

City of Tumwater

# Water Shortage Response Plan

2019 Update

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## BACKGROUND

The objective of the Water Shortage Response Plan (WSRP) is to aid decision making in the event of a water shortage. The WSRP identifies demand reduction measures available to the City and defines circumstances that may trigger their implementation. Many of the City's water utility programs support the goals of the WSRP by increasing the resilience of our water system. These programs help to avert a major supply disruption and include preventative maintenance, water system planning, wellhead protection, and water use efficiency.

A water shortage can be described as any situation in which the water supply is insufficient to meet demand. A shortage may occur for a number of reasons and may be predictable or unpredictable. The types of events that could lead to a water shortage include the following:

- Predictable
  - Summer demand increase
  - Planned water system repair or maintenance
- Unpredictable
  - Mechanical failure
  - System contamination
  - Well or aquifer contamination
  - Major water main break
  - Earthquake
  - Fire
  - Vandalism or sabotage

The WSRP provides a framework that should be tailored to meet the specific needs of a water shortage. While the WSRP is designed to take into account as many scenarios as possible, there will be events or circumstances that can't be anticipated. It's the goal of the WSRP to maintain essential public health and safety services, and minimize adverse impacts on the local economy and the environment.

## ANTICIPATING A WATER SHORTAGE

To avert or respond to a water shortage City staff need to monitor environmental and infrastructure conditions that could disrupt the water supply.

## ENVIRONMENTAL CONDITIONS

The Washington Department of Ecology maintains a thorough list of resources for assessing the potential for seasonal water shortages. This list can be found at the following link:

<http://www.ecy.wa.gov/programs/wr/ws/wtrsupply.html>

Table 1 shows additional websites that are useful for assessing environmental conditions that could contribute to a water shortage.

Table 1: Useful Websites for Assessing Water Shortage Conditions

Indicator	Organization	Website	Comments
General	Department of Ecology	<a href="http://ecy.wa.gov/programs/wr/supply/">ecy.wa.gov/programs/wr/supply/</a>	
Groundwater	USGS Groundwater Watch	<a href="http://groundwaterwatch.usgs.gov">groundwaterwatch.usgs.gov</a>	See site number 465033122570202
	Thurston County Monitoring Data	<a href="http://thurstoncountywa.gov/sw/Pages/monitoring-dashboard.aspx">thurstoncountywa.gov/sw/Pages/monitoring-dashboard.aspx</a>	
Drought Conditions	National Integrated Drought Information Center	<a href="http://drought.gov">drought.gov</a>	
	National Drought Mitigation Center	<a href="http://droughtmonitor.unl.edu">droughtmonitor.unl.edu</a>	
	NWS Climate Prediction Center: Drought Information	<a href="http://www.cpc.ncep.noaa.gov/products/Drought/">www.cpc.ncep.noaa.gov/products/Drought/</a>	
Streamflow	USGS WaterWatch	<a href="http://waterwatch.usgs.gov">waterwatch.usgs.gov</a>	See site number 12080010
Snowpack	NRCS National Water and Climate Center	<a href="http://www.wcc.nrcs.usda.gov/snow/">www.wcc.nrcs.usda.gov/snow/</a>	
Climate	NWS Climate Prediction Center: Three Month Outlook	<a href="http://www.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=1">www.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=1</a>	
	NWS Climate Services	<a href="http://w2.weather.gov/climate/">http://w2.weather.gov/climate/</a>	Recent weather data for Olympia Airport
	PRISM Climate Group	<a href="http://prism.oregonstate.edu/">prism.oregonstate.edu/</a>	Historical climate data

In addition to the external data sources listed above, data from the City’s monitoring and production wells (water levels, specific capacity, etc.) can be useful for assessing environmental conditions that might suggest an imminent water shortage. While our groundwater supplies are generally protected from short-term drought conditions, periods of sustained drought can impact water levels which have the potential to reduce well production capacities.

Using the environmental indicators described above, staff can forecast the ability of the water utility to meet summer demand. City staff should begin monitoring environmental conditions in February or March in anticipation of the yearly summer demand spike.

## INFRASTRUCTURE CONDITIONS

The City of Tumwater operates 11 groundwater wells. Three of these wells (wells 9, 10 and 11) are typically only used in the summer months while the rest are used year-round. Table 2 shows the percentage of monthly production that each well provided from January thru September 2017.

Table 2: Percentage of Monthly Production for Each City Well.

Well Field	Well	January - May	June - September
Palermo	Well 4	7%	6%
	Well 6	8%	6%
	Well 8	6%	5%
	Well 16	6%	5%
	Well 17	6%	5%
Port	Well 9	0%	6%
	Well 10	0%	2%
	Well 11	0%	3%
	Well 15	6%	11%
Bush	Well 12	14%	12%
	Well 14	49%	40%

City staff monitor specific capacity annually at production wells to identify when a well requires rehabilitation. When capacity declines noticeably the City will investigate rehabilitation. In addition to specific capacity, staff should regularly assess well yield, pump limitations, and other operational conditions that could reduce well production.

#### CUSTOMER PORTFOLIO AND DEMAND CYCLE

Demand patterns are addressed in detail in the 2019 Water System Plan. The information provided below is meant to provide context for the WSRP. As of July 2017 the City of Tumwater has approximately 7,900 active service connections. The vast majority (84%) of these accounts are residential with institutional, commercial, and industrial (ICI) accounts making up the second largest category. Residential and ICI accounts are also the largest users of water, making up nearly 80% of all the consumption in the City. Table 3 shows the full summary of the main account types and their associated consumption.

Table 3: Water Consumption by Account Type

Account Type	Percent Active Accounts	Percent Total Consumption
Mobile Home Parks	0.1%	1.2%
Fill Stations & Hydrant Meters	1.2%	0.3%
Multi-Family	2.5%	8.6%
Irrigation	3.1%	11.2%
ICI	8.6%	35.9%
Residential	84.5%	42.8%

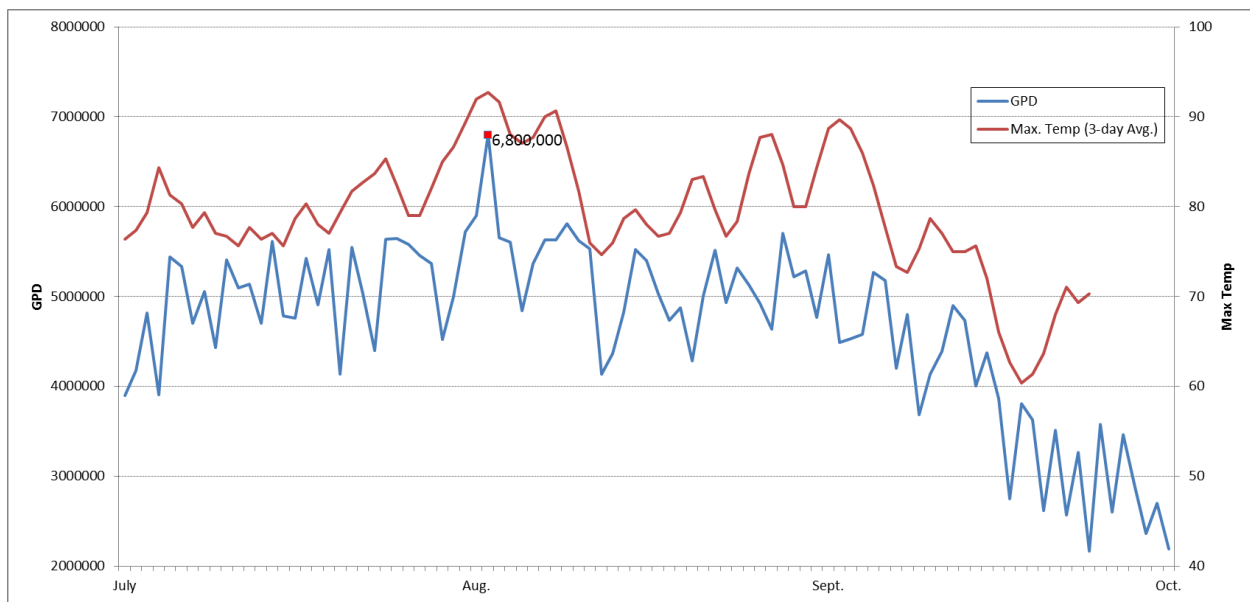
Every summer water consumption increases dramatically. From 2014 to 2016 monthly average consumption during the non-irrigation season (October – May) averaged 90,000 ccf compared to an average of 167,000 ccf during the irrigation season (June – September). Maximum day demand (MDD) is the highest 24-hour demand that occurs in a calendar year. MDD generally occurs on or near the

warmest day of the year, or within a prolonged period of warm, dry weather in July or August. For forecasting purposes, MDD can be estimated by multiplying average day demand ADD by 2.04, the City’s current peaking factor as described in the 2019 Water System Plan. Table 4 below shows MDD and date of MDD for 2012-2017.

*Table 4: Maximum Day Demand 2012 - 2017*

	2012	2013	2014	2015	2016	2017
Maximum Day Demand (mgd)	5.969	5.396	5.758	6.975	5.933	6.8
Date of Maximum Day	8/16	8/19	8/11	7/8	8/15	8/2

In 2017 the MDD occurred on August 2<sup>nd</sup> after the 3-day average temperature reached 93 degrees. The Figure 1 illustrates demand fluctuations over the summer 2017 which are typical for the City.



*Figure 1: GPD Production and Maximum Temperature, Summer 2017*

## RESPONDING TO A WATER SHORTAGE

The WSRP involves four stages of phased response. These different stages can be triggered by environmental, infrastructure, or emergency factors. When possible, the stages will be implemented progressively to provide City staff, cooperating agencies and the general public with time to adjust to any new requirements.

The four stages of the WSRP are as follows:

- **Stage 1: Advisory – Voluntary Reductions.** Water Resources staff evaluate operational and environmental conditions and collaborate with other departments to determine the likelihood of a shortage and to facilitate next steps. The public is encouraged to use water wisely. This stage is implemented every summer in preparation for high seasonal demand.
- **Stage 2: Minor Shortage – Voluntary Reductions.** This is the first step in reducing water consumption during a real or impending water shortage. Based on previous studies, a 5% - 10%

reduction in water consumption can realistically be achieved with a voluntary program.

- **Stage 3: Moderate Shortage – Mandatory Restrictions.** Under a mandatory program, it is possible to achieve a 10% - 20% reduction in water usage. An appropriate response at this level is to institute mandatory conservation measures for nonessential outdoor uses and revising the utility rate schedule. These activities are enforceable under the authority of City’s water code (TMC 13.04.170).
- **Stage 4: Severe Shortage – Emergency Curtailment.** After implementing emergency curtailment measures, it is possible to achieve a 30% reduction in water consumption. Appropriate responses might include fixed allotments or percentage cutbacks, but should only be initiated during a severe shortage. This type of program will allow the City to conserve the maximum amount of water without creating hardship, and would have to be enforced through action by Council.

**TRIGGERS**

**ENVIRONMENTAL**

In anticipation of high demand each summer the City will enter Stage 1 of the WSRP. Other environmental conditions, such as low aquifer levels, may trigger implementation of the WSRP or an increase in stage. Tumwater’s water system operators will work with water resources staff to identify environmental conditions that may be impact well performance or water availability.

**SUPPLY LIMITATIONS**

The City uses a metric called Present Possible Production (P3) to assess the water utility’s ability to meet demand. P3 is expressed in million gallons per day (MGD) and represents the upper limit of sustainable production capacity based on a maximum pumping duration of 22 hours per day to allow adequate downtime for the pumps. To calculate P3, first determine the current capacity of each useable well expressed in gallons per minute (GPM). Current capacity is considered the average GPM, during a pumping cycle, for each well over a week of production. Sum the capacities for each well and calculate the total production potential over 22 hours of pumping. Different stages of the WSRP are triggered when daily demand exceeds certain thresholds relative to the P3 value. These thresholds are shown in Table 5.

*Table 5: WSRP Daily Demand Triggers*

Stage	Stage Triggers
1	Every Summer
2	> 90% of P3 for 3 days, or
	> 95% of P3 for 1 day
3	> 95% of P3 for 3 days, or
	> 97% of P3 for 1 day
4	100% of P3 for 1 day

Other infrastructure considerations that may trigger WSRP implementation include water main

breaks, booster pump failures, etc.

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## EMERGENCY

The context of a specific emergency will determine if it's necessary to initiate the WSRP. For example, during a theoretical emergency at the Palermo treatment plant during the winter months that requires removing that wellfield from production, the City could make up the lost production by running other wells longer or (with approval from Ecology) activating seasonal wells in the Port wellfield. If this same emergency occurred in the summer when all 11 primary wells are pumping 20+ hours per day, making up lost production would not be possible with operational adjustments alone. In this scenario the City would likely need to activate some of the conservation measures and/or restrictions outlined in this plan to keep up with high demand.

If an emergency occurs that will impact the water supply Water Resources staff will work with Operations to calculate the new P3 value based on revised production capacity. Staff will look at daily demand for the preceding month and determine if any of the P3 triggers described above would have been met. Staff will forecast demand for the coming months to determine if it is necessary to activate the WSRP. The severity and timing of the emergency will be critical factors to consider. For example, if the water supply impact is expected to last a long time or worsen over time staff should consider implementing the WSRP even if it looks like the short-term impact is not significant. Or, if the emergency occurs in the fall after the peak demand season, staff should consider that demand will naturally decrease in the winter months.

## IMPLEMENTATION

The Operations and Maintenance and Water Resources Program managers within the Public Works Department have the primary responsibility of identifying water system supply and demand conditions that may lead to a water shortage. When environmental or operational conditions trigger a need for demand reduction these managers will convene a meeting to discuss options. This group will evaluate conditions and develop recommendations regarding the implementation of the WSRP. Pending approval from the Director of Public Works, this group will coordinate with other departments and staff to implement the plan.

By April of each year Water Resources staff will prepare a brief memo summarizing recent and forecast environmental conditions that could impact the water supply such as low groundwater levels or drought predictions. Every summer the City will implement Stage 1 of the WSRP, but if environmental conditions warrant it staff may choose to take extra steps to promote water conservation.

Each year after the City activates seasonal wells (typically by early to mid-June) and implements Stage 1 of the WSRP staff will calculate the P3 value and begin tracking daily demand. Staff will track daily demand every year from July thru September and as needed any time the WSRP is activated. At the end of the summer staff will prepare a brief memo summarizing the peak demand season.

Actions the City can take to address a water shortage can be grouped into two categories: supply augmentation and demand reduction. Because demand is significantly lower in the fall, winter, and

spring there are more options for keeping up with demand through increased production without relying on reducing consumption. In the event of a summer water shortage keeping up with demand would rely more heavily on conservation (demand reduction), although the City does have some flexibility to augment supply with emergency sources.

Water rights are an important consideration with any type of supply augmentation. Each well that the City operates is allowed a certain maximum flow rate ( $Q_i$ ) and annual volume ( $Q_a$ ). The City currently operates within its water rights, but a significant increase in the pumping rate or duration at any single well could put the City out of compliance. Before undergoing any drastic supply augmentation the City will analyze the impact to its annual allowance. If the added pumping is projected to exceed water rights then the City will work with Ecology to secure emergency authorization.

## SUPPLY AUGMENTATION

### INCREASE PUMPING TIME

The day to day cycles of the water system are largely automated by a supervisory control and data acquisition (SCADA) system. Pumps are switched on and off when reservoir levels reach certain set points. Figure 2 shows the average monthly on/off time for the City's 11 wells.

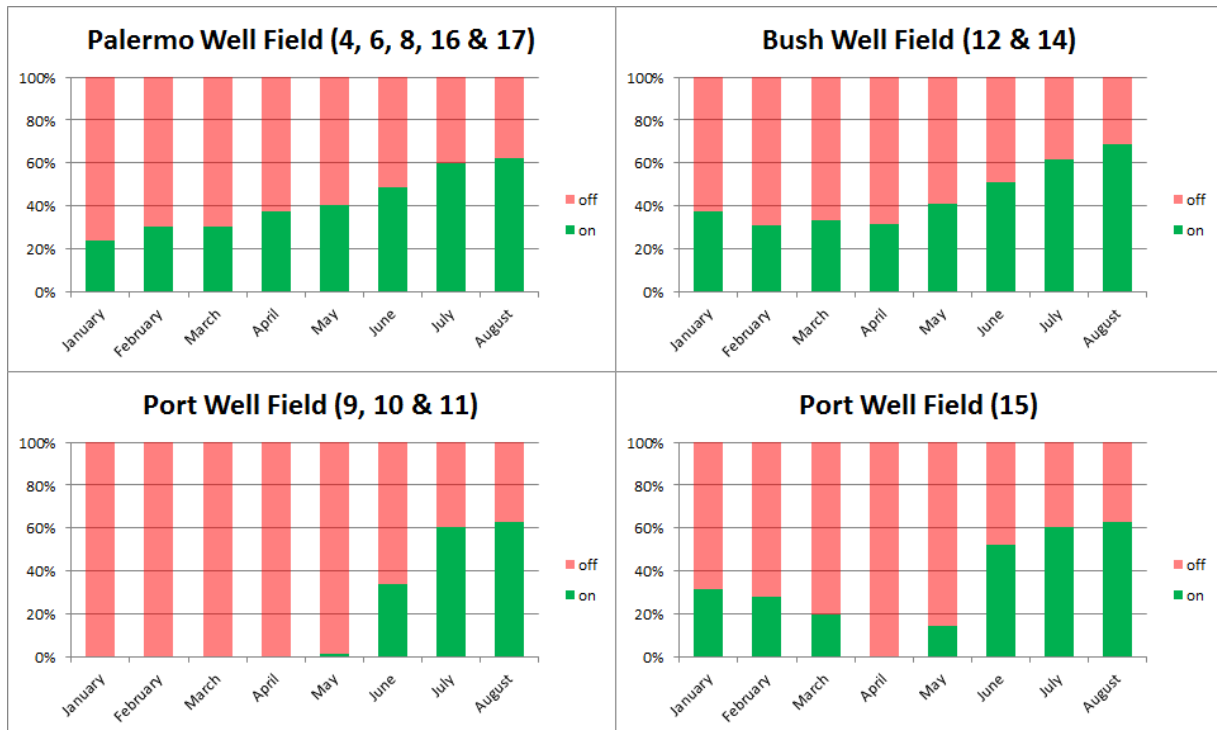


Figure 2: Typical ON/OFF Duration by Month for City Wells

This figure helps illustrate the typical amount of surplus capacity that exists each month from January thru August. On August 2<sup>nd</sup>, 2017 when the City reached its maximum daily demand (6.8 mgd) each well pumped for approximately 20 hours. To provide adequate downtime for the pumps they should

generally not operate longer than 22 hours a day.

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#### ACTIVATE SOURCE

Wells 9, 10, and 11 are used as seasonal sources of supply and in the summer these wells account for a total of 11% of the City’s production. The water rights for these wells restrict their use to May – October, but in the event of a water shortage emergency the City can request authorization from Ecology to pump outside of this timeframe.

Prior to 2019 the City maintained an emergency source of supply on the Tumwater Valley Municipal Golf Course near the Palermo wellfield. This well, known as well 24, was formerly used by the Olympia Brewery and is capable of yielding approximately 500 gpm with an appropriately sized pump. This well no longer serves as an emergency source of supply to the City and has been disconnected from the distribution system. The City will operate this well as an exempt well and has agreed to allow access to no more than five customers who intend to use this untreated source for non-consumptive commercial purposes.

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#### ACTIVATE INTERTIE

The City of Tumwater and City of Olympia maintain two emergency system interties to share water in the event either jurisdiction suffers a critical loss of service. The specific requirements for use of these interties are outlined in the 2001 Mutual Aid Agreement between the Cities of Tumwater and Olympia for the Use of Emergency Water System Interties. A copy of this agreement is found as an attachment to the 2019 Water System Plan.

Both interties must be manually operated by Olympia and Tumwater. Water transfer to the City of Tumwater through the 8-inch intertie at SR 101/Crosby requires a portable booster pump as Olympia’s pressure zone is at a substantially lower elevation than the adjacent Tumwater 454 Zone. At the 6-inch intertie located near Capital Boulevard the two jurisdictions’ pressure zones are almost hydraulically equivalent. A portable booster pump can be installed to pump water from either system through either intertie as necessary.

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#### DEMAND REDUCTION

In the event of a water shortage the City can maintain an adequate water supply by reducing demand. Staff has the discretion to use whatever tools are appropriate given the severity of the water shortage.


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#### PUBLIC OUTREACH

Public outreach is critical to reducing water demand. Every spring prior to the peak demand season the City will conduct public outreach to stress the importance of water conservation through social media, the City’s consumer confidence report (CCR), etc. If indicators point to a supply concern beyond normal summer peak demand staff will increase outreach efforts. These efforts will outline

the severity of water shortage, actions the City will take to alleviate the problem, and what individual consumers can do to help. Outreach for water shortages associated with summer peak demands should focus on outdoor water use while shortages during other times of the year should focus on indoor water use. Table 6 describes some specific tools the City may elect to use.


Table 6: Public Outreach Tools Available to the City Related to Severity of Water Shortage

Water Shortage Severity	Public Outreach Toolkit
Low  High	Reminders to use water wisely (social media, bill inserts, CCR, Johnson box, etc)
	Promote City and LOTT incentive programs (social media, bill inserts, CCR, Johnson box, etc)
	Conservation banner over Tumwater Blvd
	Prepare and distribute technical conservation information to specific consumer types
	Special purpose utility mailing
	News release to announce severe shortage
	News release to announce water use restrictions and prohibitions

#### WATER CONSERVATION ON CITY ACCOUNTS

The City of Tumwater irrigates many different properties including parks, City buildings, and right(s)-of-way and is one of top water users in the summer. The City can achieve significant water savings by reducing consumption on City properties. Doing so can send an important message to customers about water scarcity and the importance of conservation. If the City is asking its customers to cut back on water use during a shortage it is important that we demonstrate that we are willing to do so as well. Conservation messages posted on the City’s irrigated landscapes could be an effective component of an outreach campaign. The Table 7 shows irrigation related conservation measures the City should take at different stages of a summer water shortage.

Table 7: Irrigation Related Conservation Measures Related to Severity of Water Shortage

Water Shortage Severity	City of Tumwater Conservation Toolkit
Low  High	Promote water conservation practices within the City through internal publications, conversation, etc.
	Reduce irrigation on City properties
	Reduce water use for main flushing, car washing, street cleaning, power washing, etc.
	Let irrigated turfgrass go dormant (include educational signage)
	Convert turfgrass to a drought tolerant landscape
	Restrict irrigation on City properties
	Restrict main flushing to emergencies only
	Reduce system pressure to permissible levels

## COOPERATIVE DEMAND REDUCTION

The City has a few significant commercial/institutional water users in its customer portfolio. Through cooperation with these entities the City may be able to reduce overall demand or peak summer demand for a short period of time. In the event of a water shortage staff will use the City’s database tools to determine who the current major users are and reach out to these customers directly to request that they reduce consumption. The City may ask large users to reduce consumption by a certain percentage or may offer to conduct a free water use audit to determine if further reductions are possible.

## RESTRICTIONS AND PROHIBITIONS

Water use restrictions and prohibitions are applied differently to three separate types of use. *Essential* uses are those needed to sustain human and pet life, maintain standards of hygiene and sanitation, and firefighting. *Social* uses include commercial applications such as car washes, laundromats, restaurants, agricultural irrigation, schools, churches, motels, etc. *Non-essential* uses are outdoor uses such as landscape watering, golf course irrigation, power washing, personal car washing, etc.


The demand reductions for Stage 1 of the WSRP are achieved through voluntary measures. Restrictions begin in Stage 2 for non-essential uses and expand to social uses in Stage 3 and essential uses in Stage 4. Prohibitions apply to non-essential uses in Stages 3 and 4. Table 8 below shows how restrictions and prohibitions are applied at different stages of the WSRP.

*Table 8: Application of Restrictions and Prohibitions Based on WSRP Stage*

Use Type	Stage 1: Advisory	Stage 2: Minor Shortage	Stage 3: Moderate	Stage 4: Severe Shortage
<b>Essential Uses</b>	Voluntary Conservation	Voluntary Conservation	Voluntarily Conserved	Restrictions
<b>Social &amp; Economic Uses</b>	Voluntary Conservation	Voluntary Conservation	Restrictions	Restrictions
<b>Non-Essential Uses</b>	Voluntary Conservation	Restrictions	Prohibitions	Prohibitions

The specific regulations enacted by the City are at the discretion of the Public Works Director. These restrictions or prohibitions may target specific uses or broadly address use types depending on the nature and severity of the water shortage. The Table 9 lists a variety of measures the City could implement to reduce water consumption during a shortage.

Table 9: Water restriction measures the City may consider in a water shortage.

Water Shortage Severity	Water restrictions and prohibitions toolkit
<div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: center; margin-right: 10px;"> <p>Low</p>  </div> </div>	Require that customers use the minimum quantity of water needed to maintain landscapes in a healthy, non-dormant condition
	Implement odd/even watering schedule for irrigation (even numbered addresses on even numbered days, odd numbered addresses on odd numbered days)
	Time of day restriction for irrigation (6 am to 9 am, 6 pm to 9 pm)
	Sprinkler bans (hand watering only)
	Prohibit potable water use for golf course irrigation
	Prohibit filling wading pools, swimming pools, and hot tubs
	Prohibit vehicle washing except at commercial facilities that reuse water
	Prohibit washing driveways, sidewalks, buildings, fences, or windows.
	Prohibit outdoor water use for aesthetic fountains or ponds
	Prohibit "water waste"
	Prohibit firefighting training activities
	Rescind hydrant permits
	Prohibit or limit the installation of new water meters
	Prohibit water waste from leaks or breaks in private distribution systems. Require repairs within reasonable timeframe.
	Restrict water for construction purposes (dust control, etc.)
	Require commercial kitchens to post bulletin alerting customers to water shortage. Businesses advised to only offer water when specifically requested
	Water consumption permitted for essential indoor use only
	Require that residential customers reduce water use by a percentage
	Require that commercial customers reduce water use by a percentage
	High
	Water rationing

VariANCES

To soften the impact of these restrictions the City may elect to establish certain variances that would allow certain types of uses when restrictions or prohibitions are in effect. Some variances that the City may consider include:

- Newly planted flowers, plants, shrubbery, groundcover or trees may be hand watered any day of the week if the watering done is the minimum needed to sustain plant life
- Outdoor water use allowed for food production
- Outdoor washing permitted if it is required to prevent imminent damage
- Single-family and multifamily residential customers using less than 400 cubic feet of water

per month per customer or per housing unit shall be exempt from the requirement to reduce non-irrigation use

- Reclaimed water allowed for dust control or power washing
- Golf course watering allowed on greens and tees
- Certain recreational outdoor uses allowed if temperature is over 90 degrees

#### Authority

Tumwater Municipal Code, Chapter 13.04.170 contains provisions that allow the City to restrict water use in the event of a water shortage. This section of the water service regulations states the following:

*The City reserves the right in the case of shortage of waters, or for any other cause, to make any order regulating, forbidding or restricting the use of water for irrigation or sprinkling or any other nonessential outside usage.*

The Public Works Director, or their designee, is authorized to enforce the provisions of this section and any adopted use restrictions; the Director shall have the authority to authorize other City employees and departments to enforce such provisions and restrictions as deemed necessary, in consultation with the City Administrator. The City Council may need to be called on to take legal action through an ordinance, motion, resolution, and/or proclamation in order to restrict essential uses or social and economic uses during a severe shortage.

#### Enforcement

To enforce water use regulations during a stage 2 water shortage City staff will be directed to discuss regulations with customers and request compliance when these regulations are violated. During a stage 3 or 4 water shortage the City will begin to assess penalties to incentivize conservation. To facilitate the enforcement of water use regulations by Water Resources staff at these stages the City will do the following:

- Print self-duplicating “Notice of Violation” forms. One to be given to the customer and the other will be kept on file at the City
- Provide informational memo to all City staff alerting them to the new regulations
- Establish a process for reporting violations observed by City employees and the general public
- Establish a process for recording violations

Initial contact with violators will be made by Water Resources staff following visual confirmation of the reported violation. Contact will be in person or by phone and the goal will be to educate the customer about new regulations. Staff will record this as a first violation and inform the customer about the penalties to be levied after further violations. Future violations at the same location or by the same owner/operator will be subject to the terms outlined below. Multiple violations occurring on the same day will be treated as one violation. Each separate daily violation, and each day any violation is committed or permitted to continue, will be considered a separate offense as follows:

- Second Violation
  - On a second offense, the violator will be issued a formal written warning describing

the violation, requiring immediate cessation of the use in question, and advising that future violations will result in penalties. This Notice of Violation will be delivered by registered mail or hand delivered with date and initials of recipient. These written notices will be processed by the City's Public Works Department. There will be no monetary penalty for the second violation.

- Third, fourth, and fifth violations
  - On a third, fourth or fifth offense, the violator shall be issued another written notice and penalties will be imposed. The fine for a third offence is \$50, fourth is \$150, and fifth is \$350.
- Further violations
  - Sixth or subsequent violations will be fined a penalty of \$400.

Any monetary penalty imposed under the framework above that is not paid within 30 days from the issuance of the written notice will be added to the customer's water utility bill and collected in the same manner as delinquent accounts.

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## SUPPLY MONITORING

Throughout the water shortage incident water resources staff will monitor daily water production. If daily production surpasses any of the infrastructure triggers shown in the Triggers section of this plan, water resources and operations staff will discuss implementing a more advanced stage of the WSRP. Staff may elect to *not* increase the WSRP stage if the elevated daily production is believed to be temporary. However, if environmental, emergency or infrastructure conditions suggest a challenge to the water supply staff will increase the WSRP stage and implement the more proactive water conservation measures described above.

## ADDITIONAL RESOURCES

The following websites catalogue additional resources that may be useful for planning a response to a water shortage.

- American Water Works Association (AWWA) drought resource community
  - <https://www.awwa.org/resources-tools/water-knowledge/drought.aspx#4429414-response-and-contingency-plans>
- EPA Drought Response and Recovery Guide
  - [https://www.epa.gov/waterutilityresponse/drought-response-and-recovery-water-utilities#Drought Guide](https://www.epa.gov/waterutilityresponse/drought-response-and-recovery-water-utilities#Drought%20Guide)
- Municipal Research and Services Center (MRSC) guide to water shortage use restrictions
  - <http://mrsc.org/Home/Explore-Topics/Environment/Water-Topics/Water-Shortage-Use-Restrictions.aspx>
- The Washington Water/Wastewater Agency Response Network (WAWARN)
  - <https://wawarn.org/>
- Washington Department of Health (DOH) guidance for preparing water shortage response plans
  - [http://www.watersupplyforum.org/docs/6/773f6f0d95152843a051c624d028d80d5841da51/Dept.ofHealth\\_PreparingWaterShortageResponsePlans1.pdf](http://www.watersupplyforum.org/docs/6/773f6f0d95152843a051c624d028d80d5841da51/Dept.ofHealth_PreparingWaterShortageResponsePlans1.pdf)