 2.962638 | 2.929836 | 0.474978 | 0.758703 | 1.233681 | 0.04857 | 1.771061 | 0.069727 |
| 300 | 0.260648 | 12.11551 | 6.188079 | 7.196272 | 1.843481 | 0.065483 | 0.061031 | 0.397426 | 0.370408 | 5.942707 | 1.017883 | 0.78668 | 1.014409 | -0.24184 | 0.792961 | 1.317673 | 16.57726 | 12.71085 | 5.541129 | 2.676964 | 2.864165 | 0.464424 | 0.508932 | 0.973356 | 0.038321 | 1.332788 | 0.052472 |
| 301 | 0.622685 | 11.88472 | 6.253704 | 6.857158 | 2.398928 | 0.065745 | 0.061031 | 0.372377 | 0.345677 | 7.731448 | 1.015489 | 0.758626 | 1.014918 | -0.24748 | 0.792961 | 1.311383 | 16.35464 | 12.54015 | 5.280012 | 2.535981 | 2.744031 | 0.4169 | 0.68649 | 1.10339 | 0.043441 | 1.58476 | 0.062392 |
| 302 | 0.104861 | 11.08148 | 5.593171 | 7.612021 | 1.99622 | 0.063147 | 0.061031 | 0.381319 | 0.368545 | 6.448822 | 0.967659 | 0.731659 | 1.015423 | -0.25305 | 0.792961 | 1.305146 | 16.13519 | 12.37188 | 5.861256 | 3.140918 | 2.720338 | 0.423225 | 0.560896 | 0.984121 | 0.038745 | 1.37977 | 0.054322 |
| 303 | -0.66921 | 11.1919 | 5.261343 | 7.149502 | 2.387566 | 0.061875 | 0.061031 | 0.358799 | 0.353908 | 7.722271 | 0.955619 | 0.71941 | 1.015923 | -0.25855 | 0.792961 | 1.298966 | 15.91897 | 12.20609 | 5.505116 | 2.880888 | 2.624228 | 0.384161 | 0.645553 | 1.029714 | 0.04054 | 1.48173 | 0.058336 |
| 304 | -1.01829 | 11.35394 | 5.167824 | 8.163021 | 1.94481 | 0.06152 | 0.061031 | 0.377639 | 0.374637 | 6.29235 | 0.955455 | 0.693712 | 1.016418 | -0.26396 | 0.792961 | 1.292843 | 15.70605 | 12.04284 | 6.285526 | 3.72522 | 2.560307 | 0.394484 | 0.617019 | 1.011503 | 0.039823 | 1.449172 | 0.057054 |
| 305 | -0.9529 | 10.79348 | 4.92029 | 7.597659 | 1.84783 | 0.060591 | 0.061031 | 0.378772 | 0.381528 | 5.9839 | 0.93226 | 0.660794 | 1.016908 | -0.2693 | 0.792961 | 1.286781 | 15.4965 | 11.88216 | 5.850197 | 3.412595 | 2.437602 | 0.376705 | 0.619764 | 0.996468 | 0.039231 | 1.437956 | 0.056612 |
| 306 | -1.23913 | 10.58188 | 4.671377 | 7.319437 | 2.244918 | 0.059668 | 0.061031 | 0.356688 | 0.36484 | 7.276322 | 0.917268 | 0.665239 | 1.017394 | -0.27456 | 0.792961 | 1.280782 | 15.29038 | 11.72411 | 5.635966 | 3.25984 | 2.376126 | 0.345795 | 0.669061 | 1.014855 | 0.039955 | 1.486535 | 0.058525 |
| 307 | -0.29879 | 11.21643 | 5.458816 | 7.721078 | 2.356095 | 0.062629 | 0.061031 | 0.36296 | 0.3537 | 7.615078 | 0.964682 | 0.694177 | 1.017874 | -0.27974 | 0.792961 | 1.274847 | 15.08774 | 11.56874 | 5.94523 | 3.645571 | 2.299659 | 0.340551 | 0.728594 | 1.069145 | 0.042092 | 1.583059 | 0.062325 |
| 308 | -0.0971 | 10.37343 | 5.138164 | 6.06194 | 2.22451 | 0.061408 | 0.061031 | 0.364226 | 0.36199 | 7.198073 | 0.932764 | 0.722105 | 1.018349 | -0.28483 | 0.792961 | 1.268979 | 14.88865 | 11.41608 | 4.667694 | 2.389844 | 2.27785 | 0.338498 | 0.548898 | 0.887396 | 0.034937 | 1.273303 | 0.05013 |
| 309 | 0.392995 | 11.47415 | 5.933575 | 6.304611 | 2.119164 | 0.064475 | 0.061031 | 0.380426 | 0.360109 | 6.837641 | 0.991579 | 0.747129 | 1.018818 | -0.28984 | 0.792961 | 1.263181 | 14.69315 | 11.26618 | 4.85455 | 2.647672 | 2.206879 | 0.342538 | 0.601909 | 0.944447 | 0.037183 | 1.370756 | 0.053967 |
| 310 | 0.457488 | 10.82585 | 5.641667 | 5.653982 | 2.373199 | 0.063335 | 0.061031 | 0.364806 | 0.35154 | 7.665327 | 0.964517 | 0.727631 | 1.019282 | -0.29477 | 0.792961 | 1.257456 | 14.50131 | 11.11908 | 4.353566 | 2.203168 | 2.150398 | 0.320067 | 0.638328 | 0.958395 | 0.037732 | 1.40789 | 0.055429 |
| 311 | 0.091063 | 10.70628 | 5.398671 | 6.288901 | 2.343656 | 0.062399 | 0.061031 | 0.362651 | 0.354705 | 7.57651 | 0.951082 | 0.694091 | 1.01974 | -0.2996 | 0.792961 | 1.251804 | 14.31317 | 10.97483 | 4.842454 | 2.799179 | 2.043275 | 0.302326 | 0.690643 | 0.992969 | 0.039093 | 1.480893 | 0.058303 |
| 312 | 0.28744 | 10.06087 | 5.174155 | 5.709576 | 2.513337 | 0.061544 | 0.061031 | 0.352227 | 0.349291 | 8.131607 | 0.928338 | 0.702034 | 1.020192 | -0.30435 | 0.792961 | 1.24623 | 14.12879 | 10.83345 | 4.396373 | 2.373265 | 2.023108 | 0.290738 | 0.642773 | 0.933511 | 0.036752 | 1.384817 | 0.05452 |
| 313 | -0.10483 | 9.938406 | 4.916787 | 6.175639 | 2.242197 | 0.060577 | 0.061031 | 0.360289 | 0.362988 | 7.261085 | 0.91453 | 0.706605 | 1.020639 | -0.30901 | 0.792961 | 1.240735 | 13.94821 | 10.69499 | 4.755242 | 2.805041 | 1.950201 | 0.286675 | 0.548024 | 0.834699 | 0.032862 | 1.221183 | 0.048078 |
| 314 | -0.44807 | 8.982126 | 4.267029 | 5.70477 | 2.146764 | 0.058194 | 0.061031 | 0.355336 | 0.37266 | 6.968327 | 0.868921 | 0.684721 | 1.021079 | -0.31358 | 0.792961 | 1.235322 | 13.77148 | 10.55948 | 4.392673 | 2.473895 | 1.918778 | 0.278179 | 0.478333 | 0.756512 | 0.029784 | 1.093555 | 0.043053 |
| 315 | -0.44807 | 8.574396 | 4.063164 | 5.649832 | 2.518779 | 0.057463 | 0.061031 | 0.336513 | 0.357408 | 8.181892 | 0.853317 | 0.639947 | 1.021513 | -0.31805 | 0.792961 | 1.229993 | 13.59864 | 10.42695 | 4.35037 | 2.52292 | 1.827451 | 0.250904 | 0.623953 | 0.874857 | 0.034443 | 1.312877 | 0.051688 |
| 316 | 0.005797 | 8.593478 | 4.299638 | 4.698718 | 2.539382 | 0.058312 | 0.061031 | 0.338949 | 0.354757 | 8.241783 | 0.863984 | 0.680733 | 1.02194 | -0.32243 | 0.792961 | 1.224752 | 13.42973 | 10.29744 | 3.618013 | 1.737692 | 1.880321 | 0.260032 | 0.535795 | 0.795827 | 0.031332 | 1.170382 | 0.046078 |
| 317 | -1.11884 | 8.735749 | 3.808454 | 5.990291 | 2.42354 | 0.056561 | 0.061031 | 0.336908 | 0.363536 | 7.879766 | 0.845272 | 0.643623 | 1.022361 | -0.32671 | 0.792961 | 1.219601 | 13.2648 | 10.17097 | 4.612524 | 2.929487 | 1.683038 | 0.231348 | 0.57764 | 0.808988 | 0.03185 | 1.215429 | 0.047852 |
| 318 | -0.31812 | 8.458696 | 4.07029 | 5.137149 | 2.74813 | 0.057489 | 0.061031 | 0.327486 | 0.347667 | 8.926676 | 0.851775 | 0.620666 | 1.022776 | -0.3309 | 0.792961 | 1.214542 | 13.10388 | 10.04758 | 3.955605 | 2.266838 | 1.688767 | 0.225643 | 0.717248 | 0.942892 | 0.037122 | 1.445508 | 0.05691 |
| 319 | -0.63382 | 7.590821 | 3.478502 | 4.563011 | 2.852115 | 0.05541 | 0.061031 | 0.315504 | 0.34751 | 9.284279 | 0.813215 | 0.610657 | 1.023183 | -0.33499 | 0.792961 | 1.209579 | 12.94701 | 9.927299 | 3.513519 | 1.793653 | 1.719866 | 0.221391 | 0.653527 | 0.874918 | 0.034446 | 1.33047 | 0.052381 |
| 320 | -0.43043 | 7.6843 | 3.626932 | 4.613908 | 2.630928 | 0.055925 | 0.061031 | 0.326 | 0.355764 | 8.559668 | 0.820924 | 0.646953 | 1.023584 | -0.33898 | 0.792961 | 1.204713 | 12.79422 | 9.810144 | 3.552709 | 1.866908 | 1.685801 | 0.224225 | 0.529782 | 0.754007 | 0.029685 | 1.123979 | 0.044251 |
| 321 | -1.2715 | 7.622464 | 3.175483 | 5.24424 | 2.386999 | 0.054371 | 0.061031 | 0.329654 | 0.370034 | 7.778747 | 0.801016 | 0.617563 | 1.023978 | -0.34287 | 0.792961 | 1.199948 | 12.64554 | 9.696144 | 4.038065 | 2.503453 | 1.534612 | 0.206404 | 0.528053 | 0.734457 | 0.028916 | 1.106085 | 0.043547 |
| 322 | -0.49565 | 6.930435 | 3.217391 | 4.177261 | 2.943661 | 0.054514 | 0.061031 | 0.308637 | 0.345535 | 9.591341 | 0.793099 | 0.617721 | 1.024365 | -0.34665 | 0.792961 | 1.195286 | 12.50101 | 9.585322 | 3.216491 | 1.569568 | 1.646924 | 0.207387 | 0.58123 | 0.788617 | 0.031048 | 1.19218 | 0.046936 |
| 323 | -0.99879 | 7.954589 | 3.477899 | 5.369243 | 2.899152 | 0.055408 | 0.061031 | 0.313752 | 0.345593 | 9.437414 | 0.818629 | 0.61279 | 1.024744 | -0.35034 | 0.792961 | 1.190729 | 12.36065 | 9.477701 | 4.134317 | 2.748634 | 1.385683 | 0.177382 | 0.671344 | 0.848727 | 0.033414 | 1.31806 | 0.051892 |
| 324 | -2.61594 | 6.952415 | 2.168237 | 5.569955 | 2.486709 | 0.051037 | 0.061031 | 0.31183 | 0.372895 | 8.133343 | 0.751217 | 0.579629 | 1.025116 | -0.35392 | 0.792961 | 1.186282 | 12.22449 | 9.373302 | 4.288865 | 2.979375 | 1.30949 | 0.166602 | 0.520405 | 0.687007 | 0.027048 | 1.05272 | 0.041446 |
| 325 | -2.6686 | 6.697101 | 2.014251 | 5.742979 | 2.609742 | 0.050543 | 0.061031 | 0.304975 | 0.368262 | 8.54053 | 0.741542 | 0.565049 | 1.025481 | -0.3574 | 0.792961 | 1.181946 | 12.09257 | 9.272144 | 4.422094 | 3.214085 | 1.208009 | 0.150313 | 0.555098 | 0.705411 | 0.027772 | 1.095057 | 0.043112 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 326 | -3.02802 | 5.817391 | 1.394686 | 4.740186 | 2.721891 | 0.048597 | 0.061031 | 0.29256 | 0.367417 | 8.927656 | 0.705978 | 0.517026 | 1.025838 | -0.36077 | 0.792961 | 1.177723 | 11.96489 | 9.174246 | 3.649943 | 2.320816 | 1.329127 | 0.158651 | 0.619794 | 0.778445 | 0.030647 | 1.212023 | 0.047717 |
| 327 | -2.98841 | 5.537681 | 1.274638 | 4.970551 | 2.591666 | 0.048227 | 0.061031 | 0.295806 | 0.374339 | 8.504247 | 0.697824 | 0.546216 | 1.026188 | -0.36403 | 0.792961 | 1.173618 | 11.84149 | 9.079626 | 3.827324 | 2.562907 | 1.264417 | 0.152601 | 0.482642 | 0.635243 | 0.02501 | 0.972877 | 0.038302 |
| 328 | -1.7157 | 6.374396 | 2.329348 | 4.474269 | 3.229767 | 0.051558 | 0.061031 | 0.287058 | 0.3398 | 10.5575 | 0.749119 | 0.59921 | 1.02653 | -0.36719 | 0.792961 | 1.169631 | 11.72238 | 8.988299 | 3.445187 | 2.109154 | 1.336034 | 0.156476 | 0.53779 | 0.694266 | 0.027333 | 1.065761 | 0.041959 |
| 329 | -1.65048 | 6.312077 | 2.330797 | 4.141528 | 3.092351 | 0.051563 | 0.061031 | 0.291707 | 0.345273 | 10.10826 | 0.748359 | 0.543877 | 1.026864 | -0.37023 | 0.792961 | 1.165767 | 11.60759 | 8.900281 | 3.188977 | 1.862387 | 1.326589 | 0.157886 | 0.713666 | 0.871552 | 0.034313 | 1.368192 | 0.053866 |
| 330 | -2.39783 | 5.382609 | 1.492391 | 4.876639 | 2.462413 | 0.0489 | 0.061031 | 0.303672 | 0.379012 | 8.073709 | 0.703982 | 0.548956 | 1.027189 | -0.37317 | 0.792961 | 1.162026 | 11.49713 | 8.815586 | 3.755012 | 2.618783 | 1.13623 | 0.140777 | 0.474386 | 0.615163 | 0.024219 | 0.948713 | 0.037351 |
| 331 | -3.21425 | 5.532126 | 1.158937 | 4.814438 | 2.673882 | 0.047874 | 0.061031 | 0.29122 | 0.37126 | 8.777733 | 0.693549 | 0.552425 | 1.027507 | -0.376 | 0.792961 | 1.158413 | 11.39102 | 8.734226 | 3.707117 | 2.585877 | 1.12124 | 0.133223 | 0.4599 | 0.593123 | 0.023351 | 0.91451 | 0.036004 |
| 332 | -3.06256 | 4.989372 | 0.963406 | 4.494948 | 2.704398 | 0.047281 | 0.061031 | 0.287542 | 0.371169 | 8.884244 | 0.679504 | 0.54487 | 1.027817 | -0.37871 | 0.792961 | 1.154929 | 11.28928 | 8.656214 | 3.46111 | 2.302833 | 1.158278 | 0.135886 | 0.443965 | 0.579851 | 0.022829 | 0.889445 | 0.035018 |
| 333 | -2.06932 | 5.193478 | 1.562077 | 4.01536 | 2.797304 | 0.049116 | 0.061031 | 0.292022 | 0.362864 | 9.169416 | 0.704436 | 0.571688 | 1.028119 | -0.38131 | 0.792961 | 1.151577 | 11.19192 | 8.581562 | 3.091827 | 1.843835 | 1.247992 | 0.148692 | 0.441685 | 0.590377 | 0.023243 | 0.897471 | 0.035334 |
| 334 | -1.86812 | 6.265942 | 2.198913 | 4.413597 | 2.984478 | 0.051136 | 0.061031 | 0.29372 | 0.350559 | 9.760322 | 0.742524 | 0.603965 | 1.028412 | -0.3838 | 0.792961 | 1.14836 | 11.09895 | 8.510279 | 3.39847 | 2.284806 | 1.113664 | 0.133459 | 0.474087 | 0.607546 | 0.023919 | 0.937065 | 0.036892 |
| 335 | -2.77174 | 5.071981 | 1.150121 | 4.20109 | 3.065334 | 0.047847 | 0.061031 | 0.277395 | 0.353834 | 10.0631 | 0.687368 | 0.552513 | 1.028696 | -0.38618 | 0.792961 | 1.145278 | 11.01039 | 8.442374 | 3.234839 | 2.110201 | 1.124638 | 0.127283 | 0.480176 | 0.607459 | 0.023916 | 0.940141 | 0.037013 |
| 336 | -3.75097 | 4.005072 | 0.127053 | 4.202237 | 2.805856 | 0.044815 | 0.061031 | 0.273146 | 0.371984 | 9.245773 | 0.6382 | 0.512452 | 1.028973 | -0.38844 | 0.792961 | 1.142336 | 10.92625 | 8.377858 | 3.235722 | 2.147904 | 1.087818 | 0.12123 | 0.432485 | 0.553715 | 0.0218 | 0.854421 | 0.033639 |
| 337 | -4.943 | 3.753623 | -0.59469 | 4.826507 | 2.769704 | 0.042777 | 0.061031 | 0.265232 | 0.378415 | 9.150827 | 0.611135 | 0.478101 | 1.02924 | -0.39059 | 0.792961 | 1.139535 | 10.84654 | 8.316737 | 3.71641 | 2.856991 | 0.859419 | 0.093002 | 0.460669 | 0.553671 | 0.021798 | 0.875274 | 0.03446 |
| 338 | -5.31836 | 2.836473 | -1.24094 | 4.485046 | 2.97923 | 0.041021 | 0.061031 | 0.250319 | 0.372431 | 9.866486 | 0.580059 | 0.456272 | 1.029499 | -0.39262 | 0.792961 | 1.136877 | 10.77127 | 8.25902 | 3.453485 | 2.523876 | 0.929609 | 0.094941 | 0.454867 | 0.549808 | 0.021646 | 0.865194 | 0.034063 |
| 339 | -4.44662 | 3.876329 | -0.28514 | 4.479202 | 2.752406 | 0.043641 | 0.061031 | 0.269745 | 0.377233 | 9.083353 | 0.62271 | 0.489509 | 1.02975 | -0.39453 | 0.792961 | 1.134364 | 10.70044 | 8.204712 | 3.448986 | 2.550016 | 0.89897 | 0.098937 | 0.456417 | 0.555354 | 0.021864 | 0.874044 | 0.034411 |
| 340 | -5.64903 | 2.775121 | -1.43696 | 4.360934 | 2.616156 | 0.0405 | 0.061031 | 0.259919 | 0.391682 | 8.670326 | 0.573311 | 0.458818 | 1.029991 | -0.39633 | 0.792961 | 1.131998 | 10.63407 | 8.15382 | 3.35792 | 2.44136 | 0.916559 | 0.097198 | 0.388819 | 0.486017 | 0.019135 | 0.757388 | 0.029818 |
| 341 | -5.18986 | 2.078261 | -1.5558 | 4.21223 | 2.929667 | 0.040187 | 0.061031 | 0.248053 | 0.37671 | 9.713599 | 0.562373 | 0.443199 | 1.030224 | -0.39801 | 0.792961 | 1.129781 | 10.57216 | 8.106349 | 3.243417 | 2.317 | 0.926417 | 0.093759 | 0.436084 | 0.529842 | 0.02086 | 0.832277 | 0.032767 |
| 342 | -5.26111 | 2.488164 | -1.38647 | 3.794224 | 2.836177 | 0.040634 | 0.061031 | 0.253141 | 0.380216 | 9.397763 | 0.571788 | 0.458705 | 1.030447 | -0.39957 | 0.792961 | 1.127715 | 10.51471 | 8.062304 | 2.921552 | 1.873485 | 1.048068 | 0.108246 | 0.404063 | 0.512309 | 0.02017 | 0.792401 | 0.031197 |
| 343 | -3.53164 | 3.114493 | -0.20857 | 3.70368 | 3.204111 | 0.043857 | 0.061031 | 0.255912 | 0.356126 | 10.57108 | 0.617239 | 0.49144 | 1.030662 | -0.40102 | 0.792961 | 1.125801 | 10.46175 | 8.021691 | 2.851833 | 1.80051 | 1.051323 | 0.109771 | 0.473586 | 0.583356 | 0.022967 | 0.910159 | 0.035833 |
| 344 | -2.34928 | 4.039614 | 0.845169 | 3.955052 | 3.201389 | 0.046925 | 0.061031 | 0.269085 | 0.349976 | 10.52146 | 0.664731 | 0.533472 | 1.030867 | -0.40234 | 0.792961 | 1.124042 | 10.41326 | 7.984512 | 3.04539 | 2.095838 | 0.949552 | 0.104248 | 0.483326 | 0.587575 | 0.023133 | 0.922167 | 0.036306 |
| 345 | -2.07729 | 3.97971 | 0.951208 | 3.759619 | 3.542889 | 0.047244 | 0.061031 | 0.259878 | 0.33572 | 11.6393 | 0.66825 | 0.548433 | 1.031063 | -0.40355 | 0.792961 | 1.122437 | 10.36926 | 7.950772 | 2.894907 | 1.88769 | 1.007217 | 0.106795 | 0.468191 | 0.574987 | 0.022637 | 0.896484 | 0.035295 |
| 346 | -2.72222 | 4.148309 | 0.713043 | 3.612189 | 2.798665 | 0.046531 | 0.061031 | 0.280921 | 0.368467 | 9.202332 | 0.660832 | 0.547565 | 1.031251 | -0.40463 | 0.792961 | 1.120989 | 10.32974 | 7.920474 | 2.781386 | 1.73411 | 1.047276 | 0.120034 | 0.384059 | 0.504093 | 0.019846 | 0.771002 | 0.030354 |
| 347 | -3.25459 | 3.935266 | 0.340338 | 4.215379 | 3.121117 | 0.045433 | 0.061031 | 0.265334 | 0.35643 | 10.27658 | 0.644981 | 0.508581 | 1.031428 | -0.4056 | 0.792961 | 1.119699 | 10.29472 | 7.893621 | 3.245842 | 2.446451 | 0.799391 | 0.086539 | 0.499615 | 0.586154 | 0.023077 | 0.933217 | 0.036741 |
| 348 | -3.53261 | 3.631159 | 0.049275 | 3.980755 | 3.042399 | 0.044592 | 0.061031 | 0.264239 | 0.361657 | 10.02808 | 0.631443 | 0.504795 | 1.031597 | -0.40644 | 0.792961 | 1.118568 | 10.2642 | 7.870216 | 3.065181 | 2.189201 | 0.87598 | 0.094439 | 0.459319 | 0.553758 | 0.021801 | 0.872601 | 0.034354 |
| 349 | -4.02367 | 3.413043 | -0.30531 | 3.915259 | 3.453481 | 0.043584 | 0.061031 | 0.247248 | 0.346223 | 11.39785 | 0.61686 | 0.490948 | 1.031756 | -0.40717 | 0.792961 | 1.117597 | 10.23817 | 7.850261 | 3.014749 | 2.127773 | 0.886976 | 0.089476 | 0.496873 | 0.586348 | 0.023085 | 0.928402 | 0.036551 |
| 350 | -5.3628 | 3.120048 | -1.12138 | 4.772588 | 3.158824 | 0.041341 | 0.061031 | 0.246193 | 0.363455 | 10.45666 | 0.58698 | 0.461167 | 1.031906 | -0.40777 | 0.792961 | 1.116787 | 10.21665 | 7.833758 | 3.674893 | 3.111886 | 0.563006 | 0.056552 | 0.478155 | 0.534707 | 0.021051 | 0.866799 | 0.034126 |
| 351 | -5.5913 | 3.040338 | -1.27548 | 4.453499 | 3.06203 | 0.040928 | 0.061031 | 0.247303 | 0.368772 | 10.14199 | 0.581287 | 0.447808 | 1.032046 | -0.40826 | 0.792961 | 1.116137 | 10.19963 | 7.820709 | 3.429194 | 2.767625 | 0.661569 | 0.066752 | 0.499221 | 0.565973 | 0.022282 | 0.913017 | 0.035946 |
| 352 | -5.36159 | 1.949034 | -1.70628 | 4.072428 | 2.888461 | 0.039795 | 0.061031 | 0.247535 | 0.379635 | 9.582291 | 0.556411 | 0.434567 | 1.032177 | -0.40862 | 0.792961 | 1.11565 | 10.18712 | 7.811115 | 3.135769 | 2.335971 | 0.799798 | 0.080775 | 0.443242 | 0.524017 | 0.020631 | 0.832256 | 0.032766 |
| 353 | -4.59589 | 2.11256 | -1.24167 | 3.327195 | 3.576514 | 0.041019 | 0.061031 | 0.23271 | 0.346248 | 11.84458 | 0.572813 | 0.446059 | 1.032298 | -0.40886 | 0.792961 | 1.115325 | 10.17911 | 7.804979 | 2.56194 | 1.491276 | 1.070664 | 0.101655 | 0.519836 | 0.621491 | 0.024468 | 0.977393 | 0.03848 |
| 354 | -4.31401 | 3.076812 | -0.6186 | 3.866965 | 2.818101 | 0.042711 | 0.061031 | 0.263291 | 0.376226 | 9.311543 | 0.60277 | 0.478853 | 1.03241 | -0.40899 | 0.792961 | 1.115163 | 10.17562 | 7.802301 | 2.977563 | 2.100872 | 0.876691 | 0.094176 | 0.43411 | 0.528286 | 0.020799 | 0.830697 | 0.032705 |
| 355 | -5.17222 | 2.8 | -1.18611 | 4.75413 | 2.573784 | 0.041167 | 0.061031 | 0.26456 | 0.392217 | 8.522029 | 0.581389 | 0.463066 | 1.032512 | -0.40898 | 0.792961 | 1.115163 | 10.17664 | 7.803082 | 3.66068 | 3.106179 | 0.554501 | 0.059853 | 0.395492 | 0.455345 | 0.017927 | 0.733337 | 0.028872 |
| 356 | -4.25749 | 2.712077 | -0.77271 | 4.403858 | 3.034041 | 0.042287 | 0.061031 | 0.254317 | 0.367047 | 10.03072 | 0.593975 | 0.468597 | 1.032605 | -0.40886 | 0.792961 | 1.115327 | 10.18217 | 7.807324 | 3.390971 | 2.714427 | 0.676544 | 0.070199 | 0.461609 | 0.531808 | 0.020937 | 0.852847 | 0.033577 |
| 357 | -5.16159 | 2.507246 | -1.32717 | 4.012411 | 3.154742 | 0.040791 | 0.061031 | 0.24384 | 0.364834 | 10.45106 | 0.573854 | 0.459273 | 1.032688 | -0.40862 | 0.792961 | 1.115652 | 10.19222 | 7.815026 | 3.089556 | 2.25433 | 0.835227 | 0.083094 | 0.436887 | 0.519981 | 0.020472 | 0.82194 | 0.03236 |
| 358 | -4.4558 | 2.441304 | -1.00725 | 4.439009 | 3.040844 | 0.041648 | 0.061031 | 0.251228 | 0.368148 | 10.06188 | 0.583573 | 0.470796 | 1.032761 | -0.40826 | 0.792961 | 1.116141 | 10.20678 | 7.82619 | 3.418037 | 2.730318 | 0.68772 | 0.070492 | 0.417755 | 0.488247 | 0.019222 | 0.778315 | 0.030642 |
| 359 | -5.11594 | 1.857246 | -1.62935 | 4.073593 | 3.042593 | 0.039995 | 0.061031 | 0.243631 | 0.371775 | 10.09075 | 0.557974 | 0.45159 | 1.032824 | -0.40777 | 0.792961 | 1.116791 | 10.22585 | 7.840815 | 3.136666 | 2.305314 | 0.831352 | 0.082638 | 0.399097 | 0.481735 | 0.018966 | 0.757854 | 0.029837 |
| 360 | -4.03551 | 2.30628 | -0.86461 | 3.573852 | 3.51976 | 0.042036 | 0.061031 | 0.238698 | 0.346563 | 11.64047 | 0.587153 | 0.477437 | 1.032878 | -0.40717 | 0.792961 | 1.117602 | 10.24944 | 7.858901 | 2.751866 | 1.731887 | 1.019979 | 0.099334 | 0.442612 | 0.541946 | 0.021336 | 0.844971 | 0.033267 |
| 361 | -2.96522 | 3.268841 | 0.151812 | 3.704608 | 3.228989 | 0.044886 | 0.061031 | 0.259577 | 0.352943 | 10.6391 | 0.631623 | 0.535331 | 1.032922 | -0.40644 | 0.792961 | 1.118574 | 10.27754 | 7.880449 | 2.852548 | 1.851448 | 1.001101 | 0.106024 | 0.361577 | 0.467601 | 0.018409 | 0.71618 | 0.028196 |
| 362 | -5.23841 | 2.881643 | -1.17838 | 4.828436 | 2.494289 | 0.041188 | 0.061031 | 0.267493 | 0.396366 | 8.258578 | 0.582518 | 0.486793 | 1.032956 | -0.40559 | 0.792961 | 1.119706 | 10.31016 | 7.905457 | 3.717896 | 3.089352 | 0.628544 | 0.068597 | 0.31335 | 0.381947 | 0.015037 | 0.601862 | 0.023695 |
| 363 | -5.52174 | 2.551691 | -1.48502 | 4.555384 | 3.380011 | 0.040373 | 0.061031 | 0.235356 | 0.35578 | 11.20384 | 0.569385 | 0.467114 | 1.03298 | -0.40463 | 0.792961 | 1.120997 | 10.34728 | 7.933925 | 3.507646 | 2.777806 | 0.729839 | 0.070083 | 0.407665 | 0.477748 | 0.018809 | 0.758343 | 0.029856 |
| 364 | -5.82729 | 1.237198 | -2.29505 | 3.872517 | 2.430148 | 0.038289 | 0.061031 | 0.255688 | 0.407563 | 8.0794 | 0.531738 | 0.440994 | 1.032995 | -0.40354 | 0.792961 | 1.122445 | 10.38892 | 7.965852 | 2.981838 | 1.998923 | 0.982915 | 0.102538 | 0.298809 | 0.401348 | 0.015801 | 0.609604 | 0.024 |
| 365 | -5.21667 | 1.898148 | -1.65926 | 3.537427 | 3.410915 | 0.039917 | 0.061031 | 0.232444 | 0.355398 | 11.31354 | 0.557406 | 0.459209 | 1.033 | -0.40233 | 0.792961 | 1.124051 | 10.43507 | 8.001235 | 2.723819 | 1.613685 | 1.110134 | 0.105282 | 0.394828 | 0.50011 | 0.019689 | 0.769868 | 0.03031 |

This worksheet uses RCP8.5 scenario, LOCA5 downscaled multi-model mean temperature data to calculate the tall crop reference ET (Etrs) using the Penman Montieth FAO56 model.
Total solar radiation (Rs) is estimated using Heargraves' radiation formula.
Vapor pressure derived from relative humidity is estimated with dewpoint offsets from Allen and Robison (2007)

| | | from LOCA5_All_GCM_2068 spre | | | Heargrave | IMBO Historic | | | | | | | Estimate from $T_{min}$, adjusted with $K_0$ offsets from Allen & Robison, 2007 | | | | | | | albedo = 0.23 | | | | | | | Cn=1600, Cd=0.38 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Multi-model ave (2068) | | | Total solar | daily mear | Slope of sa | psychrome | delta term | Psi term | temperatu | mean satu | vapor pres | inverse rel | solar decli | latitude (r | sunset hou | extraterre | clear sky s | net shortw | net outgoi | net radiati | radiation t | wind term | short crop | reference I | tall crop | reference ET |
| | DOY | Tmin (C) | Tmax (C) | Tmean (C) | Rs (MJ/m2 | u2 (m/s) | Δ | γ | DT | PT | TT | es | ea | dr | δ | φ | ωs | Ra | Rso | Rns | Rnl | Rn | ETrad | ETwind | Etos (mm) | Etos (in) | ETrs (mm) | Future ETrs (in) |
| 1/1/2018 | 1/1 | -0.07471 | 7.043536 | 3.484411 | 4.476154 | 3.135579 | 0.055431 | 0.061031 | 0.305358 | 0.33621 | 10.2068 | 0.806172 | 0.702107 | 1.032995 | -0.40101 | 0.792961 | 1.125811 | 10.48572 | 8.040075 | 3.446638 | 2.570766 | 0.875872 | 0.109121 | 0.357112 | 0.466234 | 0.018356 | 0.713884 | 0.028106 |
| 1/2/2018 | 1/2 | -0.52282 | 6.859571 | 3.168375 | 4.582426 | 3.800246 | 0.054347 | 0.061031 | 0.2798 | 0.314212 | 12.38455 | 0.790093 | 0.679894 | 1.03298 | -0.39956 | 0.792961 | 1.127726 | 10.54088 | 8.082367 | 3.528468 | 2.669534 | 0.858934 | 0.098054 | 0.428825 | 0.52688 | 0.020743 | 0.821188 | 0.03233 |
| 1/3/2018 | 1/3 | -1.17354 | 7.051714 | 2.939089 | 4.864323 | 2.928112 | 0.053573 | 0.061031 | 0.305493 | 0.348027 | 9.550299 | 0.782991 | 0.648742 | 1.032956 | -0.398 | 0.792961 | 1.129793 | 10.60054 | 8.128111 | 3.745529 | 2.9687 | 0.776829 | 0.096825 | 0.446211 | 0.543036 | 0.021379 | 0.855228 | 0.03367 |
| 1/4/2018 | 1/4 | -1.15154 | 6.181071 | 2.514768 | 4.620591 | 3.592576 | 0.052164 | 0.061031 | 0.277846 | 0.325078 | 11.73555 | 0.754183 | 0.649775 | 1.032922 | -0.39632 | 0.792961 | 1.132011 | 10.66469 | 8.177302 | 3.557855 | 2.658145 | 0.89971 | 0.101992 | 0.398314 | 0.500306 | 0.019697 | 0.77395 | 0.03047 |
| 1/5/2018 | 1/5 | -0.92886 | 5.937714 | 2.504429 | 4.500127 | 2.928518 | 0.05213 | 0.061031 | 0.299718 | 0.350896 | 9.566694 | 0.750904 | 0.660305 | 1.032878 | -0.39452 | 0.792961 | 1.134377 | 10.73334 | 8.229937 | 3.465098 | 2.488774 | 0.976323 | 0.119389 | 0.304135 | 0.423524 | 0.016674 | 0.634012 | 0.024961 |
| 1/6/2018 | 1/6 | -0.61089 | 6.799286 | 3.094196 | 4.706718 | 3.409696 | 0.054096 | 0.061031 | 0.291023 | 0.328337 | 11.11478 | 0.786153 | 0.675602 | 1.032824 | -0.39261 | 0.792961 | 1.136891 | 10.80647 | 8.286012 | 3.624173 | 2.680278 | 0.943895 | 0.112076 | 0.403445 | 0.515521 | 0.020296 | 0.793766 | 0.031251 |
| 1/7/2018 | 1/7 | 0.848571 | 7.218536 | 4.033554 | 4.395217 | 3.901687 | 0.057358 | 0.061031 | 0.287721 | 0.306149 | 12.67543 | 0.83328 | 0.749907 | 1.032761 | -0.39058 | 0.792961 | 1.13955 | 10.88408 | 8.345522 | 3.384317 | 2.287723 | 1.096594 | 0.128729 | 0.323535 | 0.452264 | 0.017806 | 0.671804 | 0.026449 |
| 1/8/2018 | 1/8 | 1.848643 | 8.31125 | 5.079946 | 4.460451 | 3.144246 | 0.061189 | 0.061031 | 0.326401 | 0.325561 | 10.17629 | 0.896879 | 0.804901 | 1.032688 | -0.38843 | 0.792961 | 1.142352 | 10.96617 | 8.408462 | 3.434547 | 2.308625 | 1.125922 | 0.149941 | 0.304721 | 0.454662 | 0.0179 | 0.66446 | 0.02616 |
| 1/9/2018 | 1/9 | 1.289107 | 7.827321 | 4.558214 | 4.521876 | 3.137249 | 0.059252 | 0.061031 | 0.319619 | 0.329217 | 10.17273 | 0.865378 | 0.773709 | 1.032605 | -0.38617 | 0.792961 | 1.145295 | 11.05272 | 8.474826 | 3.481845 | 2.344117 | 1.137727 | 0.148365 | 0.307001 | 0.455366 | 0.017928 | 0.666604 | 0.026244 |
| 1/10/2018 | 1/10 | 0.135321 | 7.167286 | 3.651304 | 4.728122 | 2.835011 | 0.05601 | 0.061031 | 0.318476 | 0.347025 | 9.222837 | 0.815133 | 0.712738 | 1.032512 | -0.38379 | 0.792961 | 1.148377 | 11.14373 | 8.544607 | 3.640654 | 2.53747 | 1.103184 | 0.143346 | 0.327723 | 0.471069 | 0.018546 | 0.698477 | 0.027499 |
| 1/11/2018 | 1/11 | -0.44089 | 7.6055 | 3.582304 | 5.100999 | 2.978064 | 0.05577 | 0.061031 | 0.312266 | 0.341724 | 9.690633 | 0.81788 | 0.683908 | 1.03241 | -0.3813 | 0.792961 | 1.151595 | 11.23918 | 8.617798 | 3.927769 | 2.899481 | 1.028288 | 0.131009 | 0.443652 | 0.574661 | 0.022624 | 0.883749 | 0.034793 |
| 1/12/2018 | 1/12 | -0.41604 | 7.444286 | 3.514125 | 5.086482 | 3.581179 | 0.055534 | 0.061031 | 0.29094 | 0.319742 | 11.65605 | 0.812694 | 0.68513 | 1.032298 | -0.3787 | 0.792961 | 1.154948 | 11.33907 | 8.69439 | 3.916591 | 2.835211 | 1.08138 | 0.128363 | 0.475422 | 0.603785 | 0.023771 | 0.93092 | 0.03665 |
| 1/13/2018 | 1/13 | -0.38625 | 7.7455 | 3.679625 | 5.221153 | 2.972613 | 0.056109 | 0.061031 | 0.313768 | 0.341292 | 9.669492 | 0.824079 | 0.686597 | 1.032177 | -0.37598 | 0.792961 | 1.158433 | 11.44338 | 8.774374 | 4.020288 | 2.927997 | 1.092291 | 0.139832 | 0.453706 | 0.593538 | 0.023368 | 0.909512 | 0.035808 |
| 1/14/2018 | 1/14 | -0.40014 | 7.323357 | 3.461607 | 5.136748 | 3.096768 | 0.055352 | 0.061031 | 0.306416 | 0.337856 | 10.0813 | 0.808781 | 0.685913 | 1.032046 | -0.37315 | 0.792961 | 1.162047 | 11.55211 | 8.85774 | 3.955296 | 2.787647 | 1.16765 | 0.145977 | 0.418493 | 0.56447 | 0.022223 | 0.854215 | 0.033631 |
| 1/15/2018 | 1/15 | -0.26318 | 7.385571 | 3.561196 | 5.161887 | 2.562758 | 0.055697 | 0.061031 | 0.327808 | 0.359204 | 8.339863 | 0.813947 | 0.692688 | 1.031906 | -0.37022 | 0.792961 | 1.165787 | 11.66523 | 8.944477 | 3.974653 | 2.760053 | 1.2146 | 0.162447 | 0.363259 | 0.525706 | 0.020697 | 0.779536 | 0.03069 |
| 1/16/2018 | 1/16 | -0.713 | 7.482214 | 3.384607 | 5.396921 | 3.194507 | 0.055087 | 0.061031 | 0.302 | 0.334591 | 10.40238 | 0.807671 | 0.670656 | 1.031756 | -0.36717 | 0.792961 | 1.169653 | 11.78273 | 9.034573 | 4.155629 | 2.95348 | 1.20215 | 0.148124 | 0.476888 | 0.625012 | 0.024607 | 0.955091 | 0.037602 |
| 1/17/2018 | 1/17 | -0.86632 | 7.670893 | 3.402286 | 5.565353 | 3.458535 | 0.055147 | 0.061031 | 0.293422 | 0.324729 | 11.26142 | 0.811153 | 0.663289 | 1.031597 | -0.36401 | 0.792961 | 1.17364 | 11.90459 | 9.128015 | 4.285322 | 3.070956 | 1.214366 | 0.145379 | 0.540724 | 0.686104 | 0.027012 | 1.059089 | 0.041696 |
| 1/18/2018 | 1/18 | -0.15671 | 7.903321 | 3.873304 | 5.464911 | 3.568545 | 0.05679 | 0.061031 | 0.295978 | 0.318086 | 11.59986 | 0.834797 | 0.697995 | 1.031428 | -0.36075 | 0.792961 | 1.177746 | 12.0308 | 9.224788 | 4.207982 | 2.900662 | 1.307319 | 0.157871 | 0.504766 | 0.662637 | 0.026088 | 1.009402 | 0.03974 |
| 1/19/2018 | 1/19 | -0.23754 | 7.969786 | 3.866125 | 5.574451 | 3.362518 | 0.056764 | 0.061031 | 0.302629 | 0.325379 | 10.93043 | 0.835442 | 0.693963 | 1.031251 | -0.35738 | 0.792961 | 1.181969 | 12.16134 | 9.324876 | 4.292327 | 2.951879 | 1.340447 | 0.165509 | 0.503177 | 0.668685 | 0.026326 | 1.015599 | 0.039984 |
| 1/20/2018 | 1/20 | 0.343929 | 8.080107 | 4.212018 | 5.47209 | 2.841231 | 0.057996 | 0.061031 | 0.325849 | 0.342902 | 9.224375 | 0.852447 | 0.723436 | 1.031063 | -0.3539 | 0.792961 | 1.186306 | 12.29618 | 9.428264 | 4.21351 | 2.782776 | 1.430734 | 0.190211 | 0.408068 | 0.598279 | 0.023554 | 0.88132 | 0.034698 |
| 1/21/2018 | 1/21 | -0.31196 | 7.429464 | 3.55875 | 5.535878 | 3.116452 | 0.055688 | 0.061031 | 0.307012 | 0.336468 | 10.14181 | 0.81443 | 0.690268 | 1.030867 | -0.35032 | 0.792961 | 1.190754 | 12.43529 | 9.534934 | 4.262626 | 2.792845 | 1.469781 | 0.184106 | 0.423692 | 0.607798 | 0.023929 | 0.899603 | 0.035417 |
| 1/22/2018 | 1/22 | -1.03354 | 6.936214 | 2.951339 | 5.681681 | 2.864749 | 0.053614 | 0.061031 | 0.307964 | 0.350573 | 9.34322 | 0.781917 | 0.655336 | 1.030662 | -0.34663 | 0.792961 | 1.195311 | 12.57866 | 9.644866 | 4.374894 | 2.879724 | 1.49517 | 0.187867 | 0.414615 | 0.602482 | 0.02372 | 0.889237 | 0.035009 |
| 1/23/2018 | 1/23 | -0.38936 | 7.651036 | 3.630839 | 5.77377 | 2.983506 | 0.055939 | 0.061031 | 0.312718 | 0.341186 | 9.706638 | 0.820622 | 0.686444 | 1.030447 | -0.34285 | 0.792961 | 1.199973 | 12.72626 | 9.75804 | 4.445803 | 2.89681 | 1.548993 | 0.197634 | 0.444368 | 0.642002 | 0.025276 | 0.948982 | 0.037361 |
| 1/24/2018 | 1/24 | 1.434679 | 9.445214 | 5.439946 | 5.831782 | 3.112008 | 0.062557 | 0.061031 | 0.332458 | 0.324351 | 10.05893 | 0.930324 | 0.78172 | 1.030224 | -0.33856 | 0.792961 | 1.204739 | 12.87806 | 9.874434 | 4.490472 | 2.86035 | 1.630122 | 0.221114 | 0.484841 | 0.705955 | 0.027794 | 1.041022 | 0.040985 |
| 1/25/2018 | 1/25 | 1.220679 | 9.428321 | 5.3245 | 5.974587 | 2.970095 | 0.062115 | 0.061031 | 0.336161 | 0.330296 | 9.604204 | 0.924474 | 0.769969 | 1.029991 | -0.33497 | 0.792961 | 1.209606 | 13.03403 | 9.994025 | 4.600432 | 2.93064 | 1.669792 | 0.229018 | 0.490125 | 0.719144 | 0.028313 | 1.058804 | 0.041685 |
| 1/26/2018 | 1/26 | 1.288107 | 8.331214 | 4.809661 | 5.602516 | 2.604688 | 0.060179 | 0.061031 | 0.343371 | 0.348235 | 8.438221 | 0.88385 | 0.773654 | 1.02975 | -0.33088 | 0.792961 | 1.21457 | 13.19414 | 10.11679 | 4.313937 | 2.526406 | 1.787531 | 0.250424 | 0.323807 | 0.574232 | 0.022608 | 0.79716 | 0.031384 |
| 1/27/2018 | 1/27 | 0.930214 | 8.732036 | 4.831125 | 5.969949 | 2.742882 | 0.060259 | 0.061031 | 0.338139 | 0.342475 | 8.885231 | 0.890426 | 0.754268 | 1.029499 | -0.32669 | 0.792961 | 1.219629 | 13.35834 | 10.2427 | 4.596861 | 2.797072 | 1.799788 | 0.2483 | 0.414323 | 0.662623 | 0.026088 | 0.949209 | 0.03737 |
| 1/28/2018 | 1/28 | 0.476536 | 9.090857 | 4.783696 | 6.352136 | 3.290603 | 0.060083 | 0.061031 | 0.317232 | 0.322242 | 10.66133 | 0.893718 | 0.730311 | 1.02924 | -0.3224 | 0.792961 | 1.224781 | 13.52662 | 10.37173 | 4.891145 | 3.078819 | 1.812326 | 0.234571 | 0.561391 | 0.795961 | 0.031337 | 1.182445 | 0.046553 |
| 1/29/2018 | 1/29 | 0.503393 | 8.4885 | 4.495946 | 6.193653 | 3.476222 | 0.059025 | 0.061031 | 0.307116 | 0.317558 | 11.2744 | 0.871265 | 0.73171 | 1.028973 | -0.31803 | 0.792961 | 1.230022 | 13.69893 | 10.50384 | 4.769113 | 2.866168 | 1.902945 | 0.238445 | 0.499644 | 0.73809 | 0.029059 | 1.079055 | 0.042482 |
| 1/30/2018 | 1/30 | 0.781321 | 8.993786 | 4.887554 | 6.362043 | 3.125393 | 0.060468 | 0.061031 | 0.324482 | 0.327503 | 10.12227 | 0.896998 | 0.74633 | 1.028696 | -0.31355 | 0.792961 | 1.235351 | 13.87522 | 10.63902 | 4.898773 | 2.939318 | 1.959456 | 0.25941 | 0.499474 | 0.758883 | 0.029877 | 1.102234 | 0.043395 |
| 1/31/2018 | 1/31 | 0.623036 | 9.025893 | 4.824464 | 6.518964 | 2.84609 | 0.060234 | 0.061031 | 0.334032 | 0.334555 | 9.219782 | 0.894564 | 0.737973 | 1.028412 | -0.30898 | 0.792961 | 1.240765 | 14.05546 | 10.77722 | 5.019602 | 3.005877 | 2.013725 | 0.274441 | 0.488639 | 0.76308 | 0.030043 | 1.10072 | 0.043335 |
| 2/1/2018 | 2/1 | -0.13032 | 8.622964 | 4.246321 | 6.740677 | 2.744048 | 0.05812 | 0.061031 | 0.330053 | 0.346588 | 8.907759 | 0.862088 | 0.674658 | 1.028119 | -0.30433 | 0.792961 | 1.24626 | 14.23961 | 10.91842 | 5.190321 | 3.163155 | 2.027167 | 0.272981 | 0.578656 | 0.851637 | 0.033529 | 1.253998 | 0.04937 |
| 2/2/2018 | 2/2 | -1.01932 | 7.904893 | 3.442786 | 6.896033 | 2.58428 | 0.055287 | 0.061031 | 0.325325 | 0.359127 | 8.413502 | 0.816394 | 0.632708 | 1.027817 | -0.29958 | 0.792961 | 1.251835 | 14.42761 | 11.06257 | 5.309946 | 3.23058 | 2.079366 | 0.276 | 0.550099 | 0.831008 | 0.032717 | 1.217485 | 0.047932 |
| 2/3/2018 | 2/3 | -0.71239 | 8.8875 | 4.087554 | 7.247418 | 2.873495 | 0.05755 | 0.061031 | 0.322938 | 0.342472 | 9.333317 | 0.859607 | 0.646923 | 1.027507 | -0.29474 | 0.792961 | 1.257487 | 14.61942 | 11.20965 | 5.580512 | 3.450236 | 2.130276 | 0.280682 | 0.679821 | 0.960503 | 0.037815 | 1.432851 | 0.056411 |
| 2/4/2018 | 2/4 | -0.97396 | 8.261786 | 3.643911 | 7.20373 | 2.897791 | 0.055985 | 0.061031 | 0.316035 | 0.344524 | 9.427325 | 0.830442 | 0.634791 | 1.027189 | -0.28981 | 0.792961 | 1.263213 | 14.81499 | 11.3596 | 5.546872 | 3.333664 | 2.213208 | 0.285376 | 0.635463 | 0.920839 | 0.036253 | 1.360747 | 0.053573 |
| 2/5/2018 | 2/5 | -0.54329 | 8.444286 | 3.9505 | 7.20187 | 3.268057 | 0.057063 | 0.061031 | 0.30694 | 0.328187 | 10.62013 | 0.846367 | 0.654875 | 1.026864 | -0.2848 | 0.792961 | 1.269011 | 15.01427 | 11.5124 | 5.54544 | 3.246466 | 2.298974 | 0.287904 | 0.667627 | 0.955531 | 0.037619 | 1.414111 | 0.055674 |
| 2/6/2018 | 2/6 | -0.18157 | 8.112714 | 3.965571 | 7.012035 | 3.268445 | 0.057116 | 0.061031 | 0.307126 | 0.328179 | 10.62082 | 0.841904 | 0.672175 | 1.02653 | -0.27971 | 0.792961 | 1.274879 | 15.21719 | 11.668 | 5.399267 | 3.008434 | 2.390833 | 0.299589 | 0.591596 | 0.891184 | 0.035086 | 1.295721 | 0.051013 |
| 2/7/2018 | 2/7 | 0.483357 | 8.389964 | 4.436661 | 6.939116 | 2.789724 | 0.058809 | 0.061031 | 0.33089 | 0.343397 | 9.049819 | 0.86711 | 0.705032 | 1.026188 | -0.27453 | 0.792961 | 1.280814 | 15.42372 | 11.82635 | 5.343119 | 2.866866 | 2.476253 | 0.334301 | 0.503685 | 0.837987 | 0.032992 | 1.184358 | 0.046628 |
| 2/8/2018 | 2/8 | 1.367857 | 9.070679 | 5.219268 | 6.942387 | 2.700122 | 0.061715 | 0.061031 | 0.34521 | 0.341385 | 8.734512 | 0.913951 | 0.750935 | 1.025838 | -0.26927 | 0.792961 | 1.286814 | 15.63378 | 11.98742 | 5.345638 | 2.783812 | 2.561825 | 0.360822 | 0.486087 | 0.846909 | 0.033343 | 1.181417 | 0.046512 |
| 2/9/2018 | 2/9 | 0.917857 | 10.08389 | 5.500875 | 7.676555 | 2.558429 | 0.062791 | 0.061031 | 0.354928 | 0.344983 | 8.267789 | 0.943855 | 0.727262 | 1.025481 | -0.26393 | 0.792961 | 1.292877 | 15.84731 | 12.15115 | 5.910947 | 3.285096 | 2.625851 | 0.380251 | 0.617776 | 0.998027 | 0.039292 | 1.428101 | 0.056224 |
| 2/10/2018 | 2/10 | 0.941143 | 10.05039 | 5.495768 | 7.757504 | 2.604688 | 0.062771 | 0.061031 | 0.352941 | 0.343159 | 8.417433 | 0.94302 | 0.728471 | 1.025116 | -0.25852 | 0.792961 | 1.298999 | 16.06426 | 12.3175 | 5.973278 | 3.266037 | 2.707241 | 0.389843 | 0.619731 | 1.009573 | 0.039747 | 1.440099 | 0.056697 |
| 2/11/2018 | 2/11 | 1.67575 | 10.21375 | 5.94475 | 7.61318 | 2.302645 | 0.064519 | 0.061031 | 0.372227 | 0.352108 | 7.429357 | 0.967548 | 0.767522 | 1.024744 | -0.25302 | 0.792961 | 1.30518 | 16.28455 | 12.48641 | 5.862254 | 3.063937 | 2.798318 | 0.424977 | 0.523256 | 0.948233 | 0.037332 | 1.31264 | 0.051679 |
| 2/12/2018 | 2/12 | 1.53125 | 11.16375 | 6.3475 | 8.197612 | 2.991669 | 0.066122 | 0.061031 | 0.349421 | 0.322521 | 9.638542 | 1.004694 | 0.759697 | 1.024365 | -0.24745 | 0.792961 | 1.311417 | 16.50813 | 12.65784 | 6.312162 | 3.426079 | 2.886082 | 0.411451 | 0.761606 | 1.173057 | 0.046183 | 1.699812 | 0.066922 |
| 2/13/2018 | 2/13 | 0.977857 | 10.64425 | 5.811054 | 8.324838 | 2.69293 | 0.063994 | 0.061031 | 0.353743 | 0.337366 | 8.692758 | 0.968827 | 0.73038 | 1.023978 | -0.24181 | 0.792961 | 1.317708 | 16.73492 | 12.83173 | 6.410125 | 3.44708 | 2.963045 | 0.427648 | 0.699279 | 1.126927 | 0.044367 | 1.612222 | 0.063473 |
| 2/14/2018 | 2/14 | 0.779536 | 10.56275 | 5.671143 | 8.490058 | 2.395551 | 0.063449 | 0.061031 | 0.364252 | 0.350373 | 7.736704 | 0.960689 | 0.720119 | 1.023584 | -0.2361 | 0.792961 | 1.32405 | 16.96485 | 13.00803 | 6.537345 | 3.488149 | 3.049196 | 0.453156 | 0.652122 | 1.105277 | 0.043515 | 1.560105 | 0.061421 |
| 2/15/2018 | 2/15 | 0.074929 | 10.66518 | 5.370054 | 8.954617 | 2.978258 | 0.062289 | 0.061031 | 0.336477 | 0.329683 | 9.629026 | 0.948961 | 0.684686 | 1.023183 | -0.23031 | 0.792961 | 1.330442 | 17.19784 | 13.18669 | 6.895055 | 3.756846 | 3.138209 | 0.430822 | 0.838948 | 1.269769 | 0.049991 | 1.849639 | 0.07282 |
| 2/16/2018 | 2/16 | -0.04243 | 11.1135 | 5.535536 | 9.316775 | 2.882047 | 0.062924 | 0.061031 | 0.342426 | 0.332125 | 9.31243 | 0.965784 | 0.678936 | 1.022776 | -0.22446 | 0.792961 | 1.336881 | 17.43383 | 13.36763 | 7.173917 | 3.935813 | 3.238104 | 0.452395 | 0.887189 | 1.339584 | 0.05274 | 1.954776 | 0.07696 |
| 2/17/2018 | 2/17 | 0.512179 | 10.87275 | 5.692464 | 9.101554 | 2.615573 | 0.063532 | 0.061031 | 0.355247 | 0.341266 | 8.446642 | 0.967799 | 0.706488 | 1.022361 | -0.21854 | 0.792961 | 1.343367 | 17.67273 | 13.55081 | 7.008196 | 3.677078 | 3.331119 | 0.482815 | 0.753243 | 1.236059 | 0.048664 | 1.759107 | 0.069256 |
| 2/18/2018 | 2/18 | 0.680607 | 10.57704 | 5.628821 | 9.017625 | 2.545213 | 0.063285 | 0.061031 | 0.357276 | 0.344555 | 8.221301 | 0.958993 | 0.715048 | 1.02194 | -0.21256 | 0.792961 | 1.349896 | 17.91447 | 13.73617 | 6.943109 | 3.526218 | 3.416891 | 0.498076 | 0.691019 | 1.189095 | 0.046815 | 1.668041 | 0.065671 |
| 2/19/2018 | 2/19 | -0.29486 | 10.56475 | 5.134946 | 9.574547 | 2.929667 | 0.061396 | 0.061031 | 0.335095 | 0.333104 | 9.479931 | 0.936515 | 0.666714 | 1.021513 | -0.20651 | 0.792961 | 1.356467 | 18.15897 | 13.92364 | 7.372401 | 3.847246 | 3.525155 | 0.481955 | 0.851981 | 1.333937 | 0.052517 | 1.921579 | 0.075653 |
| 2/20/2018 | 2/20 | -0.34836 | 9.901464 | 4.776554 | 9.428462 | 2.672716 | 0.060056 | 0.061031 | 0.340169 | 0.345692 | 8.659638 | 0.907683 | 0.664148 | 1.021079 | -0.2004 | 0.792961 | 1.363078 | 18.40614 | 14.11317 | 7.259916 | 3.655153 | 3.604763 | 0.500301 | 0.729038 | 1.229338 | 0.048399 | 1.732344 | 0.068203 |
| 2/21/2018 | 2/21 | -0.61921 | 10.62229 | 5.001536 | 10.00802 | 2.724612 | 0.060894 | 0.061031 | 0.341215 | 0.341983 | 8.820636 | 0.931967 | 0.651294 | 1.020639 | -0.19424 | 0.792961 | 1.369728 | 18.6559 | 14.30467 | 7.706179 | 3.971229 | 3.73495 | 0.519964 | 0.846651 | 1.366616 | 0.053804 | 1.952356 | 0.076864 |
| 2/22/2018 | 2/22 | 0.695 | 11.41189 | 6.053446 | 9.903847 | 2.900901 | 0.064948 | 0.061031 | 0.348855 | 0.327817 | 9.355952 | 0.995742 | 0.715784 | 1.020192 | -0.18801 | 0.792961 | 1.376414 | 18.90817 | 14.4981 | 7.625962 | 3.786137 | 3.839825 | 0.546533 | 0.858644 | 1.405176 | 0.055322 | 1.997046 | 0.078624 |
| 2/23/2018 | 2/23 | 2.125143 | 11.70643 | 6.915786 | 9.490565 | 2.841231 | 0.068441 | 0.061031 | 0.363219 | 0.323894 | 9.135275 | 1.043814 | 0.792311 | 1.01974 | -0.18173 | 0.792961 | 1.383135 | 19.16285 | 14.69339 | 7.307735 | 3.39772 | 3.910015 | 0.579438 | 0.744162 | 1.3236 | 0.05211 | 1.834851 | 0.072238 |
| 2/24/2018 | 2/24 | 1.276821 | 11.46057 | 6.368696 | 9.915625 | 2.493706 | 0.066207 | 0.061031 | 0.369904 | 0.340987 | 8.033596 | 1.011696 | 0.746092 | 1.019282 | -0.1754 | 0.792961 | 1.38989 | 19.41987 | 14.89045 | 7.635031 | 3.607194 | 4.027837 | 0.607884 | 0.727585 | 1.335469 | 0.052578 | 1.838824 | 0.072395 |
| 2/25/2018 | 2/25 | 1.469179 | 11.56354 | 6.516357 | 10.0038 | 2.303811 | 0.066804 | 0.061031 | 0.380343 | 0.347478 | 7.417919 | 1.020992 | 0.756358 | 1.018818 | -0.16901 | 0.792961 | 1.396676 | 19.67912 | 15.08924 | 7.702925 | 3.57507 | 4.127856 | 0.640561 | 0.682113 | 1.322674 | 0.052074 | 1.795706 | 0.070697 |
| 2/26/2018 | 2/26 | 1.354464 | 11.83132 | 6.592893 | 10.32695 | 2.684767 | 0.067115 | 0.061031 | 0.365039 | 0.33195 | 8.642173 | 1.03037 | 0.750221 | 1.018349 | -0.16258 | 0.792961 | 1.403492 | 19.94052 | 15.28967 | 7.951749 | 3.698223 | 4.253526 | 0.633502 | 0.803683 | 1.437186 | 0.056582 | 1.991286 | 0.078397 |
| 2/27/2018 | 2/27 | 1.211214 | 11.172 | 6.191607 | 10.20243 | 2.799053 | 0.065497 | 0.061031 | 0.354785 | 0.330595 | 9.023008 | 0.997293 | 0.742618 | 1.017874 | -0.15609 | 0.792961 | 1.410337 | 20.20397 | 15.49168 | 7.85587 | 3.537453 | 4.318417 | 0.625101 | 0.759683 | 1.384784 | 0.054519 | 1.905132 | 0.075005 |
| 2/28/2018 | 2/28 | 1.909643 | 11.06696 | 6.488304 | 9.910808 | 2.893709 | 0.06669 | 0.061031 | 0.355173 | 0.325036 | 9.318238 | 1.00983 | 0.780337 | 1.017394 | -0.14956 | 0.792961 | 1.417209 | 20.46939 | 15.69519 | 7.631322 | 3.264585 | 4.366737 | 0.632786 | 0.695081 | 1.327867 | 0.052278 | 1.800738 | 0.070895 |
| 3/1/2018 | 2/29 | 1.101 | 11.23114 | 6.166071 | 10.56007 | 2.894681 | 0.065395 | 0.061031 | 0.350658 | 0.327258 | 9.332126 | 0.997266 | 0.661728 | 1.016908 | -0.14299 | 0.792961 | 1.424106 | 20.73667 | 15.90013 | 8.131253 | 3.696272 | 4.434981 | 0.634506 | 1.024735 | 1.659242 | 0.065324 | 2.366583 | 0.093173 |
| 3/2/2018 | 3/1 | 0.394714 | 11.568 | 5.981357 | 11.23435 | 2.518584 | 0.064663 | 0.061031 | 0.363364 | 0.342956 | 8.125009 | 0.995839 | 0.628776 | 1.016418 | -0.13637 | 0.792961 | 1.431028 | 21.00572 | 16.10643 | 8.65045 | 4.042636 | 4.607814 | 0.68312 | 1.022828 | 1.705948 | 0.067163 | 2.417939 | 0.095194 |
| 3/3/2018 | 3/2 | -0.01543 | 11.50882 | 5.746696 | 11.55647 | 2.171059 | 0.063743 | 0.061031 | 0.375344 | 0.359378 | 7.009782 | 0.983946 | 0.610314 | 1.015923 | -0.12971 | 0.792961 | 1.437973 | 21.27644 | 16.31401 | 8.898483 | 4.159254 | 4.73923 | 0.725767 | 0.94124 | 1.667006 | 0.06563 | 2.326474 | 0.091593 |
| 3/4/2018 | 3/3 | 0.428536 | 12.2255 | 6.327018 | 11.84205 | 2.704009 | 0.066039 | 0.061031 | 0.360515 | 0.333176 | 8.712398 | 1.026835 | 0.63032 | 1.015423 | -0.12302 | 0.792961 | 1.444939 | 21.54873 | 16.52279 | 9.118378 | 4.239327 | 4.879051 | 0.71766 | 1.150987 | 1.868646 | 0.073569 | 2.667723 | 0.105028 |
| 3/5/2018 | 3/4 | 1.148179 | 11.93161 | 6.539893 | 11.46576 | 2.875439 | 0.066899 | 0.061031 | 0.35661 | 0.325331 | 9.257695 | 1.030008 | 0.663982 | 1.014918 | -0.11628 | 0.792961 | 1.451925 | 21.8225 | 16.73271 | 8.828638 | 3.907228 | 4.92141 | 0.71605 | 1.102401 | 1.818451 | 0.071593 | 2.579357 | 0.101549 |
| 3/6/2018 | 3/5 | 1.903964 | 13.46579 | 7.684875 | 12.02207 | 2.544046 | 0.071691 | 0.061031 | 0.386448 | 0.328986 | 8.157339 | 1.122414 | 0.701036 | 1.014409 | -0.10952 | 0.792961 | 1.45893 | 22.09765 | 16.94368 | 9.256992 | 4.141114 | 5.115877 | 0.806625 | 1.130832 | 1.937457 | 0.076278 | 2.725741 | 0.107313 |
| 3/7/2018 | 3/6 | 2.114393 | 14.71429 | 8.414339 | 12.70715 | 2.11586 | 0.074895 | 0.061031 | 0.416472 | 0.33938 | 6.766797 | 1.192834 | 0.711672 | 1.013896 | -0.10272 | 0.792961 | 1.465952 | 22.37406 | 17.15563 | 9.784509 | 4.458205 | 5.326304 | 0.905048 | 1.104998 | 2.010046 | 0.079136 | 2.789369 | 0.109818 |
| 3/8/2018 | 3/7 | 3.134357 | 14.41496 | 8.774661 | 12.17268 | 2.509061 | 0.076522 | 0.061031 | 0.403558 | 0.321865 | 8.014044 | 1.203594 | 0.765273 | 1.013379 | -0.09589 | 0.792961 | 1.472991 | 22.65166 | 17.36847 | 9.372963 | 4.026853 | 5.346109 | 0.880246 | 1.130623 | 2.010869 | 0.079168 | 2.799799 | 0.110228 |
| 3/9/2018 | 3/8 | 2.660821 | 14.35196 | 8.506393 | 12.54465 | 2.799053 | 0.075308 | 0.061031 | 0.387343 | 0.313913 | 8.948813 | 1.187602 | 0.73996 | 1.012858 | -0.08903 | 0.792961 | 1.480045 | 22.93032 | 17.58214 | 9.65938 | 4.165871 | 5.493509 | 0.868171 | 1.257492 | 2.125663 | 0.083688 | 2.998332 | 0.118045 |
| 3/10/2018 | 3/9 | 1.966857 | 13.97411 | 7.970482 | 12.86814 | 2.410129 | 0.072931 | 0.061031 | 0.396421 | 0.331738 | 7.720084 | 1.149945 | 0.7042 | 1.012333 | -0.08215 | 0.792961 | 1.487113 | 23.20995 | 17.79655 | 9.908471 | 4.278753 | 5.629718 | 0.910549 | 1.141574 | 2.052123 | 0.080792 | 2.848903 | 0.112162 |
| 3/11/2018 | 3/10 | 1.909571 | 13.84207 | 7.875821 | 12.98306 | 2.516446 | 0.072518 | 0.061031 | 0.390371 | 0.328536 | 8.063356 | 1.141691 | 0.701317 | 1.011804 | -0.07524 | 0.792961 | 1.494194 | 23.49044 | 18.01163 | 9.996953 | 4.256689 | 5.740264 | 0.91426 | 1.166596 | 2.080856 | 0.081923 | 2.892553 | 0.11388 |
| 3/12/2018 | 3/11 | 1.664964 | 14.67343 | 8.169196 | 13.71808 | 2.508283 | 0.073805 | 0.061031 | 0.394922 | 0.326572 | 8.028813 | 1.17936 | 0.689126 | 1.011272 | -0.06831 | 0.792961 | 1.501286 | 23.7717 | 18.22729 | 10.56292 | 4.59226 | 5.97066 | 0.962041 | 1.285388 | 2.247429 | 0.088481 | 3.144156 | 0.123786 |
| 3/13/2018 | 3/12 | 2.404893 | 14.83918 | 8.622036 | 13.57097 | 2.667274 | 0.075829 | 0.061031 | 0.394515 | 0.317528 | 8.524001 | 1.207061 | 0.72659 | 1.010736 | -0.06135 | 0.792961 | 1.508389 | 24.05362 | 18.44345 | 10.44965 | 4.40109 | 6.048557 | 0.973589 | 1.300445 | 2.274034 | 0.089529 | 3.177835 | 0.125112 |
| 3/14/2018 | 3/13 | 3.206821 | 14.85211 | 9.029464 | 13.28758 | 2.636953 | 0.077691 | 0.061031 | 0.401625 | 0.315505 | 8.414928 | 1.229069 | 0.769213 | 1.010198 | -0.05438 | 0.792961 | 1.515501 | 24.3361 | 18.66005 | 10.23144 | 4.138917 | 6.092523 | 0.998339 | 1.220894 | 2.219233 | 0.087371 | 3.066759 | 0.120739 |
| 3/15/2018 | 3/14 | 2.706357 | 15.54514 | 9.12575 | 14.11409 | 2.550266 | 0.078136 | 0.061031 | 0.406774 | 0.317727 | 8.135519 | 1.254123 | 0.742362 | 1.009656 | -0.0474 | 0.792961 | 1.522621 | 24.61903 | 18.87699 | 10.86785 | 4.517373 | 6.350477 | 1.05395 | 1.32284 | 2.37679 | 0.093574 | 3.298748 | 0.129872 |
| 3/16/2018 | 3/15 | 3.171179 | 15.34407 | 9.257625 | 13.90134 | 2.622376 | 0.07875 | 0.061031 | 0.405515 | 0.314275 | 8.361645 | 1.255256 | 0.767273 | 1.009111 | -0.0404 | 0.792961 | 1.529748 | 24.90231 | 19.0942 | 10.70403 | 4.302662 | 6.401368 | 1.059107 | 1.28235 | 2.341458 | 0.092183 | 3.232286 | 0.127255 |
| 3/17/2018 | 3/16 | 2.897107 | 14.81161 | 8.854357 | 13.90959 | 2.372811 | 0.076886 | 0.061031 | 0.410814 | 0.326101 | 7.576713 | 1.218511 | 0.752497 | 1.008564 | -0.03339 | 0.792961 | 1.536882 | 25.18585 | 19.3116 | 10.71039 | 4.229748 | 6.480639 | 1.086234 | 1.151418 | 2.237652 | 0.088097 | 3.039135 | 0.119651 |
| 3/18/2018 | 3/17 | 3.995607 | 14.69664 | 9.346125 | 13.33072 | 2.513337 | 0.079164 | 0.061031 | 0.411565 | 0.317295 | 8.011454 | 1.242667 | 0.813276 | 1.008014 | -0.02636 | 0.792961 | 1.54402 | 25.46952 | 19.52911 | 10.26466 | 3.823277 | 6.441379 | 1.081628 | 1.09151 | 2.173138 | 0.085557 | 2.928668 | 0.115302 |
| 3/19/2018 | 3/18 | 3.889714 | 15.01854 | 9.454125 | 13.746 | 2.707313 | 0.079672 | 0.061031 | 0.40467 | 0.309989 | 8.626469 | 1.257176 | 0.807234 | 1.007462 | -0.01934 | 0.792961 | 1.551163 | 25.75324 | 19.74666 | 10.58442 | 3.960698 | 6.623725 | 1.093611 | 1.203196 | 2.296808 | 0.090425 | 3.127634 | 0.123135 |
| 3/20/2018 | 3/19 | 3.176857 | 13.73732 | 8.457089 | 13.53788 | 2.748324 | 0.075086 | 0.061031 | 0.388752 | 0.315984 | 8.788166 | 1.169444 | 0.767582 | 1.006907 | -0.0123 | 0.792961 | 1.558308 | 26.0369 | 19.96416 | 10.42417 | 3.797977 | 6.626194 | 1.050985 | 1.115938 | 2.166923 | 0.085312 | 2.932992 | 0.115472 |
| 3/21/2018 | 3/20 | 2.735929 | 15.44854 | 9.092232 | 15.01515 | 2.074654 | 0.077981 | 0.061031 | 0.428318 | 0.335222 | 6.619072 | 1.249451 | 0.743925 | 1.006351 | -0.00526 | 0.792961 | 1.565455 | 26.3204 | 20.18154 | 11.56167 | 4.478318 | 7.08335 | 1.237843 | 1.121689 | 2.359532 | 0.092895 | 3.144482 | 0.123798 |
| 3/22/2018 | 3/21 | 4.203714 | 16.64439 | 10.42405 | 15.01354 | 2.121611 | 0.084361 | 0.061031 | 0.445371 | 0.322206 | 6.737078 | 1.359743 | 0.825266 | 1.005793 | 0.001779 | 0.792961 | 1.572603 | 26.60364 | 20.39871 | 11.56042 | 4.355818 | 7.204606 | 1.309158 | 1.160205 | 2.469363 | 0.097219 | 3.282002 | 0.129213 |
| 3/23/2018 | 3/22 | 3.520214 | 17.28346 | 10.40184 | 15.95934 | 2.139493 | 0.084251 | 0.061031 | 0.444178 | 0.321763 | 6.794393 | 1.379508 | 0.786461 | 1.005232 | 0.008819 | 0.792961 | 1.57975 | 26.88651 | 20.61561 | 12.28869 | 4.772711 | 7.515982 | 1.36208 | 1.296511 | 2.658591 | 0.104669 | 3.568719 | 0.140501 |
| 3/24/2018 | 3/23 | 3.254571 | 16.47571 | 9.865143 | 15.80618 | 2.569119 | 0.081631 | 0.061031 | 0.416542 | 0.311427 | 8.17424 | 1.322922 | 0.771819 | 1.004671 | 0.015857 | 0.792961 | 1.586897 | 27.16893 | 20.83215 | 12.17076 | 4.618534 | 7.552225 | 1.283493 | 1.402929 | 2.686423 | 0.105765 | 3.660442 | 0.144112 |
| 3/25/2018 | 3/24 | 3.234 | 17.10304 | 10.16852 | 16.35678 | 2.427427 | 0.083103 | 0.061031 | 0.427254 | 0.313777 | 7.715139 | 1.360431 | 0.770696 | 1.004108 | 0.022889 | 0.792961 | 1.594041 | 27.45078 | 21.04827 | 12.59472 | 4.812469 | 7.782251 | 1.3566 | 1.427652 | 2.784252 | 0.109616 | 3.779498 | 0.148799 |
| 3/26/2018 | 3/25 | 3.656143 | 17.50668 | 10.58141 | 16.5133 | 2.525776 | 0.085143 | 0.061031 | 0.428747 | 0.30733 | 8.016035 | 1.397309 | 0.794047 | 1.003544 | 0.029915 | 0.792961 | 1.601181 | 27.73197 | 21.26388 | 12.71524 | 4.794476 | 7.920769 | 1.38557 | 1.486174 | 2.871744 | 0.113061 | 3.906365 | 0.153794 |
| 3/27/2018 | 3/26 | 3.97575 | 17.89514 | 10.93545 | 16.72171 | 2.649198 | 0.086926 | 0.061031 | 0.428355 | 0.300751 | 8.397254 | 1.431147 | 0.81214 | 1.002978 | 0.036932 | 0.792961 | 1.608317 | 28.01241 | 21.47891 | 12.87571 | 4.80478 | 8.070933 | 1.410548 | 1.563291 | 2.973838 | 0.11708 | 4.060328 | 0.159855 |
| 3/28/2018 | 3/27 | 3.569393 | 17.11121 | 10.3403 | 16.65797 | 2.847839 | 0.083947 | 0.061031 | 0.411357 | 0.299067 | 9.045855 | 1.370184 | 0.789198 | 1.002412 | 0.043938 | 0.792961 | 1.615448 | 28.29199 | 21.69328 | 12.82664 | 4.705427 | 8.121208 | 1.363013 | 1.57175 | 2.934763 | 0.115542 | 4.020273 | 0.158278 |
| 3/29/2018 | 3/28 | 4.090929 | 16.74518 | 10.41805 | 16.2614 | 2.801969 | 0.084331 | 0.061031 | 0.414393 | 0.299901 | 8.897712 | 1.362569 | 0.818749 | 1.001845 | 0.050931 | 0.792961 | 1.622572 | 28.57063 | 21.90693 | 12.52128 | 4.423796 | 8.097482 | 1.369059 | 1.451149 | 2.820208 | 0.111032 | 3.820464 | 0.150412 |
| 3/30/2018 | 3/29 | 3.379357 | 17.2235 | 10.30143 | 17.17402 | 2.604494 | 0.083755 | 0.061031 | 0.421237 | 0.30695 | 8.27403 | 1.371879 | 0.778667 | 1.001278 | 0.057909 | 0.792961 | 1.629688 | 28.84822 | 22.11977 | 13.224 | 4.800871 | 8.423126 | 1.447639 | 1.506588 | 2.954227 | 0.116308 | 3.998164 | 0.157408 |
| 3/31/2018 | 3/30 | 2.5305 | 16.60793 | 9.569214 | 17.48408 | 2.625291 | 0.080217 | 0.061031 | 0.409845 | 0.311823 | 8.36171 | 1.311495 | 0.733125 | 1.00071 | 0.06487 | 0.792961 | 1.636795 | 29.12467 | 22.33175 | 13.46274 | 4.893506 | 8.569234 | 1.432918 | 1.508025 | 2.940943 | 0.115785 | 3.983414 | 0.156827 |
| 4/1/2018 | 3/31 | 2.896036 | 15.70471 | 9.300375 | 16.83519 | 2.509061 | 0.07895 | 0.061031 | 0.411099 | 0.317796 | 7.99912 | 1.268234 | 0.675939 | 1.000142 | 0.071811 | 0.792961 | 1.643893 | 29.3999 | 22.54279 | 12.9631 | 4.634148 | 8.328948 | 1.397 | 1.505666 | 2.902666 | 0.114278 | 3.947825 | 0.155426 |
| 4/2/2018 | 4/1 | 3.451714 | 16.10171 | 9.776714 | 16.88646 | 2.418098 | 0.081206 | 0.061031 | 0.422037 | 0.317187 | 7.696135 | 1.30627 | 0.703437 | 0.999574 | 0.078732 | 0.792961 | 1.650979 | 29.67381 | 22.75281 | 13.00257 | 4.573063 | 8.42951 | 1.451488 | 1.471581 | 2.92307 | 0.115081 | 3.946554 | 0.155376 |
| 4/3/2018 | 4/2 | 2.979714 | 17.19257 | 10.08614 | 18.06359 | 2.240837 | 0.082701 | 0.061031 | 0.43474 | 0.320827 | 7.124167 | 1.35909 | 0.680018 | 0.999006 | 0.085629 | 0.792961 | 1.658054 | 29.94631 | 22.96175 | 13.90896 | 5.064814 | 8.844149 | 1.568722 | 1.552103 | 3.120825 | 0.122867 | 4.207036 | 0.165631 |
| 4/4/2018 | 4/3 | 2.669964 | 16.73189 | 9.700929 | 18.13002 | 2.487486 | 0.080844 | 0.061031 | 0.417814 | 0.315421 | 7.919102 | 1.322625 | 0.665026 | 0.998438 | 0.0925 | 0.792961 | 1.665115 | 30.21732 | 23.16955 | 13.96012 | 5.025448 | 8.934668 | 1.523075 | 1.642583 | 3.165658 | 0.124632 | 4.308019 | 0.169607 |
| 4/5/2018 | 4/4 | 3.219607 | 17.07629 | 10.14795 | 18.15769 | 2.322859 | 0.083003 | 0.061031 | 0.431777 | 0.317483 | 7.383323 | 1.358388 | 0.691833 | 0.997871 | 0.099344 | 0.792961 | 1.672161 | 30.48674 | 23.37613 | 13.98142 | 4.950844 | 9.030575 | 1.590873 | 1.562458 | 3.153331 | 0.124147 | 4.243401 | 0.167063 |
| 4/6/2018 | 4/5 | 4.032036 | 16.65514 | 10.34359 | 17.48283 | 2.284002 | 0.083963 | 0.061031 | 0.436423 | 0.317229 | 7.254802 | 1.355441 | 0.733205 | 0.997305 | 0.106159 | 0.792961 | 1.679192 | 30.75449 | 23.58144 | 13.46178 | 4.551337 | 8.91044 | 1.586599 | 1.432034 | 3.018633 | 0.118844 | 4.016044 | 0.158112 |
| 4/7/2018 | 4/6 | 3.22375 | 16.74225 | 9.983 | 18.24874 | 2.436554 | 0.0822 | 0.061031 | 0.424168 | 0.314933 | 7.749225 | 1.338094 | 0.692039 | 0.996739 | 0.112942 | 0.792961 | 1.686206 | 31.02049 | 23.78539 | 14.05153 | 4.847104 | 9.204425 | 1.592924 | 1.576687 | 3.169611 | 0.124788 | 4.265013 | 0.167914 |
| 4/8/2018 | 4/7 | 3.433893 | 16.22489 | 9.829393 | 17.90208 | 2.422398 | 0.081459 | 0.061031 | 0.4226 | 0.316624 | 7.708386 | 1.312996 | 0.70254 | 0.996174 | 0.119692 | 0.792961 | 1.693202 | 31.28465 | 23.98794 | 13.7846 | 4.617417 | 9.167187 | 1.580615 | 1.489913 | 3.070528 | 0.120887 | 4.103457 | 0.161553 |
| 4/9/2018 | 4/8 | 4.135214 | 17.12718 | 10.6312 | 18.19341 | 2.109843 | 0.085392 | 0.061031 | 0.448949 | 0.320873 | 6.694815 | 1.387218 | 0.738613 | 0.995611 | 0.126406 | 0.792961 | 1.700178 | 31.5469 | 24.18903 | 14.00892 | 4.66319 | 9.345734 | 1.711871 | 1.393324 | 3.105195 | 0.122252 | 4.078449 | 0.160569 |
| 4/10/2018 | 4/9 | 3.60325 | 17.30582 | 10.45454 | 18.83848 | 2.210799 | 0.084512 | 0.061031 | 0.441502 | 0.318837 | 7.019535 | 1.383216 | 0.711105 | 0.995048 | 0.133083 | 0.792961 | 1.707133 | 31.80715 | 24.38858 | 14.50563 | 4.89474 | 9.610886 | 1.731237 | 1.504243 | 3.23548 | 0.127381 | 4.28464 | 0.168687 |
| 4/11/2018 | 4/10 | 3.449464 | 17.44025 | 10.44486 | 19.19007 | 2.193663 | 0.084464 | 0.061031 | 0.442184 | 0.319511 | 6.965363 | 1.387369 | 0.703324 | 0.994487 | 0.139721 | 0.792961 | 1.714066 | 32.06532 | 24.58654 | 14.77636 | 4.98639 | 9.789967 | 1.766218 | 1.522347 | 3.288565 | 0.129471 | 4.350639 | 0.171285 |
| 4/12/2018 | 4/11 | 3.627214 | 17.29871 | 10.46296 | 19.1213 | 2.317344 | 0.084554 | 0.061031 | 0.436583 | 0.315128 | 7.357608 | 1.383442 | 0.712325 | 0.993928 | 0.146317 | 0.792961 | 1.720976 | 32.32135 | 24.78284 | 14.7234 | 4.884656 | 9.838748 | 1.752535 | 1.556047 | 3.308582 | 0.130259 | 4.390589 | 0.172858 |
| 4/13/2018 | 4/12 | 3.837179 | 17.88796 | 10.86257 | 19.53694 | 2.595999 | 0.086557 | 0.061031 | 0.429654 | 0.30295 | 8.230739 | 1.426741 | 0.723088 | 0.993371 | 0.152869 | 0.792961 | 1.727861 | 32.57514 | 24.97745 | 15.04345 | 4.994987 | 10.04846 | 1.761481 | 1.754563 | 3.516045 | 0.138427 | 4.731849 | 0.186293 |
| 4/14/2018 | 4/13 | 3.629893 | 17.96082 | 10.79536 | 19.88308 | 2.370243 | 0.086217 | 0.061031 | 0.438914 | 0.310699 | 7.516751 | 1.425614 | 0.712461 | 0.992815 | 0.159377 | 0.792961 | 1.734719 | 32.82664 | 25.17029 | 15.30997 | 5.085189 | 10.22478 | 1.831021 | 1.665532 | 3.496553 | 0.13766 | 4.654847 | 0.183262 |
| 4/15/2018 | 4/14 | 3.389107 | 17.01846 | 10.20379 | 19.53744 | 2.613321 | 0.083276 | 0.061031 | 0.419451 | 0.307408 | 8.304936 | 1.359474 | 0.70029 | 0.992262 | 0.165837 | 0.792961 | 1.74155 | 33.07577 | 25.36131 | 15.04383 | 4.877386 | 10.16644 | 1.739844 | 1.682898 | 3.422741 | 0.134754 | 4.584347 | 0.180486 |
| 4/16/2018 | 4/15 | 3.865393 | 17.52786 | 10.69663 | 19.70704 | 2.529501 | 0.08572 | 0.061031 | 0.430234 | 0.306321 | 8.024597 | 1.404547 | 0.724545 | 0.991711 | 0.172248 | 0.792961 | 1.748351 | 33.32245 | 25.55046 | 15.17442 | 4.875999 | 10.29842 | 1.80774 | 1.671513 | 3.479253 | 0.136978 | 4.635644 | 0.182506 |
| 4/17/2018 | 4/16 | 3.354107 | 17.94746 | 10.65079 | 20.5166 | 2.094196 | 0.08549 | 0.061031 | 0.450001 | 0.321256 | 6.644708 | 1.417102 | 0.698536 | 0.991162 | 0.178608 | 0.792961 | 1.755121 | 33.56663 | 25.73768 | 15.79778 | 5.171349 | 10.62643 | 1.951018 | 1.533887 | 3.484905 | 0.137201 | 4.55534 | 0.179344 |
| 4/18/2018 | 4/17 | 4.10375 | 17.64861 | 10.87618 | 19.90809 | 2.034032 | 0.086625 | 0.061031 | 0.456249 | 0.321447 | 6.448688 | 1.419022 | 0.73696 | 0.990616 | 0.184915 | 0.792961 | 1.761859 | 33.80823 | 25.92293 | 15.32923 | 4.833921 | 10.49531 | 1.953698 | 1.413855 | 3.367553 | 0.132581 | 4.353364 | 0.171392 |
| 4/19/2018 | 4/18 | 3.636179 | 17.88286 | 10.75952 | 20.56165 | 2.285678 | 0.086036 | 0.061031 | 0.442352 | 0.313791 | 7.249485 | 1.420753 | 0.712781 | 0.990073 | 0.191167 | 0.792961 | 1.768563 | 34.04718 | 26.10615 | 15.83247 | 5.059523 | 10.77295 | 1.944299 | 1.610509 | 3.554808 | 0.139953 | 4.673353 | 0.18399 |



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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/20/2018 | 4/19 | 4.211107 | 18.7075 | 11.4593 | 20.88499 | 2.354969 | 0.089623 | 0.061031 | 0.449189 | 0.305889 | 7.450881 | 1.491519 | 0.742613 | 0.989533 | 0.197363 | 0.792961 | 1.775231 | 34.28343 | 26.2873 | 16.08144 | 5.119508 | 10.96193 | 2.008983 | 1.706865 | 3.715847 | 0.146293 | 4.902156 | 0.192998 |
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| 4/23/2018 | 4/22 | 5.289 | 17.96832 | 11.62866 | 19.92644 | 2.406379 | 0.09051 | 0.061031 | 0.449235 | 0.302923 | 7.609006 | 1.474974 | 0.801524 | 0.987931 | 0.215591 | 0.792961 | 1.795003 | 34.97532 | 26.81782 | 15.34336 | 4.534907 | 10.80845 | 1.981058 | 1.552261 | 3.53332 | 0.139107 | 4.606323 | 0.181351 |
| 4/24/2018 | 4/23 | 4.390786 | 17.65214 | 11.02146 | 20.50965 | 2.283443 | 0.087364 | 0.061031 | 0.44624 | 0.311737 | 7.235716 | 1.427589 | 0.752159 | 0.987404 | 0.221542 | 0.792961 | 1.80151 | 35.20013 | 26.9902 | 15.79243 | 4.739466 | 11.05297 | 2.012367 | 1.523527 | 3.535894 | 0.139208 | 4.590163 | 0.180715 |
| 4/25/2018 | 4/24 | 4.471536 | 18.32114 | 11.39634 | 21.09168 | 2.138155 | 0.089295 | 0.061031 | 0.458641 | 0.313473 | 6.766401 | 1.473343 | 0.756485 | 0.986881 | 0.227427 | 0.792961 | 1.807972 | 35.42195 | 27.16028 | 16.24059 | 4.916733 | 11.32386 | 2.118985 | 1.520516 | 3.639501 | 0.143287 | 4.696218 | 0.18489 |
| 4/26/2018 | 4/25 | 5.355036 | 18.85718 | 12.10611 | 20.95403 | 2.039061 | 0.09305 | 0.061031 | 0.473795 | 0.310761 | 6.436744 | 1.536029 | 0.805264 | 0.986362 | 0.233245 | 0.792961 | 1.814388 | 35.64071 | 27.32801 | 16.13461 | 4.784672 | 11.34993 | 2.194037 | 1.461739 | 3.655776 | 0.143928 | 4.67421 | 0.184024 |
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| 4/28/2018 | 4/27 | 3.085893 | 16.78354 | 9.934714 | 21.35872 | 2.472317 | 0.081967 | 0.061031 | 0.421856 | 0.314108 | 7.864308 | 1.336853 | 0.685225 | 0.985336 | 0.244671 | 0.792961 | 1.827071 | 36.06884 | 27.65629 | 16.44621 | 4.905144 | 11.54107 | 1.986416 | 1.60968 | 3.596096 | 0.141579 | 4.70201 | 0.185119 |
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| 4/30/2018 | 4/29 | 3.472321 | 17.93325 | 10.70279 | 22.19843 | 2.118783 | 0.085751 | 0.061031 | 0.44955 | 0.319957 | 6.721488 | 1.419445 | 0.704475 | 0.984327 | 0.255808 | 0.792961 | 1.839544 | 36.48414 | 27.97473 | 17.09279 | 5.128447 | 11.96434 | 2.194454 | 1.537606 | 3.73206 | 0.146931 | 4.797872 | 0.188893 |
| 5/1/2018 | 4/30 | 4.68575 | 19.23357 | 11.95966 | 22.38873 | 2.040179 | 0.092265 | 0.061031 | 0.471626 | 0.311972 | 6.443582 | 1.541489 | 0.768066 | 0.983829 | 0.261263 | 0.792961 | 1.845696 | 36.68685 | 28.13016 | 17.23932 | 5.120926 | 12.1184 | 2.331861 | 1.554748 | 3.886609 | 0.153016 | 4.969342 | 0.195643 |
| 5/2/2018 | 5/1 | 5.561036 | 21.1075 | 13.33427 | 23.27019 | 2.022297 | 0.099867 | 0.061031 | 0.492288 | 0.300852 | 6.356443 | 1.705272 | 0.817029 | 0.983336 | 0.266641 | 0.792961 | 1.851788 | 36.88622 | 28.28302 | 17.91804 | 5.387345 | 12.5307 | 2.516836 | 1.698629 | 4.215465 | 0.165963 | 5.40508 | 0.212798 |
| 5/3/2018 | 5/2 | 6.03425 | 21.23371 | 13.63398 | 23.13127 | 2.16833 | 0.101593 | 0.061031 | 0.489325 | 0.293959 | 6.808325 | 1.730131 | 0.844631 | 0.982848 | 0.27194 | 0.792961 | 1.857819 | 37.08218 | 28.43328 | 17.81107 | 5.26736 | 12.54371 | 2.504284 | 1.772213 | 4.276497 | 0.168366 | 5.514292 | 0.217098 |
| 5/4/2018 | 5/3 | 5.575571 | 18.99739 | 12.28648 | 21.84942 | 2.332577 | 0.094026 | 0.061031 | 0.462135 | 0.299968 | 7.358636 | 1.552511 | 0.817865 | 0.982366 | 0.277159 | 0.792961 | 1.863787 | 37.27471 | 28.5809 | 16.82406 | 4.753177 | 12.07088 | 2.275976 | 1.621624 | 3.8976 | 0.153449 | 5.018408 | 0.197575 |
| 5/5/2018 | 5/4 | 5.14 | 19.219 | 12.1795 | 22.49144 | 2.180996 | 0.093446 | 0.061031 | 0.467851 | 0.305562 | 6.883022 | 1.554234 | 0.793143 | 0.981888 | 0.282295 | 0.792961 | 1.869688 | 37.46375 | 28.72586 | 17.31841 | 4.965888 | 12.35252 | 2.357891 | 1.600721 | 3.958611 | 0.155851 | 5.068504 | 0.199547 |
| 5/6/2018 | 5/5 | 5.616286 | 20.45975 | 13.03802 | 23.20835 | 2.061041 | 0.098185 | 0.061031 | 0.486101 | 0.302159 | 6.48493 | 1.65811 | 0.82021 | 0.981416 | 0.287347 | 0.792961 | 1.875521 | 37.64928 | 28.86811 | 17.87043 | 5.177985 | 12.69245 | 2.517283 | 1.64185 | 4.159133 | 0.163745 | 5.304003 | 0.208819 |
| 5/7/2018 | 5/6 | 5.949679 | 20.02071 | 12.9852 | 22.70564 | 2.000877 | 0.097887 | 0.061031 | 0.488366 | 0.30449 | 6.296791 | 1.636569 | 0.839638 | 0.980949 | 0.292315 | 0.792961 | 1.881283 | 37.83125 | 29.00764 | 17.48334 | 4.935977 | 12.54736 | 2.500106 | 1.527962 | 4.028068 | 0.158585 | 5.092382 | 0.200487 |
| 5/8/2018 | 5/7 | 5.339893 | 20.40589 | 12.87289 | 23.60546 | 2.087304 | 0.097258 | 0.061031 | 0.482424 | 0.302732 | 6.571361 | 1.645454 | 0.804405 | 0.980488 | 0.297196 | 0.792961 | 1.886972 | 38.00962 | 29.14441 | 18.1762 | 5.253724 | 12.92248 | 2.54352 | 1.673149 | 4.216669 | 0.166011 | 5.381973 | 0.211889 |
| 5/9/2018 | 5/8 | 6.13725 | 21.86989 | 14.00357 | 24.23295 | 2.141135 | 0.103757 | 0.061031 | 0.495926 | 0.291712 | 6.714278 | 1.783534 | 0.850746 | 0.980033 | 0.301988 | 0.792961 | 1.892585 | 38.18435 | 29.27839 | 18.65937 | 5.419304 | 13.24007 | 2.678967 | 1.82699 | 4.505957 | 0.1774 | 5.782482 | 0.227657 |
| 5/10/2018 | 5/9 | 6.788393 | 23.38207 | 15.08523 | 24.99873 | 2.01019 | 0.110316 | 0.061031 | 0.517769 | 0.286451 | 6.279985 | 1.931207 | 0.89032 | 0.979584 | 0.306692 | 0.792961 | 1.898121 | 38.35542 | 29.40955 | 19.24903 | 5.63983 | 13.6092 | 2.874942 | 1.872462 | 4.747404 | 0.186906 | 6.064091 | 0.238744 |
| 5/11/2018 | 5/10 | 7.657571 | 24.22346 | 15.94052 | 25.08679 | 2.231475 | 0.115749 | 0.061031 | 0.518856 | 0.273579 | 6.95066 | 2.03609 | 0.945669 | 0.979141 | 0.311304 | 0.792961 | 1.903575 | 38.52278 | 29.53788 | 19.31682 | 5.589048 | 13.72778 | 2.906079 | 2.073495 | 4.979574 | 0.196046 | 6.43515 | 0.253352 |
| 5/12/2018 | 5/11 | 7.995893 | 23.54686 | 15.77138 | 24.4094 | 2.212289 | 0.114657 | 0.061031 | 0.517417 | 0.275419 | 6.894936 | 1.988092 | 0.96802 | 0.978704 | 0.315824 | 0.792961 | 1.908946 | 38.6864 | 29.66334 | 18.79523 | 5.281393 | 13.51384 | 2.852856 | 1.937112 | 4.789968 | 0.188581 | 6.1468 | 0.242 |
| 5/13/2018 | 5/12 | 6.774786 | 22.33511 | 14.55495 | 24.57163 | 2.166095 | 0.107058 | 0.061031 | 0.502531 | 0.286483 | 6.779524 | 1.842444 | 0.889476 | 0.978273 | 0.320251 | 0.792961 | 1.914231 | 38.84626 | 29.78591 | 18.87858 | 5.342093 | 13.53648 | 2.77542 | 1.850869 | 4.62629 | 0.182137 | 5.918935 | 0.233029 |
| 5/14/2018 | 5/13 | 6.021929 | 22.21446 | 14.1182 | 25.11122 | 1.87496 | 0.104436 | 0.061031 | 0.511004 | 0.298626 | 5.877246 | 1.80761 | 0.843902 | 0.977848 | 0.324583 | 0.792961 | 1.919427 | 39.00232 | 29.90557 | 19.33564 | 5.557787 | 13.77785 | 2.872537 | 1.691405 | 4.563942 | 0.179683 | 5.750684 | 0.226405 |
| 5/15/2018 | 5/14 | 6.715357 | 21.95821 | 14.33679 | 24.45881 | 1.736378 | 0.105741 | 0.061031 | 0.521397 | 0.300939 | 5.438705 | 1.809825 | 0.885802 | 0.977431 | 0.328818 | 0.792961 | 1.924533 | 39.15455 | 30.0223 | 18.83329 | 5.252184 | 13.5811 | 2.889106 | 1.512364 | 4.40147 | 0.173286 | 5.463555 | 0.215101 |
| 5/16/2018 | 5/15 | 7.152393 | 23.13754 | 15.14496 | 25.14218 | 1.781454 | 0.110688 | 0.061031 | 0.530406 | 0.292455 | 5.564244 | 1.922642 | 0.913142 | 0.97702 | 0.332956 | 0.792961 | 1.929544 | 39.30292 | 30.13606 | 19.35948 | 5.447782 | 13.9117 | 3.01057 | 1.642753 | 4.653324 | 0.183202 | 5.809942 | 0.228738 |
| 5/17/2018 | 5/16 | 7.855536 | 24.60686 | 16.2312 | 25.83229 | 1.966231 | 0.117646 | 0.061031 | 0.536027 | 0.278075 | 6.118316 | 2.078304 | 0.958692 | 0.976615 | 0.336995 | 0.792961 | 1.934459 | 39.4474 | 30.24685 | 19.89086 | 5.631283 | 14.25958 | 3.118559 | 1.904851 | 5.023409 | 0.197772 | 6.365739 | 0.25062 |
| 5/18/2018 | 5/17 | 7.135821 | 24.63868 | 15.88725 | 26.4995 | 2.023042 | 0.115404 | 0.061031 | 0.528371 | 0.279428 | 6.302591 | 2.055739 | 0.912092 | 0.976218 | 0.340935 | 0.792961 | 1.939275 | 39.58797 | 30.35463 | 20.40461 | 5.882004 | 14.52261 | 3.130717 | 2.014103 | 5.144821 | 0.202552 | 6.562945 | 0.258384 |
| 5/19/2018 | 5/18 | 8.238143 | 25.25918 | 16.74866 | 26.2224 | 1.986907 | 0.12109 | 0.061031 | 0.54215 | 0.273254 | 6.171611 | 2.153653 | 0.984308 | 0.975828 | 0.344773 | 0.792961 | 1.943989 | 39.7246 | 30.45939 | 20.19125 | 5.686351 | 14.5049 | 3.208445 | 1.972 | 5.180445 | 0.203955 | 6.571508 | 0.258721 |
| 5/20/2018 | 5/19 | 8.199857 | 25.52411 | 16.86198 | 26.54329 | 2.021925 | 0.121855 | 0.061031 | 0.541957 | 0.27144 | 6.277926 | 2.177743 | 0.981718 | 0.975445 | 0.34851 | 0.792961 | 1.948599 | 39.85727 | 30.56112 | 20.43833 | 5.773803 | 14.66453 | 3.242596 | 2.038126 | 5.280722 | 0.207902 | 6.718439 | 0.264505 |
| 5/21/2018 | 5/20 | 8.259214 | 25.14375 | 16.70148 | 26.28887 | 1.91091 | 0.120772 | 0.061031 | 0.545355 | 0.275591 | 5.93652 | 2.14343 | 0.985737 | 0.975069 | 0.352143 | 0.792961 | 1.953101 | 39.98595 | 30.65978 | 20.24243 | 5.646695 | 14.59573 | 3.24762 | 1.894046 | 5.141666 | 0.202428 | 6.478346 | 0.255053 |
| 5/22/2018 | 5/21 | 8.22325 | 25.02879 | 16.62602 | 26.30907 | 1.940899 | 0.120266 | 0.061031 | 0.542784 | 0.275447 | 6.031256 | 2.131202 | 0.9833 | 0.9747 | 0.355672 | 0.792961 | 1.957493 | 40.11061 | 30.75537 | 20.25798 | 5.626436 | 14.63155 | 3.240244 | 1.906998 | 5.147241 | 0.202647 | 6.491641 | 0.255576 |
| 5/23/2018 | 5/22 | 8.690393 | 23.81736 | 16.25388 | 25.03568 | 1.943879 | 0.117796 | 0.061031 | 0.537478 | 0.278474 | 6.048289 | 2.037815 | 1.015364 | 0.974339 | 0.359095 | 0.792961 | 1.961773 | 40.23125 | 30.84787 | 19.27747 | 5.123208 | 14.15426 | 3.103901 | 1.722103 | 4.826004 | 0.19 | 6.034749 | 0.237589 |
| 5/24/2018 | 5/23 | 7.766929 | 23.47504 | 15.62098 | 25.58598 | 1.791327 | 0.113693 | 0.061031 | 0.536553 | 0.288025 | 5.585851 | 1.973518 | 0.952843 | 0.973986 | 0.362412 | 0.792961 | 1.965937 | 40.34783 | 30.93726 | 19.70121 | 5.338134 | 14.36307 | 3.14427 | 1.642129 | 4.786399 | 0.188441 | 5.941001 | 0.233898 |
| 5/25/2018 | 5/24 | 7.490429 | 23.87489 | 15.68266 | 26.20388 | 1.853167 | 0.114088 | 0.061031 | 0.534185 | 0.285763 | 5.777453 | 1.998843 | 0.934796 | 0.97364 | 0.365621 | 0.792961 | 1.969983 | 40.46033 | 31.02353 | 20.17699 | 5.545847 | 14.63114 | 3.188817 | 1.756721 | 4.945539 | 0.194706 | 6.180949 | 0.243344 |
| 5/26/2018 | 5/25 | 8.202036 | 24.37921 | 16.29063 | 26.10736 | 1.932144 | 0.118038 | 0.061031 | 0.538586 | 0.278476 | 6.011013 | 2.070067 | 0.981865 | 0.973302 | 0.368723 | 0.792961 | 1.973909 | 40.56874 | 31.10665 | 20.10267 | 5.449565 | 14.6531 | 3.219915 | 1.821563 | 5.041478 | 0.198483 | 6.322182 | 0.248905 |
| 5/27/2018 | 5/26 | 9.038214 | 25.33371 | 17.18596 | 26.27002 | 1.849255 | 0.124066 | 0.061031 | 0.555177 | 0.273107 | 5.735391 | 2.191161 | 1.039833 | 0.972973 | 0.371714 | 0.792961 | 1.977712 | 40.67304 | 31.18662 | 20.22792 | 5.435436 | 14.79248 | 3.35068 | 1.803414 | 5.154094 | 0.202917 | 6.426914 | 0.253028 |
| 5/28/2018 | 5/27 | 8.822786 | 24.78175 | 16.80227 | 26.06137 | 1.721477 | 0.121451 | 0.061031 | 0.556594 | 0.279698 | 5.346159 | 2.130609 | 1.024617 | 0.972651 | 0.374596 | 0.792961 | 1.981389 | 40.7732 | 31.26343 | 20.06725 | 5.353026 | 14.71423 | 3.341457 | 1.653801 | 4.995258 | 0.196664 | 6.162853 | 0.242632 |
| 5/29/2018 | 5/28 | 9.718036 | 25.006 | 17.36202 | 25.56767 | 1.966417 | 0.125281 | 0.061031 | 0.551615 | 0.268722 | 6.095065 | 2.186931 | 1.08916 | 0.972337 | 0.377367 | 0.792961 | 1.984938 | 40.86922 | 31.33705 | 19.68711 | 5.110243 | 14.57686 | 3.280654 | 1.798016 | 5.07867 | 0.199948 | 6.343055 | 0.249727 |
| 5/30/2018 | 5/29 | 9.863643 | 25.54557 | 17.70461 | 25.95321 | 1.676959 | 0.127676 | 0.061031 | 0.571243 | 0.273065 | 5.191741 | 2.244489 | 1.099989 | 0.972031 | 0.380026 | 0.792961 | 1.988356 | 40.96107 | 31.40748 | 19.98397 | 5.212267 | 14.7717 | 3.442796 | 1.622538 | 5.065334 | 0.199423 | 6.213497 | 0.244626 |
| 5/31/2018 | 5/30 | 9.242143 | 24.97204 | 17.10709 | 26.0485 | 1.713653 | 0.123524 | 0.061031 | 0.561181 | 0.27727 | 5.316271 | 2.164741 | 1.054419 | 0.971734 | 0.382572 | 0.792961 | 1.991641 | 41.04874 | 31.4747 | 20.05734 | 5.263756 | 14.79359 | 3.387165 | 1.636662 | 5.023827 | 0.197788 | 6.179343 | 0.243281 |
| 6/1/2018 | 5/31 | 8.550607 | 24.79357 | 16.67209 | 26.52374 | 1.673979 | 0.120575 | 0.061031 | 0.557333 | 0.282106 | 5.200987 | 2.121352 | 1.005674 | 0.971445 | 0.385005 | 0.792961 | 1.994791 | 41.13222 | 31.5387 | 20.42328 | 5.448952 | 14.97433 | 3.405042 | 1.636952 | 5.041994 | 0.198504 | 6.1981 | 0.24402 |
| 6/2/2018 | 6/1 | 8.931036 | 24.51264 | 16.72184 | 26.02821 | 1.71682 | 0.120909 | 0.061031 | 0.555736 | 0.280519 | 5.333177 | 2.109848 | 1.032238 | 0.971164 | 0.387324 | 0.792961 | 1.997803 | 41.21148 | 31.59948 | 20.04172 | 5.239751 | 14.80197 | 3.356205 | 1.612169 | 4.968373 | 0.195605 | 6.104682 | 0.240342 |
| 6/3/2018 | 6/2 | 8.7675 | 25.21829 | 16.99289 | 26.79302 | 1.589041 | 0.122744 | 0.061031 | 0.566296 | 0.281576 | 4.931627 | 2.169676 | 1.020744 | 0.970892 | 0.389528 | 0.792961 | 2.000675 | 41.28653 | 31.65702 | 20.63062 | 5.495177 | 15.13545 | 3.497026 | 1.595439 | 5.092464 | 0.200491 | 6.222003 | 0.244961 |
| 6/4/2018 | 6/3 | 8.903393 | 25.73057 | 17.31698 | 27.14427 | 1.655538 | 0.124969 | 0.061031 | 0.567129 | 0.276969 | 5.132267 | 2.224431 | 1.030287 | 0.970629 | 0.391617 | 0.792961 | 2.003405 | 41.35734 | 31.71132 | 20.90109 | 5.592827 | 15.30826 | 3.542159 | 1.697452 | 5.239611 | 0.206284 | 6.441702 | 0.25361 |
| 6/5/2018 | 6/4 | 9.718179 | 25.57529 | 17.64673 | 26.39265 | 1.784807 | 0.127268 | 0.061031 | 0.564794 | 0.270847 | 5.526732 | 2.241464 | 1.089171 | 0.970374 | 0.39359 | 0.792961 | 2.005991 | 41.4239 | 31.76235 | 20.32234 | 5.270588 | 15.05175 | 3.468467 | 1.724863 | 5.19333 | 0.204462 | 6.410926 | 0.252399 |
| 6/6/2018 | 6/5 | 10.56893 | 27.018 | 18.79346 | 26.9212 | 1.855402 | 0.135545 | 0.061031 | 0.576597 | 0.259623 | 5.722753 | 2.422338 | 1.153795 | 0.970129 | 0.395446 | 0.792961 | 2.00843 | 41.4862 | 31.81013 | 20.72932 | 5.378618 | 15.3507 | 3.611278 | 1.88475 | 5.496028 | 0.216379 | 6.830336 | 0.268911 |
| 6/7/2018 | 6/6 | 10.57243 | 27.77064 | 19.17154 | 27.56592 | 1.801944 | 0.138371 | 0.061031 | 0.584352 | 0.25774 | 5.550675 | 2.502806 | 1.154068 | 0.969892 | 0.397185 | 0.792961 | 2.010722 | 41.54424 | 31.85463 | 21.22576 | 5.58391 | 15.64185 | 3.729264 | 1.929548 | 5.658812 | 0.222788 | 7.028992 | 0.276732 |
| 6/8/2018 | 6/7 | 11.39757 | 29.04414 | 20.22086 | 27.95907 | 1.769161 | 0.146479 | 0.061031 | 0.599779 | 0.249901 | 5.430189 | 2.681859 | 1.219959 | 0.969664 | 0.398806 | 0.792961 | 2.012863 | 41.59801 | 31.89585 | 21.52848 | 5.641749 | 15.88673 | 3.887643 | 1.983815 | 5.871458 | 0.23116 | 7.285582 | 0.286834 |
| 6/9/2018 | 6/8 | 12.19943 | 29.42732 | 20.81338 | 27.65826 | 1.65144 | 0.151233 | 0.061031 | 0.613439 | 0.247559 | 5.058641 | 2.76339 | 1.287137 | 0.969444 | 0.400309 | 0.792961 | 2.014854 | 41.64749 | 31.93379 | 21.29686 | 5.462892 | 15.83397 | 3.962975 | 1.84873 | 5.811705 | 0.228807 | 7.13296 | 0.280825 |
| 6/10/2018 | 6/9 | 12.27032 | 28.90189 | 20.58611 | 27.20485 | 1.603383 | 0.149394 | 0.061031 | 0.613033 | 0.25044 | 4.915236 | 2.705392 | 1.29323 | 0.969234 | 0.401693 | 0.792961 | 2.01669 | 41.69267 | 31.96844 | 20.94774 | 5.297498 | 15.65024 | 3.914398 | 1.73833 | 5.652728 | 0.222548 | 6.894029 | 0.271418 |
| 6/11/2018 | 6/10 | 11.62929 | 29.23236 | 20.43082 | 28.01558 | 1.727623 | 0.148149 | 0.061031 | 0.604616 | 0.249077 | 5.298901 | 2.714212 | 1.239047 | 0.969034 | 0.402958 | 0.792961 | 2.018373 | 41.73356 | 31.99979 | 21.572 | 5.611099 | 15.9609 | 3.937291 | 1.946977 | 5.884268 | 0.231664 | 7.273391 | 0.286354 |
| 6/12/2018 | 6/11 | 11.68589 | 29.34068 | 20.51329 | 28.0813 | 1.685713 | 0.148809 | 0.061031 | 0.60783 | 0.249291 | 5.168904 | 2.729498 | 1.24375 | 0.968842 | 0.404104 | 0.792961 | 2.019899 | 41.77015 | 32.02785 | 21.6226 | 5.620249 | 16.00235 | 3.968501 | 1.914473 | 5.882974 | 0.231613 | 7.250139 | 0.285439 |
| 6/13/2018 | 6/12 | 11.72829 | 29.82896 | 20.77863 | 28.45568 | 1.714212 | 0.15095 | 0.061031 | 0.60977 | 0.246539 | 5.251542 | 2.789624 | 1.247282 | 0.968659 | 0.40513 | 0.792961 | 2.021268 | 41.80243 | 32.0526 | 21.91087 | 5.735699 | 16.17517 | 4.024161 | 1.996884 | 6.021045 | 0.237049 | 7.448266 | 0.293239 |
| 6/14/2018 | 6/13 | 12.22632 | 29.67243 | 20.94938 | 27.95511 | 1.721849 | 0.152342 | 0.061031 | 0.611562 | 0.245005 | 5.271874 | 2.793812 | 1.289446 | 0.968486 | 0.406037 | 0.792961 | 2.022479 | 41.83039 | 32.07404 | 21.52543 | 5.518677 | 16.00676 | 3.993965 | 1.943092 | 5.937057 | 0.233742 | 7.324749 | 0.288376 |
| 6/15/2018 | 6/14 | 11.54821 | 29.46193 | 20.50507 | 28.34328 | 1.735633 | 0.148743 | 0.061031 | 0.605164 | 0.248307 | 5.322121 | 2.73759 | 1.232339 | 0.968322 | 0.406822 | 0.792961 | 2.02353 | 41.85404 | 32.09217 | 21.82433 | 5.700997 | 16.12333 | 3.98096 | 1.989218 | 5.970177 | 0.235046 | 7.389953 | 0.290943 |
| 6/16/2018 | 6/15 | 12.18746 | 30.15607 | 21.17177 | 28.39979 | 1.762269 | 0.154171 | 0.061031 | 0.612346 | 0.242409 | 5.391551 | 2.850596 | 1.286111 | 0.968168 | 0.407488 | 0.792961 | 2.024421 | 41.87337 | 32.10699 | 21.86784 | 5.660685 | 16.20715 | 4.049151 | 2.04472 | 6.093871 | 0.239916 | 7.55511 | 0.297445 |
| 6/17/2018 | 6/16 | 13.26611 | 31.68532 | 22.47571 | 28.76398 | 1.592953 | 0.16527 | 0.061031 | 0.637232 | 0.235319 | 4.852031 | 3.097459 | 1.381531 | 0.968023 | 0.408032 | 0.792961 | 2.025151 | 41.88837 | 32.1185 | 22.14827 | 5.677405 | 16.47086 | 4.28227 | 1.959201 | 6.241471 | 0.245727 | 7.65058 | 0.301204 |
| 6/18/2018 | 6/17 | 13.21957 | 32.21868 | 22.71913 | 29.22072 | 1.686272 | 0.167415 | 0.061031 | 0.635502 | 0.231673 | 5.132049 | 3.166634 | 1.377289 | 0.967887 | 0.408456 | 0.792961 | 2.025719 | 41.89906 | 32.12669 | 22.49995 | 5.831836 | 16.66811 | 4.321786 | 2.127452 | 6.449239 | 0.253907 | 7.979236 | 0.314143 |
| 6/19/2018 | 6/18 | 13.72796 | 31.90168 | 22.81482 | 28.58328 | 1.754446 | 0.168265 | 0.061031 | 0.633284 | 0.229698 | 5.337803 | 3.149511 | 1.424253 | 0.967761 | 0.408758 | 0.792961 | 2.026125 | 41.90542 | 32.13157 | 22.00913 | 5.567587 | 16.44154 | 4.24816 | 2.115314 | 6.363474 | 0.25053 | 7.881668 | 0.310302 |
| 6/20/2018 | 6/19 | 13.10304 | 31.93418 | 22.51861 | 29.0971 | 1.616981 | 0.165646 | 0.061031 | 0.636536 | 0.234527 | 4.924505 | 3.122507 | 1.366718 | 0.967645 | 0.40894 | 0.792961 | 2.026369 | 41.90746 | 32.13314 | 22.40477 | 5.800208 | 16.60456 | 4.312312 | 2.027817 | 6.340129 | 0.249611 | 7.799016 | 0.307048 |
| 6/21/2018 | 6/20 | 13.61571 | 32.06929 | 22.8425 | 28.80235 | 1.666342 | 0.168511 | 0.061031 | 0.638009 | 0.231074 | 5.069277 | 3.166298 | 1.413764 | 0.967538 | 0.409 | 0.792961 | 2.02645 | 41.90519 | 32.13139 | 22.17781 | 5.651009 | 16.5268 | 4.302057 | 2.05288 | 6.354937 | 0.250194 | 7.831009 | 0.308307 |
| 6/22/2018 | 6/21 | 12.97014 | 31.69511 | 22.33263 | 29.00881 | 1.596678 | 0.16402 | 0.061031 | 0.635285 | 0.236387 | 4.865734 | 3.084157 | 1.354749 | 0.96744 | 0.408939 | 0.792961 | 2.026368 | 41.89859 | 32.12633 | 22.33678 | 5.785863 | 16.55092 | 4.289935 | 1.989162 | 6.279097 | 0.247209 | 7.709825 | 0.303536 |
| 6/23/2018 | 6/22 | 13.13282 | 31.09864 | 22.11573 | 28.4073 | 1.802875 | 0.162141 | 0.061031 | 0.622223 | 0.234211 | 5.49814 | 3.014359 | 1.369413 | 0.967353 | 0.408757 | 0.792961 | 2.026123 | 41.88769 | 32.11797 | 21.87362 | 5.572716 | 16.3009 | 4.138259 | 2.118239 | 6.256498 | 0.246319 | 7.772734 | 0.306013 |
| 6/24/2018 | 6/23 | 12.60436 | 31.14671 | 21.87554 | 28.84902 | 1.612697 | 0.16008 | 0.061031 | 0.628811 | 0.239737 | 4.922169 | 2.994849 | 1.322281 | 0.967275 | 0.408454 | 0.792961 | 2.025716 | 41.87247 | 32.1063 | 22.21374 | 5.773519 | 16.44022 | 4.217819 | 1.973676 | 6.191495 | 0.24376 | 7.608905 | 0.299563 |
| 6/25/2018 | 6/24 | 12.83104 | 31.04282 | 21.93693 | 28.57737 | 1.643058 | 0.160605 | 0.061031 | 0.628023 | 0.238655 | 5.013792 | 2.992426 | 1.34232 | 0.967206 | 0.408029 | 0.792961 | 2.025147 | 41.85295 | 32.09133 | 22.00458 | 5.665676 | 16.3389 | 4.186571 | 1.974461 | 6.161033 | 0.24256 | 7.577867 | 0.298341 |
| 6/26/2018 | 6/25 | 13.06111 | 31.64046 | 22.35079 | 28.84789 | 1.696331 | 0.164178 | 0.061031 | 0.630462 | 0.234367 | 5.169099 | 3.081395 | 1.362931 | 0.967148 | 0.407484 | 0.792961 | 2.024417 | 41.82912 | 32.07307 | 22.21588 | 5.739151 | 16.47373 | 4.23751 | 2.081858 | 6.319368 | 0.248794 | 7.814323 | 0.307651 |
| 6/27/2018 | 6/26 | 13.38218 | 31.82618 | 22.60418 | 28.7233 | 1.670626 | 0.166399 | 0.061031 | 0.634876 | 0.232858 | 5.086407 | 3.121949 | 1.39216 | 0.967099 | 0.406818 | 0.792961 | 2.023525 | 41.80101 | 32.05151 | 22.11694 | 5.672223 | 16.44472 | 4.259666 | 2.048778 | 6.308444 | 0.248364 | 7.780863 | 0.306333 |
| 6/28/2018 | 6/27 | 13.47675 | 31.64096 | 22.55886 | 28.48251 | 1.716634 | 0.166 | 0.061031 | 0.632014 | 0.232365 | 5.227285 | 3.102139 | 1.400874 | 0.96706 | 0.406032 | 0.792961 | 2.022473 | 41.76861 | 32.02667 | 21.93154 | 5.590493 | 16.34104 | 4.213727 | 2.066423 | 6.28015 | 0.24725 | 7.763497 | 0.305649 |
| 6/29/2018 | 6/28 | 12.87254 | 31.2225 | 22.04752 | 28.60264 | 1.734329 | 0.161553 | 0.061031 | 0.624787 | 0.236032 | 5.290321 | 3.017572 | 1.346017 | 0.967031 | 0.405125 | 0.792961 | 2.021261 | 41.73193 | 31.99854 | 22.02403 | 5.69779 | 16.32624 | 4.161775 | 2.08724 | 6.249015 | 0.246024 | 7.745596 | 0.304945 |
| 6/30/2018 | 6/29 | 12.70857 | 31.37107 | 22.03982 | 28.81689 | 1.619402 | 0.161487 | 0.061031 | 0.630508 | 0.23829 | 4.939883 | 3.028916 | 1.331461 | 0.967011 | 0.404098 | 0.792961 | 2.019891 | 41.69099 | 31.96715 | 22.189 | 5.794986 | 16.39402 | 4.217316 | 1.998118 | 6.215434 | 0.244702 | 7.651422 | 0.301237 |
| 7/1/2018 | 6/30 | 12.0555 | 32.44768 | 22.25159 | 30.09004 | 1.648087 | 0.163316 | 0.061031 | 0.63167 | 0.236056 | 5.023779 | 3.142048 | 1.274845 | 0.967001 | 0.402952 | 0.792961 | 2.018364 | 41.64578 | 31.93248 | 23.16933 | 6.30878 | 16.86055 | 4.345323 | 2.214305 | 6.559628 | 0.258253 | 8.15496 | 0.321061 |
| 7/2/2018 | 7/1 | 13.48468 | 33.58468 | 23.53468 | 29.83822 | 1.676773 | 0.174774 | 0.061031 | 0.645877 | 0.225541 | 5.089102 | 3.371702 | 1.401606 | 0.967001 | 0.401686 | 0.792961 | 2.016681 | 41.59633 | 31.89457 | 22.97543 | 6.085807 | 16.88963 | 4.450717 | 2.261282 | 6.711999 | 0.264252 | 8.344544 | 0.328525 |
| 7/3/2018 | 7/2 | 14.19839 | 34.081 | 24.1397 | 29.63812 | 1.594256 | 0.180408 | 0.061031 | 0.657173 | 0.22232 | 4.828809 | 3.4813 | 1.468957 | 0.967011 | 0.400301 | 0.792961 | 2.014843 | 41.54263 | 31.8534 | 22.82135 | 5.951005 | 16.87035 | 4.523388 | 2.160328 | 6.683716 | 0.263138 | 8.247049 | 0.324687 |
| 7/4/2018 | 7/3 | 14.13611 | 34.48357 | 24.30984 | 29.94079 | 1.698379 | 0.182019 | 0.061031 | 0.654056 | 0.219306 | 5.141241 | 3.538471 | 1.462968 | 0.967031 | 0.398797 | 0.792961 | 2.012852 | 41.48472 | 31.80899 | 23.05441 | 6.074929 | 16.97948 | 4.531057 | 2.340141 | 6.871197 | 0.27052 | 8.563719 | 0.337154 |
| 7/5/2018 | 7/4 | 13.92725 | 34.27875 | 24.103 | 29.89892 | 1.699497 | 0.180062 | 0.061031 | 0.651551 | 0.220841 | 5.155146 | 3.496725 | 1.443042 | 0.96706 | 0.397175 | 0.792961 | 2.010711 | 41.42259 | 31.76135 | 23.02216 | 6.100034 | 16.92213 | 4.498454 | 2.334904 | 6.833358 | 0.26903 | 8.521463 | 0.335491 |
| 7/6/2018 | 7/5 | 14.31854 | 35.00425 | 24.66139 | 30.09515 | 1.661312 | 0.185388 | 0.061031 | 0.659996 | 0.217277 | 5.023094 | 3.627977 | 1.480569 | 0.967099 | 0.395436 | 0.792961 | 2.008417 | 41.35626 | 31.71049 | 23.17326 | 6.138021 | 17.03524 | 4.58722 | 2.343682 | 6.930902 | 0.27287 | 8.629173 | 0.339731 |
| 7/7/2018 | 7/6 | 15.05364 | 35.24321 | 25.14843 | 29.68135 | 1.695399 | 0.190141 | 0.061031 | 0.664009 | 0.213133 | 5.117784 | 3.704976 | 1.553392 | 0.967148 | 0.393579 | 0.792961 | 2.005977 | 41.28575 | 31.65642 | 22.85464 | 5.925324 | 16.92932 | 4.586418 | 2.346882 | 6.9333 | 0.272965 | 8.633861 | 0.339916 |
| 7/8/2018 | 7/7 | 15.14768 | 35.35621 | 25.25195 | 29.64157 | 1.692233 | 0.191165 | 0.061031 | 0.665358 | 0.212423 | 5.106453 | 3.727979 | 1.562931 | 0.967206 | 0.391606 | 0.792961 | 2.00339 | 41.21106 | 31.59916 | 22.82401 | 5.918263 | 16.90575 | 4.589336 | 2.348486 | 6.937821 | 0.273143 | 8.640186 | 0.340165 |
| 7/9/2018 | 7/8 | 14.63757 | 34.88839 | 24.76298 | 29.6158 | 1.590904 | 0.186371 | 0.061031 | 0.664626 | 0.217647 | 4.808567 | 3.627025 | 1.511798 | 0.967275 | 0.389517 | 0.792961 | 2.000659 | 41.13222 | 31.53871 | 22.80417 | 5.991406 | 16.81276 | 4.559075 | 2.213732 | 6.772807 | 0.266646 | 8.378554 | 0.329864 |
| 7/10/2018 | 7/9 | 14.08261 | 34.21839 | 24.1505 | 29.47199 | 1.744201 | 0.18051 | 0.061031 | 0.649936 | 0.219747 | 5.282781 | 3.495739 | 1.457841 | 0.967353 | 0.387312 | 0.792961 | 1.997787 | 41.04925 | 31.47508 | 22.69343 | 6.027938 | 16.66549 | 4.419257 | 2.365748 | 6.785005 | 0.267126 | 8.494795 | 0.334441 |
| 7/11/2018 | 7/10 | 14.20911 | 34.71821 | 24.46366 | 29.68083 | 1.684409 | 0.183487 | 0.061031 | 0.656551 | 0.218382 | 5.096315 | 3.578064 | 1.469989 | 0.96744 | 0.384992 | 0.792961 | 1.994774 | 40.96215 | 31.4083 | 22.85424 | 6.106889 | 16.74735 | 4.48616 | 2.346167 | 6.832327 | 0.268989 | 8.531592 | 0.335889 |
| 7/12/2018 | 7/11 | 14.20943 | 35.28629 | 24.74786 | 30.02186 | 1.800081 | 0.186224 | 0.061031 | 0.654317 | 0.21444 | 5.44109 | 3.666362 | 1.47002 | 0.967538 | 0.382559 | 0.792961 | 1.991623 | 40.87095 | 31.33837 | 23.11683 | 6.248707 | 16.86813 | 4.50314 | 2.56266 | 7.0658 | 0.278181 | 8.921234 | 0.35123 |
| 7/13/2018 | 7/12 | 15.55618 | 35.05143 | 25.3038 | 28.80616 | 1.698193 | 0.191679 | 0.061031 | 0.66567 | 0.211952 | 5.123548 | 3.70303 | 1.604968 | 0.967645 | 0.380012 | 0.792961 | 1.988338 | 40.77566 | 31.26531 | 22.18074 | 5.692061 | 16.48868 | 4.478216 | 2.278384 | 6.7566 | 0.266008 | 8.407628 | 0.331009 |
| 7/14/2018 | 7/13 | 15.05389 | 34.40986 | 24.73188 | 28.63314 | 1.71831 | 0.18607 | 0.061031 | 0.658055 | 0.215844 | 5.1942 | 3.576564 | 1.553418 | 0.967761 | 0.377352 | 0.792961 | 1.984919 | 40.67631 | 31.18913 | 22.04752 | 5.719283 | 16.32823 | 4.383906 | 2.268224 | 6.65213 | 0.261895 | 8.293269 | 0.326507 |
| 7/15/2018 | 7/14 | 14.37779 | 35.45418 | 24.91598 | 29.80261 | 1.777357 | 0.18786 | 0.061031 | 0.657375 | 0.213566 | 5.369369 | 3.701796 | 1.486325 | 0.967887 | 0.374581 | 0.792961 | 1.981369 | 40.57291 | 31.10985 | 22.94801 | 6.228143 | 16.71987 | 4.484422 | 2.540515 | 7.024937 | 0.276572 | 8.866274 | 0.349066 |
| 7/16/2018 | 7/15 | 14.16729 | 36.37025 | 25.26877 | 30.50776 | 1.901783 | 0.191331 | 0.061031 | 0.655635 | 0.209136 | 5.738463 | 3.839398 | 1.465963 | 0.968023 | 0.371698 | 0.792961 | 1.977691 | 40.46549 | 31.02748 | 23.49097 | 6.534128 | 16.95684 | 4.53594 | 2.848408 | 7.384348 | 0.290722 | 9.449443 | 0.372025 |
| 7/17/2018 | 7/16 | 14.13014 | 36.44989 | 25.29002 | 30.50366 | 1.779592 | 0.191542 | 0.061031 | 0.661628 | 0.210816 | 5.36938 | 3.85069 | 1.462395 | 0.968168 | 0.368706 | 0.792961 | 1.973888 | 40.35407 | 30.94204 | 23.48782 | 6.567807 | 16.92001 | 4.567459 | 2.703429 | 7.270888 | 0.286255 | 9.234969 | 0.363581 |
| 7/18/2018 | 7/17 | 14.25843 | 36.63493 | 25.44668 | 30.45507 | 1.696889 | 0.193102 | 0.061031 | 0.667377 | 0.210929 | 5.117163 | 3.888362 | 1.474749 | 0.968322 | 0.365604 | 0.792961 | 1.969961 | 40.23866 | 30.85355 | 23.4504 | 6.565612 | 16.88479 | 4.597555 | 2.605155 | 7.20271 | 0.283571 | 9.098677 | 0.358216 |
| 7/19/2018 | 7/18 | 14.49004 | 37.389 | 25.93952 | 30.71717 | 1.722967 | 0.198081 | 0.061031 | 0.671768 | 0.206981 | 5.187237 | 4.029574 | 1.497285 | 0.968486 | 0.362394 | 0.792961 | 1.965914 | 40.11929 | 30.76203 | 23.65222 | 6.664434 | 16.98778 | 4.656033 | 2.718815 | 7.374849 | 0.290348 | 9.35602 | 0.368347 |
| 7/20/2018 | 7/19 | 15.41479 | 36.55279 | 25.98379 | 29.42174 | 1.691949 | 0.198533 | 0.061031 | 0.673739 | 0.207115 | 5.0931 | 3.937497 | 1.590307 | 0.968659 | 0.359076 | 0.792961 | 1.961749 | 39.99599 | 30.66749 | 22.65474 | 6.111014 | 16.54373 | 4.547631 | 2.475955 | 7.023586 | 0.276519 | 8.825618 | 0.347465 |
| 7/21/2018 | 7/20 | 15.31679 | 36.36379 | 25.84029 | 29.26497 | 1.6626 | 0.19707 | 0.061031 | 0.67351 | 0.208582 | 5.007156 | 3.900524 | 1.580214 | 0.968842 | 0.355653 | 0.792961 | 1.957469 | 39.86878 | 30.56994 | 22.53402 | 6.101816 | 16.43221 | 4.515438 | 2.42334 | 6.938778 | 0.27318 | 8.702876 | 0.342633 |
| 7/22/2018 | 7/21 | 15.28296 | 36.70136 | 25.99216 | 29.42496 | 1.721881 | 0.198619 | 0.061031 | 0.672417 | 0.20662 | 5.183057 | 3.955063 | 1.576744 | 0.969034 | 0.352123 | 0.792961 | 1.953076 | 39.73768 | 30.46942 | 22.65722 | 6.196755 | 16.46047 | 4.515865 | 2.546992 | 7.062858 | 0.278065 | 8.916955 | 0.351061 |
| 7/23/2018 | 7/22 | 15.80186 | 35.96493 | 25.88339 | 28.45269 | 1.718772 | 0.197508 | 0.061031 | 0.671328 | 0.207445 | 5.175578 | 3.862488 | 1.630724 | 0.969234 | 0.34849 | 0.792961 | 1.948574 | 39.60272 | 30.36594 | 21.90857 | 5.823227 | 16.08535 | 4.405806 | 2.396128 | 6.801933 | 0.267793 | 8.543737 | 0.336368 |
| 7/24/2018 | 7/23 | 15.42504 | 36.11382 | 25.76943 | 28.72022 | 1.664293 | 0.19635 | 0.061031 | 0.672624 | 0.209071 | 5.013443 | 3.865388 | 1.591366 | 0.969444 | 0.344753 | 0.792961 | 1.943964 | 39.46393 | 30.25952 | 22.11457 | 6.000341 | 16.11423 | 4.422239 | 2.383551 | 6.80579 | 0.267945 | 8.540791 | 0.336252 |
| 7/25/2018 | 7/24 | 15.19536 | 36.38329 | 25.78932 | 28.95959 | 1.698566 | 0.196552 | 0.061031 | 0.672116 | 0.208534 | 5.116345 | 3.896996 | 1.567787 | 0.969664 | 0.340914 | 0.792961 | 1.939249 | 39.32133 | 30.15018 | 22.29889 | 6.151313 | 16.14776 | 4.421889 | 2.48374 | 6.905628 | 0.271875 | 8.714031 | 0.343072 |
| 7/26/2018 | 7/25 | 15.41057 | 36.73793 | 26.07425 | 28.94656 | 1.618471 | 0.19946 | 0.061031 | 0.678261 | 0.207536 | 4.870443 | 3.968373 | 1.589872 | 0.969892 | 0.336974 | 0.792961 | 1.934433 | 39.17495 | 30.03794 | 22.28885 | 6.157585 | 16.13127 | 4.464013 | 2.404172 | 6.868185 | 0.270401 | 8.622251 | 0.339459 |
| 7/27/2018 | 7/26 | 14.84143 | 36.80011 | 25.82077 | 29.25931 | 1.715143 | 0.196871 | 0.061031 | 0.670787 | 0.207948 | 5.165736 | 3.947416 | 1.532053 | 0.970129 | 0.332934 | 0.792961 | 1.929517 | 39.02482 | 29.92283 | 22.52967 | 6.387143 | 16.14252 | 4.417903 | 2.594597 | 7.0125 | 0.276083 | 8.903498 | 0.350531 |
| 7/28/2018 | 7/27 | 15.6295 | 37.30114 | 26.46532 | 28.95285 | 1.678449 | 0.203511 | 0.061031 | 0.679794 | 0.203865 | 5.044337 | 4.077086 | 1.612617 | 0.970374 | 0.328795 | 0.792961 | 1.924505 | 38.87098 | 29.80487 | 22.2937 | 6.211149 | 16.08255 | 4.460591 | 2.534377 | 6.994968 | 0.275392 | 8.845086 | 0.348232 |
| 7/29/2018 | 7/28 | 16.03557 | 36.47893 | 26.25725 | 28.00644 | 1.719614 | 0.201347 | 0.061031 | 0.675522 | 0.204761 | 5.171646 | 3.960661 | 1.655561 | 0.970629 | 0.324559 | 0.792961 | 1.919399 | 38.71344 | 29.68407 | 21.56496 | 5.859747 | 15.70521 | 4.328557 | 2.440989 | 6.769546 | 0.266518 | 8.547703 | 0.336524 |
| 7/30/2018 | 7/29 | 15.04796 | 36.62279 | 25.83538 | 28.65123 | 1.701546 | 0.19702 | 0.061031 | 0.671599 | 0.208043 | 5.124532 | 3.928827 | 1.552818 | 0.970892 | 0.320227 | 0.792961 | 1.914202 | 38.55224 | 29.56047 | 22.06145 | 6.266012 | 15.79543 | 4.328143 | 2.533119 | 6.861261 | 0.270128 | 8.708159 | 0.342841 |
| 7/31/2018 | 7/30 | 15.28561 | 36.79521 | 26.04041 | 28.48559 | 1.653489 | 0.199113 | 0.061031 | 0.676208 | 0.207269 | 4.976385 | 3.97106 | 1.577015 | 0.971164 | 0.3158 | 0.792961 | 1.908917 | 38.38742 | 29.43409 | 21.9339 | 6.218601 | 15.7153 | 4.335737 | 2.469335 | 6.805072 | 0.267916 | 8.607666 | 0.338884 |
| 8/1/2018 | 7/31 | 15.46882 | 37.20139 | 26.33511 | 28.50723 | 1.637284 | 0.202154 | 0.061031 | 0.680287 | 0.205382 | 4.922762 | 4.050739 | 1.595896 | 0.971445 | 0.311279 | 0.792961 | 1.903545 | 38.21901 | 29.30496 | 21.95056 | 6.247946 | 15.70262 | 4.358371 | 2.481961 | 6.840333 | 0.269304 | 8.654339 | 0.340722 |
| 8/2/2018 | 8/1 | 15.33593 | 37.21843 | 26.27718 | 28.47668 | 1.685527 | 0.201553 | 0.061031 | 0.677352 | 0.205106 | 5.068794 | 4.046217 | 1.582181 | 0.971734 | 0.306666 | 0.792961 | 1.89809 | 38.04704 | 29.1731 | 21.92704 | 6.302407 | 15.62463 | 4.31802 | 2.561707 | 6.879727 | 0.270855 | 8.751151 | 0.344534 |
| 8/3/2018 | 8/2 | 14.59271 | 37.05336 | 25.82304 | 28.71733 | 1.741221 | 0.196894 | 0.061031 | 0.669578 | 0.207549 | 5.244237 | 3.977107 | 1.507372 | 0.972031 | 0.301962 | 0.792961 | 1.892555 | 37.87154 | 29.03853 | 22.11234 | 6.543075 | 15.56927 | 4.253337 | 2.688153 | 6.94149 | 0.273287 | 8.903569 | 0.350534 |
| 8/4/2018 | 8/3 | 15.68993 | 37.34236 | 26.51614 | 28.06266 | 1.691674 | 0.204042 | 0.061031 | 0.679739 | 0.203318 | 5.08322 | 4.08768 | 1.618945 | 0.972337 | 0.297169 | 0.792961 | 1.886941 | 37.69256 | 28.90129 | 21.60825 | 6.198159 | 15.41009 | 4.273737 | 2.551465 | 6.825202 | 0.268709 | 8.690117 | 0.342131 |
| 8/5/2018 | 8/4 | 15.06521 | 37.26818 | 26.1667 | 28.27964 | 1.833982 | 0.200412 | 0.061031 | 0.669155 | 0.203778 | 5.51727 | 4.039786 | 1.554563 | 0.972651 | 0.292288 | 0.792961 | 1.881252 | 37.51012 | 28.76141 | 21.77532 | 6.417034 | 15.35829 | 4.19305 | 2.794133 | 6.987183 | 0.275086 | 9.025475 | 0.355334 |
| 8/6/2018 | 8/5 | 14.73143 | 37.54482 | 26.13813 | 28.52373 | 1.698379 | 0.200117 | 0.061031 | 0.675179 | 0.205915 | 5.109818 | 4.069757 | 1.521094 | 0.972973 | 0.28732 | 0.792961 | 1.875489 | 37.32427 | 28.61891 | 21.96327 | 6.611163 | 15.35211 | 4.229094 | 2.681674 | 6.910768 | 0.272077 | 8.8724 | 0.349307 |
| 8/7/2018 | 8/6 | 16.20282 | 37.34743 | 26.77513 | 27.32145 | 1.700801 | 0.206768 | 0.061031 | 0.682195 | 0.201362 | 5.10623 | 4.118256 | 1.673539 | 0.973302 | 0.282267 | 0.792961 | 1.869656 | 37.13505 | 28.47382 | 21.03752 | 6.00467 | 15.03285 | 4.184178 | 2.513665 | 6.697844 | 0.263695 | 8.535981 | 0.336062 |
| 8/8/2018 | 8/7 | 15.62868 | 36.38575 | 26.00721 | 26.92956 | 1.861363 | 0.198773 | 0.061031 | 0.666065 | 0.204509 | 5.602629 | 3.921752 | 1.612531 | 0.97364 | 0.27713 | 0.792961 | 1.863754 | 36.9425 | 28.32618 | 20.73576 | 5.990104 | 14.74566 | 4.007197 | 2.64588 | 6.653076 | 0.261932 | 8.580333 | 0.337808 |
| 8/9/2018 | 8/8 | 15.60104 | 36.05725 | 25.82914 | 26.59196 | 1.78518 | 0.196956 | 0.061031 | 0.667578 | 0.206864 | 5.376523 | 3.866075 | 1.609643 | 0.973986 | 0.271911 | 0.792961 | 1.857786 | 36.74665 | 28.17601 | 20.47581 | 5.920725 | 14.55508 | 3.964393 | 2.509623 | 6.474016 | 0.254883 | 8.303292 | 0.326901 |
| 8/10/2018 | 8/9 | 16.14289 | 37.10689 | 26.62489 | 26.77413 | 1.725947 | 0.205183 | 0.061031 | 0.679349 | 0.202071 | 5.184323 | 4.073195 | 1.667078 | 0.974339 | 0.266612 | 0.792961 | 1.851755 | 36.54755 | 28.02335 | 20.61608 | 5.969918 | 14.64616 | 4.05954 | 2.520656 | 6.580195 | 0.259063 | 8.423197 | 0.331622 |
| 8/11/2018 | 8/10 | 15.68014 | 36.80136 | 26.24075 | 26.72558 | 1.694468 | 0.201176 | 0.061031 | 0.676521 | 0.205238 | 5.096301 | 3.994355 | 1.617919 | 0.9747 | 0.261234 | 0.792961 | 1.845662 | 36.34525 | 27.86823 | 20.57869 | 6.07133 | 14.50736 | 4.004329 | 2.485644 | 6.489973 | 0.255511 | 8.307685 | 0.327074 |
| 8/12/2018 | 8/11 | 14.78111 | 37.24811 | 26.01461 | 27.40805 | 1.762828 | 0.198849 | 0.061031 | 0.670744 | 0.205867 | 5.305911 | 4.020786 | 1.526035 | 0.975069 | 0.255778 | 0.792961 | 1.83951 | 36.13979 | 27.71069 | 21.1042 | 6.51968 | 14.58452 | 3.991249 | 2.725051 | 6.716299 | 0.264421 | 8.709355 | 0.342888 |
| 8/13/2018 | 8/12 | 15.43439 | 36.57811 | 26.00625 | 26.43519 | 1.614932 | 0.198763 | 0.061031 | 0.677666 | 0.208081 | 4.860898 | 3.942839 | 1.592333 | 0.975445 | 0.250246 | 0.792961 | 1.833301 | 35.93121 | 27.55076 | 20.3551 | 6.109795 | 14.2453 | 3.93865 | 2.377449 | 6.316099 | 0.248665 | 8.056929 | 0.317202 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8/14/2018 | 8/13 | 15.48661 | 36.33157 | 25.90909 | 26.09316 | 1.671743 | 0.19777 | 0.061031 | 0.673853 | 0.20795 | 5.033534 | 3.904722 | 1.597739 | 0.975828 | 0.244641 | 0.792961 | 1.827037 | 35.71956 | 27.38847 | 20.09173 | 6.030267 | 14.06146 | 3.86595 | 2.414768 | 6.280718 | 0.247272 | 8.046973 | 0.31681 |
| 8/15/2018 | 8/14 | 15.52789 | 35.63782 | 25.58286 | 25.47495 | 1.676586 | 0.194467 | 0.061031 | 0.669909 | 0.210244 | 5.053631 | 3.794064 | 1.602025 | 0.976218 | 0.238962 | 0.792961 | 1.82072 | 35.50489 | 27.22387 | 19.61572 | 5.845891 | 13.76982 | 3.76361 | 2.329027 | 6.092636 | 0.239868 | 7.794206 | 0.306858 |
| 8/16/2018 | 8/15 | 15.52457 | 35.55025 | 25.53741 | 25.26571 | 1.730976 | 0.194011 | 0.061031 | 0.666793 | 0.209758 | 5.21837 | 3.779877 | 1.60168 | 0.976615 | 0.233213 | 0.792961 | 1.814353 | 35.28725 | 27.05699 | 19.45459 | 5.825755 | 13.62884 | 3.707747 | 2.384241 | 6.091987 | 0.239842 | 7.83264 | 0.308372 |
| 8/17/2018 | 8/16 | 14.92796 | 36.19121 | 25.55959 | 25.87198 | 1.679939 | 0.194234 | 0.061031 | 0.669483 | 0.210363 | 5.064132 | 3.850532 | 1.540724 | 0.97702 | 0.227395 | 0.792961 | 1.807937 | 35.0667 | 26.88788 | 19.92142 | 6.205286 | 13.71614 | 3.746548 | 2.460648 | 6.207196 | 0.244378 | 8.007836 | 0.315269 |
| 8/18/2018 | 8/17 | 15.42357 | 36.77214 | 26.09786 | 25.75866 | 1.661685 | 0.199703 | 0.061031 | 0.676465 | 0.206735 | 5.000091 | 3.974884 | 1.591214 | 0.977431 | 0.22151 | 0.792961 | 1.801474 | 34.84327 | 26.71657 | 19.83417 | 6.160993 | 13.67318 | 3.773766 | 2.463987 | 6.237752 | 0.245581 | 8.043657 | 0.316679 |
| 8/19/2018 | 8/18 | 15.66096 | 37.42961 | 26.54529 | 25.84196 | 1.675469 | 0.204347 | 0.061031 | 0.680827 | 0.203339 | 5.034036 | 4.101211 | 1.615909 | 0.977848 | 0.215558 | 0.792961 | 1.794967 | 34.61704 | 26.5431 | 19.89831 | 6.230178 | 13.66814 | 3.796698 | 2.543998 | 6.340695 | 0.249634 | 8.207512 | 0.32313 |
| 8/20/2018 | 8/19 | 15.85561 | 37.22846 | 26.54204 | 25.43658 | 1.762269 | 0.204313 | 0.061031 | 0.676729 | 0.202149 | 5.29489 | 4.077452 | 1.636407 | 0.978273 | 0.209543 | 0.792961 | 1.788416 | 34.38804 | 26.36751 | 19.58617 | 6.107913 | 13.47825 | 3.721419 | 2.61279 | 6.334209 | 0.249378 | 8.248837 | 0.324757 |
| 8/21/2018 | 8/20 | 15.48546 | 36.61554 | 26.0505 | 25.12129 | 1.593325 | 0.199216 | 0.061031 | 0.6792 | 0.208078 | 4.795152 | 3.951991 | 1.597621 | 0.978704 | 0.203466 | 0.792961 | 1.781825 | 34.15635 | 26.18986 | 19.34339 | 6.09967 | 13.24372 | 3.670015 | 2.349108 | 6.019124 | 0.236973 | 7.743518 | 0.304863 |
| 8/22/2018 | 8/21 | 15.02429 | 35.711 | 25.36764 | 24.6858 | 1.779405 | 0.192314 | 0.061031 | 0.662536 | 0.210258 | 5.367422 | 3.777727 | 1.550425 | 0.979141 | 0.197329 | 0.792961 | 1.775194 | 33.92201 | 26.01017 | 19.00807 | 6.051359 | 12.95671 | 3.502392 | 2.513605 | 6.015997 | 0.23685 | 7.853493 | 0.309193 |
| 8/23/2018 | 8/22 | 14.28211 | 35.60525 | 24.94368 | 24.88761 | 1.664479 | 0.188131 | 0.061031 | 0.66313 | 0.215126 | 5.0279 | 3.720816 | 1.477039 | 0.979584 | 0.191133 | 0.792961 | 1.768526 | 33.68509 | 25.82851 | 19.16346 | 6.30122 | 12.86224 | 3.479969 | 2.426937 | 5.906906 | 0.232555 | 7.68446 | 0.302538 |
| 8/24/2018 | 8/23 | 14.73546 | 36.14725 | 25.44136 | 24.76201 | 1.581963 | 0.193049 | 0.061031 | 0.672862 | 0.212722 | 4.770674 | 3.832841 | 1.521495 | 0.980033 | 0.18488 | 0.792961 | 1.761822 | 33.44564 | 25.64491 | 19.06675 | 6.266475 | 12.80028 | 3.514032 | 2.345613 | 5.859645 | 0.230695 | 7.581952 | 0.298502 |
| 8/25/2018 | 8/24 | 15.34411 | 36.07121 | 25.70766 | 24.18668 | 1.665969 | 0.195725 | 0.061031 | 0.671841 | 0.209495 | 5.01953 | 3.853873 | 1.583022 | 0.980488 | 0.178573 | 0.792961 | 1.755084 | 33.20373 | 25.45943 | 18.62374 | 6.020228 | 12.60352 | 3.454766 | 2.387947 | 5.842712 | 0.230028 | 7.593989 | 0.298976 |
| 8/26/2018 | 8/25 | 14.86668 | 36.79918 | 25.83293 | 24.69697 | 1.748299 | 0.196995 | 0.061031 | 0.669357 | 0.207375 | 5.26538 | 3.948634 | 1.534579 | 0.980949 | 0.172213 | 0.792961 | 1.748314 | 32.95943 | 25.27211 | 19.01667 | 6.377406 | 12.63926 | 3.451754 | 2.635925 | 6.087678 | 0.239672 | 8.021513 | 0.315808 |
| 8/27/2018 | 8/26 | 14.68664 | 36.41329 | 25.54996 | 24.39686 | 1.618844 | 0.194137 | 0.061031 | 0.672311 | 0.211357 | 4.880119 | 3.874145 | 1.516652 | 0.981416 | 0.165801 | 0.792961 | 1.741513 | 32.7128 | 25.08299 | 18.78558 | 6.350268 | 12.43532 | 3.411045 | 2.431625 | 5.842669 | 0.230026 | 7.629514 | 0.300375 |
| 8/28/2018 | 8/27 | 13.96868 | 35.91989 | 24.94429 | 24.33604 | 1.761338 | 0.188136 | 0.061031 | 0.658472 | 0.213608 | 5.320471 | 3.755147 | 1.446976 | 0.981888 | 0.159341 | 0.792961 | 1.734682 | 32.4639 | 24.89215 | 18.73875 | 6.49613 | 12.24262 | 3.28906 | 2.623225 | 5.912284 | 0.232767 | 7.834663 | 0.308451 |
| 8/29/2018 | 8/28 | 13.3495 | 35.87521 | 24.61236 | 24.46176 | 1.841432 | 0.184915 | 0.061031 | 0.650749 | 0.21478 | 5.568616 | 3.716401 | 1.38916 | 0.982366 | 0.152833 | 0.792961 | 1.727823 | 32.2128 | 24.69961 | 18.83556 | 6.715035 | 12.12052 | 3.218064 | 2.783447 | 6.001511 | 0.23628 | 8.039233 | 0.316505 |
| 8/30/2018 | 8/29 | 13.49536 | 35.85129 | 24.67332 | 24.17783 | 1.61605 | 0.185503 | 0.061031 | 0.662349 | 0.217916 | 4.886043 | 3.719846 | 1.402594 | 0.982848 | 0.146281 | 0.792961 | 1.720938 | 31.95957 | 24.50545 | 18.61693 | 6.654877 | 11.96205 | 3.232604 | 2.467286 | 5.69989 | 0.224405 | 7.513057 | 0.29579 |
| 8/31/2018 | 8/30 | 14.37532 | 35.58486 | 24.98009 | 23.36165 | 1.604874 | 0.188487 | 0.061031 | 0.666454 | 0.215796 | 4.847258 | 3.722482 | 1.486086 | 0.983336 | 0.139684 | 0.792961 | 1.714028 | 31.70429 | 24.30971 | 17.98847 | 6.261534 | 11.72694 | 3.18871 | 2.339308 | 5.528018 | 0.217638 | 7.247086 | 0.285318 |
| 9/1/2018 | 8/31 | 13.62221 | 35.29175 | 24.45698 | 23.42202 | 1.623873 | 0.183423 | 0.061031 | 0.659437 | 0.219418 | 4.913267 | 3.636908 | 1.41437 | 0.983829 | 0.133047 | 0.792961 | 1.707095 | 31.44702 | 24.11244 | 18.03495 | 6.467202 | 11.56775 | 3.112308 | 2.396032 | 5.50834 | 0.216864 | 7.268329 | 0.286155 |
| 9/2/2018 | 9/1 | 13.85743 | 34.56189 | 24.20966 | 22.70583 | 1.579355 | 0.181069 | 0.061031 | 0.658737 | 0.222035 | 4.782548 | 3.535913 | 1.436435 | 0.984327 | 0.12637 | 0.792961 | 1.70014 | 31.18784 | 23.91372 | 17.48349 | 6.196938 | 11.28655 | 3.033425 | 2.229419 | 5.262845 | 0.207199 | 6.900051 | 0.271656 |
| 9/3/2018 | 9/2 | 13.42279 | 33.413 | 23.41789 | 22.12403 | 1.739544 | 0.173704 | 0.061031 | 0.641371 | 0.225348 | 5.281699 | 3.343777 | 1.395896 | 0.984829 | 0.119655 | 0.792961 | 1.693163 | 30.92683 | 23.71358 | 17.0355 | 6.064565 | 10.97093 | 2.870868 | 2.318406 | 5.189274 | 0.204302 | 6.884529 | 0.271044 |
| 9/4/2018 | 9/3 | 13.18086 | 33.92314 | 23.552 | 22.34488 | 1.833237 | 0.174933 | 0.061031 | 0.63843 | 0.222738 | 5.563655 | 3.406061 | 1.373769 | 0.985336 | 0.112905 | 0.792961 | 1.686168 | 30.66406 | 23.5121 | 17.20555 | 6.282548 | 10.92301 | 2.845217 | 2.51849 | 5.363707 | 0.21117 | 7.204854 | 0.283656 |
| 9/5/2018 | 9/4 | 13.64907 | 34.35589 | 24.20248 | 22.13323 | 1.844226 | 0.179117 | 0.061031 | 0.64334 | 0.219208 | 5.588518 | 3.494068 | 1.416874 | 0.985847 | 0.106122 | 0.792961 | 1.679154 | 30.39961 | 23.30933 | 17.04258 | 6.221384 | 10.8212 | 2.840377 | 2.544667 | 5.385044 | 0.21201 | 7.247039 | 0.285317 |
| 9/6/2018 | 9/5 | 12.17621 | 33.29514 | 22.73568 | 22.15676 | 1.607295 | 0.167562 | 0.061031 | 0.639682 | 0.232992 | 4.891414 | 3.266484 | 1.285148 | 0.986362 | 0.099307 | 0.792961 | 1.672123 | 30.13356 | 23.10533 | 17.06071 | 6.48536 | 10.57535 | 2.760061 | 2.258055 | 5.018116 | 0.197564 | 6.674402 | 0.262772 |
| 9/7/2018 | 9/6 | 11.78114 | 33.17032 | 22.47573 | 22.10008 | 1.594815 | 0.16527 | 0.061031 | 0.637137 | 0.235283 | 4.857704 | 3.230427 | 1.251699 | 0.986881 | 0.092463 | 0.792961 | 1.665076 | 29.86598 | 22.90016 | 17.01706 | 6.595229 | 10.42183 | 2.709176 | 2.261562 | 4.970738 | 0.195698 | 6.630215 | 0.261032 |
| 9/8/2018 | 9/7 | 12.01661 | 33.75743 | 22.88702 | 22.08031 | 1.565758 | 0.168908 | 0.061031 | 0.643631 | 0.232562 | 4.762567 | 3.325969 | 1.271541 | 0.987404 | 0.085591 | 0.792961 | 1.658015 | 29.59697 | 22.69389 | 17.00184 | 6.662591 | 10.33925 | 2.715104 | 2.275472 | 4.990575 | 0.196479 | 6.663332 | 0.262336 |
| 9/9/2018 | 9/8 | 11.61182 | 33.28714 | 22.44948 | 21.84563 | 1.59407 | 0.16504 | 0.061031 | 0.636853 | 0.235506 | 4.855866 | 3.239399 | 1.237599 | 0.987931 | 0.078694 | 0.792961 | 1.650941 | 29.32661 | 22.48659 | 16.82114 | 6.686496 | 10.13464 | 2.633345 | 2.289231 | 4.922576 | 0.193802 | 6.603921 | 0.259997 |
| 9/10/2018 | 9/9 | 11.998 | 32.83675 | 22.41738 | 21.22151 | 1.623873 | 0.16476 | 0.061031 | 0.634942 | 0.2352 | 4.947189 | 3.193324 | 1.269963 | 0.988462 | 0.071773 | 0.792961 | 1.643854 | 29.05497 | 22.27831 | 16.34056 | 6.430604 | 9.909958 | 2.567239 | 2.23798 | 4.80522 | 0.189182 | 6.447372 | 0.253834 |
| 9/11/2018 | 9/10 | 11.48232 | 31.2765 | 21.37941 | 20.48859 | 1.657587 | 0.155895 | 0.061031 | 0.620298 | 0.242841 | 5.067706 | 2.959598 | 1.22691 | 0.988996 | 0.064832 | 0.792961 | 1.636756 | 28.78215 | 22.06912 | 15.77621 | 6.205976 | 9.570235 | 2.422052 | 2.132329 | 4.554381 | 0.179306 | 6.114409 | 0.240725 |
| 9/12/2018 | 9/11 | 10.68336 | 31.09643 | 20.88989 | 20.60841 | 1.671185 | 0.151856 | 0.061031 | 0.613397 | 0.246526 | 5.117788 | 2.901327 | 1.16274 | 0.989533 | 0.057871 | 0.792961 | 1.629649 | 28.50823 | 21.85909 | 15.86848 | 6.440371 | 9.428104 | 2.359533 | 2.193521 | 4.553054 | 0.179254 | 6.15765 | 0.242427 |
| 9/13/2018 | 9/12 | 9.9435 | 30.34671 | 20.14511 | 20.40474 | 1.738054 | 0.145881 | 0.061031 | 0.600387 | 0.251181 | 5.336091 | 2.77575 | 1.105969 | 0.990073 | 0.050893 | 0.792961 | 1.622533 | 28.23331 | 21.64828 | 15.71165 | 6.499242 | 9.212407 | 2.256652 | 2.238046 | 4.494698 | 0.176957 | 6.128383 | 0.241275 |
| 9/14/2018 | 9/13 | 9.992143 | 29.87918 | 19.93566 | 19.94816 | 1.645107 | 0.144237 | 0.061031 | 0.60248 | 0.254929 | 5.05434 | 2.720533 | 1.109625 | 0.990616 | 0.0439 | 0.792961 | 1.615409 | 27.95746 | 21.43678 | 15.36008 | 6.356633 | 9.003448 | 2.213153 | 2.075652 | 4.288805 | 0.168851 | 5.805807 | 0.228575 |
| 9/15/2018 | 9/14 | 8.489464 | 29.33364 | 18.91155 | 20.22045 | 1.681802 | 0.136422 | 0.061031 | 0.587136 | 0.262668 | 5.185206 | 2.596311 | 1.001462 | 0.991162 | 0.036894 | 0.792961 | 1.608278 | 27.68079 | 21.22463 | 15.56975 | 6.727727 | 8.84202 | 2.118118 | 2.172162 | 4.29028 | 0.168909 | 5.875911 | 0.231335 |
| 9/16/2018 | 9/15 | 9.181607 | 29.97111 | 19.57636 | 19.99153 | 1.519936 | 0.141453 | 0.061031 | 0.604438 | 0.260791 | 4.675506 | 2.69913 | 1.05007 | 0.991711 | 0.029877 | 0.792961 | 1.601142 | 27.40338 | 21.01192 | 15.39348 | 6.662549 | 8.73093 | 2.153141 | 2.010747 | 4.163888 | 0.163933 | 5.638403 | 0.221984 |
| 9/17/2018 | 9/16 | 9.363821 | 29.96682 | 19.66532 | 19.69972 | 1.672302 | 0.142138 | 0.061031 | 0.597543 | 0.256574 | 5.142638 | 2.705791 | 1.063208 | 0.992262 | 0.022851 | 0.792961 | 1.594002 | 27.12532 | 20.79872 | 15.16878 | 6.59834 | 8.570444 | 2.089453 | 2.167332 | 4.256785 | 0.16759 | 5.842219 | 0.230009 |
| 9/18/2018 | 9/17 | 9.003893 | 29.49007 | 19.24698 | 19.44202 | 1.60357 | 0.138941 | 0.061031 | 0.595681 | 0.261659 | 4.938332 | 2.634446 | 1.037396 | 0.992815 | 0.015818 | 0.792961 | 1.586858 | 26.84671 | 20.58509 | 14.97036 | 6.593548 | 8.37681 | 2.035882 | 2.063643 | 4.099525 | 0.161399 | 5.610418 | 0.220883 |
| 9/19/2018 | 9/18 | 9.172821 | 28.49939 | 18.83611 | 18.68746 | 1.842177 | 0.135861 | 0.061031 | 0.57784 | 0.259526 | 5.681133 | 2.526388 | 1.049441 | 0.993371 | 0.008781 | 0.792961 | 1.579711 | 26.56764 | 20.37111 | 14.38935 | 6.265805 | 8.123514 | 1.915195 | 2.17804 | 4.093234 | 0.161151 | 5.678647 | 0.223569 |
| 9/20/2018 | 9/19 | 8.278357 | 27.42493 | 17.85164 | 18.4046 | 1.966231 | 0.128715 | 0.061031 | 0.558303 | 0.264724 | 6.084228 | 2.374235 | 0.987036 | 0.993928 | 0.001741 | 0.792961 | 1.572564 | 26.2882 | 20.15685 | 14.17154 | 6.276285 | 7.895258 | 1.798441 | 2.234283 | 4.032724 | 0.158769 | 5.652806 | 0.222551 |
| 9/21/2018 | 9/20 | 8.183571 | 27.35514 | 17.76936 | 18.22066 | 1.721663 | 0.128132 | 0.061031 | 0.569757 | 0.271384 | 5.328954 | 2.363279 | 0.980618 | 0.994487 | -0.0053 | 0.792961 | 1.565416 | 26.0085 | 19.94238 | 14.02991 | 6.289177 | 7.740734 | 1.799418 | 1.999594 | 3.799012 | 0.149567 | 5.25602 | 0.20693 |
| 9/22/2018 | 9/21 | 8.653321 | 27.29586 | 17.97459 | 17.77416 | 1.638402 | 0.12959 | 0.061031 | 0.576931 | 0.271711 | 5.067664 | 2.374571 | 1.012787 | 0.995048 | -0.01234 | 0.792961 | 1.558269 | 25.72863 | 19.72779 | 13.6861 | 6.113114 | 7.57299 | 1.78259 | 1.875094 | 3.657684 | 0.144003 | 5.026583 | 0.197897 |
| 9/23/2018 | 9/22 | 8.591964 | 26.76329 | 17.67763 | 17.35715 | 1.685527 | 0.127486 | 0.061031 | 0.570424 | 0.27308 | 5.218752 | 2.31646 | 1.008533 | 0.995611 | -0.01937 | 0.792961 | 1.551124 | 25.44868 | 19.51313 | 13.36501 | 5.986627 | 7.378381 | 1.717192 | 1.863975 | 3.581167 | 0.140991 | 4.939973 | 0.194487 |
| 9/24/2018 | 9/23 | 7.198643 | 25.51879 | 16.35871 | 17.23638 | 1.648274 | 0.118487 | 0.061031 | 0.5544 | 0.285565 | 5.126669 | 2.141301 | 0.916078 | 0.996174 | -0.0264 | 0.792961 | 1.543981 | 25.16875 | 19.29849 | 13.27201 | 6.109271 | 7.162743 | 1.620179 | 1.793725 | 3.413904 | 0.134406 | 4.720154 | 0.185833 |
| 9/25/2018 | 9/24 | 7.257214 | 25.46571 | 16.36146 | 16.99274 | 1.723712 | 0.118505 | 0.061031 | 0.550407 | 0.283465 | 5.361255 | 2.138207 | 0.919809 | 0.996739 | -0.03342 | 0.792961 | 1.536843 | 24.88894 | 19.08395 | 13.08441 | 6.074743 | 7.00967 | 1.574134 | 1.851634 | 3.425768 | 0.134873 | 4.772649 | 0.1879 |
| 9/26/2018 | 9/25 | 7.535714 | 26.01586 | 16.77579 | 16.92672 | 1.766553 | 0.121272 | 0.061031 | 0.553854 | 0.278732 | 5.486648 | 2.201953 | 0.937731 | 0.997305 | -0.04044 | 0.792961 | 1.529709 | 24.60935 | 18.86957 | 13.03357 | 6.135562 | 6.898013 | 1.558761 | 1.933379 | 3.49214 | 0.137486 | 4.899383 | 0.192889 |
| 9/27/2018 | 9/26 | 8.498286 | 26.78032 | 17.6393 | 16.64469 | 1.803434 | 0.127216 | 0.061031 | 0.563727 | 0.270445 | 5.584553 | 2.314686 | 1.002069 | 0.997871 | -0.04744 | 0.792961 | 1.522582 | 24.33008 | 18.65543 | 12.81641 | 6.023198 | 6.793215 | 1.562442 | 1.982466 | 3.544908 | 0.139563 | 4.989486 | 0.196436 |
| 9/28/2018 | 9/27 | 7.580429 | 26.15332 | 16.86688 | 16.58429 | 1.619589 | 0.121888 | 0.061031 | 0.562923 | 0.281865 | 5.028618 | 2.217261 | 0.940637 | 0.998438 | -0.05442 | 0.792961 | 1.515462 | 24.05122 | 18.44161 | 12.7699 | 6.158954 | 6.610947 | 1.518354 | 1.809476 | 3.32783 | 0.131017 | 4.650285 | 0.183082 |
| 9/29/2018 | 9/28 | 6.616857 | 26.34432 | 16.48059 | 16.89418 | 1.613069 | 0.119295 | 0.061031 | 0.557979 | 0.285461 | 5.01506 | 2.203136 | 0.87974 | 0.999006 | -0.06139 | 0.792961 | 1.50835 | 23.77287 | 18.22818 | 13.00852 | 6.534783 | 6.473738 | 1.473782 | 1.894582 | 3.368364 | 0.132613 | 4.754358 | 0.187179 |
| 9/30/2018 | 9/29 | 6.789393 | 26.55068 | 16.67004 | 16.71112 | 1.786856 | 0.120561 | 0.061031 | 0.551336 | 0.279102 | 5.551732 | 2.229945 | 0.890382 | 0.999574 | -0.06834 | 0.792961 | 1.501247 | 23.49513 | 18.01522 | 12.86756 | 6.534898 | 6.332661 | 1.4245 | 2.07565 | 3.50015 | 0.137801 | 5.014512 | 0.197422 |
| 10/1/2018 | 9/30 | 7.120786 | 26.24032 | 16.68055 | 16.24372 | 1.719055 | 0.120632 | 0.061031 | 0.55505 | 0.280818 | 5.340882 | 2.209844 | 0.943267 | 1.000142 | -0.07527 | 0.792961 | 1.494155 | 23.2181 | 17.80281 | 12.50766 | 6.265763 | 6.2419 | 1.413544 | 1.899631 | 3.313175 | 0.13044 | 4.699911 | 0.185036 |
| 10/2/2018 | 10/1 | 7.23425 | 26.39007 | 16.81216 | 16.0657 | 1.801199 | 0.121518 | 0.061031 | 0.552542 | 0.277509 | 5.59355 | 2.228911 | 0.950695 | 1.00071 | -0.08218 | 0.792961 | 1.487074 | 22.94189 | 17.59101 | 12.37059 | 6.269125 | 6.101461 | 1.375495 | 1.984127 | 3.359622 | 0.132269 | 4.806726 | 0.189241 |
| 10/3/2018 | 10/2 | 5.961643 | 26.61957 | 16.29061 | 16.4835 | 1.959712 | 0.118038 | 0.061031 | 0.537183 | 0.277751 | 6.096777 | 2.209582 | 0.870263 | 1.001278 | -0.08907 | 0.792961 | 1.480007 | 22.66658 | 17.37992 | 12.69229 | 6.756037 | 5.936256 | 1.301053 | 2.267984 | 3.569037 | 0.140513 | 5.219386 | 0.205488 |
| 10/4/2018 | 10/3 | 5.932107 | 25.721 | 15.82655 | 15.93782 | 1.807159 | 0.115012 | 0.061031 | 0.53859 | 0.285803 | 5.631211 | 2.11856 | 0.86847 | 1.001845 | -0.09593 | 0.792961 | 1.472953 | 22.39228 | 17.16959 | 12.27212 | 6.516674 | 5.755449 | 1.264729 | 2.011918 | 3.276647 | 0.129002 | 4.743473 | 0.186751 |
| 10/5/2018 | 10/4 | 5.063857 | 24.53546 | 14.79966 | 15.61665 | 1.725761 | 0.108551 | 0.061031 | 0.528504 | 0.297144 | 5.396756 | 1.978691 | 0.817191 | 1.002412 | -0.10276 | 0.792961 | 1.465914 | 22.11908 | 16.96011 | 12.02482 | 6.47022 | 5.5546 | 1.197736 | 1.862599 | 3.060335 | 0.120486 | 4.418392 | 0.173952 |
| 10/6/2018 | 10/5 | 4.637286 | 23.94111 | 14.2892 | 15.35801 | 1.707879 | 0.105456 | 0.061031 | 0.522247 | 0.302245 | 5.350327 | 1.911928 | 0.792991 | 1.002978 | -0.10955 | 0.792961 | 1.458891 | 21.84708 | 16.75155 | 11.82567 | 6.441739 | 5.38393 | 1.147191 | 1.809445 | 2.956636 | 0.116403 | 4.275698 | 0.168335 |
| 10/7/2018 | 10/6 | 5.299536 | 24.60986 | 14.9547 | 15.17027 | 1.529994 | 0.109506 | 0.061031 | 0.541344 | 0.301708 | 4.781985 | 1.992811 | 0.830839 | 1.003544 | -0.11632 | 0.792961 | 1.451886 | 21.57638 | 16.54399 | 11.68111 | 6.414154 | 5.266954 | 1.163303 | 1.676452 | 2.839755 | 0.111801 | 4.068539 | 0.160179 |
| 10/8/2018 | 10/7 | 5.548143 | 24.22304 | 14.88559 | 14.73238 | 1.694095 | 0.10908 | 0.061031 | 0.53141 | 0.29733 | 5.296152 | 1.965177 | 0.845453 | 1.004108 | -0.12305 | 0.792961 | 1.4449 | 21.30708 | 16.3375 | 11.34393 | 6.224168 | 5.119764 | 1.110043 | 1.763236 | 2.873279 | 0.113121 | 4.160851 | 0.163813 |
| 10/9/2018 | 10/8 | 5.020607 | 24.04364 | 14.53213 | 14.68218 | 1.931958 | 0.106919 | 0.061031 | 0.513936 | 0.293364 | 6.047192 | 1.932655 | 0.814708 | 1.004671 | -0.12975 | 0.792961 | 1.437934 | 21.03926 | 16.13215 | 11.30528 | 6.34608 | 4.959196 | 1.039873 | 1.983266 | 3.02314 | 0.119021 | 4.464468 | 0.175766 |
| 10/10/2018 | 10/9 | 5.384929 | 24.08596 | 14.73545 | 14.37318 | 1.870862 | 0.108157 | 0.061031 | 0.519962 | 0.293405 | 5.85182 | 1.947689 | 0.835833 | 1.005232 | -0.13641 | 0.792961 | 1.43099 | 20.77304 | 15.92802 | 11.06735 | 6.239064 | 4.828283 | 1.024293 | 1.909006 | 2.933299 | 0.115484 | 4.323158 | 0.170203 |
| 10/11/2018 | 10/10 | 5.325536 | 23.49532 | 14.41043 | 13.98713 | 1.866765 | 0.106184 | 0.061031 | 0.515576 | 0.296338 | 5.845606 | 1.893524 | 0.832357 | 1.005793 | -0.14302 | 0.792961 | 1.424068 | 20.50849 | 15.72517 | 10.77009 | 6.091848 | 4.678242 | 0.984092 | 1.838233 | 2.822325 | 0.111115 | 4.16001 | 0.16378 |
| 10/12/2018 | 10/11 | 5.241571 | 22.526 | 13.88379 | 13.46731 | 1.744015 | 0.103051 | 0.061031 | 0.514556 | 0.304742 | 5.471251 | 1.808512 | 0.827464 | 1.006351 | -0.1496 | 0.792961 | 1.417171 | 20.24572 | 15.52369 | 10.36983 | 5.843947 | 4.525878 | 0.950158 | 1.635723 | 2.585881 | 0.101806 | 3.777798 | 0.148732 |
| 10/13/2018 | 10/12 | 4.918071 | 22.92186 | 13.91996 | 13.56757 | 2.049306 | 0.103264 | 0.061031 | 0.499294 | 0.295095 | 6.428187 | 1.831761 | 0.808848 | 1.006907 | -0.15613 | 0.792961 | 1.410299 | 19.98482 | 15.32364 | 10.44703 | 6.062206 | 4.384822 | 0.893241 | 1.940387 | 2.833627 | 0.11156 | 4.240247 | 0.166939 |
| 10/14/2018 | 10/13 | 4.798786 | 22.59914 | 13.69896 | 13.3159 | 1.954496 | 0.101971 | 0.061031 | 0.500939 | 0.299821 | 6.135518 | 1.801086 | 0.802078 | 1.007462 | -0.16261 | 0.792961 | 1.403454 | 19.72587 | 15.12509 | 10.25324 | 6.009191 | 4.244052 | 0.867412 | 1.837736 | 2.705148 | 0.106502 | 4.039805 | 0.159047 |
| 10/15/2018 | 10/14 | 4.302643 | 21.98479 | 13.14371 | 13.09877 | 1.874774 | 0.098782 | 0.061031 | 0.497101 | 0.307129 | 5.896675 | 1.736114 | 0.774451 | 1.008014 | -0.16905 | 0.792961 | 1.396638 | 19.46897 | 14.92811 | 10.08605 | 5.994598 | 4.091454 | 0.829817 | 1.741608 | 2.571425 | 0.101237 | 3.837621 | 0.151087 |
| 10/16/2018 | 10/15 | 4.588643 | 22.01504 | 13.30184 | 12.83354 | 1.955427 | 0.099681 | 0.061031 | 0.495214 | 0.303203 | 6.149556 | 1.746966 | 0.790272 | 1.008564 | -0.17543 | 0.792961 | 1.389852 | 19.21422 | 14.73277 | 9.881824 | 5.910616 | 3.971208 | 0.802372 | 1.783062 | 2.585435 | 0.101789 | 3.880238 | 0.152765 |
| 10/17/2018 | 10/16 | 4.424643 | 22.17082 | 13.29773 | 12.78054 | 2.018944 | 0.099658 | 0.061031 | 0.491934 | 0.301265 | 6.346714 | 1.754738 | 0.781165 | 1.009111 | -0.18177 | 0.792961 | 1.383098 | 18.96168 | 14.53914 | 9.841019 | 6.00834 | 3.832679 | 0.769253 | 1.861514 | 2.630767 | 0.103574 | 3.981737 | 0.156761 |
| 10/18/2018 | 10/17 | 4.684393 | 22.46079 | 13.57259 | 12.62262 | 1.821129 | 0.101237 | 0.061031 | 0.506039 | 0.305068 | 5.719376 | 1.786192 | 0.795632 | 1.009656 | -0.18805 | 0.792961 | 1.376377 | 18.71147 | 14.34728 | 9.719421 | 6.006917 | 3.712504 | 0.766498 | 1.728327 | 2.494825 | 0.098221 | 3.75562 | 0.147859 |
| 10/19/2018 | 10/18 | 3.702607 | 22.00479 | 12.8537 | 12.63831 | 1.96977 | 0.09715 | 0.061031 | 0.488056 | 0.306604 | 6.201749 | 1.720548 | 0.742164 | 1.010198 | -0.19427 | 0.792961 | 1.369691 | 18.46365 | 14.15726 | 9.731497 | 6.193475 | 3.538022 | 0.704515 | 1.860382 | 2.564897 | 0.10098 | 3.91723 | 0.154222 |
| 10/20/2018 | 10/19 | 4.332393 | 21.80136 | 13.06688 | 12.18321 | 1.833609 | 0.098347 | 0.061031 | 0.498145 | 0.309133 | 5.76875 | 1.722287 | 0.776084 | 1.010736 | -0.20044 | 0.792961 | 1.363042 | 18.21832 | 13.96915 | 9.381073 | 5.932429 | 3.448644 | 0.700913 | 1.687376 | 2.388289 | 0.094027 | 3.618646 | 0.142466 |
| 10/21/2018 | 10/20 | 4.291286 | 20.94575 | 12.61852 | 11.73728 | 1.770837 | 0.095844 | 0.061031 | 0.495008 | 0.315209 | 5.580008 | 1.654408 | 0.773829 | 1.011272 | -0.20655 | 0.792961 | 1.356431 | 17.97555 | 13.783 | 9.037705 | 5.699356 | 3.33835 | 0.674224 | 1.548825 | 2.223049 | 0.087522 | 3.352831 | 0.132001 |
| 10/22/2018 | 10/21 | 3.983857 | 19.77654 | 11.8802 | 11.2769 | 2.017827 | 0.091841 | 0.061031 | 0.471599 | 0.313394 | 6.374764 | 1.559234 | 0.757146 | 1.011804 | -0.21259 | 0.792961 | 1.34986 | 17.73543 | 13.59889 | 8.683209 | 5.45883 | 3.224379 | 0.62041 | 1.602421 | 2.222831 | 0.087513 | 3.383571 | 0.133211 |
| 10/23/2018 | 10/22 | 4.440929 | 18.36846 | 11.4047 | 10.44832 | 1.941644 | 0.089338 | 0.061031 | 0.468574 | 0.320106 | 6.144341 | 1.475572 | 0.782065 | 1.012333 | -0.21857 | 0.792961 | 1.343331 | 17.49803 | 13.41686 | 8.045205 | 4.892046 | 3.153158 | 0.602815 | 1.364014 | 1.966829 | 0.077434 | 2.954282 | 0.11631 |
| 10/24/2018 | 10/23 | 3.532786 | 18.06064 | 10.79671 | 10.52806 | 1.799895 | 0.086224 | 0.061031 | 0.467074 | 0.330607 | 5.707978 | 1.429387 | 0.733244 | 1.012858 | -0.22449 | 0.792961 | 1.336846 | 17.26345 | 13.23699 | 8.106604 | 5.098027 | 3.008577 | 0.573333 | 1.313689 | 1.887021 | 0.074292 | 2.841153 | 0.111856 |
| 10/25/2018 | 10/24 | 3.654286 | 17.84657 | 10.75043 | 10.26609 | 2.132567 | 0.08599 | 0.061031 | 0.449567 | 0.319078 | 6.764079 | 1.418922 | 0.739616 | 1.013379 | -0.23034 | 0.792961 | 1.330407 | 17.03174 | 13.05932 | 7.90489 | 4.99419 | 2.910701 | 0.53389 | 1.466127 | 2.000017 | 0.078741 | 3.057128 | 0.120359 |
| 10/26/2018 | 10/25 | 3.62925 | 17.77932 | 10.70429 | 10.11313 | 2.128655 | 0.085758 | 0.061031 | 0.449089 | 0.319602 | 6.75277 | 1.413903 | 0.738299 | 1.013896 | -0.23613 | 0.792961 | 1.324015 | 16.80299 | 12.88393 | 7.787114 | 4.982188 | 2.804926 | 0.513942 | 1.458085 | 1.972027 | 0.077639 | 3.023806 | 0.119047 |
| 10/27/2018 | 10/26 | 3.254643 | 17.71975 | 10.4872 | 10.08774 | 1.843481 | 0.084674 | 0.061031 | 0.460288 | 0.331767 | 5.852586 | 1.399735 | 0.71884 | 1.014409 | -0.24184 | 0.792961 | 1.317673 | 16.57726 | 12.71085 | 7.767556 | 5.086626 | 2.68093 | 0.503472 | 1.322088 | 1.825559 | 0.071872 | 2.785699 | 0.109673 |
| 10/28/2018 | 10/27 | 2.533214 | 17.40339 | 9.968304 | 10.09065 | 2.398928 | 0.082129 | 0.061031 | 0.425672 | 0.316323 | 7.629955 | 1.360425 | 0.682637 | 1.014918 | -0.24748 | 0.792961 | 1.311383 | 16.35464 | 12.54015 | 7.7698 | 5.225526 | 2.544274 | 0.441875 | 1.635862 | 2.077737 | 0.081801 | 3.251384 | 0.128007 |
| 10/29/2018 | 10/28 | 2.420536 | 17.22718 | 9.823857 | 9.933958 | 1.99622 | 0.081433 | 0.061031 | 0.442841 | 0.331896 | 6.352356 | 1.346483 | 0.677131 | 1.015423 | -0.25305 | 0.792961 | 1.305146 | 16.13519 | 12.37188 | 7.649147 | 5.209088 | 2.440059 | 0.440867 | 1.411212 | 1.852079 | 0.072916 | 2.873535 | 0.113131 |
| 10/30/2018 | 10/29 | 2.857071 | 16.75864 | 9.807857 | 9.496572 | 2.387566 | 0.081356 | 0.061031 | 0.423881 | 0.317987 | 7.598125 | 1.329202 | 0.698685 | 1.015923 | -0.25855 | 0.792961 | 1.298966 | 15.91897 | 12.20609 | 7.312361 | 4.926533 | 2.385828 | 0.412613 | 1.523393 | 1.936006 | 0.076221 | 3.028884 | 0.119247 |
| 10/31/2018 | 10/30 | 2.904964 | 15.95089 | 9.427929 | 9.076628 | 1.94481 | 0.079549 | 0.061031 | 0.439651 | 0.337309 | 6.197437 | 1.282631 | 0.701086 | 1.016418 | -0.26396 | 0.792961 | 1.292843 | 15.70605 | 12.04284 | 6.989004 | 4.664191 | 2.324812 | 0.417019 | 1.21569 | 1.632709 | 0.06428 | 2.512323 | 0.09891 |
| 11/1/2018 | 10/31 | 2.608143 | 16.35007 | 9.479107 | 9.191312 | 1.84783 | 0.07979 | 0.061031 | 0.445344 | 0.340643 | 5.887328 | 1.298147 | 0.791361 | 1.016908 | -0.2693 | 0.792961 | 1.286781 | 15.4965 | 11.88216 | 7.07731 | 4.69704 | 2.380271 | 0.432496 | 1.016348 | 1.448844 | 0.057041 | 2.184339 | 0.085998 |
| 11/2/2018 | 11/1 | 2.880964 | 16.07014 | 9.475554 | 8.884788 | 2.244918 | 0.079773 | 0.061031 | 0.425711 | 0.325695 | 7.152571 | 1.288919 | 0.806737 | 1.017394 | -0.27456 | 0.792961 | 1.280782 | 15.29038 | 11.72411 | 6.841287 | 4.526558 | 2.314729 | 0.402046 | 1.12327 | 1.525316 | 0.060052 | 2.330803 | 0.091764 |
| 11/3/2018 | 11/2 | 3.300107 | 16.23246 | 9.766286 | 8.681265 | 2.356095 | 0.081156 | 0.061031 | 0.424728 | 0.319405 | 7.499075 | 1.30976 | 0.830872 | 1.017874 | -0.27974 | 0.792961 | 1.274847 | 15.08774 | 11.56874 | 6.684574 | 4.438009 | 2.246565 | 0.389305 | 1.147053 | 1.536358 | 0.060487 | 2.357543 | 0.092817 |
| 11/4/2018 | 11/3 | 2.124286 | 15.32325 | 8.723768 | 8.654563 | 2.22451 | 0.07629 | 0.061031 | 0.415792 | 0.332629 | 7.106461 | 1.226552 | 0.764727 | 1.018349 | -0.28483 | 0.792961 | 1.268979 | 14.88865 | 11.41608 | 6.664013 | 4.550606 | 2.113407 | 0.358525 | 1.091671 | 1.450196 | 0.057094 | 2.233176 | 0.08792 |
| 11/5/2018 | 11/4 | 2.359679 | 15.30421 | 8.831946 | 8.458205 | 2.119164 | 0.076783 | 0.061031 | 0.422377 | 0.335727 | 6.767322 | 1.231524 | 0.777584 | 1.018818 | -0.28984 | 0.792961 | 1.263181 | 14.69315 | 11.26618 | 6.512818 | 4.468792 | 2.044026 | 0.352246 | 1.031339 | 1.383586 | 0.054472 | 2.125257 | 0.083672 |
| 11/6/2018 | 11/5 | 2.74925 | 15.15911 | 8.954179 | 8.173548 | 2.373199 | 0.077344 | 0.061031 | 0.412235 | 0.325292 | 7.575271 | 1.23364 | 0.799281 | 1.019282 | -0.29477 | 0.792961 | 1.257456 | 14.50131 | 11.11908 | 6.293632 | 4.298495 | 1.995137 | 0.335566 | 1.070336 | 1.405901 | 0.05535 | 2.171335 | 0.085486 |
| 11/7/2018 | 11/6 | 2.729571 | 14.26057 | 8.495071 | 7.776594 | 2.343656 | 0.075257 | 0.061031 | 0.406968 | 0.330041 | 7.493169 | 1.184592 | 0.798172 | 1.01974 | -0.2996 | 0.792961 | 1.251804 | 14.31317 | 10.97483 | 5.987977 | 4.032748 | 1.955229 | 0.324652 | 0.955636 | 1.280288 | 0.050405 | 1.96283 | 0.077277 |
| 11/8/2018 | 11/7 | 3.154536 | 14.51054 | 8.832536 | 7.617943 | 2.513337 | 0.076786 | 0.061031 | 0.404199 | 0.321267 | 8.026053 | 1.209231 | 0.822419 | 1.020192 | -0.30435 | 0.792961 | 1.24623 | 14.12879 | 10.83345 | 5.865816 | 3.967989 | 1.897827 | 0.312977 | 0.997398 | 1.310375 | 0.05159 | 2.020859 | 0.079561 |
| 11/9/2018 | 11/8 | 3.134036 | 13.84429 | 8.489161 | 7.303623 | 2.242197 | 0.07523 | 0.061031 | 0.411569 | 0.33389 | 7.168935 | 1.173764 | 0.821234 | 1.020639 | -0.30901 | 0.792961 | 1.240735 | 13.94821 | 10.69499 | 5.62379 | 3.768885 | 1.854905 | 0.311476 | 0.843828 | 1.155304 | 0.045484 | 1.758942 | 0.06925 |
| 11/10/2018 | 11/9 | 1.454107 | 12.40457 | 6.929339 | 7.2915 | 2.146764 | 0.068498 | 0.061031 | 0.393493 | 0.350603 | 6.902054 | 1.059483 | 0.729144 | 1.021079 | -0.31358 | 0.792961 | 1.235322 | 13.77148 | 10.55948 | 5.614455 | 3.881789 | 1.732666 | 0.278171 | 0.79938 | 1.077551 | 0.042423 | 1.649627 | 0.064946 |
| 11/11/2018 | 11/10 | 0.5685 | 11.42682 | 5.997661 | 7.169631 | 2.518779 | 0.064727 | 0.061031 | 0.363586 | 0.342825 | 8.125161 | 0.993482 | 0.68437 | 1.021513 | -0.31805 | 0.792961 | 1.229993 | 13.59864 | 10.42695 | 5.520616 | 3.868797 | 1.651819 | 0.245036 | 0.861033 | 1.106069 | 0.043546 | 1.716475 | 0.067578 |
| 11/12/2018 | 11/11 | 1.168571 | 11.56882 | 6.368696 | 6.929618 | 2.539382 | 0.066207 | 0.061031 | 0.367955 | 0.339191 | 8.180743 | 1.013961 | 0.714434 | 1.02194 | -0.32243 | 0.792961 | 1.224752 | 13.42973 | 10.29744 | 5.335806 | 3.713411 | 1.622394 | 0.243563 | 0.831139 | 1.074702 | 0.042311 | 1.66382 | 0.065505 |
| 11/13/2018 | 11/12 | 1.424286 | 11.91871 | 6.6715 | 6.875434 | 2.42354 | 0.067436 | 0.061031 | 0.377248 | 0.34142 | 7.7991 | 1.036078 | 0.727595 | 1.022361 | -0.32671 | 0.792961 | 1.219601 | 13.2648 | 10.17097 | 5.294084 | 3.738669 | 1.555416 | 0.239405 | 0.821418 | 1.060823 | 0.041765 | 1.64525 | 0.064774 |
| 11/14/2018 | 11/13 | 1.090071 | 11.99046 | 6.540268 | 6.92215 | 2.74813 | 0.066901 | 0.061031 | 0.361709 | 0.329975 | 8.847802 | 1.031336 | 0.710436 | 1.022776 | -0.3309 | 0.792961 | 1.214542 | 13.10388 | 10.04758 | 5.330055 | 3.872992 | 1.457063 | 0.215029 | 0.936886 | 1.151915 | 0.045351 | 1.814777 | 0.071448 |
| 11/15/2018 | 11/14 | 1.694321 | 13.02961 | 7.361964 | 6.97438 | 2.852115 | 0.070311 | 0.061031 | 0.369037 | 0.320331 | 9.155677 | 1.095514 | 0.741726 | 1.023183 | -0.33499 | 0.792961 | 1.209579 | 12.94701 | 9.927299 | 5.370273 | 3.996686 | 1.373586 | 0.206817 | 1.037605 | 1.244422 | 0.048993 | 1.979122 | 0.077918 |
| 11/16/2018 | 11/15 | 1.923179 | 12.77689 | 7.350036 | 6.744082 | 2.630928 | 0.070261 | 0.061031 | 0.377978 | 0.328328 | 8.445994 | 1.088911 | 0.753892 | 1.023584 | -0.33898 | 0.792961 | 1.204713 | 12.79422 | 9.810144 | 5.192943 | 3.841915 | 1.351028 | 0.208349 | 0.929029 | 1.137378 | 0.044779 | 1.797836 | 0.070781 |
| 11/17/2018 | 11/16 | 2.7255 | 12.8815 | 7.8035 | 6.447905 | 2.386999 | 0.072204 | 0.061031 | 0.39506 | 0.333929 | 7.650543 | 1.114665 | 0.797943 | 1.023978 | -0.34287 | 0.792961 | 1.199948 | 12.64554 | 9.696144 | 4.964887 | 3.604216 | 1.360671 | 0.219319 | 0.809143 | 1.028463 | 0.040491 | 1.606573 | 0.063251 |
| 11/18/2018 | 11/17 | 2.35425 | 12.34589 | 7.350071 | 6.322421 | 2.943661 | 0.070261 | 0.061031 | 0.365228 | 0.317252 | 9.449953 | 1.079304 | 0.777285 | 1.024365 | -0.34665 | 0.792961 | 1.195286 | 12.50101 | 9.585322 | 4.868264 | 3.559905 | 1.30836 | 0.194962 | 0.905459 | 1.100422 | 0.043324 | 1.739681 | 0.068491 |
| 11/19/2018 | 11/18 | 2.08 | 11.69482 | 6.887411 | 6.13242 | 2.899152 | 0.068324 | 0.061031 | 0.36052 | 0.322041 | 9.32245 | 1.04214 | 0.762329 | 1.024744 | -0.35034 | 0.792961 | 1.190729 | 12.36065 | 9.477701 | 4.721963 | 3.443956 | 1.278007 | 0.187985 | 0.84005 | 1.028035 | 0.040474 | 1.620874 | 0.063814 |
| 11/20/2018 | 11/19 | 2.131643 | 10.77579 | 6.453714 | 5.750583 | 2.486709 | 0.06655 | 0.061031 | 0.37141 | 0.340611 | 8.008617 | 1.002797 | 0.765126 | 1.025116 | -0.35392 | 0.792961 | 1.186282 | 12.22449 | 9.373302 | 4.427949 | 3.122463 | 1.305485 | 0.197827 | 0.648325 | 0.846152 | 0.033313 | 1.306152 | 0.051423 |
| 11/21/2018 | 11/20 | 1.995071 | 11.57129 | 6.783179 | 5.98736 | 2.609742 | 0.067894 | 0.061031 | 0.370845 | 0.333361 | 8.394956 | 1.034398 | 0.757749 | 1.025481 | -0.3574 | 0.792961 | 1.181946 | 12.09257 | 9.272144 | 4.610267 | 3.433044 | 1.177224 | 0.178119 | 0.774214 | 0.952333 | 0.037493 | 1.502224 | 0.059143 |
| 11/22/2018 | 11/21 | 1.545929 | 10.93479 | 6.240357 | 5.865905 | 2.721891 | 0.065692 | 0.061031 | 0.358572 | 0.333133 | 8.772734 | 0.995036 | 0.733931 | 1.025838 | -0.36077 | 0.792961 | 1.177723 | 11.96489 | 9.174246 | 4.516747 | 3.379988 | 1.136759 | 0.166305 | 0.763074 | 0.929379 | 0.03659 | 1.46958 | 0.057857 |
| 11/23/2018 | 11/22 | 2.154893 | 10.94193 | 6.548411 | 5.616263 | 2.591666 | 0.066934 | 0.061031 | 0.368287 | 0.335809 | 8.343811 | 1.010579 | 0.766388 | 1.026188 | -0.36403 | 0.792961 | 1.173618 | 11.84149 | 9.079626 | 4.324522 | 3.169945 | 1.154578 | 0.173488 | 0.684206 | 0.857694 | 0.033767 | 1.343098 | 0.052878 |
| 11/24/2018 | 11/23 | 1.781071 | 10.92975 | 6.355411 | 5.673029 | 3.229767 | 0.066153 | 0.061031 | 0.340638 | 0.314263 | 10.40535 | 1.000629 | 0.746317 | 1.02653 | -0.36719 | 0.792961 | 1.169631 | 11.72238 | 8.988299 | 4.368232 | 3.296794 | 1.071438 | 0.148909 | 0.831605 | 0.980514 | 0.038603 | 1.563827 | 0.061568 |
| 11/25/2018 | 11/24 | 1.540857 | 11.26443 | 6.402643 | 5.791284 | 3.092351 | 0.066344 | 0.061031 | 0.346364 | 0.318629 | 9.960949 | 1.009378 | 0.733666 | 1.026864 | -0.37023 | 0.792961 | 1.165767 | 11.60759 | 8.900281 | 4.459289 | 3.489298 | 0.969991 | 0.137076 | 0.875067 | 1.012143 | 0.039848 | 1.628565 | 0.064117 |
| 11/26/2018 | 11/25 | 0.446464 | 9.508857 | 4.977661 | 5.537718 | 2.462413 | 0.060805 | 0.061031 | 0.35161 | 0.352919 | 7.972481 | 0.909531 | 0.678394 | 1.027189 | -0.37317 | 0.792961 | 1.162026 | 11.49713 | 8.815586 | 4.264043 | 3.288775 | 0.975268 | 0.139909 | 0.650336 | 0.790245 | 0.031112 | 1.252522 | 0.049312 |
| 11/27/2018 | 11/26 | 1.036464 | 9.036643 | 5.036554 | 5.155046 | 2.673882 | 0.061026 | 0.061031 | 0.343726 | 0.343757 | 8.655315 | 0.904672 | 0.707717 | 1.027507 | -0.376 | 0.792961 | 1.158413 | 11.39102 | 8.734226 | 3.969385 | 2.919427 | 1.049958 | 0.147246 | 0.586008 | 0.733254 | 0.028868 | 1.146872 | 0.045152 |
| 11/28/2018 | 11/27 | 0.971143 | 8.942643 | 4.956893 | 5.099837 | 2.704398 | 0.060727 | 0.061031 | 0.341401 | 0.343111 | 8.756602 | 0.899481 | 0.704416 | 1.027817 | -0.37871 | 0.792961 | 1.154929 | 11.28928 | 8.656214 | 3.926874 | 2.910328 | 1.016547 | 0.141596 | 0.58607 | 0.727666 | 0.028648 | 1.141143 | 0.044927 |
| 11/29/2018 | 11/28 | 0.297393 | 9.35475 | 4.826071 | 5.389213 | 2.797304 | 0.06024 | 0.061031 | 0.33594 | 0.340354 | 9.06169 | 0.900006 | 0.671158 | 1.028119 | -0.38131 | 0.792961 | 1.151577 | 11.19192 | 8.581562 | 4.149694 | 3.289061 | 0.860633 | 0.117961 | 0.705813 | 0.823774 | 0.032432 | 1.322379 | 0.052062 |
| 11/30/2018 | 11/29 | 1.054643 | 9.685964 | 5.370304 | 5.217239 | 2.984478 | 0.06229 | 0.061031 | 0.336246 | 0.329452 | 9.649126 | 0.930832 | 0.708638 | 1.028412 | -0.3838 | 0.792961 | 1.14836 | 11.09895 | 8.510279 | 4.017274 | 3.135448 | 0.881826 | 0.120976 | 0.706337 | 0.827313 | 0.032571 | 1.324591 | 0.052149 |
| 12/1/2018 | 11/30 | 1.5765 | 9.564179 | 5.570339 | 4.978897 | 3.065334 | 0.063059 | 0.061031 | 0.335958 | 0.325158 | 9.903425 | 0.938548 | 0.789594 | 1.028696 | -0.38618 | 0.792961 | 1.145278 | 11.01039 | 8.442374 | 3.833751 | 2.850171 | 0.98358 | 0.13482 | 0.479658 | 0.614478 | 0.024192 | 0.949682 | 0.037389 |
| 12/2/2018 | 12/1 | 1.258857 | 9.440964 | 5.349911 | 5.00062 | 2.805856 | 0.062212 | 0.061031 | 0.342829 | 0.336322 | 9.072288 | 0.925896 | 0.772054 | 1.028973 | -0.38844 | 0.792961 | 1.142336 | 10.92625 | 8.377858 | 3.850477 | 2.921389 | 0.929089 | 0.129956 | 0.469404 | 0.59936 | 0.023597 | 0.929372 | 0.036589 |
| 12/3/2018 | 12/2 | 1.886036 | 8.740429 | 5.313232 | 4.543555 | 2.769704 | 0.062072 | 0.061031 | 0.343744 | 0.33798 | 8.956577 | 0.913995 | 0.807025 | 1.02924 | -0.39059 | 0.792961 | 1.139535 | 10.84654 | 8.316737 | 3.498537 | 2.45004 | 1.048497 | 0.147049 | 0.323814 | 0.470864 | 0.018538 | 0.696634 | 0.027427 |
| 12/4/2018 | 12/3 | 1.771143 | 8.32625 | 5.048696 | 4.412418 | 2.97923 | 0.061071 | 0.061031 | 0.332047 | 0.33183 | 9.6433 | 0.895504 | 0.800516 | 1.029499 | -0.39262 | 0.792961 | 1.136877 | 10.77127 | 8.25902 | 3.397562 | 2.343569 | 1.053993 | 0.14279 | 0.303955 | 0.446745 | 0.017588 | 0.657168 | 0.025873 |
| 12/5/2018 | 12/4 | 1.089821 | 7.721429 | 4.405625 | 4.408908 | 2.752406 | 0.058696 | 0.061031 | 0.331912 | 0.345119 | 8.929759 | 0.856781 | 0.76286 | 1.02975 | -0.39453 | 0.792961 | 1.134364 | 10.70044 | 8.204712 | 3.394859 | 2.380882 | 1.013977 | 0.137313 | 0.289449 | 0.426762 | 0.016802 | 0.628027 | 0.024725 |
| 12/6/2018 | 12/5 | 0.449357 | 6.889607 | 3.669482 | 4.317882 | 2.616156 | 0.056074 | 0.061031 | 0.327167 | 0.356092 | 8.5103 | 0.812678 | 0.728897 | 1.029991 | -0.39633 | 0.792961 | 1.131998 | 10.63407 | 8.15382 | 3.324769 | 2.318419 | 1.00635 | 0.134332 | 0.253892 | 0.388224 | 0.015284 | 0.564655 | 0.02223 |
| 12/7/2018 | 12/6 | -0.03025 | 7.699464 | 3.834607 | 4.702895 | 2.929667 | 0.056653 | 0.061031 | 0.317425 | 0.341956 | 9.52446 | 0.830232 | 0.704346 | 1.030224 | -0.39801 | 0.792961 | 1.129781 | 10.57216 | 8.106349 | 3.621229 | 2.785374 | 0.835855 | 0.108251 | 0.410005 | 0.518256 | 0.020404 | 0.804895 | 0.031689 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/8/2018 | 12/7 | 0.083571 | 7.276714 | 3.680143 | 4.51208 | 2.836177 | 0.056111 | 0.061031 | 0.318822 | 0.346779 | 9.225669 | 0.81779 | 0.710105 | 1.030447 | -0.39957 | 0.792961 | 1.127715 | 10.51471 | 8.062304 | 3.474302 | 2.595627 | 0.878675 | 0.114298 | 0.344511 | 0.458809 | 0.018063 | 0.699253 | 0.02753 |
| 12/9/2018 | 12/8 | -0.01064 | 7.359321 | 3.674339 | 4.544194 | 3.204111 | 0.056091 | 0.061031 | 0.30549 | 0.332397 | 10.42272 | 0.818587 | 0.705335 | 1.030662 | -0.40102 | 0.792961 | 1.125801 | 10.46175 | 8.021691 | 3.49903 | 2.65936 | 0.839669 | 0.104656 | 0.392361 | 0.497017 | 0.019568 | 0.769409 | 0.030292 |
| 12/10/2018 | 12/9 | 0.577036 | 7.436536 | 4.006786 | 4.36368 | 3.201389 | 0.057262 | 0.061031 | 0.309988 | 0.330391 | 10.40137 | 0.83461 | 0.735559 | 1.030867 | -0.40234 | 0.792961 | 1.124042 | 10.41326 | 7.984512 | 3.360034 | 2.470107 | 0.889927 | 0.112554 | 0.34039 | 0.452944 | 0.017832 | 0.68856 | 0.027109 |
| 12/11/2018 | 12/10 | 0.436571 | 7.73625 | 4.086411 | 4.482491 | 3.542889 | 0.057546 | 0.061031 | 0.299572 | 0.317715 | 11.5076 | 0.842066 | 0.728233 | 1.031063 | -0.40355 | 0.792961 | 1.122437 | 10.36926 | 7.950772 | 3.451518 | 2.62902 | 0.822499 | 0.10053 | 0.416187 | 0.516717 | 0.020343 | 0.804209 | 0.031662 |
| 12/12/2018 | 12/11 | 0.595607 | 7.711786 | 4.153696 | 4.408927 | 2.798665 | 0.057787 | 0.061031 | 0.326678 | 0.34502 | 9.088092 | 0.84484 | 0.736533 | 1.031251 | -0.40463 | 0.792961 | 1.120989 | 10.32974 | 7.920474 | 3.394874 | 2.561902 | 0.832972 | 0.111022 | 0.339606 | 0.450629 | 0.017741 | 0.688187 | 0.027094 |
| 12/13/2018 | 12/12 | -0.80064 | 7.685821 | 3.442589 | 4.798417 | 3.121117 | 0.055286 | 0.061031 | 0.305309 | 0.337035 | 10.16126 | 0.813071 | 0.666436 | 1.031428 | -0.4056 | 0.792961 | 1.119699 | 10.29472 | 7.893621 | 3.694781 | 3.053125 | 0.641655 | 0.079929 | 0.502182 | 0.582111 | 0.022918 | 0.933421 | 0.036749 |
| 12/14/2018 | 12/13 | -1.25382 | 6.538536 | 2.642357 | 4.584367 | 3.042399 | 0.052584 | 0.061031 | 0.29751 | 0.345303 | 9.933738 | 0.763907 | 0.644988 | 1.031597 | -0.40644 | 0.792961 | 1.118568 | 10.2642 | 7.870216 | 3.529962 | 2.820538 | 0.709425 | 0.086113 | 0.407911 | 0.494024 | 0.01945 | 0.778571 | 0.030652 |
| 12/15/2018 | 12/14 | -0.87379 | 6.996643 | 3.061429 | 4.595593 | 3.453481 | 0.053985 | 0.061031 | 0.289186 | 0.326934 | 11.25885 | 0.78733 | 0.662932 | 1.031756 | -0.40717 | 0.792961 | 1.117597 | 10.23817 | 7.850261 | 3.538606 | 2.843787 | 0.694819 | 0.08198 | 0.457897 | 0.539877 | 0.021255 | 0.857301 | 0.033752 |
| 12/16/2018 | 12/15 | 0.441536 | 7.666536 | 4.054036 | 4.393871 | 3.158824 | 0.057431 | 0.061031 | 0.312107 | 0.331675 | 10.26132 | 0.839678 | 0.728491 | 1.031906 | -0.40777 | 0.792961 | 1.116787 | 10.21665 | 7.833758 | 3.383281 | 2.602538 | 0.780742 | 0.099419 | 0.378415 | 0.477834 | 0.018812 | 0.741099 | 0.029177 |
| 12/17/2018 | 12/16 | 0.654857 | 7.227393 | 3.941125 | 4.183799 | 3.06203 | 0.057029 | 0.061031 | 0.314039 | 0.336076 | 9.950948 | 0.82907 | 0.739646 | 1.032046 | -0.40826 | 0.792961 | 1.116137 | 10.19963 | 7.820709 | 3.221525 | 2.364747 | 0.856779 | 0.109777 | 0.299058 | 0.408835 | 0.016096 | 0.616077 | 0.024255 |
| 12/18/2018 | 12/17 | 0.354714 | 7.801143 | 4.077929 | 4.447801 | 2.888461 | 0.057516 | 0.061031 | 0.322245 | 0.341942 | 9.382253 | 0.842537 | 0.723993 | 1.032177 | -0.40862 | 0.792961 | 1.11565 | 10.18712 | 7.811115 | 3.424807 | 2.681715 | 0.743092 | 0.097699 | 0.380311 | 0.478009 | 0.018819 | 0.744397 | 0.029307 |
| 12/19/2018 | 12/18 | 0.490286 | 7.915107 | 4.202696 | 4.437854 | 3.576514 | 0.057963 | 0.061031 | 0.3 | 0.315882 | 11.61195 | 0.849762 | 0.731027 | 1.032298 | -0.40886 | 0.792961 | 1.115325 | 10.17911 | 7.804979 | 3.417148 | 2.672363 | 0.744784 | 0.091162 | 0.43552 | 0.526681 | 0.020735 | 0.828001 | 0.032598 |
| 12/20/2018 | 12/19 | 1.16975 | 7.720393 | 4.445071 | 4.166994 | 2.818101 | 0.058839 | 0.061031 | 0.329912 | 0.342204 | 9.141597 | 0.858654 | 0.767195 | 1.03241 | -0.40899 | 0.792961 | 1.115163 | 10.17562 | 7.802301 | 3.208586 | 2.35025 | 0.858336 | 0.115536 | 0.286109 | 0.401645 | 0.015813 | 0.600992 | 0.023661 |
| 12/21/2018 | 12/20 | 0.6955 | 7.33375 | 4.014625 | 4.195186 | 2.573784 | 0.05729 | 0.061031 | 0.333608 | 0.355393 | 8.362034 | 0.833734 | 0.741789 | 1.032512 | -0.40898 | 0.792961 | 1.115163 | 10.17664 | 7.803082 | 3.230294 | 2.388305 | 0.841988 | 0.114605 | 0.273245 | 0.38785 | 0.01527 | 0.579182 | 0.022802 |
| 12/22/2018 | 12/21 | -1.33871 | 5.781821 | 2.221554 | 4.347272 | 3.034041 | 0.051209 | 0.061031 | 0.292291 | 0.348355 | 9.921596 | 0.737435 | 0.641039 | 1.032605 | -0.40886 | 0.792961 | 1.115327 | 10.18217 | 7.807324 | 3.347399 | 2.584088 | 0.763311 | 0.091028 | 0.333169 | 0.424198 | 0.016701 | 0.655612 | 0.025812 |
| 12/23/2018 | 12/22 | -2.74954 | 5.516143 | 1.383304 | 4.688436 | 3.154742 | 0.048562 | 0.061031 | 0.277407 | 0.348639 | 10.34781 | 0.70155 | 0.578463 | 1.032688 | -0.40862 | 0.792961 | 1.115652 | 10.19222 | 7.815026 | 3.610096 | 2.995599 | 0.614496 | 0.06955 | 0.444055 | 0.513605 | 0.020221 | 0.822784 | 0.032393 |
| 12/24/2018 | 12/23 | -2.80954 | 5.369893 | 1.280179 | 4.670573 | 3.040844 | 0.048244 | 0.061031 | 0.27988 | 0.354061 | 9.97797 | 0.695862 | 0.575926 | 1.032761 | -0.40826 | 0.792961 | 1.116141 | 10.20678 | 7.82619 | 3.596341 | 2.966432 | 0.629909 | 0.07193 | 0.423711 | 0.495641 | 0.019513 | 0.791124 | 0.031147 |
| 12/25/2018 | 12/24 | -2.48129 | 5.590607 | 1.554661 | 4.648439 | 3.042593 | 0.049093 | 0.061031 | 0.283349 | 0.352252 | 9.973729 | 0.708925 | 0.589927 | 1.032824 | -0.40777 | 0.792961 | 1.116791 | 10.22585 | 7.840815 | 3.579298 | 2.927313 | 0.651986 | 0.075374 | 0.418069 | 0.493443 | 0.019427 | 0.784957 | 0.030904 |
| 12/26/2018 | 12/25 | -1.66004 | 5.585571 | 1.962768 | 4.414256 | 3.51976 | 0.050379 | 0.061031 | 0.273134 | 0.330887 | 11.52077 | 0.724723 | 0.626284 | 1.032878 | -0.40717 | 0.792961 | 1.117602 | 10.24944 | 7.858901 | 3.398977 | 2.631508 | 0.767469 | 0.085526 | 0.375261 | 0.460786 | 0.018141 | 0.719153 | 0.028313 |
| 12/27/2018 | 12/26 | -1.96714 | 5.268571 | 1.650714 | 4.423336 | 3.228989 | 0.049393 | 0.061031 | 0.278384 | 0.343978 | 10.58104 | 0.708747 | 0.612463 | 1.032922 | -0.40644 | 0.792961 | 1.118574 | 10.27754 | 7.880449 | 3.405969 | 2.630298 | 0.775671 | 0.088101 | 0.350442 | 0.438543 | 0.017265 | 0.680859 | 0.026805 |
| 12/28/2018 | 12/27 | -1.14689 | 6.357214 | 2.605161 | 4.518921 | 2.494289 | 0.052461 | 0.061031 | 0.317464 | 0.369326 | 8.145203 | 0.760074 | 0.649993 | 1.032956 | -0.40559 | 0.792961 | 1.119706 | 10.31016 | 7.905457 | 3.479569 | 2.718724 | 0.760845 | 0.098549 | 0.331151 | 0.4297 | 0.016917 | 0.662838 | 0.026096 |
| 12/29/2018 | 12/28 | -1.34182 | 5.604036 | 2.131107 | 4.363242 | 3.380011 | 0.050918 | 0.061031 | 0.279634 | 0.335178 | 11.05658 | 0.731724 | 0.640894 | 1.03298 | -0.40463 | 0.792961 | 1.120997 | 10.34728 | 7.933925 | 3.359696 | 2.521112 | 0.838584 | 0.095675 | 0.336607 | 0.432282 | 0.017019 | 0.663997 | 0.026142 |
| 12/30/2018 | 12/29 | -1.49679 | 5.937821 | 2.220518 | 4.532309 | 2.430148 | 0.051206 | 0.061031 | 0.314794 | 0.375198 | 7.94684 | 0.739237 | 0.633742 | 1.032995 | -0.40354 | 0.792961 | 1.122445 | 10.38892 | 7.965852 | 3.489878 | 2.697334 | 0.792544 | 0.101791 | 0.314547 | 0.416338 | 0.016391 | 0.637728 | 0.025107 |
| 12/31/2018 | 12/30 | -1.80796 | 5.258679 | 1.725357 | 4.438353 | 3.410915 | 0.049627 | 0.061031 | 0.273524 | 0.336377 | 11.17415 | 0.711571 | 0.619592 | 1.033 | -0.40233 | 0.792961 | 1.124051 | 10.43507 | 8.001235 | 3.417532 | 2.568418 | 0.849115 | 0.094759 | 0.345724 | 0.440483 | 0.017342 | 0.678251 | 0.026703 |
| | | -2.76418 | 4.714286 | | | | | | | | | | | | | | | | | | | | | | | | | |

OWRD primary water rights are divided spatially into 8 subwatersheds, and further separated by surface water and groundwater acres for each subwatershed.
Satellite photo interpretation was used to estimate irrigated acres by irrigation system type for each subwatershed.
Based on the ratio of irrigation types present in each subwatershed, an existing efficiency was calculated for the subwatershed using the "NRCS water savings estimator" tool.
A high efficiency scenario efficiency was calculated for each subwatershed based on the assumptions that: 90% of flood irrigation is converted to sprinkler, 33% of wheel lines are converted to pivot/linear, 75% of unconverted wheel lines get nozzle upgrades, 75% of pivots get sprinkler package upgrades, and IWM is implemented on all upgrad

| Number | Basin | Total Acres | Primary WR Acres | % Water Rights | % SW Irr | % GW Irr | SW ac | GW ac | Pivot acres | Linear acres | % Pivot & Linear | Pivot/Linear to Sprinkler Ratio | Flood Acres | Sprinkler acres | Irrigated Wetland | Existing Efficiency | Scenario Efficiency | Existing Consumption ac/in per ac | Existing Total Consumption ac/ft | Scenario Consumption ac/in per ac | Scenario Total Consumption ac/ft | Potential ac-ft demand | Potential SW Demand | Potential GW Demand |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Lookingglass Cr/Cabin Cr | 168992 | 1233 | 0.7% | 94% | 6% | 1158 | 75 | 0 | 0 | 0 | 0.00 | 0 | 1233 | 0 | 55% | 76% | 38.8 | 3986 | 29.1 | 2992 | 3699 | 3474 | 225 |
| 2 | Willow Cr./Indian Cr. | 149800 | 22109 | 14.8% | 78% | 22% | 17296 | 4813 | 5963 | 857 | 31% | 0.45 | 0 | 15289 | 0 | 60% | 79% | 37.5 | 69125 | 27.9 | 51393 | 66327 | 51888 | 14439 |
| 3 | Lower 5 Points Cr | 41005 | 15759 | 38.4% | 50% | 50% | 7928 | 7831 | 4749 | 1362 | 39% | 0.64 | 64 | 9584 | 0 | 62% | 80% | 38.6 | 50661 | 27.5 | 36127 | 47277 | 23784 | 23493 |
| 4 | Beaver Cr, Upper 5 Points | 178051 | 931 | 0.5% | 27% | 73% | 251 | 680 | 127 | 0 | 14% | 0.16 | 0 | 805 | 0 | 57% | 77% | 37.7 | 2923 | 28.6 | 2220 | 2793 | 753 | 2040 |
| 5 | Meadow Cr Upr GRR | 249739 | 173 | 0.1% | 100% | 0% | 173 | 0 | 0 | 0 | 0% | 0.00 | 0 | 173 | 0 | 55% | 76% | 38.8 | 559 | 29.1 | 420 | 519 | 519 | 0 |
| 6 | Ladd Cr. Lower Catherine | 142259 | 50812 | 35.7% | 70% | 30% | 35444 | 15368 | 17974 | 554 | 36% | 0.64 | 2881 | 28780 | 623 | 60% | 79% | 37.1 | 157201 | 28.2 | 119323 | 152436 | 106332 | 46104 |
| 7 | Upper Catherine Creek 1 | 55494 | 8186 | 14.8% | 98% | 2% | 8009 | 177 | 676 | 0 | 8% | 0.13 | 2341 | 5169 | 0 | 52% | 75% | 42.2 | 28788 | 29.5 | 20137 | 24558 | 24027 | 531 |
| 8 | Upper Catherine Creek 2 | 61818 | 119 | 0.2% | 100% | 0% | 119 | 0 | 0 | 0 | 0% | 0.00 | 119 | 0 | 0 | 41% | 71% | 53.1 | 527 | 31.6 | 313 | 357 | 357 | 0 |
| | | | 99322 | | 71% | 29% | 70378 | 28944 | 29488 | 2774 | 0 | 0.53 | 5404 | 61033 | | | | | | | | 297966 | | |

led systems.

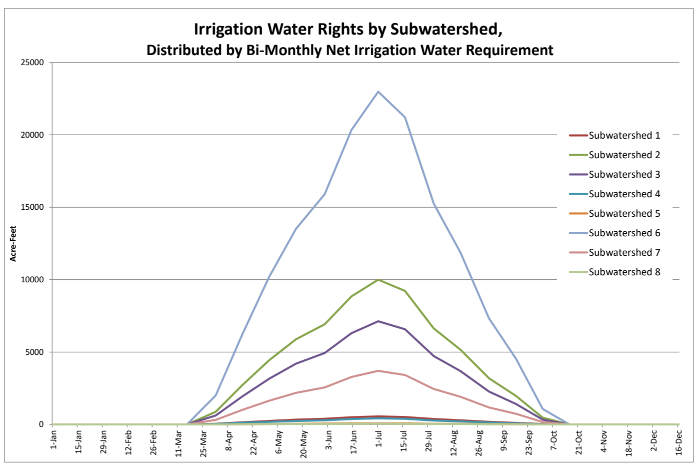
This worksheet uses spatial water right data to calculate potential total irrigation diversion volume for each subwatershed, based on a duty of 3 Ac-ft. The volume is further divided by surface and groundwater.

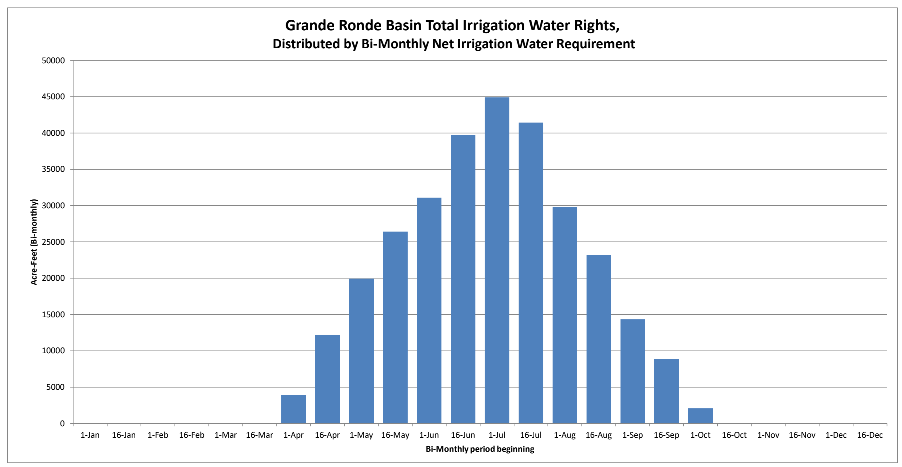
| | ORWD Irrigated Acres by Subwatershed | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | subwatershed | Primary WR acres | SW Acres | GW Acres | Pivot acres | Linear acres | % Pivot & Linear | Pivot/Linear to Sprinkler Ratio | Flood Acres | Sprinkler acres | Irrigated Wetland |
| Lookingglass Cr/Cabin Cr | 1 | 1233 | 1158 | 75 | 0 | 0 | 0.0% | 0.00 | 0 | 1233 | 0 |
| Willow Cr./Indian Cr. | 2 | 22109 | 17296 | 4813 | 5962.7 | 857.1 | 30.8% | 0.45 | 0 | 15289 | 0 |
| Lower 5 Points Cr | 3 | 15759 | 7928 | 7831 | 4748.6 | 1362.3 | 38.8% | 0.64 | 64 | 9584 | 0 |
| Beaver Cr, Upper 5 Points | 4 | 931 | 251 | 680 | 126.5 | 0 | 13.6% | 0.16 | 0 | 805 | 0 |
| Meadow Cr Upr GRR | 5 | 173 | 173 | 0 | 0 | 0 | 0.0% | 0.00 | 0 | 173 | 0 |
| Ladd Cr. Lower Catherine | 6 | 50812 | 35444 | 15368 | 17973.78 | 554.4 | 36.5% | 0.64 | 2881 | 28780 | 623 |
| Upper Catherine Creek 1 | 7 | 8186 | 8009 | 177 | 676 | 0 | 8.3% | 0.13 | 2341 | 5169 | 0 |
| Upper Catherine Creek 2 | 8 | 119 | 119 | 0 | 0 | 0 | 0.0% | #DIV/0! | 119 | 0 | 0 |
| | **total** | **99322** | **70378** | **28944** | **29487.58** | **2773.8** | **32.5%** | **0.53** | **5404.4** | **61033.22** | **623** |

Water Rights by Subwatershed Distributed According to Irrigation Diversion Demand

| | | | Subwatershed 1 | | | Subwatershed 2 | | | Subwatershed 3 | | | Subwatershed 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bi-Monthly period beginning | NIWR (Ac-in) | % | SW Demand (Ac-Ft) | GW Demand (Ac-Ft) | Demand (Ac-Ft) | SW Demand (Ac-Ft) | GW Demand (Ac-Ft) | Demand (Ac-Ft) | SW Demand (Ac-Ft) | GW Demand (Ac-Ft) | Demand (Ac-Ft) | SW Demand (Ac-Ft) | GW Demand (Ac-Ft) | Demand (Ac-Ft) |
| 1-Jan | 0.00 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Jan | 0.00 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0.00 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Feb | 0.00 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Mar | 0.00 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Mar | 0.00 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Apr | 0.26 | 1.3% | 46 | 3 | 49 | 683 | 190 | 873 | 313 | 309 | 622 | 10 | 27 | 37 |
| 16-Apr | 0.80 | 4.1% | 142 | 9 | 152 | 2127 | 592 | 2719 | 975 | 963 | 1938 | 31 | 84 | 114 |
| 1-May | 1.31 | 6.7% | 233 | 15 | 248 | 3473 | 967 | 4440 | 1592 | 1573 | 3165 | 50 | 137 | 187 |
| 16-May | 1.73 | 8.9% | 308 | 20 | 328 | 4600 | 1280 | 5880 | 2108 | 2083 | 4191 | 67 | 181 | 248 |
| 1-Jun | 2.04 | 10.4% | 362 | 23 | 386 | 5412 | 1506 | 6918 | 2481 | 2450 | 4931 | 79 | 213 | 291 |
| 16-Jun | 2.60 | 13.3% | 464 | 30 | 494 | 6924 | 1927 | 8851 | 3174 | 3135 | 6309 | 100 | 272 | 373 |
| 1-Jul | 2.94 | 15.1% | 524 | 34 | 558 | 7821 | 2176 | 9997 | 3585 | 3541 | 7126 | 113 | 307 | 421 |
| 16-Jul | 2.71 | 13.9% | 483 | 31 | 514 | 7217 | 2008 | 9225 | 3308 | 3267 | 6575 | 105 | 284 | 388 |
| 1-Aug | 1.95 | 10.0% | 347 | 23 | 370 | 5189 | 1444 | 6633 | 2379 | 2349 | 4728 | 75 | 204 | 279 |
| 16-Aug | 1.52 | 7.8% | 270 | 18 | 288 | 4038 | 1124 | 5162 | 1851 | 1828 | 3680 | 59 | 159 | 217 |
| 1-Sep | 0.94 | 4.8% | 167 | 11 | 178 | 2495 | 694 | 3190 | 1144 | 1130 | 2273 | 36 | 98 | 134 |
| 16-Sep | 0.58 | 3.0% | 104 | 7 | 110 | 1547 | 430 | 1977 | 709 | 700 | 1409 | 22 | 61 | 83 |
| 1-Oct | 0.14 | 0.7% | 24 | 2 | 26 | 362 | 101 | 463 | 166 | 164 | 330 | 5 | 14 | 20 |
| 16-Oct | 0.00 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Nov | 0.00 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Nov | 0.00 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Dec | 0.00 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec | 0.00 | 0.0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | **3474** | **225** | **3699** | **51888** | **14439** | **66327** | **23784** | **23493** | **47277** | **753** | **2040** | **2793** |

| | Subwatershed 5 | | | Subwatershed 6 | | | Subwatershed 7 | | | Subwatershed 8 | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bi-Monthly period beginning | SW Demand (Ac-Ft) | GW Demand (Ac-Ft) | Demand (Ac-Ft) | SW Demand (Ac-Ft) | GW Demand (Ac-Ft) | Demand (Ac-Ft) | SW Demand (Ac-Ft) | GW Demand (Ac-Ft) | Demand (Ac-Ft) | SW Demand (Ac-Ft) | GW Demand (Ac-Ft) | Demand (Ac-Ft) | SW Demand (Ac-Ft) | Demand (Ac-Ft) | Demand (Ac-Ft) |
| 1-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Mar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Mar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Apr | 7 | 0 | 7 | 1399 | 607 | 2006 | 316 | 7 | 323 | 5 | 0 | 5 | 2778 | 1143 | 3921 |
| 16-Apr | 21 | 0 | 21 | 4359 | 1890 | 6248 | 985 | 22 | 1007 | 15 | 0 | 15 | 8654 | 3559 | 12214 |
| 1-May | 35 | 0 | 35 | 7118 | 3086 | 10204 | 1608 | 36 | 1644 | 24 | 0 | 24 | 14133 | 5812 | 19945 |
| 16-May | 46 | 0 | 46 | 9426 | 4087 | 13513 | 2130 | 47 | 2177 | 32 | 0 | 32 | 18716 | 7697 | 26414 |
| 1-Jun | 54 | 0 | 54 | 11091 | 4809 | 15899 | 2506 | 55 | 2561 | 37 | 0 | 37 | 22022 | 9057 | 31078 |
| 16-Jun | 69 | 0 | 69 | 14189 | 6152 | 20341 | 3206 | 71 | 3277 | 48 | 0 | 48 | 28174 | 11587 | 39760 |
| 1-Jul | 78 | 0 | 78 | 16027 | 6949 | 22976 | 3621 | 80 | 3702 | 54 | 0 | 54 | 31823 | 13088 | 44911 |
| 16-Jul | 72 | 0 | 72 | 14789 | 6412 | 21201 | 3342 | 74 | 3416 | 50 | 0 | 50 | 29365 | 12077 | 41442 |
| 1-Aug | 52 | 0 | 52 | 10634 | 4611 | 15245 | 2403 | 53 | 2456 | 36 | 0 | 36 | 21115 | 8684 | 29799 |
| 16-Aug | 40 | 0 | 40 | 8276 | 3588 | 11864 | 1870 | 41 | 1911 | 28 | 0 | 28 | 16432 | 6758 | 23190 |
| 1-Sep | 25 | 0 | 25 | 5113 | 2217 | 7330 | 1155 | 26 | 1181 | 17 | 0 | 17 | 10153 | 4176 | 14329 |
| 16-Sep | 15 | 0 | 15 | 3169 | 1374 | 4544 | 716 | 16 | 732 | 11 | 0 | 11 | 6293 | 2588 | 8881 |
| 1-Oct | 4 | 0 | 4 | 743 | 322 | 1065 | 168 | 4 | 172 | 2 | 0 | 2 | 1475 | 607 | 2081 |
| 16-Oct | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **519** | **0** | **519** | **106332** | **46104** | **152436** | **24027** | **531** | **24558** | **357** | **0** | **357** | **211134** | **86832** | **297966** |



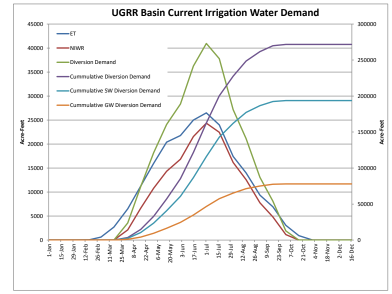
This worksheet calculates the current irrigation demand based on ET modeling.
ET for the basin crop distribution comes from the "Current_Etrs_PM_FAO56" worksheet. This is multiplied by irrigated acres for each subwatershed to get total ET by subwatershed.
The net irrigation water requirement (NIWR) for each subwatershed is calculated by subtracting effective precipitation (see "IMBO Weather_Daily_Averages" worksheet) from the subwatershed ET.
Diversion demand is calculated by dividing the subwatershed NIWR by the subwatershed-specific application efficiency (see "NRCS_WR_Irr_Efficiency" worksheet")
Finally, the total diversion demand is separated into surface water and groundwater demand, according to their respective portions of primary water rights. (see "NRCS_WR_Irr_Efficiency" worksheet")

| | Subwatershed 1 | | | | | Subwatershed 2 | | | | | Subwatershed 3 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acre-Feet | | | | | Acre-Feet | | | | | Acre-Feet | | | | |
| Bi-Monthly period beginning | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand |
| 1-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Feb | 1 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 |
| 1-Mar | 8 | 0 | 0 | 0 | 0 | 140 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| 16-Mar | 33 | 0 | 0 | 0 | 0 | 600 | 0 | 0 | 0 | 0 | 428 | 0 | 0 | 0 | 0 |
| 1-Apr | 81 | 26 | 48 | 45 | 3 | 1445 | 473 | 784 | 614 | 171 | 1030 | 337 | 543 | 273 | 270 |
| 16-Apr | 140 | 82 | 149 | 140 | 9 | 2502 | 1474 | 2443 | 1911 | 532 | 1783 | 1051 | 1693 | 852 | 841 |
| 1-May | 198 | 134 | 243 | 228 | 15 | 3558 | 2407 | 3990 | 3121 | 869 | 2536 | 1716 | 2764 | 1391 | 1374 |
| 16-May | 253 | 178 | 322 | 302 | 20 | 4540 | 3187 | 5284 | 4134 | 1150 | 3236 | 2272 | 3661 | 1842 | 1819 |
| 1-Jun | 270 | 209 | 379 | 356 | 23 | 4846 | 3750 | 6217 | 4864 | 1353 | 3454 | 2673 | 4307 | 2167 | 2140 |
| 16-Jun | 310 | 268 | 485 | 455 | 29 | 5561 | 4798 | 7954 | 6222 | 1732 | 3964 | 3420 | 5510 | 2772 | 2738 |
| 1-Jul | 329 | 302 | 548 | 514 | 33 | 5897 | 5420 | 8984 | 7028 | 1956 | 4204 | 3863 | 6224 | 3131 | 3093 |
| 16-Jul | 298 | 279 | 505 | 475 | 31 | 5338 | 5001 | 8290 | 6486 | 1805 | 3805 | 3565 | 5743 | 2889 | 2854 |
| 1-Aug | 216 | 201 | 363 | 341 | 22 | 3879 | 3596 | 5961 | 4663 | 1298 | 2765 | 2563 | 4130 | 2078 | 2052 |
| 16-Aug | 174 | 156 | 283 | 266 | 17 | 3112 | 2798 | 4639 | 3629 | 1010 | 2218 | 1995 | 3214 | 1617 | 1597 |
| 1-Sep | 116 | 96 | 175 | 164 | 11 | 2083 | 1729 | 2866 | 2242 | 624 | 1485 | 1232 | 1986 | 999 | 987 |
| 16-Sep | 86 | 60 | 108 | 102 | 7 | 1541 | 1072 | 1777 | 1390 | 387 | 1098 | 764 | 1231 | 619 | 612 |
| 1-Oct | 38 | 14 | 25 | 24 | 2 | 684 | 251 | 416 | 326 | 91 | 488 | 179 | 288 | 145 | 143 |
| 16-Oct | 11 | 0 | 0 | 0 | 0 | 205 | 0 | 0 | 0 | 0 | 146 | 0 | 0 | 0 | 0 |
| 1-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2562 | 2005 | 3633 | 3412 | 221 | 45941 | 35956 | 59606 | 46630 | 12976 | 32746 | 25629 | 41294 | 20774 | 20520 |

| | Subwatershed 4 | | | | | Subwatershed 5 | | | | | Subwatershed 6 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acre-Feet | | | | | Acre-Feet | | | | | Acre-Feet | | | | |
| Bi-Monthly period beginning | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand |
| 1-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 |
| 1-Mar | 6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 322 | 0 | 0 | 0 | 0 |
| 16-Mar | 25 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 1379 | 0 | 0 | 0 | 0 |
| 1-Apr | 61 | 20 | 35 | 9 | 25 | 11 | 4 | 7 | 7 | 0 | 3321 | 1087 | 1817 | 1268 | 550 |
| 16-Apr | 105 | 62 | 108 | 29 | 79 | 20 | 12 | 21 | 21 | 0 | 5749 | 3387 | 5662 | 3949 | 1712 |
| 1-May | 150 | 101 | 177 | 48 | 129 | 28 | 19 | 34 | 34 | 0 | 8177 | 5532 | 9245 | 6449 | 2796 |
| 16-May | 191 | 134 | 234 | 63 | 171 | 36 | 25 | 45 | 45 | 0 | 10435 | 7325 | 12244 | 8541 | 3703 |
| 1-Jun | 204 | 158 | 276 | 74 | 202 | 38 | 29 | 53 | 53 | 0 | 11137 | 8619 | 14406 | 10049 | 4357 |
| 16-Jun | 234 | 202 | 353 | 95 | 258 | 44 | 38 | 68 | 68 | 0 | 12782 | 11027 | 18431 | 12856 | 5574 |
| 1-Jul | 248 | 228 | 399 | 107 | 291 | 46 | 42 | 77 | 77 | 0 | 13554 | 12456 | 20818 | 14522 | 6296 |
| 16-Jul | 225 | 211 | 368 | 99 | 269 | 42 | 39 | 71 | 71 | 0 | 12267 | 11493 | 19210 | 13400 | 5810 |
| 1-Aug | 163 | 151 | 265 | 71 | 193 | 30 | 28 | 51 | 51 | 0 | 8914 | 8264 | 13813 | 9635 | 4178 |
| 16-Aug | 131 | 118 | 206 | 56 | 150 | 24 | 22 | 40 | 40 | 0 | 7152 | 6432 | 10750 | 7498 | 3251 |
| 1-Sep | 88 | 73 | 127 | 34 | 93 | 16 | 14 | 25 | 25 | 0 | 4787 | 3974 | 6642 | 4633 | 2009 |
| 16-Sep | 65 | 45 | 79 | 21 | 58 | 12 | 8 | 15 | 15 | 0 | 3542 | 2463 | 4117 | 2872 | 1245 |
| 1-Oct | 29 | 11 | 18 | 5 | 13 | 5 | 2 | 4 | 4 | 0 | 1573 | 577 | 965 | 673 | 292 |
| 16-Oct | 9 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 472 | 0 | 0 | 0 | 0 |
| 1-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1935 | 1514 | 2645 | 713 | 1932 | 359 | 281 | 510 | 510 | 0 | ###### | 82637 | ###### | 96345 | 41774 |

| | Subwatershed 7 | | | | | Subwatershed 8 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Acre-Feet | | | | | Acre-Feet | | | | |
| Bi-Monthly period beginning | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand |
| 1-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Feb | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Mar | 52 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 16-Mar | 222 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| 1-Apr | 535 | 175 | 334 | 327 | 7 | 8 | 3 | 6 | 6 | 0 |
| 16-Apr | 926 | 546 | 1042 | 1019 | 23 | 13 | 8 | 19 | 19 | 0 |
| 1-May | 1317 | 891 | 1701 | 1665 | 37 | 19 | 13 | 32 | 32 | 0 |
| 16-May | 1681 | 1180 | 2253 | 2204 | 49 | 24 | 17 | 42 | 42 | 0 |
| 1-Jun | 1794 | 1389 | 2651 | 2594 | 57 | 26 | 20 | 49 | 49 | 0 |
| 16-Jun | 2059 | 1776 | 3392 | 3318 | 73 | 30 | 26 | 63 | 63 | 0 |
| 1-Jul | 2184 | 2007 | 3831 | 3748 | 83 | 32 | 29 | 71 | 71 | 0 |
| 16-Jul | 1976 | 1852 | 3535 | 3459 | 76 | 29 | 27 | 66 | 66 | 0 |
| 1-Aug | 1436 | 1331 | 2542 | 2487 | 55 | 21 | 19 | 47 | 47 | 0 |
| 16-Aug | 1152 | 1036 | 1978 | 1935 | 43 | 17 | 15 | 37 | 37 | 0 |
| 1-Sep | 771 | 640 | 1222 | 1196 | 26 | 11 | 9 | 23 | 23 | 0 |
| 16-Sep | 571 | 397 | 758 | 741 | 16 | 8 | 6 | 14 | 14 | 0 |
| 1-Oct | 253 | 93 | 178 | 174 | 4 | 4 | 1 | 3 | 3 | 0 |
| 16-Oct | 76 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 17010 | 13313 | 25417 | 24868 | 550 | 247 | 194 | 472 | 472 | 0 |

| | Total | | | | | Cummulative | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Acre-Feet | | | | | Acre-Feet | | | | |
| Bi-Monthly period beginning | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | ET | NIWR | Cummulativ e Diversion Demand | e SW Diversion Demand | e GW Diversion Demand |
| 1-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Feb | 45 | 0 | 0 | 0 | 0 | 45 | 0 | 0 | 0 | 0 |
| 1-Mar | 629 | 0 | 0 | 0 | 0 | 673 | 0 | 0 | 0 | 0 |
| 16-Mar | 2696 | 0 | 0 | 0 | 0 | 3369 | 0 | 0 | 0 | 0 |
| 1-Apr | 6491 | 2125 | 3575 | 2549 | 1026 | 9860 | 2125 | 3575 | 2549 | 1026 |
| 16-Apr | 11238 | 6621 | 11137 | 7941 | 3196 | 21098 | 8747 | 14712 | 10490 | 4222 |
| 1-May | 15983 | 10813 | 18187 | 12968 | 5219 | 37081 | 19559 | 32899 | 23457 | 9441 |
| 16-May | 20397 | 14319 | 24085 | 17173 | 6912 | 57478 | 33878 | 56984 | 40630 | 16353 |
| 1-Jun | 21769 | 16848 | 28339 | 20206 | 8133 | 79247 | 50726 | 85322 | 60836 | 24486 |
| 16-Jun | 24984 | 21554 | 36255 | 25850 | 10405 | ###### | 72280 | 121577 | 86687 | 34891 |
| 1-Jul | 26494 | 24347 | 40952 | 29199 | 11752 | ###### | 96627 | 162529 | 115886 | 46643 |
| 16-Jul | 23979 | 22466 | 37789 | 26944 | 10845 | ###### | ###### | 200317 | 142830 | 57488 |
| 1-Aug | 17424 | 16154 | 27172 | 19374 | 7798 | ###### | ###### | 227489 | 162204 | 65286 |
| 16-Aug | 13980 | 12572 | 21146 | 15077 | 6069 | ###### | ###### | 248635 | 177281 | 71354 |
| 1-Sep | 9357 | 7768 | 13065 | 9316 | 3750 | ###### | ###### | 261701 | 186597 | 75104 |
| 16-Sep | 6923 | 4815 | 8098 | 5774 | 2324 | ###### | ###### | 269799 | 192371 | 77428 |
| 1-Oct | 3074 | 1128 | 1898 | 1353 | 545 | ###### | ###### | 271697 | 193724 | 77973 |
| 16-Oct | 923 | 0 | 0 | 0 | 0 | ###### | ###### | 271697 | 193724 | 77973 |
| 1-Nov | 0 | 0 | 0 | 0 | 0 | ###### | ###### | 271697 | 193724 | 77973 |
| 16-Nov | 0 | 0 | 0 | 0 | 0 | ###### | ###### | 271697 | 193724 | 77973 |
| 1-Dec | 0 | 0 | 0 | 0 | 0 | ###### | ###### | 271697 | 193724 | 77973 |
| 16-Dec | 0 | 0 | 0 | 0 | 0 | ###### | ###### | 271697 | 193724 | 77973 |
| | ###### | ###### | ###### | ###### | 77973 | | | | | |



This worksheet calculates the future irrigation demand based on ET modeling using RCP8.5 scenario multi-model mean temperature and precipitation data.
ET for the basin crop distribution comes from the "Future_Env_PM_FAO56" worksheet. This is multiplied by irrigated acres for each subwatershed to get total ET by subwatershed.
The net irrigation water requirement (NIWR) for each subwatershed is calculated by subtracting effective precipitation (see "FAO Weather_Daily_Averages" worksheet) from the subwatershed ET.
Diversion demand is calculated for two future scenarios; existing irrigation application efficiency and higher irrigation application efficiency. This is done by dividing the subwatershed NIWR by the subwatershed-specific application efficiency for the appropriate scenario(see "NRCS_WR_Irr_Efficiency" worksheet")
Finally, the total diversion demand is separated into surface water and groundwater demand, according to their respective portions of primary water rights. (see "NRCS_WR_Irr_Efficiency" worksheet")

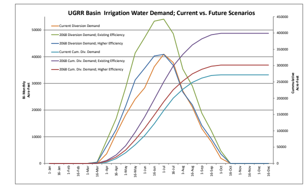
| | Subwatershed 1 | | | | | | | | Subwatershed 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Future Climate + Current Efficiency | | | | | Future Climate + Higher Efficiency | | | Future Climate + Current Efficiency | | | | | Future Climate + Higher Efficiency | | |
| Bi-Monthly | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | Diversion Demand; Higher Efficiency | SW Diversion Demand; Higher Efficiency | GW Diversion Demand; Higher Efficiency | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | Diversion Demand; Higher Efficiency | SW Diversion Demand; Higher Efficiency | GW Diversion Demand; Higher Efficiency |
| 1-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Feb | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Mar | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 205 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Mar | 51 | 4 | 7 | 6 | 0 | 5 | 5 | 0 | 912 | 66 | 109 | 85 | 24 | 83 | 65 | 18 |
| 1-Apr | 120 | 63 | 115 | 108 | 7 | 83 | 78 | 5 | 2154 | 1134 | 1880 | 1470 | 409 | 1433 | 1121 | 312 |
| 16-Apr | 189 | 124 | 225 | 211 | 14 | 163 | 153 | 10 | 3383 | 2227 | 3692 | 2888 | 804 | 2815 | 2202 | 613 |
| 1-May | 275 | 210 | 380 | 357 | 23 | 276 | 259 | 17 | 4937 | 3761 | 6235 | 4877 | 1357 | 4753 | 3718 | 1035 |
| 16-May | 374 | 306 | 554 | 520 | 34 | 402 | 378 | 24 | 6712 | 5479 | 9083 | 7106 | 1977 | 6925 | 5418 | 1508 |
| 1-Jun | 405 | 348 | 631 | 593 | 38 | 458 | 431 | 28 | 7271 | 6247 | 10356 | 8101 | 2254 | 7895 | 6177 | 1719 |
| 16-Jun | 433 | 394 | 713 | 670 | 43 | 518 | 486 | 32 | 7755 | 7057 | 11699 | 9152 | 2547 | 8920 | 6978 | 1942 |
| 1-Jul | 427 | 399 | 723 | 679 | 44 | 525 | 493 | 32 | 7658 | 7157 | 11865 | 9282 | 2583 | 9046 | 7077 | 1969 |
| 16-Jul | 379 | 359 | 650 | 611 | 40 | 472 | 444 | 29 | 6788 | 6437 | 10671 | 8348 | 2323 | 8136 | 6365 | 1771 |
| 1-Aug | 278 | 261 | 473 | 444 | 29 | 343 | 322 | 21 | 4979 | 4679 | 7756 | 6068 | 1689 | 5914 | 4626 | 1287 |
| 16-Aug | 234 | 214 | 388 | 365 | 24 | 282 | 265 | 17 | 4198 | 3843 | 6371 | 4984 | 1387 | 4857 | 3800 | 1057 |
| 1-Sep | 164 | 139 | 252 | 236 | 15 | 183 | 172 | 11 | 2942 | 2490 | 4128 | 3230 | 899 | 3147 | 2462 | 685 |
| 16-Sep | 122 | 90 | 163 | 153 | 10 | 119 | 111 | 7 | 2188 | 1617 | 2681 | 2097 | 584 | 2044 | 1599 | 445 |
| 1-Oct | 66 | 34 | 62 | 58 | 4 | 45 | 42 | 3 | 1179 | 616 | 1021 | 799 | 222 | 779 | 609 | 170 |
| 16-Oct | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 367 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 3549 | 2945 | 5336 | 5011 | 325 | 3875 | 3640 | 236 | 63640 | 52811 | 87547 | 68488 | 19058 | 66747 | 52216 | 14530 |

| | Subwatershed 3 | | | | | | | | Subwatershed 4 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Future Climate + Current Efficiency | | | | | Future Climate + Higher Efficiency | | | Future Climate + Current Efficiency | | | | | Future Climate + Higher Efficiency | | |
| Bi-Monthly | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | Diversion Demand; Higher Efficiency | SW Diversion Demand; Higher Efficiency | GW Diversion Demand; Higher Efficiency | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | Diversion Demand; Higher Efficiency | SW Diversion Demand; Higher Efficiency | GW Diversion Demand; Higher Efficiency |
| 1-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Feb | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Mar | 146 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Mar | 650 | 47 | 75 | 38 | 37 | 58 | 29 | 29 | 38 | 3 | 5 | 1 | 4 | 4 | 1 | 3 |
| 1-Apr | 1535 | 808 | 1302 | 655 | 647 | 1008 | 507 | 501 | 91 | 48 | 83 | 22 | 61 | 62 | 17 | 45 |
| 16-Apr | 2411 | 1587 | 2558 | 1287 | 1271 | 1980 | 996 | 984 | 142 | 94 | 164 | 44 | 120 | 121 | 33 | 89 |
| 1-May | 3519 | 2681 | 4319 | 2173 | 2146 | 3344 | 1682 | 1662 | 208 | 158 | 277 | 75 | 202 | 205 | 55 | 150 |
| 16-May | 4784 | 3906 | 6293 | 3166 | 3127 | 4872 | 2451 | 2421 | 283 | 231 | 403 | 109 | 294 | 299 | 81 | 218 |
| 1-Jun | 5182 | 4453 | 7174 | 3609 | 3565 | 5555 | 2795 | 2760 | 306 | 263 | 460 | 124 | 336 | 340 | 92 | 249 |
| 16-Jun | 5528 | 5030 | 8105 | 4077 | 4028 | 6276 | 3157 | 3119 | 327 | 297 | 519 | 140 | 379 | 385 | 104 | 281 |
| 1-Jul | 5458 | 5102 | 8220 | 4135 | 4085 | 6365 | 3202 | 3163 | 322 | 301 | 527 | 142 | 385 | 390 | 105 | 285 |
| 16-Jul | 4839 | 4588 | 7393 | 3719 | 3674 | 5724 | 2880 | 2845 | 286 | 271 | 474 | 128 | 346 | 351 | 95 | 256 |
| 1-Aug | 3549 | 3335 | 5373 | 2703 | 2670 | 4161 | 2093 | 2068 | 210 | 197 | 344 | 93 | 251 | 255 | 69 | 186 |
| 16-Aug | 2993 | 2739 | 4413 | 2220 | 2193 | 3417 | 1719 | 1698 | 177 | 162 | 283 | 76 | 206 | 209 | 56 | 153 |
| 1-Sep | 2097 | 1775 | 2860 | 1439 | 1421 | 2215 | 1114 | 1100 | 124 | 105 | 183 | 49 | 134 | 136 | 37 | 99 |
| 16-Sep | 1559 | 1153 | 1857 | 934 | 923 | 1438 | 723 | 715 | 92 | 68 | 119 | 32 | 87 | 88 | 24 | 64 |
| 1-Oct | 841 | 439 | 708 | 356 | 352 | 548 | 276 | 272 | 50 | 26 | 45 | 12 | 33 | 34 | 9 | 25 |
| 16-Oct | 262 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 45361 | 37643 | 60650 | 30512 | 30139 | 46962 | 23625 | 23336 | 2680 | 2224 | 3885 | 1047 | 2838 | 2878 | 776 | 2102 |

| | Subwatershed 5 | | | | | | | | Subwatershed 6 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Future Climate + Current Efficiency | | | | | Future Climate + Higher Efficiency | | | Future Climate + Current Efficiency | | | | | Future Climate + Higher Efficiency | | |
| Bi-Monthly | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | Diversion Demand; Higher Efficiency | SW Diversion Demand; Higher Efficiency | GW Diversion Demand; Higher Efficiency | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | Diversion Demand; Higher Efficiency | SW Diversion Demand; Higher Efficiency | GW Diversion Demand; Higher Efficiency |
| 1-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Mar | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 471 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Mar | 7 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 2095 | 151 | 252 | 176 | 76 | 192 | 134 | 58 |
| 1-Apr | 17 | 9 | 16 | 16 | 0 | 12 | 12 | 0 | 4950 | 2606 | 4355 | 3038 | 1317 | 3310 | 2309 | 1001 |
| 16-Apr | 26 | 17 | 32 | 32 | 0 | 23 | 23 | 0 | 7774 | 5118 | 8555 | 5967 | 2587 | 6502 | 4535 | 1966 |
| 1-May | 39 | 29 | 53 | 53 | 0 | 39 | 39 | 0 | 11346 | 8643 | 14447 | 10077 | 4369 | 10979 | 7658 | 3321 |
| 16-May | 53 | 43 | 78 | 78 | 0 | 56 | 56 | 0 | 15427 | 12593 | 21047 | 14682 | 6366 | 15996 | 11158 | 4838 |
| 1-Jun | 57 | 49 | 89 | 89 | 0 | 64 | 64 | 0 | 16710 | 14357 | 23996 | 16739 | 7258 | 18237 | 12721 | 5516 |
| 16-Jun | 61 | 55 | 100 | 100 | 0 | 73 | 73 | 0 | 17824 | 16220 | 27110 | 18910 | 8199 | 20603 | 14372 | 6231 |
| 1-Jul | 60 | 56 | 101 | 101 | 0 | 74 | 74 | 0 | 17599 | 16449 | 27493 | 19178 | 8315 | 20894 | 14575 | 6319 |
| 16-Jul | 53 | 50 | 91 | 91 | 0 | 66 | 66 | 0 | 15601 | 14794 | 24727 | 17249 | 7479 | 18792 | 13109 | 5684 |
| 1-Aug | 39 | 37 | 66 | 66 | 0 | 48 | 48 | 0 | 11442 | 10753 | 17973 | 12537 | 5436 | 13659 | 9528 | 4131 |
| 16-Aug | 33 | 30 | 54 | 54 | 0 | 40 | 40 | 0 | 9649 | 8832 | 14762 | 10297 | 4465 | 11219 | 7826 | 3393 |
| 1-Sep | 23 | 19 | 35 | 35 | 0 | 26 | 26 | 0 | 6760 | 5723 | 9566 | 6673 | 2893 | 7270 | 5071 | 2199 |
| 16-Sep | 17 | 13 | 23 | 23 | 0 | 17 | 17 | 0 | 5028 | 3717 | 6212 | 4333 | 1879 | 4721 | 3293 | 1428 |
| 1-Oct | 9 | 5 | 9 | 9 | 0 | 6 | 6 | 0 | 2711 | 1416 | 2367 | 1651 | 716 | 1799 | 1255 | 544 |
| 16-Oct | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 844 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 498 | 413 | 749 | 749 | 0 | 544 | 544 | 0 | 146260 | 121373 | 202862 | 141507 | 61355 | 154172 | 107543 | 46629 |

| | Subwatershed 7 | | | | | | | | Subwatershed 8 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Future Climate + Current Efficiency | | | | | Future Climate + Higher Efficiency | | | Future Climate + Current Efficiency | | | | | Future Climate + Higher Efficiency | | |
| Bi-Monthly | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | Diversion Demand; Higher Efficiency | SW Diversion Demand; Higher Efficiency | GW Diversion Demand; Higher Efficiency | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | Diversion Demand; Higher Efficiency | SW Diversion Demand; Higher Efficiency | GW Diversion Demand; Higher Efficiency |
| 1-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Feb | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Mar | 76 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Mar | 338 | 24 | 46 | 45 | 1 | 32 | 32 | 1 | 5 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| 1-Apr | 797 | 420 | 802 | 784 | 17 | 558 | 546 | 12 | 12 | 6 | 15 | 15 | 0 | 9 | 9 | 0 |
| 16-Apr | 1252 | 825 | 1574 | 1540 | 34 | 1096 | 1072 | 24 | 18 | 12 | 29 | 29 | 0 | 17 | 17 | 0 |
| 1-May | 1828 | 1392 | 2659 | 2601 | 57 | 1850 | 1810 | 40 | 27 | 20 | 49 | 49 | 0 | 29 | 29 | 0 |
| 16-May | 2485 | 2029 | 3873 | 3789 | 84 | 2696 | 2638 | 58 | 36 | 29 | 72 | 72 | 0 | 42 | 42 | 0 |
| 1-Jun | 2692 | 2313 | 4416 | 4320 | 95 | 3074 | 3007 | 66 | 39 | 34 | 82 | 82 | 0 | 48 | 48 | 0 |
| 16-Jun | 2871 | 2613 | 4989 | 4881 | 108 | 3472 | 3397 | 75 | 42 | 38 | 93 | 93 | 0 | 54 | 54 | 0 |
| 1-Jul | 2835 | 2650 | 5059 | 4950 | 109 | 3522 | 3445 | 76 | 41 | 39 | 94 | 94 | 0 | 54 | 54 | 0 |
| 16-Jul | 2513 | 2383 | 4550 | 4452 | 98 | 3167 | 3099 | 68 | 37 | 35 | 85 | 85 | 0 | 49 | 49 | 0 |
| 1-Aug | 1843 | 1732 | 3307 | 3236 | 72 | 2302 | 2252 | 50 | 27 | 25 | 61 | 61 | 0 | 36 | 36 | 0 |
| 16-Aug | 1554 | 1423 | 2717 | 2658 | 59 | 1891 | 1850 | 41 | 23 | 21 | 50 | 50 | 0 | 29 | 29 | 0 |
| 1-Sep | 1089 | 922 | 1760 | 1722 | 38 | 1225 | 1199 | 26 | 16 | 13 | 33 | 33 | 0 | 19 | 19 | 0 |
| 16-Sep | 810 | 599 | 1143 | 1118 | 25 | 796 | 778 | 17 | 12 | 9 | 21 | 21 | 0 | 12 | 12 | 0 |
| 1-Oct | 437 | 228 | 436 | 426 | 9 | 303 | 297 | 7 | 6 | 3 | 8 | 8 | 0 | 5 | 5 | 0 |
| 16-Oct | 136 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 23563 | 19554 | 37332 | 36524 | 807 | 25985 | 25423 | 562 | 343 | 284 | 693 | 693 | 0 | 402 | 402 | 0 |

| | Total | | | | | | | | Cummulative | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acre-Feet | | | | | | | | Acre-Feet | | | | | | | |
| Bi-Monthly | ET | NIWR | Diversion Demand | SW Diversion Demand | GW Diversion Demand | Diversion Demand; Higher Efficiency | SW Diversion Demand; Higher Efficiency | GW Diversion Demand; Higher Efficiency | Cummulative ET | Cummulative NIWR | Cummulative Diversion Demand | Cummulative SW Diversion Demand | Cummulative GW Diversion Demand | Cummulative Diversion Demand; Higher Efficiency | Cummulative SW Diversion Demand; Higher Efficiency | Cummulative GW Diversion Demand; Higher Efficiency |
| 1-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Feb | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Mar | 921 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 976 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16-Mar | 4096 | 295 | 496 | 354 | 142 | 375 | 266 | 109 | 5071 | 295 | 496 | 354 | 142 | 375 | 266 | 109 |
| 1-Apr | 9675 | 5094 | 8568 | 6109 | 2459 | 6475 | 4598 | 1876 | 14746 | 5389 | 9064 | 6463 | 2601 | 6850 | 4864 | 1985 |
| 16-Apr | 15197 | 10005 | 16828 | 11999 | 4829 | 12717 | 9032 | 3686 | 29943 | 15394 | 25892 | 18462 | 7431 | 19567 | 13896 | 5671 |
| 1-May | 22179 | 16895 | 28418 | 20262 | 8155 | 21475 | 15252 | 6224 | 52122 | 32289 | 54310 | 38724 | 15586 | 41042 | 29148 | 11894 |
| 16-May | 30154 | 24615 | 41403 | 29521 | 11882 | 31288 | 22221 | 9068 | 82276 | 56904 | 95713 | 68245 | 27468 | 72330 | 51368 | 20962 |
| 1-Jun | 32663 | 28063 | 47203 | 33657 | 13547 | 35671 | 25334 | 10338 | 114938 | 84967 | 142916 | 101902 | 41015 | 108001 | 76702 | 31300 |
| 16-Jun | 34840 | 31705 | 53328 | 38024 | 15304 | 40300 | 28621 | 11679 | 149778 | 116672 | 196244 | 139925 | 56319 | 148301 | 105322 | 42979 |
| 1-Jul | 34401 | 32153 | 54087 | 38561 | 15521 | 40870 | 29025 | 11844 | 184179 | 148825 | 250326 | 178487 | 71839 | 189171 | 134348 | 54823 |
| 16-Jul | 30496 | 28918 | 48641 | 34682 | 13959 | 36758 | 26105 | 10653 | 214675 | 177743 | 298967 | 213169 | 85799 | 225929 | 160453 | 65476 |
| 1-Aug | 22366 | 21020 | 35355 | 25209 | 10146 | 26718 | 18975 | 7743 | 237042 | 198763 | 334323 | 238378 | 95945 | 252647 | 179428 | 73219 |
| 16-Aug | 18861 | 17264 | 29038 | 20705 | 8333 | 21944 | 15584 | 6360 | 255902 | 216026 | 363361 | 259082 | 104278 | 274591 | 195012 | 79579 |
| 1-Sep | 13215 | 11188 | 18818 | 13417 | 5400 | 14221 | 10099 | 4121 | 269117 | 227214 | 382178 | 272499 | 109679 | 288811 | 205112 | 83700 |
| 16-Sep | 9828 | 7265 | 12219 | 8713 | 3507 | 9234 | 6558 | 2676 | 278944 | 234479 | 394398 | 281212 | 113186 | 298045 | 211670 | 86376 |
| 1-Oct | 5299 | 2768 | 4656 | 3320 | 1336 | 3519 | 2499 | 1020 | 284243 | 237247 | 399054 | 284532 | 114522 | 301564 | 214169 | 87396 |
| 16-Oct | 1650 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 285893 | 237247 | 399054 | 284532 | 114522 | 301564 | 214169 | 87396 |
| 1-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 285893 | 237247 | 399054 | 284532 | 114522 | 301564 | 214169 | 87396 |
| 16-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 285893 | 237247 | 399054 | 284532 | 114522 | 301564 | 214169 | 87396 |
| 1-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 285893 | 237247 | 399054 | 284532 | 114522 | 301564 | 214169 | 87396 |
| 16-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 285893 | 237247 | 399054 | 284532 | 114522 | 301564 | 214169 | 87396 |
| | 285893 | 237247 | 399054 | 284532 | 114522 | 301564 | 214169 | 87396 | | | | | | | | |



ORWD Irrigated Acres by Subwatershed

| | subwatershed | Primary WR acres | SW Acres | GW Acres | Pivot acres | Linear acres | % Pivot & Linear | Pivot/Linear to Spri | Flood Acres | Sprinkler acres | Irrigated Wetland |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lookingglass Cr/Cabin Cr | 1 | 1233 | 1158 | 75 | 0 | 0 | 0 | 0 | 0 | 1233 | 0 |
| Willow Cr./Indian Cr. | 2 | 22109 | 17296 | 4813 | 5962.7 | 857.1 | 0.308462617 | 0.446053423 | 0 | 15289.2 | 0 |
| Lower 5 Points Cr | 3 | 15759 | 7928 | 7831 | 4748.6 | 1362.3 | 0.387772067 | 0.637608122 | 64 | 9584.1 | 0 |
| Beaver Cr, Upper 5 Points | 4 | 931 | 251 | 680 | 126.5 | 0 | 0.135875403 | 0.157240522 | 0 | 804.5 | 0 |
| Meadow Cr Upr GRR | 5 | 173 | 173 | 0 | 0 | 0 | 0 | 0 | 0 | 173 | 0 |
| Ladd Cr. Lower Catherine | 6 | 50812 | 35444 | 15368 | 17973.78 | 554.4 | 0.364641817 | 0.643781736 | 2880.6 | 28780.22 | 623 |
| Upper Catherine Creek 1 | 7 | 8186 | 8009 | 177 | 676 | 0 | 0.082580015 | 0.130774588 | 2340.8 | 5169.2 | 0 |
| Upper Catherine Creek 2 | 8 | 119 | 119 | 0 | 0 | 0 | 0 | #DIV/0! | 119 | 0 | 0 |
| | total | 99322 | 70378 | 28944 | 29487.58 | 2773.8 | 0.324816053 | 0.528587219 | 5404.4 | 61033.22 | 623 |

Water Rights by Subwatershed Distributed According to Irrigation Demand

| Bi-Monthly period beginning | | | Subwatershed 1 | Subwatershed 2 | Subwatershed 3 | Subwatershed 4 | Subwatershed 5 | Subwatershed 6 | Subwatershed 7 | Subwatershed 8 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | NIWR (Ac-in) | % | Demand (Ac-Ft) | Demand (Ac-Ft) | Demand (Ac-Ft) | Demand (Ac-Ft) | Demand (Ac-Ft) | Demand (Ac-Ft) | Demand (Ac-Ft) | Demand (Ac-Ft) | Demand (Ac-Ft) |
| 1-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15-Jan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15-Feb | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Mar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15-Mar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Apr | 0 | 0 | 42 | 759 | 541 | 32 | 6 | 1744 | 281 | 4 | 3409 |
| 15-Apr | 1 | 0 | 158 | 2828 | 2016 | 119 | 22 | 6499 | 1047 | 15 | 12703 |
| 1-May | 1 | 0 | 230 | 4121 | 2938 | 174 | 32 | 9472 | 1526 | 22 | 18515 |
| 15-May | 2 | 0 | 345 | 6184 | 4408 | 260 | 48 | 14212 | 2290 | 33 | 27780 |
| 1-Jun | 2 | 0 | 357 | 6402 | 4563 | 270 | 50 | 14714 | 2370 | 34 | 28760 |
| 15-Jun | 3 | 0 | 521 | 9345 | 6661 | 394 | 73 | 21477 | 3460 | 50 | 41982 |
| 1-Jul | 3 | 0 | 520 | 9323 | 6646 | 393 | 73 | 21427 | 3452 | 50 | 41884 |
| 15-Jul | 3 | 0 | 552 | 9889 | 7049 | 416 | 77 | 22727 | 3661 | 53 | 44425 |
| 1-Aug | 2 | 0 | 348 | 6235 | 4444 | 263 | 49 | 14330 | 2309 | 34 | 28010 |
| 15-Aug | 2 | 0 | 311 | 5568 | 3969 | 234 | 44 | 12797 | 2062 | 30 | 25013 |
| 1-Sep | 1 | 0 | 170 | 3047 | 2172 | 128 | 24 | 7002 | 1128 | 16 | 13687 |
| 15-Sep | 1 | 0 | 120 | 2152 | 1534 | 91 | 17 | 4946 | 797 | 12 | 9669 |
| 1-Oct | 0 | 0 | 26 | 474 | 338 | 20 | 4 | 1089 | 175 | 3 | 2128 |
| 15-Oct | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15-Nov | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15-Dec | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | 3699 | 66327 | 47277 | 2793 | 519 | 152436 | 24558 | 357 | 297966 |

# Water Savings Estimator for Irrigation System Planning and Ranking

**Purpose**

The purpose of this water savings estimator is to compare irrigation water use in an existing irrigation system compared to projected use in a planned system. The associated savings are estimated for the given field based on crop water use for existing and planned conditions. The resulting estimates are used on a per-field basis. FIRI should be used for any basin-wide analysis.

**Description**

Estimates of water savings are based on crop water use, irrigation system efficiencies, and the effects of irrigation water management.

- → Crop water use is the Net Irrigation Requirement (NIR) for a given crop for 7 out of 10 years as obtained from *Oregon Crop Water Use and Irrigation Requirements* , OSU Extension Miscellaneous 8530. A five-year crop rotation can be specified both for **Existing** and **Planned** conditions. Crop water use data for 27 regions in Oregon are contained in the NIR sheet.
- → Irrigation system efficiency is computed as the product of application efficiency of the application system (e.g. wild flood, border, hand-line sprinkler, center-pivot sprinkler, microirrigation) and the conveyance efficiency of the conveyance system (e.g. unlined ditch, lined ditch, pipeline) used to supply the application system. Values of application and conveyance efficiencies are contained in the Efficiencies & IWM sheet. The numbers for the efficiencies are obtained from design data, field observations and measurements, and system simulation techniques. The resulting values are representative for different system components under normal conditions on different soils. Application efficiencies are lower for existing than for planned systems due to system aging and operational constraints. (e.g. The efficiency for an existing hand-line system has been observed to be 10 percent lower than that for a new system.) Contact your Basin Engineer, State Irrigation Engineer, or State Conservation Engineer if local conditions vary greatly from the tabled values.
- → Water savings are related to the level of irrigation water management (IWM). The levels of IWM range from "No IWM Plan" to "Non-Intense" to "Intense".

**Quality Criteria:** Water Quantity - Inefficient Water Use on Irrigated Land

Land and water management is planned and coordinated to provide optimal use of natural and applied moisture. Irrigation systems operate at 80% of potential efficiency. Water delivery beyond the irrigator's control is not considered when evaluating quality criteria for irrigation water management.

## The Workbook

The Workbook and all sheets are protected. Contact your Basin Engineer if irrigation system efficiency values are in question and need to be changed for a specific situation.

When opening the workbook **ALWAYS** open it as "Read Only", then save it with an appropriate descriptive name.

The Workbook includes four "Working Sheets":

Estimator | Summary | Working Summary | Multi-Field Summary

The **Estimator Sheet** is used for data entry, and it displays results of estimated water use and water savings for the data entered.

The **Summary Sheet** serves as a database of data entries and results for multiple fields with up to 70 sets of data from the Estimator Sheet.

The **Working Summary Sheet** can be used for sorting and ranking purposes. Information in this sheet is copied from the Summary Sheet.

The **Multi-Field Summary Sheet** is used for obtaining weighted-average values for water savings and efficiency data for up to five separate fields.

## Estimator Sheet

**Input Data and Information**

Information is entered in the Estimator sheet in gray shaded cells and is displayed in red.

**Steps and Directions for all entries are described on the right of the Estimator sheet.**

CLICK to

To erase existing data before beginning entry for a new applicant, click the Erase button.

CLICK to erase ALL input values

**Applicant information** is self-explanitory.

The **Climatic Region** is selected from a drop-down list.
Click the button to display climatic regions.

CLICK to display map of Oregon Climatic Regions

The following information is entered for EXISTING and PLANNED systems in order to estimate the overall irrigation system efficiences and associated estimated water savings.

**Crops**

Crops are selected from a drop-down list for existing and planned conditions. The crop list displayed is that associated with the climatic region selected. Up to a five-year rotation can be selected for each condition. If the crop rotations are the same, clicking the button will copy the the existing crop rotation information into the planned rotation cells.

CLICK if Planned and Existing crop rotations are the same

**Existing Water Right**

Enter the existing water right (acre-inches/acre or inches) ONLY if it is known.

**Irrigation Application System Inputs**

**Soils**

The predominant soil textural class in the irrigated field is selected from the drop-down list shown.

Clicking on the button provides a direct link to the Web Soil Survey, which can be used identify the soil(s).

CLICK to access Web Soil Survey

*Sand*
*Loamy Sand*
*Sandy Loam*
*Loam*
*Silt Loam*
*Sandy Clay Loam*
*Clay Loam*
*Silty Clay Loam*
*Clay*

**Existing Application System**

Existing application system options:

Flood - existing
Border - existing
Furrow - existing
Hand/Wheel Line - used
Solid Set - used
Center-Pivot - used
Big Gun - used
Microirrigation - used

**Planned Application System**

Planned application system options:

It should be noted that the efficiencies of planned systems are greater than those for existing systems. The efficiencies of planned systems are "reasonable" design efficiencies while the efficiencies of existing systems are lower due to system aging and operational factors as observed in the field.

The "No Change" option is selected if there is no change in the existing application system. However, if the system is to be upgraded or changed, select the correct name, even if it is the same as the existing system name.

No Change
Level Basin
Border
Border-w/ Tailwater Reuse
Furrow
Furrow-w/ Tailwater Reuse
Hand/Wheel Line
Solid Set
Center-Pivot
Linear-Move
Traveling Big Gun
Microirrigation

**Irrigation Conveyance System Inputs**

**Soils**

The soil list is the same as that associated with the application system.

**Existing Conveyance System**

Existing conveyance system options:

The "None" option is selected is the project does NOT include conveyance system components.

- None
- Ditch-Unlined-Poor
- Ditch-Unlined-Good
- Ditch-Deteriorated Concrete
- Ditch-Concrete Lined
- Pipeline-Deteriorated
- Pipeline

**Planned Conveyance System**

Planned conveyance system options:

The "No Change" option is selected if there is no change in the existing conveyance system OR if the "None" option is selected for the existing system. However, if the system is to be upgraded or changed, select the correct name, even if it is the same as the existing system name.

- No Change
- Ditch-Unlined-Poor
- Ditch-Unlined-Good
- Ditch-Deteriorated Concrete
- Ditch-Concrete Lined
- Pipeline-Deteriorated
- Pipeline

**Planned Level of IWM (Irrigation Water Management)**

Planned level of IWM options:

As noted in the comments, the definitions of "Non-Intense" and "Intense" are defined on p. OR10-4 (210-VI-NEH 652, Amendment OR1, Feb 2007).

- No IWM Plan
- Non-Intense
- Intense

**Water Use and Savings**

The expected water use for existing and planned systems is based on the net irrigation requirement and overall system efficiency for each system. Expected savings is the difference in water use.

CLICKing on the button will adjust the existing water use to equal the existing water right, if given, by computing an Alternative NIR value. (The result indicates that the NIR for the crop cannot be supplied for the given water right and overall system efficiency.) There will be NO change in the results if the existing water use is less than the existing wa

*CLICK to adjust Existing water use to given water right*

The overall system efficiency is the product of the application and conveyance efficiencies.

**Quality Criteria**

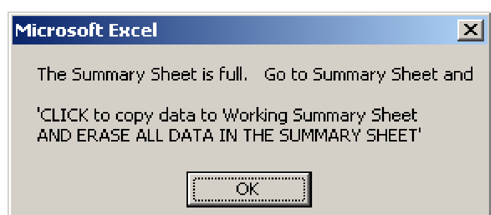
The potential efficiency relative to the Quality Criterion is calculated from the DESIGN efficiencies of comparable application and conveyance system components for both EXISTING and PLANNED systems. The System must be at least 80 percent of the potential efficiency to meet Quality Criteria.

**Copy Data to Summary Sheet**

Data can be copied from the Estimator Sheet to the Summary Sheet by clicking the button.

*CLICK to copy data to SUMMARY Sheet*

When data for 70 fields have been copied to the Summary Sheet, the dialog box shown appears. Data from Summary Sheet must be copied to the Working Summary Sheet and erased from the Summary Sheet if data from more fields are to be entered.




**Printout**

The Estimator Sheet is designed to print on 8.5x11 size paper.

**Summary Sheet**

The purpose of the Summary Sheet is to provide a secure database of all input and output data from the Estimator Sheet for multiple fields. All cells in this sheet are locked with the exception of "Field Office" and "Date" information. Data are transferred to this sheet from the Estimator Sheet as described in the **Copy Data to Summary Sheet** section for the Estimator Sheet

Data stored in the Summary Sheet can be copied to the Working Summary Sheet and to the Estimator Sheet.

To access the Summary Sheet, click on the Summary tab or click on the button at the bottom of the Estimator Sheet.

*CLICK to go to SUMMARY*

**Copy Data to Working Summary Sheet**

To copy data from the Summary Sheet to the Working Summary Sheet, use the "CLICK to copy all Summary Data to Working Summary Sheet" button at the top of the sheet. All da[ta in the] Summary Sheet are copied.

*CLICK to copy all Summary Data to Working Summary sheet*

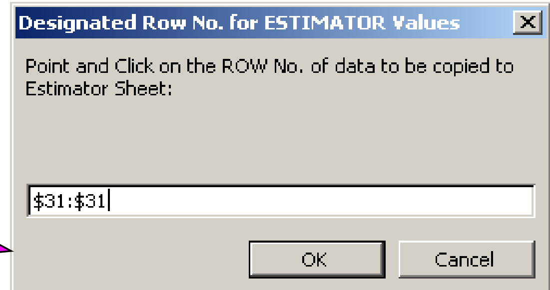
**Copy Data to Estimator Sheet**

Data can be copied from a designated row in the Summary Sheet back to the Estimator Sheet by clicking on the "Copy designated row to Estimator" button.

*CLICK to copy designated row to Estimator*

As indicated in the dialog, Point and Click on the ROW No. of the designated row to be copied, then click OK in the box. (Row 31 in this example.)

Data from the designated row will be copied into the proper cells in the Estimator Sheet for review or modification as needed.




**Printout**

The Summary Sheet is designed to print on 11x17 size paper. Rows 1-84 are included in the printout, which requires two sheets.

**Copy Data to Working Summary Sheet**

*CLICK to copy all Summary Data to Working Summary sheet AND ERASE ALL DATA IN SUMMARY SHEET*

CLICKing on the RED box will copy all data in the Summary Sheet to the Working Summary Sheet and erase all data in the Summary Sheet. Clicking this button is the only way to erase the data in the Summary Sheet. **DO NOT** click the button unless it is desired to erase the Summary Sheet.

**Working Summary Sheet**

The Working Summary Sheet is intended to be used as a database of input and output data from the Estimator Sheet for multiple fields. Cells in rows 11 and greater (up to 60,000) in this sheet are unprotected so that data for various fields can be moved, copied, and/or arranged as needed for ranking purposes.

When data are copied to this sheet from the Summary Sheet as described in the Summary Sheet section, all existing data are shifted down by 70 rows. Data can be moved and/or deleted, but rows cannot be deleted because the sheet is protected.

**Printout**

The Working Summary Sheet is designed to print on 11x17 size paper. The Print Area for this sheet is currently $A$1:$AO$80. If more than 80 rows are to be printed, block and set the desired print area. (Block the print area and set the print area by selecting File --> Print Area --> Set Print Area) It is recommended to do a Print Preview to before printing.

**Multi-Field Summary Sheet**

This summary sheet can be used to obtain the weighted average summary values for up to five fields for the data in Columns H-S ( Water Use, Annual Water Savings, Field area and estimated savings, and weighted values for Existing and Planned Systems).

Highlight the rows for which multi-field summary information is desired in either the Summary or Working Summary sheet, copy, and then paste in cell a11, a21, a31, .... up to a61 in this sheet. The summary information will appear under the pasted rows.

**Printout**

The Multi-Field Summary Sheet is designed to print on 11x17 size paper. Rows 1-84 are included in the printout, which requires two sheets.

*Comments associated with Existing and Planned system components and IWM*

**Existing Application System**

**Flood - *existing*:** Water flooded across a field no designed guidance structures.

Poor to average condition.

**Border – existing:** Graded border system with water guided by designed border dikes.
- No tailwater reuse.
- Poor to average condition.

**Furrow – existing:** Furrows (corrugates) used to guide water across a field. No tailwater reuse.
- Poor to average condition.

**Hand/Wheel Line > 15 yr:** Periodic-move sprinkler system -- either hand-line or wheel-line.
- Age = 15 or more years.

**Solid Set > 15 yr:** Solid-set sprinkler system -- up to 80 x 80 spacing.
Solid-set big guns choose "Big Gun" option.
- Age = 15 or more years.

**Center-Pivot > 15 yr:** Center-pivot sprinkler system.
- Age = 15 or more years.

**Big Gun > 15 yr:** Big-gun sprinkler system -- traveler, periodic move, or solid-set big gun.
- Age = 15 or more years.

**Microirrigation > 15 yr:** Includes drip, trickle, and microspray (less than 1 gpm sprays).
Loss of efficiency due to plugged emitters and/or leaks.
- Age = 15 or more years.

## Planned Application System

**No Change:** This option is selected if there is no change in the application system.
(i.e. The existing system is unchanged.)

**Level Basin:** Level basins (laser leveled) supplied with appropriate flow rates.

**Border:** Graded border system with water guided by designed border dikes.
- No tailwater reuse.

**Border-w/ Tailwater Reuse:** Graded border system with water guided by designed border dikes.
- Tailwater is reused.

**Furrow:** Furrows (corrugates) used to guide water across a field.
- No tailwater reuse.

**Furrow-w/ Tailwater Reuse:** Furrows (corrugates) used to guide water across a field.
- Tailwater is reused.

**Hand/Wheel Line:** Periodic-move sprinkler system -- either hand-line or wheel-line.

**Solid Set:** Solid-set sprinkler system.

**Center-Pivot:** Center-pivot sprinkler system.

**Linear-Move:** Linear-move sprinkler system.

**Traveling Big Gun:** Traveling Big-gun sprinkler system.

**Microirrigation:** Includes drip, trickle, and microspray (less than 1 gpm sprays).

## Existing Conveyance System

**None:** This option is selected if there is no conveyance system considered.

**Ditch-Unlined-Poor:** Unlined ditch with poor water control and retardance due to grass and weeds.

**Ditch-Unlined-Good:** Unlined ditch with good water control and essentialy free of grass and weeds.

**Ditch-Deteriorated Concrete:** Lined ditch with significant breaks in the lining and poor water control.

**Ditch-Concrete Lined:** Lined ditch in good condition and with good water control.

**Pipeline-Deteriorated:** Pipeline with noticeable leaks and poor water control.

**Pipeline:** Pipeline in good condition and with good water control.

## Planned Conveyance System

**No Change:** This option is selected if there is no change in the conveyanve system or if the
NONE option is selected for the existing conveyance system.
(i.e. The existing system is unchanged.)

**Ditch-Unlined-Poor:** Unlined ditch with poor water control and retardance due to grass and weeds.

**Ditch-Unlined-Good:** Unlined ditch with good water control and essentialy free of grass and weeds.

**Ditch-Deteriorated:** Lined ditch with significant breaks in the lining and poor water control.

**Ditch-Concrete Lined:** Lined ditch in good condition and with good water control.

**Pipeline-Deteriorated:** Pipeline with noticeable leaks and poor water control.

**Pipeline:** Pipeline in good condition and with good water control.

## IWM

**No IWM Plan:** No IWM plan is intended for the planned system.

**Non-Intense:** Non-intense (Irrigation Application Cycle) as outlined on p. OR10-4
(210-VI-NEH 652, Amendment OR1, Feb 2007).

**Intense:** Intense (Detailed) as outlined on p. OR10-4
(210-VI-NEH 652, Amendment OR1, Feb 2007).

# Water Savings Estimator for Irrigation System Planning and Ranking

NRCS Natural Resources Conservation Service OREGON

Applicant: 
Farm/Tract ID: 
Date: 
County: Union
Field ID: 
Evaluator: 

Climatic Region: Region23 Grande Ronde Valley

**EXISTING**

| Crop Rotation | | Annual Net Irrig Reqt (in) | Peak ET Rate (in/day) |
|---|---|---|---|
| Year 1: | Alfalfa Hay | 22.9 | 0.25 |
| Year 2: | Alfalfa Hay | 22.9 | 0.25 |
| Year 3: | Alfalfa Hay | 22.9 | 0.25 |
| Year 4: | Alfalfa Hay | 22.9 | 0.25 |
| Year 5: | Grain (Winter) | 15.8 | 0.23 |
| | Average: | **21.5** | |

Alternative NIR Value: 

**PLANNED**

| Crop Rotation | | Annual Net Irrig Reqt (in) | Peak ET Rate (in/day) |
|---|---|---|---|
| Year 1: | Alfalfa Hay | 22.9 | 0.25 |
| Year 2: | Alfalfa Hay | 22.9 | 0.25 |
| Year 3: | Alfalfa Hay | 22.9 | 0.25 |
| Year 4: | Alfalfa Hay | 22.9 | 0.25 |
| Year 5: | Grain (Winter) | 15.8 | 0.23 |
| | Average: | **21.5** | |

Alternative NIR Value: 

**Water right** (ac-in/ac): 

## Application System

Application System Predominant Soil: Silt Loam
Existing Application System: Hand/Wheel Line - used
Planned Application System: Center-Pivot

## Conveyance System

Conveyance System Predominant Soil: Silt Loam
Existing Conveyance System: Pipeline
Planned Conveyance System: Pipeline

## IWM

Planned Level of IWM: No IWM Plan

## Estimated Water Savings

Estimated EXISTING water use: 39.5 acre-in/acre
Estimated PLANNED water use: 26.5 acre-in/acre
Annual Water Savings Estimate: 13.0 acre-in/acre
Annual Water Savings Estimate: 32.9%
Total Annual Water Savings — Acres: 
Estimated savings for this field **ONLY**: 

## Quality Criteria

| | Existing System | Planned System |
|---|---|---|
| System Efficiency: | 54% | 81% |
| Quality Criteria Potential Efficiency: | 66% | 81% |
| Quality Criteria Met? | **Yes** | **Yes** |

| | | | | | |
|---|---|---|---|---|---|
| 16 | Tomatoes | 15.78 | 17.99 | 7.95 | 0.28 |
| 17 | | | | | 0.00 |
| 18 | | | | | 0.00 |
| 19 | | | | | 0.00 |
| 20 | | | | | 0.00 |
| 21 | | | | | 0.00 |
| 22 | | | | | 0.00 |
| 23 | | | | | |
| 24 | | | | | |
| 25 | | | | | |
| 26 | | | | | |
| 27 | | | | | |
| 28 | | | | | |
| 29 | | | | | |
| | | | | | |
| 1 | | Region7 | Medford-Grants Pass | | *1.1* |
| 2 | Alfalfa Hay | 28.48 | 32.48 | 7.36 | 0.26 |
| 3 | Apples | 37.96 | 45.36 | 9.84 | 0.35 |
| 4 | Cherries | 37.96 | 45.36 | 9.84 | 0.35 |
| 5 | Filberts | 37.96 | 45.36 | 9.84 | 0.35 |
| 6 | Grain (Spring) | 20.27 | 23.93 | 7.56 | 0.27 |
| 7 | Grain (Winter) | 19.14 | 22.84 | 7.6 | 0.27 |
| 8 | Grass Seed (Spring) | 29.18 | 34.8 | 7.95 | 0.28 |
| 9 | Onions | 25.59 | 29.13 | 7.99 | 0.28 |
| 10 | Pasture | 32.84 | 39.67 | 7.91 | 0.28 |
| 11 | Pears | 34.65 | 41.73 | 9.02 | 0.32 |
| 12 | Plums | 34.65 | 41.73 | 9.02 | 0.32 |
| 13 | Potatoes | 24.62 | 27.4 | 8.82 | 0.31 |
| 14 | | | | | 0.00 |
| 15 | | | | | 0.00 |
| 16 | | | | | 0.00 |
| 17 | | | | | 0.00 |
| 18 | | | | | 0.00 |
| 19 | | | | | 0.00 |
| 20 | | | | | 0.00 |
| 21 | | | | | 0.00 |
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| 25 | | | | | |
| 26 | | | | | |
| 27 | | | | | |
| 28 | | | | | |
| 29 | | | | | |
| | | | | | |
| 1 | | Region8 | Lake Creek-Little Butte C | | *1.1* |
| 2 | Alfalfa Hay | 25.82 | 31.02 | 7.17 | 0.25 |
| 3 | Apples | 34.33 | 42.66 | 9.53 | 0.34 |
| 4 | Cherries | 34.33 | 42.66 | 9.53 | 0.34 |
| 5 | Corn (Sweet) | 23.32 | 26.49 | 8.86 | 0.31 |
| 6 | Filberts | 34.33 | 42.66 | 9.53 | 0.34 |
| 7 | Grain (Spring) | 18.38 | 22.55 | 7.36 | 0.26 |
| 8 | Grain (Winter) | 17.21 | 21.58 | 7.36 | 0.26 |
| 9 | Grass Seed (Spring) | 26.17 | 32.77 | 7.72 | 0.27 |
| 10 | Onions | 23.43 | 27.87 | 7.76 | 0.28 |
| 11 | Pasture | 28.09 | 37.02 | 7.68 | 0.27 |
| 12 | Pears | 31.29 | 39.36 | 8.78 | 0.31 |
| 13 | Peas | 11.97 | 15.94 | 7.09 | 0.25 |
| 14 | Plums | 31.29 | 39.36 | 8.78 | 0.31 |

| | Soils | Soil No. |
|---|---|---|
| s | Sand | 1 |
| ls | Loamy Sand | 2 |
| sl | Sandy Loam | 3 |
| l | Loam | 4 |
| sil | Silt Loam | 5 |
| scl | Sandy Clay Loam | 6 |
| cl | Clay Loam | 7 |
| sicl | Silty Clay Loam | 8 |
| c | Clay | 9 |


84 93.33333 88.42105

Soil No. Selected for application system: 5
Soil No. Selected for conveyance system: 5

**Existing appication systems and associated efficiencies**
System application efficiencies of existing systems

| Soil --> | Sand | Loamy Sar | Sandy Loa | Loam | Silt Loam | Sandy Clay | Clay Loam | Silty Clay L | Clay | Quality che | Quality check comparison index: |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Flood - existing | 20% | 25% | 30% | 35% | 45% | 45% | 50% | 50% | 50% | 1 | 3 |
| Border - existing | 28% | 40% | 50% | 50% | 55% | 60% | 60% | 60% | 60% | 2 | 3 |
| Furrow - existing | 30% | 40% | 45% | 50% | 52% | 55% | 60% | 60% | 60% | 3 | 5 |
| Hand/Wheel Line - used | 55% | 55% | 55% | 55% | 55% | 55% | 55% | 55% | 55% | 4 | 7 |
| Solid Set - used | 58% | 58% | 58% | 58% | 58% | 58% | 58% | 58% | 58% | 5 | 8 |
| Center-Pivot - used | 70% | 70% | 70% | 70% | 70% | 70% | 70% | 70% | 70% | 6 | 9 |
| Big Gun - used | 51% | 51% | 51% | 51% | 51% | 51% | 51% | 51% | 51% | 7 | 11 |
| Microirrigation - used | 72% | 72% | 72% | 72% | 72% | 72% | 72% | 72% | 72% | 8 | 12 |
| | | | | | | | | | | 9 | 13 |

Existing System Selected: Hand/Wheel Line - used
**Application efficiency of existing system selected:** 55%

Quality check index: 4
Quality check comparison index: 7

Quality Criterion Application Efficiency of Existing System: 67%

**Planned application systems and associated efficiencies**
System application efficiencies of new systems without high degree of IWM

| Soil --> | Sand | Loamy Sar | Sandy Loa | Loam | Silt Loam | Sandy Clay | Clay Loam | Silty Clay L | Clay | |
|---|---|---|---|---|---|---|---|---|---|---|
| No Change | | | | | | | | | | 1 |
| Level Basin | 65% | 82% | 82% | 82% | 82% | 82% | 82% | 82% | 82% | 2 |
| Border | 55% | 55% | 60% | 63% | 65% | 68% | 68% | 68% | 68% | 3 |
| Border-w/ Tailwater Reuse | 58% | 58% | 67% | 78% | 78% | 78% | 78% | 78% | 78% | 4 |
| Furrow | 48% | 55% | 58% | 61% | 63% | 65% | 65% | 65% | 65% | 5 |
| Furrow-w/ Tailwater Reuse | 50% | 58% | 67% | 75% | 75% | 75% | 75% | 75% | 75% | 6 |
| Hand/Wheel Line | 67% | 67% | 67% | 67% | 67% | 67% | 67% | 67% | 67% | 7 |
| Solid Set | 70% | 70% | 70% | 70% | 70% | 70% | 70% | 70% | 70% | 8 |
| Center-Pivot | 82% | 82% | 82% | 82% | 82% | 82% | 82% | 82% | 82% | 9 |
| Linear-Move | 84% | 84% | 84% | 84% | 84% | 84% | 84% | 84% | 84% | 10 |
| Traveling Big Gun | 62% | 62% | 62% | 62% | 62% | 62% | 62% | 62% | 62% | 11 |
| Microirrigation | 85% | 85% | 85% | 85% | 85% | 85% | 85% | 85% | 85% | 12 |
| | | | | | | | | | | 13 |

**Application efficiency of planned system:** 82%

Quality Criterion Application Efficiency of planned system: 82%

**Existing conveyance Systems and associated conveyance efficiencies**

| Soil --> | Sand | Loamy Sar | Sandy Loa | Loam | Silt Loam | Sandy Clay | Clay Loam | Silty Clay L | Clay | |
|---|---|---|---|---|---|---|---|---|---|---|
| None | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 1 |
| Ditch-Unlined-Poor | 76% | 79% | 81% | 82% | 86% | 84% | 86% | 86% | 87% | 2 |
| Ditch-Unlined-Good | 82% | 84% | 86% | 87% | 90% | 88% | 90% | 90% | 91% | 3 |
| Ditch-Deteriorated Concret | 92% | 92% | 92% | 92% | 92% | 92% | 92% | 92% | 92% | 4 |
| Ditch-Concrete Lined | 97% | 97% | 97% | 97% | 97% | 97% | 97% | 97% | 97% | 5 |
| Pipeline-Deteriorated | 93% | 93% | 93% | 93% | 93% | 93% | 93% | 93% | 93% | 6 |
| Pipeline | 99% | 99% | 99% | 99% | 99% | 99% | 99% | 99% | 99% | 7 |

**Planned conveyance systems and associated conveyance efficiencies**

| Soil --> | Sand | Loamy Sar | Sandy Loa | Loam | Silt Loam | Sandy Clay | Clay Loam | Silty Clay L | Clay | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 1 |
| No Change | | | | | | | | | | 2 |
| Ditch-Unlined-Good | 82% | 84% | 86% | 87% | 90% | 88% | 90% | 90% | 91% | 3 |
| Ditch-Concrete Lined | 97% | 97% | 97% | 97% | 97% | 97% | 97% | 97% | 97% | 4 |
| Pipeline | 99% | 99% | 99% | 99% | 99% | 99% | 99% | 99% | 99% | 5 |

Quality check index: 7
Quality check comparison index: 5

**Conveyance efficiency of existing system:** 99%

Quality criterion conveyance efficiency of existing system: 99%

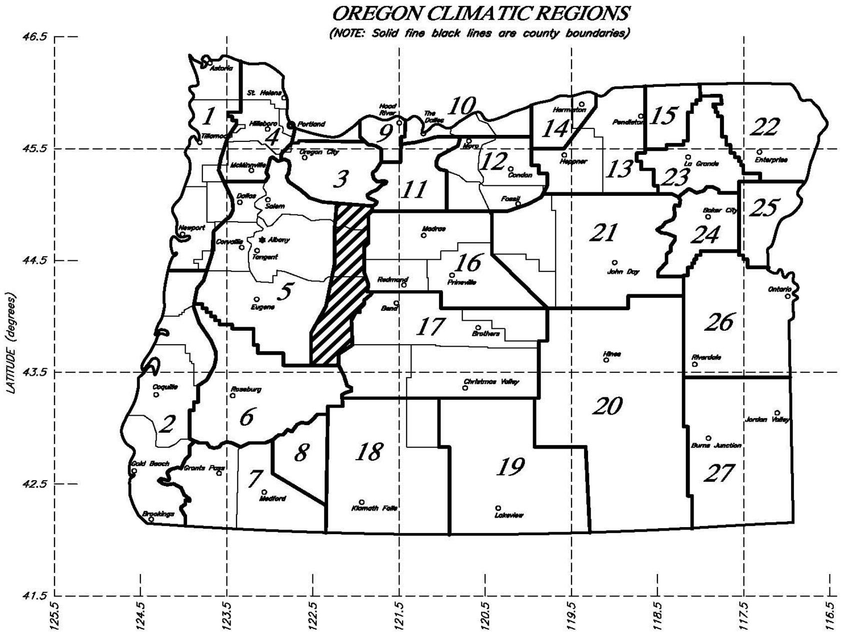
**Conveyance efficiency of planned system:** 99%

Quality criterion conveyance efficiency of planned system: 99%

| IWM Level | Reduction |
|---|---|
| No IWM Plan | 0.0% |
| Non-intense | 5.0% |
| Intense | 10.0% |

IWM Factor: 0.0%

Overall Efficiency of Planned System: 81%




Net Irrigation Requirements

Source: Oregon Crop Water Use and Irrigation Requirements
Extension Miscellaneous 8530
Oregon State University Water Resources Engineering Team

**Index to Regions**

| | |
|---|---|
| Region1 | North Coast |
| Region2 | South Coast |
| Region3 | Columbia River Below Hood River |
| Region4 | Tualatin Valley |
| Region5 | Willamette Valley |
| Region6 | Umqua River |
| Region7 | Medford-Grants Pass |
| Region8 | Lake Creek-Little Butte Creek |
| Region9 | Hood River Valley |
| Region10 | Columbia River above Hood River |
| Region11 | East Slope of Mt. Hood |
| Region12 | Columbia Basin wheat land |
| Region13 | Pendleton-Heppner |
| Region14 | Hermiston |
| Region15 | Milton Freewater |
| Region16 | Madras-Redmond |
| Region17 | Bend |
| Region18 | Klamath |
| Region19 | Lakeview |
| Region20 | Harney Valley |
| Region21 | Dayville-Canyon City |
| Region22 | Wallowa Valley |
| Region23 | Grande Ronde Valley |
| Region24 | Baker Valley |
| Region25 | Pine and Eagle Valleys |
| Region26 | Malheur |
| Region27 | Jordan Valley |

# APPENDIX C
## Instream Demand Calculations

**Step 3 Determining Instream Flow Ecological Needs**

## 1.0 INTRODUCTION

Step 3 in the Place Based Planning (PBP) process helps groups to understand and ideally reach consensus on the various water interests and needs in a water planning area. Instream flow demand is one of several categories of water needs. Instream flow demand recognizes the value and importance of suitable flows and water elevations throughout a basin's drainage network to: sustain and enhance fish and wildlife populations and their habitats, support ecological functions, maintain and improve water quality, meet recreational needs, and contribute to the sustainable socioeconomics of local communities. Instream flow demand encompasses the entire hydrologic network including streams, rivers, wetlands, floodplains, groundwater/surface water interactions, and species needs now and in the future of a changing climate.

This document describes the elements within an instream flow demand for ecological needs and provides an overview of tools for assessing instream flow needs both now and in the future with respect to climate change. Historically, instream flow demand often focused on minimum instream flows with primary consideration given to low flow conditions. However, instream flow demand has been expanded to encompass all elements of an annual flow regime, including floods, pulsed flows and low flows (Poff et al., 1997; Hill and Beschta, 1991). There is an underlying assumption that the natural flow regime is the condition to which the system is adapted, and aquatic dependent species have evolved to the full hydrologic flow regime within their habitat. Thus, an instream flow that mimics the natural hydrologic cycle provides the best assurance that the habitat needs of aquatic dependent fish and wildlife species will be met. The magnitude, timing and rate of change for various environmental flow components are factors to be considered for establishing instream flow demand.

Hydrologic regimes in the Western United States have undergone substantial changes over the last fifty years including earlier snowmelt runoff, reduced summer base flows and increased magnitude of floods (Wenger et al., 2010). These trends have been related to the effects of a warming trend in climate (Barnett et al., 2008). Recognition of climate change effects on the full hydrologic regime is also essential for evaluating future instream flow demand. Therefore, an instream flow demand is more appropriately viewed as containing two essential components: 1) representation of the full hydrologic regime that includes natural varying flows that maintain aquatic habitat, function and shape of the stream, floodplain and any estuarine habitats; and 2) the influence of climate change on water quality and quantity as it affects fish and wildlife habitat needs.

When considering which tools are best to use in determining instream flow demand essential objectives are to select and apply tools that can account for the full hydrologic regime for both current and future conditions. It is essential to incorporate climate change effects on water quality and quantity as well as the response for future species distribution. The extent these objectives are or are not met should be fully documented as information gaps within the Step 3 report.

## 2.0 KEY ELEMENTS OF INSTREAM FLOW DEMAND

There are three key elements for determining ecological instream flow demand at a basin scale:

1) Recognizing the full hydrologic regime,
2) Identifying climate change effects on water quality and quantity, and
3) Discussing the level of uncertainty and information gaps related to a demand analysis.

### 2.1 Full Hydrologic Regime

The full hydrologic regime encompasses the magnitude and frequency of annual and inter-annual variation in streamflow. The full hydrologic regime can be statistically partitioned into key aspects to which aquatic dependent species are adapted. Five aspects, known as environmental flow components (EFC), commonly used to describe the full hydrologic regime are depicted in Figure 1. Understanding the biology, physical/geomorphic processes, water quality and connectivity functions associated with each of the EFC forms a framework for defining a complete ecological instream flow demand (Figure 1, Table 1).

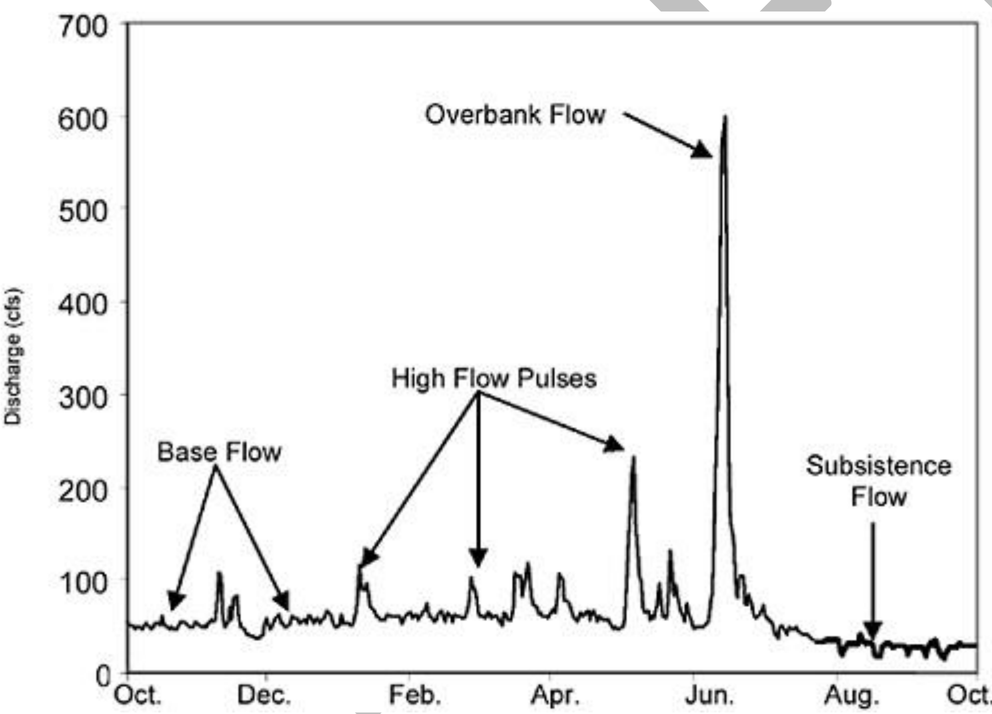



Figure 1. Hydrograph of daily flow showing environmental flow components (Annear et al., 2004).

Table 1. Full Hydrologic Regime - Environmental Flow Components and their functions.

| Component | Hydrology | Biology | Physical/Geomorphic | Water Quality | Connectivity |
|---|---|---|---|---|---|
| Subsistence flow | Minimum stream flow during critical drought periods to maintain tolerable water quality and provide minimal habitat for the survival of aquatic dependent species. 10$^{th}$ percentile of flows | Aquatic habitat is restricted | Increase in deposition of fine particulate matter, notably organic matter | DO decreases, temperature increases. Thermal refugia essential | Fish passage issues longitudinal fragmentation |
| Base flow | "Normal" conditions between storm events Typically defined on a monthly time step and vary by channel type/size | Provide suitable habitat for targeted species | Fine sediment deposition | Meets water quality standards | Longitudinal fish passage unimpeded |
| High flow pulses | Small peak flow events that facilitate biological function including longitudinal connectivity. Typically between 75th percentile flow and the bankfull flow | Initiates migration Mobilize nutrients | Flushing flows for fine sediments | Increasing levels of bacteria and TSS | Connection to low off-channel habitats |
| Bankfull flows | 1.5 year recurrence interval | Access to secondary and off channel habitat | Channel maintenance; majority of sediment transport | Increasing levels of bacteria and TSS | Connection to low off-channel habitats |
| Overbank flows | Infrequent events that overtop streambanks. Equal or greater than 10 year flood | Biotic exchange between channel and floodplain | Floodplain construction and maintenance; large woody debris recruitment and transport | Increases in TSS and sediment loads | Lateral; Floodplains inundated |

## 2.2 Vulnerabilities and Resiliency Related to Climate Change

Habitat conditions within many Oregon streams are being transformed by the effects of increasing greenhouse gasses on air temperature and precipitation. Place Based Planning should consider climate change effects on instream flow when evaluating future instream flow demand. Effects include water quality (temperature, dissolved oxygen and concentration of impurities) and quantity (magnitude and frequency of peak flows, shifts in seasonal runoff and reduced summer flows). Climate change scenarios in the Pacific Northwest predict increased frequency and duration of summer drought.

The regional and global climate is projected to warm by 3.6°C (6.5°F) by 2040 (USACE, 2008; NWPCC, 2004). Climate induced changes in both air temperatures and stream flow will affect future stream temperatures. Columbia River basin stream temperatures, on average, are projected to increase 3.5°C for the spring, 5.2°C for the summer, 2.7°C for the fall, and 1.6°C for the winter (Ficklin et al., 2014). Additionally, decreases in snow pack will reduce the thermal buffering for snowmelt dominated streams.

As thermal regimes in river networks warm more rapidly due to human influences and climate change, the distribution of cold-water species will potentially shrink and become disconnected. Projection of the effects of climate change on 57 species of North American freshwater fish indicated that 37% of the current locations inhabited by cold-water fishes would not support these species over the next century (Mohseni et al., 2003). Another study of climate effects on coldwater fishes concluded that trout habitats throughout the U.S. would be reduced by 15-40% by 2090 (O'Neal et al., 2002). These shifts will likely have adverse effects on aquatic species adapted to the full hydrologic regime.

Climate change will also affect the magnitude and timing of both floods and summer base flows. In the Pacific Northwest, climate change assessments indicate that winter floods may increase as a result of expanded rain-on-snow zones (Hamlet and Lettenmaier, 2007). This may also result in an earlier timing for spring runoff, especially in snowmelt systems (Mote, 2003).

Increased magnitude and frequency of flooding could have both positive and negative effects on aquatic ecosystems. More frequent flooding would flush fine sediments. Higher magnitude floods could scour redds. Shifts in timing of spring runoff could adversely affect the migration and survival of salmon smolt. Small headwater streams will become intermittent, increasing the death rate of eggs and juvenile fish. Extension of drought into early autumn can have substantial negative impacts on salmonid fishes (Hixon et al., 2013). Fish passage for adult salmon migrating upstream is impaired by low water at shallow riffles during drought. A lack of early autumn freshets can delay upstream migration. Juvenile rearing fish are stressed during draught

Ecological resilience is the capacity of an ecosystem to absorb disturbances without shifting to a drastically different state that is undesirable – and perhaps irreversible – from a human perspective (Holling, 1973 and Gunderson, 2000). Therefore fostering resilience is a fundamental principle for ensuring that the negative effects of climate change are minimized or otherwise slowed by management policy (Holling, 1986; Walker and Salt, 2006). Identification of resilient streams within a PBP area is an important element of the Step 3 process of evaluating instream flow demand.

## 2.3 Uncertainty and Information Gaps

Planning groups will not have the information they need to complete all desired analyses, nor will they be able to realistically collect new data through the PBP process. Therefore documenting uncertainties and identifying information gaps within the Step 3 process is an important element of determining instream flow demand. This information will also help focus ongoing and future efforts to fill information gaps.

Anomalies and uncertainties should be documented within the hydrologic record used for analyzing instream flow demand by PBP groups. Uncertainties may differ between various hydrologic records (i.e., existing, natural flows and future flow projections based on climate change). Consider how hydrologic records used for instream flow demand compare with hydrologic records used for determining other water demands.

A discussion of the uncertainty associated with instream flow demand projections will be helpful when implementing Step 4 of the PBP process. Some of the methods for determining instream flow allow for quantification of uncertainty while others involve a solely qualitative discussion. The PBP group may choose more conservative (e.g., higher flow) estimates of instream flow demand as being more protective of aquatic species where there is a higher degree of uncertainty.

In addition, place based planning will provide insight on both the process and information gaps for ongoing and future statewide efforts to better understand instream flow demand. Oregon Department of Fish and Wildlife, in collaboration with the Oregon Water Resources Department (OWRD), developed streamflow restoration priorities in 1997. A process based on the Bradury Prioritization Model to identify critical areas for flow protection and restoration was used. In applying the process ODFW gathered information on existing Instream Water Rights (ISWRs), the presence of fish resources, habitat integrity, risks to fish survival, and restoration potential for each water availability basin. As newer data has been collected in the last 20 years and this basin restoration prioritization did not account for climate change impacts to streamflow, ODFW is re-initiating this process in 2018 to update these priorities. Information gaps identified in Step 3 of the PBP process are useful for guiding the approach of this ongoing basin prioritization effort.

# 3.0 TOOLS FOR DETERMINING INSTREAM FLOW DEMAND

Methods to determine instream flow demand can be broadly grouped into five categories:

- 3.1 Habitat methods based on field studies and modelling,
- 3.2 Hydrological methods,
- 3.3 Desktop assessments,
- 3.4 Holistic methods, and
- 3.5 Climate assessment methods for instream flow demand.

The specific tools selected by a PBP group will be dependent upon on the schedule, available resources, desired level of resolution, and accepted level of uncertainty.

## 3.1 Habitat Methods Based on Field Studies and Modeling

Habitat methods based on field studies use empirical data collected and analyzed from basin specific field studies to quantify flow – habitat relationships. They typically include data collection of stream hydraulics (depth, velocity, slope, channel width), habitat features (substrate, cover) and flow. These physical data are then compared to specific habitat requirements for targeted biota. These habitat methods use a variety of models to establish the relationship between flow and the amount and quality of available habitat for various species.

While conducting extensive field studies is likely beyond the scope of the PBP process, information from existing field studies provides a useful tool for evaluating instream flow demand. Existing field studies include ODFW's Basin Investigation Reports (see Section 3.1.1), associated instream water rights, and site-specific habitat simulation studies conducted for projects. In general existing field-based instream flow studies likely did not consider climate change and focused solely on base flow, not the full hydrologic regime.

### 3.1.1 Basin Investigation Reports and Instream Water Rights

In the early 1960s the Oregon State Game Commission (a predecessor to ODFW) began conducting field studies and recommending instream flow levels needed to support native fishes in major streams across Oregon. Over a period of about ten years, the Game Commission reported the results of these investigations to the Oregon Water Resources Board in a series of 19 Basin Environmental Investigation Reports (BIR). These reports made recommendations for instream flows by month needed to support the anadromous salmonid species present in those basins. The BIR flow recommendations are representative of ecological base flow needs but do not address all environmental flow components

Approximately 1500 instream water rights (ISWR) across the State have been established for fish and wildlife purposes, with the majority originating from applications based on the BIR and submitted by ODFW in the 1990s. Most of the existing ISWRs are established at a minimum or even subsistence flow level to support fish and wildlife.

Information on existing instream water rights is available through OWRD: https://apps.wrd.state.or.us/apps/wars/wars_display_wa_tables/search_for_water_rights.aspx

BIR and Associated ISWRs as a Tool for Instream Flow Demand

*Strengths:*

- Based on field studies that quantified in-channel physical habitat relative to habitat suitability for target fish species.
- Although not comprehensive of all streams, numerous locations are represented.
- Provide site specific reference data which can be compared to base flows determined by other methods for validation purposes.

*Limitations:*

- DO NOT represent the full hydrologic regime (may only protect minimum base flow needs), and do not address all environmental flow components.
- Future conditions and climate change effects are not accounted for.

### 3.1.2 Habitat Simulation Methods

Whereas the BIR field studies relied on direct measurement of habitat features over a range of flows, other field methods incorporate modeling to simulate habitat as a function of streamflow. This type of modelling links streamflow records and hydraulic model predictions to habitat suitability criteria. In this way habitat models are designed to directly assess how streamflow affects the available habitat for aquatic species; an underlying assumption is that maintaining sufficient suitable habitat ensures that a target species will thrive within the stream reach. Typically, habitat simulation models address a limited number of target species for which habitat preferences are well established.

Physical Habitat Simulation (PHABSIM) is probably the most widely used habitat simulation method. Other habitat simulation methods include Habitat Quality Indices (Binns and Eiserman (1979), 2-D modeling (Kondolf et al., 2000) and individual based models (Railsback, 2001). PHABSIM calculates an index of the amount of suitable microhabitat available for different target species and lifestages across a range of incremental flow values (Bovee, 1982). This index is most often reported as Weighted Usable Area (WUA), which is a flow – habitat relationship plotted as a curve for each species and lifestage. In addition a time series analysis of WUA as a function of daily flow provides insight on the habitat effects of seasonal variation in flow.

The PHABSIM flow – relationship is a useful tool for determining instream flow demand. It is not always possible or practical to identify a flow that optimizes habitat for all species and lifestages occupying a stream at a given time. Physical habitat simulation model results may predict habitat that is optimized for spawning steelhead at a flow considerably higher than a flow that optimizes habitat for juvenile rearing Coho. In streams where suitable habitat is flow-limited at certain times of the year, the optimum flow based on habitat simulation may be greater than naturally occurring flows. Therefore habitat simulation results need to be reviewed relative to the natural hydrograph as well as fish species timing information.

Both PHABSIM and other modelling efforts that require intensive data collection and analysis are likely beyond the scope of place based planning. However, there may be field based habitat simulation studies already completed within a basin planning area. The results of these studies can be used as a frame of reference for evaluating instream flow demand in other similar stream reaches. Caution should be applied when making geographic extrapolations though, as the habitat model results are site specific.

<u>Habitat Simulation Methods (PHABSIM Emphasis) as a Tool for Instream Flow Demand</u>

*Strengths:*

- Habitat simulation, particularly PHABSIM, is widely accepted.
- Well defined methods allow replication of results for validating studies.
- Directly assess suitable habitat as a function of flow.
- Depending on a study's objectives, one or more environmental flow components may be addressed.

*Limitations:*

- Expensive and time consuming to implement.
- Existing studies are site specific and therefore not comprehensive geographically.
- Studies may not account for all ecological functions encompassed by the full hydrologic regime. Flow effects on channel change are not addressed.
- Most existing studies have not addressed climate change effects on instream quality and quantity.

### 3.2 Hydrological Methods

Hydrologic methods are commonly applied worldwide to define instream flow demand based on simple hydrologic indices from existing information. These methods are a quick way to evaluate biological need based on a certain percent of natural flow. Hydrologic methods assume a relationship between flow and specific biological parameters. A flow is identified that will maintain a river at an acceptable or desirable condition. Hydrologic methods use a long-term time series flow data (usually 30 – 50 years) to derive hydrologic indices. These indices may be a single flow value or variable values expressed as a percentage of natural flow. Hydrologic methods also commonly rely on percent exceedance flow data.

It is essential to define an appropriate period of record for hydrological data that can be applied consistently across the planning basin to calculate hydrologic indices. The indices should also be based on natural flows (i.e., absent of or corrected for consumptive water uses and water storage). Oregon Water Resources Department maintains a database of natural flow exceedance tables for streamflow gaging stations covering the entire state (though gage density varies by basin). The United States Geological Service StreamStats is an interactive web based system that provides hydrologic indices based on natural streamflow for ungaged streams (Risley et al., 2009).

One of the oldest hydrological methods developed specifically for the flow needs of fish is the Tennant Method. Tennant (1976) used hydraulic data from channel cross sections and subjective assessments of habitat quality to define relationships between flow and habitat quality. The percentage of mean annual discharge (MAD) was used as an index of habitat quality:

- Flow equal or greater than 60% MAD equated to optimum habitat quality,
- Flow 20 - 40% MAD equated to good habitat quality,
- Flow 10 - 30% equated to MAD fair habitat quality, and
- Flow 10% MAD equated to poor habitat quality.

This relationship between percentage of flow and habitat quality is specific to the region the relationship was quantified within. Many variations of the Tennant Method have been applied in other regions (Reiser et al., 1989; Jowett, 1997; Annear and Conder, 1983).

The percent of natural flow recommended to provide instream flow need varies among hydrological methods and their specific applications (Olden and Poff, 2003). Mathews and Bao (1991) determined that methods based on a percentage of mean flow resulted in unrealistically high flow for many Texas rivers. They developed a method using variable percentage of median monthly flow based on known fish species timing and life history needs. Their approach allowed for regional adjustments to the percentage of median flow recommended to meet instream needs.

Other indices used in hydrologic methods include the average monthly natural flow and the $Q_{50}$ or median monthly flow. The $Q_{50}$ was used to establish a seasonal base flow for streams in Maine (USFWS, 1981). It should be noted that fish have evolved to the full range of habitat conditions they experience over the geographic range of the population. Average flows in some streams may provide suitable habitat, but other streams may only have suitable habitat for a species during periods when flow is above average for that time of year.

Hydrological Methods as a Tool for Instream Flow Demand

*Strengths:*

- Analyses can be done quickly with available statistical software.
- Once the criteria are established, relatively few resources are needed to apply the procedure at a broad scale.

*Limitations*:

- Best applied to setting ecological base flows (i.e., does not account for the full hydrologic regime).
- Simplistic in approach - complex ecological and hydrological processes are described using basic statistics.
- The relationship between flow and habitat is assumed or based on a qualitative relationship only.
- A percent exceedance or average flow does not equate to a similar level of habitat protection across the spectrum of stream conditions occurring throughout Oregon.
- The relationship between instream flow and habitat quality is not always linear. Small streams commonly support a relatively high proportion of salmonid production, and tend to require higher instream flows to maintain high quality habitat (Beecher, 1990).

### 3.3 Desktop Assessments

Desktop methods are those that generally rely on existing data. Methods may be subdivided into purely hydrologic models and those that rely on both hydrological and ecological data. An example of each category of desktop assessment tool is provided. Hydrologic methods within this approach can look at the full hydrologic regime as described in Table 1. Actual and synthesized hydrologic data may be used.

#### 3.3.1 Indicators of Hydrologic Alteration (IHA) as a Desktop Assessment Tool

Indicators of Hydrologic Alteration (IHA) is a desktop assessment tool that, in itself, does not identify instream flow needs. It provides an in-depth analysis of the hydrologic character of a basin and how flow regimes have changed. This information is useful to frame an understanding of instream flow demands and related data gaps. The value of IHA in defining instream flow demand is enhanced when IHA is used interactively and in conjunction with ecological models to better understand the flow – ecology relationships (Mathews and Richter, 2007). Indicators of Hydrologic Alteration can be assessed with a public domain software developed by the Nature Conservancy (TNC, 2005 and 2007).

The IHA software computes values for 33 parameters that reflect the degree of flow alteration within a basin. The magnitude, timing, frequency and duration of these hydrologic parameters can be evaluated. Analysis can look at pre- and post-condition relative to a major event (such as reservoir construction) or trends in change over time (climate change). Ideally, a hydrologic record is available for both existing and natural conditions. Oregon Water Resources Department has constructed natural daily flow records for selected stream gaging stations throughout the State.

The IHA results can be grouped by the environmental flow components (EFC) listed in Table 1 and depicted in Figure 1. The definition of the EFCs is subject to discussion for a particular basin application. The change in selected hydrologic parameters within each EFC can be linked to an ecological model. The latter may be a highly-detailed quantitative model or a simple qualitative model, depending on available information and the capacity to analyze that information.

An example of a simple, qualitative ecological model would be the following statement:

> *Migration of spawning fish occurs in early fall (timing), initiated by high flow pulses (EFC) with migration occurring over a one month period (duration). Successful spawning requires high flow pulses for migration with moderate low flows in early autumn at least every two years (frequency).*

Testable hypotheses for flow – ecological relationships and data gaps can be clearly identified. The process becomes iterative through testing hypotheses with IHA and ecological models thereby refining the understanding of instream flow demands.

Where no ecological information is available to relate alteration in hydrology to a change in habitat, a change in ± 1 standard deviation is a suggested threshold for an acceptable level of alteration.

IHA as a Desktop Assessment Tool for Instream Flow Demand

*Strengths:*

- All environmental flow components are explicitly analyzed (i.e., the full hydrologic regime).
- IHA can be run for both current and future (climate change) scenarios.
- Can be applied across a broad geographic area with user defined resolution.
- Public domain software.

*Limitations:*

- Moderate level of work intensity.
- Requires a daily or weekly flow record of sufficient length to be representative of seasonal and inter-annual variation.
- Does not directly address habitat, only hydrology.

### 3.3.2 PHABSIM Meta-Analysis as a Desktop Assessment Tool



A desktop assessment method that considers both hydrological and ecological data developed by Hatfield and Bruce (2000) has been used to define instream flow demand at a large basin scale (ESSA et al., 2009). Physical Habitat Simulation (PHABSIM) studies provide a site specific and incremental relationship between flow and habitat. Hatfield and Bruce (2000) compiled metadata from 1500 flow – relationship curves based on 127 PHABSIM studies conducted throughout Western North America. Regression analysis was then used to develop habitat flow relationships that can be assessed for large geographic areas based on readily available hydrologic summary data. Regression equations were developed for individual salmonid species and aggregated species. Separate equations are also available for juvenile rearing and adult spawning flows. The approach can be applied to different stream sizes over a broad geographic range. Prediction intervals provide a quantitative analysis of the uncertainty associated with the flow – habitat relationships and identification of instream flow to optimize species and lifestage habitat.

Data requirements for this approach are mean annual discharge (MAD), latitude, longitude and species timing. Regression equations are available for Chinook, steelhead, rainbow trout and all salmonids aggregated. The latter would be applied for species not individually identified. Application of the regression equations in Hatfield and Bruce (2000) to a watershed should take into consideration whether the metadata are sufficiently representative of stream conditions found in that particular watershed. Figure 2 shows the geographic distribution of all metadata within ecoregions. It would be advisable to test a subset of the metadata that occur within similar bioclimatic zones. If there are PHABSIM studies available within the PBP area, the results of flow - habitat relationships from the metadata analysis can also be compared to local site specific PHABSIM results to validate this approach.

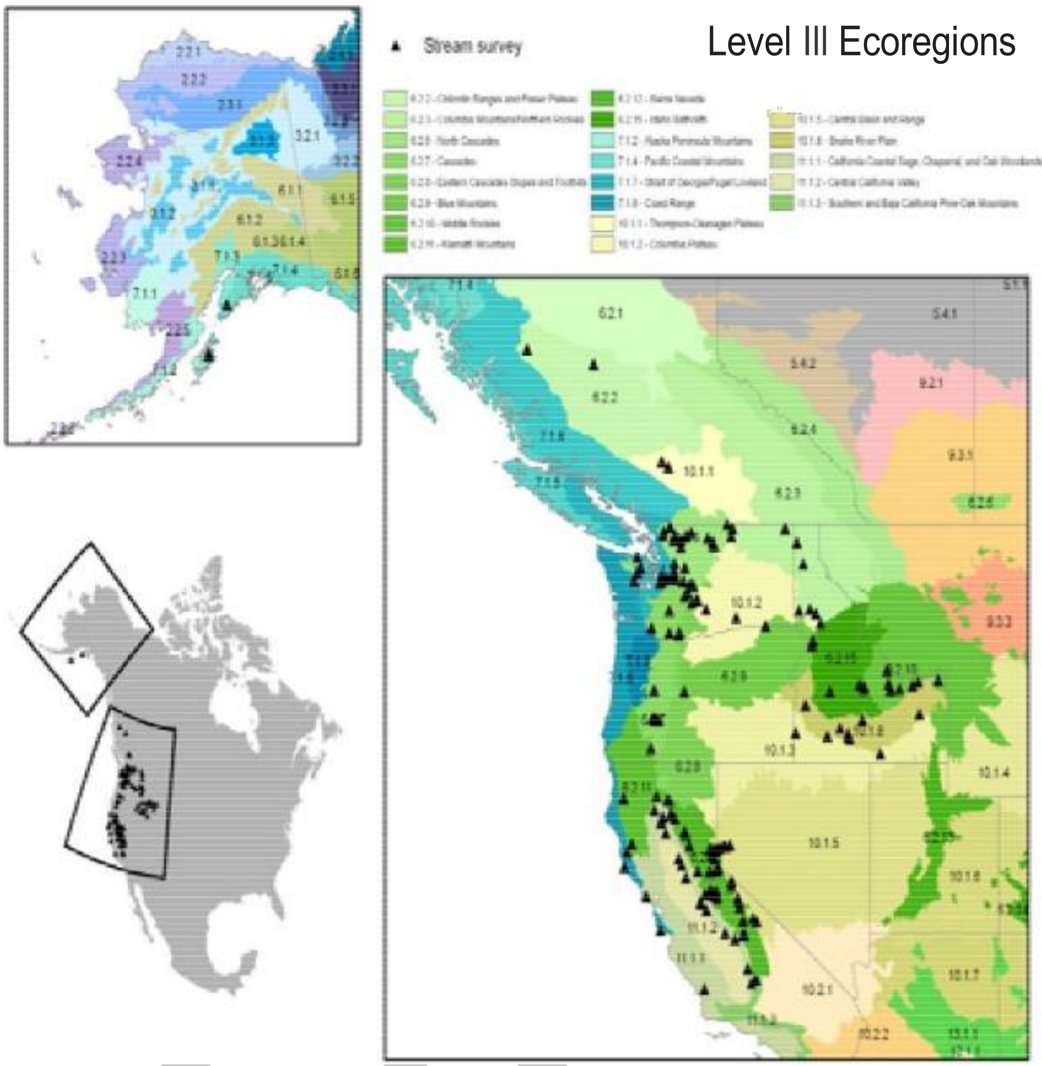



Figure 2. Distribution of PHABSIM study sites by ecoregions in Western North America (Hatfield and Bruce 2000).

PHABSIM Meta-Analysis as a Desktop Assessment Tool for Instream Flow Demand

*Strengths:*

- The Meta-Analysis has been applied in other basin wide instream flow demand analyses.
- Addresses both hydrologic and habitat conditions.
- Can be readily applied to a broad geographic area.
- Can quantify uncertainty for instream flow values.
- Can be applied in combination with hydrologic output from a climate change model to evaluate flow – habitat response to climate change.

*Limitations:*

- An important validation task requires existing PHABSIM studies within the PBP area.
- Does not evaluate climate change effects.
- Only considers the base flow environmental flow component, i.e. not the full hydrologic regime.



## 3.4 Holistic Methods

There is a trend within instream flow assessments towards a holistic, ecosystem approach that considers the full hydrologic regime and ecological interactions of multiple species within the aquatic environment. A basic premise of holistic methods is that instream flow demand should reflect the natural flow regimes in terms of spatial and temporal variability in order to maintain or restore stream habitat, morphology, a multitude of species, and biotic interactions essential to ecological integrity. Methods in this group recognize the functional linkages between hydrology and ecology of a stream. Multiple species and physical processes can be accounted for within this approach. Holistic approaches often rely more on input from interdisciplinary expert teams rather than modeling in order to evaluate instream flow demand at the complexity level of an ecosystem approach. Holistic approaches may also include stakeholder participation as exemplified in the PBP process so that the process is holistic to both interested parties and scientific issues.

### 3.4.1 Building Block Methodology as a Holistic Method

The Building Block Methodology was the first development in holistic methods for determining instream flow needs (King et al., 1998). This method relies on segregating the full hydrologic regime into blocks which are similar, if not identical, to the environmental flow components discussed in Section 2.1. The Building Block Method (BBM) has three phases. Phase One is compilation of existing data (synonymous with Step Two in the PBP process). In addition to hydrologic information, data on a waterbody's biological communities and habitat needs is compiled. The desired level of ecological integrity (acceptable risk for loss of intolerant biota) is identified for various streams in the assessment area. Phase Two of BBM is a workshop where an interdisciplinary team of experts apply a structured evaluation of available information and their expertise to come to a consensus on the building blocks of the full hydrologic flow regime. Each building block is associated with an ecological function (base flows, channel flushing, migration etc.) and a flow and time period is assigned to each building block. The blocks are additive to yield a monthly instream flow regime that is responsive to all EFCs. Phase Three of BBM is the development of scenarios by the interdisciplinary team of possible consequences to the ecological function of the river when flows within each building block are not met. The third phase is more appropriate for evaluating project effects, though it is applicable to comparing existing and future instream flows with respect to climate change.

<u>The Building Block Methodology as a Holistic Method for Instream Flow Demand</u>

*Strengths:*

- Can be completed within a short time frame at relatively low cost.
- Draws upon the expertise and knowledge within a PBP group.
- Addresses the full hydrologic regime.
- Climate change effects on water quality and quantity can be evaluated provided appropriate expertise on the panel.

*Limitations:*

- Documenting the process and decision making can be challenging.
- It is a prescriptive approach and specifies a single desired (pre-determined) river condition.
- It can be subjective depending upon the expert panel’s understanding of the relationships between flow and ecological function.

### 3.4.2 <u>Ecological Limits of Hydrologic Alteration as a Holistic Method</u>

Ecological Limits of Hydrologic Alteration (ELOHA), is a holistic method that is based on a synthesis of a number of existing hydrologic techniques and environmental flow methods which address the full hydrologic flow regime (Poff et al., 2010). The flexible approach of ELOHA allows a PBP group to analyze and synthesize available scientific information into ecologically based and socially acceptable goals and standards for determining instream flow demand. There are five main steps in the ELOHA process. The first step is to build a hydrologic foundation for the basin. This consists of assembling hydrologic data and agreeing on a record for analysis (period of record, locations, time step). The second step is to classify the drainage network into a few distinctive flow regime types that are expected to have different ecological characteristics. This classification can be refined through subdividing each type based on geomorphology such as Rosgen classification (Rosgen, 1996). The third step is to quantify the deviation of current conditions from baseline conditions for each river type. In the fourth step, flow alteration–ecological response relationships are developed for each river type, based on a combination of existing hydroecological literature, expert knowledge and field studies across gradients of hydrologic alteration. Hypotheses for relationships between flow alteration and ecological response are initially developed by an interdisciplinary team. Existing information and literature can be used to further define these hypotheses. Monitoring and field studies are then applied to validate the hypotheses. The fifth step in ELOHA is implementation of adaptive management for a flow strategy (Step 4 and beyond in PBP). Figure 3 is a schematic of the ELOHA process.

Further information and case studies on ELOHA can be found at:

https://www.conservationgateway.org/ConservationPractices/Freshwater/EnvironmentalFlows/MethodsandTools/ELOHA/Pages/ecological-limits-hydrolo.aspx

ELOHA as a Holistic Method for Instream Flow Demand

*Strengths*:

- Addresses the full hydrologic regime.
- Can be combined with climate change models to evaluate effects on water quality and quantity.
- Allows consideration of complex interactions between instream flow and ecological response.
- Systematic process that includes testing hypotheses to guide adaptive management.
- Flexible process that is consistent with PBP concept for engagement of all interested parties.

*Limitations:*

- Full implementation can be a lengthy process, especially if field studies for validating hypotheses for ecological response to hydrologic alteration are required.
- May require areas of expertise not represented within the PBP group.

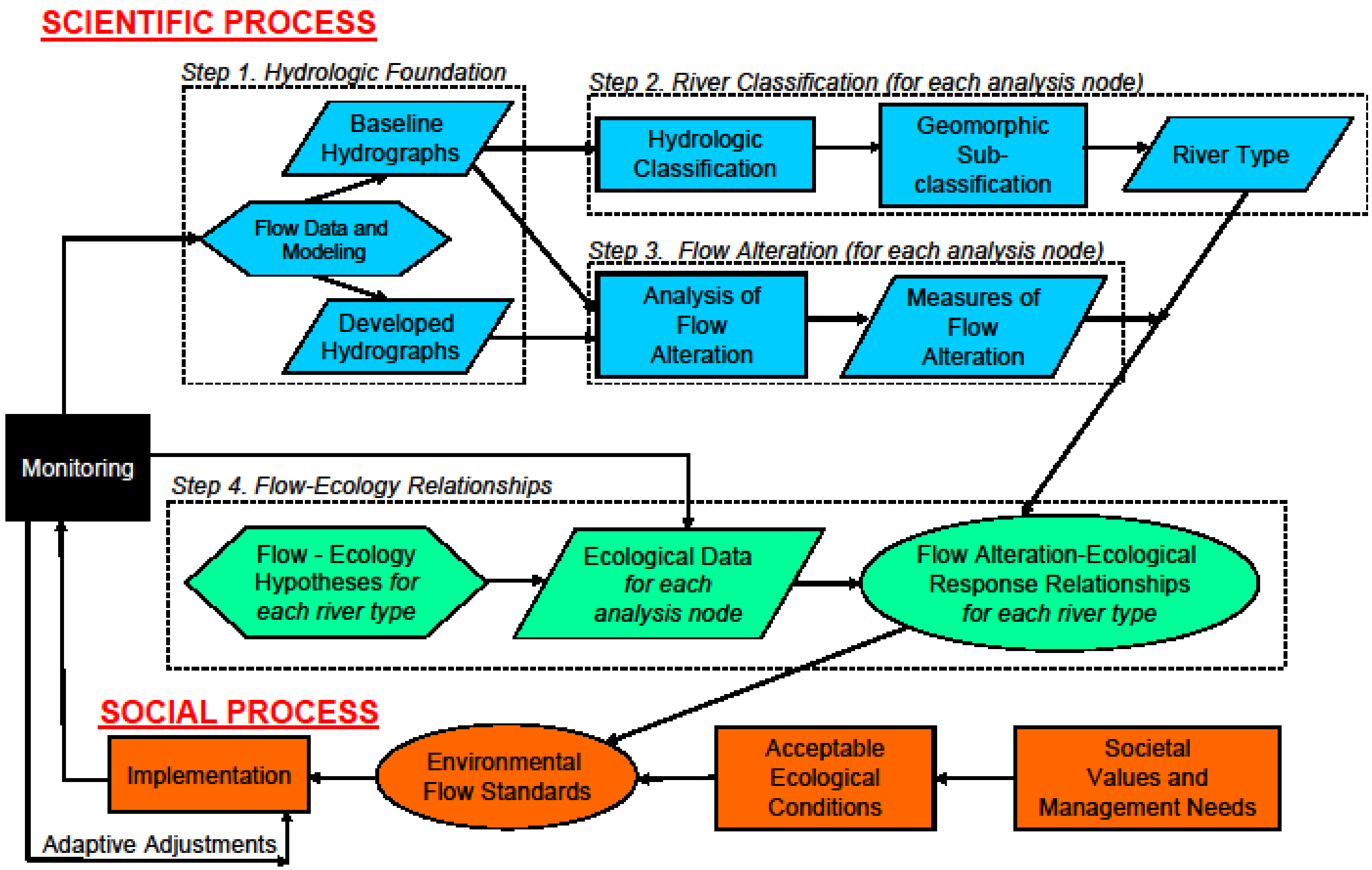



Figure 3. Ecological Limits of Hydrologic Alteration flow chart (Poff et al., 2010).

## 3.5 Climate Change Assessment Methods for Instream Flow Demand

As previously discussed, results of climate change modelling can be integrated with the IHA desktop method and holistic methods to better identify how climate change affects future instream flow demand. Modeling climate change effects on instream flow at a reach scale for the entire PBP basin may exceed the capacity of PBP processes. At a minimum, implementation of Step 3 should include an evaluation of climate change on instream flows at a basin scale and information gaps should be documented. The level of detail and intensity is up to the PBP group to determine based on available time and resources.

**Variable Infiltration Capacity Model (VIC)** is the most widely used model for our region. Outputs for climate change projections are available. This model is best suited for large landscape scale applications. For most streams with varying size VIC accurately modeled the center of flow timing, mean annual and summer flows and the frequency of winter floods (Wenger et al., 2010).

**Precipitation Runoff Modeling System (PRMS)** is a USGS, originating in 1983, that simulates water movement within a system. The model provides analyses of streamflow under different future scenarios. PRMS can be linked to SNTEMP to analyze changes in water temperature and GSFLOW to link it with a groundwater model, such as MODFLOW (Markstrom et al., 2015).

**Visualizing Ecosystem Land Management Assessments Model (VELMA)** is a fully distributed hydroecological model. The model is data intensive and allows resolution at a finer scale than the above two listed models. This model predicts flows under future scenarios as well as the fate and transport of nutrients and impurities. It can be linked with other models to address water temperature effects (McKane et al, 2016).

# 4.0 SUMMARY

A full understanding of instream flow demand recognizes multiple environmental flow components. These components comprise the full hydrologic regime to which species are adapted. The magnitude, timing and rate of change for various environmental flow components are factors to be considered for establishing instream flow demand. An instream flow that mimics the natural hydrologic cycle provides the best assurance that the habitat needs of aquatic dependent species will be met.

The determination of instream flow ecological demand as part of the Step 3 PBP process needs to address the full hydrologic regime for both current and future demand as affected by climate change. Step 3 of the PBP process includes building on Step 2 efforts to assemble information. Available tools to analyze instream flow demand range from simple, low cost approaches that can be readily applied across a broad geographic area to detailed modelling approaches. The best approach is to use a suite of tools to evaluate current and future needs. The BIR/ISWR is a tool that provides valuable information on base flow needs for current conditions. Some of the other tools described in this document go beyond base flow to address environmental flow components including high flow pulses and flood events. All Environmental Flow Components are an integral part of instream flow demand for providing biological, physical geomorphic, water quality and connectivity functions of the aquatic environment. The Indicators of Hydraulic Alteration tool is useful for analyzing change in Environmental Flow Components when comparing existing flow conditions and instream flow alterations resulting from climate change. Holistic methods best integrate ecological functions for determining instream flow demand. The full hydrologic regime is affected by climate change as well as changes in water quality and species distribution. It is essential that any suite of tools applied to determine instream flow demand in Step 3 include quantitative tools for assessing climate change effects.

The tools applied in Step 3 by the PBP group will depend on available time, resources and expertise. Table 2 summarizes tools for the instream flow ecological demand assessment. The tools selected will affect the uncertainty associated with instream flow demand. Uncertainty and information gaps will subsequently influence Step 4 PBP discussions on the acceptable level of risk associated with instream flow demand projections.

Step 3 is intended to provide the PBP group with a thorough understanding of ecological instream demand, alongside other instream demands including recreational, cultural, hydropower and socioeconomic needs that define the complex spectrum of instream flow demand. The determination of other water needs is also examined with instream flow demands. The goal of Step 3 is to help a PBP group move towards a shared understanding of various water interests and needs within the basin for both current and future conditions.

Table 2. Tools for determining instream flow ecological demand.

| Tool | Base Flow | Full Hydrologic Regime | Climate Change | Notes |
|---|---|---|---|---|
| 1) Habitat Methods based on field studies | √ | | | |
| a) BIR/ISWR | √ | | | Not comprehensive of all streams |
| b) Habitat Simulation | √ | | | Based on limited number of target species |
| 2) Hydrologic Methods | √ | | | High uncertainty |
| 3) Desktop Assessment | | | | |
| a) IHA | √ | √ | partial | Hydrologic output from climate change model can be compared to existing |
| b) PHABSIM metadata | √ | | | |
| 4) Holistic Methods | | | | Flexible process |
| a) Building Block Method | √ | √ | | Interdisciplinary team of experts consensus approach |
| b) ELOHA | √ | √ | √ | |
| 5) Climate | | | | |
| a) VIC | √ | √ | √ | |
| b) PRMS | √ | √ | √ | |
| c) VELMA | √ | √ | √ | Land use changes |

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| app_char | app_nbr | StreamName | Priority Date | cert_num | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Legal | TributaryTo | StreamCode |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| IS | 71664 | CHICKEN CR > SHEEP CR | 6/7/1991 | 73299 | 3.74 | 3.74 | 5.69 | 5.69 | 11.3 | 11.3 | 26 | 26 | 26 | 26 | 15.8 | 15.8 | 3.63 | 3.63 | 1.48 | 1.48 | 1.24 | 1.24 | 1.58 | 1.58 | 2.55 | 2.55 | 3.22 | 3.22 | [illegible] | [illegible] | [illegible] |
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| IS | 70873 | FIVE POINTS CR > GRANDE RONDE R | 11/8/1990 | 73295 | 17 | 17 | 17 | 17 | 30 | 30 | 43 | 43 | 43 | 43 | 30 | 30 | 6.45 | 6.45 | 3.7 | 3.7 | 3.97 | 3.97 | 4.25 | 4.25 | 8.44 | 8.44 | 12.8 | 12.8 | [illegible] | [illegible] | [illegible] |
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| IS | 71683 | GORDON CR > GRANDE RONDE R | 6/7/1991 | 73315 | 13 | 13 | 13 | 13 | 20 | 20 | 20 | 34 | 34 | 34 | 20 | 20 | 17.7 | 17.7 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | [illegible] | [illegible] | [illegible] |
| IS | 71665 | INDIAN CR > GRANDE RONDE R | 6/7/1991 | 73019 | 14.6 | 14.6 | 22.5 | 22.5 | 36.7 | 36.7 | 50 | 68 | 68 | 68 | 50 | 50 | 22.3 | 22.3 | 7.89 | 7.89 | 5.4 | 5.4 | 5.49 | 5.49 | 8.27 | 8.27 | 11.2 | 11.2 | [illegible] | [illegible] | [illegible] |
| IS | 71682 | JARBOE CR > LOOKINGGLASS CR | 6/7/1991 | 72656 | 12.9 | 12.9 | 13 | 13 | 20 | 20 | 20 | 34 | 34 | 34 | 20 | 20 | 13.5 | 13.5 | 10.6 | 10.6 | 10.6 | 10.6 | 10.6 | 10.6 | 13 | 13 | 13 | 13 | [illegible] | [illegible] | [illegible] |
| IS | 70867 | LIMBER JIM CR > GRANDE RONDE R | 11/8/1990 | 73394 | 3.73 | 3.73 | 5.51 | 5.51 | 10.74 | 10.74 | 26 | 26 | 26 | 26 | 19.64 | 19.64 | 4.22 | 4.22 | 1.63 | 1.63 | 1.47 | 1.47 | 1.82 | 1.82 | 2.84 | 2.84 | 3.18 | 3.18 | [illegible] | [illegible] | [illegible] |
| IS | 71681 | LITTLE CATHERINE CR > CATHERINE CR | 6/7/1991 | 73020 | 5 | 5 | 7.08 | 7.08 | 10.7 | 10.7 | 20 | 20 | 20 | 20 | 13 | 13 | 11.6 | 11.6 | 5 | 5 | 4.36 | 4.36 | 4.15 | 4.15 | 4.78 | 4.78 | 5 | 5 | [illegible] | [illegible] | [illegible] |
| IS | 71680 | LITTLE CR > CATHERINE CR | 6/7/1991 | 73314 | 12.5 | 12.5 | 20 | 20 | 20 | 26.5 | 34 | 34 | 34 | 34 | 20 | 20 | 12.9 | 12.9 | 7.38 | 7.38 | 5.76 | 5.76 | 7.38 | 7.38 | 6.8 | 6.8 | 9.74 | 9.74 | [illegible] | [illegible] | [illegible] |
| IS | 70866 | LITTLE LOOKINGGLASS CR > LOOKINGGLASS CR | 11/8/1990 | 73017 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 100 | 100 | 100 | 80 | 80 | 80 | 80 | 64.1 | 64.1 | 64.2 | 64.2 | 64.4 | 64.4 | 80 | 80 | 65 | 65 | [illegible] | [illegible] | [illegible] |
| IS | 71679 | MARLEY CR > MEADOW CR | 6/7/1991 | 73313 | 1.24 | 1.24 | 3.4 | 3.4 | 6.8 | 6.8 | 11.4 | 11.4 | 6.45 | 6.45 | 1.44 | 1.44 | 0.36 | 0.36 | 0.21 | 0.21 | 0.17 | 0.17 | 0.23 | 0.23 | 0.39 | 0.39 | 0.96 | 0.96 | [illegible] | [illegible] | [illegible] |
| IS | 71678 | MCCOY CR > MEADOW CR | 6/7/1991 | 73312 | 8.45 | 8.45 | 13 | 13 | 20 | 20 | 34 | 34 | 34 | 34 | 6 | 6 | 1.88 | 1.88 | 1.05 | 1.05 | 1.08 | 1.08 | 1.4 | 1.4 | 2.7 | 2.7 | 6.69 | 6.69 | [illegible] | [illegible] | [illegible] |
| IS | 71676 | MEADOW CR > GRANDE RONDE R | 6/7/1991 | 73310 | 25.8 | 25.8 | 27 | 27 | 40 | 40 | 68 | 68 | 68 | 68 | 24.1 | 24.1 | 6.86 | 6.86 | 4.23 | 4.23 | 3.81 | 3.81 | 5.08 | 5.08 | 8.52 | 8.52 | 20.2 | 20.2 | [illegible] | [illegible] | [illegible] |
| IS | 71677 | MEADOW CR > GRANDE RONDE R | 6/7/1991 | 73311 | 6.99 | 6.99 | 10 | 10 | 15 | 15 | 26 | 26 | 26 | 26 | 6.91 | 6.91 | 2.21 | 2.21 | 0.89 | 0.89 | 0.91 | 0.91 | 1.19 | 1.19 | 2.77 | 2.77 | 5.5 | 5.5 | [illegible] | [illegible] | [illegible] |
| IS | 71733 | MILL CR > WILLOW CR | 7/1/1991 | 73317 | 1.62 | 1.62 | 4 | 4 | 6.93 | 6.93 | 10 | 10 | 6.93 | 6.93 | 1.55 | 1.55 | 0.19 | 0.19 | 0.07 | 0.07 | 0.04 | 0.04 | 0.07 | 0.07 | 0.18 | 0.18 | 1.02 | 1.02 | [illegible] | [illegible] | [illegible] |
| IS | 71675 | N FK CABIN CR > CABIN CR | 6/7/1991 | 73309 | 10 | 10 | 10 | 10 | 15 | 15 | 15 | 26 | 20.3 | 20.3 | 8.26 | 8.26 | 4.88 | 4.88 | 4.53 | 4.53 | 4.86 | 4.86 | 7.92 | 7.92 | 10 | 10 | 10 | 10 | [illegible] | [illegible] | [illegible] |
| IS | 70865 | N FK CATHERINE CR > CATHERINE CR | 11/8/1990 | 72655 | 15.4 | 15.4 | 19.2 | 19.2 | 29 | 29 | 50 | 50 | 50 | 50 | 34 | 34 | 31.4 | 31.4 | 14.5 | 14.5 | 11.8 | 11.8 | 11.3 | 11.3 | 13 | 13 | 14 | 14 | [illegible] | [illegible] | [illegible] |
| IS | 71674 | PELICAN CR > FIVE POINTS CR | 6/7/1991 | 73308 | 7 | 7 | 7 | 7 | 12 | 12 | 17 | 17 | 17 | 17 | 5.3 | 5.3 | 1.11 | 1.11 | 0.5 | 0.5 | 0.55 | 0.55 | 0.62 | 0.62 | 1.4 | 1.4 | 3.39 | 3.39 | [illegible] | [illegible] | [illegible] |
| IS | 71663 | PHILLIPS CR > GRANDE RONDE R | 6/7/1991 | 73298 | 17 | 17 | 17 | 17 | 30 | 30 | 43 | 43 | 43 | 43 | 30 | 30 | 26.6 | 26.6 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | [illegible] | [illegible] | [illegible] |
| IS | 71673 | ROCK CR > GRANDE RONDE R | 6/7/1991 | 73307 | 13.5 | 13.5 | 17 | 17 | 30 | 30 | 43 | 43 | 43 | 43 | 29.8 | 29.8 | 4.83 | 4.83 | 2.22 | 2.22 | 2.14 | 2.14 | 2.43 | 2.43 | 4.03 | 4.03 | 6.27 | 6.27 | [illegible] | [illegible] | [illegible] |
| IS | 71672 | S FK CABIN CR > CABIN CR | 6/7/1991 | 73306 | 13 | 13 | 13 | 13 | 20 | 20 | 20 | 34 | 28 | 28 | 12.3 | 12.3 | 7.36 | 7.36 | 5.95 | 5.95 | 6.5 | 6.5 | 10.5 | 10.5 | 12.7 | 12.7 | 13 | 13 | [illegible] | [illegible] | [illegible] |
| IS | 70862 | S FK CATHERINE CR > CATHERINE CR | 11/8/1990 | 72654 | 11.9 | 11.9 | 14.8 | 14.8 | 20 | 22.4 | 34 | 34 | 34 | 34 | 20 | 20 | 20 | 20 | 11.2 | 11.2 | 9.15 | 9.15 | 8.7 | 8.7 | 10 | 10 | 10.9 | 10.9 | [illegible] | [illegible] | [illegible] |
| IS | 70861 | SHEEP CR > GRANDE RONDE R | 11/8/1990 | 73292 | 10.4 | 10.4 | 18.3 | 18.3 | 20 | 34 | 34 | 34 | 34 | 34 | 25 | 25 | 8.13 | 8.13 | 3.52 | 3.52 | 3.13 | 3.13 | 3.95 | 3.95 | 6.66 | 6.66 | 8.88 | 8.88 | [illegible] | [illegible] | [illegible] |
| IS | 71671 | SPRING CR > GRANDE RONDE R | 6/7/1991 | 73305 | 7.04 | 7.04 | 10 | 10 | 15 | 15 | 26 | 26 | 25.9 | 25.9 | 4.29 | 4.29 | 0.88 | 0.88 | 0.46 | 0.46 | 0.39 | 0.39 | 0.46 | 0.46 | 1.3 | 1.3 | 3.14 | 3.14 | [illegible] | [illegible] | [illegible] |
| IS | 71670 | W CHICKEN CR > CHICKEN CR | 6/7/1991 | 73304 | 1.4 | 1.4 | 2.24 | 2.24 | 4.54 | 4.54 | 10.4 | 10.4 | 11.4 | 11.4 | 3.94 | 3.94 | 0.93 | 0.93 | 0.39 | 0.39 | 0.31 | 0.31 | 0.41 | 0.41 | 0.85 | 0.85 | 1.2 | 1.2 | [illegible] | [illegible] | [illegible] |
| IS | 71669 | WILLOW CR > GRANDE RONDE R | 6/7/1991 | 73303 | 13 | 13 | 13 | 13 | 20 | 20 | 34 | 34 | 34 | 34 | 20 | 20 | 8.03 | 8.03 | 7.34 | 7.34 | 5.25 | 5.25 | 6.89 | 6.89 | 11.2 | 11.2 | 13 | 13 | [illegible] | [illegible] | [illegible] |
| IS | 71734 | WILLOW CR > GRANDE RONDE R | 7/1/1991 | 73318 | 4 | 4 | 4 | 4 | 7 | 7 | 10 | 10 | 10 | 10 | 7 | 7 | 6.4 | 6.4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | [illegible] | [illegible] | [illegible] |
| MF | 226 | CATHERINE CR > GRANDE RONDE R | 11/3/1983 | 59537 | 30 | 30 | 30 | 30 | 100 | 100 | 200 | 200 | 200 | 200 | 200 | 125 | 80 | 80 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | IN CATHERINE CREEK FROM USGS GAGE 13320000 (SEC. 2, T. 5S, R 40E, WM) TO THE SWACKHAMMER DIVERSION AT UNION. | [illegible] | [illegible] |
| MF | 229 | GRANDE RONDE R > SNAKE R | 5/9/1961 | 59538 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | [illegible] | [illegible] | [illegible] |
| MF | 230 | GRANDE RONDE R > SNAKE R | 11/3/1983 | 59539 | 70 | 70 | 70 | 70 | 100 | 100 | 300 | 300 | 300 | 300 | 300 | 200 | 100 | 100 | 30 | 30 | 30 | 30 | 30 | 30 | 70 | 70 | 70 | 70 | [illegible] | [illegible] | [illegible] |

**Subwatershed 1**

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CABIN CR > GRANDE RONDE R | 20 | 20 | 20 | 20 | 30 | 30 | 30 | 50 | 50 | 50 | 20.9 | 20.9 | 12.4 | 12.4 | 10.5 | 10.5 | 11.4 | 11.4 | 18.6 | 18.6 | 20 | 20 | 20 | 20 |
| GORDON CR > GRANDE RONDE R | 13 | 13 | 13 | 13 | 20 | 20 | 20 | 34 | 34 | 34 | 20 | 20 | 17.7 | 17.7 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| JARBOE CR > LOOKINGGLASS CR | 12.9 | 12.9 | 13 | 13 | 20 | 20 | 20 | 34 | 34 | 34 | 20 | 20 | 13.5 | 13.5 | 10.6 | 10.6 | 10.6 | 10.6 | 10.6 | 10.6 | 13 | 13 | 13 | 13 |
| LITTLE LOOKINGGLASS CR > LOOKINGGLASS CR | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 100 | 100 | 100 | 80 | 80 | 80 | 80 | 64.1 | 64.1 | 64.2 | 64.2 | 64.4 | 64.4 | 80 | 80 | 65 | 65 |
| N FK CABIN CR > CABIN CR | 10 | 10 | 10 | 10 | 15 | 15 | 15 | 26 | 20.3 | 20.3 | 8.26 | 8.26 | 4.88 | 4.88 | 4.53 | 4.53 | 4.86 | 4.86 | 7.92 | 7.92 | 10 | 10 | 10 | 10 |
| PHILLIPS CR > GRANDE RONDE R | 17 | 17 | 17 | 17 | 30 | 30 | 43 | 43 | 43 | 43 | 30 | 30 | 26.6 | 26.6 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| S FK CABIN CR > CABIN CR | 13 | 13 | 13 | 13 | 20 | 20 | 20 | 34 | 28 | 28 | 12.3 | 12.3 | 7.36 | 7.36 | 5.95 | 5.95 | 6.5 | 6.5 | 10.5 | 10.5 | 12.7 | 12.7 | 13 | 13 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CABIN CR > GRANDE RONDE R | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| GORDON CR > GRANDE RONDE R | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| JARBOE CR > LOOKINGGLASS CR | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| LITTLE LOOKINGGLASS CR > LOOKINGGLASS CR | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| N FK CABIN CR > CABIN CR | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| PHILLIPS CR > GRANDE RONDE R | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| S FK CABIN CR > CABIN CR | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Total | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 129.057 |

**Subwatershed 2**

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLARK CR > GRANDE RONDE R | 13.1 | 13.1 | 20 | 20 | 30 | 30 | 30 | 43 | 43 | 43 | 14.6 | 14.6 | 2.55 | 2.55 | 1.09 | 1.09 | 0.36 | 0.36 | 1.46 | 1.46 | 4.73 | 4.73 | 9.83 | 9.83 |
| INDIAN CR > GRANDE RONDE R | 14.6 | 14.6 | 22.5 | 22.5 | 36.7 | 36.7 | 50 | 68 | 68 | 68 | 50 | 50 | 22.3 | 22.3 | 7.89 | 7.89 | 5.4 | 5.4 | 5.49 | 5.49 | 8.27 | 8.27 | 11.2 | 11.2 |
| MILL CR > WILLOW CR | 1.62 | 1.62 | 4 | 4 | 6.93 | 6.93 | 10 | 10 | 6.93 | 6.93 | 1.55 | 1.55 | 0.19 | 0.19 | 0.07 | 0.07 | 0.04 | 0.04 | 0.07 | 0.07 | 0.18 | 0.18 | 1.02 | 1.02 |
| WILLOW CR > GRANDE RONDE R | 13 | 13 | 13 | 13 | 20 | 20 | 34 | 34 | 34 | 34 | 20 | 20 | 8.03 | 8.03 | 7.34 | 7.34 | 5.25 | 5.25 | 6.89 | 6.89 | 11.2 | 11.2 | 13 | 13 |
| WILLOW CR > GRANDE RONDE R | 4 | 4 | 4 | 4 | 7 | 7 | 10 | 10 | 10 | 10 | 7 | 7 | 6.4 | 6.4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLARK CR > GRANDE RONDE R | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| INDIAN CR > GRANDE RONDE R | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| MILL CR > WILLOW CR | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| WILLOW CR > GRANDE RONDE R | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| WILLOW CR > GRANDE RONDE R | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Total | 1378 | 1470 | 1763 | 1763 | 2994 | 3194 | 3987 | 4909 | 4818 | 5139 | 2771 | 2771 | 1174 | 1253 | 607 | 647 | 448 | 448 | 533 | 568 | 844 | 844 | 1162 | 1239 | 46.725 |

35

**Subwatershed 3**

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRANDE RONDE R > SNAKE R | 70 | 70 | 70 | 70 | 100 | 100 | 300 | 300 | 300 | 300 | 300 | 200 | 100 | 100 | 30 | 30 | 30 | 30 | 30 | 30 | 70 | 70 | 70 | 70 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRANDE RONDE R > SNAKE R | 2083 | 2221 | 1944 | 1944 | 2975 | 3174 | 8926 | 8926 | 8926 | 9521 | 8926 | 5950 | 2975 | 3174 | 893 | 952 | 893 | 893 | 893 | 952 | 2083 | 2083 | 2083 | 2221 | 85.607 |

**Subwatershed 4**

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BEAVER CR > GRANDE RONDE R | 11.3 | 11.3 | 16.6 | 16.6 | 31.1 | 31.1 | 68 | 68 | 68 | 68 | 40 | 40 | 13.6 | 13.6 | 5.87 | 5.87 | 5.36 | 5.36 | 6.59 | 6.59 | 9.21 | 9.21 | 9.99 | 9.99 |
| FIVE POINTS CR > GRANDE RONDE R | 17 | 17 | 17 | 17 | 30 | 30 | 43 | 43 | 43 | 43 | 30 | 30 | 6.45 | 6.45 | 3.7 | 3.7 | 3.97 | 3.97 | 4.25 | 4.25 | 8.44 | 8.44 | 12.8 | 12.8 |
| PELICAN CR > FIVE POINTS CR | 7 | 7 | 7 | 7 | 12 | 12 | 17 | 17 | 17 | 17 | 5.3 | 5.3 | 1.11 | 1.11 | 0.5 | 0.5 | 0.55 | 0.55 | 0.62 | 0.62 | 1.4 | 1.4 | 3.39 | 3.39 |
| ROCK CR > GRANDE RONDE R | 13.5 | 13.5 | 17 | 17 | 30 | 30 | 43 | 43 | 43 | 43 | 29.8 | 29.8 | 4.83 | 4.83 | 2.22 | 2.22 | 2.14 | 2.14 | 2.43 | 2.43 | 4.03 | 4.03 | 6.27 | 6.27 |
| SPRING CR > GRANDE RONDE R | 7.04 | 7.04 | 10 | 10 | 15 | 15 | 26 | 26 | 25.9 | 25.9 | 4.29 | 4.29 | 0.88 | 0.88 | 0.46 | 0.46 | 0.39 | 0.39 | 0.46 | 0.46 | 1.3 | 1.3 | 3.14 | 3.14 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BEAVER CR > GRANDE RONDE R | 336 | 359 | 461 | 461 | 925 | 987 | 2023 | 2023 | 2023 | 2158 | 1190 | 1190 | 405 | 432 | 175 | 186 | 159 | 159 | 196 | 209 | 274 | 274 | 297 | 317 | 17.220 |
| FIVE POINTS CR > GRANDE RONDE R | 506 | 540 | 472 | 472 | 893 | 952 | 1279 | 1279 | 1279 | 1365 | 893 | 893 | 192 | 205 | 110 | 117 | 118 | 118 | 126 | 135 | 251 | 251 | 381 | 406 | 13.233 |
| PELICAN CR > FIVE POINTS CR | 208 | 222 | 194 | 194 | 357 | 381 | 506 | 506 | 506 | 540 | 158 | 158 | 33 | 35 | 15 | 16 | 16 | 16 | 18 | 20 | 42 | 42 | 101 | 108 | 4.391 |
| ROCK CR > GRANDE RONDE R | 402 | 428 | 472 | 472 | 893 | 952 | 1279 | 1279 | 1279 | 1365 | 887 | 887 | 144 | 153 | 66 | 70 | 64 | 64 | 72 | 77 | 120 | 120 | 187 | 199 | 11.930 |
| SPRING CR > GRANDE RONDE R | 209 | 223 | 278 | 278 | 446 | 476 | 774 | 774 | 771 | 822 | 128 | 128 | 26 | 28 | 14 | 15 | 12 | 12 | 14 | 15 | 39 | 39 | 93 | 100 | 5.710 |
| Total | 1661 | 1772 | 1877 | 1877 | 3514 | 3748 | 5861 | 5861 | 5858 | 6249 | 3255 | 3255 | 799 | 853 | 379 | 405 | 369 | 369 | 427 | 455 | 725 | 725 | 1059 | 1129 | 52.484 |

**Subwatershed 5**

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BEAR CR > MEADOW CR | 1.5 | 1.5 | 4.7 | 4.7 | 9.33 | 9.33 | 15.2 | 15.2 | 8.15 | 8.15 | 1.34 | 1.34 | 0.38 | 0.38 | 0.16 | 0.16 | 0.14 | 0.14 | 0.19 | 0.19 | 0.43 | 0.43 | 1.11 | 1.11 |
| BURNT CORRAL CR > MEADOW CR | 1.12 | 1.12 | 2.83 | 2.83 | 5.61 | 5.61 | 10.5 | 10.5 | 7.43 | 7.43 | 1.34 | 1.34 | 0.37 | 0.37 | 0.1 | 0.1 | 0.12 | 0.12 | 0.17 | 0.17 | 0.42 | 0.42 | 0.87 | 0.87 |
| CLEAR CR > GRANDE RONDE R | 2.39 | 2.39 | 3.2 | 3.2 | 6.18 | 6.18 | 19.5 | 19.5 | 34 | 34 | 20 | 20 | 5.84 | 5.84 | 1.99 | 1.99 | 1.78 | 1.78 | 2.12 | 2.12 | 2.19 | 2.19 | 2.02 | 2.02 |
| DARK CAN CR > MEADOW CR | 3.06 | 3.06 | 9.34 | 9.34 | 17.1 | 17.1 | 26.6 | 26.6 | 13.7 | 13.7 | 2.08 | 2.08 | 0.61 | 0.61 | 0.33 | 0.33 | 0.31 | 0.31 | 0.41 | 0.41 | 0.99 | 0.99 | 2.47 | 2.47 |
| FLY CR > GRANDE RONDE R | 9.63 | 9.63 | 13 | 13 | 20 | 20 | 34 | 34 | 34 | 34 | 20 | 20 | 6.45 | 6.45 | 4.16 | 4.16 | 3.75 | 3.75 | 4.69 | 4.69 | 6.24 | 6.24 | 8.36 | 8.36 |
| LIMBER JIM CR > GRANDE RONDE R | 3.73 | 3.73 | 5.51 | 5.51 | 10.74 | 10.74 | 26 | 26 | 26 | 26 | 19.64 | 19.64 | 4.22 | 4.22 | 1.63 | 1.63 | 1.47 | 1.47 | 1.82 | 1.82 | 2.84 | 2.84 | 3.18 | 3.18 |
| MARLEY CR > MEADOW CR | 1.24 | 1.24 | 3.4 | 3.4 | 6.8 | 6.8 | 11.4 | 11.4 | 6.45 | 6.45 | 1.44 | 1.44 | 0.36 | 0.36 | 0.21 | 0.21 | 0.17 | 0.17 | 0.23 | 0.23 | 0.39 | 0.39 | 0.96 | 0.96 |
| MCCOY CR > MEADOW CR | 8.45 | 8.45 | 13 | 13 | 20 | 20 | 34 | 34 | 34 | 34 | 6 | 6 | 1.88 | 1.88 | 1.05 | 1.05 | 1.08 | 1.08 | 1.4 | 1.4 | 2.7 | 2.7 | 6.69 | 6.69 |
| MEADOW CR > GRANDE RONDE R | 25.8 | 25.8 | 27 | 27 | 40 | 40 | 68 | 68 | 68 | 68 | 24.1 | 24.1 | 6.86 | 6.86 | 4.23 | 4.23 | 3.81 | 3.81 | 5.08 | 5.08 | 8.52 | 8.52 | 20.2 | 20.2 |
| MEADOW CR > GRANDE RONDE R | 6.99 | 6.99 | 10 | 10 | 15 | 15 | 26 | 26 | 26 | 26 | 6.91 | 6.91 | 2.21 | 2.21 | 0.89 | 0.89 | 0.91 | 0.91 | 1.19 | 1.19 | 2.77 | 2.77 | 5.5 | 5.5 |
| SHEEP CR > GRANDE RONDE R | 10.4 | 10.4 | 18.3 | 18.3 | 20 | 34 | 34 | 34 | 34 | 34 | 25 | 25 | 8.13 | 8.13 | 3.52 | 3.52 | 3.13 | 3.13 | 3.95 | 3.95 | 6.66 | 6.66 | 8.88 | 8.88 |
| CHICKEN CR > SHEEP CR | 3.74 | 3.74 | 5.69 | 5.69 | 11.3 | 11.3 | 26 | 26 | 26 | 26 | 15.8 | 15.8 | 3.63 | 3.63 | 1.48 | 1.48 | 1.24 | 1.24 | 1.58 | 1.58 | 2.55 | 2.55 | 3.22 | 3.22 |
| W CHICKEN CR > CHICKEN CR | 1.4 | 1.4 | 2.24 | 2.24 | 4.54 | 4.54 | 10.4 | 10.4 | 11.4 | 11.4 | 3.94 | 3.94 | 0.93 | 0.93 | 0.39 | 0.39 | 0.31 | 0.31 | 0.41 | 0.41 | 0.85 | 0.85 | 1.2 | 1.2 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BEAR CR > MEADOW CR | 45 | 48 | 131 | 131 | 278 | 296 | 452 | 452 | 242 | 259 | 40 | 40 | 11 | 12 | 5 | 5 | 4 | 4 | 6 | 6 | 13 | 13 | 33 | 35 | 2.559 |
| BURNT CORRAL CR > MEADOW CR | 33 | 36 | 79 | 79 | 167 | 178 | 312 | 312 | 221 | 236 | 40 | 40 | 11 | 12 | 3 | 3 | 4 | 4 | 5 | 5 | 12 | 12 | 26 | 28 | 1.857 |
| CLEAR CR > GRANDE RONDE R | 71 | 76 | 89 | 89 | 184 | 196 | 580 | 580 | 1012 | 1079 | 595 | 595 | 174 | 185 | 59 | 63 | 53 | 53 | 63 | 67 | 65 | 65 | 60 | 64 | 6.118 |
| DARK CAN CR > MEADOW CR | 91 | 97 | 259 | 259 | 509 | 543 | 791 | 791 | 408 | 435 | 62 | 62 | 18 | 19 | 10 | 10 | 9 | 9 | 12 | 13 | 29 | 29 | 73 | 78 | 4.620 |
| FLY CR > GRANDE RONDE R | 287 | 306 | 361 | 361 | 595 | 635 | 1012 | 1012 | 1012 | 1079 | 595 | 595 | 192 | 205 | 124 | 132 | 112 | 112 | 140 | 149 | 186 | 186 | 249 | 265 | 9.897 |
| LIMBER JIM CR > GRANDE RONDE R | 111 | 118 | 153 | 153 | 320 | 341 | 774 | 774 | 774 | 825 | 584 | 584 | 126 | 134 | 48 | 52 | 44 | 44 | 54 | 58 | 84 | 84 | 95 | 101 | 6.434 |
| MARLEY CR > MEADOW CR | 37 | 39 | 94 | 94 | 202 | 216 | 339 | 339 | 192 | 205 | 43 | 43 | 11 | 11 | 6 | 7 | 5 | 5 | 7 | 7 | 12 | 12 | 29 | 30 | 1.985 |
| MCCOY CR > MEADOW CR | 251 | 268 | 361 | 361 | 595 | 635 | 1012 | 1012 | 1012 | 1079 | 179 | 179 | 56 | 60 | 31 | 33 | 32 | 32 | 42 | 44 | 80 | 80 | 199 | 212 | 7.845 |
| MEADOW CR > GRANDE RONDE R | 768 | 819 | 750 | 750 | 1190 | 1269 | 2023 | 2023 | 2023 | 2158 | 717 | 717 | 204 | 218 | 126 | 134 | 113 | 113 | 151 | 161 | 253 | 253 | 601 | 641 | 18.177 |
| MEADOW CR > GRANDE RONDE R | 208 | 222 | 278 | 278 | 446 | 476 | 774 | 774 | 774 | 825 | 206 | 206 | 66 | 70 | 26 | 28 | 27 | 27 | 35 | 38 | 82 | 82 | 164 | 175 | 6.285 |
| SHEEP CR > GRANDE RONDE R | 309 | 330 | 508 | 508 | 595 | 1079 | 1012 | 1012 | 1012 | 1079 | 744 | 744 | 242 | 258 | 105 | 112 | 93 | 93 | 118 | 125 | 198 | 198 | 264 | 282 | 11.019 |
| CHICKEN CR > SHEEP CR | 111 | 119 | 158 | 158 | 336 | 359 | 774 | 774 | 774 | 825 | 470 | 470 | 108 | 115 | 44 | 47 | 37 | 37 | 47 | 50 | 76 | 76 | 96 | 102 | 6.162 |
| W CHICKEN CR > CHICKEN CR | 42 | 44 | 62 | 62 | 135 | 144 | 309 | 309 | 339 | 362 | 117 | 117 | 28 | 30 | 12 | 12 | 9 | 9 | 12 | 13 | 25 | 25 | 36 | 38 | 2.293 |
| Total | 2.364 | 2.521 | 3.283 | 3.283 | 5.552 | 6.366 | 10.163 | 10.163 | 9.792 | 10.445 | 4.391 | 4.391 | 1.246 | 1.329 | 599 | 639 | 542 | 542 | 691 | 738 | 1.117 | 1.117 | 1.924 | 2.052 | 85.251 |

**Subwatershed 6** No ISWR's

**Subwatershed 7**

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CATHERINE CR > GRANDE RONDE R | 30 | 30 | 30 | 30 | 100 | 100 | 200 | 200 | 200 | 200 | 200 | 125 | 80 | 80 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| LITTLE CR > CATHERINE CR | 12.5 | 12.5 | 20 | 20 | 20 | 26.5 | 34 | 34 | 34 | 34 | 20 | 20 | 12.9 | 12.9 | 7.38 | 7.38 | 5.76 | 5.76 | 7.38 | 7.38 | 6.8 | 6.8 | 9.74 | 9.74 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CATHERINE CR > GRANDE RONDE R | 893 | 952 | 833 | 833 | 2975 | 3174 | 5950 | 5950 | 5950 | 6347 | 5950 | 3719 | 2380 | 2539 | 893 | 952 | 893 | 893 | 893 | 952 | 893 | 893 | 893 | 952 | 57.550 |
| LITTLE CR > CATHERINE CR | 372 | 397 | 555 | 555 | 595 | 841 | 1012 | 1012 | 1012 | 1079 | 595 | 595 | 384 | 409 | 220 | 234 | 171 | 171 | 220 | 234 | 202 | 202 | 290 | 309 | 11.666 |
| Total | 1264 | 1349 | 1388 | 1388 | 3570 | 4015 | 6962 | 6962 | 6962 | 7426 | 6545 | 4314 | 2764 | 2948 | 1112 | 1186 | 1064 | 1064 | 1112 | 1186 | 1095 | 1095 | 1182 | 1261 | 69.217 |

**Subwatershed 8**

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CATHERINE CR > GRANDE RONDE R | 30 | 30 | 30 | 30 | 30 | 60 | 60 | 60 | 70 | 70 | 70 | 70 | 70 | 70 | 37.8 | 37.8 | 31 | 31 | 29.5 | 29.5 | 34 | 34 | 30 | 30 |
| LITTLE CATHERINE CR > CATHERINE CR | 5 | 5 | 7.08 | 7.08 | 10.7 | 10.7 | 20 | 20 | 20 | 20 | 13 | 13 | 11.6 | 11.6 | 5 | 5 | 4.36 | 4.36 | 4.15 | 4.15 | 4.78 | 4.78 | 5 | 5 |
| N FK CATHERINE CR > CATHERINE CR | 15.4 | 15.4 | 19.2 | 19.2 | 29 | 29 | 50 | 50 | 50 | 50 | 34 | 34 | 31.4 | 31.4 | 14.5 | 14.5 | 11.8 | 11.8 | 11.3 | 11.3 | 13 | 13 | 14 | 14 |
| S FK CATHERINE CR > CATHERINE CR | 11.9 | 11.9 | 14.8 | 14.8 | 20 | 22.4 | 34 | 34 | 34 | 34 | 20 | 20 | 20 | 20 | 11.2 | 11.2 | 9.15 | 9.15 | 8.7 | 8.7 | 10 | 10 | 10.9 | 10.9 |

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CATHERINE CR > GRANDE RONDE R | 893 | 952 | 833 | 833 | 893 | 1904 | 1785 | 1785 | 2083 | 2221 | 2083 | 2083 | 2083 | 2221 | 1125 | 1200 | 922 | 922 | 878 | 936 | 1012 | 1012 | 893 | 952 | 32.502 |
| LITTLE CATHERINE CR > CATHERINE CR | 149 | 159 | 197 | 197 | 318 | 340 | 595 | 595 | 595 | 635 | 387 | 387 | 345 | 368 | 149 | 159 | 130 | 130 | 123 | 132 | 142 | 142 | 149 | 159 | 6.679 |
| N FK CATHERINE CR > CATHERINE CR | 458 | 489 | 533 | 533 | 863 | 920 | 1488 | 1488 | 1488 | 1587 | 1012 | 1012 | 934 | 996 | 431 | 460 | 351 | 351 | 336 | 359 | 387 | 387 | 417 | 444 | 17.723 |
| S FK CATHERINE CR > CATHERINE CR | 354 | 378 | 411 | 411 | 595 | 711 | 1012 | 1012 | 1012 | 1079 | 595 | 595 | 595 | 635 | 333 | 355 | 272 | 272 | 259 | 276 | 298 | 298 | 324 | 346 | 12.426 |
| Total | 1854 | 1977 | 1974 | 1974 | 2669 | 3875 | 4879 | 4879 | 5177 | 5522 | 4076 | 4076 | 3957 | 4221 | 2038 | 2174 | 1675 | 1675 | 1596 | 1703 | 1838 | 1838 | 1782 | 1901 | 69.330 |

**Totals**

| Subwatershed | AF/Yr |
|---|---|
| Subwatershed 1 | 129.057 |
| Subwatershed 2 | 46.725 |
| Subwatershed 3 | 85.607 |
| Subwatershed 4 | 52.484 |
| Subwatershed 5 | 85.251 |
| Subwatershed 6 | 0 |
| Subwatershed 7 | 69.217 |
| Subwatershed 8 | 69.330 |

| Subwatershed 1 | CFS | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** |
| CABIN CR > GRANDE RONDE R | 20 | 20 | 20 | 20 | 30 | 30 | 30 | 50 | 50 | 50 | 20.9 | 20.9 | 12.4 | 12.4 | 10.5 | 10.5 | 11.4 | 11.4 | 18.6 | 18.6 | 20 | 20 | 20 | 20 |
| GORDON CR > GRANDE RONDE R | 13 | 13 | 13 | 13 | 20 | 20 | 20 | 34 | 34 | 34 | 20 | 20 | 17.7 | 17.7 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| JARBOE CR > LOOKINGGLASS CR | 12.9 | 12.9 | 13 | 13 | 20 | 20 | 20 | 34 | 34 | 34 | 20 | 20 | 13.5 | 13.5 | 10.6 | 10.6 | 10.6 | 10.6 | 10.6 | 10.6 | 13 | 13 | 13 | 13 |
| LITTLE LOOKINGGLASS CR > LOOKINGGLASS CR | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 100 | 100 | 100 | 80 | 80 | 80 | 80 | 64.1 | 64.1 | 64.2 | 64.2 | 64.4 | 64.4 | 80 | 80 | 65 | 65 |
| N FK CABIN CR > CABIN CR | 10 | 10 | 10 | 10 | 15 | 15 | 15 | 26 | 20.3 | 20.3 | 8.26 | 8.26 | 4.88 | 4.88 | 4.53 | 4.53 | 4.86 | 4.86 | 7.92 | 7.92 | 10 | 10 | 10 | 10 |
| PHILLIPS CR > GRANDE RONDE R | 17 | 17 | 17 | 17 | 30 | 30 | 30 | 43 | 43 | 43 | 30 | 30 | 26.6 | 26.6 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| S FK CABIN CR > CABIN CR | 13 | 13 | 13 | 13 | 20 | 20 | 20 | 34 | 28 | 28 | 12.3 | 12.3 | 7.36 | 7.36 | 5.95 | 5.95 | 6.5 | 6.5 | 10.5 | 10.5 | 12.7 | 12.7 | 13 | 13 |

| | Acre-Feet | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** | **Total** |
| CABIN CR > GRANDE RONDE R | 595 | 635 | 555 | 555 | 893 | 952 | 893 | 1488 | 1488 | 1587 | 622 | 622 | 369 | 394 | 312 | 333 | 339 | 339 | 553 | 590 | 595 | 595 | 595 | 635 | **16,533** |
| GORDON CR > GRANDE RONDE R | 387 | 413 | 361 | 361 | 595 | 635 | 595 | 1012 | 1012 | 1079 | 595 | 595 | 527 | 562 | 387 | 413 | 387 | 387 | 387 | 413 | 387 | 387 | 387 | 413 | **12,672** |
| JARBOE CR > LOOKINGGLASS CR | 384 | 409 | 361 | 361 | 595 | 635 | 595 | 1012 | 1012 | 1079 | 595 | 595 | 402 | 428 | 315 | 336 | 315 | 315 | 315 | 336 | 387 | 387 | 387 | 413 | **11,969** |
| LITTLE LOOKINGGLASS CR > LOOKINGGLASS CR | 1934 | 2063 | 1805 | 1805 | 1934 | 2063 | 1934 | 2975 | 2975 | 3174 | 2380 | 2380 | 2380 | 2539 | 1907 | 2034 | 1910 | 1910 | 1916 | 2044 | 2380 | 2380 | 1934 | 2063 | **52,819** |
| N FK CABIN CR > CABIN CR | 298 | 317 | 278 | 278 | 446 | 476 | 446 | 774 | 604 | 644 | 246 | 246 | 145 | 155 | 135 | 144 | 145 | 145 | 236 | 251 | 298 | 298 | 298 | 317 | **7,617** |
| PHILLIPS CR > GRANDE RONDE R | 506 | 540 | 472 | 472 | 893 | 952 | 893 | 1279 | 1279 | 1365 | 893 | 893 | 791 | 844 | 506 | 540 | 506 | 506 | 506 | 540 | 506 | 506 | 506 | 540 | **17,230** |
| S FK CABIN CR > CABIN CR | 387 | 413 | 361 | 361 | 595 | 635 | 595 | 1012 | 833 | 889 | 366 | 366 | 219 | 234 | 177 | 189 | 193 | 193 | 312 | 333 | 378 | 378 | 387 | 413 | **10,217** |
| **Total** | **4490** | **4789** | **4193** | **4193** | **5950** | **6347** | **5950** | **9550** | **9202** | **9816** | **5696** | **5696** | **4833** | **5155** | **3739** | **3989** | **3795** | **3795** | **4225** | **4507** | **4930** | **4930** | **4493** | **4792** | **129,057** |

| Subwatershed 1 | Acre-Feet/Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** | **Oct** | **Nov** | **Dec** | **Total** |
| CABIN CR > GRANDE RONDE R | 1230 | 1111 | 1845 | 2380 | 3074 | 1244 | 762 | 646 | 678 | 1144 | 1190 | 1230 | **16,533** |
| GORDON CR > GRANDE RONDE R | 799 | 722 | 1230 | 1607 | 2091 | 1190 | 1088 | 799 | 774 | 799 | 774 | 799 | **12,672** |
| JARBOE CR > LOOKINGGLASS CR | 793 | 722 | 1230 | 1607 | 2091 | 1190 | 830 | 652 | 631 | 652 | 774 | 799 | **11,969** |
| LITTLE LOOKINGGLASS CR > LOOKINGGLASS CR | 3997 | 3610 | 3997 | 4909 | 6149 | 4760 | 4919 | 3941 | 3820 | 3960 | 4760 | 3997 | **52,819** |
| N FK CABIN CR > CABIN CR | 615 | 555 | 922 | 1220 | 1248 | 492 | 300 | 279 | 289 | 487 | 595 | 615 | **7,617** |
| PHILLIPS CR > GRANDE RONDE R | 1045 | 944 | 1845 | 2172 | 2644 | 1785 | 1636 | 1045 | 1012 | 1045 | 1012 | 1045 | **17,230** |
| S FK CABIN CR > CABIN CR | 799 | 722 | 1230 | 1607 | 1722 | 732 | 453 | 366 | 387 | 646 | 756 | 799 | **10,217** |
| **Total** | **9,278** | **8,386** | **12,298** | **15,501** | **19,018** | **11,393** | **9,988** | **7,728** | **7,590** | **8,732** | **9,860** | **9,285** | **129,057** |

| Subwatershed 2 | CFS | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** |
| CLARK CR > GRANDE RONDE R | 13.1 | 13.1 | 20 | 20 | 30 | 30 | 30 | 43 | 43 | 43 | 14.6 | 14.6 | 2.55 | 2.55 | 1.09 | 1.09 | 0.36 | 0.36 | 1.46 | 1.46 | 4.73 | 4.73 | 9.83 | 9.83 |
| INDIAN CR > GRANDE RONDE R | 14.6 | 14.6 | 22.5 | 22.5 | 36.7 | 36.7 | 50 | 68 | 68 | 68 | 50 | 50 | 22.3 | 22.3 | 7.89 | 7.89 | 5.4 | 5.4 | 5.49 | 5.49 | 8.27 | 8.27 | 11.2 | 11.2 |
| MILL CR > WILLOW CR | 1.62 | 1.62 | 4 | 4 | 6.93 | 6.93 | 10 | 10 | 6.93 | 6.93 | 1.55 | 1.55 | 0.19 | 0.19 | 0.07 | 0.07 | 0.04 | 0.04 | 0.07 | 0.07 | 0.18 | 0.18 | 1.02 | 1.02 |
| WILLOW CR > GRANDE RONDE R | 13 | 13 | 13 | 13 | 20 | 20 | 34 | 34 | 34 | 34 | 20 | 20 | 8.03 | 8.03 | 7.34 | 7.34 | 5.25 | 5.25 | 6.89 | 6.89 | 11.2 | 11.2 | 13 | 13 |
| WILLOW CR > GRANDE RONDE R | 4 | 4 | 4 | 4 | 7 | 7 | 10 | 10 | 10 | 10 | 7 | 7 | 6.4 | 6.4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

| | Acre-Feet | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** | **Total** |
| CLARK CR > GRANDE RONDE R | 390 | 416 | 555 | 555 | 893 | 952 | 893 | 1279 | 1279 | 1365 | 434 | 434 | 76 | 81 | 32 | 35 | 11 | 11 | 43 | 46 | 141 | 141 | 292 | 312 | **10,666** |
| INDIAN CR > GRANDE RONDE R | 434 | 463 | 625 | 625 | 1092 | 1165 | 1488 | 2023 | 2023 | 2158 | 1488 | 1488 | 663 | 708 | 235 | 250 | 161 | 161 | 163 | 174 | 246 | 246 | 333 | 355 | **18,767** |
| MILL CR > WILLOW CR | 48 | 51 | 111 | 111 | 206 | 220 | 298 | 298 | 206 | 220 | 46 | 46 | 6 | 6 | 2 | 2 | 1 | 1 | 2 | 2 | 5 | 5 | 30 | 32 | **1,957** |
| WILLOW CR > GRANDE RONDE R | 387 | 413 | 361 | 361 | 595 | 635 | 1012 | 1012 | 1012 | 1079 | 595 | 595 | 239 | 255 | 218 | 233 | 156 | 156 | 205 | 219 | 333 | 333 | 387 | 413 | **11,202** |
| WILLOW CR > GRANDE RONDE R | 119 | 127 | 111 | 111 | 208 | 222 | 298 | 298 | 298 | 317 | 208 | 208 | 190 | 203 | 119 | 127 | 119 | 119 | 119 | 127 | 119 | 119 | 119 | 127 | **4,132** |
| **Total** | **1378** | **1470** | **1763** | **1763** | **2994** | **3194** | **3987** | **4909** | **4818** | **5139** | **2771** | **2771** | **1174** | **1253** | **607** | **647** | **448** | **448** | **533** | **568** | **844** | **844** | **1162** | **1239** | **46,725** |

| Subwatershed 2 | Acre-Feet/Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** | **Oct** | **Nov** | **Dec** | **Total** |
| CLARK CR > GRANDE RONDE R | 805 | 1111 | 1845 | 2172 | 2644 | 869 | 157 | 67 | 21 | 90 | 281 | 604 | **10,666** |
| INDIAN CR > GRANDE RONDE R | 898 | 1250 | 2257 | 3511 | 4181 | 2975 | 1371 | 485 | 321 | 338 | 492 | 689 | **18,767** |
| MILL CR > WILLOW CR | 100 | 222 | 426 | 595 | 426 | 92 | 12 | 4 | 2 | 4 | 11 | 63 | **1,957** |
| WILLOW CR > GRANDE RONDE R | 799 | 722 | 1230 | 2023 | 2091 | 1190 | 494 | 451 | 312 | 424 | 666 | 799 | **11,202** |
| WILLOW CR > GRANDE RONDE R | 246 | 222 | 430 | 595 | 615 | 417 | 394 | 246 | 238 | 246 | 238 | 246 | **4,132** |
| **Total** | **2,848** | **3,527** | **6,187** | **8,896** | **9,957** | **5,543** | **2,427** | **1,254** | **896** | **1,101** | **1,689** | **2,401** | **46,725** |

| Subwatershed 3 | CFS | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** |
| GRANDE RONDE R > SNAKE R | 70 | 70 | 70 | 70 | 100 | 100 | 300 | 300 | 300 | 300 | 300 | 200 | 100 | 100 | 30 | 30 | 30 | 30 | 30 | 30 | 70 | 70 | 70 | 70 |

| | Acre-Feet | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** | **Total** |
| GRANDE RONDE R > SNAKE R | 2083 | 2221 | 1944 | 1944 | 2975 | 3174 | 8926 | 8926 | 8926 | 9521 | 8926 | 5950 | 2975 | 3174 | 893 | 952 | 893 | 893 | 893 | 952 | 2083 | 2083 | 2083 | 2221 | 85,607 |

| Subwatershed 3 | Acre-Feet/Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** | **Oct** | **Nov** | **Dec** | **Total** |
| GRANDE RONDE R > SNAKE R | 4304 | 3888 | 6149 | 17851 | 18446 | 14876 | 6149 | 1845 | 1785 | 1845 | 4165 | 4304 | **85,607** |
| **Total** | **4,304** | **3,888** | **6,149** | **17,851** | **18,446** | **14,876** | **6,149** | **1,845** | **1,785** | **1,845** | **4,165** | **4,304** | **85,607** |

| Subwatershed 4 | | | | | | | | | | | | CFS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
| BEAVER CR > GRANDE RONDE R | 11.3 | 11.3 | 16.6 | 16.6 | 31.1 | 31.1 | 68 | 68 | 68 | 68 | 40 | 40 | 13.6 | 13.6 | 5.87 | 5.87 | 5.36 | 5.36 | 6.59 | 6.59 | 9.21 | 9.21 | 9.99 | 9.99 |
| FIVE POINTS CR > GRANDE RONDE R | 17 | 17 | 17 | 17 | 30 | 30 | 43 | 43 | 43 | 43 | 30 | 30 | 6.45 | 6.45 | 3.7 | 3.7 | 3.97 | 3.97 | 4.25 | 4.25 | 8.44 | 8.44 | 12.8 | 12.8 |
| PELICAN CR > FIVE POINTS CR | 7 | 7 | 7 | 7 | 12 | 12 | 17 | 17 | 17 | 17 | 5.3 | 5.3 | 1.11 | 1.11 | 0.5 | 0.5 | 0.55 | 0.55 | 0.62 | 0.62 | 1.4 | 1.4 | 3.39 | 3.39 |
| ROCK CR > GRANDE RONDE R | 13.5 | 13.5 | 17 | 17 | 30 | 30 | 43 | 43 | 43 | 43 | 29.8 | 29.8 | 4.83 | 4.83 | 2.22 | 2.22 | 2.14 | 2.14 | 2.43 | 2.43 | 4.03 | 4.03 | 6.27 | 6.27 |
| SPRING CR > GRANDE RONDE R | 7.04 | 7.04 | 10 | 10 | 15 | 15 | 26 | 26 | 25.9 | 25.9 | 4.29 | 4.29 | 0.88 | 0.88 | 0.46 | 0.46 | 0.39 | 0.39 | 0.46 | 0.46 | 1.3 | 1.3 | 3.14 | 3.14 |

| | | | | | | | | | | | | Acre-Feet | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
| BEAVER CR > GRANDE RONDE R | 336 | 359 | 461 | 461 | 925 | 987 | 2023 | 2023 | 2023 | 2158 | 1190 | 1190 | 405 | 432 | 175 | 186 | 159 | 159 | 196 | 209 | 274 | 274 | 297 | 317 | **17,220** |
| FIVE POINTS CR > GRANDE RONDE R | 506 | 540 | 472 | 472 | 893 | 952 | 1279 | 1279 | 1279 | 1365 | 893 | 893 | 192 | 205 | 110 | 117 | 118 | 118 | 126 | 135 | 251 | 251 | 381 | 406 | **13,233** |
| PELICAN CR > FIVE POINTS CR | 208 | 222 | 194 | 194 | 357 | 381 | 506 | 506 | 506 | 540 | 158 | 158 | 33 | 35 | 15 | 16 | 16 | 16 | 18 | 20 | 42 | 42 | 101 | 108 | **4,391** |
| ROCK CR > GRANDE RONDE R | 402 | 428 | 472 | 472 | 893 | 952 | 1279 | 1279 | 1279 | 1365 | 887 | 887 | 144 | 153 | 66 | 70 | 64 | 64 | 72 | 77 | 120 | 120 | 187 | 199 | **11,930** |
| SPRING CR > GRANDE RONDE R | 209 | 223 | 278 | 278 | 446 | 476 | 774 | 774 | 771 | 822 | 128 | 128 | 26 | 28 | 14 | 15 | 12 | 12 | 14 | 15 | 39 | 39 | 93 | 100 | **5,710** |
| **Total** | **1661** | **1772** | **1877** | **1877** | **3514** | **3748** | **5861** | **5861** | **5858** | **6249** | **3255** | **3255** | **799** | **853** | **379** | **405** | **369** | **369** | **427** | **455** | **725** | **725** | **1059** | **1129** | **52,484** |

| Subwatershed 4 | | | | | | Acre-Feet/Month | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| StreamName | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
| BEAVER CR > GRANDE RONDE R | 695 | 922 | 1912 | 4046 | 4181 | 2380 | 836 | 361 | 319 | 405 | 548 | 614 | **17,220** |
| FIVE POINTS CR > GRANDE RONDE R | 1045 | 944 | 1845 | 2559 | 2644 | 1785 | 397 | 228 | 236 | 261 | 502 | 787 | **13,233** |
| PELICAN CR > FIVE POINTS CR | 430 | 389 | 738 | 1012 | 1045 | 315 | 68 | 31 | 33 | 38 | 83 | 208 | **4,391** |
| ROCK CR > GRANDE RONDE R | 830 | 944 | 1845 | 2559 | 2644 | 1773 | 297 | 137 | 127 | 149 | 240 | 386 | **11,930** |
| SPRING CR > GRANDE RONDE R | 433 | 555 | 922 | 1547 | 1593 | 255 | 54 | 28 | 23 | 28 | 77 | 193 | **5,710** |
| **Total** | **3,433** | **3,754** | **7,262** | **11,722** | **12,107** | **6,509** | **1,652** | **784** | **738** | **882** | **1,451** | **2,188** | **52,484** |

| Subwatershed 5 | | | | | | | | | | | | CFS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
| BEAR CR > MEADOW CR | 1.5 | 1.5 | 4.7 | 4.7 | 9.33 | 9.33 | 15.2 | 15.2 | 8.15 | 8.15 | 1.34 | 1.34 | 0.38 | 0.38 | 0.16 | 0.16 | 0.14 | 0.14 | 0.19 | 0.19 | 0.43 | 0.43 | 1.11 | 1.11 |
| BURNT CORRAL CR > MEADOW CR | 1.12 | 1.12 | 2.83 | 2.83 | 5.61 | 5.61 | 10.5 | 10.5 | 7.43 | 7.43 | 1.34 | 1.34 | 0.37 | 0.37 | 0.1 | 0.1 | 0.12 | 0.12 | 0.17 | 0.17 | 0.42 | 0.42 | 0.87 | 0.87 |
| CLEAR CR > GRANDE RONDE R | 2.39 | 2.39 | 3.2 | 3.2 | 6.18 | 6.18 | 19.5 | 19.5 | 34 | 34 | 20 | 20 | 5.84 | 5.84 | 1.99 | 1.99 | 1.78 | 1.78 | 2.12 | 2.12 | 2.19 | 2.19 | 2.02 | 2.02 |
| DARK CAN CR > MEADOW CR | 3.06 | 3.06 | 9.34 | 9.34 | 17.1 | 17.1 | 26.6 | 26.6 | 13.7 | 13.7 | 2.08 | 2.08 | 0.61 | 0.61 | 0.33 | 0.33 | 0.31 | 0.31 | 0.41 | 0.41 | 0.99 | 0.99 | 2.47 | 2.47 |
| FLY CR > GRANDE RONDE R | 9.63 | 9.63 | 13 | 13 | 20 | 20 | 34 | 34 | 34 | 34 | 20 | 20 | 6.45 | 6.45 | 4.16 | 4.16 | 3.75 | 3.75 | 4.69 | 4.69 | 6.24 | 6.24 | 8.36 | 8.36 |
| LIMBER JIM CR > GRANDE RONDE R | 3.73 | 3.73 | 5.51 | 5.51 | 10.74 | 10.74 | 26 | 26 | 26 | 26 | 19.64 | 19.64 | 4.22 | 4.22 | 1.63 | 1.63 | 1.47 | 1.47 | 1.82 | 1.82 | 2.84 | 2.84 | 3.18 | 3.18 |
| MARLEY CR > MEADOW CR | 1.24 | 1.24 | 3.4 | 3.4 | 6.8 | 6.8 | 11.4 | 11.4 | 6.45 | 6.45 | 1.44 | 1.44 | 0.36 | 0.36 | 0.21 | 0.21 | 0.17 | 0.17 | 0.23 | 0.23 | 0.39 | 0.39 | 0.96 | 0.96 |
| MCCOY CR > MEADOW CR | 8.45 | 8.45 | 13 | 13 | 20 | 20 | 34 | 34 | 34 | 34 | 6 | 6 | 1.88 | 1.88 | 1.05 | 1.05 | 1.08 | 1.08 | 1.4 | 1.4 | 2.7 | 2.7 | 6.69 | 6.69 |
| MEADOW CR > GRANDE RONDE R | 25.8 | 25.8 | 27 | 27 | 40 | 40 | 68 | 68 | 68 | 68 | 24.1 | 24.1 | 6.86 | 6.86 | 4.23 | 4.23 | 3.81 | 3.81 | 5.08 | 5.08 | 8.52 | 8.52 | 20.2 | 20.2 |
| MEADOW CR > GRANDE RONDE R | 6.99 | 6.99 | 10 | 10 | 15 | 15 | 26 | 26 | 26 | 26 | 6.91 | 6.91 | 2.21 | 2.21 | 0.89 | 0.89 | 0.91 | 0.91 | 1.19 | 1.19 | 2.77 | 2.77 | 5.5 | 5.5 |
| SHEEP CR > GRANDE RONDE R | 10.4 | 10.4 | 18.3 | 18.3 | 20 | 34 | 34 | 34 | 34 | 34 | 25 | 25 | 8.13 | 8.13 | 3.52 | 3.52 | 3.13 | 3.13 | 3.95 | 3.95 | 6.66 | 6.66 | 8.88 | 8.88 |
| CHICKEN CR > SHEEP CR | 3.74 | 3.74 | 5.69 | 5.69 | 11.3 | 11.3 | 26 | 26 | 26 | 26 | 15.8 | 15.8 | 3.63 | 3.63 | 1.48 | 1.48 | 1.24 | 1.24 | 1.58 | 1.58 | 2.55 | 2.55 | 3.22 | 3.22 |
| W CHICKEN CR > CHICKEN CR | 1.4 | 1.4 | 2.24 | 2.24 | 4.54 | 4.54 | 10.4 | 10.4 | 11.4 | 11.4 | 3.94 | 3.94 | 0.93 | 0.93 | 0.39 | 0.39 | 0.31 | 0.31 | 0.41 | 0.41 | 0.85 | 0.85 | 1.2 | 1.2 |

| | | | | | | | | | | | | Acre-Feet | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
| BEAR CR > MEADOW CR | 45 | 48 | 131 | 131 | 278 | 296 | 452 | 452 | 242 | 259 | 40 | 40 | 11 | 12 | 5 | 5 | 4 | 4 | 6 | 6 | 13 | 13 | 33 | 35 | **2,559** |
| BURNT CORRAL CR > MEADOW CR | 33 | 36 | 79 | 79 | 167 | 178 | 312 | 312 | 221 | 236 | 40 | 40 | 11 | 12 | 3 | 3 | 4 | 4 | 5 | 5 | 12 | 12 | 26 | 28 | **1,857** |
| CLEAR CR > GRANDE RONDE R | 71 | 76 | 89 | 89 | 184 | 196 | 580 | 580 | 1012 | 1079 | 595 | 595 | 174 | 185 | 59 | 63 | 53 | 53 | 63 | 67 | 65 | 65 | 60 | 64 | **6,118** |
| DARK CAN CR > MEADOW CR | 91 | 97 | 259 | 259 | 509 | 543 | 791 | 791 | 408 | 435 | 62 | 62 | 18 | 19 | 10 | 10 | 9 | 9 | 12 | 13 | 29 | 29 | 73 | 78 | **4,620** |
| FLY CR > GRANDE RONDE R | 287 | 306 | 361 | 361 | 595 | 635 | 1012 | 1012 | 1012 | 1079 | 595 | 595 | 192 | 205 | 124 | 132 | 112 | 112 | 140 | 149 | 186 | 186 | 249 | 265 | **9,897** |
| LIMBER JIM CR > GRANDE RONDE R | 111 | 118 | 153 | 153 | 320 | 341 | 774 | 774 | 774 | 825 | 584 | 584 | 126 | 134 | 48 | 52 | 44 | 44 | 54 | 58 | 84 | 84 | 95 | 101 | **6,434** |
| MARLEY CR > MEADOW CR | 37 | 39 | 94 | 94 | 202 | 216 | 339 | 339 | 192 | 205 | 43 | 43 | 11 | 11 | 6 | 7 | 5 | 5 | 7 | 7 | 12 | 12 | 29 | 30 | **1,985** |
| MCCOY CR > MEADOW CR | 251 | 268 | 361 | 361 | 595 | 635 | 1012 | 1012 | 1012 | 1079 | 179 | 179 | 56 | 60 | 31 | 33 | 32 | 32 | 42 | 44 | 80 | 80 | 199 | 212 | **7,845** |
| MEADOW CR > GRANDE RONDE R | 768 | 819 | 750 | 750 | 1190 | 1269 | 2023 | 2023 | 2023 | 2158 | 717 | 717 | 204 | 218 | 126 | 134 | 113 | 113 | 151 | 161 | 253 | 253 | 601 | 641 | **18,177** |
| MEADOW CR > GRANDE RONDE R | 208 | 222 | 278 | 278 | 446 | 476 | 774 | 774 | 774 | 825 | 206 | 206 | 66 | 70 | 26 | 28 | 27 | 27 | 35 | 38 | 82 | 82 | 164 | 175 | **6,285** |
| SHEEP CR > GRANDE RONDE R | 309 | 330 | 508 | 508 | 595 | 1079 | 1012 | 1012 | 1012 | 1079 | 744 | 744 | 242 | 258 | 105 | 112 | 93 | 93 | 118 | 125 | 198 | 198 | 264 | 282 | **11,019** |
| CHICKEN CR > SHEEP CR | 111 | 119 | 158 | 158 | 336 | 359 | 774 | 774 | 774 | 825 | 470 | 470 | 108 | 115 | 44 | 47 | 37 | 37 | 47 | 50 | 76 | 76 | 96 | 102 | **6,162** |
| W CHICKEN CR > CHICKEN CR | 42 | 44 | 62 | 62 | 135 | 144 | 309 | 309 | 339 | 362 | 117 | 117 | 28 | 30 | 12 | 12 | 9 | 9 | 12 | 13 | 25 | 25 | 36 | 38 | **2,293** |
| **Total** | **2,364** | **2,521** | **3,283** | **3,283** | **5,552** | **6,366** | **10,163** | **10,163** | **9,792** | **10,445** | **4,391** | **4,391** | **1,246** | **1,329** | **599** | **639** | **542** | **542** | **691** | **738** | **1,117** | **1,117** | **1,924** | **2,052** | **85,251** |

| Subwatershed 5 | | | | | | Acre-Feet/Month | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| StreamName | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
| BEAR CR > MEADOW CR | **92** | **261** | **574** | **904** | **501** | **80** | **23** | **10** | **8** | **12** | **26** | **68** | **2,559** |
| BURNT CORRAL CR > MEADOW CR | **69** | **157** | **345** | **625** | **457** | **80** | **23** | **6** | **7** | **10** | **25** | **53** | **1,857** |
| CLEAR CR > GRANDE RONDE R | **147** | **178** | **380** | **1160** | **2091** | **1190** | **359** | **122** | **106** | **130** | **130** | **124** | **6,118** |
| DARK CAN CR > MEADOW CR | **188** | **519** | **1051** | **1583** | **842** | **124** | **38** | **20** | **18** | **25** | **59** | **152** | **4,620** |
| FLY CR > GRANDE RONDE R | **592** | **722** | **1230** | **2023** | **2091** | **1190** | **397** | **256** | **223** | **288** | **371** | **514** | **9,897** |
| LIMBER JIM CR > GRANDE RONDE R | **229** | **306** | **660** | **1547** | **1599** | **1169** | **259** | **100** | **87** | **112** | **169** | **196** | **6,434** |
| MARLEY CR > MEADOW CR | **76** | **189** | **418** | **678** | **397** | **86** | **22** | **13** | **10** | **14** | **23** | **59** | **1,985** |
| MCCOY CR > MEADOW CR | **520** | **722** | **1230** | **2023** | **2091** | **357** | **116** | **65** | **64** | **86** | **161** | **411** | **7,845** |
| MEADOW CR > GRANDE RONDE R | **1586** | **1500** | **2460** | **4046** | **4181** | **1434** | **422** | **260** | **227** | **312** | **507** | **1242** | **18,177** |
| MEADOW CR > GRANDE RONDE R | **430** | **555** | **922** | **1547** | **1599** | **411** | **136** | **55** | **54** | **73** | **165** | **338** | **6,285** |
| SHEEP CR > GRANDE RONDE R | **639** | **1016** | **1674** | **2023** | **2091** | **1488** | **500** | **216** | **186** | **243** | **396** | **546** | **11,019** |
| CHICKEN CR > SHEEP CR | **230** | **316** | **695** | **1547** | **1599** | **940** | **223** | **91** | **74** | **97** | **152** | **198** | **6,162** |
| W CHICKEN CR > CHICKEN CR | **86** | **124** | **279** | **619** | **701** | **234** | **57** | **24** | **18** | **25** | **51** | **74** | **2,293** |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total** | **956** | **1,457** | **2,648** | **4,189** | **4,390** | **2,662** | **780** | **331** | **278** | **365** | **599** | **818** | **19,474** |

| Subwatershed 6 | No ISWR's |
|---|---|

| Subwatershed 7 | CFS | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** |
| CATHERINE CR > GRANDE RONDE R | 30 | 30 | 30 | 30 | 100 | 100 | 200 | 200 | 200 | 200 | 200 | 125 | 80 | 80 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| LITTLE CR > CATHERINE CR | 12.5 | 12.5 | 20 | 20 | 20 | 26.5 | 34 | 34 | 34 | 34 | 20 | 20 | 12.9 | 12.9 | 7.38 | 7.38 | 5.76 | 5.76 | 7.38 | 7.38 | 6.8 | 6.8 | 9.74 | 9.74 |

| | Acre-Feet | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** | **Total** |
| CATHERINE CR > GRANDE RONDE R | 893 | 952 | 833 | 833 | 2975 | 3174 | 5950 | 5950 | 5950 | 6347 | 5950 | 3719 | 2380 | 2539 | 893 | 952 | 893 | 893 | 893 | 952 | 893 | 893 | 893 | 952 | **57,550** |
| LITTLE CR > CATHERINE CR | 372 | 397 | 555 | 555 | 595 | 841 | 1012 | 1012 | 1012 | 1079 | 595 | 595 | 384 | 409 | 220 | 234 | 171 | 171 | 220 | 234 | 202 | 202 | 290 | 309 | **11,666** |
| **Total** | 1264 | 1349 | 1388 | 1388 | 3570 | 4015 | 6962 | 6962 | 6962 | 7426 | 6545 | 4314 | 2764 | 2948 | 1112 | 1186 | 1064 | 1064 | 1112 | 1186 | 1095 | 1095 | 1182 | 1261 | **69,217** |

| Subwatershed 7 | Acre-Feet/Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** | **Oct** | **Nov** | **Dec** | **Total** |
| CATHERINE CR > GRANDE RONDE R | 1845 | 1666 | 6149 | 11901 | 12298 | 9669 | 4919 | 1845 | 1785 | 1845 | 1785 | 1845 | **57,550** |
| LITTLE CR > CATHERINE CR | 769 | 1111 | 1436 | 2023 | 2091 | 1190 | 793 | 454 | 343 | 454 | 405 | 599 | **11,666** |
| **Total** | **2,613** | **2,777** | **7,585** | **13,924** | **14,388** | **10,860** | **5,712** | **2,298** | **2,128** | **2,298** | **2,190** | **2,444** | **69,217** |

| Subwatershed 8 | CFS | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** |
| CATHERINE CR > GRANDE RONDE R | 30 | 30 | 30 | 30 | 30 | 60 | 60 | 60 | 70 | 70 | 70 | 70 | 70 | 70 | 37.8 | 37.8 | 31 | 31 | 29.5 | 29.5 | 34 | 34 | 30 | 30 |
| LITTLE CATHERINE CR > CATHERINE CR | 5 | 5 | 7.08 | 7.08 | 10.7 | 10.7 | 20 | 20 | 20 | 20 | 13 | 13 | 11.6 | 11.6 | 5 | 5 | 4.36 | 4.36 | 4.15 | 4.15 | 4.78 | 4.78 | 5 | 5 |
| N FK CATHERINE CR > CATHERINE CR | 15.4 | 15.4 | 19.2 | 19.2 | 29 | 29 | 50 | 50 | 50 | 50 | 34 | 34 | 31.4 | 31.4 | 14.5 | 14.5 | 11.8 | 11.8 | 11.3 | 11.3 | 13 | 13 | 14 | 14 |
| S FK CATHERINE CR > CATHERINE CR | 11.9 | 11.9 | 14.8 | 14.8 | 20 | 22.4 | 34 | 34 | 34 | 34 | 20 | 20 | 20 | 20 | 11.2 | 11.2 | 9.15 | 9.15 | 8.7 | 8.7 | 10 | 10 | 10.9 | 10.9 |

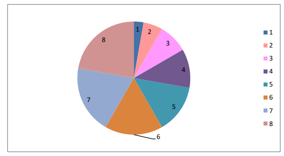
| | Acre-Feet | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan Beg** | **Jan End** | **Feb Beg** | **Feb End** | **Mar Beg** | **Mar End** | **Apr Beg** | **Apr End** | **May Beg** | **May End** | **Jun Beg** | **Jun End** | **Jul Beg** | **Jul End** | **Aug Beg** | **Aug End** | **Sept Beg** | **Sept End** | **Oct Beg** | **Oct End** | **Nov Beg** | **Nov End** | **Dec Beg** | **Dec End** | **Total** |
| CATHERINE CR > GRANDE RONDE R | 893 | 952 | 833 | 833 | 893 | 1904 | 1785 | 1785 | 2083 | 2221 | 2083 | 2083 | 2083 | 2221 | 1125 | 1200 | 922 | 922 | 878 | 936 | 1012 | 1012 | 893 | 952 | **32,502** |
| LITTLE CATHERINE CR > CATHERINE CR | 149 | 159 | 197 | 197 | 318 | 340 | 595 | 595 | 595 | 635 | 387 | 387 | 345 | 368 | 149 | 159 | 130 | 130 | 123 | 132 | 142 | 142 | 149 | 159 | **6,679** |
| N FK CATHERINE CR > CATHERINE CR | 458 | 489 | 533 | 533 | 863 | 920 | 1488 | 1488 | 1488 | 1587 | 1012 | 1012 | 934 | 996 | 431 | 460 | 351 | 351 | 336 | 359 | 387 | 387 | 417 | 444 | **17,723** |
| S FK CATHERINE CR > CATHERINE CR | 354 | 378 | 411 | 411 | 595 | 711 | 1012 | 1012 | 1012 | 1079 | 595 | 595 | 595 | 635 | 333 | 355 | 272 | 272 | 259 | 276 | 298 | 298 | 324 | 346 | **12,426** |
| **Total** | **1854** | **1977** | **1974** | **1974** | **2669** | **3875** | **4879** | **4879** | **5177** | **5522** | **4076** | **4076** | **3957** | **4221** | **2038** | **2174** | **1675** | **1675** | **1596** | **1703** | **1838** | **1838** | **1782** | **1901** | **69,330** |

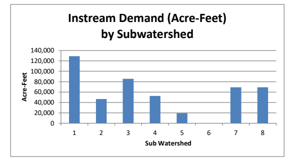
| Subwatershed 8 | Acre-Feet/Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **StreamName** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** | **Oct** | **Nov** | **Dec** | **Total** |
| CATHERINE CR > GRANDE RONDE R | 1845 | 1666 | 2797 | 3570 | 4304 | 4165 | 4304 | 2324 | 1845 | 1814 | 2023 | 1845 | **32,502** |
| LITTLE CATHERINE CR > CATHERINE CR | 307 | 393 | 658 | 1190 | 1230 | 774 | 713 | 307 | 259 | 255 | 284 | 307 | **6,679** |
| N FK CATHERINE CR > CATHERINE CR | 947 | 1066 | 1783 | 2975 | 3074 | 2023 | 1931 | 892 | 702 | 695 | 774 | 861 | **17,723** |
| S FK CATHERINE CR > CATHERINE CR | 732 | 822 | 1306 | 2023 | 2091 | 1190 | 1230 | 689 | 544 | 535 | 595 | 670 | **12,426** |
| **Total** | **3,831** | **3,948** | **6,544** | **9,759** | **10,699** | **8,152** | **8,178** | **4,212** | **3,351** | **3,299** | **3,676** | **3,683** | **69,330** |

| StreamName | Acre-Feet/Month Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subwatershed 1 | | | | | | | | | | | | | |
| CABIN CR > GRANDE RONDE R | 1230 | 1111 | 1845 | 2380 | 3074 | 1244 | 762 | 646 | 678 | 1144 | 1190 | 1230 | **16,533** |
| GORDON CR > GRANDE RONDE R | 799 | 722 | 1230 | 1607 | 2091 | 1190 | 1088 | 799 | 774 | 799 | 774 | 799 | **12,672** |
| JARBOE CR > LOOKINGGLASS CR | 793 | 722 | 1230 | 1607 | 2091 | 1190 | 830 | 652 | 631 | 652 | 774 | 799 | **11,969** |
| LITTLE LOOKINGGLASS CR > LOOKINGGLASS CI | 3997 | 3610 | 3997 | 4909 | 6149 | 4760 | 4919 | 3941 | 3820 | 3960 | 4760 | 3997 | **52,819** |
| N FK CABIN CR > CABIN CR | 615 | 555 | 922 | 1220 | 1248 | 492 | 300 | 279 | 289 | 487 | 595 | 615 | **7,617** |
| PHILLIPS CR > GRANDE RONDE R | 1045 | 944 | 1845 | 2172 | 2644 | 1785 | 1636 | 1045 | 1012 | 1045 | 1012 | 1045 | **17,230** |
| S FK CABIN CR > CABIN CR | 799 | 722 | 1230 | 1607 | 1722 | 732 | 453 | 366 | 387 | 646 | 756 | 799 | **10,217** |
| **Total** | **9,278** | **8,386** | **12,298** | **15,501** | **19,018** | **11,393** | **9,988** | **7,728** | **7,590** | **8,732** | **9,860** | **9,285** | **129,057** |
| Subwatershed 2 | | | | | | | | | | | | | |
| CLARK CR > GRANDE RONDE R | 805 | 1111 | 1845 | 2172 | 2644 | 869 | 157 | 67 | 21 | 90 | 281 | 604 | **10,666** |
| INDIAN CR > GRANDE RONDE R | 898 | 1250 | 2257 | 3511 | 4181 | 2975 | 1371 | 485 | 321 | 338 | 492 | 689 | **18,767** |
| MILL CR > WILLOW CR | 100 | 222 | 426 | 595 | 426 | 92 | 12 | 4 | 2 | 4 | 11 | 63 | **1,957** |
| WILLOW CR > GRANDE RONDE R | 799 | 722 | 1230 | 2023 | 2091 | 1190 | 494 | 451 | 312 | 424 | 666 | 799 | **11,202** |
| WILLOW CR > GRANDE RONDE R | 246 | 222 | 430 | 595 | 615 | 417 | 394 | 246 | 238 | 246 | 238 | 246 | **4,132** |
| **Total** | **2,848** | **3,527** | **6,187** | **8,896** | **9,957** | **5,543** | **2,427** | **1,254** | **896** | **1,101** | **1,689** | **2,401** | **46,725** |
| Subwatershed 3 | | | | | | | | | | | | | |
| GRANDE RONDE R > SNAKE R | 4304 | 3888 | 6149 | 17851 | 18446 | 14876 | 6149 | 1845 | 1785 | 1845 | 4165 | 4304 | **85,607** |
| **Total** | **4,304** | **3,888** | **6,149** | **17,851** | **18,446** | **14,876** | **6,149** | **1,845** | **1,785** | **1,845** | **4,165** | **4,304** | **85,607** |
| Subwatershed 4 | | | | | | | | | | | | | |
| BEAVER CR > GRANDE RONDE R | 695 | 922 | 1912 | 4046 | 4181 | 2380 | 836 | 361 | 319 | 405 | 548 | 614 | **17,220** |
| FIVE POINTS CR > GRANDE RONDE R | 1045 | 944 | 1845 | 2559 | 2644 | 1785 | 397 | 228 | 236 | 261 | 502 | 787 | **13,233** |
| PELICAN CR > FIVE POINTS CR | 430 | 389 | 738 | 1012 | 1045 | 315 | 68 | 31 | 33 | 38 | 83 | 208 | **4,391** |
| ROCK CR > GRANDE RONDE R | 830 | 944 | 1845 | 2559 | 2644 | 1773 | 297 | 137 | 127 | 149 | 240 | 386 | **11,930** |
| SPRING CR > GRANDE RONDE R | 433 | 555 | 922 | 1547 | 1593 | 255 | 54 | 28 | 23 | 28 | 77 | 193 | **5,710** |
| **Total** | **3,433** | **3,754** | **7,262** | **11,722** | **12,107** | **6,509** | **1,652** | **784** | **738** | **882** | **1,451** | **2,188** | **52,484** |
| Subwatershed 5 | | | | | | | | | | | | | |
| BEAR CR > MEADOW CR | 92 | 261 | 574 | 904 | 501 | 80 | 23 | 10 | 8 | 12 | 26 | 68 | **2,559** |
| BURNT CORRAL CR > MEADOW CR | 69 | 157 | 345 | 625 | 457 | 80 | 23 | 6 | 7 | 10 | 25 | 53 | **1,857** |
| CLEAR CR > GRANDE RONDE R | 147 | 178 | 380 | 1160 | 2091 | 1190 | 359 | 122 | 106 | 130 | 130 | 124 | **6,118** |
| DARK CAN CR > MEADOW CR | 188 | 519 | 1051 | 1583 | 842 | 124 | 38 | 20 | 18 | 25 | 59 | 152 | **4,620** |
| FLY CR > GRANDE RONDE R | 592 | 722 | 1230 | 2023 | 2091 | 1190 | 397 | 256 | 223 | 288 | 371 | 514 | **9,897** |
| LIMBER JIM CR > GRANDE RONDE R | 229 | 306 | 660 | 1547 | 1599 | 1169 | 259 | 100 | 87 | 112 | 169 | 196 | **6,434** |
| MARLEY CR > MEADOW CR | 76 | 189 | 418 | 678 | 397 | 86 | 22 | 13 | 10 | 14 | 23 | 59 | **1,985** |
| MCCOY CR > MEADOW CR | 520 | 722 | 1230 | 2023 | 2091 | 357 | 116 | 65 | 64 | 86 | 161 | 411 | **7,845** |
| MEADOW CR > GRANDE RONDE R | 1586 | 1500 | 2460 | 4046 | 4181 | 1434 | 422 | 260 | 227 | 312 | 507 | 1242 | **18,177** |
| MEADOW CR > GRANDE RONDE R | 430 | 555 | 922 | 1547 | 1599 | 411 | 136 | 55 | 54 | 73 | 165 | 338 | **6,285** |
| SHEEP CR > GRANDE RONDE R | 639 | 1016 | 1674 | 2023 | 2091 | 1488 | 500 | 216 | 186 | 243 | 396 | 546 | **11,019** |
| CHICKEN CR > SHEEP CR | 230 | 316 | 695 | 1547 | 1599 | 940 | 223 | 91 | 74 | 97 | 152 | 198 | **6,162** |
| W CHICKEN CR > CHICKEN CR | 86 | 124 | 279 | 619 | 701 | 234 | 57 | 24 | 18 | 25 | 51 | 74 | **2,293** |
| **Total** | **956** | **1,457** | **2,648** | **4,189** | **4,390** | **2,662** | **780** | **331** | **278** | **365** | **599** | **818** | **19,474** |
| Subwatershed 6 | | | | | | | | | | | | | |
| | No ISWR's | | | | | | | | | | | | |
| Subwatershed 7 | | | | | | | | | | | | | |
| CATHERINE CR > GRANDE RONDE R | 1845 | 1666 | 6149 | 11901 | 12298 | 9669 | 4919 | 1845 | 1785 | 1845 | 1785 | 1845 | **57,550** |
| LITTLE CR > CATHERINE CR | 769 | 1111 | 1436 | 2023 | 2091 | 1190 | 793 | 454 | 343 | 454 | 405 | 599 | **11,666** |
| **Total** | **2,613** | **2,777** | **7,585** | **13,924** | **14,388** | **10,860** | **5,712** | **2,298** | **2,128** | **2,298** | **2,190** | **2,444** | **69,217** |
| Subwatershed 8 | | | | | | | | | | | | | |
| CATHERINE CR > GRANDE RONDE R | 1845 | 1666 | 2797 | 3570 | 4304 | 4165 | 4304 | 2324 | 1845 | 1814 | 2023 | 1845 | **32,502** |
| LITTLE CATHERINE CR > CATHERINE CR | 307 | 393 | 658 | 1190 | 1230 | 774 | 713 | 307 | 259 | 255 | 284 | 307 | **6,679** |
| N FK CATHERINE CR > CATHERINE CR | 947 | 1066 | 1783 | 2975 | 3074 | 2023 | 1931 | 892 | 702 | 695 | 774 | 861 | **17,723** |
| S FK CATHERINE CR > CATHERINE CR | 732 | 822 | 1306 | 2023 | 2091 | 1190 | 1230 | 689 | 544 | 535 | 595 | 670 | **12,426** |
| **Total** | **3,831** | **3,948** | **6,544** | **9,759** | **10,699** | **8,152** | **8,178** | **4,212** | **3,351** | **3,299** | **3,676** | **3,683** | **69,330** |

| Subwatershed | Demand (Acre-Feet) |
|---|---|
| 1 | 129,057 |
| 2 | 46,725 |
| 3 | 85,607 |
| 4 | 52,484 |
| 5 | 19,474 |
| 6 | 0 |
| 7 | 69,217 |
| 8 | 69,330 |

| Subwatersh | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Demand (Acre- | 129,057 | 46,725 | 85,607 | 52,484 | 19,474 | 0 | 69,217 | 69,330 |



Subwatershed 1 — Source: Grande Ronde Basin Investigation

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 7140 | 7617 | 6664 | 6664 | 7140 | 7617 | 7140 | 7140 | 7140 | 7617 | 7140 | 7140 | 7140 | 7617 | 7140 | 7617 | 7140 | 7140 | 7140 | 7617 | 7140 | 7140 | 7140 | 7617 | **173752** |

Acre-Feet/Month

| StreamName | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 14757 | 13329 | 14757 | 14281 | 14757 | 14281 | 14757 | 14757 | 14281 | 14757 | 14281 | 14757 | **173752** |

Subwatershed 2 — Source: Grande Ronde Basin Investigation

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 175 | 175 | 175 | 175 | 175 | 175 | 300 | 300 | 300 | 300 | 175 | 175 | 175 | 175 | 175 | 175 | 175 | 175 | 175 | 175 | 175 | 175 | 175 | 175 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 5207 | 5554 | 4860 | 4860 | 5207 | 5554 | 8926 | 8926 | 8926 | 9521 | 5207 | 5207 | 5207 | 5554 | 5207 | 5554 | 5207 | 5207 | 5207 | 5554 | 5207 | 5207 | 5207 | 5554 | **141818** |

Acre-Feet/Month

| StreamName | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 10760 | 9719 | 10760 | 17851 | 18446 | 10413 | 10760 | 10760 | 10413 | 10760 | 10413 | 10760 | **141818** |

Subwatershed 3 — Source: Certificate 59539

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 70 | 70 | 70 | 70 | 100 | 100 | 300 | 300 | 300 | 300 | 300 | 200 | 100 | 100 | 30 | 30 | 30 | 30 | 30 | 30 | 70 | 70 | 70 | 70 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 2083 | 2221 | 1944 | 1944 | 2975 | 3174 | 8926 | 8926 | 8926 | 9521 | 8926 | 5950 | 2975 | 3174 | 893 | 952 | 893 | 893 | 893 | 952 | 2083 | 2083 | 2083 | 2221 | **85607** |

Acre-Feet/Month

| StreamName | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 4304 | 3888 | 6149 | 17851 | 18446 | 14876 | 6149 | 1845 | 1785 | 1845 | 4165 | 4304 | **85607** |

Subwatershed 4 — Source: Certificate 59539

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 70 | 70 | 70 | 70 | 100 | 100 | 300 | 300 | 300 | 300 | 300 | 200 | 100 | 100 | 30 | 30 | 30 | 30 | 30 | 30 | 70 | 70 | 70 | 70 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 2083 | 2221 | 1944 | 1944 | 2975 | 3174 | 8926 | 8926 | 8926 | 9521 | 8926 | 5950 | 2975 | 3174 | 893 | 952 | 893 | 893 | 893 | 952 | 2083 | 2083 | 2083 | 2221 | **85607** |

Acre-Feet/Month

| StreamName | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 4304 | 3888 | 6149 | 17851 | 18446 | 14876 | 6149 | 1845 | 1785 | 1845 | 4165 | 4304 | **85607** |

Subwatershed 5 — Source: Grande Ronde Basin Investigation

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 40 | 40 | 40 | 50 | 50 | 50 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 100 | 100 | 100 | | 75 | 75 | 75 | 40 | 40 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 1190 | 1269 | 1111 | 1388 | 1488 | 1587 | 2231 | 2231 | 2231 | 2380 | 2231 | 2231 | 2231 | 2380 | 2231 | 3174 | 2975 | 2975 | 0 | 2380 | 2231 | 2231 | 1190 | 1269 | **46840** |

Acre-Feet/Month

| StreamName | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grande Ronde River | 2460 | 2499 | 3074 | 4463 | 4612 | 4463 | 4612 | 5405 | 5950 | 2380 | 4463 | 2460 | **46840** |

Subwatershed 6 — Source: Certificate 59537 (Note that this legally only applies upstream of the Swackhammer diversion)

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catherine Creek | 30 | 30 | 30 | 30 | 100 | 100 | 200 | 200 | 200 | 200 | 200 | 125 | 80 | 80 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catherine Creek | 893 | 952 | 833 | 833 | 2975 | 3174 | 5950 | 5950 | 5950 | 6347 | 5950 | 3719 | 2380 | 2539 | 893 | 952 | 893 | 893 | 893 | 952 | 893 | 893 | 893 | 952 | **57550** |

Acre-Feet/Month

| StreamName | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catherine Creek | 1845 | 1666 | 6149 | 11901 | 12298 | 9669 | 4919 | 1845 | 1785 | 1845 | 1785 | 1845 | **57550** |

Subwatershed 7 — Source: Certificate 59537

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catherine Creek | 30 | 30 | 30 | 30 | 100 | 100 | 200 | 200 | 200 | 200 | 200 | 125 | 80 | 80 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catherine Creek | 893 | 952 | 833 | 833 | 2975 | 3174 | 5950 | 5950 | 5950 | 6347 | 5950 | 3719 | 2380 | 2539 | 893 | 952 | 893 | 893 | 893 | 952 | 893 | 893 | 893 | 952 | **57550** |

Acre-Feet/Month

| StreamName | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catherine Creek | 1845 | 1666 | 6149 | 11901 | 12298 | 9669 | 4919 | 1845 | 1785 | 1845 | 1785 | 1845 | **57550** |

Subwatershed 8 — Source: Certificate 73316

CFS

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cathereine Creek | 30 | 30 | 30 | 30 | 30 | 60 | 60 | 60 | 70 | 70 | 70 | 70 | 70 | 70 | 37.8 | 37.8 | 31 | 31 | 29.5 | 29.5 | 34 | 34 | 30 | 30 |

Acre-Feet

| StreamName | Jan Beg | Jan End | Feb Beg | Feb End | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catherine Creek | 893 | 952 | 833 | 833 | 893 | 1904 | 1785 | 1785 | 2083 | 2221 | 2083 | 2083 | 2083 | 2221 | 1125 | 1200 | 922 | 922 | 878 | 936 | 1012 | 1012 | 893 | 952 | **32502** |

Acre-Feet/Month

| StreamName | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catherine Creek | 1845 | 1666 | 2797 | 3570 | 4304 | 4165 | 4304 | 2324 | 1845 | 1814 | 2023 | 1845 | **32502** |

| Subwatershed | Acre-Feet/Month Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 14757 | 13329 | 14757 | 14281 | 14757 | 14281 | 14757 | 14757 | 14281 | 14757 | 14281 | 14757 | **173752** |
| 2 | 10760 | 9719 | 10760 | 17851 | 18446 | 10413 | 10760 | 10760 | 10413 | 10760 | 10413 | 10760 | **141818** |
| 3 | 4304 | 3888 | 6149 | 17851 | 18446 | 14876 | 6149 | 1845 | 1785 | 1845 | 4165 | 4304 | **85607** |
| 4 | 4304 | 3888 | 6149 | 17851 | 18446 | 14876 | 6149 | 1845 | 1785 | 1845 | 4165 | 4304 | **85607** |
| 5 | 2460 | 2499 | 3074 | 4463 | 4612 | 4463 | 4612 | 5405 | 5950 | 2380 | 4463 | 2460 | **46840** |
| 6 | 1845 | 1666 | 6149 | 11901 | 12298 | 9669 | 4919 | 1845 | 1785 | 1845 | 1785 | 1845 | **57550** |
| 7 | 1845 | 1666 | 6149 | 11901 | 12298 | 9669 | 4919 | 1845 | 1785 | 1845 | 1785 | 1845 | **57550** |
| 8 | 1845 | 1666 | 2797 | 3570 | 4304 | 4165 | 4304 | 2324 | 1845 | 1814 | 2023 | 1845 | **32502** |
| **Total** | **42,119** | **38,321** | **55,983** | **99,669** | **103,607** | **82,413** | **56,569** | **40,625** | **39,630** | **37,090** | **43,081** | **42,119** | **681,226** |

| Subwatershed | Source for flow values |
|---|---|
| 1 | Grande Ronde Basin Investigation |
| 2 | Grande Ronde Basin Investigation |
| 3 | Certificate 59539 |
| 4 | Certificate 59539 |
| 5 | Grande Ronde Basin Investigation |
| 6 | Certificate 59537 (Note that this legally only applies upstream of the Swackhammer diversion) |
| 7 | Certificate 59537 |
| 8 | Certificate 73316 |

Subwatershed 1

Source: Grande Ronde Basin Investigation

| StreamName | | Oct Beg | Oct End | Nov Beg | Nov End | Dec Beg | Dec End | Jan Beg | Jan End | Feb Beg | Feb End |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 7140.49576 | 7616.52882 | 7140.4958 | 7140.4958 | 7140.4958 | 7616.5288 | 7140.4958 | 7616.5288 | 6664.46271 | 6664.463 |
| | 2 | 5206.6115 | 5553.71893 | 5206.6115 | 5206.6115 | 5206.6115 | 5553.7189 | 5206.6115 | 5553.7189 | 4859.50406 | 4859.504 |
| | 3 | 892.561971 | 952.066102 | 2082.6446 | 2082.6446 | 2082.6446 | 2221.4876 | 2082.6446 | 2221.4876 | 1943.80162 | 1943.802 |
| | 4 | 892.561971 | 952.066102 | 2082.6446 | 2082.6446 | 2082.6446 | 2221.4876 | 2082.6446 | 2221.4876 | 1943.80162 | 1943.802 |
| | 5 | 0 | 2380.16525 | 2231.4049 | 2231.4049 | 1190.0826 | 1269.4215 | 1190.0826 | 1269.4215 | 1110.74379 | 1388.43 |
| | 6 | 892.561971 | 952.066102 | 892.56197 | 892.56197 | 892.56197 | 952.0661 | 892.56197 | 952.0661 | 833.057839 | 833.0578 |
| | 7 | 892.561971 | 952.066102 | 892.56197 | 892.56197 | 892.56197 | 952.0661 | 892.56197 | 952.0661 | 833.057839 | 833.0578 |
| | 8 | 877.685938 | 936.198334 | 1011.5702 | 1011.5702 | 892.56197 | 952.0661 | 892.56197 | 952.0661 | 833.057839 | 833.0578 |
| Total Bi Weekly | | 16795.0411 | 20294.8757 | 21540.496 | 21540.496 | 20380.165 | 21738.843 | 20380.165 | 21738.843 | 19021.4873 | 19299.17 |

| StreamName | | Mar Beg | Mar End | Apr Beg | Apr End | May Beg | May End | Jun Beg | Jun End | Jul Beg | Jul End | Aug Beg | Aug End | Sept Beg | Sept End | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 7140.496 | 7616.529 | 7140.496 | 7140.496 | 7140.496 | 7616.529 | 7140.496 | 7140.496 | 7140.496 | 7616.529 | 7140.496 | 7616.529 | 7140.496 | 7140.496 | 173752.1 |
| | 2 | 5206.611 | 5553.719 | 8925.62 | 8925.62 | 8925.62 | 9520.661 | 5206.611 | 5206.611 | 5206.611 | 5553.719 | 5206.611 | 5553.719 | 5206.611 | 5206.611 | 141818.2 |
| | 3 | 2975.207 | 3173.554 | 8925.62 | 8925.62 | 8925.62 | 9520.661 | 8925.62 | 5950.413 | 2975.207 | 3173.554 | 892.562 | 952.0661 | 892.562 | 892.562 | 85606.61 |
| | 4 | 2975.207 | 3173.554 | 8925.62 | 8925.62 | 8925.62 | 9520.661 | 8925.62 | 5950.413 | 2975.207 | 3173.554 | 892.562 | 952.0661 | 892.562 | 892.562 | 85606.61 |
| | 5 | 1487.603 | 1586.777 | 2231.405 | 2231.405 | 2231.405 | 2380.165 | 2231.405 | 2231.405 | 2231.405 | 2380.165 | 2231.405 | 3173.554 | 2975.207 | 2975.207 | 46839.67 |
| | 6 | 2975.207 | 3173.554 | 5950.413 | 5950.413 | 5950.413 | 6347.107 | 5950.413 | 3719.008 | 2380.165 | 2538.843 | 892.562 | 952.0661 | 892.562 | 892.562 | 57550.41 |
| | 7 | 2975.207 | 3173.554 | 5950.413 | 5950.413 | 5950.413 | 6347.107 | 5950.413 | 3719.008 | 2380.165 | 2538.843 | 892.562 | 952.0661 | 892.562 | 892.562 | 57550.41 |
| | 8 | 892.562 | 1904.132 | 1785.124 | 1785.124 | 2082.645 | 2221.488 | 2082.645 | 2082.645 | 2082.645 | 2221.488 | 1124.628 | 1199.603 | 922.314 | 922.314 | 32501.75 |
| Total Bi Weekly | | 26628.1 | 29355.37 | 49834.71 | 49834.71 | 50132.23 | 53474.38 | 46413.22 | 36000 | 27371.9 | 29196.69 | 19273.39 | 21351.67 | 19814.88 | 19814.88 | 681225.7 |

| StreamName | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Total Bi Weekly |
|---|---|---|---|---|---|---|---|---|---|
| Oct Beg | 7,140 | 5,207 | 893 | 893 | - | 893 | 893 | 878 | 16,795 |
| Oct End | 7,617 | 5,554 | 952 | 952 | 2,380 | 952 | 952 | 936 | 20,295 |
| Nov Beg | 7,140 | 5,207 | 2,083 | 2,083 | 2,231 | 893 | 893 | 1,012 | 21,540 |
| Nov End | 7,140 | 5,207 | 2,083 | 2,083 | 2,231 | 893 | 893 | 1,012 | 21,540 |
| Dec Beg | 7,140 | 5,207 | 2,083 | 2,083 | 1,190 | 893 | 893 | 893 | 20,380 |
| Dec End | 7,617 | 5,554 | 2,221 | 2,221 | 1,269 | 952 | 952 | 952 | 21,739 |
| Jan Beg | 7,140 | 5,207 | 2,083 | 2,083 | 1,190 | 893 | 893 | 893 | 20,380 |
| Jan End | 7,617 | 5,554 | 2,221 | 2,221 | 1,269 | 952 | 952 | 952 | 21,739 |
| Feb Beg | 6,664 | 4,860 | 1,944 | 1,944 | 1,111 | 833 | 833 | 833 | 19,021 |
| Feb End | 6,664 | 4,860 | 1,944 | 1,944 | 1,388 | 833 | 833 | 833 | 19,299 |
| Mar Beg | 7,140 | 5,207 | 2,975 | 2,975 | 1,488 | 2,975 | 2,975 | 893 | 26,628 |
| Mar End | 7,617 | 5,554 | 3,174 | 3,174 | 1,587 | 3,174 | 3,174 | 1,904 | 29,355 |
| Apr Beg | 7,140 | 8,926 | 8,926 | 8,926 | 2,231 | 5,950 | 5,950 | 1,785 | 49,835 |
| Apr End | 7,140 | 8,926 | 8,926 | 8,926 | 2,231 | 5,950 | 5,950 | 1,785 | 49,835 |
| May Beg | 7,140 | 8,926 | 8,926 | 8,926 | 2,231 | 5,950 | 5,950 | 2,083 | 50,132 |
| May End | 7,617 | 9,521 | 9,521 | 9,521 | 2,380 | 6,347 | 6,347 | 2,221 | 53,474 |
| Jun Beg | 7,140 | 5,207 | 8,926 | 8,926 | 2,231 | 5,950 | 5,950 | 2,083 | 46,413 |
| Jun End | 7,140 | 5,207 | 5,950 | 5,950 | 2,231 | 3,719 | 3,719 | 2,083 | 36,000 |
| Jul Beg | 7,140 | 5,207 | 2,975 | 2,975 | 2,231 | 2,380 | 2,380 | 2,083 | 27,372 |
| Jul End | 7,617 | 5,554 | 3,174 | 3,174 | 2,380 | 2,539 | 2,539 | 2,221 | 29,197 |
| Aug Beg | 7,140 | 5,207 | 893 | 893 | 2,231 | 893 | 893 | 1,125 | 19,273 |
| Aug End | 7,617 | 5,554 | 952 | 952 | 3,174 | 952 | 952 | 1,200 | 21,352 |
| Sept Beg | 7,140 | 5,207 | 893 | 893 | 2,975 | 893 | 893 | 922 | 19,815 |
| Sept End | 7,140 | 5,207 | 893 | 893 | 2,975 | 893 | 893 | 922 | 19,815 |
| Total | 173,752 | 141,818 | 85,607 | 85,607 | 46,840 | 57,550 | 57,550 | 32,502 | 681,226 |

# APPENDIX D
## Water Balance Calculations

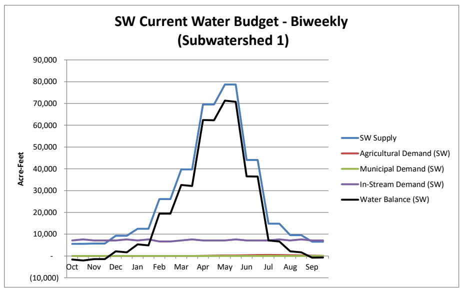
Water Budget - Biweekly (Subwatershed 1)

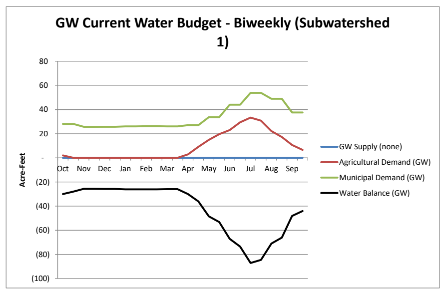
**Current**

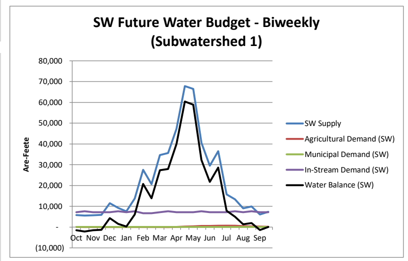
| Month | Days | SW Supply Available (AF) | | | GW Used (from Step 2 report) AF | Agricultural Demand SW (AF) (water rights) | Agricultural Demand GW (AF) (water rights) | Agricultural Demand SW (AF) (ET estimate) | Agricultural Demand GW (AF) (ET estimate) | Municipal Demand SW (AF) SSIU only | Municipal Demand GW (sum of SSIU, unic, and municipal) | Instream Demand SW(AF) | SW Balance (ag ET) | GW Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Days | SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Supply (none) | Surface Water Rights by Subwatershed Distributed According to | Groundwater Rights by Subwatershed Distributed | Agricultural Demand (SW) | Agricultural Demand (GW) | Municipal Demand (SW) | Municipal Demand (GW) | In-Stream Demand (SW) | Water Balance (SW) | Water Balance (GW) |
| Oct | 1st to 15th | 5,573 | 3,488 | 9,188 | - | 24 | 2 | 24 | 2 | 16 | 28 | 7,140 | (1,607) | (30) |
| | 16th to 31st | 5,573 | 3,488 | 9,188 | - | - | - | - | - | 16 | 28 | 7,617 | (2,059) | (28) |
| Nov | 1st to 15th | 5,763 | 3,664 | 14,450 | - | - | - | - | - | 16 | 26 | 7,140 | (1,393) | (26) |
| | 16th to 30th | 5,763 | 3,664 | 14,450 | - | - | - | - | - | 16 | 26 | 7,140 | (1,393) | (26) |
| Dec | 1st to 15th | 9,316 | 4,126 | 32,968 | - | - | - | - | - | 16 | 26 | 7,140 | 2,160 | (26) |
| | 16th to 31st | 9,316 | 4,126 | 32,968 | - | - | - | - | - | 16 | 26 | 7,617 | 1,684 | (26) |
| Jan | 1st to 15th | 12,506 | 5,020 | 59,129 | - | - | - | - | - | 16 | 26 | 7,140 | 5,350 | (26) |
| | 16th to 31st | 12,506 | 5,020 | 59,129 | - | - | - | - | - | 16 | 26 | 7,617 | 4,874 | (26) |
| Feb | 1st to 15th | 26,089 | 7,055 | 73,266 | - | - | - | - | - | 16 | 26 | 6,664 | 19,409 | (26) |
| | 16th to 28th | 26,089 | 7,055 | 73,266 | - | - | - | - | - | 16 | 26 | 6,664 | 19,409 | (26) |
| Mar | 1st to 15th | 39,774 | 15,484 | 111,877 | - | - | - | - | - | 16 | 26 | 7,140 | 32,618 | (26) |
| | 16th to 31st | 39,774 | 15,484 | 111,877 | - | - | - | - | - | 16 | 26 | 7,617 | 32,142 | (26) |
| Apr | 1st to 15th | 69,572 | 30,834 | 128,028 | - | 46 | 3 | 45 | 3 | 16 | 27 | 7,140 | 62,371 | (30) |
| | 16th to 30th | 69,572 | 30,834 | 128,028 | - | 142 | 9 | 140 | 9 | 16 | 27 | 7,140 | 62,276 | (36) |
| May | 1st to 15th | 78,697 | 31,394 | 131,445 | - | 233 | 15 | 228 | 15 | 16 | 34 | 7,140 | 71,312 | (48) |
| | 16th to 31st | 78,697 | 31,394 | 131,445 | - | 308 | 20 | 302 | 20 | 16 | 34 | 7,617 | 70,762 | (53) |
| Jun | 1st to 15th | 44,048 | 14,861 | 87,685 | - | 362 | 23 | 356 | 23 | 16 | 44 | 7,140 | 36,536 | (67) |
| | 16th to 30th | 44,048 | 14,861 | 87,685 | - | 464 | 30 | 455 | 29 | 16 | 44 | 7,140 | 36,436 | (73) |
| Jul | 1st to 15th | 14,804 | 11,060 | 31,436 | - | 524 | 34 | 514 | 33 | 16 | 54 | 7,140 | 7,133 | (87) |
| | 16th to 31st | 14,804 | 11,060 | 31,436 | - | 483 | 31 | 475 | 31 | 16 | 54 | 7,617 | 6,697 | (85) |
| Aug | 1st to 15th | 9,614 | 8,550 | 12,719 | - | 347 | 23 | 341 | 22 | 16 | 49 | 7,140 | 2,116 | (71) |
| | 16th to 31st | 9,614 | 8,550 | 12,719 | - | 270 | 18 | 266 | 17 | 16 | 49 | 7,617 | 1,716 | (66) |
| Sep | 1st to 15th | 6,546 | 5,228 | 10,086 | - | 167 | 11 | 164 | 11 | 16 | 38 | 7,140 | (775) | (48) |
| | 16th to 30th | 6,546 | 5,228 | 10,086 | - | 104 | 7 | 102 | 7 | 16 | 38 | 7,140 | (712) | (44) |
| Total | - | 644,604 | 281,528 | 1,404,554 | - | 3,474 | 225 | 3,412 | 221 | 383 | 805 | 173,752 | 467,057 | (1,027) |

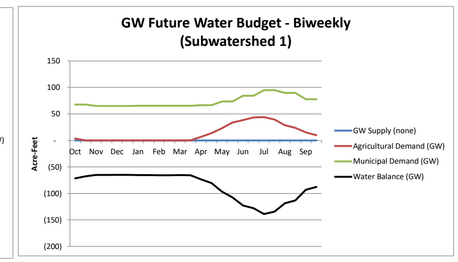
**2068**

| Month | Days | Temp Change (MM table) (+ is hotter, - is colder) | SW Supply Available (Acre-feet) | | | GW Used (from Step 2 report) AF | Agricultural Demand SW (AF) (water rights) | Agricultural Demand GW (AF) (water rights) | Agricultural Demand SW (AF) (ET estimate) | Agricultural Demand GW (AF) (ET estimate) | Municipal Demand SW (AF) SSIU only | Municipal Demand GW (future is increased by 6% for rural and municipal and calculated value for SSIU | Instream Demand SW (AF) | SW Balance (ag ET) | GW Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Days | deg F | SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Supply (none) | Surface Water Rights by Subwatershed Distributed | Groundwater Rights by Subwatershed | Agricultural Demand (SW) | Agricultural Demand (GW) | Municipal Demand (SW) | Municipal Demand (GW) | In-Stream Demand (SW) | Water Balance (SW) | Water Balance (GW) |
| Oct | 1st to 15th | -0.7 | 5,768 | 3,610 | 9,510 | - | 24 | 2 | 58 | 4 | 64 | 68 | 7,140 | (1,495) | (71) |
| | 16th to 31st | 0.1 | 5,545 | 3,471 | 9,142 | - | - | - | 0 | 0 | 64 | 68 | 7,617 | (2,135) | (68) |
| Nov | 1st to 15th | 0.4 | 5,648 | 3,591 | 14,161 | - | - | - | 0 | 0 | 64 | 65 | 7,140 | (1,557) | (65) |
| | 16th to 30th | -0.5 | 5,907 | 3,756 | 14,811 | - | - | - | 0 | 0 | 64 | 65 | 7,140 | (1,297) | (65) |
| Dec | 1st to 15th | -4.7 | 11,505 | 5,096 | 40,715 | - | - | - | 0 | 0 | 64 | 65 | 7,140 | 4,301 | (65) |
| | 16th to 31st | 0.1 | 9,269 | 4,105 | 32,803 | - | - | - | 0 | 0 | 64 | 65 | 7,617 | 1,589 | (65) |
| Jan | 1st to 15th | 8.0 | 7,504 | 3,012 | 35,477 | - | - | - | 0 | 0 | 64 | 65 | 7,140 | 299 | (65) |
| | 16th to 31st | -2.0 | 13,757 | 5,522 | 65,042 | - | - | - | 0 | 0 | 64 | 65 | 7,617 | 6,076 | (65) |
| Feb | 1st to 15th | -1.1 | 27,524 | 7,443 | 77,296 | - | - | - | 0 | 0 | 64 | 66 | 6,664 | 20,796 | (66) |
| | 16th to 28th | 4.2 | 20,610 | 5,573 | 57,880 | - | - | - | 0 | 0 | 64 | 66 | 6,664 | 13,882 | (66) |
| Mar | 1st to 15th | 2.6 | 34,603 | 13,471 | 97,333 | - | - | - | 0 | 0 | 64 | 65 | 7,140 | 27,399 | (65) |
| | 16th to 31st | 2.1 | 35,598 | 13,858 | 100,130 | - | - | - | 6 | 0 | 64 | 65 | 7,617 | 27,911 | (66) |
| Apr | 1st to 15th | 6.4 | 47,309 | 20,967 | 87,059 | - | 46 | 3 | 108 | 7 | 64 | 67 | 7,140 | 39,997 | (74) |
| | 16th to 30th | 0.5 | 67,833 | 30,063 | 124,827 | - | 142 | 9 | 211 | 14 | 64 | 67 | 7,140 | 60,417 | (80) |
| May | 1st to 15th | 3.1 | 66,499 | 26,528 | 111,071 | - | 233 | 15 | 357 | 23 | 64 | 74 | 7,140 | 58,938 | (97) |
| | 16th to 31st | 9.7 | 40,529 | 16,168 | 67,694 | - | 308 | 20 | 520 | 34 | 64 | 74 | 7,617 | 32,329 | (107) |
| Jun | 1st to 15th | 6.6 | 29,512 | 9,957 | 58,749 | - | 362 | 23 | 593 | 38 | 64 | 85 | 7,140 | 21,715 | (123) |
| | 16th to 30th | 3.4 | 36,560 | 12,335 | 72,779 | - | 464 | 30 | 670 | 43 | 64 | 85 | 7,140 | 28,686 | (128) |
| Jul | 1st to 15th | -1.3 | 15,766 | 11,779 | 33,479 | - | 524 | 34 | 679 | 44 | 64 | 95 | 7,140 | 7,883 | (139) |
| | 16th to 31st | 2.0 | 13,324 | 9,954 | 28,292 | - | 483 | 31 | 611 | 40 | 64 | 95 | 7,617 | 5,032 | (134) |
| Aug | 1st to 15th | 1.2 | 9,037 | 8,037 | 11,956 | - | 347 | 23 | 444 | 29 | 64 | 90 | 7,140 | 1,389 | (118) |
| | 16th to 31st | -0.7 | 9,950 | 8,849 | 13,164 | - | 270 | 18 | 365 | 24 | 64 | 90 | 7,617 | 1,906 | (113) |
| Sep | 1st to 15th | 1.5 | 6,055 | 4,836 | 9,330 | - | 167 | 11 | 236 | 15 | 64 | 78 | 7,140 | (1,386) | (93) |
| | 16th to 30th | -2.6 | 7,397 | 5,908 | 11,397 | - | 104 | 7 | 153 | 10 | 64 | 78 | 7,140 | 39 | (88) |
| Total | | 1.6 | 593,170 | 259,064 | 1,292,482 | - | 3,474 | 225 | 5011 | 325 | 1532 | 1762.1 | 173,752 | 412,875 | (2,087) |




Notes:
SW supply = Median Water Volume (50% exceedance)
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET (described in Step 3 report/ag presentation)
Municipal Demand = Municipal + Unincorporated + SSIU (Municipal demand is from 2011-2016 useage reports to OWRD (only watersheds 1,2,6,7), SSIU is from water rights (only watersheds 1,3,4,6,7) and Unincorporated demand is included for each
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

Notes:
SW supply = Median Water Volume (50% exceedance) plus every 1 degree increas in temp is a 5% decrease in stream flow for future scenario
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky) (Assume constant in future scenario)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET and RCP 8.5 temp and precip climate scenario (described in Step 3 report/ag presentation)
Municipal Demand = SW demand is only SSIU (growth in use), GW demand calculated from OWRD reports (municipal demand), unincorporated extrapolation (6% increase in demand, PSU population increa
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed (no change for future scenario, based on water rights)
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

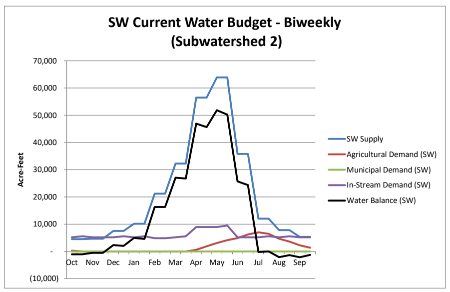
Water Budget - Biweekly (Subwatershed 2)

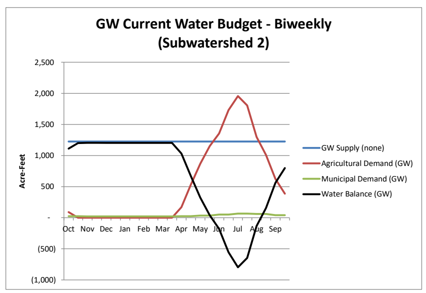
**Current**

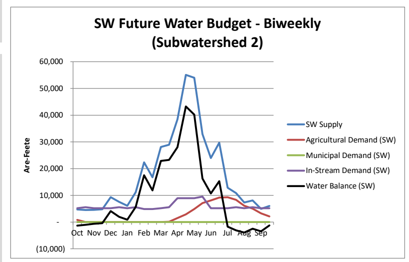
| Month | Days | SW Supply Available (AF): SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Used (from Step 2 report) AF: GW Supply (none) | Agricultural Demand SW (AF) (water rights): Surface Water Rights by Subwatershed Distributed According to | Agricultural Demand GW (AF) (water rights): Groundwater Rights by Subwatershed Distributed According to | Agricultural Demand SW (AF) (ET estimate): Agricultural Demand (SW) | Agricultural Demand GW (AF) (ET estimate): Agricultural Demand (GW) | Municipal Demand (SW) | Municipal Demand GW (sum of SSIU, unic, and municipal): Municipal Demand (GW) | Instream Demand SW(AF): In-Stream Demand (SW) | SW Balance (ag ET): Water Balance (SW) | GW Balance (ag ET): Water Balance (GW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 1st to 15th | 4,525 | 2,832 | 7,460 | 1,225 | 362 | 101 | 326 | 91 | - | 25 | 5,207 | (1,007) | 1,110 |
| | 16th to 31st | 4,525 | 2,832 | 7,460 | 1,225 | - | - | - | - | - | 25 | 5,554 | (1,029) | 1,200 |
| Nov | 1st to 15th | 4,679 | 2,975 | 11,732 | 1,225 | - | - | - | - | - | 21 | 5,207 | (528) | 1,204 |
| | 16th to 30th | 4,679 | 2,975 | 11,732 | 1,225 | - | - | - | - | - | 21 | 5,207 | (528) | 1,204 |
| Dec | 1st to 15th | 7,564 | 3,350 | 26,768 | 1,225 | - | - | - | - | - | 21 | 5,207 | 2,357 | 1,204 |
| | 16th to 31st | 7,564 | 3,350 | 26,768 | 1,225 | - | - | - | - | - | 21 | 5,554 | 2,010 | 1,204 |
| Jan | 1st to 15th | 10,155 | 4,076 | 48,009 | 1,225 | - | - | - | - | - | 22 | 5,207 | 4,948 | 1,204 |
| | 16th to 31st | 10,155 | 4,076 | 48,009 | 1,225 | - | - | - | - | - | 22 | 5,554 | 4,601 | 1,204 |
| Feb | 1st to 15th | 21,183 | 5,728 | 59,488 | 1,225 | - | - | - | - | - | 21 | 4,860 | 16,323 | 1,204 |
| | 16th to 28th | 21,183 | 5,728 | 59,488 | 1,225 | - | - | - | - | - | 21 | 4,860 | 16,323 | 1,204 |
| Mar | 1st to 15th | 32,294 | 12,572 | 90,838 | 1,225 | - | - | - | - | - | 21 | 5,207 | 27,087 | 1,204 |
| | 16th to 31st | 32,294 | 12,572 | 90,838 | 1,225 | - | - | - | - | - | 21 | 5,554 | 26,740 | 1,204 |
| Apr | 1st to 15th | 56,488 | 25,035 | 103,952 | 1,225 | 683 | 190 | 614 | 171 | - | 24 | 8,926 | 46,949 | 1,031 |
| | 16th to 30th | 56,488 | 25,035 | 103,952 | 1,225 | 2,127 | 592 | 1,911 | 532 | - | 24 | 8,926 | 45,651 | 670 |
| May | 1st to 15th | 63,897 | 25,490 | 106,726 | 1,225 | 3,473 | 967 | 3,121 | 869 | - | 33 | 8,926 | 51,850 | 323 |
| | 16th to 31st | 63,897 | 25,490 | 106,726 | 1,225 | 4,600 | 1,280 | 4,134 | 1,150 | - | 33 | 9,521 | 50,243 | 41 |
| Jun | 1st to 15th | 35,765 | 12,066 | 71,195 | 1,225 | 5,412 | 1,506 | 4,864 | 1,353 | - | 50 | 5,207 | 25,695 | (178) |
| | 16th to 30th | 35,765 | 12,066 | 71,195 | 1,225 | 6,924 | 1,927 | 6,222 | 1,732 | - | 50 | 5,207 | 24,336 | (556) |
| Jul | 1st to 15th | 12,020 | 8,980 | 25,524 | 1,225 | 7,821 | 2,176 | 7,028 | 1,956 | - | 66 | 5,207 | (215) | (797) |
| | 16th to 31st | 12,020 | 8,980 | 25,524 | 1,225 | 7,217 | 2,008 | 6,486 | 1,805 | - | 66 | 5,554 | (19) | (646) |
| Aug | 1st to 15th | 7,806 | 6,942 | 10,327 | 1,225 | 5,189 | 1,444 | 4,663 | 1,298 | - | 60 | 5,207 | (2,064) | (133) |
| | 16th to 31st | 7,806 | 6,942 | 10,327 | 1,225 | 4,038 | 1,124 | 3,629 | 1,010 | - | 60 | 5,554 | (1,377) | 155 |
| Sep | 1st to 15th | 5,315 | 4,245 | 8,189 | 1,225 | 2,495 | 694 | 2,242 | 624 | - | 39 | 5,207 | (2,134) | 562 |
| | 16th to 30th | 5,315 | 4,245 | 8,189 | 1,225 | 1,547 | 430 | 1,390 | 387 | - | 39 | 5,207 | (1,282) | 799 |
| Total | - | 523,382 | 228,582 | 1,140,416 | 29,404 | 51,888 | 14,439 | 46,630 | 12,976 | - | 809 | 141,818 | 334,933 | 15,619 |

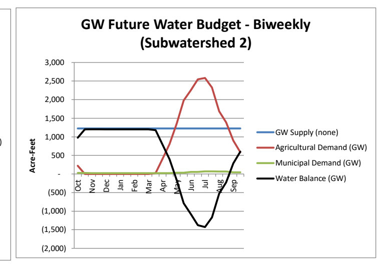
**2068**

| Month | Days | Temp Change (MM table) (+ is hotter, - is colder): deg F | SW Supply Available (Acre-feet): SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Used (from Step 2 report) AF: GW Supply (none) | Agricultural Demand SW (AF) (water rights): Surface Water Rights by Subwatershed Distributed | Agricultural Demand GW (AF) (water rights): Groundwater Rights by Subwatershed | Agricultural Demand SW (AF) (ET estimate): Agricultural Demand (SW) | Agricultural Demand GW (AF) (ET estimate): Agricultural Demand (GW) | Municipal Demand SW (AF) SSIU only: Municipal Demand (SW) | Municipal Demand GW (future is increased by 6% for rural and municipal and calculated value for SSIU: Municipal Demand (GW) | Instream Demand SW (AF): In-Stream Demand (SW) | SW Balance (ag ET): Water Balance (SW) | GW Balance (ag ET): Water Balance (GW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 1st to 15th | -0.7 | 4,683 | 2,931 | 7,721 | 1,225 | 362 | 101 | 799 | 222 | - | 26 | 5,207 | (1,322) | 976 |
| | 16th to 31st | 0.1 | 4,502 | 2,818 | 7,423 | 1,225 | - | - | 0 | 0 | - | 26 | 5,554 | (1,051) | 1,199 |
| Nov | 1st to 15th | 0.4 | 4,585 | 2,916 | 11,497 | 1,225 | - | - | 0 | 0 | - | 22 | 5,207 | (621) | 1,203 |
| | 16th to 30th | -0.5 | 4,796 | 3,049 | 12,025 | 1,225 | - | - | 0 | 0 | - | 22 | 5,207 | (411) | 1,203 |
| Dec | 1st to 15th | -4.7 | 9,342 | 4,137 | 33,058 | 1,225 | - | - | 0 | 0 | - | 22 | 5,207 | 4,135 | 1,203 |
| | 16th to 31st | 0.1 | 7,526 | 3,333 | 26,634 | 1,225 | - | - | 0 | 0 | - | 22 | 5,554 | 1,972 | 1,203 |
| Jan | 1st to 15th | 8.0 | 6,093 | 2,446 | 28,805 | 1,225 | - | - | 0 | 0 | - | 23 | 5,207 | 886 | 1,202 |
| | 16th to 31st | -2.0 | 11,171 | 4,484 | 52,810 | 1,225 | - | - | 0 | 0 | - | 23 | 5,554 | 5,617 | 1,202 |
| Feb | 1st to 15th | -1.1 | 22,348 | 6,043 | 62,760 | 1,225 | - | - | 0 | 0 | - | 23 | 4,860 | 17,489 | 1,202 |
| | 16th to 28th | 4.2 | 16,735 | 4,525 | 46,996 | 1,225 | - | - | 0 | 0 | - | 23 | 4,860 | 11,875 | 1,202 |
| Mar | 1st to 15th | 2.6 | 28,096 | 10,938 | 79,029 | 1,225 | - | - | 0 | 0 | - | 23 | 5,207 | 22,889 | 1,202 |
| | 16th to 31st | 2.1 | 28,903 | 11,252 | 81,300 | 1,225 | - | - | 85 | 24 | - | 23 | 5,554 | 23,264 | 1,179 |
| Apr | 1st to 15th | 6.4 | 38,412 | 17,024 | 70,687 | 1,225 | 683 | 190 | 1470 | 409 | - | 25 | 8,926 | 28,016 | 791 |
| | 16th to 30th | 0.5 | 55,076 | 24,409 | 101,353 | 1,225 | 2,127 | 592 | 2888 | 804 | - | 25 | 8,926 | 43,262 | 396 |
| May | 1st to 15th | 3.1 | 53,993 | 21,539 | 90,183 | 1,225 | 3,473 | 967 | 4877 | 1357 | - | 35 | 8,926 | 40,190 | (167) |
| | 16th to 31st | 9.7 | 32,907 | 13,127 | 54,964 | 1,225 | 4,600 | 1,280 | 7106 | 1977 | - | 35 | 9,521 | 16,280 | (788) |
| Jun | 1st to 15th | 6.6 | 23,963 | 8,084 | 47,701 | 1,225 | 5,412 | 1,506 | 8101 | 2254 | - | 53 | 5,207 | 10,655 | (1,082) |
| | 16th to 30th | 3.4 | 29,685 | 10,015 | 59,092 | 1,225 | 6,924 | 1,927 | 9152 | 2547 | - | 53 | 5,207 | 15,326 | (1,375) |
| Jul | 1st to 15th | -1.3 | 12,801 | 9,564 | 27,183 | 1,225 | 7,821 | 2,176 | 9282 | 2583 | - | 70 | 5,207 | (1,687) | (1,428) |
| | 16th to 31st | 2.0 | 10,818 | 8,082 | 22,972 | 1,225 | 7,217 | 2,008 | 8348 | 2323 | - | 70 | 5,554 | (3,084) | (1,168) |
| Aug | 1st to 15th | 1.2 | 7,338 | 6,525 | 9,707 | 1,225 | 5,189 | 1,444 | 6068 | 1689 | - | 64 | 5,207 | (3,937) | (527) |
| | 16th to 31st | -0.7 | 8,079 | 7,185 | 10,688 | 1,225 | 4,038 | 1,124 | 4984 | 1387 | - | 64 | 5,554 | (2,458) | (226) |
| Sep | 1st to 15th | 1.5 | 4,916 | 3,927 | 7,575 | 1,225 | 2,495 | 694 | 3230 | 899 | - | 42 | 5,207 | (3,520) | 285 |
| | 16th to 30th | -2.6 | 6,006 | 4,797 | 9,254 | 1,225 | 1,547 | 430 | 2097 | 584 | - | 42 | 5,207 | (1,298) | 600 |
| Total | - | 1.6 | 432,773 | 210,415 | 1,049,777 | 29,404 | 51,888 | 14,439 | 68488 | 19058 | - | 857 | 141,818 | 222,467 | 9,488 |




Notes:
SW supply = Median Water Volume (50% exceedance)
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET (described in Step 3 report/ag presentation)
Municipal Demand = Municipal + Unincorporated + SSIU (Municipal demand is from 2011-2016 useage reports to OWRD (only watersheds 1,2,6,7), SSIU is from water rights (only watersheds 1,3,4,6,7) and Unincorporated demand is included fo
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

Notes:
SW supply = Median Water Volume (50% exceedance) plus every 1 degree increas in temp is a 5% decrease in stream flow for future scenario
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky) (Assume constant in future scenario)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET and RCP 8.5 temp and precip climate scenario (described in Step 3 report/ag presentation)
Municipal Demand = SW demand is only SSIU (growth in use), GW demand calculated from OWRD reports (municipal demand), unincorporated extrapolation (6% increase in demand, PSU population increase)
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed (no change for future scenario, based on water rights)
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

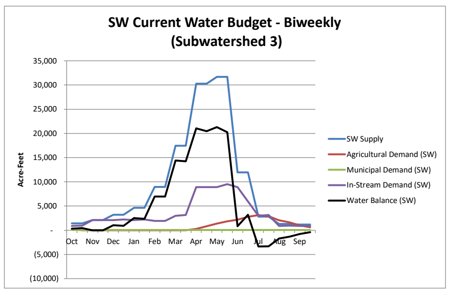
Water Budget - Biweekly (Subwatershed 3)

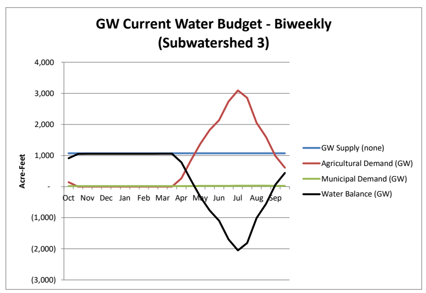
**Current**

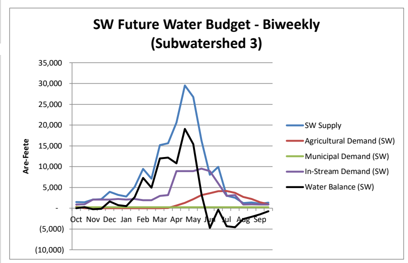
| Month | Days | SW Supply Available (AF) | | | GW Used (from Step 2 report) AF | Agricultural Demand SW (AF) (water rights) | Agricultural Demand GW (AF) (water rights) | Agricultural Demand SW (AF) (ET estimate) | Agricultural Demand GW (AF) (ET estimate) | Municipal Demand SW (AF) SSIU only | Municipal Demand GW (sum of SSIU, unic, and municipal) | Instream Demand SW(AF) | SW Balance (ag ET) | GW Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Days | SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Supply (none) | Surface Water Rights by Subwatershed Distributed According to | Groundwater Rights by Subwatershed Distributed According to | Agricultural Demand (SW) | Agricultural Demand (GW) | Municipal Demand (SW) | Municipal Demand (GW) | In-Stream Demand (SW) | Water Balance (SW) | Water Balance (GW) |
| Oct | 1st to 15th | 1,441 | 1,025 | 2,627 | 1,072 | 166 | 164 | 145 | 143 | 58 | 18 | 893 | 345 | 910 |
| | 16th to 31st | 1,441 | 1,025 | 2,627 | 1,072 | - | - | - | - | 58 | 18 | 952 | 431 | 1,053 |
| Nov | 1st to 15th | 2,108 | 1,240 | 6,107 | 1,072 | - | - | - | - | 58 | 17 | 2,083 | (33) | 1,055 |
| | 16th to 30th | 2,108 | 1,240 | 6,107 | 1,072 | - | - | - | - | 58 | 17 | 2,083 | (33) | 1,055 |
| Dec | 1st to 15th | 3,203 | 1,313 | 14,383 | 1,072 | - | - | - | - | 58 | 17 | 2,083 | 1,062 | 1,055 |
| | 16th to 31st | 3,203 | 1,313 | 14,383 | 1,072 | - | - | - | - | 58 | 17 | 2,221 | 923 | 1,055 |
| Jan | 1st to 15th | 4,645 | 1,602 | 23,640 | 1,072 | - | - | - | - | 58 | 17 | 2,083 | 2,504 | 1,055 |
| | 16th to 31st | 4,645 | 1,602 | 23,640 | 1,072 | - | - | - | - | 58 | 17 | 2,221 | 2,365 | 1,055 |
| Feb | 1st to 15th | 8,962 | 2,306 | 32,110 | 1,072 | - | - | - | - | 58 | 17 | 1,944 | 6,960 | 1,055 |
| | 16th to 28th | 8,962 | 2,306 | 32,110 | 1,072 | - | - | - | - | 58 | 17 | 1,944 | 6,960 | 1,055 |
| Mar | 1st to 15th | 17,458 | 5,862 | 56,378 | 1,072 | - | - | - | - | 58 | 17 | 2,975 | 14,425 | 1,055 |
| | 16th to 31st | 17,458 | 5,862 | 56,378 | 1,072 | - | - | - | - | 58 | 17 | 3,174 | 14,226 | 1,055 |
| Apr | 1st to 15th | 30,286 | 14,167 | 65,719 | 1,072 | 313 | 309 | 273 | 270 | 58 | 18 | 8,926 | 21,029 | 784 |
| | 16th to 30th | 30,286 | 14,167 | 65,719 | 1,072 | 975 | 963 | 852 | 841 | 58 | 18 | 8,926 | 20,451 | 213 |
| May | 1st to 15th | 31,680 | 12,493 | 59,581 | 1,072 | 1,592 | 1,573 | 1,391 | 1,374 | 58 | 22 | 8,926 | 21,306 | (323) |
| | 16th to 31st | 31,680 | 12,493 | 59,581 | 1,072 | 2,108 | 2,083 | 1,842 | 1,819 | 58 | 22 | 9,521 | 20,260 | (769) |
| Jun | 1st to 15th | 11,966 | 4,030 | 30,193 | 1,072 | 2,481 | 2,450 | 2,167 | 2,140 | 58 | 26 | 8,926 | 816 | (1,094) |
| | 16th to 30th | 11,966 | 4,030 | 30,193 | 1,072 | 3,174 | 3,135 | 2,772 | 2,738 | 58 | 26 | 5,950 | 3,185 | (1,692) |
| Jul | 1st to 15th | 2,819 | 1,409 | 7,207 | 1,072 | 3,585 | 3,541 | 3,131 | 3,093 | 58 | 29 | 2,975 | (3,345) | (2,050) |
| | 16th to 31st | 2,819 | 1,409 | 7,207 | 1,072 | 3,308 | 3,267 | 2,889 | 2,854 | 58 | 29 | 3,174 | (3,302) | (1,811) |
| Aug | 1st to 15th | 1,313 | 865 | 2,627 | 1,072 | 2,379 | 2,349 | 2,078 | 2,052 | 58 | 28 | 893 | (1,715) | (1,008) |
| | 16th to 31st | 1,313 | 865 | 2,627 | 1,072 | 1,851 | 1,828 | 1,617 | 1,597 | 58 | 28 | 952 | (1,314) | (553) |
| Sep | 1st to 15th | 1,178 | 868 | 2,170 | 1,072 | 1,144 | 1,130 | 999 | 987 | 58 | 25 | 893 | (772) | 60 |
| | 16th to 30th | 1,178 | 868 | 2,170 | 1,072 | 709 | 700 | 619 | 612 | 58 | 25 | 893 | (392) | 436 |
| Total | - | 234,118 | 94,360 | 605,484 | 25,721 | 23,784 | 23,493 | 20,774 | 20,520 | 1393 | 497 | 85,607 | 126,344 | 4,704 |

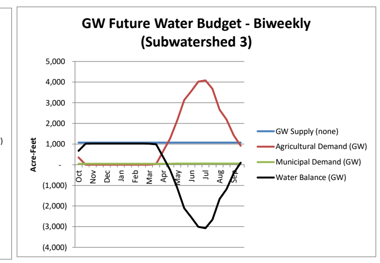
**2068**

| Month | Days | Temp Change (MM table) (+ is hotter, - is colder) | SW Supply Available (Acre-feet) | | | GW Used (from Step 2 report) AF | Agricultural Demand SW (AF) (water rights) | Agricultural Demand GW (AF) (water rights) | Agricultural Demand SW (AF) (ET estimate) | Agricultural Demand GW (AF) (ET estimate) | Municipal Demand SW (AF) SSIU only | Municipal Demand GW (future is increased by 6% for rural and municipal and calculated value for SSIU | Instream Demand SW (AF) | SW Balance (ag ET) | GW Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Days | deg F | SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Supply (none) | Surface Water Rights by Subwatershed Distributed | Groundwater Rights by Subwatershed | Agricultural Demand (SW) | Agricultural Demand (GW) | Municipal Demand (SW) | Municipal Demand (GW) | In-Stream Demand (SW) | Water Balance (SW) | Water Balance (GW) |
| Oct | 1st to 15th | -0.7 | 1,491 | 1,061 | 2,719 | 1,072 | 166 | 164 | 356 | 352 | 232 | 49 | 893 | 11 | 671 |
| | 16th to 31st | 0.1 | 1,434 | 1,020 | 2,614 | 1,072 | - | - | 0 | 0 | 232 | 49 | 952 | 250 | 1,022 |
| Nov | 1st to 15th | 0.4 | 2,066 | 1,215 | 5,985 | 1,072 | - | - | 0 | 0 | 232 | 48 | 2,083 | (249) | 1,024 |
| | 16th to 30th | -0.5 | 2,161 | 1,271 | 6,260 | 1,072 | - | - | 0 | 0 | 232 | 48 | 2,083 | (154) | 1,024 |
| Dec | 1st to 15th | -4.7 | 3,956 | 1,622 | 17,763 | 1,072 | - | - | 0 | 0 | 232 | 48 | 2,083 | 1,641 | 1,024 |
| | 16th to 31st | 0.1 | 3,187 | 1,306 | 14,311 | 1,072 | - | - | 0 | 0 | 232 | 48 | 2,221 | 733 | 1,024 |
| Jan | 1st to 15th | 8.0 | 2,787 | 961 | 14,184 | 1,072 | - | - | 0 | 0 | 232 | 48 | 2,083 | 472 | 1,024 |
| | 16th to 31st | -2.0 | 5,110 | 1,762 | 26,004 | 1,072 | - | - | 0 | 0 | 232 | 48 | 2,221 | 2,656 | 1,024 |
| Feb | 1st to 15th | -1.1 | 9,455 | 2,433 | 33,876 | 1,072 | - | - | 0 | 0 | 232 | 48 | 1,944 | 7,279 | 1,024 |
| | 16th to 28th | 4.2 | 7,080 | 1,822 | 25,367 | 1,072 | - | - | 0 | 0 | 232 | 48 | 1,944 | 4,904 | 1,024 |
| Mar | 1st to 15th | 2.6 | 15,188 | 5,100 | 49,049 | 1,072 | - | - | 0 | 0 | 232 | 48 | 2,975 | 11,981 | 1,024 |
| | 16th to 31st | 2.1 | 15,625 | 5,246 | 50,458 | 1,072 | - | - | 38 | 37 | 232 | 48 | 3,174 | 12,181 | 986 |
| Apr | 1st to 15th | 6.4 | 20,594 | 9,634 | 44,689 | 1,072 | 313 | 309 | 655 | 647 | 232 | 49 | 8,926 | 10,782 | 376 |
| | 16th to 30th | 0.5 | 29,529 | 13,813 | 64,076 | 1,072 | 975 | 963 | 1287 | 1271 | 232 | 49 | 8,926 | 19,084 | (248) |
| May | 1st to 15th | 3.1 | 26,770 | 10,557 | 50,346 | 1,072 | 1,592 | 1,573 | 2173 | 2146 | 232 | 53 | 8,926 | 15,439 | (1,127) |
| | 16th to 31st | 9.7 | 16,315 | 6,434 | 30,684 | 1,072 | 2,108 | 2,083 | 3166 | 3127 | 232 | 53 | 9,521 | 3,397 | (2,108) |
| Jun | 1st to 15th | 6.6 | 8,017 | 2,700 | 20,229 | 1,072 | 2,481 | 2,450 | 3609 | 3565 | 232 | 57 | 8,926 | (4,750) | (2,550) |
| | 16th to 30th | 3.4 | 9,932 | 3,345 | 25,060 | 1,072 | 3,174 | 3,135 | 4077 | 4028 | 232 | 57 | 5,950 | (328) | (3,013) |
| Jul | 1st to 15th | -1.3 | 3,002 | 1,501 | 7,675 | 1,072 | 3,585 | 3,541 | 4135 | 4085 | 232 | 60 | 2,975 | (4,340) | (3,073) |
| | 16th to 31st | 2.0 | 2,537 | 1,268 | 6,486 | 1,072 | 3,308 | 3,267 | 3719 | 3674 | 232 | 60 | 3,174 | (4,588) | (2,662) |
| Aug | 1st to 15th | 1.2 | 1,234 | 813 | 2,469 | 1,072 | 2,379 | 2,349 | 2703 | 2670 | 232 | 60 | 893 | (2,594) | (1,658) |
| | 16th to 31st | -0.7 | 1,359 | 895 | 2,719 | 1,072 | 1,851 | 1,828 | 2220 | 2193 | 232 | 60 | 952 | (2,046) | (1,181) |
| Sep | 1st to 15th | 1.5 | 1,090 | 803 | 2,007 | 1,072 | 1,144 | 1,130 | 1439 | 1421 | 232 | 56 | 893 | (1,474) | (405) |
| | 16th to 30th | -2.6 | 1,331 | 981 | 2,452 | 1,072 | 709 | 700 | 934 | 923 | 232 | 56 | 893 | (728) | 93 |
| Total | | 1.6 | 215,511 | 86,860 | 557,361 | 25,721 | 23,784 | 23,493 | 30512 | 30139 | 5573 | 1244 | 85607 | 93,819 | (5,662) |




Notes:
SW supply = Median Water Volume (50% exceedance)
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET (described in Step 3 report/ag presentation)
Municipal Demand = Municipal + Unincorporated + SSIU (Municipal demand is from 2011-2016 useage reports to OWRD (only watersheds 1,2,6,7), SSIU is from water rights (only watersheds 1,3,4,6,7) and Unincorporated demand is included fo
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

Notes:
SW supply = Median Water Volume (50% exceedance) plus every 1 degree increas in temp is a 5% decrease in stream flow for future scenario
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky) (Assume constant in future scenario)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET and RCP 8.5 temp and precip climate scenario (described in Step 3 report/ag presentation)
Municipal Demand = SW demand is only SSIU (growth in use), GW demand calculated from OWRD reports (municipal demand), unincorporated extrapolation (6% increase in demand, PSU population increase)
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed (no change for future scenario, based on water rights)
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

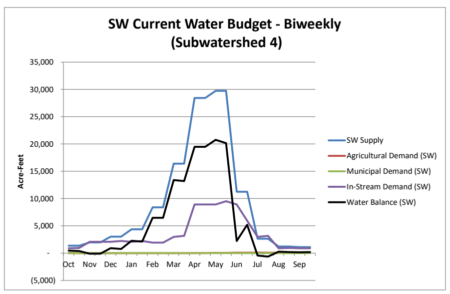
Water Budget - Biweekly (Subwatershed 4)

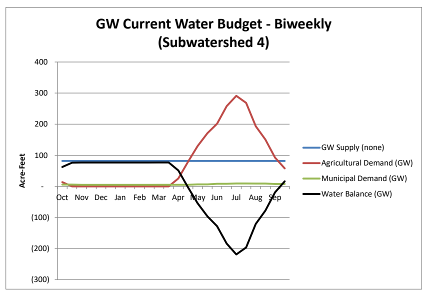
**Current**

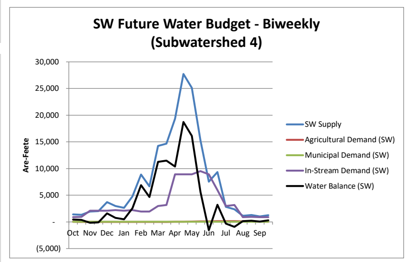
| Month | Days | SW Supply Available (AF) | | | GW Used (from Step 2 report) AF | Agricultural Demand SW (AF) (water rights) | Agricultural Demand GW (AF) (water rights) | Agricultural Demand SW (AF) (ET estimate) | Agricultural Demand GW (AF) (ET estimate) | Municipal Demand SW (AF) SSIU only | Municipal Demand GW (sum of SSIU, unic, and municipal) | Instream Demand SW(AF) | SW Balance (ag ET) | GW Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Days | SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Supply (none) | Surface Water Rights by Subwatershed Distributed According to | Groundwater Rights by Subwatershed Distributed According to | Agricultural Demand (SW) | Agricultural Demand (GW) | Municipal Demand (SW) | Municipal Demand (GW) | In-Stream Demand (SW) | Water Balance (SW) | Water Balance (GW) |
| Oct | 1st to 15th | 1,354 | 962 | 2,466 | 82 | 5 | 14 | 5 | 13 | 7 | 6 | 893 | 449 | 63 |
| | 16th to 31st | 1,354 | 962 | 2,466 | 82 | - | - | - | - | 7 | 6 | 952 | 395 | 76 |
| Nov | 1st to 15th | 1,979 | 1,164 | 5,734 | 82 | - | - | - | - | 7 | 5 | 2083 | (111) | 77 |
| | 16th to 30th | 1,979 | 1,164 | 5,734 | 82 | - | - | - | - | 7 | 5 | 2083 | (111) | 77 |
| Dec | 1st to 15th | 3,008 | 1,233 | 13,505 | 82 | - | - | - | - | 7 | 5 | 2083 | 918 | 77 |
| | 16th to 31st | 3,008 | 1,233 | 13,505 | 82 | - | - | - | - | 7 | 5 | 2221 | 779 | 77 |
| Jan | 1st to 15th | 4,361 | 1,504 | 22,198 | 82 | - | - | - | - | 7 | 5 | 2083 | 2,271 | 77 |
| | 16th to 31st | 4,361 | 1,504 | 22,198 | 82 | - | - | - | - | 7 | 5 | 2221 | 2,132 | 77 |
| Feb | 1st to 15th | 8,415 | 2,165 | 30,151 | 82 | - | - | - | - | 7 | 5 | 1944 | 6,464 | 77 |
| | 16th to 28th | 8,415 | 2,165 | 30,151 | 82 | - | - | - | - | 7 | 5 | 1944 | 6,464 | 77 |
| Mar | 1st to 15th | 16,393 | 5,504 | 52,937 | 82 | - | - | - | - | 7 | 5 | 2975 | 13,411 | 77 |
| | 16th to 31st | 16,393 | 5,504 | 52,937 | 82 | - | - | - | - | 7 | 5 | 3174 | 13,212 | 77 |
| Apr | 1st to 15th | 28,438 | 13,302 | 61,709 | 82 | 10 | 27 | 9 | 25 | 7 | 5 | 8926 | 19,496 | 51 |
| | 16th to 30th | 28,438 | 13,302 | 61,709 | 82 | 31 | 84 | 29 | 79 | 7 | 5 | 8926 | 19,476 | (3) |
| May | 1st to 15th | 29,747 | 11,730 | 55,945 | 82 | 50 | 137 | 48 | 129 | 7 | 7 | 8926 | 20,766 | (54) |
| | 16th to 31st | 29,747 | 11,730 | 55,945 | 82 | 67 | 181 | 63 | 171 | 7 | 7 | 9521 | 20,156 | (96) |
| Jun | 1st to 15th | 11,236 | 3,784 | 28,351 | 82 | 79 | 213 | 74 | 202 | 7 | 8 | 8926 | 2,229 | (128) |
| | 16th to 30th | 11,236 | 3,784 | 28,351 | 82 | 100 | 272 | 95 | 258 | 7 | 8 | 5950 | 5,183 | (184) |
| Jul | 1st to 15th | 2,647 | 1,323 | 6,768 | 82 | 113 | 307 | 107 | 291 | 7 | 9 | 2975 | (443) | (219) |
| | 16th to 31st | 2,647 | 1,323 | 6,768 | 82 | 105 | 284 | 99 | 269 | 7 | 9 | 3174 | (633) | (196) |
| Aug | 1st to 15th | 1,233 | 812 | 2,466 | 82 | 75 | 204 | 71 | 193 | 7 | 9 | 893 | 262 | (120) |
| | 16th to 31st | 1,233 | 812 | 2,466 | 82 | 59 | 159 | 56 | 150 | 7 | 9 | 952 | 218 | (78) |
| Sep | 1st to 15th | 1,106 | 815 | 2,038 | 82 | 36 | 98 | 34 | 93 | 7 | 8 | 893 | 172 | (19) |
| | 16th to 30th | 1,106 | 815 | 2,038 | 82 | 22 | 61 | 21 | 58 | 7 | 8 | 893 | 185 | 16 |
| Total | - | 219,834 | 88,596 | 568,536 | 1,964 | 753 | 2,040 | 713 | 1,932 | 171 | 155 | 85607 | 133,343 | (123) |

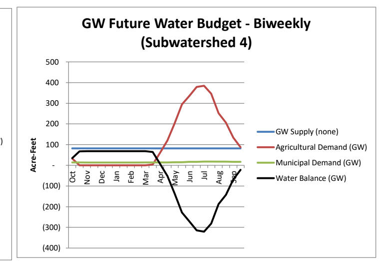
**2068**

| Month | Days | Temp Change (MM table) (+ is hotter, - is colder) | SW Supply Available (Acre-feet) | | | GW Used (from Step 2 report) AF | Agricultural Demand SW (AF) (water rights) | Agricultural Demand GW (AF) (water rights) | Agricultural Demand SW (AF) (ET estimate) | Agricultural Demand GW (AF) (ET estimate) | Municipal Demand SW (AF) SSIU only | Municipal Demand GW (future is increased by 6% for rural and municipal and calculated value for SSIU | Instream Demand SW (AF) | SW Balance (ag ET) | GW Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Days | deg F | SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Supply (none) | Surface Water Rights by Subwatershed Distributed | Groundwater Rights by Subwatershed | Agricultural Demand (SW) | Agricultural Demand (GW) | Municipal Demand (SW) | Municipal Demand (GW) | In-Stream Demand (SW) | Water Balance (SW) | Water Balance (GW) |
| Oct | 1st to 15th | -0.7 | 1,401 | 996 | 2,552 | 82 | 5 | 14 | 12 | 33 | 29 | 14 | 893 | 468 | 35 |
| | 16th to 31st | 0.1 | 1,347 | 957 | 2,454 | 82 | - | - | 0 | 0 | 29 | 14 | 952 | 367 | 68 |
| Nov | 1st to 15th | 0.4 | 1,939 | 1,141 | 5,619 | 82 | - | - | 0 | 0 | 29 | 13 | 2,083 | (172) | 68 |
| | 16th to 30th | -0.5 | 2,028 | 1,193 | 5,877 | 82 | - | - | 0 | 0 | 29 | 13 | 2,083 | (83) | 68 |
| Dec | 1st to 15th | -4.7 | 3,715 | 1,523 | 16,679 | 82 | - | - | 0 | 0 | 29 | 13 | 2,083 | 1,604 | 68 |
| | 16th to 31st | 0.1 | 2,993 | 1,227 | 13,437 | 82 | - | - | 0 | 0 | 29 | 13 | 2,221 | 743 | 68 |
| Jan | 1st to 15th | 8.0 | 2,617 | 902 | 13,319 | 82 | - | - | 0 | 0 | 29 | 13 | 2,083 | 505 | 68 |
| | 16th to 31st | -2.0 | 4,797 | 1,654 | 24,418 | 82 | - | - | 0 | 0 | 29 | 13 | 2,221 | 2,547 | 68 |
| Feb | 1st to 15th | -1.1 | 8,878 | 2,284 | 31,809 | 82 | - | - | 0 | 0 | 29 | 13 | 1,944 | 6,905 | 68 |
| | 16th to 28th | 4.2 | 6,648 | 1,710 | 23,819 | 82 | - | - | 0 | 0 | 29 | 13 | 1,944 | 4,675 | 68 |
| Mar | 1st to 15th | 2.6 | 14,262 | 4,788 | 46,055 | 82 | - | - | 0 | 0 | 29 | 14 | 2,975 | 11,258 | 68 |
| | 16th to 31st | 2.1 | 14,672 | 4,926 | 47,379 | 82 | - | - | 1 | 4 | 29 | 14 | 3,174 | 11,468 | 65 |
| Apr | 1st to 15th | 6.4 | 19,338 | 9,045 | 41,962 | 82 | 10 | 27 | 22 | 61 | 29 | 14 | 8,926 | 10,361 | 7 |
| | 16th to 30th | 0.5 | 27,727 | 12,969 | 60,166 | 82 | 31 | 84 | 44 | 120 | 29 | 14 | 8,926 | 18,729 | (52) |
| May | 1st to 15th | 3.1 | 25,136 | 9,912 | 47,274 | 82 | 50 | 137 | 75 | 202 | 29 | 15 | 8,926 | 16,107 | (136) |
| | 16th to 31st | 9.7 | 15,320 | 6,041 | 28,812 | 82 | 67 | 181 | 109 | 294 | 29 | 15 | 9,521 | 5,662 | (228) |
| Jun | 1st to 15th | 6.6 | 7,528 | 2,535 | 18,995 | 82 | 79 | 213 | 124 | 336 | 29 | 17 | 8,926 | (1,550) | (271) |
| | 16th to 30th | 3.4 | 9,326 | 3,141 | 23,531 | 82 | 100 | 272 | 140 | 379 | 29 | 17 | 5,950 | 3,207 | (314) |
| Jul | 1st to 15th | -1.3 | 2,819 | 1,409 | 7,208 | 82 | 113 | 307 | 142 | 385 | 29 | 18 | 2,975 | (327) | (321) |
| | 16th to 31st | 2.0 | 2,382 | 1,191 | 6,091 | 82 | 105 | 284 | 128 | 346 | 29 | 18 | 3,174 | (948) | (282) |
| Aug | 1st to 15th | 1.2 | 1,159 | 763 | 2,318 | 82 | 75 | 204 | 93 | 251 | 29 | 18 | 893 | 145 | (187) |
| | 16th to 31st | -0.7 | 1,276 | 840 | 2,552 | 82 | 59 | 159 | 76 | 206 | 29 | 18 | 952 | 219 | (142) |
| Sep | 1st to 15th | 1.5 | 1,023 | 754 | 1,885 | 82 | 36 | 98 | 49 | 134 | 29 | 16 | 893 | 53 | (68) |
| | 16th to 30th | -2.6 | 1,250 | 921 | 2,303 | 82 | 22 | 61 | 32 | 87 | 29 | 16 | 893 | 297 | (21) |
| Total | | 1.6 | 202,362 | 81,554 | 523,349 | 1,964 | 753 | 2,040 | 1047 | 2838 | 686 | 360 | 85607 | 115,022 | (1,234) |




Notes:
SW supply = Median Water Volume (50% exceedance)
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET (described in Step 3 report/ag presentation)
Municipal Demand = Municipal + Unincorporated + SSIU (Municipal demand is from 2011-2016 useage reports to OWRD (only watersheds 1,2,6,7), SSIU is from water rights (only watersheds 1,3,4,6,7) and Unincorporated demand is included fo
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

Notes:
SW supply = Median Water Volume (50% exceedance) plus every 1 degree increas in temp is a 5% decrease in stream flow for future scenario
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky) (Assume constant in future scenario)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET and RCP 8.5 temp and precip climate scenario (described in Step 3 report/ag presentation)
Municipal Demand = SW demand is only SSIU (growth in use), GW demand calculated from OWRD reports (municipal demand), unincorporated extrapolation (6% increase in demand, PSU population increase)
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed (no change for future scenario, based on water rights)
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

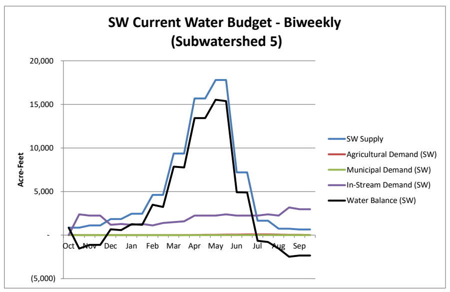
Water Budget - Biweekly (Subwatershed 5)

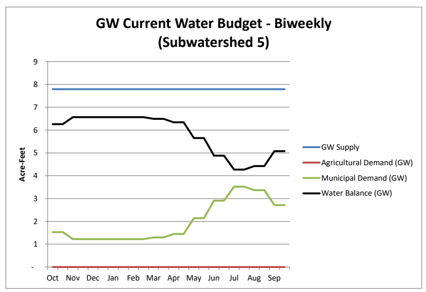
**Current**

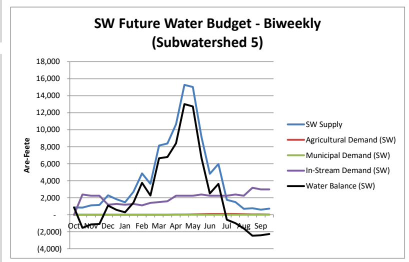
| Month | Days | SW Supply Available (AF)<br>SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Used (from Step 2 report) AF<br>GW Supply | Agricultural Demand SW (AF) (water rights)<br>Surface Water Rights by Subwatershed Distributed According to | Agricultural Demand GW (AF) (water rights)<br>Groundwater Rights by Subwatershed Distributed According to | Agricultural Demand SW (AF) (ET estimate)<br>Agricultural Demand (SW) | Agricultural Demand GW (AF) (ET estimate)<br>Agricultural Demand (GW) | Municipal Demand SW (AF) SSIU only<br>Municipal Demand (SW) | Municipal Demand GW (sum of SSIU, unic, and municipal)<br>Municipal Demand (GW) | Instream Demand SW(AF)<br>In-Stream Demand (SW) | SW Balance (ag ET)<br>Water Balance (SW) | GW Balance (ag ET)<br>Water Balance (GW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 1st to 15th | 846 | 557 | 1,470 | 8 | 4 | - | 4 | - | 0 | 1.5 | 0 | 842 | 6 |
| | 16th to 31st | 846 | 557 | 1,470 | 8 | - | - | - | - | 0 | 1.5 | 2380 | (1,534) | 6 |
| Nov | 1st to 15th | 1,121 | 668 | 3,470 | 8 | - | - | - | - | 0 | 1.2 | 2231 | (1,110) | 7 |
| | 16th to 30th | 1,121 | 668 | 3,470 | 8 | - | - | - | - | 0 | 1.2 | 2231 | (1,110) | 7 |
| Dec | 1st to 15th | 1,848 | 713 | 7,216 | 8 | - | - | - | - | 0 | 1.2 | 1190 | 658 | 7 |
| | 16th to 31st | 1,848 | 713 | 7,216 | 8 | - | - | - | - | 0 | 1.2 | 1269 | 579 | 7 |
| Jan | 1st to 15th | 2,450 | 891 | 12,205 | 8 | - | - | - | - | 0 | 1.2 | 1190 | 1,260 | 7 |
| | 16th to 31st | 2,450 | 891 | 12,205 | 8 | - | - | - | - | 0 | 1.2 | 1269 | 1,181 | 7 |
| Feb | 1st to 15th | 4,607 | 1,299 | 15,161 | 8 | - | - | - | - | 0 | 1.2 | 1111 | 3,496 | 7 |
| | 16th to 28th | 4,607 | 1,299 | 15,161 | 8 | - | - | - | - | 0 | 1.2 | 1388 | 3,219 | 7 |
| Mar | 1st to 15th | 9,354 | 2,984 | 29,398 | 8 | - | - | - | - | 0 | 1.3 | 1488 | 7,866 | 6 |
| | 16th to 31st | 9,354 | 2,984 | 29,398 | 8 | - | - | - | - | 0 | 1.3 | 1587 | 7,767 | 6 |
| Apr | 1st to 15th | 15,669 | 7,543 | 32,976 | 8 | 7 | - | 7 | - | 0 | 1.5 | 2231 | 13,431 | 6 |
| | 16th to 30th | 15,669 | 7,543 | 32,976 | 8 | 21 | - | 21 | - | 0 | 1.5 | 2231 | 13,417 | 6 |
| May | 1st to 15th | 17,795 | 7,394 | 31,625 | 8 | 35 | - | 34 | - | 0 | 2.1 | 2231 | 15,529 | 6 |
| | 16th to 31st | 17,795 | 7,394 | 31,625 | 8 | 46 | - | 45 | - | 0 | 2.1 | 2380 | 15,370 | 6 |
| Jun | 1st to 15th | 7,199 | 2,414 | 17,953 | 8 | 54 | - | 53 | - | 0 | 2.9 | 2231 | 4,914 | 5 |
| | 16th to 30th | 7,199 | 2,414 | 17,953 | 8 | 69 | - | 68 | - | 0 | 2.9 | 2231 | 4,900 | 5 |
| Jul | 1st to 15th | 1,648 | 802 | 4,521 | 8 | 78 | - | 77 | - | 0 | 3.5 | 2231 | (660) | 4 |
| | 16th to 31st | 1,648 | 802 | 4,521 | 8 | 72 | - | 71 | - | 0 | 3.5 | 2380 | (803) | 4 |
| Aug | 1st to 15th | 735 | 468 | 1,492 | 8 | 52 | - | 51 | - | 0 | 3.4 | 2231 | (1,547) | 4 |
| | 16th to 31st | 735 | 468 | 1,492 | 8 | 40 | - | 40 | - | 0 | 3.4 | 3174 | (2,478) | 4 |
| Sep | 1st to 15th | 647 | 453 | 1,207 | 8 | 25 | - | 25 | - | 0 | 2.7 | 2975 | (2,353) | 5 |
| | 16th to 30th | 647 | 453 | 1,207 | 8 | 15 | - | 15 | - | 0 | 2.7 | 2975 | (2,343) | 5 |
| **Total** | - | 127,838 | 52,372 | 317,388 | 187 | 519 | - | 510 | - | 0 | 47.7 | 46,840 | 80,489 | 139 |

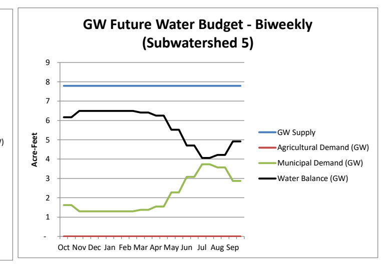
**2068**

| Month | Days | Temp Change (MM table) (+ is hotter, - is colder)<br>deg F | SW Supply Available (Acre-feet)<br>SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Used (from Step 2 report) AF<br>GW Supply | Agricultural Demand SW (AF) (water rights)<br>Surface Water Rights by Subwatershed Distributed | Agricultural Demand GW (AF) (water rights)<br>Groundwater Rights by Subwatershed | Agricultural Demand SW (AF) (ET estimate)<br>Agricultural Demand (SW) | Agricultural Demand GW (AF) (ET estimate)<br>Agricultural Demand (GW) | Municipal Demand SW (AF) SSIU only<br>Municipal Demand (SW) | Municipal Demand GW (future is increased by 6% for rural and municipal and calculated value for SSIU<br>Municipal Demand (GW) | Instream Demand SW (AF)<br>In-Stream Demand (SW) | SW Balance (ag ET)<br>Water Balance (SW) | GW Balance (ag ET)<br>Water Balance (GW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 1st to 15th | -0.7 | 876 | 576 | 1,521 | 8 | 4 | 0 | 9 | 0 | 0 | 2 | 0 | 867 | 6 |
| | 16th to 31st | 0.1 | 842 | 554 | 1,463 | 8 | 0 | 0 | 0 | 0 | 0 | 2 | 2380 | (1,538) | 6 |
| Nov | 1st to 15th | 0.4 | 1,099 | 655 | 3,401 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 2231 | (1,133) | 6 |
| | 16th to 30th | -0.5 | 1,149 | 685 | 3,557 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 2231 | (1,082) | 6 |
| Dec | 1st to 15th | -4.7 | 2,282 | 881 | 8,912 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 1190 | 1,092 | 6 |
| | 16th to 31st | 0.1 | 1,839 | 709 | 7,180 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 1269 | 569 | 6 |
| Jan | 1st to 15th | 8.0 | 1,470 | 535 | 7,323 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 1190 | 280 | 6 |
| | 16th to 31st | -2.0 | 2,695 | 980 | 13,426 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 1269 | 1,426 | 6 |
| Feb | 1st to 15th | -1.1 | 4,860 | 1,370 | 15,995 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 1111 | 3,750 | 6 |
| | 16th to 28th | 4.2 | 3,640 | 1,026 | 11,977 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 1388 | 2,251 | 6 |
| Mar | 1st to 15th | 2.6 | 8,138 | 2,596 | 25,576 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 1488 | 6,650 | 6 |
| | 16th to 31st | 2.1 | 8,372 | 2,671 | 26,311 | 8 | 0 | 0 | 1 | 0 | 0 | 1 | 1587 | 6,784 | 6 |
| Apr | 1st to 15th | 6.4 | 10,655 | 5,129 | 22,424 | 8 | 7 | 0 | 16 | 0 | 0 | 2 | 2231 | 8,407 | 6 |
| | 16th to 30th | 0.5 | 15,277 | 7,354 | 32,152 | 8 | 21 | 0 | 32 | 0 | 0 | 2 | 2231 | 13,014 | 6 |
| May | 1st to 15th | 3.1 | 15,037 | 6,248 | 26,723 | 8 | 35 | 0 | 53 | 0 | 0 | 2 | 2231 | 12,752 | 6 |
| | 16th to 31st | 9.7 | 9,164 | 3,808 | 16,287 | 8 | 46 | 0 | 78 | 0 | 0 | 2 | 2380 | 6,707 | 6 |
| Jun | 1st to 15th | 6.6 | 4,823 | 1,617 | 12,029 | 8 | 54 | 0 | 89 | 0 | 0 | 3 | 2231 | 2,503 | 5 |
| | 16th to 30th | 3.4 | 5,975 | 2,004 | 14,901 | 8 | 69 | 0 | 100 | 0 | 0 | 3 | 2231 | 3,644 | 5 |
| Jul | 1st to 15th | -1.3 | 1,755 | 854 | 4,815 | 8 | 78 | 0 | 101 | 0 | 0 | 4 | 2231 | (578) | 4 |
| | 16th to 31st | 2.0 | 1,483 | 722 | 4,069 | 8 | 72 | 0 | 91 | 0 | 0 | 4 | 2380 | (988) | 4 |
| Aug | 1st to 15th | 1.2 | 691 | 440 | 1,402 | 8 | 52 | 0 | 66 | 0 | 0 | 4 | 2231 | (1,607) | 4 |
| | 16th to 31st | -0.7 | 761 | 484 | 1,544 | 8 | 40 | 0 | 54 | 0 | 0 | 4 | 3174 | (2,467) | 4 |
| Sep | 1st to 15th | 1.5 | 598 | 419 | 1,116 | 8 | 25 | 0 | 35 | 0 | 0 | 3 | 2975 | (2,412) | 5 |
| | 16th to 30th | -2.6 | 731 | 512 | 1,364 | 8 | 15 | 0 | 23 | 0 | 0 | 3 | 2975 | (2,267) | 5 |
| **Total** | | 1.6 | 104212 | 42830 | 265467 | 187 | 519 | 0 | 749 | 0 | 0 | 51 | 46840 | 56,624 | 136 |




Notes:
SW supply = Median Water Volume (50% exceedance)
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweky)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET (described in Step 3 report/ag presentation)
Municipal Demand = Municipal + Unincorporated + SSIU (Municipal demand is from 2011-2016 useage reports to OWRD (only watersheds 1,2,6,7), SSIU is from water rights (only watersheds 1,3,4,6,7) and Unincorporated demand is included fo
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

Notes:
SW supply = Median Water Volume (50% exceedance) plus every 1 degree increas in temp is a 5% decrease in stream flow for future scenario
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweky) (Assume constant in future scenario)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET and RCP 8.5 temp and precip climate scenario (described in Step 3 report/ag presentation)
Municipal Demand = SW demand is only SSIU (growth in use), GW demand calculated from OWRD reports (municipal demand), unincorporated extrapolation (6% increase in demand, PSU population increase)
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed (no change for future scenario, based on water rights)
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

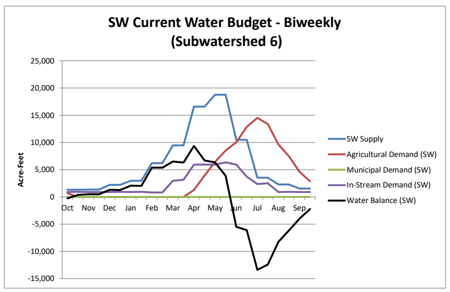
Water Budget - Biweekly (Subwatershed 6)

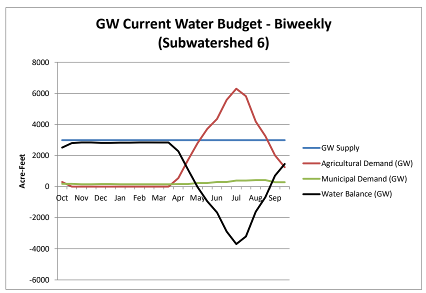
**Current**

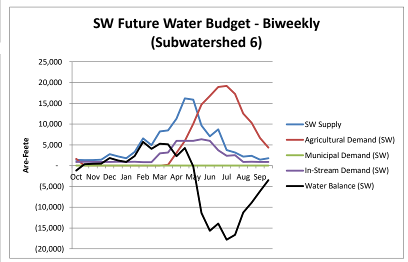
| Month | Days | SW Supply Available (AF): SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Used (from Step 2 report) AF: GW Supply | Agricultural Demand SW (AF) (water rights): Surface Water Rights by Subwatershed Distributed According to... | Agricultural Demand GW (AF) (water rights): Groundwater Rights by Subwatershed Distributed... | Agricultural Demand SW (AF) (ET estimate): Agricultural Demand (SW) | Agricultural Demand GW (AF) (ET estimate): Agricultural Demand (GW) | Municipal Demand SW (AF) SSIU only: Municipal Demand (SW) | Municipal Demand GW (sum of SSIU, unic, and municipal): Municipal Demand (GW) | Instream Demand SW(AF): In-Stream Demand (SW) | SW Balance (ag ET): Water Balance (SW) | GW Balance (ag ET): Water Balance (GW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 1st to 15th | 1,329 | 832 | 2,191 | 2988 | 743 | 322 | 673 | 292 | 4.7 | 184 | 893 | (241) | 2,512 |
| | 16th to 31st | 1,329 | 832 | 2,191 | 2988 | - | - | - | - | 4.7 | 184 | 952 | 372 | 2,804 |
| Nov | 1st to 15th | 1,375 | 874 | 3,446 | 2988 | - | - | - | - | 4.7 | 154 | 893 | 478 | 2,835 |
| | 16th to 30th | 1,375 | 874 | 3,446 | 2988 | - | - | - | - | 4.7 | 154 | 893 | 478 | 2,835 |
| Dec | 1st to 15th | 2,222 | 984 | 7,863 | 2988 | - | - | - | - | 4.7 | 170 | 893 | 1,325 | 2,818 |
| | 16th to 31st | 2,222 | 984 | 7,863 | 2988 | - | - | - | - | 4.7 | 170 | 952 | 1,265 | 2,818 |
| Jan | 1st to 15th | 2,983 | 1,197 | 14,102 | 2988 | - | - | - | - | 4.7 | 156 | 893 | 2,086 | 2,832 |
| | 16th to 31st | 2,983 | 1,197 | 14,102 | 2988 | - | - | - | - | 4.7 | 156 | 952 | 2,026 | 2,832 |
| Feb | 1st to 15th | 6,222 | 1,683 | 17,474 | 2988 | - | - | - | - | 4.7 | 152 | 833 | 5,384 | 2,836 |
| | 16th to 28th | 6,222 | 1,683 | 17,474 | 2988 | - | - | - | - | 4.7 | 152 | 833 | 5,384 | 2,836 |
| Mar | 1st to 15th | 9,486 | 3,693 | 26,683 | 2988 | - | - | - | - | 4.7 | 151 | 2975 | 6,506 | 2,837 |
| | 16th to 31st | 9,486 | 3,693 | 26,683 | 2988 | - | - | - | - | 4.7 | 151 | 3174 | 6,308 | 2,837 |
| Apr | 1st to 15th | 16,593 | 7,354 | 30,535 | 2988 | 1,399 | 607 | 1,268 | 550 | 4.7 | 172 | 5950 | 9,370 | 2,267 |
| | 16th to 30th | 16,593 | 7,354 | 30,535 | 2988 | 4,359 | 1,890 | 3,949 | 1,712 | 4.7 | 172 | 5950 | 6,689 | 1,104 |
| May | 1st to 15th | 18,769 | 7,487 | 31,349 | 2988 | 7,118 | 3,086 | 6,449 | 2,796 | 4.7 | 225 | 5950 | 6,365 | (33) |
| | 16th to 31st | 18,769 | 7,487 | 31,349 | 2988 | 9,426 | 4,087 | 8,541 | 3,703 | 4.7 | 225 | 6347 | 3,876 | (940) |
| Jun | 1st to 15th | 10,505 | 3,544 | 20,913 | 2988 | 11,091 | 4,809 | 10,049 | 4,357 | 4.7 | 299 | 5950 | (5,499) | (1,668) |
| | 16th to 30th | 10,505 | 3,544 | 20,913 | 2988 | 14,189 | 6,152 | 12,856 | 5,574 | 4.7 | 299 | 3719 | (6,075) | (2,886) |
| Jul | 1st to 15th | 3,531 | 2,638 | 7,497 | 2988 | 16,027 | 6,949 | 14,522 | 6,296 | 4.7 | 386 | 2380 | (13,376) | (3,694) |
| | 16th to 31st | 3,531 | 2,638 | 7,497 | 2988 | 14,789 | 6,412 | 13,400 | 5,810 | 4.7 | 386 | 2539 | (12,413) | (3,208) |
| Aug | 1st to 15th | 2,293 | 2,039 | 3,033 | 2988 | 10,634 | 4,611 | 9,635 | 4,178 | 4.7 | 419 | 893 | (8,240) | (1,609) |
| | 16th to 31st | 2,293 | 2,039 | 3,033 | 2988 | 8,276 | 3,588 | 7,498 | 3,251 | 4.7 | 419 | 952 | (6,162) | (682) |
| Sep | 1st to 15th | 1,561 | 1,247 | 2,405 | 2988 | 5,113 | 2,217 | 4,633 | 2,009 | 4.7 | 280 | 893 | (3,969) | 699 |
| | 16th to 30th | 1,561 | 1,247 | 2,405 | 2988 | 3,169 | 1,374 | 2,872 | 1,245 | 4.7 | 280 | 893 | (2,208) | 1,463 |
| Total | - | 153,738 | 67,144 | 334,982 | 71,716 | 106,332 | 46,104 | 96,345 | 41,774 | 114 | 5,498 | 57,550 | (272) | 24,445 |

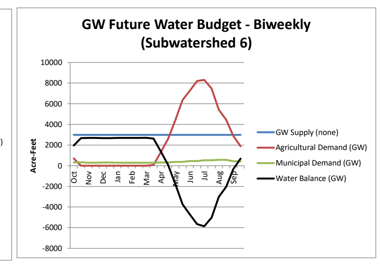
**2068**

| Month | Days | Temp Change (MM table) (+ is hotter, - is colder): deg F | SW Supply Available (Acre-feet): SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Used (from Step 2 report) AF: GW Supply (none) | Agricultural Demand SW (AF) (water rights): Surface Water Rights by Subwatershed Distributed... | Agricultural Demand GW (AF) (water rights): Groundwater Rights by Subwatershed | Agricultural Demand SW (AF) (ET estimate): Agricultural Demand (SW) | Agricultural Demand GW (AF) (ET estimate): Agricultural Demand (GW) | Municipal Demand SW (AF) SSIU only: Municipal Demand (SW) | Municipal Demand GW (future is increased by 6% for rural and municipal and calculated value for SSIU: Municipal Demand (GW) | Instream Demand SW (AF): In-Stream Demand (SW) | SW Balance (ag ET): Water Balance (SW) | GW Balance (ag ET): Water Balance (GW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 1st to 15th | -0.7 | 1,376 | 861 | 2,268 | 2988 | 743 | 322 | 1651 | 716 | 19.0 | 322 | 893 | (1,187) | 1,950 |
| | 16th to 31st | 0.1 | 1,322 | 828 | 2,180 | 2988 | - | - | 0 | 0 | 19.0 | 322 | 952 | 351 | 2,666 |
| Nov | 1st to 15th | 0.4 | 1,348 | 857 | 3,377 | 2988 | - | - | 0 | 0 | 19.0 | 290 | 893 | 436 | 2,698 |
| | 16th to 30th | -0.5 | 1,409 | 896 | 3,532 | 2988 | - | - | 0 | 0 | 19.0 | 290 | 893 | 498 | 2,698 |
| Dec | 1st to 15th | -4.7 | 2,744 | 1,215 | 9,711 | 2988 | - | - | 0 | 0 | 19.0 | 307 | 893 | 1,833 | 2,681 |
| | 16th to 31st | 0.1 | 2,211 | 979 | 7,824 | 2988 | - | - | 0 | 0 | 19.0 | 307 | 952 | 1,240 | 2,681 |
| Jan | 1st to 15th | 8.0 | 1,790 | 718 | 8,461 | 2988 | - | - | 0 | 0 | 19.0 | 293 | 893 | 878 | 2,696 |
| | 16th to 31st | -2.0 | 3,281 | 1,317 | 15,512 | 2988 | - | - | 0 | 0 | 19.0 | 293 | 952 | 2,310 | 2,696 |
| Feb | 1st to 15th | -1.1 | 6,564 | 1,776 | 18,435 | 2988 | - | - | 0 | 0 | 19.0 | 288 | 833 | 5,712 | 2,700 |
| | 16th to 28th | 4.2 | 4,915 | 1,330 | 13,804 | 2988 | - | - | 0 | 0 | 19.0 | 288 | 833 | 4,063 | 2,700 |
| Mar | 1st to 15th | 2.6 | 8,253 | 3,213 | 23,214 | 2988 | - | - | 0 | 0 | 19.0 | 287 | 2,975 | 5,259 | 2,701 |
| | 16th to 31st | 2.1 | 8,490 | 3,305 | 23,881 | 2988 | - | - | 176 | 76 | 19.0 | 287 | 3,174 | 5,121 | 2,625 |
| Apr | 1st to 15th | 6.4 | 11,283 | 5,001 | 20,764 | 2988 | 1,399 | 607 | 3038 | 1317 | 19.0 | 309 | 5,950 | 2,276 | 1,362 |
| | 16th to 30th | 0.5 | 16,178 | 7,170 | 29,772 | 2988 | 4,359 | 1,890 | 5967 | 2587 | 19.0 | 309 | 5,950 | 4,241 | 92 |
| May | 1st to 15th | 3.1 | 15,860 | 6,327 | 26,490 | 2988 | 7,118 | 3,086 | 10077 | 4369 | 19.0 | 366 | 5,950 | (187) | (1,747) |
| | 16th to 31st | 9.7 | 9,666 | 3,856 | 16,145 | 2988 | 9,426 | 4,087 | 14682 | 6366 | 19.0 | 366 | 6,347 | (11,382) | (3,743) |
| Jun | 1st to 15th | 6.6 | 7,038 | 2,374 | 14,012 | 2988 | 11,091 | 4,809 | 16739 | 7258 | 19.0 | 444 | 5,950 | (15,670) | (4,714) |
| | 16th to 30th | 3.4 | 8,719 | 2,942 | 17,358 | 2988 | 14,189 | 6,152 | 18910 | 8199 | 19.0 | 444 | 3,719 | (13,929) | (5,655) |
| Jul | 1st to 15th | -1.3 | 3,761 | 2,809 | 7,984 | 2988 | 16,027 | 6,949 | 19178 | 8315 | 19.0 | 536 | 2,380 | (17,816) | (5,863) |
| | 16th to 31st | 2.0 | 3,178 | 2,374 | 6,747 | 2988 | 14,789 | 6,412 | 17249 | 7479 | 19.0 | 536 | 2,539 | (16,628) | (5,027) |
| Aug | 1st to 15th | 1.2 | 2,155 | 1,917 | 2,851 | 2988 | 10,634 | 4,611 | 12537 | 5436 | 19.0 | 571 | 893 | (11,293) | (3,019) |
| | 16th to 31st | -0.7 | 2,373 | 2,110 | 3,139 | 2988 | 8,276 | 3,588 | 10297 | 4465 | 19.0 | 571 | 952 | (8,895) | (2,047) |
| Sep | 1st to 15th | 1.5 | 1,444 | 1,153 | 2,225 | 2988 | 5,113 | 2,217 | 6673 | 2893 | 19.0 | 424 | 893 | (6,141) | (329) |
| | 16th to 30th | -2.6 | 1,764 | 1,409 | 2,718 | 2988 | 3,169 | 1,374 | 4333 | 1879 | 19.0 | 424 | 893 | (3,481) | 686 |
| Total | - | 1.6 | 127123 | 56736 | 282403 | 71,716 | 106,332 | 46,104 | 141507 | 61355 | 455.7 | 8873.2 | 57550.4 | (72,390) | 1,488 |




Notes:
SW supply = Median Water Volume (50% exceedance)
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET (described in Step 3 report/ag presentation)
Municipal Demand = Municipal + Unincorporated + SSIU (Municipal demand is from 2011-2016 useage reports to OWRD (only watersheds 1,2,6,7), SSIU is from water rights (only watersheds 1,3,4,6,7) and Unincorporated demand is included fo
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

Notes:
SW supply = Median Water Volume (50% exceedance) plus every 1 degree increas in temp is a 5% decrease in stream flow for future scenario
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky) (Assume constant in future scenario)
Agricultural De 0
Municipal Demand = SW demand is only SSIU (growth in use), GW demand calculated from OWRD reports (municipal demand), unincorporated extrapolation (6% increase in demand, PSU population increase)
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed (no change for future scenario, based on water rights)
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

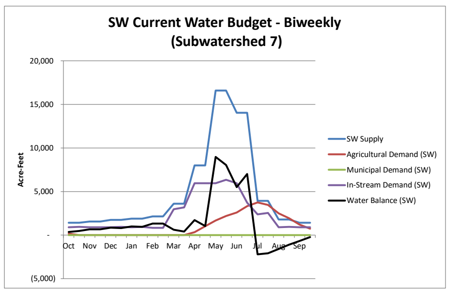
Water Budget - Biweekly (Subwatershed 7)

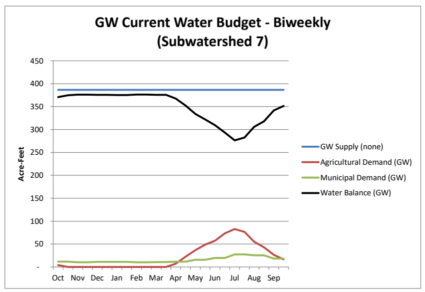
## Current

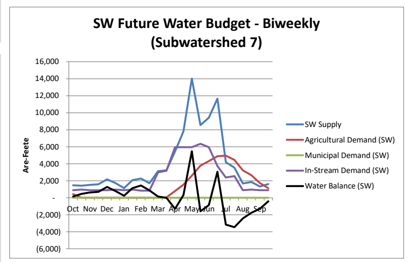
| Month | Days | SW Supply Available (AF)<br>SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Used (from Step 2 report) AF<br>GW Supply (none) | Agricultural Demand SW (AF) (water rights)<br>Surface Water Rights by Subwatershed Distributed According to | Agricultural Demand GW (AF) (water rights)<br>Groundwater Rights by Subwatershed Distributed According to | Agricultural Demand SW (AF) (ET estimate)<br>Agricultural Demand (SW) | Agricultural Demand GW (AF) (ET estimate)<br>Agricultural Demand (GW) | Municipal Demand SW (AF) SSIU only<br>Municipal Demand (SW) | Municipal Demand GW (sum of SSIU, unic, and municipal)<br>Municipal Demand (GW) | Instream Demand SW(AF)<br>In-Stream Demand (SW) | SW Balance (ag ET)<br>Water Balance (SW) | GW Balance (ag ET)<br>Water Balance (GW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 1st to 15th | 1,418 | 1,040 | 2,126 | 387 | 168 | 4 | 174 | 4 | - | 12 | 893 | 352 | 371 |
| | 16th to 31st | 1,418 | 1,040 | 2,126 | 387 | - | - | - | - | - | 12 | 952 | 466 | 375 |
| Nov | 1st to 15th | 1,555 | 1,098 | 3,110 | 387 | - | - | - | - | - | 10 | 893 | 662 | 376 |
| | 16th to 30th | 1,555 | 1,098 | 3,110 | 387 | - | - | - | - | - | 10 | 893 | 662 | 376 |
| Dec | 1st to 15th | 1,748 | 1,087 | 3,591 | 387 | - | - | - | - | - | 11 | 893 | 855 | 376 |
| | 16th to 31st | 1,748 | 1,087 | 3,591 | 387 | - | - | - | - | - | 11 | 952 | 796 | 376 |
| Jan | 1st to 15th | 1,890 | 1,087 | 4,442 | 387 | - | - | - | - | - | 11 | 893 | 997 | 375 |
| | 16th to 31st | 1,890 | 1,087 | 4,442 | 387 | - | - | - | - | - | 11 | 952 | 938 | 375 |
| Feb | 1st to 15th | 2,153 | 1,120 | 5,211 | 387 | - | - | - | - | - | 10 | 833 | 1,320 | 376 |
| | 16th to 28th | 2,153 | 1,120 | 5,211 | 387 | - | - | - | - | - | 10 | 833 | 1,320 | 376 |
| Mar | 1st to 15th | 3,591 | 1,701 | 9,167 | 387 | - | - | - | - | - | 11 | 2,975 | 616 | 376 |
| | 16th to 31st | 3,591 | 1,701 | 9,167 | 387 | - | - | - | - | - | 11 | 3,174 | 417 | 376 |
| Apr | 1st to 15th | 8,003 | 3,933 | 16,234 | 387 | 316 | 7 | 327 | 7 | - | 12 | 5,950 | 1,725 | 368 |
| | 16th to 30th | 8,003 | 3,933 | 16,234 | 387 | 985 | 22 | 1,019 | 23 | - | 12 | 5,950 | 1,033 | 352 |
| May | 1st to 15th | 16,586 | 8,648 | 30,621 | 387 | 1,608 | 36 | 1,665 | 37 | - | 16 | 5,950 | 8,971 | 334 |
| | 16th to 31st | 16,586 | 8,648 | 30,621 | 387 | 2,130 | 47 | 2,204 | 49 | - | 16 | 6,347 | 8,034 | 322 |
| Jun | 1st to 15th | 14,039 | 5,213 | 27,301 | 387 | 2,506 | 55 | 2,594 | 57 | - | 20 | 5,950 | 5,495 | 309 |
| | 16th to 30th | 14,039 | 5,213 | 27,301 | 387 | 3,206 | 71 | 3,318 | 73 | - | 20 | 3,719 | 7,002 | 293 |
| Jul | 1st to 15th | 3,922 | 2,126 | 9,404 | 387 | 3,621 | 80 | 3,748 | 83 | - | 27 | 2,380 | (2,206) | 276 |
| | 16th to 31st | 3,922 | 2,126 | 9,404 | 387 | 3,342 | 74 | 3,459 | 76 | - | 27 | 2,539 | (2,076) | 283 |
| Aug | 1st to 15th | 1,796 | 1,134 | 2,646 | 387 | 2,403 | 53 | 2,487 | 55 | - | 26 | 893 | (1,584) | 306 |
| | 16th to 31st | 1,796 | 1,134 | 2,646 | 387 | 1,870 | 41 | 1,935 | 43 | - | 26 | 952 | (1,091) | 318 |
| Sep | 1st to 15th | 1,418 | 960 | 1,966 | 387 | 1,155 | 26 | 1,196 | 26 | - | 18 | 893 | (670) | 342 |
| | 16th to 30th | 1,418 | 960 | 1,966 | 387 | 716 | 16 | 741 | 16 | - | 18 | 893 | (216) | 352 |
| Total | - | 116,238 | 58,294 | 231,638 | 9,279 | 24,027 | 531 | 24,868 | 550 | - | 369 | 57,550 | 33,820 | 8,361 |

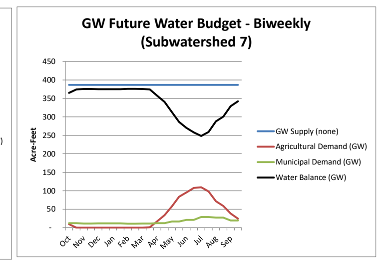
## 2068

| Month | Days | Temp Change (MM table) (+ is hotter, - is colder)<br>deg F | SW Supply Available (Acre-feet)<br>SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Used (from Step 2 report) AF<br>GW Supply (none) | Agricultural Demand SW (AF) (water rights)<br>Surface Water Rights by Subwatershed Distributed | Agricultural Demand GW (AF) (water rights)<br>Groundwater Rights by Subwatershed | Agricultural Demand SW (AF) (ET estimate)<br>Agricultural Demand (SW) | Agricultural Demand GW (AF) (ET estimate)<br>Agricultural Demand (GW) | Municipal Demand SW (AF) SSIU only<br>Municipal Demand (SW) | Municipal Demand GW (future is increased by 6% for rural and municipal and calculated value for SSIU<br>Municipal Demand (GW) | Instream Demand SW (AF)<br>In-Stream Demand (SW) | SW Balance (ag ET)<br>Water Balance (SW) | GW Balance (ag ET)<br>Water Balance (GW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 1st to 15th | -0.7 | 1,468 | 1,076 | 2,200 | 387 | 168 | 4 | 426 | 9 | - | 12 | 893 | 149 | 365 |
| | 16th to 31st | 0.1 | 1,411 | 1,035 | 2,115 | 387 | - | - | 0 | 0 | - | 12 | 952 | 459 | 374 |
| Nov | 1st to 15th | 0.4 | 1,524 | 1,076 | 3,048 | 387 | - | - | 0 | 0 | - | 11 | 893 | 631 | 376 |
| | 16th to 30th | -0.5 | 1,594 | 1,125 | 3,188 | 387 | - | - | 0 | 0 | - | 11 | 893 | 701 | 376 |
| Dec | 1st to 15th | -4.7 | 2,159 | 1,342 | 4,435 | 387 | - | - | 0 | 0 | - | 12 | 893 | 1,266 | 375 |
| | 16th to 31st | 0.1 | 1,739 | 1,082 | 3,573 | 387 | - | - | 0 | 0 | - | 12 | 952 | 787 | 375 |
| Jan | 1st to 15th | 8.0 | 1,134 | 652 | 2,665 | 387 | - | - | 0 | 0 | - | 12 | 893 | 241 | 375 |
| | 16th to 31st | -2.0 | 2,079 | 1,196 | 4,886 | 387 | - | - | 0 | 0 | - | 12 | 952 | 1,127 | 375 |
| Feb | 1st to 15th | -1.1 | 2,271 | 1,182 | 5,498 | 387 | - | - | 0 | 0 | - | 11 | 833 | 1,438 | 376 |
| | 16th to 28th | 4.2 | 1,701 | 885 | 4,117 | 387 | - | - | 0 | 0 | - | 11 | 833 | 868 | 376 |
| Mar | 1st to 15th | 2.6 | 3,124 | 1,480 | 7,975 | 387 | - | - | 0 | 0 | - | 11 | 2,975 | 149 | 375 |
| | 16th to 31st | 2.1 | 3,214 | 1,522 | 8,204 | 387 | - | - | 45 | 1 | - | 11 | 3,174 | (5) | 374 |
| Apr | 1st to 15th | 6.4 | 5,442 | 2,674 | 11,039 | 387 | 316 | 7 | 784 | 17 | - | 12 | 5,950 | (1,293) | 357 |
| | 16th to 30th | 0.5 | 7,803 | 3,835 | 15,828 | 387 | 985 | 22 | 1540 | 34 | - | 12 | 5,950 | 312 | 340 |
| May | 1st to 15th | 3.1 | 14,015 | 7,308 | 25,875 | 387 | 1,608 | 36 | 2601 | 57 | - | 17 | 5,950 | 5,464 | 313 |
| | 16th to 31st | 9.7 | 8,542 | 4,454 | 15,770 | 387 | 2,130 | 47 | 3789 | 84 | - | 17 | 6,347 | (1,595) | 286 |
| Jun | 1st to 15th | 6.6 | 9,406 | 3,493 | 18,292 | 387 | 2,506 | 55 | 4320 | 95 | - | 21 | 5,950 | (865) | 270 |
| | 16th to 30th | 3.4 | 11,652 | 4,327 | 22,660 | 387 | 3,206 | 71 | 4881 | 108 | - | 21 | 3,719 | 3,052 | 258 |
| Jul | 1st to 15th | -1.3 | 4,177 | 2,264 | 10,015 | 387 | 3,621 | 80 | 4950 | 109 | - | 29 | 2,380 | (3,153) | 248 |
| | 16th to 31st | 2.0 | 3,530 | 1,913 | 8,464 | 387 | 3,342 | 74 | 4452 | 98 | - | 29 | 2,539 | (3,461) | 259 |
| Aug | 1st to 15th | 1.2 | 1,688 | 1,066 | 2,487 | 387 | 2,403 | 53 | 3236 | 72 | - | 27 | 893 | (2,440) | 288 |
| | 16th to 31st | -0.7 | 1,859 | 1,174 | 2,739 | 387 | 1,870 | 41 | 2658 | 59 | - | 27 | 952 | (1,751) | 301 |
| Sep | 1st to 15th | 1.5 | 1,312 | 888 | 1,819 | 387 | 1,155 | 26 | 1722 | 38 | - | 19 | 893 | (1,303) | 329 |
| | 16th to 30th | -2.6 | 1,602 | 1,085 | 2,222 | 387 | 716 | 16 | 1118 | 25 | - | 19 | 893 | (409) | 342 |
| Total | - | 1.6 | 94,446 | 48,133 | 189,113 | 9,279 | 24,027 | 531 | 36524 | 807 | - | 388 | 57,550 | 371 | 8,084 |




Notes:
SW supply = Median Water Volume (50% exceedance)
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET (described in Step 3 report/ag presentation)
Municipal Demand = Municipal + Unincorporated + SSIU (Municipal demand is from 2011-2016 useage reports to OWRD (only watersheds 1,2,6,7), SSIU is from water rights (only watersheds 1,3,4,6,7) and Unincorporated demand is included fo
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

Notes:
SW supply = Median Water Volume (50% exceedance) plus every 1 degree increas in temp is a 5% decrease in stream flow for future scenario
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky) (Assume constant in future scenario)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET and RCP 8.5 temp and precip climate scenario (described in Step 3 report/ag presentation)
Municipal Demand = SW demand is only SSIU (growth in use), GW demand calculated from OWRD reports (municipal demand), unincorporated extrapolation (6% increase in demand, PSU population increase)
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed (no change for future scenario, based on water rights)
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

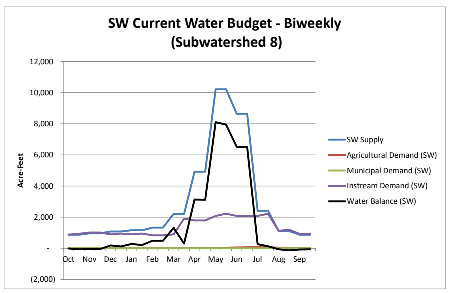
Water Budget - Biweekly (Subwatershed 8)

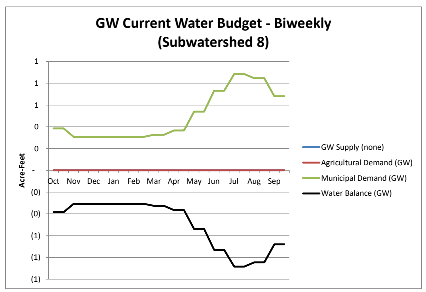
**Current**

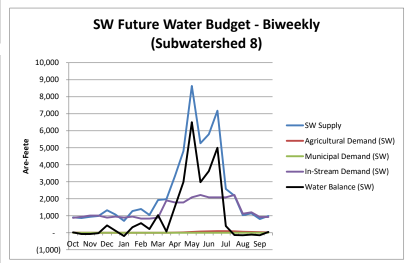
| Month | Days | SW Supply Available (AF) | | | GW Used (from Step 2 report) AF | Agricultural Demand SW (AF) (water rights) | Agricultural Demand GW (AF) (water rights) | Agricultural Demand SW (AF) (ET estimate) | Agricultural Demand GW (AF) (ET estimate) | Municipal Demand SW (AF) SSIU only | Municipal Demand GW (sum of SSIU, unic, and municipal) | Instream Demand SW(AF) | SW Balance (ag ET) | GW Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Days | SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Supply (none) | Surface Water Rights by Subwatershed Distributed | Groundwater Rights by Subwatershed Distributed | Agricultural Demand (SW) | Agricultural Demand (GW) | Municipal Demand (SW) | Municipal Demand (GW) | Instream Demand (SW) | Water Balance (SW) | Water Balance (GW) |
| Oct | 1st to 15th | 873 | 640 | 1,310 | - | 2 | - | 3 | - | 0 | 0.4 | 878 | (8) | (0) |
| | 16th to 31st | 873 | 640 | 1,310 | - | - | - | - | - | 0 | 0.4 | 936 | (63) | (0) |
| Nov | 1st to 15th | 958 | 676 | 1,915 | - | - | - | - | - | 0 | 0.3 | 1012 | (54) | (0) |
| | 16th to 30th | 958 | 676 | 1,915 | - | - | - | - | - | 0 | 0.3 | 1012 | (54) | (0) |
| Dec | 1st to 15th | 1,077 | 669 | 2,212 | - | - | - | - | - | 0 | 0.3 | 893 | 184 | (0) |
| | 16th to 31st | 1,077 | 669 | 2,212 | - | - | - | - | - | 0 | 0.3 | 952 | 125 | (0) |
| Jan | 1st to 15th | 1,164 | 669 | 2,736 | - | - | - | - | - | 0 | 0.3 | 893 | 271 | (0) |
| | 16th to 31st | 1,164 | 669 | 2,736 | - | - | - | - | - | 0 | 0.3 | 952 | 212 | (0) |
| Feb | 1st to 15th | 1,326 | 690 | 3,210 | - | - | - | - | - | 0 | 0.3 | 833 | 493 | (0) |
| | 16th to 28th | 1,326 | 690 | 3,210 | - | - | - | - | - | 0 | 0.3 | 833 | 493 | (0) |
| Mar | 1st to 15th | 2,212 | 1,048 | 5,647 | - | - | - | - | - | 0 | 0.3 | 893 | 1,319 | (0) |
| | 16th to 31st | 2,212 | 1,048 | 5,647 | - | - | - | - | - | 0 | 0.3 | 1904 | 308 | (0) |
| Apr | 1st to 15th | 4,929 | 2,422 | 10,000 | - | 5 | - | 6 | - | 0 | 0.4 | 1785 | 3,138 | (0) |
| | 16th to 30th | 4,929 | 2,422 | 10,000 | - | 15 | - | 19 | - | 0 | 0.4 | 1785 | 3,125 | (0) |
| May | 1st to 15th | 10,217 | 5,327 | 18,861 | - | 24 | - | 32 | - | 0 | 0.5 | 2083 | 8,103 | (1) |
| | 16th to 31st | 10,217 | 5,327 | 18,861 | - | 32 | - | 42 | - | 0 | 0.5 | 2221 | 7,954 | (1) |
| Jun | 1st to 15th | 8,648 | 3,211 | 16,816 | - | 37 | - | 49 | - | 0 | 0.7 | 2083 | 6,516 | (1) |
| | 16th to 30th | 8,648 | 3,211 | 16,816 | - | 48 | - | 63 | - | 0 | 0.7 | 2083 | 6,502 | (1) |
| Jul | 1st to 15th | 2,416 | 1,310 | 5,792 | - | 54 | - | 71 | - | 0 | 0.9 | 2083 | 262 | (1) |
| | 16th to 31st | 2,416 | 1,310 | 5,792 | - | 50 | - | 66 | - | 0 | 0.9 | 2221 | 129 | (1) |
| Aug | 1st to 15th | 1,106 | 699 | 1,630 | - | 36 | - | 47 | - | 0 | 0.8 | 1125 | (66) | (1) |
| | 16th to 31st | 1,106 | 699 | 1,630 | - | 28 | - | 37 | - | 0 | 0.8 | 1200 | (130) | (1) |
| Sep | 1st to 15th | 873 | 592 | 1,211 | - | 17 | - | 23 | - | 0 | 0.7 | 922 | (72) | (1) |
| | 16th to 30th | 873 | 592 | 1,211 | - | 11 | - | 14 | - | 0 | 0.7 | 922 | (63) | (1) |
| Total | - | 71,598 | 35,906 | 142,680 | - | 357 | - | 472 | - | 0 | 12.0 | 32502 | 38,624 | (12) |

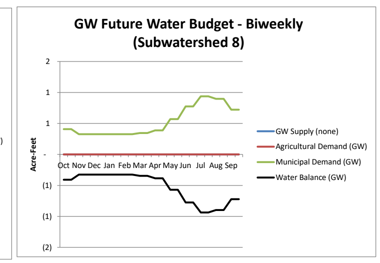
**2068**

| Month | Days | Temp Change (MM table) (+ is hotter, - is colder) | SW Supply Available (Acre-feet) | | | GW Used (from Step 2 report) AF | Agricultural Demand SW (AF) (water rights) | Agricultural Demand GW (AF) (water rights) | Agricultural Demand SW (AF) (ET estimate) | Agricultural Demand GW (AF) (ET estimate) | Municipal Demand SW (AF) SSIU only | Municipal Demand GW (future is increased by 6% for rural and municipal and calculated value for SSIU | Instream Demand SW (AF) | SW Balance (ag ET) | GW Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Days | deg F | SW Supply | Low Water Volume (90% exceedance) | High Water Volume (10% exceedance) | GW Supply (none) | Surface Water Rights by Subwatershed Distributed | Groundwater Rights by Subwatershed | Agricultural Demand (SW) | Agricultural Demand (GW) | Municipal Demand (SW) | Municipal Demand (GW) | In-Stream Demand (SW) | Water Balance (SW) | Water Balance (GW) |
| Oct | 1st to 15th | -0.7 | 904 | 662 | 1,356 | - | 2 | - | 8 | 0 | - | 0 | 878 | 18 | (0) |
| | 16th to 31st | 0.1 | 869 | 637 | 1,303 | - | - | - | 0 | 0 | - | 0 | 936 | (68) | (0) |
| Nov | 1st to 15th | 0.4 | 939 | 662 | 1,877 | - | - | - | 0 | 0 | - | 0 | 1,012 | (73) | (0) |
| | 16th to 30th | -0.5 | 982 | 693 | 1,963 | - | - | - | 0 | 0 | - | 0 | 1,012 | (30) | (0) |
| Dec | 1st to 15th | -4.7 | 1,330 | 826 | 2,732 | - | - | - | 0 | 0 | - | 0 | 893 | 438 | (0) |
| | 16th to 31st | 0.1 | 1,072 | 666 | 2,201 | - | - | - | 0 | 0 | - | 0 | 952 | 120 | (0) |
| Jan | 1st to 15th | 8.0 | 698 | 401 | 1,642 | - | - | - | 0 | 0 | - | 0 | 893 | (194) | (0) |
| | 16th to 31st | -2.0 | 1,280 | 736 | 3,010 | - | - | - | 0 | 0 | - | 0 | 952 | 328 | (0) |
| Feb | 1st to 15th | -1.1 | 1,399 | 728 | 3,387 | - | - | - | 0 | 0 | - | 0 | 833 | 566 | (0) |
| | 16th to 28th | 4.2 | 1,048 | 545 | 2,536 | - | - | - | 0 | 0 | - | 0 | 833 | 214 | (0) |
| Mar | 1st to 15th | 2.6 | 1,924 | 912 | 4,913 | - | - | - | 0 | 0 | - | 0 | 893 | 1,032 | (0) |
| | 16th to 31st | 2.1 | 1,980 | 938 | 5,054 | - | - | - | 1 | 0 | - | 0 | 1,904 | 75 | (0) |
| Apr | 1st to 15th | 6.4 | 3,352 | 1,647 | 6,800 | - | 5 | - | 15 | 0 | - | 0 | 1,785 | 1,552 | (0) |
| | 16th to 30th | 0.5 | 4,806 | 2,361 | 9,750 | - | 15 | - | 29 | 0 | - | 0 | 1,785 | 2,991 | (0) |
| May | 1st to 15th | 3.1 | 8,633 | 4,501 | 15,938 | - | 24 | - | 49 | 0 | - | 1 | 2,083 | 6,501 | (1) |
| | 16th to 31st | 9.7 | 5,262 | 2,743 | 9,713 | - | 32 | - | 72 | 0 | - | 1 | 2,221 | 2,968 | (1) |
| Jun | 1st to 15th | 6.6 | 5,794 | 2,151 | 11,267 | - | 37 | - | 82 | 0 | - | 1 | 2,083 | 3,630 | (1) |
| | 16th to 30th | 3.4 | 7,178 | 2,665 | 13,957 | - | 48 | - | 93 | 0 | - | 1 | 2,083 | 5,003 | (1) |
| Jul | 1st to 15th | -1.3 | 2,573 | 1,395 | 6,168 | - | 54 | - | 94 | 0 | - | 1 | 2,083 | 396 | (1) |
| | 16th to 31st | 2.0 | 2,174 | 1,179 | 5,213 | - | 50 | - | 85 | 0 | - | 1 | 2,221 | (132) | (1) |
| Aug | 1st to 15th | 1.2 | 1,040 | 657 | 1,532 | - | 36 | - | 61 | 0 | - | 1 | 1,125 | (146) | (1) |
| | 16th to 31st | -0.7 | 1,145 | 723 | 1,687 | - | 28 | - | 50 | 0 | - | 1 | 1,200 | (105) | (1) |
| Sep | 1st to 15th | 1.5 | 808 | 548 | 1,120 | - | 17 | - | 33 | 0 | - | 1 | 922 | (147) | (1) |
| | 16th to 30th | -2.6 | 986 | 669 | 1,368 | - | 11 | - | 21 | 0 | - | 1 | 922 | 43 | (1) |
| Total | | 1.6 | 58,175 | 29,647 | 116,486 | - | 357 | - | 693 | 0 | - | 13 | 32,502 | 24,980 | (13) |




Notes:
SW supply = Median Water Volume (50% exceedance)
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET (described in Step 3 report/ag presentation)
Municipal Demand = Municipal + Unincorporated + SSIU (Municipal demand is from 2011-2016 useage reports to OWRD (only watersheds 1,2,6,7), SSIU is from water rights (only watersheds 1,3,4,6,7) and Unincorporated demand is included fo
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

Notes:
SW supply = Median Water Volume (50% exceedance) plus every 1 degree increas in temp is a 5% decrease in stream flow for future scenario
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky) (Assume constant in future scenario)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET and RCP 8.5 temp and precip climate scenario (described in Step 3 report/ag presentation)
Municipal Demand = SW demand is only SSIU (growth in use), GW demand calculated from OWRD reports (municipal demand), unincorporated extrapolation (6% increase in demand, PSU population increase)
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed (no change for future scenario, based on water rights)
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

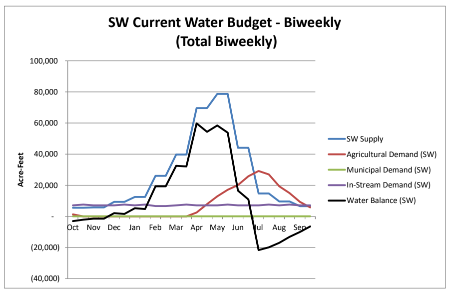
Water Budget - Biweekly (Total Biweekly)

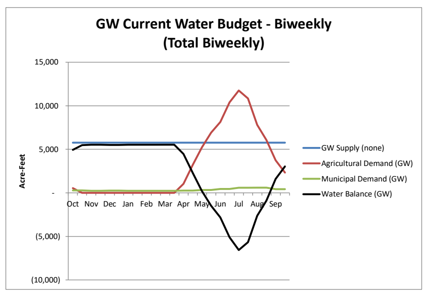
**Current**

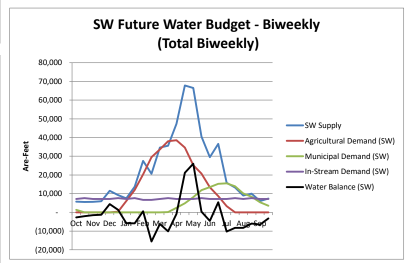
| Month | Days | SW Supply Available (AF): SW Supply | SW Supply Available (AF): Low Water Volume (90% exceedance) | SW Supply Available (AF): High Water Volume (10% exceedance) | GW Used (from Step 2 report) AF: GW Supply (none) | Agricultural Demand SW (AF) (water rights): Surface Water Rights by Subwatershed Distributed | Agricultural Demand GW (AF) (water rights): Groundwater Rights by Subwatershed Distributed | Agricultural Demand SW (AF) (ET estimate): Agricultural Demand (SW) | Agricultural Demand GW (AF) (ET estimate): Agricultural Demand (GW) | Municipal Demand SW (AF) SSIU only: Municipal Demand (SW) | Municipal Demand GW (sum of SSIU, unic, and municipal): Municipal Demand (GW) | Instream Demand SW(AF): In-Stream Demand (SW) | SW Balance (ag ET): Water Balance (SW) | GW Balance (ag ET): Water Balance (GW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 1st to 15th | 5,573 | 3,488 | 9,188 | 5,761 | 1,474 | 607 | 1,353 | 545 | 85.9 | 275 | 7140 | (3,007) | 4,941 |
| | 16th to 31st | 5,573 | 3,488 | 9,188 | 5,761 | - | - | - | - | 85.9 | 275 | 7617 | (2,129) | 5,486 |
| Nov | 1st to 15th | 5,763 | 3,664 | 14,450 | 5,761 | - | - | - | - | 85.9 | 234 | 7140 | (1,463) | 5,527 |
| | 16th to 30th | 5,763 | 3,664 | 14,450 | 5,761 | - | - | - | - | 85.9 | 234 | 7140 | (1,463) | 5,527 |
| Dec | 1st to 15th | 9,316 | 4,126 | 32,968 | 5,761 | - | - | - | - | 85.9 | 251 | 7140 | 2,090 | 5,510 |
| | 16th to 31st | 9,316 | 4,126 | 32,968 | 5,761 | - | - | - | - | 85.9 | 251 | 7617 | 1,614 | 5,510 |
| Jan | 1st to 15th | 12,506 | 5,020 | 59,129 | 5,761 | - | - | - | - | 85.9 | 238 | 7140 | 5,280 | 5,523 |
| | 16th to 31st | 12,506 | 5,020 | 59,129 | 5,761 | - | - | - | - | 85.9 | 238 | 7617 | 4,804 | 5,523 |
| Feb | 1st to 15th | 26,089 | 7,055 | 73,266 | 5,761 | - | - | - | - | 85.9 | 233 | 6664 | 19,339 | 5,528 |
| | 16th to 28th | 26,089 | 7,055 | 73,266 | 5,761 | - | - | - | - | 85.9 | 233 | 6664 | 19,339 | 5,528 |
| Mar | 1st to 15th | 39,774 | 15,484 | 111,877 | 5,761 | - | - | - | - | 85.9 | 233 | 7140 | 32,548 | 5,528 |
| | 16th to 31st | 39,774 | 15,484 | 111,877 | 5,761 | - | - | - | - | 85.9 | 233 | 7617 | 32,072 | 5,528 |
| Apr | 1st to 15th | 69,572 | 30,834 | 128,028 | 5,761 | 2,778 | 1,143 | 2,549 | 1,026 | 85.9 | 259 | 7140 | 59,797 | 4,476 |
| | 16th to 30th | 69,572 | 30,834 | 128,028 | 5,761 | 8,654 | 3,559 | 7,941 | 3,196 | 85.9 | 259 | 7140 | 54,405 | 2,306 |
| May | 1st to 15th | 78,697 | 31,394 | 131,445 | 5,761 | 14,133 | 5,812 | 12,968 | 5,219 | 85.9 | 339 | 7140 | 58,503 | 203 |
| | 16th to 31st | 78,697 | 31,394 | 131,445 | 5,761 | 18,716 | 7,697 | 17,173 | 6,912 | 85.9 | 339 | 7617 | 53,822 | (1,490) |
| Jun | 1st to 15th | 44,048 | 14,861 | 87,685 | 5,761 | 22,022 | 9,057 | 20,206 | 8,133 | 85.9 | 451 | 7140 | 16,616 | (2,822) |
| | 16th to 30th | 44,048 | 14,861 | 87,685 | 5,761 | 28,174 | 11,587 | 25,850 | 10,405 | 85.9 | 451 | 7140 | 10,971 | (5,094) |
| Jul | 1st to 15th | 14,804 | 11,060 | 31,436 | 5,761 | 31,823 | 13,088 | 29,199 | 11,752 | 85.9 | 576 | 7140 | (21,622) | (6,567) |
| | 16th to 31st | 14,804 | 11,060 | 31,436 | 5,761 | 29,365 | 12,077 | 26,944 | 10,845 | 85.9 | 576 | 7617 | (19,842) | (5,659) |
| Aug | 1st to 15th | 9,614 | 8,550 | 12,719 | 5,761 | 21,115 | 8,684 | 19,374 | 7,798 | 85.9 | 595 | 7140 | (16,986) | (2,632) |
| | 16th to 31st | 9,614 | 8,550 | 12,719 | 5,761 | 16,432 | 6,758 | 15,077 | 6,069 | 85.9 | 595 | 7617 | (13,166) | (902) |
| Sep | 1st to 15th | 6,546 | 5,228 | 10,086 | 5,761 | 10,153 | 4,176 | 9,316 | 3,750 | 85.9 | 411 | 7140 | (9,996) | 1,600 |
| | 16th to 30th | 6,546 | 5,228 | 10,086 | 5,761 | 6,293 | 2,588 | 5,774 | 2,324 | 85.9 | 411 | 7140 | (6,455) | 3,026 |
| Total | - | 644,604 | 281,528 | 1,404,554 | 138,271 | 211,134 | 86,832 | 193,725 | 77,973 | 2061.6 | 8192 | 173,752 | 275,066 | 52,106 |

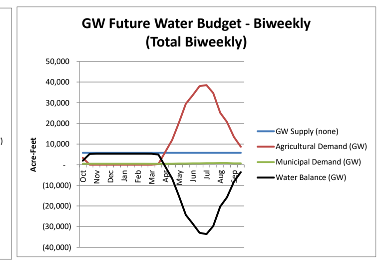
**2068**

| Month | Days | Temp Change (MM table) (+ is hotter, - is colder): deg F | SW Supply Available (Acre-feet): SW Supply | SW Supply Available (Acre-feet): Low Water Volume (90% exceedance) | SW Supply Available (Acre-feet): High Water Volume (10% exceedance) | GW Used (from Step 2 report) AF: GW Supply (none) | Agricultural Demand SW (AF) (water rights): Surface Water Rights by Subwatershed Distributed | Agricultural Demand GW (AF) (water rights): Groundwater Rights by Subwatershed | Agricultural Demand SW (AF) (ET estimate): Agricultural Demand (SW) | Agricultural Demand GW (AF) (ET estimate): Agricultural Demand (GW) | Municipal Demand SW (AF) SSIU only: Municipal Demand (SW) | Municipal Demand GW (future is increased by 6% for rural and municipal and calculated value for SSIU: Municipal Demand (GW) | Instream Demand SW (AF): In-Stream Demand (SW) | SW Balance (ag ET): Water Balance (SW) | GW Balance (ag ET): Water Balance (GW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct | 1st to 15th | -0.7 | 5,768 | 3,610 | 9,510 | 5,761 | 1,474 | 607 | 0 | 3320 | 1336 | 494 | 7,140 | (2,709) | 1,947 |
| | 16th to 31st | 0.1 | 5,545 | 3,471 | 9,142 | 5,761 | - | - | 0 | 0 | 0 | 494 | 7,617 | (2,071) | 5,267 |
| Nov | 1st to 15th | 0.4 | 5,648 | 3,591 | 14,161 | 5,761 | - | - | 0 | 0 | 0 | 451 | 7,140 | (1,493) | 5,311 |
| | 16th to 30th | -0.5 | 5,907 | 3,756 | 14,811 | 5,761 | - | - | 0 | 0 | 0 | 451 | 7,140 | (1,233) | 5,311 |
| Dec | 1st to 15th | -4.7 | 11,505 | 5,096 | 40,715 | 5,761 | - | - | 0 | 0 | 0 | 469 | 7,140 | 4,365 | 5,292 |
| | 16th to 31st | 0.1 | 9,269 | 4,105 | 32,803 | 5,761 | - | - | 354 | 0 | 0 | 469 | 7,617 | 1,299 | 5,292 |
| Jan | 1st to 15th | 8.0 | 7,504 | 3,012 | 35,477 | 5,761 | - | - | 6109 | 0 | 0 | 455 | 7,140 | (5,746) | 5,306 |
| | 16th to 31st | -2.0 | 13,757 | 5,522 | 65,042 | 5,761 | - | - | 11999 | 0 | 0 | 455 | 7,617 | (5,859) | 5,306 |
| Feb | 1st to 15th | -1.1 | 27,524 | 7,443 | 77,296 | 5,761 | - | - | 20262 | 0 | 0 | 450 | 6,664 | 597 | 5,311 |
| | 16th to 28th | 4.2 | 20,610 | 5,573 | 57,880 | 5,761 | - | - | 29521 | 0 | 0 | 450 | 6,664 | (15,575) | 5,311 |
| Mar | 1st to 15th | 2.6 | 34,603 | 13,471 | 97,333 | 5,761 | - | - | 33657 | 0 | 0 | 450 | 7,140 | (6,194) | 5,311 |
| | 16th to 31st | 2.1 | 35,598 | 13,858 | 100,130 | 5,761 | - | - | 38024 | 354 | 142 | 450 | 7,617 | (10,185) | 4,958 |
| Apr | 1st to 15th | 6.4 | 47,309 | 20,967 | 87,059 | 5,761 | 2,778 | 1,143 | 38561 | 6109 | 2459 | 477 | 7,140 | (852) | (825) |
| | 16th to 30th | 0.5 | 67,833 | 30,063 | 124,827 | 5,761 | 8,654 | 3,559 | 34682 | 11999 | 4829 | 477 | 7,140 | 21,181 | (6,715) |
| May | 1st to 15th | 3.1 | 66,499 | 26,528 | 111,071 | 5,761 | 14,133 | 5,812 | 25209 | 20262 | 8155 | 562 | 7,140 | 25,994 | (15,063) |
| | 16th to 31st | 9.7 | 40,529 | 16,168 | 67,694 | 5,761 | 18,716 | 7,697 | 20705 | 29521 | 11882 | 562 | 7,617 | 326 | (24,322) |
| Jun | 1st to 15th | 6.6 | 29,512 | 9,957 | 58,749 | 5,761 | 22,022 | 9,057 | 13417 | 33657 | 13547 | 681 | 7,140 | (4,592) | (28,576) |
| | 16th to 30th | 3.4 | 36,560 | 12,335 | 72,779 | 5,761 | 28,174 | 11,587 | 8713 | 38024 | 15304 | 681 | 7,140 | 5,403 | (32,943) |
| Jul | 1st to 15th | -1.3 | 15,766 | 11,779 | 33,479 | 5,761 | 31,823 | 13,088 | 3320 | 38561 | 15521 | 813 | 7,140 | (10,215) | (33,613) |
| | 16th to 31st | 2.0 | 13,324 | 9,954 | 28,292 | 5,761 | 29,365 | 12,077 | 0 | 34682 | 13959 | 813 | 7,617 | (8,252) | (29,734) |
| Aug | 1st to 15th | 1.2 | 9,037 | 8,037 | 11,956 | 5,761 | 21,115 | 8,684 | 0 | 25209 | 10146 | 834 | 7,140 | (8,250) | (20,281) |
| | 16th to 31st | -0.7 | 9,950 | 8,849 | 13,164 | 5,761 | 16,432 | 6,758 | 0 | 20705 | 8333 | 834 | 7,617 | (5,999) | (15,777) |
| Sep | 1st to 15th | 1.5 | 6,055 | 4,836 | 9,330 | 5,761 | 10,153 | 4,176 | 0 | 13417 | 5400 | 639 | 7,140 | (6,486) | (8,295) |
| | 16th to 30th | -2.6 | 7,397 | 5,908 | 11,397 | 5,761 | 6,293 | 2,588 | 0 | 8713 | 3507 | 639 | 7,140 | (3,250) | (3,590) |
| Total | | 1.6 | 593,372 | 259,152 | 1,292,921 | 138,271 | 211,134 | 86,832 | 284532 | 284532 | 114522 | 13,548 | 173,752 | 20,566 | (159,808) |




Notes:
SW supply = Median Water Volume (50% exceedance)
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET (described in Step 3 report/ag presentation)
Municipal Demand = Municipal + Unincorporated + SSIU (Municipal demand is from 2011-2016 useage reports to OWRD (only watersheds 1,2,6,7), SSIU is from water rights (only watersheds 1,3,4,6,7) and Unincorporated demand is included fo
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

Notes:
SW supply = Median Water Volume (50% exceedance) plus every 1 degree increas in temp is a 5% decrease in stream flow for future scenario
GW supply = Annual pumping rate (from OWRD in Step 2 report) divided by 24 (biweeky) (Assume constant in future scenario)
Agricultural Demand = Gross Irrigation Water Requirement (GWIR) demand calculated using ET and RCP 8.5 temp and precip climate scenario (described in Step 3 report/ag presentation)
Municipal Demand = SW demand is only SSIU (growth in use), GW demand calculated from OWRD reports (municipal demand), unincorporated extrapolation (6% increase in demand, PSU population increase)
and total SSIU and unincorporated demand divided evenly between each subwatershed and by 24 (biweekly)
In-stream Demand = No GW demand, SW demand calculated by adding in-stream water rights for all segments in the subwatershed (no change for future scenario, based on water rights)
Water Balance SW = SW supply - Ag demand (ET) - In-Stream Demand
Water Balance GW = GW Supply - Agricultural Demand - Municipal Demand

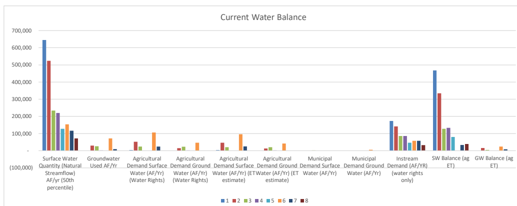
**Water Budget - Annual**

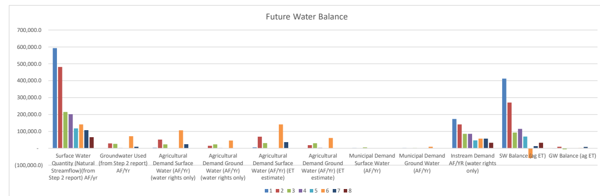
**Current**

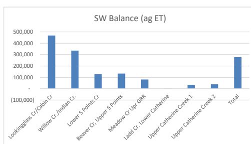
| Subwatershed | Name | Surface Water Quantity (Natural Streamflow) AF/yr (50th percentile) | Groundwater Used AF/Yr | Agricultural Demand Surface Water (AF/Yr) (Water Rights) | Agricultural Demand Ground Water (AF/Yr) (Water Rights) | Agricultural Demand Surface Water (AF/Yr) (ET estimate) | Agricultural Demand Ground Water (AF/Yr) (ET estimate) | Municipal Demand Surface Water (AF/Yr) | Municipal Demand Ground Water (AF/Yr) | Instream Demand (AF/YR) (water rights only) | SW Balance (ag ET) | GW Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lookingglass Cr/Cabin | 1 | 644,604 | - | 3,474 | 225 | 3,412 | 221 | 383 | 805 | 173752 | 467,440 | (1,027) |
| Willow Cr./Indian Cr. | 2 | 523,382 | 29,404 | 51,888 | 14,439 | 46,630 | 12,976 | - | 809 | 141818 | 334,933 | 15,619 |
| Lower 5 Points Cr | 3 | 234,118 | 25,721 | 23,784 | 23,493 | 20,774 | 20,520 | 1,393 | 497 | 85607 | 127,737 | 4,704 |
| Beaver Cr, Upper 5 Poi | 4 | 219,834 | 1,964 | 753 | 2,040 | 713 | 1,932 | 171 | 155 | 85607 | 133,514 | (123) |
| Meadow Cr Upr GRR | 5 | 127,836 | 187 | 519 | - | 510 | - | - | 48 | 46840 | 80,487 | 139 |
| Ladd Cr. Lower Cather | 6 | 153,738 | 71,716 | 106,332 | 46,104 | 96,345 | 41,774 | 114 | 5.498 | 57.550 | (158) | 24.445 |
| Upper Catherine Creel | 7 | 116,238 | 9,279 | 24,027 | 531 | 24,868 | 550 | - | 369 | 57,550 | 33,820 | 8,361 |
| Upper Catherine Creel | 8 | 71,598 | - | 357 | - | 472 | - | - | 12 | 32,502 | 38,624 | (12) |
| **Total** | **Total** | 644,604 | 138,271 | 211,134 | 86,832 | 193,725 | 77,973 | 2,062 | 8,192 | 173752 | 277,127 | 52,106 |
| **Method/source** | N/A | Naturalization method (Copper, 2002) See Step 2 report. 50th percentile | OWRD method. Se | Nick Table "Irrigation data" | Nick Table "Irrigation data" | IMBO weather station2004-2017 ave P-M ET adjusted for effective precip. and irrigation efficiency according to NRCS estimates. | IMBO weather station2004-2017 ave P-M ET adjusted for effective precip. and irrigation efficiency according to NRCS estimates. | OWRD reporting website Kyle table "Municipal_Water_Use" _SP (includes municipal, unincorporated . ssiu) | OWRD reporting website Kyle table "Municipal_Water_Use" 2001-2016 Monthly Data | Bailey "ExistingISWR calcs 5-15-18" | SW - ag sw et - instream | GW-ag gw et-muni gw |
| **bi-weekly method** | N/A | monthly divide by 2 - already in step 2 report | annual divided by 24 | Water Rights by Subwatershed Distributed According to Irrigation Demand (Jed table) | Water Rights by Subwatershed Distributed According to Irrigation Demand (Jed table) | Distributed according to bi-monthly net irrigation water requirement (NIWR) | Distributed according to bi-monthly net irrigation water requirement (NIWR) | monthly divide by 2 | monthly divide by 2 | Take instream water right monthly divide by 2 | yes, original data | original data |

**2068**

| Subwatershed | Name | 2068 temperature change from current | Surface Water Quantity (Natural Streamflow)(from Step 2 report) AF/yr | Groundwater Used (from Step 2 report) AF/Yr | Agricultural Demand Surface Water (AF/Yr) (water rights only) | Agricultural Demand Ground Water (AF/Yr) (water rights only) | Agricultural Demand Surface Water (AF/Yr) (ET estimate) | Agricultural Demand Ground Water (AF/Yr) (ET estimate) | Municipal Demand Surface Water (AF/Yr) | Municipal Demand Ground Water (AF/Yr) | Instream Demand AF/YR (water rights only) | SW Balance (ag ET) | GW Balance (ag ET) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lookingglass Cr/Cabin Cr | 1 | 1.6 | 593,036 | - | 3,474 | 225 | 5011 | 325 | 1,532 | 1,762 | 173,752 | 412,741 | (2,087) |
| Willow Cr./Indian Cr. | 2 | 1.6 | 481,511 | 29,404 | 51,888 | 14,439 | 68488 | 19058 | - | 857 | 141,818 | 271,205 | 9,489 |
| Lower 5 Points Cr | 3 | 1.6 | 215,389 | 25,721 | 23,784 | 23,493 | 30512 | 30139 | 5,573 | 1,244 | 85,607 | 93,697 | (5,662) |
| Beaver Cr, Upper 5 Point | 4 | 1.6 | 202,247 | 1,964 | 753 | 2,040 | 1047 | 2838 | 686 | 360 | 85,607 | 114,908 | (1,234) |
| Meadow Cr Upr GRR | 5 | 1.6 | 117,609 | 187 | 519 | - | 749 | 0 | - | 51 | 46,840 | 70,020 | 136 |
| Ladd Cr. Lower Catherin | 6 | 1.6 | 141,439 | 71,716 | 106,332 | 46,104 | 141507 | 61355 | 456 | 8,873 | 57,550 | (58,074) | 1,488 |
| Upper Catherine Creek 1 | 7 | 1.6 | 106,939 | 9,279 | 24,027 | 531 | 36524 | 807 | - | 388 | 57,550 | 12,865 | 8,084 |
| Upper Catherine Creek 2 | 8 | 1.6 | 65,870 | - | 357 | - | 693 | 0 | - | 13 | 32,502 | 32,675 | (13) |
| **Total** | | 1.6 | 593,036 | 138,271 | 211,134 | 86,832 | 284532 | 114522 | 8,246 | 13,548 | 173,752 | 126,505 | 10,201 |
| **Future Scenerio Method** | N/A | Margaret table (+ is hotter, - is colder) | avg annual temp 2068 (climate model 8.5) every 1 degree increase, is 5% decrease in stream flow (take average temp for bi-weekly) | assume GW remains the same as 2018 | This will not change | This will not change | | | SSIU only (assume increase use from 1/2 max for 1 shift to 1/2 max for 2 shifts | 6% growth - Assume 1 decade of high growth decade (population estimates, everyone gets to 10% efficiency) | This remains the same because it is based on water rights. | SW - ag sw et - instream | GW-ag gw et-muni gw |
| **bi-weekly method** | - | - | - | - | - | - | - | - | - | - | - | - | - |



## Biweekly surface water balance by subwatershed

| | Oct | | Nov | | Dec | | Jan | | Feb | | Mar | | Apr | | May | | Jun | | Jul | | Aug | | Sep | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subwaters | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 30th | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 28th | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 30th | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 30th | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 30th |
| 1 | -1607 | -2059 | -1393 | -1393 | 2160 | 1684 | 5350 | 4874 | 19409 | 19409 | 32618 | 32142 | 62371 | 62276 | 71312 | 70762 | 36536 | 36436 | 7133 | 6697 | 2116 | 1716 | -775 | -712 |
| 2 | -1007 | -1029 | -528 | -528 | 2357 | 2010 | 4948 | 4601 | 16323 | 16323 | 27087 | 26740 | 46949 | 45651 | 51850 | 50243 | 25695 | 24336 | -215 | -19 | -2064 | -1377 | -2134 | -1282 |
| 3 | 345 | 431 | -33 | -33 | 1062 | 923 | 2504 | 2365 | 6960 | 6960 | 14425 | 14226 | 21029 | 20451 | 21306 | 20260 | 816 | 3185 | -3345 | -3302 | -1715 | -1314 | -772 | -392 |
| 4 | 449 | 395 | -111 | -111 | 918 | 779 | 2271 | 2132 | 6464 | 6464 | 13411 | 13212 | 19496 | 19476 | 20766 | 20156 | 2229 | 5183 | -443 | -633 | 262 | 218 | 172 | 185 |
| 5 | 842 | -1534 | -1110 | -1110 | 658 | 579 | 1260 | 1181 | 3496 | 3219 | 7866 | 7767 | 13431 | 13417 | 15529 | 15370 | 4914 | 4900 | -660 | -803 | -1547 | -2478 | -2353 | -2343 |
| 6 | -241 | 372 | 478 | 478 | 1325 | 1265 | 2086 | 2026 | 5384 | 5384 | 6506 | 6308 | 9370 | 6689 | 6365 | 3876 | -5499 | -6075 | -13376 | -12413 | -8240 | -6162 | -3969 | -2208 |
| 7 | 352 | 466 | 662 | 662 | 855 | 796 | 997 | 938 | 1320 | 1320 | 616 | 417 | 1725 | 1033 | 8971 | 8034 | 5495 | 7002 | -2206 | -2076 | -1584 | -1091 | -670 | -216 |
| 8 | -8 | -63 | -54 | -54 | 184 | 125 | 271 | 212 | 493 | 493 | 1319 | 308 | 3138 | 3125 | 8103 | 7954 | 6516 | 6502 | 262 | 129 | -66 | -130 | -72 | -63 |

sum

## 2068 biweekly surface water balance by subwatershed

| | Oct | | Nov | | Dec | | Jan | | Feb | | Mar | | Apr | | May | | Jun | | Jul | | Aug | | Sep | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subwaters | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 30th | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 28th | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 30th | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 30th | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 31st | 1st to 15th | 16th to 30th |
| 1 | -1495 | -2135 | -1557 | -1297 | 4301 | 1589 | 299 | 6076 | 20796 | 13882 | 27399 | 27911 | 39997 | 60417 | 58938 | 32329 | 21715 | 28686 | 7883 | 5032 | 1389 | 1906 | -1386 | 39 |
| 2 | -1322 | -1051 | -621 | -411 | 4135 | 1972 | 886 | 5617 | 17489 | 11875 | 22889 | 23264 | 28016 | 43262 | 40190 | 16280 | 10655 | 15326 | -1687 | -3084 | -3937 | -2458 | -3520 | -1298 |
| 3 | 11 | 250 | -249 | -154 | 1641 | 733 | 472 | 2656 | 7279 | 4904 | 11981 | 12181 | 10782 | 19084 | 15439 | 3397 | -4750 | -328 | -4340 | -4588 | -2594 | -2046 | -1474 | -728 |
| 4 | 468 | 367 | -172 | -83 | 1604 | 743 | 505 | 2547 | 6905 | 4675 | 11258 | 11468 | 10361 | 18729 | 16107 | 5662 | -1550 | 3207 | -327 | -948 | 145 | 219 | 53 | 297 |
| 5 | 867 | -1538 | -1133 | -1082 | 1092 | 569 | 280 | 1426 | 3750 | 2251 | 6650 | 6784 | 8407 | 13014 | 12752 | 6707 | 2503 | 3644 | -578 | -988 | -1607 | -2467 | -2412 | -2267 |
| 6 | -1187 | 351 | 436 | 498 | 1833 | 1240 | 878 | 2310 | 5712 | 4063 | 5259 | 5121 | 2276 | 4241 | -187 | -11382 | -15670 | -13929 | -17816 | -16628 | -11293 | -8895 | -6141 | -3481 |
| 7 | 149 | 459 | 631 | 701 | 1266 | 787 | 241 | 1127 | 1438 | 868 | 149 | -5 | -1293 | 312 | 5464 | -1595 | -865 | 3052 | -3153 | -3461 | -2440 | -1751 | -1303 | -409 |
| 8 | 18 | -68 | -73 | -30 | 438 | 120 | -194 | 328 | 566 | 214 | 1032 | 75 | 1552 | 2991 | 6501 | 2968 | 3630 | 5003 | 396 | -132 | -146 | -105 | -147 | 43 |

| | |
|---|---|
| | AF<-10000 |
| | -10000<AF<-5000 |
| | -5000<AF<-2000 |
| | -2000<AF<-1000 |
| | -1000<AF<-500 |
| | -500<AF<0 |
| | 0<AF<500 |
| | 500<AF<1000 |
| | 1000<AF<2000 |
| | 2000<AF<10000 |
| | 10000<AF<20000 |
| | 20000<AF<50000 |
| | AF>50000 |

# APPENDIX E
## Additional Information

## Appendix E – Additional Information

### Alkalinity

Alkalinity is related to pH. It is a measure of the water's ability to provide a stable pH level and to avoid rapid changes in pH that could adversely affect the health of the aquatic life. Fish exposed to changes in pH outside their normal range can be stressed or even die. Stress leaves fish vulnerable to disease, degrading their health. Very rapid changes in pH can can cause fish to lose control over their swim bladders, making it hard for them to swim correctly. Additionally, alkaline conditions can transform nitrogen in the water column into a more toxic form of ammonia that can interfere with a fish's ability to breath normally and at high concentrations can poison fish. Withdrawals from the stream will reduce the stream's heat capacity and cause greater fluctuation in daytime and nighttime stream temperatures. When substantial plant or algal growth are present, this will lead to greater fluctuations in alkalinity and pH. Additional withdrawals from a stream that is already impaired for pH will exacerbate these problems. Fish and aquatic insects are sensitive to imbalances in pH. Low pH levels (below 5) may lead to death and high pH levels (9-14) can harm fish by denaturing cellular membranes.

### Ammonia

Alkaline conditions can transform nitrogen in the water column into a more toxic form of ammonia that can interfere with a fish's ability to breath normally and at high concentrations can poison fish.

### Aquatic weeds and/or algae

Both rooted aquatic plants and algae are a natural part of stream systems. They grow by taking in nutrients from the water column and sunlight. When water temperatures are warm enough and sufficient nutrients are present, excessive growth can occur; this can be a problem for both aquatic life and recreational beneficial uses. Excessive growth can affect aquatic life in several ways. During sunlight hours, plants and algae remove carbon dioxide from the water column as part of photosynthesis. With excessive growth, this can result in increased pH (alkaline conditions). During the night, plant growth removes oxygen from water and releases carbon dioxide, resulting in both low pH (acidic conditions) and low dissolved oxygen. In addition, when algae die and decompose they remove oxygen from the surrounding water. Low dissolved oxygen can lead to decreased fish habitat and even fish kills. Additionally, low dissolved oxygen levels can lead to changes in water chemistry that allow mercury to be more able to enter the food chain. Algal blooms also often create odors and coloration that are objectionable to recreational users.

### Biological Criteria

Oregon's biological criteria standards are based on the assemblage of macroinvertebrates and other species needed to maintain a healthy resident biological community. Resident biological communities are the local food webs that support fish.

### Dissolved Oxygen

Fish and other aquatic organisms require different concentrations of dissolved oxygen based on their species and life history stage. Oregon's dissolved oxygen standards are based on the most sensitive species and life history stage at the location and season of concern. Dissolved oxygen levels are affected by temperature, flow, nutrient loading, algae growth, sediment and other factors. If dissolved oxygen drops too low enough levels, fish kills may occur.

**E. coli**
Bacteria numbers multiply faster than die off rates in warm stagnant streams. High e. coli concentrations threaten the health of swimmers, boaters and individuals engaging in water contact recreation.

**Flow Modification**
Fish and aquatic life need variable stream flows to trigger life stages and migration events. Some triggers are dependent on a change in flow, some triggers are dependent on a change in temperature. Dams and diversions alter the volume, timing, and temperature of flows. This prevents fish and aquatic life from accessing habitat or changing life stages at the appropriate time. Dams can also increase water clarity which promotes algal growth. Dams and diversions can prevent fish passage, which fragments river systems, isolates previously continuous populations, and prevents the migrations of fish species.

**Iron**
Iron is common in many rocks and is an important component of many soils. Iron is an essential trace element required by both plants and animals. Ferrous ($Fe^{2+}$) and ferric ($Fe^{3+}$) irons are the primary forms of concern in the aquatic environment. Ferrous iron is colorless (clear) while ferric iron will show up as a rust colored stain in the water. Iron bacteria may also be present in streams associated with mining waste or ground water recharge. A rust-colored slime often forms rocks and other surfaces when iron bacteria are present. Iron and manganese often occur together. High concentrations of these metals can result in discolored water. Where water supplies are used for domestic purposes, elevated iron and manganese concentrations can result in stained plumbing fixtures and an unpleasant metallic taste to the water. Iron deposits can buildup in pressure tanks, storage tanks, water heaters, and pipelines, decreasing capacity, reducing pressure, and increasing maintenance. Iron and manganese concentrations of concern are generally established on the basis of aesthetic and economic considerations (unpleasant tastes and coloration) rather than toxicity.

**Manganese**
Manganese is a metal found naturally in rocks and soil. It does not occur as a pure element in nature, but always combines with oxygen or other elements. Manganese is an essential trace element required by both plants and animals. Iron and manganese often occur together. High concentrations of these metals can result in discolored water. Where water supplies are used for domestic purposes, elevated iron and manganese concentrations can result in stained plumbing fixtures and an unpleasant metallic taste to the water. Iron deposits can buildup in pressure tanks, storage tanks, water heaters, and pipelines, decreasing capacity, reducing pressure, and increasing maintenance. Iron and manganese concentrations of concern are generally established on the basis of aesthetic and economic considerations (unpleasant tastes and coloration) rather than toxicity.

**pH**
pH is a measure of how acidic or basic (alkaline) the water is. Water with a pH greater than 7 is alkaline, water with a pH of less than 7 is acidic. Every species of fish has adapted to a specific range of pH. Fish exposed to changes in pH outside their normal range can be stressed or even die. Stress leaves fish vulnerable to disease, degrading their health. Additionally, alkaline conditions can transform nitrogen in the water column into a more toxic form of ammonia that can poison fish. When nutrients and sunlight are sufficiently present, higher stream temperatures lead to more algal growth. During the day, algae absorb carbon dioxide from the water for cell growth, raising pH. At night, photosynthesis stops and algae continue to respire, releasing carbon dioxide and lowering pH. This cycle creates diel fluctuations in pH. Additional withdrawals from a stream that is already impaired for pH will lead to larger diel

fluctuations in pH. Fish and aquatic insects are sensitive to imbalances in pH. Low pH levels (below 5) may lead to death and high pH levels (9-14) can harm fish by denaturing cellular membranes.

**Phosphorus/Phosphate**

Phosphorus is an essential plant nutrient, but an excess of phosphorus can be detrimental to aquatic life. High phosphorus concentrations can lead to eutrophication, a situation where aquatic plants grow so rapidly that dissolved oxygen concentrations drop below the levels needed to sustain fish and other aquatic life. Phosphate (also referred to as orthophosphate) is a chemical form of phosphorus that is very soluble and readily available for plant uptake, leading to rapid growth and, in the case of algae, rapid expansion of algal blooms.

**Sedimentation**

While sediment is an essential part of healthy functioning stream systems, excessive sediment loads can have severe negative impacts on a stream ecosystem. Many fish species are adapted to high suspended sediment levels that occur for short periods of time, but longer exposure to high levels of suspended sediment can interfere with feeding behavior, damage gills, reduce available food, and reduce growth rates. Deposition and sedimentation (when sediment falls out of the water column and deposits on the streambed) can smother eggs and fry in the substrate and fill in pools within the stream channel (reducing or eliminating cold water refugia important to cold water aquatic life during periods of high water temperature). Because bacteria, nutrients and other chemical substances are often attached to sediment particles, excessive sediment loading can also increase nutrient and toxics concentrations and contribute to decreased dissolved oxygen in both the water column and the spawning gravels.

**Temperature**

Oregon's stream temperature standards vary based on location and the life history stage habitat needs of salmonids and resident fish. Stream temperatures that exceed standards can disrupt the life cycle of a fish species, cause stress which degrades their health and leaves them vulnerable to disease, and may even cause death.

### *Water Rights*

Water rights are the basis of demand values (for water quantity) in this report (the water quality component of demand is discussed above). Using water rights as the basis of demand values is a major assumption of this report. While out-of-stream demands are considered adequately represented by water rights (although additional calculations are made with respect to evapotranspiration for agricultural use, and actual pumping rates for municipal use), instream demands not considered adequately represented. This is because ODFW has not completed instream flow needs studies on every stream segment in the Upper Grande Ronde River Watershed. Although existing instream rights are used to estimate instream demand, it should be noted that these values could change based on instream flow needs assessments. Water rights are central to the discussion of water demand as they are what put limits on the amounts of water that can legally be used. Water right certificates describe the duty and (place of use (Oregon Department of Agriculture, 2017).

Oregon has adopted the prior appropriation doctrine, which means that the oldest water right (or more "senior") is the last to be shut off in times of water shortage. Older water rights can require that rights junior in time be shut off to satisfy the needs of the senior rights or when their limit is reached, whichever is less (OWRD, 2018a).

There are several fundamental provisions of Oregon Water Code that are relevant when considering demand values in this report:

- Beneficial Use Without Waste - Surface or groundwater may be legally diverted for use only when used beneficially without waste.
- Priority - The water right priority date determines who gets water in times of shortage. The older the right, the longer water is available when water supply is insufficient for all rights..
- Appurtenancy - Water use is attached to particular land or area. A water right document and water right map describe the particular land to which the water right is attached. Water may not be used elsewhere unless formally approved by the OWRD.
- Must be used - Once established, a water right must be beneficially used under the provisions of the right at least once every 5 years. This is commonly referred to as "use it or lose it". After 5 consecutive years of non-use, the right may be subject to forfeiture andcancellation, except for exemptions such as municipal water rights.
- This provision provides some level of protection for water rights that have become accustomed to using available water from the resumed use of a forfeit right. However cancellation of water rights subject to forfeiture is not automatic. Owners of alleged forfeit rights may rebut the presumption that their right is forfeit under the provisions of ORS 540.610, which lists exemptions.

## Characterization of Groundwater in the Upper Grande Ronde Basin

**NOTE:** *It is important to note that this information is for planning purposes only; any interpretation is done at the discretion of the planning group. If the group would like to use this information beyond its initially intended use as an informational resource to inform planning, OWRD requests that the group contact OWRD staff. Also, OWRD requests that staff be able to review any products that this information is used in – including those related to place-based planning- in order to ensure accurate use of the data and analysis.*

### Introduction and Purpose

This memo is intended to expand upon the background and data included in the Upper Grande Ronde (UGR) Place-Based Planning Step 2 and Step 3 reports regarding groundwater supply for current and future appropriation. The purpose of the memo is to introduce and document foundational groundwater concepts important to the Upper Grande Ronde basin and how those concepts, along with legal controls, impact current and future groundwater supply. For a broader exploration of groundwater, please review the USGS Publication, "Groundwater and Surface Water – A Single Resource" (Winter 1998).

This memo is organized by the following sections:

- Understanding groundwater supply for appropriation
- Understanding capture and how
- What we know about the UGR groundwater resources – physical and legal controls
- Summary of gaps in groundwater data and knowledge and future proposed work to improve groundwater data sets

## Understanding Groundwater Supply for Appropriation- Background

This section describes foundational groundwater concepts for understanding groundwater supply and utilizes a simplified Groundwater supply, or the amount of water available for withdrawal, is ultimately a balance between the three major components of a groundwater system:

- Recharge - the groundwater coming into an aquifer system controlled by surficial and subsurface characteristics, precipitation variability in space and time, climate patterns, and groundwater flow from other aquifers. Think of this as a deposit to the groundwater budget "account". Note that annual recharge will vary with climate variability.

- Storage - the groundwater slowly moving through an aquifer system controlled by the characteristics of the aquifer such as its porosity and the degree of fracturing. This can be thought of as a "savings account" for groundwater. That said, storage and supply are not the same thing – supply is the water that can be appropriated and is a function of how storage responds to other factors.

- Discharge – the groundwater leaving an aquifer system, naturally through discharge to rivers and streams, springs, into other aquifers or pumped from wells. Think of this as a withdrawal from the groundwater budget "account".

The amount of groundwater available for withdrawal over a period of time depends on the management tradeoffs made between these three system components. Ultimately, the three components achieve a balance (known as dynamic equilibrium), and it is the understanding and management of this balance that is key to defining and achieving sustainable groundwater development (e.g., Theis, 1940).

To introduce conceptually how these components can work together, below is a description of a very simplified aquifer system as it responds to increased pumping over time. For this example, we are assuming that recharge remains constant over the example, and we are assuming the entire aquifer system is homogenous and therefor responds similarly across the aquifer systems. As a reminder, this is a simplified system and actual aquifer systems will have many complicating factors that shift the response of the system in time and space.

**Stage 1 – Dynamic Equilibrium**. In a system where there is no pumping, the components of recharge, storage, and discharge are in equilibrium over the long term, with fluctuations in the system occurring as climate patterns shift rates of recharge, or over geologic periods when the characteristics of aquifers change (Figure 1).

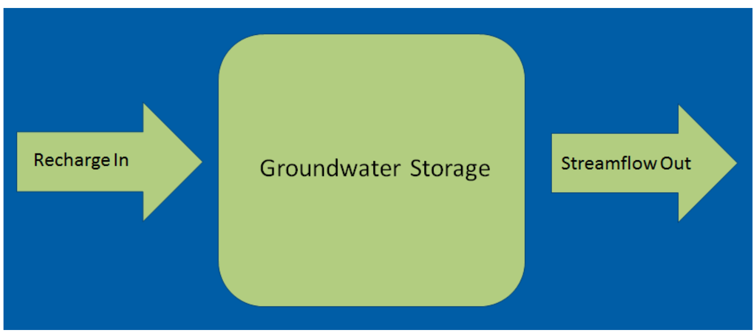



*Figure 1. A groundwater system in equilibrium where, generally on average, recharge is equivalent to discharge, and storage doesn't increase or decrease.*

**Stage 2 - Increased discharge.** In this hypothetical example, pumping has greatly increased, and so discharge overall has increased (Figure 2). The immediate impacts of increased discharge on the groundwater system may not be noticeable for some time depending on the characteristics of the aquifer and stream system, with initial development affecting groundwater storage to a larger degree than stream discharge (e.g., Barlow and Leake, 2012).

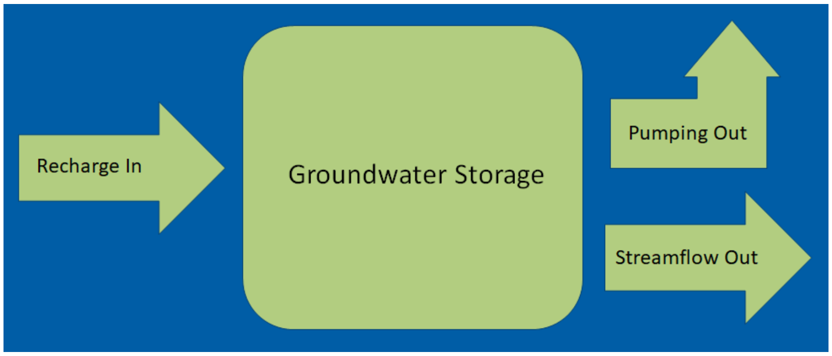



*Figure 2. In this system, groundwater discharge has increased, but there is yet to be a measureable change in the groundwater storage or other aspects of discharge such as streamflow from groundwater.*

**Stage 3 – Decreased storage.** If pumping continues to increase or continues at the same rate for a long time, eventually the groundwater storage in our hypothetical aquifer is decreased since recharge is not changing (Figure 3). If there are wells that are not deep enough to reach the lowering water table, they will no longer be able to withdraw water without being deepened.

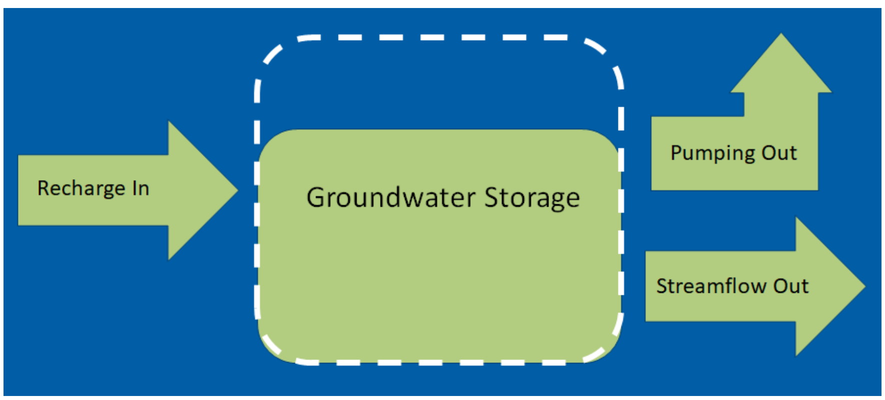



*Figure 3. In this system, groundwater storage has now decreased given that discharge is now greater than recharge because discharge to pumping and streamflow is greater than recharge.*

**Stage 4 – Continued declines or new equilibrium.** In this hypothetical example, the storage volume has dropped enough that natural discharge to streams has decreased, and therefore overall discharge has decreased (Figure 4). In this new equillibrium, recharge and discharge are once again equivalent, and groundwater storage ceases to decrease. If the rate of discharge continued to increase beyond the rate of recharge, groundwater storage would continue to decline until the rate of stream discharge decreased or stopped, otherwise known as capture (see below). If pumping continued to increase, storage would diminish to the point where the only groundwater available would be year-to-year recharge, what may be described as “living paycheck to paycheck.”

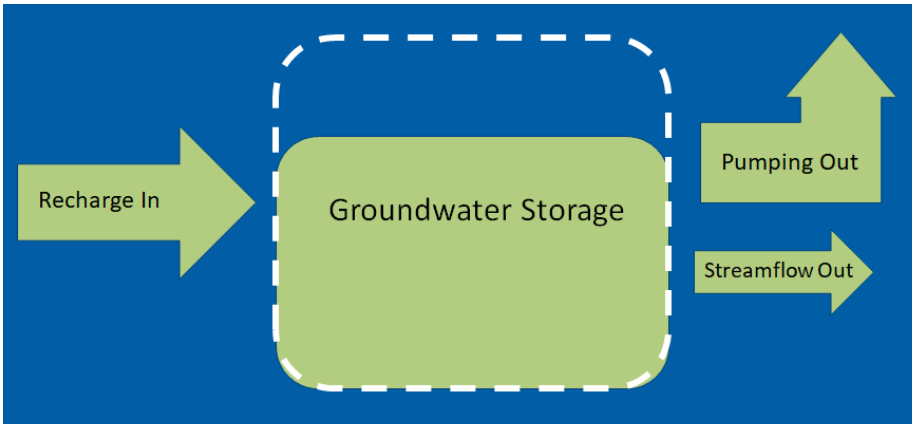



*Figure 4. A new equilibrium is established when groundwater discharge decreases, in this example because discharge to rivers and streams has decreased significantly and discharge to pumping has decreased minimally.*

## Understanding Capture – interaction between groundwater discharge and pumping

Capture is a term used to describe any decreases in groundwater discharge and/or increases in groundwater recharge at interfaces with surface waters caused by pumping of groundwater (Barlow, 2018). Almost all pumping captures some groundwater discharge (Figure 5). Capture is important to understand because it may limit groundwater supplies in the future.

Within the simplified groundwater development process described above, capture occurred when pumping interfered with groundwater discharge to streamflow (Stage 4). Capture, and the concepts discussed here, highlight the complexity of managing groundwater.

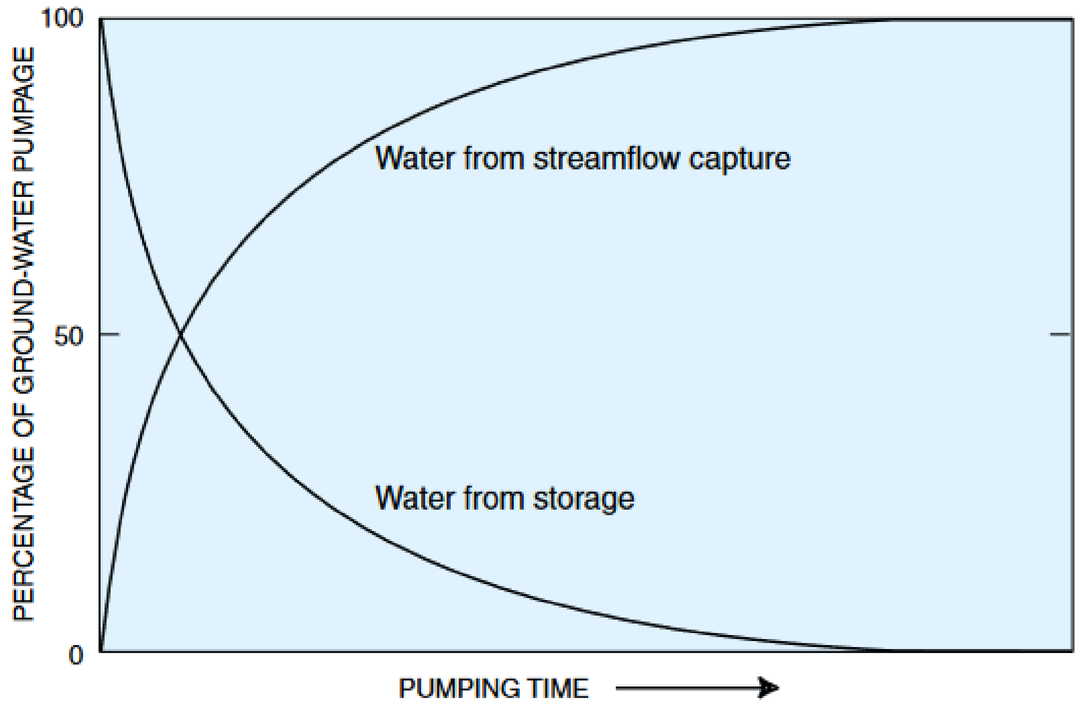



*Figure 5. Copied from Alley, 1999. Graph relating the percent of pumped water coming from storage versus that being captured from streamflow over time in a theoretical, simple aquifer system.*

Reviewing this same stage-wise process across the landscape can help demonstrate how capture occurs in terms of flow-paths (Figure 6). Under natural conditions (Figure 6, A), groundwater discharges to the stream. Once a well is drilled and water is being pumped from that well, the flow paths of the water change, and some of the groundwater that would have discharged to the stream naturally now is captured by the well (Figure 6, B). If pumping were to occur at a higher rate, the hydraulic gradient may be reversed, resulting in a losing reach of the stream where surface water is lost to the surrounding geologic materials. If this condition persists, it is possible that captured surface water from the stream would inevitably be discharged from the well (Figure 6, C).

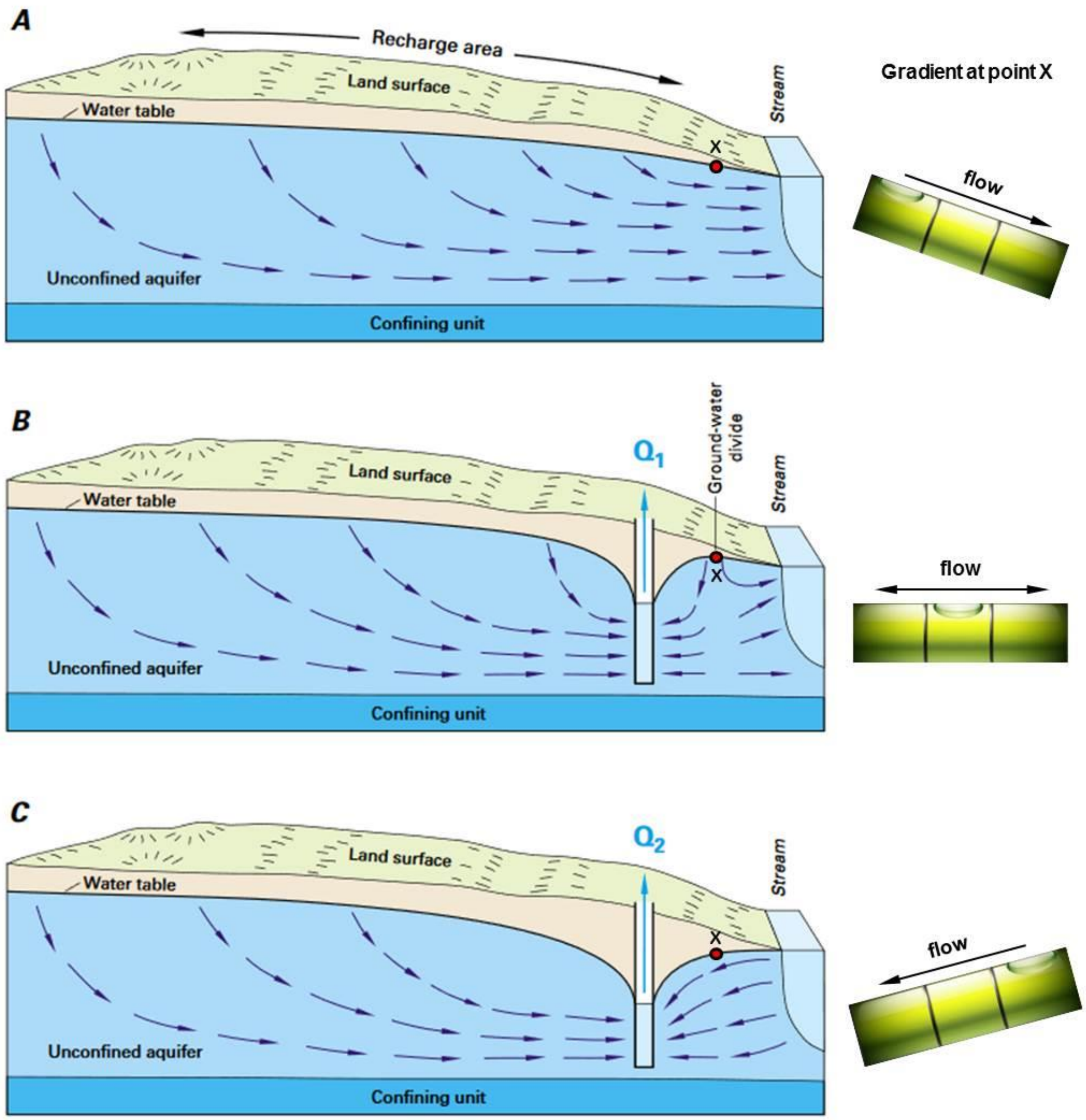



*Figure 6. Adapted from Alley, 1999. Diagram showing the development of groundwater capture at two different pumping rates (Q1<Q2) and the impact of pumping rates on hydraulic gradient and ultimately, flow path direction.*

In more complex aquifer systems, where there may be a mix of different aquifers and variation in the characteristics of those aquifers, flow paths can vary both in their length and the time it takes water to move along the pathway to a point of discharge (Figure 7).

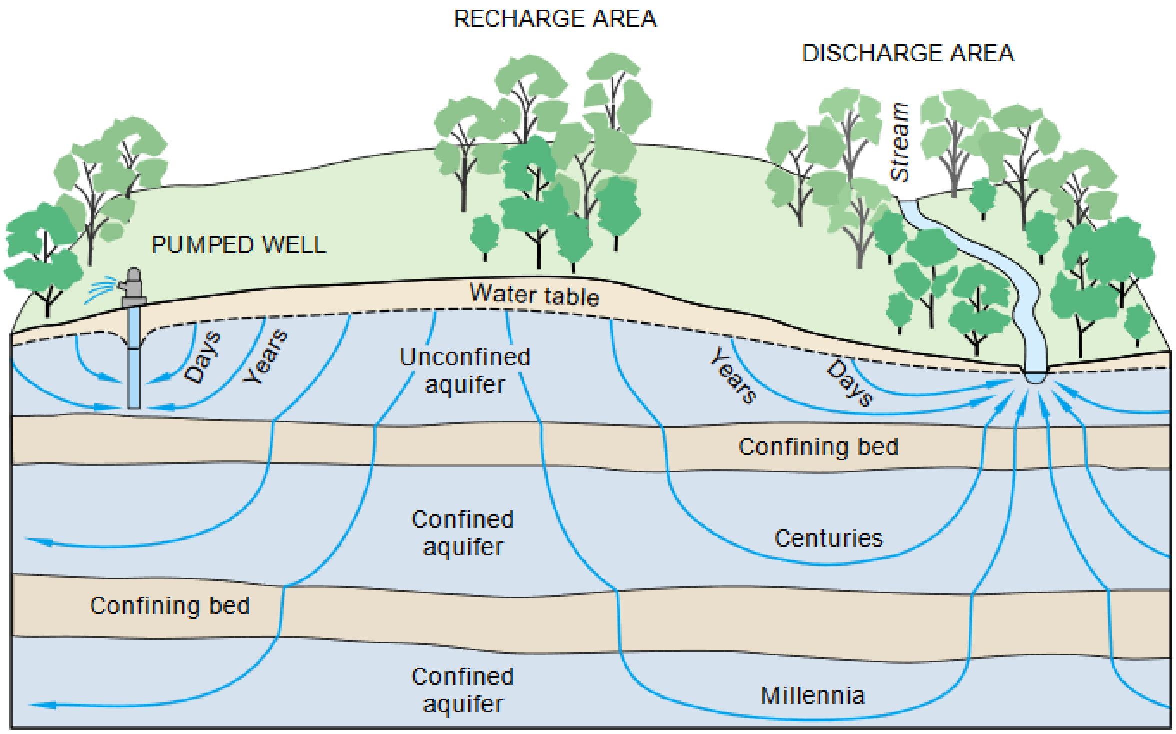



*Figure 7. Copied from Winter, 1998. Diagram showing how groundwater flow paths, literally the path that water takes from a recharge area to discharge into a stream or by pumping from a well. These flow paths vary by length and the amount of time it takes to traverse the path.*

## Understanding Aquifer Systems of the Upper Grande Ronde (UGR) Basin

In the UGR basin, there are multiple aquifers, though generally they can be divided into two systems: the alluvial system and the Miocene volcanic system. These systems, though governed principally by the characteristics of each system (permeability, porosity, specific yield), are also impacted by interaction with the other aquifer systems, though these interactions have not been directly studied. It is important to note that these aquifer systems are distributed unevenly across the basin, with the alluvial systems found only in the valley bottoms. The alluvial basin-fill aquifer system was created primarily by the deposition of sediments from water that has flowed through the valley (Figures 8 and 9) and is composed of fragments of rock and soil from higher elevation drainages. Miocene volcanic rocks are exposed at the surface on the edges and outside of the low-lying river valleys, where subsided volcanic rocks have not been covered by sedimentary deposits. Within the valley, alluvium above the Miocene volcanics may be greater than 2,500 feet thick in many cases making it expensive or infeasible to drill wells targeting the volcanic aquifers. Below are described past and, where available, current information about both aquifer systems.

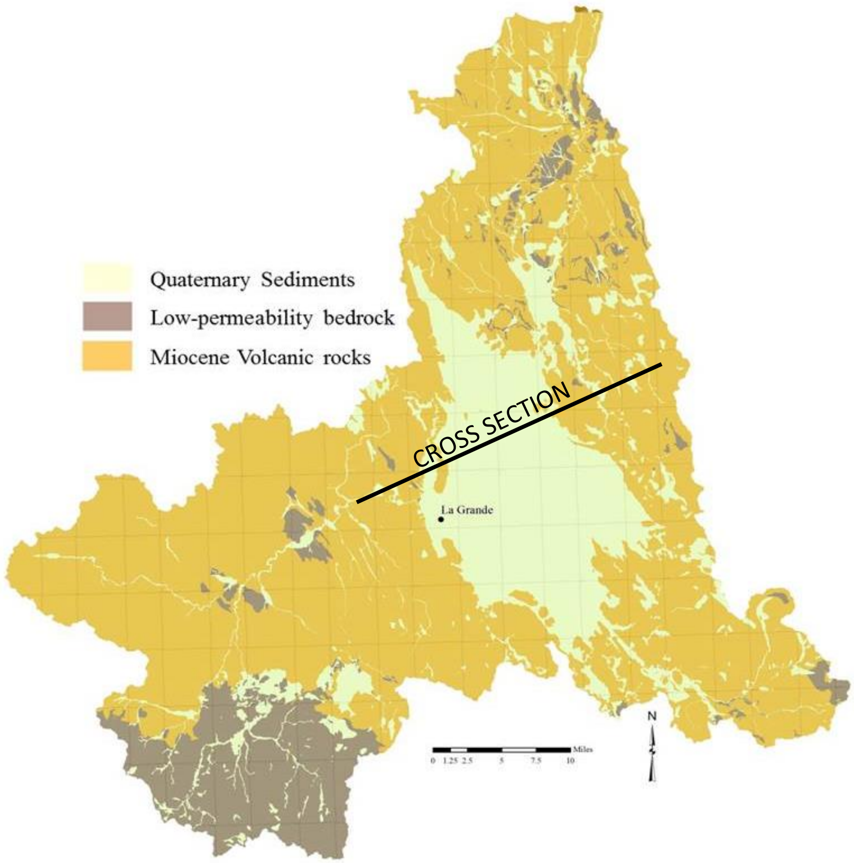



*Figure 8. Geologic map of the UGR basin. The Quaternary sediments are the alluvial sediments referred to earlier in this memo, the Miocene Volcanic rocks are inclusive of the Columbia River Basalt Group (CRBG) and later erupted Powder River Volcanics (PRV). The low-permeability bedrock generally underlays these two other systems and typically does not yield adequate groundwater for economic use* (Ferns et al., 2010).

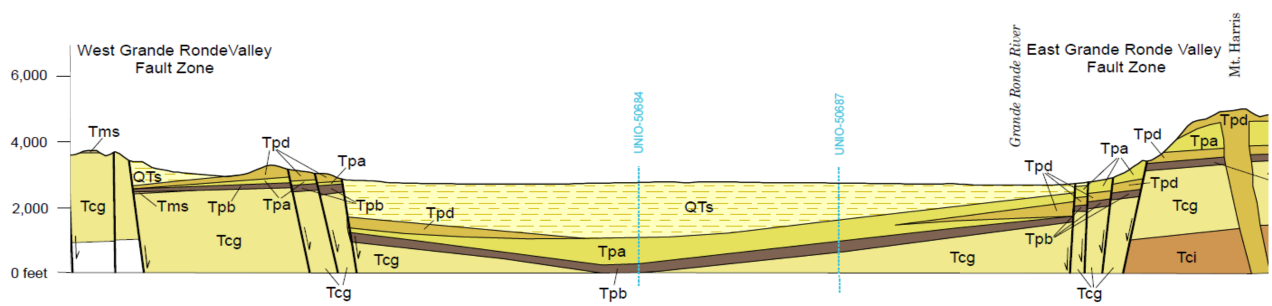



*Figure 9. Geologic cross-section of the UGR basin (see Figure 6 for location). The valley formation is clearly visible here where the QTs (quaternary) sediments have collected* (Ferns et al., 2010).

## Alluvial groundwater system

The unconfined alluvial aquifer system is characterized by sediments ranging in size from clay to boulders that were deposited as the Grande Ronde Valley deepened during the last 8 million years (Ferns, 2010) and is over 2,500 feet deep in places. Generally, the alluvial aquifer of the Grande Ronde Valley yields moderate to low rates of groundwater to wells, has relatively high rates of recharge, has an efficient hydraulic connection to surface waters, and supports the largest share of groundwater use in the basin. Recharge in the alluvial system is dependent on precipitation, flood events, and deep infiltration from surface water irrigation in excess of crop evapotranspiration.

In 1966, Herbert Ham of the Bureau of Reclamation published a groundwater supply study of the Grande Ronde basin. Using available precipitation and pumping data at the time, Ham estimated recharge rates from precipitation within the La Grande-Union – Upper State Ditch area of between 24,000 and 41,000 acre-feet per year. Note that this estimate of recharge should not be used to define a “safe yield” – although recharge does affect the water budget, including groundwater storage, it is the characteristics of the historic aquifer flow system relative to rates of pumping that are most important for informing management decisions around the amount of groundwater development that can be sustained while limiting impact on groundwater quality and freshwater ecosystems (Bredehoeft, 2002).

The alluvial system is recharged predominantly by precipitation that falls onto the valley fill and infiltrates below the vegetative rooting zone. Water level hydrographs show that there is a direct relationship between increased precipitation and rising water tables in the aquifer, indicating recharge from precipitation happens relatively rapidly (Ham, 1966). Ham concluded that recharge of groundwater was also occurring during high flow events from seasonally varying streams, primarily in areas of alluvial fans and unconsolidated deposits near the base of steep mountain slopes bordering the valley floor. Some additional recharge, he asserted, is likely to come from deep infiltration of irrigation water that originated from surface water.

Ham estimated that the average, annual contribution of groundwater to the Grande Ronde river and its tributaries was 13,000 acre-feet, with the majority occurring between June and October, though this number is estimated and should be used with caution (Ham, 1966). Ham speculated that given what is known about the geologic structure of the basin that there is likely little inter-basin flow. An advanced groundwater study would be required to determine the magnitude and direction of exchanges of water between aquifers. At this time, OWRD cannot easily estimate the annual volume of groundwater consumed by water rights since there is little to no metered water use reported to the Department.

## Miocene volcanic groundwater system

The alluvial groundwater system is underlain by an aquifer system hosted in extrusive volcanic rocks of the Powder River Volcanics (PRV) and Columbia River Basalt Group (CRBG), initially erupted between 17 and 10.4 million years ago (Ferns and others, 2010). Portions of these thick lava flows are quite porous, providing high to moderate yield to wells. Existing estimates of recharge to the volcanic groundwater system are poorly quantified; there are no known location-specific estimates of rates of recharge for the volcanic aquifers in the UGR area. The volcanic groundwater system generally displays relatively low rates of recharge, though portions of this system may be connected to surface waters or other recharge conduits.

The regional volcanic aquifer system is known to produce significant rates and volumes of groundwater to wells, though much of this volume is thought to be derived from groundwater storage. Storage of water in these layered volcanic sequences largely takes place in the interflow zones between layers of dense rock. The dense interiors of flows themselves do not store or transmit groundwater effectively, it is the zones in between flows or the brecciated (cracked) areas of the flows that provide storage (Burns et al., 2012). Most of the discharge from subsurface Miocene volcanics is likely from pumping, though little is known about the total volume of water pumped from this aquifer. There are no known estimates of input from and discharge to the Miocene volcanics from other aquifer units within the basin. Some wells within the area show water levels which infer there is a pressure gradient driving water from the CRBG to the overlying PRV and alluvium (where present), though this data is sparse and may represent only small areas.

## Groundwater Level Trends within the Alluvial and Volcanic aquifer systems

Groundwater levels can provide insight into the stability of groundwater supplies within a region, as well as the stability of aquifer storage. Within the UGR, declines in both major aquifer systems have been observed. Water levels show an estimated long-term average decline of 0 to 0.5 feet per year of the alluvial system, depending on the well (Figure 10a and 10b). Limited monitoring of the volcanic aquifer shows long-term average declines of 0.5 to 2.5 feet per year, depending on the well (Figure 11a and 11b). It is important to note that only limited data is available for both of these assessments, and without a more comprehensive network of monitoring wells and consistent measurements made over time, it is difficult to determine the spatial extent and long-term trends of any declines.

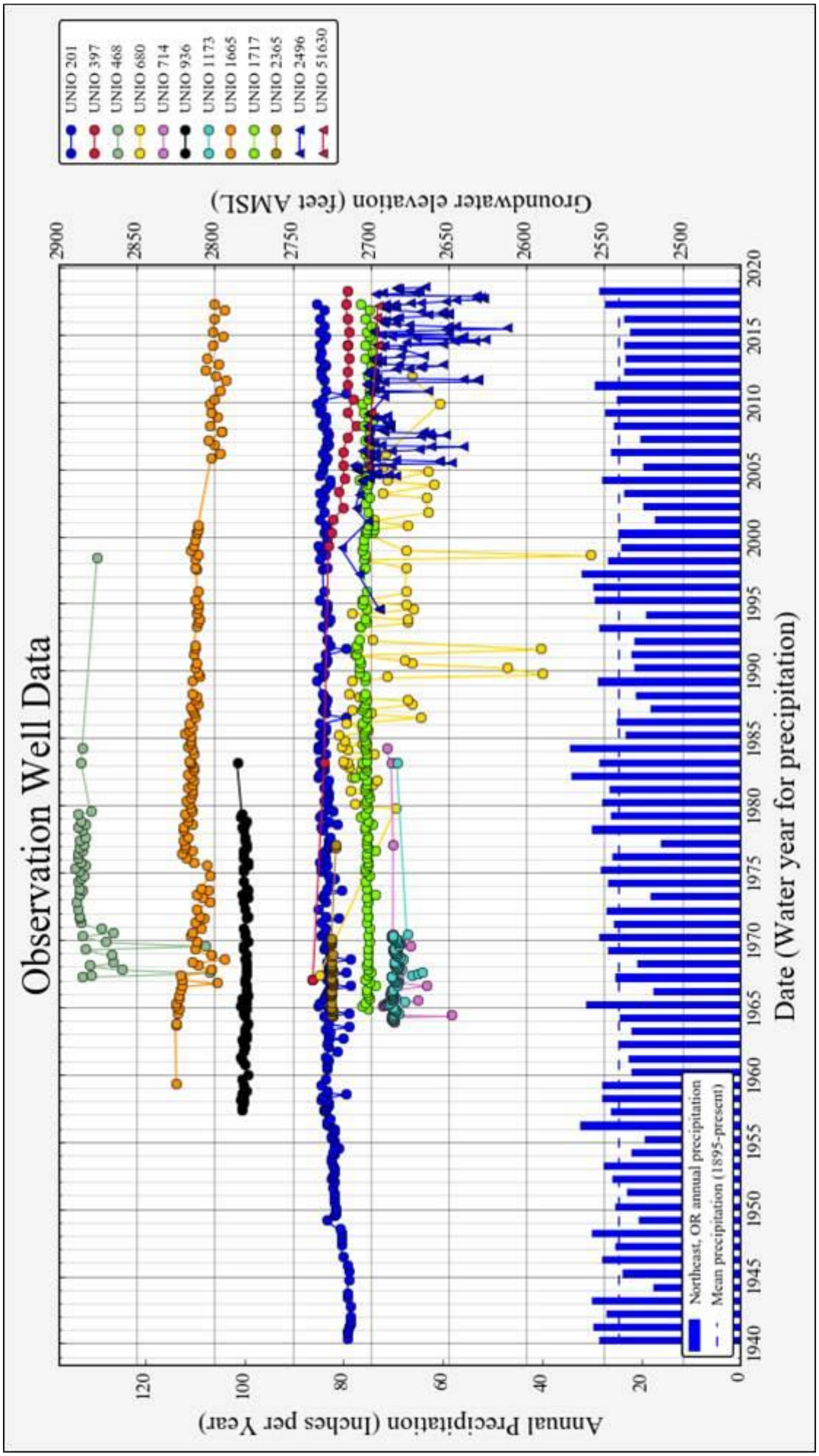



*Figure 10a: Hydrographs for alluvial wells within the upper Grande Ronde Basin suggest that groundwater elevations are fairly stable. Groundwater elevations vary greatly depending on location and surface elevation of each observation well. Seasonal variations in water levels are much* more pronounced in some alluvial wells (UNIO 680 and UNIO 2496) than others.

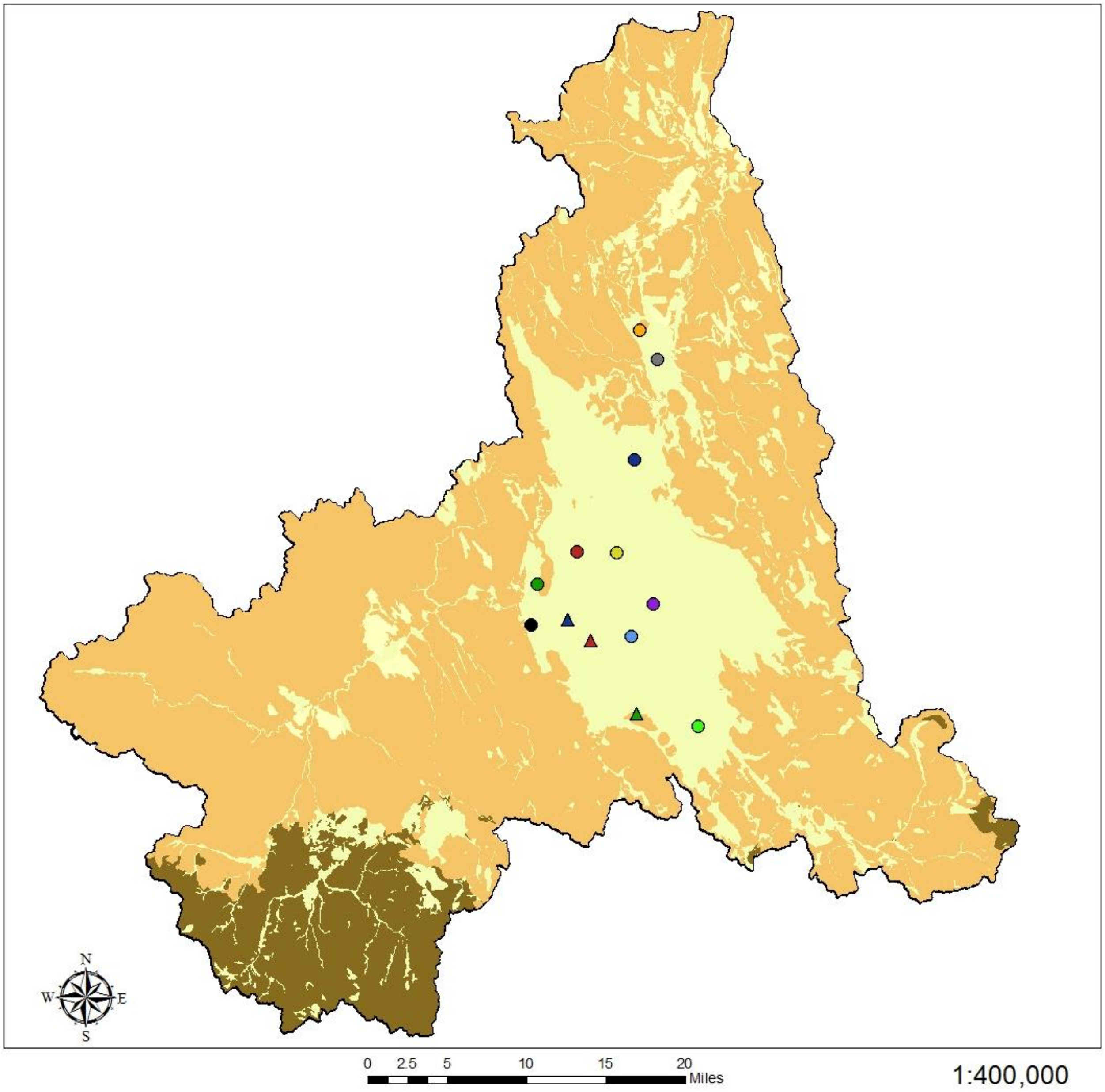



*Figure 10 b. Accompanying map of the locations of alluvial wells with data displayed in figure 10 a. Note that all of the observations wells are located within the alluvial fill area (light yellow).*

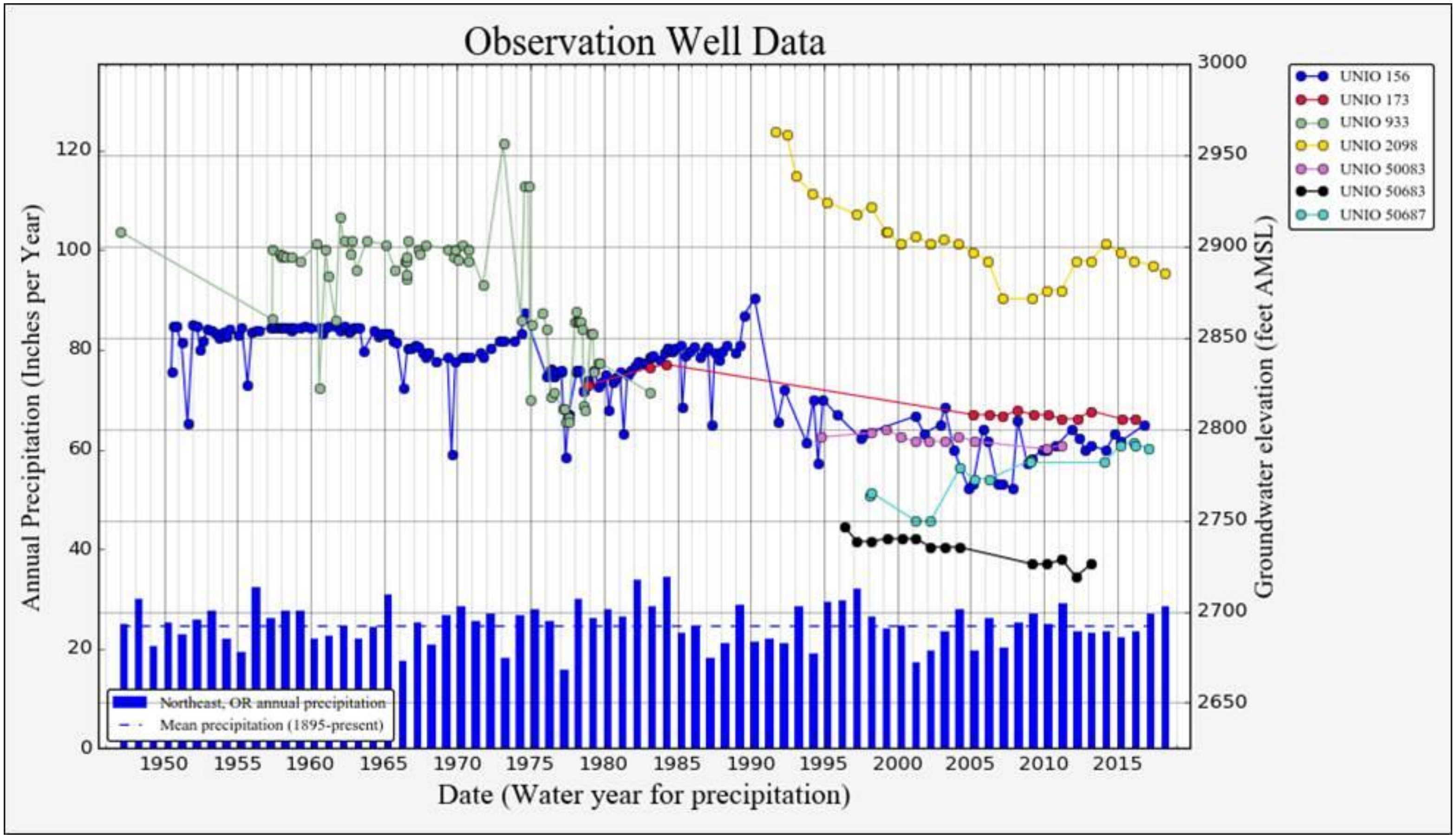



*Figure 11a: Groundwater elevations within volcanic aquifers display relatively rapid changes in trend as compared to the alluvial groundwater system. The data suggest that there may be at least three distinct and separate aquifer systems represented here, based on groundwater elevation, with all three groups displaying* some degree of decline.

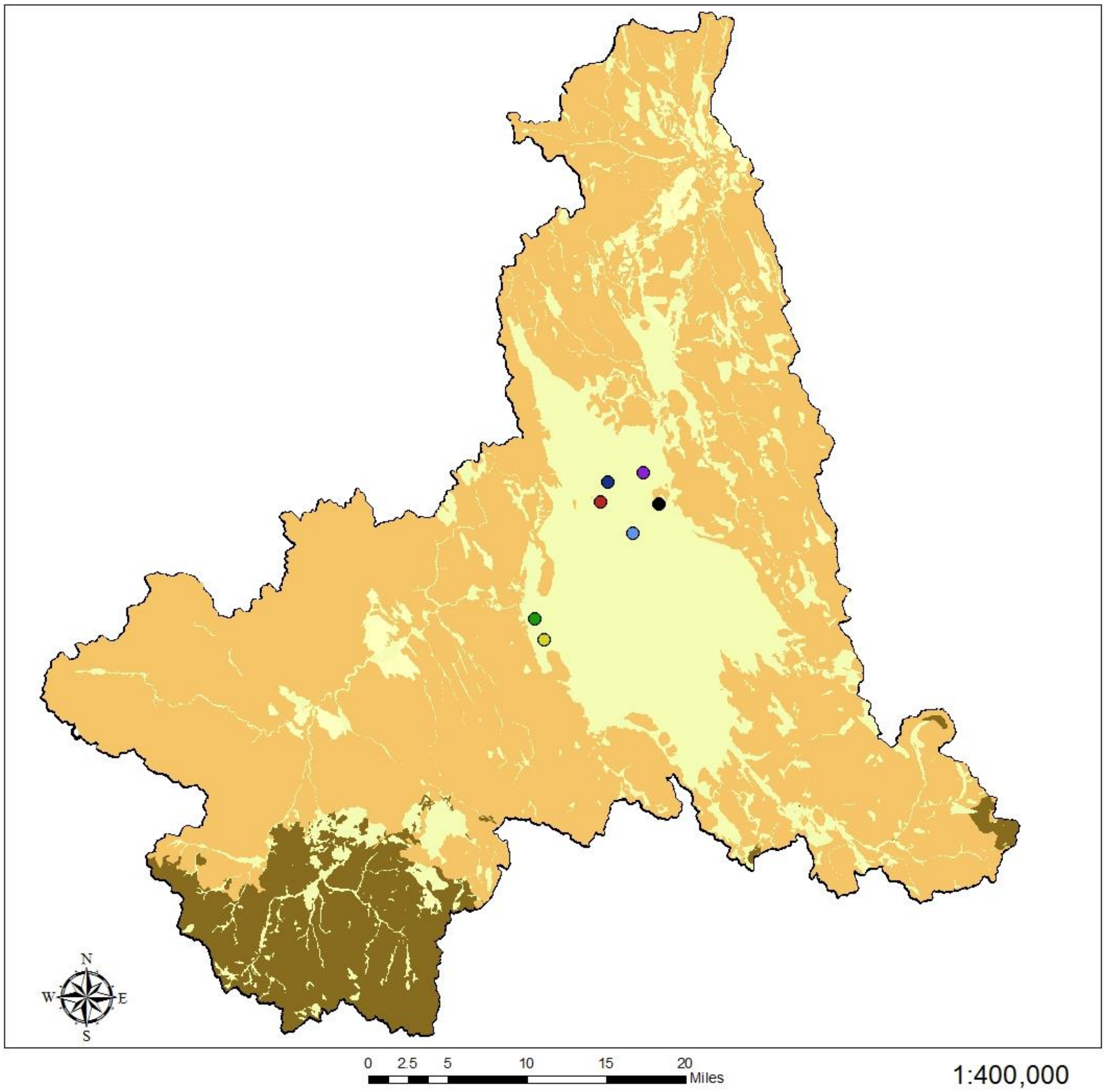



*Figure 11b. Accompanying map of the locations of wells producing from Miocene volcanics with data displayed in figure 11a. Note that there are very few volcanic observation wells and that their locations are clustered.*

## Management of Groundwater Supply

**Potential for development of additional groundwater resources**

As noted in UGR's Step 2 report, OWRD has closed the alluvial system to new appropriation of groundwater within the basin to comply with State Scenic Waterway (SSW) rules which limit the granting of water rights from hydraulically connected groundwater to one percent of the mean daily flow of the SSW or 1 cfs (whoever is greater) once available surface water has been allocated (OAR 690-310-0260(9)). The intention of the rule is to consider the concept of capture in protecting instream flows such that new allocation of hydraulically connected groundwater does not measurably impact the protective SSW flows. Division 310 allows for mitigation of groundwater impacts, including impacts to SSWs, though there currently are no specific rules or laws governing groundwater mitigation for state scenic waterways outside of the Deschutes Basin. The UGR PBP group is welcome to pursue conversations with the Department regarding a new basin-wide mitigation program, though note that this would be a significant action and the Department would need time to prepare and coordinate with the PBP group. Any conversations about this solution would benefit from the establishment of an improved well monitoring network in order to collect more spatially and temporally complete data to be able to characterize the system and develop a better informed mitigation program.

The volcanic groundwater system is not closed to development, though as mentioned earlier, the cost of deep wells to develop this aquifer within the Grande Ronde Valley may prevent affordably accessing this resource. Additionally, there are many unknowns regarding the source, including large regional declines in volcanic aquifer water levels and unknown aquifer characteristics, which may discourage water users from investing in this source.

## Summary of Key Findings

- Groundwater supplies are controlled by recharge, available storage, and discharge within the basin and groundwater interflow between the two major aquifer systems, as well as the underlying geologic structure of the basin
- Groundwater pumping, especially from the alluvial system, captures some natural groundwater discharge, and has the potential to reduce flows in hydraulically connected streams/rivers
- Water levels are declining in both aquifer systems, though most notably in the volcanic aquifer system
- New allocations of groundwater from the alluvial aquifer may occur if an approved approach to mitigation is established
- The lack of spatially distributed water level data, as well as data over time, prevents a more complete understanding of characteristics of the aquifers

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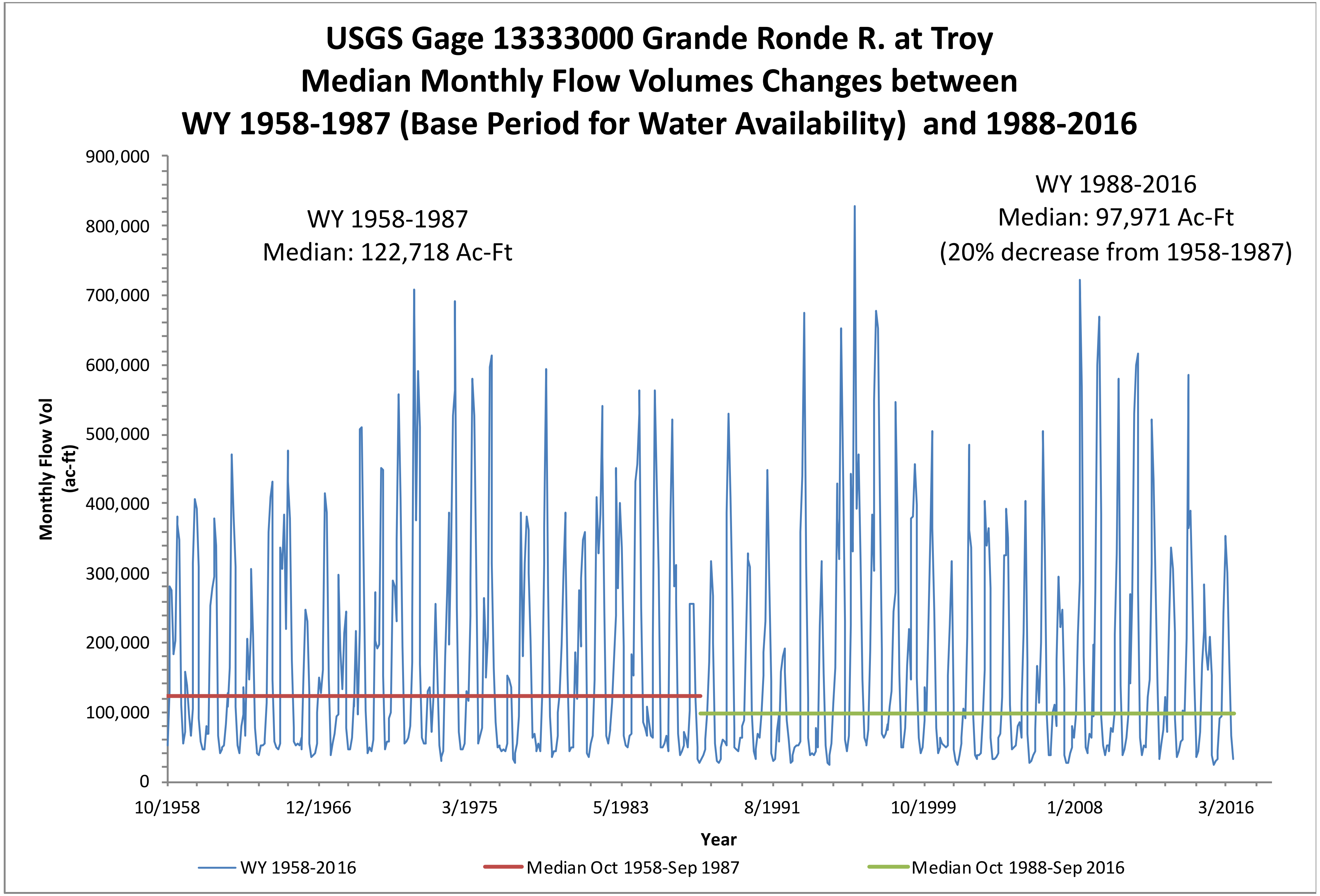
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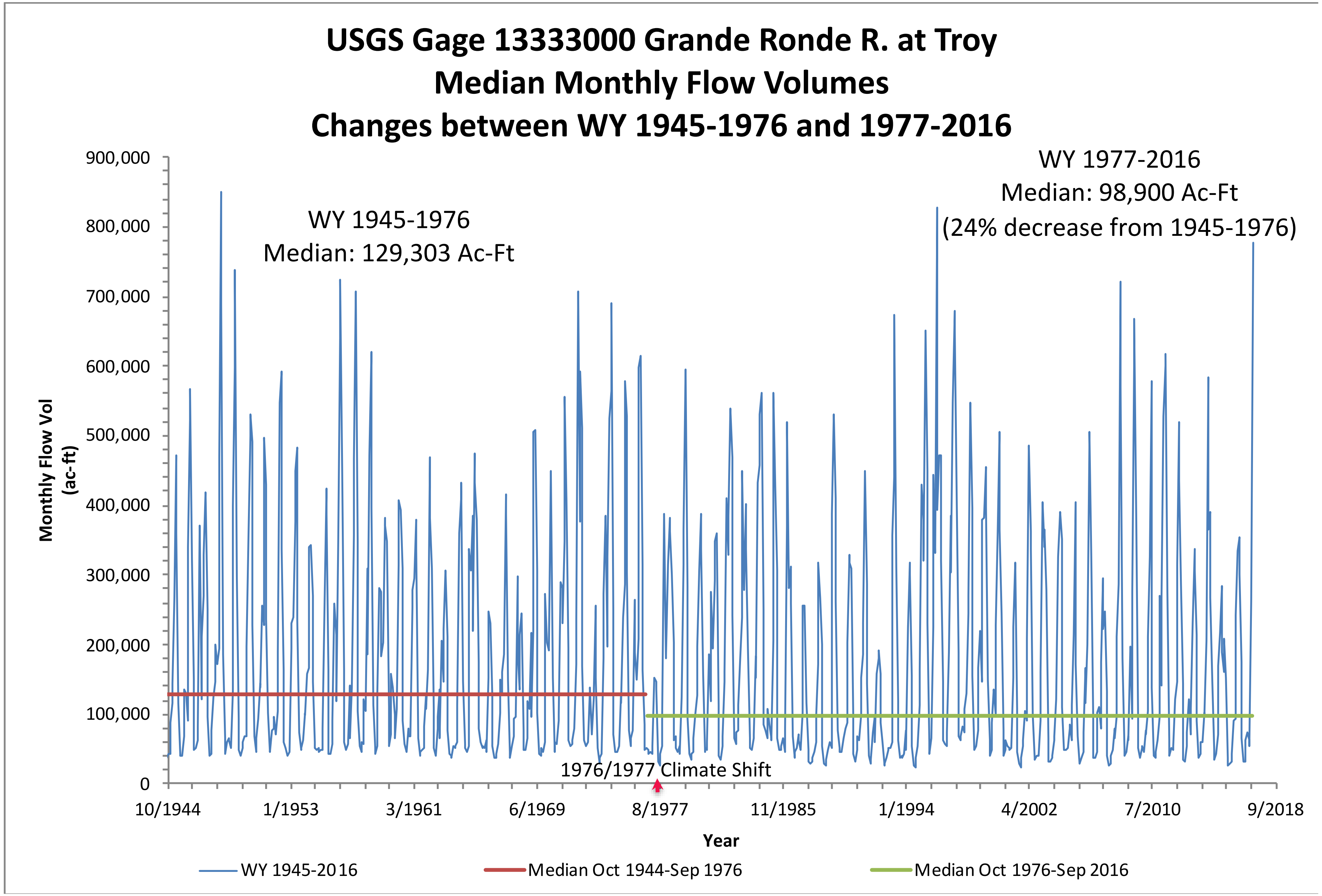
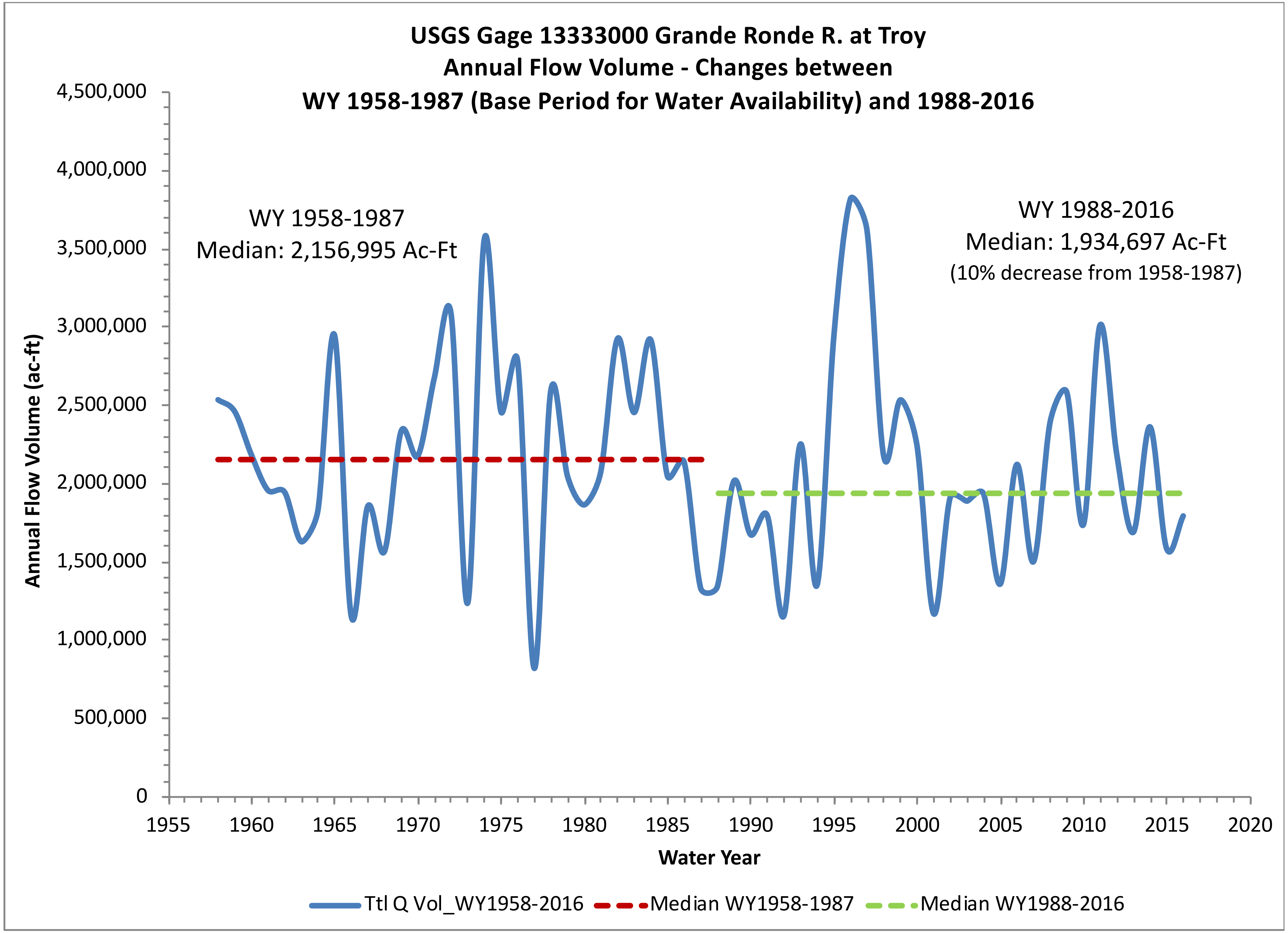
Median Monthly Flow Volumes Changes between
WY 1958-1987 (Base Period for Water Availability) and 1988-2016
WY 1958-1987
Median: 122,718 Ac-Ft
WY 1988-2016
Median: 97,971 Ac-Ft
(20% decrease from 1958-1987)
Monthly Flow Vol
(ac-ft)
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
10/1958
12/1966
3/1975
5/1983
8/1991
10/1999
1/2008
3/2016
Year
WY 1958-2016
Median Oct 1958-Sep 1987
Median Oct 1988-Sep 2016


USGS Gage 13333000 Grande Ronde R. at Troy
Median Monthly Flow Volumes
Changes between WY 1945-1976 and 1977-2016
WY 1945-1976
Median: 129,303 Ac-Ft
WY 1977-2016
Median: 98,900 Ac-Ft
(24% decrease from 1945-1976)
1976/1977 Climate Shift
Monthly Flow Vol (ac-ft)
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
10/1944
1/1953
3/1961
6/1969
8/1977
11/1985
1/1994
4/2002
7/2010
9/2018
Year
WY 1945-2016
Median Oct 1944-Sep 1976
Median Oct 1976-Sep 2016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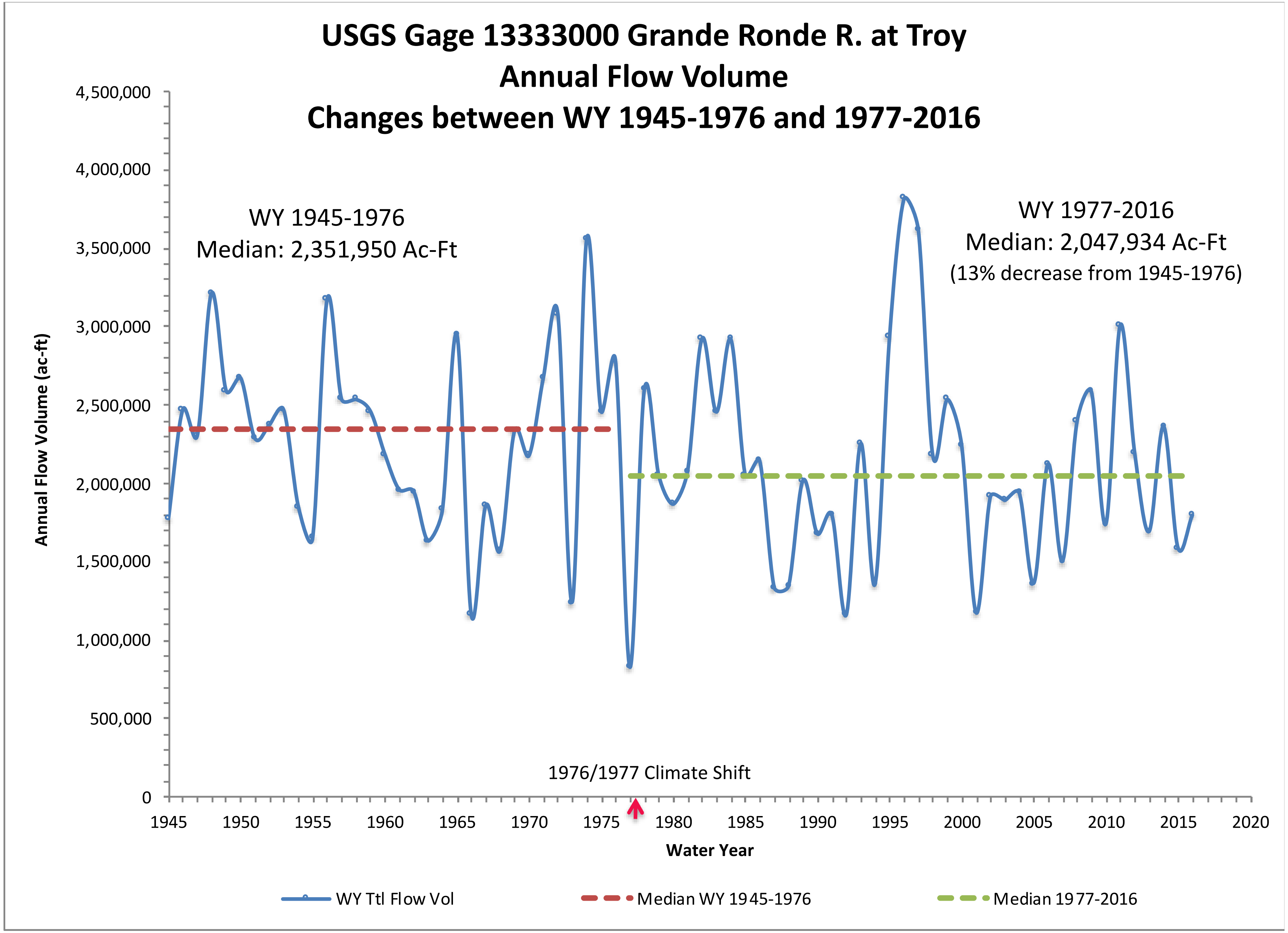
Annual Flow Volume - Changes between
WY 1958-1987 (Base Period for Water Availability) and 1988-2016
WY 1958-1987
Median: 2,156,995 Ac-Ft
WY 1988-2016
Median: 1,934,697 Ac-Ft
(10% decrease from 1958-1987)
Annual Flow Volume (ac-ft)
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Water Year
Ttl Q Vol_WY1958-2016
Median WY1958-1987
Median WY1988-2016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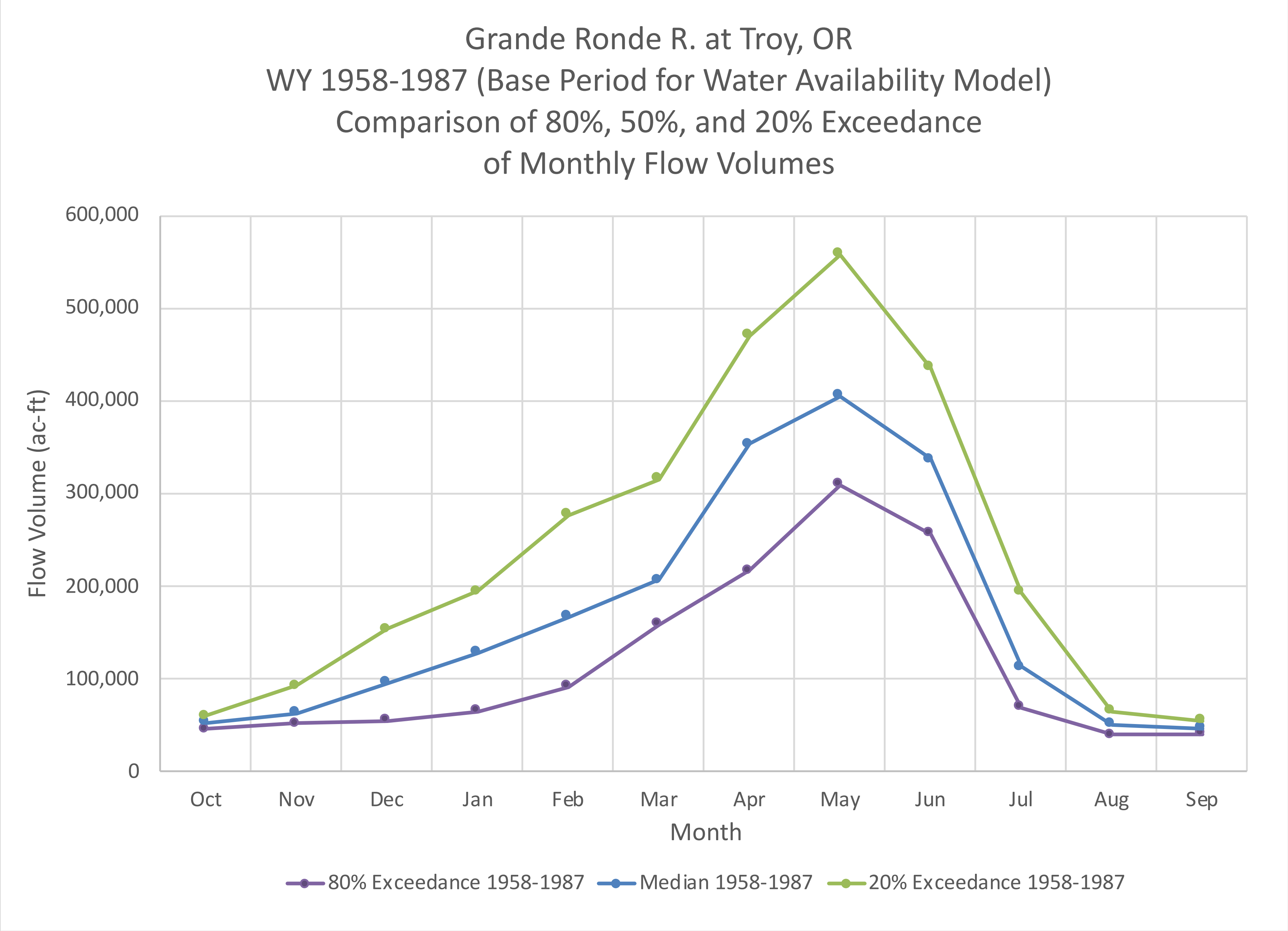
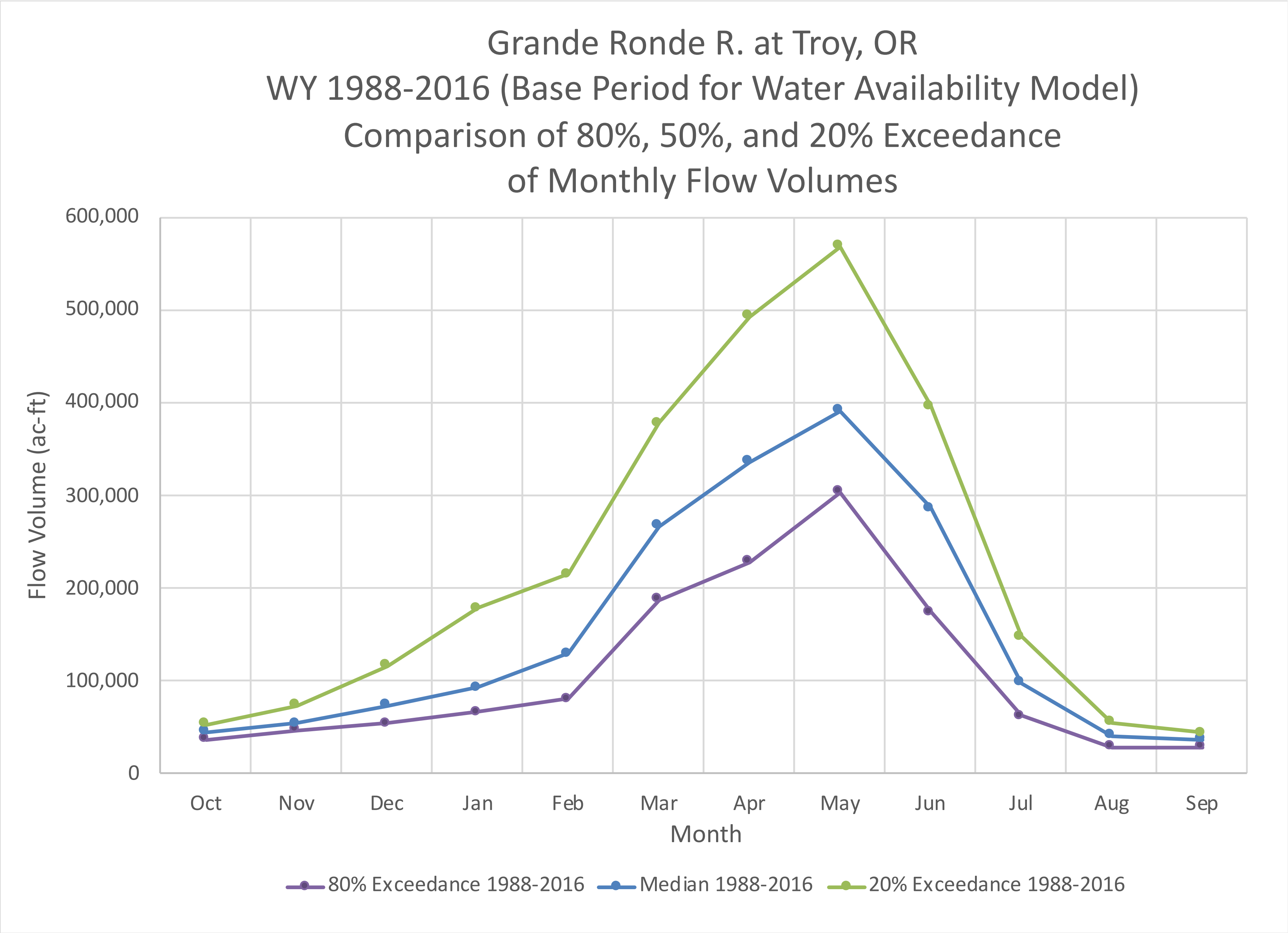
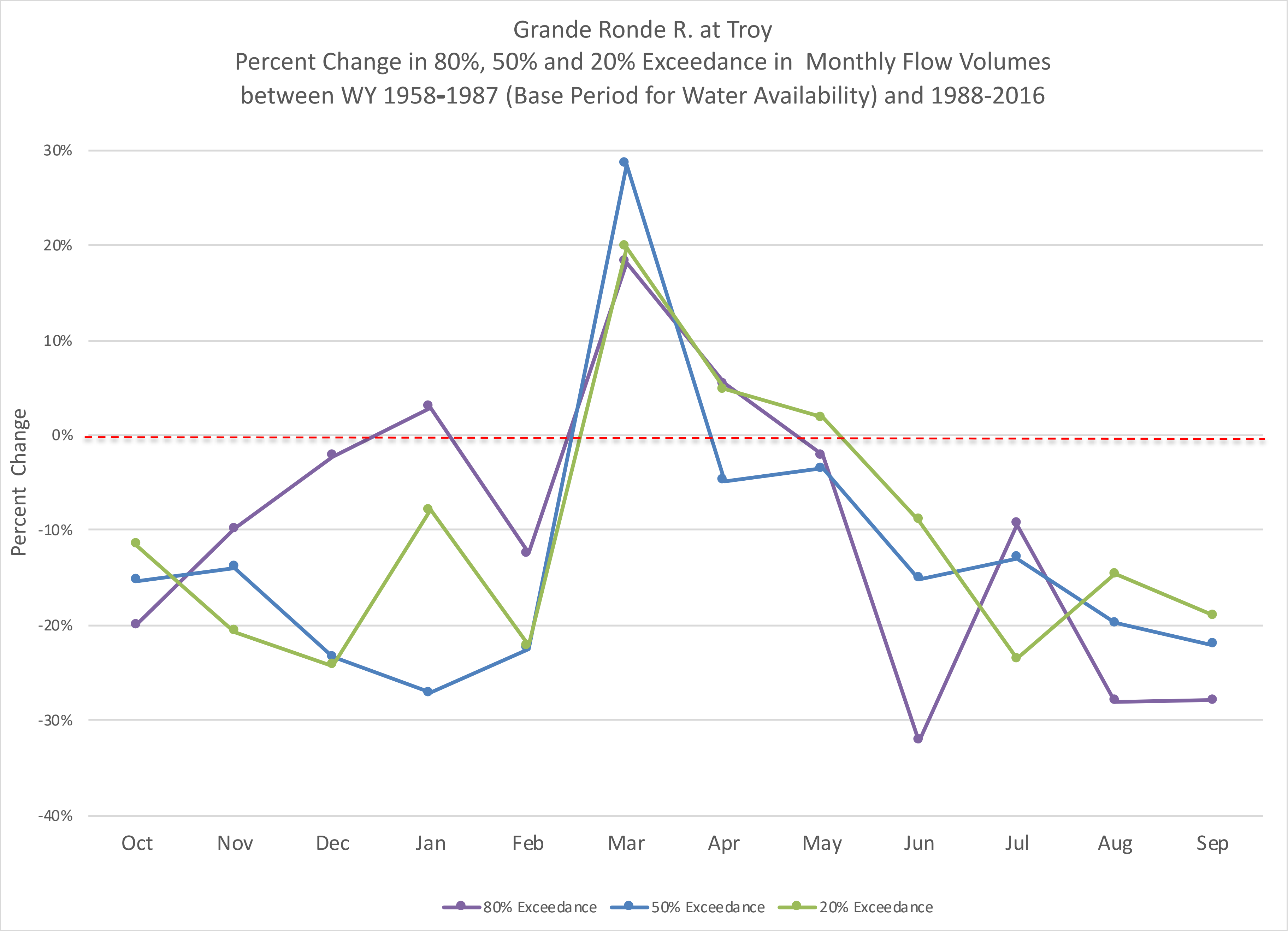
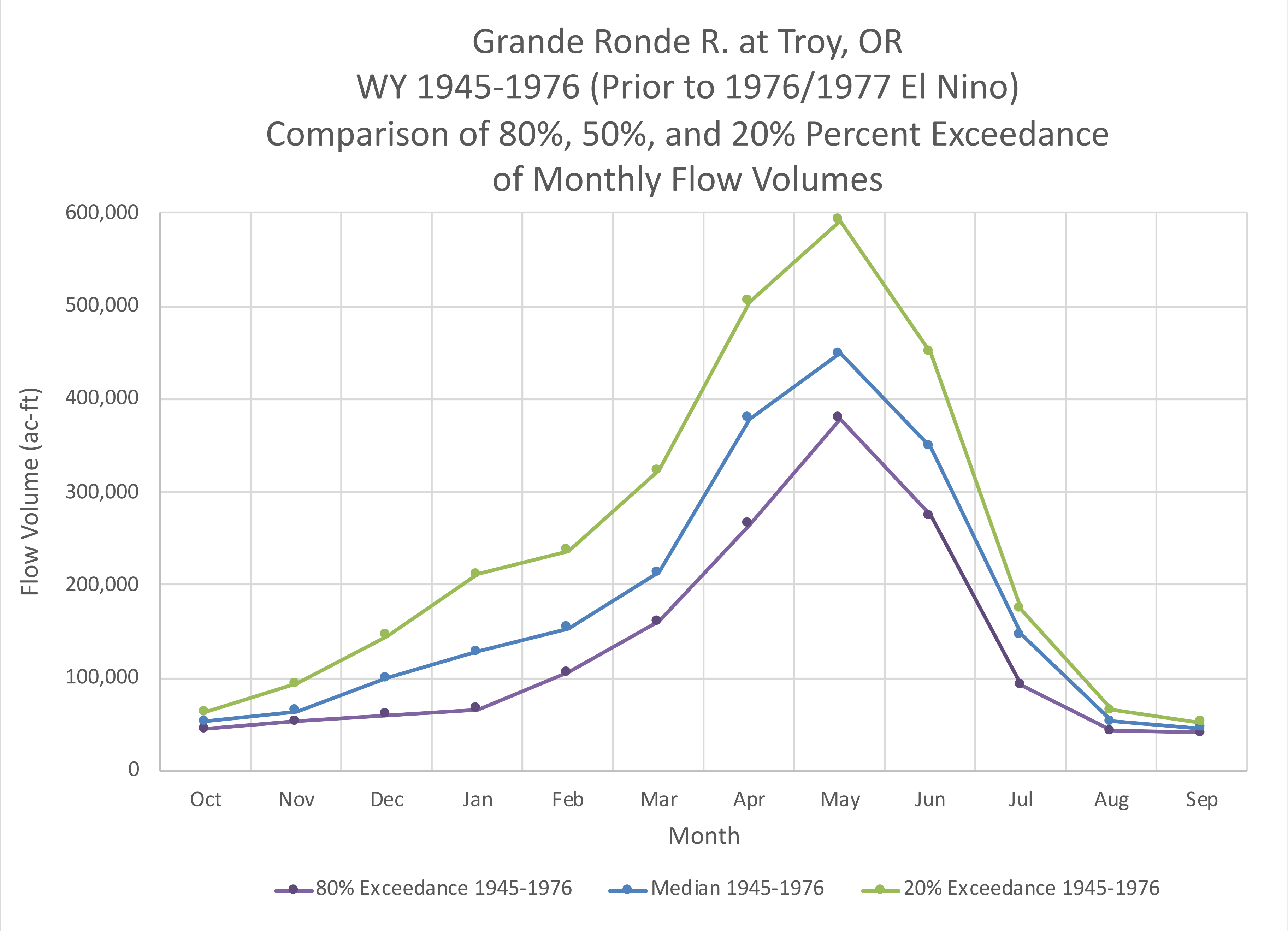
Annual Flow Volume
Changes between WY 1945-1976 and 1977-2016
WY 1945-1976
Median: 2,351,950 Ac-Ft
WY 1977-2016
Median: 2,047,934 Ac-Ft
(13% decrease from 1945-1976)
1976/1977 Climate Shift
Annual Flow Volume (ac-ft)
Water Year
0
500,000
1,000,000
1,500,000
2,000,000
2,500,000
3,000,000
3,500,000
4,000,000
4,500,000
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
WY Ttl Flow Vol
Median WY 1945-1976
Median 1977-2016

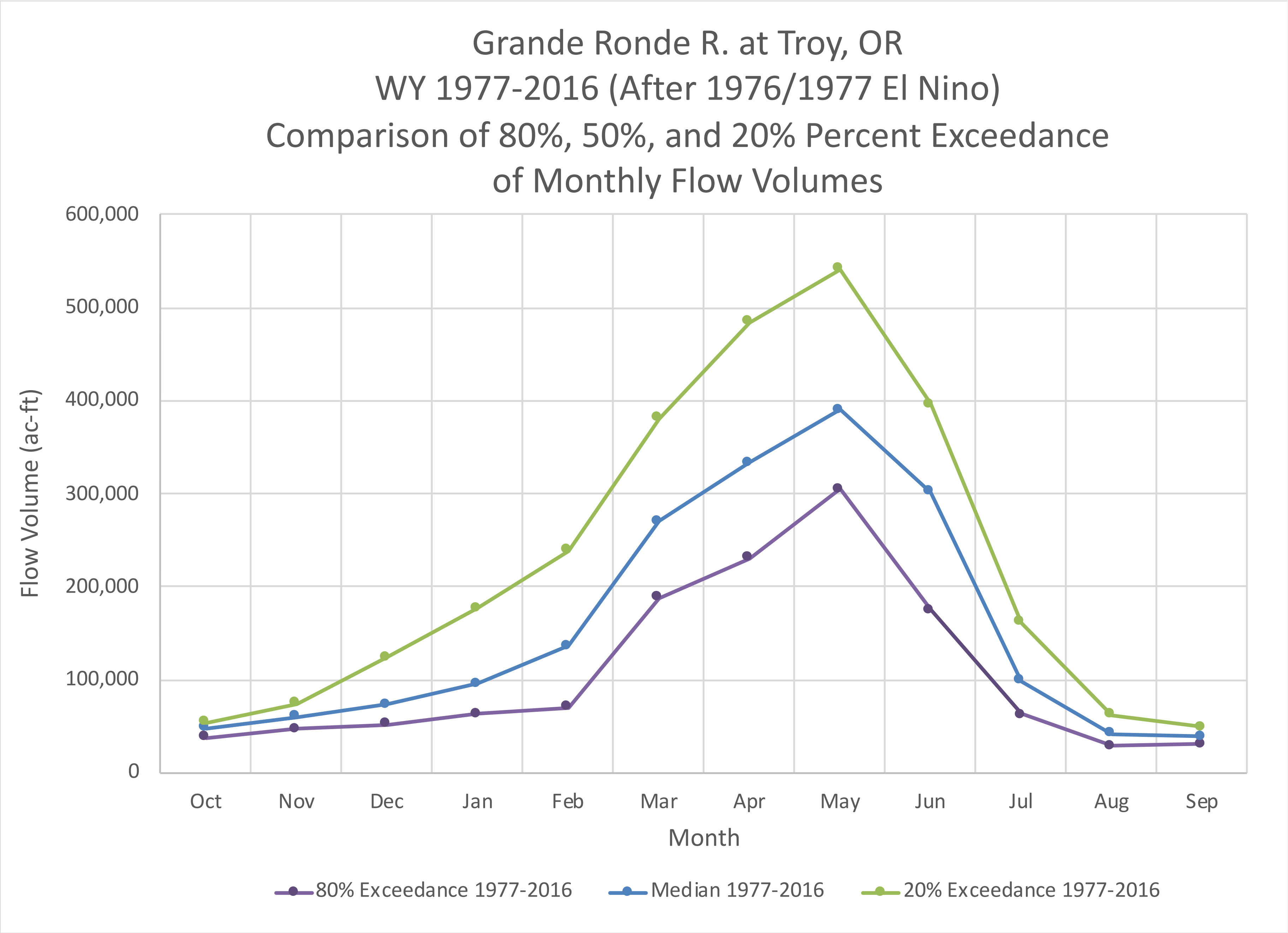


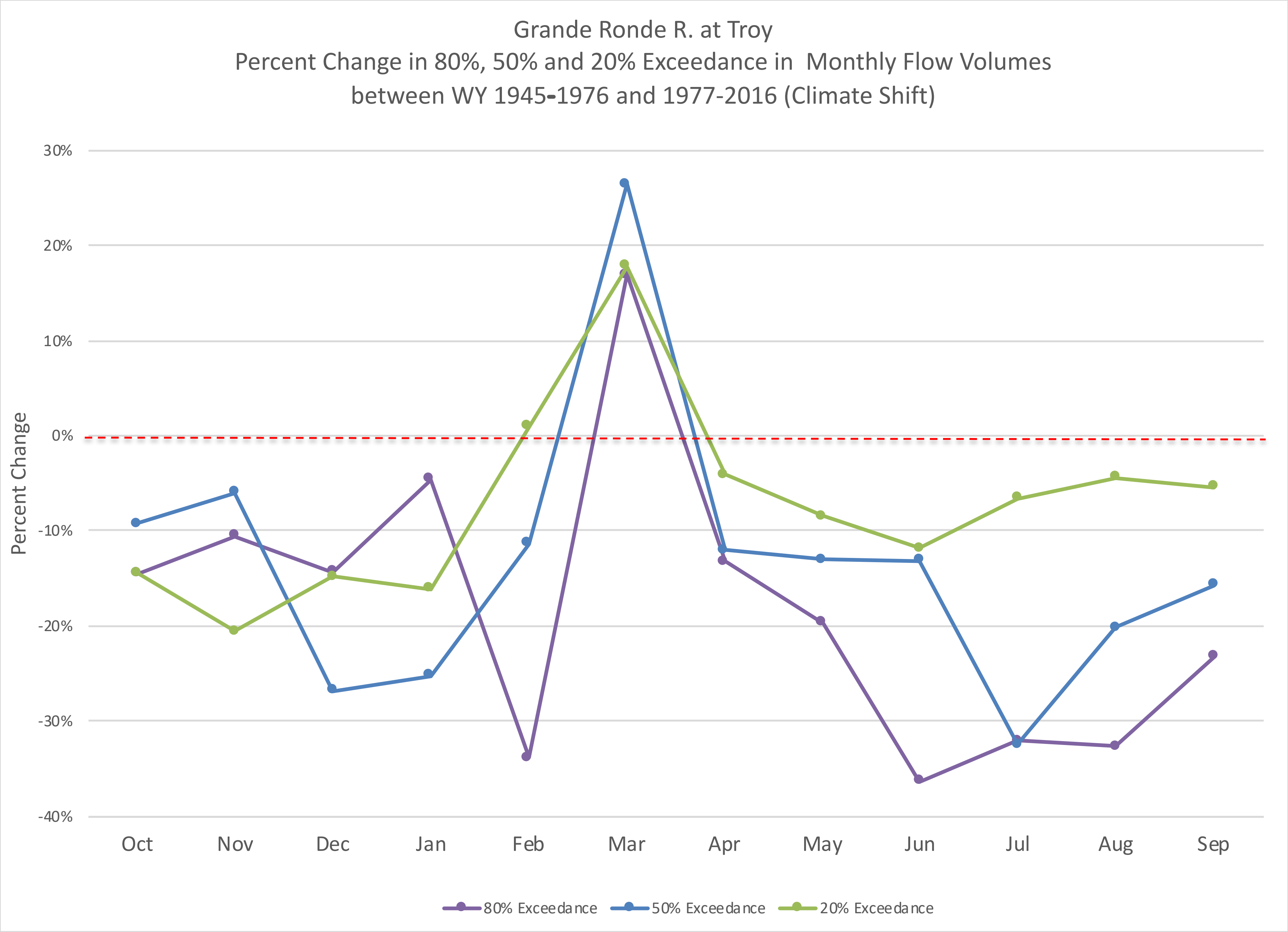
Grande Ronde R. at Troy, OR
WY 1958-1987 (Base Period for Water Availability Model)
Comparison of 80%, 50%, and 20% Exceedance
of Monthly Flow Volumes
600,000
500,000
400,000
300,000
200,000
100,000
0
Flow Volume (ac-ft)
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
80% Exceedance 1958-1987
Median 1958-1987
20% Exceedance 1958-1987

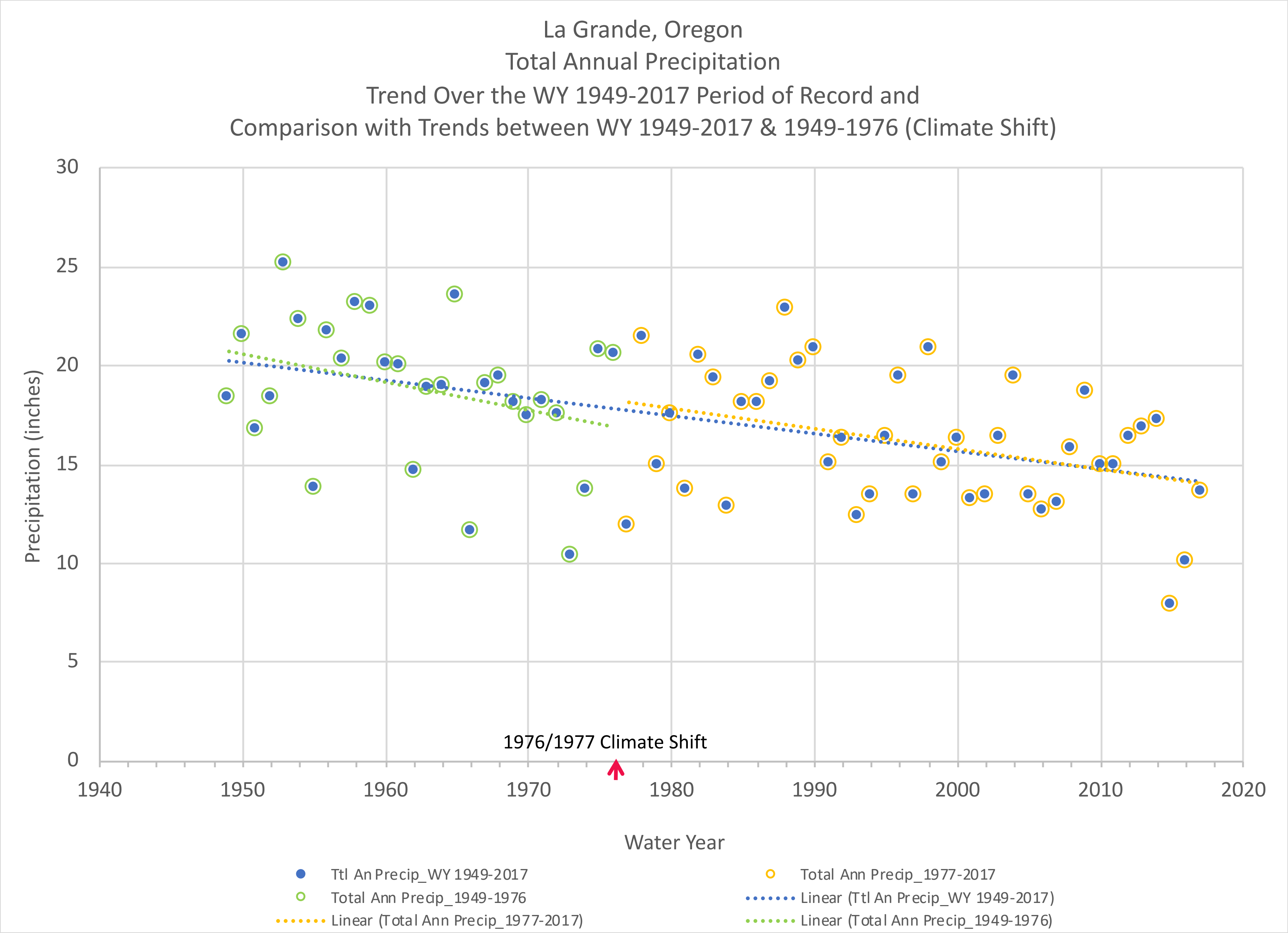

Grande Ronde R. at Troy, OR
WY 1988-2016 (Base Period for Water Availability Model)
Comparison of 80%, 50%, and 20% Exceedance
of Monthly Flow Volumes
Flow Volume (ac-ft)
600,000
500,000
400,000
300,000
200,000
100,000
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
80% Exceedance 1988-2016
Median 1988-2016
20% Exceedance 1988-2016

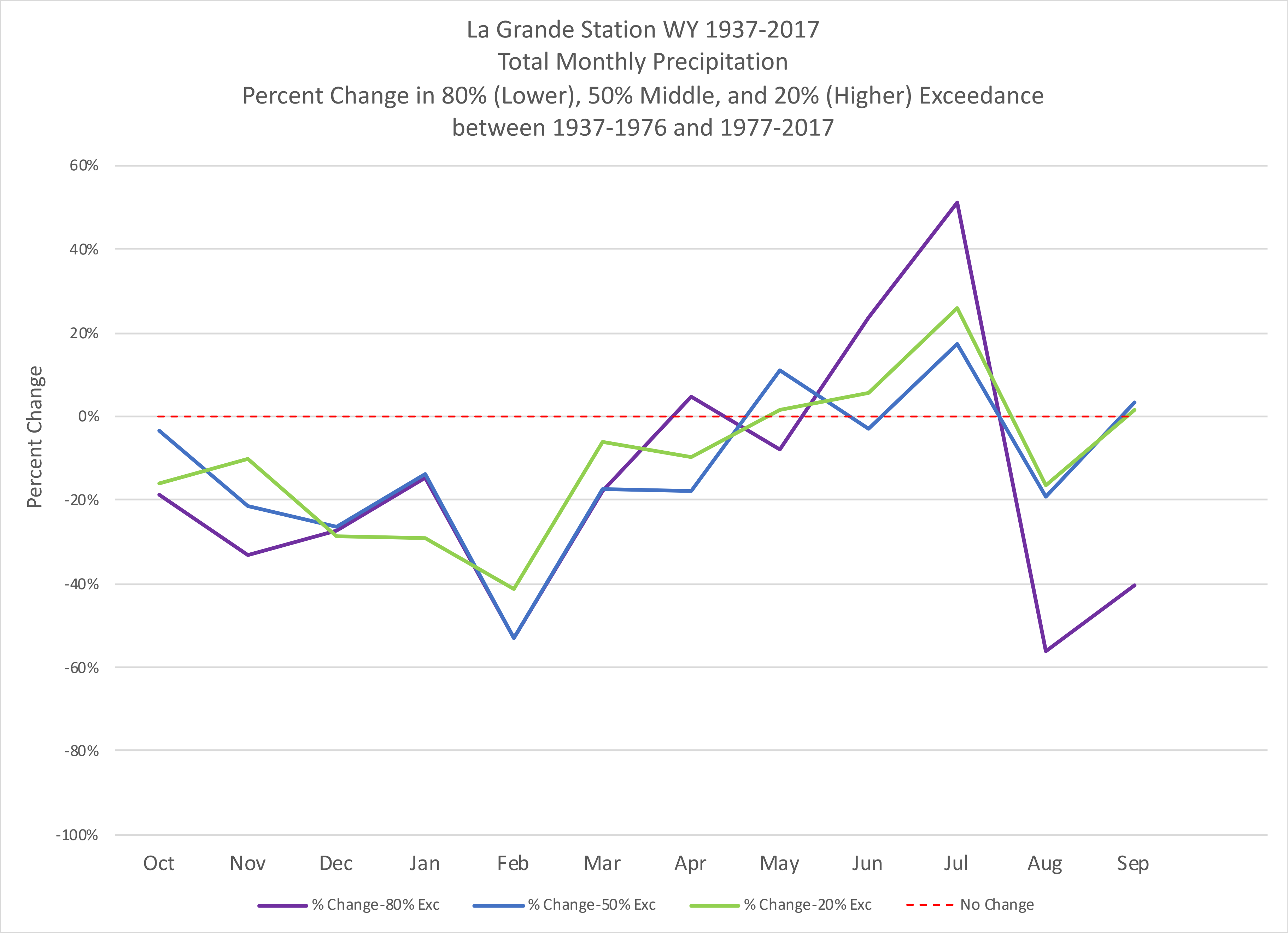

Grande Ronde R. at Troy
Percent Change in 80%, 50% and 20% Exceedance in Monthly Flow Volumes
between WY 1958-1987 (Base Period for Water Availability) and 1988-2016
30%
20%
10%
0%
-10%
-20%
-30%
-40%
Percent Change
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
80% Exceedance
50% Exceedance
20% Exceedance


Grande Ronde R. at Troy, OR
WY 1945-1976 (Prior to 1976/1977 El Nino)
Comparison of 80%, 50%, and 20% Percent Exceedance
of Monthly Flow Volumes
600,000
500,000
400,000
300,000
200,000
100,000
0
Flow Volume (ac-ft)
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
80% Exceedance 1945-1976
Median 1945-1976
20% Exceedance 1945-1976

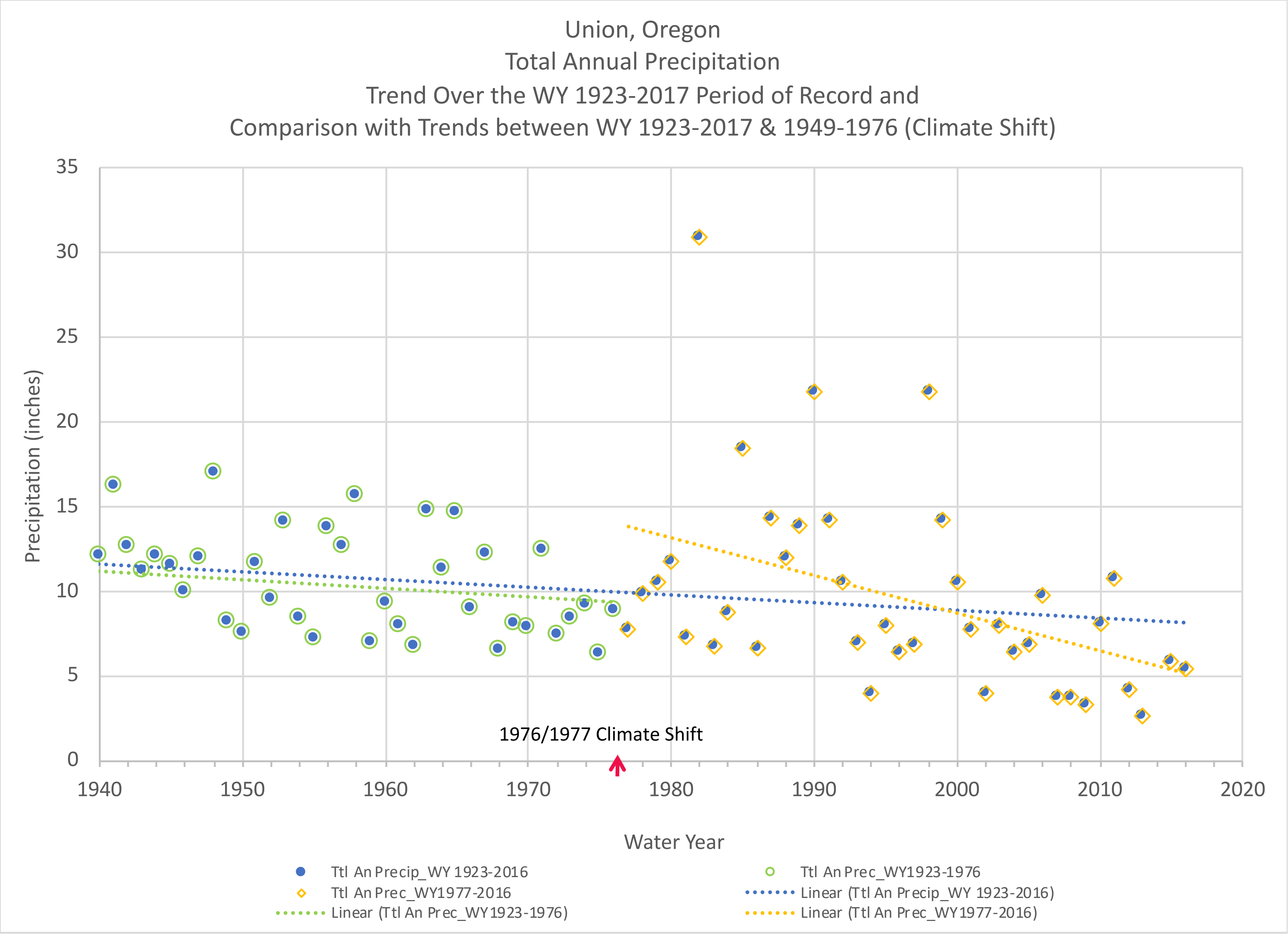

Grande Ronde R. at Troy, OR
WY 1977-2016 (After 1976/1977 El Nino)
Comparison of 80%, 50%, and 20% Percent Exceedance
of Monthly Flow Volumes
Flow Volume (ac-ft)
600,000
500,000
400,000
300,000
200,000
100,000
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
80% Exceedance 1977-2016
Median 1977-2016
20% Exceedance 1977-2016

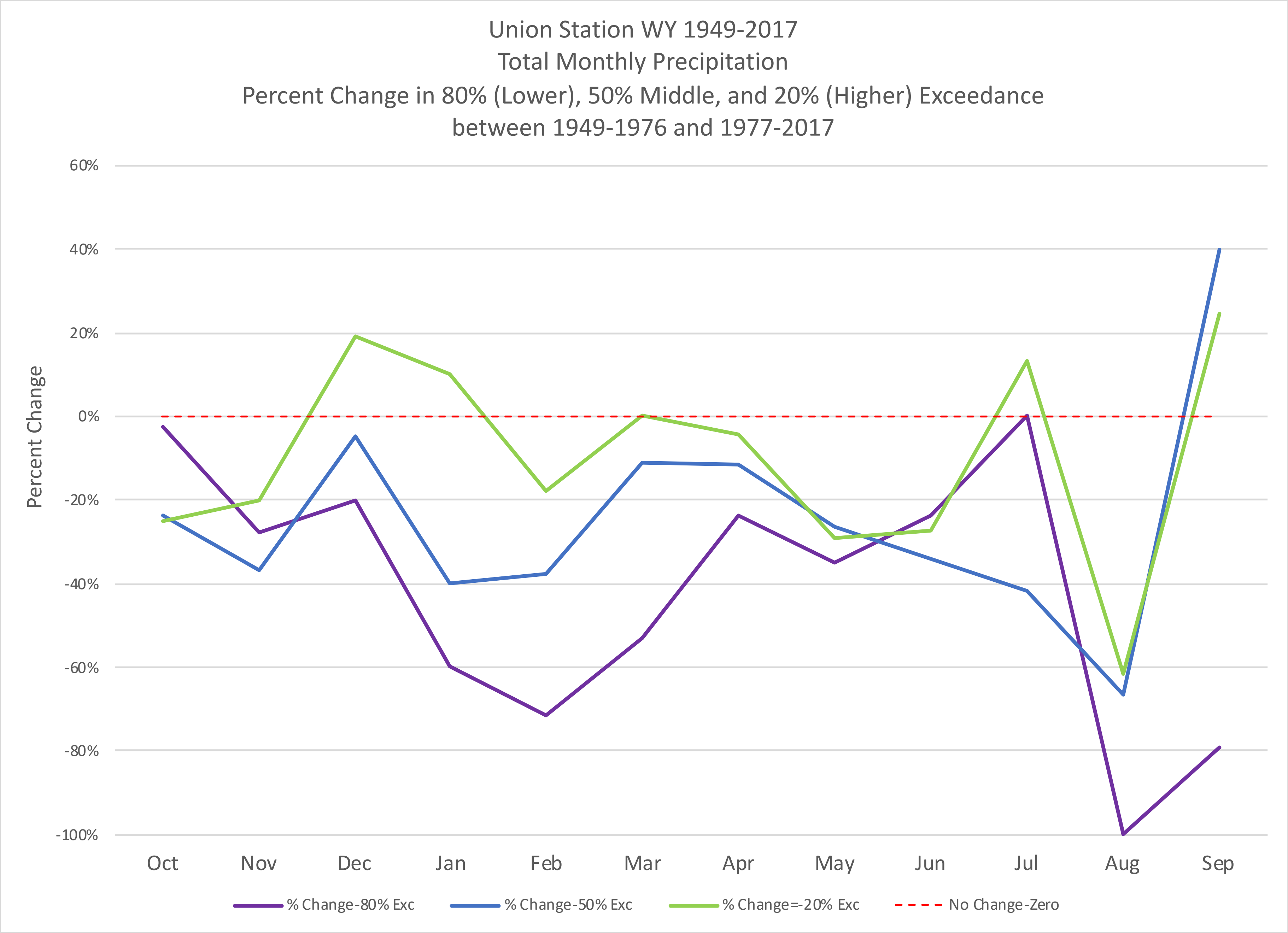

Grande Ronde R. at Troy
Percent Change in 80%, 50% and 20% Exceedance in Monthly Flow Volumes
between WY 1945-1976 and 1977-2016 (Climate Shift)
Percent Change
30%
20%
10%
0%
-10%
-20%
-30%
-40%
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
80% Exceedance
50% Exceedance
20% Exceedance

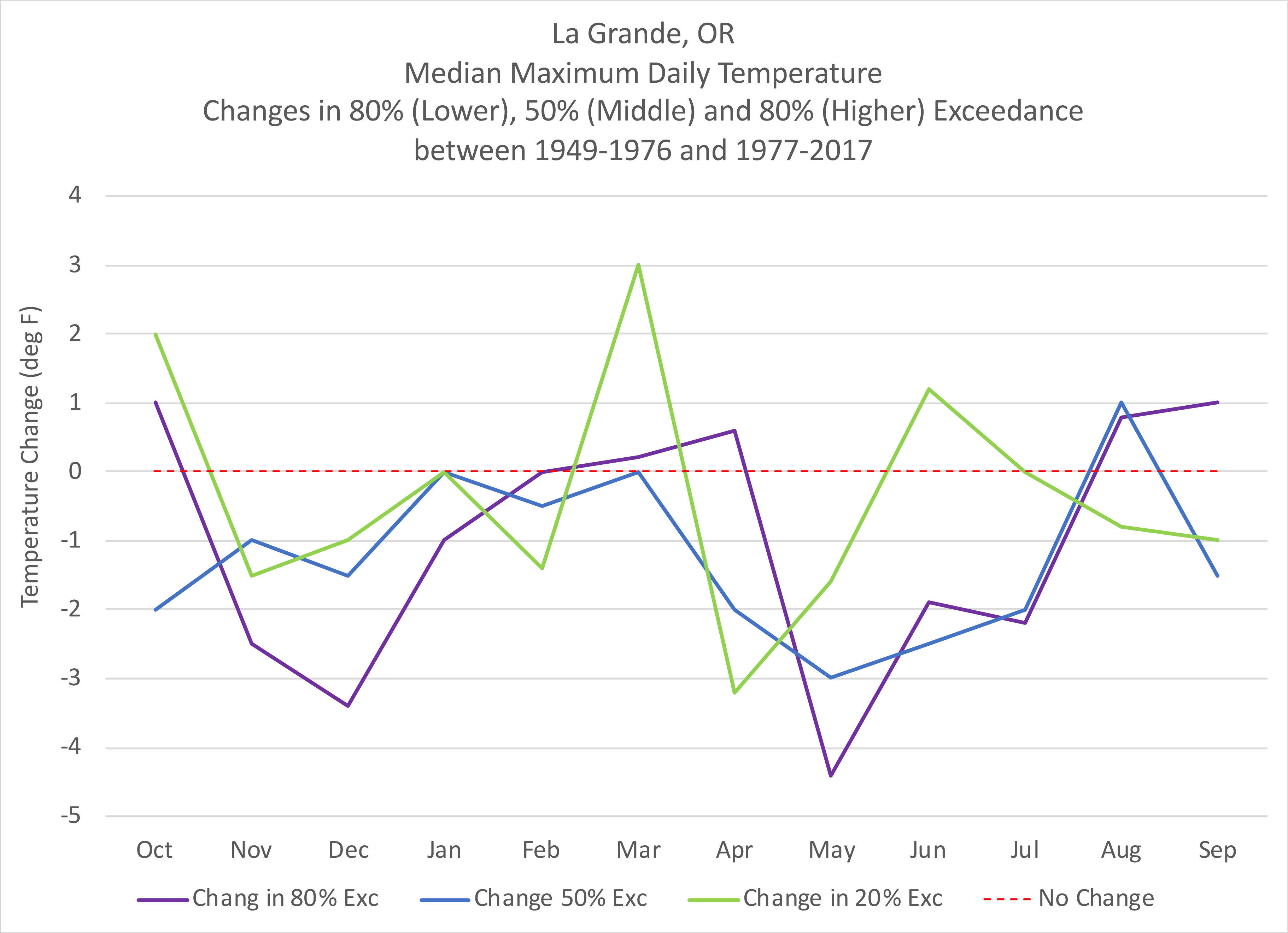

La Grande, Oregon
Total Annual Precipitation
Trend Over the WY 1949-2017 Period of Record and
Comparison with Trends between WY 1949-2017 & 1949-1976 (Climate Shift)
Precipitation (inches)
30
25
20
15
10
5
0
1976/1977 Climate Shift
1940
1950
1960
1970
1980
1990
2000
2010
2020
Water Year
Ttl An Precip_WY 1949-2017
Total Ann Precip_1977-2017
Total Ann Precip_1949-1976
Linear (Ttl An Precip_WY 1949-2017)
Linear (Total Ann Precip_1977-2017)
Linear (Total Ann Precip_1949-1976)

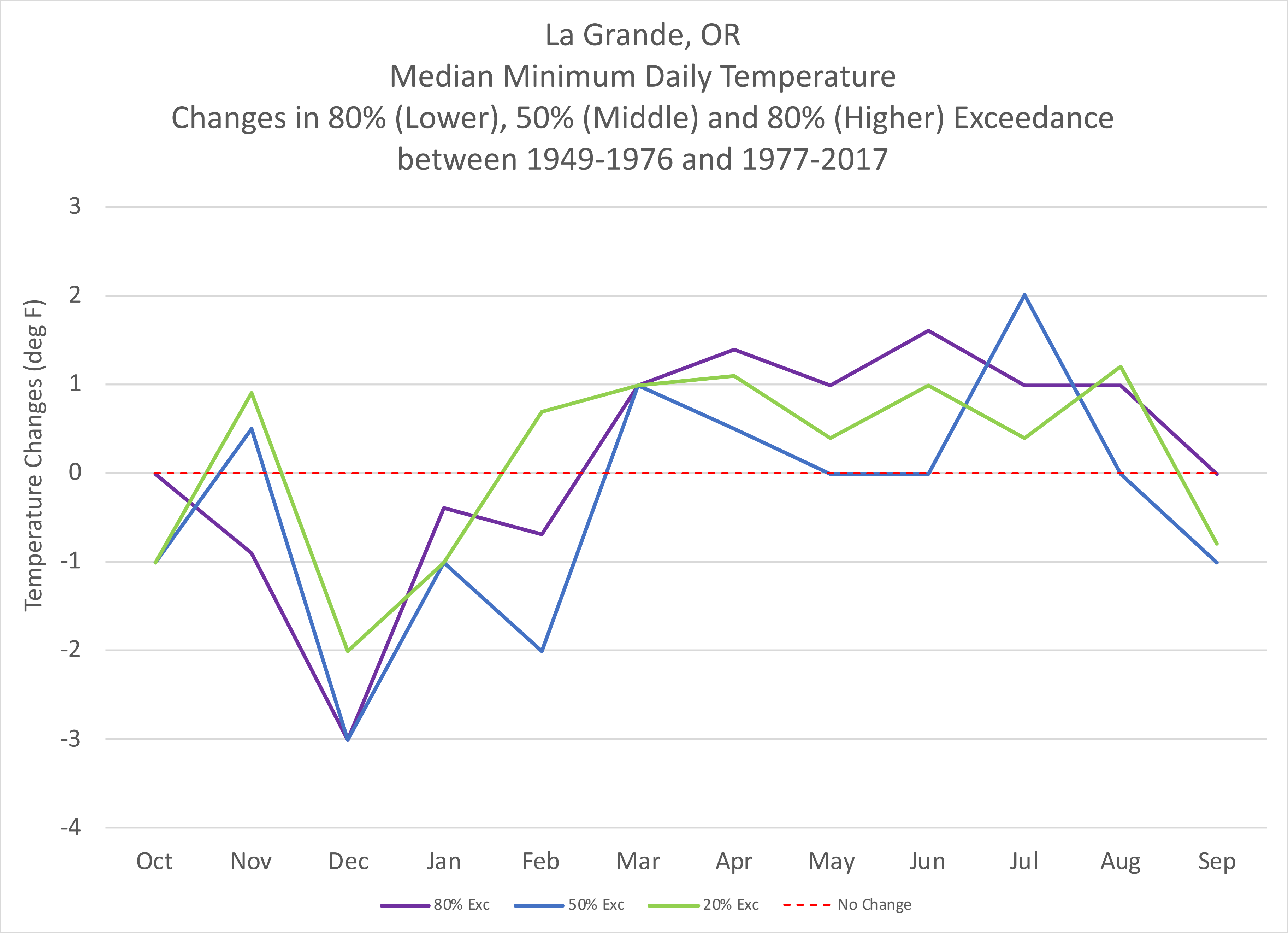


La Grande Station WY 1937-2017
Total Monthly Precipitation
Percent Change in 80% (Lower), 50% Middle, and 20% (Higher) Exceedance
between 1937-1976 and 1977-2017
Percent Change
60%
40%
20%
0%
-20%
-40%
-60%
-80%
-100%
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
% Change-80% Exc
% Change-50% Exc
% Change-20% Exc
No Change

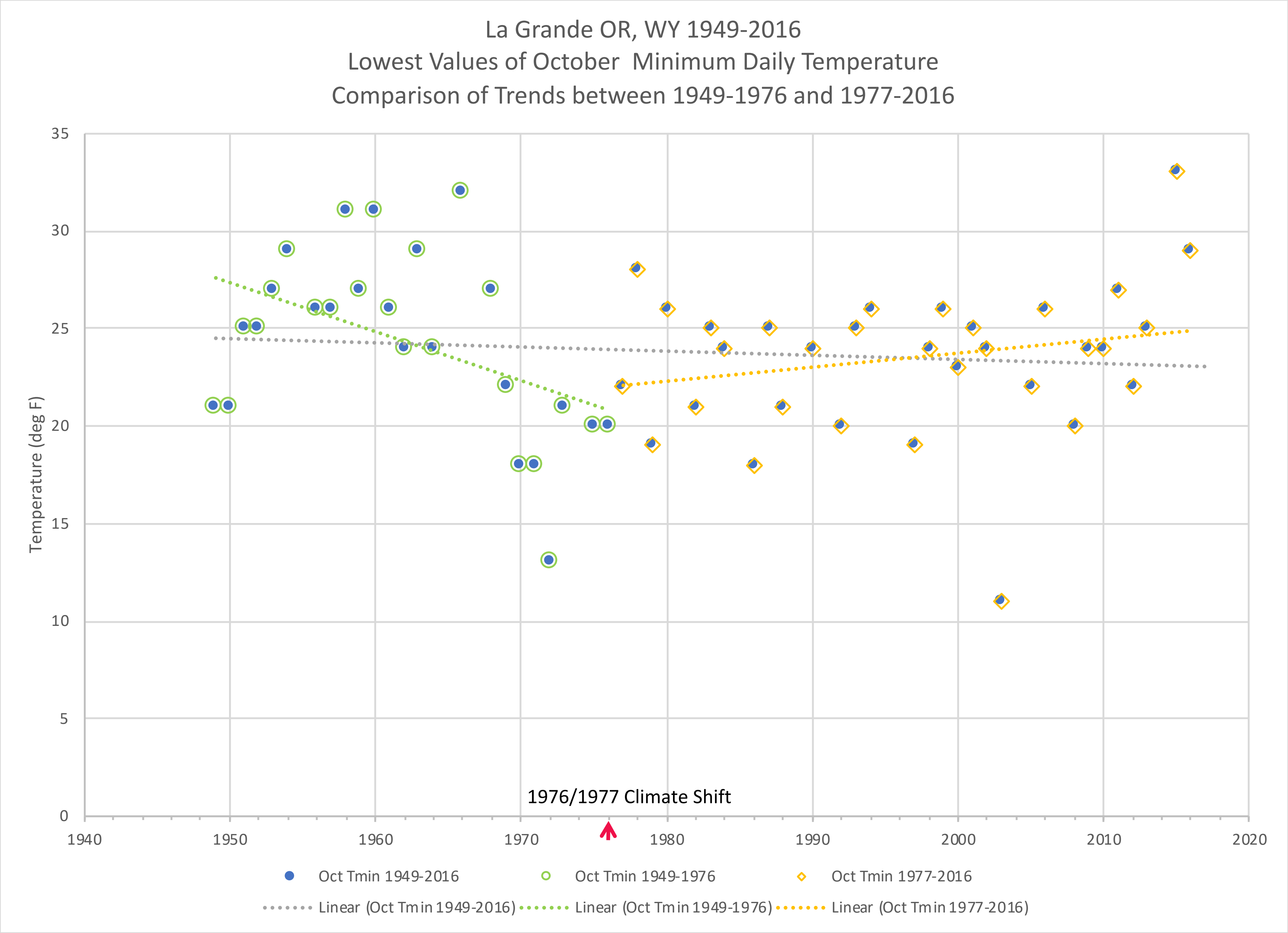

Union, Oregon
Total Annual Precipitation
Trend Over the WY 1923-2017 Period of Record and
Comparison with Trends between WY 1923-2017 & 1949-1976 (Climate Shift)
Precipitation (inches)
35
30
25
20
15
10
5
0
1940
1950
1960
1970
1980
1990
2000
2010
2020
1976/1977 Climate Shift
Water Year
Ttl An Precip_WY 1923-2016
Ttl An Prec_WY1923-1976
Ttl An Prec_WY1977-2016
Linear (Ttl An Precip_WY 1923-2016)
Linear (Ttl An Prec_WY1923-1976)
Linear (Ttl An Prec_WY1977-2016)


Union Station WY 1949-2017
Total Monthly Precipitation
Percent Change in 80% (Lower), 50% Middle, and 20% (Higher) Exceedance
between 1949-1976 and 1977-2017
60%
40%
20%
0%
-20%
-40%
-60%
-80%
-100%
Percent Change
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
% Change-80% Exc
% Change-50% Exc
% Change=-20% Exc
No Change-Zero


La Grande, OR
Median Maximum Daily Temperature
Changes in 80% (Lower), 50% (Middle) and 80% (Higher) Exceedance
between 1949-1976 and 1977-2017
Temperature Change (deg F)
4
3
2
1
0
-1
-2
-3
-4
-5
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Chang in 80% Exc
Change 50% Exc
Change in 20% Exc
No Change



La Grande, OR
Median Minimum Daily Temperature
Changes in 80% (Lower), 50% (Middle) and 80% (Higher) Exceedance
between 1949-1976 and 1977-2017
Temperature Changes (deg F)
3
2
1
0
-1
-2
-3
-4
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
80% Exc
50% Exc
20% Exc
No Change



La Grande OR, WY 1949-2016
Lowest Values of October Minimum Daily Temperature
Comparison of Trends between 1949-1976 and 1977-2016
Temperature (deg F)
35
30
25
20
15
10
5
0
1940
1950
1960
1970
1980
1990
2000
2010
2020
1976/1977 Climate Shift
Oct Tmin 1949-2016
Oct Tmin 1949-1976
Oct Tmin 1977-2016
Linear (Oct Tmin 1949-2016)
Linear (Oct Tmin 1949-1976)
Linear (Oct Tmin 1977-2016)

| Change in Median Tmin 1949-1976 & 1977-2017 | Change in Max Tmin | Change in Min Tmin | Change in 80% Exc Tmin | Change in 50% Exc Tmin (Median) | Change in 20% Exc Tmin |
|---|---|---|---|---|---|
| **Oct** | -4 | 1 | 0 | -1 | -1 |
| **Nov** | 2 | -11 | -1 | 1 | 1 |
| **Dec** | -2 | -9 | -3 | -3 | -2 |
| **Jan** | -2 | 0 | 0 | -1 | -1 |
| **Feb** | -4 | -6 | -1 | -2 | 1 |
| **Mar** | 1 | 4 | 1 | 1 | 1 |
| **Apr** | 1 | 1 | 1 | 1 | 1 |
| **May** | 0 | 6 | 1 | 0 | 0 |
| **Jun** | 1 | 1 | 2 | 0 | 1 |
| **Jul** | 0 | 3 | 1 | 2 | 0 |
| **Aug** | -3 | 1 | 1 | 0 | 1 |
| **Sep** | 0 | 1 | 0 | -1 | -1 |

| Change in Median Tmax 1949-1976 & 1977-2017 | Change in Max TMax | Change in Min TMax | Change in 80% Exc TMax | Change in 50% Exc Tmax (Median) | Change in 20% Exc TMax |
|---|---|---|---|---|---|
| **Oct** | 0 | -6 | 1 | -2 | 2 |
| **Nov** | -3 | -12 | -3 | -1 | -2 |
| **Dec** | 0 | -5 | -3 | -2 | -1 |
| **Jan** | -3 | 1 | -1 | 0 | 0 |
| **Feb** | -1 | -4 | 0 | -1 | -1 |
| **Mar** | 6 | 2 | 0 | 0 | 3 |
| **Apr** | 3 | -3 | 1 | -2 | -3 |
| **May** | -4 | -6 | -4 | -3 | -2 |
| **Jun** | -1 | -1 | -2 | -3 | 1 |
| **Jul** | 1 | -11 | -2 | -2 | 0 |
| **Aug** | -1 | 1 | 1 | 1 | -1 |
| **Sep** | -2 | -4 | 1 | -2 | -1 |