TUALATIN RIVER FLOW MANAGEMENT TECHNICAL COMMITTEE

2017 Annual Report

prepared by
Bernie Bonn for

Clean Water Services

Cover photos taken in the Tualatin Basin by Erin Poor, US Geological Survey
clockwise from left: Egret, Muskrat, Blue Heron & Egret, Beaver, Mallard ducks, Cardinal Meadowhawk dragonfly

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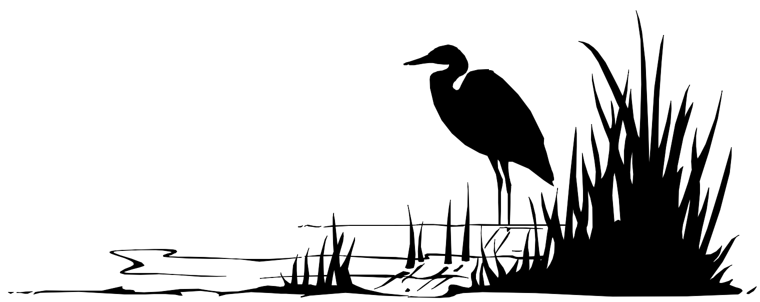

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For:

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FLOW MANAGEMENT TECHNICAL COMMITTEE MEMBERS

Kristel Griffith, Chair	*City of Hillsboro Water Department*
John Goans	*Tualatin Valley Irrigation District*
Jake Constans	*Oregon Water Resources Department*
Jamie Hughes	*Clean Water Services*
Raj Kapur	*Clean Water Services*
Laura Porter	*Clean Water Services*
Chris Walsh	*Washington County — Emergency Management System*
Mark Rosenkranz	*Lake Oswego Corporation*
Brian Dixon	*City of Forest Grove*

ACRONYMS USED IN THIS REPORT

FULL NAME	ACRONYM
Facilities	
Spring Hill Pumping Plant	SHPP
Wastewater Treatment Facility	WWTF
Organization	
Barney Reservoir Joint Ownership Commission	BRJOC
Clean Water Services	CWS
Joint Water Commission	JWC
Lake Oswego Corporation	LOC
Oregon Department of Environmental Quality	ODEQ
Oregon Department of Fish and Wildlife	ODFW
Oregon Department of Forestry	ODF
Oregon Water Resources Department	OWRD
National Marine Fisheries Service	NMFS
Tualatin Valley Irrigation District	TVID
Tualatin Valley Water District	TVWD
Bureau of Reclamation	BOR
U.S. Fish and Wildlife Service	USFWS
U.S. Geological Survey	USGS

FULL NAME	ACRONYM
Units of Measurement	
Acre-Feet	ac-ft
Cubic Feet per Second	cfs
Micrograms per liter	µg/L
Milligrams per Liter	mg/L
Million Gallons per Day	MGD
Pounds	lbs
River Mile	RM
Water Year	WY
Water Quality Parameters	
Biochemical Oxygen Demand	BOD
Dissolved Oxygen	DO
Sediment Oxygen Demand	SOD
Other	
Biological Opinion	BiOp
Total Maximum Daily Load	TMDL
Wasteload Allocation	WLA

Disclaimer

This report and the data presented herein are provided without any warranty, explicit or implied. The data presented in this report were supplied by the members of the committee. Although every effort was made to faithfully reproduce the data as provided, the data are not warranted to be accurate, appropriate for interpretation, merchantable, or suitable for any particular purpose.

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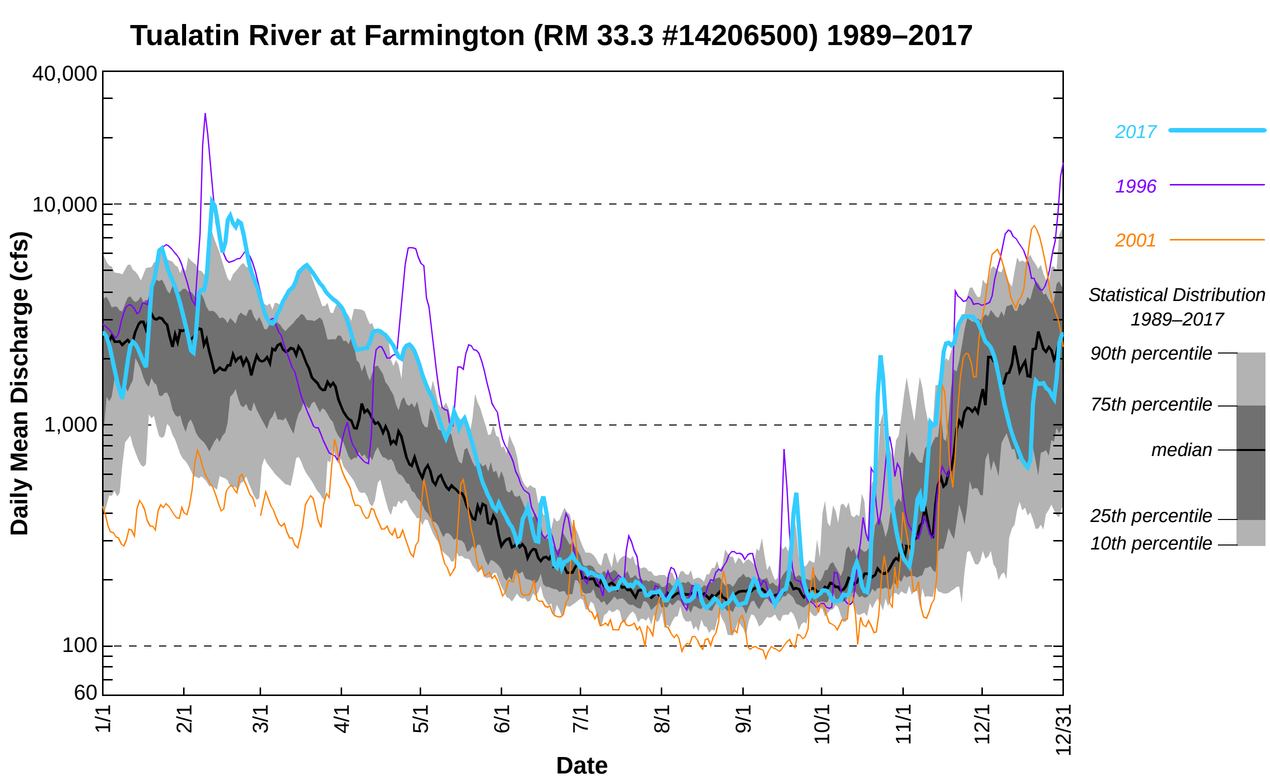
Appendices

2017 SUMMARY

This is the twenty-ninth year that the Tualatin River Flow Management Technical Committee has prepared an annual report documenting the flow management of the Tualatin River. Members of the committee include Clean Water Services (CWS), Tualatin Valley Irrigation District (TVID), Joint Water Commission (JWC), Lake Oswego Corporation (LOC) and Oregon Water Resources Department (OWRD).

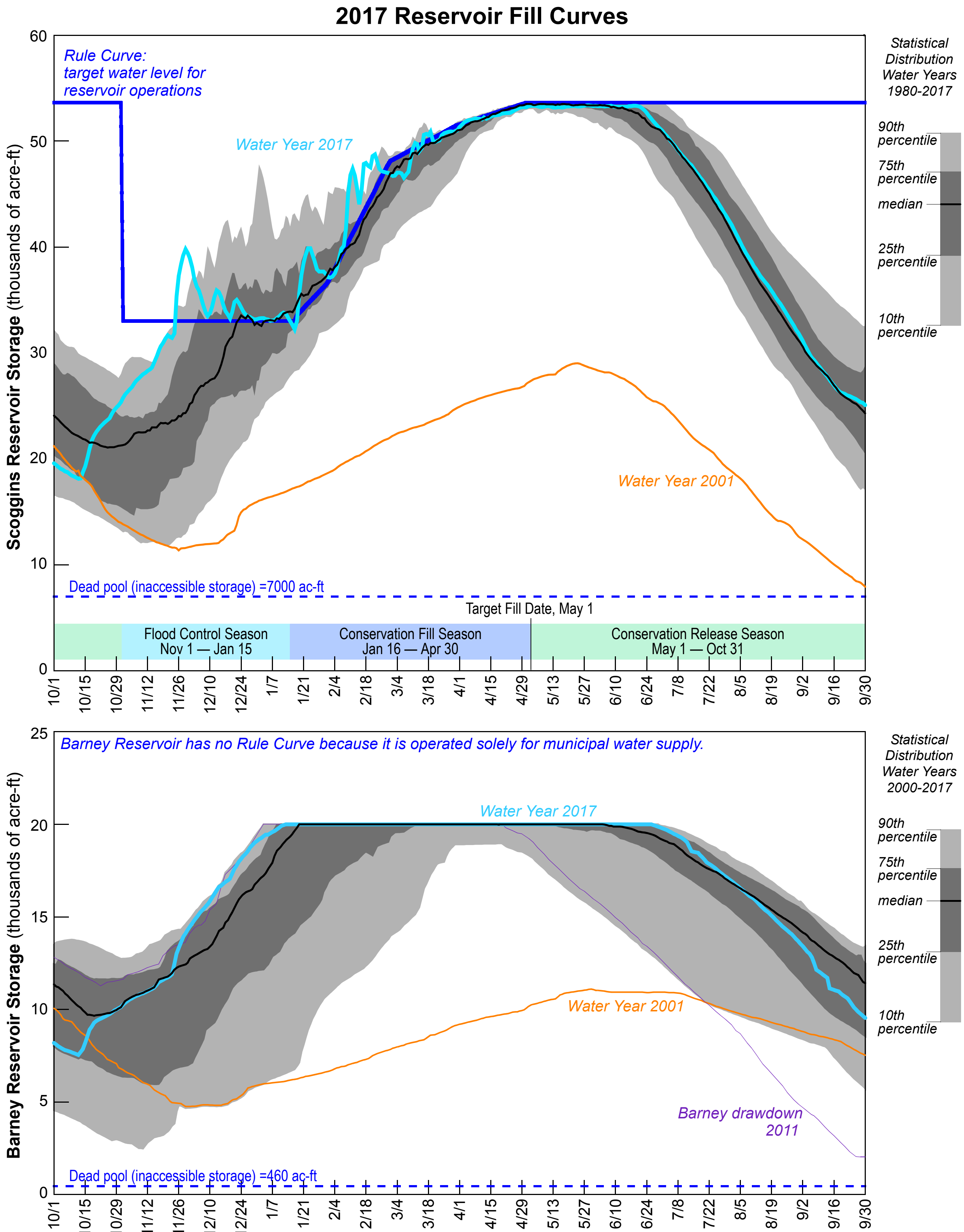
Highlights

- Both Scoggins and Barney Reservoirs filled. The fill curves are on the following page.
- Weather highlights:
  - Spring was very wet with February, March and April all having rainfall in the 75th percentile or above.
  - Summer was dry and warm. All precipitation stations except Sain Creek had only one day with measurable rain from mid-June through the end of August. Thirteen days in August had temperatures exceeding 90°F; temperatures exceeded 100°F on two of those days.
- Regulation of river water began on June 21st which is later than average but not rare. It ended on October 23rd which is very near the long-term average date.
- The wet spring led to high water levels at Wapato Lake and US Fish and Wildlife Service was granted an extension of the deadline for discharging lake water into the Tualatin River. The lake was mostly drained by May 13th when the primary pump stopped operating.
- Clean Water Services began trial use of the Forest Grove Natural Treatment System (NTS) at the Forest Grove Wastewater Treatment Facility. The NTS operated from June through July of 2017.
- Trend analysis of historic data has been added to Appendices A, B and F. Appendices H, I and J that report on nutrient and metals concentrations in Tualatin Basin streams have been added.



Reservoir Status

Barney Reservoir filled on January 17, 2017. Scoggins Reservoir filled on May 3, 2017 and peaked on May 29th at 53,356 ac-ft. The reservoir levels for 2017 and the reservoir filling histories are shown below.



BACKGROUND

Basin Description

The Tualatin River Basin comprises an area of 712 square miles situated in the northwest corner of Oregon and is a subbasin of the Willamette River. The headwaters are in the Coast Range and flow in a generally easterly direction to the confluence with the Willamette River. The basin lies almost entirely in Washington County. (See map below)

The Tualatin River is about 80 miles long and changes dramatically from its headwaters to its mouth. The mountain or headwater reach (upstream of RM 55) is narrow (about 15 ft) and steep with an average slope of about 74 ft/mi. The meander reach (RM 55–33) is wider with an average slope of about 1.3 ft/mi. The reservoir reach (RM 33–3.4) is very wide (up to 150 ft) and has an estimated slope of only 0.08 ft/mi. It includes several deep pools. Travel times through this reach are very long. The slow movement of the water causes this reach to act much like a lake. In the riffle reach (RM 3.4–0), the Tualatin River flows through a short reservoir section and then drops into a narrow gorge near the City of West Linn before it enters the Willamette River just upstream of Willamette Falls. The average slope in this reach is 10 ft/mi.

Water sources to the Tualatin River

Precipitation: Seasonal rainfall accounts for most of the natural flow in the Tualatin Basin; streamflow from snowmelt is minimal. The amount of rainfall ranges from 110 inches on the eastern slopes of the Coast Range to 37 inches in the southeastern area of the drainage basin. Peak months for rainfall are November through February while the driest months are normally June through October. The peak streamflow month is usually February and the lowest streamflow month is August.

Barney Reservoir: Barney Reservoir is located behind Eldon Mills Dam on the Middle Fork of the North Fork of the Trask River (outside of the Tualatin Basin). A trans-basin aqueduct carries water over a low Coast Range divide to a pipeline that discharges into the Tualatin River at RM 78. Barney Reservoir has a capacity of 20,000 acre-feet and stores water for the Joint Water Commission (Cities of Hillsboro, Forest Grove and Beaverton, and the Tualatin Valley Water District) and Clean Water Services. The Barney Reservoir Joint Ownership Commission owns, operates and manages Barney Reservoir. Reservoir content is monitored through calibrated reservoir elevations; water releases are monitored using a stream gage located in the outlet flume. Water is released during the summer low-flow season to supplement shortages in natural flow. The water is used for municipal supply and for instream water quality. Storage in Barney Reservoir is also allocated to the Oregon Department of Fish and Wildlife. Those flows, to the Trask River, are measured using an instream weir.

Scoggins Reservoir: In the early 1970s the Bureau of Reclamation built an earthen dam on Scoggins Creek (RM 5.1). Releases from Scoggins Reservoir (Henry Hagg Lake) flow down Scoggins Creek and enter the Tualatin River at RM 60.0. Scoggins Reservoir has an active storage capacity of 53,323 acre-feet. It is a multipurpose facility with contracted water for irrigation, municipal and industrial, and water quality uses.

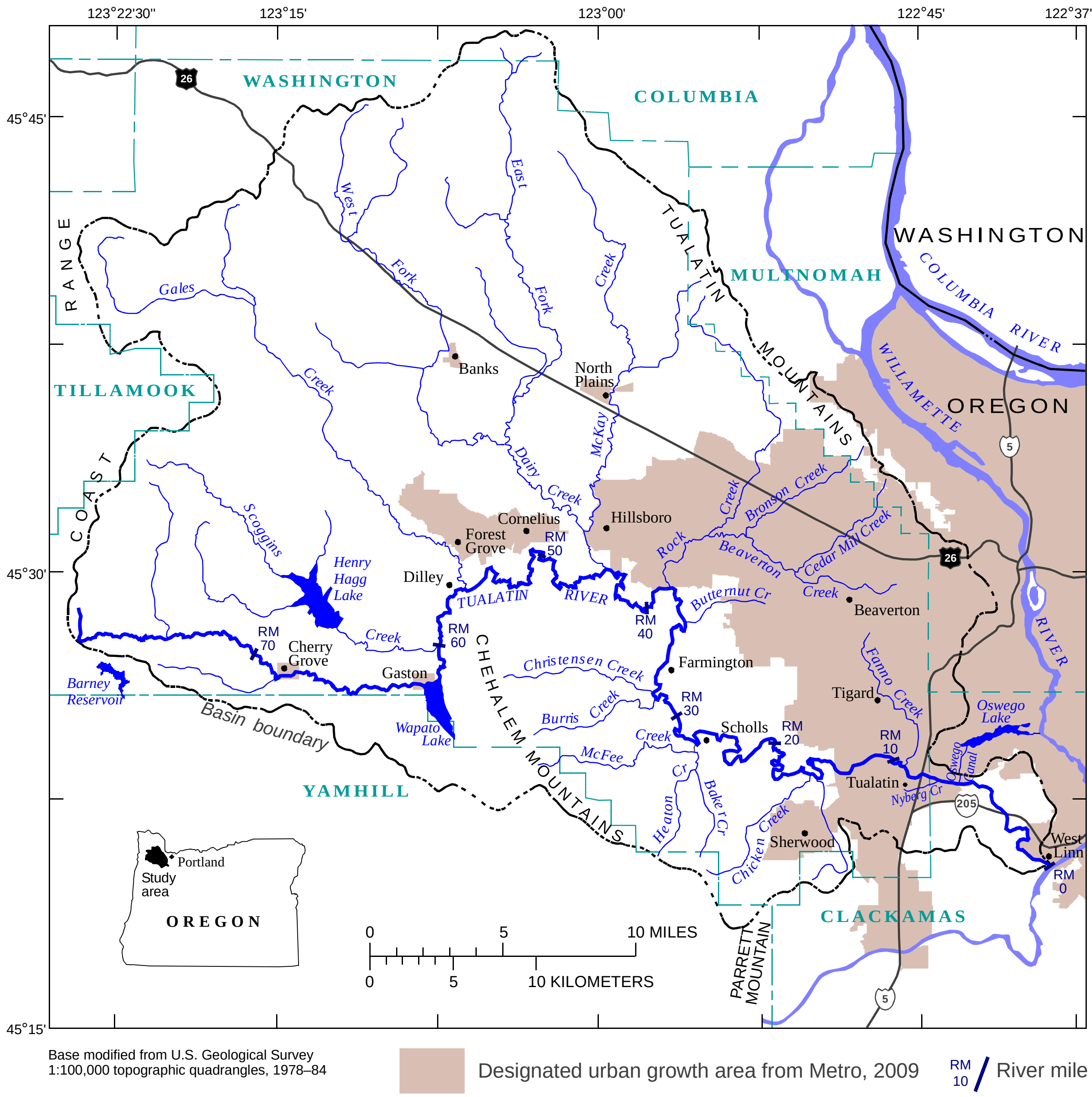
Scoggins Reservoir is operated and maintained by the Tualatin Valley Irrigation District under contract with the Bureau of Reclamation. Flow into Scoggins Creek (RM 4.8) is monitored by a Bureau of Reclamation stream gage; Oregon Water Resources Department maintains the rating curve for this site.

Clean Water Services: Clean Water Services provides wastewater treatment, stormwater management, and watershed management services primarily in urban areas of Washington County. A watershed-based NPDES permit allows Clean Water Services to discharge treated wastewater into the Tualatin River from four wastewater treatment facilities (WWTFs). The Rock Creek and Durham WWTFs (RM 38.1 and 9.3, are the largest. The Forest Grove and Hillsboro WWTFs (RM 55.2 and 43.8, respectively) are much smaller and prior to 2017 did not discharge during the dry season (generally May–October). In 2017, Clean Water Services began directing treated water from the Forest Grove and Hillsboro WWTFs through a 95-acre natural treatment system (NTS) at Forest Grove prior to discharge into the Tualatin River. WWTF flow rates are continuously monitored at each WWTF. Clean Water Services also releases storage water from Scoggins and Barney Reservoirs for flow augmentation during the summer and early fall. (River mile locations given here are based on USGS topographic maps and may be slightly different from those used in Clean Water Services watershed-based NPDES permit which are from a different source.)

Water sources to the tributaries

Clean Water Services: Clean Water Services has been using Tualatin Valley Irrigation District transmission lines to deliver water to several tributaries for flow restoration in the summer. Approximately 1 to 2.5 cfs of water has been added to McKay Creek every year since 2005. Similar measures have been implemented for Gales Creek (2009), East Fork Dairy Creek (2010), and West Fork Dairy Creek (2011). The goal of the program is to improve water quality, specifically increasing the dissolved oxygen concentration and decreasing stream temperature. The flow augmentation water for the tributaries is from Clean Water Services' allocation in Scoggins Reservoir.

Tualatin River Basin



Water diversions from the Tualatin River

Cherry Grove Intake (RM 73.2): The City of Hillsboro diverts water for municipal and industrial uses at the Cherry Grove Intake. This water is delivered to the rural residents of the Dilley and Cherry Grove areas (served by the City of Hillsboro), as well as the City of Gaston and the LA Water Cooperative (as Hillsboro wholesale customers). The diversion is less than 3 cfs and is monitored via metered flows.

Spring Hill Pumping Plant (RM 56.3): The Spring Hill Pumping Plant is the largest diversion facility on the river. It is owned by the Bureau of Reclamation (BOR) and operated jointly by the Tualatin Valley Irrigation District (TVID) and the Joint Water Commission (JWC). TVID, with a pumping capacity of approximately 90 MGD (140 cfs), delivers water to about 12,000 acres of irrigated cropland via a pressure pipeline. JWC, with a pumping capacity of approximately 86 MGD (160 cfs), delivers water to the Cities of Hillsboro, Forest Grove and Beaverton, to the Tualatin Valley Water District, and to the wholesale customers of these entities. Both TVID and JWC have natural flow water rights that are used when natural flow is adequate; they release contracted stored water from Scoggins and Barney Reservoirs to augment low natural flow in the summer. Pumping rates are monitored by TVID and JWC using telemetry-equipped flow meters. Additional monitoring is provided by real-time stream gages on the Tualatin River located above and below the pumping plant and on Gales Creek.

Wapato Canal Diversion: The US Fish and Wildlife Service (USFWS) now owns most of the land within the levees surrounding the Wapato Lake area. The duties of the now defunct Wapato Improvement District have been split between USFWS (to maintain the dike and levee system), and TVID (to operate and maintain the irrigation water delivery system).

TVID diverts water from the Tualatin River at the Wapato Canal Diversion, near RM 62 as needed for irrigation of the historic lake bed and surrounding TVID customers. Water levels in Wapato Canal, which discharges from the lake bed into Wapato Creek, have been monitored by the USGS since September 2011.

Irrigation Withdrawals: Water is obtained directly from the Tualatin River for irrigation purposes by members of the TVID and by irrigators with natural flow water rights. About 5,000 acres of cropland served by TVID is irrigated with water obtained directly from the Tualatin River. Some of the discharge from the Rock Creek WWTF (RM 38.1) is contracted to TVID to be used by downstream irrigators.

Patton Valley Pump Plant: Tualatin Valley Irrigation District pumps water from Scoggins Creek (RM 1.71) into a low-pressure pipeline that serves customers along Patton Valley Road. Historically, this pipeline also diverted water into the upper Tualatin River (at RM 63.1 and RM 64.3) to supplement low flows in this reach, but this has not been needed in recent years due to releases from Barney Reservoir.

Oswego Lake Canal Diversion: The Lake Oswego Corporation (LOC) diverts a portion of the Tualatin flow into the Oswego Lake Canal at RM 6.7. A headwork structure regulates the flow into this mile long canal that feeds into Oswego Lake. The Lake Oswego Corporation has several natural flow water rights, including water rights for hydropower generation, irrigation, and lake level maintenance. At RM 3.4, a combination diversion dam/fish ladder structure is used during low flow periods to elevate the Tualatin River enough to divert the flow into the canal. During most of the year, river elevation is adequate to allow diversion of the LOC water right. Historically, flash boards were installed to increase the water level during the summer, but they have not been used since 2003. The dam plus several natural basalt sills cause the water to pool in the reservoir reach. Flow in Lake Oswego Canal was monitored during the summer by a gaging station operated by the Oregon Water Resources Department, but that site was discontinued partway through 2011.

Water diversions from the tributaries

Irrigation withdrawals: Water is obtained directly from some tributaries for irrigation by irrigators with natural flow water rights.

Tualatin River Water Management

Tualatin River Flow Management Technical Committee

The Tualatin River Flow Management Technical Committee provides a mechanism for the coordination and management of flow in the Tualatin River. The members of the committee are technical staff with detailed knowledge of the specific characteristics of flow in this river. The committee meets monthly from April through November. Meetings focus on the current status of the reservoirs. In addition, a variety of other water issues and any problems are discussed. Each member updates the committee on changes that could impact the flow management of the Tualatin. The communication, coordination and cooperation among the partner agencies has proven invaluable in managing the resource.

Data collection system

Water in the Tualatin Basin is monitored by gages on streams and flow meters on major diversions and wastewater treatment facility discharges. Stream gages are present along the mainstem Tualatin and all major tributaries that affect water distribution. Various water quality parameters are monitored at a several sites. Many of these monitors have telemetry, making the data available in real-time. Throughout the season, daily operations can be monitored by Clean Water Services (CWS), Joint Water Commission (JWC), Tualatin Valley Irrigation District (TVID), and the Lake Oswego Corporation (LOC). A map showing monitoring locations is shown on the next page. Selected data are shown in the appendices of this report.

A coordinated information system was developed to provide flow information to all members of the committee. Flow conditions and a summary of daily releases are reported via daily email by the superintendent of Scoggins Dam. The JWC provides a daily email containing information about the rate of intake at the Spring Hill Pump Plant, releases from Scoggins and Barney Reservoirs, and available natural flow. Because use or release of water by any one of the entities can impact the other users, coordination of flow information is an important aspect of the committee's work.

The monitoring effort makes it possible to proactively manage storage, instream flows, and diversions so that minimum instream flow requirements and general compliance with water rights and storage agreements are met. Flow data are also required to calculate pollutant loads, which are necessary for the Total Maximum Daily Load (TMDL) program. Monitoring includes temperature as well as flow at some sites. As water quality issues have come to the forefront, the monitoring system has provided information vital to understanding the Tualatin Basin, helped guide basin management, and been an excellent example of interagency cooperation. The members of the Flow Management Committee appreciate the efforts all those who provide data.

Some of the monitoring data for the Tualatin Basin can be accessed at the following web sites:

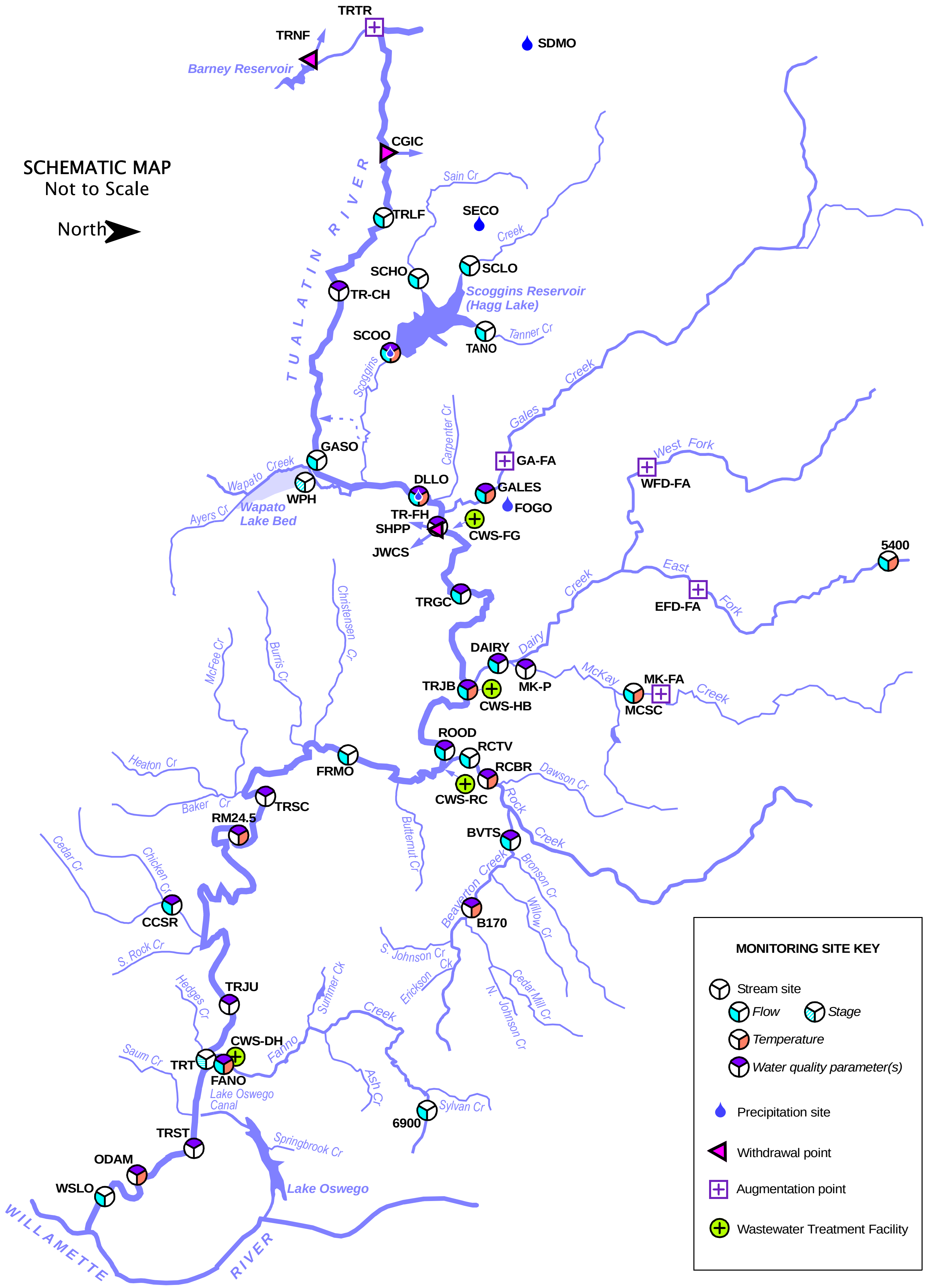
- Bureau of Reclamation data:
  https://www.usbr.gov/pn/hydromet/tuatea.html
- Jackson Bottom Wetlands Center data:
  https://or.water.usgs.gov/cgi-bin/grapher/graph_setup.pl?basin_id=tualatin&site_id=14206241
- Oregon Water Resources Department data:
  http://apps.wrd.state.or.us/apps/sw/hydro_near_real_time/
- USGS data:
  https://or.water.usgs.gov/tualatin/monitors/

Annual Tualatin Basin Flow Management Report

This report is published annually and describes water management, accounting, storage, stream gaging, diversions, and effluent discharge for the Tualatin Basin. Annual reports dating from 1992 are available at:

http://www.co.washington.or.us/Watermaster/SurfaceWater/tualatin-river-flow-technical-committee-annual-report.cfm

2017 MAP OF TUALATIN BASIN MONITORING SITES



2017 MONITORING SITES — ALPHABETICAL LISTING BY SITE CODE

CODE	SITE NAME	FL	T	P	WQ	WQ PARAMETERS	FLOW REPORT
Ambient monitoring sites							
5400	East Fork Dairy Creek near Meacham Corner, OR	●	●				App-A, F
6900	Fanno Creek at 56th Avenue	●					App-A
B170	Beaverton Creek at 170th Ave, Beaverton, OR		●		●	**DO**, pH, **cond**, **turb**,	App-F, main
BVTS	Beaverton Creek at Cornelius Pass Road	●			●	**totP**, **NO3-N**, **Cu**, **Zn**	App-A, H–J
CCSR	Chicken Creek at Roy Rogers Rd near Sherwood, OR	●			●	**totP**, **NO3-N**, **Cu**, **Zn**	App-A, H–J
DAIRY	Dairy Creek at Hwy 8 near Hillsboro, Oregon	●			●	**totP**, **NO3-N**, **Cu**, **Zn**	App-A, H–J
DLLO	Tualatin River at Dilley, Oregon	●	●	●	●	pH, cond, turb, chlor-*a*, phyc, fDOM	App-A, F, G
FANO	Fanno Creek at Durham Road near Tigard, Oregon	●	●		●	**DO**, pH, cond, **turb**, **totP**, **NO3-N**, **Cu**, **Zn**	App-A, F, H–J main
FOGO	Forest Grove, Oregon AgriMet Weather Station (Verboort)			●			App-G
FRMO	Tualatin River at Farmington, Oregon	●					App-A
GALES	Gales Creek at Old Hwy 47 near Forest Grove, Oregon	●	●		●	**DO**, pH, cond, turb, fDOM, **totP**, **NO3-N**, **Cu**, **Zn**	App-A, F, H–J, main
GASO	Tualatin River at Gaston, Oregon	●					App-A
MK-P	McKay Creek at Padgett Rd				●	**totP**, **NO3-N**, **Cu**, **Zn**	App-H–J
MCSC	McKay Creek at Scotch Church Rd above Waible Ck near North Plains, OR	●	●				App-A, F
ODAM	Tualatin River at Oswego Dam near West Linn, Oregon		●		●	**DO**, pH, cond, turb, **chlor-*a***, phyc, bar press, air T	App-F, main
RCBR	Rock Creek at Brookwood Avenue, Hillsboro, Oregon		●		●	**DO**, pH, cond, **turb**	App-F, main
RCTV	Rock Creek at Hwy 8 near Hillsboro, Oregon	●			●	**totP**, **NO3-N**, **Cu**, **Zn**	App-A, H–J
RM24.5	Tualatin River at RM 24.5 near Scholls, Oregon		●		●	**DO**, pH, cond, **turb**	App-F, main
ROOD	Tualatin River at Rood Bridge Road near Hillsboro, Oregon	●			●	**totP**, **NO3-N**, **Cu**, **Zn**	App-A, H–J
SCHO	Sain Creek above Henry Hagg Lake near Gaston, Oregon	●					App-A
SCLO	Scoggins Creek above Henry Hagg Lake near Gaston, Oregon	●					App-A
SCOO	Scoggins Creek below Henry Hagg Lake near Gaston, Oregon	●	●	●	●	**DO**, pH, cond, turb, **totP**, **NO3-N**, **Cu**, **Zn**	App-A, F–J, main
SDMO	Saddle Mountain Precipitation Station (SNOTEL #726)			●			App-G
SECO	Sain Creek Precipitation Station (SNOTEL #743)			●			App-G
TANO	Tanner Creek above Henry Hagg Lake near Gaston, Oregon	●					App-A
TRCH	Tualatin River at Cherry Grove (South Rd Bridge)				●	**totP**, **NO3-N**	App-H, I
TRFH	Tualatin River at Fern Hill Rd				●	**totP**, **NO3-N**, **Cu**, **Zn**	App-H–J
TRGC	Tualatin River at Golf Course Road near Cornelius, Oregon	●			●	**totP**, **NO3-N**, **Cu**, **Zn**	App-A, H–J
TRJB	Tualatin River at Hwy 219 Bridge	●	●		●	DO, pH, cond, turb, **totP**, **NO3-N**, **Cu**, **Zn**	App-A, F, H–J
TRJU	Tualatin River at Jurgens Park				●	**totP**, **NO3-N**, **Cu**, **Zn**	App-H–J
TRLF	Tualatin River below Lee Falls near Cherry Grove, Oregon	●					App-A
TRSC	Tualatin River at Hwy 210 (Scholls Bridge)				●	**totP**, **NO3-N**, **Cu**, **Zn**	App-H–J
TRST	Tualatin River at Stafford				●	**totP**, **NO3-N**,	App-H, I
TRT	Tualatin River at Tualatin, Oregon	Stg					App-A
WPH	Wapato Canal at Pumphouse at Gaston, Oregon	Stg					App-A
WSLO	Tualatin River at West Linn	●					App-A
Monitored withdrawals and releases							
CGIC	City of Hillsboro Withdrawal at Cherry Grove	●					App-B
CWS-DH	CWS Durham WWTF Release	●					App-B
CWS-FG	CWS Forest Grove WWTF Release	●					App-B
CWS-HB	CWS Hillsboro WWTF Release	●					App-B
CWS-RC	CWS Rock Creek WWTF Release	●					App-B
EFD-FA	CWS East Fork Dairy Flow Augmentation with TVID	●					App-B
GA-FA	CWS Gales Creek Flow Augmentation with TVID	●					App-B
JWCS	Joint Water Commission Withdrawal at Spring Hill Pump Plant	●					App-B
MK-FA	CWS McKay Creek Flow Augmentation with TVID	●					App-B
SHPP	TVID–Withdrawal at Spring Hill Pump Plant	●					App-B
TRNF	Barney Reservoir Measured Flow to North Fork Trask River	●					App-B
TRTR	Barney Reservoir Release to Tualatin River	●					App-B
WFD-FA	CWS West Fork Dairy Flow Augmentation with TVID	●					App-B

Abbreviations: FL=flow, T=water temperature, P=precipitation, WQ=water quality, App=Appendix, Stg=stage

Water quality abbreviations (underlined & bold indicates data shown in Flow Report): DO=dissolved oxygen, cond=conductance, turb=turbidity, chlor-*a*=chlorophyll-*a*, phyc=phycocyanin, fDOM=fluorescent dissolved organic matter; totP=total phosphorus, NO3-N=nitrate+nitrite, Cu=copper, Zn=zinc

CLEAN WATER SERVICES
BY RAJ KAPUR AND JAMIE HUGHES, CLEAN WATER SERVICES

Introduction
Clean Water Services (the District) provides wastewater treatment, stormwater management, and watershed management to more than 570,000 customers primarily in the urban areas of Washington County. The District has twelve member cities.

Wastewater treatment: The District owns and operates four wastewater treatment facilities (WWTFs) at sites in Forest Grove, Hillsboro, and Tigard. The Rock Creek and Durham WWTFs discharge directly to the Tualatin River year-round and are considerably larger than the Forest Grove and Hillsboro WWTFs. The Forest Grove and Hillsboro WWTFs generally have not discharged directly into the Tualatin River during the dry season (typically May–October). Rather, wastewater is conveyed to the Rock Creek WWTF for treatment and discharge. In 2017, the District began operating a 95-acre natural treatment system (NTS) at Forest Grove. During the dry season, treated water from the Forest Grove and Hillsboro WWTFs may be directed through the NTS prior to discharge into the Tualatin River.


Rock Creek Wastewater Treatment Facility


Durham Wastewater Treatment Facility

Stormwater management: Clean Water Services also implements the municipal separate storm sewer system (MS4) program in the urban parts of the Tualatin River watershed.

Watershed management: Activities occur across the entire Tualatin watershed and include streamflow enhancement in the mainstem Tualatin River and tributaries, and riparian and stream restoration.

Permits: The four WWTFs and the MS4 program are permitted by the Oregon Department of Environmental Quality (DEQ) under a watershed-based National Pollutant Discharge Elimination System (NPDES) permit.

Flow augmentation program

During the summer low-flow season, Clean Water Services releases stored water to the Tualatin River and several tributaries. The District has rights to 24% of the water in Scoggins Reservoir, which equates to 12,618 ac-ft. The District also owns 10% of the water in Barney Reservoir, which equates to 1,654 ac-ft after accounting for dead pool and required Oregon Department of Fish and Wildlife (ODFW) releases to the Trask River. In all, the District has 14,272 ac-ft of stored water available for use. The stored water releases serve multiple purposes including the following:

Maintain minimum stream flows: One of the purposes of the stored water releases is to maintain stream flows in the Tualatin River to ensure that the minimum dilutions are met at the WWTFs during summer and fall low flow conditions.

Offset thermal load from the District's WWTFs: The watershed-based permit provides Clean Water Services with a mechanism to offset a portion of the thermal load discharged from the Rock Creek and Durham WWTFs and the Forest Grove WWTF and NTS by releasing stored water from Scoggins and Barney Reservoirs. Stored water releases in July and August form the basis of the flow augmentation credit. The District offsets the remainder of its thermal load by planting riparian areas in the Tualatin River basin to increase shading of the stream channel.

Provide sustainable base flows in the upper Tualatin River: During the dry season, Clean Water Services' releases from Hagg Lake and Barney Reservoir can account for more than half of the flow in the Tualatin River in the 20-mile stretch between the Spring Hill Pump Plant (where water is withdrawn for municipal and irrigation uses) and the Rock Creek WWTF (where highly treated water discharged from the Rock Creek WWTF enters the river). The stored water releases provide sustainable base flows that provide habitat for aquatic life and result in cooler river temperatures and higher dissolved oxygen levels.

Improve dissolved oxygen levels and enhance overall water quality in the lower Tualatin River: During the low flow season (summer and early fall) oxygen levels in the lower Tualatin River are heavily influenced by the oxygen consumed by decaying substances in river sediment (sediment oxygen demand). When days are long and sunny, photosynthetic production of oxygen by algae tends to offset the oxygen consumed by sediment oxygen demand. However, when days grow short (September-October), or when it is cloudy, photosynthetic production of oxygen does not keep up with consumption of oxygen by sediment oxygen demand causing oxygen levels to decrease. Clean Water Services' stored water releases from Scoggins and Barney Reservoirs lessens the effect of sediment oxygen demand and helps preserve dissolved oxygen levels in the lower Tualatin River during the late summer/early fall period when photosynthetic oxygen production wanes.

Maintaining adequate dissolved oxygen is important for aquatic life and the general health of the river. In addition, dissolved oxygen levels measured downstream of the WWTFs are used to calculate the ammonia limits specified in the watershed-based NPDES permit.

Restore stream flows in Tualatin River tributaries: Clean Water Services uses Tualatin Valley Irrigation District transmission lines to deliver stored water to select tributaries to restore flow and improve water quality. In 2017, Clean Water Services released stored water into Gales Creek, West Fork Dairy Creek, East Fork Dairy Creek, and McKay Creek. Details are in Appendix B.

Wastewater discharges

A watershed-based NPDES permit allows Clean Water Services to discharge treated wastewater into the Tualatin River from its WWTFs. A summary of the discharges is shown below. Details are in Appendix B.

WASTEWATER TREATMENT FACILITY DISCHARGES 2017

Rock Creek WWTF annual average	**Durham WWTF** annual average	**Forest Grove WWTF** wet season average*	**Hillsboro WWTF** wet season average*	**Forest Grove NTS** dry season*
65 cfs [42 MGD]	39 cfs [25 MGD]	9.6 cfs [6.2 MGD]	9.9 cfs [6.4 MGD]	*May:* none *June–mid-July:* 1.2 cfs [1.8 MGD] *mid-July–Aug 1:* 2.5 cfs [3.8 MGD] *after August 1*: none

*Wet season is generally January–April plus November and December; dry season is generally May–October

2017 Water releases for flow augmentation

Clean Water Services released flow augmentation water for 126 days in 2017. The total average daily release (for days with releases) was 48.4 cfs. In all, 12,108 acre-feet were released. This is 85% of the District's allocation and slightly more than its water releases for 2016 (77%). The amount of water available to and released by Clean Water Services during 2017 is summarized below.

CLEAN WATER SERVICES WATER AVAILABILITY AND USE — 2017

Reservoir		**Maximum Available** (acre-ft)	**Available** (acre-ft)	**Total CWS Release** (acre-ft)
Scoggins Reservoir	Storage	12,618	12,618	10,585
	Natural flow credit	4,282	0	—
Barney Reservoir	Storage	2,000	1,654	1,524
	Summer storage*	—	0	—
Total		**18,900**	**14,272**	**12,108**
Percent of available				**84.8%**

*Summer storage is water from rain that is stored in Barney Reservoir after releases have begun for the season. Summer storage (when it occurs) is allocated among the members of the Barney Partnership.

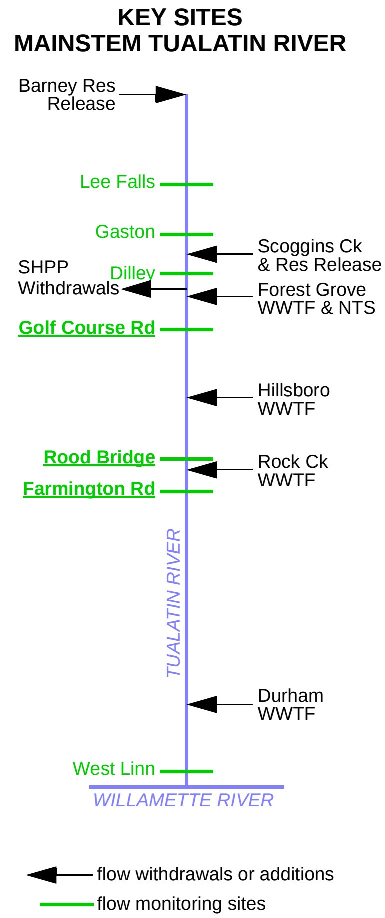
Details by month and reservoir: Stored water releases from Scoggins Reservoir for Clean Water Services began with 10 cfs on June 21. Releases increased over the course of the summer to a maximum of 65 cfs in late August and early September. Average daily releases were 46.3 cfs (July/August period) and 43.2 cfs (September). The last release day for Scoggins Reservoir was October 23. The District began releasing water from Barney Reservoir at a rate of 10 cfs on September 1. Releases from Barney Reservoir increased to 21 cfs for most of September and then decreased to 7 cfs on October 1 and remained constant. The last release day for Barney Reservoir was October 24. Details of releases by month are shown in the table below.

CLEAN WATER SERVICES WATER RELEASE SUMMARY — 2017

	Units	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov 1-18**	**Total**
Scoggins Release	acre-ft	0	337	2,301	3,393	2,569	1,984	0	10,585
	days	0	10	31	31	30	23	0	125
Barney Release	acre-ft	0	0	0	0	1,163	361	0	1,524
	days	0	0	0	0	30	24	0	54
Total Release	acre-ft	0	337	2,301	3,393	3,732	2,345	0	12,108
Daily Average Release (for days with releases)	cfs	0	17	37	55	63	49	0	48.4

Flow augmentation effects on Tualatin River flow— 2017

Clean Water Services monitors flow in the upper, middle and lower reaches of the river to inform the management of its stored water releases. The figure at the right illustrates the locations of several significant additions and withdrawals along with several key monitoring sites.



Flow targets in the Tualatin River have evolved as the understanding of the river has changed and new objectives were added. The District began managing stored water releases in 1987 with a goal of preventing the large nuisance algal blooms that were then common during the summer. In the early 1990s, work by the US Geological Survey showed that releasing water in the late fall could improve low oxygen conditions by lessening the expression of sediment oxygen demand and the District increased late season flow targets. Flow targets changed again in 2004 when stored water releases were allowed to offset some of the thermal loads from the WWTFs. New mixing zone studies have also affected flow targets as have effluent load limits which are calculated from river flows. The current flow targets are used at three key sites and are applied for the entire dry season (May–October).

FLOW TARGETS AND MEASURED FLOWS AT KEY SITES — 2017

	Golf Course Rd	Rood Bridge Rd	Farmington Rd
Flow target	60 cfs	110 cfs	160 cfs
Daily mean flow (May–October)			
minimum	63 cfs	111 cfs	154 cfs
average	178 cfs	409 cfs	493 cfs

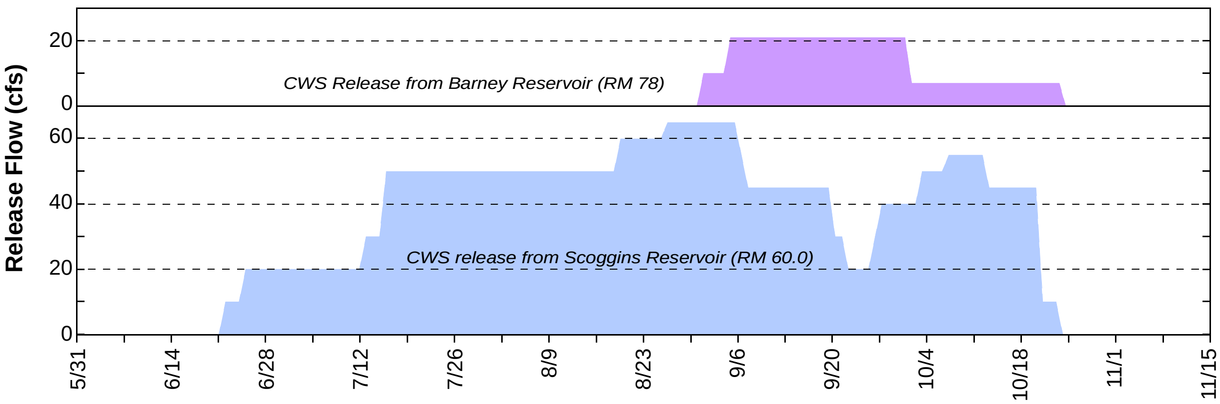
The graphs on pages 16, 18 and 19 illustrate the importance of the District's stored water releases plus the discharges from the Rock Creek and Durham treatment facilities at the key flow target sites. With its releases of stored water and discharge from the WWTFs, the District was able to maintain minimum stream flows, offset thermal loads from the WWTFs, provide sustainable base flows in the upper Tualatin River and key tributaries and improve overall water quality. Flow management will continue to be vital as the population in Washington County increases.

Upper Tualatin River — Golf Course Road site: The graph on page 16 shows flow at the Golf Course Rd site (RM 51.5). This site is an important monitoring site for the Flow Committee because it occurs downstream of the major withdrawals by JWC and TVID at the Spring Hill Pump Plant (SHPP, RM 56.3). Flow at this site includes natural flow from the Tualatin River headwaters and Gales Creek plus storage water from Barney Reservoir and Hagg Lake that was not withdrawn at SHPP. The Forest Grove WWTF and NTS (RM 55.2) are upstream of the Golf Course Rd site; the NTS began discharging in June and July of 2017 and will continue to do so in the future. As a result, the District tries to maintain a minimum stream flow target of 60 cfs at this site. The site is unaffected by discharges from Clean Water Services' two large WWTFs (they are downstream).

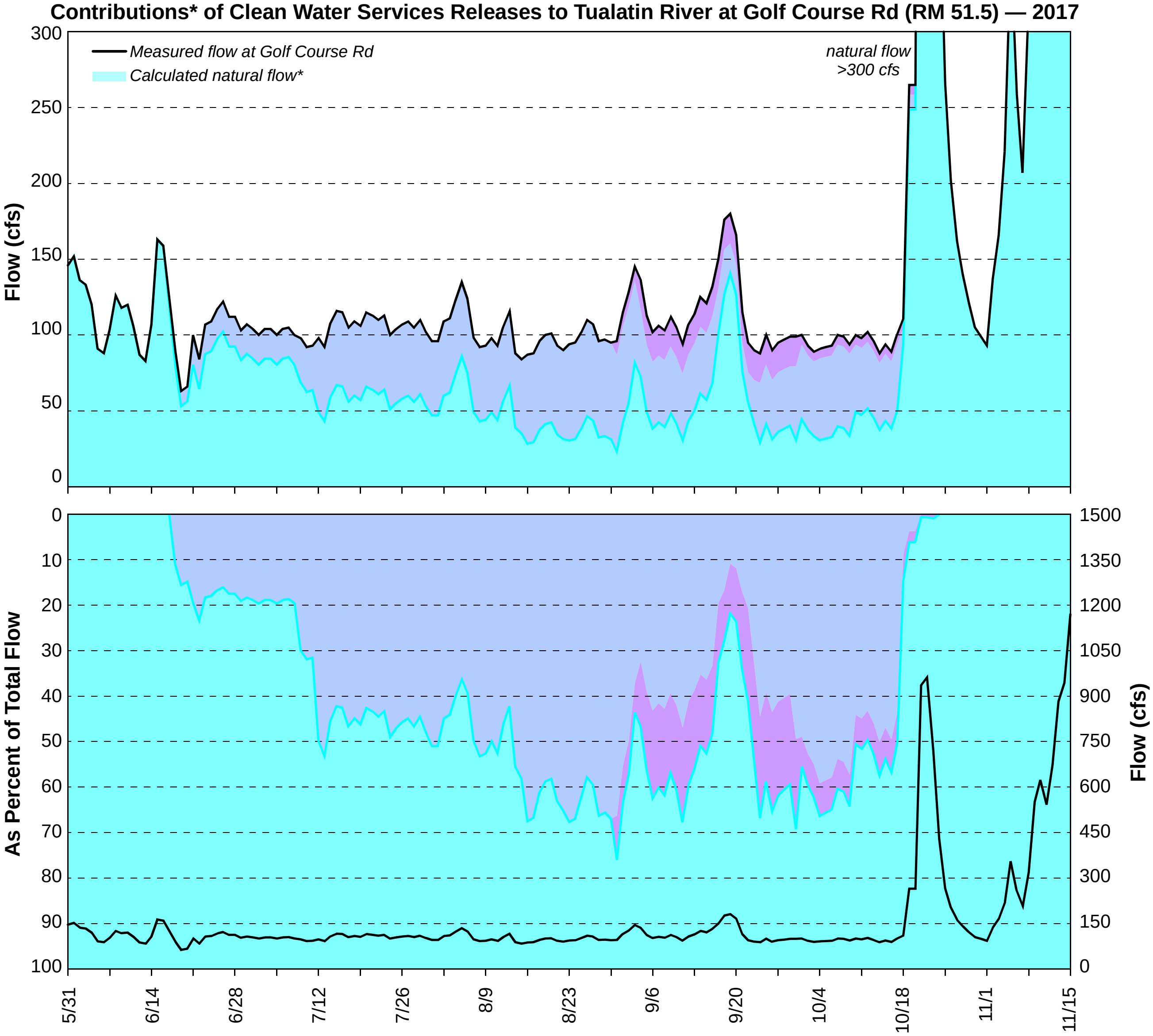
During the dry periods between June and October, the District's stored water releases accounted for about 50% of the total flow in the upper Tualatin River. Without these releases, flow in the upper Tualatin would have dropped below 50 cfs, making the river considerably slower and warmer.

Note that flow at this site shows a wavy pattern with high flows and low flows repeating approximately every week. This pattern is due to decreased withdrawals by TVID from the SHPP that occur on Sundays, when the demand for irrigation water is generally lower than other days. Releases from Hagg Lake and Barney Reservoir are mostly influenced by weather conditions and do not exhibit a weekly cycle.

Clean Water Services Releases to Tualatin River upstream of Golf Course Rd (RM 51.5) — 2017



Contributions* of Clean Water Services Releases to Tualatin River at Golf Course Rd (RM 51.5) — 2017



*Natural flow and contributions of CWS releases were calculated as follows. Constant travel times and a uniform evaporative loss of 0.25% per mile were assumed.

Natural Flow at Golf Course Rd without CWS releases =

+ Measured flow at Golf Course Rd (OWRD data)
– Calculated Scoggins release contribution (= 0.979 x Scoggins Release for CWS from the same day)
– Calculated Barney release contribution (= 0.934 x Barney Release for CWS from the same day)

Flow additions from the Fern Hill NTS are not included.

Middle Tualatin River — Farmington Road site: The graph on page 18 shows flows at the Farmington Road site (RM 33.3). This site is just downstream of the Rock Creek WWTF (RM 38.08) and includes flows from Dairy and Rock Creeks and their tributaries. Flow at this site is a particularly important factor affecting water quality in the middle and lower parts of the river. Keeping Farmington flow from becoming very low (below 120 cfs) can mostly prevent the large scale algal blooms that were a recurring problem in the lower river in the 1990s.

Stream flow measurements at this site are also important because they are used to define ammonia limits at the treatment facilities. In addition, flow at this site is used to define when dry and wet season limits apply at the District's treatment facilities.

During the summer low flow period, the District's stored water releases plus the Rock Creek WWTF discharge accounted for 50-60% of the flow at the Farmington Road site. Without this additional water, flow in the Tualatin River at this site would average less than 100 cfs during the July-August period and drop to as low as 55-60 cfs on some days. Flows this low would almost certainly be associated with significant water quality problems down river, such as those that were common in the 1990s and before.

Note that the weekly cyclical signature of decreased irrigation withdrawals on Sundays is still clearly evident at this site.

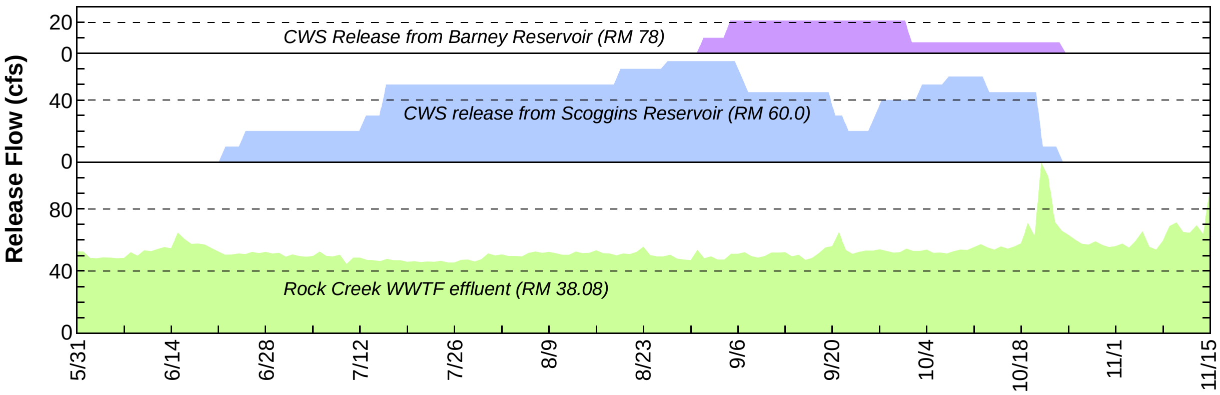
Lower Tualatin River — West Linn site: Flows at the West Linn site (RM 1.75) are shown on page 19. Between this site and the Farmington Road site, the river receives water from the Durham WWTF (RM 9.33) plus a number of small tributaries and the flow increases by 50-60 cfs during the low flow period. Slightly less than half of this increase is discharge from the Durham WWTF.

The District's stored water releases account for 15–20% of the flow during the low flow season. When stored water and discharges from the WWTFs are combined, Clean Water Services' releases account for 50-60% of the flow. Without this additional water, at times flows at the West Linn site would drop below 100 cfs during the summer. Flows this low would be associated with significant water quality problems such as:

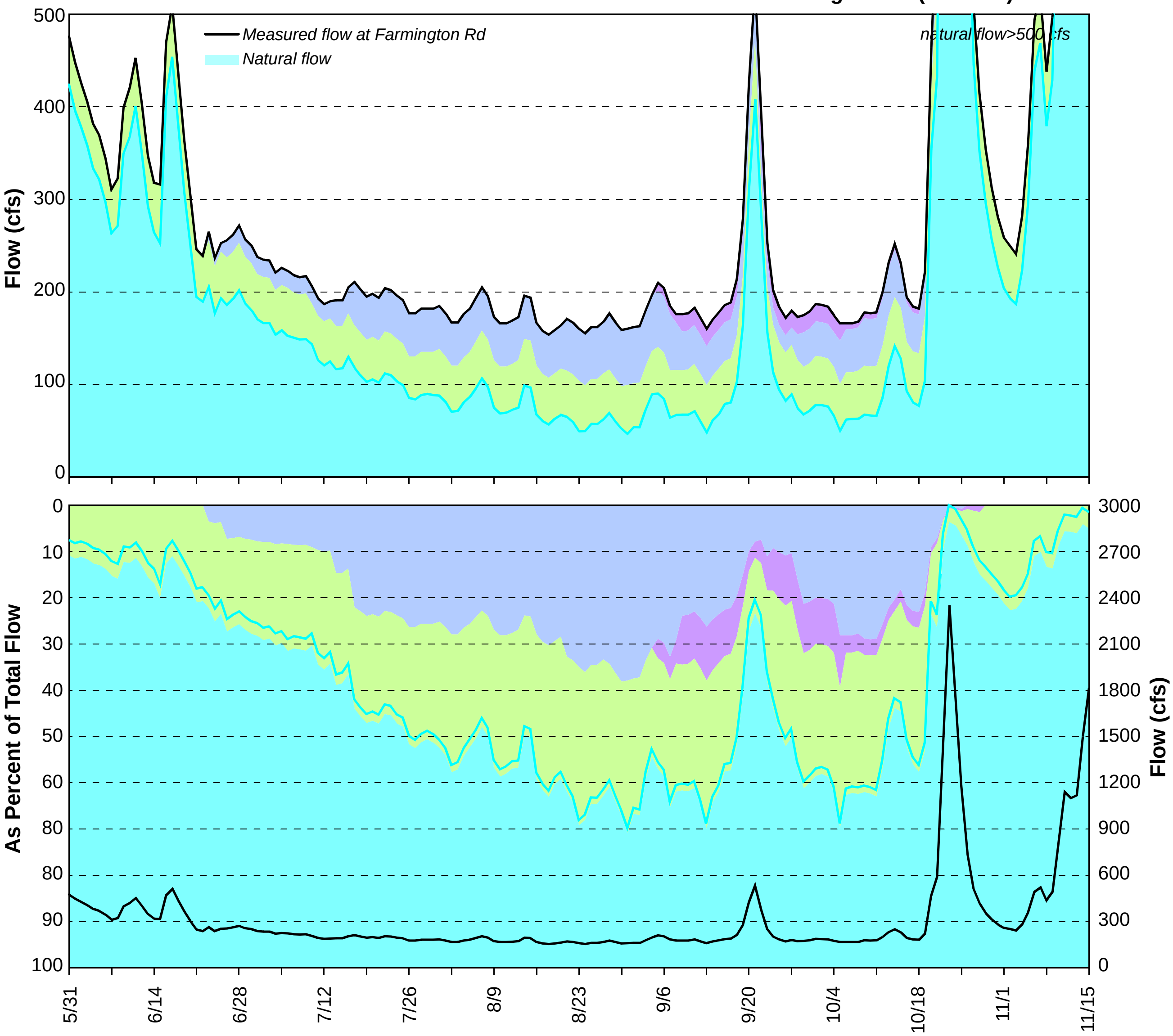
- high temperatures,
- severe algal blooms that would likely increase the pH to levels that exceed the criteria for aquatic health, and
- very low dissolved oxygen concentrations caused by an increased expression of sediment oxygen demand, especially during cloudy days when photosynthetic production of oxygen is decreased.

Note that the weekly cyclical signature of decreased irrigation withdrawals on Sundays is still clearly evident even this far down river from the SHPP.

Clean Water Services Releases to Tualatin River upstream of Farmington Rd (RM 33.3) — 2017



Contributions* of Clean Water Services Releases to Tualatin River at Farmington Rd (RM 33.3) — 2017



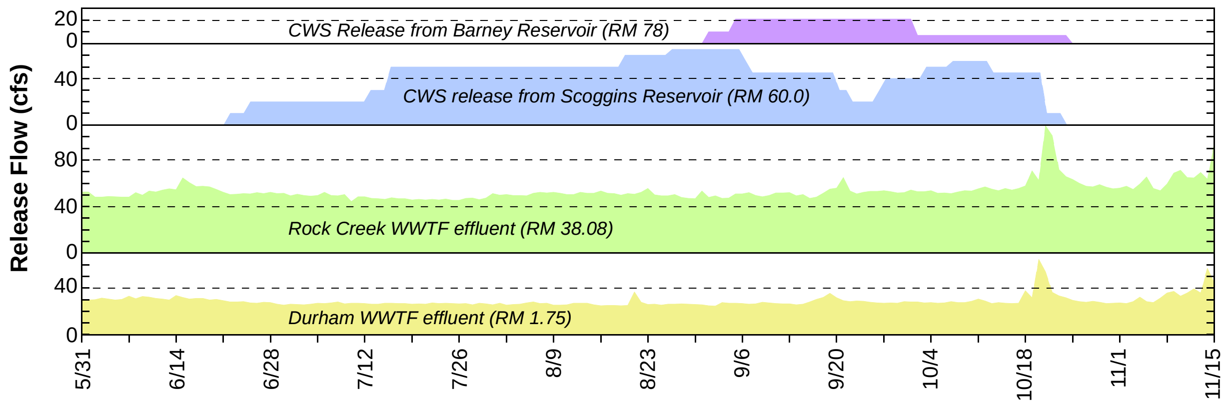
*Natural flow and contributions of CWS releases were calculated as follows. Constant travel times and a uniform evaporative loss of 0.25% per mile were assumed.

Natural flow at Farmington Rd without CWS releases =

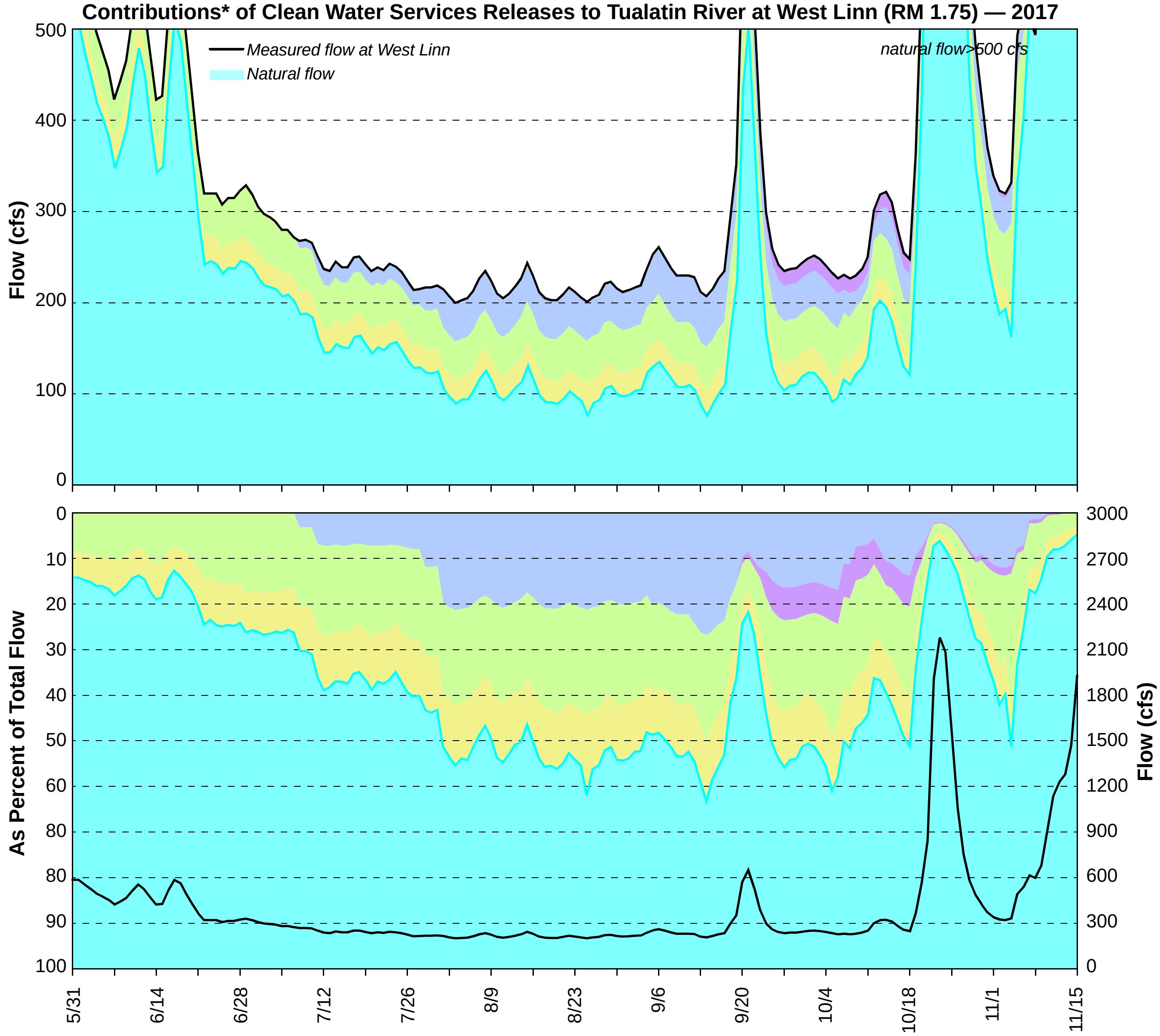
+ Measured flow at Farmington (OWRD data)
– Calculated RC-WWTF effluent contribution (= 0.988 x Rock Ck WWTF flow from the same day)
– Calculated Scoggins release contribution (=0.933 x Scoggins Release for CWS from 2 days before)
– Calculated Barney release contribution(= 0.888 x Barney Release for CWS from 4 days before)

Flow additions from the Fern Hill NTS are not included.

Clean Water Services Releases to Tualatin River upstream of West Linn (RM 1.75) — 2017



Contributions* of Clean Water Services Releases to Tualatin River at West Linn (RM 1.75) — 2017



*Natural flows and contributions of CWS releases were calculated as follows. (Constant travel times and a uniform evaporative loss of 0.25% per mile were assumed.)

Natural Flow at West Linn without CWS releases =

+ Measured flow at West Linn (USGS data)
– Calculated Durham WWTF effluent contribution (= 0.981 x Durham WWTF flow from 3 days before)
– Calculated Rock Creek WWTF effluent contribution (= 0.909 x Rock Ck WWTF flow from 14 days before)
– Calculated Scoggins release for CWS (= 0.854 x CWS Scoggins Release from 17 days before)
– Calculated Barney release for CWS (= 0.809 x CWS Barney Release from 19 days before)

Flow additions from the Fern Hill NTS are not included.

Historical record of stored water releases

Scoggins Reservoir: Water releases from Scoggins Reservoir usually began in June or July and continued until high natural flow resumed. During the low-flow period, release rates were adjusted as needed to meet the flow targets at that time. Clean Water Services' allocation is 12,618 ac-ft at full pool.

CLEAN WATER SERVICES — SCOGGINS RESERVOIR RELEASES

Year	Start Date	End Date	Total Release Days	Total Release (acre-ft)	Average per Release Day (cfs)	Comments
1987	6/9	11/30	175	*16,722	48.2	*Bureau of Reclamation allowed Clean Water Services to release its entire allocation (stored and natural flow).
1988	7/2	11/4	126	*15,071	60.3	
1989	6/27	11/15	141	*16,586	59.3	
1990	7/12	11/1	113	11,889	53.0	
1991	7/12	11/4	116	13,024	56.6	
1992	6/5	11/19	168	12,730	38.2	
1993	7/3	12/1	150	11,486	38.6	
1994	6/21	10/27	129	10,917	42.7	
1995	6/24	11/8	138	9,824	35.9	
1996	7/27	11/10	114	10,952	48.4	
1997	7/4	10/2	91	6,716	37.2	
1998	8/12	11/7	87	9,407	54.5	
1999	7/27	11/12	109	12,001	55.5	
2000	7/21	11/27	130	15,275	59.2	CWS purchased additional water because low flow conditions persisted until late November
2001	9/25	11/14	50	2,403	24.0	Allocations were severely decreased because Scoggins Reservoir did not fill in 2001
2002	6/12	11/9	151	12,618	42.0	
2003	7/11	11/17	130	11,765	52.4	
2004	7/1	11/2	125	8,650	34.9	
2005	7/8	10/31	116	9,918	43.1	
2006	7/1	11/3	126	9,634	38.5	
2007	7/3	11/13	119	10,134	42.9	
2008	7/1	11/4	127	11,896	47.2	
2009	7/1	10/27	119	10,614	45.0	
2010	7/24	10/25	94	8,392	45.0	
2011	7/23	11/18	119	10,464	44.3	
2012	7/7	10/22	106	10,950	52.1	
2013	7/2	11/4	103	6,884	33.7	
2014	7/1	10/22	114	9,037	40.0	
2015	6/9	11/5	150	12,307	41.4	CWS purchased an additional 600 ac-ft from TVID, but it was not released
2016	6/21	10/13	115	9,692	47.5	
2017	6/21	10/23	125	10,585	42.7	

Barney Reservoir: Water usually is released from Barney Reservoir during the late summer. Accounting for dead pool volume and the 15% allocation to the Oregon Department of Fish and Wildlife, Clean Water Services has 1,654 ac-ft available at full pool.

CLEAN WATER SERVICES — BARNEY RESERVOIR RELEASES

Year	Start Date	End Date	Total Release Days	Total Release (acre-ft)	Average per Release Day (cfs)	Comment
1998	7/12	8/27	47	2,779	24.6	extra water released to draw down reservoir
1999	9/1	10/19	49	1,025	10	10 cfs also released 6/4–6/10
2000	9/8	10/23	46	1,461	18	—
2001	9/18	10/29	42	1,416	17	1000 acre-ft purchased in addition to allocation; reservoir did not fill; 4,000 acre-ft held in reserve
2002	8/26	10/24	60	1,667	14.0	—
2003	8/15	10/14	61	1,742	14.0	—
2004	9/1	11/2	63	1,777	14.0	—
2005	9/1	11/8	69	1,874	14.0	miscommunication about end date; extra water released
2006	9/1	11/3	64	1,638	14.0	—
2007	9/1	10/30	60	1,667	14.0	—
2008	9/4	10/31	58	1,611	14.0	—
2009	9/1	10/30	60	1,667	14.0	—
2010	9/1	10/30	58	1,653	13.9	7 cfs on 9/1/2010 only, all other days 14 cfs
2011	7/1	8/30	61	1,089	9.0	Barney Reservoir was drawn down for maintenance which resulted in a reduced allocation
2012	8/31	10/29	60	1,667	14.0	—
2013	8/30	11/5	58	1,611	14.0	release suspended 9/30/2013 – 10/9/2013
2014	9/2	10/23	52	1,438	14.0	—
2015	8/14	10/28	76	1,569	10.4	14 cfs (8/14–8/22), 10 cfs (8/23–10/27), 5 cfs (10/28)
2016	8/31	10/14	45	1,250	14.0	
2017	9/1	10/24	54	1,524	14.2	

Natural flow credit

When Scoggins Dam was constructed, Clean Water Services was granted a natural flow credit of up to 4,282 acre-ft. The credit applies only in May, June, October and November, and only if the monthly mean daily natural flow in the Tualatin River measured at West Linn is less than the flow targets specified for each month. Natural flow is calculated as the monthly mean daily flow measured at West Linn minus Clean Water Services' mean daily release of stored water. Clean Water Services was not entitled to a natural flow credit in 2017 because the natural flow exceeded the target flow for months in question (see table below). Clean Water Services last received a natural flow credit in 1994.

BUREAU OF RECLAMATION NATURAL FLOW CREDIT 2017

Month	Mean Daily Measured Flow at West Linn (cfs)	Mean Daily CWS Release (cfs)	Calculated Natural Flow at West Linn (cfs)	Target Natural Flow at West Linn (cfs)	Maximum Possible CWS Natural Flow Credit (cfs)	*[acre-ft]*	CWS Natural Flow Credit (cfs)
May	1193	0	1193	85	13	*[798]*	0
June	439	17	422	140	21	*[1250]*	0
October	574	49	525	95	16	*[984]*	0
November	2035	0	2035	110	21	*[1250]*	0

JOINT WATER COMMISSION

BY KRISTEL GRIFFITH, WATER RESOURCES PROGRAM COORDINATOR,
JOINT WATER COMMISSION/CITY OF HILLSBORO

Introduction

Over 365,000 people in Washington County receive at least a portion of their drinking water from the Joint Water Commission (JWC). The JWC provides water to its member agencies: the Cities of Hillsboro (the managing and operating agency), Forest Grove, Beaverton, and the Tualatin Valley Water District. JWC also provides wholesale service directly to the City of North Plains, and to Cornelius, Gaston, and the LA Water Cooperative as wholesale customers of Hillsboro.

JWC's water treatment plant (WTP) is supplied with water from the nearby Tualatin River. An intake facility at Spring Hill constructed by the Bureau of Reclamation, and shared with the Tualatin Valley Irrigation District (TVID), pumps river water to the JWC WTP.

Flows in the Tualatin River are supplemented during the summer with water from two impoundments—Hagg Lake and Barney Reservoir. Hagg Lake is located on Scoggins Creek behind Scoggins Dam. Scoggins Dam is owned by the Bureau of Reclamation (BOR) and operated by TVID under contract to the BOR. Barney Reservoir is located on the upper Trask River behind the Eldon S. Mills Dam. The reservoir and dam are owned and operated by the Barney Reservoir Joint Ownership Commission (BRJOC). The BRJOC includes the cities of Hillsboro (the managing and operating agency), Forest Grove, and Beaverton, the Tualatin Valley Water District, and Clean Water Services.

The JWC WTP uses conventional dual media filtration plus disinfection to produce high quality potable water. Treated water is pumped from the plant to the member agencies either directly through finished water pipelines or via the Fern Hill Reservoirs. The Fern Hill Reservoirs are located about one-third mile to the east of the treatment plant and can store up to 40 million gallons of finished water (in two 20 million gallon covered concrete tanks). The JWC finished water pipelines include flow meters and pressure reducing stations at the connection points to the member agencies.

2017 Operations

Production and demands: In 2017 the JWC WTP produced an average of 32.2 million gallons per day (MGD) of finished water. A maximum day production of 62.0 MG occurred on September 2nd, which is slightly more than the 2016 maximum day production of 57.3 MG. A minimum day production of 16.0 MG occurred on November 23rd.

2017 Stored water releases: The amount of stored water released by JWC for 2017 is summarized in the tables below. In all, 50% of the total allocation was released (55% for Scoggins Reservoir and 64% for Barney Reservoir).

STORED WATER RELEASE FROM EACH RESERVOIR — 2017

Description	Beginning Balance (acre-ft)	Amount Released (acre-ft)	Ending Balance (acre-ft)	Average Release	
				(acre-ft/day)	cfs
Barney (M&I)	14,886	7,819	7,067	63	32
Scoggins	13,500	6,425	7,075	55	28
Total	**28,386**	**14,244**	**14,142**	**114**	57

Regulation of natural flow began on June 21, a little later than average, and continued until being lifted on October 23th. Note that stored water releases are adjusted the day after regulation; therefore, dates in the table on the next page lag regulation by one day.

COMPARISON OF STORED WATER RELEASES— 10-YEAR RECORD

Year	Regulated Use			Stored Water Release (acre-ft)			Average Release (acre-ft/day)
	First Day*	Last Day*	Days**	Barney	Scoggins	Total	
2017	6/22	10/24	125	7,819	6,425	14,244	114
2016	5/11	10/12	153	7,476	9,465	16,941	111
2015	5/8	10/29	173	11,730	9,904	21,633	124
2014	6/5	10/24	142	6,548	9,090	15,638	110
2013	5/4	10/1	141	6,387	7,490	13,877	98
2012	6/23	10/30	129	6,557	7,016	13,573	105
2011	6/28	11/7	132	8,848	3,945	12,794	97
2010	6/30	10/22	114	5,647	5,171	10,818	95
2009	6/14	10/26	134	4,723	9,203	13,926	104
2008	6/18	10/31	135	4,407	10,163	14,571	108
10-yr average	**6/7**	**10/23**	**138**	**7,014**	**7,787**	**14,801**	**106**

*First and Last Day(s) of Regulated Use lag regulation by 1 day because releases of stored water are adjusted the day after regulation was imposed or lifted.
**Days of Regulated Use does not equal the elapsed days between the start and end dates for regulation if regulation was temporarily suspended during the period.

STORED WATER RELEASE TO EACH AGENCY — 2017

Description	Beginning Storage (acre-ft)	Amount Released (acre-ft)			Ending Balance* (acre-ft)	Average Release (acre-ft/day)
		from Barney	from Scoggins	Total		
Hillsboro	10,127	2,495	3,498	5,993	4,134	48
Forest Grove	4,914	43	924	967	3,947	8
Beaverton	7,556	1,161	2,003	3,164	4,392	25
TVWD	5,789	4,119		4,119	1,670	33
Total	**28,386**	**7,819**	**6,425**	**14,244**	**14,142**	**114**

North Plains and Tigard: usage is reflected in the values for JWC partners
No internal leases between JWC partner agencies occurred in 2017.

Efficiency: JWC maximizes the capture of released water by coordination with partner agencies to anticipate and track system demands, and by leveraging finished water storage at the Fern Hill Reservoirs. During the peak season, the JWC and Cherry Grove pump station (at the City of Hillsboro's slow sand filter plant) recovered an average of 97% of the water available for municipal use from natural flow rights and releases from impounded supplies.

ESTIMATED WATER CAPTURE RATES – 2017

Water Available		Raw Water Pumped		Finished Water Produced			
				Total		Average Daily	Peak Day
Source	(acre-ft)	(acre-ft)	(MG)	(acre-ft)	(MG)	(MGD)	(MGD)
Reservoir release*	14,244	*JWC WTP (Spring Hill)***					
		15,974	5,205	16,550	5,593	43.1	62
Natural flow	2,452	*Slow Sand Filter Plant (Cherry Grove)*					
		153	50	153	50	0.4	1
Total:	**16,696**	**16,127**	5,255	**16,704**	**5,443**		
Capture rate:		**97%**		**100%**			

*The JWC no longer accounts for a water loss rate from stored water of 0.25% per river mile.
**The values shown here were measured and reported by JWC.

Regulatory matters

Water Right Activity and Fish Monitoring: The JWC submitted an application requesting another secondary permit to release water from Barney Reservoir on December 27, 2017. Approval is not expected until 2019, and is contingent on the completion of a fish monitoring survey of the JWC's portion of the Spring Hill Pumping Plant and mitigation for detrimental impacts. A more detailed description is provided in the BRJOC section.

Facility expansion

In order to meet increasing water demand, the JWC is expanding its WTP to increase peak capacity from 75 MGD to 85 MGD. A Facility Plan was developed to plan for future expansions and minimize creation of stranded assets. The Facility Plan documents assumptions about future WTP build-out capacity, processes, and site layout, as well as phasing of future improvements and expansion. The Facility Plan assumptions are guiding the design and location of the new structures and facilities for the near-term WTP expansion project.

The project scope, valued at around $27M, includes construction of two new filters, a new surge basin, two new solids drying beds, associated yard piping, upsized existing pumps, seismic life safety improvements, several maintenance projects, and minor modifications to existing structures. Substantial completion of the expansion is scheduled for June 2019.

Construction began in November 2017 with the concrete surge basin and filters. To ensure that these structures are seismically resilient, auger cast piles were installed under the foundation. The piles were completed in January 2018 and concrete construction began. The structures are expected to be finished and ready for commissioning in the spring of 2019.

Construction of New Surge Basin

Auger cast piles installed for forthcoming concrete structures

Concrete slab completed and concrete walls in progress

2017 Maintenance

New sand and anthracite media installed in the filters

Filter media replacement: The JWC staff, with assistance from contractors, replaced the filter media (a combination of sand and anthracite) in all 14 WTP filters. The existing media had been installed in 1995 and was nearing the end of its expected time of utility. The new filter media profile has more sand and less anthracite compared to the old media profile. Specifically, the media profile will change from 6 inches of sand and 50 inches of anthracite to 10 inches of sand and 46 inches of anthracite. This change is expected to improve the filters' effectiveness and increase the amount of time between backwash cleanings.

Meter replacements: In spring 2017 the finished water ultrasonic meters were replaced with new insertion magnetic meters. This required the installation of new vaults in several locations to improve the accuracy of the meters in relationship to any turns or bends in the finished water pipe. The raw water ultrasonic meters had been replaced with new insertion magnetic meters in the fall of 2016. The relationship between the raw and finished water meter daily production is still undergoing evaluation and calibration.

Other maintenance: In May 2017, Advanced American Construction was hired to clean sediment from under the JWC side of the Spring Hill Pump Plant and directly in front of the trash rack on the river side. In addition, the JWC electrical panels were retrofitted with seismic bracing to better withstand an earthquake.

The valve actuator in pump #1 was rebuilt. These actuators are oil over air and the seal was allowing the air to blow through the wrong chambers, making it difficult to open and close the valve. A new air compressor is ordered and planned for installation in fall 2018. The current vintage compressor is struggling to provide high enough pressure to the actuators to open and close the valves.

Acknowledgements

The Joint Water Commission appreciates the efforts of the Watermaster and our partners on the Flow Management Committee, and we extend our thanks for all of their involvement and cooperation. The communication and coordination that comes from this committee among the various Tualatin River users is invaluable.

MILLS DAM/BARNEY RESERVOIR

BY KRISTEL GRIFFITH, WATER RESOURCES PROGRAM COORDINATOR,
JOINT WATER COMMISSION/CITY OF HILLSBORO

Overview

Mills Dam/Barney Reservoir is a rock and earth impoundment on the Middle Fork of the North Fork of the Trask River. When Trask Dam was built in 1970 by the Cities of Hillsboro and Forest Grove, the reservoir held 4,000 ac-ft of water. In 1999, the dam height was raised to accommodate 20,000 ac-ft of storage and was renamed the Mills Dam. Barney Reservoir is named for J.W. Barney and Mills Dam is named for Eldon S. Mills, both former Hillsboro City Managers and key leaders in the original dam construction and its later expansion.

Water stored in Barney Reservoir is released to both the Trask and Tualatin Rivers. Flows to the Trask River include all storage overflows and 15% of the stored water, which is allocated to Oregon Department of Fish and Wildlife (ODFW). A gravity flow diversion pipeline conveys water from the Trask River to the headwaters of the Tualatin River. The additional flow in the Tualatin River is used for municipal purposes and flow augmentation to improve water quality.

Release from Barney Reservoir to the Trask River through a Howell-Bunger Valve

The current owners of Barney Reservoir are the Cities of Hillsboro, Forest Grove, Beaverton, the Tualatin Valley Water District (the same entities that form the Joint Water Commission) and Clean Water Services. Collectively they form the Barney Reservoir Joint Ownership Commission (BRJOC). As with the Joint Water Commission, the City of Hillsboro serves as the managing and operating agency for the BRJOC.

RESERVOIR OWNERSHIP AND WATER ALLOCATION FOR BARNEY RESERVOIR

		Water Allocation (percent)	Storage at Full Capacity (acre-ft)	Reservoir Ownership (percent)
Reserved	Dead pool	2.3%	460	—
	Oregon Department of Fish and Wildlife (ODFW)	15.0%	3,000	0.0%
BRJOC Partners	Clean Water Services	8.3%	1,654	10.0%
	JWC Partners	74.4%	14,886	90.0%
	City of Hillsboro	*25.6%*	*5,127*	*31.0%*
	City of Forest Grove	*2.1%*	*414*	*2.5%*
	City of Beaverton	*17.8%*	*3,556*	*21.5%*
	Tualatin Valley Water District (TVWD)	*28.9%*	*5,789*	*35.0%*
	TOTAL	100.0%	20,000	100.0%

2017 Operations

Barney Reservoir filled on January 11, 2017. By the end of the release season, 62% of the total allocated water was released.

Releases to the Tualatin River: The majority of the JWC's natural flow rights were regulated off on June 21, 2017, and releases from Barney Reservoir to the Tualatin River began on June 23rd. Natural flow rights were restored on October 23rd, however releases continued through the 24th, bringing the total release days to 124. Clean Water Services used 92% of their allotment and the JWC partners used 53%.

Releases to the Trask River: Releases from Barney Reservoir to the Trask River for ODFW began on June 22, 2017 and continued through November 21st for a total of 152 release days. All of the stored water for ODFW was released to the Trask River.

STORED WATER ALLOCATION AND RELEASES FOR BARNEY RESERVOIR — 2017

	Total Storage	Oregon Dept of Fish and Wildlife	BRJOC Partners					
					JWC Partners			
			Clean Water Services	*JWC Total*	*City of Hillsboro*	*City of Forest Grove*	*City of Beaverton*	*TVWD*
Water Allocation (acre-ft)	20,000	3,000	1,654	14,886	*5,127*	*414*	*3,556*	*5,789*
Water Released (acre-ft)	12,400	*3,058	1,524	7,819	*2,495*	*43*	*1,161*	*4,119*
Percent Allocation Used	62%	102%	92%	53%	*49%*	*10%*	*33%*	*71%*
Release Start Date		Jun-23	Sep-1	Jun-23				
Release End Date		Nov-21	Oct-24	Oct-24				
Number of Days with Releases		152	54	124				
Average Daily Release (cfs)		10	14	32				

An extra 210 acre-ft was erroneously released for ODFW due to inconsistency between planned and operational releases. The extra release will not affect ODFW's beginning balance for storage for the 2017 release season.

Dam Inspection

Oregon Water Resources Department (OWRD) inspected Mills Dam on January 18, 2017 to assess the dam's exterior surfaces and identify conditions that may affect the safety of the dam. Mills Dam is classified as a high-hazard dam based on the downstream risk to people and property. OWRD did not identify any major issues or concerns and reported that the dam is very well maintained and operated. The crest and embankment show no signs of settlement, instability or internal erosion. OWRD intends to inspect the dam again in 2018.

Calibration of Trask Weir

In September 2017 the Trask River Watermaster conducted flow testing at three points along the Trask River near the weir. This effort was initiated by BRJOC staff to validate the accuracy between operational release settings and the actual flow through the weir and into the Trask River. During the flow test the release rate was set to about 12 cfs, and the flow test results yielded estimated flow values of 14 cfs, 9 cfs, and 14 cfs downstream, inside, and upstream of the weir, respectively.

Upon receiving the results of the flow test, an elevation survey was conducted at the weir site in order to determine whether any settling or shifting of the weir and staff gauges had occurred. The survey results indicated a slight upward shift occurred in the staff gauge, and that the pressure monitor at the weir was reading slightly lower than the surveyed level. Calibration adjustments according to the survey results are planned to be made prior to the 2018 release season.

Water Right Activity and Fish Monitoring

All of the existing primary and secondary water rights for Barney Reservoir are certificated. The "primary" water right provides the ability to store the water. The "secondary" water right allows the water to be released for a specified beneficial use such as municipal or water quality improvement.

Currently, there is one primary water right certificate that allows the storage of 20,000 acre feet in Barney Reservoir. There are three secondary water right certificates allowing release of water from Barney Reservoir to the Tualatin River. Two of these secondary water rights are for use by the drinking water providers (JWC), and the other is for use by Clean Water Services (CWS). The JWC certificates authorize a release rate up to 38.7 cfs (25 mgd) while CWS has access to 30.0 cfs (19.4 mgd). The total authorized rate of 68.7 cfs (44.4 mgd) on the certificates is equal to the pipeline capacity to move the stored water from Barney Reservoir to the Tualatin River. In recent years, the drinking water providers released water at a higher rate than authorized on the water right. To date OWRD has not objected to these high release rates because they involve stored water for municipal use.

There is an opportunity to correct this issue for two reasons. First, CWS historically has not required the use of their entire release rate. Second, the CWS release rate goes unused for part of the release season because the CWS needed time frame is shorter than that of the drinking water partners.

The use of release rates can be improved if the drinking water providers obtain authorization to release water from Barney Reservoir at a maximum rate of 68.7 cfs (44.4 mgd), less the release rate to meet CWS's needs. The change would only affect how release rates are shared. It is not a request to store or use any additional water in Barney Reservoir. It also does not affect the 15% of stored water held for the Oregon Department of Fish and Wildlife for releases to the Trask River. It does not hinder CWS's access to their stored water or release capacity to the Tualatin River.

The drinking water providers, under the name JWC, submitted an application requesting the release rate change to OWRD on December 27, 2017. Approval is not expected until 2019, and is contingent on the completion of a fish monitoring survey of the JWC's portion of the Spring Hill Pumping Plant and mitigation for detrimental impacts.

LAKE OSWEGO CORPORATION

BY MARK ROSENKRANZ, WATER RESOURCE SPECIALIST, LAKE OSWEGO CORPORATION

Introduction

The Lake Oswego Corporation (LOC), a non-profit organization, owns and manages Oswego Lake, a 163-hectare (403 acre) reservoir located 10 miles south of Portland, Oregon. LOC was formed in 1942 when the Oregon Iron and Steel Company, then owner of the land around the Lake, deeded to LOC the land, three dam structures, and all water rights. The original dam was constructed in 1871 and later upgraded in 1921. Oswego Lake is a private water body whose primary water right is hydropower generation. Secondary uses include irrigation, aesthetic viewing, contact recreation, fishing, and boating.

Oswego Lake and Watershed Morphology

The original natural lake, called Waluga, was formed 10,000 years ago by the Missoula glacial floods which altered the old Tualatin River channel. Today, the Lake has three basins: West Bay, the Main Lake, and Lakewood Bay. There are also two shallow, man-made canals, Blue Heron Canal and Oswego Canal. Oswego Canal is the 2.4-km conduit from the Tualatin River (RM 6.7). Total lake surface area and volume is 1.63 km^2 (403 acres) and 12.7 x 10^6 m^3 (10,300 acre-feet). Shoreline length, including bays and canals, is 18.62 km (11.56 mi). Oswego Lake has a 5.08-km (3.15-mi) fetch and a narrow 0.56-km width (0.34-mi). The hydraulic residence time is 390 days.

Oswego Lake's two watersheds include the natural, 7.5-mi^2 urban basin around the Lake (10:1 watershed to lake-area ratio) and the larger 700-mi^2 Tualatin River basin (1,000:1 ratio) when the LOC Headgate is open. Major inflows from the watershed include Springbrook Creek, Lostdog Creek, Blue Heron Creek, and 70-plus storm drains from the City of Lake Oswego.

Aerial view of the West Bay of Oswego Lake looking to the East

LOC Water Rights and Contracts

Hydropower Generation: The primary hydropower water right is 57.5 cubic feet per second (cfs) obtained in 1906 that allows year-round diversion. To guarantee this flow during the dry season, LOC owns and operates a diversion dam located downstream of the Oswego Canal (RM 3.4). Flaps are erected on an “as needed” basis. No flaps have been used since 2004.

Irrigation: A contract between LOC and the Bureau of Reclamation (Oct 20, 1972) provides for up to 500 acre-feet from Scoggins Reservoir for irrigation use during March through November. The largest irrigator on the Lake is the Lake Oswego Country Club (approximately 175 acre-feet).

Maintenance/Evaporation: LOC also has a maintenance/evaporation water right of 3.36 cfs dating from 1985. This water can be diverted between September 16th and July 30th.

LOC Facilities

In fall 2017 LOC started a remodel project on their marina and boathouse buildings. The original structures were built in the 1950's and 1970's with several remodels since then. The goal is to have buildings that are healthy, resilient and can survive a Cascadia level earthquake. The remodel is coordinated with a drawdown scheduled to start in October 2017 which will lower the lake level by 10 feet.

Oswego Lake Watershed Management Plan

Water quality improvements and safety are the top priorities for LOC. For many years, Oswego Lake has had issues with overgrowth of cyanobacteria that can impair lake aesthetics. Under extreme conditions cyanobacteria also can be harmful to health. The goal of the annual LOC Water Quality Management Plan is to reduce cyanobacteria productivity and maximize the aesthetic value of the Lake. In order to accomplish this goal and provide long-term water quality solutions, LOC conducts a variety of watershed activities as part of the management plan.

Role of phosphorus: Algae require sunlight and nutrients in order to grow. To limit the growth of algae (especially cyanobacteria) in the Oswego Lake, LOC has focused its efforts on reducing the availability of one particular nutrient—phosphorus. The LOC has targeted 20 μg/L as the maximum phosphorus concentration in the lake that would substantially limit cyanobacteria growth. In order to reach this goal, LOC is trying to curb additional phosphorus loading to the lake as well as pursue methods to reduce the bioavailability of the phosphorus that is already present in the lake.

Management of phosphorus: Oswego Lake is fed by rainwater, creeks draining the surrounding watershed, likely groundwater inflow, stormwater inputs, and water from the Tualatin River that is conveyed via the Oswego Canal. In recent years, LOC has tried to minimize or eliminate flow from the Tualatin River into the lake because the river has a much higher phosphorus concentration than the target level for the lake. Flow into the lake from the Oswego Canal is regulated by a headgate.

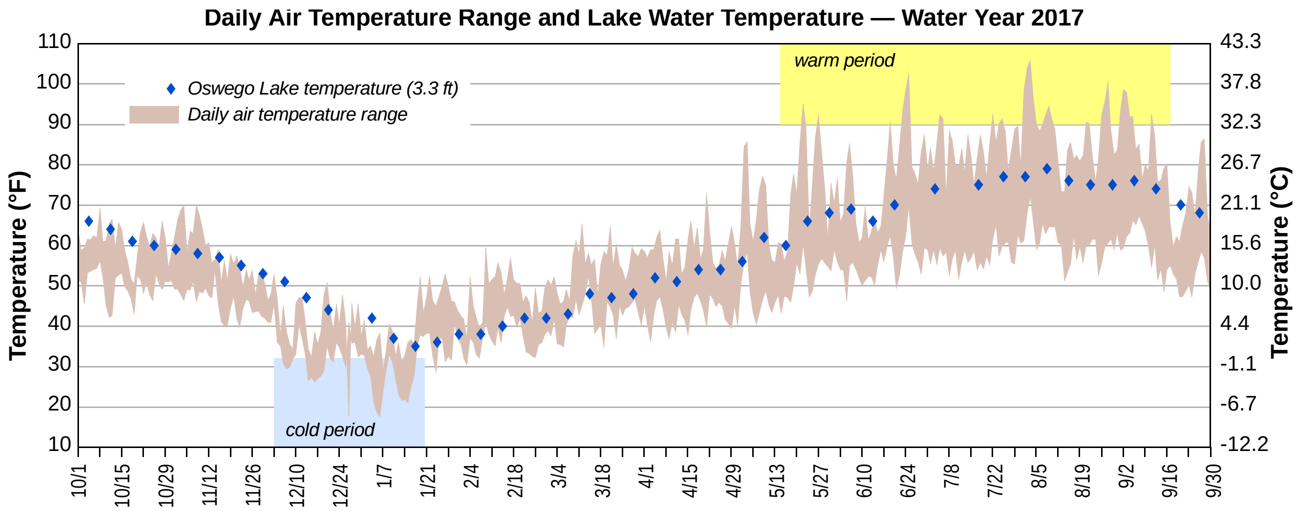
Two methods have been used in Oswego Lake to reduce the amount of phosphorus that is available to algae: hypolimnetic aeration to prevent phosphorus release from the sediments and alum addition to bind dissolved phosphorus making it biologically unavailable. Both methods have been successful in decreasing phosphorus concentrations in the lake, although not always to the target level of 20 μg/L.

Effects of lake temperature on water quality: Warm temperatures increase the rate of oxygen consumption by biological activity— biochemical oxygen demand in the water and sediment oxygen demand at the sediment/water interface. The result is a rapid loss of oxygen in the hypolimnion and subsequent release of phosphorus from the sediment. Hypolimnetic aeration helps to counter this effect, but is not able to prevent phosphorus release entirely if the dissolved oxygen concentration becomes very low.

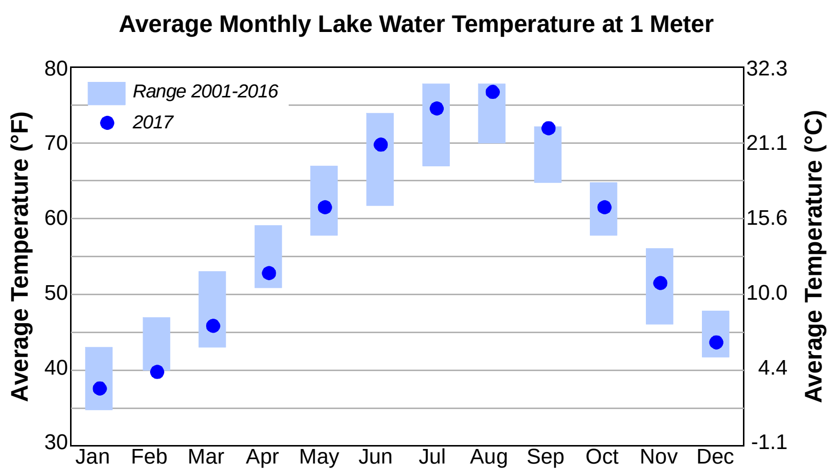
Cyanobacteria: Compared to typical fresh water algae, cyanobacteria grow better at higher temperatures. Increased cyanobacteria productivity in the epilimnion fueled by warm water and available phosphorus reinforces a feedback loop that leads to further oxygen depletion in the hypolimnion. Cyanobacteria are present in Oswego Lake every year but warm water and nutrient abundance allow them to proliferate.

Conditions in 2017

Weather: Weather plays a particularly large role in water quality on Oswego lake just as it does other waterbodies. January 2017 was cold with air temperatures dipping below 18ºF and 15 days in a row below freezing as highlighted in light blue in the graph on the following page. This led to frozen bays and canals by the end of the month. The cold January was followed by a very warm spring as the air temperature exceeded 90ºF for two days in May. In August and early September, the air temperature exceeded 90ºF for 19 days (see yellow highlighted area in the graph below).

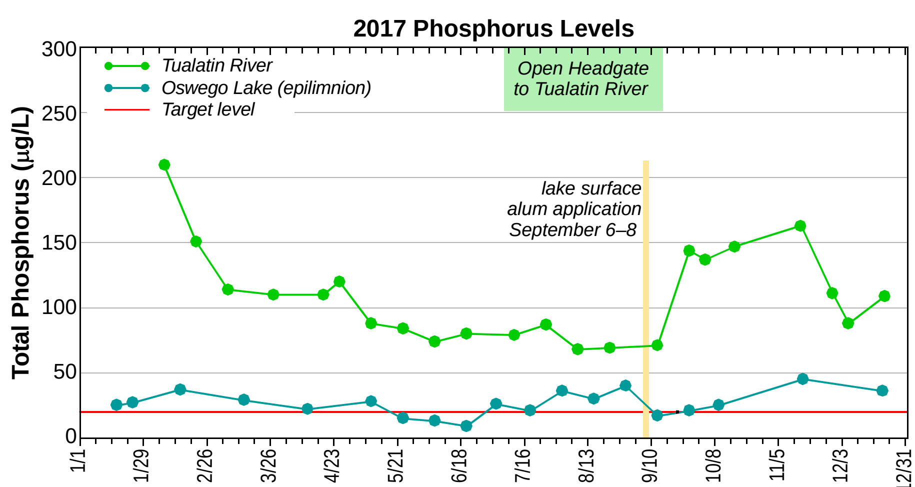


The warm late summer weather led to a high lake water temperatures (See graph at the right.) The average lake water temperature in August was 77°F, the 2nd highest over the past 17 years. September's average temperature was 72°F, which tied the highest average.



2017 Lake Management

Tualatin River flows: As usual, minimal Tualatin River flows were used for keeping the lake full. In 2017 the average annual concentration of phosphorus in the Tualatin River at Stafford was 110 µg/L; the average during the summer was 84 µg/L. These values are several times more than the average for Oswego Lake and influences the decision to restrict river use as much as possible (see figure at the right). LOC opened the headgate on July 7 and closed it on September 15.



Alum treatment: A warm late summer with abundant sunshine resulted in a cyanobacteria bloom in late August 2017 that required an alum application in early September. Phosphorus in the main lake was reduced from 40 µg/L before treatment to 17 µg/L after the treatment. The goal is to keep phosphorus at or below 20 µg/L in order to prevent an algal bloom, because algal blooms in the summer are almost always cyanobacteria.

Water quality parameters

Data for nutrient concentrations in the lake and lake clarity are shown in the table below.

2017 OSWEGO LAKE WATER QUALITY SUMMARY AVERAGES

	Location	Chlorophyll-a (µg/L)	Total P (µg/L)	SRP (µg/L)	Total N (µg/L)	Secchi (m)	Turbidity (NTU)
Annual	Lakewood Bay (depth 3.2 m)	drawdown in 2017 prevented collecting a complete year of data					
Annual	Main Lake (depth 16 m)	12	29	2	914	2.0	5.0
Annual	West Bay (depth 1.4 m)	drawdown in 2017 prevented collecting a complete year of data					
Annual	Oswego Canal (depth 1.2 m)	drawdown in 2017 prevented collecting a complete year of data					
Annual	Blue Heron Canal (depth 1.3 m)	drawdown in 2017 prevented collecting a complete year of data					
Annual	Outlet (depth 6 m)	drawdown in 2017 prevented collecting a complete year of data					
Summer	Lakewood Bay (depth 3.2 m)	14	44	1	572	0.82	9.5
Summer	Main Lake (depth 16 m)	13	24	1	509	2.4	5.1
Summer	West Bay (depth 1.4 m)	44	106	2	1029	0.5	31
Summer	Oswego Canal (depth 1.2 m)	1	54	3	3682	0.75	4.4
Summer	Blue Heron Canal (depth 1.3 m)	9	38	1	732	1.1	7.1
Summer	Outlet (depth 6 m)	12	22	1	461	2.1	4.6

Boxed cell = highest average during the summer; Shaded cell = lowest average during the summer; Summer=June–September

Abbreviations: Total P = Total Phosphorus, SRP = Soluble Reactive Phosphorus, Total N = Total Nitrogen, Secchi = Secchi depth, ug/L = micrograms per liter, m = meters, NTU = nephelometric turbidity units

Sunset across Oswego Lake

OREGON WATER RESOURCES DEPARTMENT

BY JAKE CONSTANS, WATERMASTER, DISTRICT 18

Introduction

The District 18 Watermaster's Office is a field office of the Oregon Water Resources Department (OWRD) (www.wrd.state.or.us) in cooperation with Washington County (www.co.washington.or.us/index.htm), and is responsible for water distribution management within the Tualatin, Oswego Lake, and Lower Willamette Drainage Basins in northwestern Oregon. District 18 covers approximately 1,111 square miles and serves the majority of the population in Washington and Columbia counties, as well as parts of Clackamas, Multnomah, and Yamhill counties. There are 2,806 total surface water rights in the district which cover 58,602 acres of land. As part of the surface water rights within the Tualatin River Basin there the following streams have instream water rights: Tualatin River, Gales Creek, Scoggins Creek, Rock Creek, West Fork Dairy Creek, and Fanno Creek. To assist in monitoring surface water in the basin we currently utilize 17 total gaging stations, 10 of which are on real time data.

WATERMASTER DISTRICT 18 GAGING STATIONS FOR 2017

Station Number	Stream	Stream Mile	Latitude	Longitude	Type
14206200	Dairy Creek at Hwy 8 near Hillsboro, OR	2.06	45°30'38"N	123°06'56"W	*Logger
14205480	E. Fk. Dairy Creek at Dairy Creek Rd near Mountaindale, OR	12.33	45°40'32"N	123°03'54"W	Staff
14205000	W. Fk. Dairy Creek @ Banks, OR	7.7	45°37'26"N	123°06'59"W	Staff
14205160	W. Fk. Dairy Creek @ Evers Rd near Roy, OR	1.96	45°34'34"N	123°05'34"W	Staff
14204530	Gales Creek @ Old Hwy 47 near Forest Grove, OR	2.36	45°30'39"N	123°06'56"W	*Logger
14204540	Gales Creek @ Clapshaw Hill Rd near Gales Creek, OR	12.36	45°35'39"N	123°12'38"W	Staff
14202920	Sain Creek above Hagg Lake near Gaston, OR	1.6	45°28'50"N	123°14'40"W	*Logger
14202850	Scoggins Creek above Hagg Lake near Gaston, OR	8.0	45°30'06"N	123°15'06"W	Logger
14202980	Scoggins Creek below Hagg Lake near Gaston, OR	4.8	45°28'10"N	123°11'56"W	*Logger
14202860	Tanner Creek above Hagg Lake near Gaston, OR	1.6	45°30'21"N	123°13'10"W	Staff
14206500	Tualatin River @ Farmington, OR	33.3	45°26'58"N	122°57'02"W	*Logger
14202510	Tualatin River @ Gaston, OR	62.3	45°26'21"N	123°07'85"W	*Logger
14204800	Tualatin River @ Golf Course Rd near Cornelius, OR	51.5	45°30'08"N	123°03'22"W	*Logger
14202450	Tualatin River below Lee Falls near Cherry Grove, OR	70.7	45°30'21"N	123°13'06"W	*Logger
14206295	Tualatin River @ Rood Bridge Rd near Hillsboro, OR	38.4	45°29'24"N	122°57'06"W	*Logger
14206956	Tualatin River @ Tualatin (station number formerly 14206960) (stage only)	8.9	45°23'14"N	122°45'46"W	*Logger
WAPO	Wapato Canal near Gaston, OR (from Tualatin River)	61.9	45°26'29"N	123°07'17"W	Staff

*Telemetry

Water Rights

All water in Oregon, by law, is publicly owned. With a few exceptions, a person or organization (such as a city, business, or other entity) must obtain a authorization from the state before they are allowed to divert water from its natural source, whether that water is from a stream, a lake or underground. This authorization is called a water right and they have been required for surface water since 1909. The Oregon Water Resources Department (OWRD) is responsible for issuing and managing water rights in Oregon.

Water right characteristics:

- Every water right establishes the following conditions:
  - the location where the water is being diverted,
  - how much water is being diverted,
  - where the water will be used,
  - and what the water will be used for.

  The use must be considered "beneficial" by the State and the water must be used in a way that is not considered wasteful. Changing any of these conditions requires legally changing the water right.
- Every water right has a "priority date" which is the date when it was issued.
- Water rights are usually associated with the land cited in the water right and when that land is sold, the water right usually goes with it. This is called "appurtenancy" which is a legal term for rights or restrictions that go with a property (an easement is a common example). It is possible, however, to sell or transfer a water right independent of the land. In such a case, a water right transfer must applied for and granted by OWRD. Note that mere ownership of land does confer the right to the water adjacent to or under that land; the land owner must own a water right.
- An instream water right is designed to retain a specified amount of flow in the stream for fish and wildlife, water quality or recreation. The Departments of Fish and Wildlife, Environmental Quality and Parks and Recreation may apply for instream water rights. An instream water right has a priority date and is not treated differently than other water rights.
- A water right remains in perpetuity as long as it is used at least once every 5 years. If it has not been used for 5 years, it may be forfeited or cancelled, but this is not automatic.

Prior Appropriation: In Oregon and throughout the western U.S., water is managed by a a system called "Prior Appropriation." Prior Appropriation is most simply explained as first come, first served, where "first" to "last" is in order of priority date.

A water source may not always be adequate to meet all of the water rights that have been issued for it. Because summers in western U.S. are typically dry, surface water shortages in the summer are not uncommon. If a water source cannot meet all of the water rights associated with it, the entity with the oldest (most senior) priority date is entitled to all of the water documented in their water right. If water is still available after that water right has been fulfilled, then the entity with the next oldest priority date is entitled to water. This process continues on in order of priority date. The entities with more recent (junior) priority dates may exercise their water rights only after the more senior rights have been met.

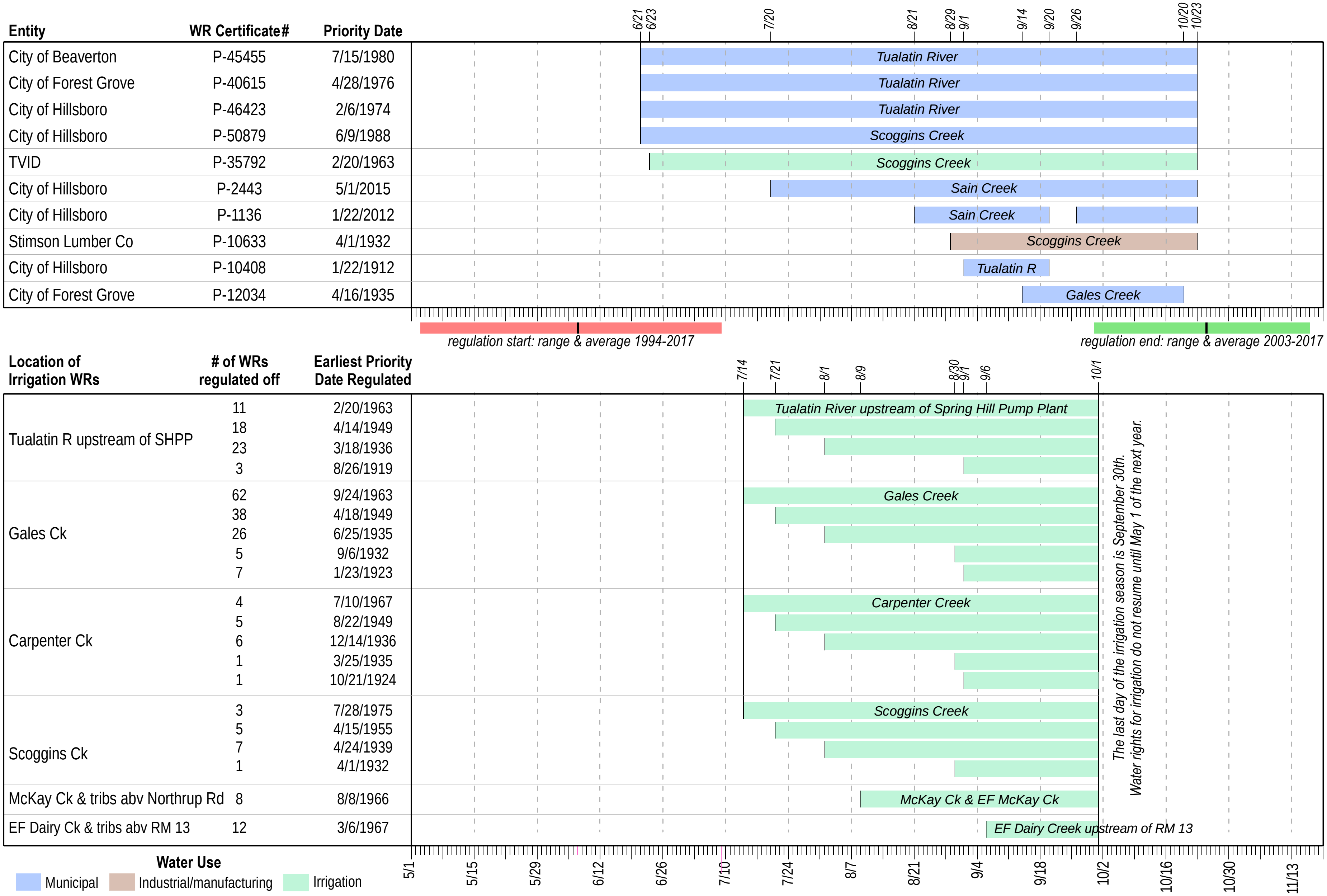
The Oregon Water Resources Department monitors the availability of water throughout the season. Based upon flow, location and priority date, OWRD determines which, if any, water rights holders in the basin will be restricted from exercising their water rights. Note that the eventual use of the water (for example, irrigation, municipal supply, etc.) is taken into consideration only if two water rights have the same priority date or if a drought has been officially declared by the Governor.

Regulatory Overview 2017

Regulation in 2017 began on June 21 and ended on October 23. Details of the regulation season are shown on the next page.

REGULATION OF WATER RIGHTS IN THE TUALATIN BASIN — 2017

Bars show period when water right is suspended



SCOGGINS DAM/HENRY HAGG LAKE

BY WALLY OTTO, RETIRED, TVID,
JOHN GOANS, RESERVOIR SUPERINTENDENT, TVID,
BERNIE BONN,
AND TOM VANDERPLAAT, CLEAN WATER SERVICES

Scoggins Dam

Scoggins Dam/Henry Hagg Lake is located on Scoggins Creek in the upper part of the Tualatin Basin. Scoggins Dam is an earthfill dam constructed during 1972–75 to store water during the winter for summer and fall use. The Dam is owned by the Bureau of Reclamation (BOR) and managed by the Tualatin Valley Irrigation District (TVID). Stored water from Hagg Lake is used for irrigation, municipal and industrial use, and flow augmentation in the Tualatin Basin to support water quality and protect fish and wildlife.

Three tributaries flow into Hagg Lake—Sain, Scoggins and Tanner Creeks. Flows in Sain and Scoggins Creeks are monitored by Oregon Water Resources Department gages; flow in Tanner Creek is monitored by daily readings of a staff plate by TVID personnel. Outflow is measured by a BOR stream gage in Scoggins Creek at RM 4.8. Oregon Water Resources Department maintains the rating curves for Tanner Creek, Sain Creek, and for Scoggins Creek at RM 4.8.

Scoggins Dam stores 53,323 acre-feet of water in Henry Hagg Lake as active storage—the amount of water that can be moved in or out of the reservoir between the intake structure and the top of the spillway gates. Another 7,000 acre-feet of stored water that is not engineered to be removed exists below the intake structure. It is reserved for the protection of fish if the lake were to be drafted down completely to the intake structure.

ALLOCATION OF WATER FROM SCOGGINS RESERVOIR

Contracted To	Water Use	Available Volume	
		ac-ft	as percent
Tualatin Valley Irrigation District	Irrigation (up to 17,000 acres)	26,705	50%
Joint Water Commission	Municipal and industrial	13,500	25%
City of Beaverton		*4,000*	
City of Forest Grove		*4,500*	
City of Hillsboro		*5,000*	
Clean Water Services	Instream water quality	12,618	24%
Lake Oswego Corporation	Irrigation	500	1%
Total		***53,323**	**100%**

The active storage in Scoggins Reservoir was revised in 2011

Scoggins Dam is authorized by the U.S. Congress to provide flood control for communities located downstream, including Gaston, Cornelius and Forest Grove. The dam controls runoff from a 39 square mile watershed (about 5% of the Tualatin Basin). From November 1st to January 15th, 20,000 acre-feet are designated for flood control storage. The dam does not generate electricity.

During the summer months, recreation is a major activity at Hagg Lake and the surrounding area. Washington County maintains and operates the 2,851 acre Scoggins Valley Park/Henry Hagg Lake recreational facility. In addition to the 1,100 acre lake, the park includes picnic areas, hiking trails, two boat launching facilities, and observation decks for bird and wildlife watching. The lake is stocked for fishing. Most of the park's facilities were designed to be accessible for disabled visitors. The park is open year round and is for day-use only.

http://www.co.washington.or.us/Support_Services/Facilities/Parks/Hagglake/index.cfm

2017 Water Use

Water year 2017 marks the 43rd year since Scoggins Dam began storing and releasing water for downstream beneficial use. A total of 35,731 acre-feet were delivered in 2017 (calendar year) bringing the total delivery from the Project to more than 1.3 million acre-feet.

2017 flow regulation began on June 22nd for the Joint Water Commission and June 23rd for TVID. With the exception of TVID's extended season irrigators, all users were permitted to return to natural flow use in the Tualatin River on October 25, 2017. As usual, TVID continued to deliver a small amount of storage water primarily to nurseries and greenhouses beginning in March and continuing until the end of November as permitted by the Oregon Water Resources Department.

2017 WATER DELIVERIES FROM SCOGGINS RESERVOIR

Delivered to	Volume (ac-ft)
Tualatin Valley Irrigation District	17,223
Clean Water Services	10,582
Municipal Use (Cities of Beaverton, Forest Grove and Hillsboro)	6,425
Lake Oswego Corporation	500
Other (includes two golf courses, from TVID allocation)	1,002
Total	**35,731**

Events in 2017

Recreation: In 2017 there were 800,000 users recorded at Scoggins Valley Park/Henry Hagg Lake. In addition to the usual recreational uses, numerous races were held including triathlons.

Coho Salmon: Eleven Coho were spotted in Scoggins Creek below the dam on October 27th.

Lake Fish Habitat: Over the previous years, the Oregon Panfish Club anchored a total of 300 fish habitat structures (8' diameter) in the upper reaches of Henry Hagg Lake. These have caused no problems in terms of operation and maintenance of Scoggins Dam. They have remained in place weighted down with concrete anchors.

Elk Mitigation: Roughly 50% of the fir trees planted in February 2012 remain standing and continue to form a visual barrier for the elk along the side of the Control House entry road. The field remains off limits to all trespassers including dogs. On numerous occasions, elk were observed grazing in the pasture.

Endangered species: BOR committed to avoid or minimize impacts to Fender's Blue Butterfly (FBB) and Kincaid's lupine. Reclamation continues to use trail maintenance practices that support Kincaid's lupine or FBB and is working with partner agencies to study and control invasive weeds.

Scoggins Dam Security

Department of Homeland Security Alert Levels: The Project follows the Department of Homeland Security (DHS) alert levels as required by BOR. No incidences of heightened security level occurred at Scoggins Dam in 2017 due to any specific terrorist alerts.

Scoggins Dam Safety

At Scoggins Dam, earthquake activity, weather including temperature and precipitation, river stage levels, and water surface elevation are reported and recorded electronically. In addition, key dam behavioral instruments report electronically over BOR's Hydromet system. The data is collected, stored and transmitted via satellite to BOR's Pacific Northwest Regional office in Boise. It is available on the Internet through both secure and non-secure channels. Many of these electronic reporting stations have alarms to alert operators if sudden or unusual conditions develop including earthquakes and flooding. While operators are not on site 24/7, the Project is monitored 24/7, both by BOR and TVID personnel.

Spills and Water Quality: No spills or accidents that jeopardized the water quality in Henry Hagg Lake occurred in 2017 and the BOR on-site Response Trailer was not needed for emergency response. No containment booms were deployed to contain any contaminant spills during 2017.

Drownings: A 68 year old man drowned in Hagg Lake on the evening of July 30th. He had been swimming with a friend. No evidence of foul play was found. He was not wearing a life jacket. Loaner life jackets area available at several stations near swimming areas in the park.

Earthquakes: On December 13, 2017 there was an earthquake at 17:25 with a magnitude of 4.0, 70 km SE of the dam. An OVIC inspection was promptly done on the facility and no damage was observed, all operations and equipment were unaffected.

Future of the Project

Tualatin Basin Water Supply: In 2001, the water resource agencies in the Tualatin Basin (except TVID) began to explore and compare alternatives for providing the additional water needed to meet future needs. TVID was not part of this group because it is limited to serving 17,000 acres of irrigated land and the current supply is adequate. After studying many different options as well as seismic issues, the municipal and industrial water providers decided to focus on the Willamette River for future water supply.

Clean Water Services is continuing to collaborate with BOR on the Tualatin Basin Dam Safety and Water Supply Joint Project. The Project goals include developing alternatives to:

- strengthen the dam to reduce risk from a Cascadia Subduction Zone earthquake, and
- increase the storage capacity of Hagg Lake to ensure that future water supply needs are met for the maintenance and improvement of water quality in the Tualatin River.

In May 2016, Congress passed the Federal Energy and Water Appropriations Bill. The bill raised the funding cap for necessary safety upgrades to Scoggins Dam and granted BOR the statutory authority to pursue conservation storage and paved the way for the Joint Project. It earmarked $2 million for updates to Scoggins Dam. The two alternatives under consideration for upgrading Scoggins Dam are:

- strengthening and raising Scoggins Dam in its current location, and
- replacing the existing dam with a new dam located downstream at a narrow gap in the valley.

Geotechnical investigations began in July 2017 and continued through December. The preferred alternative is scheduled to be selected in 2019.

More information about the Tualatin Basin Water Supply Project and updates can be found at:

http://www.tualatinbasinwatersupply.org

TUALATIN VALLEY IRRIGATION DISTRICT

BY WALLY OTTO, RETIRED, TVID
UPDATED BY JOHN GOANS, RESERVOIR SUPERINTENDENT, TVID

Tualatin Valley Irrigation District Overview

The Tualatin Valley Irrigation District (TVID), located in Forest Grove, Oregon, is the agricultural water service agency in the Tualatin Basin. In the early twentieth century, relatively little agricultural land was irrigated in Washington County: about 15 acres in 1915 and about 130 acres in 1933. By 1951, however, 18,455 acres had water rights registered in the county. When the TVID was formed in 1962, the total had grown to 33,885 acres. TVID was formed to assist in the delivery of irrigation water to about half of those acres (17,000) in the Tualatin Basin. The water was supplied from natural flow and return flows, and was extremely limited due to early summer withdrawals from the Tualatin River and increasing demands for water for irrigation and municipal use and for maintaining instream water quality and fish. The only storage at this time was Barney Reservoir which stored 4000 acre-feet for municipal use. Beginning in 1975, additional stored water became available behind the newly completed Bureau of Reclamation Project, Scoggins Dam. Approximately half of the water stored in Scoggins Reservoir (Henry Hagg Lake) is allocated to TVID.

Most of the water supplied by TVID is pumped from the Tualatin River at the Spring Hill Pump Plant and delivered to TVID patrons via approximately 120 miles of pressurized pipeline. Additionally, water in both Scoggins Creek and the Tualatin River is withdrawn by irrigators for use on land abutting the river. They are known as “river users” and pay for their own pumping costs because they are not associated with the pressure pipeline or the Spring Hill Pumping Plant. When natural flow no longer meets demand, the District 18 Watermaster begins regulating water users with “junior” (or more recent) water rights off, starting with users with the most recent water right. The TVID storage right is dated 1963, so TVID patrons with water rights after that date must stop withdrawing natural and return flow water, and all water withdrawals must be supplied from storage. Storage water is discharged from Scoggins Reservoir to either augment the river flow or supply the entire need of the TVID patrons, both the pump plant/pressure pipeline users and the river users. Water for some of the TVID members on the lower Tualatin River is supplied by water discharged from Clean Water Services’ Rock Creek Wastewater Treatment Facility. Crops irrigated with District water range from row crops including blueberries, blackcaps, corn, pumpkins and other vegetables to nursery stock.

TVID is allowed to use storage water early and late in the year because of an extended season for irrigation made possible by an agreement with the Oregon Water Resources Department. The early season begins March 1 and the extended season ends November 30. All water used outside the normal irrigation season (May through September) must come from TVID's annual contracted storage allotment of 27,022 acre-feet. TVID's total contracted amount with Reclamation is 37,000 acre-feet with the additional coming from natural and return flows in the Tualatin River and its tributaries.

The extension of the irrigation season for the Tualatin Valley Irrigation District has made growing specialty crops within the District much more appealing. During the extended spring season, the water is used primarily for berries and nurseries; during the extended fall season, water is primarily used for the nurseries. A more diverse nursery stock is now possible, including flowers which are raised well into November when protected by greenhouses. Water availability and moderate temperatures make the Tualatin Valley Irrigation District home to many small specialty nurseries along with several large operations.

2017 TVID Water Use

For the 2017 irrigation season (March through the end of November), TVID took delivery of 17,223 acre-feet of water from storage in Henry Hagg Lake—about 1,000 ac-ft less than in 2016 The least amount was 8,333 ac-ft in 1993; the largest seasonal delivery was 25,852 ac-ft in 2015. TVID 2017 peak use from storage was 130 cfs on August 3rd.

WEATHER STATISTICS AT SCOGGINS DAM 2017

Month	Description	Precipitation 2017	[average]*	Average Temperature Low	High	Other
January	wet	6.41”	[7.87”]	28ºF	40ºF	2.37” rain on 1/18/2017
February	very wet	14.24”	[6.29”]	35ºF	48ºF	4th wettest since 1970
March	very wet	9.75”	[5.80”]	39ºF	52ºF	4th wettest since 1970
April	wet	5.99”	[3.47”]	40ºF	56ºF	1.01” rain on 1/12/2017
May	warm	1.85”	[2.17”]	46ºF	68ºF	6 days ≥80ºF
June	last half warm	0.86”	[1.47”]	51ºF	73ºF	3 days ≥90ºF
July	very dry	0.00”	[0.42”]	53ºF	77ºF	only 1 day 90ºF
August	hot	0.15”	[0.65”]	54ºF	87ºF	13 days ≥90ºF, 2 days ≥100ºF
September	warm	1.74”	[1.52”]	52ºF	78ºF	6 days ≥90ºF
October	dry with 1 big storm	6.05”	[3.76”]	41ºF	64ºF	3.15” precip on 10/22/16
November	wet	10.21”	[7.88”]	41ºF	51ºF	no freezing temperatures
December	average precip, cold	5.02”	[9.25”]	31ºF	41ºF	18 days with low ≤32ºF

*average based on 1970–current year

2017 TVID Operation and Maintenance

The year was uneventful from an operations standpoint. A “moratorium” remains in place regarding new turn-out deliveries. No new deliveries were added to the delivery system during 2017.

Pipeline Maintenance: TVID delivers irrigation water by high pressure pipeline to customers from Gaston to North Plains and from west of Forest Grove to Highway 219 south of Hillsboro. The water is withdrawn from the Tualatin River at the Spring Hill Pump Plant and lifted by pumps to a water regulating tank off Winter’s Road. From there it flows under gravity pressure to all points of delivery through 120 miles of pipeline. Preventative maintenance continues to keep service delivery as dependable as possible. Several minor disruptions of service occurred during the year, but were quickly isolated and repaired. Service was restored in minutes in some cases or in up to a day if conditions did not allow quick access. There were no long term disruptions of service to District patrons.

Tributary Flow Restoration Projects: TVID and Clean Water Services continue their cooperative effort using the TVID water distribution network to supply water to West Fork Dairy Creek, Gales Creek, East Fork Dairy Creek, and McKay Creek. Each site consists of a metered pipeline with a diffuser at the outlet. All sites are located near delivery lines for the Irrigation District. Flow augmentation occurs during the summer and fall. The water not only adds to streamflow, but it cools the stream as well. The partnership between the Tualatin Valley Irrigation District and Clean Water Services is a novel way to improve the water quality of these streams at minimal cost.

WAPATO LAKE

BY KRISTEL GRIFFITH, WATER RESOURCES PROGRAM COORDINATOR, JWC
UPDATED BY JOHN GOANS, RESERVOIR SUPERINTENDENT, TVID

The former Wapato Lake bed, located south-east of Gaston, Oregon, is a 780 acre wetland that was once the winter residence of the Atfalati indigenous people. Settlement of the area began in the 1830s and during the 1930s a levee and pump system was constructed by the Wapato Improvement District (WID) to drain the lake bed during spring so that the land could be farmed in summer. The levee protects the former lake bed from severe flooding during the winter, thereby allowing easier drainage in spring.

In 2011, the United State Fish and Wildlife Service (USFWS) became the majority land-owner and the WID was dissolved. In 2013 Wapato Lake was established as a National Wildlife Refuge (NWR) as part of the Tualatin River NWR Complex.

Levee, pump and drainage issues

2007–2008: A levee failure in December 2007 resulted in flooding. By the spring 2008, the lake was supporting a substantial population of algae and zooplankton. When the impounded water was discharged in June 2008, it created many water quality problems which affected drinking water treatment, agricultural irrigation, fish and wildlife, and recreational use. The State of Oregon issued a Public Health Advisory for recreational contact with the Tualatin River due to high levels of toxic algae. Detailed descriptions of these events can be found in USGS Report 2015-5178, "Upstream Factors Affecting Tualatin River Algae- Tracking the 2008 Anabaena Algae Bloom to Wapato Lake, Oregon."

2010: In 2010 when the primary pump failed, Clean Water Services lead a collaborative effort to acquire temporary pumps to prevent a repeat of the 2008 problems. See the Tualatin River Flow Management Technical Committee's 2010 report for details.

2012 TMDL: Drainage from Wapato Lake was included in the 2012 Total Maximum Daily Load (TMDL) Implementation Plan. USFWS must limit pumping from the lakebed after April 30th each year to be in compliance with Department of Environmental Quality requirements (DEQ). This avoids draining the area during conditions favorable to algal blooms (low water and high temperature), and protects water quality in the Tualatin River.

2016: As in 2010, mechanical and electrical failures caused the primary pump to be non-operational in February 2016. Pump repairs could not have been completed soon enough to drain the lake bed by April 30th as mandated by the TMDL. The possibility of a repeat of the 2008 water quality problems was a serious concern. The water and natural resource managers in the Tualatin Basin, including CWS, USGS, JWC and USFWS, worked together to obtain emergency repairs and acquire auxiliary pumps. The lake was pumped out on May 1st, only 1 day late. No water quality problems were evident.

Pumping operations in 2017

On February 28, 2017, the lake bed reached its highest level since official measurements began in 2011: a water level elevation of 171.15 ft comprising 4,713 ac-ft of stored water. Due to high water levels, the USFWS requested an extension of the April 30th pumping deadline, which was granted by DEQ. On May 13th, the large primary pump quit unexpectedly and attempts to restart it were unsuccessful. By this time the lake levels were low enough that emergency repairs were not required; repairs were planned for the off-season.

2017 PUMPING CAPACITY AND DATES OF OPERATION

Pump	**Nominal Capacity** (gpm)	Operation Period
USFWS Primary	~10,000	2/28 – 3/7 and 3/22 – 5/13
USFWS Secondary	~3,000	3/22 – 6/2

WATER QUALITY
BY BERNIE BONN

Concern about water quality in the Tualatin River is longstanding. Until the formation of Clean Water Services (formerly the Unified Sewerage Agency of Washington County), numerous small towns and cities discharged minimally treated sewage into the river and its tributaries. Water use by agricultural activities in the basin depleted river flow in the summer and contributed nutrients and sediment. By the 1960s, the local newspaper documented the poor water quality in the Tualatin River. In 1984, the Oregon Department of Environmental Quality (ODEQ) included sections of the Tualatin River on the 303d list as being water quality limited. Water quality issues in the Tualatin Basin have included elevated pH and nuisance algae, low dissolved oxygen, high temperatures, and excess bacteria. Many groups have worked to improve water quality in the Tualatin Basin, including Clean Water Services, the Tualatin River Watershed Council, the Tualatin Riverkeepers and others. Part of the reason for the formation of the Flow Committee is to manage river flow to improve and preserve water quality.

Algal growth and pH

Background: In the reservoir section (about RM 3.4-30), the Tualatin River is wide and slow moving. Because the river is so broad, streamside vegetation cannot adequately shade the full width and consequently much of the water surface is in exposed to the sun. Nutrients, both naturally occurring and anthropogenic, are ample. These conditions—slow movement, sunlight, and ample nutrients— are ideal for algal growth during summer. Most of the algae in the Tualatin River are phytoplankton that float in the upper few feet of the water. During the day, photosynthesis by algae converts carbon dioxide dissolved in the water into biomass. As the concentration of dissolved carbon dioxide decreases, the pH of the water increases. High pH values can negatively affect aquatic resources.

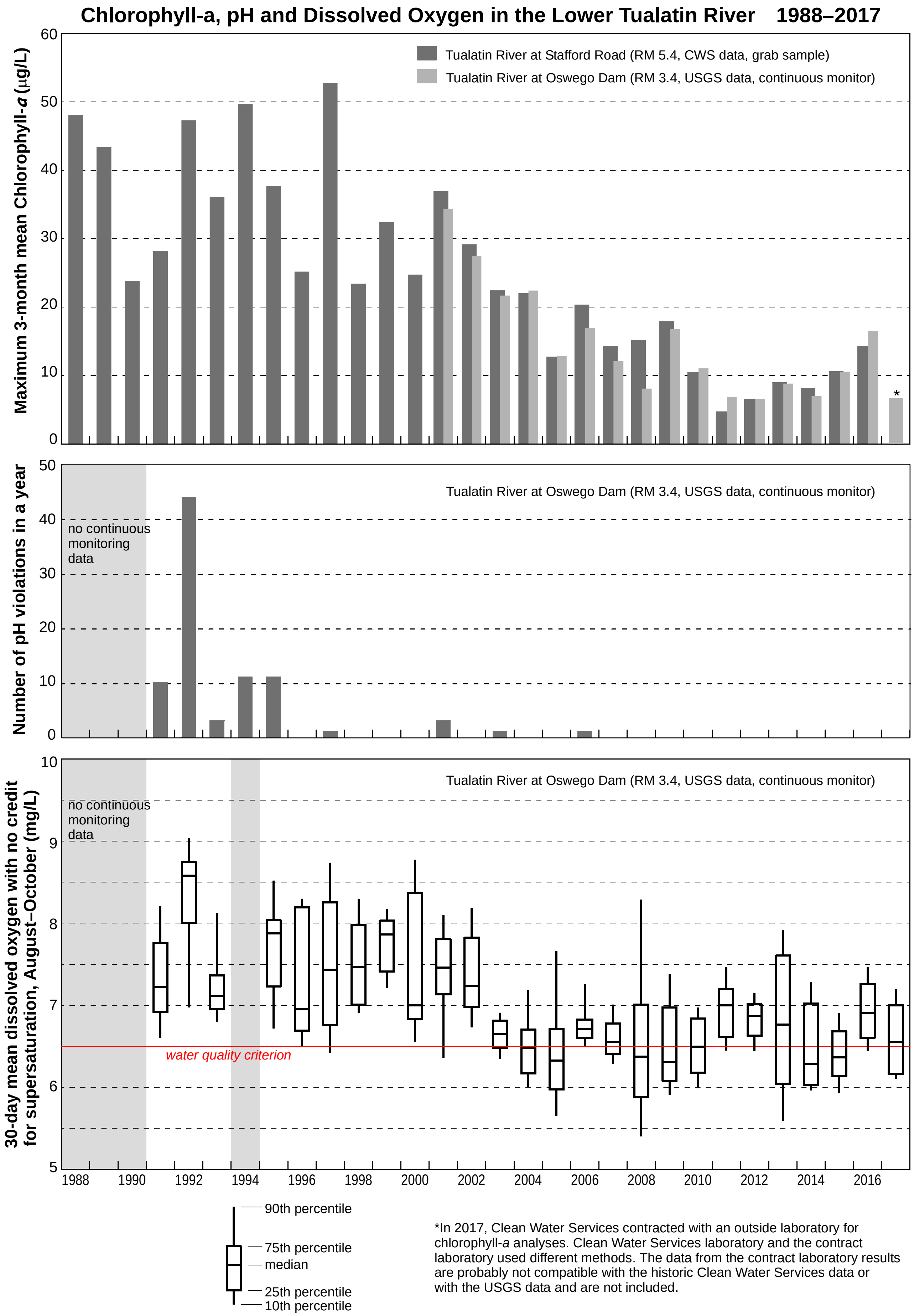
In the 1980s the lower section of the Tualatin River was listed by the ODEQ for elevated pH (>8.5) and degraded aesthetics due to nuisance algal growth. To address these water quality problems, the ODEQ developed a TMDL for phosphorus to limit nutrient availability. Since then, advanced wastewater treatment by Clean Water Services has dramatically decreased phosphorus concentrations in the river. Median total phosphorus concentrations during low flow season in the Tualatin River at Elsner/Jurgens Park and at Stafford have been below the TMDL target levels (0.11 and 0.10 μg/L, respectively) since 1998. More details about phosphorus concentrations are in Appendix H.

In addition, summertime flows in the Tualatin River have increased due to Clean Water Services' releases of stored water from Scoggins and Barney Reservoirs as well as increased discharge from the wastewater treatment facilities.

Chlorophyll-*a* concentrations are an indicator of the amount of algae in the river. Since 2001, chlorophyll-*a* is measured hourly at the Oswego Dam (RM 3.4) by the USGS as part of a cooperative agreement with Clean Water Services. Chlorophyll-*a* levels have decreased substantially since the 1990s (see the figure on page 43). Clean Water Services collects water samples at several sites for chlorophyll-*a* analysis.

2017: The average chlorophyll-*a* levels in 2017 were the lowest since USGS began chlorphyll-*a* continuous monitoring. The maximum 3-month average chlorophyll-*a* concentration in 2017 was 6.7 μg/L and occurred for June–August. Total phosphorus concentrations for the 2017 summer season (May–October) were 0.083 μg/L at Jurgens Park and 0.082 μg/L at Stafford.

Because the algal population has declined, high pH values have become rare. The pH is monitored hourly at RM 3.4 (Oswego Dam, year-round) and at RM 24.5 (summer only). No pH values at either site exceeded 8.5 in 2017. The maximum pH at the Oswego Dam was only 7.2, which was slightly less than the maximum pH at RM 24.5 (7.3) where algal blooms are smaller and more rare.Low pH values (<6.5) are not a problem in the Tualatin River system.



*In 2017, Clean Water Services contracted with an outside laboratory for chlorophyll-*a* analyses. Clean Water Services laboratory and the contract laboratory used different methods. The data from the contract laboratory results are probably not compatible with the historic Clean Water Services data or with the USGS data and are not included.

Dissolved oxygen

Background: The amount of oxygen dissolved in water is the net result of processes that contribute oxygen and processes that consume oxygen. In the lower Tualatin River the primary sources of oxygen are photosynthesis by algae in the daytime and inflow of oxygen rich water. The processes that consume oxygen are biochemical oxygen demand and sediment oxygen demand (from substances that decompose in the water and at the sediment water interface, respectively) and respiration by algae. Because the lower section of the river moves slowly and is not turbulent, oxygen exchange with the atmosphere is slow. Consequently, if dissolved oxygen becomes depleted, it cannot be quickly replenished from the air. Similarly, if dissolved oxygen is in excess, the river water stays supersaturated for a prolonged period of time.

In the 1980s the lower section of the Tualatin River was listed by the ODEQ for low dissolved oxygen that could impair fish health. The water quality criteria for this section of the river, which is considered 'Cool Water Habitat,' are:

- Grab samples: dissolved oxygen > 6.5 mg/L
- Continuous Monitoring:
  - 30-day average of daily mean dissolved oxygen > 6.5 mg/L (no credit for supersaturation)
  - 7-day average of daily minimum dissolved oxygen > 5.0 mg/L (no credit for supersaturation)
  - Daily minimum dissolved oxygen > 4.0 mg/L

ODEQ also developed a TMDL for ammonia which consumes oxygen as it decomposes into nitrate. Since then, Clean Water Services has decreased the amount of ammonia discharged to the river by its WWTFs.

Streamflow in the Tualatin River during the summer has increased since the TMDLs were instituted in 1988. Increased river flow affects two different processes with opposite effects on oxygen. Faster river flow decreases the amount of time water is in contact with sediment, thereby decreasing the extent to which sediment oxygen demand can be exerted and the resultant amount of oxygen depleted. Faster river flow also decreases the time available for algal populations to grow, which in turn decreases photosynthetic oxygen production. The net effect of decreased oxygen production plus decreased oxygen consumption is variable and not well predicted. In general, low dissolved oxygen is still an issue in the lower Tualatin River periodically during the late summer through fall (see the figure on page 43). Chlorophyll-*a* levels have decreased substantially since the 1990s (see the figure on page 43).

2017: Dissolved oxygen conditions in the Tualatin River in 2017 met criteria during much of the low-flow season (see table below). The 30-day criterion (30-day mean with no credit for supersaturation) was not met at the Oswego Dam during all of September and the first 2 weeks of October. The lowest values of the 30-day statistic at that site was 6.03. The daily minimum dissolved oxygen criterion was not met on August 13th and 14th when the DO concentrations were only 3.31 and 3.53. These are the lowest dissolved oxygen concentrations recorded at Oswego Dam since continuous monitoring began in 1991. All criteria for DO were met throughout the dry season at RM 24.5

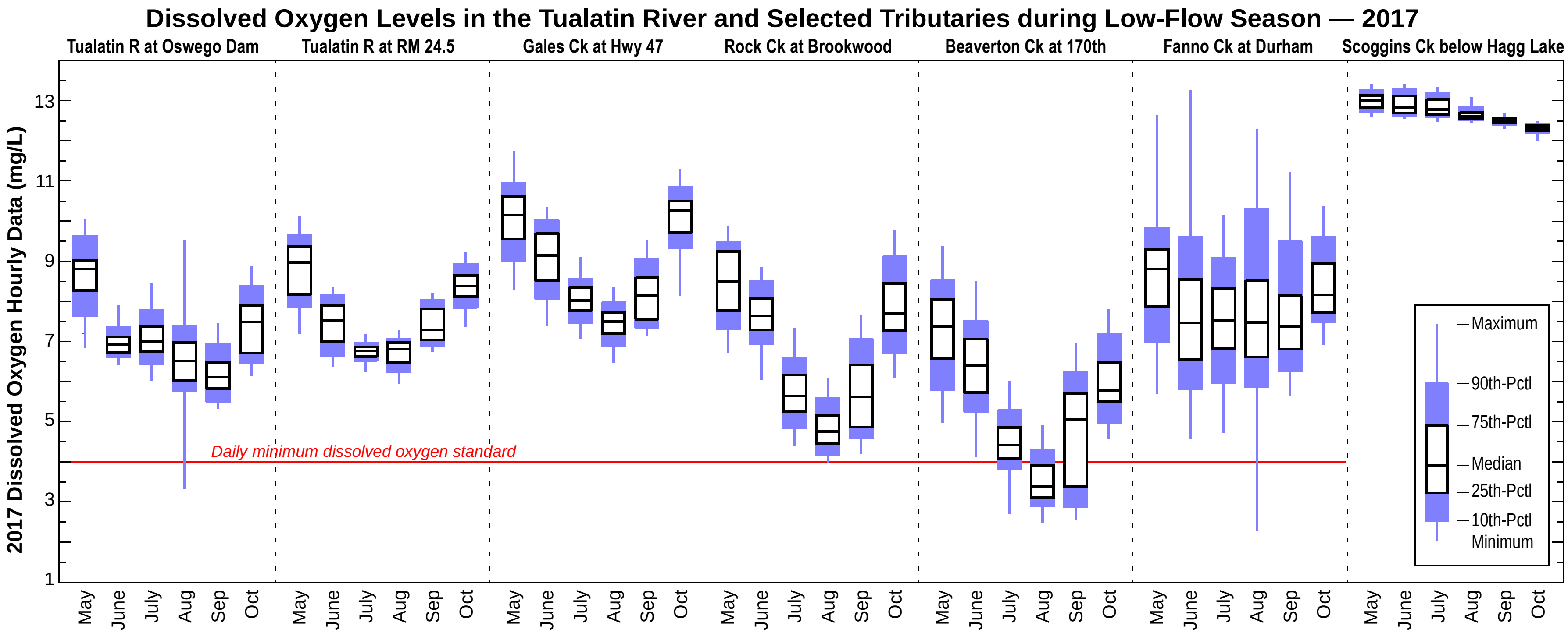
NUMBER OF DAYS THAT DID NOT MEET DISSOLVED OXYGEN CRITERIA IN 2017

Criterion	May	June	July	Aug	Sept	Oct	May–October Percentage
Tualatin River at RM 24.5							
30 day	0	0	0	0	0	0	0%
7 day	0	0	0	0	0	0	0%
Daily	0	0	0	0	0	0	0%
Tualatin River at Oswego Dam (RM 3.4)							
30 day	0	0	0	2	30	12	24%
7 day	0	0	0	0	0	0	0%
Daily	0	0	0	2	0	0	1%

Continuous monitoring of dissolved oxygen

As previously discussed, low dissolved oxygen (DO) concentrations have been an ongoing problem in the lower Tualatin River. Some of the tributaries in the Tualatin Basin also have had low DO levels. In general, the slow moving valley bottom streams are more likely to have low DO than faster moving headwaters streams. It is thought that sediment oxygen demand is largely responsible for the low DO levels in the tributaries. Transport of material from the landscape and re-suspension of sediment are also thought to be important sources of biochemical oxygen demands to the tributaries. Continuous monitoring can provide insight into the processes that affect DO concentrations.

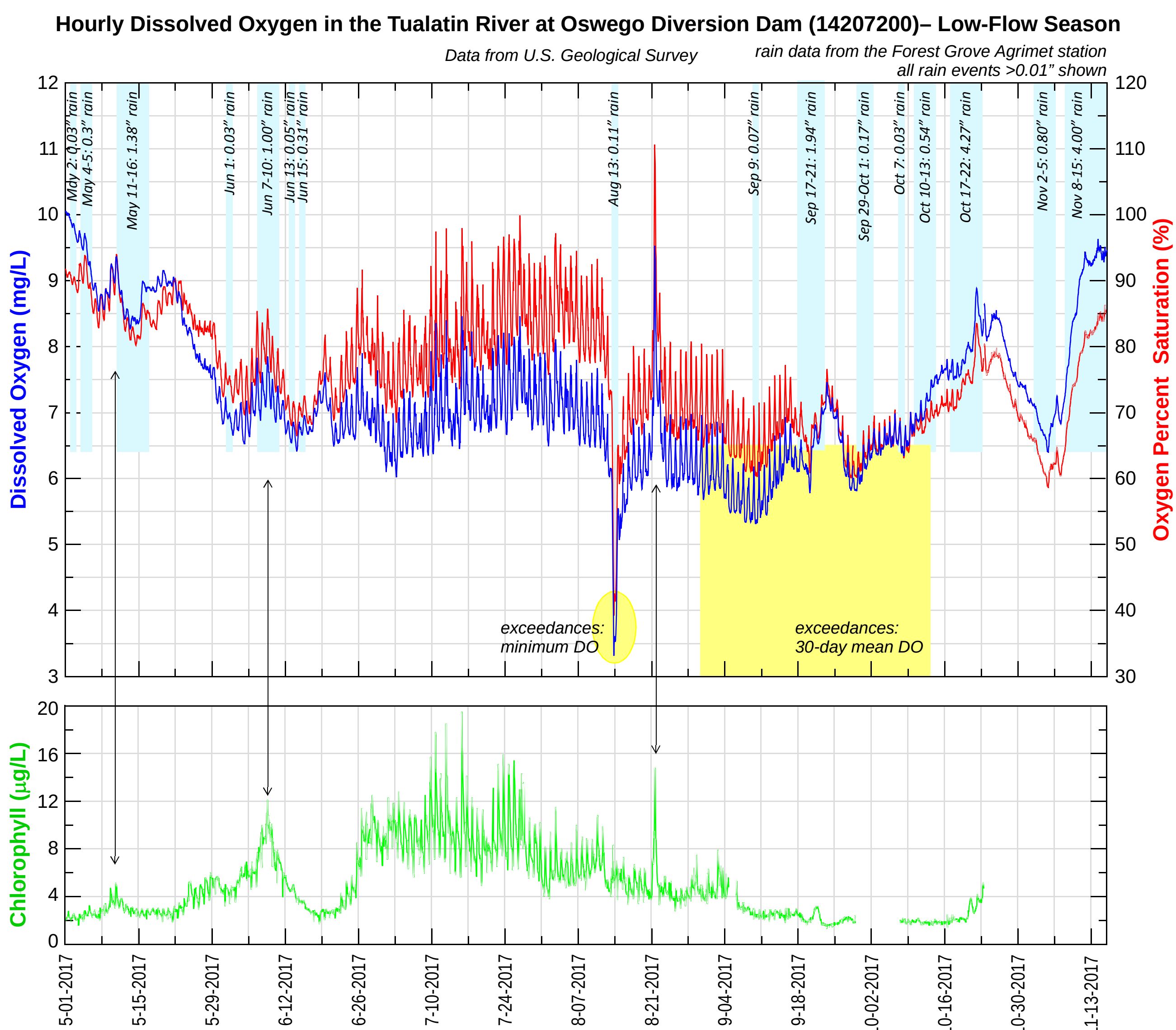
Continuous monitors are deployed at 2 locations in the reservoir section of the river and 5 tributary sites. Measurements are taken every 30 minutes. A statistical summary of the data is shown below. More detailed descriptions for each site are provided on the following pages. Data are available at: https://or.water.usgs.gov/cgi-bin/grapher/table_setup.pl?basin_id=tualatin



- At most sites, DO concentrations decrease from spring through summer and then increase. In late summer, higher temperatures and lower flows increase the rate and effect of sediment oxygen demand.
- The lowest DO concentrations overall occurred in Beaverton and Rock Creeks, both of which are slow-moving valley bottom streams that trap sediment.
- Very low DO concentrations occurred for less than 24 hours at the Tualatin River at the Oswego Dam and at Fanno Creek in August.
- DO concentrations in a month can span a range of more than 4 mg/L at some sites.
- Because of releases from Hagg Lake, DO concentrations in Scoggins Creek are greater and show a different pattern than other sites.

Tualatin River – Oswego Dam:

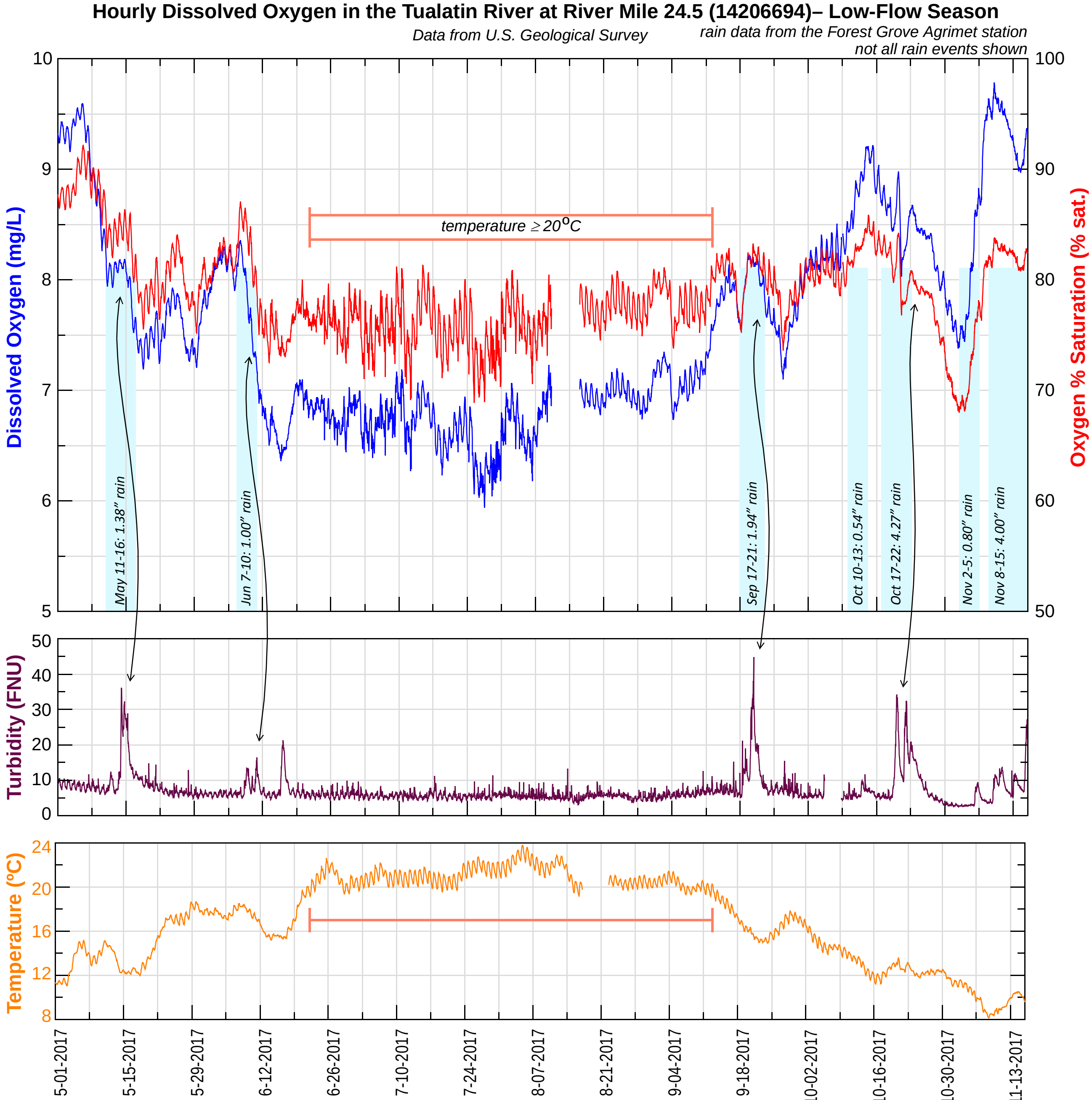
- Algal blooms at the Oswego Dam site strongly affect DO. They can be identified by high chlorophyll concentrations, large daily DO ranges and DO concentrations that exceed 100% saturation. Algal activity in 2017 was lower than in 2016. Peak DO concentrations rarely exceeded 100%. From mid-August through mid-September, when warm temperatures (21–23ºC) increased the rate of sediment oxygen demand, algal production of oxygen was able to maintain DO only at about 70% saturation.
- The 30-day DO criterion was not met for 44 days (August 30–October 12) in 2017.
- On August 13–14, the DO was less than 4 mg/L for 14 hours (the lowest values measured since continuous monitoring began in 1991). This sharp decline might have been caused by a turnover in the lower Tualatin River. Since mid-June, 2017 had been warm and dry. If the reservoir reach of the river had become stratified, oxygen in the lower water layer would have been consumed by sediment oxygen demand, but not replenished. August 13th was the first cool day in 2 months which could have triggered a turn over. Low DO water from the bottom mixing into the upper layers would decrease the DO in the now well-mixed river. No depth specific measurements were done in August 2017, so this hypothesis cannot be confirmed. Stratification and turnover in this part of the river have been documented previously, although flows were lower. An unknown discharge could also have caused the decrease. The low DO was not caused by an algal crash because algal activity in the previous week was small (DO<100% saturation, low chlorophyll).
- From October 17–22, more than four inches of rain fell. The rain was intense enough to resuspend sediment in the tributaries and to create stormwater inflows. Those oxygen demands were transported to the Tualatin River which caused the large oxygen sag during the first week of November.



Tualatin River – RM 24.5:

- DO concentrations at RM 24.5 were about 75% saturation which is low; typical DO saturation at this site in the dry season is about 80%. The lowest DO in 2017 correlated with the period when the water temperature exceeded 20ºC and the rate of sediment oxygen demand would have been high.
- The daily DO range at RM24.5 was small (<0.5 mg/L) compared to DO ranges at Oswego Dam (>1.5 mg/L). Significant algal blooms are rare here, so daytime photosynthesis and nighttime respiration have only a small effect.
- In several instances (marked by the arrows) a decrease in DO was probably caused by rainfall which was sufficient to increase turbidity. Turbidity is associated with an increase in oxygen demanding substances—from resuspension of sediment in the Tualatin River and in Rock Creek and its tributaries, and from stormwater inflows.

Hourly Dissolved Oxygen in the Tualatin River at River Mile 24.5 (14206694)– Low-Flow Season

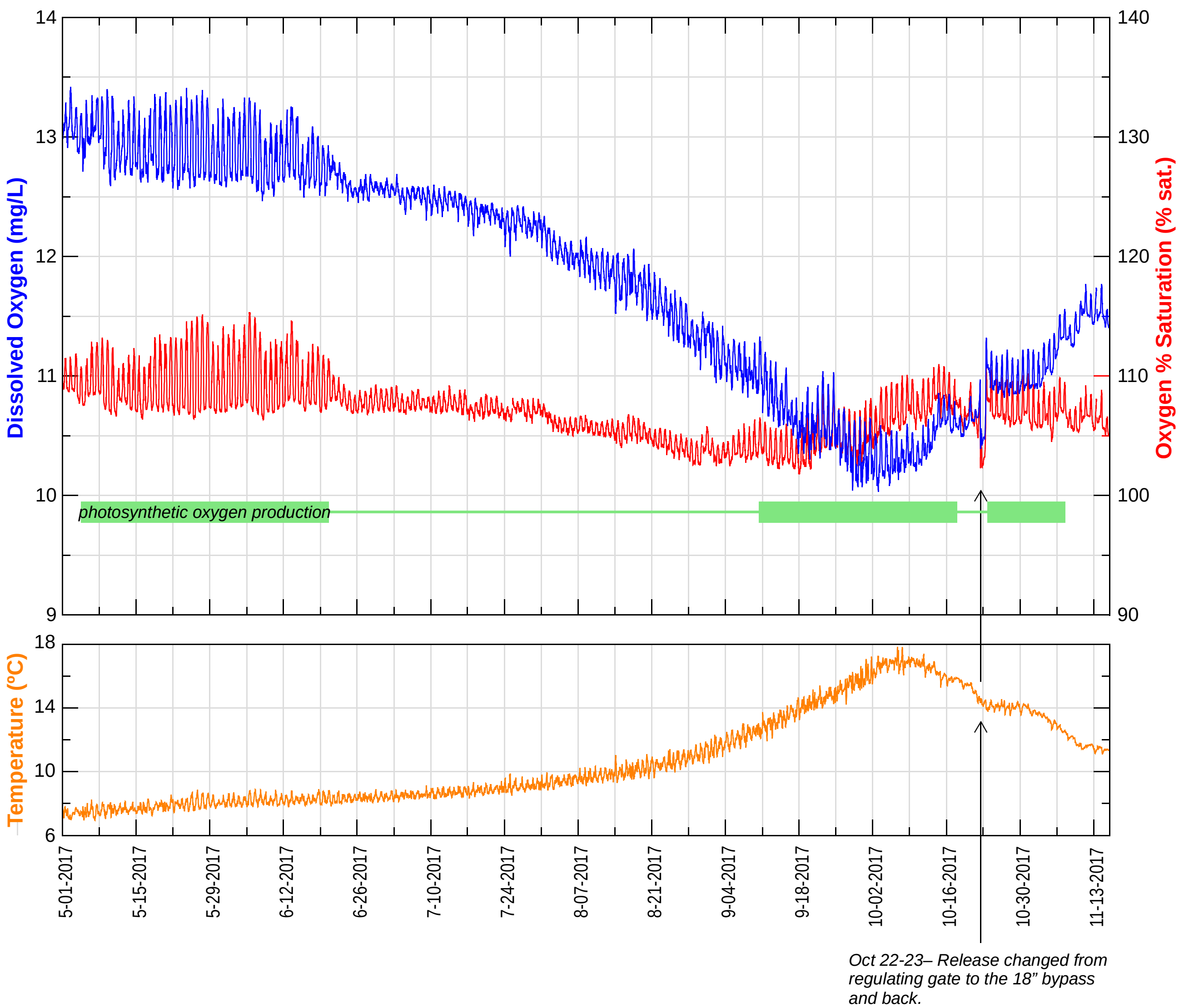


Scoggins Creek below Hagg Lake:

- The DO pattern through the low flow season at Scoggins Creek is very different from the other sites because of releases from Scoggins Dam—colder in summer and warming through fall.
- In May–mid-June, photosynthetic activity by instream plants or periphyton upstream of the site was clearly evident. The daily DO range was about 0.8 mg/L, about three times more than in 2016. DO saturation exceeded 110% which is unusual for this site. Photosynthetic oxygen production decreased through mid-summer and increased again in September, although not to the same level as earlier.
- As the reservoir is drawn down, more of the warmer water from the upper layers is released. Although the absolute concentration decreases, the percent saturation usually stays constant. In 2017, percent saturation decreased slightly during August.
- Short-term abrupt changes in DO can be caused by changes in dam operation. Only one such change occurred in 2017 and it was minor. It is denoted by an arrow on the graph. DO saturation is consistently about 100% when water is diverted through the bypass. When water is released through the regulating gate, air is entrained and DO saturation is greater than 100%.

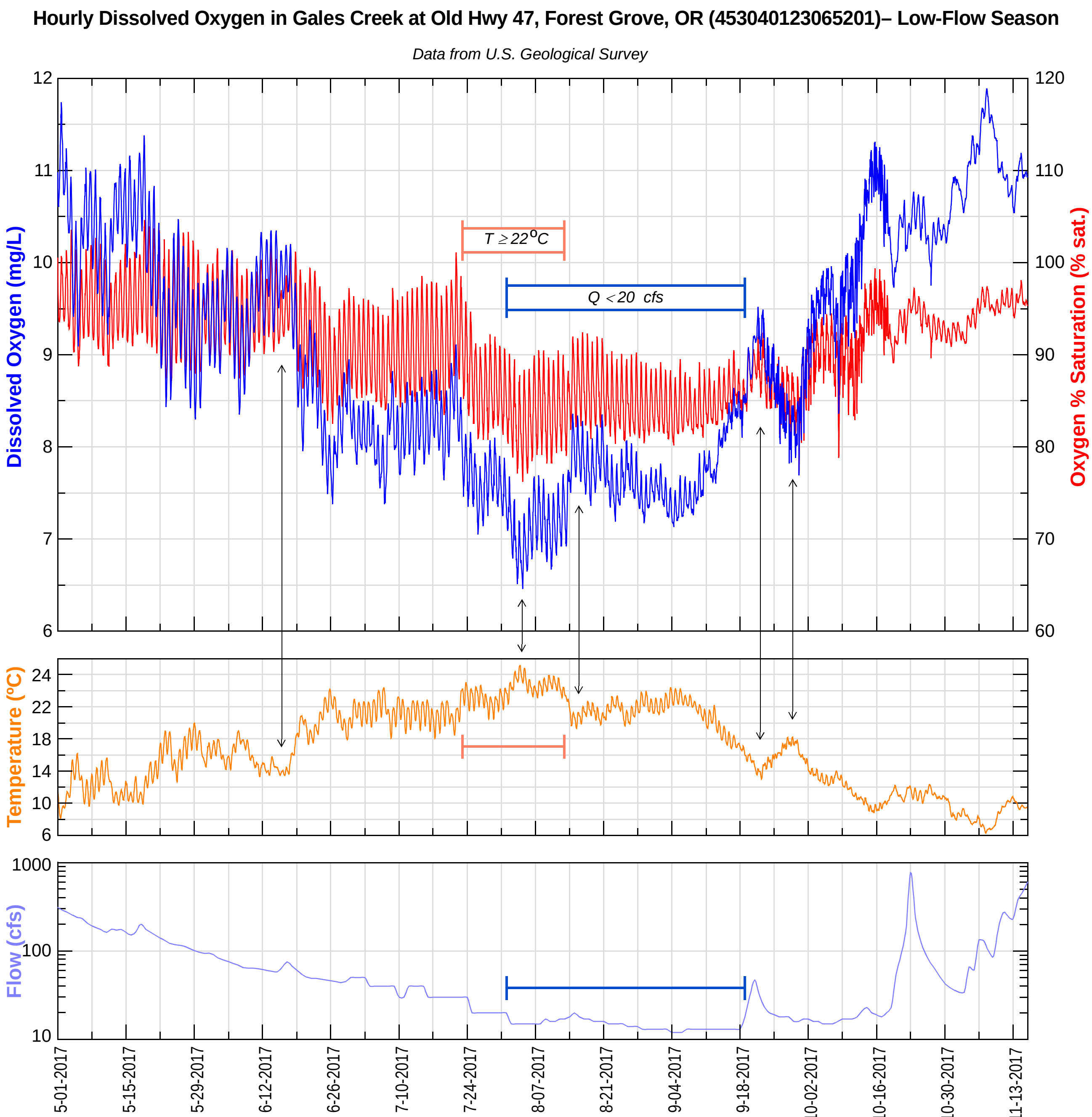
Hourly Dissolved Oxygen in Scoggins Creek below Henry Hagg Lake near Gaston, OR (14202980) – Low-Flow Season

Data from U.S. Geological Survey



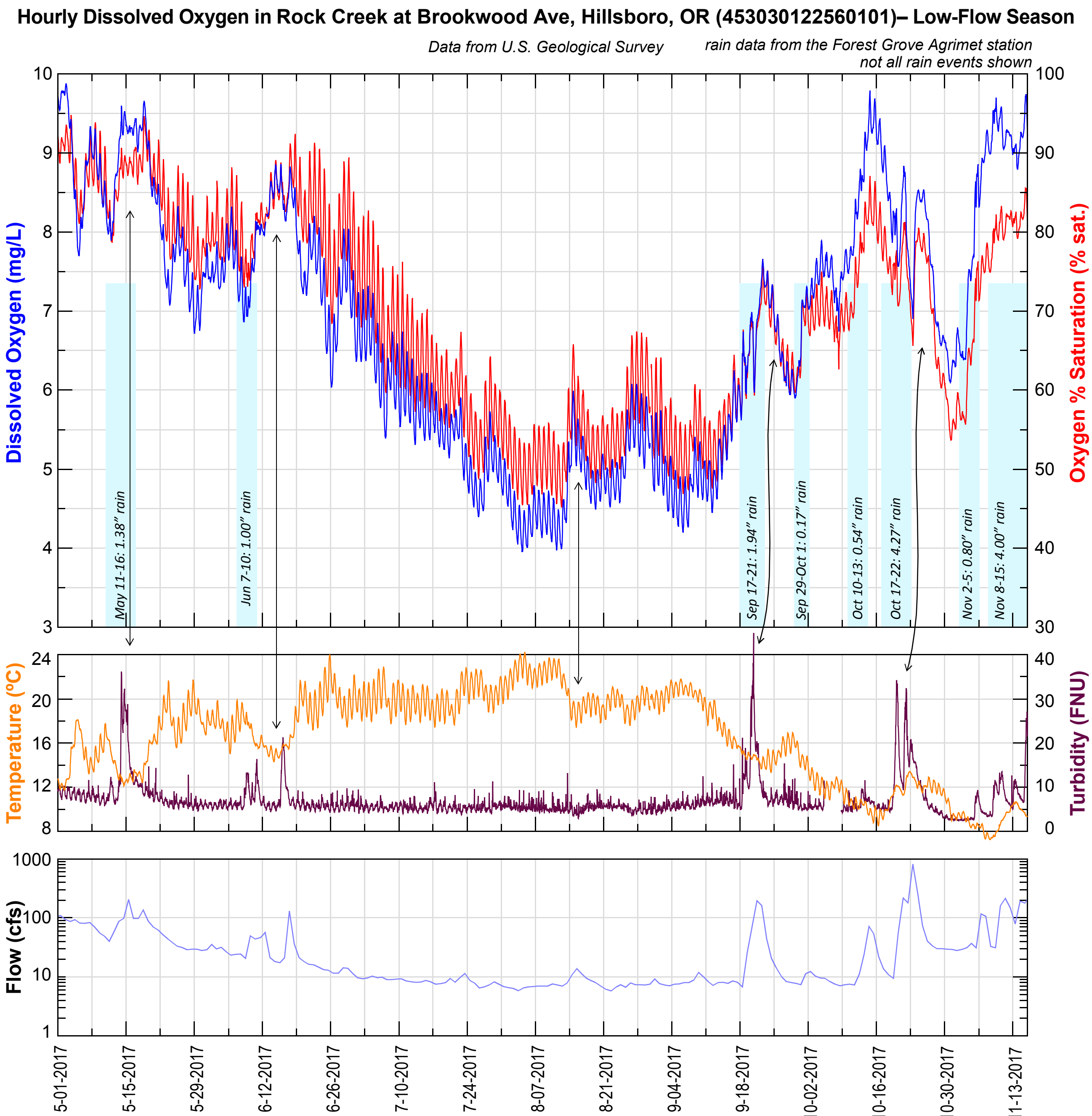
Gales Creek at Old Hwy 47:

- Algal activity at Gales Creek was moderate— more than at RM 24.5 in the Tualatin River, but less than at Oswego Dam. The daily DO range was about 0.5-1 mg/L.
- DO levels at Gales Creek were about 90% saturation or higher until late July. The substrate of Gales Creek is mostly gravel and it has higher flow than many of the valley bottom streams. These conditions lead to less sediment oxygen demand and more reaeration than in valley bottom streams.
- DO levels fell below 90% saturation when the water temperature exceeded 22ºC and the rate of oxygen demand increased. Arrows on the graph show some examples of DO response to temperature changes.
- Beginning in late July and continuing through August, DO saturation dropped an average of 85%. By this time, flows had dropped below 20 cfs and were as low as 12 cfs in September. Low flows exacerbate oxygen loss from sediment oxygen demand because they increase the time that a smaller volume of water is in contact with the sediment.



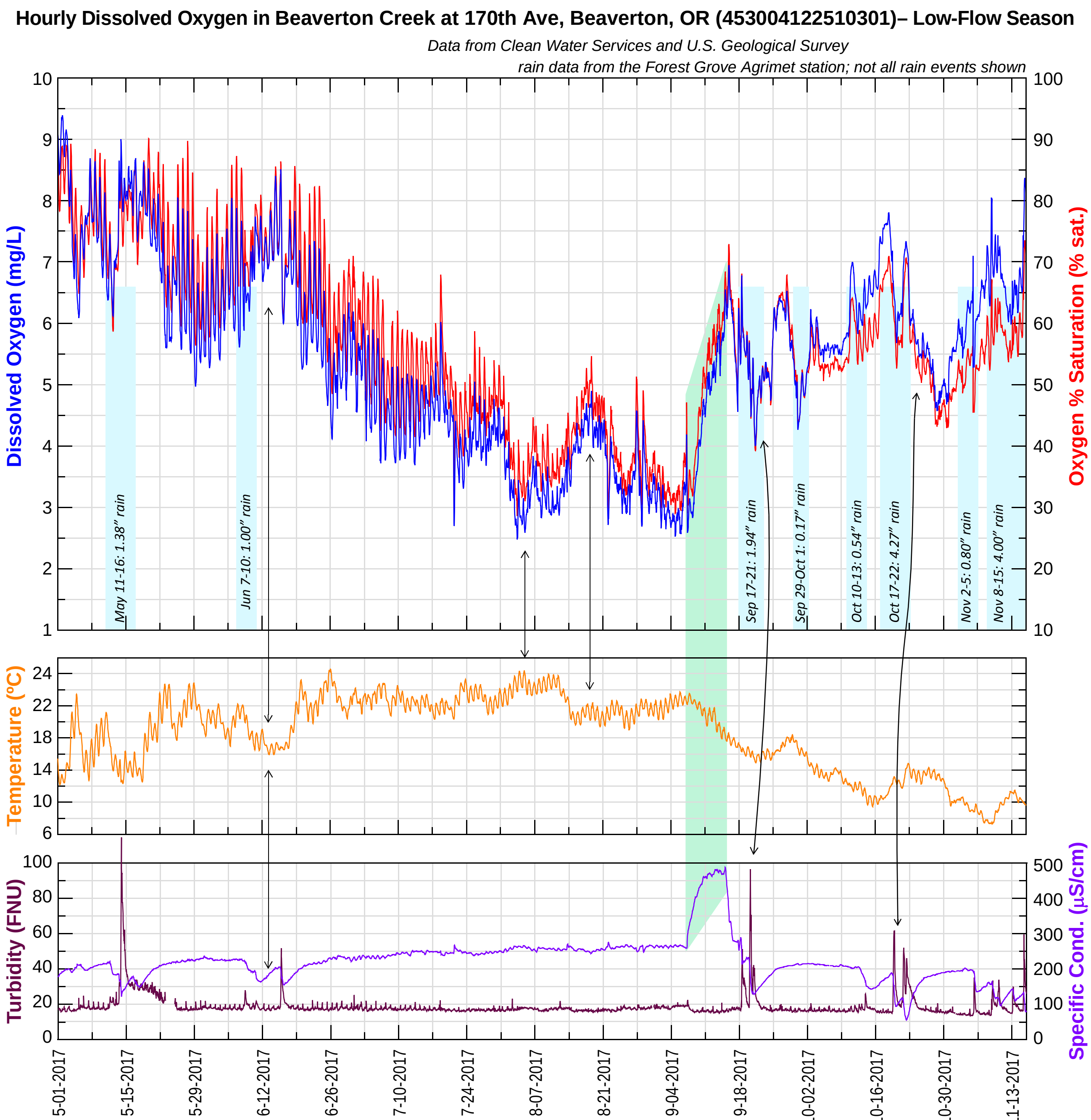
Rock Creek at Brookwood:

- Dissolved oxygen in Rock Creek were lower overall than all other sites except Beaverton Creek. Like Beaverton Creek, Rock Creek is a valley bottom stream with high sediment oxygen demand and little reaeration.
- Temperature strongly affects DO in Rock Creek. Arrows on the graph show some examples when DO was responding to temperature changes in May, June and August.
- The lowest DO levels in Rock Creek occurred in mid-August (50% saturation) when warm water increased the rate of sediment oxygen demand and low flow increased contact time with the sediment and provided less total oxygen due to the decreased water volume.
- Algal activity in Rock Creek was present (daily DO range about 0.5–0.7 mg/L) but slightly less than at Gales Creek.
- Two rainstorms (September 17–21 and October 17–22) were sufficiently intense to increase the turbidity. The oxygen demand associated with turbidity (resuspended sediment and stormwater inflow from the landscape) caused the subsequent sags in DO as noted by the arrows.



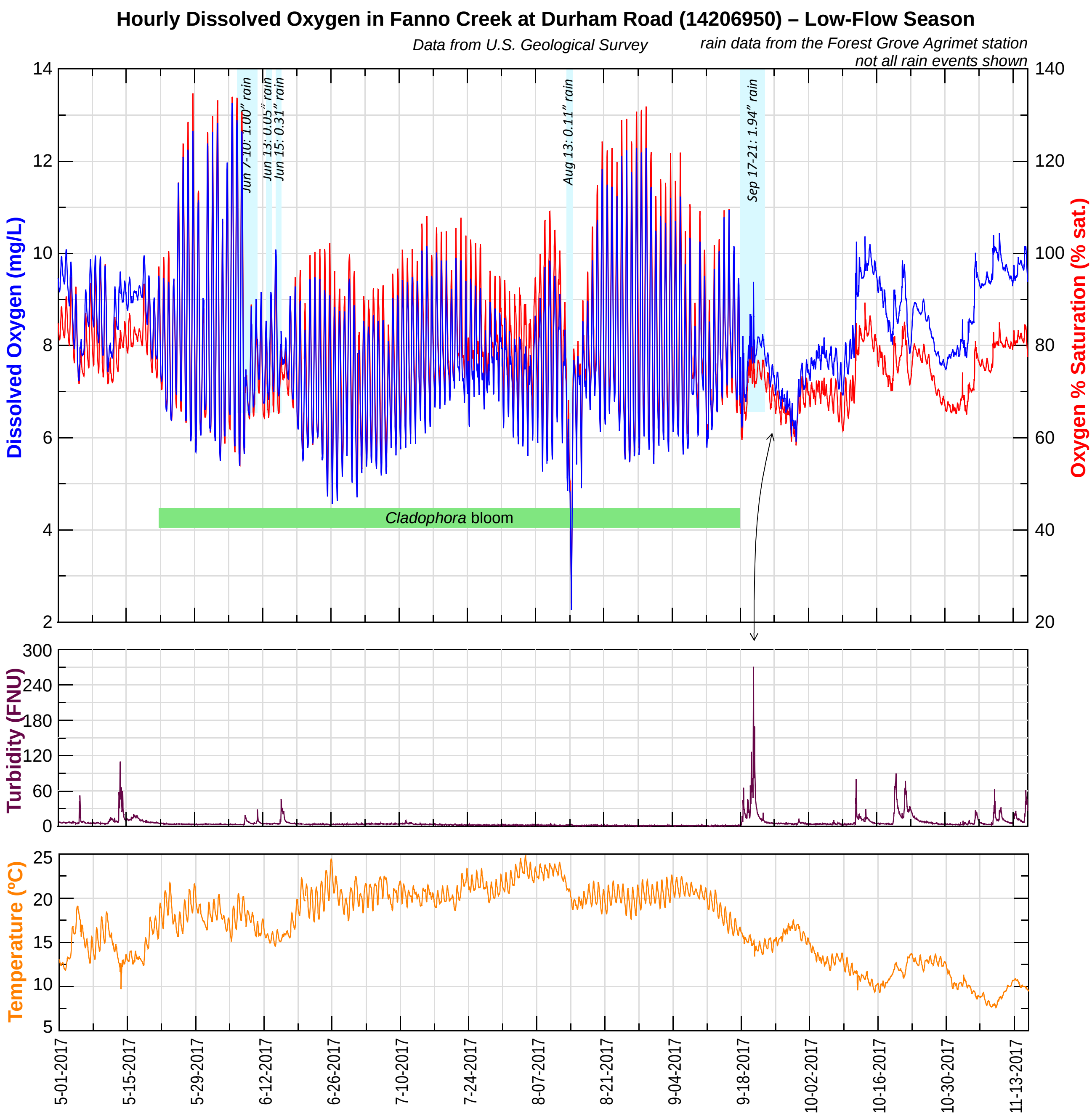
Beaverton Creek at 170th:

- Dissolved oxygen in Beaverton Creek was lower overall than at any other sites. The organic-rich, silty bottom and low flow of Beaverton Creek result in high sediment oxygen demand and little reaeration.
- Both absolute and percent-saturated DO decreased with high stream temperatures; arrows on the graph show some examples. Rates of sediment oxygen demand are greater at higher temperature.
- Based on the daily DO range, algal activity was greater in 2017 than in 2016 by about 0.5 mg/L.
- The lowest DO levels occurred in August and September (<3 mg/L, <35% saturation) when temperatures exceeded 22ºC and flows were expected to be low. (The closest flow monitoring site on Beaverton Creek is more than 4 miles downstream and not an accurate estimate of flow at this site.)
- From September 7–15, DO and specific conductance increased and temperature decreased (green shading), suggesting an influx of well-oxygenated, cooler, high-conductance water from an unknown source.
- The two large rainstorms in September and October caused spikes in turbidity that were followed by sags in DO, indicating increased oxygen demand from resuspended sediment and stormwater inflows.



Fanno Creek at Durham:

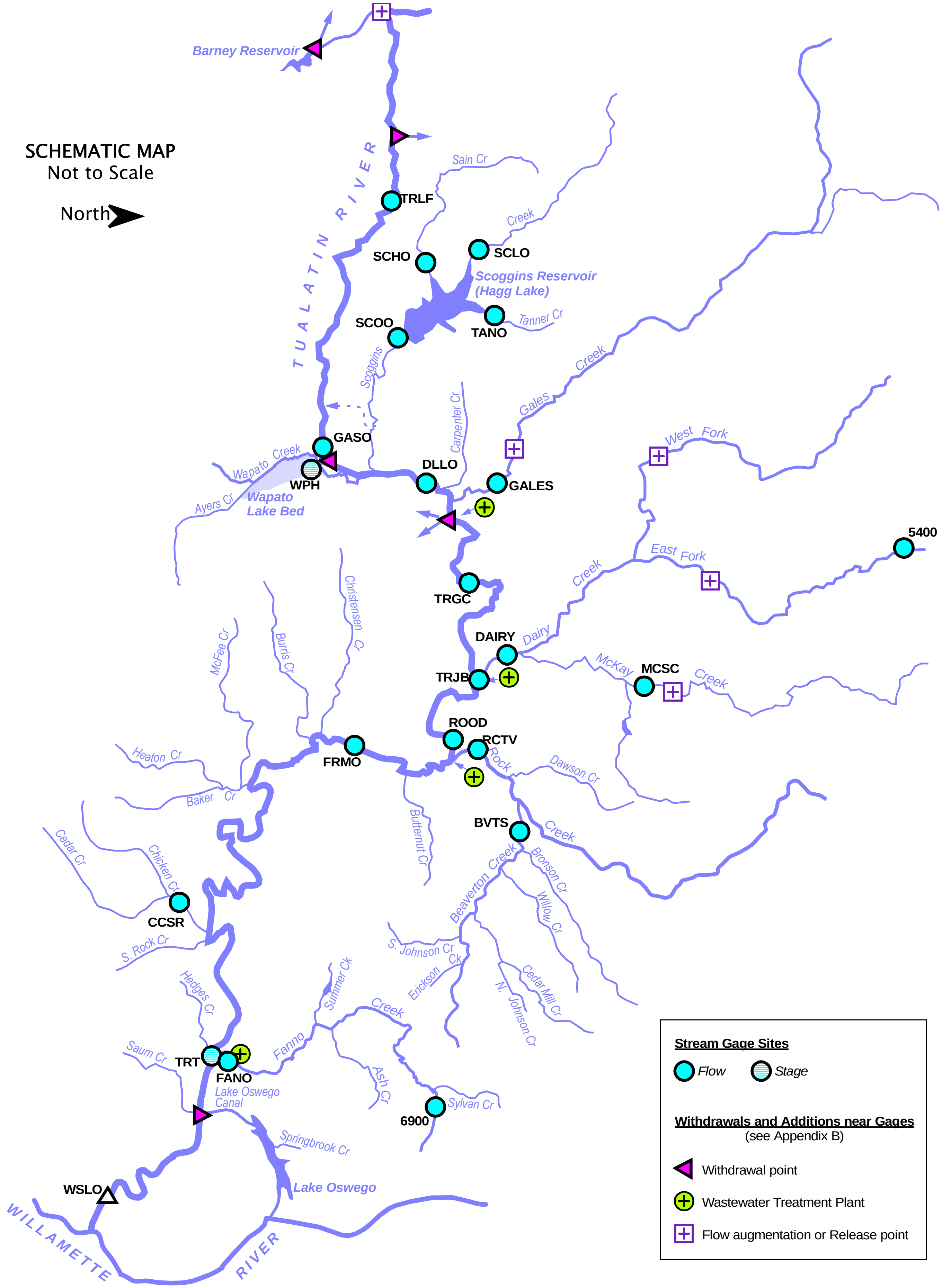
- Algal activity in Fanno Creek was considerably more than at other valley bottom sites, and in 2017 more than in the Tualatin River at Oswego Dam. On some days the range of DO exceeded 6 mg/L. Persons who visited the site identified the algal species as *Cladophora sp*.
- The large bloom caused high pH values (>8 in late May) with a high daily range (0.5–0.8 units).
- The *Cladophora* bloom was stimulated by mostly sunny weather and no rain after mid-June. When a cloudy day occurred on August 13th and decreased the potential for photosynthetic DO production, respiration by the large *Cladophora* population drove the DO concentration down to 2.3 mg/L (24% saturation). This was the lowest DO measured at the Tualatin basin sites in 2017 and the second lowest DO in lower Fanno Creek since continuous monitoring began in 2001. The DO rebounded quickly when sunny weather returned the next day.
- A large rainstorm in mid-September largely curtailed algal activity as evidenced by a sharp decrease in the daily DO range. It also caused a high spike in turbidity and contributed additional oxygen demand either by resuspension of sediment in the stream or transport of oxygen demand from stormwater inflow. Without algal productivity to add oxygen, the increased oxygen demand temporarily decreased DO.



Appendix A

Stream Gage Records

MAP OF STREAM GAGE SITES



STREAM GAGE SITES — ALPHABETICAL LISTING BY SITE CODE

SITE CODE	SITE NAME	RIVER MILE	STATION ID	PAGE
5400	East Fork Dairy Creek near Meacham Corner, OR	12.4	14205400	A-43
6900	Fanno Creek at 56th Avenue	11.9	14206900	A-61
BVTS	Beaverton Creek at Cornelius Pass Road	1.2	14206435	A-52
DAIRY	Dairy Creek at Hwy 8 near Hillsboro, Oregon	2.06	14206200	A-49
DLLO	Tualatin River near Dilley, Oregon	58.8	14203500	A-14
FANO	Fanno Creek at Durham Road near Tigard, Oregon	1.2	14206950	A-64
FRMO	Tualatin River at Farmington, Oregon	33.3	14206500	A-26
GALES	Gales Creek at Old Hwy 47 near Forest Grove, Oregon	2.36	14204530	A-40
GASO	Tualatin River at Gaston, Oregon	62.3	14202510	A-8
MCSC	McKay Creek at Scotch Church Rd above Waible Ck near North Plains, Oregon	6.3	14206070	A-46
RCTV	Rock Creek at Hwy 8 near Hillsboro, Oregon	1.2	14206451	A-55
ROOD	Tualatin River at Rood Bridge Road near Hillsboro, Oregon	38.4	14206295	A-23
SCHO	Sain Creek above Henry Hagg Lake near Gaston, Oregon	1.6	14202920	A-35
SCLO	Scoggins Creek above Henry Hagg Lake near Gaston, Oregon	9.3	14202850	A-32
SCOO	Scoggins Creek below Henry Hagg Lake near Gaston, Oregon	4.80	14202980	A-11
TANO	Tanner Creek above Henry Hagg Lake near Gaston, Oregon	1.6	14202860	A-38
TRGC	Tualatin River at Golf Course Road near Cornelius, Oregon	51.5	14204800	A-17
TRJB	Tualatin River at Hwy 219 Bridge	44.4	14206241	A-20
TRLF	Tualatin River below Lee Falls near Cherry Grove, Oregon	70.7	14202450	A-5
TRT	Tualatin River at Tualatin, Oregon	8.9	14206956	A-70
WPH	Wapato Canal at Pumphouse at Gaston, Oregon	—	14202630	A-67
WSLO	Tualatin River at West Linn	1.75	14207500	A-29

Mainstem sites (plus Scoggins Creek below Hagg Lake) are presented first, followed by the tributaries. Stage only sites are presented last.

Explanation of Figures and Tables in this Appendix

Page 1

A table of 2017 discharge (or water level elevation) for each site is at the top of the page. A graph of the 2017 discharge compared to a statistical summary for the period of record is at the bottom of the page.

Page 2

Page 2 contains a frequency chart and a table of monthly medians of daily mean discharge (or water level) for the period of record. An example section of the frequency chart is shown below. The top row shows the ranges of discharge in each bin. Months are at the left. Each cell is color-coded for the percent of the total distribution in the selected bin and month. The bottom row shows the total for all months. Many sites do not have data for every month or have periods of missing data. The frequency of missing data is shown in the “Missing” column at the far right. Note that missing data are likely to skew the percentages in the bottom row.

FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	0.05 < Q < 0.1	0.1 < Q ≤ 0.5	0.5 < Q ≤ 2	2 < Q ≤ 3	3 < Q ≤ 5	5 < Q ≤ 10	10 < Q ≤ 20	20 < Q ≤ 30	30 < Q ≤ 45	45 < Q ≤ 65	65 < Q ≤ 120	120 < Q ≤ 400	400 < Q ≤ 2,000	Missing
Jan														
Feb														
Mar														
"														
All	0.1%	2.4%	11%	8.0%	10%	12%	13%	9.9%	9.8%	8.7%	9.6%	5.1%	0.1%	0.8%

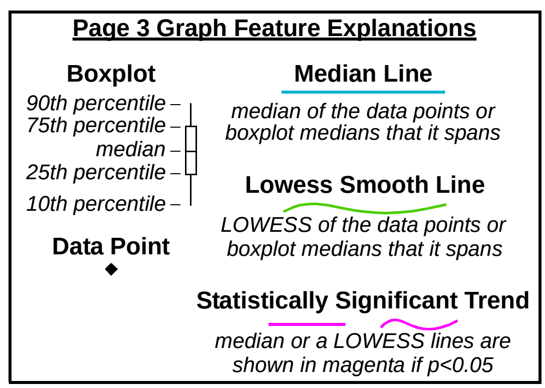
Key
f ≥ 3%
2% ≤ f < 3%
1% ≤ f < 2%
0.2% ≤ f < 1%
0.06% ≤ f < 0.2%
0 < f < 0.06%

The table of monthly medians of mean daily discharge is color-coded by the percentile of each entry. Two keys for the color code are at the right— the upper one is in units of discharge and the lower one is as percentile. Note that missing data are likely to skew the percentiles relative to the true annual distribution. Medians are not shown if more than 20% of the data for the month are missing.

Page 3

In addition to figures, page 3 contains a discussion of charts and graphs for the site, including a trend analysis.

The graphs on page 3 focus on high flow and low flow periods. An explanation of the features used in these graphs is shown at the right. Low flow season is almost always during July-August and boxplots of discharge for these months are shown for all sites. Similarly, December-January (by water year) was chosen to be representative of high flow. Flows during select other months are shown for some sites.



In order to identify when “low” or “high” flow starts, somewhat arbitrary definitions were developed.

Low flow: The uppermost graph shows the date when the low flow period began for each year. The beginning of “low flow” is defined as:

- the first day after March 31 when the 7-day median discharge is less than a specified value that
  - a) *for mainstem sites:* correlates with a 7-day median discharge of 200 cfs at Farmington
  - b) *for tributary sites:* is a round number near the 25th percentile

High flow: The definition of the beginning of “high flow” season, or more accurately, rainy season flow is based on the ODEQ criteria for the TMDL that uses discharge at Tualatin River at Farmington.The beginning of the rainy season flow regime is defined as:

- the first day after August 31 when the 7-day median discharge for 7 consecutive days is greater than a specified value that
- a) *for mainstem sites:* correlates with a 7-day median discharge of 350 cfs at Farmington
  b) *for tributary sites:* is a rounded number near the 75th percentile
- and the difference between the daily maximum and minimum within the 7-day median period is at least 50% of their average

14202450 — TUALATIN RIVER BELOW LEE FALLS NEAR CHERRY GROVE, OREGON — TRLF

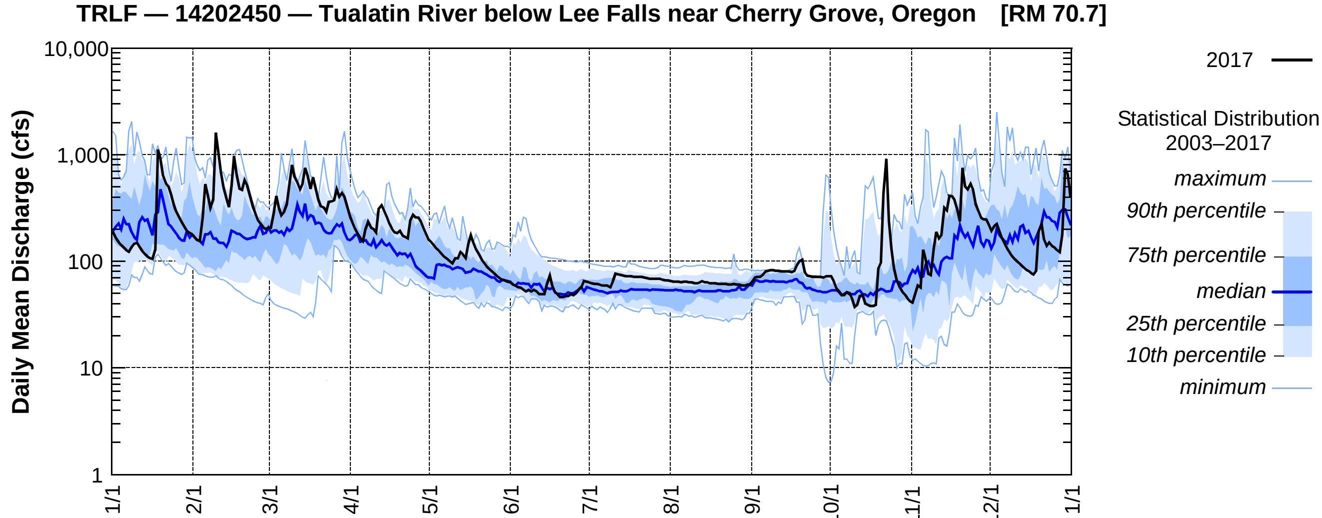
Data source: Oregon Water Resources Division

River mile: 70.7 *Latitude:* 45 30 21 *Longitude:* 123 13 06

Day	2017 Daily Mean Discharge in Cubic Feet per Second†											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	184	167	206	267	159	63	63	65	64	72	41	192
2	165	157	205	229	150	60	62	64	70	65	49	214
3	151	155	281	201	141	59	61	64	71	55	59	224
4	142	257	408	178	131	57	61	64	71	52	56	193
5	134	527	316	164	124	56	60	63	74	48	128	164
6	127	414	270	154	116	54	59	64	80	48	103	145
7	123	316	289	200	109	52	59	64	81	51	76	130
8	136	382	344	234	105	54	59	63	82	50	74	119
9	146	1610	527	206	100	52	57	63	82	44	131	111
10	149	1040	798	201	95	54	65	62	81	37	188	104
11	136	680	615	186	106	52	76	62	81	39	163	98
12	124	493	544	309	106	49	75	63	80	47	176	93
13	117	389	472	335	122	49	74	65	80	48	316	88
14	111	320	536	295	116	49	73	63	80	40	299	84
15	107	502	752	261	107	61	72	63	80	39	408	81
16	105	970	633	225	144	73	72	62	79	38	407	77
17	129	649	477	202	174	58	72	62	81	38	373	75
18	1110	479	609	186	148	51	71	62	92	39	301	81
19	913	466	486	183	129	49	71	61	100	86	235	193
20	633	574	381	192	116	46	71	61	103	98	750	226
21	534	510	327	175	105	46	71	61	79	436	503	158
22	502	406	318	169	97	47	70	61	73	909	474	139
23	422	333	290	164	89	47	69	60	72	239	532	150
24	344	281	359	243	84	49	68	60	71	130	465	139
25	292	244	363	272	80	48	68	61	71	85	345	134
26	258	227	373	258	76	50	68	60	71	65	298	126
27	232	207	473	255	72	54	68	60	71	57	256	121
28	210	201	404	233	69	57	68	59	70	52	247	179
29	193	206	436	203	67	65	67	59	72	49	245	741
30	184	—	401	180	66	64	66	60	72	45	220	656
31	177	—	320	—	64	—	66	60	—	42	—	408
TOTAL	8290	13162	13213	6560	3367	1625	2082	1921	2334	3143	7918	5643
MEAN	267	454	426	219	109	54.2	67.2	62.0	77.8	101	264	182
MAX	1110	1610	798	335	174	73	76	65	103	909	750	741
MIN	105	155	205	154	64	46	57	59	64	37	41	75
AC-FT	16443	26106	26208	13012	6678	3223	4130	3810	4629	6234	15705	11193

† All 2017 data are provisional–subject to revision

TRLF — 14202450 — Tualatin River below Lee Falls near Cherry Grove, Oregon [RM 70.7]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	7 < Q < 10	10 < Q ≤ 35	35 < Q ≤ 45	45 < Q ≤ 50	50 < Q ≤ 60	60 < Q ≤ 70	70 < Q ≤ 85	85 < Q ≤ 120	120 < Q ≤ 170	170 < Q ≤ 250	250 < Q ≤ 500	500 < Q ≤ 1,700	1,700 < Q ≤ 3,000
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.1%	3.9%	7.9%	6.5%	13%	11%	9.4%	11%	11%	9.5%	12%	4.9%	0.1%

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003	206	177	350	165	45.8	48.5	51.1	67.2	55.9	39.2	38	182
2004	247	214	118	76	46.1	57.7	57.9	50.2	45.3	44.6	42.4	75.1
2005	88.2	60.4	40	134	62.6	44.3	41.1	50.1	65.4	51.4	119	116
2006	532	148	161	120	52.2	50	43.3	31.8	65.9	68.5	377	292
2007	169	144	206	91.6	47.4	40.7	40.7	29.9	45.7	40.5	47.1	306
2008	270	182	216	178	97	47.5	36	40	48	46	82	76
2009	251	80	181	119	102	47	50	43	52	43	211	116
2010	389	161	139	228	98	83.5	63	58	64	54	125	346
2011	207	110	359	306	150	107	89	87	74	26.	40	58
2012	279	206	298	169	93	57.5	57	63	68.5	60	202	397
2013	164	152	138	107	80	64.5	50	53	59	56	77	81
2014	100	234	287	151	105	56.5	54	51	62	54	111.5	244
2015	171	145	97	74	72	65	62	58	79	51	108	523
2016	368	265	316	83.5	59	65.5	53	50	64	156	200	289
2017	165	398	401	203	106	53	68	62	79	50	246	139
Median	210	169	206	133	73	56	53	52.7	62	52	117	198

Key

Q in cfs

- Q ≤ 37
- 37 < Q ≤ 43
- 43 < Q ≤ 47
- 47 < Q ≤ 51
- 51< Q ≤ 58
- 58< Q ≤ 66
- 66 < Q ≤ 80
- 80 < Q ≤ 177
- 177 < Q ≤ 346
- 346 < Q ≤ 499
- Q > 499

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

- The highest flow months are December through March due to normal patterns in rainfall.
- The lowest flow months are July, August and October. Flow during this time is mostly controlled by releases from Barney Reservoir. Most of the released water is withdrawn downstream for municipal use. Flows during September are likely higher because of Barney releases for Clean Water Services that historically started in September.

Seasonal onsets

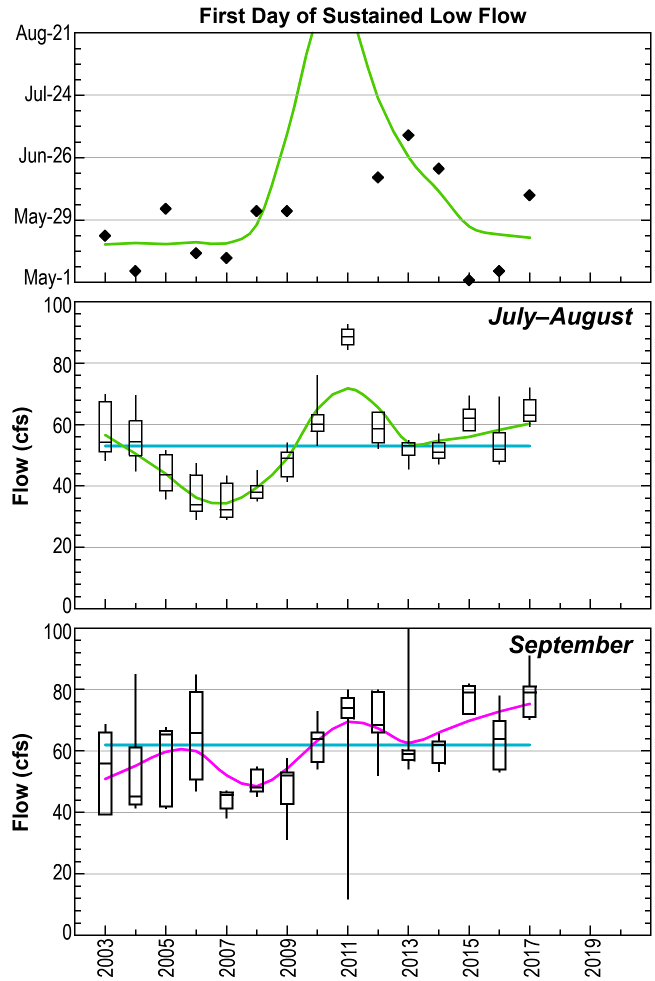
- Low flow criterion: 7d-Q ≤ 55 cfs (~27th pctl)
- Low flow did not occur in 2010 and not until 9/30 in 2011.
- Rainy season criterion: 7d-Q ≥ 80 cfs (~50th pctl)

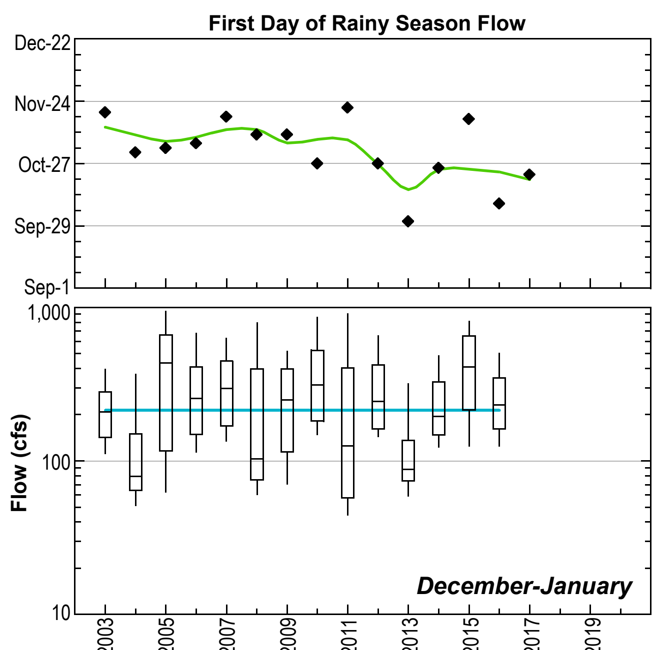
Trends

- Flow during the dry season generally has increased although there is substantial variability year-to-year. The trend is statistically significant for September.
- For the rainy season, onset may be trending earlier, although the trend is not statistically significant.
- No trends are evident for the magnitude of the December–January rainy season flow.

Anomalies

- To facilitate repairs of Eldon Mills Dam in 2011, higher than normal releases from Barney Reservoir occurred mid-April through late-September after which releases were temporarily discontinued.





14202510 — TUALATIN RIVER AT GASTON, OREGON — GASO

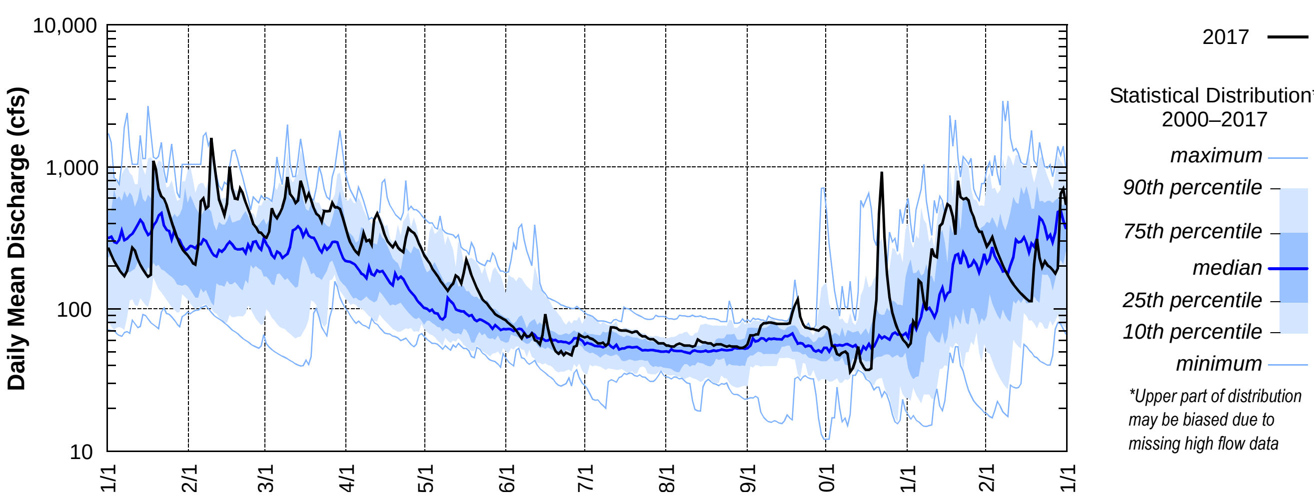
Data source: Oregon Water Resources Division

River mile: 62.3 *Latitude:* 45 26 21 *Longitude:* 123 07 85

Day	2017 Daily Mean Discharge in Cubic Feet per Second[†]											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	264	225	325	378	238	83	63	55	56	74	54	275
2	239	209	317	327	223	79	64	55	65	71	57	295
3	216	205	351	291	210	76	62	54	65	55	81	321
4	201	277	511	267	193	74	61	54	66	54	75	282
5	188	574	459	252	182	70	59	56	66	48	158	250
6	178	600	436	242	170	66	57	57	76	47	152	223
7	170	508	468	283	158	62	57	56	79	49	113	202
8	186	526	518	341	150	67	58	55	79	50	98	185
9	222	1600e	600e	299	142	64	55	55	80	48	186	171
10	270	1100e	850e	305	134	64	57	55	80	36	266	159
11	257	800e	645	282	144	67	74	54	79	38	236	149
12	223	592	606	425	150	60	74	55	78	43	231	141
13	203	519	555	469	171	59	73	61	78	54	382	134
14	189	458	578	423	166	56	71	59	78	42	399	128
15	177	550e	800e	380	150	65	70	58	78	39	470	122
16	168	1000e	700e	331	178	92	70	58	78	37	543	117
17	174	700e	584	301	220	73	70	57	79	37	527	113
18	1100e	597	650e	284	198	61	69	57	93	38	445	113
19	950e	592	582	272	172	55	68	55	106	81	332	206
20	700e	700e	511	292	153	50	69	56	117	116	800e	310
21	616	653	466	270	139	48	69	56	87	463e	610	228
22	595	560	448	258	128	50	66	56	78	921e	592	197
23	539	502	409	250	118	47	64	55	74	323	602	216
24	471	450	488	315	112	49	64	54	73	176	580	202
25	409	397	486	369	108	48	62	55	72	120	485	197
26	357	376	488	354	102	47	61	54	72	93	441	188
27	315	345	555	343	97	54	61	54	71	81	377	177
28	284	343	516	319	92	55	59	54	70	72	348	194
29	263	325	520	286	89	66	57	53	73	66	348	650e
30	248	—	505	263	87	64	57	53	75	61	309	700e
31	238	—	438	—	85	—	57	54	—	58	—	550
TOTAL	10610	16283	16365	9471	4659	1871	1978	1720	2321	3491	10297	7395
MEAN	342	561	528	316	150	62.4	63.8	55.5	77.4	113	343	239
MAX	1100	1600	850	469	238	92.0	74.0	61.0	117	921	800	700
MIN	168	205	317	242	85.0	47.0	55.0	53.0	56.0	36.0	54.0	113
AC-FT	21045	32297	32459	18785	9241	3711	3923	3412	4604	6924	20424	14668

[†] All 2017 data are provisional–subject to revision; e=estimated value

GASO — 14202510 — Tualatin River at Gaston, Oregon [RM 62.3]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	10 < Q < 15	15 < Q ≤ 30	30 < Q ≤ 45	45 < Q ≤ 55	55 < Q ≤ 65	65 < Q ≤ 75	75 < Q ≤ 100	100 < Q ≤ 160	160 < Q ≤ 250	250 < Q ≤ 400	400 < Q ≤ 700	700 < Q ≤ 2,000	2,000 < Q ≤ 5,000
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.1%	2.2%	8.4%	12%	11%	8.5%	11%	11%	11%	11%	9.9%	4.3%	0.1%

Key

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	442	310	278	86	70	75	62	51	68	65	57	72
2001	78	103	81	72	68	38	32	30	24	36	95	571
2002	479	391	286	172	61	51	48	52	56	45	35	229
2003	353	315	545	307	98	57	54	73	65	41	47	320
2004	372	357	179	114	71	70	64	55	52	63	67	113
2005	123	78	52	179	99	57	45	52	71	85	184	235
2006	855	216	240	175	70	58	39	32	62	69	452	446
2007	256	189	300	120	56	42	40	35	48	55	77	426
2008	366	303	276	217	111	58	41	40	45	50	102	86
2009	379	102	248	155	126	62	50	40	48	47	284	199
2010	587	270	238	325	119	123	66	58	62	65	167	507
2011	385	296	583	482	260	123	87	85	69	24	42	64
2012	359	271	454	242	113	68	61	65	68	64	294	671
2013	224	181	180	126	83	72	49	50	59	61	103	102
2014	134	382	427	231	138	68	52	48	59	52	123	399
2015	255	231	152	101	72	62	58	54	77	47	149	840
2016	615	499	583	117	67	65	48	44	60	194	262	386
2017	248	538	511	300	150	63	63	55	78	55	348	197
Median	338	277	281	163	88	63	53.0	50.6	59.0	56	126	295

Key

Q in cfs
Q ≤ 36
36 < Q ≤ 44
44 < Q ≤ 49
49 < Q ≤ 53
53 < Q ≤ 60
60 < Q ≤ 71
71 < Q ≤ 88
88 < Q ≤ 247
247 < Q ≤ 493
493 < Q ≤ 659
Q > 659

Q as percentile
Q ≤ 5th
5th < Q ≤ 10th
10th < Q ≤ 15th
15th < Q ≤ 20th
20th < Q ≤ 30th
30th < Q ≤ 40th
40th < Q ≤ 50th
50th < Q ≤ 75th
75th < Q ≤ 90th
90th < Q ≤ 95th
Q > 95th

Distribution

- The highest flow months are December and January due to normal patterns in rainfall. Although low flows are less common during these months, they do occur, especially in December.
- The lowest flow months are July and August, but may persist into October. Flow during this time is mostly controlled by releases from Barney Reservoir. Most of the released water is withdrawn downstream for municipal use. Flows during September are likely higher because of Barney releases for Clean Water Services that historically started in September.

Seasonal onsets

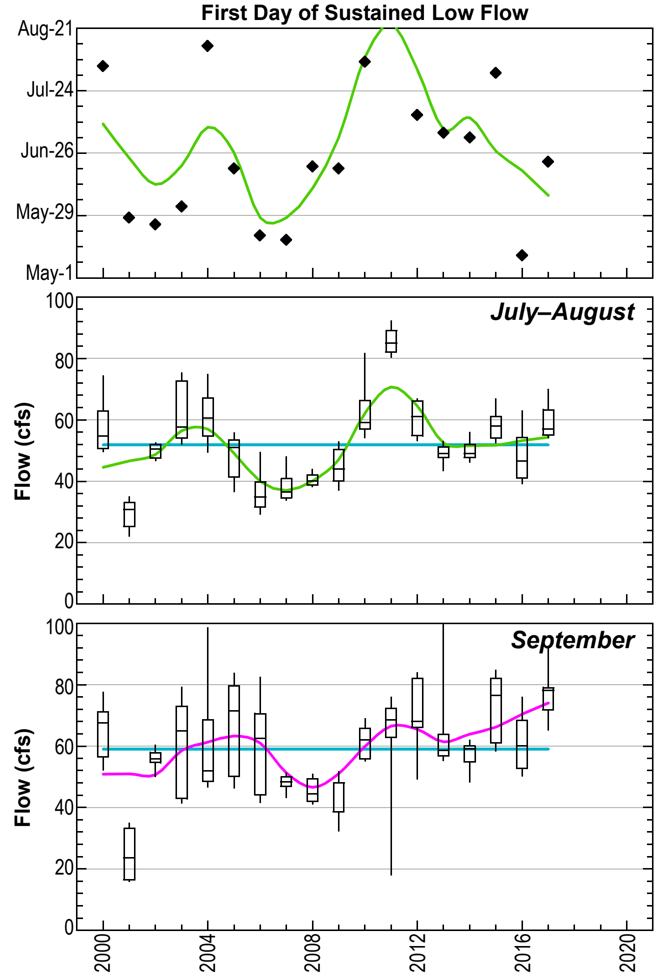
- Low flow criterion: 7d-Q ≤ 55 cfs (~23rd pctl)
- Low flow did not occur until 9/30 in 2011.
- Rainy season criterion: 7d-Q ≥ 85 cfs (~48th pctl)

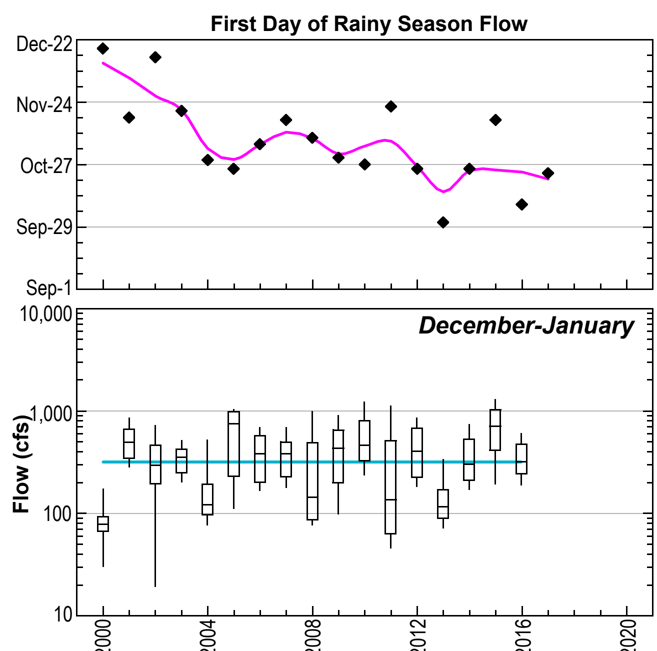
Trends

- Flow during the dry season generally has increased although there is substantial variability year-to-year. The trend is statistically significant for September.
- For the rainy season, onset is arriving earlier; the trend is statistically significant.
- No trends are evident for the magnitude of the December–January rainy season flow.

Anomalies

- To facilitate repairs of Eldon Mills Dam in 2011, higher than normal releases from Barney Reservoir occurred mid-April through late-September after which releases were temporarily discontinued.



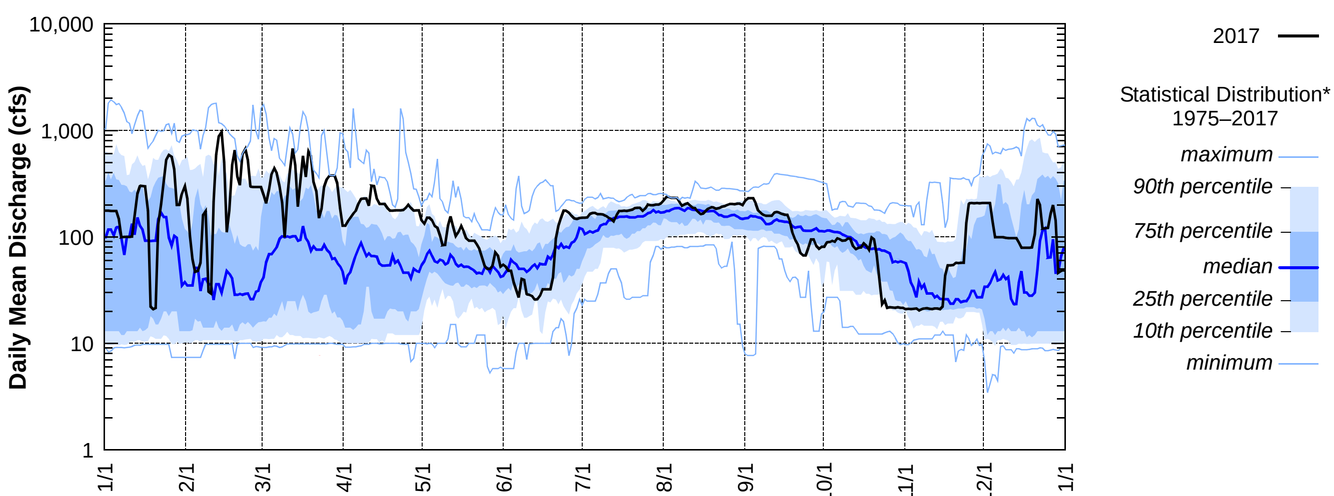


Data source: Bureau of Reclamation (in cooperation with District 18 Watermaster)

River mile: 4.8 *Latitude:* 45 28 10 *Longitude:* 123 11 56

Day	2017 Daily Mean Discharge in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	176	227	293	127	144	54.6	152	221	219	80.8	21.0	208
2	176	103	248	127	134	52.5	151	236	231	88.9	21.1	208
3	175	61.8	206	140	151	48.0	153	236	231	89.6	21.0	207
4	175	47.1	277	151	151	48.0	164	232	231	91.7	21.1	141
5	175	48.0	392	166	143	37.8	168	232	206	90.3	21.3	99.2
6	147	57.1	442	176	127	32.0	167	231	176	97.0	20.4	99.2
7	99.4	161	394	205	122	27.0	163	212	167	94.9	21.0	99.2
8	99.7	175	298	228	103	40.5	163	197	161	92.1	21.3	99.3
9	100	30.4	210	228	83.5	39.6	162	202	158	92.4	21.4	97.8
10	100	29.2	99.0	228	84.3	28.9	158	206	158	96.8	21.1	97.4
11	101	214	232	197	128	28.7	152	196	158	95.6	21.0	97.4
12	156	593	412	303	156	27.9	148	187	169	82.1	21.2	97.2
13	255	881	676	300	125	25.8	140	187	172	77.0	21.2	97.3
14	301	968	473	226	102	26.0	160	173	169	78.8	21.0	88.0
15	300	504	193	204	111	28.0	175	163	164	79.4	22.1	79.0
16	298	111	327	204	127	32.1	175	166	161	87.1	43.4	78.9
17	176	177	578	204	113	32.1	176	175	161	82.9	54.0	79.1
18	22.2	477	365	186	96.3	32.2	175	184	139	75.2	54.0	79.2
19	21.0	654	634	176	91.9	32.1	177	190	109	98.6	54.4	79.5
20	21.6	369	569	177	92.0	41.5	180	189	92.9	94.7	56.9	106
21	132	305	327	177	92.0	96.2	186	184	84.3	69.0	56.5	228
22	203	597	267	177	84.9	127	188	185	70.4	39.6	56.9	199
23	326	673	150	177	76.9	151	188	191	66.9	23.4	57.2	120
24	530	525	183	178	64.8	176	176	194	66.8	25.4	135	121
25	590	295	295	187	52.8	177	184	199	79.5	21.5	206	121
26	564	294	346	201	50.0	169	201	204	94.7	21.8	207	163
27	430	294	377	187	50.0	157	198	204	94.6	21.7	207	200
28	199	294	376	176	53.8	149	198	202	82.5	21.6	207	143
29	199	293	376	177	71.9	147	201	205	77.5	21.8	207	46.0
30	257	—	321	177	66.7	150	201	204	80.4	21.6	208	48.0
31	301	—	186	—	52.6	—	206	200	—	21.5	—	48.6
TOTAL	6808	9456	10523	5767	3101	2216	5383	6188	4229	2075	2128	3675
MEAN	220	326	339	192	100	73.9	174	200	141	66.9	70.9	119
MAX	590	968	676	303	156	177	206	236	231	98.6	208	228
MIN	21.0	29.2	99.0	127	50.0	25.8	140	163	66.8	21.5	20.4	46.0
AC-FT	13504	18755	20873	11438	6150	4396	10677	12273	8388	4116	4221	7289

SCOO — 14202980 — Scoggins Creek below Henry Hagg Lake near Gaston, Oregon [RM 4.8]



14202980 — SCOGGINS CREEK BELOW HENRY HAGG LAKE NEAR GASTON, OREGON — SCOO

Data source: Bureau of Reclamation (in cooperation with District 18 Watermaster)

FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	1 < Q < 6	6 < Q ≤ 11	11 < Q ≤ 20	20 < Q ≤ 30	30 < Q ≤ 50	50 < Q ≤ 75	75 < Q ≤ 100	100 < Q ≤ 130	130 < Q ≤ 160	160 < Q ≤ 200	200 < Q ≤ 350	350 < Q ≤ 1,200	1,200 < Q ≤ 2,000
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.1%	4.7%	10%	8.8%	10%	11%	11%	11%	9.0%	10%	9.0%	5.1%	0.2%

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1975	98.0	93.0	166	34.0	65.0	50.5	154	271	348	35.0	37.0	31.0
1976	86.0	24.0	124	85.0	45.0	31.0	95.0	94.0	171	140	23.0	14.0
1977	13.0	10.0	11.0	10.5	21.0	10.0	82.0	82.0	81.5	13.3	76.7	374
1978	181	41.7	28.6	60.3	76.7	33.3	84.8	122	215	173	16.0	14.0
1979	14.0	14.0	45.0	21.0	49.0	33.0	92.0	121	141	142	31.5	150
1980	205	22.0	135	74.0	35.0	29.0	80.0	117	123	84.0	78.5	123
1981	21.0	32.5	47.0	55.0	35.0	50.0	78.0	176	104	130	129	353
1982	228	217	199	142	74.0	73.0	82.0	107	103	150	131	341
1983	333	76.0	343	97.5	55.0	67.4	49.1	104	155	175	119	348
1984	65.1	66.1	59.1	60.0	76.0	68.7	108	157	107	112	212	126
1985	21.0	17.9	12.0	12.0	90.6	99.9	178	142	66.7	31.0	22.0	50.0
1986	11.0	51.0	98.1	13.0	45.9	91.8	149	158	88.4	27.0	19.0	9.0
1987	27.0	13.5	194	36.0	34.0	54.5	173	162	91.0	45.0	16.0	13.0
1988	15.0	13.0	14.0	41.0	52.0	47.5	143	166	136	90.0	27.0	27.0
1989	120	18.0	175	36.0	26.0	72.0	144	158	152	116	31.5	13.0
1990	12.0	63.5	150	15.0	33.0	54.0	188	177	114	98.0	19.0	9.9
1991	10.0	10.0	69.0	107	37.0	23.0	148	192	152	135	17.0	9.1
1992	9.9	11.0	11.0	10.5	30.0	105	164	175	102	66.0	22.0	11.0
1993	12.0	11.0	12.0	135	82.0	32.0	44.0	118	179	102	107	13.0
1994	14.0	12.0	76.0	36.0	30.0	30.0	201	188	132	83.0	22.0	17.0
1995	585	145	177	62.0	47.0	57.0	134	181	128	54.0	21.0	569
1996	334	609	32.0	202	116	38.5	181	204	93.0	75.0	24.0	57.0
1997	365	78.0	221	10.0	74.0	46.5	129	209	192	61.0	38.0	372
1998	211	172	193	35.5	59.0	50.0	133	149	199	104	39.0	121
1999	409	582	158	52.5	53.0	111	167	183	170	112	26.5	73.0
2000	191	25.0	94.0	15.5	37.0	89.0	133	173	135	113	51.0	10.0
2001	9.8	9.8	10.0	9.9	10.0	68.5	105	99.0	79.5	43.4	14.3	16.7
2002	230	54.6	92.0	80.8	46.9	122	154	160	169	134	29.5	9.7
2003	13.3	104	199	127	63.6	108	162	177	154	116	90.5	10.7
2004	10.7	117	50.5	51.0	39.7	90.6	158	204	103	95.0	20.8	10.7
2005	10.4	10.6	9.9	10.5	81.0	51.3	168	197	155	105	21.2	10.8
2006	688	75.1	33.7	66.1	45.0	60.4	176	205	156	79.2	20.8	201
2007	193	25.4	99.4	39.8	52.3	145	182	202	180	49.0	21.2	23.4
2008	289	107	33.2	96.0	73.6	50.2	186	178	174	105	22.3	19.6
2009	58.2	15.9	16.6	57.0	110	58.0	180	183	154	74.4	21.7	90.0
2010	207	99.1	68.6	169	87.4	154	139	174	98.9	79.0	27.2	318
2011	222	28.4	290	174	97.5	51.8	99.4	134	149	92.0	50.5	56.0
2012	309	82.5	249	113	100	55.0	158	187	167	63.0	113	386
2013	124	27.5	25.0	14.0	36.0	67.0	184	182	97.5	32.0	33.0	91.0
2014	47.0	48.5	299	98.0	111	89.5	178	198	164	82.0	26.0	24.0
2015	152	85.5	47.0	20.5	67.0	170	225	214	115	85.0	20.5	208
2016	292	105	290	59.0	36.6	124	167	194	120	22.0	26.1	397
2017	176	294	327	182	96.3	41.0	175	199	158	80.8	32.8	99.2
Median	98.8	32.0	74.3	55.4	54.0	60.9	147	169	134	90.0	27.0	43.0

Key

Q in cfs

- Q ≤ 11.0
- 11.0 < Q ≤ 13.3
- 13.3 < Q ≤ 19
- 19 < Q ≤ 24
- 24 < Q ≤ 40
- 40 < Q ≤ 62
- 62 < Q ≤ 86
- 86 < Q ≤ 158
- 158 < Q ≤ 227
- 227 < Q ≤ 357
- Q > 357

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

- The very highest flows occur December through April, but the average high flow months are July and August. Flows are determined by the operation of Scoggins Dam.
- The lowest flows occur December through April and are due to the filling of Scoggins Reservoir. The month with average lowest flow is November when water is not being released for municipal use or irrigation and the reservoir is filling.

Seasonal onsets

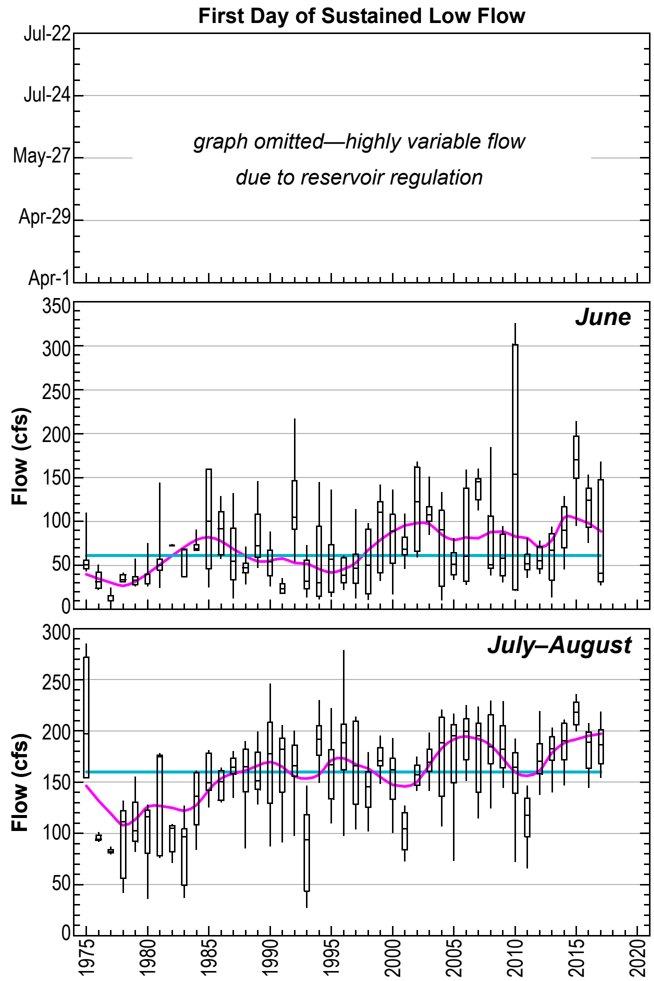
- At this site, flow is more related to reservoir operation than rainfall. Analysis of the first day of sustained low or rainy season flows was not meaningful.
- Low or high flows are often not sustained for more than 2 weeks. Distinguishing between reservoir releases and rainfall is nearly impossible.

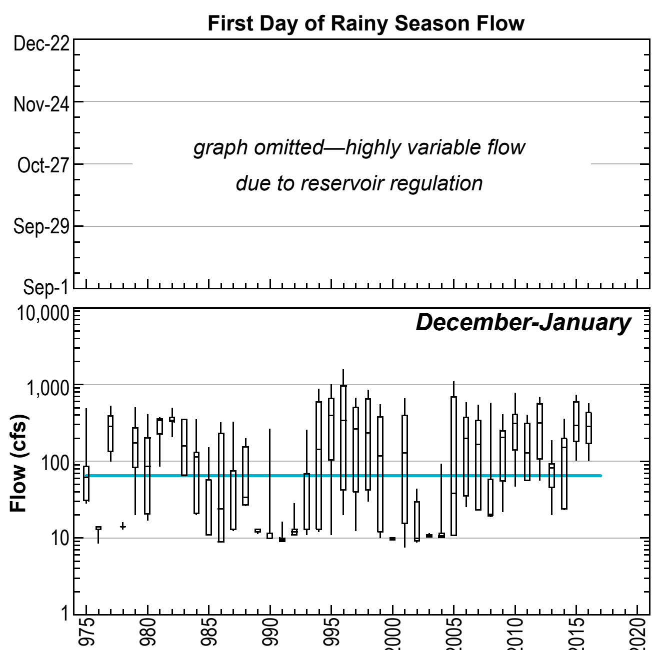
Trends

- Flow during the summer season generally has increased although there is substantial variability year-to-year. The trend is statistically significant for June through August.
- No trends are evident for the magnitude of the December–January flow.

Anomalies

- 1993: Spring was very wet. Flow regulation did not start until July. Therefore, releases were low in early July. Flow augmentation water was also being saved for use later in the year.
- 2001: The reservoir did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.
- 2011: Joint Water Commission was releasing more water than usual from Barney Reservoir and therefore decreased their releases from Scoggins Reservoir.
- Winter releases can be highly variable due to reservoir operations when water is being passed or stored. When water is mostly being stored for an entire month, winter releases are small and must be at least 10 cfs for the benefit of fish.





14203500 — TUALATIN RIVER NEAR DILLEY, OREG. — DLLO

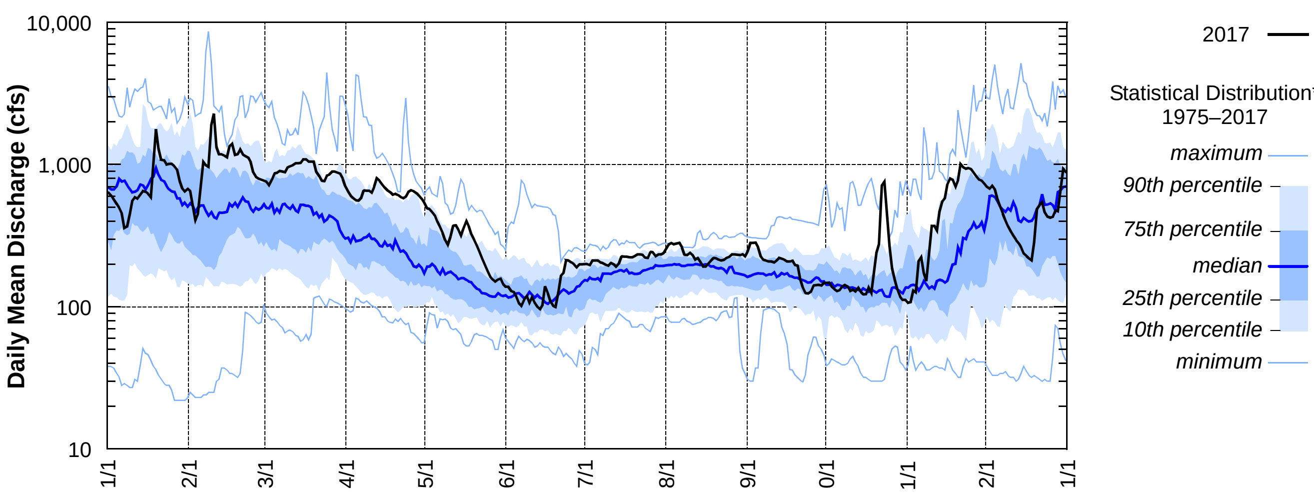
Data source: U.S. Geological Survey, Oregon Water Science Center

River Mile: 58.8 *Latitude:* 452830 *Longitude:* 1230723 *Drainage area:* 125.00 sq mile *Datum:* 147.57 ft

2017 Daily Mean Discharge in Cubic Feet per Second

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	636	651	773	701	540	138	200	257	244	147	107	699
2	606	514	760	647	493	138	200	276	282	148	108	680
3	565	408	719	607	488	129	197	281	282	138	130	710
4	530	453	784	580	465	127	211	276	283	133	126	673
5	496	698	866	559	442	118	211	279	261	129	210	574
6	454	1050	875	558	398	106	212	281	227	131	224	511
7	359	992	902	581	363	102	205	261	214	139	173	454
8	369	964	891	657	331	113	203	232	211	143	152	405
9	447	1890	886	654	293	119	198	231	208	139	249	369
10	556	2280	956	654	273	107	195	240	208	129	370	340
11	589	1330	974	635	313	117	204	231	205	132	371	315
12	578	1180	991	700	373	106	200	215	212	128	343	296
13	615	1180	1020	801	374	100	192	221	220	136	464	281
14	652	1160	1020	770	347	96.2	202	207	218	127	552	262
15	644	1130	1030	726	317	103	226	192	215	122	582	237
16	625	1350	1090	689	362	140	225	192	208	123	734	227
17	590	1400	1090	660	403	124	225	201	208	137	802	218
18	1010	1170	1050	642	366	109	223	210	211	125	785	212
19	1780	1180	1050	614	322	102	223	220	197	176	699	284
20	1290	1280	1050	626	293	99.8	227	219	195	239	780	489
21	1080	1180	890	611	269	127	233	215	156	276	1010	520
22	1070	1150	829	593	243	166	234	212	136	716	962	544
23	1000	1120	768	582	219	174	232	214	125	760	936	461
24	1010	1040	766	597	200	213	222	222	124	471	946	431
25	1010	879	841	645	179	212	221	225	128	267	931	423
26	969	823	852	662	164	205	243	233	141	186	878	431
27	921	797	893	652	156	199	242	233	142	153	831	476
28	769	784	892	630	150	190	228	232	143	131	783	471
29	681	773	878	605	156	199	233	231	141	118	771	640
30	648	—	866	579	158	199	234	235	147	112	737	934
31	676	—	792	—	144	—	238	226	—	112	—	889
TOTAL	23225	30806	28044	19217	9594	4178	6739	7200	5892	6123	16746	14456
MEAN	749	1062	905	641	309	139	217	232	196	198	558	466
MAX	1780	2280	1090	801	540	213	243	281	283	760	1010	934
MIN	359	408	719	558	144	96.2	192	192	124	112	107	212
AC-FT	46066	61103	55624	38116	19029	8287	13367	14281	11687	12145	33215	28673

DLLO — 14203500 — Tualatin River near Dilley, Oregon [RM 58.8]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	20 < Q < 30	30 < Q ≤ 70	70 < Q ≤ 110	110 < Q ≤ 135	135 < Q ≤ 160	160 < Q ≤ 190	190 < Q ≤ 220	220 < Q ≤ 270	270 < Q ≤ 400	400 < Q ≤ 700	700 < Q ≤ 1,200	1,200 < Q ≤ 3,500	3,500 < Q ≤ 10,000
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.2%	3.6%	11%	11%	11%	10%	9.4%	9.1%	9.4%	11%	9.2%	5.3%	0.1%

Key

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1975	833	637	688	212	189	84	151	302	382	65	316	702
1976	1010	310	546	311	111	69	93	111	199	195	42	35
1977	30	34	247	85	74	58	90	83	102	49	307	1120
1978	885	617	245	284	233	90	103	141	275	222	78	232
1979	183	745	305	146	147	62	99	134	160	170	143	632
1980	963	452	475	336	109	67	102	134	145	111	175	660
1981	260	431	222	297	132	138	125	198	174	191	611	1210
1982	877	1081	725	597	157	103	91	123	123	206	307	1070
1983	913	1415	1010	440	139	103	89	119	202	210	785	748
1984	516	595	460	303	280	169	143	187	126	166	761	588
1985	194	291	196	222	150	184	196	151	71	63	144	158
1986	474	568	452	117	138	105	153	162	107	66	117	373
1987	604	536	943	180	79	79	180	168	111	83	42	254
1988	541	264	161	193	156	92	148	171	153	114	190	259
1989	569	288	616	219	81	106	171	174	163	140	116	96
1990	368	1053	494	128	90	111	170	174	124	123	132	203
1991	327	386	354	394	149	68	159	192	163	136	84	187
1992	248	377	153	177	94	132	150	152	109	83	86	328
1993	278	160	310	458	207	120	89	120	190	135	123	150
1994	494	188	356	179	84	74	193	185	145	100	293	1050
1995	1450	1050	611	282	160	115	149	178	140	93	332	1970
1996	1290	1210	350	597	437	145	184	205	127	114	162	1440
1997	976	537	887	261	187	112	162	266	277	280	359	723
1998	1320	1014	673	229	171	142	184	235	241	139	150	1280
1999	1450	2285	696	344	181	156	209	224	226	173	259	902
2000	856	463	495	124	123	189	211	238	218	205	128	130
2001	112	140	116	103	108	109	131	136	99	95	153	1270
2002	1310	571	461	300	116	179	202	207	224	177	110	317
2003	536	508	1020	480	153	159	201	225	195	151	153	340
2004	572	613	293	194	120	157	205	240	154	133	67	139
2005	195	122	82	266	203	123	196	232	188	146	244	326
2006	2430	491	481	307	124	128	211	226	206	165	659	1100
2007	571	252	521	196	128	165	197	209	198	105	142	755
2008	1050	663	455	393	231	137	255	202	212	135	125	108
2009	931	151	318	271	252	105	213	200	162	117	310	411
2010	920	466	440	585	248	441	181	193	141	150	238	1110
2011	823	323	807	654	325	162	176	216	194	114	130	162
2012	719	465	809	500	237	129	193	217	217	137	389	1260
2013	416	280	267	167	161	126	198	204	151	121	154	187
2014	187	822	882	468	259	134	199	206	186	130	162	537
2015	513	408	360	159	142	202	254	238	153	124	219	1570
2016	1190	732	986	240	94	159	189	241	182	305	483	964
2017	644	1125	890	639	317	126	222	231	208	137	641	454
Median	699	499	463	265	150	121	175	193	163	135	173	520

Key

Q in cfs	*Q as percentile*
Q ≤ 77.0	Q ≤ 5th
77.0 < Q ≤ 95.0	5th < Q ≤ 10th
95.0 < Q ≤ 110	10th < Q ≤ 15th
110 < Q ≤ 121	15th < Q ≤ 20th
121 < Q ≤ 144	20th < Q ≤ 30th
144 < Q ≤ 169	30th < Q ≤ 40th
169 < Q ≤ 199	40th < Q ≤ 50th
199 < Q ≤ 409	50th < Q ≤ 75th
409 < Q ≤ 894	75th < Q ≤ 90th
894 < Q ≤ 1,230	90th < Q ≤ 95th
Q > 1,230	Q > 95th

Distribution

- The highest flow months on average are December and January, although very high flows can occur any day in November through April. Between late fall and summer, flows are strongly affected by the operation of Scoggins Dam.
- The very lowest daily flows occur July through October, however, June and October had the lowest average flows.

Seasonal onsets

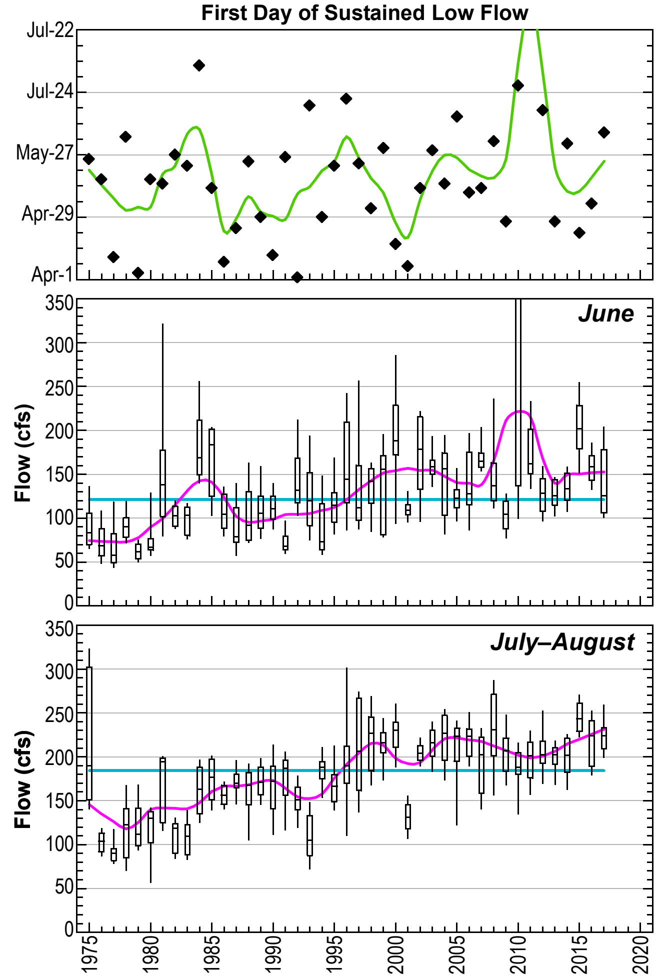
- At this site, flow is highly related to reservoir operations. Low or high flows are often not sustained for more than 2 weeks.
- Low flow criterion: 7d-Q ≤ 130 cfs (~23rd pctl)
- Low flow did not occur until 10/2 in 2011.
- Rainy season criterion: 7d-Q ≥ 200 cfs (~50th pctl)
- Rainy season flow that began in September may be at least partly related to reservoir releases.

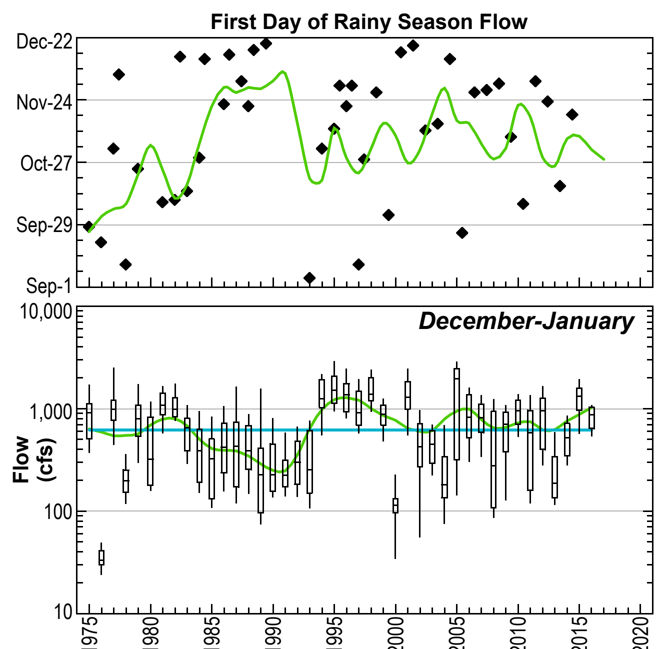
Trends

- Flow during the summer season generally has increased although there is substantial variability year-to-year. The trend is statistically significant for June through August.
- No general trends are evident for the magnitude of the December–January flow, although very low flows were less common in the late 1990s.

Anomalies

- 1993: Spring was very wet. Flow regulation did not start until July. Therefore, releases were low in early July. Flow augmentation water was also being saved for use later in the year.
- 2001: The reservoir did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.
- 2010: June was a particularly wet month.





14204800 — TUALATIN RIVER AT GOLF COURSE ROAD NEAR CORNELIUS, OREGON — TRGC

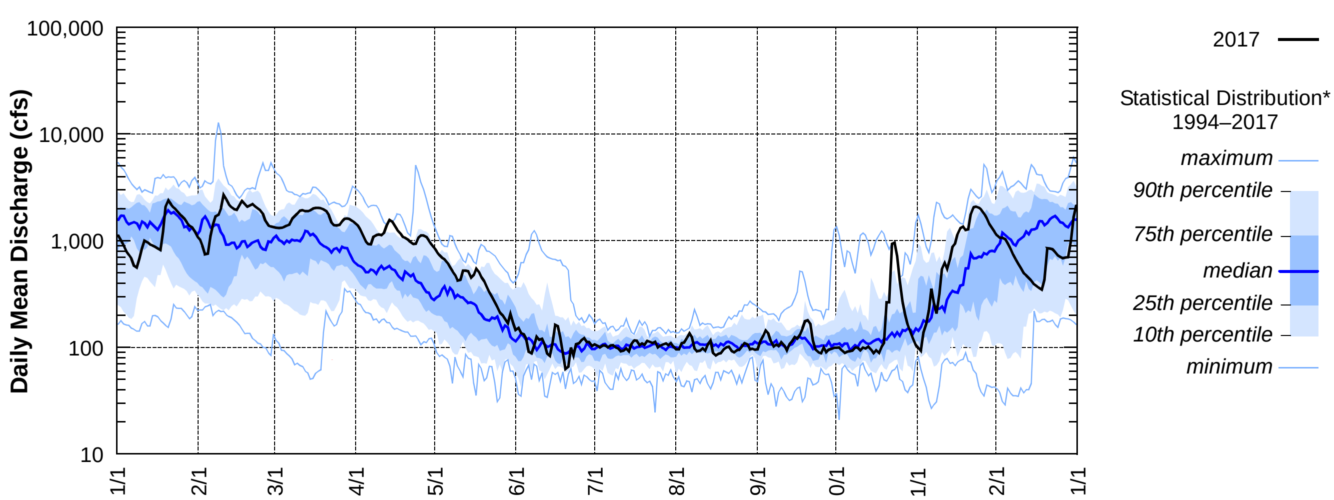
Data source: Oregon Water Resources Division

River mile: 51.5 *Latitude:* 45 30 08 *Longitude:* 123 03 22

Day	2017 Daily Mean Discharge in Cubic Feet per Second†											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1110	1030	1340	1460	869	146	107	96	96	99	99	1120
2	1010	892	1320	1390	788	152	104	96	115	100	93	1060
3	896	743	1310	1270	737	136	100	109	128	93	137	1070
4	797	756	1320	1110	694	133	104	111	145	89	166	1040
5	739	1100	1350	986	671	120	104	123	136	91	221	945
6	681	1420	1390	927	624	91	100	135	113	92	355	839
7	584	1700	1420	925	565	88	104	124	102	93	259	741
8	560	1760	1600	1090	517	103	105	98	106	100	207	666
9	676	2030	1700	1130	478	126	100	92	103	99	319	606
10	841	2680	1790	1140	423	118	98	93	112	94	550	554
11	1000	2440	1900	1130	428	120	92	98	105	100	623	495
12	970	2200	1930	1180	523	106	93	93	94	98	542	471
13	922	2050	1890	1410	524	87	98	106	107	102	673	446
14	902	1970	1890	1570	516	83	92	116	114	96	882	422
15	882	1950	1930	1520	450	107	108	88	125	88	944	389
16	851	2150	2000	1390	475	163	116	84	121	94	1170	374
17	822	2370	2030	1270	549	159	115	87	132	89	1310	360
18	1220	2220	2030	1180	514	123	105	88	150	101	1360	349
19	2120	2080	2020	1090	457	89	109	96	176	111	1260	429
20	2390	2140	1980	1070	418	63	106	100	180	265	1280	852
21	2190	2200	1910	1030	369	66	115	101	166	265	1790	843
22	2040	2090	1730	970	328	100	113	93	115	936	2060	832
23	1940	2000	1490	928	297	84	110	90	95	962	2090	786
24	1830	1920	1400	938	264	107	113	94	90	721	2040	729
25	1720	1790	1390	1070	238	109	100	95	88	429	1940	703
26	1620	1530	1410	1120	212	117	104	102	100	266	1800	688
27	1490	1390	1520	1120	200	122	107	110	90	202	1620	693
28	1390	1360	1600	1090	185	112	109	107	95	162	1430	698
29	1340	1340	1610	1000	167	112	105	96	97	140	1310	1010
30	1220	—	1590	931	206	103	110	97	99	121	1210	1650
31	1100	—	1530	—	171	—	102	95	—	105	—	2110
TOTAL	37853	51301	51320	34435	13857	3345	3248	3113	3495	6403	29740	23970
MEAN	1221	1769	1655	1148	447	112	105	100	117	207	991	773
MAX	2390	2680	2030	1570	869	163	116	135	180	962	2090	2110
MIN	560	743	1310	925	167	63.0	92.0	84.0	88.0	88.0	93.0	349
AC-FT	75080	101754	101792	68301	27485	6635	6442	6175	6932	12700	58988	47544

† All 2017 data are provisional–subject to revision; e=estimated value

TRGC — 14204800 — Tualatin River at Golf Course Road near Cornelius, Oregon [RM 51.5]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	20 < Q < 30	30 < Q ≤ 65	65 < Q ≤ 90	90 < Q ≤ 110	110 < Q ≤ 125	125 < Q ≤ 160	160 < Q ≤ 250	250 < Q ≤ 450	450 < Q ≤ 750	750 < Q ≤ 1,400	1,400 < Q ≤ 2,300	2,300 < Q ≤ 5,000	5,000 < Q ≤ 15,000
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.1%	3.8%	10%	11%	7.9%	9.2%	9.1%	10%	10%	12%	10%	5.3%	0.1%

Key

- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1994	773	461	796	405	125	76.5	120	110	91.5	75.0	623	1780
1995	2051	1766	1550	591	240	94.3	77.3	117	96.0	88.4	616	2273
1996	2036	2709	613	1005	663	152	85.6	117	82.6	125	262	2922
1997	1905	963	1843	469	251	124	87.1	134	223	452	805	1174
1998	2431	1951	1188	469	278	128	114	106	131	135	248	2198
1999	2318	3448	1290	639	303	139	120	128	146	163	526	1410
2000	1637	846	835	244	181	149	110	142	170	184	147	231
2001	183	276	199	154	123	78.6	55.3	52.7	43.4	60.8	354	2256
2002	1693	1122	854	535	125	80.9	78.8	77.3	127	124	98.6	715
2003	1073	1042	1629	806	216	78.1	69.2	117	107	130	159	755
2004	1038	1168	546	316	127	68.3	83.4	116	84.9	131	91.4	247
2005	371	176	93.7	475	298	102	99.6	89.8	76.1	126	418	620
2006	2478	1183	864	530	140	102	103	99.9	111	93.1	1603	2058
2007	1172	382	998	328	112	100	107	109	113	83.3	145	1756
2008	1800	1435	790	647	244	123	133	106	126	125	192	175
2009	1810	286	597	454	427	68.5	117	116	112	104	575	646
2010	2070	845	799	994	376	621	110	102	105	119	468	2420
2011	1840	560	1990	1210	454	186	115	112	105	82.0	138	274
2012	1480	851	1490	740	313	139	111	101	113	113	656	2510
2013	748	487	531	326	154	127	105	97.0	106	143	244	271
2014	319	1545	1560	796	381	108	102	97.0	98.0	120	264	1170
2015	862	782	603	261	96.0	94.0	98.0	100	85.5	77.0	386	2770
2016	2270	1300	1860	332	82.0	75.0	92.0	99.0	113	501	762	1470
2017	1010	1960	1600	1115	457	111	105	96.0	110	100	1057	703
Median	1490	989	926	493	222	103	101	105	109	121	357	1300

Key

Q in cfs

- Q ≤ 68
- 68 < Q ≤ 81
- 81 < Q ≤ 91
- 91 < Q ≤ 100
- 100 < Q ≤ 117
- 117 < Q ≤ 144
- 144 < Q ≤ 222
- 222 < Q ≤ 843
- 843 < Q ≤ 1840
- 1840 < Q ≤ 2349
- Q > 2349

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

- December and January are the months with the highest average flow, although very high daily flows can occur from November through April. This pattern is consistent with normal rainfall.
- June through September are the months with the lowest average flow
- Very low daily flows can occur anytime from early summer through fall depending on weather and releases from the reservoirs. Even November and December can have very low flows if the weather is dry and Scoggins Reservoir is filling.

Seasonal onsets

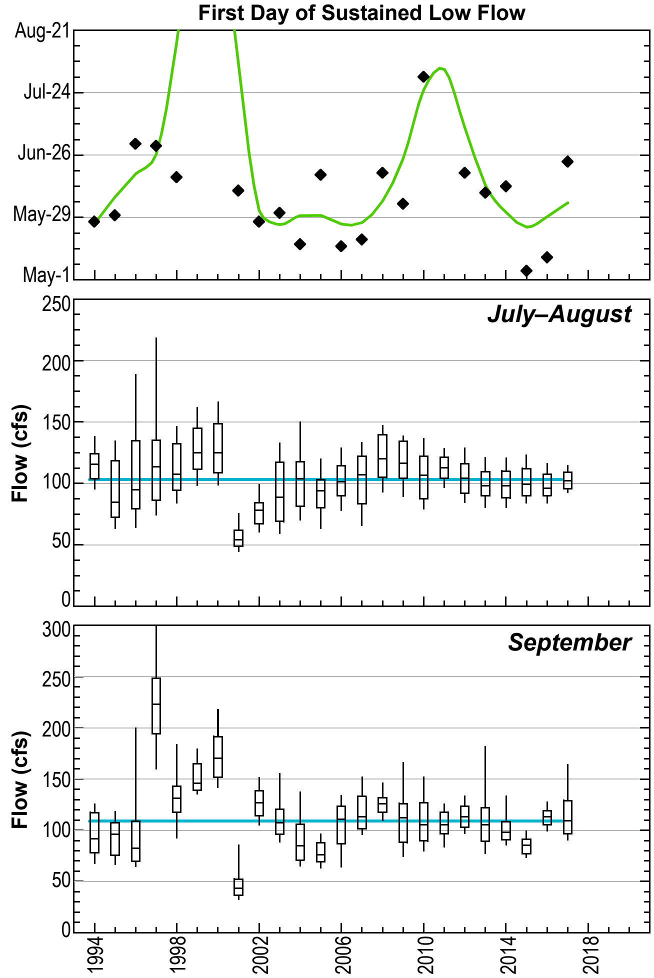
- Low flow criterion: 7d-Q ≤ 95 cfs (~17th pctl)
- Low flow did not occur in 1999 and 2000 and not until 9/6 in 2011.
- Rainy season criterion: 7d-Q ≥ 170 cfs (~44th pctl)

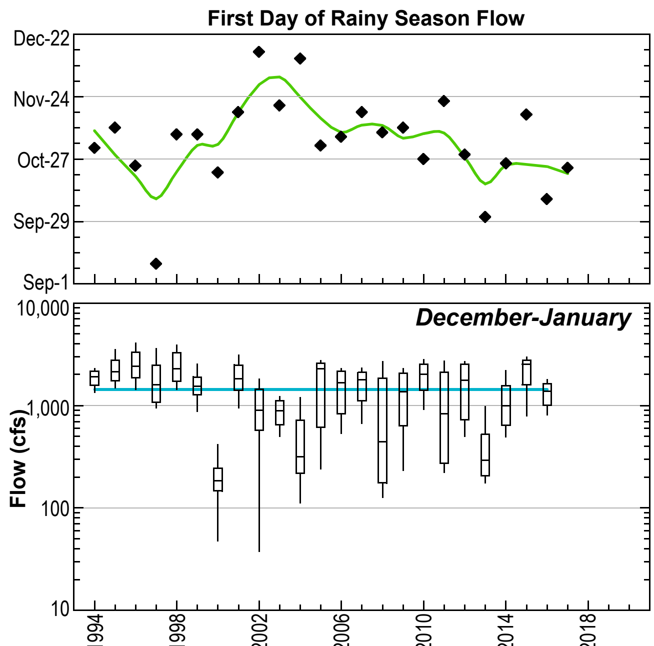
Trends

- No trend is evident in the onset of low flow season.
- No trends are evident in the magnitude of the flow from July– September.
- For the rainy season, onset possibly is arriving earlier, but the trend is not statistically significant. More years will be required to determine if the trend is real.
- No trends are evident for the magnitude of the December–January rainy season flow.

Anomalies

- 1997: September was wet.
- 2001: The reservoir did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.
- 2011: Joint Water Commission was releasing more water than usual from Barney Reservoir during the spring to facilitate repairs of Eldon Mills Dam which caused the late onset of low flow season.





14206241 — TUALATIN RIVER AT HWY 219 BRIDGE — TRJB

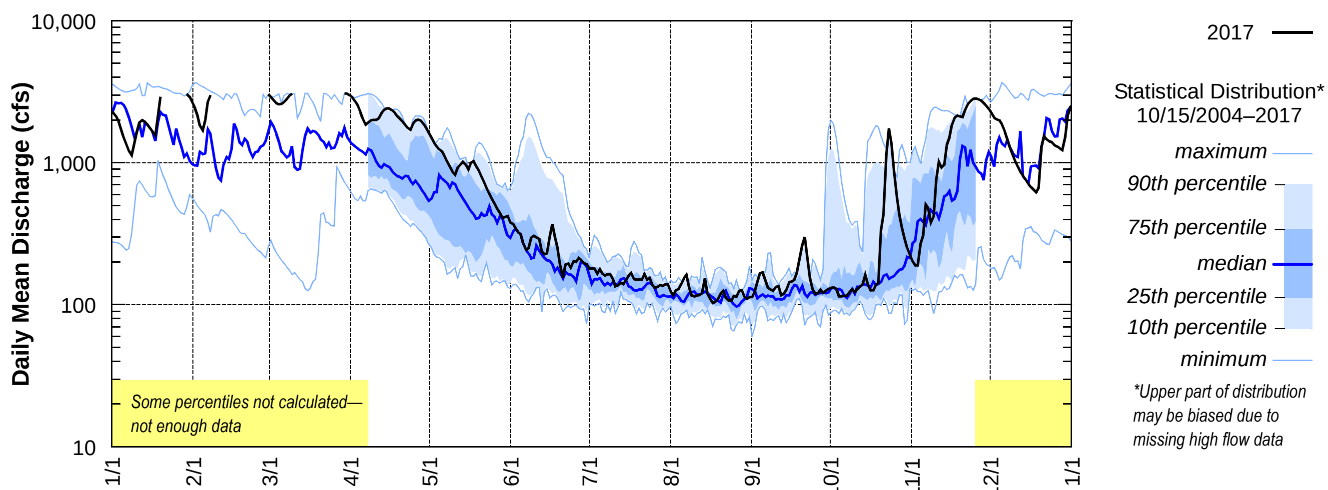
Data source: Jackson Bottom Wetland Education Center

River mile: 44.4 *Latitude:* 45 30 01 *Longitude:* 122 59 24

Day	2017 Daily Mean Discharge in Cubic Feet per Second											
	JAN*	FEB*	MAR*	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV*	DEC*
1	2258	2449	3029	2986	1627	381	180	124	113	132	201	2248
2	2137	2173	2902	2875	1495	372	180	117	125	133	189	2072
3	1952	1825	2756	2715	1388	343	180	127	146	130	190	2019
4	1704	1686	2632	2515	1307	322	166	129	167	114	270	1994
5	1496	1988	2576	2271	1245	313	178	141	170	115	307	1866
6	1346	2710	2600	2026	1197	270	166	154	148	116	507	1662
7	1212	3007	2679	1857	1108	243	160	164	132	116	476	1462
8	1128	M	2818	1917	1014	252	165	134	128	123	381	1282
9	1353	M	2973	1993	939	298	163	116	126	129	424	1145
10	1641	M	3070	2005	870	307	152	115	133	123	763	1033
11	1917	M	M	2006	828	299	135	117	136	129	1014	935
12	1998	M	M	2060	926	292	138	117	117	134	924	859
13	1952	M	M	2239	968	237	143	121	120	139	969	809
14	1863	M	M	2364	1016	228	140	154	128	162	1336	762
15	1757	M	M	2418	968	231	150	119	145	140	1504	711
16	1651	M	M	2412	898	304	161	110	146	126	1865	674
17	1561	M	M	2346	998	370	168	103	150	127	2074	648
18	2126	M	M	2251	1024	301	152	105	168	139	2157	622
19	2919	M	M	2136	947	251	150	111	207	142	2124	669
20	M	M	M	2041	877	192	151	120	262	334	2103	1297
21	M	M	M	1965	800	156	150	126	301	435	2364	1543
22	M	M	M	1852	731	193	165	112	211	1142	2583	1462
23	M	M	M	1758	666	196	150	107	155	1752	2722	1418
24	M	M	M	1709	601	183	155	107	127	1366	2821	1392
25	M	M	M	1884	554	203	139	116	120	874	2835	1331
26	M	M	M	1985	515	200	132	114	121	575	2809	1305
27	M	M	M	2012	475	213	134	125	128	426	2748	1265
28	M	M	M	1981	446	207	138	126	121	346	2640	1229
29	3042	3029	M	1886	407	197	136	114	126	291	2530	1514
30	2901	—	3080	1755	417	193	140	110	130	250	2404	2150
31	2682	—	3058	—	423	—	139	113	—	223	—	2461
TOTAL				64222	27675	7749	4755	3769	4506	10484	46231	41837
MEAN				2141	893	258	153	122	150	338	1541	1350
MAX				2986	1627	381	180	164	301	1752	2835	2460
MIN				1709	407	156	132	103	113	114	189	622
AC-FT				127382	54892	15369	9431	7477	8938	20794	91698	82983

*Incomplete record (monthly totals were computed when at least 80% of the record was complete for the month).

TRJB — 14206241 —Tualatin River at Hwy 219 Bridge [RM 44.4]



14206241 — TUALATIN RIVER AT HWY 219 BRIDGE — TRJB

Data source: Jackson Bottom Wetland Education Center

FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	60 < Q < 70	70 < Q ≤ 100	100 < Q ≤ 120	120 < Q ≤ 140	140 < Q ≤ 180	180 < Q ≤ 300	300 < Q ≤ 500	500 < Q ≤ 800	800 < Q ≤ 1,200	1,200 < Q ≤ 2,000	2,000 < Q ≤ 2,900	2,900 < Q ≤ 3,500	3,500 < Q ≤ 4,000	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	0.1%	4.8%	10%	8.9%	9.2%	9.3%	7.9%	8.9%	9.2%	9.7%	7.8%	3.3%	0.2%	11%

Key

- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2004											176	451
2005	722	407	228	1003	802	232	126.8	91.8	88.9	154.5	780	1284
2006	3264	2395	1404	954	332	212	128	98	107	124	2264	2865
2007	2394	710	1604	638	235	152	124	118	123	118	275	2533
2008		2493	1380	1214	460	204	169	124	139	144	353	333
2009		527	1109	817	694	146	125	115	115	124	841	1088
2010		1678	1415	2081	667	995	187	120	128	127	676	
2011		1213		1901	808	316	176	135	119	117	182	415
2012		1507			597	294	157	119	121	159		
2013	1126	831	965	589	248	220	124	106	131	203	409	421
2014	563			1485	669	193	138	107	105	148	512	1721
2015	1517		1205	596	215	128	113	101	102	96	576	
2016		2254		650	193	127	117	114	132	812	1231	
2017				2019	926	247	151	117	132	139	1685	1305
Median	1855	1240	1417	955	490	201	137	114	119	141	567	1329

Key

Q in cfs

- Q ≤ 99
- 99 < Q ≤ 110
- 110 < Q ≤ 118
- 118 < Q ≤ 127
- 127 < Q ≤ 150
- 150 < Q ≤ 204
- 204 < Q ≤ 364
- 364 < Q ≤ 1,140
- 1,140 < Q ≤
- 2,258 < Q ≤
- Q > 2,817

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

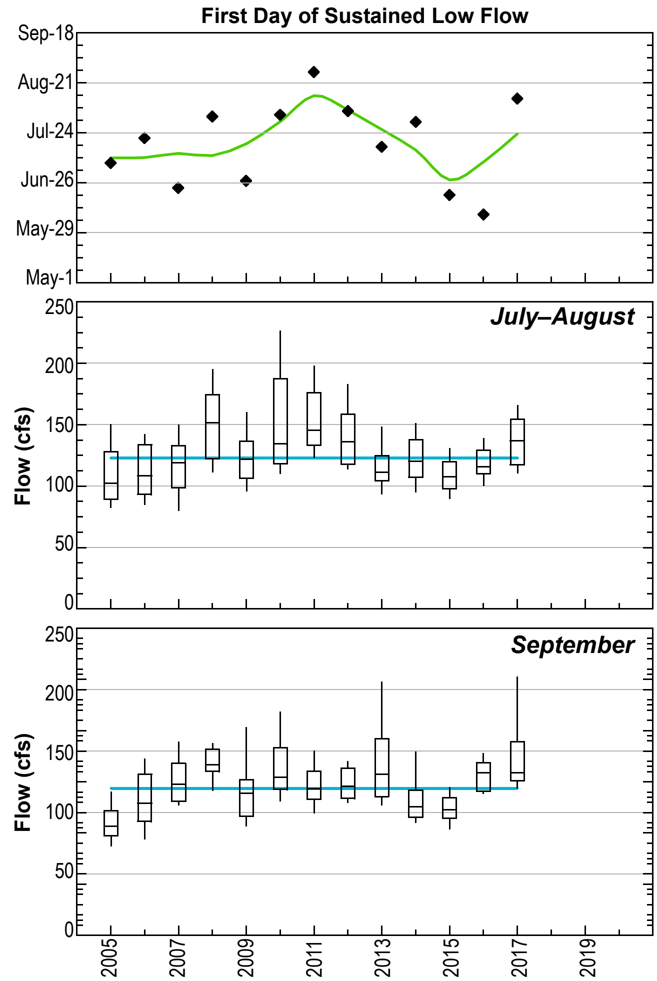
- December and January are the months with the highest average flow.
- August and September are the months with the lowest average flow.
- Much of the high flow data are missing because the rating curve has an upper limit. The percentiles are therefore skewed with low values overrepresented.
- The missing values for the April through October period are all from 2004. Sensors were not installed at this site until October 15, 2004.

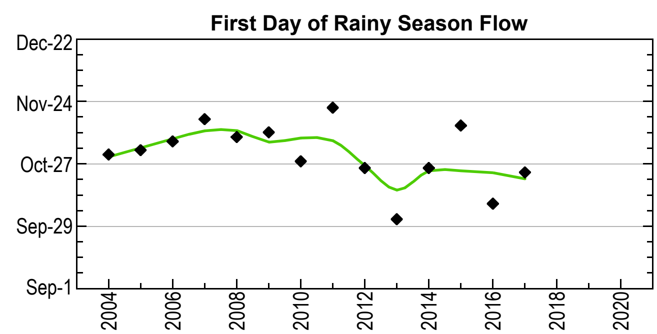
Seasonal onsets

- Low flow criterion: 7d-Q ≤ 125 cfs (~19th pctl)
- Rainy season criterion: 7d-Q ≥ 200 cfs (~39th pctl)

Trends

- No trend is evident in the onset of low flow season.
- No trends are evident in the magnitude of the flow from July– September.
- For the rainy season, onset possibly is arriving earlier, but the trend is not statistically significant. More years will be required to determine if the trend is real.
- Boxplots were not shown for the December–January rainy season because too many data are missing.





14206295 — TUALATIN RIVER AT ROOD BRIDGE ROAD NEAR HILLSBORO, OREGON — ROOD

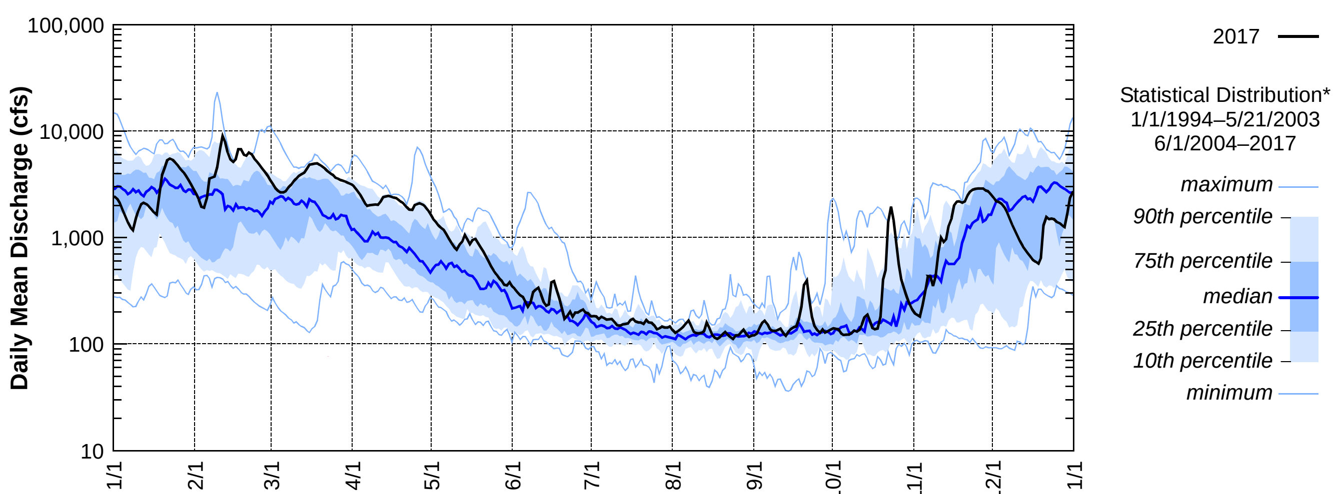
Data source: Oregon Water Resources Division

River mile: 38.4 *Latitude:* 45 29 24 *Longitude:* 122 57 06

Day	2017 Daily Mean Discharge in Cubic Feet per Second†											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2400	2550	3480	3150	1660	347	182	136	121	141	195	2370
2	2290	2260	3190	3000	1510	331	183	128	125	139	188	2190
3	2090	1940	2930	2800	1400	310	182	132	143	138	182	2160
4	1820	1900	2760	2590	1300	288	172	138	158	127	229	2080
5	1580	2340	2660	2350	1230	279	181	145	166	122	304	1950
6	1390	3590	2650	2110	1180	251	175	155	155	123	435	1750
7	1250	3660	2730	1980	1080	223	170	166	139	123	431	1540
8	1170	3740	2940	2010	969	246	171	149	133	127	350	1320
9	1500	4560	3120	2020	884	307	172	131	133	134	431	1170
10	1800	6740	3380	2040	815	325	161	127	136	131	733	1040
11	2060	8970	3570	2030	770	339	150	126	140	136	995	927
12	2130	7840	3790	2170	859	297	149	128	127	154	908	831
13	2070	6230	3920	2390	918	248	153	132	120	179	966	771
14	1960	5420	4070	2430	1060	230	154	158	130	189	1300	716
15	1840	5100	4430	2460	959	237	156	142	139	165	1530	664
16	1720	5430	4850	2430	864	381	168	123	144	142	2010	619
17	1630	6730	4870	2380	957	391	173	115	147	138	2170	593
18	2610	6750	4950	2340	977	319	163	112	172	140	2180	570
19	3880	6000	4970	2230	892	268	159	116	224	181	2120	648
20	4510	5880	4800	2150	813	214	159	124	359	402	2190	1300
21	5320	6290	4620	2060	738	173	155	130	396	494	2480	1560
22	5510	6060	4410	1930	667	185	168	123	256	1400	2680	1480
23	5370	5570	4160	1830	599	202	159	116	179	1960	2800	1500
24	5090	5180	4000	1810	538	180	158	111	147	1450	2870	1480
25	4760	4840	3870	2030	490	198	150	121	135	909	2880	1400
26	4420	4490	3650	2070	453	198	138	121	128	565	2880	1370
27	4130	4170	3560	2090	416	206	141	129	138	403	2880	1300
28	3810	3830	3460	2040	393	212	146	136	129	330	2760	1260
29	3480	3480	3390	1940	361	197	143	124	132	278	2710	1650
30	3160	—	3340	1810	355	195	143	117	137	240	2540	2370
31	2840	—	3250	—	381	—	147	120	—	213	—	2660
TOTAL	89590	141540	115770	66670	26488	7777	4981	4031	4888	11373	47327	43239
MEAN	2890	4881	3735	2222	854	259	161	130	163	367	1578	1395
MAX	5510	8970	4970	3150	1660	391	183	166	396	1960	2880	2660
MIN	1170	1900	2650	1810	355	173	138	111	120	122	182	570
AC-FT	177699	280740	229626	132238	52538	15425	9880	7995	9695	22558	93872	85763

† All 2017 data are provisional–subject to revision

ROOD — 14206295 — Tualatin River at Rood Bridge Road near Hillsboro, Oregon [RM 38.4]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	10 < Q < 45	45 < Q ≤ 100	100 < Q ≤ 120	120 < Q ≤ 140	140 < Q ≤ 180	180 < Q ≤ 280	280 < Q ≤ 500	500 < Q ≤ 900	900 < Q ≤ 1,600	1,600 < Q ≤ 2,800	2,800 < Q ≤ 4,500	4,500 < Q ≤ 12,000	12,000 < Q ≤ 25,000
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.1%	5.2%	8.2%	9.8%	10%	9.7%	10%	10%	11%	10%	9.6%	5.4%	0.1%

Key

- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

Jun-2003–May-2004 omitted from analysis

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1994	1310	762	1480	656	205	123	107.0	96.0	91.5	82	1095	3590
1995	3903	4086	2810	1104	478	207	111.0	115.8	106.8	140.5	972	5587
1996	2880	4720	1123	1705	1421	317	145	147	138	257	523	4549
1997	3934	1931	3518	815	412	322	128	135	236	610	1748	2470
1998	4637	3079	2163	798	496	300	152	121	131	179	367	4046
1999	5027	6820	2665	1129	457	207			128	142	695	2582
2000	2626	1670	1584	412	297	200	120	124	155	196	144	375
2001	293	429	326	282	194	111	66	57	49	84	544	3823
2002	2941	2476	1516	701	239	134	111	99	123	122	121	1037
2003	2683	3123	3382	1777	424							
2004						134	105	122	114	196	212	468
2005	721	387	222	1067	905	256	124	91	85	156	899	1497
2006	5846	3111	1569	1017	332	202	139	117	122	118	2850	4187
2007	2928	815	1739	622	235	148	129	126	135	146	254	3230
2008	3560	2905	1410	1205	461	184	154	118	129	120	361	304
2009	3280	523	1140	865	768	163	126	126	130	152	1047	1110
2010	3230	1775	1530	2265	801	1100	197	136	166	169	886	3750
2011	3370	1375	3380	2090	916	342	190	146	133	133	256	418
2012	2940	1690	2900	1495	679	344	169	130	134	236	1175	4130
2013	1330	859	1020	622	264	257	138	121	175	215	434	420
2014	609	2735	2810	1680	739	201	144	114	114	181	612	2240
2015	1610	2250	1360	638	219	127	116	113	115	81	580	5570
2016	3800	2440	2860	646	188	129	114	97	115	964	1425	3240
2017	2290	5140	3570	2100	864	247	159	128	139	165	1770	1370
Median	2860	1980	1835	909	435	204	133	120	127	156	625	2522

Key

Q in cfs

- Q ≤ 98
- 98 < Q ≤ 112
- 112 < Q ≤ 122
- 122 < Q ≤ 131
- 131 < Q ≤ 162
- 162 < Q ≤ 236
- 236 < Q ≤ 406
- 406 < Q ≤ 1635
- 1635 < Q ≤ 3440
- 3440 < Q ≤ 4603
- Q > 4603

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

- December and January are the months with the highest average flow.
- July through September are the months with the lowest average flow and the lowest daily flows.

Seasonal onsets

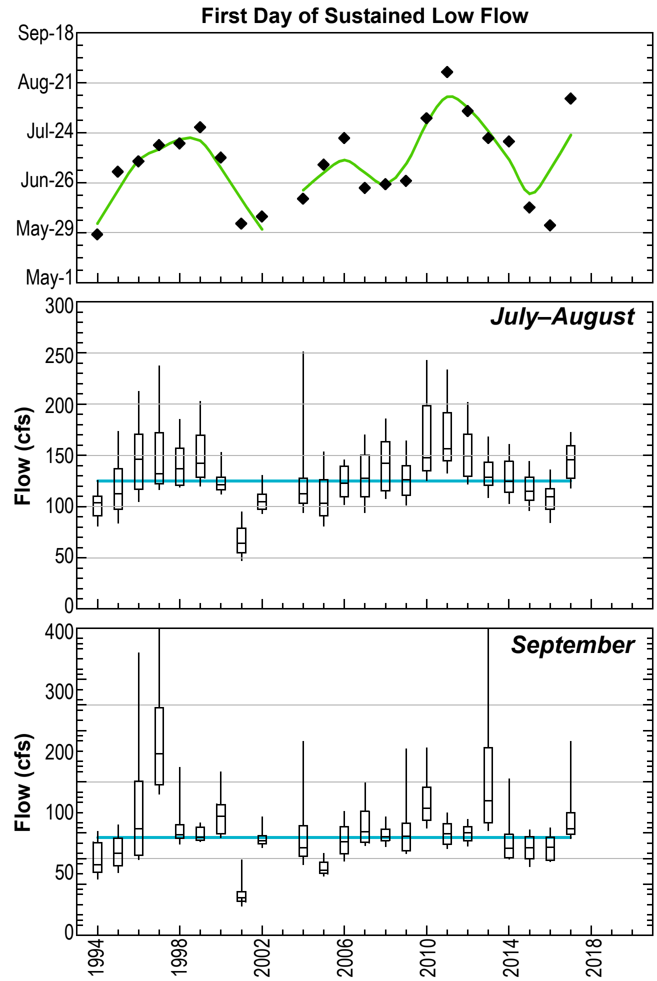
- Low flow criterion: 7d-Q ≤ 123 cfs (~21st pctl)
- Rainy season criterion: 7d-Q ≥ 240 cfs (~40th pctl)

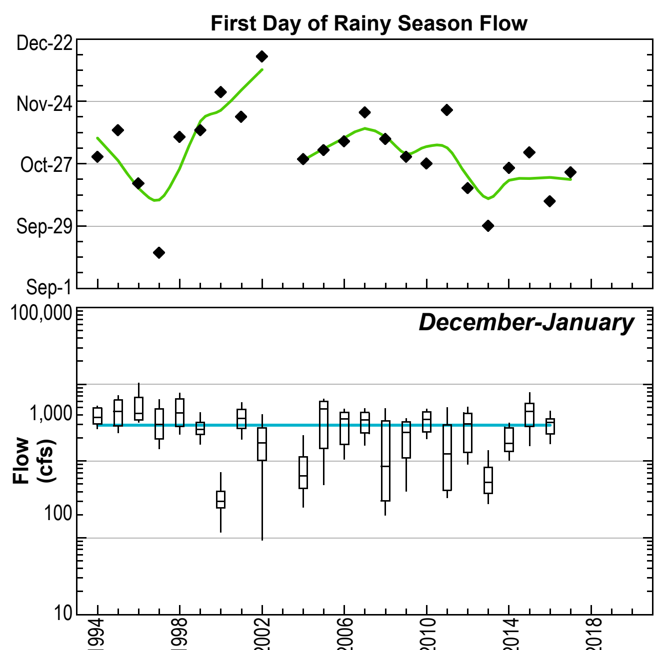
Trends

- No trend is evident in the onset of low flow season.
- No trends are evident in the magnitude of the flow from July– September.
- For the rainy season, onset possibly is arriving earlier, but the trend is not statistically significant. More years will be required to determine if the trend is real.
- No trends are evident in the magnitude of the flow in the December–January rainy season.

Anomalies

- 1997: September was wet.
- 2001: The reservoir did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.
- 2003-4: All data are missing from June-2003 through May-2004 because the bridge was being rebuilt.
- 2011: Joint Water Commission was releasing more water than usual from Barney Reservoir during the spring to facilitate repairs of Eldon Mills Dam which caused the late onset of low flow season.





14206500 — TUALATIN RIVER AT FARMINGTON, OREGON — FRMO

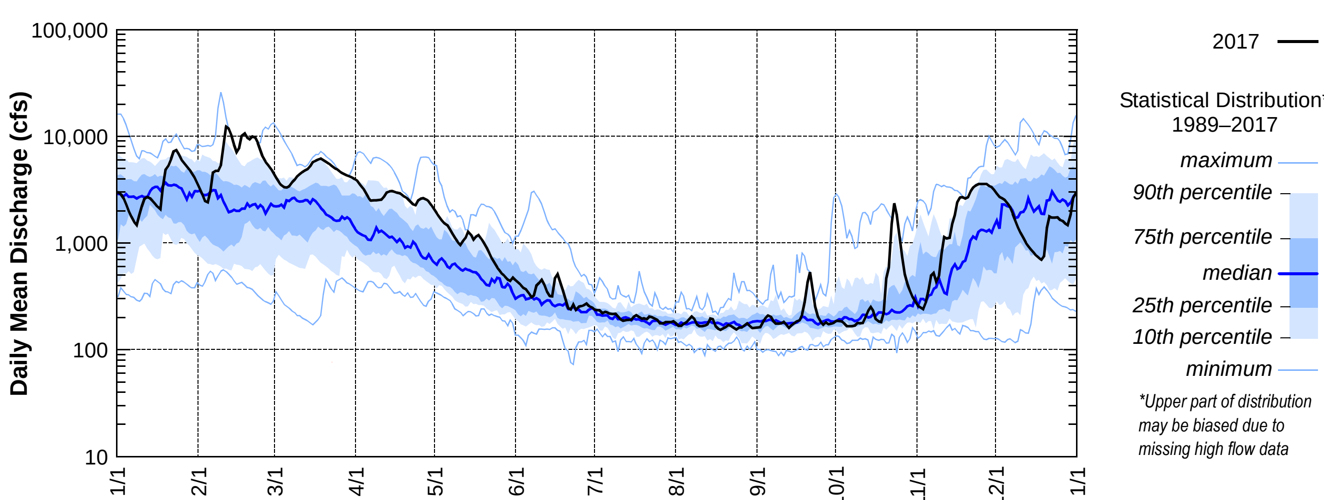
Data source: Oregon Water Resources Division

River mile: 33.3 *Latitude:* 45 26 58 *Longitude:* 122 57 02

Day	2017 Daily Mean Discharge in Cubic Feet per Second†											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2980	3210	4520	3970	2100	448	238	177	162	187	259	2930
2	2860	2850	4100	3790	1910	426	235	167	163	186	250	2710
3	2620	2470	3730	3530	1760	406	234	167	181	184	241	2640
4	2300	2410	3480	3260	1640	381	221	176	197	175	282	2550
5	1990	3020	3330	2970	1540	369	226	182	210	166	361	2380
6	1760	4590	3300	2680	1470	344	223	193	204	166	494	2150
7	1590	4740	3400	2490	1350	311	218	205	185	166	522	1890
8	1470	4750	3690	2510	1220	323	216	195	176	168	438	1610
9	1830	5420	3900	2510	1120	399	217	173	176	178	497	1400
10	2220	8200	4200	2530	1030	421	206	166	177	177	805	1250
11	2600	12300	4420	2540	960	453	193	166	183	178	1140	1120
12	2710	11800	4650	2700	1040	403	187	169	172	200	1100	1010
13	2640	10100	4790	2980	1120	347	190	173	160	232	1120	933
14	2500	8360	4950	3050	1280	318	191	196	170	252	1500	872
15	2340	7110	5270	3060	1200	316	191	194	178	231	1810	811
16	2190	7790	5740	3030	1070	470	205	167	186	194	2420	757
17	2070	10100	5920	2970	1150	511	211	158	189	184	2670	725
18	3400	10600	6080	2920	1190	433	203	154	214	182	2690	699
19	4880	9730	6200	2800	1100	364	195	159	279	222	2610	754
20	5260	9360	6010	2700	994	303	198	164	426	464	2690	1390
21	6120	9950	5780	2600	900	246	194	171	533	589	3040	1780
22	7240	9750	5560	2440	806	239	204	167	374	1520	3310	1730
23	7420	8700	5290	2310	721	265	202	160	253	2350	3480	1730
24	6770	7430	5090	2260	649	237	196	155	202	1830	3570	1740
25	6070	6380	4950	2510	593	253	191	162	183	1180	3570	1650
26	5620	5770	4710	2600	553	256	177	162	172	735	3570	1610
27	5260	5370	4550	2630	514	262	177	168	180	509	3570	1530
28	4900	4970	4410	2570	489	272	182	177	173	415	3430	1470
29	4490	4520	4290	2450	457	257	182	167	175	354	3360	1840
30	4060	—	4220	2280	442	250	182	159	179	312	3150	2660
31	3620	—	4100	—	476	—	185	160	—	281	—	2940
TOTAL	113780	201750	144630	83640	32844	10283	6270	5309	6412	14167	57949	51261
MEAN	3670	6957	4665	2788	1059	343	202	171	214	457	1932	1654
MAX	7420	12300	6200	3970	2100	511	238	205	533	2350	3570	2940
MIN	1470	2410	3300	2260	442	237	177	154	160	166	241	699
AC-FT	225679	400165	286869	165897	65145	20396	12436	10530	12718	28100	114940	101675

† All 2017 data are provisional–subject to revision

FRMO — 14206500 — Tualatin River at Farmington, Oregon [RM 33.3]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	10 < Q < 100	100 < Q ≤ 150	150 < Q ≤ 180	180 < Q ≤ 200	200 < Q ≤ 250	250 < Q ≤ 350	350 < Q ≤ 600	600 < Q ≤ 1,000	1,000 < Q ≤ 1800	1,800 < Q ≤ 3,000	3,000 < Q ≤ 5,000	5,000 < Q ≤ 13,000	13,000 < Q ≤ 30,000
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.2%	4.9%	10%	8.2%	12%	8.9%	10%	9.8%	12%	9.7%	9.6%	5.0%	0.1%

Key

- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1989	3026	1135	3117	1154	332	157	169	186	149	185	223	390
1990	2923	5460	2514	552	406	417	203	174	164	224	419	968
1991	1349	2031	1940	2464	620	283	197	192	178	180	343	1020
1992	1184	3089	774	720	306	152	141	133	137	150	288	1763
1993	1618	723	1651	2111	938	450	200	155	202	193	217	799
1994	1797	969	1802	852	327	173	152	136	138	133	1349	3782
1995	3978	4361	2952	1296	590	264	186	180	170	215	1137	5537
1996	3520	5746	1421	2046	1794	379	200	200	196	299	600	5701
1997	4071	2127	3652	991	492	394	193	190	283	695	2069	2701
1998	5248	3584	2539	949	584	378	206	172	187	228	418	5136
1999	6113	8123	2929	1356	553	265	198	178	184	197	851	2802
2000	3002	1998	1870	503	370	252	172	172	205	255	207	375
2001	380	515	410	356	261	170	125	113	100	135	610	4827
2002	3552	2708	1803	850	299	186	148	130	166	170	172	1238
2003	2530	2870	3050	1790	535	207	148	169	170	219	219	1350
2004	2430	2555	1150	644	321	200	172	193	184	266	286	543
2005	920	505	286	1340	1180	344	180	145	144	239	1155	1910
2006	6010	3400	1800	1190	421	301	207	168	170	187	3100	4000
2007	3500	966	2120	823	339	219	190	180	190	223	397	3350
2008	4200	3360	1600	1400	587	263	223	193	204	210	430	361
2009	3830	630	1300	934	898	215	176	176	189	221	1170	1280
2010	3880	2020	1740	2590	930	1220	265	208	224	214	914	4500
2011	4110	1555	4140	2525	1060	450	257	212	193	190	299	497
2012	3560	2000	3720	1840	825	426	239	203	204	331	1455	5200
2013	1690	1105	1300	827	375	353	203	190	252	288	554	538
2014	731	3385	3550	1965	898	297	219	187	187	277	759	2670
2015	1910	2805	1660	777	307	202	178	173	183	169	793	8310
2016	4760	3020	3490	777	280	206	182	170	199	1170	1725	4060
2017	2860	7270	4550	2655	1070	334	198	167	182	222	2115	1610
Median	3008	2349	2023	1056	509	262	192	177	185	214	605	2225

Key

Q in cfs

- Q ≤ 149
- 149 < Q ≤ 167
- 167 < Q ≤ 179
- 179 < Q ≤ 191
- 191 < Q ≤ 221
- 221 < Q ≤ 296
- 296 < Q ≤ 473
- 473 < Q ≤ 1,741
- 1,741 < Q ≤ 3,667
- 3,667 < Q ≤ 5,022
- Q > 5,022

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

- December through March are the months with the highest average flow.
- July through September are the months with the lowest average flow. The lowest daily flows can occur June through October.

Seasonal onsets

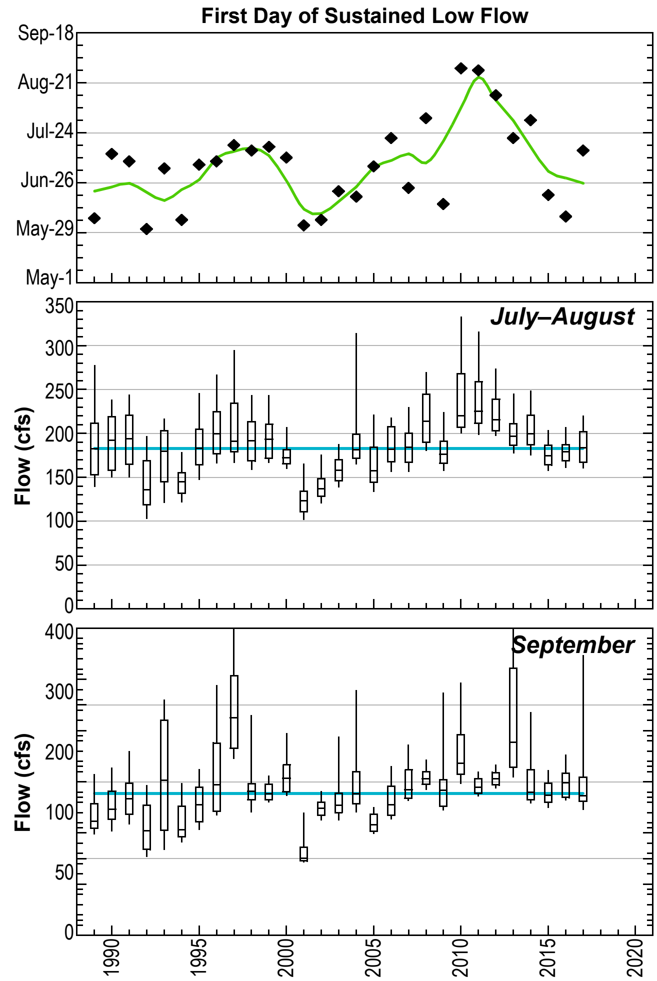
- Low flow criterion: 7d-Q ≤ 200 cfs (~24th pctl)
- Rainy season criterion: 7d-Q ≥ 350 cfs (~44th pctl)

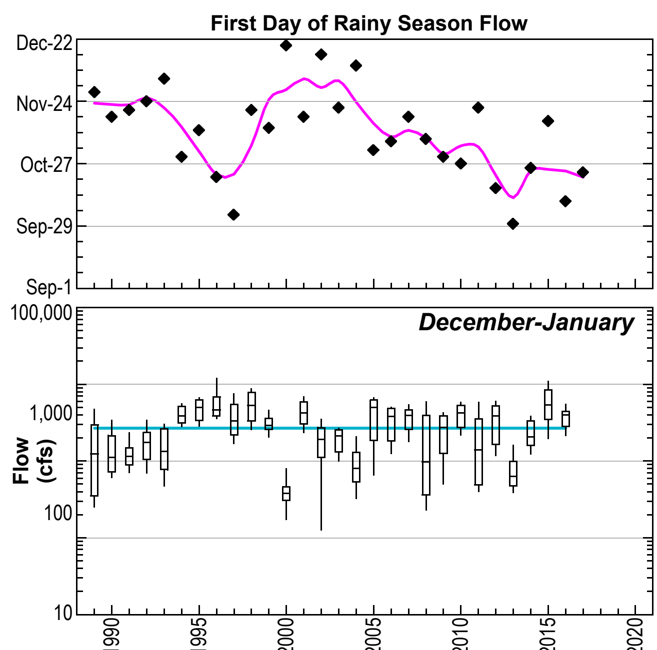
Trends

- No trend is evident in the onset of low flow season.
- No trends are evident in the magnitude of the flow from July– September.
- For the rainy season, onset is arriving earlier. The trend is statistically significant.
- No trends are evident in the magnitude of the flow in the December–January rainy season.

Anomalies

- 1997: September was wet.
- 2001: The reservoir did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.
- 2011: Joint Water Commission was releasing more water than usual from Barney Reservoir during the spring to facilitate repairs of Eldon Mills Dam which caused the late onset of low flow season.





14207500 — TUALATIN RIVER AT WEST LINN, OREG. — WSLO

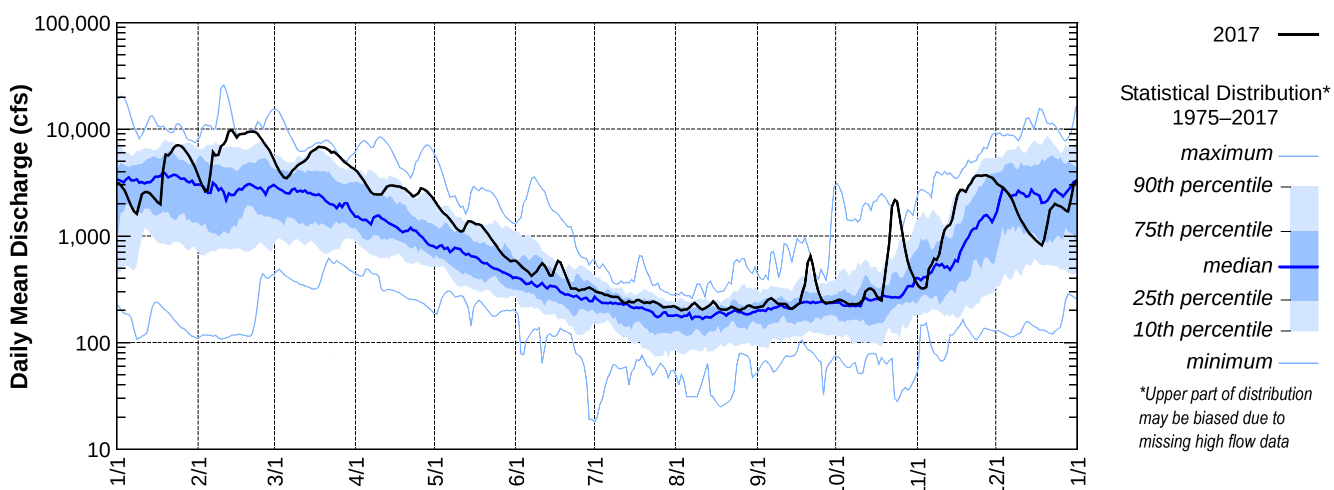
Data source: U.S. Geological Survey, Oregon Water Science Center

River mile: 1.75 *Latitude:* 452103 *Longitude:* 1224030 *Drainage area:* 706.00 sq mile *Datum:* 85.61

Discharge, Cubic Feet per Second, Calendar Year January to December 2017 Daily Mean Values

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	3120	3350	5260	4170	2170	586	306	215	214	249	339	3090
2	2980	2930	4630	3960	1990	553	298	207	217	252	323	2960
3	2750	2620	4120	3680	1840	525	294	200	219	248	320	2870
4	2460	2710	3810	3360	1710	497	289	203	237	241	332	2720
5	2140	3840	3540	3060	1610	477	280	205	253	233	493	2550
6	1880	6130	3470	2800	1530	455	280	213	261	227	538	2330
7	1700	5670	3680	2570	1440	423	272	227	250	231	614	2090
8	1610	5760	4080	2460	1330	444	268	235	239	227	597	1810
9	1990	6950	4290	2440	1230	465	269	224	230	230	683	1580
10	2460	7250	4550	2450	1150	514	266	210	230	237	919	1410
11	2570	7920	4750	2450	1100	554	251	205	230	251	1140	1280
12	2580	9510	4900	2650	1110	523	237	210	228	302	1230	1160
13	2520	9870	5090	2910	1260	472	235	218	212	319	1280	1070
14	2370	9110	5400	2970	1370	423	245	227	207	322	1470	1010
15	2220	8390	6060	2970	1370	427	239	244	215	310	1930	949
16	2070	8960	6310	2940	1330	514	239	230	227	280	2450	895
17	1990	9040	6530	2910	1290	585	250	212	235	255	2690	852
18	4090	9120	6850	2910	1290	564	251	205	297	248	2690	824
19	5820	9400	6820	2800	1260	494	242	203	352	363	2610	951
20	5690	9500	6770	2770	1160	429	235	203	572	562	2930	1290
21	6090	9570	6660	2620	1080	366	239	209	651	844	3120	1760
22	6730	9390	6400	2480	1000	320	236	217	528	1910	3470	1870
23	7020	9020	6060	2340	925	320	243	212	385	2180	3690	2000
24	7110	8370	6150	2410	848	320	240	206	299	2080	3680	1940
25	6920	7680	5830	2510	782	308	234	201	259	1520	3640	1890
26	6520	7150	5520	2790	725	315	224	206	242	1060	3710	1820
27	6030	6580	5230	2750	678	315	214	209	235	752	3700	1730
28	5510	5940	4900	2660	637	323	215	221	237	578	3610	1700
29	4990	5260	4730	2510	608	329	217	223	238	483	3530	2220
30	4430	—	4540	2360	578	319	217	216	244	425	3330	2990
31	3860	—	4350	—	584	—	219	212	—	370	—	3270
TOTAL	120220	206990	161280	84660	36985	13159	7744	6628	8443	17789	61058	56881
MEAN	3878	7138	5203	2822	1193	439	250	214	281	574	2035	1835
MAX	7110	9870	6850	4170	2170	586	306	244	651	2180	3710	3270
MIN	1610	2620	3470	2340	578	308	214	200	207	227	320	824
AC-FT	238453	410558	319894	167921	73359	26100	15360	13146	16746	35284	121107	112822

WSLO — 14207500 —Tualatin River at West Linn, Oregon [RM 1.75]



14207500 — TUALATIN RIVER AT WEST LINN, OREG. — WSLO

Data source: U.S. Geological Survey, Oregon Water Science Center

FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	15 < Q < 30	30 < Q ≤ 120	120 < Q ≤ 180	180 < Q ≤ 2400	240 < Q ≤ 300	300 < Q ≤ 500	500 < Q ≤ 800	800 < Q ≤ 1,200	1,200 < Q ≤ 2,000	2,000 < Q ≤ 3,500	3,500 < Q ≤ 6,000	6,000 < Q ≤ 15,000	15,000 < Q ≤ 30,000
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.1%	5.3%	8.2%	12%	8.9%	12%	9.5%	8.9%	10%	10%	9.8%	4.3%	0.1%

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1975	5390	4570	3560	946	737	235	213	298	387	232	1070	3330
1976	4920	1585	3090	1255	441	247	161	176	232	213	144	132
1977	164	118	1000	306	219	161	61	37	172	150	850	4240
1978	4470	3470	1300	1035	959	347	142	128	376	268	197	905
1979	852	4435	2040	695	600	142	89	117	191	238	622	2820
1980	4450	2740	2600	1950	483	318	125	89	220	163	588	3220
1981	1390	2035	1120	1465	557	510	153	184	195	382	1785	6660
1982	4250	4765	3400	3005	598	193	99	124	184	264	780	5260
1983	4070	6610	5470	2045	609	282	254	128	267	272	3040	3380
1984	2510	3375	2440	1620	1210	757	259	133	182	333	2710	2470
1985	964	1575	964	895	345	323	128	142	143	100	431	666
1986	2080	2980	2250	618	640	182	159	78	89	100	335	1540
1987	3630	3525	5000	840	329	183	178	111	79	72	138	1830
1988	2900	1245	866	1235	735	389	147	122	117	118	688	1150
1989	3060	1235	3540	1325	441	229	135	160	117	189	228	432
1990	3320	6530	2580	582	389	411	174	135	130	203	460	1220
1991	1620	2170	2080	3055	676	339	244	147	131	139	377	1140
1992	1350	3765	882	821	330	143	110	84	96	110	306	2230
1993	2010	917	2010	2495	1200	580	235	141	177	172	196	932
1994	2010	1015	1960	966	337	205	135	126	124	113	1560	4200
1995	5030	5410	3390	1550	769	302	177	151	155	265	1365	6620
1996	4320	6930	1750	2395	2280	443	264	233	257	474	799	6440
1997	5060	2445	4680	1305	682	549	235	226	374	867	2340	3250
1998	6170	4375	3100	1150	798	569	280	212	251	340	673	5890
1999	6790	8685	3740	1745	805	416	262	230	240	261	1085	3470
2000	3910	2525	2300	758	590	385	221	212	268	367	285	596
2001	543	709	603	564	425	250	150	130	128	201	934	5430
2002	4770	3715	2440	1150	511	296	234	158	204	225	264	1610
2003	3250	3960	4140	2385	766	311	173	188	215	285	288	1740
2004	3020	3165	1350	840	432	263	178	198	228	363	358	712
2005	1030	706	436	1520	1380	485	234	171	188	282	1330	1910
2006	8630	4175	2150	1505	578	389	235	195	219	239	3500	5410
2007	3980	1140	2440	1005	454	282	235	237	248	319	482	4380
2008	4930	3855	1880	1550	692	351	261	225	242	260	603	537
2009	4380	742	1490	1110	1050	292	216	215	222	249	1230	1470
2010	4680	2300	2050	3115	1120	1490	326	245	290	289	1028	5510
2011	4930	1915	5200	2925	1320	573	341	249	254	284	439	618
2012	3890	2210	4390	2205	1020	511	278	228	237	451	1425	5990
2013	1650	1070	1250	853	436	459	245	208	293	330	626	554
2014	798	3945	4040	2280	985	347	255	199	209	329	897	2690
2015	2000	3085	1840	930	362	218	202	188	218	213	907	8020
2016	5350	3290	3880	1065	433	280	228	208	257	1210	1820	4480
2017	2980	7800	5090	2760	1230	450	242	212	238	310	2190	1810
Median	3380	2790	2310	1220	613	321	212	186	220	260	685	2500

Key

Q in cfs

- $Q \leq 117$
- $117 < Q \leq 153$
- $153 < Q \leq 188$
- $188 < Q \leq 213$
- $213 < Q \leq 264$
- $264 < Q \leq 366$
- $366 < Q \leq 584$
- $584 < Q \leq 1{,}950$
- $1{,}950 < Q \leq 4{,}290$
- $4{,}290 < Q \leq 5{,}760$
- $Q > 5{,}760$

Q as percentile

- $Q \leq$ 5th
- 5th $< Q \leq$ 10th
- 10th $< Q \leq$ 15th
- 15th $< Q \leq$ 20th
- 20th $< Q \leq$ 30th
- 30th $< Q \leq$ 40th
- 40th $< Q \leq$ 50th
- 50th $< Q \leq$ 75th
- 75th $< Q \leq$ 90th
- 90th $< Q \leq$ 95th
- $Q >$ 95th

Distribution

- December through March are the months with the highest average flow and also when the highest daily flows occur.
- July through September are the months with the lowest average flow. The lowest daily flows can occur June through October.

Seasonal onsets

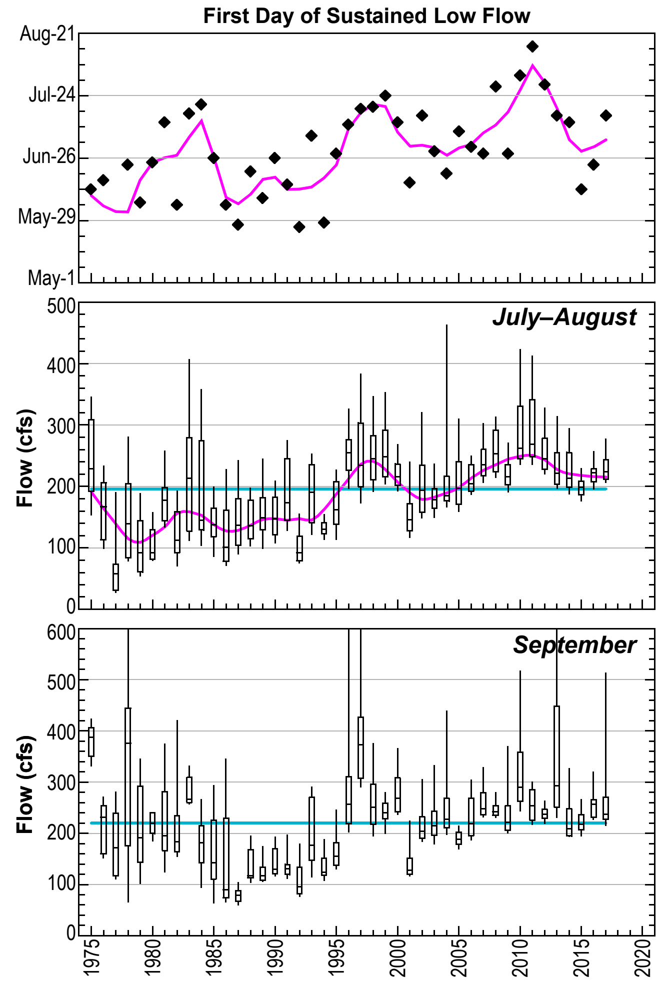
- Low flow criterion: 7d-Q ≤ 250 cfs (~28th pctl)
- Rainy season criterion: 7d-Q ≥ 300 cfs (~47th pctl)
- Rainy season flow for 1976 did not occur until the following March (3/3/1977).

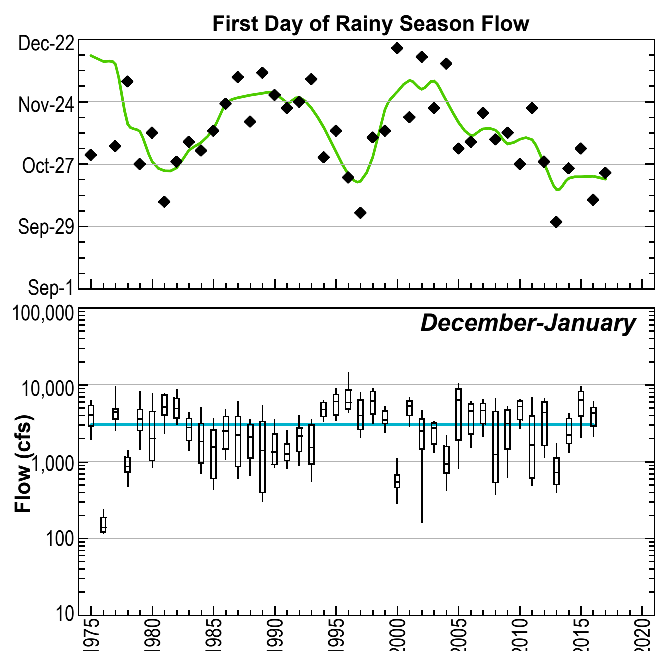
Trends

- Low flow onset is becoming later. The trend is statistically significant. As natural flow decreases in the spring, a greater fraction of the flow is effluent from the WWTFs. WWTF discharges have increased over time which may account for an apparent delay of low flow conditions.
- Flows in July–August show a statistically significant increase despite the presence of year-to-year variability. Flows in the mid-1970s through 1980s are about half of current flows.
- The sharp increase in July–August flows that occurred between 1995 and 1996 is likely due to a reduction of about 40 cfs in the diversion of water into the Oswego Canal.
- For the rainy season, onset may be arriving earlier, but the trend is statistically significant.
- No trends are evident in the magnitude of the flow in the December–January rainy season.

Anomalies

- 1977: Water year 1977 was a drought year which accounts for the low December-1976 to January-1977 flow.
- 2001: The reservoir did not fill and water allocations were severely curtailed. The water users cooperated to conserve water.
- 2011: Joint Water Commission was releasing more water than usual from Barney Reservoir during the spring to facilitate repairs of Eldon Mills Dam which caused the late onset of low flow season.





14202850 — SCOGGINS CREEK ABOVE HENRY HAGG LAKE NEAR GASTON, OREGON — SCLO

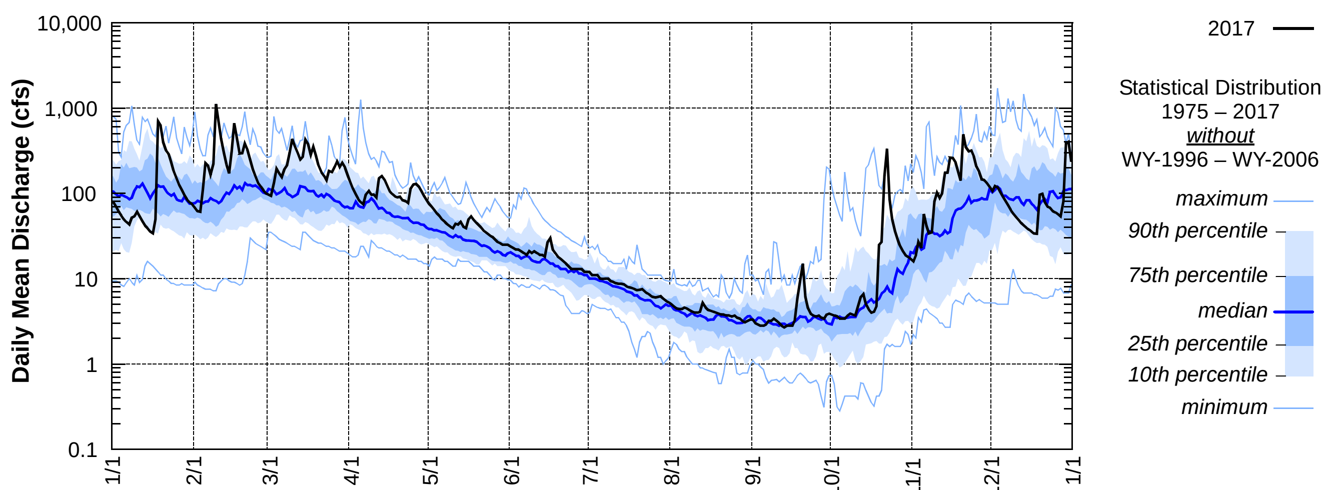
Data source: Oregon Water Resources Division

River mile: 9.3 *Latitude:* 45 30 06 *Longitude:* 123 15 06

Day	2017 Daily Mean Discharge in Cubic Feet per Second†											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	79	68	97	136	75	24	12	5.0	3.3	3.8	16	107
2	69	62	94	114	70	23	11	4.7	3.0	3.7	19	122
3	61	61	132	98	64	22	11	4.5	2.9	3.6	27	118
4	55	110	194	86	58	22	11	4.4	2.8	3.4	23	104
5	50	225	171	79	54	21	10	4.4	2.8	3.4	57	92
6	46	211	154	74	49	20	9.9	4.6	2.9	3.4	42	81
7	43	165	194	97	46	19	10	4.5	3.2	3.7	34	72
8	52	222	215	107	43	21	10	4.3	3.2	3.9	35	64
9	54	1120	297	96	41	20	9.3	4.1	3.4	3.8	80	58
10	61	699	436	97	39	21	9.2	4.0	3.2	3.7	101	53
11	54	435	357	90	44	20	8.9	4.0	3.0	4.7	88	49
12	47	295	297	150	43	19	8.7	4.1	2.8	6.1	100	45
13	42	216	248	160	46	19	8.7	5.2	2.7	6.6	174	42
14	39	171	269	145	41	18	8.6	4.6	2.8	5.0	174	39
15	36	310	426	124	39	27	8.1	4.3	2.8	4.4	261	37
16	34	663	372	107	50	30	7.9	4.2	2.8	4.0	259	35
17	50	425	282	98	54	22	7.8	4.1	3.3	4.1	230	34
18	697	294	350	92	49	20	7.6	4.0	5.9	4.8	179	33
19	619	296	278	90	45	18	7.3	3.9	9.7	25	141	97
20	401	382	213	91	42	17	7.4	3.8	15	27	491	100
21	319	325	178	83	39	16	7.5	3.8	6.1	162	348	78
22	291	245	162	81	36	15	7.0	3.7	4.5	334	312	70
23	231	192	142	77	34	14	6.7	3.7	3.9	85	320	68
24	181	158	184	114	32	13	6.4	3.6	3.7	50	270	62
25	148	133	178	127	31	13	6.1	3.7	3.6	36	205	60
26	125	120	203	129	29	13	6.0	3.5	3.7	29	177	57
27	109	108	237	120	27	13	6.1	3.4	3.5	24	146	54
28	95	100	204	107	26	13	6.2	3.2	3.4	21	143	81
29	85	97	228	94	25	12	5.8	3.1	3.8	19	132	385
30	78	—	201	84	25	12	5.5	3.2	3.9	18	120	403
31	74	—	165	—	25	—	5.3	3.3	—	17	—	243
TOTAL	4325	7908	7158	3147	1321	557	253	125	122	923	4704	2943
MEAN	140	273	231	105	43	19	8.2	4.0	4.1	30	157	95
MAX	697	1120	436	160	75	30	12	5.2	15	334	491	403
MIN	34	61	94	74	25	12	5.3	3.1	2.7	3.4	16	33
AC-FT	8579	15685	14198	6242	2620	1105	502	248	241	1831	9330	5837

† All 2017 data are provisional data–subject to revision; e=estimated value

SCLO — 14202850 — Scoggins Creek above Henry Hagg Lake near Gaston, Oregon [RM 9.3]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	7 < Q < 10	10 < Q ≤ 35	35 < Q ≤ 45	45 < Q ≤ 50	50 < Q ≤ 60	60 < Q ≤ 70	70 < Q ≤ 85	85 < Q ≤ 120	120 < Q ≤ 170	170 < Q ≤ 250	250 < Q ≤ 500	500 < Q ≤ 1,700	1,700 < Q ≤ 3,000
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.2%	3.5%	11%	8.4%	8.8%	11%	10%	13%	9.2%	10%	9.7%	4.3%	0.1%

Key

- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

WY-1996 -- WY-2006 omitted from analysis

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1975	179	133	123	53	33	11	5.4	3.0	1.9	4.9	79	147
1976	164	92	129	60	21	12	5.7	3.8	2.4	2.2	5.9	6.8
1977	9.1	9.1	59	21	16	12	4.5	1.5	4.5	6.2	72	144
1978	163	122	55	51	46	17	5.7	1.6	3.8	1.8	6.7	45
1979	31	190	68	37	29	11	4.0	3.0	2.8	4.0	24	127
1980	151	125	93	67	21	15	6.2	3.4	3.2	2.2	40	117
1981	59	106	51	69	26	24	8.4	3.6	2.2	20	96	215
1982	147	202	131	110	33	14	7.9	4.1	3.8	11	50	211
1983	158	304	160	74	29	12	11.0	3.3	5.9	5.3	154	96
1984	102	132	102	66	68	31	12	6.3	5.2	11	135	94
1985	44	79	69	67	24	19	7.4	3.7	4.4	8.4	29	47
1986	124	138	93	39	35	13	9.1	2.3	4.4	5.5	34	65
1987	117	114	154	43	19	9.7	5.8	2.3	2.1	4.7	15	75
1988	98	72	43	50	26.0	16	7.8	2.9	1.8	3.5	53	54
1989	121	51	136	53	19	8.4	3.7	1.8	0.7	0.6	11	17
1990	80	172	109	35	22	19	5.1	3.0	3.0	4.6	21	41
1991	68	102	82	78	30	15	9.1	4.3	2.2	1.2	11	46
1992	70	91	32	40	16	8.1	2.4	1.1	1.7	3.1	16	80
1993	67	45	71	94	44	25	9.8	5.1	2.8	3.5	5.0	37
1994	71	63	74	44	20	12	5.5	2.4	1.5	2.3	77	183
1995	153	121	120	57	26	13	7.4	3.5	3.9			
1996–2005												
2006										3	187	150
2007	86	64	104	44	21	10	5.1	3.2	2.9	10	29	178
2008	139	112	107	85	39	19	7.2	4.6	3.4	6.2	40	39
2009	129	40	92	54	52	17	6.6	4.4	3.7	10	104	90
2010	202	90	81	99	41	41	12	6.1	7.5	10	81	189
2011	105	69	175	118	45	24	13	6.6	4.1	8.3	24	39
2012	125	90	150	78	44	22	10	4.9	3.3	7.0	94	200
2013	75	69	64	44	21	18	6.9	4.8	4.7	19	33	27
2014	35	111	136	75	50	16	7.5	3.9	2.9	8.2	60	126
2015	84	73	50	32	16	7.8	4.2	2.6	3.0	3.8	52	332
2016	189	143	175	44	17	10	5.8	2.9	3.0	79	106	127
2017	69	219	204	98	42	19	7.9	4.0	3.3	5.0	142	68
Median	96	100	96	57	28	14	6.8	3.6	3.2	5.3	46	91

Key

Q in cfs

- Q ≤ 2.2
- 2.2 < Q ≤ 3.1
- 3.1 < Q ≤ 3.9
- 3.9 < Q ≤ 5.0
- 5.0 < Q ≤ 8.8
- 8.8 < Q ≤ 16
- 16 < Q ≤ 28
- 28 < Q ≤ 82
- 82 < Q ≤ 163
- 163 < Q ≤ 235
- Q > 235

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

- December through February are the months with the highest average flow.
- August and September are the months with the lowest average flows. The lowest daily flows occur in September and October.
- Data from October-1996 through September-2006 are missing due to issues with OWRD data processing.

Seasonal onsets

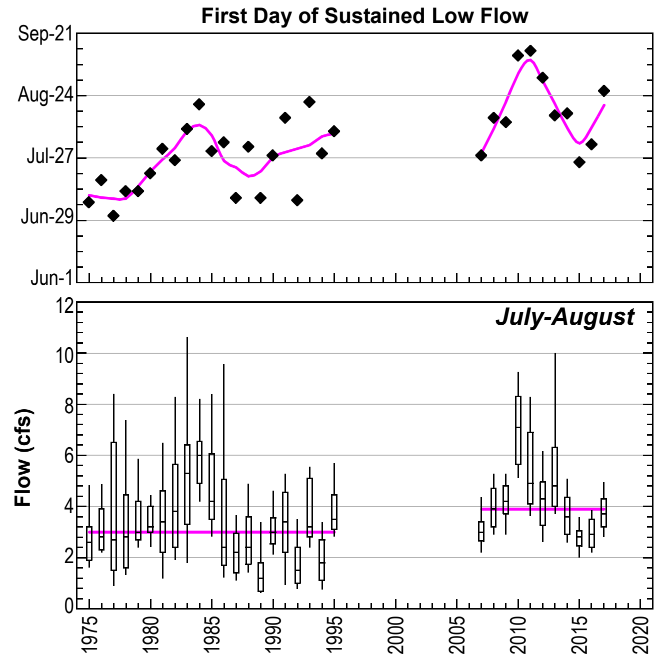
- Low flow criterion: 7d-Q ≤ 7 cfs (~26th pctl)
- Rainy season criterion: 7d-Q ≥ 80 cfs (~70th pctl)

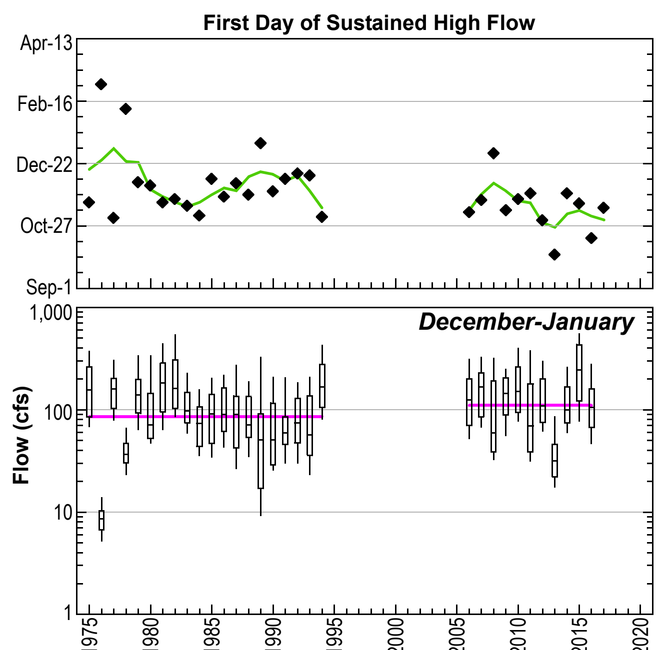
Trends

- Flows before and after the data gap have a statistically significant difference. Flows from the later period are about 1.3 times those in the earlier period. The factor is the same for both the July–August period and the December–January period.
- Low flow onset occurs later after 2006 compared to before 1996. The difference is statistically significant and is consistent with higher flows in the more recent period.
- For the rainy season, onset may be earlier, but the trend is not statistically significant. An earlier onset of higher flow would be consistent with higher flows in the more recent period.

Anomalies

- 1977: Water year 1977 was a drought year which accounts for the low December-1976 to January-1977 flow.





14202920 — SAIN CREEK ABOVE HENRY HAGG LAKE NEAR GASTON, OREGON — SCHO

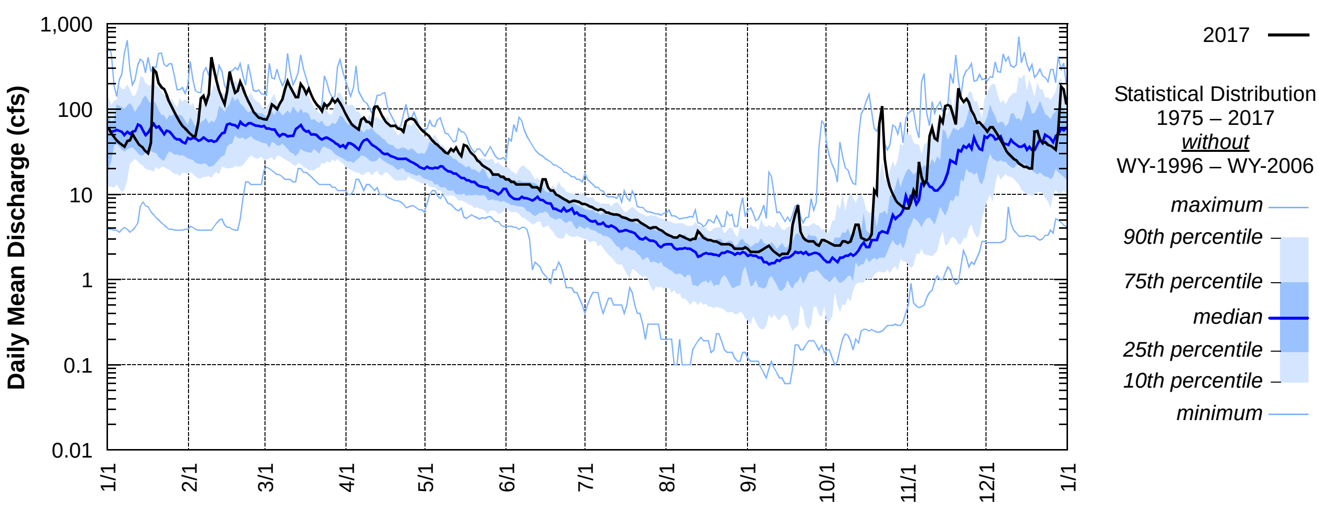
Data source: Oregon Water Resources Division

River mile: 1.6 *Latitude:* 45 28 50 *Longitude:* 123 14 40

Day	2017 Daily Mean Discharge in Cubic Feet per Second†											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	59	51	76	88	53	15	7.7	3.4	2.3	2.8	6.8	54
2	52	48	75	77	50	15	7.5	3.3	2.1	2.7	8.1	61
3	47	48	89	69	47	14	7.2	3.2	2.1	2.6	11	61
4	43	70	113	63	43	14	7.0	3.1	2.1	2.5	9.5	55
5	40	133	107	60	40	13	6.7	3.1	2.1	2.5	24	49
6	38	142	100	57	38	13	6.5	3.3	2.2	2.5	16	43
7	36	117	116	75	35	13	6.7	3.2	2.3	2.8	13	38
8	42	148	131	79	33	13	6.5	3.1	2.4	2.8	15	33
9	43	404	171	71	31	13	6.1	3.0	2.5	2.7	48	30
10	51	289	212	70	30	13	6.1	2.9	2.3	2.8	60	28
11	45	213	182	65	34	12	5.9	3.0	2.1	3.4	45	26
12	40	163	157	106	32	12	5.8	3.0	2.0	4.4	43	25
13	37	133	137	107	35	12	5.8	3.7	1.9	4.4	78	23
14	35	114	138	95	31	11	5.7	3.4	2.0	3.1	69	22
15	32	161	198	82	28	15	5.4	3.1	2.0	3.0	109	21
16	30	275	180	73	38	15	5.3	3.0	2.0	2.9	112	21
17	40	202	151	68	37	12	5.2	2.9	2.3	3.0	108	20
18	294	155	174	63	33	11	5.0	2.9	4.4	3.4	84	20
19	273	163	146	63	30	11	4.9	2.8	5.8	11	66	54
20	201	208	126	64	28	10	5.0	2.8	7.4	10	175	55
21	180	178	114	59	25	9.6	5.0	2.7	3.6	67	134	44
22	172	143	105	58	24	9.2	4.7	2.6	3.1	108	121	40
23	147	123	94	54	22	8.8	4.5	2.6	2.9	26	132	41
24	121	108	115	72	21	8.5	4.3	2.6	2.8	16	119	38
25	105	93	107	76	20	8.1	4.1	2.6	2.8	12	95	37
26	90	86	116	77	19	8.3	4.0	2.5	2.8	10	84	35
27	79	79	132	75	17	8.4	4.1	2.3	2.6	8.7	69	33
28	70	78	120	68	17	8.2	4.1	2.3	2.5	7.9	70	55
29	63	76	129	62	17	8.1	3.9	2.3	2.9	7.4	65	184
30	59	—	117	57	16	7.7	3.8	2.3	2.9	7.1	60	170
31	55	—	102	—	16	—	3.6	2.4	—	6.8	—	117
TOTAL	2619	4201	4030	2153	940	342	168	89	83	352	2049	1533
MEAN	84	145	130	72	30	11	5.4	2.9	2.8	11	68	49
MAX	294	404	212	107	53	15	7.7	3.7	7.4	108	175	184
MIN	30	48	75	54	16	7.7	3.6	2.3	1.9	2.5	6.8	20
AC-FT	5195	8333	7993	4270	1864	678	333	177	165	699	4065	3041

† All 2017 data are provisional–subject to revision; e=estimated value

SCHO — 14202920 — Sain Creek above Henry Hagg Lake near Gaston, Oregon [RM 1.6]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	0.05 < Q < 0.1	0.1 < Q ≤ 0.5	0.5 < Q ≤ 2	2 < Q ≤ 3	3 < Q ≤ 5	5 < Q ≤ 10	10 < Q ≤ 20	20 < Q ≤ 30	30 < Q ≤ 45	45 < Q ≤ 65	65 < Q ≤ 120	120 < Q ≤ 400	400 < Q ≤ 2,000	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	0.1%	2.4%	11%	8.0%	10%	12%	13%	9.9%	9.8%	8.7%	9.6%	5.1%	0.1%	0.8%

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

WY-1996 -- WY-2006 omitted from analysis

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1975	115	86	78	27	16	5.1	1.9	0.8	0.2	2.3	26	70
1976	81	39	65	31	11	6.0	2.8	2.2	1.4	1.6	3.0	3.2
1977	3.9	4.2	30	10	6.9	1.4	0.5	0.6	2.0	2.7	20	70
1978	92	67	38	27	25	13	4.1	1.1	4.1	2.7	2.6	19
1979	17	87	35	19	15	6.4	3.6	2.7	2.4	2.6	10	62
1980	75	57	46	25	8.9	3.9	2.2	1.8	1.7	1.8	14	39
1981	27	55	26	34	12	9.5	2.2	0.2	0.1	10	43	89
1982	83	107	71	66	16	6.5	3.0	1.1	1.2	3.1	17	93
1983	77	157	89	45	17	11	6.5	3.0	4.1	3.0	73	53
1984	52	67	57	36	32	16	6.4	3.7	3.0	5.4	56	51
1985	26	43	29	29	11	7.7	2.4	1.7	1.9	1.9	9.3	20
1986	57	69	44	19	17	6.5	3.0	0.5	0.7	2.2	7.4	28
1987	59	60	81	19	7.4	5.1	3.3	0.5	0.3	0.3	1.3	30
1988	51	38	25	30	16	12	4.7	1.5	0.9	1.7	23	23
1989	68	27	68	34	11	5.7	2.5	1.1	0.6	1.1	3.7	7.1
1990	53	91	57	19	11	9.5	2.0	1.2	1.1	2.1	9.0	24
1991	35	49	43	35	15	7.1	3.5	2.1	1.1	1.1	7.2	23
1992	28	44	18	24	8.9	4.3	1.2	0.8	0.8	1.2	7.5	45
1993	35	21	33	44	21	11	5.2	3.0	1.6	1.2	1.4	16
1994	32	27	35	22	10	5.8	1.7	0.6	0.4	0.3	33	90
1995	82	68	63	31	15	7.8	4.7	4.2	4.1			
1996–2005												
2006										2.1	72	67
2007	51	39	57	29	14	6.7	4.1	2.6	1.9			
2008	72	63	53	50	17	9.7	3.6	2.3	2.0	3.6	21	22
2009	68	21	41	26	30	11	4.8	3.0	2.4	3.5	52	36
2010	119	54	52	62	30	26	8.1	4.3	4.5	4.2	33	125
2011	64	35	117	61	27	13	7.4	3.9	2.6	3.8	7.2	14
2012	85	52	88	40	24	12	5.6	3.2	2.1	2.9	52	118
2013	36	30	31	22	11	8.2	3.9	2.8	2.4	6.6	15	16
2014	20	83	90	51	28	9.5	4.3	2.4	1.8	3.0	18	67
2015	45	49	30	22	8.8	4.5	2.5	1.6	2.0	1.8	23	206
2016	109	83	91	24	10	6.3	3.8	2.1	2.2	40	56	84
2017	52	138	120	70	31	12	5.3	2.9	2.4	3.4	68	38
Median	51	60	45	26	12	6.9	3.0	1.5	1.3	2.1	12	35

Key

Q in cfs

- $Q \leq 0.9$
- $0.9 < Q \leq 1.6$
- $1.6 < Q \leq 2.1$
- $2.1 < Q \leq 2.7$
- $2.7 < Q \leq 4.4$
- $4.4 < Q \leq 7.9$
- $7.9 < Q \leq 14$
- $14 < Q \leq 42$
- $42 < Q \leq 85$
- $85 < Q \leq 122$
- $Q > 122$

Q as percentile

- $Q \leq 5th$
- $5th < Q \leq 10th$
- $10th < Q \leq 15th$
- $15th < Q \leq 20th$
- $20th < Q \leq 30th$
- $30th < Q \leq 40th$
- $40th < Q \leq 50th$
- $50th < Q \leq 75th$
- $75th < Q \leq 90th$
- $90th < Q \leq 95th$
- $Q > 95th$

Distribution

- December through February are the months with the highest average flows.
- August and September are the months with the lowest average flows.
- Data from October–December 2007 are missing. The effect of the missing data on the percentiles is unknown because they could include both low and high flow values.
- Data from October-1996 through September-2006 are missing due to issues with OWRD data processing.

Seasonal onsets

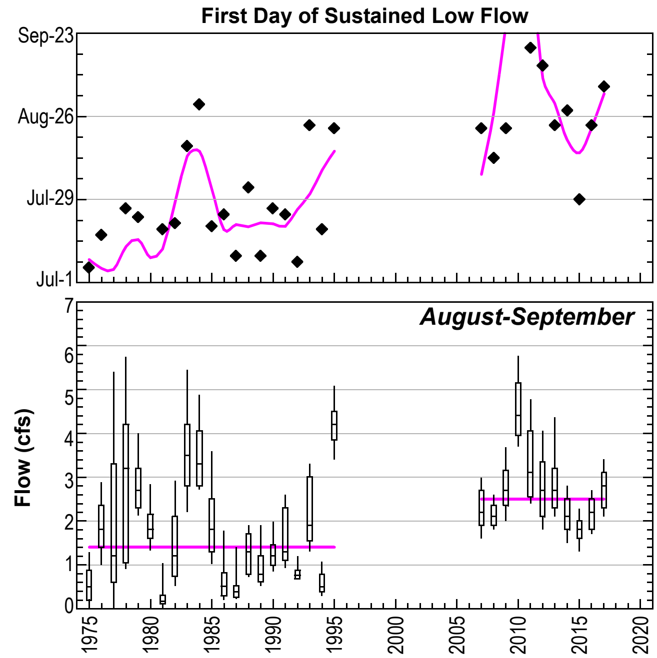
- Low flow criterion: 7d-Q ≤ 3.5 cfs (~25th pctl)
- Low flow did not occur in 2010.
- Rainy season criterion: 7d-Q ≥ 40 cfs (~73rd pctl)

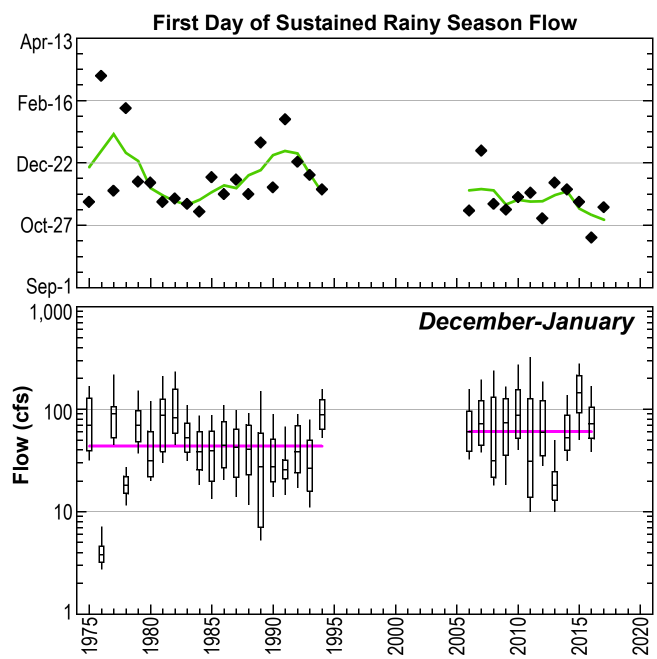
Trends

- Flows before and after the data gap have a statistical significant difference. For July–August, flows from the later period are about 1.8 times those in the earlier period. For December–January, flows from the later period are about 1.4 times those in the earlier period.
- Low flow onset occurs later after 2006 compared to before 1996. The difference is statistically significant and is consistent with higher flows in the more recent period.
- For the rainy season, onset may be earlier in the more recent period, but the trend is not statistically significant. An earlier onset of higher flow would be consistent with higher flows in the more recent period.

Anomalies

- 1977: Water year 1977 was a drought year which accounts for the low December-1976 to January-1977 flow.





14202860 — TANNER CREEK ABOVE HENRY HAGG LAKE NEAR GASTON, OREGON — TANO

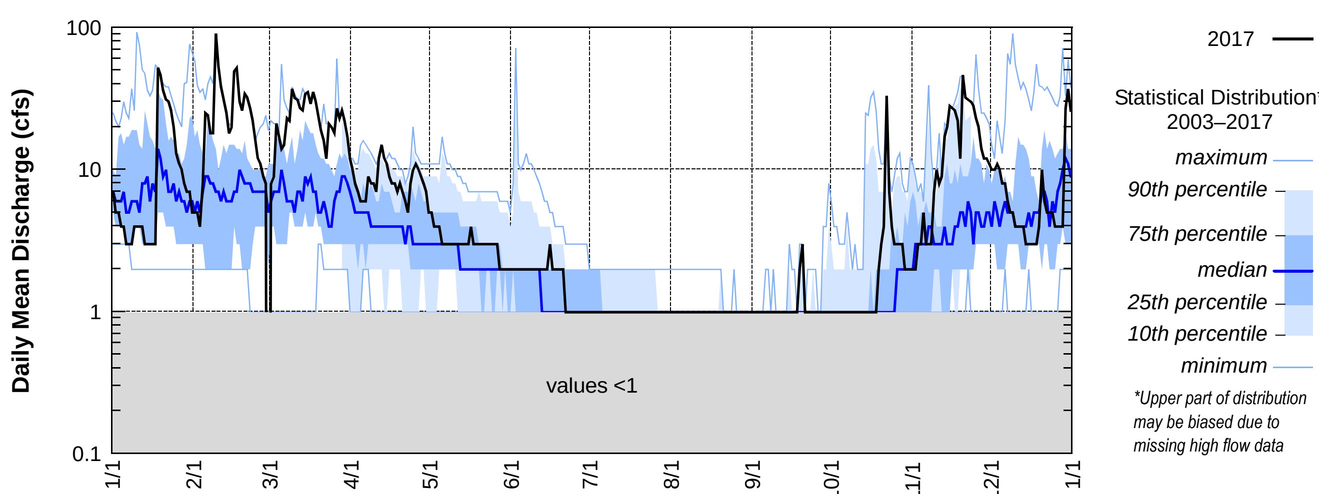
Data source: Tualatin Valley Irrigation District

River mile: 1.6 *Latitude:* 45 30 21 *Longitude:* 123 13 10

Day	2017 Daily Mean Discharge in Cubic Feet per Second[a]											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	7	5	0	12	5	2	1	1	1	1	2	10
2	5	5	8	10	5	2	1	1	1	1	2	10
3	5	4	9	8	4	2	1	1	1	1	3	11
4	4	8	21	7	4	2	1	1	1	1	3	10
5	4	25	17	6	4	2	1	1	1	1	5	8
6	3	24	14	6	3	2	1	1	1	1	3	8
7	3	18	15	6	3	2	1	1	1	1	3	6
8	3	18	23	9	3	2	1	1	1	1	3	5
9	4	90	22	8	3	2	1	1	1	1	7	5
10	4	53	37	8	3	2	1	1	1	1	10	4
11	4	38	32	7	3	2	1	1	1	1	8	4
12	4	31	31	12	3	2	1	1	1	1	9	4
13	3	25	27	15	3	2	1	1	1	1	17	4
14	3	18	26	12	3	2	1	1	1	1	20	3
15	3	20	34	11	3	2	1	1	1	1	28	3
16	3	49	35	9	3	3	1	1	1	1	27	3
17	3	52	29	8	4	2	1	1	1	1	26	3
18	52	30	35	8	3	2	1	1	1	1	22	3
19	46	26	30	7	3	2	1	1	2	2	12	4
20	36	34	24	8	3	2	1	1	3	3	46	10
21	31	32	19	7	3	2	1	1	1	4	32	6
22	30	27	16	6	3	1	1	1	1	33	31	5
23	26	22	12	5	3	1	1	1	1	7	30	5
24	20	16	21	8	3	1	1	1	1	4	28	5
25	13	12	20	10	3	1	1	1	1	3	23	4
26	11	11	18	11	3	1	1	1	1	3	20	4
27	10	9	27	10	3	1	1	1	1	3	14	4
28	8	8	23	9	2	1	1	1	1	3	12	4
29	7	0	26	8	2	1	1	1	1	2	12	27
30	7	—	22	7	2	1	1	1	1	2	11	37
31	5	—	17	—	2	—	1	1	—	2	—	26
TOTAL	367	710	690	258	97	52	31	31	33	89	469	245
AC-FT	728	1408	1369	512	192	103	61	61	65	177	930	486

[a]Values are read from a staff plate. Values may be daily readings taken at about 0800 or averages over several days

TANO — 14202860 — Tanner Creek above Henry Hagg Lake near Gaston, Oregon [RM 1.6]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	Q=1	Q=2	Q=3	Q=4	Q=5	6 ≤ Q ≤ 8	9 ≤ Q ≤ 14	15 ≤ Q ≤ 29	30 ≤ Q ≤ 49	50 ≤ Q ≤ 79	80 < Q ≤ 100	Missing
Jan												
Feb												
Mar												
Apr												
May												
Jun												
July												
Aug												
Sep												
Oct												
Nov												
Dec												
All	2.8%	35%	16%	8.7%	10%	8.3%	7.8%	4.8%	1.9%	0.4%	0.1%	3.7%

Key
- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003	9	8	11	6	2	1	1	1	1	1	2	7
2004	10	8	4	3	2	1	1	0	1	1	2	2
2005	4	2	1	4	3	1	1	1	1	1	3	6
2006	25	5	3	2	1	1	1	1	0	1	10	9
2007	6	4	5	2	1	1	1	1	1	1	1	
2008	10	12	8	7	4	2	1	1	1	1	2	2
2009		2	5	1	1	0	1	1	1	1	3	2
2010				10	5	5	2	2	1	1		
2011		11	17	11	7	2	1	1	1	1	1	1
2012	5	4		4	2	2	2	1	1	1	6	5
2013	2	2	2	3	2	2	1	1	1	2	4	3
2014	4	6	6	5	4	1	1	1	1	1	4	9
2015	5	7	4	3	2	1	1	1	1	1	5	32
2016	27	19	19	4	2	1	1	1	1	7	9	12
2017	5	23	22	8	3	2	1	1	1	1	12	5
Median	7	7	7	4	2	1	1	1	1	1	3	5

Key

Q in cfs
- Q = 0
- Q = 1
- 1 < Q ≤ 2
- 2 < Q ≤ 5
- 5 < Q ≤ 12
- 12 < Q ≤ 20
- Q > 20

Q as percentile
- Q ≤ 3rd
- 3rd < Q ≤ 40th
- 40th < Q ≤ 56th
- 56th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

- December through March are the months with the highest average flows. Because some of data from these months are missing, the distribution likely under-represents the frequency and range of high flows.
- June through October are the months with the lowest average flows.
- Low flows can occur almost any time of the year.
- Tanner Creek drains a small watershed and therefore flows tend to be very low overall.
- Low flow measurements have only one significant digit and cannot be distinguished from one another.

14204530 — GALES CREEK AT OLD HWY 47 NEAR FOREST GROVE, OREGON — GALES

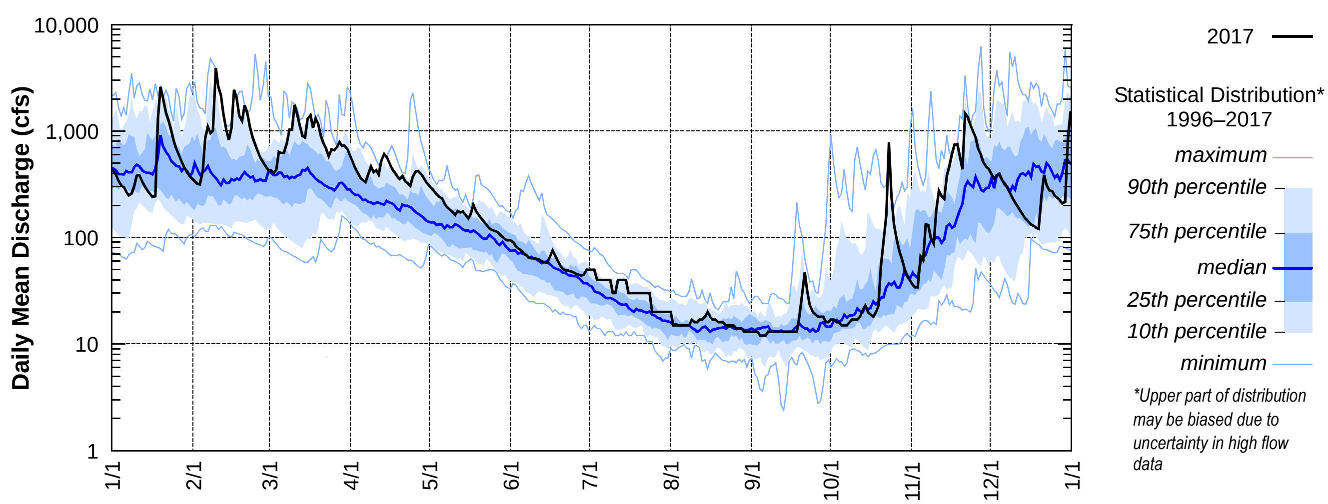
Data source: Oregon Water Resources Division

River mile: 2.36 *Latitude:* 45 30 39 *Longitude:* 123 06 56

Day	2017 Daily Mean Discharge in Cubic Feet per Second†											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	423	337	428	519	291	91	50e	15e	13	17	34	354
2	392	320	404	452	275	83	50e	15e	13	16	34	383
3	338	316	433	401	255	79	40e	15e	12	16	66	389
4	308	415	637	363	240	76	40e	15e	12	15	61	348
5	299	860	619	344	234	72	40e	15e	12	15	134	321
6	269	1090	623	334	208	69e	40e	15e	13	15	131	292
7	249	952	769	389	193	65e	40e	15e	13	16	99	262
8	260	1010	1030	464	182	64e	40e	17	13	17	87	234
9	305	3900e	1030	411	174	64e	30e	16	13	17	180	212
10	383	2600e	1760	427	163	63e	30e	16	13	17	273	193
11	384	2160	1410	387	178	62e	40e	17	13	18	246	177
12	333	1430	1110	535	173	60e	40e	17	13	21	231	162
13	301	1020	900	611	176	59e	40e	18	13	23	379	151
14	277	822	869	569	163	58e	40e	20	13	20	468	141
15	258	1070	1310	503	152	66e	30e	18	13	19	607	133
16	240	2430	1410	446	167	76e	30e	17	13	18	744	129
17	244	2050	1070	407	202	68e	30e	17	13	20	755	123
18	1300e	1360	1310	375	178	61e	30e	16	18	23	578	121
19	2590e	1240	1160	354	164	55e	30e	16	31	54	436	247
20	2030	1750	912	378	152	51e	30e	16	47	90	1470	389
21	1490	1490	758	336	141	49e	30e	15	31	165	1360	308
22	1260	1080	680	321	132	49e	30e	15	23	777	1130	276
23	1030	874	582	305	122e	48e	30e	15	20	242	987	272
24	816	749	667	374	118e	47e	20e	15	19	132	871	246
25	681	640	662	415	116	46e	20e	14	18	94	677	236
26	586	561	703	422	113	45e	20e	14	18	74	592	224
27	514	503	792	397	107	44e	20e	14	18	62	502	209
28	454	463	724	364	101	45e	20e	13	16	51	461	217
29	413	428	731	333	97	50e	20e	13	16	43	438	789
30	380	—	678	314	94	50e	20e	13	17	39	392	1480
31	358	—	592	—	95	—	20e	13	—	36.0	—	842
TOTAL	19165	33920	26763	12250	5156	1815	990	480	510	2182	14423	9860
MEAN	618	1170	863	408	166	60.5	31.9	15.5	17.0	70.4	481	318
MAX	2590	3900	1760	611	291	91	50	20	47	777	1470	1480
MIN	240	316	404	305	94	44	20	13	12	15	34	121
AC-FT	38013	67279	53084	24298	10227	3600	1964	952	1012	4328	28608	19557

† All 2017 data are provisional–subject to revision; e=estimated value

GALES — 14204530 — Gales Creek at Old Hwy 47 near Forest Grove, Oregon [RM 2.36]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	2 < Q < 6	6 < Q ≤ 10	10 < Q ≤ 15	15 < Q ≤ 20	20 < Q ≤ 35	35 < Q ≤ 70	70 < Q ≤ 120	120 < Q ≤ 200	200 < Q ≤ 300	300 < Q ≤ 500	500 < Q ≤ 1,000	1,000 < Q ≤ 4,000	4,000 < Q ≤ 10,000
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.2%	3.1%	9.2%	8.6%	11%	10%	11%	11%	10%	11%	9.7%	4.9%	0.1%

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1996	634	751	256	336	231	70	26	13	18	33	88	1034
1997	645	356	725	195	97	72	29	16	26	146	342	314
1998	805	599	403	203	104	55	30	14	15	26	86	742
1999	628	1255	438	246	119	48	24	19	14	19	175	581
2000	527	337	310		88	62	26	14	11	15	31	101
2001	86	136	89	72	76	31	17	15	13	23	140	743
2002	648	474	298	185	78	40	15	8	8	9	68	239
2003	385	330	545	282	122	38	20	12	12	24	43	294
2004	431	429	255	168	87	45	21	13	20	29	88	141
2005	211	117	81	235	133	73	26	17	13	28	169	281
2006	986	279	279	215	99	60	22	10	9	11	538	512
2007	307	169	344	143	71	29	17	13	7	22	66	722
2008	581	465	333	274	119	38	15	13	11	15	77	82
2009	403	140	272	182	143	60	22	13	18	30	243	243
2010	745	321	285	349	146	145	41	25	29	29	190	758
2011	459	315	753	401	172	79	40	21	17	19	50	107
2012	461	376	566	275	141	66	27	16	12	21	271	1040
2013	291	226	233	142	86	55	20	15	15	65	113	116
2014	155	447	430	277	182	58	23	16	13	20	123	392
2015	283	283	207	150	62	23	13	13	14	16	167	1290
2016	732	518	656	132	60	28	19	10	10	194	309	578
2017	383	1015	758	399	167	62	30	15	13	20	437	246
Median	502	337	324	207	115	54	23.4	14.6	14.0	24	118	365

Key

Q in cfs

- Q ≤ 11
- 11 < Q ≤ 14
- 14 < Q ≤ 16
- 16 < Q ≤ 19
- 19 < Q ≤ 30
- 30 < Q ≤ 60
- 60 < Q ≤ 102
- 102 < Q ≤ 307
- 307 < Q ≤ 653
- 653 < Q ≤ 999
- Q > 999

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

- December through March are the months with the highest average flows.
- August and September are the months with the lowest average flow and the lowest daily flows.

Seasonal onsets

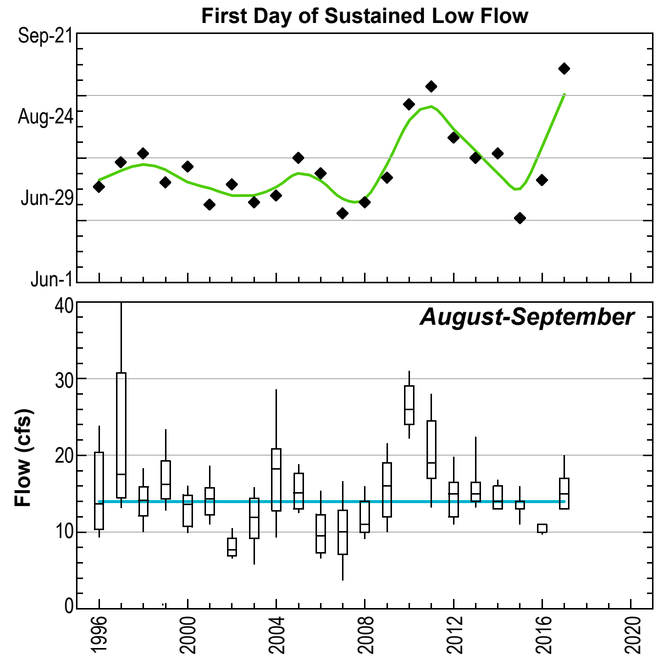
- Low flow criterion: 7d-Q ≤ 25 cfs (~26th pctl)
- Rainy season criterion: 7d-Q ≥ 300 cfs (~74th pctl)
- The rainy season criterion was not met in 2000.

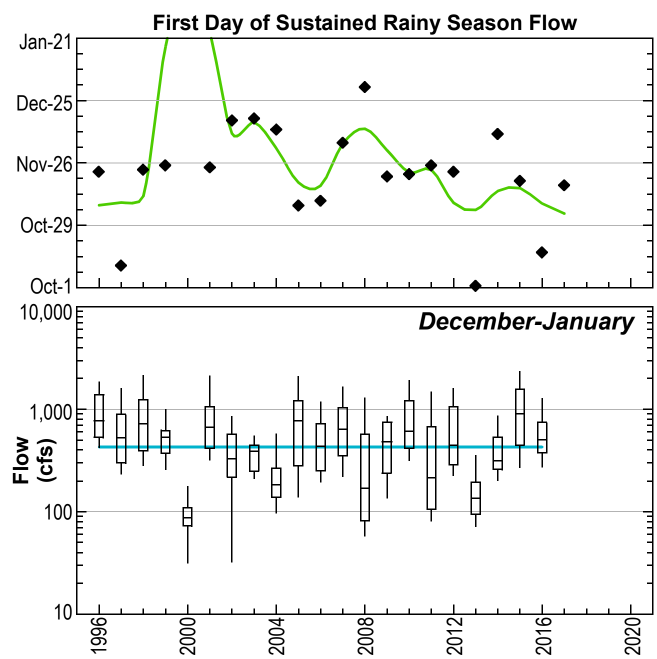
Trends

- No trend is evident in the onset of low flow season.
- No trends are evident in the magnitude of the flow for August–September.
- No trend is evident in the onset of the rainy season.
- No trend is evident in the magnitude of the flow for December–January.

Anomalies

- 2000: The winter of 2000-2001 was very dry, causing the rainy season criterion not to met in 2000. Winter flows were low that year.
- Spring rainfall in both 2010 and 2011 was high, resulting in higher flows that persisted into summer.





14205400 — EAST FORK DAIRY CREEK NEAR MEACHAM CORNER, OR — 5400

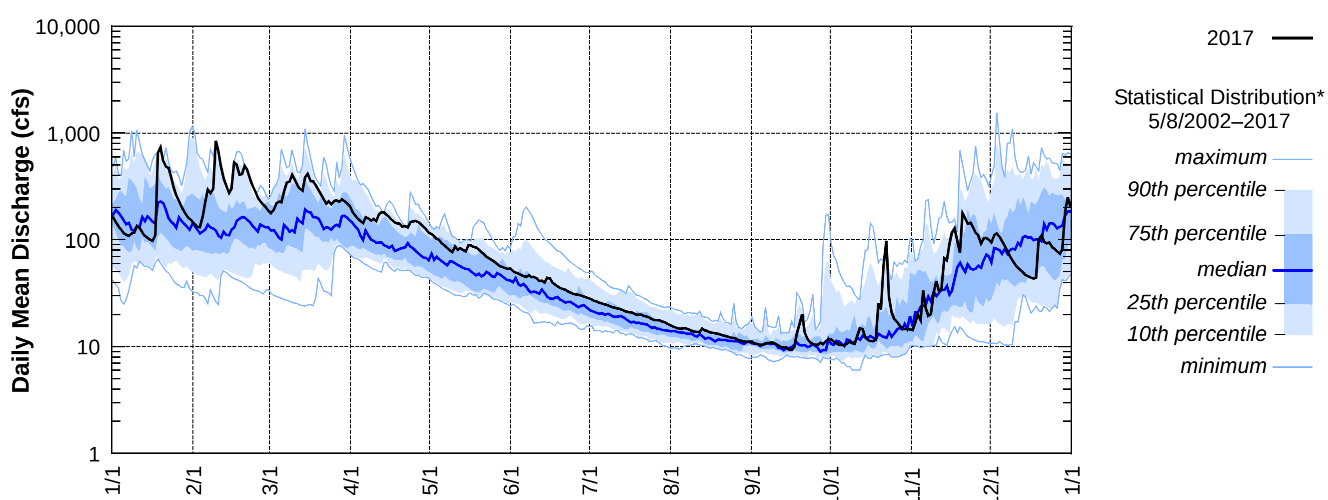
Data source: U.S. Geological Survey, Oregon Water Science Center

River mile: 12.4 *Latitude:* 45 40 51 *Longitude:* 123 04 12 *Drainage area:* 32.92 sq mile *Datum:* 29.0 ft

Discharge, Cubic Feet per Second, Calendar Year January to December 2017 Daily Mean Values

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	161	139	187	206	117	53.6	28.3	15.8	11.1	11.7	14.3	94.7
2	146	132	178	183	113	50.8	27.6	15.4	10.6	11.1	16.7	111
3	133	131	191	170	108	49.5	26.8	15.1	10.6	10.7	19.8	115
4	125	165	220	158	102	48.3	26.3	14.8	10.4	10.4	17.5	107
5	116	226	228	149	99.9	47.0	25.7	14.7	10.4	10.3	33.5	97.5
6	112	296	225	143	92.0	45.9	25.3	14.9	10.6	10.3	23.0	87.3
7	109	275	279	163	88.0	44.8	24.8	14.8	10.7	10.6	19.5	77.8
8	115	302	345	159	83.5	46.4	24.5	14.4	10.9	11.1	20.1	69.9
9	117	848	351	151	79.4	44.7	23.7	14.1	10.9	10.7	31.9	64.0
10	135	679	407	157	77.1	45.0	23.3	13.8	10.6	10.6	41.0	58.8
11	129	487	366	149	86.4	43.6	23.0	13.7	10.2	12.6	33.4	55.0
12	117	382	324	173	80.9	41.1	22.7	13.7	9.94	14.8	34.2	51.9
13	109	318	299	181	83.5	41.3	22.4	14.8	9.80	14.5	67.0	49.3
14	104	275	288	180	80.5	39.7	21.9	14.2	9.76	12.1	63.7	46.9
15	101	302	385	170	78.0	43.9	21.3	14.0	9.26	11.5	91.0	45.6
16	97.8	527	414	163	88.9	43.2	21.0	13.6	9.33	11.3	117	44.4
17	112	504	354	153	88.7	39.6	20.8	13.4	9.90	11.2	128	43.3
18	659	407	351	145	85.8	38.0	20.4	13.3	13.1	11.7	95.9	44.2
19	743	412	323	142	84.6	36.8	19.8	13.1	16.1	25.5	75.2	101
20	551	489	293	141	80.9	35.5	19.9	12.9	20.2	22.1	176	110
21	484	451	267	133	76.5	34.4	19.8	12.7	13.4	56.6	159	96.2
22	472	371	238	135	73.5	34.0	19.3	12.5	11.8	98.1	141	92.6
23	389	319	217	131	69.3	32.9	19.0	12.3	11.0	29.4	144	93.8
24	311	284	229	146	66.9	32.0	18.6	12.1	10.6	21.3	130	85.2
25	262	249	216	148	64.9	31.2	18.0	12.0	10.4	18.3	116	82.5
26	229	230	230	150	62.7	30.7	17.7	11.8	10.4	17.0	110	77.6
27	202	214	234	146	59.2	30.5	17.6	11.4	10.9	15.7	92.9	73.9
28	182	202	228	139	56.9	30.0	17.5	11.3	10.5	14.9	103	82.1
29	168	187	238	132	55.7	29.4	17.0	11.1	11.3	14.6	104	186
30	157	—	229	126	54.5	28.8	16.8	11.0e	11.7	14.5	101	251
31	149	—	218	—	53.3	—	16.2	11.1e	—	14.4	—	205
TOTAL	6997	9803	8552	4622	2492	1193	667	414	336	570	2320	2801
MEAN	226	338	276	154	80.4	39.8	21.5	13.3	11.2	18.4	77.3	90.3
MAX	743	848	414	206	117	53.6	28.3	15.8	20.2	98.1	176	251
MIN	97.8	131	178	126	53.3	28.8	16.2	11.0	9.26	10.3	14.3	43.3
AC-FT	13878	19444	16963	9168	4942	2365	1323	821	667	1130	4601	5555

5400 — 14205400 — East Fork Dairy Creek near Meacham Corner, Oregon [RM 12.4]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	7 < Q < 10	10 < Q ≤ 35	35 < Q ≤ 45	45 < Q ≤ 50	50 < Q ≤ 60	60 < Q ≤ 70	70 < Q ≤ 85	85 < Q ≤ 120	120 < Q ≤ 170	170 < Q ≤ 250	250 < Q ≤ 500	500 < Q ≤ 1,700	1,700 < Q ≤ 3,000	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	0.3%	5.3%	10%	9.1%	8.9%	11%	11%	9.3%	9.2%	9.3%	8.8%	5.2%	0.1%	2.2%

Key

- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002					39.0	25.6	16.3	11.6	9.7	8.5	12.8	43.6
2003	98.7	142	201	126	59.5	28.4	17.8	12.8	9.9	11.1	15.2	69.3
2004	166	155	90.5	61.2	36.1	25.4	14.0	11.1	11.4	16.7	22.4	52.1
2005	65.6	45.7	29.4	93.5	93.3	39.9	22.1	10.8	10.5	12.5	38.2	82.0
2006	418	131	111	84.2	45.8	35.5	18.4	11.9	9.3	9.8	152	181
2007	148	85.6	126	69.0	38.3	22.5	15.5	10.6	7.9	12.0	19.5	239
2008	228	176	129	102	45.6	27.8	14.3	11.7	8.7	9.0	22.5	22.4
2009	161	56.1	86.7	75.8	64.4	27.6	17.0	11.8	9.0	9.3	45.6	50.6
2010	203	125	123	154	78.5	90.3	31.0	16.8	14.4	13.0	49.1	272
2011	181	109	303	156	85.8	45.8	28.9	17.8	12.9	14.3	26.4	33.0
2012	98.6	160	280	135	67.6	44.2	23.2	13.6	10.3	15.0	61.3	395
2013	120	77.9	89.1	68.1	35.2	31.2	14.8	11.4	10.6	21.7	37.3	44.5
2014	44.5	152	226	131	79.2	33.1	19.5	12.5	9.2	13.6	42.3	142
2015	108	121	93.4	66.4	35.5	16.7	13.0	10.0	10.3	8.7	29.9	260
2016	255	212	218	66.5	32.2	21.1	15.3	10.2	9.8	50.2	86.3	206
2017	146	302	238	150	80.9	40.4	21.0	13.6	10.6	12.6	83.1	82.5
Median	154	131	138	92.4	51.9	30.7	17.6	12.0	10.2	12.1	35.7	99.1

Key

Q in cfs

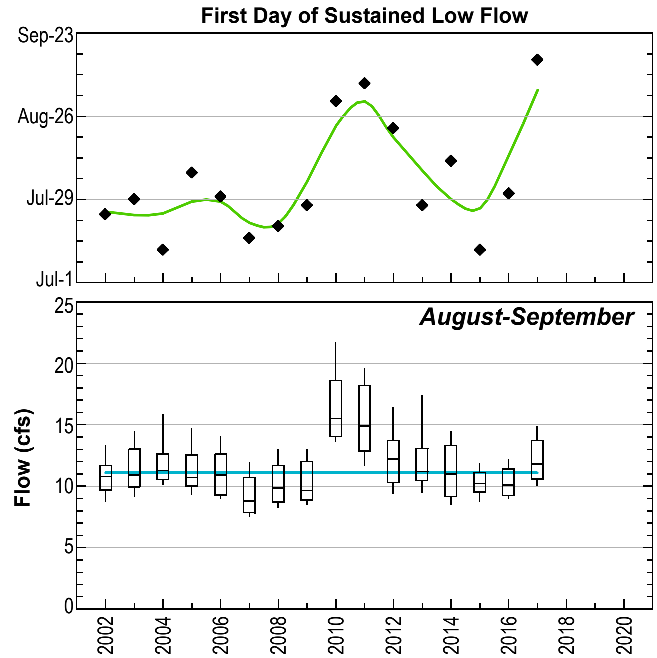
- Q ≤ 9.3
- 9.3 < Q ≤ 10.5
- 10.5 < Q ≤ 12
- 12 < Q ≤ 13
- 13 < Q ≤ 19
- 19 < Q ≤ 27
- 27 < Q ≤ 41
- 41 < Q ≤ 105
- 105 < Q ≤ 221
- 221 < Q ≤ 310
- Q > 310

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

- December through March are the months with the highest average flows.
- August through October are the months with the lowest average flow and the lowest daily flows.
- The missing values for the January through May period are all from 2002. The gage was not installed at this site until May 8, 2002. Missing values during this time likely result in the under-representation of high flows in the frequency distribution.



Seasonal onsets

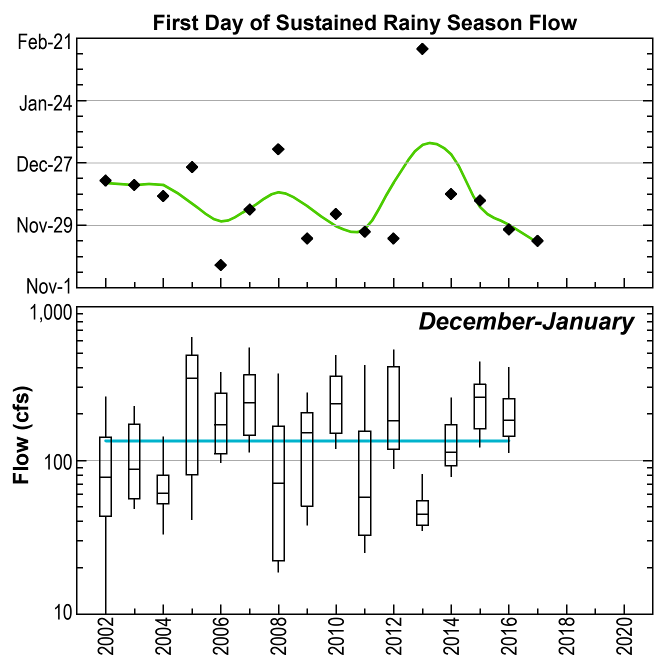
- Low flow criterion: 7d-Q ≤ 16 cfs (~26th pctl)
- Rainy season criterion: 7d-Q ≥ 100 cfs (~74th pctl)

Trends

- No trend is evident in the onset of low flow season.
- No trends are evident in the magnitude of the flow for August–September.
- No trend is evident in the onset of the rainy season.
- No trend is evident in the magnitude of the flow for December–January.

Anomalies

- Spring rainfall in both 2010 and 2011 was high, resulting in later onset of low flow and higher flows that persisted into summer.



14206070 – McKAY CREEK AT SCOTCH CHURCH RD ABOVE WAIBLE CREEK NEAR NORTH PLAINS, OREGON – MCSC

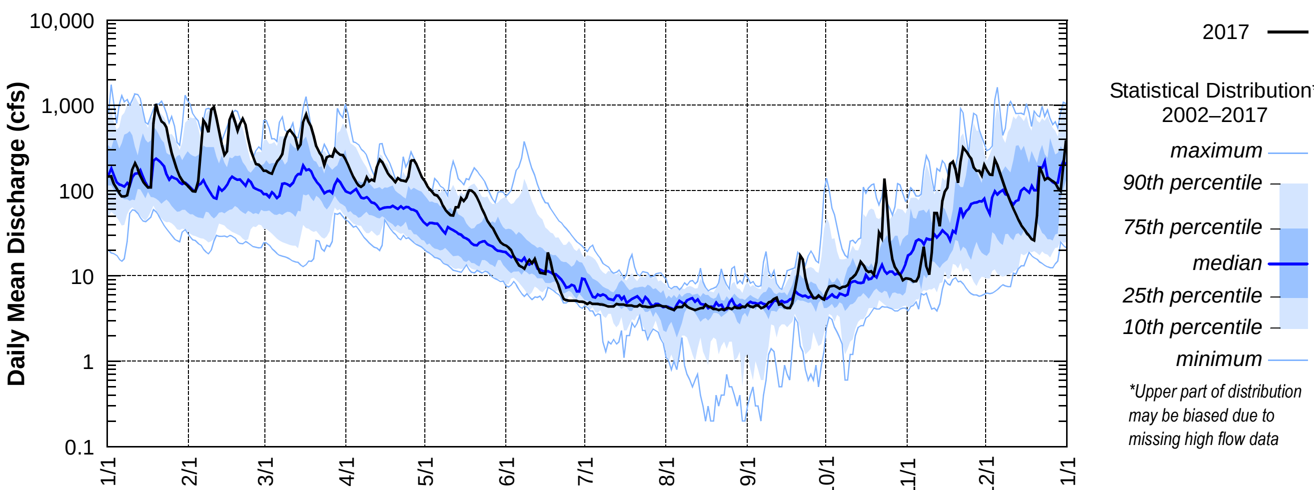
Data source: WEST Consultants for Clean Water Services

River mile: 6.3 *Latitude:* 45 57 21 *Longitude:* 122 99 18

Day	2017 Daily Mean Discharge in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	146	106	170	201	115	21.4	4.71e	4.20e	4.39e	7.45	9.13	154
2	147	98.0	162	170	104	20.1	4.87e	4.11e	4.31e	7.63	8.61	153
3	118	97.1	158	143	97.3	17.0	4.65e	4.00e	4.45e	7.72	8.70	230
4	105	128	189	127	89.3	14.9	4.68e	4.25e	4.54e	7.35	9.92	199
5	93.4	281	220	116	86.7	13.3	4.71e	4.25e	4.24e	7.13	14.6	158
6	85.8	663	237	111	78.8	12.8	4.58e	4.31e	4.26e	7.35	22.1	129
7	85.2	596	270	117	67.1	12.1	4.56e	4.70e	4.51e	7.51	12.8	105
8	88.5	486	405	143	60.1	14.1	4.53e	4.35e	4.86e	7.77	10.4	86.9
9	119	884	486	128	55.4	15.4	4.44e	4.17e	5.00e	9.23	18.8	73.3
10	180	955	515	135	51.3	14.2	4.37e	4.06e	5.43e	9.62	54.7	61.3
11	209	711	466	130	51.0	15.9	4.36e	3.99e	5.58e	10.3	54.8	52.7
12	179	512	414	194	64.0	12.9	4.65e	4.07e	4.55e	12.0	38.3	45.0
13	147	344	316	230	63.9	10.9	4.57e	4.23e	4.67e	14.7	75.0	39.8
14	128	263	348	215	81.9	10.8	4.58e	4.24e	4.29e	13.5	98.4	35.6
15	118	290	646	188	75.5	10.6	4.56e	4.60e	4.16e	11.7	109	32.0
16	109	685	789	164	82.8	18.9	4.52e	4.41e	4.22e	11.1	205	29.7
17	109	813	632	147	101	14.9	4.46e	4.31e	4.82e	11.3	219	27.2
18	619	643	557	138	100	10.9	4.46e	4.12e	6.79	10.4	179	26.2
19	1040	505	439	126	93.5	9.31	4.39e	4.07e	10.5	14.6	124	51.3
20	788	613	328	140	83.0	7.77	4.37e	4.04e	17.1	31.9	220	189
21	644	699	282	132	72.1	6.34	4.55e	4.14e	15.4	27.7	320	161
22	610	585	255	130	60.7	5.41	4.41e	3.96e	9.45	139	292	134
23	545	408	200	128	52.0	5.21e	4.40e	4.19e	7.01	69.6	261	141
24	379	301	248	146	44.1	5.14e	4.27e	4.18e	6.24	25.8	239	135
25	277	246	257	225	39.8	5.07e	4.33e	4.13e	5.53	15.6	187	129
26	215	205	249	227	36.7	5.06e	4.38e	4.30e	5.50	12.6	171	122
27	173	201	306	203	32.0	5.11e	4.51e	4.20e	5.90	11.3	170	107
28	146	188	278	172	27.5	5.04e	4.50e	4.16e	5.47	10.4	150	99.0
29	131	170	262	146	24.6	4.95e	4.46e	4.36e	5.31	8.89	200	199
30	121	—	261	133	23.4	4.87e	4.35e	4.30e	6.47	9.36	173	375
31	114	—	232	—	22.8	—	4.35e	4.58e	—	9.28	—	366
TOTAL	7969	12676	10577	4705	2037	330	140	131	185	560	3655	3846
MEAN	257	437	341	157	65.7	11.0	4.50	4.23	6.17	18.1	122	124
MAX	1040	955	789	230	115	21.4	4.87	4.70	17.1	139	320	375
MIN	85.2	97.1	158	111	22.8	4.87	4.27	3.96	4.16	7.13	8.61	26.2
AC-FT	15806	25143	20979	9332	4041	655	277	260	367	1110	7250	7628

e=estimated value

MCSC — 14206070 — McKay Creek at Scotch Church Road above Waible Creek near North Plains, Oregon [RM 6.3]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	0.1 < Q < 0.3	0.3 < Q ≤ 3	3 < Q ≤ 5	5 < Q ≤ 7	7 < Q ≤ 11	11 < Q ≤ 20	20 < Q ≤ 40	40 < Q ≤ 65	65 < Q ≤ 100	100 < Q ≤ 170	170 < Q ≤ 350	350 < Q ≤ 1,200	1,200 < Q ≤ 2,000	Missing
Jan*														
Feb*														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec*														
All	0.2%	3.5%	10%	11%	9.5%	11%	11%	10.0%	9.1%	9.1%	9.6%	5.1%	0.1%	0.2%

*Fill-in values were used for discharge that was reported as greater than the rating curve in 2002–2004.

Key

- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002		130	91.8	46.1	17.0	9.18	3.18	0.45	0.69	4.15	7.67	52.7
2003	170	123	153	115	34.5	9.52	3.85	2.25	5.50	11.2	23.3	82.4
2004			86.9	41.4	14.9	8.67	4.30	3.45	5.40	10.6	16.5	31.4
2005	59.0	41.2	19.5	94.2	91.3	20.5	8.80	2.84	4.98	13.4	47.8	124
2006	573	82.4	94.8	72.9	26.5	18.2	6.24	5.49	5.35	29.8	140	
2007	95.9	65.9	94.4	53.3	21.6	9.63	5.37	4.61	7.93	5.61	11.0	230
2008	359	253	126	78.4	22.3	10.2	4.95	5.24	4.89	6.50	21.8	19.8
2009	109	29.4	61.3	43.9	35.3	12.4	5.20	3.62	4.19	5.86	39.1	29.6
2010	274	117	97.0	115	62.4	77.7	8.54	4.76	8.78	10.7	53.3	246
2011	149	88.3	311	117	54.3	20.4	8.86	5.62	3.60	4.49	9.20	22.0
2012	160	105	238	92.5	43.9	22.5	8.89	6.64	5.57	9.92	48.3	364
2013	75.4	57.7	75.7	39.6	15.2	18.7	7.10	6.44	9.52	10.1	33.6	25.8
2014	35.1	149	127	94.0	43.8	12.0	6.86	5.20	4.85	9.05	46.0	156
2015	87.3	96.3	82.5	45.7	13.7	6.35	5.12	5.32	6.62	5.51	19.2	540
2016	232	153	171	37.7	11.9	6.58	4.27	3.77	4.78	62.4	121	204
2017	146	447	278	145	67.1	11.5	4.51	4.20	4.93	10.4	104	122
Median	146	111	119	69.8	28.9	12.3	5.53	4.60	5.32	8.37	32.2	107

Key

Q in cfs

- Q ≤ 3.54
- 3.54 < Q ≤ 4.39
- 4.39 < Q ≤ 5.13
- 5.13 < Q ≤ 5.86
- 5.86 < Q ≤ 8.48
- 8.48 < Q ≤ 14.3
- 14.3 < Q ≤ 26.1
- 26.1 < Q ≤ 94.8
- 94.8 < Q ≤ 234
- 234 < Q ≤ 358
- Q > 358

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

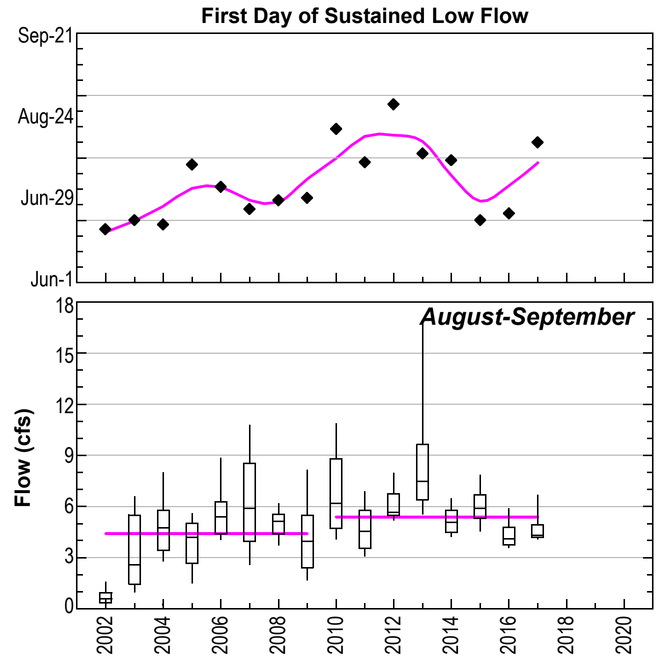
- December through March are the months with the highest average flows.
- July through September are the months with the lowest average flow. The lowest daily flows occur in August and September.

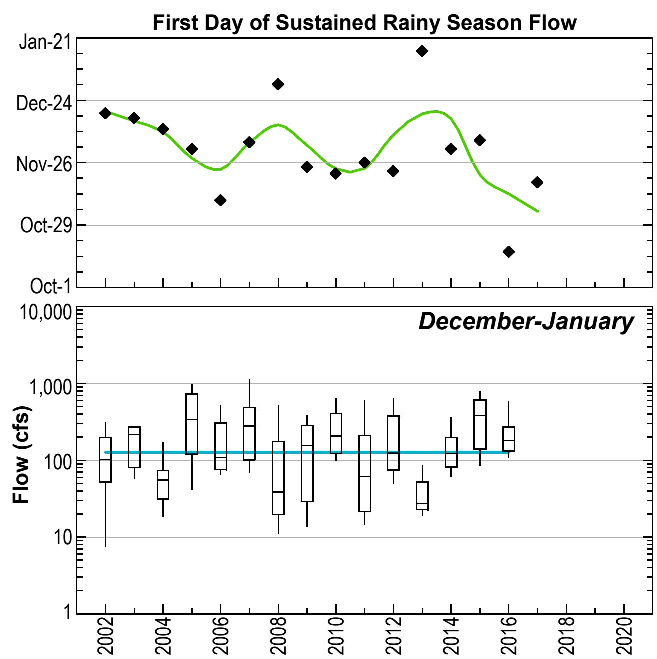
Seasonal onsets

- Low flow criterion: 7d-Q ≤ 7 cfs (~25th pctl)
- Rainy season criterion: 7d-Q ≥ 90 cfs (~74th pctl)

Trends

- Low flow onset is becoming later. Although there is considerable variability, the trend is statistically significant. The period of record is rather short and more years will be needed to determine if this trend persists.
- July–August flows before 2010 are lower than those after 2010. The average difference is about 1 cfs. CWS, in cooperation with TVID, began flow augmentation in McKay Creek in 2005, but increased flow augmentation in 2012.
- No trend is evident in the onset of the rainy season.
- No trend is evident in the magnitude of the flow for December–January.





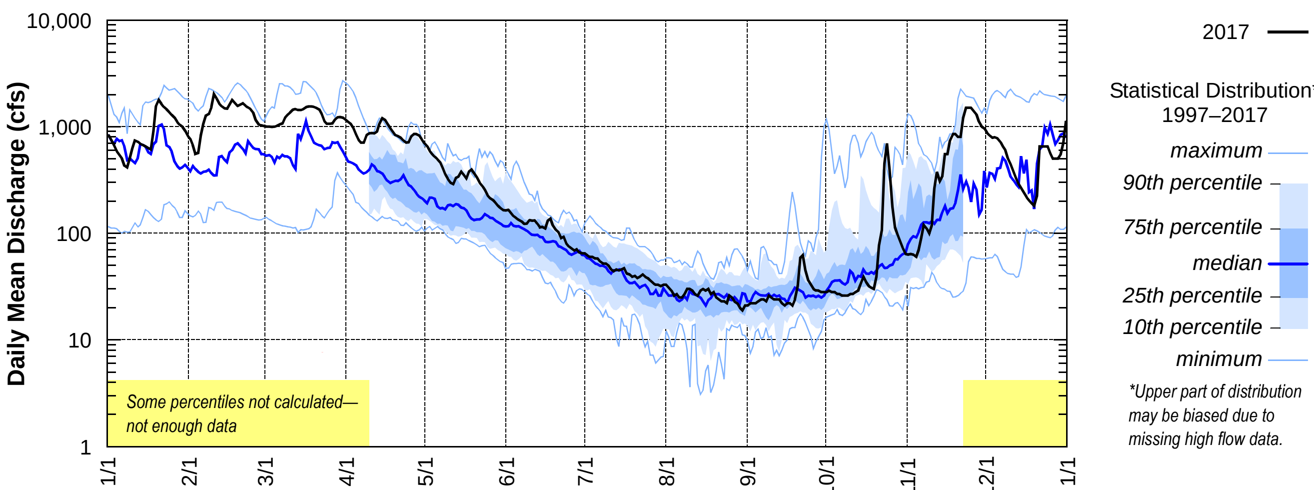
Data source: Oregon Water Resources Division

River mile: 2.06 *Latitude:* 45 30 38 *Longitude:* 123 06 56

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	2017 Daily Mean Discharge in Cubic Feet per Second†											
1	824e	771e	1010e	1110e	660e	166	62	31	22	29	64	823e
2	750e	668e	997e	1060e	596e	155	60	29	22	28	63	786e
3	665e	557e	989e	968e	556e	144	60	26	22	28	60	794e
4	592e	566e	997e	846e	522e	139	58	27	23	27	70	780e
5	549e	824e	1020e	752e	493	134	58	25	24	27	90	720e
6	506e	1060e	1050e	707e	463	129	54	25	24	26	120	652e
7	434e	1270e	1070e	706e	410	122	52	27	23	26	112	600e
8	416e	1320e	1210e	832e	358	123	52	30	26	26	99	500e
9	503e	1520e	1290e	863e	325	133	50	30	25	27	118	444
10	626e	2010e	1350e	871e	299	131	46	29	24	27	263	380
11	744e	1830e	1440e	863e	290	132	44	27	24	28	378	329
12	722e	1650e	1460e	902e	330	123	46	26	24	29	309	291
13	686e	1540e	1430e	1080e	339	113	45	29	22	34	344	266
14	672e	1480e	1430e	1200e	379	115	46	30	21	39	550e	239
15	657e	1470e	1460e	1160e	355	111	47	29	22	35	550e	218
16	634e	1620e	1520e	1060e	329	132	42	30	22	32	750e	204
17	613e	1780e	1540e	972e	381	138	41	27	21	31	850e	192
18	910e	1670e	1540e	903e	395	117	39	28	24	30	850e	181
19	1580e	1570e	1530e	835e	362	108	40	25	32	39	800e	224
20	1780e	1610e	1500e	819e	333	102	38	24	59	77	800e	651e
21	1630e	1660e	1450e	789e	301	90	39	23	62	107	1200e	651e
22	1520e	1570e	1310e	741e	280	93	41	23	45	450e	1500e	651e
23	1450e	1510e	1130e	708e	254	81	39	22	36	700e	1500e	651e
24	1370e	1450e	1060e	710e	228	75	38	26	33	400e	1500e	563e
25	1290e	1350e	1060e	805e	214	72	36	25	30	178	1400e	500e
26	1210e	1150e	1070e	852e	207	69	34	23	29	114	1300e	500e
27	1110e	1050e	1160e	852e	196	71	33	22	29	97	1100e	500e
28	1040e	1030e	1220e	829e	181	66	33	20	28	84	1000e	550e
29	1000e	1010e	1230e	765e	172	65	32	19	28	73	963e	700e
30	913e	—	1210e	707e	165	65	33	21	28	64	882e	1100e
31	823e	—	1160e	—	163	—	33	21	—	63	—	1400e
TOTAL	28219	38566	38893	26267	10536	3314	1371	799	854	2975	19585	17040
MEAN	910	1330	1255	876	340	110	44.2	25.8	28.5	96.0	653	550
MAX	1780	2010	1540	1200	660	166	62.0	31.0	62.0	700	1500	1400
MIN	416	557	989	706	163	65.0	32.0	19.0	21.0	26.0	60.0	181
AC-FT	55972	76495	77143	52100	20898	6573	2719	1585	1694	5901	38847	33798

†All 2017 data are provisional–subject to revision; e=estimated value

DAIRY — 14206200 — Dairy Creek at Hwy 8 near Hillsboro, Oregon [RM 2.06]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	3 < Q < 8	8 < Q ≤ 20	20 < Q ≤ 30	30 < Q ≤ 40	40 < Q ≤ 60	60 < Q ≤ 100	100 < Q ≤ 150	150 < Q ≤ 250	250 < Q ≤ 400	400 < Q ≤ 600	600 < Q ≤ 1,300	1,300 < Q ≤ 2,500	2,500 < Q ≤ 3,000	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	0.4%	5.4%	9.2%	8.4%	8.7%	9.1%	8.7%	8.2%	7.2%	6.0%	7.6%	4.0%	0.1%	17%

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997				383	200	167	62	38	52	224		
1998				400	224	155	59	32	29	60	156	
1999				622	203	97	49	35	26	37	270	
2000				198	111	58	25	18	19	30	32	114
2001	140	207	157	142	93	46	16	14	16	44		
2002				388	115	55	27	19	19	36	65	
2003					171	71	31	17	27	52	63	
2004				210	91	58	21	13	26	47	69	114
2005		182	122			86	45	18	21	36	255	
2006				488	165	123	42	24	19	21		
2007				285	114	58	26	19	16	43	82	
2008				505	156	93	33	29	19	34	100	103
2009		198		300	216	83	34	27	30	60		
2010							85	39	54	47		
2011					309	130	71	40	34	38	71	136
2012	994	672	1240	620	254	137	54	34	27	55	388	1850
2013	552	367	460	255	116	103	35	30	42	76	149	136
2014	203	1245	1430	703	264	106	46	26	26	55	218	885
2015	697	740	603	266	103	44	23	17	25	26	157	1790
2016	1700	1010	1470	245	99	52	32	18	24	381	555	1080
2017	750	1475	1220	849	330	116	42	26	24	34	650	550
Median	555	508	614	346	163	86	39	25	26	42	146	500

Key

Q in cfs

- Q ≤ 18
- 18 < Q ≤ 23
- 23 < Q ≤ 27
- 27 < Q ≤ 31
- 31 < Q ≤ 42
- 42 < Q ≤ 63
- 63 < Q ≤ 101
- 101 < Q ≤ 330
- 330 < Q ≤ 816
- 816 < Q ≤ 1290
- Q > 1290

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

- December through March are the months with the highest average flows.
- August and September are the months with the lowest average flow and the lowest daily flows.
- A large portion of high flow data are missing for this site. Most of these data are known to be above the upper limit of the rating curve. These missing values will result in the under-representation of high flows in the frequency distribution as well as skewing the magnitude of high flow data.

Seasonal onsets

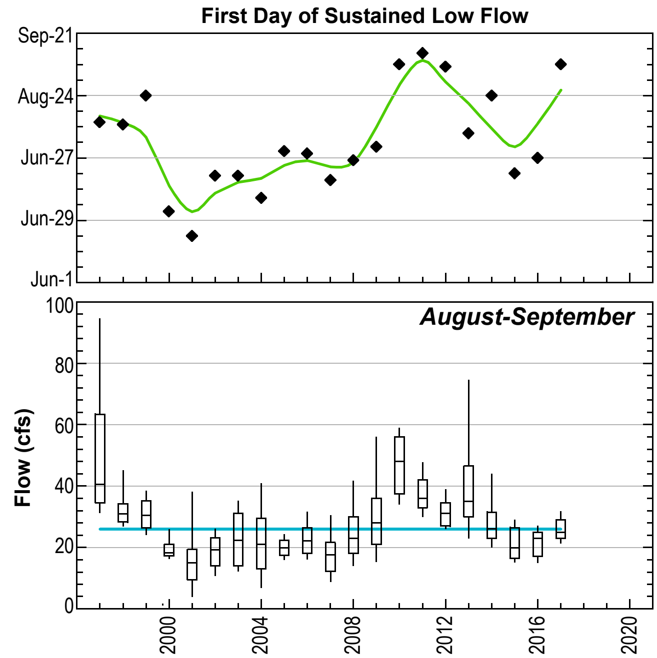
- Low flow criterion: 7d-Q ≤ 35 cfs (~24th pctl)
- Rainy season criterion: 7d-Q ≥ 350 cfs (~76th pctl)

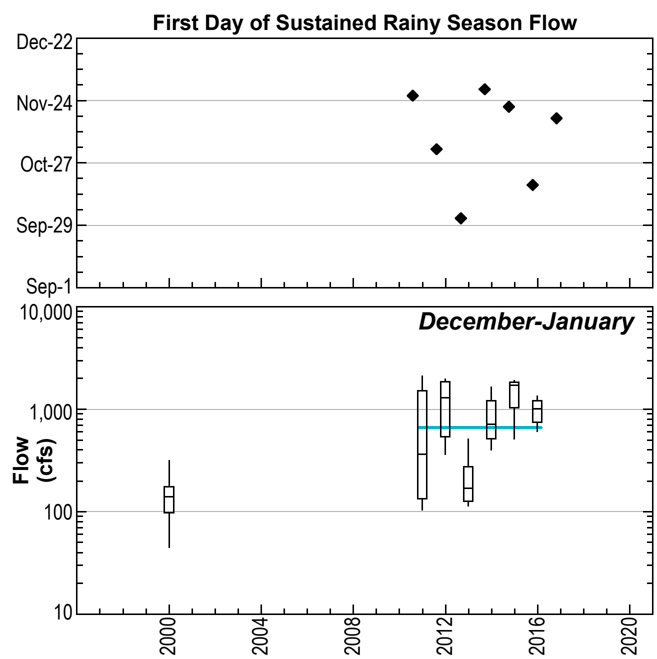
Trends

- No trend is evident in the onset of low flow season.
- No trends are evident in the magnitude of the flow for August–September.
- Too few high flow data are available to assess trends. No trends are evident in the onset of the rainy season or in the magnitude of the flow for December–January.

Anomalies

- Spring rainfall in both 2010 and 2011 was high, resulting in later onset of low flow and higher flows that persisted into summer.





14206435 — BEAVERTON CREEK AT CORNELIUS PASS ROAD — BVTS

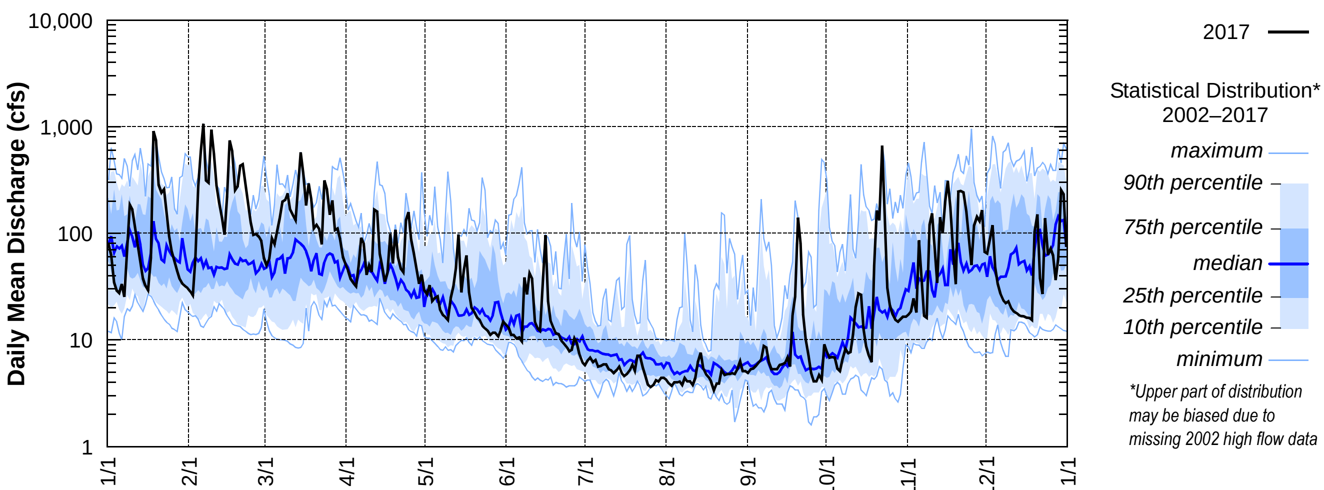
Data source: WEST Consultants for Clean Water Services

River mile: 1.2 *Latitude:* 45 31 15 *Longitude:* 122 53 59

Day	2017 Daily Mean Discharge in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	78.0	28.4	58.8	51.1	29.2	14.0	5.84	4.24e	4.86	7.66	17.3	64.8
2	62.0	26.0	50.4	44.6	26.8	13.0	6.35e	3.89e	5.28	6.84	18.5	90.3
3	34.6	59.3	58.3	37.2	32.8	11.1	6.76e	3.69	5.42	6.89	24.4	119
4	29.1	278	89.5	34.0	23.1	11.1	6.23e	4.02	5.73	6.81	18.1	48.6
5	27.5	592	78.4	31.8	24.8	10.4	6.46e	3.99	6.14	5.43	86.3	33.5
6	33.4	1060	104	49.5	25.7	10.6	5.60e	4.10	6.55	5.05	36.8	26.7
7	25.3	311	136	91.1	19.0	9.74	5.69e	3.75	8.77	6.61	16.7	23.7
8	69.3	297	198	79.8	17.1	38.7	5.87e	4.44	8.47	8.21	16.0	22.2
9	184	937	206	40.8	16.4	26.7	5.90e	4.14	6.19	7.54	120	23.0
10	166	556	237	50.1	15.4	42.3	5.28e	4.06	5.28	7.70	154	20.2
11	114	280	166	43.3	24.8	37.5	5.15e	3.83	5.29	11.4	67.4	18.5
12	75.5	196	146	167	31.6	14.7	4.93e	4.37	5.34	20.1	34.2	17.9
13	54.1	140	132	160	47.1	12.9	5.20e	6.15	5.83	27.4	141	17.1
14	37.9	97.1	296	64.2	97.6	12.2	5.61e	7.60	5.86	26.6	99.8	16.7
15	32.1	221	575	48.4	27.9	29.0	4.88e	5.42	6.14	12.5	200	16.6
16	29.1	743	368	35.3	45.4	95.9	4.55e	4.82	6.88	8.71	310	16.2
17	58.7	587	182	42.1	62.3	23.2	4.75e	4.54	5.57	7.04	176	16.0
18	909	254	294	98.8	28.0	15.0	5.19e	4.07	17.2	6.22	65.6	15.3
19	742	276	210	52.4	19.9	13.0	5.92e	3.35	25.5	49.7	33.4	103
20	286	429	111	108	18.0	11.5	5.10e	3.89	140	163	246	151
21	240	446	120	59.8	16.2	11.3	7.05e	3.89	80.1	132	250	38.1
22	260	295	109	46.5	15.4	9.91	7.05e	5.17	17.3	664	243	26.9
23	151	196	78.7	43.2	13.7	9.25	5.48e	4.66	10.2	180	160	139
24	94.0	126	313	133	12.8	8.70	4.60e	4.80	7.09	31.0	88.4	63.2
25	67.4	96.4	258	158	12.2	7.77	3.76e	4.81	4.89	21.2	50.6	72.2
26	53.7	98.6	149	87.6	11.1	8.09	3.61e	4.91	4.11	17.2	118	62.1
27	44.2	92.6	204	63.9	11.7	10.3	3.82e	4.81	4.07	15.4	142	36.4
28	37.1	84.1	107	46.1	11.7	9.28	4.22e	5.42	4.70	14.8	129	57.9
29	33.7	58.8	111	33.5	10.8	7.32	4.11e	6.29	4.22	15.6	165	253
30	31.8	—	88.7	41.1	12.4	6.19	4.39e	5.09	9.07	16.5	67.1	231
31	30.5	—	59.9	—	14.9	—	4.40e	5.09	—	16.5	—	76.4
TOTAL	4091	8861	5295	2042	776	541	164	143	432	1526	3295	1917
MEAN	132	306	171	68.1	25.0	18.0	5.28	4.62	14.4	49.2	110	61.8
MAX	909	1060	575	167	97.6	95.9	7.05	7.60	140	664	310	253
MIN	25.3	26.0	50.4	31.8	10.8	6.19	3.61	3.35	4.07	5.05	16.0	15.3
AC-FT	8114	17576	10502	4051	1539	1072	325	284	857	3026	6535	3801

e=estimated value

BVTS — 14206435 — Beaverton Creek at Cornelius Pass Road [RM 1.2]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	1 < Q < 2	2 < Q ≤ 4	4 < Q ≤ 6	6 < Q ≤ 9	9 < Q ≤ 13	13 < Q ≤ 20	20 < Q ≤ 30	30 < Q ≤ 40	40 < Q ≤ 60	60 < Q ≤ 100	100 < Q ≤ 250	250 < Q ≤ 700	700 < Q ≤ 1,100
Jan*													
Feb*													
Mar*													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec*													
All	0.1%	3.9%	11%	10%	9.8%	11%	11%	8.3%	9.8%	10%	10%	4.3%	0.2%

*Fill-in values were used for discharge that was reported as greater than the rating curve in 2002–2003

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002		61.9	52.9	25.8	12.8	8.77	5.97	4.24	4.56	9.48	15.5	
2003	77.1	48.3	82.9	74.1	24.0	10.5	7.43	6.78	5.87	13.8	20.6	93.3
2004	115	80.7	35.5	19.3	13.1	10.1	7.52	7.46	9.08	29.1	25.0	37.6
2005	31.4	17.8	15.1	44.6	45.0	25.4	10.7	6.85	6.14	23.4	57.2	79.8
2006	272	42.7	49.5	38.5	21.3	14.0	8.24	6.22	7.69	10.8	130	88.6
2007	53.5	60.0	51.7	35.3	16.9	10.8	6.23	5.00	4.52	19.3	22.6	126
2008	145	44.9	46.7	30.1	15.8	9.33	5.02	5.93	4.64	4.61	27.4	21.9
2009	32.1	18.6	30.1	21.5	25.9	9.54	4.32	4.67	4.22	13.3	77.9	25.8
2010	101	60.7	44.0	51.0	35.1	39.8	9.57	7.97	12.9	14.4	54.5	143
2011	65.4	50.8	114	57.2	33.6	18.7	14.3	8.81	5.23	7.60	43.7	16.7
2012	74.5	46.9	102	65.9	30.5	22.4	7.12	5.90	5.23	29.9	86.2	154
2013	36.5	29.3	23.0	20.2	16.3	13.8	5.58	4.74	17.1	13.2	24.7	14.6
2014	19.1	67.9	66.0	53.4	28.4	11.3	6.08	3.95	3.24	25.7	34.3	59.6
2015	26.5	35.2	28.5	23.3	10.2	4.33	4.07	3.24	5.06	6.06	27.5	269
2016	149	67.1	85.2	25.6	12.8	8.39	5.60	3.81	5.04	70.6	59.2	63.5
2017	58.7	265	136	49.8	19.0	11.4	5.20	4.44	6.00	14.8	94.1	36.4
Median	69.3	49.2	56.1	37.4	19.9	11.6	6.98	5.38	5.88	14.1	40.4	62.7

Key

Q in cfs

- Q ≤ 4.18
- 4.18 < Q ≤ 5.05
- 5.05 < Q ≤ 6.11
- 6.11 < Q ≤ 7.32
- 7.32 < Q ≤ 10.9
- 10.9 < Q ≤ 15.8
- 15.8 < Q ≤ 23.3
- 23.3 < Q ≤ 59.3
- 59.3 < Q ≤ 147
- 147 < Q ≤ 236
- Q > 236

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

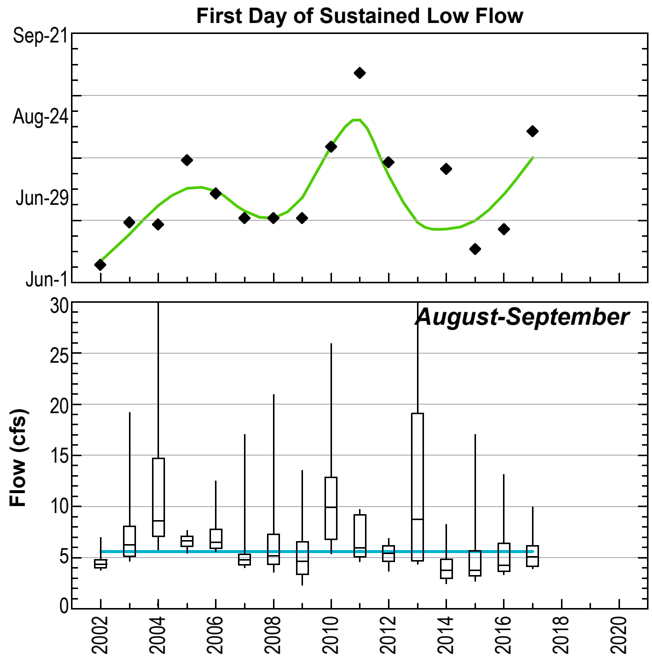
- December and January are the months with the highest average flows.
- July through September are the months with the lowest average flow and the lowest daily flows.
- Although the July–September median flows are relatively low, higher flows in these months are not uncommon. The August–September boxplots show this variability. This pattern is typical of flashy urban streams such as Beaverton Creek.

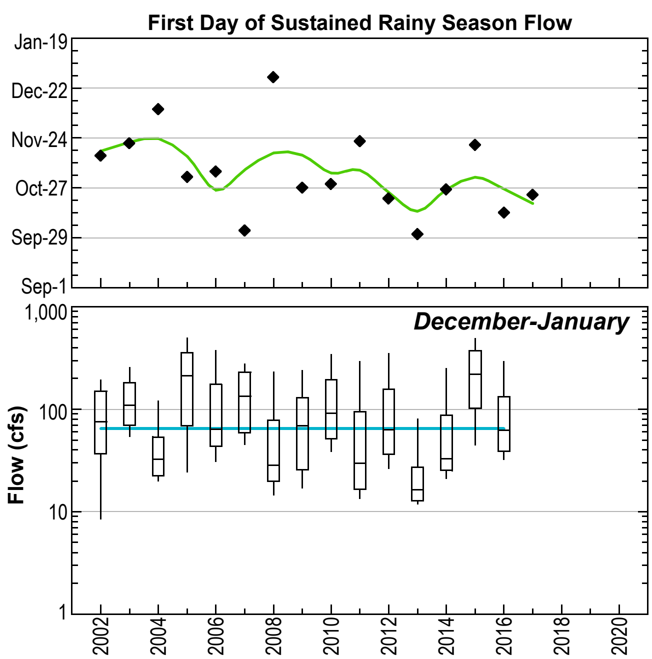
Seasonal onsets

- Low flow criterion: 7d-Q ≤ 9 cfs (~25th pctl)
- Rainy season criterion: 7d-Q ≥ 60 cfs (~75th pctl)

Trends

- No trend is evident in the onset of low flow season.
- No trends are evident in the magnitude of the flow for August–September.
- For the rainy season, onset possibly is arriving earlier, but the trend is not statistically significant. More years will be required to determine if the trend is real.
- No trends are evident in the magnitude of the flow for December–January.





14206451** — ROCK CREEK AT HWY 8 NEAR HILLSBORO, OREGON — RCTV

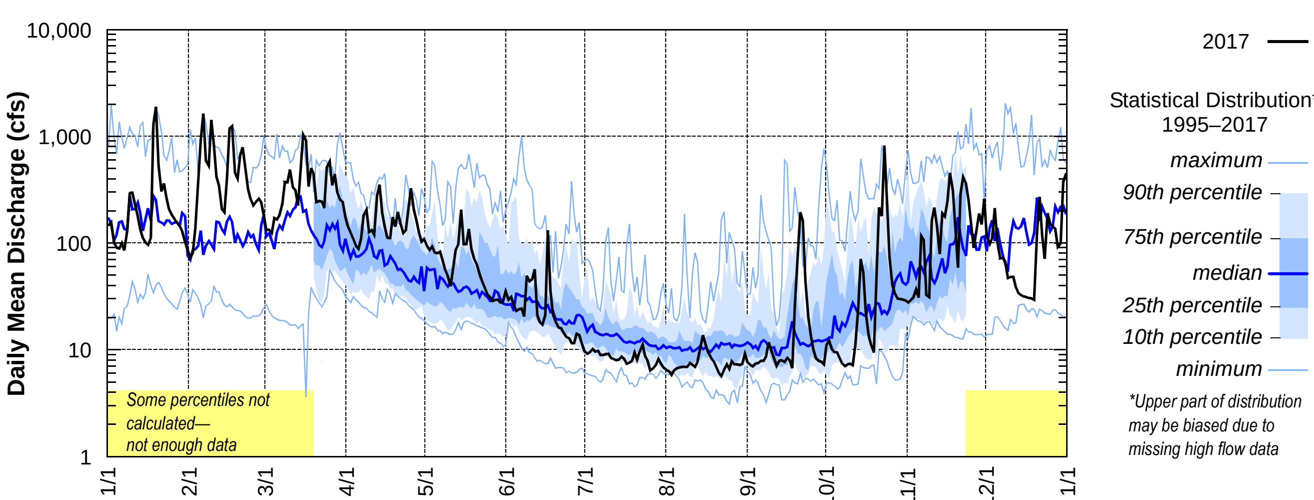
Data source: WEST Consultants for Clean Water Services

River mile: 1.2 *Latitude:* 45 30 08 *Longitude:* 122 56 52

Day	2017 Daily Mean Discharge in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	147	73.3	183	142	93.3	29.5	9.16e	6.29	7.18e	12.2	29.0e	98.4
2	157	81.0e	133	125	86.3	31.4	9.49e	5.76	6.96e	10.2	30.8e	113
3	100	138e	124	108	93.0	26.6	10.2e	6.44	7.35e	9.51	36.8e	213
4	90.3	388e	172	94.3	81.4	23.2	9.62e	6.65	7.52e	9.41	30.8e	103
5	89.0	925e	167	88.4	80.0	24.0	9.78e	6.81	7.89e	8.31	116e	72.1
6	99.8e	1630e	183	109	82.9	24.3	8.85e	6.89	7.86e	7.37	106	72.5
7	85.5	586e	232	183	69.1	20.5	8.90e	6.89	8.68e	7.00	32.4	66.1
8	130	527e	372	205	55.8	49.5e	9.06e	6.86	11.8	7.34	30.9	47.0
9	294	1420e	369	127	49.2	43.7e	9.22e	7.45	10.0	7.35	161	48.2
10	297	827e	486	132	39.5	45.9e	8.36e	7.20	8.34	7.24	215	48.3
11	236	417e	334	119	57.8	56.8e	8.17e	6.91	7.08e	11.0	146	38.4
12	179	346e	313	274	87.5	21.1e	8.00e	7.75	7.87e	24.2	78.9	33.9
13	134	208	225	353	97.9	18.0e	8.13e	10.7	7.99e	70.7	190	32.4
14	111	194	470	193	206	17.2e	8.58e	13.7	7.70e	53.0	178	31.5
15	101	408	1030	142	97.5	21.2e	8.15e	11.2	8.42e	22.1	246	31.2
16	96.3	1190	904	112	97.3	131e	7.36e	9.40	7.96e	13.5	455	30.6
17	113	1250	337	111	136	36.0e	7.62e	8.50	6.68e	10.9	310	30.3
18	1300	451	503	175	87.6	21.2e	7.87e	7.79	25.9	9.38	126	29.5
19	1890	400	440	142	70.2	18.3e	9.44e	6.87	71.5	57.3	58.9	123
20	536	659	242	196	62.5	16.2e	8.06e	6.06	195	216	293	271
21	305	790	248	149	51.8	15.9e	9.65e	5.72	161	179	415	119
22	363	477	244	124	44.1	14.4e	11.3e	6.64	44.6	815e	359	71.3
23	264	317	212	132	37.9	13.2e	8.65e	7.28	20.4	261e	252	191
24	206	256	513	207	32.9	12.9e	7.76e	6.62	13.7	73.3e	146	152
25	184	224	584	326	31.1	11.5e	6.38e	7.78e	10.0	40.1e	90.3	142
26	167	242	347	205	28.7	11.5e	6.70	7.28e	8.25	33.4e	134	136
27	156	259	442	164	29.2	14.2e	7.21	7.31e	7.89	30.0e	189	92.0
28	144	239	295	126	29.4	13.8e	8.15	7.15e	7.74	29.8e	149	99.7
29	128	183	255	103	27.7	11.3e	7.40	7.42e	7.30	29.4e	259	375
30	102	—	241	109	28.5	9.61e	6.78	9.23e	11.2	28.9e	113	438
31	85.8	—	175	—	35.3	—	6.48	7.64e	—	27.7e	—	208
TOTAL	8291	15105	10775	4776	2107	804	260	236	722	2122	4977	3557
MEAN	267	521	348	159	68.0	26.8	8.40	7.62	24.1	68.4	166	115
MAX	1890	1630	1030	353	206	131	11.3	13.7	195	815	455	438
MIN	85.5	73.3	124	88.4	27.7	9.61	6.38	5.72	6.68	7.00	29.0	29.5
AC-FT	16444	29961	21372	9472	4180	1595	517	468	1432	4208	9871	7056

**Site moved 120 feet downstream in 2012, previous ID was 14205450; e=estimated value

RCTV — 14206451 — Rock Creek at Hwy 8 near Hillsboro, Oregon [RM 1.2]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	3 < Q < 4	4 < Q ≤ 7	7 < Q ≤ 11	11 < Q ≤ 15	15 < Q ≤ 20	20 < Q ≤ 28	28 < Q ≤ 40	40 < Q ≤ 60	60 < Q ≤ 100	100 < Q ≤ 180	180 < Q ≤ 400	400 < Q ≤ 1,500	1,500 < Q ≤ 3,000	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	0.2%	3.5%	9.5%	9.3%	8.2%	8.3%	8.6%	8.9%	9.6%	9.2%	9.3%	5.1%	0.1%	10.3%

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1995				102	40.2	22.2	12.3	10.2	9.53	24.9		
1996					161	30.0	15.8	10.2	15.9	50.8		
1997				81.0	41.8	38.4	16.5	11.3	15.1			
1998				53.3	153	35.4	18.3	14.3	13.7	26.9		
1999				60.8	39.6	22.0	15.8	14.9	12.0	14.3		
2000		206	149	37.2	30.0	17.9		11.7	12.9	26.6	20.1	61.2
2001	37.5	41.1	35.9	38.1	17.9	16.0	9.84	9.53	8.59	13.7	83.6	
2002			125	41.1	22.8	16.8	13.2	10.0	9.35	17.7	27.0	133
2003			368	155	37.8	17.3	12.5	12.0	11.1	23.3	30.6	178
2004	288		61.6	30.4	18.8	16.2	11.5	11.3	14.0	31.4	30.6	50.5
2005	52.2	30.4	21.6	81.0	82.4	32.7	16.4	13.0	10.7	31.1	104	
2006			118	70.9	28.4	26.7	11.1	10.8	11.9	15.8		
2007		147	182	53.5	22.5	19.2	10.7		17.4	26.3	35.4	
2008	334	127	121	68.0	33.7	16.5	8.72	9.00	6.07	7.75	44.7	31.3
2009	102	45.1	71.3	49.7	54.7	28.1	7.60	7.01	7.99	25.2	177	59.9
2010	377	217	151	176	67.0	85.3	19.8	15.8	20.7	19.9	122	352
2011	231	103	265	118	64.8	29.9	19.5	9.01	6.75	18.6	43.8	30.0
2012	104	96.7	291	118	66.0	37.6	14.0	9.76	8.16	49.1	126	434
2013	91.1	70.7	56.0	41.5	24.2	32.4	9.60	7.28	28.2	19.8	42.2	26.8
2014	43.6	132	135	122	47.7	19.6	12.6	5.91	5.22	50.4	61.8	143
2015	54.0	53.4	53.7	55.5	18.2	7.77	5.78	4.54	8.13	10.5	68.4	433
2016	357	181	226	53.6	21.9	15.3	10.3	5.77	9.52	108	111	196
2017	147	404	295	137	62.5	20.8	8.17	7.20	8.12	24.2	146	92.0
Median	159	112	140	69.4	37.8	23.3	12.6	10.5	11.4	23.4	72.2	133

Key

Q in cfs

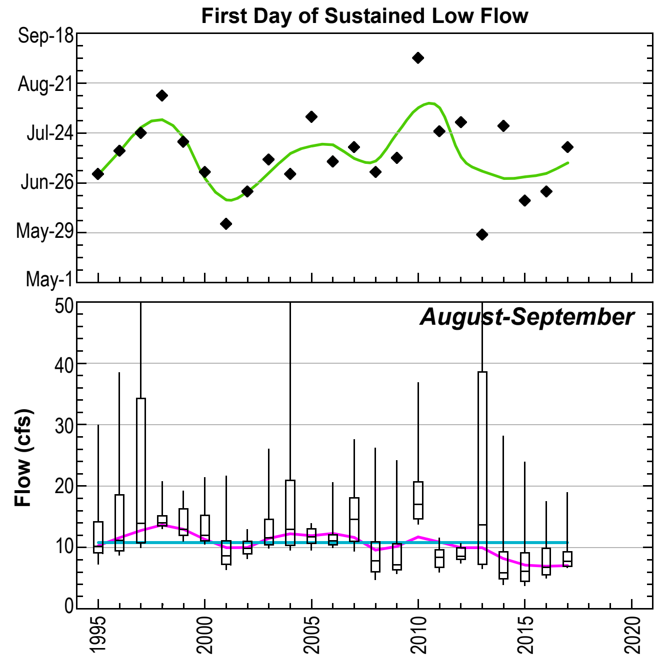
- $Q \leq 7.35$
- $7.35 < Q \leq 9.49$
- $9.49 < Q \leq 11.0$
- $11.0 < Q \leq 12.9$
- $12.9 < Q \leq 17.7$
- $17.7 < Q \leq 24.7$
- $24.7 < Q \leq 35.1$
- $35.1 < Q \leq 107$
- $107 < Q \leq 281$
- $281 < Q \leq 427$
- $Q > 427$

Q as percentile

- $Q \leq$ 5th
- 5th $< Q \leq$ 10th
- 10th $< Q \leq$ 15th
- 15th $< Q \leq$ 20th
- 20th $< Q \leq$ 30th
- 30th $< Q \leq$ 40th
- 40th $< Q \leq$ 50th
- 50th $< Q \leq$ 75th
- 75th $< Q \leq$ 90th
- 90th $< Q \leq$ 95th
- $Q >$ 95th

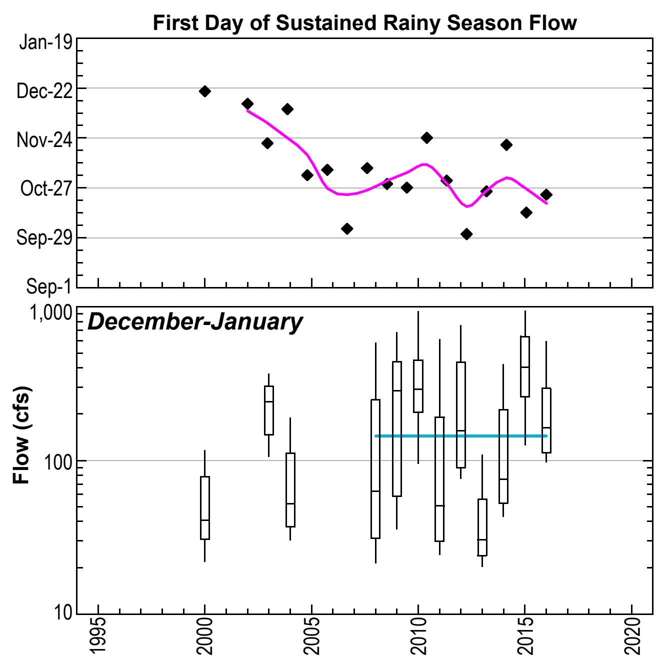
Distribution

- December through March are the months with the highest average flows.
- July through September are the months with the lowest average flow and the lowest daily flows.
- Although the July–September median flows are relatively low, higher flows in these months are not uncommon. The August–September boxplots show this variability. This pattern is typical of flashy urban streams such as Rock Creek.
- A large portion of high flow data from before 2008 are missing for this site. Most of these data are known to be above the upper limit of the rating curve. These missing values will result in the under-representation of high flows in the frequency distribution as well as skewing the magnitude of high flow data.



Seasonal onsets

- Low flow criterion: 7d-Q ≤ 15cfs (~25th pctl)
- Rainy season criterion: 7d-Q ≥ 100 cfs (~74th pctl)
- Too many values were missing in 1995-1999 and 2001 to determine the onset of rainy season flow in those years.



Trends

- No trend is evident in the onset of low flow season.
- August–September flows show a statistically significant decreasing trend.
- The onset of rainy season flow is becoming earlier. The trend is statistically significant. Because the period of record is not very long, more years will be needed to determine if this trend persists.
- No trends are evident in the magnitude of the flow for December–January.

Anomalies

- Spring rainfall in 2010 was high, resulting in later onset of low flow and higher flows that persisted into summer.

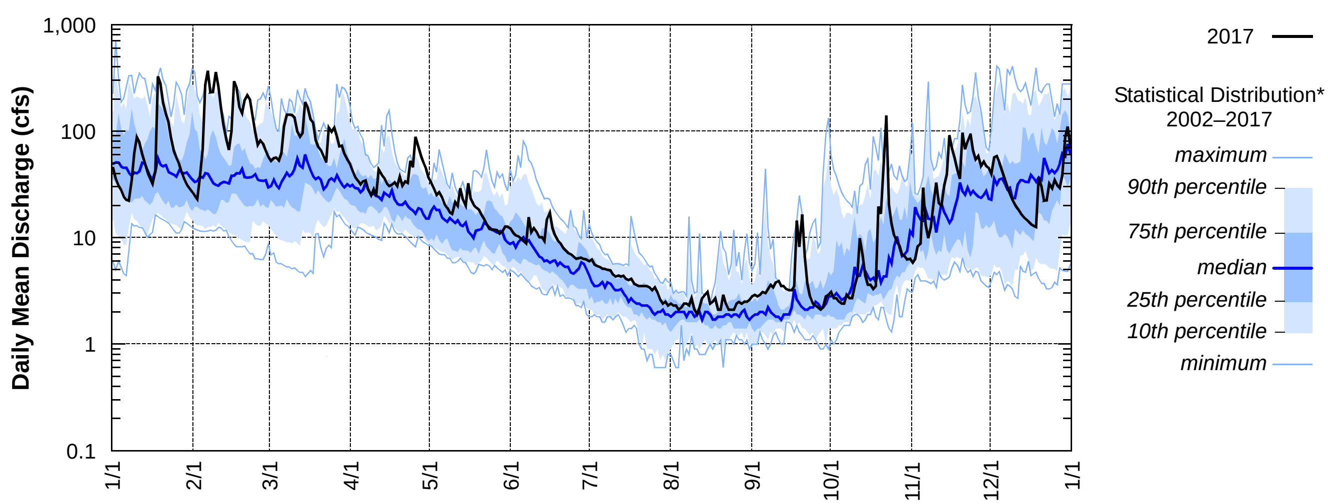
14206750 — CHICKEN CREEK AT ROY ROGERS RD NEAR SHERWOOD, OREGON — CCSR

Data source: WEST Consultants for Clean Water Services

River mile: 2.3 *Latitude:* 45 22 31 *Longitude:* 122 51 24

Day	2017 Daily Mean Discharge in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	44.9	24.7	57.2	48.9	36.2	12.2	5.98	2.38	2.81	3.11	5.78	39.4
2	35.8	23.0	52.2	42.3	32.1	11.1	6.24	2.29	2.87	2.70	6.29	56.7
3	30.4	36.4	55.4	37.3	28.7	10.5	5.61	2.30	2.82	2.68	8.33	58.1
4	27.8	67.7	56.2	34.2	25.1	10.3	5.40	2.13	2.92	2.52	8.77	50.6
5	24.3	273	53.0	31.5	26.5	9.77	5.34	2.18	3.11	2.42	29.5	42.9
6	22.6	370	62.1	33.7	23.7	9.34	5.08	2.36	3.03	2.44	13.1	35.8
7	22.1	231	110	34.4	20.5	8.81	5.05	2.42	3.29	2.87	9.94	30.0
8	34.6	232	142	28.2	19.0	15.6	5.03	2.30	3.55	2.72	12.5	25.7
9	61.9	359	142	25.0	17.3	11.3	4.85	2.71	3.43	2.65	21.7	22.4
10	87.3	262	141	28.7	16.7	12.3	4.53	2.11	3.75	3.45	32.8	20.3
11	77.8	167	134	24.6	21.4	11.4	4.29	1.91	3.89	4.26	21.1	18.5
12	60.5	113	97.8	43.3	19.7	9.98	4.35	2.17	3.45	9.91	19.8	17.0
13	50.1	82.9	88.1	39.1	29.0	10.1	4.28	2.72	3.54	6.79	30.9	15.9
14	41.7	66.4	95.6	36.4	22.8	9.23	4.41	2.88	3.26	4.36	39.0	14.9
15	36.0	99.6	187	32.5	19.8	14.9	4.07	3.08	3.23	3.61	91.5	14.1
16	31.8	294	167	30.4	32.4	17.3	4.01	2.41	3.17	3.55	68.8	13.4
17	42.4	254	129	31.2	22.9	12.4	4.14	2.54	3.50	3.29	56.5	12.9
18	326	165	120	32.9	20.6	10.5	3.65	2.71	14.4	3.54	42.9	12.6
19	278	146	82.9	30.3	19.2	9.50	3.56	2.05	8.23	19.6	35.5	36.7
20	185	195	71.4	37.3	18.3e	8.89	3.47	2.05	16.5	16.7	96.7	30.0
21	144	217	66.5	30.7	16.3e	8.02	3.47	2.88	6.67	46.0	67.5	22.2
22	121	195	57.3	33.7	15.0e	7.55	3.48	2.40	3.71	139	80.5	22.3
23	85.8	136	50.6	32.6	13.4e	7.19	3.51	2.12	2.84	20.5	94.5	31.9
24	66.3	98.0	107	52.6	12.0e	7.04	3.37	2.14	2.40	13.6	65.5	28.8
25	56.7	74.1	98.3	45.7	11.9e	6.58	3.20	2.10	2.30	10.5	54.1	34.6
26	49.0	81.6	108	88.1	11.8e	6.32	3.43	2.39	2.23	9.05	58.4	30.9
27	40.9	75.6	90.1	71.4	11.7e	6.41	2.95	2.45	2.14	8.35	46.9	29.3
28	35.5	65.2	71.9	59.3	10.9e	6.45	2.64	2.44	2.15	6.91	51.5	38.6
29	31.6	57.2	72.9	50.5	11.5e	6.30	2.38	2.45	2.75	6.67	46.7	86.8
30	29.0	—	60.6	44.3	12.7	6.20	2.47	2.49	2.92	6.17	44.7	110
31	26.9	—	53.6	—	12.7	—	2.32	2.64	—	6.30	—	71.7
TOTAL	2208	4461	2881	1191	612	293	127	74.2	125	376	1262	1075
MEAN	71.2	154	92.9	39.7	19.7	9.78	4.08	2.39	4.16	12.1	42.1	34.7
MAX	326	370	187	88.1	36.2	17.3	6.24	3.08	16.5	139	96.7	110
MIN	22.1	23.0	50.6	24.6	10.9	6.20	2.32	1.91	2.14	2.42	5.78	12.6
AC-FT	4379	8849	5714	2363	1213	582	251	147	248	746	2503	2132

CCSR — 14206750 — Chicken Creek at Roy Rogers Rd near Sherwood, Oregon [RM 2.3]



FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	0.5 < Q < 0.8	0.8 < Q ≤ 1.6	1.6 < Q ≤ 2.2	2.2 < Q ≤ 3.5	3.5 < Q ≤ 6	6 < Q ≤ 10	10 < Q ≤ 15	15 < Q ≤ 22	22 < Q ≤ 32	32 < Q ≤ 50	50 < Q ≤ 120	120 < Q ≤ 300	300 < Q ≤ 750	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	0.3%	4.6%	9.4%	10.5%	10.4%	9.6%	9.6%	10.1%	10.0%	11.2%	9.2%	4.5%	0.4%	0.4%

Key

- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	65.0	48.5	46.5		9.80	5.00	2.20	1.70	1.70	2.70	6.95	30.0
2003	33.0	39.1	47.9	36.3	14.6	6.08	2.49	1.52	1.98	4.31	7.26	37.0
2004	45.2	43.2	21.7	12.8	6.82	4.22	1.50	1.27	1.93	4.47	5.68	14.7
2005	15.1	9.74	6.59	23.7	23.0	6.80	2.17	1.04	1.29	3.16	18.1	32.8
2006	180	31.2	30.2	20.8	9.49	5.37	2.33	1.47	1.26	2.50	54.0	62.4
2007	37.7	37.7	33.7	26.5	11.2	4.79	2.22	1.91	3.06	20.4	30.8	62.1
2008	61.1	44.9	41.9	27.2	14.4	7.23	2.92	3.16	3.51	4.37	7.97	8.68
2009	20.5	11.7	19.5	13.1	16.8	6.88	2.43	1.48	2.03	4.20	21.3	16.8
2010	66.6	36.7	36.5	28.0	16.4	21.2	4.05	1.82	2.83	4.29	27.7	77.3
2011	51.6	33.6	76.5	39.7	18.7	10.3	5.59	1.93	2.12	4.51	9.08	5.94
2012	40.5	34.8	67.7	43.0	22.9	11.9	5.59	2.33	1.83	10.1	25.7	102
2013	19.4	16.7	16.7	14.1	7.74	11.5	3.49	1.95	4.04	14.1	21.4	8.12
2014	15.5	42.0	43.2	30.1	14.9	6.04	3.38	2.15	2.18	4.02	15.7	39.3
2015	19.1	29.5	25.0	17.6	7.10	3.35	1.87	1.78	1.80	2.17	15.1	167
2016	74.0	43.5	49.1	15.3	7.34	4.52	2.57	1.84	2.12	26.5	32.9	53.2
2017	42.4	141	88.1	34.3	19.2	9.64	4.07	2.39	3.20	4.36	41.0	30.0
Median	42.3	35.2	37.1	23.9	12.8	6.33	2.77	1.86	2.10	4.50	19.3	36.9

Key

Q in cfs

- Q ≤ 1.60
- 1.60 < Q ≤ 1.87
- 1.87 < Q ≤ 2.24
- 2.24 < Q ≤ 2.78
- 2.78 < Q ≤ 4.63
- 4.63 < Q ≤ 7.57
- 7.57 < Q ≤ 12.4
- 12.4 < Q ≤ 32.4
- 32.4 < Q ≤ 65.2
- 65.2 < Q ≤ 117
- Q > 117

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

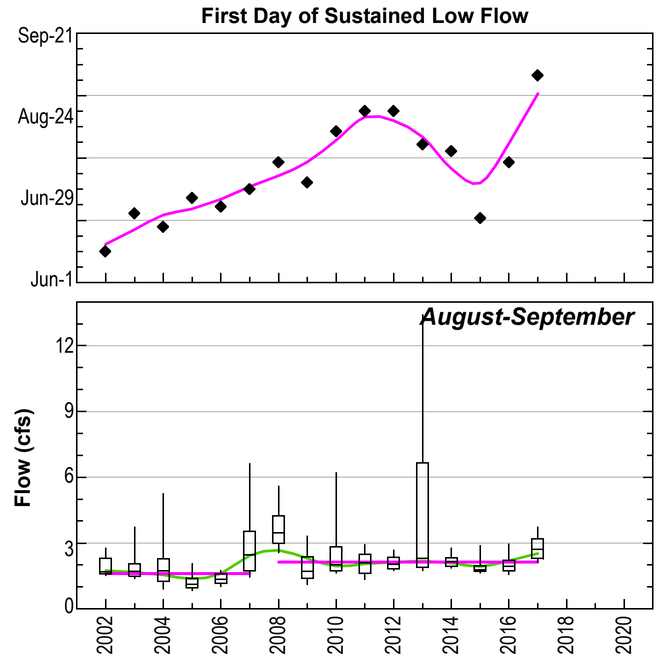
- December through March are the months with the highest average flows.
- July through September are the months with the lowest average flows, with August consistently having the lowest of the three. The lowest daily flows occur in July and August.
- High flows occasionally occur in September as was the case in 2013 which had several storms.

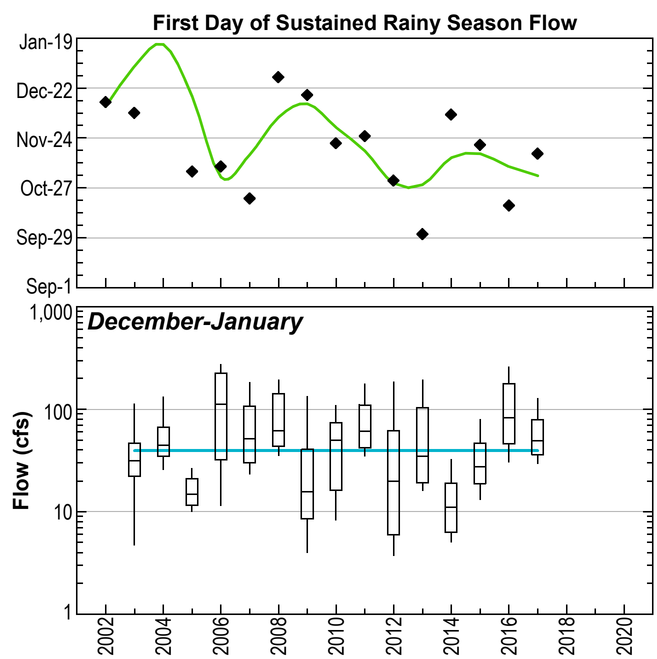
Seasonal onsets

- Low flow criterion: 7d-Q ≤ 3.5 cfs (~25th pctl)
- Rainy season criterion: 7d-Q ≥ 30 cfs (~73rd pctl)
- Rainy season flow for 2004 did not occur until the following March (3/30/2005).

Trends

- The onset of low flow is becoming later. The trend is statistically significant. The trend is clear for 2002–2012, but highly variable since then. The reason for this trend is unknown.
- August–September flows for 2002–2007 are lower than those for 2008–present by about 0.5 cfs. The difference is small, but statistically significant. The difference may be due to a change in the rating curve. Since 2008, flow has been measured by West Consultants; before 2008 it was measured by OWRD.
- For the rainy season, onset possibly is arriving earlier, but the trend is not statistically significant. More years will be required to determine if the trend is real.
- No trends are evident in the magnitude of the flow for December–January.





14206900 — FANNO CREEK AT 56TH AVENUE — 6900

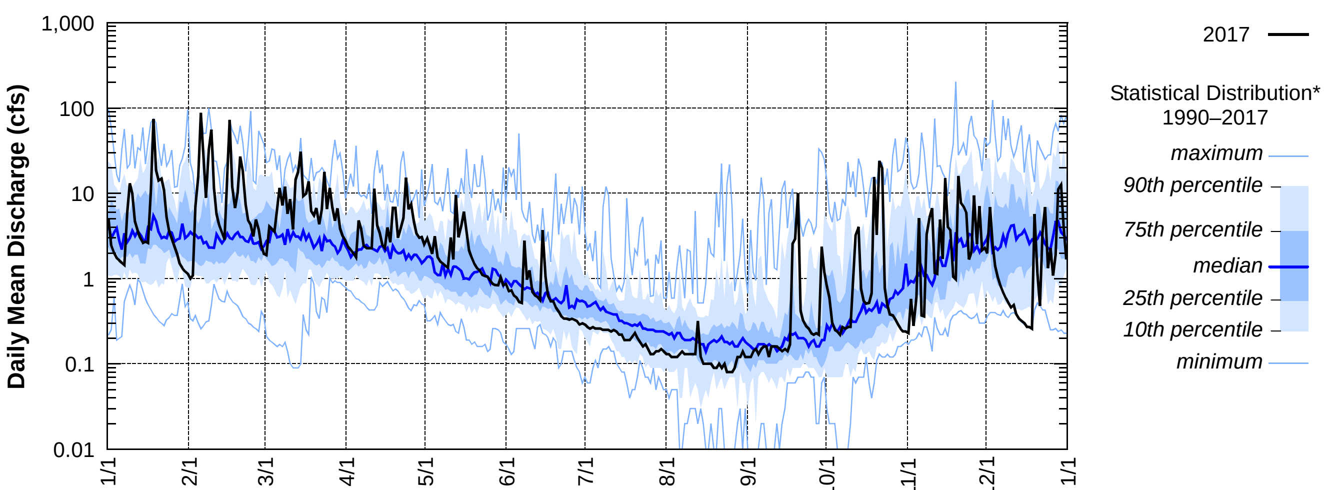
Data source: U.S. Geological Survey, Oregon Water Science Center

River mile: xx.x Latitude: 45 29 17 Longitude: 122 44 01 Drainage area: 2.37 sq mile

Discharge, Cubic Feet per Second, Calendar Year January to December 2017 Daily Mean Values

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	4.85	1.00	1.95	2.77	2.54	0.87	0.29	0.13	0.12	0.82	0.23	1.98
2	2.43	1.09	1.89	2.35	2.99	0.71	0.27	0.13	0.12	0.60	0.58	6.92
3	1.97	7.01	4.08	2.19	2.40	0.73	0.26	0.12	0.14	0.30	0.28	2.55
4	1.74	15.8	3.82	1.97	1.96	0.63	0.27	0.12	0.15	0.25	0.61	1.40
5	1.64	87.3	3.54	1.77	3.14	0.60	0.26	0.12	0.13	0.24	5.09	1.04
6	1.53	26.3	6.38	4.81	1.76	0.53	0.26	0.13	0.15	0.22	0.37	0.81
7	1.43	8.84	11.6	3.82	1.58	0.52	0.26	0.14	0.16	0.27	0.36	0.68
8	5.97	32.8	7.21	2.40	1.50	2.79	0.25	0.13	0.16	0.26	3.31	0.59
9	13.1	55.7	12.0	2.26	1.41	0.97	0.25	0.13	0.12	0.27	5.20	0.52
10	9.82	11.6	5.74	2.26	1.35	1.25	0.25	0.13	0.16	0.27	6.67	0.46
11	4.68	5.70	8.60	2.27	3.04	0.70	0.24	0.13	0.16	0.82	1.17	0.49
12	3.62	4.27	3.76	11.3	1.68	0.64	0.25	0.13	0.16	3.30	1.14	0.38
13	2.96	3.42	14.5	4.22	9.47	0.61	0.24	0.32	0.15	4.03	4.94	0.34
14	2.63	2.87	17.8	3.42	3.05	0.56	0.22	0.12	0.14	0.76	1.71	0.32
15	2.73	17.4	30.7	2.49	4.19	3.70	0.22	0.10	0.15	0.55	15.0	0.30
16	2.62	72.4	9.24	2.28	6.14	1.06	0.19	0.10	0.14	0.51	4.05	0.27
17	10.9	12.0	9.93	3.99	3.53	0.62	0.19	0.10	0.17	0.52	3.72	0.27
18	74.5	6.76	13.8	2.68	2.16	0.54	0.19	0.10	2.58	0.67	1.05	0.26
19	18.6	10.2	6.12	6.71	1.76	0.54	0.21	0.09	2.95	15.4	0.98	5.69
20	14.1	27.0	5.45	6.75	1.47	0.46	0.23	0.09	10.0	3.25	15.9	1.17
21	14.9	18.3	6.76	3.01	1.32	0.41	0.20	0.10	0.42	24.0	7.71	0.48
22	10.8	7.43	4.32	3.93	1.25	0.36	0.18	0.09	0.32	19.4	7.05	3.55
23	5.22	4.76	6.51	5.11	1.11	0.34	0.16	0.10	0.28	0.78	5.87	6.93
24	3.60	4.22	17.9	15.3	1.07	0.34	0.17	0.08	0.26	0.49	1.68	1.33
25	2.99	3.11	6.58	6.50	1.05	0.33	0.15	0.08	0.23	0.38	2.07	2.28
26	2.38	4.95	11.6	7.56	0.96	0.34	0.13	0.08	0.22	0.37	9.45	1.09
27	1.94	3.75	6.79	4.59	0.87	0.33	0.13	0.09	0.23	0.33	2.53	1.93
28	1.49	2.44	4.77	3.34	0.84	0.32	0.14	0.12	0.22	0.29	7.07	11.2
29	1.33	1.95	6.67	3.01	0.83	0.29	0.14	0.12	2.37	0.26	2.16	12.7
30	1.21	—	3.86	3.09	1.03	0.30	0.15	0.14	1.21	0.24	2.29	4.00
31	1.14	—	3.10	—	0.84	—	0.14	0.12	—	0.24	—	1.74
TOTAL	229	460	257	128	68.3	22.4	6.49	3.68	23.8	80.1	120	73.7
MEAN	7.38	15.9	8.29	4.27	2.20	0.75	0.21	0.12	0.79	2.58	4.01	2.38
MAX	74.5	87.3	30.7	15.3	9.47	3.70	0.29	0.32	10.0	24.0	15.9	12.7
MIN	1.14	1.00	1.89	1.77	0.83	0.29	0.13	0.08	0.12	0.22	0.23	0.26
AC-FT	454	913	510	254	135	44.4	12.9	7.30	47.1	159	238	146

6900 — 14206900 — Fanno Creek at 56th Avenue [RM 11.9]



14206900 — FANNO CREEK AT 56TH AVENUE — 6900

Data source: U.S. Geological Survey, Oregon Water Science Center

FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD*

MONTH	0.01 < Q < 0.02	0.02 < Q ≤ 0.1	0.1 < Q ≤ 0.2	0.2 < Q ≤ 0.3	0.3 < Q ≤ 0.5	0.5 < Q ≤ 0.8	0.8 < Q ≤ 1.3	1.3 < Q ≤ 2	2 < Q ≤ 3	3 < Q ≤ 5	5 < Q ≤ 12	12 < Q ≤ 80	80 < Q ≤ 300
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.3%	3.6%	9.4%	8.1%	11%	9.6%	11%	11%	11%	10%	10%	5.6%	0.1%

*Data from October – December 1990 not used to prevent skewing distribution.

Key

- f ≥ 3%
- 2% ≤ f < 3%
- 1% ≤ f < 2%
- 0.2% ≤ f < 1%
- 0.06% ≤ f < 0.2%
- 0 < f < 0.06%

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990										0.46	1.50	2.10
1991	2.20	3.45	2.60	1.95	1.30	0.92	0.65	0.39	0.21	0.16	2.35	2.60
1992	2.50	2.95	1.50	1.70	0.50	0.26	0.14	0.09	0.08	0.19	0.85	1.60
1993	1.90	1.25	2.90	3.80	2.10	0.97	0.62	0.52	0.38	0.49	0.55	0.71
1994	1.30	1.50	1.40	1.60	0.70	0.49	0.34	0.19	0.13	0.15	2.05	5.30
1995	4.20	3.40	3.20	2.65	1.20	0.93	0.41	0.36	0.33	0.56	2.85	5.30
1996	6.40	9.55	2.20	2.75	2.30	0.75	0.43	0.22	0.20	1.70	4.10	12.0
1997	4.00	1.85	5.90	2.00	0.80	0.68	0.30	0.25	0.33	0.74	2.00	2.10
1998	6.50	4.85	3.30	1.20	2.80	1.00	0.44	0.27	0.21	0.41	4.85	7.30
1999	6.30	9.60	4.30	1.80	1.10	0.59	0.34	0.22	0.10	0.16	2.25	2.20
2000	4.80	3.35	2.70	1.05	1.00	0.50	0.28	0.20	0.20	0.37	0.60	1.00
2001	0.73	0.81	1.30	1.20	0.65	0.46	0.26	0.20	0.16	0.22	2.08	5.11
2002	4.71	3.21	2.76	1.24	0.65	0.46	0.20	0.14	0.19	0.21	0.40	2.92
2003	3.60	2.49	2.95	3.79	1.57	0.69	0.30	0.25	0.22	0.28	1.19	5.63
2004	6.56	3.93	1.67	0.69	0.27	0.20	0.13	0.16	0.24	0.44	0.90	2.35
2005	2.02	0.73	0.25	2.53	2.85	1.17	0.30	0.16	0.12	0.46	0.78	1.46
2006	8.45	2.41	2.47	1.99	1.03	0.78	0.30	0.14	0.12	0.24	6.16	3.46
2007	2.71	3.32	3.14	1.76	0.75	0.48	0.27	0.16	0.16	0.65	1.07	5.60
2008	5.28	3.16	3.42	1.84	0.79	0.57	0.19	0.21	0.11	0.16	1.44	1.56
2009	2.91	1.78	1.48	1.00	1.14	0.40	0.25	0.12	0.17	0.33	2.84	1.65
2010	5.31	2.58	1.93	2.60	2.01	2.05	0.42	0.21	0.27	0.43	2.53	4.60
2011	2.97	2.50	6.27	3.55	1.95	0.86	0.54	0.32	0.19	0.35	1.60	0.57
2012	2.70	1.95	6.18	3.60	1.89	1.17	0.38	0.11	0.08	0.53	2.03	5.63
2013	1.83	1.40	1.22	1.05	0.51	0.75	0.22	0.05	0.31	0.47	0.48	0.42
2014	0.43	1.96	3.27	3.45	2.08	0.74	0.54	0.09	0.07	0.40	1.42	3.15
2015	1.47	3.44	4.12	2.66	0.88	0.40	0.19	0.03	0.20	0.48	1.68	11.5
2016	6.76	5.53	5.12	1.50	1.03	0.37	0.09	0.03	0.12	3.12	2.24	3.00
2017	2.96	7.22	6.58	3.22	1.58	0.55	0.22	0.12	0.16	0.49	2.41	1.09
Median	3.37	2.86	2.81	2.11	1.20	0.68	0.32	0.19	0.18	0.41	1.67	2.90

Key

Q in cfs

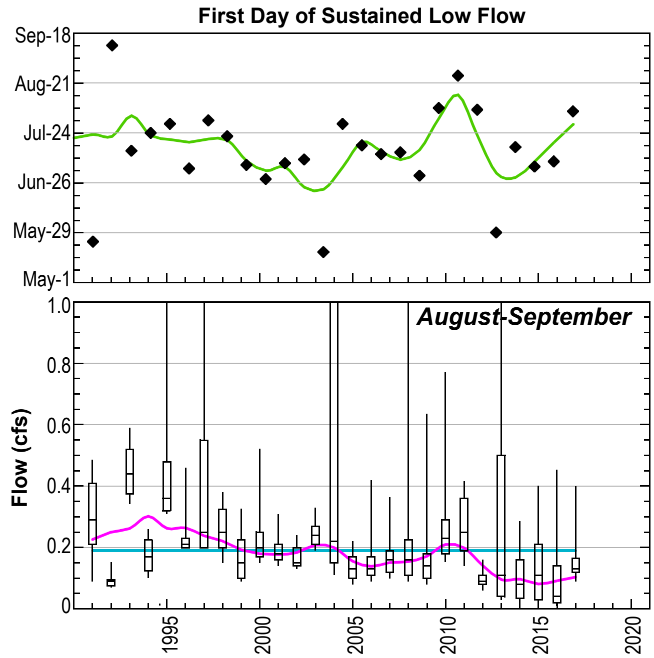
- Q ≤ 0.11
- 0.11 < Q ≤ 0.16
- 0.16 < Q ≤ 0.21
- 0.21 < Q ≤ 0.27
- 0.27 < Q ≤ 0.45
- 0.45 < Q ≤ 0.72
- 0.72 < Q ≤ 1.2
- 1.2 < Q ≤ 3.1
- 3.1 < Q ≤ 7.4
- 7.4 < Q ≤ 13
- Q > 13

Q as percentile

- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

Distribution

- December through March are the months with the highest average flows.
- August and September are the months with the lowest average flow and the lowest daily flows.
- Although median flows are low during the July through September period (around 0.2 cfs), flows that are much higher are not uncommon. Flows of up to 50 cfs have been recorded in the July–September period. The August–September boxplots show this variability. This pattern is typical of flashy urban streams such as Fanno Creek.
- This site did not start operating until October 1, 1990. To prevent a partial year from skewing the distribution, no data from 1990 was used in the calculation of the frequency distribution.

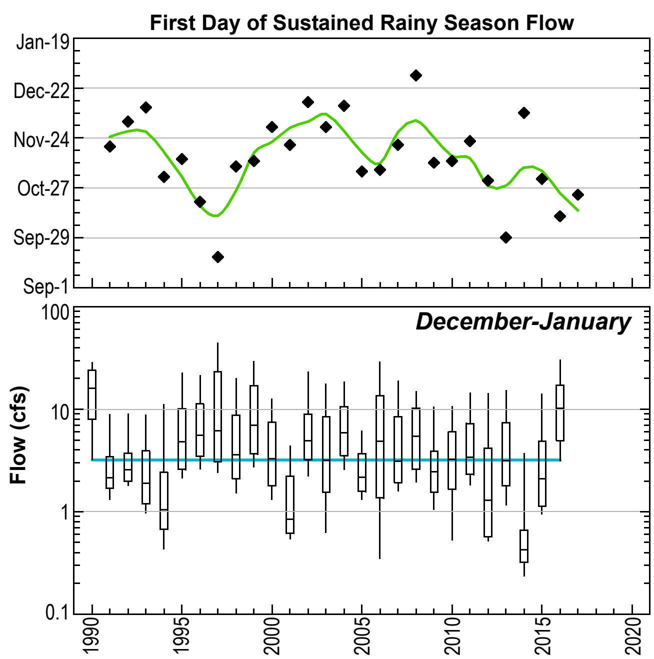


Seasonal onsets

- Low flow criterion: 7d-Q ≤ 0.4 cfs (~27th pctl)
- Rainy season criterion: 7d-Q ≥ 3.0 cfs (~74th pctl)

Trends

- No trend is evident in the onset of low flow season.
- August–September flows show a statistical significant decreasing trend.
- No trend is evident in the onset of rainy season flow.
- No trends are evident in the magnitude of the flow for December–January.



Anomalies

- Spring rainfall in both 2010 and 2011 was high, resulting in later onset of low flow and higher flows that persisted into summer.
- 2014: Rainfall in the fall of 2014 was low compared to most years, resulting in low December–January flows and a later onset of the rainy season flow.

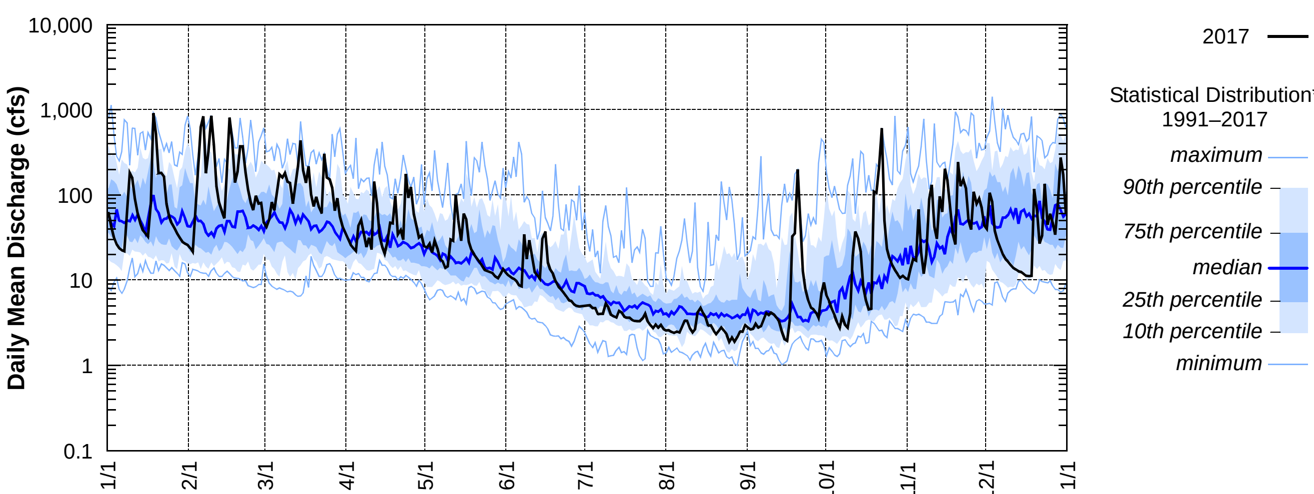
14206950 — FANNO CREEK AT DURHAM — FANO

Data source: U.S. Geological Survey, Oregon Water Science Center

River mile: 1.2 Latitude: 45 24 13 Longitude: 122 45 13 Drainage area: 31.50 sq mile

Day	Discharge, Cubic Feet per Second, Calendar Year January to December 2017 Daily Mean Values											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	61.0	23.8	47.0	35.8	25.0	12.4	4.97	2.56	2.80	6.57	10.2	39.9
2	42.9	21.5	42.0	30.7	24.2	11.3	5.04	2.59	2.64	5.68	13.8	106
3	31.1	75.4	51.6	26.2	26.8	10.8	5.09	2.47	2.68	4.54	17.8	82.6
4	26.2	219	82.9	23.8	21.1	10.4	4.68	2.41	3.07	3.88	17.0	38.0
5	23.7	623	66.2	22.0	29.0	9.75	4.68	2.51	2.78	3.18	67.8	29.2
6	22.5	837	104	44.3	23.5	8.78	3.98	2.43	2.89	2.74	20.9	24.1
7	21.8	180	174	51.4	17.6	8.46	4.01	2.85	3.48	3.74	11.9	20.1
8	74.9	323	161	36.1	16.6	34.4	4.03	3.36	4.11	3.00	20.1	17.8
9	180	848	182	24.4	13.9	17.7	5.31	3.33	3.87	2.77	89.0	16.6
10	157	389	143	31.5	14.5	29.6	4.76	2.70	4.17	4.08	132	15.2
11	90.8	127	139	22.9	30.2	19.5	3.94	2.44	3.96	19.4	42.3	14.0
12	60.0	82.1	79.3	144	29.0	12.5	3.78	2.65	3.61	37.4	30.6	13.4
13	46.7	64.2	132	78.8	101	11.4	3.66	4.20	3.24	30.6	96.4	12.7
14	38.7	53.1	220	33.2	50.5	10.3	4.38	4.75	2.53	21.4	63.4	12.5
15	35.3	207	437	24.9	29.0	31.1	4.20	4.08	2.03	8.34	203	11.7
28	32.6	804	194	20.6	60.4	37.3	3.75	3.66	1.94	5.85	147	11.2
17	79.7	449	139	27.6	51.2	16.2	3.61	2.91	3.35	4.52	72.9	11.1
18	912	140	218	47.0	28.1	13.1	3.61	2.95	32.9	4.63	34.4	11.2
19	521	188	101	46.5	22.7	11.8	3.40	2.56	35.5	110	26.1	118
20	179	371	73.3	97.3	19.8	9.67	3.32	2.34	200	106	243	66.0
21	181	372	94.6	34.6	18.0	8.36	3.29	2.54	60.2	207	127	26.9
22	165	185	70.6	38.9	16.5	7.83	3.31	2.79	12.9	606	152	33.4
23	78.3	115	60.3	29.8	14.7	7.15	3.56	2.54	7.84	50.5	119	135
24	56.2	81.7	305	176	13.1	6.50	4.04	2.30	5.72	23.2	49.9	44.8
25	46.5	66.5	160	92.3	12.8	5.80	3.31	1.89	4.78	17.9	39.2	60.1
26	40.5	98.3	153	124	12.5	5.67	2.99	2.13	4.59	14.8	109	47.0
27	35.2	78.9	121	59.5	12.1	5.19	2.75	1.90	4.15	13.0	79.2	34.1
28	31.3	80.4	65.5	42.9	11.1	5.00	3.02	2.16	3.60	11.7	90.6	78.7
29	28.4	47.0	91.3	31.6	10.6	4.91	2.77	2.51	6.94	10.7	70.5	275
30	26.8	—	55.7	33.5	11.8	4.95	2.97	2.47	9.36	11.2	44.1	174
31	25.9	—	41.8	—	13.6	—	2.68	2.97	—	10.5	—	62.2
TOTAL	3352	7150	4005	1532	781	388	119	86.0	442	1365	2240	1643
MEAN	108	247	129	51.1	25.2	12.9	3.84	2.77	14.7	44.0	74.7	53.0
MAX	912	848	437	176	101	37.3	5.31	4.75	200	606	243	275
MIN	21.8	21.5	41.8	20.6	10.6	4.91	2.68	1.89	1.94	2.74	10.2	11.1
AC-FT	6649	14182	7944	3039	1549	769	236	170	876	2707	4443	3258

FANO — 14206950 — Fanno Creek at Durham Road near Tigard, Oregon [RM 1.2]



14206950 — FANNO CREEK AT DURHAM — FANO

FREQUENCY OF MEAN DAILY DISCHARGE BY MONTH FOR PERIOD OF RECORD

MONTH	0.8 < Q < 1.2	1.2 < Q ≤ 2.5	2.5 < Q ≤ 4	4 < Q ≤ 6	6 < Q ≤ 10	10 < Q ≤ 15	15 < Q ≤ 22	22 < Q ≤ 32	32 < Q ≤ 50	50 < Q ≤ 80	80 < Q ≤ 200	200 < Q ≤ 800	800 < Q ≤ 1,500
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.1%	3.9%	9.4%	9.4%	11%	9.7%	11%	10%	11%	9.1%	11%	4.8%	0.2%

Key
f ≥ 3%
2% ≤ *f* < 3%
1% ≤ *f* < 2%
0.2% ≤ *f* < 1%
0.06% ≤ *f* < 0.2%
0 < *f* < 0.06%

MEDIAN DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	28	44	33	25	17	12	7.5	4.8	3.3	3.1	34	40
1992	42	50	22	33	12	5.2	3.4	2.8	2.9	3.7	20	56
1993	44	21	56	73	38	17	8.7	4.7	3.5	3.8	5.8	26
1994	41	37	34	25	12	8.7	3.8	3.8	3.4	3.6	49	68
1995	62	59	59	39	19	15	9.8	6.7	5.5	15	50	71
1996	95	124	25	37	25	7.8	6.6	5.9	7.5	19	80	221
1997	74	41	110	34	21	20	8.9	6.5	9.3	31	39	39
1998	100	73	58	21	54	18	9.2	7.8	24	34	70	100
1999	90	155	71	30	20	11	6.8	6.3	4.5	6.3	53	48
2000	61	68	52	17	17	7.5	5.6	3.9	3.8	12	8.9	21
2001	13	17	21	22	11	10	5.5	5.4	4.4	7.1	39	99
2002	86	54	44	19	11	7.9	5.5	3.8	4.0	4.1	8.5	66
2003	58	41	71	63	20	9.2	5.6	4.5	3.7	12	17	78
2004	100	64	25	12	9.1	6.7	3.8	5.2	6.5	17	15	25
2005	22	13	11	33	33	14	5.4	4.9	3.5	14	39	64
2006	195	32	42	33	15	9.5	4.3	3.0	2.7	4.4	117	65
2007	38	47	44	28	11	6.5	4.0	3.0	3.3	15	18	105
2008	109	34	54	29	16	9.0	4.5	4.6	3.4	4.9	19	17
2009	26	16	27	21	23	8.2	3.3	3.2	3.4	7.3	48	18
2010	86	41	31	36	21	28	6.0	3.5	6.5	5.6	46	96
2011	51	32	101	50	26	13	9.5	4.0	2.4	8.3	28	13
2012	50	35	81	46	23	15	5.5	2.7	2.0	21	49	137
2013	27	23	18	17	11	9.2	2.4	3.0	13	7.3	12	8.9
2014	20	50	67	48	21	7.6	4.8	2.2	2.2	17	26	53
2015	23	31	28	21	7.1	3.0	1.8	1.4	2.4	2.8	28	183
2016	84	55	67	16	11	6.9	3.5	1.7	3.6	58	48	55
2017	47	160	104	35	20	10	3.8	2.6	3.9	11	66	33
Median	54	43	45	30	18	10	5.2	4.0	3.9	9.5	32	54

Key
Q in cfs
Q ≤ 2.7
2.7 < Q ≤ 3.5
3.5 < Q ≤ 4.3
4 < Q ≤ 5.4
5 < Q ≤ 8.5
8 < Q ≤ 13
13 < Q ≤ 19
19 < Q ≤ 49
49 < Q ≤ 120
120 < Q ≤ 199
Q > 199
Q as percentile
Q ≤ 5th
5th < Q ≤ 10th
10th < Q ≤ 15th
15th < Q ≤ 20th
20th < Q ≤ 30th
30th < Q ≤ 40th
40th < Q ≤ 50th
50th < Q ≤ 75th
75th < Q ≤ 90th
90th < Q ≤ 95th
Q > 95th

Distribution

- December through March are the months with the highest average flows.
- July through September are the months with the lowest average flow and the lowest daily flows.
- Although median flows are low during the July through September period, flows that are much higher are not uncommon. The August–September boxplots show this variability. This pattern is typical of flashy urban streams such as Fanno Creek.

Seasonal onsets

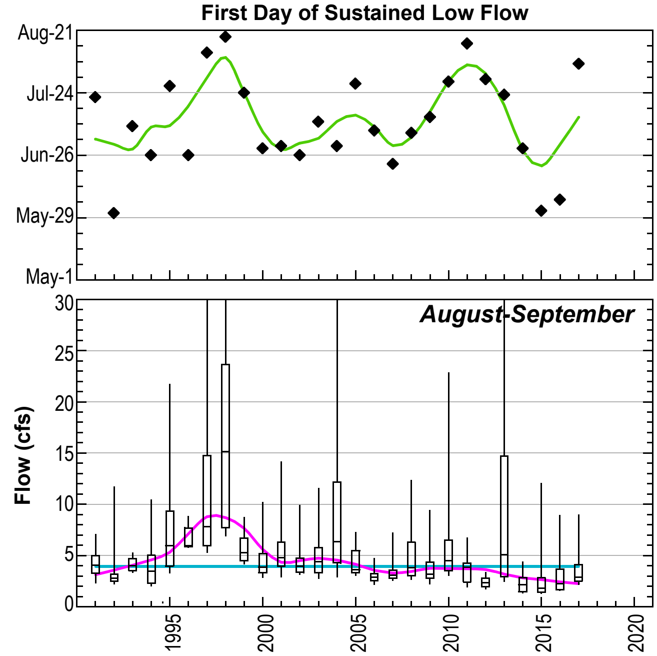
- Low flow criterion: 7d-Q ≤ 7 cfs (~26th pctl)
- Rainy season criterion: 7d-Q ≥ 50 cfs (~75th pctl)

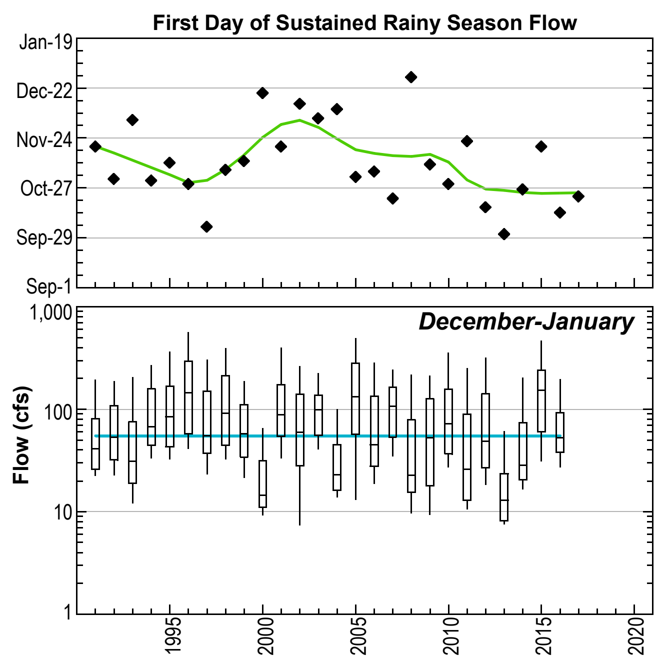
Trends

- No trend is evident in the onset of low flow season.
- August–September flows show a statistical significant decreasing trend.
- No trend is evident in the onset of rainy season flow.
- No trends are evident in the magnitude of the flow for December–January.

Anomalies

- 2000: The winter of 2000-2001 was very dry, causing the rainy season criterion not to met in 2000. Winter flows were low that year.
- 2014: Rainfall in the fall of 2014 was low compared to most years, resulting in low December–January flows and a later onset of the rainy season flow.





14202630 — WAPATO CANAL AT PUMPHOUSE AT GASTON, OREG. — WPH

Data source: U.S. Geological Survey, Oregon Water Science Center

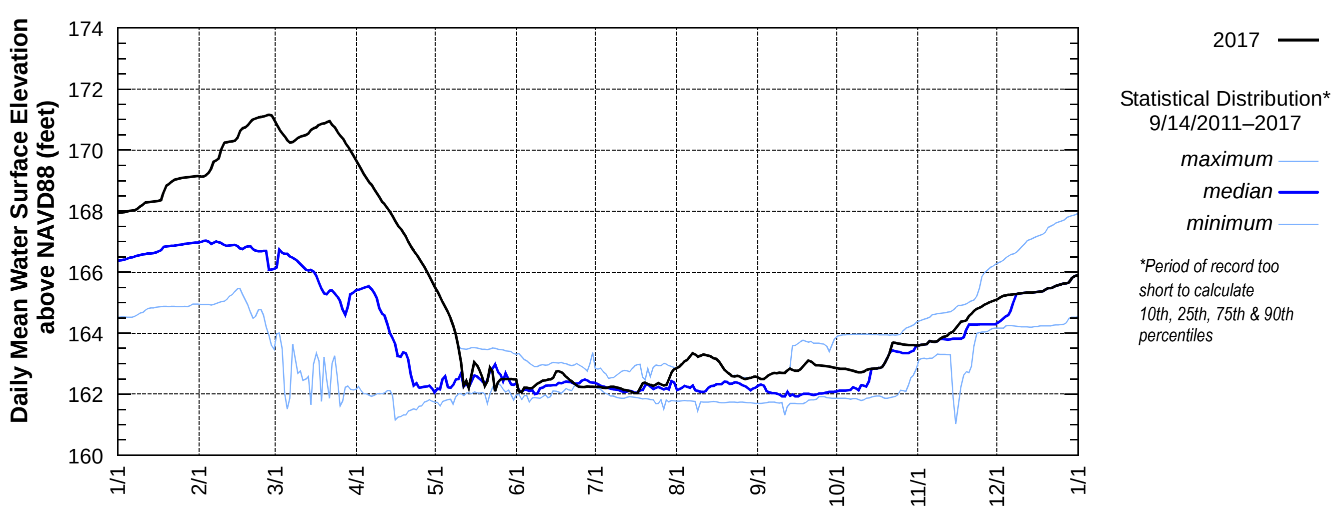
Latitude: 45 26 25 *Longitude:* 123 07 31

2017 Daily Mean Water Surface Elevation above NAVD88, in feet

Day	JAN†	FEB†	MAR†	APR†	MAY†	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	167.95	169.13	170.99	169.68	165.52	162.48	162.23	162.86	162.55	162.85	163.60	165.12
2	167.96	169.13	170.83	169.53	165.36	162.09	162.24	162.90	162.49	162.83	163.62	165.18
3	167.97	169.17	170.69	169.38	165.19	162.08	162.23	162.99	162.50	162.83	163.63	165.23
4	167.99	169.26	170.56	169.23	165.02	162.21	162.21	163.08	162.56	162.83	163.64	165.24
5	168.01	169.39	170.45	169.08	164.86	162.21	162.20	163.12	162.63	162.81	163.74	165.26
6	168.02	169.63	170.32	168.95	164.68	162.19	162.22	163.24	162.67	162.79	163.72	165.26
7	168.03	169.67	170.24	168.87	164.49	162.20	162.24	163.35	162.69	162.77	163.71	165.28
8	168.08	169.73	170.27	168.72	164.26	162.27	162.24	163.30	162.68	162.74	163.73	165.28
9	168.15	170.07	170.33	168.58	163.98	162.35	162.22	163.23	162.70	162.72	163.82	165.30
10	168.21	170.24	170.40	168.45	163.58	162.39	162.20	163.26	162.69	162.72	163.87	165.31
11	168.28	170.26	170.44	168.30	163.04	162.44	162.18	163.30	162.69	162.74	163.89	165.32
12	168.29	170.28	170.47	168.23	162.29	162.45	162.14	163.28	162.78	162.79	163.93	165.33
13	168.30	170.29	170.50	168.11	162.44	162.48	162.13	163.26	162.84	162.82	164.02	165.33
14	168.31	170.31	170.55	167.97	162.21	162.48	162.11	163.24	162.80	162.83	164.06	165.33
15	168.32	170.40	170.67	167.83	162.62	162.54	162.07	163.18	162.77	162.84	164.16	165.34
16	168.33	170.62	170.72	167.67	163.05	162.74	162.03	163.16	162.77	162.84	164.27	165.35
17	168.36	170.72	170.75	167.54	162.96	162.76	162.03	163.07	162.82	162.86	164.37	165.36
18	168.64	170.75	170.83	167.43	162.79	162.73	162.20	162.95	162.91	162.89	164.40	165.37
19	168.84	170.82	170.86	167.29	162.58	162.66	162.36	162.80	163.01	163.02	164.43	165.43
20	168.89	170.93	170.87	167.17	162.27	162.57	162.38	162.73	163.10	163.19	164.56	165.48
21	168.96	171.01	170.92	166.99	162.43	162.48	162.34	162.67	163.07	163.38	164.64	165.48
22	169.03	171.04	170.95	166.84	162.86	162.43	162.31	162.59	163.00	163.69	164.73	165.51
23	169.05	171.07	170.82	166.71	162.74	162.35	162.27	162.58	162.95	163.68	164.81	165.55
24	169.07	171.09	170.75	166.59	162.10	162.29	162.32	162.60	162.95	163.66	164.84	165.57
25	169.09	171.11	170.61	166.45	162.39	162.24	162.37	162.58	162.94	163.65	164.88	165.60
26	169.10	171.14	170.49	166.32	162.48	162.23	162.33	162.53	162.93	163.63	164.94	165.62
27	169.11	171.16	170.39	166.17	162.49	162.23	162.29	162.49	162.91	163.62	164.98	165.63
28	169.12	171.14	170.25	166.01	162.50	162.25	162.31	162.52	162.90	163.61	165.03	165.67
29	169.13	170.99	170.13	165.86	162.49	162.24	162.51	162.54	162.88	163.61	165.06	165.80
30	169.14	—	169.98	165.69	162.49	162.24	162.72	162.57	162.86	163.61	165.09	165.87
31	169.15	—	169.83	—	162.48	—	162.82	162.58	—	163.6	—	165.89
MEAN	168.54	170.36	170.54	167.72	163.25	162.38	162.27	162.92	162.80	163.11	164.27	165.43
MAX	169.15	171.16	170.99	169.68	165.52	162.76	162.82	163.35	163.10	163.69	165.09	165.89
MIN	167.95	169.13	169.83	165.69	162.10	162.08	162.03	162.49	162.49	162.72	163.60	165.12

†Provisional data (1/1–5/10)–subject to revision; *incomplete record (monthly totals were computed when at least 80% of the record was complete for the month)

WPH—14202630 — Wapato Canal Pumphouse at Gaston, Oregon



FREQUENCY OF MEAN DAILY STAGE BY MONTH FOR PERIOD OF RECORD

MONTH	161.0 < Q < 161.3	161.3 < Q ≤ 161.8	161.8 < Q ≤ 162.0	162.0 < Q ≤ 162.2	162.2 < Q ≤ 162.4	162.4 < Q ≤ 162.8	162.8 < Q ≤ 163.5	163.5 < Q ≤ 1164.5	164.5 < Q ≤ 165.5	165.5 < Q ≤ 166.5	166.5 < Q ≤ 169.0	169.0 < Q ≤ 171.0	171.0 < Q ≤ 171.2
Jan													
Feb													
Mar													
Apr													
May													
Jun													
July													
Aug													
Sep													
Oct													
Nov													
Dec													
All	0.1%	4.2%	8.8%	12%	9.7%	9.2%	9.0%	12%	10%	8.5%	10%	5.4%	0.4%

Key

- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

MEDIAN STAGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011									163.66	163.43	163.33	164.25
2012	165.06	166.32	164.45	161.89	162.23	162.24	161.90	161.74	161.73	161.95	163.58	166.04
2013	167.47	165.73	162.59	162.12	162.59	162.20	162.14	162.46	162.36	163.94	164.21	164.48
2014	164.86	165.42	166.23	164.54	162.13	162.14	162.07	162.18	161.91	162.03	163.82	164.84
2015	165.89	167.33	165.24	162.47	162.15	162.29	162.75	162.37	161.97	161.94	163.58	166.18
2016	168.31	169.40	169.29	166.37	163.49	163.00	162.37	162.21	161.94	163.51	164.88	167.18
2017	168.33	170.36	170.55	167.75	162.74	162.35	162.24	162.95	162.81	162.85	164.22	165.35
Median	166.74	166.92	165.98	163.85	162.46	162.31	162.20	162.23	162.05	162.83	164.05	165.34

Key

Q in cfs

- Q ≤ 161.82
- 161.82 <Q≤ 161.94
- 161.94 <Q≤ 162.03
- 162.03 <Q≤ 162.12
- 162.12 <Q≤ 162.30
- 162.30 <Q≤ 162.63
- 162.63 <Q≤ 163.35
- 163.35 <Q≤ 165.27
- 165.27 <Q≤ 167.49
- 167.49 <Q≤ 169.11
- Q > 169.11

Q as percentile

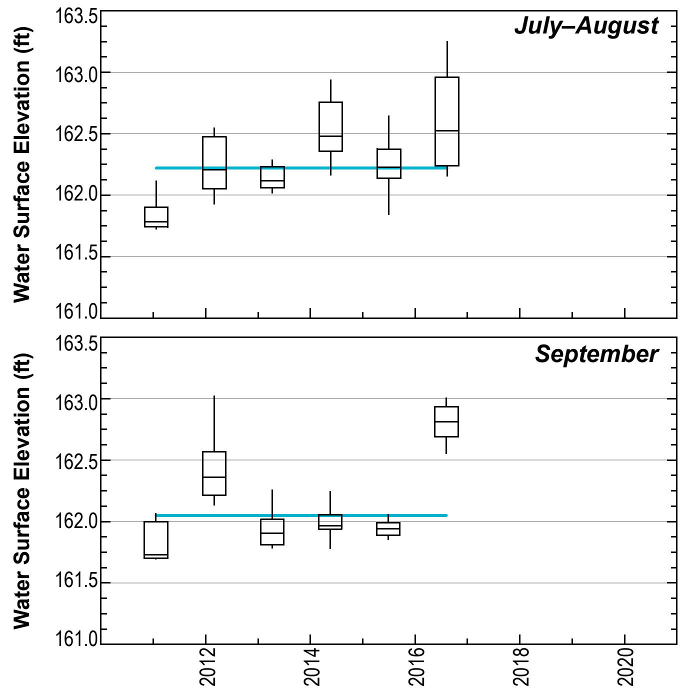
- Q ≤ 5th
- 5th < Q ≤ 10th
- 10th < Q ≤ 15th
- 15th < Q ≤ 20th
- 20th < Q ≤ 30th
- 30th < Q ≤ 40th
- 40th < Q ≤ 50th
- 50th < Q ≤ 75th
- 75th < Q ≤ 90th
- 90th < Q ≤ 95th
- Q > 95th

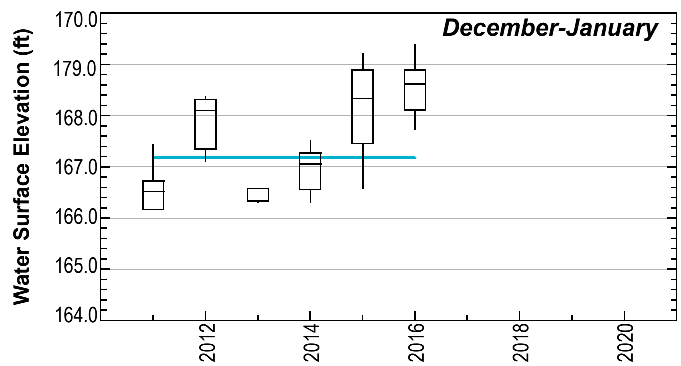
Distribution

- January through March are the months with the highest average water levels.
- June through October are the months with the lowest average water levels.
- Water levels at this site are affected by pumping that generally occurs in March and April.

Trends

- The period of record is not long enough to discern trends.





14206956 (formerly 14206960) — TUALATIN RIVER AT TUALATIN, OREGON — TRT

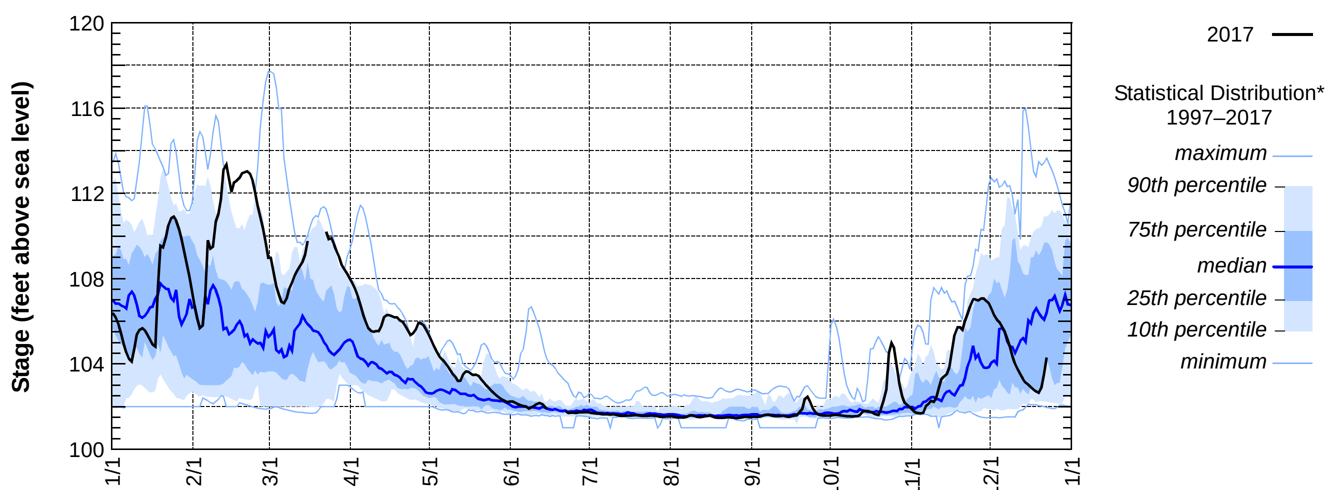
Data source: Oregon Water Resources Division

River mile: 8.9 *Latitude:* 45 23 14 *Longitude:* 122 45 46

Day	2017 Daily Mean Water Surface Elevation in feet[†]											
	JAN	FEB*	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV*	DEC*
1	106.35	106.69	108.97	107.77	105.09	102.23	101.70	101.53	101.52	101.60	101.72	106.27
2	106.16	106.12	108.25	107.52	104.82	102.17	101.68	101.50	101.52	101.60	101.69	106.08
3	105.83	105.68	107.64	107.16	104.58	102.12	101.67	101.48	101.53	101.59	101.68	105.95
4	105.41	105.80	107.26	106.76	104.36	102.07	101.66	101.49	101.57	101.58	101.71	105.75
5	104.93	107.18	106.92	106.35	104.21	102.03	101.64	101.49	101.61	101.56	102.03	105.51
6	104.53	109.80	106.85	105.98	104.09	101.99	101.64	101.52	101.62	101.54	102.12	105.18
7	104.25	109.41	107.09	105.69	103.93	101.91	101.64	101.57	101.59	101.55	102.26	104.81
8	104.11	109.50	107.56	105.55	103.74	101.97	101.62	101.59	101.56	101.53	102.22	104.37
9	104.69	110.68	107.83	105.51	103.55	102.03	101.63	101.56	101.54	101.54	102.41	104.00
10	105.38	111.03	108.15	105.53	103.41	102.12	101.62	101.52	101.55	101.54	102.87	103.72
11	105.60	111.74	108.40	105.53	103.19	102.18	101.59	101.50	101.56	101.60	103.28	103.49
12	105.67	113.11	108.59	105.81	103.21	102.13	101.56	101.51	101.57	101.77	103.42	103.28
13	105.57	113.36	108.79	106.19	103.49	102.03	101.56	101.54	101.53	101.78	103.52	103.12
14	105.36	112.70	109.13	106.28	103.64	101.89	101.58	101.56	101.52	101.78	103.86	103.01
15	105.13	112.07	109.77	106.28	103.63		101.57	101.59	101.54	101.76	104.58	102.90
16	104.90	112.51		106.24	103.54		101.57	101.53	101.57	101.69	105.37	102.79
17	104.80	112.59		106.18	103.48		101.59	101.49	101.59	101.63	105.71	102.72
18	107.58	112.73		106.18	103.50		101.59	101.47	101.74	101.61	105.72	102.66
19	109.55	112.95		106.04	103.43		101.57	101.47	101.87	101.89	105.60	102.91
20	109.47	112.99		105.98	103.27		101.56	101.47	102.35	102.26	106.03	103.54
21	109.93	113.02		105.77	103.13	101.78	101.56	101.48	102.46	102.79	106.36	104.30
22	110.54	112.90	110.21	105.57	102.99	101.70	101.56	101.50	102.23	104.52	106.77	
23	110.84	112.59	109.86	105.36	102.85	101.71	101.58	101.49	101.91	104.96	107.03	
24	110.91	112.03	109.90	105.43	102.72	101.71	101.57	101.47	101.72	104.74	107.02	
25	110.71	111.40	109.59	105.59	102.59	101.69	101.56	101.46	101.63	103.85	106.98	
26	110.33	110.89	109.26	105.93	102.49	101.72	101.54	101.47	101.59	103.05	107.07	
27	109.85	110.33	108.98	105.90	102.40	101.72	101.52	101.48	101.57	102.50	107.06	
28	109.31	109.70	108.61	105.80	102.33	101.74	101.52	101.52	101.58	102.18	106.94	
29	108.71	108.97	108.42	105.60	102.27	101.74	101.53	101.52	101.57	102.07	106.84	104.97
30	108.05	—	108.20	105.37	102.21	101.73	101.53	101.50	101.58	101.96	106.58	106.09
31	107.35	—	107.98	—	102.23	—	101.54	101.51	—	101.85	—	106.49
MEAN	107.15	110.71	108.49	106.03	103.37		101.59	101.51	101.68	102.19	104.55	
MAX	110.91	113.36	110.21	107.77	105.09		101.70	101.59	102.46	104.96	107.07	
MIN	104.11	105.68	106.85	105.36	102.21		101.52	101.46	101.52	101.53	101.68	

[†] All 2017 data are preliminary–subject to revision; *Incomplete record (monthly totals were computed when at least 80% of the record was complete for the month)

TRT — 14206956 (formerly 14206960) **— Tualatin River at Tualatin, Oregon [RM 8.9]**



FREQUENCY OF MEAN DAILY STAGE BY MONTH FOR PERIOD OF RECORD

MONTH	101.0 < Q < 101.3	101.3 < Q ≤ 101.5	101.5 < Q ≤ 101.6	101.6 < Q ≤ 101.7	101.7 < Q ≤ 101.9	101.9 < Q ≤ 102.1	102.1 < Q ≤ 102.6	102.6 < Q ≤ 103.3	103.3 < Q ≤ 104.5	104.5 < Q ≤ 106.5	106.5 < Q ≤ 110.0	110.0 < Q ≤ 116.0	116.0 < Q ≤ 120	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	0.7%	3.6%	9.0%	8.9%	11%	9.0%	10%	9.5%	10%	10%	11%	4.2%	0.1%	1.3%

Key
f ≥ 3%
2% ≤ *f* < 3%
1% ≤ *f* < 2%
0.2% ≤ *f* < 1%
0.06% ≤ *f* < 0.2%
0 < *f* < 0.06%

MEDIAN STAGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	104.87	106.60
1998	109.86	108.00	106.40	103.50	102.61	102.27	102.47	102.56	102.67	102.03	102.26	109.61
1999	110.47	112.37	107.42	104.50	102.61	101.77	101.67	101.66	101.90	101.79	103.16	106.84
2000												
2001	102.00	103.00	102.00	102.00	102.00	102.00	102.00	101.00	101.00	102.00	103.00	109.00
2002	108.39	107.15	105.46	103.33	102.09	101.79	101.73	102.23	102.05	101.78	101.71	103.82
2003	106.19	107.07	107.24	105.17	102.61	101.85	101.64	102.23	101.99	101.95	101.65	104.18
2004	106.17	106.45	103.86	102.78	101.99	101.70	101.53	101.60	101.64	101.88	101.89	102.49
2005	103.05	102.39	101.91	103.92	103.66	102.06	101.70	101.47	101.46	101.77	103.45	104.39
2006	112.57	107.80	104.88	103.90	102.27	101.87	101.65	101.54	101.57	101.67	106.92	
2007	107.89	103.45	105.51	103.21	102.07	101.79	101.70	101.69	101.72	101.91	102.14	108.04
2008		107.23	104.42	104.01	102.54	101.89	101.77	101.61	101.64	101.62	102.29	102.20
2009	107.77	102.47	103.79	103.20	103.06	101.73	101.57	101.54	101.54	101.62	103.31	103.78
2010	107.71	104.99	104.66	106.44	103.18	103.68	101.81	101.65	101.72	101.67	102.89	108.91
2011	108.30	104.35	108.52	105.78	103.55	102.17	101.74	101.62	101.59	101.59	101.85	102.21
2012	106.94	104.92	107.55	105.31	102.99	102.19	101.70	101.59	101.59	101.88	103.71	109.58
2013	104.18	103.18	103.62	102.82	101.97	102.01	101.58	101.51	101.72	101.83		102.30
2014	102.71	107.09	107.34	104.99	103.10	101.82	101.65	101.50	101.50	101.79	102.82	105.62
2015	104.70	106.34	104.58	103.03	101.88	101.57	101.53	101.50	101.53	101.53		111.91
2016	109.08	106.54	107.26	103.08	101.82	101.65	101.46	101.43	101.48	103.31		
2017	106.16	111.57		105.96	103.48		101.58	101.50	101.57	101.76	104.22	
Median	102.88	102.49	102.56	102.50	101.84	101.62	101.52	101.45	101.46	101.55	101.70	102.18

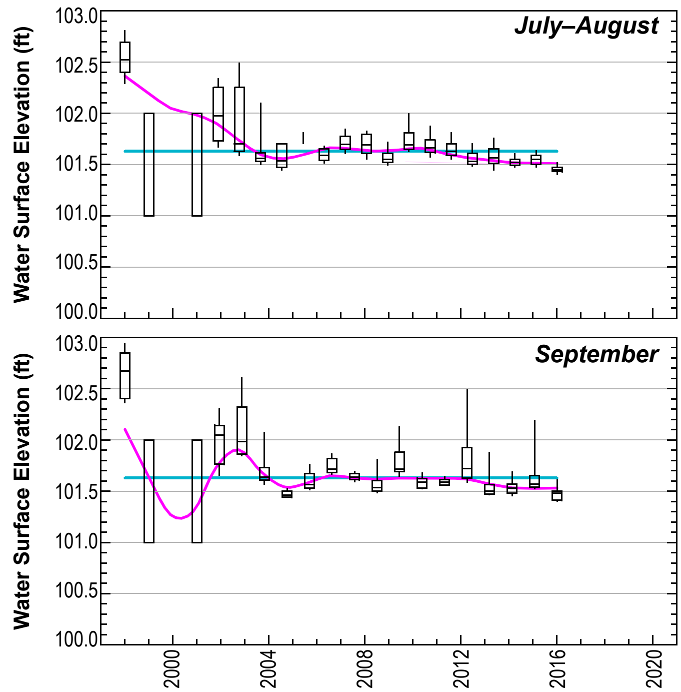
Key	
Q in cfs	*Q as percentile*
Q ≤ 101.51	Q ≤ 5th
101.51 < Q ≤ 101.56	5th < Q ≤ 10th
101.56 < Q ≤ 101.61	10th < Q ≤ 15th
101.61 < Q ≤ 101.67	15th < Q ≤ 20th
101.67 < Q ≤ 101.81	20th < Q ≤ 30th
101.81 < Q ≤ 102.00	30th < Q ≤ 40th
102.00 < Q ≤ 102.40	40th < Q ≤ 50th
102.40 < Q ≤ 104.72	50th < Q ≤ 75th
104.72 < Q ≤ 107.92	75th < Q ≤ 90th
107.92 < Q ≤ 109.71	90th < Q ≤ 95th
Q > 109.71	Q > 95th

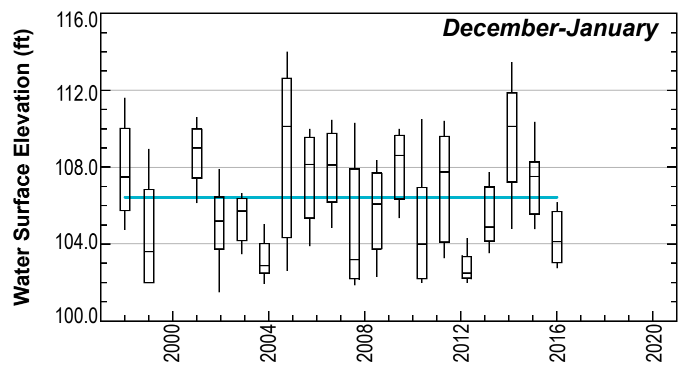
Distribution

- January through April are the months with the highest average water levels.
- July through September are the months with the lowest average water levels.
- No data were available for 2000. For 1999 and 2001, data was only reported to the nearest foot.

Trends

- July–August water levels show a statistical significant decreasing trend, as does September.
- No trends are evident in the magnitude of the water levels for December–January.





Data sources

Data were obtained from several sources. If more than one source had a value for the same date, the values were compared and the one judged the best quality was used. In some cases, quality could not be determined and none were used. Because data collection changed (for example, different agencies, new rating curves), the measurements may not have been consistent over the period of record.

DATA SOURCES

SITEID	SITE NAME	START DATE	SOURCES OF DATA FOR DISTRIBUTION
14202450	Tualatin River below Lee Falls near Cherry Grove, Oregon	1/1/2003	previous Flow Reports: 2003–2007 OWRD database: 2008–present
14202510	Tualatin River at Gaston, Oregon	1/1/2000	CWS data warehouse: 2000–2007 (origin: OWRD Dist 18) OWRD database: 2008–present
14202630	Wapato Canal at Pumphouse at Gaston, Oregon	9/14/2011	USGS database: all
14202850	Scoggins Creek above Henry Hagg Lake near Gaston, Oregon	1/1/1975	OWRD database: all (no data WY-1997–WY2006)
14202860	Tanner Creek above Henry Hagg Lake near Gaston, Oregon	1/12003	Wally Otto, TVID, pers. comm.: 2003 previous Flow Reports: 2004–present (Scoggins Dam Ops tables)
14202920	Sain Creek above Henry Hagg Lake near Gaston, Oregon	1/1/1975	OWRD database: all (no data WY-1997–WY2006)
14202980	Scoggins Creek below Henry Hagg Lake near Gaston, Oregon	1/1/1975	USGS database: 1975–WY2006 BOR WY2007–present; (BOR has data back to 1941)
14203500	Tualatin River at Dilley, Oregon	1/1/1975	USGS database: 1975–present (USGS has data back to 1939)
14204530	Gales Creek at Old Hwy 47 near Forest Grove, Oregon	1/1/1996	CWS data warehouse: 1996–2007 (origin: ORWD Dist 18) OWRD database: 2008–present
14204800	Tualatin River at Golf Course Road near Cornelius, Oregon	1/1/1994	previous Flow Report: 1994 CWS data warehouse: 1995–2007 (origin: ORWD Dist 18) OWRD database: 2008–present
14205400	East Fork Dairy Creek near Meacham Corner, OR	5/8/2002	USGS database: all
14206070	McKay Creek at Scotch Church Rd above Waible Ck near North Plains, Oregon	1/1/2002	previous Flow Reports: all
14206200	Dairy Creek at Hwy 8 near Hillsboro, Oregon	1/1/1997	CWS data warehouse: 1997–2007 (origin: OWRD Dist 18) OWRD database: 2008–present
14206241	Tualatin River at Hwy 219 Bridge	10/15/2004	Stewart Rounds, USGS pers. comm.: all (origin Jackson Bottom Wetland Education Center)
14206295 (old id= 14206440)	Tualatin River at Rood Bridge Road near Hillsboro, Oregon (new siteid in 2002)	1/1/1994	previous Flow Report: 1994 CWS data warehouse: 1995–2007 (origin: OWRD Dist 18) OWRD database: 2008–present
14206435	Beaverton Creek at NE Guston Court near Orenco, Oregon	1/1/2002	previous Flow Reports: all
14206450 14206451	Rock Creek at Hwy 8 near Hillsboro, Oregon (site moved 120 ft downstream in 2002)	1/1/1995	CWS data warehouse: 1995–2007 previous Flow Reports: 2008–present
14206500	Tualatin River at Farmington, Oregon	1/1/1989	CWS data warehouse: 1989–2002 (origin: OWRD Dist 18) previous Flow Reports: 2003—WY2005 OWRD database: WY2006–present
14206900	Fanno Creek at 56th Avenue	10/1/1990	USGS database
14206950	Fanno Creek at Durham Road near Tigard, Oregon	1/1/1991	Stewart Rounds, USGS pers. comm.: 1991-WY1993, 2/4/1996-WY2000 USGS database: WY1994-2/5/1996, WY2001–present
14206956	Tualatin River at Tualatin, Oregon	10/22/1997	previous Flow Reports: 1997-2005 (no data for 2000) OWRD database: 2006–present
14207500	Tualatin River at West Linn	1/1/1975	USGS database: all (USGS has data back to 1928)

Abbreviations: BOR=Bureau of Reclamation; CWS=Clean Water Services; OWRD=Oregon Water Resources Division; TVID=Tuallatin Valley Irrigation District; USGS=United States Geological Survey; WY=water year

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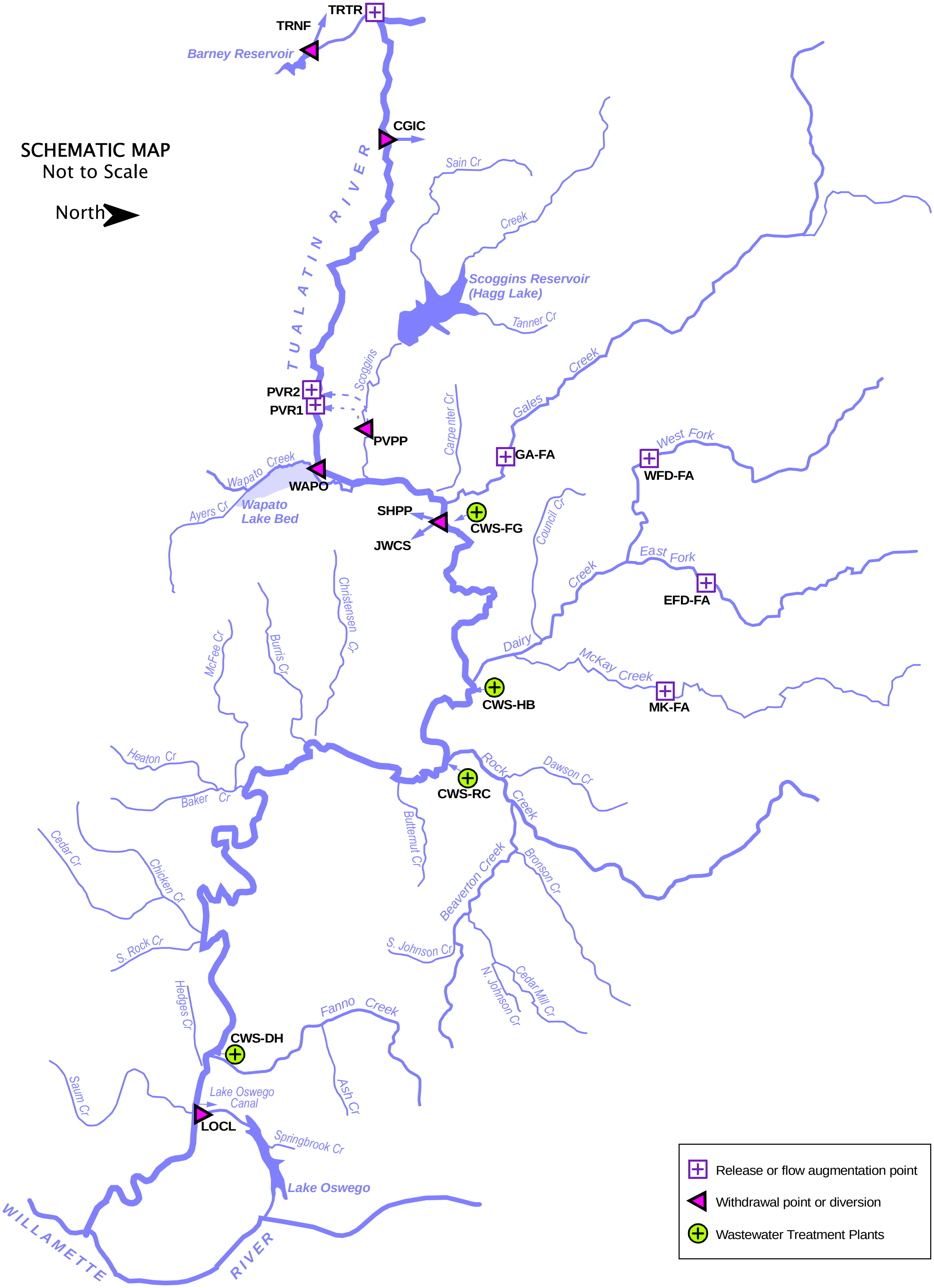
Appendix B

Selected Releases and Withdrawals

The following information is for selected water releases to and withdrawals from the Tualatin River and its tributaries. It is not a comprehensive listing of releases and withdrawals. Some of the data represent daily mean flows and some represent instantaneous measurements. All streamflow measurements are in Appendix A.

MAP OF SELECTED RELEASES AND WITHDRAWALS



SELECTED RELEASE AND WITHDRAWAL SITES — ALPHABETICAL LISTING BY SITE CODE

SITE CODE	SITE NAME	RIVER MILE	PAGE
CGIC	City of Hillsboro Withdrawal at Cherry Grove	73.3	B-8
CWS-DH	CWS Durham WWTF Release	9.33	B-20
CWS-FG	CWS Forest Grove WWTF Release	55.2	B-14
CWS-HB	CWS Hillsboro WWTF Release	43.8	B-16
CWS-RC	CWS Rock Creek WWTF Release	38.08	B-18
EFD-FA	CWS East Fork Dairy Flow Augmentation with TVID	4.9	B-22
GA-FA	CWS Gales Creek Flow Augmentation with TVID	5.0	B-22
JWCS	Joint Water Commission Withdrawal at Spring Hill Pump Plant	56.1	B-12
LOCL	Lake Oswego Corp. Canal Diversion	6.7	*
MK-FA	CWS McKay Creek Flow Augmentation with TVID	7.0	B-22
PVPP	TVID Withdrawal at Patton Valley Pump Plant	1.71	**
PVR1	TVID—Patton Valley River Turnout #1 Release	63.13	**
PVR2	TVID—Patton Valley River Turnout #2 Release	64.26	**
SHPP	TVID–Withdrawal at Spring Hill Pump Plant	56.1	B-10
TRNF	Barney Reservoir Measured Flow to North Fork Trask River	—	B-4
TRTR	Barney Reservoir Release to Tualatin River	78.0	B-6
WAPO	Wapato Canal Diversion	62.0	**
WFD-FA	CWS West Fork Dairy Flow Augmentation with TVID	5.2	B-22

*Monitoring of the Lake Oswego Canal Diversion was discontinued 8/23/2012.
**Withdrawals and releases at Patton Valley Pump Plant, Patton Valley River turnouts and Wapato Canal Diversion were not measured in 2017.

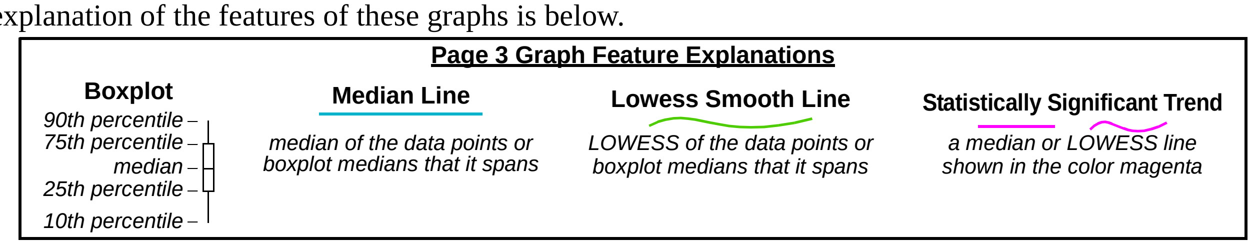
Explanation of Figures and Tables in this Appendix
two pages for each site

Page 1

A table of 2017 daily releases or withdrawals for each site is at the top of the page. A graph of the 2017 discharge compared to the previous year is shown below.

Page 2

- A discussion of the charts and graphs for each site is at the top of the page.
- A table of the monthly medians of daily releases or withdrawals by year for the period of record follows the discussion. The table is color-coded by the percentile of each entry. Two keys for the color code are at the right— the upper one is in temperature (ºC) and the lower one is as percentile.
- A the bottom of the page is a graph of boxplots of daily releases and withdrawals by year for the July-August period. July-August was chosen because it is typically a critical time for water management. An explanation of the features of these graphs is below.

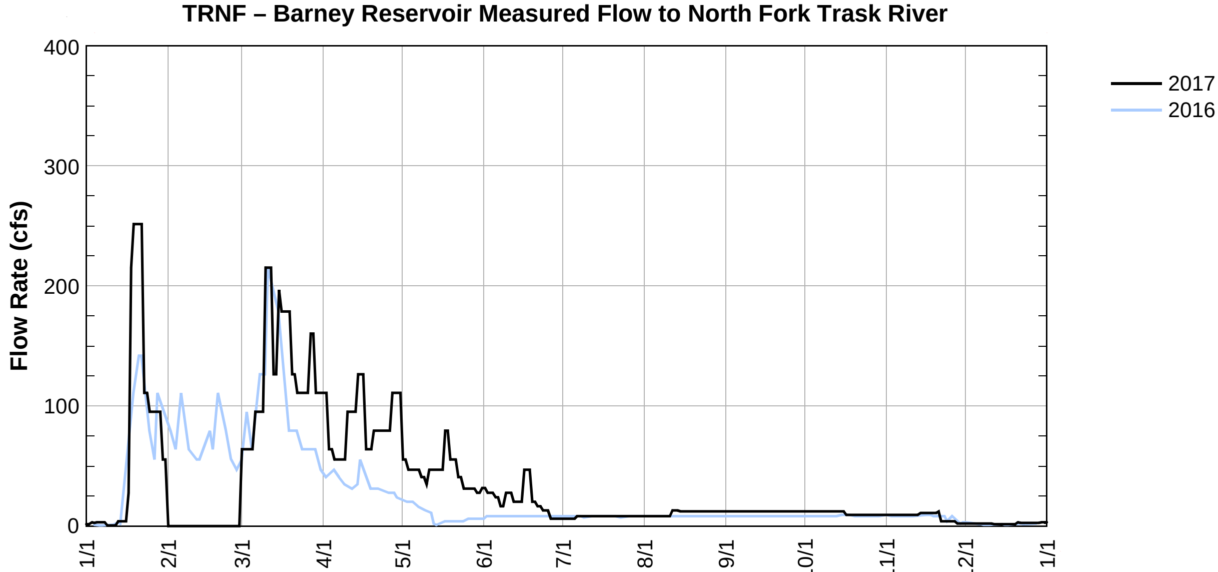


TRNF – BARNEY RESERVOIR MEASURED FLOW TO NORTH FORK TRASK RIVER

Data source: Barney Reservoir Joint Ownership Commission

Day	2017 — Instantaneous Measured Flow Rate in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1		0.0	64.0		55.5				12.25		9.6	2.3
2						27.6		8.4		12.2		
3	3.4	0	64	64	47		6.4				9.6	
4	2.8							8.4	12.25	12.25		2.3
5	3.4			55.5	47	23.9	6.4		12.25			
6		0	95.2				8.4		12.25	12.25	9.6	2.3
7				55.5		16.5	8.4	8.4				2.3
8		0	95.2		41				12.25		9.6	
9	0.5					27.6		8.4		12.25		
10		0	215.1	95.2	35		8.4				9.6	
11	0.5				47			13		12.25		1.7
12				95.2		20.2	8.4					
13	4	0	126.4						12.25	12.25	10.9	1.7
14				126.4		20.2	8.4	12.25	12.25			
15		0	196.9		47						10.9	1.7
16			178.6			47		12.25		9.6		
17	27.6	0		64	79.6		8.4				10.9	
18	215.1							12.25	12.25	9.6		1.7
19	251.7			64	55.5	20.2	8.4					
20			126.4	79.6					12.2	9.6	12.2	3.4
21		0				16.5	8.4	12.25			4	2.8
22		0	110.8		41				12.2			
23	110.8					13		12.25		9.6		
24		0	110.8	79.6	31.3		8.4					
25	95.2				31.3		8.4	12.25	12.2	9.6		
26				79.6		6.4						2.8
27	95.2	0	160.3	110.8					12.2	9.6	2.3	2.8
28						6.4	8.4	12.25				
29		—	110.8		27.6				12.2		2.3	3.4
30	55.5	—				6.4		12.25		9.6		
31		—	110.8	—	31.6	—	8.4		—		—	

TRNF – Barney Reservoir Measured Flow to North Fork Trask River



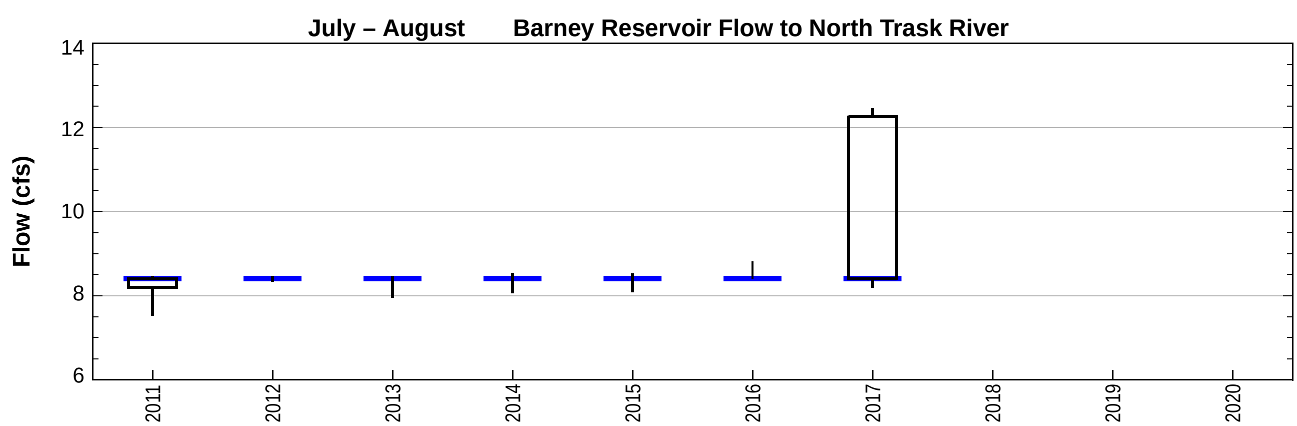
Discussion

- Winter releases from Barney Reservoir to the North Trask River and small. Large releases occurred in the early POT, but there is no significant trend for 2011–2017.
- Summer releases from Barney Reservoir to the North Trask River are generally constant (about 8.4 cfs) and do not show a trend for 2011—2017.
- The August release from Barney Reservoir to the North Trask River was larger than other years (12.4 cfs).

MEDIAN FLOW BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	47.0	38.0	79.6	55.5	35.0	16.5	8.4	8.4	9.5	9.5	7.3	6.2
2012	7.3	4.0	4.0	47.0	35.0	14.8	8.4	8.4	8.4	8.4	9.0	6.2
2013	47.0	47.0	41.0	35.0	8.4	8.4	8.4	8.4	8.4	8.4	8.4	0.5
2014	0.5	2.3	79.6	41.0	35.0	8.4	8.4	8.4	8.4	8.4	6.2	1.1
2015	1.1	51.3	35.0	27.6	7.3	8.4	8.4	8.4	8.4	8.4	6.2	2.8
2016	2.3	64.0	79.6	33.2	6.2	8.4	8.4	8.4	8.4	8.4	8.4	1.7
2017	4.0	0.0	110.8	79.6	47.0	20.2	8.4	12.3	12.3	9.6	9.6	2.3
median	4.0	38.0	79.6	41.0	35.0	8.4	8.4	8.4	8.4	8.4	8.4	2.3

Key
Q in cfs
Q ≤ 2.8
2.8 < Q ≤ 8.4
8.4 < Q ≤ 31
31 < Q ≤ 64
Q > 64
Q as percentile
Q ≤ 10th
10th < Q ≤ 25th
25th < Q ≤ 75th
75th < Q ≤ 90th
Q > 90th

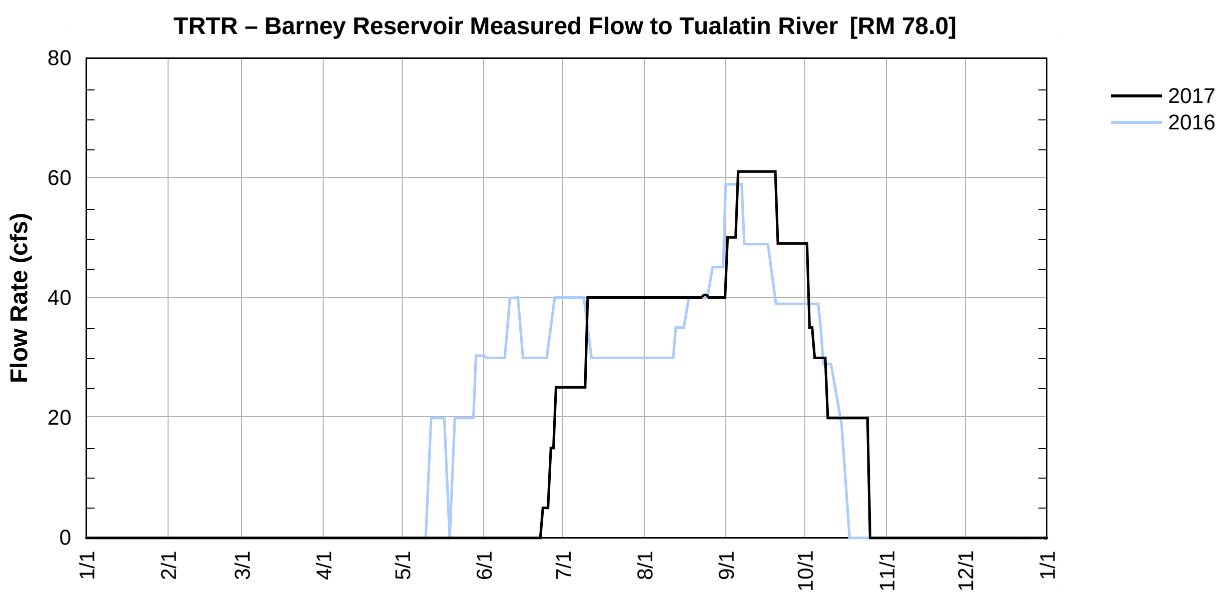


Note: Releases to the North Trask River in the July–August period are often constant. Because the data vary little, the quartile boxes and whiskers are sometimes small or zero. Blue lines are used to identify the median value.

TRTR — BARNEY RESERVOIR MEASURED FLOW TO TUALATIN RIVER [RM 78.0]

Data source: Barney Reservoir Joint Ownership Commission

Day	2017 — Instantaneous Measured Flow Rate in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1		0.0	0.0		0.0				50.1		0.0	0.0
2						0.0		40.1		35.1		
3	0.0	0.0	0.0	0.0	0.0		25.1				0.0	
4	0.0							40.1	50.1	30.0		0.0
5	0.0			0.0	0.0		25.1		61.1			
6		0.0	0.0				25.1		61.1	30.0	0.0	0.0
7				0.0		0.0	25.1	40.1				0.0
8		0.0	0.0		0.0				61.1		0.0	
9	0.0					0.0		40.1		20.0		
10		0.0	0.0	0.0	0.0		40.1				0.0	
11	0.0				0.0			40.1		20.0		0.0
12				0.0		0.0	40.1					
13	0.0	0.0	0.0						61.1	20.0	0.0	0.0
14				0.0		0.0	40.1	40.1	61.1			
15		0.0	0.0		0.0						0.0	0.0
16			0.0			0.0		40.1		20.0		
17	0.0	0.0		0.0	0.0		40.1				0.0	
18	0.0							40.1	61.1	20.0		0.0
19	0.0			0.0	0.0	0.0	40.1					
20			0.0	0.0					49.1	20.0	0.0	0.0
21		0.0				0.0	40.1	40.1			0.0	0.0
22		0.0	0.0		0.0				49.1			
23	0.0					5.0		40.5		20.0		
24		0.0	0.0	0.0	0.0		40.1					
25	0.0				0.0		40.1	40.1	49.1	0.0		
26				0.0		15.0						0.0
27	0.0	0.0	0.0	0.0					49.1	0.0	0.0	0.0
28						25.1	40.1	40.1				
29		—	0.0		0.0				49.1		0.0	0.0
30	0.0	—				25.1		40.1		0.0		0.0
31		—	0.0	—	0.0	—	40.1		—		—	



Discussion

- July–September are the most important months for water releases from Barney Reservoir to the Tualatin River.
- Because of a wet spring, releases in 2017 did not start until July. A July start occurs about 40% of the time.
- Water releases from Barney Reservoir to the Tualatin River for June–October have increased from 1991–2017. The trend increase statistically significant, but not monotonic.

MEDIAN FLOW BY MONTH AND YEAR

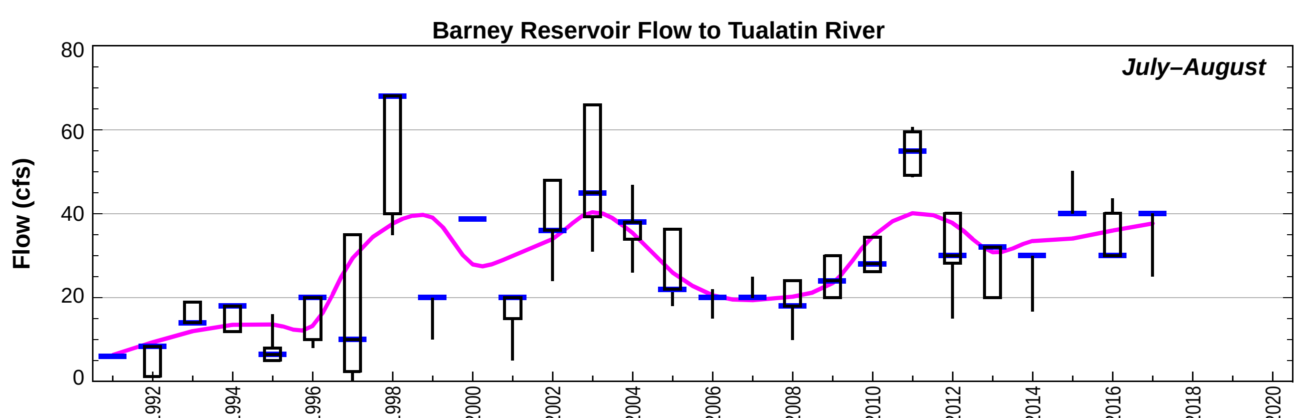
	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	0	0	0	0	0	6	6	6	6	6	0	0
1992	0	0	0	0	0	0	1	8	8	8	0	0
1993	0	0	0	0	0	6	14	19	19	3	2	2
1994	0	0	0	0	0	2	12	18	18	2	0	0
1995	0	0	0	0	2	16	8	5	5	5	5	0
1996	0	0	0	10	0	0	10	20	30	7	0	0
1997	0	0	0	0	0	0	3	10	5	0	0	0
1998	0	0	0	0	0	0	60	68	5	0	0	0
1999	0	0	0	0	0	10	20	20	30	35	0	0
2000	0	0	0	0	0	20	39	39	57	57	39	0
2001	0	0	0	0	0	5	20	20	15	19	0	0
2002	0	0	0	0	0	24	36	48	54	39	0	0
2003	0	0	0	0	0	26	40	66	44	12	0	0
2004	0	0	0	0	0	23	38	34	24	14	0	0
2005	0	0	0	0	0	0	22	36	50	31	0	0
2006	0	0	0	0	0	21	20	20	40	49	0	0
2007	0	0	0	0	0	12	20	20	39	19	0	0
2008	0	0	0	0	0	0	18	24	30	24	0	0
2009	0	0	0	0	0	0	20	24	34	20	0	0
2010	0	0	0	0	0	0	26	34	40	30	0	0
2011	0	0	0	20	50	49	49	60	49	10	0	0
2012	0	0	0	0	0	0	30	40	30	18	0	0
2013	0	0	0	0	15	20	20	32	38	14	0	0
2014	0	0	0	0	0	15	30	30	44	30	0	0
2015	0	0	0	0	25	30	40	40	50	30	0	0
2016	0	0	0	0	20	30	30	35	49	19	0	0
2017	0	0	0	0	0	0	40	40	56	20	0	0
median	0	0	0	0	0	6.0	20.0	30.0	34.0	19.0	0	0

Key

Q in cfs
- Q = 0
- 0 < Q ≤ 5
- 5 < Q ≤ 14
- 14 < Q ≤ 38
- 38 < Q ≤ 49
- Q > 49

Q as percentile
- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

days when water was not released were not used to calculate percentiles



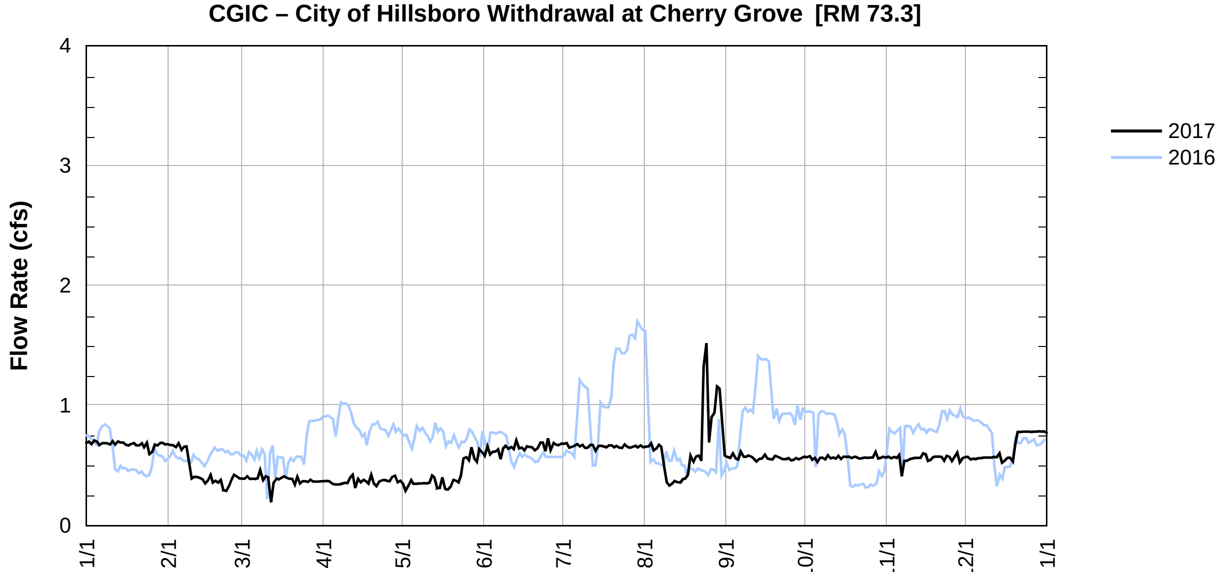
Blue lines are used to identify the median value because the quartile boxes and whiskers are sometimes small or zero.

CGIC — CITY OF HILLSBORO WITHDRAWAL AT CHERRY GROVE [RM 73.3]

Data source: Barney Reservoir Joint Ownership Commission

Day	2017 — Calculated Average Flow Rate in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.69	0.68	0.39	0.37	0.35	0.58	0.68	0.66	0.57	0.57	0.58	0.57
2	0.70	0.67	0.39	0.37	0.30	0.66	0.69	0.66	0.56	0.58	0.56	0.55
3	0.68	0.67	0.41	0.37	0.34	0.60	0.65	0.69	0.60	0.55	0.57	0.56
4	0.71	0.66	0.39	0.36	0.38	0.62	0.66	0.63	0.56	0.56	0.56	0.56
5	0.70	0.69	0.39	0.35	0.35	0.62	0.67	0.65	0.55	0.53	0.59	0.56
6	0.67	0.63	0.39	0.35	0.35	0.64	0.68	0.67	0.62	0.56	0.41	0.56
7	0.69	0.66	0.40	0.34	0.35	0.56	0.66	0.66	0.57	0.57	0.54	0.57
8	0.69	0.66	0.47	0.35	0.35	0.65	0.67	0.49	0.58	0.56	0.54	0.57
9	0.69	0.52	0.38	0.36	0.36	0.67	0.65	0.37	0.59	0.59	0.56	0.57
10	0.68	0.40	0.41	0.36	0.35	0.64	0.65	0.34	0.58	0.56	0.56	0.57
11	0.71	0.41	0.41	0.40	0.36	0.66	0.67	0.35	0.56	0.57	0.56	0.57
12	0.68	0.41	0.20	0.43	0.42	0.64	0.67	0.37	0.54	0.56	0.57	0.57
13	0.71	0.40	0.36	0.32	0.40	0.71	0.63	0.37	0.56	0.58	0.57	0.61
14	0.69	0.39	0.39	0.39	0.31	0.65	0.67	0.36	0.56	0.56	0.60	0.53
15	0.70	0.35	0.39	0.37	0.32	0.65	0.67	0.39	0.59	0.58	0.60	0.54
16	0.68	0.38	0.40	0.38	0.40	0.63	0.66	0.40	0.56	0.57	0.54	0.57
17	0.67	0.43	0.41	0.37	0.30	0.66	0.65	0.43	0.56	0.58	0.55	0.57
18	0.68	0.36	0.40	0.35	0.30	0.66	0.67	0.58	0.55	0.57	0.57	0.54
19	0.69	0.38	0.39	0.42	0.32	0.65	0.67	0.53	0.59	0.58	0.58	0.69
20	0.67	0.36	0.39	0.35	0.38	0.63	0.65	0.58	0.58	0.57	0.58	0.78
21	0.67	0.38	0.34	0.33	0.38	0.65	0.67	0.59	0.57	0.56	0.57	0.78
22	0.69	0.30	0.41	0.37	0.36	0.70	0.65	0.54	0.56	0.56	0.54	0.78
23	0.66	0.29	0.35	0.38	0.42	0.70	0.65	1.33	0.56	0.57	0.58	0.78
24	0.69	0.33	0.37	0.38	0.56	0.62	0.68	1.52	0.56	0.56	0.58	0.79
25	0.60	0.38	0.37	0.37	0.57	0.73	0.66	0.70	0.55	0.57	0.54	0.78
26	0.62	0.43	0.37	0.37	0.55	0.63	0.65	0.91	0.55	0.57	0.58	0.78
27	0.68	0.41	0.39	0.41	0.65	0.69	0.66	0.94	0.56	0.62	0.61	0.78
28	0.67	0.40	0.37	0.42	0.56	0.67	0.67	1.16	0.56	0.56	0.53	0.79
29	0.69	—	0.37	0.37	0.53	0.67	0.66	1.14	0.57	0.56	0.56	0.78
30	0.69	—	0.37	0.38	0.64	0.69	0.67	0.83	0.58	0.58	0.57	0.79
31	0.68	—	0.37	—	0.61	—	0.66	0.59	—	0.57	—	0.78

CGIC – City of Hillsboro Withdrawal at Cherry Grove [RM 73.3]



Discussion

- For 2011–2013 and 2015, withdrawal rates were greater in the summer than the rest of the year.
- For 2016-2017, the withdrawal rate was relatively constant throughout the year. This represents a decrease in withdrawal rates in the summer.

MEDIAN FLOW BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011	0.91	1.14	1.17	1.28	1.35	1.59	1.42	1.74	1.47	1.35	1.24	1.34
2012	1.00	1.30	1.26	1.34	1.33	1.37	1.60	1.47	1.27	0.98	0.86	0.97
2013	1.12	1.15	1.10	1.12	1.48	1.45	1.45	1.73	1.09	1.00	1.11	0.93
2014	0.84	0.80	0.32	0.49	0.00	0.37	1.22	0.89	0.82	0.74	0.32	0.88
2015	0.99	1.11	1.29	0.88	1.34	1.21	1.49	1.34	1.26	0.82	0.55	0.54
2016	0.54	0.59	0.58	0.83	0.74	0.57	1.14	0.50	0.94	0.60	0.82	0.72
2017	0.69	0.40	0.39	0.37	0.36	0.65	0.66	0.59	0.56	0.57	0.57	0.57
median	0.91	1.11	1.10	0.88	1.33	1.21	1.42	1.34	1.09	0.82	0.82	0.88

Key

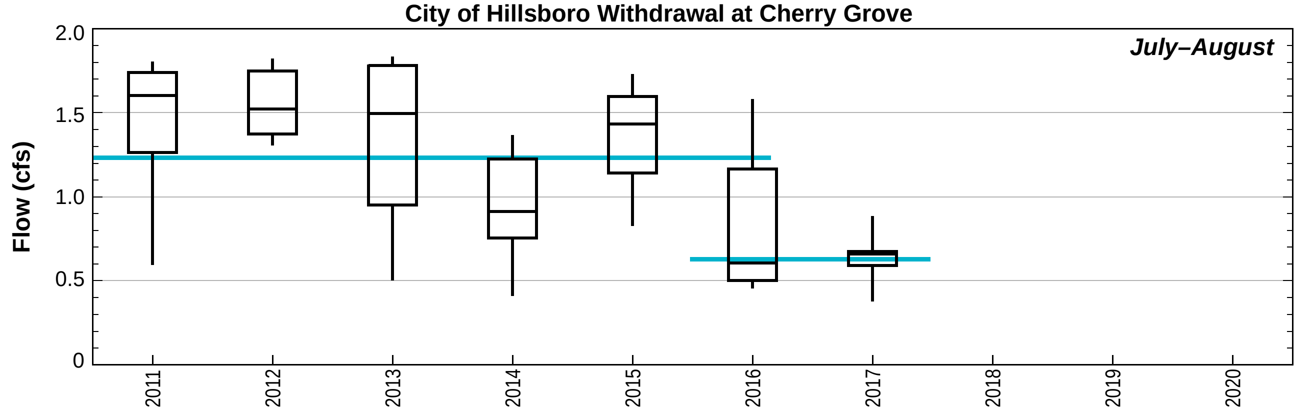
Q in cfs

- Q ≤ 0.4
- 0.4 < Q ≤ 0.6
- 0.4 < Q ≤ 1.3
- 1.3 < Q ≤ 1.5
- Q > 1.5

Q as percentile

- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

City of Hillsboro Withdrawal at Cherry Grove

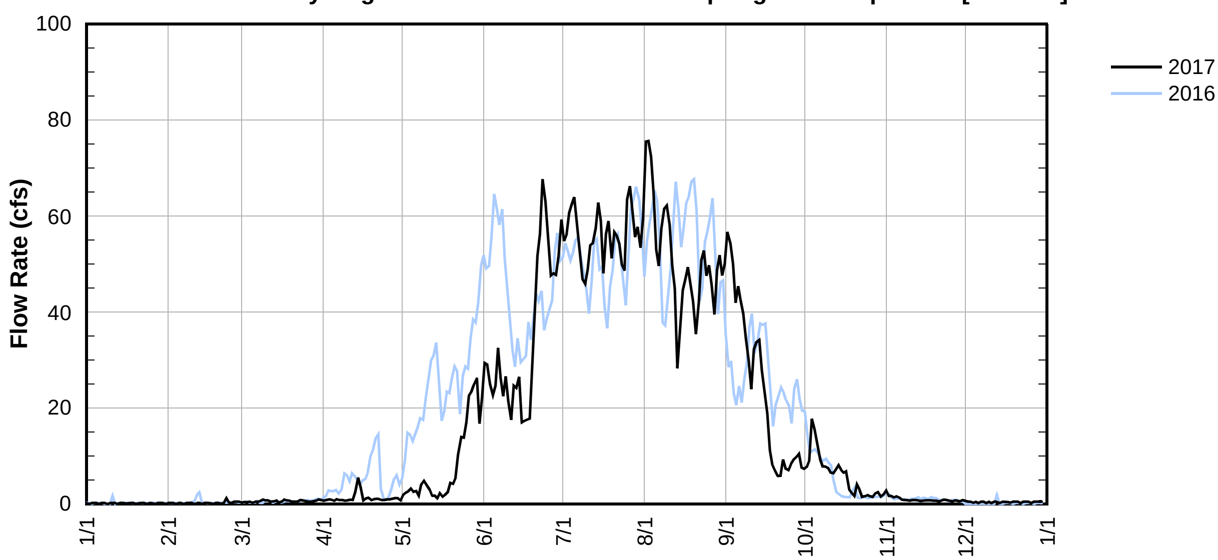


SHPP – TVID WITHDRAWAL AT SPRING HILL PUMP PLANT [RM 56.1]

Data source: US Geological Survey, Oregon Water Science Center

Day	2017 — Mean Daily Water Withdrawal in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.22	0.22	0.24	0.65	1.9	29.4	54.8	75.5	56.7	7.7	1.7	0.43
2	0.00	0.22	0.38	0.76	2.3	29.1	56.2	75.6	54.2	9.1	1.6	0.43
3	0.22	0.19	0.32	0.93	2.7	24.9	60.6	72.3	50.0	17.7	1.4	0.27
4	0.22	0.03	0.47	0.87	3.2	22.7	62.4	64.5	41.9	15.4	1.6	0.44
5	0.22	0.22	0.24	0.65	2.5	24.6	63.9	53.0	45.4	12.4	1.3	0.23
6	0.00	0.22	0.47	1.0	2.7	32.5	59.0	49.6	42.3	9.4	0.90	0.45
7	0.22	0.00	0.47	0.74	1.7	26.3	52.2	57.3	39.6	7.8	0.76	0.45
8	0.22	0.22	0.62	0.84	4.1	22.4	46.7	61.5	34.5	7.8	0.81	0.23
9	0.00	0.22	0.97	0.65	4.8	26.6	45.8	62.2	29.8	7.5	0.65	0.45
10	0.22	0.22	0.71	0.71	3.9	21.4	48.9	58.1	23.9	6.6	0.81	0.23
11	0.22	0.00	0.71	0.90	3.0	17.5	53.9	49.7	32.2	6.4	0.76	0.45
12	0.22	0.22	0.47	0.84	1.6	24.6	54.3	44.9	33.7	7.2	0.68	0.45
13	0.00	0.22	0.53	2.5	1.8	24.1	57.4	28.3	34.2	8.0	0.57	0.23
14	0.22	0.00	0.68	5.5	1.2	26.5	62.8	36.0	27.8	7.1	0.65	0.45
15	0.22	0.22	0.24	3.4	2.3	17.0	59.0	44.5	23.3	6.5	0.71	0.40
16	0.08	0.22	0.46	0.71	1.5	17.3	48.1	46.8	18.9	6.8	0.71	0.42
17	0.14	0.16	0.92	1.1	2.0	17.6	56.2	49.3	11.2	3.0	0.71	0.25
18	0.22	0.00	0.68	1.3	2.4	17.8	58.9	45.7	8.1	2.3	0.65	0.45
19	0.22	0.22	0.62	0.81	4.4	30.8	51.2	42.2	6.9	1.6	0.65	0.45
20	0.00	0.22	0.47	1.0	4.2	41.9	56.6	35.4	5.8	4.0	0.49	0.45
21	0.16	0.00	0.47	1.1	5.5	51.6	55.8	42.0	5.8	3.0	0.71	0.23
22	0.22	0.22	0.47	1.0	10.3	56.3	54.1	50.8	9.3	1.4	0.87	0.45
23	0.22	1.2	0.77	0.79	13.9	67.6	49.7	52.8	7.4	1.6	0.76	0.45
24	0.00	0.27	0.68	0.81	13.8	63.0	48.6	47.5	7.0	1.9	0.65	0.45
25	0.22	0.22	0.56	0.98	17.0	56.7	63.4	49.7	8.4	1.6	0.49	0.23
26	0.16	0.43	0.46	0.98	22.6	47.6	66.2	45.7	9.3	1.5	0.71	0.45
27	0.00	0.48	0.47	1.1	23.5	48.1	60.5	39.5	9.8	2.2	0.65	0.45
28	0.22	0.47	0.53	1.2	25.0	47.7	55.6	48.7	10.5	2.5	0.49	0.45
29	0.22	—	0.62	1.2	26.3	51.6	57.7	51.9	7.6	1.5	0.76	0.45
30	0.22	—	0.98	0.71	16.7	59.2	53.4	47.6	7.3	2.0	0.65	0.25
31	0.00	—	0.76	—	22.2	—	59.7	50.0	—	2.8	—	0.25

SHPP – Tualatin Valley Irrigation District Withdrawal at Spring Hill Pump Plant [RM 56.1]



Discussion

- TVID withdraws water at SHPP for irrigation. Peak season is July–August.
- The 2017 season was similar to others.
- Withdrawal rates in July–August have remained relatively steady from 1991–2017. The incidence of higher withdrawal rates in the spring and fall has increased slightly.

MEDIAN FLOW BY MONTH AND YEAR

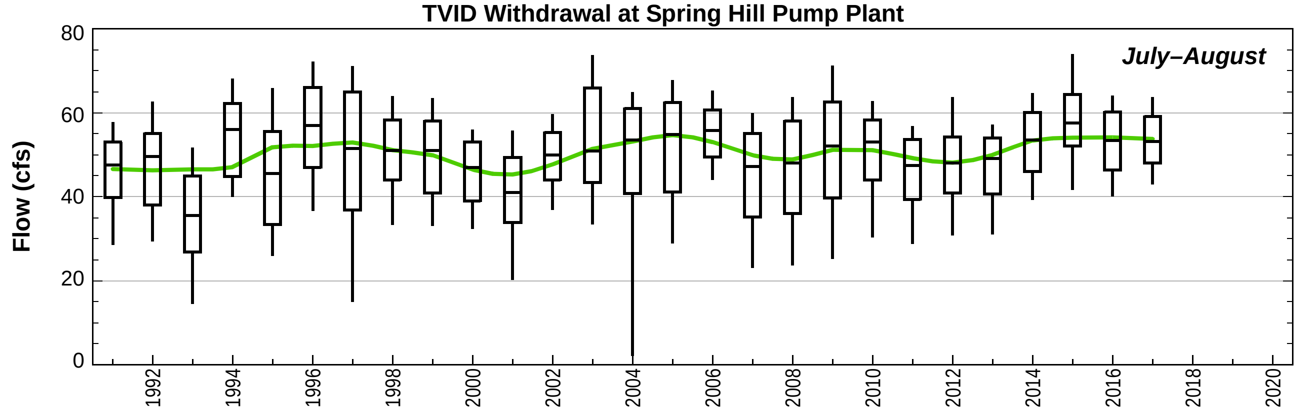
	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	0.0	0.0	0.0	0.0	1.1	10.5	49.0	45.0	25.5	12.0	0.1	0.0
1992	0.0	0.0	0.0	0.0	18.0	40.0	50.0	49.0	18.0	4.8	0.0	0.0
1993	0.0	0.0	0.0	0.6	1.8	4.4	28.0	43.0	28.5	8.8	0.8	0.0
1994	0.0	0.0	0.0	0.0	13.0	21.5	58.0	50.0	24.0	6.8	0.2	0.0
1995	0.0	0.0	0.0	0.0	6.0	13.2	44.5	46.2	20.1	3.1	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	25.2	62.0	54.0	9.1	2.1	0.0	0.0
1997	0.0	0.0	0.0	1.8	10.0	11.5	51.0	56.0	11.5	3.0	0.3	0.0
1998	0.0	0.0	0.0	1.5	1.9	14.5	49.0	52.0	28.5	4.2	0.6	0.3
1999	0.0	0.0	0.1	2.1	6.6	27.5	56.0	47.0	35.0	10.0	0.4	0.3
2000	0.3	0.3	0.3	4.8	5.9	20.5	49.0	45.0	21.5	0.0	0.0	0.0
2001	0.0	0.0	0.0	0.0	9.6	29.5	42.0	36.0	24.5	3.5	0.8	0.0
2002	0.0	0.0	0.0	0.0	15.0	37.0	50.0	51.0	30.0	8.6	1.7	0.3
2003	0.5	0.0	0.0	0.9	3.3	52.3	64.4	45.3	24.7	3.3	0.0	0.0
2004	0.0	0.0	0.0	0.0	13.2	41.8	57.9	46.3	4.1	3.1	1.1	0.2
2005	0.3	0.3	1.8	1.3	1.7	15.2	43.7	59.3	30.7	5.1	0.8	0.3
2006	0.2	0.3	0.6	1.6	17.7	24.3	56.7	55.7	29.9	10.7	1.0	0.3
2007	0.3	0.3	0.5	2.3	18.8	45.7	51.3	42.7	29.7	3.4	2.2	0.3
2008	0.3	0.4	0.9	1.9	17.0	32.0	54.0	39.0	32.5	5.1	2.7	0.3
2009	0.3	0.3	0.9	2.9	3.9	39.1	62.0	43.5	23.3	3.7	1.7	1.0
2010	1.0	1.1	1.4	2.5	3.4	3.1	53.0	56.0	20.5	3.6	1.3	0.3
2011	0.3	0.3	0.7	1.2	2.8	17.1	40.6	51.1	27.2	4.7	2.8	0.4
2012	0.4	0.4	0.5	1.6	6.2	16.5	42.0	53.0	37.5	6.0	1.4	0.4
2013							54.0	48.0	19.5	0.0	0.0	0.0
2014	0.0	0.2	0.4	1.5	11.0	39.0	53.0	54.0	38.0	5.1	0.7	0.2
2015	0.2	0.2	0.8	2.1	36.0	59.5	63.0	52.0	25.0	12.0	1.0	0.2
2016	0.2	0.2	0.5	4.8	25.6	43.1	51.5	56.8	24.1	2.0	1.0	0.0
2017	0.2	0.2	0.5	0.9	3.9	27.9	56.2	49.6	21.1	6.4	0.7	0.5
median	0.1	0.1	0.2	1.4	6.4	26.3	51.5	49.6	24.7	4.7	0.8	0.2

Key

Q in cfs
- Q = 0
- 0 < Q ≤ 0.3
- 0.3 < Q ≤ 1.0
- 1.0 < Q ≤ 36
- 36 < Q ≤ 49
- Q > 49

Q as percentile
- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

TVID Withdrawal at Spring Hill Pump Plant

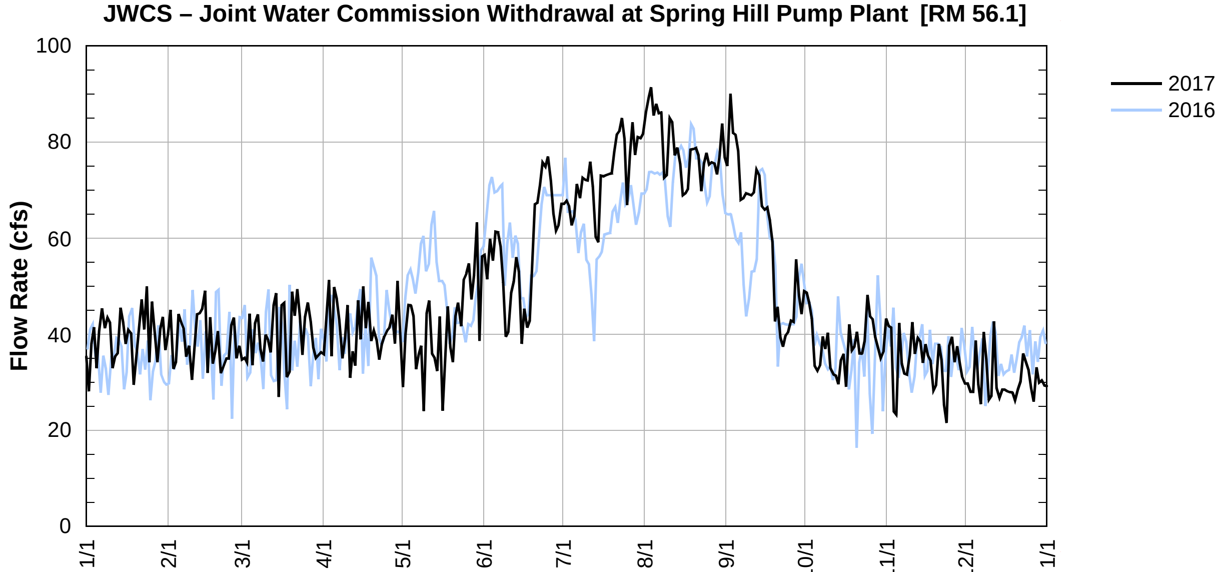


JWCS – JOINT WATER COMMISSION WITHDRAWAL AT SPRING HILL PUMP PLANT [RM 56.1]

Data source: Joint Water Commission

Day	2017 — Calculated Average Flow Rate in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	35.3	40.0	34.7	35.9	28.9	56.5	67.1	86.2	75.0	48.6	41.7	29.7
2	28.1	45.0	35.1	42.6	40.0	51.4	67.7	89.0	90.0	46.4	41.4	28.0
3	38.1	32.8	34.1	51.2	46.1	59.9	66.6	91.4	81.8	43.2	23.9	28.0
4	41.5	34.3	44.3	35.4	45.9	55.3	62.7	85.5	81.5	33.3	23.2	38.6
5	33.0	44.2	33.5	49.8	43.7	61.3	64.6	87.9	78.1	32.4	42.3	29.6
6	40.7	42.4	42.3	47.4	32.7	61.2	71.2	86.0	68.0	33.7	33.9	25.5
7	45.4	41.1	44.1	43.0	35.7	58.2	68.3	86.1	68.3	39.6	31.8	40.5
8	41.2	35.3	36.9	35.0	37.6	50.8	72.6	72.6	69.3	36.9	31.6	34.8
9	43.4	37.6	34.3	39.1	24.0	39.4	72.1	73.1	69.1	40.3	35.6	26.4
10	42.3	30.5	39.9	46.0	44.3	40.5	72.0	85.0	68.9	32.8	42.5	27.2
11	33.0	36.8	38.7	30.9	46.9	48.6	75.9	84.1	69.5	31.6	35.9	42.7
12	35.4	44.2	36.2	36.5	35.9	50.9	70.8	77.3	74.2	31.4	39.2	28.8
13	36.1	44.4	45.9	33.5	35.0	56.1	60.2	78.8	73.0	29.6	38.5	26.8
14	45.5	45.4	48.5	47.1	32.3	53.1	59.1	75.5	66.6	34.8	34.1	28.5
15	42.5	49.1	26.9	38.9	43.7	38.0	73.0	68.9	65.9	35.9	37.9	28.5
16	38.0	31.9	46.0	49.9	24.1	45.4	72.9	69.3	66.4	29.1	35.5	28.1
17	40.9	43.5	46.5	41.3	34.7	41.4	73.1	70.2	63.7	42.0	34.4	27.9
18	40.2	33.9	31.1	46.7	45.8	42.9	73.3	78.4	59.2	36.7	28.3	27.9
19	29.4	36.5	32.3	38.6	37.3	55.5	73.4	78.5	42.7	37.4	29.5	26.2
20	34.5	40.6	48.8	40.7	34.2	67.1	78.0	78.8	45.7	40.6	38.0	28.6
21	40.8	31.9	43.9	38.8	43.8	67.4	81.6	77.3	39.2	36.0	34.8	30.2
22	47.2	33.5	49.4	34.7	46.6	71.0	82.3	69.8	37.4	35.9	25.3	36.0
23	41.0	34.9	43.8	37.9	41.6	75.7	85.0	75.4	39.8	38.6	21.6	34.4
24	50.0	34.9	35.7	39.6	51.4	74.8	80.6	77.7	40.5	48.2	37.5	32.5
25	34.1	41.8	43.5	40.8	52.6	77.0	66.9	75.4	42.9	43.7	39.4	28.8
26	46.8	43.5	46.6	41.4	54.7	71.9	77.5	75.8	42.6	43.1	34.2	26.0
27	39.6	35.0	42.6	44.0	47.3	65.1	84.1	75.5	55.6	39.3	37.5	33.1
28	34.2	37.5	37.2	38.1	52.3	61.6	77.3	73.3	48.1	37.4	34.0	29.9
29	41.0	—	35.0	51.1	63.2	62.8	81.0	77.2	44.2	35.1	31.0	30.4
30	43.6	—	35.6	39.6	38.6	67.2	80.8	83.9	49.0	36.5	29.7	29.4
31	36.8	—	36.3	—	56.2	—	81.7	76.8	—	43.3	—	29.2

JWCS – Joint Water Commission Withdrawal at Spring Hill Pump Plant [RM 56.1]



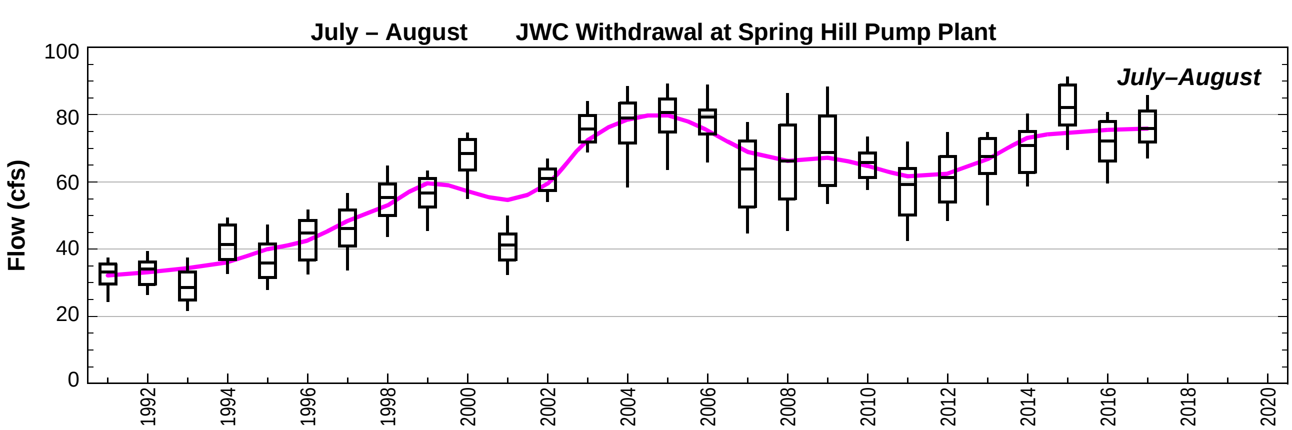
Discussion

- JWC withdraws water at SHPP for municipal use. Peak season is July–August.
- The 2017 season was similar to recent years.
- Withdrawal rates in July–August steadily increased from 1991–early-2000s. The trend is statistically significant. Withdrawal rates also increased for other months. No trend is evident from 2004–present.

MEDIAN DAILY WITHDRAWAL BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	19	19	19	19	17	21	33	34	29	23	20	16
1992	18	18	18	20	28	37	33	35	28	22	18	16
1993	17	16	17	16	20	25	25	33	32	19	17	18
1994	18	16	16	16	24	28	43	41	33	24	16	21
1995	21	21	22	21	24	30	38	35	33	24	24	23
1996	23	30	28	28	26	34	46	43	27	23	25	25
1997	24	23	28	26	43	39	48	45	33	26	25	27
1998	28	29	29	30	32	42	57	55	53	34	32	33
1999	33	30	31	30	38	46	56	58	54	41	35	42
2000	35	33	33	36	42	59	68	69	53	44	42	43
2001	43	43	45	39	37	33	38	43	39	29	35	37
2002	38	39	42	43	44	53	60	63	55	48	44	46
2003	47	48	48	50	53	66	79	73	58	50	47	49
2004	52	38	52	57	62	68	80	79	58	53	48	46
2005	48	49	54	54	50	59	75	84	78	49	47	46
2006	50	51	49	54	57	61	79	79	70	52	49	41
2007	45	44	44	42	51	57	63	65	65	39	44	47
2008	48	47	44	38	44	47	68	63	60	42	36	42
2009	44	44	42	40	43	56	73	66	54	39	32	38
2010	41	43	39	34	34	36	64	67	43	39	32	33
2011	35	38	35	35	32	41	50	62	61	36	31	31
2012	32	33	36	37	42	42	57	67	66	39	33	35
2013	38	37	33	30	46	44	63	72	46	44	43	34
2014	38	39	40	38	45	55	67	73	66	46	40	47
2015	47	39	37	45	54	72	86	78	56	42	39	36
2016	39	41	40	45	54	68	67	77	57	39	40	38
2017	41	38	39	40	44	57	73	77	66	37	35	29
median	38	38	37	37	43	46	63	65	54	39	35	36

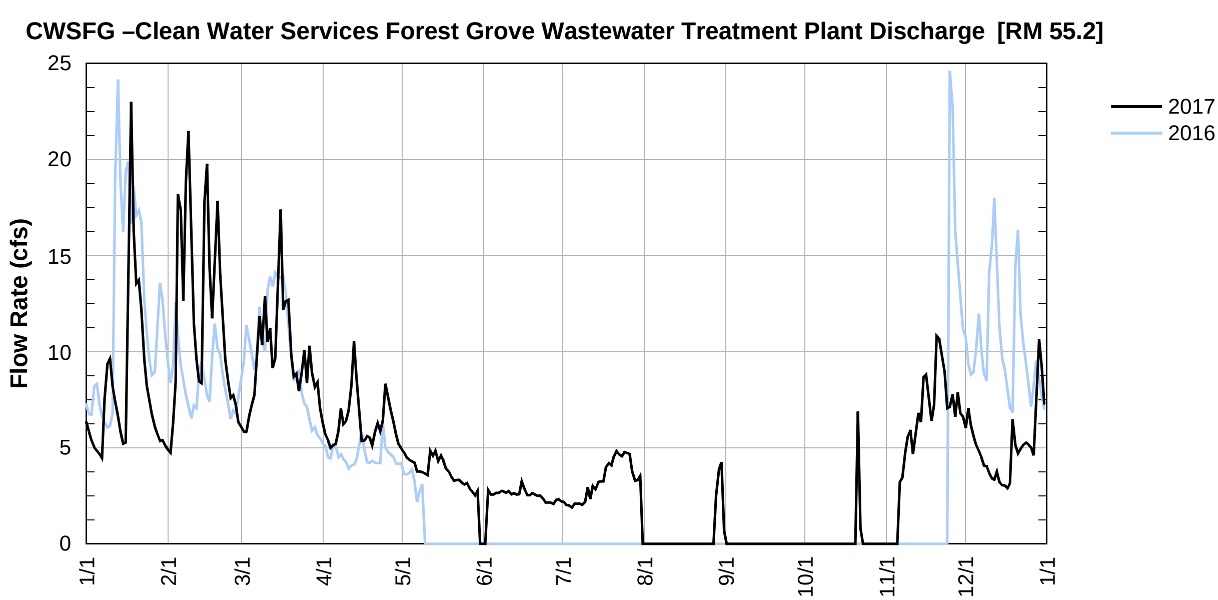
Key
Q in cfs
Q ≤ 22
22 < Q ≤ 30
30 < Q ≤ 51
51 < Q ≤ 66
Q > 66
Q as percentile
Q ≤ 10th
10th < Q ≤ 25th
25th < Q ≤ 75th
75th < Q ≤ 90th
Q > 90th



CWSFG – CLEAN WATER SERVICES FOREST GROVE WASTEWATER TREATMENT FACILITY DISCHARGE [RM 55.2]

Data source: Clean Water Services

Day	2017 — Mean Daily Water Discharge in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	7.6	5.9	7.0	6.9	5.7	0	2.6	0	0	0	0	7.2
2	7.0	5.7	7.0	6.5	5.4	3.3	2.4	0	0	0	0	8.5
3	6.5	7.5	7.9	6.0	5.2	3.1	2.4	0	0	0	0	7.4
4	6.0	10.1	8.6	6.2	5.2	3.1	2.3	0	0	0	0	6.7
5	5.8	21.8	9.3	6.3	5.1	3.2	2.5	0	0	0	0	6.2
6	5.6	20.8	12.0	7.0	4.5	3.2	2.5	0	0	0	3.9	5.8
7	5.3	15.1	14.2	8.5	4.5	3.3	2.5	0	0	0	4.1	5.4
8	9.1	22.6	12.4	7.5	4.5	3.3	2.4	0	0	0	5.7	4.9
9	11.2	25.8	15.5	7.7	4.4	3.2	2.6	0	0	0	6.7	4.8
10	11.6	18.9	12.6	8.3	4.3	3.3	3.5	0	0	0	7.1	4.4
11	9.8	13.7	13.5	9.9	5.8	3.1	2.8	0	0	0	5.6	4.1
12	8.9	11.6	11.0	12.7	5.5	3.2	3.6	0	0	0	7.0	4.0
13	8.0	10.1	11.6	10.3	5.8	3.1	3.4	0	0	0	8.2	4.5
14	7.0	10.0	15.7	8.6	5.2	3.1	3.9	0	0	0	7.6	3.9
15	6.3	21.3	20.9	6.4	5.5	3.9	3.9	0	0	0	10.4	3.7
16	6.3	23.7	14.6	6.5	5.2	3.4	3.9	0	0	0	10.6	3.6
17	14.5	17.2	15.2	6.7	4.7	3.0	4.8	0	0	0	9.1	3.5
18	27.6	14.1	15.3	6.6	4.5	3.0	5.0	0	0	0	7.7	3.8
19	19.5	17.7	11.9	6.2	4.2	3.2	4.9	0	0	0	8.7	7.8
20	16.3	21.4	10.4	7.0	3.9	3.1	5.5	0	0	0	13.0	6.2
21	16.5	16.9	10.6	7.5	4.0	3.0	5.8	0	0	0	12.8	5.7
22	14.6	13.9	9.5	7.0	4.0	3.0	5.6	0	0	0	11.7	5.9
23	11.5	11.5	10.8	7.7	3.8	2.8	5.5	0	0	0	10.7	6.2
24	9.8	10.1	12.1	10.0	3.7	2.6	5.7	0	0	0	8.5	6.3
25	8.9	9.1	10.1	9.1	3.8	2.6	5.7	0	0	0	8.6	6.2
26	8.1	9.3	12.4	8.3	3.5	2.6	5.6	0	0	0	9.3	6.0
27	7.3	8.6	10.6	7.6	3.3	2.5	4.5	0	0	0	7.9	5.5
28	6.8	7.6	9.8	6.9	3.0	2.7	3.9	3.0	0	0	9.5	9.6
29	6.4	—	10.1	6.2	3.3	2.8	4.0	4.6	0	0	8.2	12.8
30	6.5	—	8.5	5.9	0	2.6	4.3	5.1	0	0	8.0	11.1
31	6.1	—	7.6	—	0	—	0.0	0.8	—	0	—	8.8



Discussion

- Discharges from the Forest Grove WWTF during the summer were discontinued after 1994. Since 1995, effluent has been pumped to the Rock Creek WWTF during the summer.
- In 2017, discharges from the Forest Grove WWTF continued through July, which is later than usual. Discharges in 2017 resumed in November which is typical. In the future the Forest Grove WWTP will be discharging to the Forest Grove Natural Treatment System at Fern Hill Wetlands.
- No trends during 1991–2017 were evident.

MEDIAN DAILY DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	7.8	9.8	8.8	8.2	6.3	5.0	4.1	3.0	3.1	2.6	4.8	6.4
1992	7.1	7.7	5.4	5.7	3.9	2.9	2.6	2.4	2.5	2.9	4.3	7.8
1993	7.8	6.2	7.7	7.7	5.7	4.2	2.9	2.7	2.6	2.7	2.8	4.8
1994	6.4	5.8	5.2	3.1	2.2	1.2	1.1	1.0	1.0	1.4	2.8	5.6
1995	4.7	5.3	5.7	5.4	3.9	0	0	0	0	0	5.0	9.1
1996	8.5	9.8	4.9	5.4	5.0	0	0	0	0	0	2.9	10
1997	9.0	4.5	8.3	3.4	0	0	0	0	0	0	0	5.4
1998	10.7	8.9	6.6	1.9	0	2.0	0	0	0	0	0	10.5
1999	8.4	16.4	9.7	3.7	0	0	0	0	0	0	5.2	7.8
2000	9.5	6.9	6.1	0	0	0	0	0	0	0	0	4.0
2001	3.6	3.8	2.8	2.7	0	0	0	0	0	0	0	8.7
2002	7.3	5.5	4.6	0	0	0	0	0	0	0	0	0
2003	7.8	6.8	8.2	0	0	0	0	0	0	0	0	6.0
2004	7.3	7.7	5.0	0	0	0	0	0	0	0	0	0
2005	4.7	3.4	3.3	5.8	0	0	0	0	0	0	0	8.3
2006	12.8	6.0	6.4	5.6	0	0	0	0	0	0	8.1	10.9
2007	6.6	6.9	6.3	4.9	0	0	0	0	0	0	0	8.4
2008	8.8	5.1	5.6	4.6	3.2	0	0	0	0	0	3.5	4.2
2009	5.7	3.9	5.6	0	0	0	0	0	0	0	5.4	4.7
2010	9.2	7.1	5.9	5.3	0	0	0	0	0	0	0	11.1
2011	7.5	6.5	10.1	11.3	9.7	6.1	0	0	0	0	1.3	3.7
2012	8.3	6.4	10.2	6.3	5.6	0	0	0	0	0	5.8	12.3
2013	4.6	4.3	5.0	4.2	0	0	0	0	0	0	3.5	3.4
2014	4.2	8.1	8.3	6.1	4.0	0	0	0	0	0	4.1	8.8
2015	5.6	7.1	6.1	4.4	0	0	0	0	0	0	3.5	15.4
2016	11.0	8.5	10	4.4	0	0	0	0	0	0	0	9.3
2017	8.0	13.8	11.0	7.0	4.5	3.1	3.9	0	0	0	8.0	5.9
median	7.8	6.8	6.1	4.6	0	0	0	0	0	0	2.8	7.8

Key

Q in cfs
- $Q = 0$
- $0 < Q \le 2.7$
- $2.7 < Q \le 3.9$
- $3.9 < Q \le 8.2$
- $8.2 < Q \le 11.3$
- $Q > 11.3$

Q as percentile
- $Q \le$ 10th
- 10th $< Q \le$ 25th
- 25th $< Q \le$ 75th
- 75th $< Q \le$ 90th
- $Q >$ 90th

days when effluent was not discharged were not used to calculate percentiles

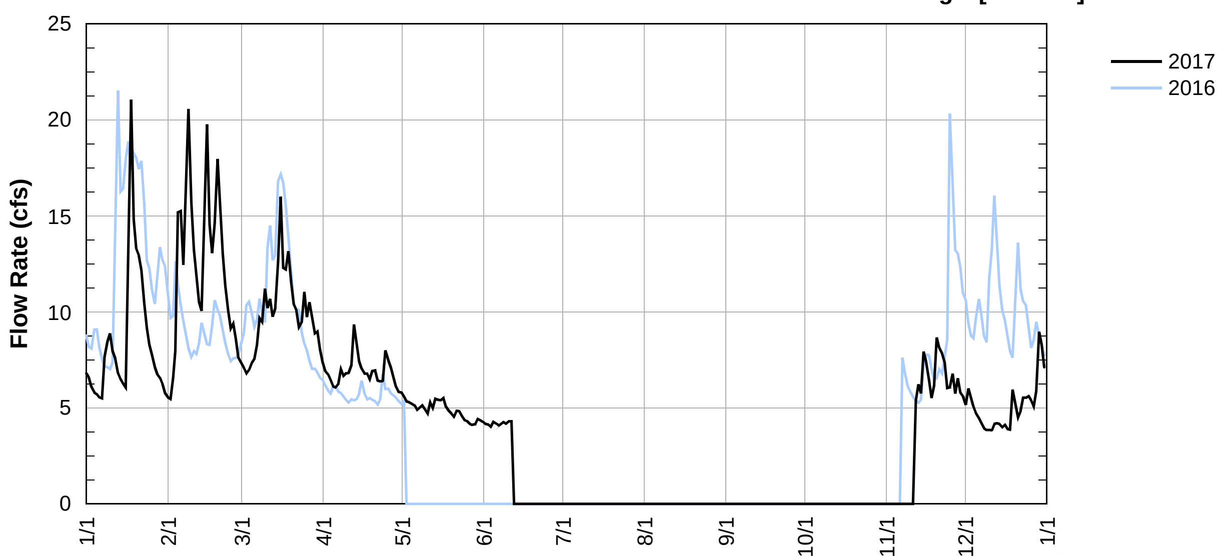
no releases during the July-August period for this site

CWSHB – CLEAN WATER SERVICES HILLSBORO WASTEWATER TREATMENT FACILITY DISCHARGE [RM 43.8]

Data source: Clean Water Services

Day	2017 — Mean Daily Water Discharge in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	8.2	6.7	8.5	8.3	6.7	5.0	0	0	0	0	0	6.2
2	7.9	6.6	8.2	8.1	6.4	5.0	0	0	0	0	0	7.2
3	7.3	7.8	8.4	7.7	6.4	4.8	0	0	0	0	0	6.6
4	6.9	9.6	8.8	7.3	6.3	5.1	0	0	0	0	0	6.0
5	6.9	18.2	9.1	7.3	6.2	5.0	0	0	0	0	0	5.6
6	6.7	18.3	9.9	7.5	5.9	4.9	0	0	0	0	0	5.3
7	6.6	14.9	11.6	8.4	6.0	5.0	0	0	0	0	0	5.0
8	9.2	21.0	11.4	8.0	6.1	5.1	0	0	0	0	0	4.7
9	10.1	24.7	13.4	8.2	5.9	5.0	0	0	0	0	0	4.6
10	10.6	18.8	12.2	8.2	5.6	5.2	0	0	0	0	0	4.6
11	9.5	15.9	12.8	8.7	6.3	5.2	0	0	0	0	0	4.6
12	9.1	14.2	11.7	11.2	6.0	0	0	0	0	0	6.5	5.0
13	8.2	12.6	12.2	10.1	6.6	0	0	0	0	0	7.5	5.0
14	7.8	12.1	15.1	8.9	6.5	0	0	0	0	0	6.9	5.0
15	7.5	19.3	19.2	8.4	6.5	0	0	0	0	0	9.5	4.8
16	7.3	23.7	14.8	8.1	6.6	0	0	0	0	0	8.9	4.9
17	12.7	17.5	14.7	8.1	6.1	0	0	0	0	0	7.8	4.7
18	25.2	15.7	15.8	7.8	5.8	0	0	0	0	0	6.6	4.6
19	17.8	17.6	13.8	8.3	5.7	0	0	0	0	0	7.4	7.1
20	15.9	21.6	12.5	8.3	5.5	0	0	0	0	0	10.4	6.2
21	15.5	18.4	12.1	7.7	5.8	0	0	0	0	0	9.7	5.4
22	14.6	15.7	11.1	7.7	5.8	0	0	0	0	0	9.4	5.8
23	12.5	13.7	11.4	7.7	5.5	0	0	0	0	0	8.8	6.6
24	11.0	12.1	13.3	9.6	5.2	0	0	0	0	0	7.2	6.6
25	9.9	11.0	11.7	9.0	5.2	0	0	0	0	0	7.3	6.7
26	9.3	11.3	12.6	8.5	5.0	0	0	0	0	0	8.1	6.5
27	8.6	10.3	11.7	7.9	4.9	0	0	0	0	0	6.9	6.1
28	8.1	9.1	10.7	7.3	5.0	0	0	0	0	0	7.8	7.1
29	7.9	—	10.8	7.0	5.3	0	0	0	0	0	6.9	10.8
30	7.5	—	9.6	7.0	5.2	0	0	0	0	0	6.7	9.9
31	6.9	—	8.9	—	5.1	—	0	0	0	0	—	8.5

CWSHB – Clean Water Services Hillsboro Wastewater Treatment Plant Discharge [RM 43.8]



Discussion

- Discharges from the Hillsboro WWTF were discontinued after 1994. Since 1995, effluent has been pumped to the Rock Creek WWTF during the summer.
- No trends during 1991–2017 were evident.

MEDIAN FLOW BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	4.2	4.8	4.3	4.5	3.8	3.5	3.1	3.8	3.7	4.4	5.0	6.6
1992	6.8	7.7	6.2	6.4	5.4	5.0	4.6	4.5	4.6	4.5	5.1	7.4
1993	7.3	6.0	6.9	7.7	6.4	6.1	4.7	4.4	4.6	3.9	4.2	5.7
1994	7.2	6.5	5.4	4.1	3.3	3.3	1.9	2.0	2.1	2.2	5.1	10.3
1995	8.3	7.6	7.4	5.6	4.5	0	0	0	0	0	5.2	9.2
1996	11.2	12.6	6.0	6.8	6.3	0	0	0	0	0	5.2	15.5
1997	9.9	6.8	9.9	5.1	4.4	0	0	0	0	0	2.4	6.2
1998	11.7	9.5	7.6	5.9	7.1	5.4	0	0	0	0	5.7	12.7
1999	11.3	15.5	9.6	7.1	0	0	0	0	0	0	6.9	8.7
2000	9.8	7.9	7.8	5.8	0	0	0	0	0	0	0	5.6
2001	5.8	5.8	5.6	5.4	0	0	0	0	0	0	0	10.9
2002	10.5	7.5	7.5	7.2	0	0	0	0	0	0	0	7.5
2003	9.4	10.3	10.5	9.3	0	0	0	0	0	0	0	7.9
2004	10.1	9.5	7.6	6.7	0	0	0	0	0	0	0	0
2005	7.1	6.9	0	6.9	7.8	0	0	0	0	0	7.2	8.7
2006	16.3	7.6	7.5	6.7	0	0	0	0	0	0	8.6	10.6
2007	7.2	7.1	6.2	5.5	0	0	0	0	0	0	0	10.6
2008	10.5	6.8	7.1	6.3	0	0	0	0	0	0	4.6	5.0
2009	6.4	5.1	6.0	3.8	4.9	0	0	0	0	0	6.0	5.8
2010	11.2	8.0	6.5	7.0	5.3	5.6	0	0	0	0	0	6.0
2011	8.7	6.9	10.4	0	0	0	0	0	0	0	0	4.9
2012	7.9	7.2	11.7	0	0	0	0	0	0	0	6.0	13.4
2013	5.8	5.5	5.8	0	0	0	0	0	0	0	4.7	4.4
2014	4.8	8.6	8.2	6.4	4.0	0	0	0	0	0	4.4	7.7
2015	5.8	7.1	6.8	5.6	0	0	0	0	0	0	0	17.1
2016	12.3	8.8	10.1	5.6	0	0	0	0	0	0	6.9	9.5
2017	8.6	15.3	11.7	8.1	5.9	0	0	0	0	0	6.9	5.8
median	8.6	7.5	7.4	5.9	0	0	0	0	0	0	4.7	7.7

Key

Q in cfs
- Q = 0
- Q ≤ 4.3
- 4.3 < Q ≤ 5.2
- 5.2 < Q ≤ 8.8
- 8.8 < Q ≤ 12.9
- Q > 12.9

Q as percentile
- Q ≤ 10th
- 10th < Q ≤ 25th
- 25th < Q ≤ 75th
- 75th < Q ≤ 90th
- Q > 90th

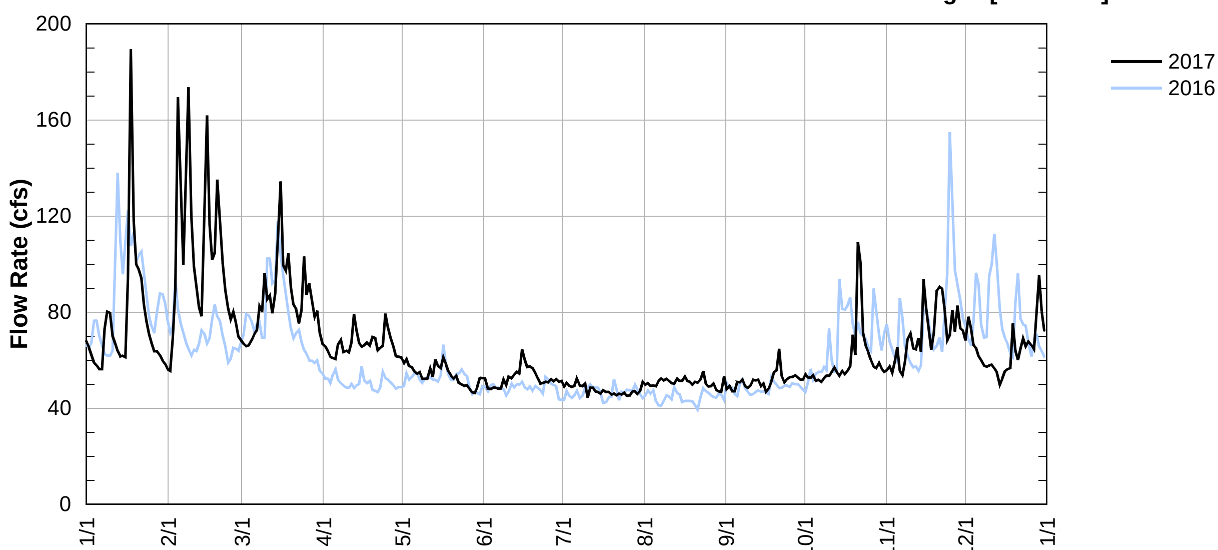
days when effluent was not discharged were not used to calculate percentiles

no releases during the July-August period for this site

CWSRC – CLEAN WATER SERVICES ROCK CREEK WASTEWATER TREATMENT FACILITY DISCHARGE [RM 38.08]

Data source: Clean Water Services

Day	2017 — Mean Daily Water Discharge in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	67.9	56.3	66.7	65.6	58.9	52.4	49.1	49.9	48.0	54.2	55.8	68.2
2	65.3	55.5	65.9	63.9	60.5	48.2	50.6	50.4	49.2	52.8	57.4	78.1
3	62.1	69.2	66.3	61.4	57.6	48.0	49.5	49.4	47.1	52.6	54.7	73.5
4	59.0	89.5	68.6	60.9	57.1	48.6	49.0	49.5	47.2	53.6	59.3	66.4
5	57.8	169.3	71.1	60.6	55.3	48.5	49.3	49.2	50.9	51.4	65.3	65.0
6	56.3	128.4	72.6	66.6	54.5	48.1	52.3	51.4	50.8	51.8	55.4	61.5
7	56.4	99.5	82.4	68.5	55.0	48.2	49.4	52.3	52.0	51.0	53.6	59.8
8	73.0	146.7	80.2	63.4	52.2	52.0	49.2	51.6	49.4	52.6	59.4	57.7
9	80.2	173.6	96.3	64.0	52.2	49.6	50.2	52.2	48.5	53.6	68.7	57.3
10	79.7	120.1	85.4	63.1	52.2	53.2	44.4	51.4	49.4	53.4	71.1	57.8
11	70.2	99.2	87.0	67.3	56.5	52.5	48.5	50.3	51.8	55.2	64.9	58.1
12	67.0	89.9	79.5	79.3	53.0	54.0	48.4	50.2	51.6	57.0	64.6	56.7
13	63.7	82.0	87.8	72.3	60.4	55.2	47.0	52.3	52.0	55.0	69.1	54.8
14	61.6	78.2	106.5	67.1	57.5	54.4	46.8	51.3	49.2	53.6	63.5	49.8
15	61.8	122.4	134.4	65.8	56.6	64.5	46.1	51.5	50.3	55.6	93.7	52.5
16	61.3	161.8	99.2	66.3	61.1	60.4	47.6	53.2	47.0	54.2	81.9	55.5
17	94.0	116.4	97.2	67.3	58.4	57.2	46.8	51.3	48.2	55.6	73.6	56.4
18	189.4	101.9	104.5	66.2	55.4	57.5	46.8	51.1	51.3	57.6	64.4	56.9
19	117.9	104.7	90.1	69.8	53.6	56.9	45.8	49.8	55.1	70.6	71.2	75.4
20	99.8	135.1	83.1	69.3	52.4	54.6	46.1	51.0	55.8	62.2	88.9	63.9
21	97.6	119.8	81.3	64.2	53.5	52.4	45.5	50.7	64.7	109.2	90.5	60.2
22	94.0	100.4	75.3	65.1	50.7	50.2	46.1	52.1	53.3	100.7	89.7	65.0
23	83.0	89.3	80.8	66.0	50.0	50.5	45.7	55.4	50.8	71.5	81.1	68.9
24	76.1	81.4	103.2	79.5	49.3	51.1	46.4	50.2	52.1	65.7	68.4	65.9
25	70.7	77.1	87.2	73.6	49.6	50.8	45.2	49.1	53.0	63.1	70.6	67.9
26	67.0	80.1	92.1	69.5	48.0	52.0	45.4	49.2	53.0	59.9	80.8	66.2
27	63.6	75.7	84.7	65.8	46.6	51.2	46.9	50.2	53.7	57.3	72.0	64.6
28	63.6	69.9	78.1	61.6	46.3	52.1	47.2	47.7	52.8	56.9	82.8	78.3
29	62.3	—	80.5	61.5	49.0	51.1	46.0	47.1	51.8	58.9	73.3	95.4
30	59.8	—	71.3	61.0	52.7	51.5	47.3	46.9	52.0	56.6	72.3	80.4
31	58.5	—	66.6	—	52.4	—	51.1	53.4	—	55.1	—	72.4



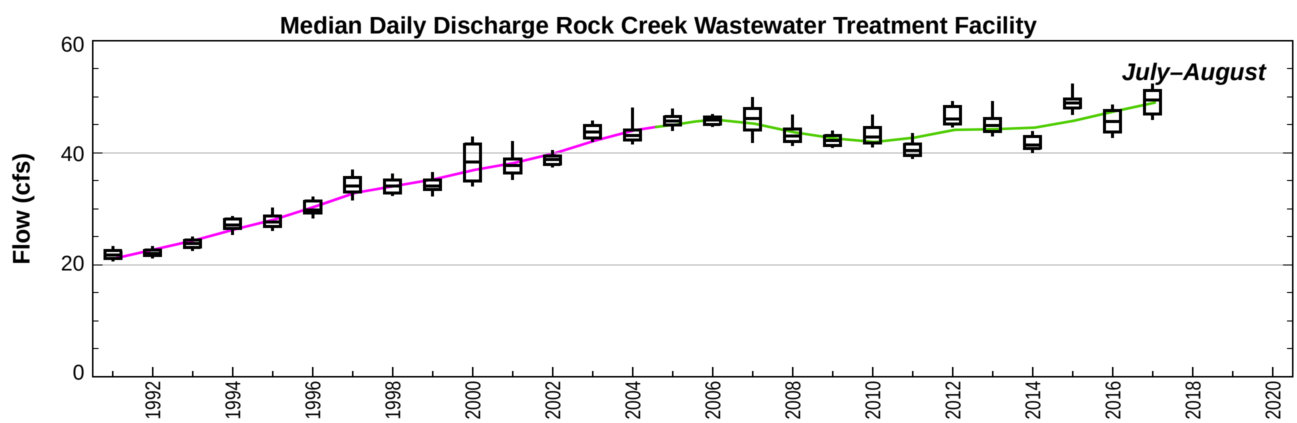
Discussion

- Discharges from the Rock Creek WWTF in 2017 were similar to recent years.
- Discharges in July–August steadily increased during 1991–mid-2000s. The trend is statistically significant and almost linear. Discharges also increased for other months during this time period.
- During 2005–present discharges appear to be increasing slightly, but the trend is not statistically significant.

MEDIAN DAILY DISCHARGE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	27	33	34	30	29	24	21	22	21	21	28	30
1992	32	36	29	29	25	23	22	22	22	22	25	35
1993	38	31	37	40	29	27	24	23	22	22	21	27
1994	32	29	33	30	29	28	27	27	26	25	38	49
1995	55	51	53	37	33	29	28	27	27	29	34	71
1996	57	68	38	42	40	33	31	29	29	30	37	97
1997	63	38	61	35	35	37	35	33	34	39	48	40
1998	68	56	48	38	42	39	34	33	35	36	40	75
1999	73	89	56	39	39	38	34	34	32	31	45	51
2000	63	59	59	44	49	44	41	35	38	41	34	40
2001	38	40	39	39	38	37	37	38	39	41	48	71
2002	72	57	52	44	42	41	39	39	40	39	41	50
2003	59	58	63	63	47	46	44	44	40	41	40	52
2004	67	58	43	41	41	45	43	43	45	47	48	47
2005	45	42	38	49	57	48	46	46	46	48	50	58
2006	101	51	51	48	46	46	46	46	42	42	66	138
2007	56	56	52	48	48	44	46	46	42	47	47	74
2008	72	53	52	46	43	43	42	43	44	43	43	43
2009	50	41	47	46	50	47	42	43	43	45	51	46
2010	69	56	53	54	51	57	44	42	44	43	57	87
2011	62	51	73	60	45	41	41	40	40	42	46	38
2012	51	49	68	57	54	51	48	45	45	49	53	80
2013	48	45	43	47	47	49	44	46	50	50	46	43
2014	43	64	63	54	46	46	43	41	41	46	48	58
2015	49	58	59	52	52	50	49	49	51	52	59	100
2016	84	70	73	50	52	49	47	45	48	70	69	71
2017	67	99	82	66	54	52	47	51	51	56	70	65
median	57	53	52	46	45	44	42	41	40	42	46	52

Key
Q in cfs
Q ≤ 5
5 < Q ≤ 14
14 < Q ≤ 38
38 < Q ≤ 49
Q > 49
Q as percentile
Q ≤ 10th
10th < Q ≤ 25th
25th < Q ≤ 75th
75th < Q ≤ 90th
Q > 90th

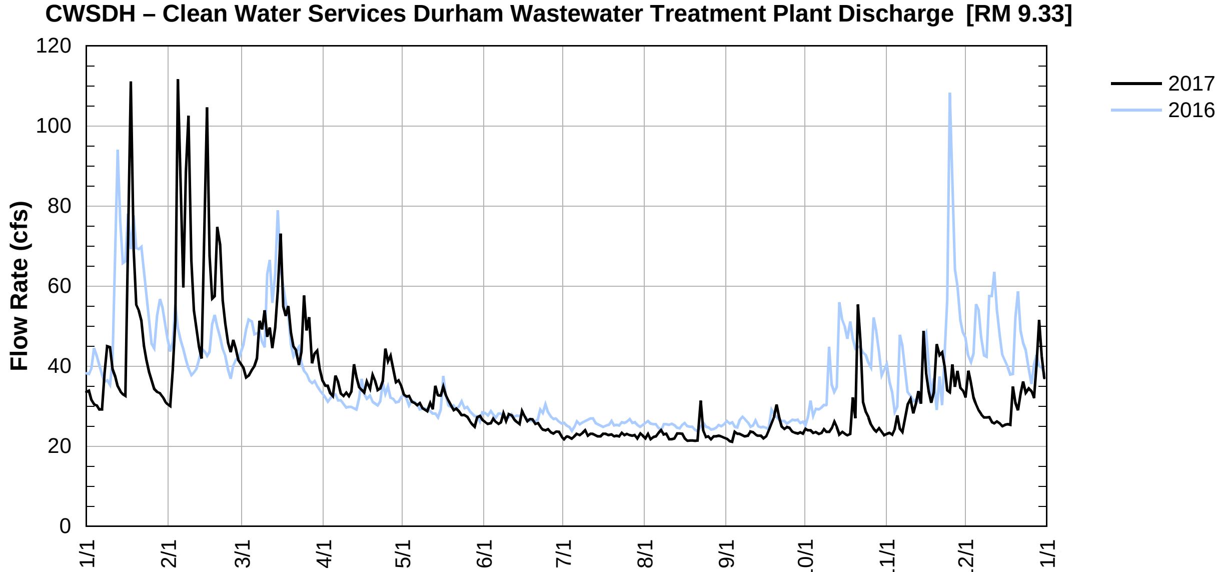


CWSDH – CLEAN WATER SERVICES DURHAM WASTEWATER TREATMENT FACILITY DISCHARGE [RM 9.33]

Data source: Clean Water Services

Day	2017 — Mean Daily Water Discharge in Cubic Feet per Second											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	39.1	35.6	46.1	41.0	38.4	30.5	25.4	25.7	25.5	28.5	26.9	37.6
2	39.6	35.0	43.5	41.0	37.7	29.9	26.1	26.9	24.8	28.0	27.2	45.3
3	36.8	45.6	43.9	38.8	37.9	30.0	26.0	25.4	24.6	28.0	26.8	41.8
4	35.6	60.0	45.6	37.9	36.4	31.4	25.5	26.0	27.5	27.2	28.5	37.6
5	35.3	130.3	46.7	43.9	36.0	30.5	26.3	26.1	26.9	27.5	32.3	35.4
6	34.0	91.6	49.0	42.2	35.3	29.9	26.9	27.2	26.9	26.9	28.5	33.7
7	34.0	69.6	59.9	38.7	35.9	30.3	26.6	28.0	26.6	27.2	27.5	32.6
8	44.7	103.3	57.4	37.9	34.5	33.0	27.2	26.8	26.3	28.3	31.4	31.7
9	52.4	119.6	63.0	39.0	34.0	30.8	28.0	26.9	26.5	27.5	35.7	31.7
10	52.1	77.5	55.2	37.9	33.6	32.8	26.5	25.4	27.7	27.5	37.1	31.9
11	45.8	63.0	58.0	39.4	35.9	32.3	26.9	25.4	27.4	28.6	33.0	30.5
12	43.8	57.9	52.0	47.2	34.2	31.1	26.9	25.5	26.8	30.6	35.7	30.0
13	40.8	52.3	58.0	43.5	41.0	30.5	26.6	27.1	26.5	28.9	39.3	30.6
14	39.4	48.9	68.7	40.5	38.2	29.7	26.3	27.1	26.5	26.8	35.7	30.0
15	38.5	78.9	85.2	39.8	38.1	33.6	26.1	26.9	25.7	27.5	56.9	29.2
16	38.1	122.1	64.0	39.0	40.7	32.0	26.9	25.5	26.3	26.9	44.7	29.5
17	68.1	78.7	61.3	42.2	38.2	30.6	26.9	24.9	28.0	26.6	39.3	29.7
18	129.6	66.4	64.2	40.1	36.5	31.2	26.6	25.1	30.2	26.9	36.0	29.5
19	80.3	67.1	56.5	44.1	35.1	31.1	26.8	25.1	32.0	37.6	39.0	40.8
20	64.5	87.3	52.3	42.4	33.9	29.9	26.3	24.9	35.4	31.6	53.1	36.0
21	62.8	82.1	51.2	39.8	34.3	30.2	26.5	25.1	31.7	64.7	50.0	33.9
22	59.9	65.9	47.0	40.2	33.6	29.1	26.1	36.7	29.1	53.8	50.7	38.7
23	52.6	59.1	50.9	42.4	32.3	28.2	27.2	27.8	28.3	36.2	46.6	42.2
24	48.3	53.4	67.3	51.8	32.5	28.0	26.6	26.0	28.9	33.3	39.6	39.0
25	45.0	50.7	57.1	48.1	32.0	28.3	26.9	26.1	28.6	31.7	39.0	40.2
26	42.5	54.3	61.0	49.8	30.8	27.4	26.6	25.4	27.7	29.5	47.2	39.3
27	40.1	51.7	47.5	45.6	29.7	27.1	26.5	26.3	27.2	28.3	40.7	37.4
28	39.1	48.3	50.4	41.9	29.1	27.7	26.6	26.1	27.1	27.7	45.3	47.2
29	38.8	—	51.2	42.5	31.9	27.5	25.7	26.5	27.4	28.6	40.4	60.2
30	37.7	—	45.8	40.8	32.2	26.1	27.1	26.1	27.1	27.7	39.6	49.7
31	36.4	—	42.4	—	30.9	—	26.5	25.8	—	26.6	—	43.2

CWSDH – Clean Water Services Durham Wastewater Treatment Plant Discharge [RM 9.33]



Discussion

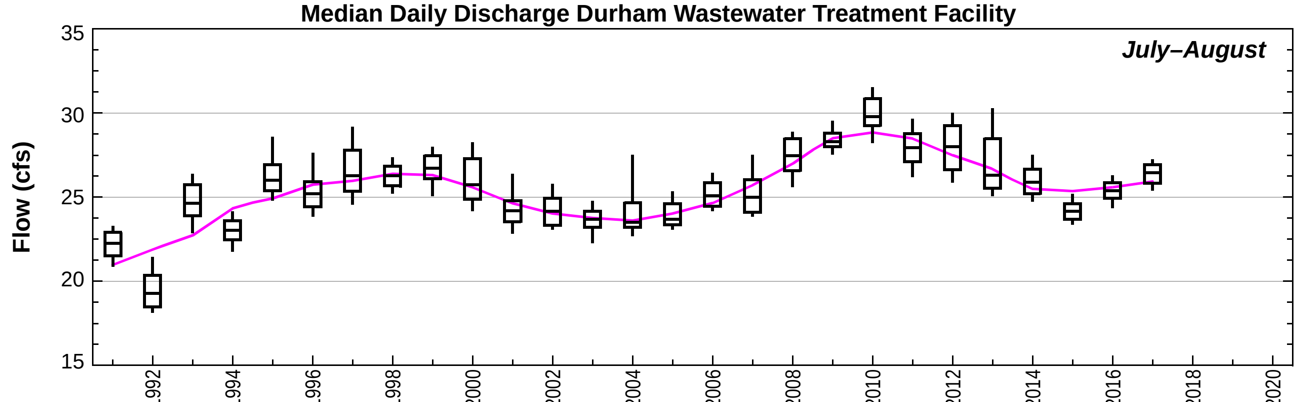
- Discharges from the Durham WWTF in 2017 were similar to recent years.
- Overall, discharges in July–August (plus June, September and October) have increased during 1991–present. Although the trend is statistically significant, periods of lower discharge repeatedly occur.
- No trends were evident for winter months

MEDIAN FLOW BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	28.9	32.8	29.4	30.7	28.2	25.4	22.3	22.0	21.5	21.5	27.0	28.1
1992	29.6	34.4	26.6	27.9	23.7	22.1	19.9	18.5	21.0	20.9	24.9	33.4
1993	33.0	26.7	30.9	39.1	31.4	24.9	24.9	24.6	23.5	24.5	21.1	27.7
1994	31.2	30.7	32.1	28.9	24.6	23.8	22.7	23.1	23.9	23.7	36.2	40.5
1995	40.3	41.7	41.3	35.6	31.5	28.2	25.9	26.1	26.0	28.8	37.4	44.4
1996	49.0	56.4	40.2	40.7	36.4	27.9	25.6	24.8	26.5	31.0	38.7	69.8
1997	60.9	36.5	51.4	34.9	30.0	30.1	26.4	25.8	28.0	30.4	34.9	33.1
1998	49.2	45.3	41.7	33.1	35.9	30.3	26.3	25.8	26.7	29.4	37.9	51.0
1999	54.7	63.1	47.4	36.9	31.1	28.5	26.7	26.8	26.2	26.8	36.7	39.8
2000	42.1	42.5	39.7	32.0	31.4	28.7	27.2	24.9	25.6	26.5	26.7	30.0
2001	28.2	28.0	28.4	28.8	25.9	25.4	24.1	24.3	24.5	25.0	30.2	42.9
2002	41.9	38.4	36.8	31.7	26.6	25.8	24.6	23.5	24.1	23.7	25.2	34.0
2003	38.2	37.1	42.5	39.3	30.9	25.5	23.5	23.8	23.6	25.2	27.2	39.0
2004	43.9	39.8	32.3	28.5	26.1	24.5	23.4	24.4	25.1	27.7	27.5	30.0
2005	30.2	27.0	25.8	33.7	34.5	28.6	24.6	23.4	23.7	28.2	34.3	40.7
2006	64.0	41.5	38.8	35.5	30.0	27.8	25.1	25.2	25.3	24.6	46.2	47.8
2007	38.7	36.1	37.0	34.3	28.6	25.8	24.4	25.5	24.1	27.4	29.8	48.6
2008	48.4	35.9	41.8	37.9	30.8	28.8	28.0	26.8	25.2	27.1	31.0	30.0
2009	37.3	33.1	36.8	34.2	33.0	29.8	28.3	28.5	29.0	29.5	38.3	35.3
2010	52.4	41.2	39.4	41.8	35.7	40.9	30.8	29.2	30.2	30.5	41.1	57.9
2011	46.4	40.2	54.3	44.9	33.7	29.9	27.2	28.0	28.2	26.3	30.6	30.2
2012	39.6	36.2	48.1	38.6	33.1	30.3	28.6	27.7	28.2	33.1	44.4	66.5
2013	39.0	36.5	35.4	35.1	31.9	32.7	28.5	25.7	29.2	28.2	30.9	29.2
2014	31.2	43.9	42.9	38.3	31.1	27.7	26.7	25.3	25.2	28.2	31.3	39.4
2015	32.2	37.3	34.5	31.7	26.9	25.4	24.0	24.3	25.7	26.0	31.3	61.4
2016	52.6	43.6	45.9	31.7	29.4	27.4	25.5	25.1	26.1	40.8	38.5	42.9
2017	40.8	64.4	52.3	41.0	34.5	30.2	26.6	26.1	27.1	28.0	39.0	36.0
median	40.3	37.3	39.4	34.9	31.1	27.9	25.6	25.2	25.6	27.4	31.3	39.4

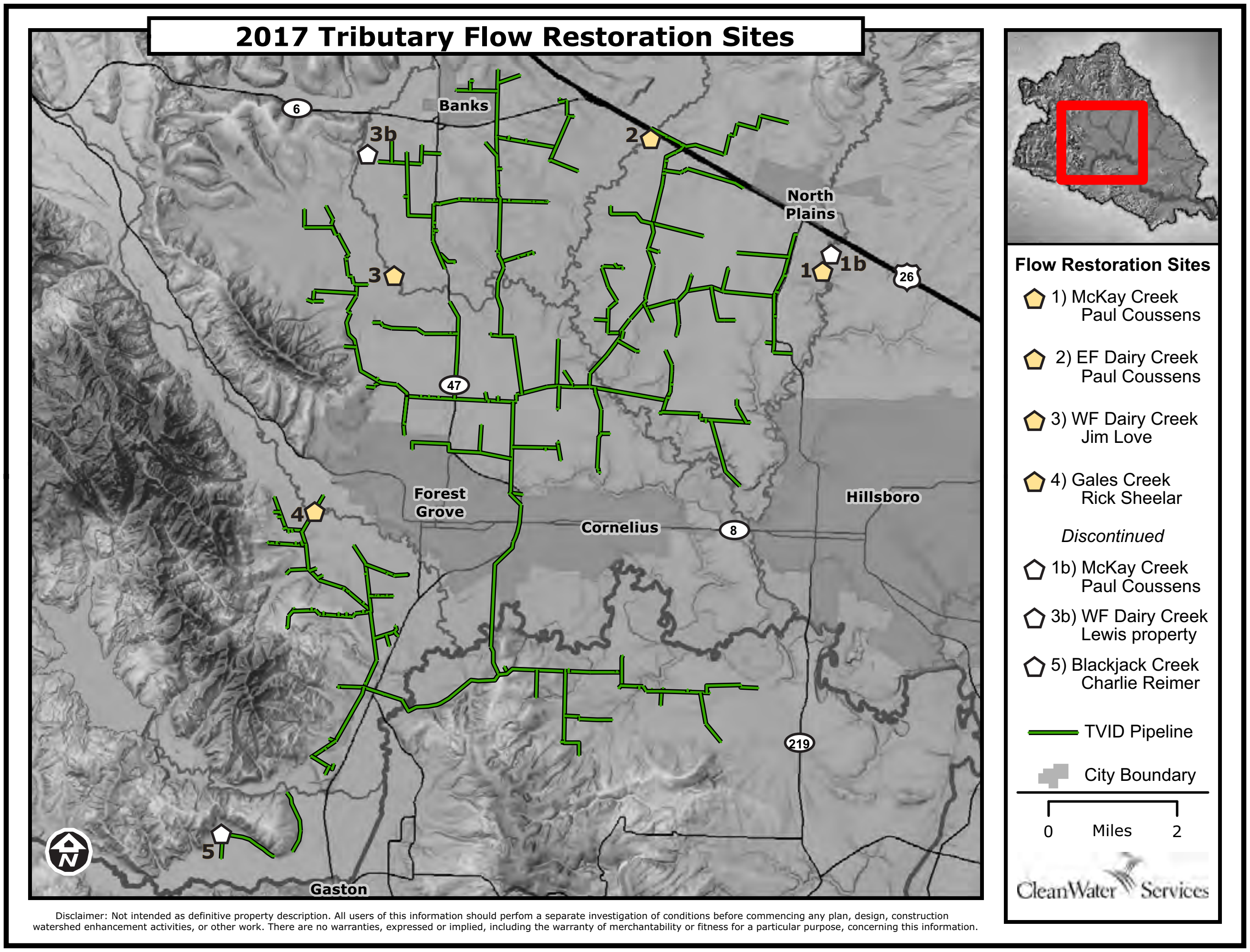
Key
Q in cfs
Q ≤ 24
24 < Q ≤ 26
26 < Q ≤ 30
39 < Q ≤ 49
Q > 49
Q as percentile
Q ≤ 10th
10th < Q ≤ 25th
25th < Q ≤ 75th
75th < Q ≤ 90th
Q > 90th

Median Daily Discharge Durham Wastewater Treatment Facility



RELEASES FOR CLEAN WATER SERVICES TRIBUTARY FLOW AUGMENTATION AT TVID RELEASE POINTS

Map #	Site Name	River Mile	Start Date	End Date	Average Flow (cfs)	Average Daily Release (ac-ft)	Total Release (ac-ft)
1	**McKay Creek**	7.0	*same start/end for all sites*		1.03	2.06	201.6
2	**East Fork Dairy Creek**	4.9	7/7/2017	10/18/2017	0.49	0.97	94.9
3	**West Fork Dairy Creek**	5.2			0.99	1.97	193.2
4	**Gales Creek**	5.0			0.53	1.06	103.8



HISTORY OF TRIBUTARY FLOW RESTORATION

Year	Dates	McKay #1 (RM 7.0)		EF Dairy #2 (RM 4.9)		WF Dairy #3 (RM 5.2)		Gales #4 (RM 5.0)		McKay #1b (RM 6.5)		WF Dairy #3b (RM 7.5)		Blackjack #5	
		Release		*Release*		*Release*		*Release*		*Release*		*Release*		*Release*	
		mean cfs	*total ac-ft*	*mean cfs*	*total ac-ft*	*mean cfs*	*total ac-ft*	*mean cfs*	*total ac-ft*	*mean cfs*	*total ac-ft*	*mean cfs*	*total ac-ft*	*mean cfs*	*total ac-ft*
2011	7/11–9/30	0.4	67	0.6	96	0.4	72	1.5	240	0.7	118	0.7	106	—	—
2012	7/20–10/16	2.2	388	0.7	118	0.8	146		177		140	1.0	175	—	—
2013	7/9–9/1	3.0	444	0.9	125	0.8	118	2.0	287			—	—	1.0	144
2014	7/11–10/21	1.6	319	1.0	205	0.7	151	1.9	384	*combined with McKay #1*		—	—	0.8	168
2015	6/30–10/30	2.1	512	1.6	395	0.7	158	1.3	315			—	—	1.0	234
2016	7/16–10/13	2.0	348	1.5	274	0.7	122	1.7	303			—	—	—	—
2017	7/7–10/18	1.0	202	0.5	95	1.0	193	0.5	104			—	—	—	—

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Appendix C

Scoggins Reservoir Operations Monthly Records

The information presented here regarding water allocations is provisional. Final allocations for municipal use can be found in the Appendix E of this report.

SCOGGINS DAM -- RESERVOIR OPERATIONS

January 2017

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOT INFLO (cfs) [4]	W.S. ELEV (ft) [5]	STOR CONT (ac-ft) [6]	CHNG STOR (ac-ft) [7]	CHNG STOR (cfs) [8]	REL (cfs) [9]	COMP INFLO (cfs) [10]	GASO (cfs) [11]	DLLO (cfs) [12]	GOLF (cfs) [13]	ROOD (cfs) [14]	FRMO (cfs) [15]	WSLO (cfs) [16]	PRECIP (inches) [17]	TEMP MAX (°F) [18]	TEMP MIN (°F) [19]	TVID (cfs) [20]	CWS (cfs) [21]	LO (cfs) [22]	MUNI (cfs) [23]	OTHR (cfs) [24]
1	63	82	7	152	283.79	33256	55	28	176	204	358	634	1190	2390	2990	3120	0.33	35	30	0	0	0	0	0
2	56	70	5	131	283.83	33293	37	19	175	194	311	614	1090	2310	2890	3010	0.12	38	31	0	0	0	0	0
3	49	61	5	115	283.82	33284	-9	-5	175	170	263	571	943	2110	2670	2780	0.00	33	28	0	0	0	0	0
4	46	56	4	106	283.72	33191	-93	-47	175	128	236	536	827	1850	2360	2500	0.00	35	27	0	0	0	0	0
5	42	50	4	96	283.67	33145	-46	-23	175	152	210	502	767	1590	2030	2180	0.00	34	17	0	0	0	0	0
6	39	45	3	87	283.55	33035	-110	-55	175	120	194	469	707	1380	1770	1900	0.00	36	14	0	0	0	0	0
7	38	44	3	85	283.56	33044	9	5	99	104	180	360	610	1210	1600	1710	0.00	35	14	0	0	0	0	0
8	40	44	3	87	283.60	33081	37	19	100	119	175	344	561	1110	1420	1560	0.23	33	26	0	0	0	0	0
9	44	54	4	102	283.82	33284	203	102	100	202	238	425	691	1440	1740	1890	0.69	34	33	0	0	0	0	0
10	52	59	4	115	284.00	33450	166	84	100	184	382	549	823	1730	2150	2400	0.16	38	35	0	0	0	0	0
11	48	56	4	108	284.24	33663	213	107	101	208	350	592	1050	2020	2570	2550	0.57	38	29	0	0	0	0	0
12	43	47	4	94	284.37	33793	130	66	100	166	363	567	1020	2120	2720	2580	0.02	32	23	0	0	0	0	0
13	39	42	3	84	284.26	33691	-102	-51	199	148	226	607	961	2070	2670	2530	0.00	38	16	0	0	0	0	0
14	37	38	3	78	283.90	33359	-332	-167	302	135	201	648	934	1960	2530	2390	0.00	30	16	0	0	0	0	0
15	35	36	3	74	283.50	32980	-379	-191	300	109	181	648	911	1840	2370	2230	0.00	34	15	0	0	0	0	0
16	33	35	3	71	283.08	32603	-377	-190	299	109	169	626	877	1720	2220	2090	0.00	34	23	0	0	0	0	0
17	32	33	3	68	282.67	32228	-375	-189	297	108	161	612	839	1610	2070	1950	0.00	35	23	0	0	0	0	0
18	307	730	52	1089	283.52	33007	779	393	81	474	1040	727	1180	2200	2960	3240	2.37	52	29	0	0	0	0	0
19	288	632	46	966	286.31	35611	2604	1313	21	1334	1030	1960	2630	3860	4860	5890	0.89	52	44	0	0	0	0	0
20	204	418	36	658	288.05	37272	1661	837	22	859	907	1320	3120	4270	5140	5640	0.15	50	38	0	0	0	0	0
21	177	310	31	518	289.32	38502	1230	620	22	642	823	1070	2890	5240	5930	5920	0.31	43	39	0	0	0	0	0
22	177	306	30	513	290.13	39295	793	400	203	603	815	1080	2710	5480	7170	6680	0.51	46	39	0	0	0	0	0
23	150	241	26	417	290.71	39866	571	288	203	491	736	995	2600	5370	7540	6980	0.03	48	32	0	0	0	0	0
24	122	187	20	329	290.73	39886	20	10	404	414	648	995	2490	5110	6940	7140	0.00	49	29	0	0	0	0	0
25	106	152	13	271	290.09	39256	-630	-318	594	276	568	1020	2360	4790	6190	6990	0.01	44	30	0	0	0	0	0
26	90	130	11	231	289.39	38571	-685	-345	569	224	499	975	2260	4440	5680	6600	0.01	45	36	0	0	0	0	0
27	80	111	10	201	288.67	37871	-700	-353	540	187	438	937	2120	4150	5330	6110	0.01	46	32	0	0	0	0	0
28	69	97	8	174	288.48	37687	-184	-93	298	205	385	785	1930	3840	4970	5600	0.00	49	32	0	0	0	0	0
29	63	88	7	158	288.48	37687	0	0	199	199	341	691	1610	3520	4570	5050	0.00	46	32	0	0	0	0	0
30	59	80	7	146	288.47	37677	-10	-5	199	194	307	638	1360	3200	4140	4520	0.00	43	31	0	0	0	0	0
31	56	74	5	135	288.20	37416	-261	-132	301	169	289	677	1180	2880	3690	3960	0.00	48	39	0	0	0	0	0
TOTALS																	6.41 inches							
cfs	2684	4408	367	7459				2125	6704	8829	13024	23174	45241	88810	113880	119690	MAX	52	44	0	0	0	0	0
ac-ft	5324	8743	728	14795			4215	4215	13297	17512	25833	45966	89736	176155	225881	237405	MIN	30	14	0	0	0	0	0

Water storage elevation ± to fill curve:	**1.29**
Water storage in ac-ft ± to fill curve:	**1232**
Percentage of full reservoir:	**70.2%**

Minimum Required Discharges	
Dec-Sept: 10 cfs	Oct-Nov: 20 cfs

SNOTEL Summary for Water Year 2017

Updated: January 31, 2017

SECO W/Y pc:	50.9"	snow depth/water content	0
SDMO W/Y pc:	69.8"	snow depth/water content	19"/ 8.8"

RESERVOIR DELIVERY STATUS		USED	REMAINING
These allocations, amounts used and	TVID	0	
remaining are provisional and subject	CWS	0	12615
to daily changes as the WS elevation	LO	0	500
rises and falls. These numbers are for	MUNI	0	13500
planning purposes only.	Other	0	

SCOGGINS DAM -- RESERVOIR OPERATIONS
February 2017

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOT INFLO (cfs) [4]	W.S. ELEV (ft) [5]	STOR CONT (ac-ft) [6]	CHNG STOR (ac-ft) [7]	CHNG STOR (cfs) [8]	REL (cfs) [9]	COMP INFLO (cfs) [10]	GASO (cfs) [11]	DLLO (cfs) [12]	GOLF (cfs) [13]	ROOD (cfs) [14]	FRMO (cfs) [15]	WSLO (cfs) [16]	PRECIP (inches) [17]	TEMP MAX (°F) [18]	TEMP MIN (°F) [19]	TVID (cfs) [20]	CWS (cfs) [21]	LO (cfs) [22]	MUNI (cfs) [23]	OTHR (cfs) [24]
1	52	68	5	125	287.89	37118	-298	-150	301	151	266	670	1100	2580	3270	3400	0.00	47	31	0	0	0	0	0
2	48	63	5	116	287.86	37089	-29	-15	149	134	235	550	956	2290	2920	2980	0.00	40	35	0	0	0	0	0
3	46	59	4	109	288.01	37233	144	73	89	162	219	413	772	1960	2530	2610	0.10	42	31	0	0	0	0	0
4	64	94	8	166	288.29	37503	270	136	59	195	298	417	737	1840	2360	2690	0.69	46	32	0	0	0	0	0
5	131	230	25	386	288.85	38045	542	273	60	333	779	615	1070	2120	2730	3200	0.98	50	37	0	0	0	0	0
6	139	213	24	376	289.84	39010	965	487	61	548	812	1050	1790	3560	4550	6290	1.73	37	33	0	0	0	0	0
7	118	172	18	308	290.65	39807	797	402	60	462	700	991	2340	3650	4760	5700	0.36	42	34	0	0	0	0	0
8	124	178	18	320	290.96	40113	306	154	221	375	636	956	2390	3650	4690	5560	0.39	40	36	0	0	0	0	0
9	448	1270	90	1808	292.61	41760	1647	830	32	862	1060	1260	2560	4250	5220	6790	2.32	56	38	0	0	0	0	0
10	304	756	53	1113	295.79	45012	3252	1640	30	1670	1030	2520	3520	5770	7040	7230	0.77	59	42	0	0	0	0	0
11	228	463	38	729	297.49	46792	1780	897	29	926	931	1360	3200	8930	12500	7620	0.08	47	33	0	0	0	0	0
12	179	315	31	525	298.03	47364	572	288	347	635	813	1190	2910	7970	12100	9340	0.00	51	31	0	0	0	0	0
13	141	227	25	393	297.45	46750	-614	-310	716	406	709	1200	2730	6270	10500	10000	0.00	53	30	0	0	0	0	0
14	120	175	18	313	296.22	45460	-1290	-650	926	276	626	1180	2640	5430	8680	9310	0.01	58	33	0	0	0	0	0
15	120	184	20	324	294.83	44020	-1440	-726	953	227	610	1170	2590	5050	7150	8300	0.46	50	34	0	0	0	0	0
16	271	680	49	1000	296.23	45470	1450	731	200	931	1040	1250	2730	5220	7410	8670	1.96	56	43	0	0	0	0	0
17	217	729	52	998	297.86	47841	2371	1195	106	1301	948	1540	3080	6480	9900	9110	0.67	51	42	0	0	0	0	0
18	167	310	30	507	298.55	47917	76	38	248	286	818	1210	2920	6760	10800	9050	0.05	57	43	0	0	0	0	0
19	150	248	26	424	298.28	47630	-287	-145	619	474	747	1330	2750	5980	9900	9403	0.36	50	39	0	0	0	0	0
20	217	384	34	635	298.16	47502	-128	-65	650	585	869	1380	2770	5720	9210	9490	1.39	46	41	0	0	0	0	0
21	194	348	32	574	299.17	48581	1079	544	177	721	874	1220	2890	6160	9900	9470	0.52	49	42	0	0	0	0	0
22	154	256	27	437	299.31	48731	150	76	442	518	768	1200	2770	6060	9950	9380	0.04	49	31	0	0	0	0	0
23	126	200	22	348	298.73	48109	-622	-314	675	361	677	1170	2660	5650	8950	9110	0.10	46	29	0	0	0	0	0
24	115	164	16	295	298.00	47332	-777	-392	659	267	611	1100	2590	5240	7670	8440	0.31	43	31	0	0	0	0	0
25	98	136	12	246	297.82	47141	-191	-96	386	290	550	911	2490	4900	6510	7780	0.12	40	31	0	0	0	0	0
26	92	125	11	228	297.78	47099	-42	-21	295	274	499	854	2200	4540	5850	7170	0.24	48	33	0	0	0	0	0
27	77	106	9	192	297.72	47035	-64	-32	294	262	467	826	1920	4220	5440	6680	0.15	41	32	0	0	0	0	0
28	79	101	8	188	297.68	46993	-42	-21	294	273	476	813	1740	3890	5050	6050	0.44	43	33	0	0	0	0	0
TOTALS																	14.24 inches							
cfs	4219	8254	710	13183				4828	9078	13906	19068	30346	64815	136140	197540	200823	MAX	59	43	0	0	0	0	0
ac-ft	8368	16372	1408	26148			9577	9577	18006	27583	37821	60191	128561	270034	391821	398332	MIN	37	29	0	0	0	0	0

Water storage elevation ± to fill curve:	**-0.52**
Water storage in ac-ft ± to fill curve:	**-556.19**
Percentage of full reservoir:	**88.1%**

Minimum Required Discharges
Dec-Sept: 10 cfs Oct-Nov: 20 cfs

SNOTEL Summary for Water Year 2017
Updated: February 28, 2017

SECO W/Y pc:	66.6"	snow depth/water content	6"/ 1.0"
SDMO W/Y pc:	88.9"	snow depth/water content	22" / 11.3"

RESERVOIR DELIVERY STATUS

These allocations, amounts used and remaining are provisional and subject to daily changes as the WS elevation rises and falls. These numbers are for planning purposes only.

	USED	REMAINING
TVID	0	
CWS	0	12615
LO	0	500
MUNI	0	13500
Other	0	

SCOGGINS DAM -- RESERVOIR OPERATIONS

March 2017

[See Appendix E for breakdown of municipal use by water provider.]

Source: Tualatin Valley Irrigation District

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOT INFLO (cfs) [4]	W.S. ELEV (ft) [5]	STOR CONT (ac-ft) [6]	CHNG STOR (ac-ft) [7]	CHNG STOR (cfs) [8]	REL (cfs) [9]	COMP INFLO (cfs) [10]	GASO (cfs) [11]	DLLO (cfs) [12]	GOLF (cfs) [13]	ROOD (cfs) [14]	FRMO (cfs) [15]	WSLO (cfs) [16]	PRECIP (inches) [17]	TEMP MAX (°F) [18]	TEMP MIN (°F) [19]	TVID (cfs) [20]	CWS (cfs) [21]	LO (cfs) [22]	MUNI (cfs) [23]	OTHR (cfs) [24]
1	75	97	8	180	297.53	46835	-158	-80	294	214	303	804	1620	3540	4590	5340	0.03	47	34	0	0	0	0	0
2	74	94	8	176	297.41	46708	-127	-64	293	229	303	801	1530	3230	4170	4720	0.15	49	38	0	0	0	0	0
3	74	101	9	184	297.44	46740	32	16	206	222	302	745	1450	2970	3790	4160	0.05	48	41	1	0	0	0	0
4	118	194	21	333	297.70	47014	274	138	206	344	542	801	1450	2790	3520	3850	0.53	49	33	0	0	0	0	0
5	111	172	17	300	297.71	47025	11	6	344	350	471	904	1620	2670	3350	3570	0.47	43	34	0	0	0	0	0
6	108	158	14	280	297.62	46930	-95	-48	378	330	433	907	1850	2640	3290	3460	0.62	43	33	1	0	0	0	0
7	104	161	15	280	297.26	46550	-380	-192	487	295	426	948	1950	2700	3360	3500	0.37	43	33	0	0	0	0	0
8	135	217	23	375	297.52	46824	274	138	330	468	547	937	2200	2910	3660	4070	0.58	49	41	0	0	0	0	0
9	143	210	22	375	297.78	47099	275	139	297	436	552	930	2320	3080	3860	4190	0.23	45	41	1	0	0	0	0
10	228	463	37	728	298.78	48174	1075	542	140	682	na	995	na	3340	4170	4540	0.65	56	43	0	0	0	0	0
11	186	340	32	558	299.78	49237	1063	536	100	636	678	1030	1880	3520	4380	4610	0.00	57	40	0	0	0	0	0
12	170	315	31	516	300.30	49800	563	284	301	585	667	1080	1920	3760	4620	4860	0.49	57	43	1	0	0	0	0
13	141	245	27	413	300.22	49713	-87	-44	493	449	582	1090	1890	3890	4770	4970	0.00	62	45	0	0	0	0	0
14	135	241	26	402	299.58	49021	-692	-349	693	344	590	1120	1870	4050	4920	5330	0.41	56	48	0	0	0	0	0
15	192	380	34	606	299.84	49302	281	142	405	547	na	1110	1910	4270	5150	5930	1.19	57	50	1	0	0	0	0
16	192	403	35	630	301.02	50583	1281	646	101	747	na	1190	1980	4840	5680	6280	0.45	55	34	0	0	0	0	0
17	154	279	29	462	301.10	50671	88	44	475	519	621	1200	2010	4870	5900	6430	0.00	55	35	0	0	0	0	0
18	209	413	35	657	300.99	50550	-121	-61	557	496	647	1170	2010	4910	6020	6690	0.91	53	38	1	0	0	0	0
19	158	298	30	486	301.29	50878	328	165	374	539	638	1150	2010	4990	6230	6830	0.01	52	31	0	0	0	0	0
20	135	223	24	382	300.52	50039	-839	-423	741	318	548	1200	1970	4840	6060	6790	0.00	55	33	0	0	0	0	0
21	120	181	19	320	300.40	49908	-131	-66	416	350	491	987	1930	4660	5830	6660	0.24	51	44	1	0	0	0	0
22	111	166	16	293	300.49	50006	98	49	294	343	468	897	1770	4470	5620	6440	0.17	59	42	0	0	0	0	0
23	96	141	12	249	300.54	50060	54	27	251	278	417	854	1540	4210	5360	6110	0.01	52	40	0	0	0	0	0
24	122	190	21	333	301.00	50561	501	253	98	351	516	801	1350	4010	5110	6200	0.79	53	41	1	0	0	0	0
25	113	184	20	317	301.16	50736	175	88	255	343	515	900	1320	3920	5000	5950	0.10	54	39	0	0	0	0	0
26	108	172	18	298	301.22	50802	66	33	295	328	461	904	1370	3680	4750	5500	0.17	51	41	0	0	0	0	0
27	141	248	27	416	301.29	50878	76	38	377	415	584	975	1490	3570	4580	5310	0.64	50	41	1	0	0	0	0
28	125	217	23	365	301.30	50889	11	6	377	383	554	975	1590	3480	4440	4960	0.03	53	42	0	0	0	0	0
29	134	241	26	401	301.28	50867	-22	-11	377	366	515	964	1600	3390	4310	4740	0.40	60	44	1	0	0	0	0
30	121	210	22	353	301.30	50889	22	11	375	386	548	960	1590	3350	4240	4580	0.06	59	38	0	0	0	0	0
31	105	172	17	294	301.39	50988	99	50	275	325	460	886	1530	3270	4130	4390	0.00	54	33	1	0	0	0	0
TOTALS																	9.75 inches							
cfs	4138	7126	698	11962				2014	10605	12619	14379	30215	52520	115820	144860	160960	MAX	62	50	11	0	0	0	0
ac-ft	8208	14134	1384	23727			3995	3995	21035	25030	28521	59931	104173	229729	287330	319264	MIN	43	31	22	0	0	0	0

Water storage elevation ± to fill curve:	**-0.24**
Water storage in ac-ft ± to fill curve:	**-259.73**
Percentage of full reservoir:	**95.6%**

SNOTEL Summary for Water Year 2017

Updated: March 31, 2017

SECO W/Y pc:	81.9"	snow depth/water content	0
SDMO W/Y pc:	111.5"	snow depth/water content	0

Minimum Required Discharges

Dec-Sept: 10 cfs Oct-Nov: 20 cfs

RESERVOIR DELIVERY STATUS		USED	REMAINING
These allocations, amounts used and remaining are provisional and subject to daily changes as the WS elevation rises and falls. These numbers are for planning purposes only.	TVID	22	
	CWS	0	12615
	LO	0	500
	MUNI	0	13500
	Other	0	

SCOGGINS DAM -- RESERVOIR OPERATIONS
April 2017

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO	SCLO	TANO	TOT INFLO	W.S. ELEV	STOR CONT	CHNG STOR	CHNG STOR	REL	COMP INFLO	GASO	DLLO	GOLF	ROOD	FRMO	WSLO	PRECIP	TEMP MAX	TEMP MIN	TVID	CWS	LO	MUNI	OTHR
	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ac-ft)	(ac-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(inches)	(°F)	(°F)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
1	89	138	12	239	301.69	51317	329	166	127	293	388	785	1350	3170	4000	4190	0.00	57	37	1	0	0	0	0
2	78	115	10	203	301.91	51559	242	122	127	249	328	723	1100	3040	3830	4000	0.02	61	35	0	0	0	0	0
3	70	99	8	177	302.09	51757	198	100	128	228	281	670	915	2850	3590	3740	0.00	55	34	1	0	0	0	0
4	64	88	7	159	302.20	51879	122	62	151	213	240	636	757	2630	3320	3410	0.00	57	36	0	0	0	0	0
5	58	76	6	140	302.27	51956	77	39	151	190	210	607	629	2400	3030	3110	0.08	55	43	1	0	0	0	0
6	58	76	6	140	302.31	52000	44	22	176	198	197	607	558	2150	2730	2820	0.36	52	44	0	0	0	0	0
7	58	76	6	140	302.35	52044	44	22	176	198	202	607	524	1970	2480	2590	0.28	60	46	1	0	0	0	0
8	82	108	9	199	302.42	52122	78	39	228	267	347	729	696	2000	2500	2460	0.78	50	37	0	0	0	0	0
9	70	94	8	172	302.40	52100	-22	-11	228	217	289	729	752	2010	2520	2440	0.01	50	37	1	0	0	0	0
10	70	94	8	172	302.39	52089	-11	-6	229	223	301	727	757	2030	2520	2440	0.42	53	39	0	0	0	0	0
11	64	88	7	159	302.34	52033	-56	-28	229	201	260	714	752	2030	2540	2450	0.08	53	34	1	0	0	0	0
12	101	143	12	256	302.52	52233	200	101	178	279	439	725	764	2110	2630	2580	1.01	57	39	1	0	0	0	0
13	108	160	15	283	302.41	52111	-122	-62	372	310	494	886	947	2360	2950	2870	0.33	57	42	1	0	0	0	0
14	99	148	12	259	302.50	52210	99	50	249	299	435	854	1130	2420	3040	2950	0.07	51	38	2	0	0	0	0
15	82	127	11	220	302.59	52310	100	50	204	254	391	811	1120	2450	3060	2960	0.01	52	33	5	0	0	0	0
16	73	108	9	190	302.66	52388	78	39	204	243	334	773	1010	2440	3040	2940	0.00	59	37	3	0	0	0	0
17	66	94	8	168	302.69	52421	33	17	204	221	287	738	898	2390	2990	2880	0.10	64	46	1	0	0	0	0
18	64	92	8	164	302.71	52443	22	11	204	215	271	720	814	2340	2930	2910	0.26	54	49	1	0	0	0	0
19	57	80	7	144	302.74	52476	33	17	176	193	226	672	722	2250	2840	2800	0.03	62	41	1	0	0	0	0
20	63	90	8	161	302.83	52576	100	50	177	227	272	691	696	2150	2700	2810	0.55	52	45	1	0	0	0	0
21	59	80	7	146	302.86	52610	34	17	177	194	244	679	656	2080	2630	2640	0.11	57	34	1	0	0	0	0
22	56	76	6	138	302.89	52643	33	17	177	194	215	650	596	1940	2460	2480	0.04	68	41	1	0	0	0	0
23	52	74	5	131	302.89	52643	0	0	177	177	209	638	559	1850	2340	2350	0.12	59	44	1	0	0	0	0
24	64	96	8	168	302.91	52665	22	11	178	189	227	634	521	1760	2210	2350	0.56	54	45	1	0	0	0	0
25	71	117	10	198	303.05	52821	156	79	178	257	369	710	668	2010	2470	2480	0.27	56	41	1	0	0	0	0
26	76	127	11	214	303.16	52943	122	62	194	256	355	732	723	2060	2590	2800	0.28	52	47	1	0	0	0	0
27	74	117	10	201	303.23	53021	78	39	201	240	325	725	726	2090	2630	2730	0.13	55	36	1	0	0	0	0
28	67	103	9	179	303.32	53122	101	51	176	227	345	703	na	2050	2590	2690	0.07	55	34	1	0	0	0	0
29	60	92	8	160	303.38	53189	67	34	177	211	301	672	1010	1960	2480	2530	0.00	59	36	1	0	0	0	0
30	59	82	7	148	303.40	53211	22	11	177	188	269	638	932	1830	2320	2390	0.02	63	44	1	0	0	0	0
TOTALS																	5.99 inches							
cfs	2112	3058	258	5428				1121	5730	6851	9051	21185	23282	66820	83960	84790	MAX	68	49	32	0	0	0	0
ac-ft	4189	6066	512	10766			2223	2223	11365	13588	17953	42020	46180	132537	166535	168181	MIN	50	33	63	0	0	0	0

Water storage elevation ± to fill curve:	**-0.06**
Water storage in ac-ft ± to fill curve:	**-67.555**
Percentage of full reservoir:	**99.8%**

SNOTEL Summary for Water Year 2017

Updated: April 30, 2017

SECO W/Y pc:	89.5"	snow depth/water content	0
SDMO W/Y pc:	123.0"	snow depth/water content	0

Minimum Required Discharges

Dec-Sept: 10 cfs Oct-Nov: 20 cfs

RESERVOIR DELIVERY STATUS

These allocations, amounts used and remaining are provisional and subject to daily changes as the WS elevation rises and falls. These numbers are for planning purposes only.

	USED	REMAINING
TVID	85	
CWS	0	12615
LO	0	500
MUNI	0	13500
Other	0	

SCOGGINS DAM -- RESERVOIR OPERATIONS

May 2017

DAY	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOT INFLO (cfs) [4]	W.S. ELEV (ft) [5]	STOR CONT (ac-ft) [6]	CHNG STOR (ac-ft) [7]	CHNG STOR (cfs) [8]	REL (cfs) [9]	COMP INFLO (cfs) [10]	GASO (cfs) [11]	DLLO (cfs) [12]	GOLF (cfs) [13]	ROOD (cfs) [14]	FRMO (cfs) [15]	WSLO (cfs) [16]	PRECIP (inches) [17]	TEMP MAX (°F) [18]	TEMP MIN (°F) [19]	TVID (cfs) [20]	CWS (cfs) [21]	LO (cfs) [22]	MUNI (cfs) [23]	OTHR (cfs) [24]
1	51	72	5	128	303.40	53211	0	0	177	177	217	605	856	1690	2150	2200	0.00	59	36	0	0	0	0	0
2	48	66	5	119	303.46	53278	67	34	124	158	198	542	784	1540	1950	2020	0.03	52	43	0	0	0	0	0
3	46	59	4	109	303.50	53323	45	23	143	166	178	538	729	1410	1780	1870	0.02	61	52	0	0	0	0	0
4	42	53	4	99	303.50	53323	0	0	151	151	152	514	684	1310	1660	1730	0.00	81	56	0	0	0	0	0
5	40	48	4	92	303.49	53311	-12	-6	151	145	138	493	667	1230	1540	1600	0.12	85	50	0	0	0	0	0
6	37	45	3	85	303.44	53265	-46	-23	135	112	126	449	618	1180	1490	1550	0.05	55	40	0	0	0	0	0
7	34	41	3	78	303.42	53233	-32	-16	124	108	112	404	556	1090	1380	1460	0.00	59	37	0	0	0	0	0
8	32	38	3	73	303.40	53211	-22	-11	124	113	104	384	508	980	1240	1340	0.00	66	38	0	0	0	0	0
9	31	36	3	70	303.42	53233	22	11	92	103	96	337	456	887	1130	1240	0.00	72	42	0	0	0	0	0
10	29	33	3	65	303.46	53278	45	23	78	101	88	308	405	827	1050	1160	0.00	74	44	0	0	0	0	0
11	32	36	3	71	303.48	53300	22	11	91	102	86	309	392	755	953	1080	0.18	72	49	0	0	0	0	0
12	31	37	3	71	303.43	53244	-56	-28	156	128	100	406	508	838	1020	1090	0.40	55	40	0	0	0	0	0
13	35	38	3	76	303.36	53166	-78	-39	156	117	105	393	490	892	1110	1160	0.26	52	43	0	0	0	0	0
14	30	36	3	69	303.37	53177	11	6	102	108	122	372	503	1070	1290	1350	0.23	56	44	0	0	0	0	0
15	27	32	3	62	303.39	53200	23	12	102	114	104	333	446	980	1250	1380	0.07	59	41	0	0	0	0	0
16	36	42	3	81	303.39	53200	0	0	127	127	127	359	414	852	1090	1330	0.36	57	47	0	0	0	0	0
17	36	46	4	86	303.37	53177	-23	-12	127	115	194	417	516	941	1150	1280	0.13	53	45	0	0	0	0	0
18	32	42	3	77	303.40	53211	34	17	102	119	164	383	499	990	1230	1280	0.00	59	40	0	0	0	0	0
19	29	38	3	70	303.44	53256	45	23	92	115	131	335	437	905	1140	1260	0.00	68	48	0	0	0	0	2
20	27	36	3	66	303.45	53267	11	6	92	98	108	304	402	818	1040	1180	0.00	75	46	0	0	0	0	2
21	24	33	3	60	303.46	53278	11	6	92	98	94	280	350	747	947	1090	0.00	71	48	0	0	0	0	2
22	23	30	3	56	303.46	53278	0	0	92	92	83	255	314	674	851	1010	0.00	83	52	0	0	0	0	2
23	21	27	3	51	303.47	53289	11	6	80	86	74	228	274	605	765	936	0.00	90	53	0	0	0	0	2
24	20	25	3	48	303.45	53267	-22	-11	75	64	66	213	248	543	688	845	0.00	85	41	0	0	0	0	2
25	19	25	3	47	303.45	53267	0	0	60	60	65	189	225	492	632	787	0.00	63	42	0	0	0	0	2
26	18	23	3	44	303.47	53289	22	11	50	61	60	171	204	451	587	726	0.00	73	47	0	0	0	0	3
27	17	21	3	41	303.51	53334	45	23	50	73	55	161	189	408	545	683	0.00	82	49	0	0	0	0	3
28	16	20	2	38	303.52	53345	11	6	50	56	51	152	172	383	518	630	0.00	88	50	0	0	0	0	3
29	16	19	2	37	303.53	53356	11	6	57	63	47	151	150	349	483	610	0.00	82	49	0	0	0	0	3
30	16	18	2	36	303.49	53311	-45	-23	80	57	46	168	168	334	455	578	0.00	73	53	0	0	0	0	3
31	15	18	2	35	303.46	53278	-33	-17	59	42	46	152	162	379	498	568	0.00	61	53	0	0	0	0	3
TOTALS																	1.85 inches							
cfs	910	1133	97	2140				34	3191	3225	3337	10305	13326	26550	33612	37023	MAX	90	56	0	0	0	0	32
ac-ft	1805	2247	192	4245			67	67	6329	6396	6619	20440	26432	52662	66669	73435	MIN	52	36	0	0	0	0	63

Water storage elevation ± to fill curve:	**-0.04**
Water storage in ac-ft ± to fill curve:	**-45**
Percentage of full reservoir:	**99.9%**

SNOTEL Summary for Water Year 2017

Updated: 5.31.17

SECO W/Y pc:	91.5"	snow depth/water content	0
SDMO W/Y pc:	127.1"	snow depth/water content	0

Minimum Required Discharges

Dec-Sept: 10 cfs Oct-Nov: 20 cfs

RESERVOIR DELIVERY STATUS

These allocations, amounts used and remaining are provisional and subject to daily changes as the WS elevation rises and falls. These numbers are for planning purposes only.

	USED	REMAINING
TVID	85	
CWS	0	12615
LO	0	500
MUNI	0	13500
Other	63	

SCOGGINS DAM -- RESERVOIR OPERATIONS
June 2017

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOT INFLO (cfs) [4]	W.S. ELEV (ft) [5]	STOR CONT (ac-ft) [6]	CHNG STOR (ac-ft) [7]	CHNG STOR (cfs) [8]	REL (cfs) [9]	COMP INFLO (cfs) [10]	GASO (cfs) [11]	DLLO (cfs) [12]	GOLF (cfs) [13]	ROOD (cfs) [14]	FRMO (cfs) [15]	WSLO (cfs) [16]	PRECIP (inches) [17]	TEMP MAX (°F) [18]	TEMP MIN (°F) [19]	TVID (cfs) [20]	CWS (cfs) [21]	LO (cfs) [22]	MUNI (cfs) [23]	OTHR (cfs) [24]
1	15	17	2	34	303.49	53311	33	17	50	67	43	140	116	336	450	584	0.07	73	57	0	0	0	0	3
2	14	16	2	32	303.47	53289	-22	-11	60	49	41	145	147	314	422	547	0.01	66	51	0	0	0	0	3
3	14	16	2	32	303.47	53289	0	0	48	48	38	134	124	291	405	522	0.00	74	54	0	0	0	0	3
4	13	15	2	30	303.47	53289	0	0	48	48	37	131	122	264	378	497	0.00	65	48	0	0	0	0	3
5	13	14	2	29	303.44	53256	-33	-17	48	31	35	126	119	260	366	473	0.00	68	39	0	0	0	0	3
6	12	14	2	28	303.46	53278	22	11	32	43	33	111	87	233	345	450	0.00	77	48	0	0	0	0	3
7	12	13	2	27	303.47	53289	11	6	26	32	29	105	76	202	310	420	0.00	82	49	0	0	0	0	3
8	13	14	2	29	303.50	53323	34	17	25	42	32	106	89	199	298	427	0.22	73	56	0	0	0	0	3
9	12	13	2	27	303.45	53267	-56	-28	51	23	30	127	111	282	384	445	0.00	61	49	0	0	0	0	3
10	12	13	2	27	303.43	53244	-23	-12	29	17	30	111	106	273	389	497	0.08	60	48	0	0	0	0	3
11	12	14	2	28	303.43	53244	0	0	29	29	35	119	105	321	434	547	0.02	60	48	0	0	0	0	3
12	11	12	2	25	303.43	53244	0	0	29	29	28	111	100	275	391	527	0.00	68	46	0	0	0	0	3
13	11	12	2	25	303.42	53233	-11	-6	26	20	27	105	79	222	342	478	0.00	61	50	0	0	0	0	3
14	11	12	2	25	303.42	53233	0	0	26	26	26	100	74	200	310	423	0.01	62	44	0	0	0	0	3
15	11	12	2	25	303.42	53233	0	0	26	26	27	101	85	191	299	397	0.07	65	43	0	0	0	0	3
16	14	23	3	40	303.47	53289	56	28	30	58	53	148	141	349	432	492	0.38	61	54	0	0	0	0	3
17	12	15	2	29	303.48	53300	11	6	32	38	38	130	149	368	483	568	0.00	64	53	0	0	0	0	3
18	11	13	2	26	303.49	53311	11	6	32	38	29	113	107	293	422	573	0.00	75	56	0	0	0	0	3
19	10	12	2	24	303.49	53311	0	0	32	32	26	105	89	238	357	497	0.00	78	56	0	0	0	0	3
20	10	11	2	23	303.48	53300	-11	-6	32	26	22	99	63	187	305	432	0.00	88	56	0	0	0	0	3
21	9	11	2	22	303.43	53244	-56	-28	47	19	21	107	61	141	251	368	0.00	77	43	0	10	0	0	3
22	9	10	1	20	303.28	53077	-167	-84	131	47	22	173	96	137	234	314	0.00	74	43	0	10	0	55	3
23	9	9	1	19	303.11	52888	-189	-95	142	47	21	164	79	172	269	306	0.00	81	55	39	10	0	60	3
24	8	9	1	18	302.89	52643	-245	-124	176	52	21	218	101	136	235	314	0.00	90	54	46	20	0	55	3
25	8	9	1	18	302.64	52365	-278	-140	177	37	20	214	102	154	251	296	0.00	96	59	80	20	0	55	3
26	8	9	1	18	302.41	52111	-254	-128	177	49	19	212	105	156	254	303	0.00	99	56	81	20	0	55	3
27	8	9	1	18	302.16	51835	-276	-139	165	26	24	209	110	163	255	303	0.00	75	55	79	20	0	45	3
28	8	9	1	18	301.94	51592	-243	-123	152	29	23	196	98	172	270	310	0.00	75	48	76	20	0	35	3
29	8	9	1	18	301.73	51361	-231	-116	147	31	32	203	99	153	257	321	0.00	73	48	76	20	0	30	3
30	8	8	1	17	301.54	51152	-209	-105	147	42	31	201	96	154	249	310	0.00	81	53	76	20	0	30	4
TOTALS																	0.86 inches							
cfs	326	373	52	751				-1072	2172	1100	893	4264	3036	6836	10047	12941	MAX	99	59	553	170	0	420	91
ac-ft	647	740	103	1490			-2126	-2126	4308	2182	1771	8458	6022	13559	19928	25668	MIN	60	39	1097	337	0	833	180

Water storage elevation ± to fill curve:	**-1.96**
Water storage in ac-ft ± to fill curve:	**-2171**
Percentage of full reservoir:	**95.9%**

SNOTEL Summary for Water Year 2017
Updated: June 30, 2017

SECO W/Y pc:	92.9"	snow depth/water content	0
SDMO W/Y pc:	130.5"	snow depth/water content	0

Minimum Required Discharges
Dec-Sept: 10 cfs Oct-Nov: 20 cfs

RESERVOIR DELIVERY STATUS

These allocations, amounts used and remaining are provisional and subject to daily changes as the WS elevation rises and falls. These numbers are for planning purposes only.

	USED	REMAINING
TVID	1182	
CWS	337	12278
LO	0	500
MUNI	833	12667
Other	244	

SCOGGINS DAM -- RESERVOIR OPERATIONS
July 2017

DAY	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
	SCHO	SCLO	TANO	TOT INFLO	W.S. ELEV	STOR CONT	CHNG STOR	CHNG STOR	REL	COMP INFLO	GASO	DLLO	GOLF	ROOD	FRMO	WSLO	PRECIP	TEMP MAX	TEMP MIN	TVID	CWS	LO	MUNI	OTHR
	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ac-ft)	(ac-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(inches)	(°F)	(°F)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
1	7	8	1	16	301.33	50922	-230	-116	152	36	29	203	95	134	239	299	0.00	85	55	82	20	0	30	4
2	7	8	1	16	301.10	50671	-251	-127	150	23	30	203	91	137	235	285	0.00	77	49	80	20	0	30	4
3	7	8	1	16	300.90	50452	-219	-110	151	41	28	201	96	137	234	285	0.00	82	50	81	20	0	30	4
4	7	8	1	16	300.66	50191	-261	-132	164	32	28	215	97	123	225	278	0.00	76	49	99	20	0	24.99	4
5	7	7	1	15	300.43	49941	-250	-126	164	38	26	212	96	134	225	268	0.00	84	52	100	20	0	25	4
6	6	7	1	14	300.70	49659	-282	-142	170	28	25	216	92	130	225	268	0.00	90	50	97	20	0	34.99	4
7	6	7	1	14	299.93	49399	-260	-131	165	34	25	208	105	125	220	262	0.00	88	52	97	20	0	30	4
8	6	7	1	14	299.67	49118	-281	-142	163	21	26	207	103	122	216	258	0.00	71	47	90	20	0	35	4
9	6	7	1	14	299.44	48871	-247	-125	161	36	24	201	101	118	216	255	0.00	86	49	88	20	0	34.99	4
10	6	7	1	14	299.20	48613	-258	-130	162	32	23	201	105	115	203	258	0.00	83	50	89	20	0	35	4
11	6	6	1	13	298.96	48356	-257	-130	157	27	71	210	95	103	199	242	0.00	76	45	85	20	0	35	4
12	6	6	1	13	298.74	48120	-236	-119	151	32	70	205	98	100	188	227	0.00	79	49	84	30	0	20	4
13	6	6	1	13	298.53	47896	-224	-113	146	33	69	198	104	102	189	221	0.00	83	54	88	30	3	8	4
14	6	10	1	17	298.34	47694	-202	-102	136	34	68	185	94	104	193	236	0.00	75	49	79	30	3	3	4
15	6	9	1	16	298.08	47417	-277	-140	174	34	66	229	108	97	187	233	0.00	85	49	81	50	3	20	4
16	6	9	1	16	297.81	47131	-286	-144	175	31	66	226	110	112	206	230	0.00	79	46	82	50	3	20	4
17	6	9	1	16	297.53	46835	-296	-149	176	27	67	229	118	121	211	239	0.00	73	47	83	50	3	20	4
18	5	9	1	15	297.26	46550	-285	-144	175	31	65	226	103	116	207	246	0.00	80	50	83	50	3	20	4
19	5	9	1	15	296.99	46266	-284	-143	175	32	63	223	107	109	194	236	0.00	84	48	83	50	3	20	4
20	5	9	1	15	296.71	45972	-294	-148	177	29	64	227	105	110	198	227	0.00	80	51	80	50	3	25	4
21	5	9	1	15	296.43	45679	-293	-148	183	35	65	235	107	104	194	233	0.00	72	51	81	50	3	30	4
22	5	9	1	15	296.15	45387	-292	-147	188	41	62	236	112	116	201	230	0.00	83	54	81	50	3	35	4
23	5	8	1	14	295.86	45085	-302	-152	187	35	60	233	104	109	206	239	0.00	90	59	81	50	3	35.01	4
24	5	8	1	14	295.56	44773	-312	-157	187	30	60	233	115	106	195	236	0.00	83	51	81	50	3	35	4
25	4	8	1	13	295.30	44504	-269	-136	168	32	59	209	99	104	194	230	0.00	88	52	83	50	3	15	4
26	4	8	1	13	294.97	44164	-340	-171	194	23	57	238	104	91	178	221	0.00	89	54	99	50	3	25	4
27	4	8	1	13	294.63	43814	-350	-176	204	28	58	251	102	92	178	210	0.00	87	52	99	50	3	35	4
28	4	8	1	13	294.30	43476	-338	-170	194	24	55	228	107	96	184	207	0.00	77	47	99	50	3	25	4
29	4	8	1	13	293.98	43149	-327	-165	201	36	54	235	100	95	183	213	0.00	81	49	101	50	3	30	4
30	4	8	1	13	293.64	42802	-347	-175	200	25	54	235	105	94	181	213	0.00	87	53	100	50	3	30	4
31	4	7	1	12	293.31	42467	-335	-169	200	31	54	236	104	100	185	215	0.00	88	52	101	50	3	30	4
TOTALS																	0.00 inches							
cfs	170	245	31	446				-4379	5350	971	1571	6794	3182	3456	6289	7500	MAX	90	59	2737	1160	57	826	124
ac-ft	337	486	61	885			-8685	-8685	10612	1927	3116	13476	6311	6855	12474	14876	MIN	71	45	5429	2301	113	1638	246

Water storage elevation ± to fill curve:	**-10.19**
Water storage in ac-ft ± to fill curve:	**-10856**
Percentage of full reservoir:	**79.6%**

SNOTEL Summary for Water Year 2017			
Updated: July 31, 2017			
SECO W/Y pc:	93.2"	snow depth/water content	0
SDMO W/Y pc:	130.3"	snow depth/water content	0

Minimum Required Discharges
Dec-Sept: 10 cfs Oct-Nov: 20 cfs

RESERVOIR DELIVERY STATUS		USED	REMAINING
These allocations, amounts used and	TVID	6611	
remaining are provisional and subject	CWS	2638	9977
to daily changes as the WS elevation	LO	113	387
rises and falls. These numbers are for	MUNI	2471	11029
planning purposes only.	Other	490	

SCOGGINS DAM -- RESERVOIR OPERATIONS
August 2017

DAY	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
	SCHO	SCLO	TANO	TOT INFLO	W.S. ELEV	STOR CONT	CHNG STOR	CHNG STOR	REL	COMP INFLO	GASO	DLLO	GOLF	ROOD	FRMO	WSLO	PRECIP	TEMP MAX	TEMP MIN	TVID	CWS	LO	MUNI	OTHR
	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ac-ft)	(ac-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(inches)	(°F)	(°F)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
1	4	7	1	12	292.94	42093	-374	-189	210	21	52	251	98	93	184	213	0.00	92	56	106	50	3	35	4
2	3	7	1	11	292.53	41680	-413	-208	230	22	51	273	95	123	170	207	0.00	97	60	122	50	3	39.99	4
3	3	7	1	11	292.11	41258	-422	-213	243	30	50	287	109	123	165	199	0.00	104	61	130	50	3	45	4
4	3	6	1	10	291.70	40849	-409	-206	232	26	49	276	105	128	178	201	0.00	104	56	129	50	3	35	5
5	3	6	1	10	291.27	40421	-428	-216	232	16	51	278	114	136	180	204	0.00	94	50	124	50	3	40	5
6	3	7	1	11	290.84	39995	-426	-215	232	17	52	281	126	145	192	213	0.00	86	55	123	50	3	40	5
7	3	7	1	11	290.43	39590	-405	-204	232	28	51	279	128	157	204	224	0.00	89	59	123	50	3	40	5
8	3	6	1	10	290.09	39256	-334	-168	202	34	51	238	98	148	202	236	0.00	92	57	109	50	3	25	5
9	3	6	1	10	289.75	38922	-334	-168	194	26	50	224	89	128	176	230	0.00	94	57	106	50	3	20	5
10	3	6	1	10	289.40	38580	-342	-172	206	34	50	240	90	122	170	213	0.00	96	58	103	50	3	34.99	5
11	3	6	1	10	298.02	38210	-370	-187	205	18	49	239	92	119	169	204	0.00	92	59	102	50	3	35.01	4
12	3	6	1	10	288.70	37900	-310	-156	187	31	50	215	98	125	171	213	0.00	87	56	90	50	3	30	4
13	4	8	1	13	288.38	37590	-310	-156	187	31	54	218	100	123	170	221	0.15	79	59	87	50	3	29.99	4
14	3	7	1	11	288.05	37272	-318	-160	187	27	54	220	139	149	188	230	0.00	73	45	89	50	3	30	4
15	3	7	1	11	287.75	36984	-288	-145	164	19	53	192	93	147	203	246	0.00	75	49	78	50	3	18.01	4
16	3	7	1	11	287.48	36725	-259	-131	164	33	52	190	94	124	170	242	0.00	81	50	78	50	3	18	4
17	3	6	1	10	287.20	36457	-268	-135	170	35	51	198	97	114	163	218	0.00	84	53	85	50	3	18.01	4
18	3	6	1	10	286.90	36171	-286	-144	178	34	51	206	93	111	157	193	0.00	81	50	83	50	3	28	4
19	3	6	1	10	286.56	35848	-323	-163	192	29	51	221	100	114	160	190	0.00	80	48	87	60	3	28	4
20	3	6	1	10	286.21	35516	-332	-167	188	21	49	219	103	119	163	190	0.00	78	48	83	60	3	28	4
21	3	6	1	10	285.87	35196	-320	-161	189	28	49	219	114	126	171	196	0.00	81	54	84	60	3	28.01	4
22	3	6	1	10	285.55	34894	-302	-152	178	26	50	209	105	121	169	201	0.00	91	56	81	60	3	20	4
23	3	4	1	8	285.23	34594	-300	-151	189	38	49	216	100	116	164	201	0.00	89	55	85	60	3	28.01	4
24	3	4	1	8	284.89	34277	-317	-160	193	33	46	219	103	106	157	199	0.00	83	57	87	60	3	31	4
25	3	4	1	8	284.52	33932	-345	-174	193	19	49	221	101	122	164	185	0.00	72	47	90	60	3	28	4
26	3	4	1	8	284.14	33597	-335	-169	204	35	47	232	107	117	163	193	0.00	80	50	96	65	3	28	4
27	2	4	1	7	283.77	33238	-359	-181	203	22	47	232	119	121	168	196	0.00	91	52	96	65	3	28	4
28	2	3	1	6	283.41	32906	-332	-167	204	37	47	233	122	134	180	204	0.00	95	55	98	65	3	28	4
29	2	3	1	6	283.04	32567	-339	-171	200	29	46	226	105	124	164	213	0.00	97	55	94	65	3	27.99	4
30	2	3	1	6	282.64	32201	-366	-185	209	24	47	239	105	116	155	207	0.00	87	50	91	65	3	40	4
31	2	4	1	7	282.26	31855	-346	-174	200	26	47	226	100	117	154	201	0.00	80	55	91	65	3	30	4
TOTALS																	0.15 inches							
cfs	90	175	31	296				-5350	6197	847	1545	7217	3242	3868	5344	6483	MAX	104	61	3030	1710	93	935	131
ac-ft	179	347	61	587			-10612	-10612	12292	1680	3065	14315	6431	7672	10600	12859	MIN	2 days	45	6010	3392	184	1855	260

Water storage elevation ± to fill curve:	**-21.24**
Water storage in ac-ft ± to fill curve:	**-21468**
Percentage of full reservoir:	**59.7%**

SNOTEL Summary for Water Year 2017
Updated: August 31, 2017

SECO W/Y pc:	93.3"	snow depth/water content	0
SDMO W/Y pc:	130.6"	snow depth/water content	0

Minimum Required Discharges
Dec-Sept: 10 cfs   Oct-Nov: 20 cfs

RESERVOIR DELIVERY STATUS

These allocations, amounts used and remaining are provisional and subject to daily changes as the WS elevation rises and falls. These numbers are for planning purposes only.

	USED	REMAINING
TVID	12621	
CWS	6030	6585
LO	298	202
MUNI	4326	9174
Other	750	

SCOGGINS DAM -- RESERVOIR OPERATIONS
September 2017

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOT INFLO (cfs) [4]	W.S. ELEV (ft) [5]	STOR CONT (ac-ft) [6]	CHNG STOR (ac-ft) [7]	CHNG STOR (cfs) [8]	REL (cfs) [9]	COMP INFLO (cfs) [10]	GASO (cfs) [11]	DLLO (cfs) [12]	GOLF (cfs) [13]	ROOD (cfs) [14]	FRMO (cfs) [15]	WSLO (cfs) [16]	PRECIP (inches) [17]	TEMP MAX (°F) [18]	TEMP MIN (°F) [19]	TVID (cfs) [20]	CWS (cfs) [21]	LO (cfs) [22]	MUNI (cfs) [23]	OTHR (cfs) [24]
1	2	4	1	7	281.89	31520	-335	-169	200	31	48	225	101	121	158	201	0.00	82	52	91	65	3	30	4
2	2	3	1	6	281.44	31114	-406	-205	230	25	56	281	119	119	155	204	0.00	94	54	99	65	3	53	4
3	2	3	1	6	280.99	30709	-405	-204	231	27	55	281	135	137	174	204	0.00	99	57	100	65	3	53	4
4	2	3	1	6	280.54	30307	-402	-203	231	28	56	282	155	150	185	224	0.00	95	58	100	65	3	53	4
5	2	3	1	6	280.09	29907	-400	-202	230	28	55	283	154	158	202	236	0.00	93	61	99	65	3	53	4
6	2	3	1	6	279.72	29580	-327	-165	189	24	74	238	118	152	203	249	0.00	92	60	86	55	3	35	4
7	2	3	1	6	279.41	29306	-274	-138	167	29	75	213	107	135	185	242	0.00	81	62	79	45	3	30	4
8	2	3	1	6	279.11	29043	-263	-133	168	35	76	216	113	124	173	233	0.05	85	60	81	45	3	30	3
9	3	4	1	8	278.82	28789	-254	-128	158	30	77	208	105	121	170	221	0.00	73	60	69	45	3	30	3
10	2	4	1	7	278.54	28544	-245	-124	158	34	77	207	116	120	171	218	0.00	77	59	70	45	3	30	3
11	2	3	1	6	278.24	28283	-261	-132	158	26	77	206	115	130	178	218	0.00	79	50	71	45	3	35	3
12	2	3	1	6	277.95	28032	-251	-127	158	31	76	204	99	124	171	215	0.00	94	48	83	45	3	35	3
13	2	3	1	6	277.62	27747	-285	-144	175	31	75	223	116	107	155	204	0.00	85	53	83	45	3	35	3
14	2	3	1	6	277.29	27463	-284	-143	170	27	75	218	115	120	165	196	0.00	75	44	83	45	3	30	3
15	2	3	1	6	276.96	27180	-283	-143	168	25	76	219	133	128	173	199	0.00	75	48	82	45	3	30	2
16	2	3	1	6	276.65	26915	-265	-134	161	27	76	208	122	133	183	213	0.00	79	49	75	45	3	30	2
17	2	3	1	6	276.34	26651	-264	-133	161	28	75	207	131	133	181	221	0.00	76	49	75	45	3	30	2
18	4	6	1	11	276.07	26422	-229	-115	162	47	86	220	147	151	197	249	0.29	63	51	71	45	3	30	2
19	6	11	2	19	275.90	26278	-144	-73	126	53	103	205	168	211	267	325	0.57	61	49	37	45	3	20	2
20	12	25	3	40	275.82	26211	-67	-34	98	64	118	193	167	330	372	507	0.62	62	50	13	30	3	10	2
21	4	7	1	12	275.69	26101	-110	-55	90	35	86	161	175	412	548	662	0.00	59	42	43	30	3	0	2
22	3	5	1	9	275.56	25991	-110	-55	76	21	77	140	114	264	395	547	0.05	62	45	33	20	3	0	1
23	3	5	1	9	275.46	25907	-84	-42	67	25	72	126	98	173	255	397	0.00	69	47	34	20	3	0	1
24	3	4	1	8	275.35	25815	-92	-46	67	21	71	124	92	136	201	296	0.00	70	46	35	20	3	0	1
25	3	4	1	8	275.25	25731	-84	-42	67	25	70	122	90	127	178	252	0.00	74	50	35	20	3	0	1
26	3	4	1	8	275.11	25614	-117	-59	87	28	70	138	89	117	168	233	0.01	66	53	30	30	3	15	1
27	3	4	1	8	274.95	25480	-134	-68	94	26	69	143	93	136	179	224	0.00	79	53	22	40	3	20	1
28	3	4	1	8	274.79	25347	-133	-67	87	20	69	147	100	119	169	227	0.00	85	54	25	40	3	10	1
29	3	4	1	8	274.66	25283	-64	-32	74	42	69	138	97	124	170	224	0.03	84	55	16	40	3	5	2
30	3	5	1	9	274.48	25089	-194	-98	80	-18	72	147	103	122	171	233	0.12	66	44	16	40	3	10	2
TOTALS																	1.74 inches							
cfs	88	142	33	263				-3411	4288	877	2211	5923	3587	4634	6252	8074	MAX	99	62	1836	1295	90	742	74
ac-ft	175	282	65	522			-6766	-6766	8505	1739	4386	11748	7115	9192	12401	16015	MIN	59	42	3642	2569	179	1472	147

Water storage elevation ± to fill curve:	**-29.02**
Water storage in ac-ft ± to fill curve:	**-28234**
Percentage of full reservoir:	**47.1%**

SNOTEL Summary for Water Year 2017

Updated: September 30, 2017

SECO W/Y pc:	95.8"	snow depth/water content	0
SDMO W/Y pc:	135.5"	snow depth/water content	0

Minimum Required Discharges

Dec-Sept: 10 cfs   Oct-Nov: 20 cfs

RESERVOIR DELIVERY STATUS

These allocations, amounts used and remaining are provisional and subject to daily changes as the WS elevation rises and falls. These numbers are for planning purposes only.

	USED	REMAINING
TVID	16263	
CWS	8598	4017
LO	476	24
MUNI	5798	7702
Other	897	

SCOGGINS DAM -- RESERVOIR OPERATIONS
October 2017

DAY	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
	SCHO	SCLO	TANO	TOT INFLO	W.S. ELEV	STOR CONT	CHNG STOR	CHNG STOR	REL	COMP INFLO	GASO	DLLO	GOLF	ROOD	FRMO	WSLO	PRECIP	TEMP MAX	TEMP MIN	TVID	CWS	LO	MUNI	OTHR
	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ac-ft)	(ac-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(inches)	(°F)	(°F)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
1	3	5	1	9	274.30	24939	-150	-76	79	3	72	148	101	127	181	236	0.07	64	46	15	40	3	10	2
2	3	4	1	8	274.14	24807	-132	-67	82	15	71	146	102	128	180	242	0.00	64	42	19	40	3	10	2
3	3	4	1	8	273.94	24642	-165	-83	96	13	55	140	100	130	180	239	0.00	64	41	23	50	3	10	2
4	3	4	1	8	273.76	24494	-148	-75	85	10	55	133	94	120	173	236	0.00	69	38	22	50	3	0	2
5	2	4	1	7	273.56	24329	-165	-83	90	7	49	130	96	112	163	224	0.00	70	38	31	50	0	0	2
6	2	4	1	7	273.38	24182	-147	-74	92	18	48	129	94	114	163	213	0.00	73	40	33	50	0	0	2
7	3	4	1	8	273.19	24026	-156	-79	93	14	48	138	91	112	161	218	0.02	70	42	16	55	0	12	2
8	3	5	1	9	272.97	23847	-179	-90	92	2	52	144	102	110	161	215	0.00	61	42	14	55	0	12	2
9	3	5	1	9	272.76	23676	-171	-86	93	7	50	142	103	123	173	215	0.00	64	37	15	55	0	12	2
10	3	4	1	8	272.56	23514	-162	-82	93	11	37	126	98	122	173	221	0.00	68	39	16	55	0	12	2
11	4	5	1	10	272.36	23352	-162	-82	100	18	38	134	105	123	170	236	0.31	54	39	13	55	0	20	2
12	3	6	1	10	272.18	23206	-146	-74	93	19	40	131	103	142	192	268	0.15	57	40	11	55	0	15	2
13	5	8	1	14	272.02	23078	-128	-65	75	10	60	138	102	170	227	303	0.23	55	40	5	45	0	10	1
14	3	6	1	10	271.85	22941	-137	-69	79	10	44	129	99	173	240	317	0.00	57	33	8	45	0	15	1
15	3	5	1	9	271.67	22797	-144	-73	79	6	41	123	89	156	235	303	0.00	58	34	9	45	0	15	1
16	3	5	1	9	271.48	22644	-153	-77	80	3	39	120	87	134	195	282	0.00	68	38	10	45	0	15	1
17	3	5	1	9	271.27	22477	-167	-84	96	12	39	131	87	133	180	246	0.00	67	40	16	45	0	25	1
18	3	5	1	9	271.14	22373	-104	-52	75	23	40	126	107	125	175	239	0.04	56	45	5	45	0	15	1
19	12	19	2	33	271.04	22293	-80	-40	75	35	48	131	91	144	195	249	0.70	63	50	1	45	0	15	1
20	10	30	3	43	270.92	22198	-95	-48	113	65	111	247	276	361	420	557	0.65	54	47	4	45	0	20	1
21	20	51	4	75	270.87	22158	-40	-20	69	49	111	202	230	428	581	646	0.73	55	46	5	10	0	15	1
22	125	380	33	538	272.07	23118	960	484	68	552	na	607	1010	1100	1320	1880	3.15	59	46	5	10	0	15	1
23	27	92	7	126	272.56	23514	396	200	27	227	543	826	1070	2040	2480	2040	0.00	63	44	5	10	0	15	1
24	15	54	4	73	272.68	23611	97	49	33	82	235	533	835	1530	2020	2150	0.00	66	42	0	0	0	28	1
25	12	38	3	53	272.76	23676	65	33	21	54	137	287	473	966	1350	1580	0.00	72	41	1	0	0	0	1
26	10	31	3	44	272.77	23684	8	4	21	25	98	195	284	588	857	1090	0.00	66	42	1	0	0	0	1
27	8	26	3	37	272.76	23676	-8	-4	22	18	85	158	211	405	583	754	0.00	69	49	0	0	0	0	1
28	7	22	3	32	272.83	23733	57	29	22	51	76	132	165	327	460	557	0.00	73	45	2	0	0	0	1
29	7	20	2	29	272.83	23733	0	0	22	22	69	119	143	268	378	464	0.00	71	43	2	0	0	0	1
30	6	19	2	27	272.78	23692	-41	-21	21	0	65	111	127	232	330	401	0.00	58	44	1	0	0	0	1
31	6	18	2	26	272.71	23635	-57	-29	22	-7	63	112	110	207	295	348	0.00	63	33	2	0	0	0	1
TOTALS																	6.05 inches							
cfs	320	888	89	1297				-733	2108	1375	2519	6068	6785	10950	14591	17169	MAX	73	50	310	1000	12	316	43
ac-ft	635	1761	177	2573			-1454	-1454	4181	2727	4996	12036	13458	21719	28941	34055	MIN	54	33	615	1984	24	627	85

Water storage elevation ± to fill curve:	**-30.79**
Water storage in ac-ft ± to fill curve:	**-29688**
Percentage of full reservoir:	**44.3%**

SNOTEL Summary for Water Year 2018

Updated: 10.31.17

SECO W/Y pc:	9.10"	snow depth/water content	0
SDMO W/Y pc:	13.90"	snow depth/water content	0

Minimum Required Discharges

Dec-Sept: 10 cfs Oct-Nov: 20 cfs

RESERVOIR DELIVERY STATUS		USED	REMAINING
These allocations, amounts used and remaining are provisional and subject to daily changes as the WS elevation rises and falls. These numbers are for planning purposes only.	TVID	16878	
	CWS	10582	2033
	LO	500	0
	MUNI	6425	7075
	Other	982	

SCOGGINS DAM -- RESERVOIR OPERATIONS

November 2017

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO	SCLO	TANO	TOT INFLO	W.S. ELEV	STOR CONT	CHNG STOR	CHNG STOR	REL	COMP INFLO	GASO	DLLO	GOLF	ROOD	FRMO	WSLO	PRECIP	TEMP MAX	TEMP MIN	TVID	CWS	LO	MUNI	OTHR
	(cfs)	(cfs)	(cfs)	(cfs)	(ft)	(ac-ft)	(ac-ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(inches)	(°F)	(°F)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]
1	6	17	2	25	272.70	23627	-8	-4	21	17	59	108	103	188	267	314	0.00	63	33	3	0	0	0	1
2	6	17	2	25	272.59	23538	-89	-45	21	-24	59	107	94	181	253	292	0.01	57	39	2	0	0	0	0
3	10	31	3	44	272.67	23603	65	33	21	54	86	133	118	168	243	289	0.28	54	36	2	0	0	0	1
4	8	25	3	36	272.67	23603	0	0	20	20	79	128	173	208	275	299	0.02	48	36	2	0	0	0	0
5	27	71	5	103	272.76	23643	40	20	21	41	156	169	163	259	349	445	0.95	46	37	2	0	0	0	1
6	15	45	3	63	272.82	23725	82	41	20	61	183	235	381	408	522	482	0.00	50	38	1	0	0	0	0
7	12	36	3	51	272.83	23733	8	4	21	25	125	179	273	438	597	568	0.00	48	35	1	0	0	0	1
8	10	31	3	44	272.88	23774	41	21	21	42	96	149	208	343	442	563	0.00	48	38	1	0	0	0	0
9	41	84	7	132	273.05	23912	138	70	22	92	192	219	264	379	451	641	1.02	46	42	1	0	0	0	1
10	60	114	10	184	273.44	24231	319	161	21	182	369	344	539	655	700	857	0.67	53	43	1	0	0	0	0
11	39	90	8	137	273.75	24485	254	128	21	149	334	382	680	985	1130	1050	0.16	52	46	0	0	0	0	1
12	37	101	9	147	273.98	24675	190	96	21	117	301	340	565	921	1120	1190	0.28	55	48	1	0	0	0	0
13	66	177	17	260	274.37	24997	322	162	21	183	596	434	619	887	1040	1230	0.61	54	48	0	0	0	0	1
14	60	185	20	265	274.92	25455	458	231	21	252	603	553	946	1260	1440	1380	0.34	54	44	1	0	0	0	0
15	104	279	28	411	275.41	25865	410	207	22	229	510	542	950	1420	1680	1630	0.76	54	45	0	0	0	0	1
16	111	265	27	403	276.33	26642	777	392	22	414	756	716	1260	1960	2350	2380	0.63	46	43	1	0	0	0	0
17	111	243	26	380	277.04	27248	606	306	54	360	749	799	1430	2150	2650	2640	0.78	46	40	30	0	0	0	1
18	88	191	22	301	277.61	27738	490	247	54	301	652	797	1510	2180	2700	2660	0.06	50	39	30	0	0	0	0
19	66	144	12	222	278.01	28084	346	174	54	228	510	716	1410	2120	2630	2580	0.00	50	37	30	0	0	0	1
20	220	637	46	903	278.77	28745	661	333	58	391	na	718	1300	2120	2600	2830	1.57	52	38	30	0	0	0	0
21	136	342	32	510	280.00	29827	1082	546	57	603	632	1030	1870	2430	2990	2980	0.19	56	43	30	0	0	0	0
22	125	321	31	477	280.88	30611	784	395	57	452	606	968	2200	2640	3260	3400	0.53	57	47	1	0	0	0	0
23	121	302	30	453	281.65	31303	692	349	57	406	577	941	2240	2770	3450	3630	0.02	61	55	0	0	0	0	0
24	128	287	28	443	282.47	32046	743	375	58	433	600	952	2200	2870	3560	3620	0.39	60	41	1	0	0	0	0
25	99	213	23	335	282.81	32356	310	156	206	362	497	956	2110	2880	3570	3580	0.00	53	38	0	0	0	0	0
26	94	188	20	302	283.01	32539	183	92	207	299	433	895	1970	2870	3560	3590	0.41	47	39	1	0	0	0	0
27	76	155	14	245	283.14	32658	119	60	207	267	393	857	1790	2890	3590	3680	0.14	49	36	0	0	0	0	0
28	68	133	12	213	283.18	32695	37	19	207	226	322	801	1580	2760	3460	3520	0.10	45	37	1	0	0	0	0
29	71	138	12	221	283.27	32777	82	41	207	248	359	797	1450	2730	3410	3510	0.29	45	41	0	0	0	0	0
30	65	124	11	200	283.26	32768	-9	-5	207	202	310	764	1220	2550	3220	3320	0.00	45	38	1	0	0	0	0
TOTALS																	10.21 inches							
cfs	2080	4986	469	7535				4605	2027	6632	11144	16729	31616	46620	57509	59150	MAX	63	55	174	0	0	0	10
ac-ft	4126	9890	930	14946			9133	9133	4021	13154	22104	33182	62710	92471	114069	117324	MIN	45	33	345	0	0	0	20

Water storage elevation ± to fill curve:	**-0.24**
Water storage in ac-ft ± to fill curve:	**-221**
Percentage of full reservoir:	**61.5%**

SNOTEL Summary for Water Year 2018

Updated: November 30, 2017

SECO W/Y pc:	35.6"	snow depth/water content	0
SDMO W/Y pc:	23.7"	snow depth/water content	0

Minimum Required Discharges

Dec-Sept: 10 cfs   Oct-Nov: 20 cfs

RESERVOIR DELIVERY STATUS

These allocations, amounts used and remaining are provisional and subject to daily changes as the WS elevation rises and falls. These numbers are for planning purposes only.

	USED	REMAINING
TVID	17223	
CWS	10582	2033
LO	500	0
MUNI	6425	7075
Other	1002	

SCOGGINS DAM -- RESERVOIR OPERATIONS
December 2017

	INFLOW				HENRY HAGG LAKE						TUALATIN RIVER						WEATHER			WATER DELIVERIES				
DAY	SCHO (cfs) [1]	SCLO (cfs) [2]	TANO (cfs) [3]	TOT INFLO (cfs) [4]	W.S. ELEV (ft) [5]	STOR CONT (ac-ft) [6]	CHNG STOR (ac-ft) [7]	CHNG STOR (cfs) [8]	REL (cfs) [9]	COMP INFLO (cfs) [10]	GASO (cfs) [11]	DLLO (cfs) [12]	GOLF (cfs) [13]	ROOD (cfs) [14]	FRMO (cfs) [15]	WSLO (cfs) [16]	PRECIP (inches) [17]	TEMP MAX (°F) [18]	TEMP MIN (°F) [19]	TVID (cfs) [20]	CWS (cfs) [21]	LO (cfs) [22]	MUNI (cfs) [23]	OTHR (cfs) [24]
1	58	112	10	180	283.24	32750	-18	-9	207	198	280	727	1140	2390	3000	3090	0.16	44	40	0	0	0	0	0
2	58	112	10	180	283.21	32722	-28	-14	208	194	276	697	1060	2200	2770	2880	0.15	46	41	0	0	0	0	0
3	68	126	11	205	283.25	32759	37	19	208	227	336	738	1070	2160	2690	2840	0.47	44	34	0	0	0	0	0
4	61	110	10	181	283.22	32732	-27	-14	207	193	288	729	1050	2100	2620	2690	0.01	48	32	0	0	0	0	0
5	56	98	8	162	283.36	32860	128	65	100	165	255	607	963	1980	2470	2520	0.00	46	30	0	0	0	0	0
6	49	86	8	143	283.48	32970	110	55	99	154	226	544	852	1780	2220	2330	0.00	52	31	0	0	0	0	0
7	45	76	6	127	283.57	33053	83	42	100	142	205	485	755	1580	1980	2080	0.00	55	35	0	0	0	0	0
8	41	69	5	115	283.61	33090	37	19	99	118	187	433	677	1340	1670	1800	0.00	52	27	0	0	0	0	0
9	39	64	5	108	283.64	33118	28	14	97	111	173	394	617	1180	1450	1560	0.00	46	26	0	0	0	0	0
10	36	57	4	97	283.66	33136	18	9	98	107	160	367	561	1050	1290	1390	0.00	47	26	0	0	0	0	0
11	34	52	4	90	283.66	33136	0	0	98	98	151	340	504	938	1150	1250	0.00	46	26	0	0	0	0	0
12	31	49	4	84	283.62	33099	-37	-19	97	78	142	322	474	833	1020	1140	0.00	46	26	0	0	0	0	0
13	29	46	4	79	283.58	33062	-37	-19	98	79	135	307	448	775	942	1040	0.00	44	28	0	0	0	0	0
14	28	44	3	75	283.55	33035	-27	-14	97	83	128	293	425	723	878	974	0.00	51	28	0	0	0	0	0
15	26	41	3	70	283.51	32998	-37	-19	79	60	122	265	387	670	813	912	0.00	44	29	0	0	0	0	0
16	21	40	3	64	283.48	32970	-28	-14	78	64	118	256	373	618	749	863	0.02	40	33	0	0	0	0	0
17	20	38	3	61	283.50	32989	19	10	78	88	113	246	358	593	713	816	0.02	41	35	0	0	0	0	0
18	20	37	3	60	283.45	32943	-46	-23	80	57	109	238	345	568	648	787	0.01	45	43	0	0	0	0	0
19	28	54	4	86	283.46	32952	9	5	80	85	122	253	360	558	654	771	0.42	50	43	0	0	0	0	0
20	57	110	10	177	283.85	33311	359	181	78	259	336	529	804	1190	1290	1150	0.84	50	37	0	0	0	0	0
21	43	79	6	128	283.87	33330	19	10	152	162	230	544	791	1570	1860	1690	0.00	46	28	0	0	0	0	0
22	38	70	5	113	283.55	33035	-295	-149	293	144	192	609	782	1490	1810	1810	0.00	40	27	0	0	0	0	0
23	41	61	5	107	283.57	33053	18	9	120	129	219	503	744	1470	1770	1980	0.43	37	33	0	0	0	0	0
24	36	59	5	100	283.57	33053	0	0	120	120	196	468	698	1500	1830	1890	0.00	39	31	0	0	0	0	0
25	35	59	4	98	283.60	33081	28	14	121	135	191	462	672	1400	1710	1850	0.38	33	30	0	0	0	0	0
26	34	58	4	96	283.58	33062	-19	-10	121	111	185	449	655	1380	1680	1790	0.00	36	29	0	0	0	0	0
27	31	54	4	89	283.41	32906	-156	-79	200	121	172	514	658	1310	1600	1700	0.00	35	30	0	0	0	0	0
28	31	54	4	89	283.22	32732	-174	-88	200	112	170	512	657	1250	1510	1610	0.00	39	33	0	0	0	0	0
29	149	262	27	438	283.70	33173	441	222	136	358	636	620	850	1490	1780	2000	1.14	53	39	0	0	0	0	0
30	182	433	37	652	285.13	34501	1328	670	48	718	na	1040	1400	2220	2740	2870	0.96	53	39	0	0	0	0	0
31	122	254	26	402	286.06	35375	874	441	50	491	570	995	1950	2470	3110	3210	0.01	50	32	0	0	0	0	0
TOTALS																	5.02 inches							
cfs	1547	2864	245	4656				1314	3847	5161	6623	15486	23080	42776	52417	55283	MAX	55	43	0	0	0	0	0
ac-ft	3068	5681	486	9235			2607	2607	7631	10238	13137	30716	45779	84846	103969	109654	MIN	33	26	0	0	0	0	0

Water storage elevation ± to fill curve:	**2.56**
Water storage in ac-ft ± to fill curve:	**2386**
Percentage of full reservoir:	**66.3%**

SNOTEL Summary for Water Year 2018
Updated: 12.31.17

SECO W/Y pc:	31.1"	snow depth/water content	0
SDMO W/Y pc:	46.7"	snow depth/water content	0

Minimum Required Discharges
Dec-Sept: 10 cfs Oct-Nov: 20 cfs

RESERVOIR DELIVERY STATUS

These allocations, amounts used and remaining are provisional and subject to daily changes as the WS elevation rises and falls. These numbers are for planning purposes only.

	USED	REMAINING
TVID	17223	
CWS	10582	2033
LO	500	0
MUNI	6425	7075
Other	1002	

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Appendix D

Barney Reservoir Operations
Monthly Records

Breakdown of allocations for municipal use by water provider can be found in Appendix E of this report.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF JANUARY 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY		MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN			
					Min	Max	TRASK	TUALATIN			CWS		MUNICIPAL	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									0	0	0	0	0	0
2									0	0	0	0	0	0
3	1638.9	19360	360	0.57	14	38	3.4	0.0	0	0	0	0	0	0
4	1639.1	19440	80	0.00	14	34	2.8	0.0	0	0	0	0	0	0
5	1639.1	19440	0	0.00	14	30	3.4	0.0	0	0	0	0	0	0
6									0	0	0	0	0	0
7									0	0	0	0	0	0
8									0	0	0	0	0	0
9	1639.8	19720	280	2.05	25	36	0.5	0.0	0	0	0	0	0	0
10									0	0	0	0	0	0
11	1640.3	19920	200	1.41	21	37	0.5	0.0	0	0	0	0	0	0
12									0	0	0	0	0	0
13	1640.5	20000	80	0.00	15	38	4.0	0.0	0	0	0	0	0	0
14									0	0	0	0	0	0
15									0	0	0	0	0	0
16									0	0	0	0	0	0
17	1640.6	20000	0	0.06	14	38	27.6	0.0	0	0	0	0	0	0
18	1641.1	20000	0	3.50	20	40	215.1	0.0	0	0	0	0	0	0
19	1641.1	20000	0	1.43	24	45	251.7	0.0	0	0	0	0	0	0
20									0	0	0	0	0	0
21									0	0	0	0	0	0
22									0	0	0	0	0	0
23	1640.8	20000	0	1.61	24	38	110.8	0.0	0	0	0	0	0	0
24									0	0	0	0	0	0
25	1640.7	20000	0	0.02	18	40	95.2	0.0	0	0	0	0	0	0
26									0	0	0	0	0	0
27	1640.7	20000	0	0.07	24	43	95.2	0.0	0	0	0	0	0	0
28									0	0	0	0	0	0
29									0	0	0	0	0	0
30	1640.7	20000	0	0.01	24	44	55.5	0.0	0	0	0	0	0	0
31									0	0	0	0	0	0
Monthly Totals			1,000	10.73						0		0		0
Year to Date Totals			1,000	10.73						0		0		0

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF FEBRUARY 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY		MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN			
					Min	Max	TRASK	TUALATIN			CWS		MUNICIPAL	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1	1640.7	20000	0	0.00	18	45	55.50	0.0	0	0	0	0	0	0
2									0	0	0	0	0	0
3	1640.6	20000	0	0.10	20	38	41.0	0.0	0	0	0	0	0	0
4									0	0	0	0	0	0
5									0	0	0	0	0	0
6	1640.9	20000	0	8.25	24	44	126.4	0.0	0	0	0	0	0	0
7									0	0	0	0	0	0
8	1640.8	20000	0	0.95	22	37	95.2	0.0	0	0	0	0	0	0
9									0	0	0	0	0	0
10	1641.1	20000	0	4.09	26	52	320.0	0.0	0	0	0	0	0	0
11									0	0	0	0	0	0
12									0	0	0	0	0	0
13	1640.8	20000	0	0.51	24	44	110.8	0.0	0	0	0	0	0	0
14									0	0	0	0	0	0
15	1641.0	20000	0	0.76	25	48	95.2	0.0	0	0	0	0	0	0
16									0	0	0	0	0	0
17	1641.1	20000	0	3.44	32	52	196.9	0.0	0	0	0	0	0	0
18									0	0	0	0	0	0
19									0	0	0	0	0	0
20									0	0	0	0	0	0
21	1640.9	20000	0	2.95	37	45	142.0	0.0	0	0	0	0	0	0
22	1640.9	20000	0	0.02	37	44	110.8	0.0	0	0	0	0	0	0
23									0	0	0	0	0	0
24	1640.9	20000	0	0.20	22	40	79.6	0.0	0	0	0	0	0	0
25									0	0	0	0	0	0
26									0	0	0	0	0	0
27	1640.7	20000	0	0.68	21	38	64.0	0.0	0	0	0	0	0	0
28									0	0	0	0	0	0
Monthly Totals			0	21.95						0		0		0
Year to Date Totals			1,000	32.68						0		0		0

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF MARCH 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY		MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN			
					Min	Max	TRASK	TUALATIN			CWS		MUNICIPAL	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1	1640.7	20000	0	1.20	24	42	64.00	0.0	0	0	0	0	0	0
2									0	0	0	0	0	0
3	1640.9	20000	0	0.38	26	42	64.0	0.0	0	0	0	0	0	0
4									0	0	0	0	0	0
5									0	0	0	0	0	0
6	1640.8	20000	0	4.06	24	44	95.2	0.0	0	0	0	0	0	0
7									0	0	0	0	0	0
8	1640.8	20000	0	1.47	24	43	95.2	0.0	0	0	0	0	0	0
9									0	0	0	0	0	0
10	1641.0	20000	0	1.66	26	51	215.1	0.0	0	0	0	0	0	0
11									0	0	0	0	0	0
12									0	0	0	0	0	0
13	1640.9	20000	0	0.81	30	50	126.4	0.0	0	0	0	0	0	0
14									0	0	0	0	0	0
15	1641.9	20000	0	2.38	38	53	196.9	0.0	0	0	0	0	0	0
16	1640.9	20000	0	0.68	25	53	178.6	0.0	0	0	0	0	0	0
17									0	0	0	0	0	0
18									0	0	0	0	0	0
19									0	0	0	0	0	0
20	1640.9	20000	0	2.12	23	53	126.4	0.0	0	0	0	0	0	0
21									0	0	0	0	0	0
22	1640.8	20000	0	0.95	31	52	110.8	0.0	0	0	0	0	0	0
23									0	0	0	0	0	0
24	1641.0	20000	0	1.21	28	44	110.8	0.0	0	0	0	0	0	0
25									0	0	0	0	0	0
26									0	0	0	0	0	0
27	1640.9	20000	0	2.68	27	48	160.3	0.0	0	0	0	0	0	0
28									0	0	0	0	0	0
29	1640.9	20000	0	0.74	32	42	110.8	0.0	0	0	0	0	0	0
30									0	0	0	0	0	0
31	1640.9	20000	0	0.36	34	50	110.8	0.0	0	0	0	0	0	0
Monthly Totals			0	20.70						0		0		0
Year to Date Totals			1,000	53.38						0		0		0

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF APRIL 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY		MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN			
					Min	Max	TRASK	TUALATIN			CWS		MUNICIPAL	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									0	0	0	0	0	0
2									0	0	0	0	0	0
3	1640.9	20000	0	0.06	24	53	64.0	0.0	0	0	0	0	0	0
4									0	0	0	0	0	0
5	1640.7	20000	0	0.13	31	52	55.5	0.0	0	0	0	0	0	0
6									0	0	0	0	0	0
7	1640.7	20000	0	1.16	33	51	55.5	0.0	0	0	0	0	0	0
8									0	0	0	0	0	0
9									0	0	0	0	0	0
10	1640.7	20000	0	2.04	25	45	95.2	0.0	0	0	0	0	0	0
11									0	0	0	0	0	0
12	1649.8	20000	0	1.25	26	51	95.2	0.0	0	0	0	0	0	0
13									0	0	0	0	0	0
14	1641.1	20000	0	1.40	32	50	126.4	0.0	0	0	0	0	0	0
15									0	0	0	0	0	0
16									0	0	0	0	0	0
17	1640.7	20000	0	0.45	25	57	64.0	0.0	0	0	0	0	0	0
18									0	0	0	0	0	0
19	1640.7	20000	0	0.63	31	52	64.0	0.0	0	0	0	0	0	0
20	1640.7	20000	0	0.67	31	50	79.6	0.0	0	0	0	0	0	0
21									0	0	0	0	0	0
22									0	0	0	0	0	0
23									0	0	0	0	0	0
24	1640.8	20000	0	1.72	27	59	79.6	0.0	0	0	0	0	0	0
25									0	0	0	0	0	0
26	1640.7	20000	0	0.85	31	50	79.6	0.0	0	0	0	0	0	0
27	1640.8	20000	0	0.83	30	50	110.8	0.0	0	0	0	0	0	0
28									0	0	0	0	0	0
29									0	0	0	0	0	0
30									0	0	0	0	0	0
Monthly Totals			0	11.19						0		0		0
Year to Date Totals			1,000	64.57						0		0		0

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF MAY 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY Min	TEMP @ BARNEY Max	MEASURED FLOW TO TRASK	MEASURED FLOW TO TUALATIN	STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN CWS		STORAGE RELEASED TO TUALATIN MUNICIPAL*	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1	1640.7	20000	0	0.61	27	57	55.50	0.0	0	0	0	0	0	0
2									0	0	0	0	0	0
3	1640.7	20000	0	0.33	35	65	47.0	0.0	0	0	0	0	0	0
4									0	0	0	0	0	0
5	1640.7	20000	0	0.10	39	74	47.0	0.0	0	0	0	0	0	0
6									0	0	0	0	0	0
7									0	0	0	0	0	0
8	1640.6	20000	0	0.08	31	61	41.0	0.0	0	0	0	0	0	0
9									0	0	0	0	0	0
10	1640.6	20000	0	0.00	35	66	35.0	0.0	0	0	0	0	0	0
11	1640.7	20000	0	0.79	35	66	47.0	0.0	0	0	0	0	0	0
12									0	0	0	0	0	0
13									0	0	0	0	0	0
14									0	0	0	0	0	0
15	1640.7	20000	0	1.58	29	52	47.0	0.0	0	0	0	0	0	0
16									0	0	0	0	0	0
17	1640.7	20000	0	1.91	32	51	79.6	0.0	0	0	0	0	0	0
18									0	0	0	0	0	0
19	1640.8	20000	0	0.00	32	59	55.5	0.0	0	0	0	0	0	0
20									0	0	0	0	0	0
21									0	0	0	0	0	0
22	1640.7	20000	0	0.00	40	76	41.0	0.0	0	0	0	0	0	0
23									0	0	0	0	0	0
24	1640.6	20000	0	0.00	37	79	31.3	0.0	0	0	0	0	0	0
25	1640.6	20000	0	0.00	34	63	31.3	0.0	0	0	0	0	0	0
26									0	0	0	0	0	0
27									0	0	0	0	0	0
28									0	0	0	0	0	0
29	1640.8	20000	0	0.00	42	76	27.6	0.0	0	0	0	0	0	0
30									0	0	0	0	0	0
31	1640.6	20000	0	0.00	39	70	31.6	0.0	0	0	0	0	0	0
Monthly Totals			0	5.40						0		0		0
Year to Date Totals			1,000	69.97						0		0		0

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF JUNE 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY		MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN			
					Min	Max	TRASK	TUALATIN			CWS		MUNICIPAL*	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									0	0	0	0	0	0
2	1640.6	20000	0	0.07	41	65	27.6	0.0	0	0	0	0	0	0
3									0	0	0	0	0	0
4									0	0	0	0	0	0
5	1640.6	20000	0	0.00	32	66	23.9		0	0	0	0	0	0
6									0	0	0	0	0	0
7	1640.6	20000	0	0.00	41	74	16.5	0.0	0	0	0	0	0	0
8									0	0	0	0	0	0
9	1640.7	20000	0	0.42	38	68	27.6	0.0	0	0	0	0	0	0
10									0	0	0	0	0	0
11									0	0	0	0	0	0
12	1640.6	20000	0	0.55	37	59	20.2	0.0	0	0	0	0	0	0
13									0	0	0	0	0	0
14	1640.6	20000	0	0.10	34	57	20.2	0.0	0	0	0	0	0	0
15									0	0	0	0	0	0
16	1640.8	20000	0	1.24	38	58	47.0	0.0	0	0	0	0	0	0
17									0	0	0	0	0	0
18									0	0	0	0	0	0
19	1640.6	20000	0	0.06	41	71	20.2	0.0	0	0	0	0	0	0
20									0	0	0	0	0	0
21	1640.7	20000	0	0.00	38	74	16.5	0.0	0	0	0	0	0	0
22									0	0	0	0	0	0
	FIRST DAY OF STORED WATER RELEASE FOR MUNICIPAL USE													
23	1640.7	20000	0	0.00	38	74	13.0	5.0	4	8	0	0	10	20
24									4	8	0	0	10	20
25									4	8	0	0	10	20
26	1640.5	20000	0	0.09	57	88	6.4	15.0	6	13	0	0	15	30
27									6	13	0	0	15	30
28	1640.3	19920	-80	0.00	42	67	6.4	25.1	6	13	0	0	25	50
29									6	13	0	0	25	50
30	1640.1	19840	-80	0.00	56	67	6.4	25.1	6	13	0	0	25	50
Monthly Totals			-160	2.53						87		0		268
Year to Date Totals			840	72.50						87		0		268

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which one day later.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF JULY 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY		MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN			
					Min	Max	TRASK	TUALATIN			CWS		MUNICIPAL*	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									6	13	0	0	25	50
2									6	13	0	0	25	50
3	1639.7	19680	-160	0.00	41	74	6.4	25.1	6	13	0	0	25	50
4									6	13	0	0	25	50
5	1639.4	19560	-120	0.00	41	77	6.4	25.1	6	13	0	0	25	50
6	1639.2	19480	-80	0.00	43	79	8.4	25.1	8	17	0	0	25	50
7	1.0	19440	-40	0.00	36	76	8.4	25.1	8	17	0	0	25	50
8									8	17	0	0	25	50
9									8	17	0	0	25	50
10	1638.6	19240	-200	0.00	41	74	8.4	40.1	8	17	0	0	40	79
11									8	17	0	0	40	79
12	1638.1	19040	-200	0.00	41	71	8.4	40.1	8	17	0	0	40	79
13									8	17	0	0	40	79
14	1637.7	18550	-490	0.00	42	72	8.4	40.1	8	17	0	0	40	79
15									8	17	0	0	40	79
16									8	17	0	0	40	79
17	1636.9	18450	-100	0.00	40	74	8.4	40.1	8	17	0	0	40	79
18									8	17	0	0	40	79
19	1636.4	18200	-250	0.00	41	73	8.4	40.1	8	17	0	0	40	79
20									8	17	0	0	40	79
21	1635.8	17925	-275	0.05	36	66	8.4	40.1	8	17	0	0	40	79
22									8	17	0	0	40	79
23									8	17	0	0	40	79
24	1635.2	17700	-225	0.00	43	79	8.4	40.1	8	17	0	0	40	79
25	1634.9	17588	-112	0.00	43	81	8.4	40.1	8	17	0	0	40	79
26									8	17	0	0	40	79
27									8	17	0	0	40	79
28	1634.1	17288	-300	0.00	43	79	8.4	40.1	8	17	0	0	40	79
29									8	17	0	0	40	79
30									8	17	0	0	40	79
31	1633.4	17025	-263	0.00	42	78	8.4	40.1	8	17	0	0	40	79
Monthly Totals			-2,815	0.05						496		0		2,194
Year to Date Totals			-1,975	72.55						583		0		2,432

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which one day later.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF AUGUST 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY		MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN			
					Min	Max	TRASK	TUALATIN			CWS		MUNICIPAL*	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									8	17	0	0	40	79
2	1632.9	16838	-187	0.00	50	86	8.4	40.1	8	17	0	0	40	79
3									8	17	0	0	40	79
4	1632.0	16500	-338	0.00	54	90	8.4	40.1	8	17	0	0	40	79
5									8	17	0	0	40	79
6									8	17	0	0	40	79
7	1631.6	16350	-150	0.00	47	82	8.4	40.1	8	17	0	0	40	79
8									8	17	0	0	40	79
9	1631.0	16125	-225	0.00	49	81	8.4	40.1	8	17	0	0	40	79
10									8	17	0	0	40	79
11	1630.5	15983	-142	0.00	48	81	13.0	40.1	13	26	0	0	40	79
12									13	26	0	0	40	79
13									13	26	0	0	40	79
14	1629.6	15600	-383	0.30	41	76	12.3	40.1	12	24	0	0	40	79
15									12	24	0	0	40	79
16	1629.0	15375	-225	0.00	43	67	12.3	40.1	13	25	0	0	40	79
17									13	25	0	0	40	79
18	1628.5	15188	-187	0.00	45	73	12.3	40.1	12	24	0	0	40	79
19									12	24	0	0	40	79
20									12	24	0	0	40	79
21	1627.5	14813	-375	0.00	43	75	12.3	40.1	12	24	0	0	40	79
22									12	24	0	0	40	79
23	1626.9	14588	-225	0.00	47	78	12.3	40.5	12	24	0	0	40	80
24									12	24	0	0	40	80
25	1626.3	14363	-225	0.00	41	73	12.3	40.1	12	24	0	0	40	79
26									12	24	0	0	40	79
27									12	24	0	0	40	79
28	1625.5	14063	-300	0.00	46	81	12.3	40.1	12	24	0	0	40	79
29									12	24	0	0	40	79
30	1624.8	13800	-263	0.00	48	86	12.3	40.1	12	24	0	0	40	79
31									12	24	0	0	40	79
Monthly Totals			-3,225	0.30						681		0		2,463
Year to Date Totals			-5,200	72.85						1,264		0		4,895

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which one day later.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF SEPTEMBER 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY		MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN			
					Min	Max	TRASK	TUALATIN			CWS		MUNICIPAL*	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1	1624.2	13538	-262	0.00	47	76	12.25	50.1	12	24	10	20	40	79
2									12	24	10	20	40	79
3									12	24	10	20	40	79
4	1623.0	13125	-413	0.00	56	86	12.3	50.1	12	24	10	20	40	79
5	1622.7	13013	-112	0.00	63	80	12.3	61.1	12	24	21	42	40	79
6	1622.2	12825	-188	0.00	53	80	12.3	61.1	12	24	21	42	40	79
7									12	24	21	42	40	79
8	1620.4	12150	-675	0.00	54	73	12.3	61.1	12	24	21	42	40	79
9									12	24	21	42	40	79
10									12	24	21	42	40	79
11									12	24	21	42	40	79
12									12	24	21	42	40	79
13	1619.1	11700	-450	0.00	40	80	12.3	61.1	12	24	21	42	40	79
14	1617.4	11133	-567	0.00	42	65	12.3	61.1	12	24	21	42	40	79
15									12	24	21	42	40	79
16									12	24	21	42	40	79
17									12	24	21	42	40	79
18	1616.9	10966	-167	0.69	40	66	12.3	61.1	12	24	21	42	40	79
19									12	24	21	42	40	79
20	1616.3	10766	-200	2.51	38	53	12.2	49.1	12	24	21	42	28	56
21									12	24	21	42	28	56
22	1615.8	10600	-166	0.20	34	51	12.2	49.1	12	24	21	42	28	56
23									12	24	21	42	28	56
24									12	24	21	42	28	56
25	1614.3	10100	-500	0.03	38	60	12.2	49.1	12	24	21	42	28	56
26									12	24	21	42	28	56
27	1613.4	9850	-250	0.00	39	71	12.2	49.1	12	24	21	42	28	56
28									12	24	21	42	28	56
29	1612.6	9650	-200	0.15	44	68	12.2	49.1	12	24	21	42	28	56
30									12	24	21	42	28	56
Monthly Totals			-4,150	3.58						727		1,163		2,121
Year to Date Totals			-9,305	76.43						1,991		1,163		7,046

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which one day later.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF OCTOBER 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY		MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN			
					Min	Max	TRASK	TUALATIN			CWS		MUNICIPAL*	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1									12	24	21	42	28	56
2	1611.3	9325	-325	0.44	35	60	12.2	35.1	12	24	7	14	28	56
3									12	24	7	14	28	56
4	1610.7	9175	-150	0.00	40	60	12.3	30.0	12	24	7	14	23	46
5									12	24	7	14	23	46
6	1610.1	9025	-150	0.00	37	60	12.3	30.0	12	24	7	14	23	46
7									12	24	7	14	23	46
8									12	24	7	14	23	46
9	1609.2	8733	-292	0.63	36	59	12.3	20.0	12	24	7	14	13	26
10									12	24	7	14	13	26
11	1608.8	8600	-133	0.30	33	55	12.3	20.0	12	24	7	14	13	26
12									12	24	7	14	13	26
13	1608.5	8500	-100	1.28	36	48	12.3	20.0	12	24	7	14	13	26
14									12	24	7	14	13	26
15									12	24	7	14	13	26
16	1607.9	8300	-200	0.04	33	52	9.6	20.0	12	24	7	14	13	26
17									12	24	7	14	13	26
18	1607.7	8233	-67	0.21	36	57	9.6	20.0	10	19	7	14	13	26
19									10	19	7	14	13	26
20	1607.5	8200	-33	2.45	44	64	9.6	20.0	10	19	7	14	13	26
21									10	19	7	14	13	26
22									10	19	7	14	13	26
23	1609.9	8966	766	6.45	46	57	9.6	20.0	10	19	7	14	13	26
24									10	19	7	14	13	26
	LAST DAY OF STORED WATER RELEASE FOR MUNICIPAL USE													
25	1609.9	8966	0	0.02	41	60	9.6	0.0	10	19	0	0	0	0
26									10	19	0	0	0	0
27	1610.0	9000	34	0.00	38	60	9.6	0.0	10	19	0	0	0	0
28									10	19	0	0	0	0
29									10	19	0	0	0	0
30	1610.1	9025	25	0.02	41	59	9.6	0.0	10	19	0	0	0	0
31									10	19	0	0	0	0
Monthly Totals			-625	11.84						678		361		806
Year to Date Totals			-9,975	88.27						2,669		1,524		7,822

*In this table (Reservoir Operations), the amount of water released is recorded on the day it was released from the reservoir. In the Municipal Use tables (Appendix E), the released water is recorded on the day that it was available for use which one day later.

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF NOVEMBER 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY		MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN			
					Min	Max	TRASK	TUALATIN			CWS		MUNICIPAL	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1	1609.9	8966	-59	0.00	32	57	9.60	0.0	10	19	0	0	0	0
2									10	19	0	0	0	0
3	1610.1	9025	59	1.33	33	52	9.6	0.0	10	19	0	0	0	0
4									10	19	0	0	0	0
5									10	19	0	0	0	0
6	1610.5	9125	100	1.52	33	43	9.6	0.0	10	19	0	0	0	0
7									10	19	0	0	0	0
8	1608.9	8633	-492	0.07	28	42	9.6	0.0	10	19	0	0	0	0
9									10	19	0	0	0	0
10	1609.7	8900	267	2.20	32	45	9.6	0.0	10	19	0	0	0	0
11									10	19	0	0	0	0
12									10	19	0	0	0	0
13	1612.4	9600	700	2.09	34	50	10.9	0.0	11	22	0	0	0	0
14									11	22	0	0	0	0
15	1613.4	9850	250	2.12	33	45	10.9	0.0	11	22	0	0	0	0
16									11	22	0	0	0	0
17	1614.6	10200	350	1.88	33	44	10.9	0.0	11	22	0	0	0	0
18									11	22	0	0	0	0
19									11	22	0	0	0	0
20	1616.0	10666	466	2.30	25	52	12.2	0.0	4	8	0	0	0	0
21	1616.8	10933	267	0.36	34	52	4.0	0.0	1	2	0	0	0	0
22									0	0	0	0	0	0
23									0	0	0	0	0	0
24									0	0	0	0	0	0
25									0	0	0	0	0	0
26									0	0	0	0	0	0
27	1620.1	12038	1105	3.53	31	58	2.3	0.0	0	0	0	0	0	0
28									0	0	0	0	0	0
29	1620.8	12300	262	0.84	30	44	2.3	0.0	0	0	0	0	0	0
30									0	0	0	0	0	0
Monthly Totals			3,275	18.24						389		0		0
Year to Date Totals			-6,700	106.51						3,058		1,524		7,822

BARNEY RESERVOIR OPERATIONS FOR THE MONTH OF DECEMBER 2017

[See Appendix E for breakdown of municipal use by water provider.] Source: Barney Reservoir Joint Ownership Commission

DAY	SURFACE ELEVATION	STORAGE	CHANGE IN STORAGE	RAIN @ BARNEY	TEMP @ BARNEY		MEASURED FLOW TO		STORAGE RELEASED TO TRASK—ODFW		STORAGE RELEASED TO TUALATIN			
					Min	Max	TRASK	TUALATIN			CWS		MUNICIPAL	
	feet	ac-ft	ac-ft	in.	ºF	ºF	cfs	cfs	cfs	ac-ft	cfs	ac-ft	cfs	ac-ft
1	1621.4	12525	225	0.30	30	42	2.30	0.0	0	0	0	0	0	0
2									0	0	0	0	0	0
3									0	0	0	0	0	0
4	1622.3	12863	338	1.09	26	42	2.3	0.0	0	0	0	0	0	0
5									0	0	0	0	0	0
6	1622.7	13013	150	0.02	25	44	2.3	0.0	0	0	0	0	0	0
7	1622.9	13088	75	0.00	32	44	2.3	0.0	0	0	0	0	0	0
8									0	0	0	0	0	0
9									0	0	0	0	0	0
10									0	0	0	0	0	0
11	1623.5	13313	225	0.00	24	45	1.7	0.0	0	0	0	0	0	0
12									0	0	0	0	0	0
13	1623.7	13763	450	0.00	24	43	1.7	0.0	0	0	0	0	0	0
14									0	0	0	0	0	0
15	1624.0	13500	-263	0.00	25	45	1.7	0.0	0	0	0	0	0	0
16									0	0	0	0	0	0
17									0	0	0	0	0	0
18	1624.3	13613	113	0.47	32	47	1.7	0.0	0	0	0	0	0	0
19									0	0	0	0	0	0
20	1625.2	13950	337	2.98	33	50	3.4	0.0	0	0	0	0	0	0
21	1625.5	14063	113	0.02	19	37	2.8	0.0	0	0	0	0	0	0
22									0	0	0	0	0	0
23									0	0	0	0	0	0
24									0	0	0	0	0	0
25									0	0	0	0	0	0
26	1626.8	14550	487	1.38	22	38	2.8	0.0	0	0	0	0	0	0
27	1626.9	14963	413	0.02	24	36	2.8	0.0	0	0	0	0	0	0
28									0	0	0	0	0	0
29	1627.9	14963	0	2.64	27	52	3.4	0.0	0	0	0	0	0	0
30									0	0	0	0	0	0
31									0	0	0	0	0	0
Monthly Totals			2,663	8.92						0		0		0
Year to Date Totals			-4037	115.43						3,058		1,524		7,822

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Appendix E

Municipal Water Use Allocations
Monthly Records

MONTHLY SUMMARIES OF MUNICIPAL ALLOCATIONS

MUNICIPAL ALLOCATIONS FOR THE MONTH OF JUNE 2017

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Scoggins	Barney	Scoggins	Barney	Scoggins	Barney	Scoggins	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21	FIRST DAY OF STORED WATER RELEASE FOR MUNICIPAL USE: June 22, 2017 from Scoggins Reservoir									
22	55	0	55	-18.9	40	0.0	1.6	0.0	13	19
23	60	0	60	-19.9	45	0.0	2.1	0.0	13	20
24	65	10	55	-11.8	40	0.0	1.3	0.0	14	22
25	65	10	55	-10.6	41	0.0	1.6	0.0	13	21
26	65	10	55	-12.4	39	0.0	1.5	0.0	14	22
27	60	15	45	-5.4	29	0.0	1.7	0.0	14	20
28	50	15	35	-5.6	21	0.0	1.6	0.0	13	21
29	55	25	30	2.1	17	0.0	1.6	1.5	12	21
30	55	25	30	2.6	17	0.0	1.9	1.7	11	21
Monthly Summary (June)										
Mean daily cfs	59	16	47	-11.4	32.0	0.0	1.7	0.5	13.0	26.7
Total ac-ft	1,051	218	833	-158.5	571	0.0	30	6.4	232	370
Stored Water Use Summary to Date (June 22–June 30)										
Mean daily cfs	59	16	47	-11.4	32.0	0.0	1.7	0.5	13.0	26.7
Total ac-ft	1,051	218	833	-159	571	0.0	30	6.4	232	370

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF JULY 2017

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Scoggins	Barney	Scoggins	Barney	Scoggins	Barney	Scoggins	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1	55	25	30	4.6	19	0.0	1.0	2.6	10	18
2	55	25	30	5.1	19	0.0	1.4	2.7	9.8	17
3	55	25	30	4.5	18	0.0	1.4	2.6	10	18
4	50	25	25	4.1	14	0.0	1.2	3.0	10.0	18
5	50	25	25	4.5	14	0.0	2.0	3.0	9.3	17
6	60	25	35	2.3	21	0.0	1.9	1.3	12	21
7	55	25	30	2.4	17	0.0	1.9	1.6	11	21
8	60	25	35	3.3	22	0.0	1.9	1.6	11	20
9	60	25	35	3.0	23	0.0	0.9	1.5	11	21
10	60	25	35	2.4	21	0.0	2.2	1.4	12	21
11	75	40	35	10	22	0.0	2.5	4.9	11	25
12	60	40	20	12	12	0.0	2.1	6.9	6.4	21
13	48	40	8	14	3.1	0.0	2.5	10	2.3	16
14	43	40	3	16	0.6	0.0	2.1	10	0.4	14
15	60	40	20	14	12	0.0	2.3	7.4	6.1	19
16	60	40	20	14	12	0.0	2.3	7.3	6.0	18
17	60	40	20	14	11	0.0	2.6	7.4	6.2	19
18	60	40	20	11	10	0.0	3.2	7.1	6.4	21
19	60	40	20	14	11	0.0	2.9	6.7	5.6	20
20	65	40	25	12	12	0.0	6.8	6.7	6.6	21
21	70	40	30	12	18	0.0	3.6	5.6	8.5	23
22	75	40	35	12	22	0.0	3.6	5.0	9.4	23
23	75	40	35	15	22	0.0	3.9	5.9	8.7	19
24	75	40	35	10	22	0.0	3.0	5.0	10	25
25	55	40	15	9.8	6.1	0.0	3.5	8.7	5.4	22
26	65	40	25	10	12	0.0	4.6	7.5	8.5	22
27	75	40	35	12	21	0.0	3.3	6.3	11	21
28	65	40	25	14	13	0.0	3.9	7.7	7.6	19
29	70	40	30	12	18	0.0	3.0	6.3	9.2	21
30	70	40	30	12	17	0.0	3.7	6.4	9.0	21
31	70	40	30	12	17	0.0	4.3	6.5	9.1	22
Monthly Summary (July)										
Mean daily cfs	62	35	27	9.6	15.5	0.0	2.8	5.4	8.4	20
Total ac-ft	3,800	2,162	1,638	593	953	0.0	169	331	516	1,237
Stored Water Use Summary to Date (June 22–July 31)										
Mean daily cfs	61	32	31	5.8	19.2	0.0	2.5	4.5	9.4	21
Total ac-ft	4,852	2,380	2,471	435	1,525	0.0	199	338	748	1,608

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF AUGUST 2017

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Scoggins	Barney	Scoggins	Barney	Scoggins	Barney	Scoggins	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1	75	40	35	12	20	0.0	4.4	5.9	10	22
2	80	40	40	11	23	0.0	4.3	5.8	12	23
3	85	40	45	11	25	0.0	6.6	5.5	13	24
4	75	40	35	12	17	0.0	7.8	6.9	10.0	21
5	80	40	40	13	24	0.0	5.6	5.9	11	21
6	80	40	40	12	22	0.0	6.3	6.2	11	22
7	80	40	40	12	23	0.0	5.9	6.0	12	22
8	65	40	25	10	9.9	0.0	6.5	9.0	8.5	21
9	60	40	20	11	8.1	0.0	5.4	9.3	6.6	19
10	75	40	35	12	18	0.0	7.1	6.8	10	22
11	75	40	35	12	18	0.0	7.2	7.0	10	21
12	70	40	30	14	16	0.0	5.1	7.7	8.7	18
13	70	40	30	14	16	0.0	5.2	7.8	8.9	18
14	70	40	30	13	15	0.0	5.6	8.0	9.3	19
15	58	40	18	14	7.6	0.0	5.4	9.1	5.0	17
16	58	40	18	11	6.6	0.0	5.6	9.6	5.8	19
17	58	40	18	11	6.5	0.0	6.1	9.1	5.5	20
18	68	40	28	12	14	0.0	5.9	7.2	8.2	21
19	68	40	28	12	14	0.0	5.8	7.1	8.1	20
20	68	40	28	13	14	0.0	6.0	7.0	7.8	20
21	68	40	28	13	14	0.0	5.6	7.0	8.0	20
22	60	40	20	12	8.4	0.0	5.6	8.5	6.0	20
23	68	40	28	15	15	0.0	6.0	7.6	7.4	18
24	71	40	31	14	16	0.0	6.0	7.3	8.7	19
25	68	40	28	14	14	0.0	6.4	7.7	7.6	18
26	68	40	28	15	15	0.0	5.7	7.7	7.6	17
27	68	40	28	15	15	0.0	5.9	7.6	7.5	18
28	68	40	28	13	14	0.0	6.3	7.9	8.1	19
29	68	40	28	13	14	0.0	6.1	7.4	7.9	19
30	80	40	40	10	20	0.0	7.0	6.2	13	24
31	70	40	30	13	16	0.0	6.3	6.7	7.9	20
Monthly Summary (August)										
Mean daily cfs	70	40	30	12.5	15.4	0.0	6.0	7.4	8.8	20
Total ac-ft	4,314	2,460	1,855	770	950	0.0	366	453	539	1,237
Stored Water Use Summary to Date (June 22–August 31)										
Mean daily cfs	65	35	31	8.8	17.6	0.0	4.0	5.8	9.1	21
Total ac-ft	9,166	4,840	4,326	1,205	2,475	0.0	565	790	1,287	2,845

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF SEPTEMBER 2017

Source: Joint Water Commission

DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Scoggins	Barney	Scoggins	Barney	Scoggins	Barney	Scoggins	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1	70	40	30	13	15	0.0	6.9	7.0	8.1	20
2	93	40	53	12	33	0.0	6.7	5.0	14	23
3	93	40	53	12	33	0.0	6.4	4.9	13	23
4	93	40	53	12	34	0.0	6.2	4.9	13	23
5	93	40	53	12	32	0.0	7.7	4.9	13	23
6	75	40	35	12	18	0.0	6.7	6.5	10	22
7	70	40	30	14	16	0.0	5.1	7.3	8.5	19
8	70	40	30	15	18	0.0	5.3	6.3	7.1	18
9	70	40	30	15	18	0.0	4.3	5.9	7.2	19
10	70	40	30	14	17	0.0	5.1	6.2	7.8	20
11	75	40	35	15	19	0.0	4.8	3.7	11	21
12	75	40	35	15	20	0.0	4.9	3.7	10	22
13	75	40	35	15	21	0.0	5.2	3.9	8.3	21
14	70	40	30	15	17	0.0	6.2	3.8	6.9	21
15	70	40	30	15	17	0.0	6.3	3.8	6.8	21
16	70	40	30	15	18	0.0	5.9	3.9	6.5	21
17	70	40	30	15	17	0.0	5.9	3.7	7.0	21
18	70	40	30	16	17	0.0	6.0	4.0	7.4	20
19	60	40	20	22	9.3	0.0	5.5	5.5	5.3	12
20	50	40	10	19	3.0	0.0	5.5	9.7	1.5	11
21	28	28	0	9.7	0.0	3.4	0.0	8.0	0.0	6.8
22	28	28	0	9.9	0.0	3.7	0.0	7.8	0.0	6.6
23	28	28	0	12	0.0	2.9	0.0	7.2	0.0	6.2
24	28	28	0	12	0.0	3.0	0.0	7.3	0.0	6.0
25	28	28	0	11	0.0	3.2	0.0	7.2	0.0	6.8
26	43	28	15	13	2.4	0.0	3.1	0.0	9.4	15
27	48	28	20	10	7.2	0.0	3.7	0.0	9.1	18
28	38	28	10	12	1.1	0.0	4.2	2.9	4.7	13
29	33	28	5	10	0.7	0.0	3.8	6.7	0.5	11
30	38	28	10	12	2.8	0.0	2.4	3.1	4.8	13
Monthly Summary (September)										
Mean daily cfs	31	18	15	10.3	5.2	0.2	2.2	1.3	7.6	6
Total ac-ft	1,464	837	627	488	217	11	93	64	317	274
Stored Water Use Summary to Date (June 22–September 30)										
Mean daily cfs	57	32	28	10.2	15.1	0.2	4.0	4.8	8.6	17
Total ac-ft	14,244	7,819	6,425	2,495	3,498	43	924	1,161	2,003	4,119

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

MUNICIPAL ALLOCATIONS FOR THE MONTH OF OCTOBER 2017

Source: Joint Water Commission

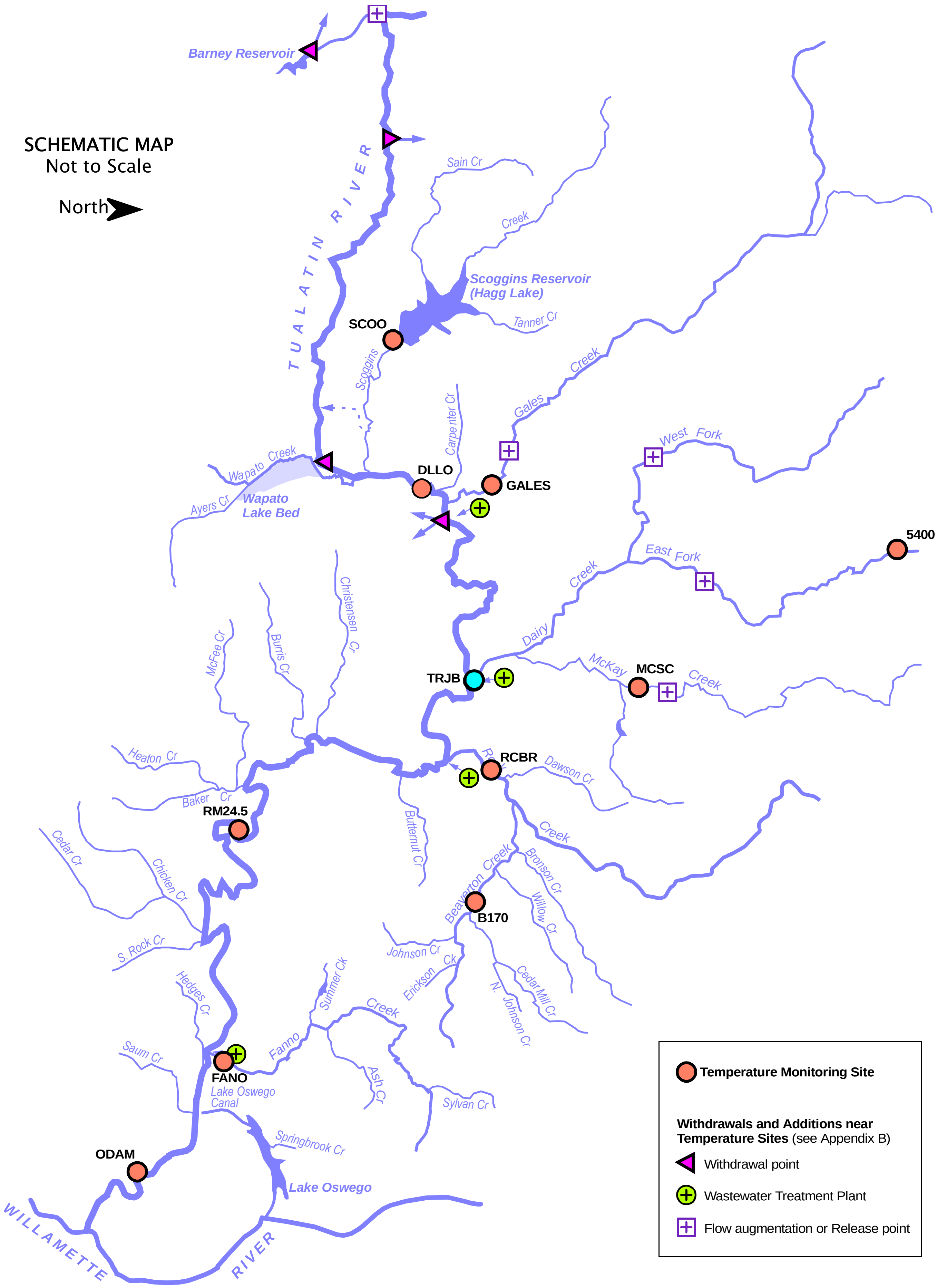
DAY	TOTAL MUNICIPAL USE	MUNICIPAL USE BY RESERVOIR		BREAKDOWN OF MUNCIPAL USE BY WATER PROVIDER†						
				HILLSBORO		FOREST GROVE		BEAVERTON		TVWD
		Barney	Scoggins	Barney	Scoggins	Barney	Scoggins	Barney	Scoggins	Barney
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
1	38	28	10	12	2.7	0.0	2.4	3.1	5.0	12
2	38	28	10	13	2.6	0.0	2.4	3.2	5.0	12
3	38	28	10	17	2.4	0.0	2.8	4.2	4.8	7.2
4	28	28	0	14	0.0	2.4	0.0	8.3	0.0	3.1
5	23	23	0	13	0.0	1.5	0.0	6.3	0.0	2.4
6	23	23	0	12	0.0	1.8	0.0	7.1	0.0	2.6
7	35	23	12	20	0.6	0.0	2.4	0.0	9.0	3.2
8	35	23	12	20	1.2	0.0	1.9	0.0	8.9	3.3
9	35	23	12	19	1.0	0.0	2.3	0.0	8.7	3.5
10	25	13	12	8.9	1.7	0.0	2.1	0.0	8.1	4.1
11	33	13	20	6.6	8.3	0.0	2.3	0.0	9.4	6.4
12	28	13	15	6.8	4.9	0.0	2.2	0.0	7.9	6.2
13	23	13	10	7.9	1.8	0.0	1.8	0.0	6.4	5.1
14	28	13	15	7.6	6.3	0.0	1.8	0.0	7.0	5.4
15	28	13	15	7.9	6.7	0.0	1.7	0.0	6.6	5.1
16	28	13	15	7.2	5.7	0.0	1.9	0.0	7.5	5.8
17	38	13	25	5.0	12	0.0	2.7	0.0	10	8.0
18	28	13	15	7.7	6.5	0.0	1.9	0.0	6.6	5.3
19	28	13	15	7.4	5.5	0.0	2.2	0.0	7.3	5.6
20	33	13	20	6.6	9.4	0.0	2.2	0.0	8.4	6.4
21	28	13	15	7.6	6.1	0.0	1.9	0.0	6.9	5.4
22	28	13	15	6.8	4.4	0.0	2.4	0.0	8.2	6.2
23	28	13	15	6.9	4.5	0.0	2.5	0.0	8.0	6.1
24	41	13	28	5.3	15	0.0	3.3	0.0	9.6	7.7
25	LAST DAY OF STORED WATER RELEASE FOR MUNICIPAL USE									
26	October 24, 2017 from Barney & Scoggins Reservoirs									
27										
28										
29										
30										
31										
Monthly Summary										
Mean daily cfs	31	18	15	10.3	5.2	0.2	2.2	1.3	7.6	6
Total ac-ft	1,464	837	627	488	217	11	93	64	317	274
Stored Water Use Summary 2017 (June 22–October 24)										
Mean daily cfs	57	32	28	10.2	15.1	0.2	4.0	4.8	8.6	17
Total ac-ft	14,244	7,819	6,425	2,495	3,498	43	924	1,161	2,003	4,119

†In this table (Municipal Use), the amount of water allocated to each provider is recorded on the day that it was available. In the Barney Reservoir Operations table (Appendix D), the amount of water released is recorded on the day it was released from the reservoir, which is one day earlier than its availability.

Appendix F

Stream Temperature Records

MAP OF STREAM TEMPERATURE MONITORING SITES



STREAM TEMPERATURE SITES — ALPHABETICAL LISTING BY SITE CODE

SITE CODE	SITE NAME	RIVER MILE	STATION ID	PAGE
5400	East Fork Dairy Creek near Meacham Corner, OR	12.4	14205400	F-23
B170	Beaverton Creek at 170th Ave, Beaverton, Oregon	4.9	—	F-29
DLLO	Tualatin River near Dilley, Oregon	58.8	14203500	F-8
FANO	Fanno Creek at Durham Road near Tigard, Oregon	1.2	14206950	F-36
GALES	Gales Creek at Old Hwy 47 near Forest Grove, Oregon	2.36	14204530	F-20
MCSC	McKay Creek at Scotch Church Road above Waible Ck near North Plains, Oregon	6.3	14206070	F-26
ODAM	Tualatin River at Oswego Dam near West Linn, Oregon	3.4	14207200	F-17
RCBR	Rock Creek at Brookwood Avenue, Hillsboro, Oregon	2.4	—	F-32
RM24.5	Tualatin River at RM 24.5 near Scholls, Oregon	24.5	14206694	F-14
SCOO	Scoggins Creek below Henry Hagg Lake near Gaston, Oregon	4.80	14202980	F-5
TRJB	Tualatin River at Hwy 219 Bridge	44.4	14206241	F-11

Explanation of Figures and Tables in this Appendix

Page 1

A table of 2017 mean daily temperature for each site is at the top of the page. A graph of the 2017 discharge compared to a statistical summary for the period of record is at the bottom of the page.

Page 2

Page 2 contains a frequency chart and a table of monthly medians of daily mean temperature for the period of record. An example section of the frequency chart is shown below. The top row shows the ranges of temperatures in each bin. Months are at the left. Each cell is color-coded for the percent of the total distribution in the selected bin and month. The bottom row shows the total for all months. Many sites do not have data for every month or have periods of missing data. The frequency of missing data is shown in the "Missing" column at the far right. Note that missing data are likely to skew the percentages in the bottom row.

FREQUENCY OF MEAN DAILY TEMPERATURE (ºC) BY MONTH FOR PERIOD OF RECORD

MONTH	0 ≤ T < 8	8 ≤ T < 10	10 ≤ T < 12	12 ≤ T < 14	14 ≤ T < 16	16 ≤ T < 17	17 ≤ T < 18	18 ≤ T < 19	19 ≤ T < 20	20 ≤ T < 21	21 ≤ T < 22	22 ≤ T < 23	23 ≤ T < 25	Missing
May														
Jun														
Jul														
"														
All	0.1%	2.4%	11%	8.0%	10%	12%	13%	9.9%	9.8%	8.7%	9.6%	5.1%	0.1%	0.8%

Key
f ≥ 3%
2% ≤ *f* < 3%
1% ≤ *f* < 2%
0.2% ≤ *f* < 1%
0.06% ≤ *f* < 0.2%
0 < *f* < 0.06%

The table of monthly medians of mean daily temperature is color-coded by the percentile of each entry. Two keys for the color code are at the right— the upper one is in temperature (ºC) and the lower one is as percentile. Note that missing data are likely to skew the percentiles relative to the true annual distribution. Medians are not shown if more than 50% of the data for the month are missing.

Page 3

In addition to figures, page 3 contains a discussion of charts and graphs for the site, including a trend analysis.

The graphs on this page focus on the high temperature period. An explanation of the features used in these graphs is shown at the right. Boxplots of mean daily temperature for June, July-August combined and September are shown for all sites.

Temperature standard: The two lower graphs on page 3 assess each site with regard to the State of Oregon water-quality standard for temperature. The Oregon standard for salmonid rearing and migration—the seven day average of the daily maximum temperature (7dADM) is not to exceed 18ºC—applies in the Tualatin Basin. For sites where hourly data were available, the daily maximum temperature was determined and the 7dADM was computed.

- The second graph from the bottom shows a bar that begins on the first day of the year when the 7dADM exceeded 18ºC and ends on the last day that the 7dADM exceeded 18ºC. Some of the 7dADM within this date range may be less than 18ºC. Purple lines show the average date range for exceedance of the temperature standard for the period of record.
- The bottom graph shows the number of days in the date range from the upper graph when the standard was exceeded (orange), and the number of days it was not (blue). Missing values that occurred within the date range are shown in grey and are infrequent.

Page 3 Graph Feature Explanations

Boxplot

90th percentile
75th percentile
median
25th percentile
10th percentile

7dADM

is an abbreviation for the seven-day average of the daily maximum temperature

Median Line

median of the data points or boxplot medians that it spans

Lowess Smooth Line

LOWESS of the data points or boxplot medians that it spans

Statistically Significant Trend

a median or LOWESS line shown in the color magenta

Average Date Range

average of the beginning and ending dates for date range bars

Median Number of Days

median number of days the 7dADM was exceeded in the POR

14202980 — SCOGGINS CK BLW HENRY HAGG LAKE, NR GASTON, OR — SCOO

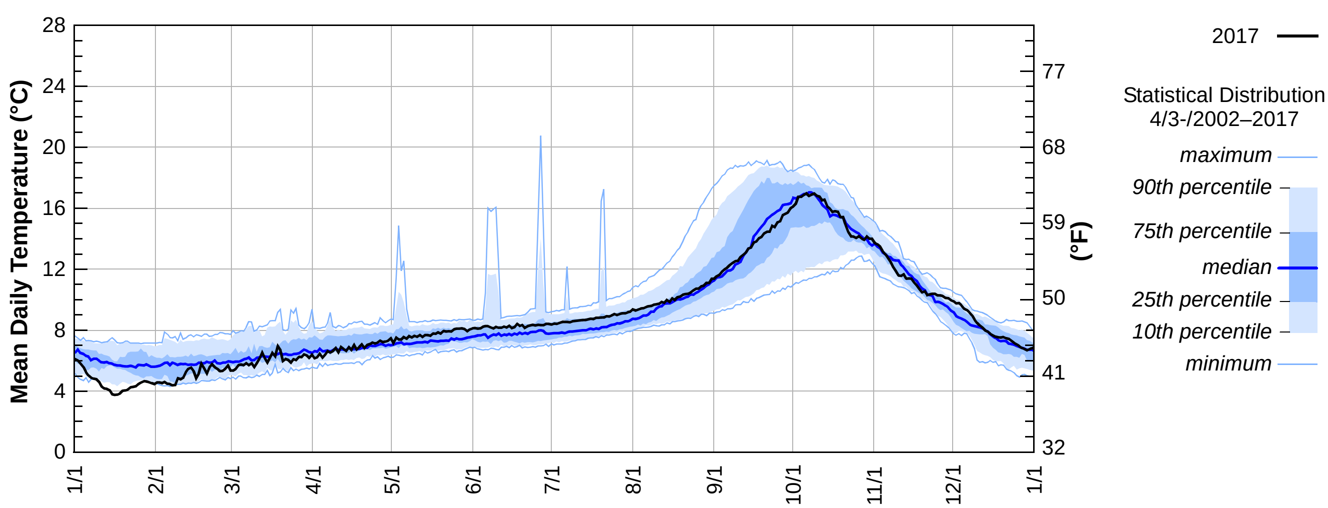
Data source: U.S. Geological Survey, Oregon Water Science Center

River mile: 4.80 *Latitude:* 45 28 10 *Longitude:* 1231 15 61

2017 Mean Daily Water Temperature in Degrees Celsius

Day	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	6.11	4.56	5.35	6.39	7.47	8.12	8.37	9.35	11.38	16.12	13.72	9.90
2	6.01	4.57	5.35	6.17	7.16	8.13	8.44	9.29	11.55	16.28	13.64	9.76
3	5.84	4.52	5.45	6.23	7.51	8.10	8.42	9.36	11.64	16.75	13.49	9.77
4	5.59	4.62	5.71	6.46	7.38	8.12	8.48	9.43	11.85	16.76	13.21	9.63
5	5.27	4.48	5.75	6.21	7.39	8.23	8.53	9.45	12.01	16.87	12.99	9.42
6	5.04	4.46	5.71	6.40	7.56	8.27	8.53	9.53	12.10	16.98	12.74	9.33
7	4.89	4.39	5.82	6.63	7.44	8.27	8.54	9.57	12.29	16.81	12.48	9.17
8	4.83	4.41	5.70	6.55	7.61	8.19	8.51	9.58	12.42	16.89	12.16	8.99
9	4.79	4.84	5.83	6.62	7.54	8.12	8.59	9.67	12.52	16.97	11.91	8.68
10	4.62	4.78	5.57	6.82	7.64	8.22	8.60	9.70	12.56	16.82	11.59	8.47
11	4.29	4.89	5.83	6.54	7.58	8.17	8.62	9.74	12.81	16.78	11.56	8.30
12	4.17	5.24	6.12	6.90	7.68	8.17	8.65	9.87	12.95	16.51	11.66	8.16
13	4.15	5.47	6.54	6.78	7.56	8.24	8.67	9.79	13.09	16.57	11.37	8.00
14	4.06	5.56	6.17	6.64	7.67	8.19	8.66	9.98	13.37	16.09	11.39	7.91
15	3.80	5.32	5.87	6.88	7.68	8.29	8.70	9.87	13.44	15.97	11.37	7.77
16	3.75	4.87	6.18	6.72	7.64	8.15	8.75	10.10	13.77	15.76	11.15	7.66
17	3.78	5.16	6.52	7.02	7.78	8.20	8.72	9.98	13.84	15.81	10.95	7.57
18	3.85	5.79	6.30	6.73	7.76	8.42	8.82	10.15	14.04	15.76	10.73	7.54
19	4.03	5.47	6.95	6.91	7.87	8.29	8.81	10.20	14.12	15.40	10.50	7.52
20	4.04	5.16	6.69	7.07	7.79	8.34	8.83	10.33	14.35	15.43	10.56	7.55
21	4.11	5.55	5.97	6.84	7.95	8.17	8.83	10.37	14.46	14.89	10.31	7.46
22	4.26	5.76	6.11	7.03	7.90	8.26	8.92	10.38	14.47	14.45	10.34	7.42
23	4.28	5.58	6.05	7.09	7.92	8.30	8.90	10.47	14.86	14.15	10.38	7.30
24	4.32	5.47	5.88	7.20	7.91	8.34	8.99	10.61	14.78	14.15	10.38	7.17
25	4.46	5.30	6.10	7.14	8.06	8.31	9.06	10.72	15.10	14.07	10.29	7.07
26	4.57	5.33	6.05	7.20	8.09	8.35	9.01	10.73	15.16	14.16	10.28	6.95
27	4.66	5.46	6.25	7.32	8.10	8.33	9.07	10.87	15.55	14.02	10.23	6.83
28	4.63	5.68	6.22	7.22	8.12	8.33	9.11	10.92	15.63	13.94	10.12	6.77
29	4.59	5.35	6.42	7.25	8.08	8.41	9.10	11.11	15.73	14.15	10.09	6.70
30	4.52	—	6.35	7.32	7.94	8.41	9.16	11.10	16.01	13.99	9.97	6.77
31	4.46	—	6.19	—	8.05	—	9.22	11.37	—	14.01	—	6.81
MEAN	4.57	5.10	6.03	6.81	7.74	8.25	8.76	10.12	13.60	15.59	11.39	8.01
MAX	6.11	5.79	6.95	7.32	8.12	8.42	9.22	11.37	16.01	16.98	13.72	9.90
MIN	3.75	4.39	5.35	6.17	7.16	8.10	8.37	9.29	11.38	13.94	9.97	6.70

SCOO – 14202980 – Scoggins Creek below Henry Hagg Lake near Gaston, Oregon [RM 4.80]



FREQUENCY OF MEAN DAILY TEMPERATURE (ºC) BY MONTH FOR PERIOD OF RECORD

MONTH	3.0 ≤ T < 5.5	5.5 ≤ T < 6.5	6.5 ≤ T < 7.0	7.0 ≤ T < 7.5	7.5 ≤ T < 8.0	8.0 ≤ T < 8.5	8.50 ≤ T < 9.0	9.0 ≤ T < 10	10 ≤ T < 12	12 ≤ T < 14	14 ≤ T < 16	160 ≤ T < 18	18 ≤ T < 21	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	5.8%	14%	8.8%	11%	9.4%	8.4%	5.9%	7.2%	9.0%	6.5%	5.0%	4.2%	1.2%	3.6%

Key
- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

MEAN DAILY TEMPERATURE (ºC) BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002					7.1	7.4	8.0	9.5	14.6	16.2	10.6	8.0
2003	6.9	7.1	7.4	7.9	8.2	8.5	9.1	11.0	18.2	18.5	10.3	7.5
2004	4.9	5.6	6.3	6.7	7.1		7.8	10.2	14.9	16.9	11.7	8.4
2005	5.8	5.9	6.4	7.1	7.5	7.9	8.2	9.3	11.8	15.5	10.7	6.3
2006	7.1	6.8	6.3	6.7	7.2	7.5	8.0	10.2	17.0	16.3	10.9	7.5
2007	5.6	5.2	5.9	6.3	6.8	7.1	8.0	10.1	17.0	15.0	10.9	7.0
2008	5.6	4.6	5.2	5.8	6.6	6.9	7.5	9.2	14.3	15.6	11.9	7.0
2009	5.1	4.6	5.4	6.4	6.8	7.1	7.5	9.1	12.4	15.0	10.7	6.1
2010	5.7	6.3	7.0	7.8	8.2	9.0	9.1	9.9	11.4	13.1	12.0	8.2
2011	6.2	6.1	6.7	6.7	7.3	7.8	8.1	8.6	10.0	11.8	11.7	7.3
2012	6.0	5.9	6.5	7.0	7.2	7.5	7.8	8.6	10.5	14.5	11.7	8.7
2013	5.7	5.5	6.2	6.8	6.8	7.2	7.6	9.1	12.4	14.2	12.1	6.5
2014	5.6	5.0	5.9	6.7	7.2	7.8	8.5	9.8	13.3	17.2	11.1	8.6
2015	7.2	7.6	8.0	8.4	8.6	8.9	9.6	12.8	18.8	17.3	11.9	8.0
2016	6.0	6.3	7.5	7.8	8.2	8.3	8.9	11.0	18.0	14.8	12.5	7.7
2017	4.5	5.2	6.1	6.8	7.7	8.3	8.7	10.0	13.6	15.8	11.3	7.7
Median	5.8	5.8	6.3	6.8	7.3	7.7	8.2	9.8	13.5	15.4	11.3	7.8

Key

T in ºC
- T ≤ 5.4
- 5.4 < T ≤ 5.8
- 5.8 < T ≤ 6.2
- 6.2 < T ≤ 6.5
- 6.5 < T ≤ 7.0
- 7.0 < T ≤ 7.5
- 7.5 < T ≤ 8.0
- 8.0 < T ≤ 10.4
- 10.4 < T ≤ 14.3
- 14.3 < T ≤ 16.3
- T > 16.3

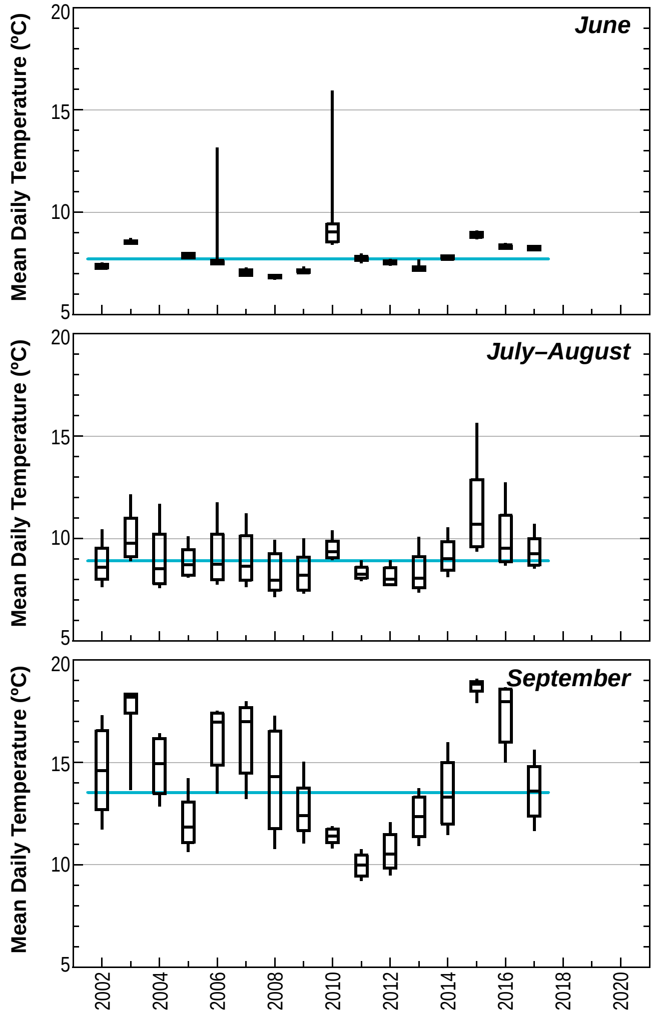
T as percentile
- T ≤ 5th
- 5th < T ≤ 10th
- 10th < T ≤ 15th
- 15th < T ≤ 20th
- 20th < T ≤ 30th
- 30th < T ≤ 40th
- 40th < T ≤ 50th
- 50th < T ≤ 75th
- 75th < T ≤ 90th
- 90th < T ≤ 95th
- T > 95th

Distribution

- The highest temperatures occurred in September and October which is unusual because that is after the warmest period of the summer.
- The lowest temperatures occurred in January and February

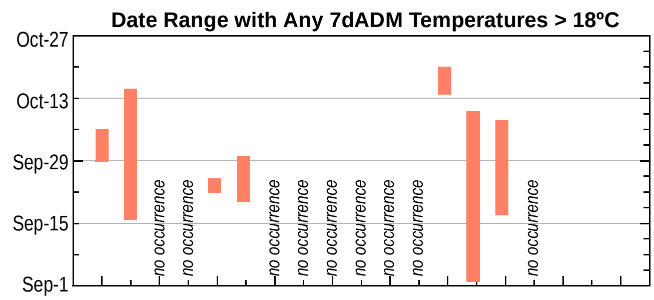
Reservoir effects

- Scoggins Reservoir is thermally stratified in the summer. During most of the summer, water is released from the lower, cooler, level of the reservoir. As the reservoir is drawn down, eventually the water from the upper, warmer level will reach the outlet and be released. The overall effect is to trap heat during the summer and release it at the end of summer through fall.
- Temperatures in June sometimes spike for a day or so. These spikes mark the occasional times when water is released over the spillway
- Exactly when warm water reaches the outlet depends on the depth of the warm water layer and how much water has been released during the season. In a cool summer (such as 2011), the upper layer is thinner, less water is released for irrigation and municipal use, and water from the upper warm layer may not be released at all. The opposite occurs for a hot summer such as 2015. This process accounts for the wide variability in the September temperatures.



Trends

- Water temperatures in July through September do no show any trend.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

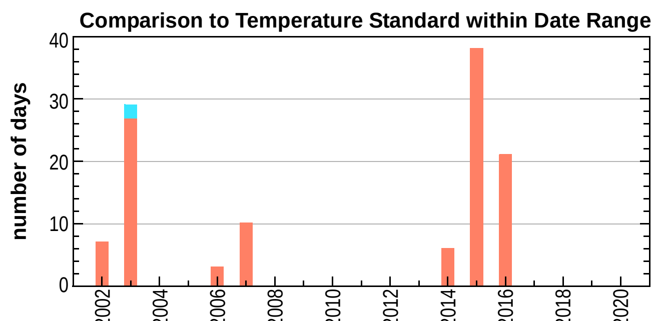


Oregon water temperature standard

- Temperatures at this site exceeded the standard in slightly less than half of the years (44%).
- Statistics for years when the standard was exceeded are:

average first day	Sep-21
average last day	Oct-7
median number of days	10

The average date range and median number of days with exceedances are not shown on the graphs at the right because many years did not have exceedances.



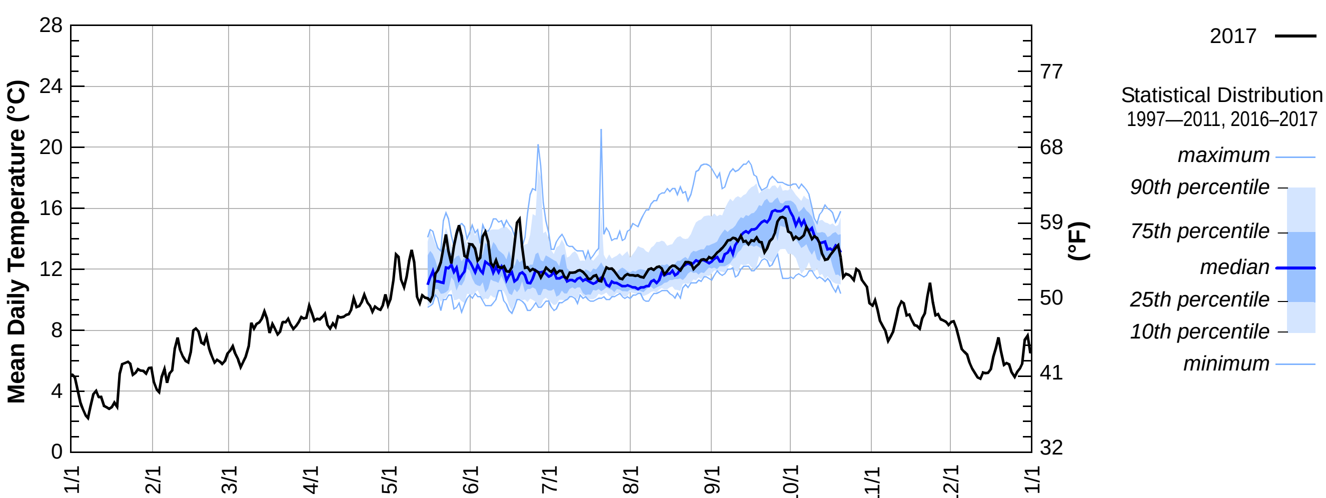
14203500 — TUALATIN RIVER NEAR DILLEY, OREG. — DLLO

Data source: U.S. Geological Survey, Oregon Water Science Center

River Mile: 58.8 *Latitude:* 452830 *Longitude:* 1230723

Day	2017 Mean Daily Water Temperature in Degrees Celsius											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	5.08	4.56	6.48	9.60	9.65	13.64	11.94	11.60	12.72	14.40	9.62	8.53
2	4.90	4.12	6.68	9.14	10.07	13.63	11.83	11.60	12.87	13.95	9.99	8.58
3	4.12	3.94	6.96	8.63	11.30	13.34	12.02	11.56	13.10	14.13	9.36	8.07
4	3.26	4.93	6.39	8.74	12.98	12.58	11.73	11.61	13.23	13.97	8.58	7.41
5	2.80	5.45	6.06	8.70	12.80	12.75	11.90	11.49	13.40	14.08	8.22	6.78
6	2.43	4.54	5.60	8.88	11.28	14.17	11.87	11.45	13.61	14.22	7.92	6.59
7	2.23	5.17	5.95	9.09	10.81	14.46	11.50	11.74	13.89	14.76	7.30	6.40
8	3.01	5.36	6.29	8.35	11.48	13.80	11.41	12.01	13.92	14.41	7.60	5.82
9	3.82	6.77	6.94	8.11	12.53	12.42	11.78	12.06	14.06	13.97	7.92	5.45
10	4.02	7.51	8.49	8.46	13.27	12.19	11.78	11.96	14.01	14.16	8.72	5.17
11	3.61	6.68	8.09	8.23	12.44	12.61	11.79	12.12	13.85	14.06	9.52	4.90
12	3.62	6.28	8.41	8.91	10.15	12.15	11.90	12.17	14.18	13.71	9.88	4.83
13	3.03	6.00	8.51	8.83	9.75	12.09	11.95	12.04	13.81	13.00	9.75	5.23
14	2.96	5.90	8.76	8.88	10.29	12.20	11.84	11.66	13.85	12.61	8.97	5.18
15	2.85	6.57	9.23	9.00	10.13	11.86	11.65	11.87	13.64	12.66	9.04	5.20
16	2.96	8.00	8.78	9.05	10.10	11.83	11.38	12.10	13.90	12.93	8.64	5.46
17	3.25	8.12	7.83	9.36	9.92	12.15	11.35	12.24	13.86	13.14	8.33	6.28
18	2.98	7.92	8.40	10.09	10.30	13.64	11.55	12.22	14.08	13.40	8.29	6.84
19	5.14	7.20	8.07	9.53	11.71	15.06	11.60	12.07	13.79	13.57	8.10	7.53
20	5.79	7.10	7.71	9.59	11.95	15.30	11.24	11.93	13.76	12.77	8.81	6.58
21	5.86	7.59	7.91	9.87	12.46	13.48	11.21	12.20	13.11	11.47	9.12	5.73
22	5.94	6.83	8.54	10.32	13.40	12.09	11.74	12.46	13.37	11.68	10.24	5.84
23	5.79	6.27	8.51	9.84	14.29	12.12	12.12	12.46	13.84	11.62	11.12	5.76
24	5.07	5.88	8.74	9.63	13.17	11.90	12.02	12.40	13.99	11.51	9.82	5.21
25	5.19	6.07	8.34	9.21	12.39	12.02	12.04	12.00	14.45	11.28	8.98	4.93
26	5.45	5.96	8.08	9.55	13.52	11.93	11.88	12.20	15.16	12.01	9.07	5.26
27	5.34	5.78	8.28	9.43	14.31	11.82	11.64	12.34	15.38	11.86	8.71	5.48
28	5.32	5.99	8.54	9.33	14.89	11.46	11.40	12.62	15.43	11.32	8.64	5.83
29	5.16	6.48	8.88	9.66	14.16	11.75	11.35	12.65	15.35	11.08	8.55	7.39
30	5.51	—	8.77	10.34	12.88	12.10	11.59	12.59	14.48	10.85	8.35	7.65
31	5.53	—	8.82	—	12.78	—	11.69	12.81	—	9.76	—	6.57
MEAN	4.26	6.17	7.84	9.21	11.97	12.75	11.70	12.07	13.94	12.85	8.91	6.21
MAX	5.94	8.12	9.23	10.34	14.89	15.30	12.12	12.81	15.43	14.76	11.12	8.58
MIN	2.23	3.94	5.60	8.11	9.65	11.46	11.21	11.45	12.72	9.76	7.30	4.83

DLLO – 14203500 – Tualatin river near Dilley, Oregon [RM 58.8]



FREQUENCY OF MEAN DAILY TEMPERATURE BY MONTH FOR PERIOD OF RECORD

MONTH	5.0 ≤ T < 10.0	10.0 ≤ T < 10.5	10.5 ≤ T < 11.0	11.0 ≤ T < 11.5	11.5 ≤ T < 12.0	12.0 ≤ T < 12.5	12.5 ≤ T < 13.0	13.0 ≤ T < 13.5	13.5 ≤ T < 14.0	14.0 ≤ T < 15.0	15.0 ≤ T < 16.0	16.0 ≤ T < 18.0	18.0 ≤ T < 22.0	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	4.3%	6.5%	10%	10%	11%	11%	7.9%	6.2%	4.7%	9.0%	4.9%	5.2%	0.8%	7.7%

Key

- f ≥ 3%
- 2% ≤ f < 3%
- 1% ≤ f < 2%
- 0.2% ≤ f < 1%
- 0.06% ≤ f < 0.2%
- 0 < f < 0.06%

MEAN DAILY TEMPERATURE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997					12.9	13.2	10.6	10.8	14.1			
1998					10.4	13.8	12.0	12.5	13.7	15.3		
1999					12.0	10.8	10.5	11.5	15.9	15.0		
2000					12.2	11.5	10.7	10.8	14.8	14.5		
2001				9.2	12.0	11.6	13.2	17.0	18.1	12.9		
2002	6.3	6.0	6.8	8.8	10.6	10.8	10.9	11.3	14.6	14.3	9.1	
2003	7.4	7.1	8.6	9.5	11.1	11.6	11.5	12.3	15.6	15.1	10.1	
2004								12.0	14.4	15.1		
2005						12.4	11.1	11.3	12.2	14.0		
2006					11.0	12.3	10.3	11.3	14.7	13.6		
2007					10.9	9.8	10.4	11.6	15.7	12.1		
2008					11.2	11.3	11.3	11.3	14.4	12.9		
2009					10.8	14.0	10.4	11.1	13.4	13.3		
2010					11.2	12.3	12.6	12.1	12.7	11.5		
2011					10.0	12.2	12.4	12.4	12.3	11.6		
2012												
2013												
2014												
2015												
2016			8.8	11.6	12.9	11.5	11.5	12.7	16.4	11.7	10.5	5.9
2017	4.1	6.0	8.3	9.2	12.4	12.2	11.7	12.1	13.9	13.0	8.8	5.8
Median	6.0	6.3	8.0	9.5	11.3	11.8	11.3	11.8	14.4	13.4	9.6	5.8

Key

T in ºC

- T ≤ 6.6
- 6.6 < T ≤ 8.5
- 8.5 < T ≤ 9.5
- 9.5 < T ≤ 10.1
- 10.1 < T ≤ 10.7
- 10.7 < T ≤ 11.2
- 11.2 < T ≤ 11.7
- 11.7 < T ≤ 13.2
- 13.2 < T ≤ 14.9
- 14.9 < T ≤ 16.1
- T > 16.1

T as percentile

- T ≤ 5th
- 5th < T ≤ 10th
- 10th < T ≤ 15th
- 15th < T ≤ 20th
- 20th < T ≤ 30th
- 30th < T ≤ 40th
- 40th < T ≤ 50th
- 50th < T ≤ 75th
- 75th < T ≤ 90th
- 90th < T ≤ 95th
- T > 95th

Distribution

- The highest average temperatures occurred in September and October which is unusual because that is after the warmest period of the summer.
- Individual days with high temperatures have occurred in June through October.
- Little data is available outside of the summer season. The lowest temperatures occur in December through February.
- No temperature data were collected in 2012–2015.

Reservoir effects

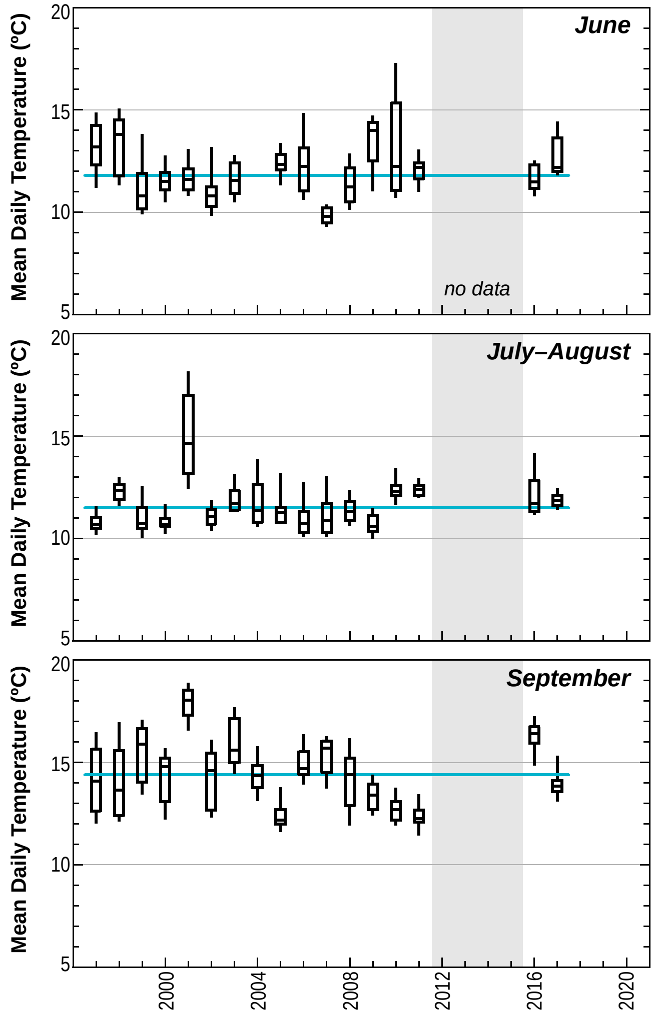
- During the summer season, a substantial fraction of the water at Dilley originated in Scoggins Reservoir. Reservoir releases account for warm temperatures in September and October. The reservoir traps heat in the upper warm layer during the summer and releases it at the end of summer through fall.

Trends

- Water temperatures in June through September do no show any trend.

Oregon water temperature standard

- Water temperature standard exceedance only can be assessed for 2016–2017 because those are the only years when daily maximum temperatures were measured.
- The water temperature standard was not exceeded during 2016–2017.



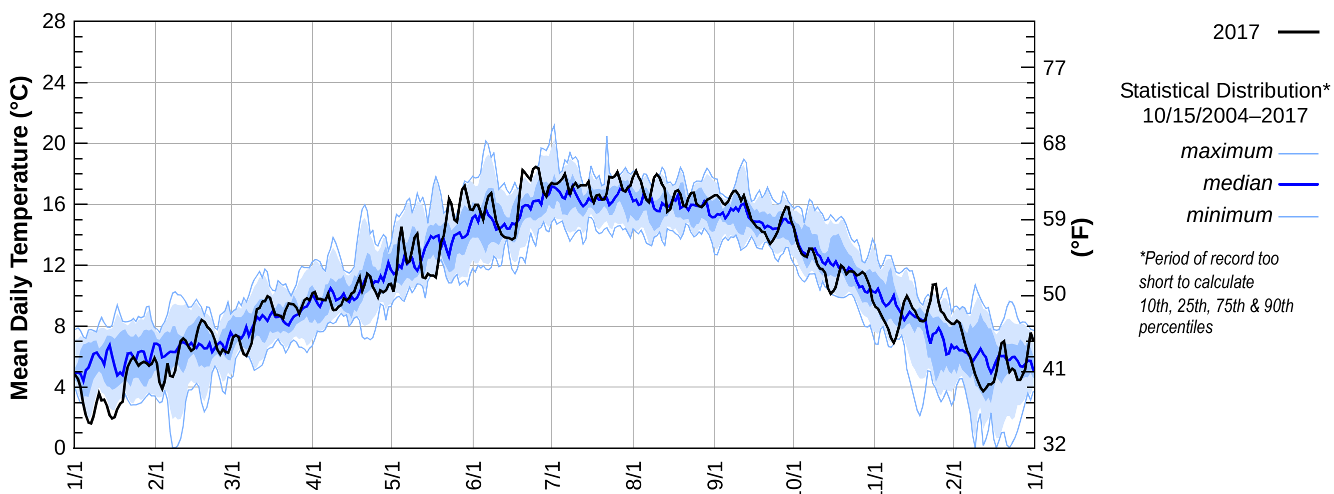
14206241 — TUALATIN RIVER AT HWY 219 BRIDGE — TRJB

Data source: Jackson Bottom Wetland Education Center

River mile: 44.4 *Latitude:* 45 30 01 *Longitude:* 122 59 24

Day	2017 Mean Daily Water Temperature in Degrees Celsius											
	JAN	**FEB**	**MAR**	**APR**	**MAY***	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
1	4.79	5.56	6.68	10.17	10.79	15.63	17.42	17.82	16.61	14.49	9.26	8.15
2	4.56	4.29	7.30	10.26	10.27	15.97	17.33	18.21	16.59	13.71	9.14	8.36
3	4.01	3.89	7.43	9.79	11.48	15.97	17.35	17.79	16.40	13.16	8.81	8.23
4	2.88	4.38	7.28	9.79	13.58	15.49	17.49	17.49	16.10	12.74	8.47	7.62
5	2.12	5.57	6.65	9.74	14.54	15.02	17.70	16.83	15.99	12.60	8.14	6.93
6	1.69	4.76	6.18	9.71	13.27	15.90	18.01	16.30	16.16	12.56	7.78	6.36
7	1.63	4.70	6.08	10.15	12.16	16.54	17.36	16.13	16.59	13.10	7.22	6.01
8	2.10	5.11	6.46	9.60	12.27	16.74	16.62	16.93	16.85	13.10	6.92	5.43
9	2.96	6.08	6.93	9.06	13.01	15.85	17.19	17.78	16.90	12.60	7.32	4.81
10	3.60	7.02	8.19	9.08	13.85	14.85	17.39	17.98	16.66	12.05	7.98	4.39
11	3.13	7.20	9.12	9.29	14.07	14.43	17.12	17.78	16.24	11.77	8.90	4.00
12	3.19	7.04	9.21	9.40	12.64	14.01	17.25	17.30	16.60	11.75	9.64	3.75
13	2.76	6.67	9.63	9.83	11.22	13.85	17.25	17.02	16.04	11.51	9.98	3.94
14	2.17	6.39	9.64	9.72	11.16	13.80	17.26	15.53	15.54	10.49	9.62	4.19
15	1.96	6.52	9.99	9.85	11.46	13.78	17.51	15.68	14.97	10.13	9.22	4.18
16	2.05	7.35	9.89	10.18	11.33	13.70	16.55	16.31	14.73	10.29	9.03	4.35
17	2.58	8.05	9.30	10.25	11.32	13.82	16.11	16.86	14.50	10.58	8.65	5.02
18	2.93	8.43	8.74	10.78	11.21	15.14	16.58	16.93	14.43	11.35	8.37	6.02
19	3.06	8.30	8.74	11.24	12.27	16.91	16.62	16.66	14.20	11.98	8.33	6.89
20	4.55	7.99	8.69	10.35	13.53	18.23	16.30	15.94	14.17	11.83	8.42	7.03
21	5.38	7.83	8.51	10.79	13.99	18.06	16.32	15.87	13.74	11.41	9.10	5.77
22	5.78	7.57	9.10	11.44	15.05	17.82	16.76	16.44	13.40	11.61	9.68	5.01
23	5.98	7.06	9.51	11.27	16.35	17.63	17.80	16.75	13.61	11.61	10.73	5.22
24	5.69	6.43	9.47	10.57	16.01	18.32	17.75	16.76	13.92	11.56	10.76	5.09
25	5.40	6.16	9.43	10.27	14.98	18.46	17.87	16.04	14.29	11.34	9.62	4.49
26	5.57	6.48	9.24	9.90	14.84	18.37	18.13	15.89	14.95	11.41	8.98	4.48
27	5.68	6.33	8.80	10.36	15.99	17.45	17.62	15.83	15.47	11.56	8.82	4.83
28	5.60	6.26	9.29	10.24	16.98	16.77	16.93	16.00	15.84	11.41	8.46	5.18
29	5.42	6.68	9.72	10.36	17.21	16.51	16.85	16.30	15.80	11.02	8.31	6.29
30	5.53	—	9.84	10.75	16.44	17.18	17.13	16.39	14.89	10.58	8.16	7.58
31	5.94	—	9.72	—	15.67	—	17.22	16.50	—	9.66	—	7.09
MEAN	3.89	6.42	8.54	10.14	13.51	16.07	17.19	16.71	15.41	11.77	8.79	5.70
MAX	5.98	8.43	9.99	11.44	17.21	18.46	18.13	18.21	16.90	14.49	10.76	8.36
MIN	1.63	3.89	6.08	9.06	10.27	13.70	16.11	15.53	13.40	9.66	6.92	3.75

TRJB – 14206241 – Tualatin River at Hwy 219 Bridge [RM 44.4]



FREQUENCY OF MEAN DAILY TEMPERATURE BY MONTH FOR PERIOD OF RECORD

MONTH	0 ≤ T < 3.0	3.0 ≤ T < 5.5	5.5 ≤ T < 7.0	7.0 ≤ T < 8.0	8.0 ≤ T < 9.0	9.0 ≤ T < 10	10 ≤ T < 12	12 ≤ T < 14	14 ≤ T < 15	15 ≤ T < 16	16 ≤ T < 17	17 ≤ T < 18	18 ≤ T < 22	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	1.5%	9.1%	9.5%	8.3%	8.2%	7.1%	12%	11%	8.9%	9.6%	8.4%	4.8%	1.4%	0.4%

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

MEAN DAILY TEMPERATURE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2004										11.8	7.7	5.8
2005	5.0	5.4	9.0	10.3	13.1	14.6	17.1	15.5	13.6	13.2	7.3	5.6
2006	7.5	6.6	7.6	10.7	13.2	15.6	16.3	14.9	15.4	12.4	8.7	6.1
2007	4.7	7.2	9.0	10.0	13.5	14.3	15.8	14.9	15.4	11.6	8.3	5.9
2008	4.9	6.1	7.1	8.3	12.7	14.8	15.0	15.1	14.8	11.5	8.9	4.3
2009	4.6	4.7	7.0	10.1	12.0	16.5	16.5	14.8	14.8	12.3	8.2	3.9
2010	7.4	8.1	8.8	10.6	11.8	13.2	17.0	16.3	14.6	11.2	8.6	7.1
2011	6.7	5.6	8.0	9.1	11.2	14.1	16.1	16.3	15.0	12.1	7.8	4.7
2012	6.0	6.7	7.1	10.6	12.3	14.9	16.6	16.0	13.6	11.6	8.8	6.7
2013	4.6	6.6	8.2	11.0	13.2	15.5	16.4	16.2	15.9	10.5	9.0	4.0
2014	4.8	6.3	9.3	10.9	13.7	15.9	17.4	16.6	15.5	14.4	8.8	8.1
2015	7.2	9.1	10.4	10.9	14.2	16.9	17.1	17.3	16.1	14.5	8.9	7.4
2016	7.3	8.4	9.4	12.2	14.6	16.4	16.0	16.4	16.0	12.1	11.1	5.3
2017	3.6	6.5	9.1	10.2	13.5	16.0	17.3	16.7	15.7	11.6	8.8	5.2
Median	5.7	6.7	8.4	10.3	13.1	15.3	16.5	16.0	15.0	12.1	8.5	5.9

Key

T in ºC

- T ≤ 4.3
- 4.3 < T ≤ 5.4
- 5.4 < T ≤ 6.3
- 6.3 < T ≤ 7.0
- 7.0 < T ≤ 8.2
- 8.2 < T ≤ 9.5
- 9.5 < T ≤ 11.1
- 11.1 < T ≤ 14.9
- 14.9 < T ≤ 16.5
- 16.5 < T ≤ 17.2
- T > 17.2

T as percentile

- T ≤ 5th
- 5th < T ≤ 10th
- 10th < T ≤ 15th
- 15th < T ≤ 20th
- 20th < T ≤ 30th
- 30th < T ≤ 40th
- 40th < T ≤ 50th
- 50th < T ≤ 75th
- 75th < T ≤ 90th
- 90th < T ≤ 95th
- T > 95th

Distribution

- The highest average temperatures occurred in July and August, but individual days with high temperatures can occur from June through September.
- The lowest average temperatures occurred in December and January.

Trends

- Water temperatures showed increasing trends in June, July–August, and September that were statistically significant. Because the period of record is short, the trend may be due to long-term weather patterns such as the Pacific Decadal Oscillation and the El-Niño Southern Oscillation. More years will be required to know if this trend persists.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

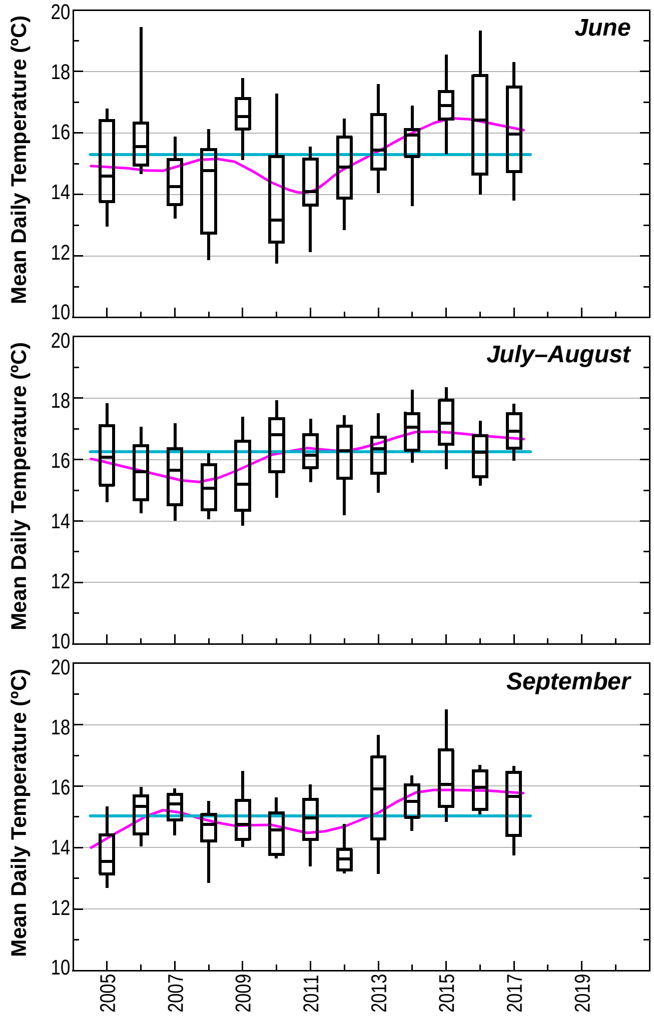
Oregon water temperature standard

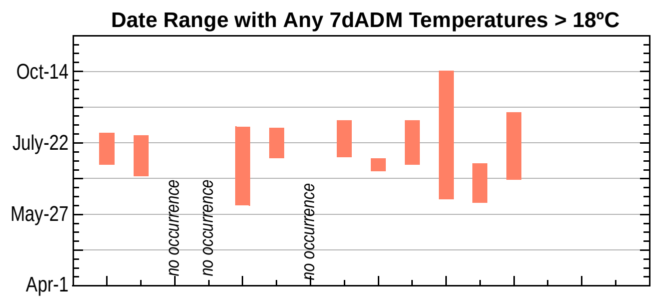
- Temperatures at this site exceeded the standard in more than half of the years (77%).
- Statistics for years with standard exceedances are:

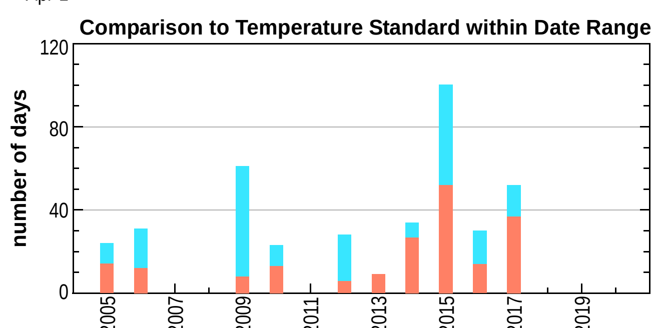
average first day	Jun-25
average last day	Aug-2
median number of days	14

The average date range and median number of days with exceedances are not shown on the graphs at the right because many years do not have exceedances.

- Days when the 7dADM did not exceed the standard often occurred within the date range of exceedances.







14206694 — TUALATIN RIVER AT RIVER MILE 24.5, NR SCHOLLS, OR — RM24.5

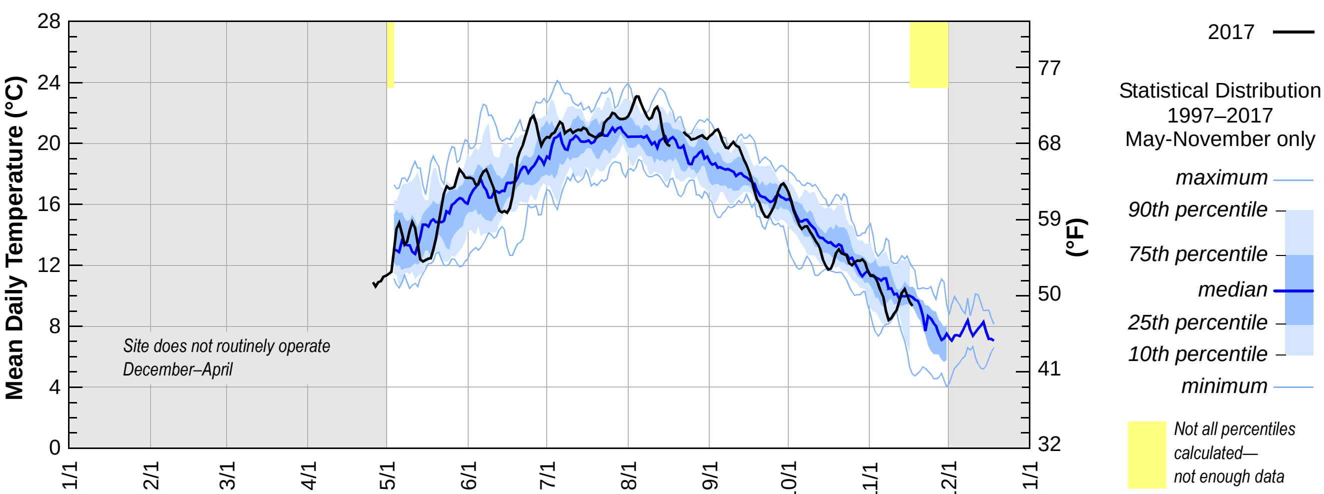
Data source: U.S. Geological Survey, Oregon Water Science Center

River mile: 24.5 *Latitude:* 45 24 06 *Longitude:* 122 53 38.

Day	2017 Mean Daily Water Temperature in Degrees Celsius											
	JAN	FEB	MAR	APR*	MAY	JUN	JUL	AUG*	SEP	OCT	NOV*	DEC
1					11.33	17.74	20.42	21.78	20.48	16.75	11.31	
2					11.43	17.75	20.38	22.16	20.62	16.22	11.31	
3					11.58	17.68	20.63	22.62	20.85	15.52	11.16	
4					13.05	17.30	20.72	23.09	20.93	15.04	10.80	
5					14.43	17.32	21.10	23.06	20.59	14.62	10.25	
6					14.79	17.83	21.42	22.55	20.08	14.39	9.88	
7					14.07	18.15	21.29	22.14	19.73	14.54	8.97	
8					13.36	18.27	20.68	21.80	19.68	14.56	8.41	
9					13.55	17.91	20.82	21.60	19.91	14.21	8.54	
10					14.28	17.44	20.93	21.71	20.11	13.96	8.85	
11					14.84	17.01	20.69	22.22	19.88	13.67	9.07	
12					14.43	16.18	20.82	22.39	19.78	13.43	9.60	
13					13.48	15.59	20.90	21.98	19.35	13.08	10.20	
14					12.38	15.48	20.86	20.95	18.91	12.36	10.45	
15					12.26	15.58	21.04	20.14	18.57	11.98	10.02	
16					12.35	15.47	20.95	19.91	18.09	11.73	9.59	
17					12.44	15.78	20.63	19.84	17.52	11.79	9.33	
18					12.46	16.51	20.55		16.89	12.24		
19					13.04	17.65	20.45		16.31	12.81		
20					13.77	19.02	20.38		16.05	13.05		
21					14.80	19.55	20.50		15.51	12.79		
22					15.81	19.94	20.55	20.78	15.19	12.73		
23					16.74	20.50	21.34	20.59	15.16	12.65		
24					17.19	21.05	21.57	20.47	15.41	12.13		
25					17.03	21.61	21.70	20.26	15.75	12.00		
26				10.88	17.06	21.81	22.01	20.30	16.20	12.20		
27				10.61	17.17	21.33	21.96	20.37	16.87	12.31		
28				10.91	17.78	20.50	21.71	20.46	17.28	12.29		
29				10.98	18.31	19.88	21.60	20.55	17.38	12.39		
30		—		11.26	18.06	20.22	21.60	20.38	17.10	12.21		
31		—		—	17.75	—	21.65	20.30	—	11.68	—	
MEAN					14.55	18.27	21.03	21.27	18.21	13.27		
MAX					18.31	21.81	22.01	23.09	20.93	16.75		
MIN					11.33	15.47	20.38	19.84	15.16	11.68		

* Incomplete record (monthly statistics computed when at least 80% of the record was complete for the month)

RM24.5 – 14206694 – Tualatin River at River Mile 24.5 near Scholls, OR [RM 24.5]



FREQUENCY OF MEAN DAILY TEMPERATURE BY MONTH FOR PERIOD OF RECORD

MONTH	0 ≤ T < 8	8 ≤ T < 10	10 ≤ T < 12	12 ≤ T < 14	14 ≤ T < 16	16 ≤ T < 17	17 ≤ T < 18	18 ≤ T < 19	19 ≤ T < 20	20 ≤ T < 21	21 ≤ T < 22	22 ≤ T < 23	23 ≤ T < 25	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	2.0%	4.3%	7.8%	11%	13%	10%	10%	10%	8.4%	9.3%	6.1%	2.2%	0.6%	1.2%

Key
f ≥ 3%
2% ≤ *f* < 3%
1% ≤ *f* < 2%
0.2% ≤ *f* < 1%
0.06% ≤ *f* < 0.2%
0 < *f* < 0.06%

MEAN DAILY TEMPERATURE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997					16.0	16.9	20.1	20.0	16.8	12.0		
1998					12.9	17.2	20.4	19.4	17.2	13.4	10.4	
1999					12.4	16.2	18.8	19.2	16.9	12.8	10.5	
2000					14.6	17.6	19.8	18.0	16.2	14.0	7.1	
2001					15.1	17.6	21.1	21.0	19.1	13.7	9.9	
2002					14.5	17.9	21.1	19.7	16.9	14.0	10.0	7.0
2003					13.6	18.4	21.8	19.5	17.6	15.0	8.6	8.0
2004					15.7	18.8	21.6	20.1	17.7	15.0	9.4	
2005			9.8	10.7	14.0	16.1	20.5	20.4	16.8	14.5		
2006					14.4	17.3	20.2	19.2	17.2	13.6	9.1	
2007					15.2	17.5	20.5	18.9	17.5	13.4	9.8	6.6
2008					14.5	16.5	19.3	18.6	17.1	12.8	10.2	
2009					13.2	18.9	21.3	18.7	17.3	13.4	9.4	
2010					13.0	14.1	19.6	19.8	16.8	12.8	10.5	
2011					12.1	15.6	18.8	19.9	17.9	13.9	9.3	
2012					13.5	16.7	19.9	20.2	16.8	13.3	9.5	8.3
2013					14.8	17.6	20.7	20.2	18.6	11.9	10.1	
2014					15.2	18.2	21.3	21.1	18.4	16.1	9.6	8.1
2015					16.1	20.7	21.6	21.1	17.9	16.0	10.4	
2016					16.4	18.9	20.1	20.4	17.5	12.9	12.1	
2017					14.3	17.8	20.9	21.0	18.3	12.8	9.9	
Median			9.8	12.5	14.5	17.6	20.4	19.9	17.3	13.7	9.8	7.6

Key
T in ºC
T ≤ 8.5
8.5 < T ≤ 10.1
10.1 < T ≤ 11.5
11.5 < T ≤ 12.3
12.3< T ≤ 14.0
14.0 < T ≤ 15.5
15.5 < T ≤ 16.7
16.7 < T ≤ 19.1
19.1 < T ≤ 20.8
20.8 < T ≤ 21.5
T > 21.5
T as percentile
T ≤ 5th
5th < T ≤ 10th
10th < T ≤ 15th
15th < T ≤ 20th
20th < T ≤ 30th
30th < T ≤ 40th
40th < T ≤ 50th
50th < T ≤ 75th
75th < T ≤ 90th
90th < T ≤ 95th
T > 95th

Distribution

- The highest temperatures occurred in July and August.
- Temperature is not routinely measured at this site during high flow which is when low temperatures would occur.
- Because data during low temperature periods are missing, the percentiles are skewed and under-represent low temperatures.

Trends

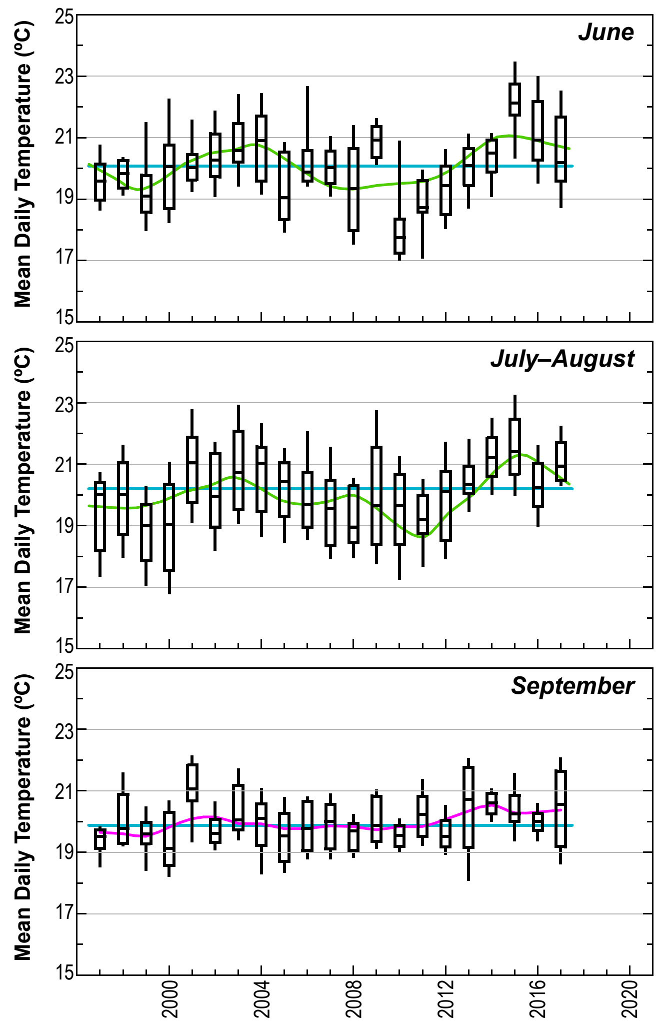
- Water temperatures in June and July–August do not show any statistically significant trends. The year-to-year variability is considerable and appears somewhat cyclical.
- Water temperatures in September show an increasing trend. The trend is statistically significant even though the increase is small. Year-to-year variability is less in September than in the earlier summer months.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

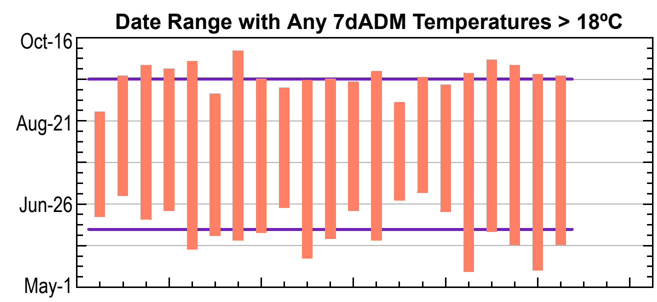
Oregon water temperature standard

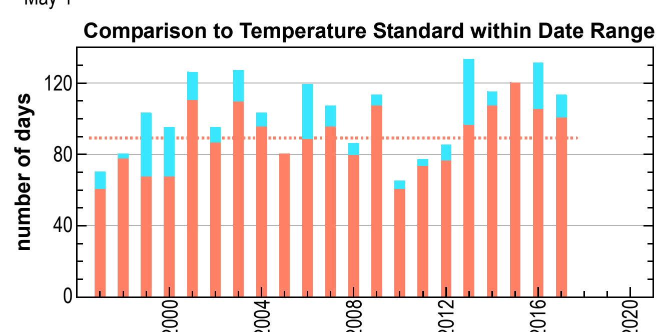
- Temperatures at this site exceeded the standard in all years.
- Statistics for exceedances of the standard are:

average first day	Jun-9
average last day	Sep-18
median number of days	89

- Days when the 7dADM did not exceed the standard occurred within the date range of exceedances, but were a minor fraction.







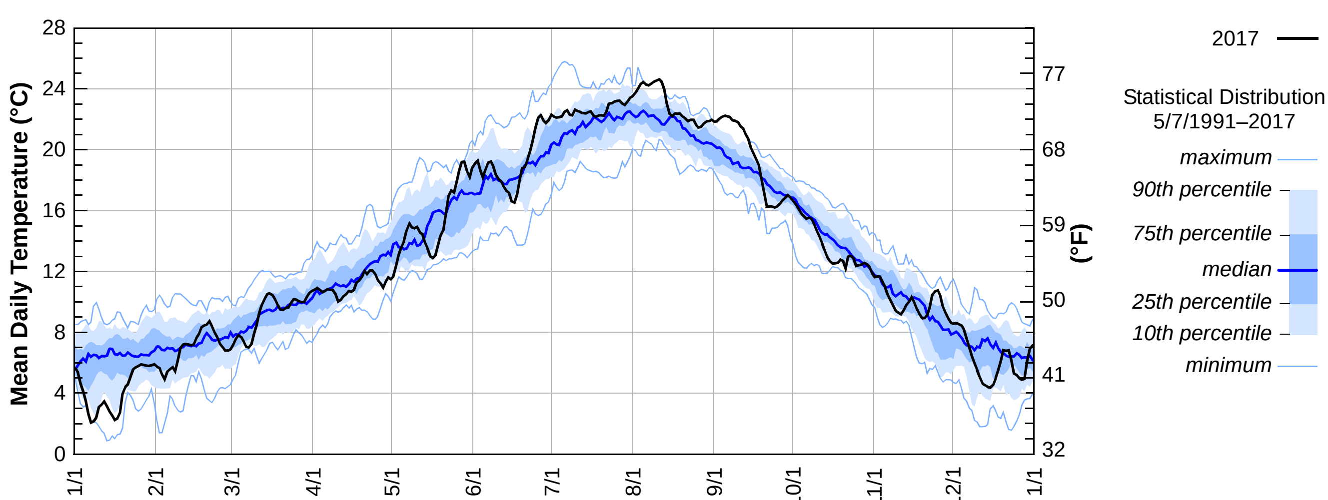
14207200 — TUALATIN RIVER AT OSWEGO DAM, NEAR WEST LINN, OR. — ODAM

Data source: U.S. Geological Survey, Oregon Water Science Center

River mile: 24.5 *Latitude:* 45 21 24 *Longitude:* 122 41 02.

Day	2017 Mean Daily Water Temperature in Degrees Celsius											
	JAN	FEB	MAR	APR*	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC*
1	5.65	5.74	6.89	10.72	11.49	18.84	22.29	23.52	21.83	16.64	11.63	8.56
2	5.37	5.66	7.17	10.80	11.67	19.08	22.18	23.74	21.86	16.42	11.67	8.61
3	4.68	5.22	7.56	10.92	12.39	19.27	22.11	24.01	22.05	16.12	11.64	8.54
4	4.12	4.90	7.81	10.79	13.09	18.66	22.14	24.32	22.17	15.80	11.31	8.46
5	3.49	5.44	7.71	10.65	13.60	18.21	22.20	24.44	22.24	15.65	10.93	8.16
6	2.65	5.57	7.41	10.72	13.98	18.71	22.48	24.28	22.20	15.47	10.44	7.59
7	2.08	5.71	7.06	10.86	14.74	19.15	22.59	24.24	22.12	15.53	10.09	6.96
8	2.15	5.43	7.01	10.79	15.16	19.20	22.30	24.33	21.91	15.47	9.76	6.43
9	2.43	6.10	7.24	10.76	14.88	18.87	22.25	24.47	21.89	15.08	9.42	5.95
10	3.10	6.98	7.92	10.49	14.85	18.32	22.64	24.55	21.82	14.66	9.29	5.53
11	3.24	7.20	8.47	10.04	14.92	18.06	22.54	24.62	21.54	14.30	9.19	5.05
12	3.46	7.23	9.28	10.14	14.56	17.93	22.48	24.47	21.37	13.88	9.45	4.64
13	3.12	7.19	9.86	10.37	14.46	17.53	22.41	23.98	20.98	13.40	9.77	4.54
14	2.78	7.15	10.23	10.52	13.90	17.27	22.39	23.04	20.68	12.91	10.01	4.41
15	2.54	7.22	10.52	10.73	13.51	17.15	22.46	22.33	20.12	12.66	10.30	4.37
16	2.24	7.61	10.56	10.66	12.99	16.60	22.51	22.19	19.70	12.51	9.97	4.55
17	2.34	7.88	10.45	10.78	12.88	16.52	22.26	22.38	19.33	12.53	9.54	5.00
18	2.77	8.34	10.13	11.27	13.08	17.05	22.18	22.36	18.96	12.58	9.21	5.52
19	4.00	8.46	9.78	11.42	13.76	17.99	22.26	22.39	18.08	12.78	8.92	6.11
20	4.40	8.51	9.48	11.65	14.39	18.78	22.26	22.18	17.26	12.69	8.94	6.81
21	4.57	8.74	9.47	12.04	14.75	18.88	22.23	22.04	16.24	12.22	9.16	6.78
22	5.09	8.40	9.60	11.84	15.80	19.38	22.48	21.88	16.28	12.99	9.65	6.81
23	5.59	7.96	9.63	12.06	16.98	19.92	23.04	21.96	16.27	13.01	10.48	6.17
24	5.70	7.65	9.93	12.07	17.31	20.59	23.05	21.96	16.21	12.84	10.71	5.31
25	5.79	7.26	10.18	11.86	17.18	21.39	23.15	21.64	16.30	12.37	10.76	5.20
26	5.90	7.04	10.16	11.47	17.86	22.08	23.21	21.46	16.46	12.40	10.38	4.99
27	5.85	6.80	10.05	11.25	18.63	22.25	23.23	21.49	16.69	12.44	9.68	4.89
28	5.81	6.80	9.98	10.93	19.19	21.92	23.04	21.71	16.83	12.57	9.23	4.95
29	5.79	6.89	9.98	11.33	19.20	21.75	22.94	21.85	17.01	12.50	8.90	6.07
30	5.83	—	10.30	11.61	18.55	21.93	23.15	21.88	16.84	12.32	8.63	6.92
31	5.89	—	10.57	—	18.19	—	23.42	21.97	—	11.90	—	7.14
MEAN	4.14	6.93	9.11	11.05	15.09	19.11	22.58	22.96	19.44	13.70	9.97	6.16
MAX	5.90	8.74	10.57	12.07	19.20	22.25	23.42	24.62	22.24	16.64	11.67	8.61
MIN	2.08	4.90	6.89	10.04	11.49	16.52	22.11	21.46	16.21	11.90	8.63	4.37

ODAM – 14207200 – Tualatin River at Oswego Dam near West Linn, Oregon [RM 3.4]



14207200 — TUALATIN RIVER AT OSWEGO DAM, NEAR WEST LINN, OR. — ODAM

Data source: U.S. Geological Survey, Oregon Water Science Center

FREQUENCY OF MEAN DAILY TEMPERATURE BY MONTH FOR PERIOD OF RECORD

MONTH	0 ≤ T < 6.0	6.0 ≤ T < 7.5	7.5 ≤ T < 9.0	9.0 ≤ T < 11	11 ≤ T < 13	13 ≤ T < 16	16 ≤ T < 18	18 ≤ T < 19	19 ≤ T < 20	20 ≤ T < 21	21 ≤ T < 22	22 ≤ T < 23	23 ≤ T < 26	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	7.4%	10%	11%	11%	9.4%	11%	9.3%	5.6%	4.7%	5.1%	5.2%	4.4%	2.6%	3.2%

Key

$f \geq 3\%$
$2\% \leq f < 3\%$
$1\% \leq f < 2\%$
$0.2\% \leq f < 1\%$
$0.06\% \leq f < 0.2\%$
$0 < f < 0.06\%$

MEAN DAILY TEMPERATURE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991					13.0	16.1	21.5	21.8	18.5	14.8	9.8	6.9
1992	6.4	8.5	11.2	12.5	16.6	20.8	21.4	21.1	17.5	14.1	10.5	5.6
1993	4.0	5.9	8.3	10.0	16.3	16.7	18.9	20.6	16.5	14.7	8.3	6.9
1994	7.5	5.6	9.3	11.6	16.3	17.8	21.7		18.6	13.5	7.0	7.6
1995	6.7	9.5			14.7	18.5	22.1	20.1	18.7	14.1	11.0	7.9
1996	8.0				13.6	18.1	21.2	20.8	16.9	14.5	9.6	7.1
1997		7.5	8.7	11.3	17.4	18.1	20.8	22.4	17.6	12.4	9.9	6.8
1998	7.1	8.6	9.9	11.1	13.5	18.4	21.8	22.0	19.6	14.0	10.8	7.1
1999	7.0	7.1	8.6	11.2	12.9	17.5	20.1	21.1	18.1	13.7	10.6	8.2
2000	6.0	7.5			15.2	18.1	21.1	20.6	17.6	14.4	8.2	6.7
2001	6.5	6.6	9.8	10.8	15.8	18.6	21.0	21.1	19.5	14.3	10.8	7.2
2002	6.6	6.7	7.5	11.7	15.3	19.3	22.4	21.3	18.6	14.0	9.7	7.5
2003	7.6	8.1	9.8	11.5	13.8	20.0	22.9	21.4	18.4	15.3	9.2	7.8
2004	6.0	7.3	10.6	12.5	16.5	18.7	23.0	23.1	18.6	15.6	9.5	7.8
2005	6.0	6.7			14.9	17.0	21.2	22.5	18.5	15.0	8.8	6.0
2006	7.8	7.0	8.1	11.5	15.4	18.2	22.3	21.3	18.2	14.1	9.3	6.1
2007	5.3	7.6	9.9	11.1	15.7	18.9	21.6	20.6	18.8	13.8	10.2	6.5
2008	5.3	6.6	8.4	9.5	15.3	16.6	21.7	20.8	18.6	13.6	11.3	4.9
2009	5.0	5.6	7.7	11.0	13.3	19.6	21.8	20.8	18.9	14.0	9.0	4.8
2010	7.6	8.3	9.4	11.8	13.3	14.5	21.0	21.6	17.8	14.3	10.2	7.3
2011	7.0	6.7			12.9	16.7	19.7	21.4	19.4	14.4	9.5	5.5
2012	6.3	7.2	7.5	11.5	14.5	17.2	21.3	22.2	18.4	13.8	10.1	7.5
2013	4.7	7.4	8.8	12.3	16.5	18.7	22.4	22.0	20.0	12.2	10.5	5.6
2014	5.8	6.6	9.9	12.3	15.4	18.8	22.7	23.0	19.5	16.5	9.8	8.6
2015	7.5	9.5	11.2	12.3	16.7	21.9	24.1	22.6	18.9	16.2	10.7	7.7
2016	7.5	8.7	10.0	13.7	17.2	19.6	21.5	22.3	18.4	13.8	12.1	5.7
2017	4.1	7.2	9.6	10.8	14.7	18.9	22.5	22.4	19.9	12.9	9.8	6.1
Median	6.4	7.3	9.2	11.6	15.2	18.5	21.7	21.6	18.5	14.2	9.9	6.9

Key

T in ºC
$Q \leq 5.4$
$5.4 < T \leq 6.4$
$6.4 < T \leq 7.1$
$7.1 < T \leq 7.7$
$7.7 < T \leq 9.1$
$9.1 < T \leq 10.8$
$10.8 < T \leq 12.9$
$12.9 < T \leq 18.7$
$18.7 < T \leq 21.5$
$21.5 < T \leq 22.4$
$T > 22.4$

T as percentile
$Q \leq 5th$
$5th < T \leq 10th$
$10th < T \leq 15th$
$15th < T \leq 20th$
$20th < T \leq 30th$
$30th < T \leq 40th$
$40th < T \leq 50th$
$50th < T \leq 75th$
$75th < T \leq 90th$
$90th < T \leq 95th$
$T > 95th$

Distribution

- The highest temperatures occurred in July and August.
- The lowest temperatures occurred in December and January.

Trends

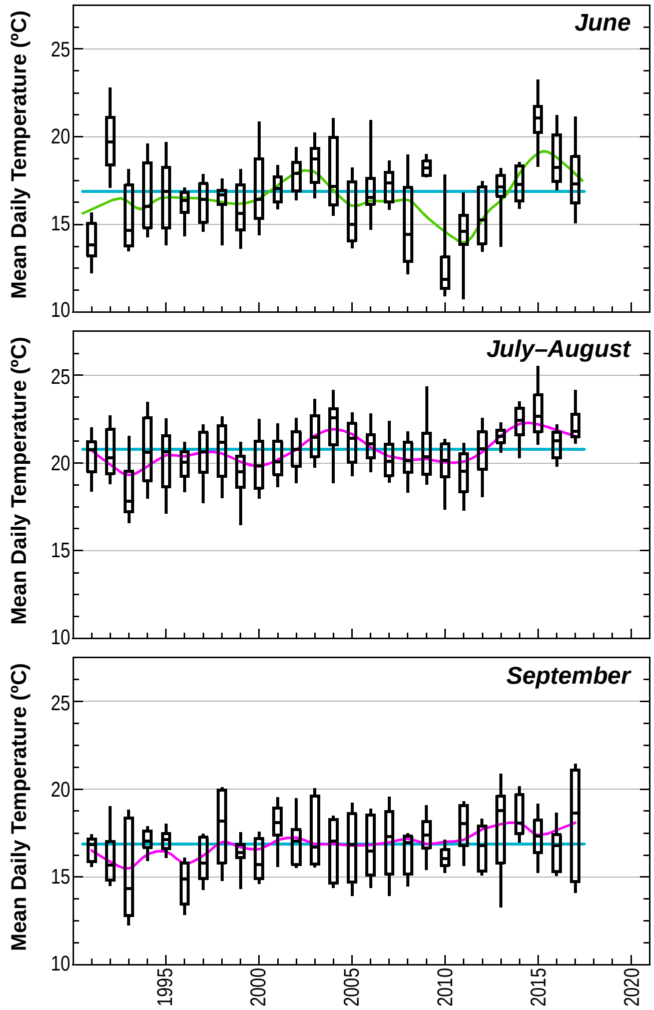
- Water temperatures in June do not show any statistically significant trends.
- Water temperatures in July–August and September show an increasing trend. The trend is statistically significant even though the increase is small.
- The year-to-year variability in June and July–August is considerable and appears to be somewhat cyclical. Year-to-year variability is less in September than in the earlier summer months.
- This site illustrates the importance of a long period of record, especially when long-term patterns such as the Pacific Decadal Oscillation and the El-Nino Southern Oscillation may be active.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

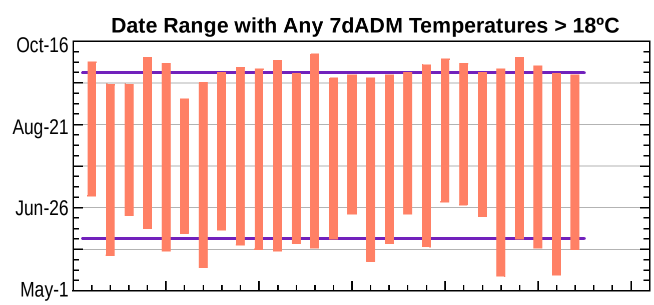
Oregon water temperature standard

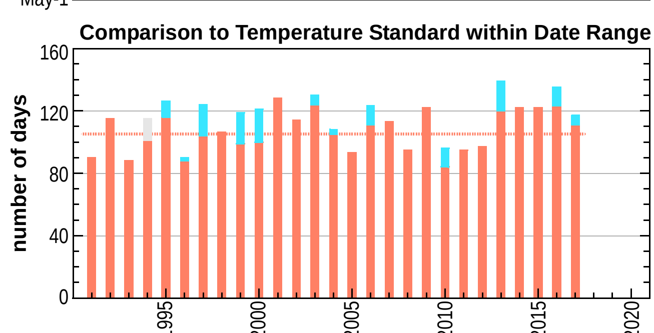
- Temperatures at this site exceeded the standard in all years.
- Statistics for exceedances of the standard are:

average first day	Jun-5
average last day	Sep-25
median number of days	106

- Days when the 7dADM did not exceed the standard occurred within the date range of exceedances, but not in all years. When they occurred, they were a minor fraction of the range.
- In 1994, 14 days in August did not have temperature data, however the days before and after had 7dADMs that exceeded 20ºC. It is likely that temperatures on these days also exceeded the standard.







453040123065201** — GALES CREEK AT OLD HWY 47, FOREST GROVE, OR — GALES

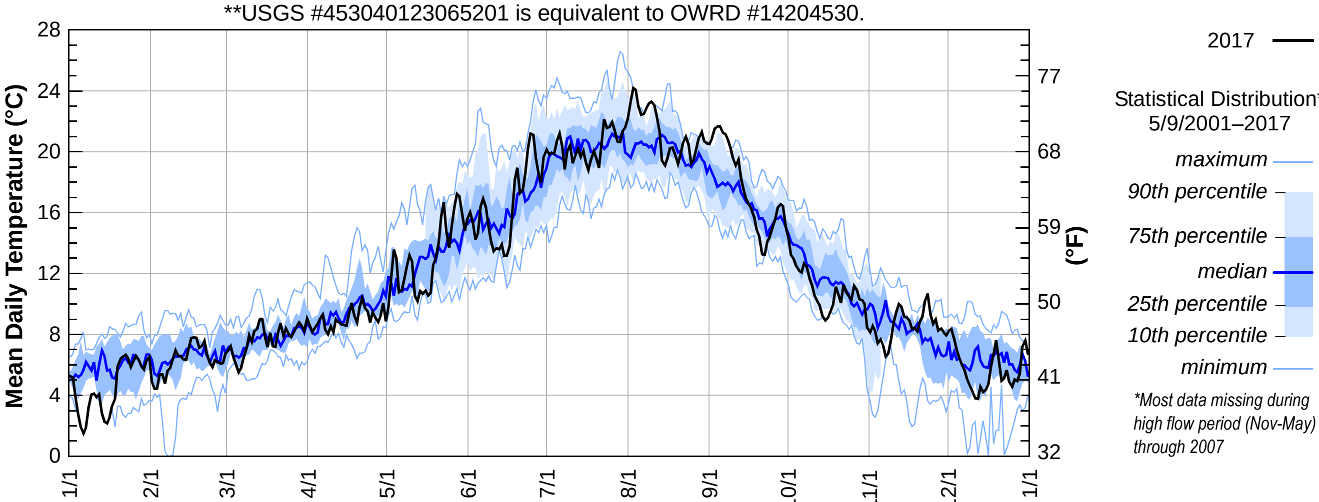
Data source: U.S. Geological Survey, Oregon Water Science Center

River mile: 2.36 *Latitude:* 45 30 39.75 *Longitude:* 123 06 52.0

Day	2017 Mean Daily Water Temperature in Degrees Celsius											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	5.26	4.85	6.76	9.03	8.88	15.64	20.15	22.16	20.50	14.36	8.13	8.24
2	5.20	4.41	6.94	8.60	9.78	16.05	19.83	23.30	20.91	13.21	8.57	8.36
3	3.94	4.44	7.24	8.18	11.65	15.36	19.93	24.19	21.53	12.99	8.19	7.70
4	2.72	5.38	6.50	8.44	13.57	14.25	19.88	24.06	21.66	12.47	7.42	6.99
5	1.90	5.36	6.02	8.73	13.01	14.68	20.74	23.01	21.69	12.20	7.68	6.43
6	1.50	4.78	5.54	9.07	10.78	16.40	21.21	22.44	21.29	12.07	7.25	5.99
7	1.92	5.61	5.82	9.32	10.93	16.92	20.37	22.51	21.16	12.68	6.56	5.59
8	3.17	5.81	6.50	8.28	11.67	16.35	18.85	22.89	20.79	12.46	6.74	5.00
9	4.07	6.36	7.10	8.01	12.50	15.09	20.07	23.19	20.25	11.68	7.60	4.60
10	4.12	6.96	7.95	8.54	13.19	14.10	20.44	23.29	19.55	11.23	8.81	4.26
11	3.90	6.60	7.50	8.13	12.78	13.48	19.25	23.06	19.11	10.51	9.48	3.80
12	4.08	6.59	8.23	8.99	10.48	13.65	19.77	22.29	19.52	10.18	9.98	3.77
13	2.81	6.38	8.36	8.80	10.18	13.60	20.22	21.38	18.23	9.87	9.81	4.54
14	2.27	6.33	8.99	8.67	10.84	13.93	19.68	19.40	17.51	9.16	9.14	4.20
15	2.17	7.10	9.01	8.62	10.67	13.16	20.09	19.10	16.87	8.92	9.13	4.35
16	2.59	7.76	7.91	8.58	10.86	13.18	19.32	19.59	16.52	9.10	8.91	4.78
17	3.34	7.81	7.17	9.35	10.56	13.81	18.81	20.23	16.17	9.53	8.36	5.89
18	3.81	7.77	8.12	10.06	10.74	15.84	19.50	20.27	15.72	10.03	8.45	6.70
19	5.96	7.13	7.24	9.18	12.61	18.15	20.04	19.81	14.86	11.13	8.21	7.64
20	6.38	7.25	7.20	8.76	13.02	18.95	19.57	19.20	14.41	10.64	8.87	6.42
21	6.54	7.62	8.09	9.79	14.00	17.30	18.96	19.83	13.27	10.06	9.20	4.96
22	6.67	6.71	8.72	10.36	15.75	17.50	20.65	20.64	13.23	11.26	10.25	5.14
23	6.40	6.12	7.93	9.73	16.68	18.61	22.14	21.01	14.13	10.74	10.69	5.65
24	5.87	5.84	8.38	9.55	14.79	20.23	21.57	20.48	14.43	10.49	9.30	4.87
25	6.24	6.30	8.04	8.79	13.70	21.19	21.64	19.24	15.07	10.29	8.71	4.56
26	6.59	6.20	7.84	9.46	15.12	21.12	21.95	19.48	15.59	11.18	8.99	5.04
27	6.30	6.07	8.17	9.10	16.34	19.58	21.42	20.22	16.35	10.90	8.27	4.95
28	5.92	6.12	8.54	8.83	17.22	18.60	20.65	20.92	16.55	10.33	8.38	5.43
29	5.70	6.76	8.80	9.27	17.06	17.97	20.64	21.33	16.44	10.25	8.13	7.23
30	6.29	—	8.58	10.07	15.92	19.68	21.36	20.67	15.03	9.99	7.95	7.64
31	6.51	—	8.22	—	14.81	—	21.60	20.55	—	8.44	—	6.76
MEAN	4.52	6.29	7.66	9.01	12.91	16.48	20.33	21.28	17.61	10.91	8.57	5.73
MAX	6.67	7.81	9.01	10.36	17.22	21.19	22.14	24.19	21.69	14.36	10.69	8.36
MIN	1.50	4.41	5.54	8.01	8.88	13.16	18.81	19.10	13.23	8.44	6.56	3.77

GALES – 453040123065201 – Gales Creek at Old Hwy 47 near Forest Grove, Oregon [RM 2.36]**

**USGS #453040123065201 is equivalent to OWRD #14204530.



FREQUENCY OF MEAN DAILY TEMPERATURE BY MONTH FOR PERIOD OF RECORD

MONTH	0 ≤ T < 5	5 ≤ T < 7	7 ≤ T < 9	9 ≤ T < 11	11 ≤ T < 14	14 ≤ T < 16	16 ≤ T < 18	18 ≤ T < 19	19 ≤ T < 20	20 ≤ T < 21	21 ≤ T < 22	22 ≤ T < 23	23 ≤ T < 27	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	4.6%	8.6%	12%	9.3%	9.9%	8.1%	8.1%	3.9%	4.9%	4.3%	3.2%	1.6%	1.0%	20%

Key
f ≥ 3%
2% ≤ *f* < 3%
1% ≤ *f* < 2%
0.2% ≤ *f* < 1%
0.06% ≤ *f* < 0.2%
0 < *f* < 0.06%

MEAN DAILY TEMPERATURE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001					13.9	15.8	19.9	20.0	17.1	10.8		
2002					12.2	17.1	21.2	19.6	16.3	11.5	7.9	5.9
2003					14.4	16.8	21.0	20.3	17.4	13.7		
2004					14.9	17.3	21.9	21.3	16.6	12.7		
2005						14.7	20.1	20.3	15.4	12.6		
2006					13.3	15.8	20.8	19.3	15.9	11.3	8.7	
2007					14.3	16.8	20.8	19.1	16.3	10.9	7.6	6.2
2008	5.5	#N/A	6.8	7.8	12.9	15.4	20.0	19.5	16.7	10.7	8.7	4.8
2009	4.6	4.6	6.6	9.3	12.0	16.7	21.6	19.5	16.5	11.3	8.2	4.3
2010	7.5	7.8	8.0	9.7	11.1	12.5	19.1	19.1	16.4	10.9	8.1	7.4
2011	6.6	5.6	7.2	8.1	10.6	14.5	17.8	19.3	17.1	12.1	6.9	4.7
2012	6.1	6.4	7.0	9.4	12.0	14.8	19.6	20.0	16.3	11.1	8.9	7.2
2013	4.7	6.4	7.7	10.1	13.3	16.2	20.5	19.9	18.1	10.3	8.6	3.9
2014	5.1	6.3	8.2	10.0	12.6	16.7	21.2	20.7	17.5	13.9	8.5	8.1
2015	7.3	8.7	9.6	10.1	14.4	20.1	22.0	20.3	16.0	13.9	8.4	8.0
2016	7.4	8.2	8.7	11.3	14.6	18.1	19.4	20.0	16.4	11.6	10.2	6.1
2017	4.1	6.3	7.9	8.9	12.8	16.2	20.2	20.9	16.7	10.6	8.5	5.4
Median	5.9	6.5	7.7	9.4	13.0	16.1	20.3	20.0	16.6	11.6	8.3	6.3

Key
T in ºC
T ≤ 4.8
4.8 < T ≤ 6.0
6.0 < T ≤ 6.8
6.8 < T ≤ 7.5
7.5 < T ≤ 8.7
8.7 < T ≤ 10.4
10.4 < T ≤ 12.5
12.5 < T ≤ 17.8
17.8 < T ≤ 20.5
20.5 < T ≤ 21.5
T > 21.5
T as percentile
T ≤ 5th
5th < T ≤ 10th
10th < T ≤ 15th
15th < T ≤ 20th
20th < T ≤ 30th
30th < T ≤ 40th
40th < T ≤ 50th
50th < T ≤ 75th
75th < T ≤ 90th
90th < T ≤ 95th
T > 95th

Distribution

- The highest temperatures occurred in July and August.
- Before 2008, temperature was not measured at this site during high flow which is when low temperatures would occur.
- Because data during low temperature periods are missing, the percentiles are skewed and under-represent low temperatures.

Trends

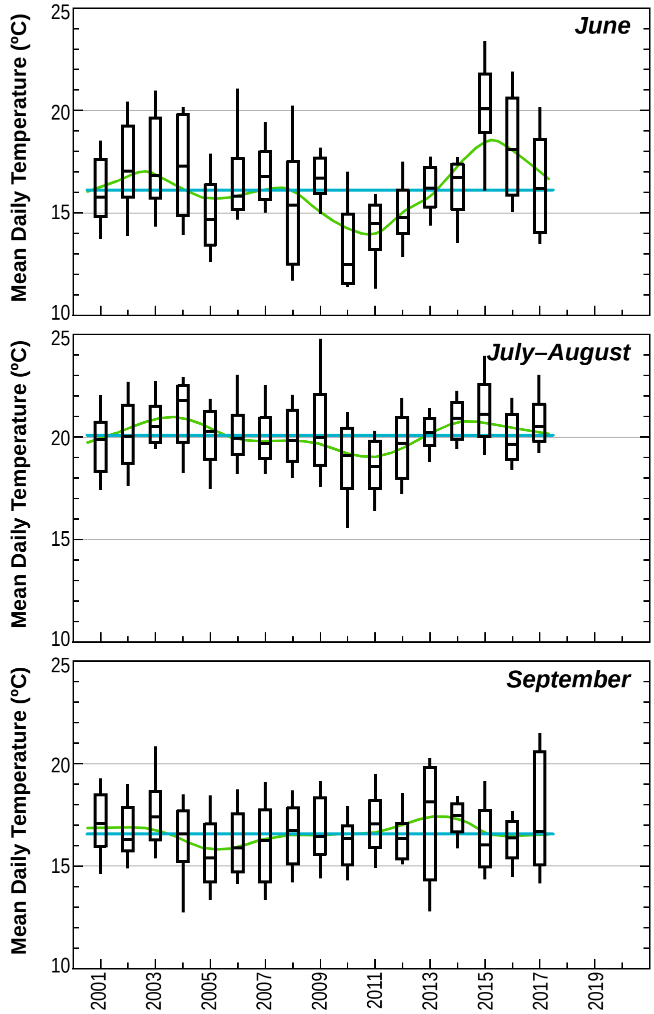
- Water temperatures in June, July–August and September do not show any statistically significant trends.
- The year-to-year variability is considerable, especially in June and appears somewhat cyclical. Year-to-year variability is less in September than in the earlier summer months.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

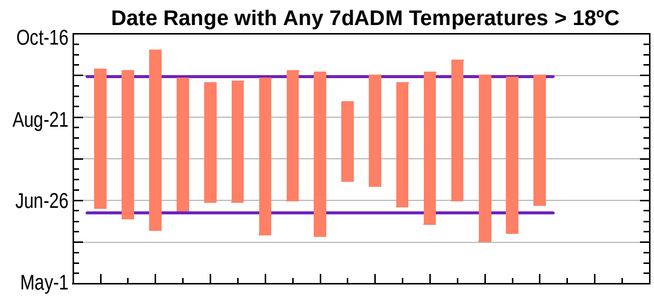
Oregon water temperature standard

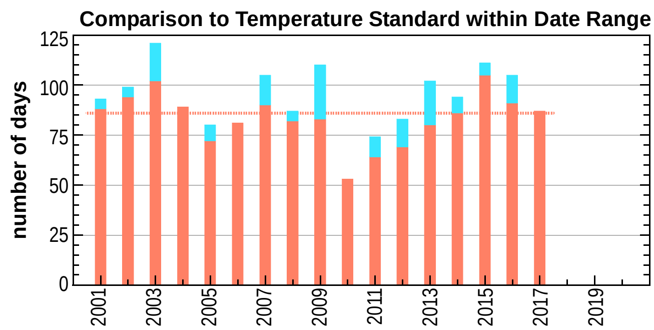
- Temperatures at this site exceeded the standard in all years.
- Statistics for exceedances of the standard are:

average first day	Jun-17
average last day	Sep-17
median number of days	93

- Days when the 7dADM did not exceed the standard occurred within the date range of exceedances, but were a minor fraction.







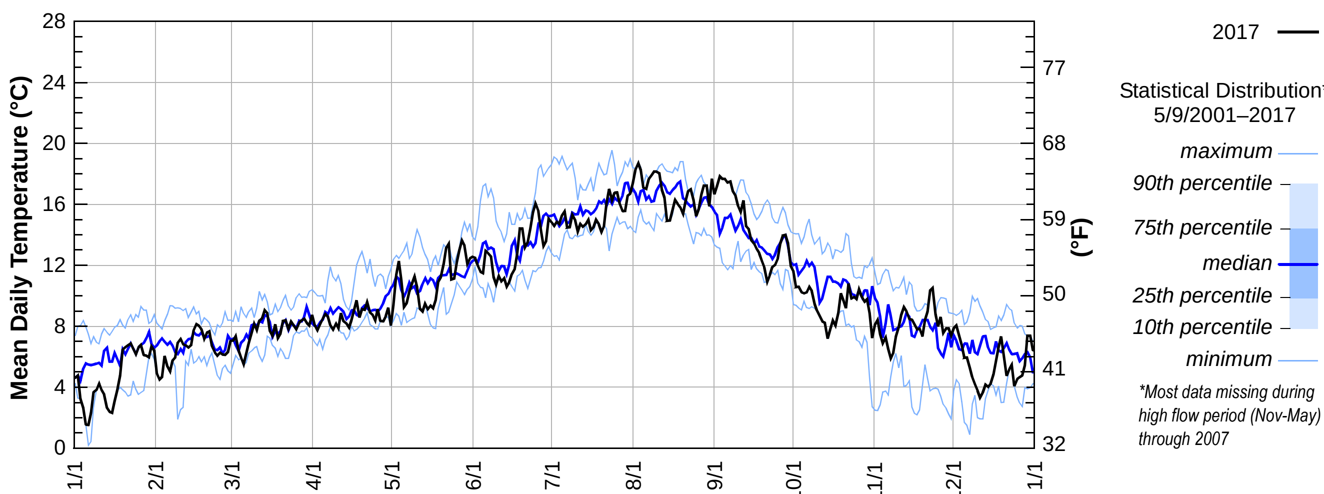
14205400 — EAST FORK DAIRY CREEK NEAR MEACHAM CORNER, OR — 5400

Data source: U.S. Geological Survey, Oregon Water Science Center

River mile: 12.4 *Latitude:* 45 30 39.75 *Longitude:* 123 06 52.0

Day	2017 Mean Daily Water Temperature in Degrees Celsius											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	4.62	4.88	7.04	8.75	8.05	12.56	14.84	17.38	16.66	11.58	8.14	7.88
2	4.77	4.50	7.07	8.08	9.40	12.50	14.58	18.35	17.18	10.57	8.44	8.05
3	3.24	4.67	7.36	7.74	11.40	11.95	14.86	18.72	17.83	10.59	7.47	7.37
4	2.64	6.06	6.43	8.11	12.29	11.58	14.71	18.26	17.67	10.24	6.90	6.75
5	1.55	5.35	5.93	8.51	10.99	11.50	15.29	17.11	17.67	10.17	7.28	5.93
6	1.52	5.03	5.49	8.81	9.29	12.95	15.55	17.02	17.44	10.23	6.51	5.96
7	2.29	5.76	6.18	8.65	9.56	12.79	14.48	17.67	17.50	10.59	5.92	5.29
8	3.69	5.95	6.89	8.05	10.30	12.58	14.49	17.90	16.83	10.33	6.28	4.62
9	3.83	6.91	7.55	7.78	10.80	11.24	15.30	18.15	16.56	9.49	7.32	4.18
10	4.25	7.17	8.16	8.18	11.26	10.77	14.95	18.16	15.88	8.99	7.95	3.79
11	3.81	6.82	7.74	7.87	10.58	11.29	14.22	18.04	15.48	8.67	8.76	3.33
12	3.51	6.75	8.37	8.88	9.15	10.96	14.74	16.95	16.26	8.32	9.24	3.68
13	2.63	6.60	8.54	8.32	8.98	11.16	14.55	16.45	14.58	8.24	8.97	4.16
14	2.38	6.77	9.05	8.17	9.49	10.61	14.70	14.91	14.40	7.20	8.48	4.03
15	2.32	7.78	8.87	7.90	9.13	10.91	15.00	14.95	13.65	7.79	8.43	4.23
16	3.09	8.16	7.67	8.41	9.36	11.44	14.32	15.63	13.42	8.36	8.11	4.84
17	3.79	8.06	7.35	9.03	9.18	11.78	14.51	16.29	13.07	8.03	7.79	5.77
18	4.76	7.82	8.14	9.71	9.71	12.79	14.98	16.03	12.80	8.85	7.85	6.63
19	6.48	7.20	7.24	8.57	10.94	14.41	14.69	15.82	12.29	10.18	7.34	7.33
20	6.62	7.58	7.53	9.12	11.22	14.42	14.21	15.37	11.85	9.72	8.42	6.11
21	6.76	7.67	8.35	9.08	12.08	13.20	14.60	16.22	10.92	9.18	8.95	4.75
22	6.87	6.68	8.39	9.58	13.16	13.55	16.10	16.88	11.38	10.80	10.35	5.18
23	6.51	6.28	7.84	8.90	13.42	14.43	17.03	17.00	11.89	9.84	10.50	5.48
24	6.17	6.07	8.31	8.75	11.07	15.47	16.29	16.27	12.03	9.93	8.78	4.09
25	6.60	6.27	8.06	8.36	11.13	16.05	16.77	15.23	12.47	9.77	7.98	4.55
26	6.78	6.14	7.80	9.13	12.20	15.56	16.78	15.70	13.44	10.42	8.62	4.67
27	6.10	6.12	8.22	8.35	12.98	14.31	16.04	16.62	13.95	9.90	7.56	4.77
28	6.07	6.31	8.38	8.33	13.61	13.29	15.54	17.22	14.00	9.60	7.86	5.43
29	5.98	7.04	8.49	8.66	13.28	13.59	15.58	17.23	13.44	9.77	7.86	7.38
30	6.67	—	8.22	9.23	12.10	15.07	16.58	15.89	11.92	8.87	7.40	7.37
31	6.37	—	8.05	—	12.46	—	16.70	17.70	—	7.23	—	6.45
MEAN	4.60	6.50	7.70	8.57	10.92	12.82	15.26	16.81	14.48	9.47	8.05	5.49
MAX	6.87	8.16	9.05	9.71	13.61	16.05	17.03	18.72	17.83	11.58	10.50	8.05
MIN	1.52	4.50	5.49	7.74	8.05	10.61	14.21	14.91	10.92	7.20	5.92	3.33

5400 – 14205400 – East Fork Dairy Creek near Meacham Corner, OR – [RM 12.4]



FREQUENCY OF MEAN DAILY TEMPERATURE BY MONTH FOR PERIOD OF RECORD

MONTH	0 ≤ T < 5	5 ≤ T < 7	7 ≤ T < 8	8 ≤ T < 9	9 ≤ T < 11	11 ≤ T < 13	13 ≤ T < 14	14 ≤ T < 15	15 ≤ T < 16	16 ≤ T < 17	17 ≤ T < 18	18 ≤ T < 18	19 ≤ T < 26	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	5.5%	11%	9.3%	11%	13%	13%	4.8%	5.5%	5.8%	4.7%	3.0%	1.7%	0.2%	12%

Key

- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

MEAN DAILY TEMPERATURE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002									13.5	9.6	7.2	6.2
2003	7.0	6.6	7.9	8.7	9.8	12.9	15.7	15.7	14.3	11.4	5.7	6.5
2004	5.7	7.0	8.4	9.5	11.2	13.6	16.8	16.7	13.9	12.1		
2005												
2006												
2007												
2008												
2009												
2010												
2011												
2012		6.1	6.6	8.8	10.3	11.8	15.0	15.9	13.6	9.7	8.1	7.2
2013	4.9	6.2	7.4	9.2	11.0	12.9	15.6	16.3	15.2	9.3	6.0	3.8
2014	4.7	6.4	7.9	9.0	11.0	12.6	16.2	17.2	14.8	12.2	7.9	7.9
2015	6.9	8.4	8.9	8.8	11.7	15.1	17.4	16.7	13.3	12.1	8.2	7.7
2016	7.4	8.1	8.4	10.0	11.7	13.6	15.1	16.6	13.5	11.0	9.8	5.8
2017	4.6	6.5	7.8	8.5	11.0	12.7	15.0	17.0	14.0	9.8	8.0	5.3
Median	6.0	6.9	8.0	9.0	11.1	13.0	15.7	16.5	13.9	10.8	7.9	6.5

Key

T in ºC
- T ≤ 4.6
- 4.6 < T ≤ 5.8
- 5.8 < T ≤ 6.5
- 6.5 < T ≤ 7.1
- 7.1< T ≤ 8.0
- 8.0 < T ≤ 8.8
- 8.8 < T ≤ 10.1
- 10.1 < T ≤ 13.7
- 13.7 < T ≤ 16.2
- 16.2 < T ≤ 17.1
- T > 17.1

T as percentile
- T ≤ 5th
- 5th < T ≤ 10th
- 10th < T ≤ 15th
- 15th < T ≤ 20th
- 20th < T ≤ 30th
- 30th < T ≤ 40th
- 40th < T ≤ 50th
- 50th < T ≤ 75th
- 75th < T ≤ 90th
- 90th < T ≤ 95th
- T > 95th

Distribution

- The highest temperatures occurred in July and August.
- Temperature was not monitored at this site from November 2004 through January 2012.

Trends

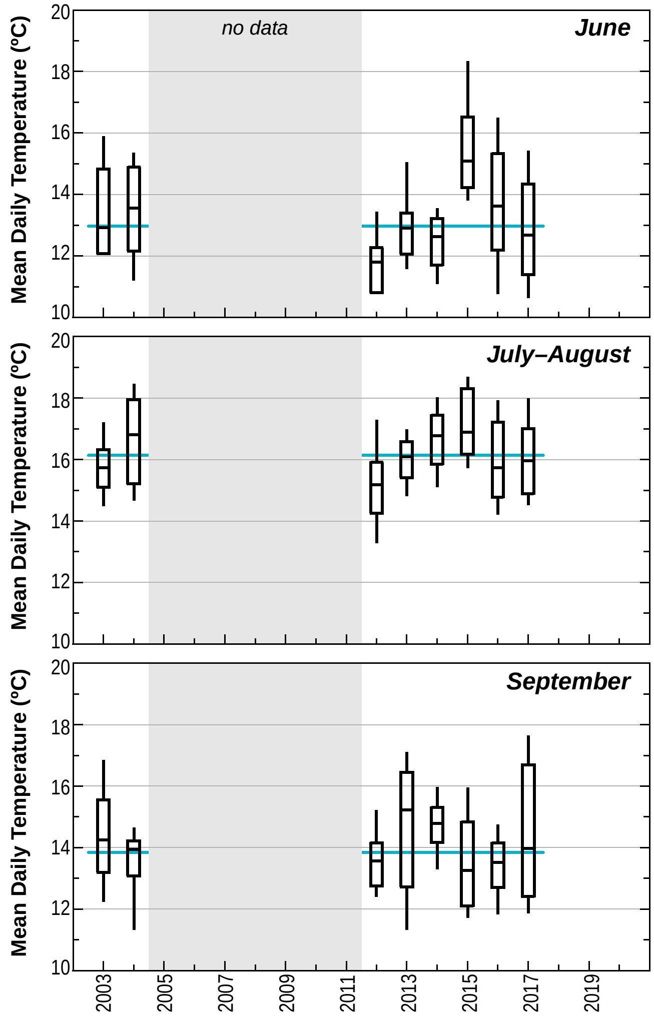
- Water temperatures in June, July–August and September do not show any statistically significant trends.
- The year-to-year variability is considerable, especially in June. Year-to-year variability is less in September than in the earlier summer months.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

Oregon water temperature standard

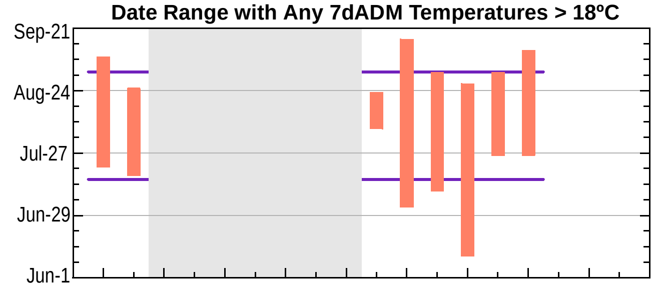
- Temperatures at this site exceeded the standard in all years that data were available.
- Statistics for exceedances of the standard are:

average first day	Jul-15
average last day	Sep-1
median number of days	32

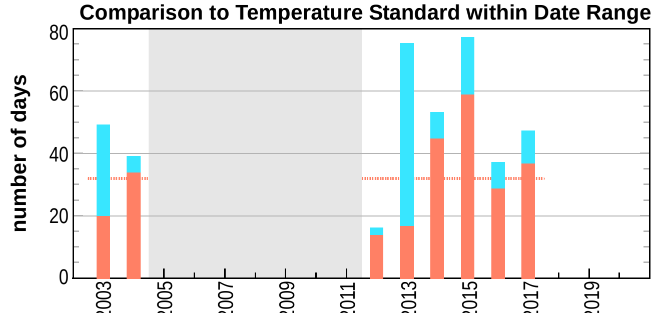
- Days when the 7dADM did not exceed the standard often occurred within the date range of exceedances.



Date Range with Any 7dADM Temperatures > 18°C



Comparison to Temperature Standard within Date Range



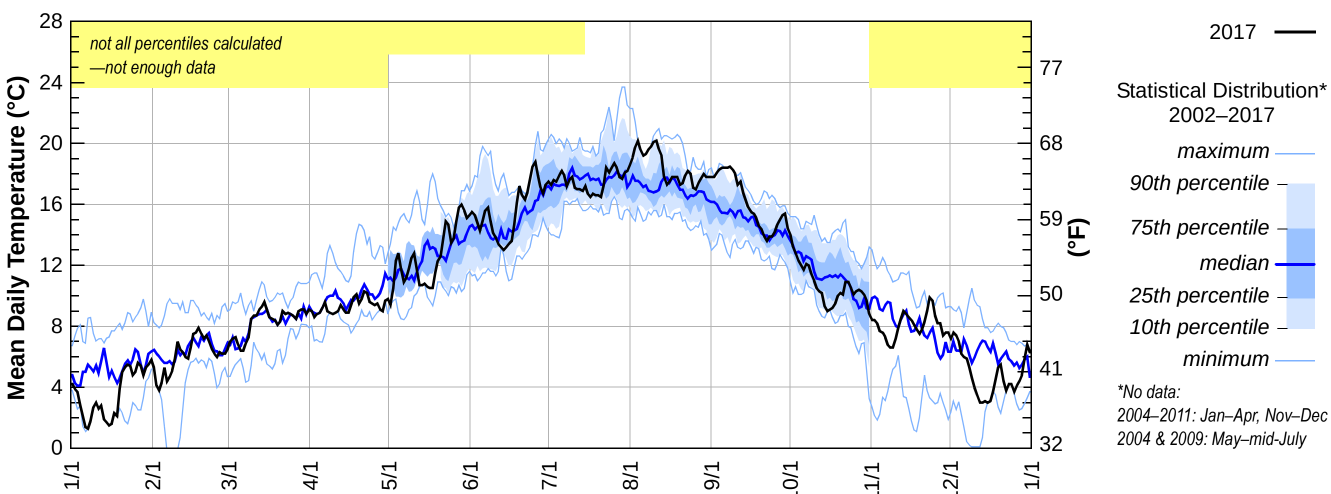
14206070 — MCKAY CREEK AT SCOTCH CHURCH ROAD ABOVE WAIBLE CREEK NEAR NORTH PLAINS, OREGON — MCSC

Data source: WEST Consultants for Clean Water Services

River mile: 6.3 *Latitude:* 45 57 21 *Longitude:* 122 99 18

Day	2017 Mean Daily Water Temperature in Degrees Celsius											
	JAN*	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	4.2	5.3	6.5	9.1	9.8	15.3	17.5	18.6	17.8	14.0	8.4	7.2
2	3.9	4.1	7.0	9.0	9.4	15.5	17.3	19.1	17.8	13.2	8.4	7.6
3	3.7	3.8	7.2	8.6	10.5	15.3	17.6	19.8	18.1	12.8	8.2	7.4
4	2.8	4.3	7.3	8.8	12.3	14.8	17.5	20.2	18.3	12.3	7.7	7.0
5	2.1	5.3	6.8	8.9	12.8	14.3	17.9	19.6	18.4	12.0	7.6	6.2
6	1.4	4.4	6.4	9.2	11.8	14.9	18.2	19.2	18.4	11.7	7.3	6.0
7	1.3	4.7	6.4	9.6	10.9	15.6	17.9	19.3	18.4	12.1	6.8	5.9
8	1.8	5.1	6.9	9.0	11.2	15.8	17.2	19.6	18.5	12.0	6.6	5.3
9	2.7	5.8	7.3	8.9	11.8	14.9	17.6	19.8	18.3	11.4	6.6	4.6
10	3.0	7.0	8.5	8.8	12.5	14.1	17.8	20.1	18.0	11.0	7.2	4.0
11	2.6	6.5	8.7	8.9	12.8	13.8	17.1	20.2	17.3	10.5	7.9	3.5
12	2.8	6.3	8.7	9.0	11.7	13.4	17.0	19.6	17.5	10.3	8.5	3.0
13	1.9	6.0	9.1	9.4	10.7	13.2	17.0	19.2	16.8	10.2	9.0	3.0
14	1.7	5.9	9.3	9.1	10.7	13.0	16.9	17.8	16.3	9.3	8.8	3.1
15	1.5	6.6	9.6	8.9	10.8	13.2	17.2	17.3	15.8	9.0	8.6	3.0
16	1.6	7.5	9.1	8.9	10.6	13.4	16.7	17.5	15.5	9.1	8.4	3.1
17	2.3	7.6	8.6	9.4	10.5	13.6	16.5	17.8	15.4	9.2	8.1	3.7
18	2.1	7.9	8.5	9.9	10.5	14.7	16.7	17.8	15.1	9.5	7.8	4.5
19	3.9	7.5	8.4	10.1	11.5	16.1	16.6	17.8	14.6	10.0	7.5	5.3
20	5.0	7.2	8.1	9.5	12.3	17.2	16.6	17.3	14.4	10.2	7.8	5.5
21	5.3	7.4	8.3	9.8	12.6	16.6	16.5	17.4	13.9	10.1	8.3	4.4
22	5.5	7.0	9.0	10.3	13.8	16.3	17.2	17.9	13.6	10.9	9.0	3.8
23	5.4	6.5	8.8	10.2	14.9	16.8	18.4	18.2	13.9	10.9	9.9	4.2
24	4.8	6.2	8.9	9.6	14.7	17.6	18.1	18.0	13.9	10.5	9.7	4.2
25	5.0	6.0	8.8	9.5	13.5	18.5	18.4	17.1	14.2	10.1	8.7	3.7
26	5.6	6.3	8.7	9.4	13.8	18.8	18.7	17.0	14.7	10.3	8.2	4.1
27	5.4	6.2	8.5	9.5	14.9	17.9	18.4	17.4	15.0	10.4	8.2	4.4
28	4.8	6.2	9.0	9.1	15.8	17.1	17.8	17.7	15.3	10.3	7.4	4.8
29	5.3	6.5	9.1	9.0	16.0	16.7	17.7	18.0	15.4	10.1	7.6	5.8
30	5.5	—	9.1	9.7	15.6	17.3	18.1	17.8	14.4	9.7	7.6	6.8
31	5.8	—	8.8	—	15.1	—	18.2	17.8	—	8.8	—	6.3
MEAN	3.6	6.1	8.2	9.3	12.4	15.5	17.5	18.4	16.2	10.7	8.1	4.9
MAX	5.8	7.9	9.6	10.3	16.0	18.8	18.7	20.2	18.5	14.0	9.9	7.6
MIN	1.3	3.8	6.4	8.6	9.4	13.0	16.5	17.0	13.6	8.8	6.6	3.0

MCSC – 14206070 – McKay Creek at Scotch Church Road above Waible Creek near North Plains, Oregon [RM 6.3]



FREQUENCY OF MEAN DAILY TEMPERATURE BY MONTH FOR PERIOD OF RECORD

MONTH	-0.1 ≤ T < 5	5 ≤ T < 7	7 ≤ T < 9	9 ≤ T < 11	11 ≤ T < 13	13 ≤ T < 14	14 ≤ T < 15	15 ≤ T < 16	16 ≤ T < 17	17 ≤ T < 18	18 ≤ T < 19	19 ≤ T < 20	20 ≤ T < 24	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	4.2%	6.7%	7.9%	8.7%	8.1%	5.6%	5.6%	6.1%	6.5%	5.4%	3.6%	1.7%	1.0%	29%

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

MEAN DAILY TEMPERATURE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	5.8	5.7	6.3	9.5	12.1	15.9	18.3	16.7	14.1	9.8	7.0	5.9
2003	6.7	6.2	7.9	9.4	11.0	15.7	18.4	17.5	15.2	12.4	5.3	6.3
2004							20.5	19.3	15.4	12.5		
2005					13.7	14.2	18.2	17.4	13.8	12.2		
2006					12.8	15.1	17.7	16.1	14.8	11.2		
2007					12.9	14.8	17.9	16.6	15.2	10.5		
2008					13.3	13.9	17.5	16.5	14.6	10.4		
2009							19.5	16.9	15.0	10.8		
2010					11.2	12.3	16.7	16.3	14.6	10.3		
2011					10.7	13.7	16.2	16.7	15.2	11.9		
2012	5.6	6.2	6.5	9.7	11.8	14.0	17.1	16.3	13.8	11.0	8.3	7.1
2013	4.0	6.0	7.5	10.5	12.9	14.7	17.1	16.7	16.8	9.5	8.6	2.9
2014	3.9	4.6	8.8	10.4	13.5	15.2	18.2	17.9	15.6	13.3	8.3	7.5
2015	7.0	8.6	9.7	10.0	13.8	17.0	18.4	17.7	15.1	13.7	8.7	7.6
2016	7.4	8.4	9.1	11.4	13.8	15.9	16.9	16.7	14.8	12.0	10.6	5.5
2017	3.7	6.2	8.6	9.2	12.3	15.4	17.5	18.0	15.7	10.3	8.2	4.5
Median	5.5	6.5	8.3	9.8	12.5	14.9	17.7	17.1	14.9	11.3	8.2	6.1

Key

T in ºC

- $T \leq 4.7$
- $4.7 < T \leq 5.9$
- $5.9 < T \leq 6.9$
- $6.9 < T \leq 7.9$
- $7.9 < T \leq 9.4$
- $9.4 < T \leq 11.2$
- $11.2 < T \leq 12.9$
- $12.9 < T \leq 16.0$
- $16.0 < T \leq 17.8$
- $17.8 < T \leq 18.6$
- $T > 18.6$

T as percentile

- $Q \leq$ 5th
- 5th $< T \leq$ 10th
- 10th $< T \leq$ 15th
- 15th $< T \leq$ 20th
- 20th $< T \leq$ 30th
- 30th $< T \leq$ 40th
- 40th $< T \leq$ 50th
- 50th $< T \leq$ 75th
- 75th $< T \leq$ 90th
- 90th $< T \leq$ 95th
- $T >$ 95th

Distribution

- The highest temperatures occurred in July and August.
- From 2004 through 2011, temperature was not measured at this site during high flow which is when low temperatures would occur.
- Because data during low temperature periods are missing, the percentiles are skewed and under-represent low temperatures.

Trends

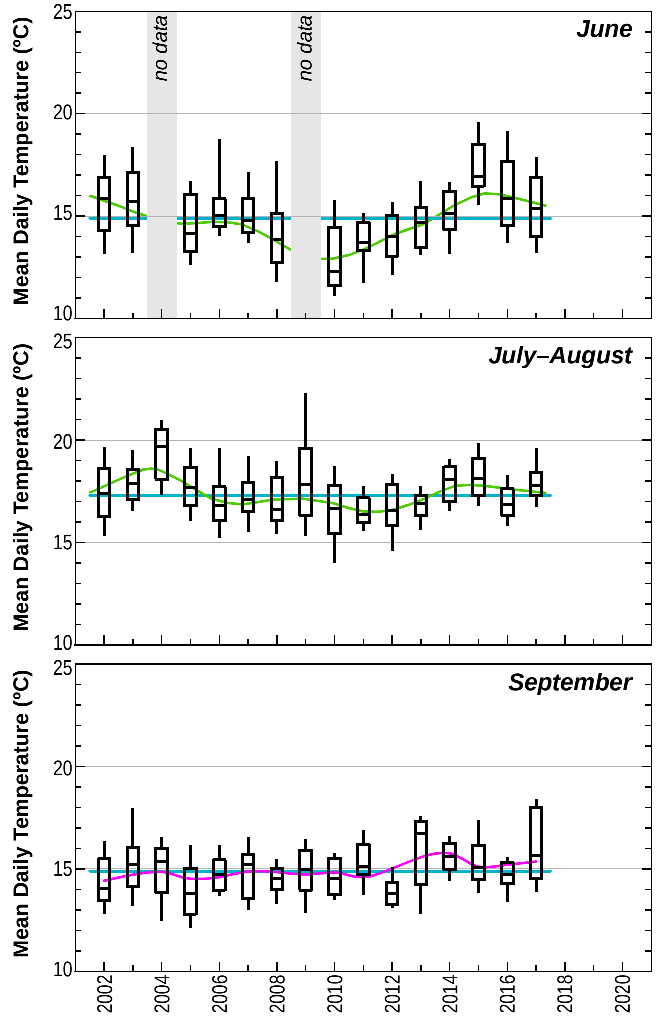
- Water temperatures in June and July–August do not show any statistically significant trends. The year-to-year variability is considerable, especially in June.
- Water temperatures in September show an increasing trend. The trend is statistically significant even though the increase is small. Year-to-year variability is less in September than in the earlier summer months.
- No trend was evident in the timing of temperature standard exceedances.
- The number of days with temperature standard exceedances has a statistically significant decreasing trend. This is likely related to the flow augmentation program that was implemented in 2005.

Oregon water temperature standard

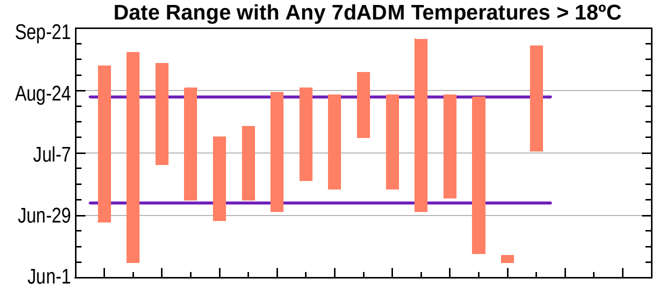
- Temperatures at this site exceeded the standard in all years that data were available.
- Statistics for exceedances of the standard are:

average first day	Jul-4
average last day	Aug-21
median number of days	31

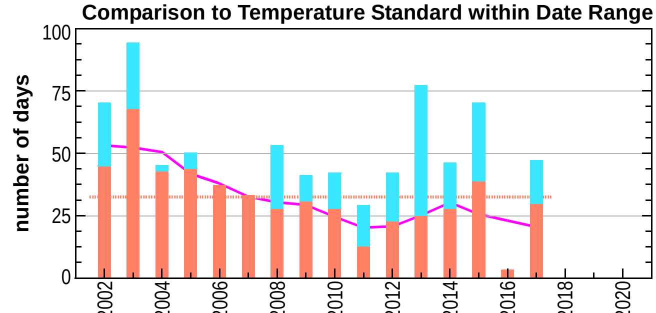
- Days when the 7dADM did not exceed the standard often occurred within the date range of exceedances and their incidence has increased in recent years.



Date Range with Any 7dADM Temperatures > 18ºC



Comparison to Temperature Standard within Date Range



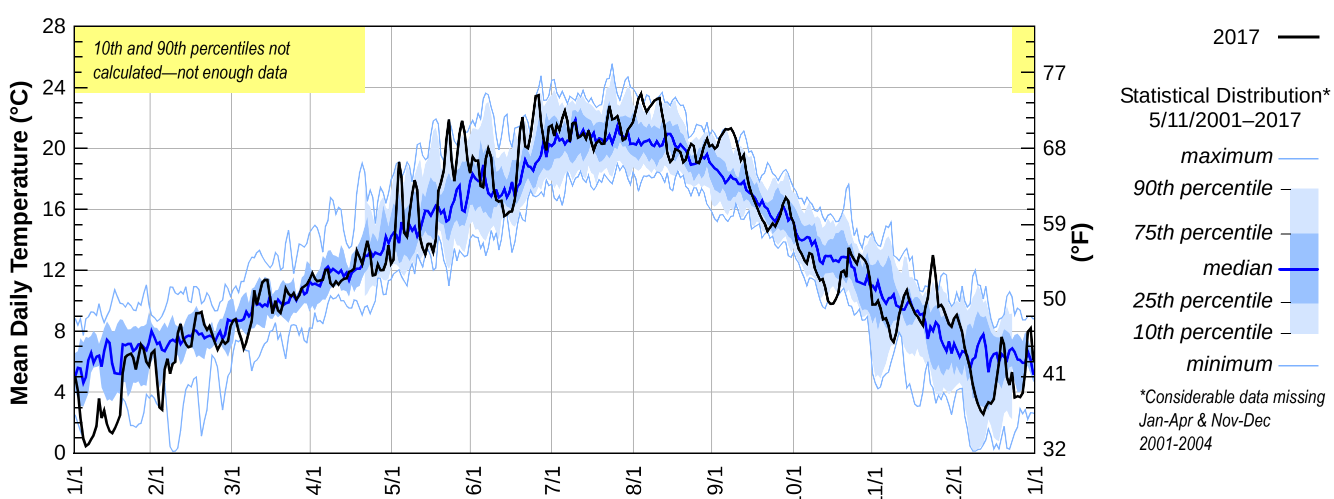
453004122510301 — BEAVERTON CREEK AT 170TH AVE, BEAVERTON, OR. — B170

Data source: U.S. Geological Survey, Oregon Water Science Center

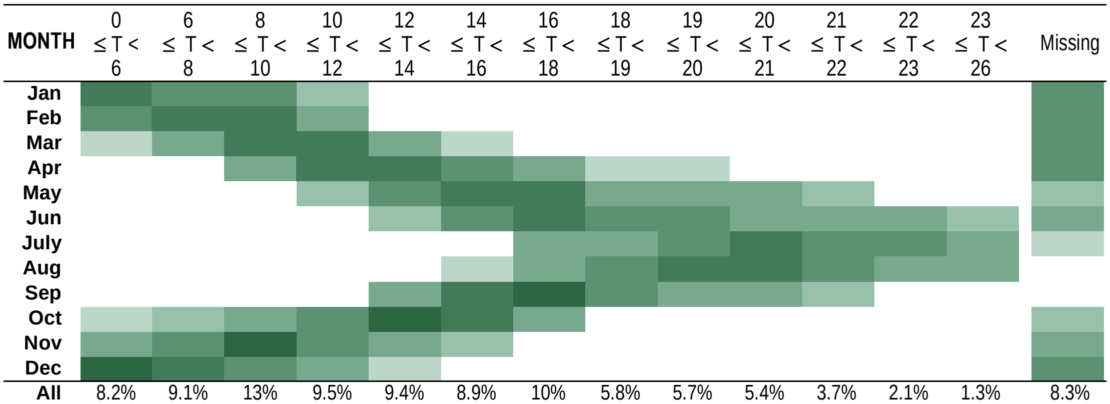
River mile: 4.9 *Latitude:* 45 30 04 *Longitude:* 122 51 03

Day	2017 Mean Daily Water Temperature in Degrees Celsius											
	JAN	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
1	4.99	4.76	8.37	11.83	12.45	19.43	21.51	21.74	19.99	15.10	9.75	8.85
2	4.11	2.99	8.72	11.48	12.72	19.19	20.83	22.53	20.13	14.01	10.01	9.09
3	2.34	2.84	8.80	11.29	15.78	19.20	21.54	23.27	20.73	13.37	9.53	8.47
4	0.96	5.50	8.02	11.32	19.13	17.55	21.18	23.59	20.99	13.05	8.78	7.95
5	0.47	6.20	7.52	11.37	18.09	17.47	21.97	22.88	21.27	12.68	8.85	6.92
6	0.59	5.22	6.87	12.03	14.47	19.31	22.46	22.40	21.24	12.46	8.39	6.27
7	0.91	5.86	7.29	12.04	14.21	19.99	21.81	22.66	21.32	13.14	7.53	5.55
8	1.18	6.00	7.96	11.16	15.75	19.42	20.45	22.88	21.06	13.06	7.30	4.53
9	1.78	7.86	8.69	10.97	17.00	17.34	21.66	23.13	20.63	12.10	7.89	3.82
10	3.59	8.50	10.70	11.29	17.93	16.63	21.68	23.24	19.99	11.68	9.08	3.22
11	2.32	7.53	9.76	11.07	17.28	16.51	20.71	23.29	19.24	11.34	9.67	2.82
12	2.81	7.18	10.42	11.31	14.12	16.56	20.81	22.24	19.58	11.43	10.36	2.57
13	1.87	6.97	11.20	11.44	13.43	15.57	20.98	21.39	18.44	10.91	10.70	3.06
14	1.44	7.03	11.37	11.47	13.03	15.67	20.61	19.71	17.59	10.00	9.93	3.34
15	1.32	8.21	11.38	11.92	13.74	15.85	21.17	19.12	17.03	9.79	9.56	3.27
16	1.63	9.18	10.27	11.97	13.72	15.87	20.46	19.32	16.54	9.81	9.18	3.55
17	2.03	9.18	9.16	12.13	13.21	16.66	19.90	19.97	16.14	10.12	8.99	4.69
18	2.53	9.27	10.01	13.29	14.02	18.69	20.36	19.87	15.69	10.59	8.68	5.96
19	5.25	8.41	9.37	12.84	17.20	21.18	20.52	19.76	15.35	11.87	8.38	7.63
20	6.29	8.09	9.21	12.39	17.75	22.06	20.29	19.09	15.11	11.98	9.54	7.11
21	6.46	8.34	9.84	13.16	18.56	20.16	20.31	19.27	14.58	11.57	10.19	4.99
22	6.53	7.84	10.80	13.94	20.57	20.02	21.72	19.91	14.81	13.49	11.78	4.49
23	6.25	7.24	10.45	13.11	21.91	20.84	22.80	20.29	15.08	12.96	13.00	5.32
24	5.49	6.80	10.30	11.66	19.24	22.15	21.91	20.16	14.90	12.68	11.49	3.66
25	6.32	7.10	10.50	11.70	17.87	23.43	21.97	19.11	15.30	12.42	9.63	3.74
26	7.10	7.42	10.08	12.37	19.47	23.48	22.12	19.03	15.72	13.01	9.73	3.69
27	6.78	7.19	10.34	12.01	20.94	21.64	21.53	19.54	16.42	12.87	9.46	3.95
28	5.97	7.35	10.83	12.03	21.80	20.56	20.55	20.19	16.78	12.68	8.94	5.32
29	5.72	8.37	10.95	12.49	21.06	19.87	20.65	20.65	16.55	12.32	8.48	7.97
30	6.53	—	11.07	13.67	19.24	21.42	21.25	20.16	15.46	11.43	8.31	8.19
31	6.72	—	11.40	—	18.39	—	21.47	20.23	—	9.75	—	6.16
MEAN	3.82	7.05	9.73	12.03	16.91	19.12	21.20	20.99	17.79	12.05	9.44	5.36
MAX	7.10	9.27	11.40	13.94	21.91	23.48	22.80	23.59	21.32	15.10	13.00	9.09
MIN	0.47	2.84	6.87	10.97	12.45	15.57	19.90	19.03	14.58	9.75	7.30	2.57

B170 – Beaverton Creek at 170th Ave, Beaverton, Oregon [RM 4.9]



FREQUENCY OF MEAN DAILY TEMPERATURE BY MONTH FOR PERIOD OF RECORD



Key

- f ≥ 3%
- 2% ≤ f < 3%
- 1% ≤ f < 2%
- 0.2% ≤ f < 1%
- 0.06% ≤ f < 0.2%
- 0 < f < 0.06%

MEAN DAILY TEMPERATURE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001					17.6		20.4	20.4	17.9	12.6		
2002					15.2	18.7	21.6	19.7	17.1	12.7	9.3	
2003					14.5	20.0	21.8	20.4	17.4	14.3	7.3	
2004		8.2	11.3	13.2	16.3	19.0	22.4	22.1	17.7	14.3	9.0	6.9
2005	5.7	6.9	10.3	11.7	15.7	17.1	21.1	20.6	16.1	13.9	8.1	5.7
2006	8.3	7.3	8.7	12.6	15.8	18.3	21.6	19.5	16.4	12.3	9.4	6.3
2007	5.1	7.8	10.6	12.0	16.3	18.3	20.9	18.9	16.6	12.1	8.4	6.2
2008	5.3	7.1	8.8	10.4	14.9	16.8	19.8	19.1	16.5	11.4	9.5	5.5
2009	4.7	5.8	8.2	12.0	15.0	18.8	20.7	19.0	17.1	11.7	8.7	3.5
2010	8.1	8.9	9.9	12.4	13.9	15.5	19.7	19.2	16.6	12.2	9.5	7.6
2011	7.4	6.4	9.0	10.5	13.4	17.2	19.2	20.0	17.3	12.9	8.5	4.3
2012	6.4	7.5	8.5	12.3	15.2	17.0	20.4	20.2	16.5	12.7	9.6	7.3
2013	4.6	7.6	9.5	12.3	15.7	18.2	20.6	20.2	18.1	11.4	10.0	4.5
2014	5.5	7.1	10.2	12.5	16.8	18.3	21.8	20.8	17.8	14.7	9.8	8.3
2015	7.5	9.9	11.5	12.5	16.6	19.9	21.3	19.7	15.9	13.9	9.6	8.0
2016	8.0	9.5	10.9	14.6	16.8	18.8	19.5	19.6	16.2	13.5	11.9	5.9
2017	3.6	7.2	10.1	11.9	17.3	19.4	21.2	20.2	16.9	12.3	9.5	5.0
Median	6.5	7.6	9.7	12.3	15.7	18.2	20.8	20.0	16.8	12.9	9.2	6.4

Key

T in ºC

- T ≤ 4.7
- 4.7 < T ≤ 6.3
- 6.3 < T ≤ 7.3
- 7.3 < T ≤ 8.2
- 8.2 < T ≤ 9.5
- 9.5< T ≤ 11.4
- 11.4 < T ≤ 13.3
- 13.3 < T ≤ 18.2
- 18.2 < T ≤ 20.6
- 20.6 < T ≤ 21.6
- T > 21.6

T as percentile

- T ≤ 5th
- 5th < T ≤ 10th
- 10th < T ≤ 15th
- 15th < T ≤ 20th
- 20th < T ≤ 30th
- 30th < T ≤ 40th
- 40th < T ≤ 50th
- 50th < T ≤ 75th
- 75th < T ≤ 90th
- 90th < T ≤ 95th
- T > 95th

Distribution

- The highest temperatures occurred in July and August.
- The lowest temperatures occurred in December and January.

Trends

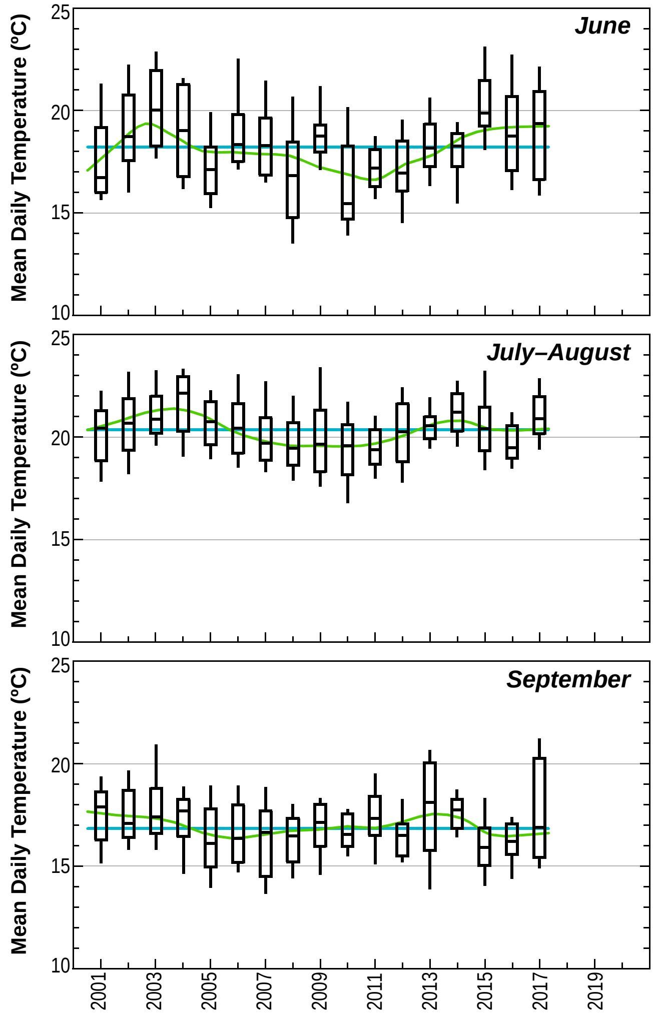
- Water temperatures in June, July–August and September do not show any statistically significant trends.
- The year-to-year variability is considerable, especially in June.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

Oregon water temperature standard

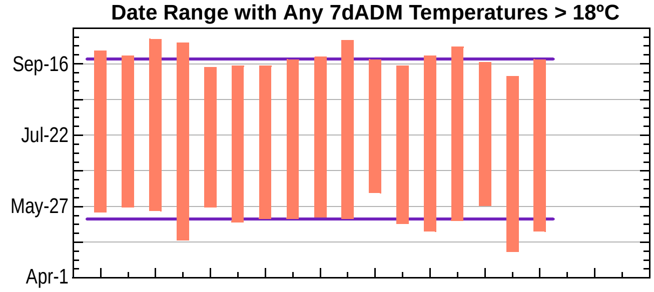
- Temperatures at this site exceeded the standard in all years.
- Statistics for exceedances of the standard are:

average first day	May-17
average last day	Sep-19
median number of days	115

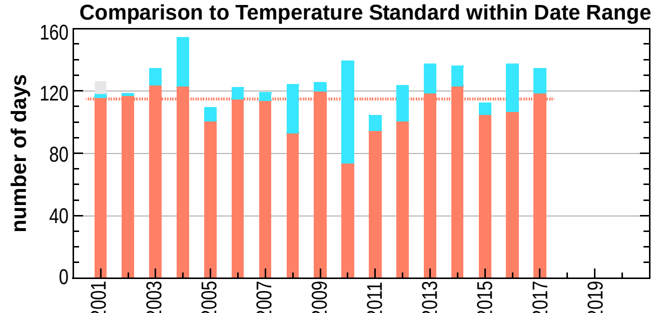
- Days when the 7dADM did not exceed the standard often occurred within the date range of exceedances, but in most years were a minor fraction.
- In 2001, 7dADM could not be computed for 8 days in June because of gaps in the temperature data. Based on data from the surrounding days, most of these days likely had 7dADMs that exceeded the temperature standard.



Date Range with Any 7dADM Temperatures > 18ºC



Comparison to Temperature Standard within Date Range



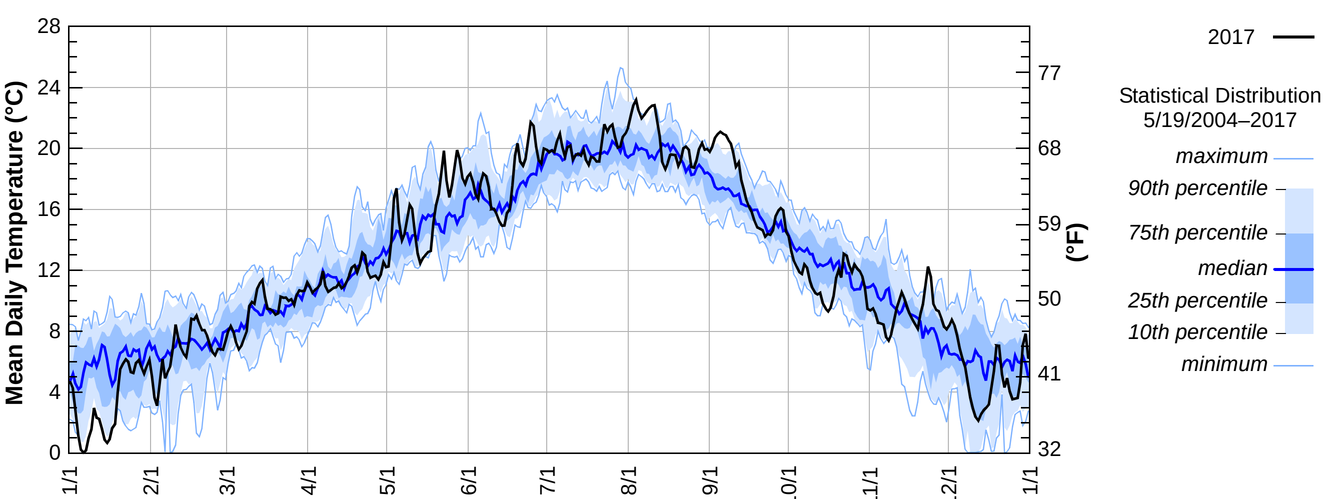
453030122560101 — ROCK CREEK AT BROOKWOOD AVENUE, HILLSBORO, OR. — RCBR

Data source: U.S. Geological Survey, Oregon Water Science Center

River mile: 2.4 *Latitude:* 45 30 29.5 *Longitude:* 122 56 00.6

Day	2017 Mean Daily Water Temperature in Degrees Celsius											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	4.66	5.05	7.36	11.21	12.22	18.16	19.91	21.37	19.79	14.21	9.37	8.38
2	4.26	3.64	8.01	10.91	12.26	18.37	19.75	22.18	20.10	13.26	9.51	8.76
3	2.75	3.11	8.35	10.54	13.99	17.78	19.87	22.85	20.71	12.60	9.14	8.37
4	1.16	4.61	7.94	10.72	16.72	16.97	19.78	23.20	20.95	12.22	8.55	7.72
5	0.23	6.19	7.23	10.86	17.37	16.66	20.55	22.47	21.09	11.87	8.51	6.88
6	0.04	4.93	6.82	11.09	15.16	17.78	20.98	21.98	20.96	11.74	8.45	6.24
7	0.18	5.36	7.05	11.96	14.00	18.35	20.08	22.18	20.88	12.40	7.64	5.68
8	0.97	5.73	7.52	10.94	14.41	18.18	19.47	22.43	20.58	12.19	7.41	4.61
9	1.57	6.83	8.03	10.59	15.35	17.46	20.09	22.64	20.33	11.32	7.82	3.64
10	2.96	8.45	9.67	10.73	16.29	16.02	20.19	22.80	19.69	10.82	8.71	2.95
11	2.34	7.56	9.93	10.84	16.02	16.03	19.29	22.83	18.80	10.53	9.51	2.40
12	2.26	6.91	9.80	10.88	14.35	15.69	19.57	21.84	19.09	10.42	10.02	2.15
13	1.59	6.57	10.83	11.13	13.09	15.20	19.67	20.81	17.91	10.53	10.55	2.55
14	0.89	6.31	11.16	10.83	12.48	14.91	19.55	19.07	17.27	9.79	10.09	2.80
15	0.69	7.27	11.38	10.95	12.80	14.95	19.95	18.64	16.57	9.50	9.60	2.98
16	0.93	8.84	10.25	11.27	13.02	15.78	19.21	19.06	16.10	9.31	9.11	3.21
17	1.66	8.77	9.48	11.68	13.22	16.05	18.92	19.61	15.78	9.57	8.76	4.25
18	1.94	9.03	9.43	12.19	13.29	17.59	19.45	19.59	15.23	10.30	8.47	5.41
19	3.98	8.47	9.32	12.33	15.10	19.50	19.38	19.56	14.83	11.50	8.16	7.07
20	5.54	8.07	9.11	11.87	16.25	20.33	19.14	18.87	14.76	12.02	9.11	7.05
21	5.87	8.08	9.18	12.34	17.00	19.15	19.15	19.24	14.64	11.53	9.76	5.20
22	6.16	7.72	10.25	13.16	18.54	18.86	20.44	20.03	14.20	13.10	11.03	4.32
23	5.99	7.11	10.20	12.96	19.85	19.34	21.59	20.12	14.39	12.96	12.26	4.92
24	5.33	6.64	10.21	11.88	17.93	20.54	21.11	19.92	14.33	12.29	11.55	4.09
25	5.25	6.43	10.00	11.52	16.79	21.73	21.43	18.79	14.65	11.88	9.78	3.53
26	5.92	6.84	10.11	11.60	17.59	21.50	21.57	18.75	15.57	12.38	9.41	3.58
27	6.09	6.84	9.72	11.66	18.78	20.12	20.79	19.22	15.90	12.11	9.33	3.63
28	5.63	6.79	10.39	11.41	19.89	19.22	20.06	19.99	16.08	11.93	8.83	4.65
29	5.21	7.36	10.70	11.75	19.31	19.02	20.13	20.35	15.93	11.58	8.31	7.06
30	5.69	—	10.64	12.53	18.02	20.00	20.77	19.91	14.51	10.84	8.13	7.85
31	6.16	—	10.66	—	17.68	—	20.99	19.98	—	9.49	—	6.29
MEAN	3.35	6.74	9.38	11.48	15.77	18.04	20.09	20.65	17.39	11.49	9.23	5.10
MAX	6.16	9.03	11.38	13.16	19.89	21.73	21.59	23.20	21.09	14.21	12.26	8.76
MIN	0.04	3.11	6.82	10.54	12.22	14.91	18.92	18.64	14.20	9.31	7.41	2.15

RCBR – Rock Creek at Brookwood Avenue, Hillsboro, Oregon [RM 2.4]



FREQUENCY OF MEAN DAILY TEMPERATURE BY MONTH FOR PERIOD OF RECORD

MONTH	0 ≤ T < 4.0	4.0 ≤ T < 7.0	7.0 ≤ T < 8.5	8.5 ≤ T < 10	10 ≤ T < 12	12 ≤ T < 14	14 ≤ T < 16	16 ≤ T < 18	18 ≤ T < 19	19 ≤ T < 20	20 ≤ T < 21	21 ≤ T < 22	22 ≤ T < 26	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	4.7%	11%	10%	10%	10.0%	10%	11%	11%	6.1%	5.5%	3.9%	2.4%	1.3%	3.1%

Key

- *f* ≥ 3%
- 2% ≤ *f* < 3%
- 1% ≤ *f* < 2%
- 0.2% ≤ *f* < 1%
- 0.06% ≤ *f* < 0.2%
- 0 < *f* < 0.06%

MEAN DAILY TEMPERATURE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2004						18.4	21.3	20.5	16.5	13.7	8.5	6.4
2005	5.4	6.1	9.8	11.3	15.3	16.4	20.0	19.8	15.1	13.4	7.6	5.7
2006	8.1	6.6	8.3	12.4	15.0	17.6	20.3	18.4	15.7	11.5	9.2	6.0
2007	4.3	7.6	9.9	11.4	14.9	16.8	19.8	18.3	16.0	11.8	8.0	6.3
2008	4.4	6.5	8.3	9.9	14.7	15.6	19.0	18.8	15.9	10.5	9.4	4.9
2009	4.3	4.8	7.9	11.6	14.6	18.0	20.4	19.0	16.6	11.4	8.6	3.2
2010	7.9	8.6	9.3	11.9	13.6	15.0	18.6	18.3	16.3	11.5	9.3	7.3
2011	7.1	6.0	8.6	10.1	12.9	16.2	18.1	18.9	16.8	12.8	8.0	3.9
2012	6.0	7.1	7.9	11.6	14.4	16.4	19.5	19.5	15.7	12.1	9.2	7.1
2013	4.0	7.0	9.2	12.1	15.0	17.4	19.5	19.9	18.1	10.6	9.6	3.9
2014	4.9	6.9	9.7	12.3	16.1	17.4	20.9	20.4	17.4	14.6	9.5	8.2
2015	7.1	9.4	11.2	12.0	15.5	19.1	21.0	19.7	15.4	13.4	9.5	7.6
2016	7.7	8.8	10.4	13.7	15.8	17.7	18.9	19.1	15.8	13.4	11.9	5.5
2017	3.0	6.8	9.7	11.3	16.0	18.2	20.0	20.0	16.3	11.7	9.1	4.7
Median	6.0	7.0	9.2	11.7	14.9	17.2	19.7	19.4	16.2	12.4	9.0	6.0

Key

T in ºC

- T ≤ 4.1
- 4.1 < T ≤ 5.7
- 5.7 < T ≤ 6.7
- 6.7 < T ≤ 7.6
- 7.6 < T ≤ 8.9
- 8.9 < T ≤ 10.5
- 10.5 < T ≤ 12.4
- 12.4 < T ≤ 17.1
- 171 < T ≤ 19.6
- 19.6 < T ≤ 20.7
- T > 20.7

T as percentile

- Q ≤ 5th
- 5th < T ≤ 10th
- 10th < T ≤ 15th
- 15th < T ≤ 20th
- 20th < T ≤ 30th
- 30th < T ≤ 40th
- 40th < T ≤ 50th
- 50th < T ≤ 75th
- 75th < T ≤ 90th
- 90th < T ≤ 95th
- T > 95th

Distribution

- The highest temperatures occurred in July and August.
- The lowest temperatures occurred in December and January.

Trends

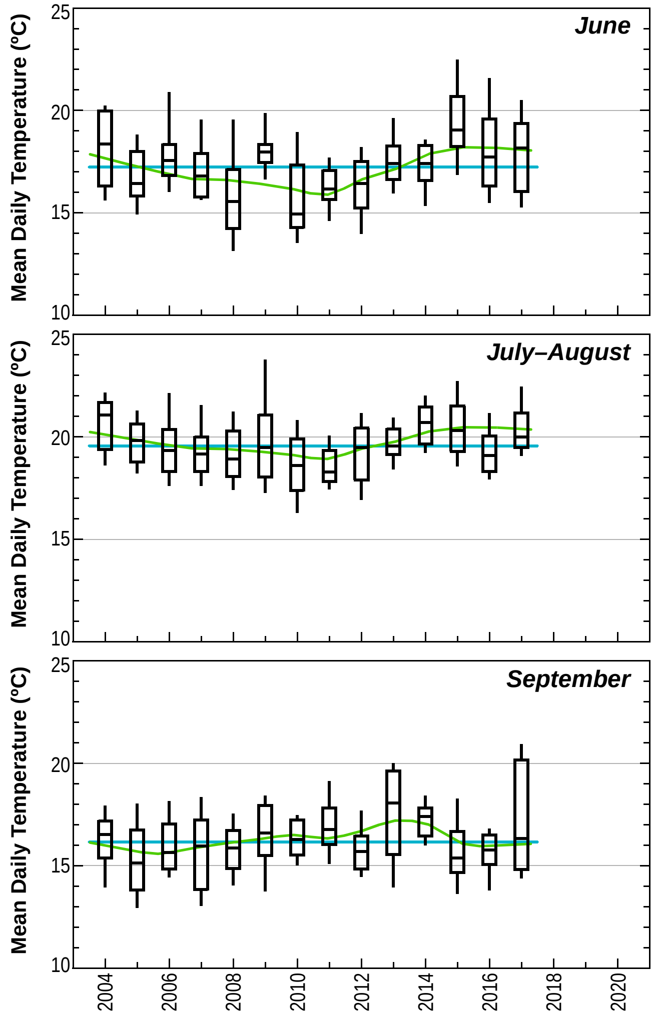
- Water temperatures in June, July–August and September do not show any statistically significant trends.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

Oregon water temperature standard

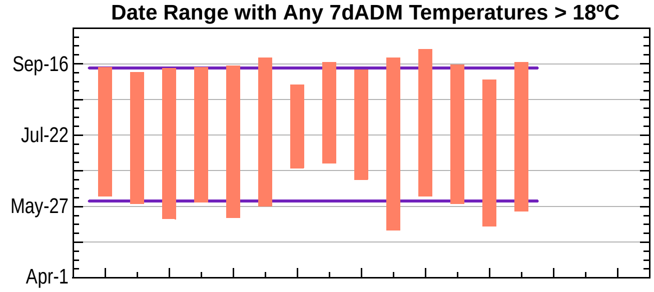
- Temperatures at this site exceeded the standard for all years.
- Statistics for exceedances of the standard are:

average first day	May-31
average last day	Sep-13
median number of days	94

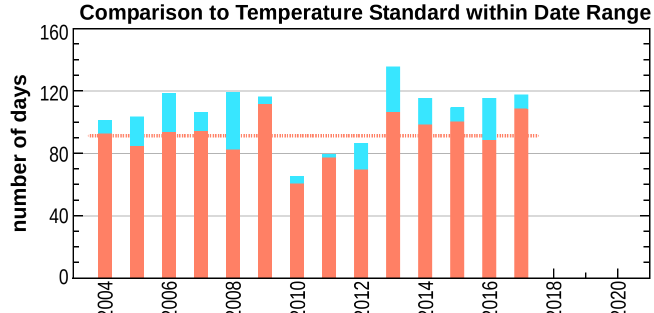
- Days when the 7dADM did not exceed the standard often occurred within the date range of exceedances, but were a minor fraction.



Date Range with Any 7dADM Temperatures > 18ºC



Comparison to Temperature Standard within Date Range



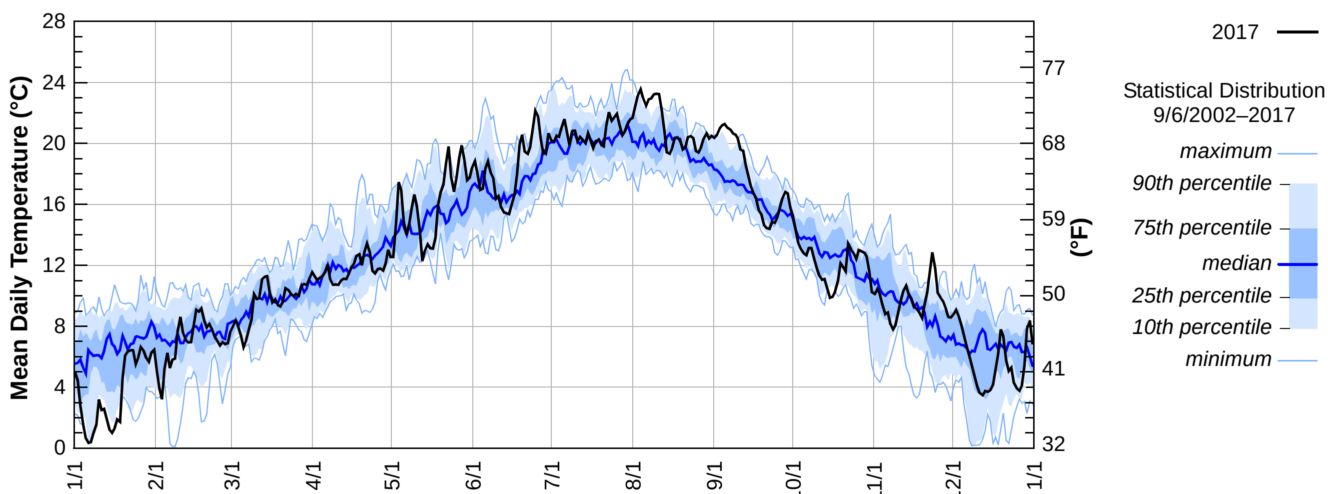
14206950 — FANNO CREEK AT DURHAM, OR — FANO

Data source: U.S. Geological Survey, Oregon Water Science Center

River mile: 1.2 *Latitude:* 45 24 13 *Longitude:* 122 45 13.

Day	2017 Mean Daily Water Temperature in Degrees Celsius											
	JAN	**FEB**	**MAR**	**APR***	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
1	4.95	5.10	7.67	11.57	12.54	18.47	20.20	21.68	20.37	15.17	10.13	8.79
2	4.43	3.93	8.04	11.29	12.54	18.86	20.13	22.46	20.54	14.30	10.45	9.08
3	2.81	3.23	8.41	11.02	14.82	17.95	20.53	23.19	21.00	13.44	10.09	8.62
4	1.54	5.21	7.93	11.18	17.47	16.96	20.45	23.57	21.19	13.04	9.42	8.08
5	0.64	6.26	7.38	11.30	16.91	17.05	21.10	22.97	21.29	12.78	8.81	7.38
6	0.34	5.25	6.64	11.56	14.83	18.36	21.59	22.48	21.05	12.66	8.92	6.70
7	0.41	5.82	7.08	12.07	14.00	18.82	20.74	22.91	20.92	13.13	8.14	6.04
8	0.99	5.89	7.74	11.07	14.74	18.04	19.88	22.97	20.68	13.13	7.81	5.38
9	1.56	7.68	8.46	10.71	15.80	17.69	20.82	23.22	20.59	12.40	8.10	4.71
10	3.20	8.61	10.08	10.75	16.64	16.36	20.84	23.25	20.32	11.82	8.93	4.09
11	2.50	7.54	9.80	10.72	15.87	16.54	20.14	23.24	19.60	11.31	9.74	3.63
12	2.59	7.12	9.86	10.99	14.28	15.80	20.44	22.23	19.53	11.05	10.36	3.47
13	1.88	6.94	11.09	11.11	12.30	15.47	20.25	20.93	18.55	11.09	10.67	3.75
14	1.23	6.97	11.24	11.09	12.98	15.42	20.02	19.42	17.87	10.46	10.02	3.71
15	1.02	7.97	11.28	11.47	13.39	15.36	20.67	19.34	17.17	9.89	9.76	3.81
16	1.32	9.08	10.19	11.90	13.12	15.98	20.22	19.74	16.69	9.95	9.27	4.19
17	1.88	8.96	9.57	12.09	13.10	16.65	19.71	20.35	16.30	10.27	9.15	5.15
18	1.71	9.18	9.78	12.63	13.80	17.99	20.18	20.36	15.57	10.97	8.89	6.23
19	4.60	8.39	9.39	12.73	15.94	19.94	20.26	20.29	15.31	12.13	8.53	7.81
20	6.09	7.93	9.31	12.01	16.79	20.56	19.91	19.61	14.65	11.87	9.44	7.33
21	6.35	8.15	9.63	12.89	17.33	19.45	19.82	19.72	14.43	11.61	10.21	5.75
22	6.44	7.81	10.51	13.42	18.70	19.31	21.18	20.42	14.39	13.41	11.54	5.06
23	6.42	7.29	10.39	12.84	19.81	19.77	22.07	20.48	14.85	13.04	12.86	5.30
24	5.53	7.03	10.12	11.64	17.80	20.94	21.49	20.33	14.80	12.79	11.81	4.27
25	5.97	6.73	9.99	11.47	16.84	22.14	21.72	19.53	15.19	12.39	10.18	3.92
26	6.64	6.97	10.14	11.75	17.79	21.75	21.96	19.42	15.80	12.98	9.90	3.77
27	6.40	6.83	10.01	11.79	19.03	20.31	21.24	19.75	16.46	12.92	9.66	4.14
28	5.92	6.89	10.65	11.64	19.87	19.34	20.54	20.32	16.84	12.85	9.17	5.43
29	5.65	7.67	10.79	12.10	18.97	19.36	20.80	20.66	16.73	12.54	8.60	7.88
30	6.26	—	10.72	13.04	17.59	20.68	21.26	20.32	15.71	11.63	8.57	8.38
31	6.46	—	11.11	—	17.76	—	21.58	20.49	—	10.26	—	6.89
MEAN	3.67	6.98	9.52	11.73	15.91	18.38	20.70	21.15	17.81	12.17	9.64	5.77
MAX	6.64	9.18	11.28	13.42	19.87	22.14	22.07	23.57	21.29	15.17	12.86	9.08
MIN	0.34	3.23	6.64	10.71	12.30	15.36	19.71	19.34	14.39	9.89	7.81	3.47

FANO – 14206950 – Fanno Creek at Durham Road near Tigard, Oregon [RM 1.2]



FREQUENCY OF MEAN DAILY TEMPERATURE BY MONTH FOR PERIOD OF RECORD

MONTH	0 ≤ T < 5.0	5.0 ≤ T < 7.0	7.0 ≤ T < 8.5	8.5 ≤ T < 10	10 ≤ T < 12	12 ≤ T < 14	14 ≤ T < 16	16 ≤ T < 18	18 ≤ T < 19	19 ≤ T < 20	20 ≤ T < 21	21 ≤ T < 23	23 ≤ T < 25	Missing
Jan														
Feb														
Mar														
Apr														
May														
Jun														
July														
Aug														
Sep														
Oct														
Nov														
Dec														
All	5.4%	8.8%	9.8%	11%	11%	10.0%	10%	10%	5.7%	5.0%	4.6%	3.9%	0.5%	4.2%

Key

- $f \geq 3\%$
- $2\% \leq f < 3\%$
- $1\% \leq f < 2\%$
- $0.2\% \leq f < 1\%$
- $0.06\% \leq f < 0.2\%$
- $0 < f < 0.06\%$

MEAN DAILY TEMPERATURE BY MONTH AND YEAR

	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002									15.7	12.0	9.1	7.1
2003	7.8	7.8	10.0	11.9	14.0	17.8	20.3	19.5	16.5	14.1	7.1	7.6
2004	6.3	7.9	11.0	12.5	15.5	18.1	21.1	20.8	16.7	13.8	9.0	6.9
2005	5.6	6.7	10.0	11.5	15.4	16.3	20.0	19.7	15.6	13.7	8.0	5.9
2006	8.3	7.0	8.6	12.3	15.1	17.4	20.3	18.6	15.8	11.8	9.6	6.4
2007	5.0	7.6	10.3	11.6	14.8	16.9	20.0	18.6	16.6	12.1	8.8	6.6
2008	5.6	7.2	8.5	9.8	14.5	15.8	19.4	18.9	16.1	11.2	9.9	5.6
2009	4.9	5.8	8.0	11.7	14.9	18.0	20.8	19.1	17.0	11.8	8.9	4.1
2010	8.1	8.8	9.7	12.0	13.7	15.0	19.1	19.0	16.4	12.1	9.6	7.4
2011	7.6	6.2	8.8	10.4	13.1	16.2	18.1	19.5	17.1	13.2	8.6	4.5
2012	6.6	7.5	8.2	12.2	14.8	16.6	19.7	19.6	16.4	12.6	9.8	7.4
2013	4.2	7.5	9.4	12.3	15.2	17.8	20.0	20.3	18.2	11.4	9.9	4.9
2014	5.8	7.0	10.0	12.6	16.5	17.7	21.4	21.0	17.9	14.7	9.8	8.2
2015	7.4	9.8	11.7	12.5	15.7	20.0	21.8	20.4	16.2	14.2	9.6	8.0
2016	7.9	9.4	10.6	14.1	16.2	18.4	19.3	20.3	16.6	13.5	11.9	6.0
2017	3.2	7.0	9.9	11.6	15.9	18.4	20.5	20.5	17.0	12.4	9.6	5.4
Median	6.6	7.5	9.6	12.0	15.0	17.5	20.2	19.7	16.6	12.9	9.2	6.7

Key

T in ºC

- Q ≤ 4.8
- 4.8 < Q ≤ 6.1
- 6.1 < Q ≤ 7.0
- 7.0 < Q ≤ 7.8
- 7.8 < Q ≤ 9.1
- 9.1 < Q ≤ 10.6
- 10.6 < Q ≤ 12.5
- 12.5 < Q ≤ 17.2
- 17.2 < Q ≤ 19.9
- 19.9 < Q ≤ 20.9
- Q > 20.9

T as percentile

- Q ≤ 5th
- 5th < T ≤ 10th
- 10th < T ≤ 15th
- 15th < T ≤ 20th
- 20th < T ≤ 30th
- 30th < T ≤ 40th
- 40th < T ≤ 50th
- 50th < T ≤ 75th
- 75th < T ≤ 90th
- 90th < T ≤ 95th
- T > 95th

Distribution

- The highest temperatures occurred in July and August.
- The lowest temperatures occurred in December and January.

Trends

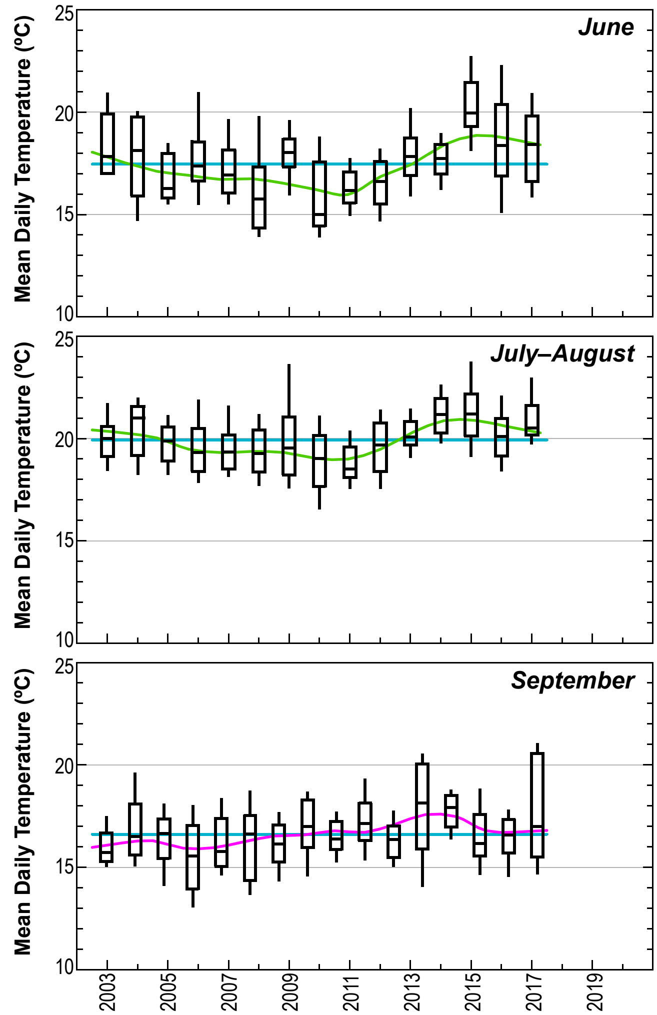
- Water temperatures in June and July–August do not show any statistically significant trends.
- Water temperatures showed an increasing trend in September that was statistically significant. The increase is small and the period of record is relatively short. More years will be required to know if this trend persists.
- No trend was evident in the timing of or number of days with temperature standard exceedances.

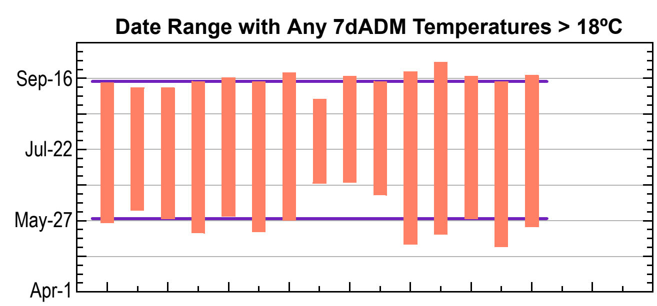
Oregon water temperature standard

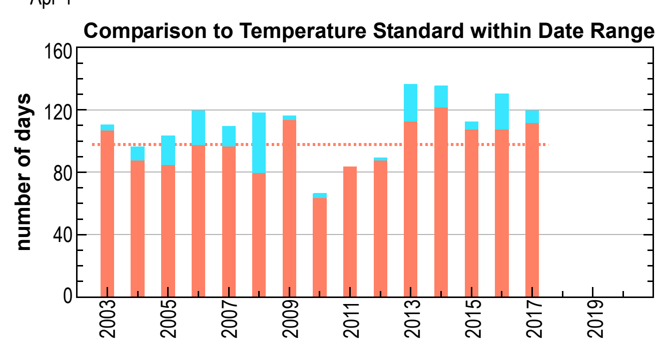
- Temperatures at this site exceeded the standard for all years.
- Statistics for exceedances of the standard are:

average first day	May-29
average last day	Sep-14
median number of days	98

- Days when the 7dADM did not exceed the standard often occurred within the date range of exceedances, but usually were a minor fraction.







Sources of data for statistical distributions

Data for the statistical distributions were obtained from the USGS database and from previous Tualatin River Flow Management Reports. For some sites, the data were collected by different organizations over the period of record; it is not known if these data are fully comparable with one another.

DATA SOURCES FOR STATISTICAL DISTRIBUTIONS

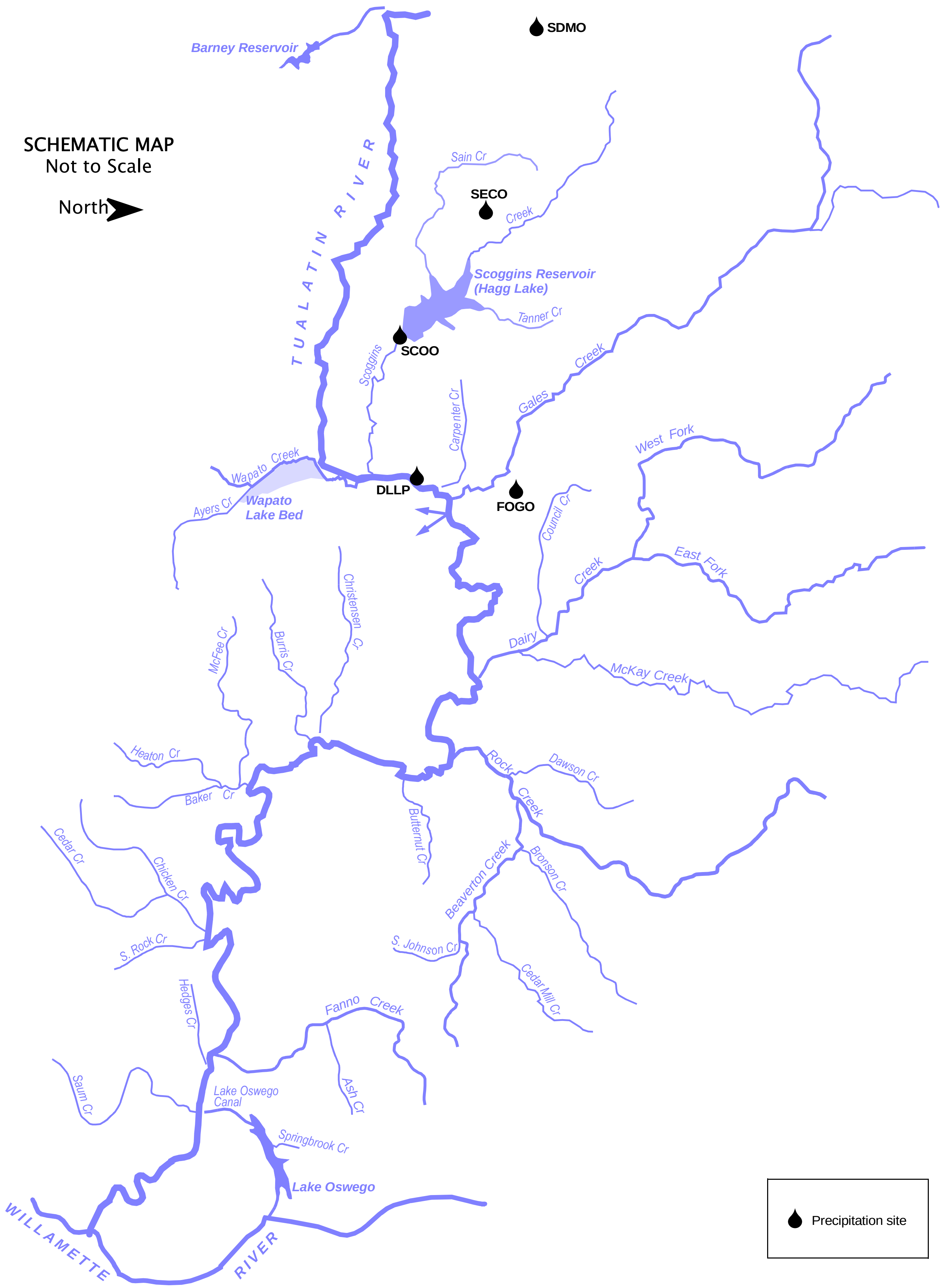
SITEID	SITE NAME	START DATE	SOURCES OF DATA FOR DISTRIBUTION
Mainstem Tualatin River & Scoggins Creek			
14202980	Scoggins Creek below Henry Hagg Lake near Gaston, Oregon	4/30/2002	USGS database: all (data collected by USGS)
14203500	Tualatin River near Dilley	5/16/1997	USGS database: 2016–present; previous Flow Reports: 1997–2000 (data collected by: OWRD 1997—2007, consultant 2008–2011 USGS 2016–present)
14206241	Tualatin River at Hwy 219 Bridge	10/15/2004	Stewart Rounds, USGS pers. comm.: all (data collected by Jackson Bottom Wetland Education Center)
14206500	Tualatin River at RM 24.5 near Scholls, Oregon	5/23/1997	USGS database: all (data collected by USGS; no data collection in winter)
14207500	Tualatin River at Oswego Dam near West Linn, Oregon	5/7/1991	USGS database: all (data collected by USGS)
Tributaries			
453040123065201 OWRD# 14204530	Gales Creek at Old Hwy 47 near Forest Grove, Oregon	5/9/2001	USGS database: all (data collected by USGS)
14205400	East Fork Dairy Creek near Meacham Corner, OR	9/6/2002	USGS database: all (data collected by USGS) (no data from 10/28/2004–2/15/20012)
14206070	McKay Creek at Scotch Church Rd above Waible Ck near North Plains, Oregon	1/1/2002	previous Flow Reports: all (data collected by: OWRD 2002—2007, consultant 2008–present)
453004122510301	Beaverton Creek at 170th, Beaverton, Oregon	5/11/2001	USGS database: all (data collected by: USGS 2001–WY2015, CWS WY2016–present)
453030122560101	Rock Creek at Brookwood Ave, Hillsboro, Oregon	5/19/2004	USGS database: all (data collected by USGS)
14206950	Fanno Creek at Durham Road near Tigard, Oregon	9/6/2002	USGS database: all (data collected by USGS)

Abbreviations: CWS=Clean Water Services; OWRD=Oregon Water Resources Division; USGS=United States Geological Survey

Appendix G

Precipitation Data

PRECIPITATION MONITORING STATIONS — LOCATIONS



PRECIPITATION SITES — ALPHABETICAL LISTING BY SITE CODE

SITE CODE	SITE NAME	Elevation (ft)	PAGE
DLLP	Dilley Precipitation Station	170	H-12
FOGO	Forest Grove, Oregon AgriMet Weather Station (Verboort)	180	H-10
SCOO	Scoggins Creek below Henry Hagg Lake	215	H-8
SDMO	South Saddle Mountain Precipitation Station (SNOTEL #726)	3250	H-4
SECO	Sain Creek Precipitation Station (SNOTEL #743)	2000	H-6

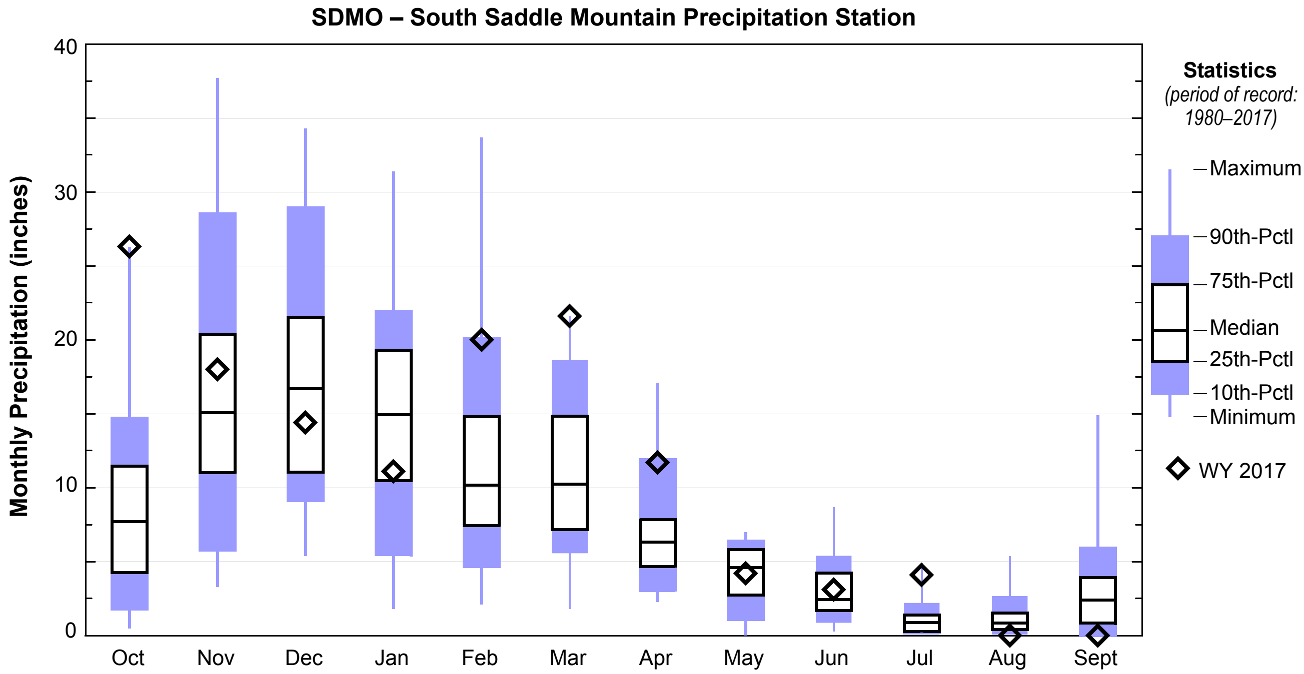
SDMO – SOUTH SADDLE MOUNTAIN PRECIPITATION STATION

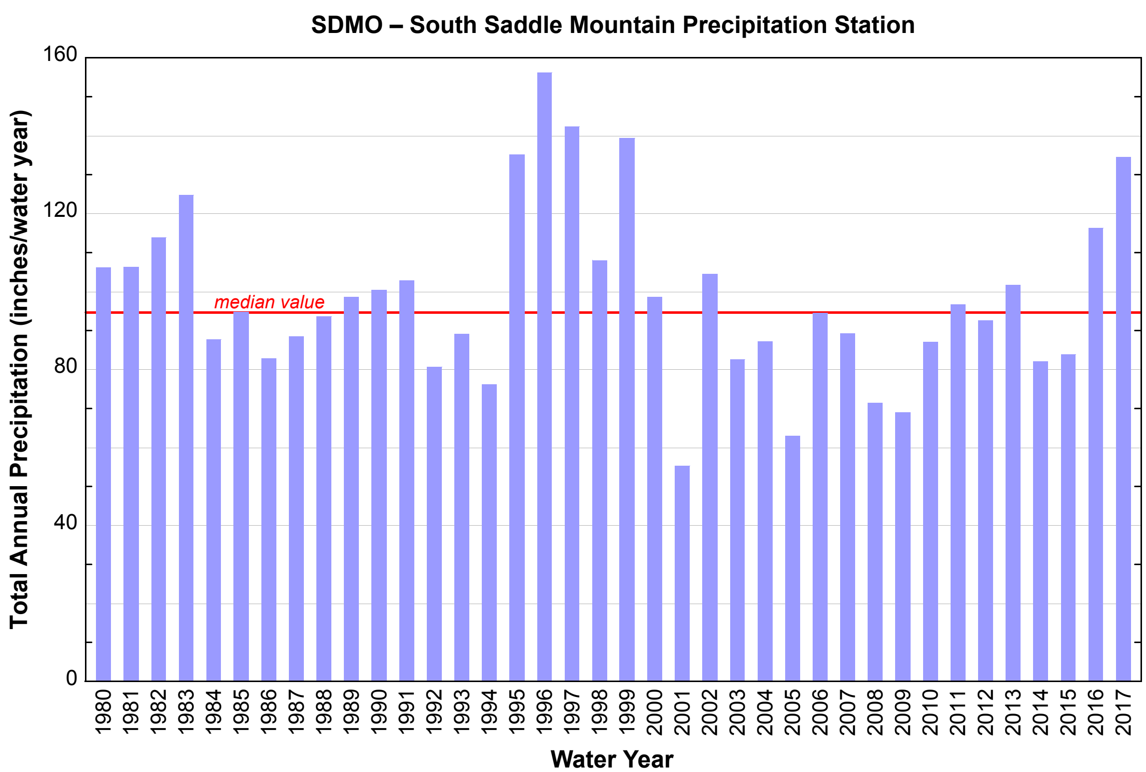
Elevation: 3250 ft
Latitude: 45 31 48 Longitude: 123 22 12

Source Agency: Natural Resources Conservation Service
https://wcc.sc.egov.usda.gov/nwcc/rgrpt?report=precsnotelmon&state=OR

Water Year*	Total Monthly Precipitation (inches)											
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1980	10.8	7.5	19.2	19.3	11.2	10.1	6.5	6.4	8.7	1.0	0.6	4.9
1981	4.2	19.3	26.8	5.2	18.6	7.5	7.9	4.1	7.2	0.4	0.7	4.4
1982	13.0	14.9	26.6	19.3	17.2	7.5	7.2	0.0	2.0	1.1	1.9	3.3
1983	13.4	16.7	21.5	17.3	15.2	11.5	7.1	4.3	4.7	4.9	3.4	4.7
1984	1.7	23.3	11.8	8.3	12.6	8.1	6.3	6.4	3.8	0.6	1.1	3.8
1985	11.4	28.6	12.9	1.8	10.2	11.8	4.8	1.5	4.3	0.2	1.4	5.9
1986	12.2	11.1	5.4	15.8	13.4	7.2	5.7	3.2	1.1	1.4	0.2	6.2
1987	5.3	20.2	11.1	17.1	7.7	16.0	2.3	4.9	1.1	1.7	0.2	0.9
1988	0.7	10.8	22.2	14.1	9.6	15.0	7.8	6.1	2.4	2.0	0.3	2.7
1989	2.5	28.5	11.4	14.9	10.2	17.4	5.3	2.8	1.7	1.9	2.0	0.0
1990	5.8	9.6	8.6	31.4	20.8	7.0	6.4	3.3	4.9	0.4	0.8	1.5
1991	11.4	18.7	10.0	12.7	12.7	12.1	15.3	4.4	2.7	1.0	1.2	0.6
1992	2.8	14.4	11.8	19.1	8.8	1.8	10.5	2.4	1.2	1.4	1.1	5.3
1993	6.8	13.8	16.2	10.8	3.3	12.4	13.7	6.4	3.2	1.6	0.9	0.0
1994	2.7	3.3	18.8	11.0	15.2	9.3	5.5	3.6	4.2	0.9	0.5	1.2
1995	14.7	20.9	31.0	19.7	13.5	14.8	6.8	1.5	4.3	3.0	1.3	3.7
1996	8.5	34.8	21.7	21.2	32.6	6.0	17.1	6.4	2.0	1.2	1.0	3.7
1997	11.6	16.9	34.3	17.2	7.3	20.1	8.3	5.9	5.3	2.1	2.6	10.7
1998	19.8	15.3	9.3	24.2	14.7	10.4	3.3	6.1	1.6	0.2	0.4	2.7
1999	7.7	25.9	28.7	20.3	33.7	12.9	2.8	5.0	0.9	0.2	1.3	0.0
2000	6.1	23.6	18.6	17.7	10.1	6.3	2.9	4.9	6.0	0.1	0.6	1.6
2001	4.3	5.6	9.2	5.5	4.8	6.2	6.1	5.2	3.3	1.4	3.1	0.7
2002	6.6	23.0	20.3	21.7	7.5	10.7	7.6	2.9	3.6	0.2	0.3	0.1
2003	0.5	5.8	17.2	21.5	5.4	19.5	7.5	2.3	0.3	0.3	0.4	1.9
2004	9.4	12.1	13.5	15.0	8.7	5.4	4.4	4.9	2.7	0.1	5.4	5.7
2005	7.4	5.0	10.9	9.3	2.1	11.0	6.5	5.8	2.2	1.0	0.4	1.4
2006	9.4	12.4	18.2	29.8	6.1	7.3	3.5	3.0	2.0	0.7	0.0	2.1
2007	1.9	37.7	15.1	9.0	10.3	4.9	3.7	0.5	2.0	0.9	1.1	2.1
2008	7.7	9.5	21.9	11.5	4.7	7.6	4.9	1.1	2.3	0.3	2.4	0.0
2009	6.6	11.9	10.7	11.5	4.4	7.1	4.8	7.0	0.8	0.5	1.3	2.4
2010	7.8	15.5	9.2	14.5	8.5	9.7	7.2	4.8	5.0	0.5	0.5	3.8
2011	9.1	14.1	19.1	12.3	8.2	13.8	10.0	5.1	1.7	1.3	0.1	1.8
2012	5.8	14.6	12.2	17.3	9.6	18.0	5.9	5.0	3.7	0.2	0.0	0.3
2013	14.8	19.4	19.4	4.8	5.9	5.6	6.1	6.5	2.0	0.3	1.9	14.9
2014	1.8	9.9	6.6	9.5	15.3	18.5	9.1	5.5	1.8	0.8	0.8	2.5
2015	13.5	12.1	18.4	8.8	11.4	8.3	3.7	2.5	0.6	0.2	2.0	2.4
2016	11.1	17.5	34.2	15.7	12.1	15.3	3.1	1.0	2.5	0.9	0.5	2.4
2017	26.3	18.0	14.4	11.1	20.0	21.6	11.7	4.2	3.1	4.1	0.0	0.0
MIN	0.5	3.3	5.4	1.8	2.1	1.8	2.3	0.0	0.3	0.1	0.0	0.0
MAX	26.3	37.7	34.3	31.4	33.7	21.6	17.1	7.0	8.7	4.9	5.4	14.9
MEDIAN	7.7	15.1	16.7	15.0	10.2	10.3	6.4	4.6	2.5	0.9	0.9	2.4
MEAN	8.34	16.37	17.06	14.93	11.67	10.94	6.82	4.13	2.97	1.08	1.15	2.96

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.


SDMO – South Saddle Mountain Precipitation Station
Monthly Precipitation (inches)
0
10
20
30
40
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Statistics
(period of record: 1980–2017)
Maximum
90th-Pctl
75th-Pctl
Median
25th-Pctl
10th-Pctl
Minimum
WY 2017


SDMO – South Saddle Mountain Precipitation Station
Total Annual Precipitation (inches/water year)
0
40
80
120
160
median value
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Water Year

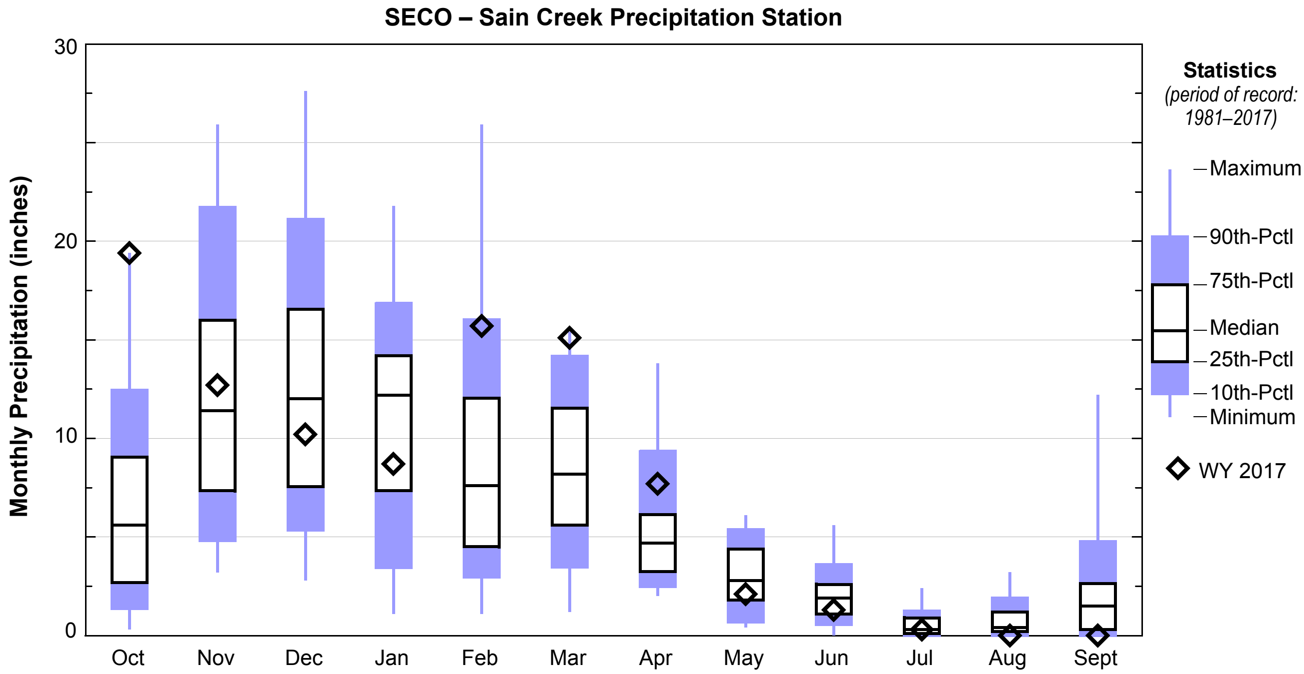
SECO – SAIN CREEK PRECIPITATION STATION

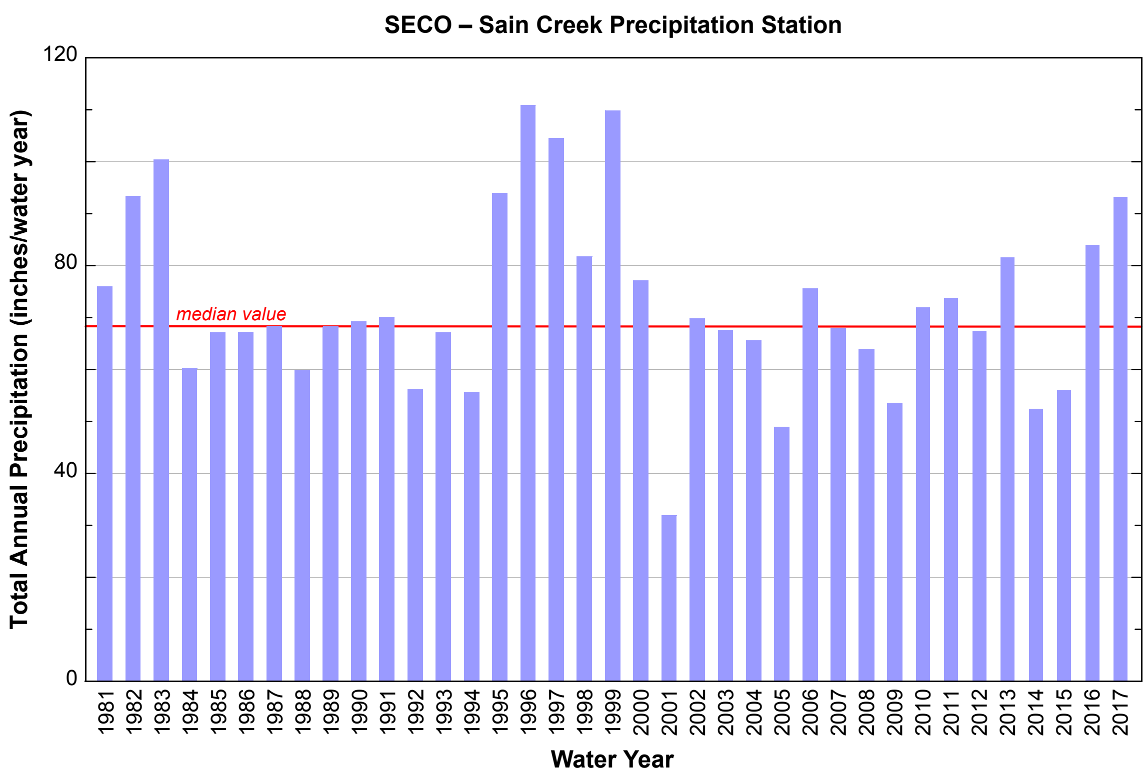
Elevation: 2000 ft
Latitude: 45 31 12   Longitude: 123 16 48

Source Agency: Natural Resources Conservation Service
https://wcc.sc.egov.usda.gov/nwcc/rgrpt?report=precsnotelmon&state=OR

Water Year*	Total Monthly Precipitation (inches)											
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1981	2.3	13.5	17.8	5.8	12.8	5.3	6.0	3.6	5.6	0.0	0.2	3.0
1982	10.3	11.8	20.8	13.2	14.9	7.9	6.4	0.7	2.0	1.1	1.9	2.4
1983	11.1	11.4	17.0	15.5	17.3	14.5	6.3	2.5	3.1	1.6	0.0	0.1
1984	1.4	16.7	3.5	3.5	12.1	9.1	2.5	5.3	3.3	0.0	0.0	2.8
1985	10.4	22.6	7.0	1.1	4.0	7.9	4.3	1.4	3.5	0.1	1.6	3.2
1986	9.3	4.9	2.8	13.2	15.1	2.9	5.2	6.1	0.2	1.0	0.2	6.3
1987	4.5	15.3	8.4	12.4	6.4	12.3	3.6	3.3	0.4	1.2	0.2	0.3
1988	0.7	6.8	15.8	12.2	2.8	9.1	4.4	4.0	2.0	0.7	0.0	1.4
1989	1.3	21.5	7.4	9.1	7.3	11.6	3.7	1.7	1.9	0.9	1.7	0.1
1990	4.5	6.2	5.8	21.8	14.5	6.4	3.2	2.6	2.5	0.3	0.7	0.8
1991	8.4	10.9	6.1	7.4	9.1	8.3	12.9	2.8	2.1	0.8	0.8	0.5
1992	2.5	9.7	8.4	12.2	6.7	1.2	9.2	1.1	1.1	0.6	0.4	3.1
1993	5.0	9.3	11.9	8.9	2.0	8.8	9.9	5.7	2.7	2.4	0.5	0.0
1994	1.7	4.5	12.7	8.5	10.7	5.9	4.2	3.1	2.4	0.1	0.2	1.6
1995	13.0	13.4	16.6	16.0	9.3	11.2	5.2	1.9	2.9	1.1	0.8	2.5
1996	6.6	24.6	15.7	15.3	21.9	3.4	13.8	4.8	1.4	0.4	0.4	2.6
1997	8.4	12.7	27.6	13.3	4.7	13.7	5.6	4.8	3.4	0.4	1.9	8.1
1998	13.0	12.0	6.4	19.8	12.0	8.5	2.5	5.1	0.8	0.0	0.2	1.5
1999	5.6	20.5	22.3	16.1	25.9	11.1	2.0	4.0	1.0	0.2	1.2	0.0
2000	4.6	18.3	15.4	13.5	8.5	5.3	2.6	3.8	4.0	0.0	0.2	0.9
2001	2.9	3.7	6.4	3.2	3.1	3.7	3.7	2.4	1.1	0.3	1.2	0.2
2002	3.8	16.7	13.3	14.9	5.1	6.6	5.1	2.0	2.0	0.1	0.0	0.3
2003	0.3	7.8	16.5	15.8	4.3	14.1	5.9	1.4	0.0	0.0	0.0	1.5
2004	5.8	7.3	12.0	12.2	7.6	3.9	4.7	2.3	2.0	0.2	3.2	4.4
2005	5.6	3.2	8.3	8.4	1.1	8.5	4.9	5.3	2.5	0.4	0.2	0.6
2006	9.1	10.4	14.7	21.8	3.7	6.9	3.3	3.1	1.5	0.2	0.0	0.9
2007	1.8	25.9	12.0	6.1	9.5	4.0	3.2	0.4	1.1	1.2	0.9	1.9
2008	4.7	7.5	20.0	11.2	5.0	7.5	4.5	0.5	0.6	0.6	1.9	0.0
2009	5.8	7.4	11.3	7.9	3.0	5.9	2.9	5.3	0.8	0.0	1.3	2.0
2010	6.2	12.5	7.7	13.0	7.2	8.2	6.7	3.3	4.1	0.1	0.2	2.7
2011	7.0	10.1	16.1	7.3	6.6	12.3	7.7	2.6	1.4	1.4	0.0	1.3
2012	4.8	10.2	7.7	13.4	6.5	15.4	4.0	2.7	2.0	0.1	0.3	0.3
2013	12.3	16.8	16.6	2.1	4.0	3.5	5.3	5.9	1.2	0.2	1.5	12.2
2014	1.4	6.1	2.9	4.7	11.4	13.0	5.8	3.1	1.4	0.6	0.4	1.6
2015	9.0	7.1	11.7	6.0	8.9	6.3	2.1	1.3	0.9	0.2	1.1	1.5
2016	6.3	11.9	25.0	12.9	8.5	11.5	2.5	0.7	1.6	0.9	0.6	1.6
2017	19.4	12.7	10.2	8.7	15.7	15.1	7.7	2.1	1.3	0.3	0.0	0.0
MIN	0.3	3.2	2.8	1.1	1.1	1.2	2.0	0.4	0.0	0.0	0.0	0.0
MAX	19.4	25.9	27.6	21.8	25.9	15.4	13.8	6.1	5.6	2.4	3.2	12.2
MEDIAN	5.6	11.4	12.0	12.2	7.6	8.2	4.7	2.8	1.9	0.3	0.4	1.5
MEAN	6.24	12.00	12.48	11.04	8.90	8.40	5.23	3.05	1.94	0.53	0.70	2.01

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.


SECO – Sain Creek Precipitation Station
Monthly Precipitation (inches)
0
10
20
30
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Statistics
(period of record: 1981–2017)
Maximum
90th-Pctl
75th-Pctl
Median
25th-Pctl
10th-Pctl
Minimum
WY 2017


SECO – Sain Creek Precipitation Station
Total Annual Precipitation (inches/water year)
0
40
80
120
median value
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Water Year

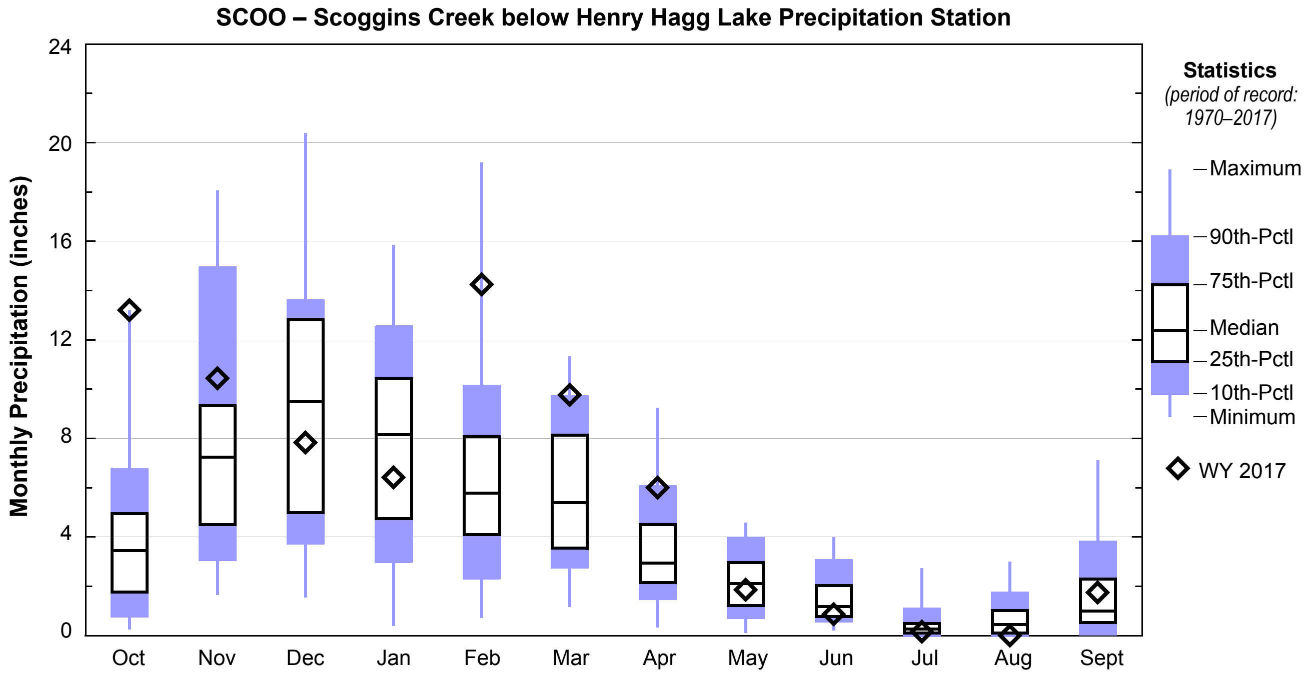
SCOO – SCOGGINS CREEK BELOW HENRY HAGG LAKE PRECIPITATION STATION

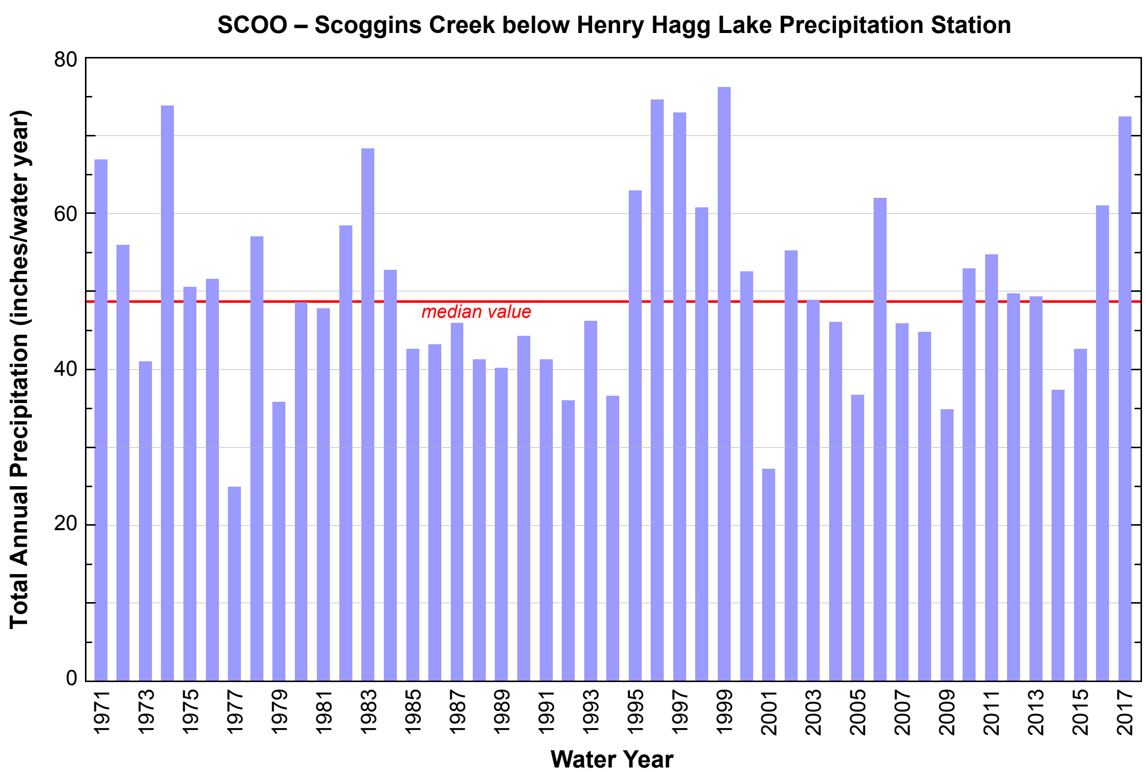
Elevation: 187.5 ft
Latitude: 45 28 10 Longitude: 123 11 56

Source Agency: Tualatin Valley Irrigation District
data not available online

Water Year*	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
	Total Monthly Precipitation (inches)											
1970			8.53	15.85	6.30	3.47	3.49	1.27	0.77	0.01	0.00	1.10
1971	4.40	6.86	16.85	10.82	5.60	10.30	3.96	1.54	2.03	0.14	0.52	3.92
1972	4.02	8.68	12.12	10.20	5.05	6.79	3.92	0.92	0.58	0.28	0.25	3.12
1973	0.72	6.31	12.28	6.44	2.36	3.75	2.15	1.19	1.37	0.04	0.86	3.54
1974	3.82	18.05	14.64	12.46	7.92	9.31	3.98	1.31	0.86	1.38	0.02	0.06
1975	1.33	8.02	9.94	10.45	8.11	5.71	2.00	2.12	0.67	0.47	1.72	0.03
1976	6.69	6.38	9.50	7.68	8.25	5.98	1.81	1.63	0.48	0.70	1.80	0.69
1977	1.26	1.65	1.54	1.05	3.37	5.33	0.32	2.50	1.11	0.41	2.99	3.42
1978	2.76	8.11	13.47	7.92	6.66	2.47	5.04	2.95	1.00	0.65	2.11	3.94
1979	0.81	4.29	3.77	3.16	9.75	3.30	2.83	2.99	0.68	0.15	1.71	2.42
1980	6.69	4.25	9.21	8.30	7.13	4.09	4.38	1.10	1.81	0.22	0.05	1.37
1981	1.76	8.71	11.80	3.60	6.07	3.22	2.88	2.67	3.14	0.08	0.06	3.77
1982	5.55	6.77	13.00	7.21	8.43	4.85	6.45	0.51	1.41	0.37	1.46	2.49
1983	5.82	6.90	13.00	8.13	13.46	9.93	2.88	1.54	2.10	2.73	1.19	0.67
1984	1.34	15.16	7.91	3.09	7.92	4.81	4.05	3.95	3.34	0.00	0.00	1.13
1985	5.16	14.86	4.88	0.37	4.03	5.22	1.50	0.73	2.58	0.41	0.68	2.17
1986	4.48	4.55	2.93	9.23	8.42	4.13	2.57	2.65	0.59	1.07	0.00	2.60
1987	3.43	7.85	5.96	8.19	6.67	8.51	1.80	2.10	0.31	0.79	0.11	0.23
1988	0.23	3.09	12.51	9.46	1.67	4.50	3.32	2.78	2.59	0.15	0.09	0.89
1989	0.27	12.19	4.64	4.61	4.59	8.21	1.26	1.63	0.89	0.48	0.83	0.55
1990	2.74	4.39	3.52	13.00	8.87	2.60	2.20	3.01	2.02	0.26	1.18	0.49
1991	4.35	4.49	3.87	4.69	4.72	5.38	9.03	2.29	1.44	0.22	0.54	0.23
1992	1.80	6.31	5.74	7.72	4.66	1.16	5.63	0.09	0.71	0.42	0.35	1.47
1993	2.84	5.94	8.85	6.25	1.21	5.40	6.71	3.95	2.26	2.59	0.17	0.04
1994	1.21	1.92	9.97	6.47	7.71	3.41	2.49	0.96	1.30	0.00	0.13	0.98
1995	4.94	9.30	11.54	12.00	5.36	7.88	4.53	1.47	2.44	0.58	1.01	1.89
1996	3.70	12.24	12.17	11.53	13.61	2.81	9.23	4.49	1.59	0.58	0.34	2.32
1997	5.44	8.73	20.40	10.71	2.98	9.22	3.38	2.68	3.34	0.29	1.28	4.52
1998	8.57	9.32	4.41	14.18	9.08	6.26	2.31	4.56	0.96	0.24	0.00	0.91
1999	4.51	15.20	13.27	11.84	19.20	6.25	1.77	2.15	0.93	0.08	0.96	0.06
2000	3.13	12.68	9.50	9.02	6.51	4.08	1.40	2.94	2.26	0.03	0.19	0.81
2001	3.24	3.08	5.11	2.30	2.36	3.05	2.19	2.20	1.79	0.23	1.12	0.52
2002	3.28	12.10	11.86	11.36	4.11	5.84	2.79	1.58	1.46	0.13	0.19	0.57
2003	0.73	4.37	13.26	9.33	4.20	9.29	5.17	0.86	0.20	0.01	0.62	0.86
2004	3.34	5.26	9.92	8.84	5.96	3.11	3.12	1.63	0.90	0.00	2.01	2.00
2005	4.60	2.75	4.95	4.92	0.70	7.73	3.34	4.52	1.99	0.38	0.39	0.38
2006	5.54	8.57	12.92	15.72	4.10	6.13	3.63	2.96	1.53	0.15	0.00	0.75
2007	0.83	17.64	7.76	4.37	6.42	2.79	2.15	0.90	0.76	0.69	0.58	0.99
2008	3.91	4.68	13.42	8.69	3.30	5.03	2.50	0.92	1.25	0.02	0.98	0.09
2009	2.89	6.29	4.58	6.36	2.20	4.13	1.99	3.95	0.76	0.21	0.66	0.82
2010	3.73	8.95	5.11	10.29	5.16	5.72	5.79	3.20	3.04	0.36	0.05	1.54
2011	4.53	7.24	12.96	4.99	4.78	9.67	5.35	2.96	0.78	1.11	0.00	0.35
2012	2.29	8.12	3.93	9.33	4.53	11.32	2.99	2.94	3.98	0.25	0.02	0.04
2013	6.95	9.95	11.78	1.19	2.35	2.61	1.93	3.79	0.94	0.00	0.79	7.10
2014	1.04	3.33	2.06	3.28	8.96	9.39	4.56	2.01	0.94	0.33	0.10	1.37
2015	7.15	3.75	9.16	4.36	7.79	5.42	1.49	0.54	0.65	0.23	0.77	1.33
2016	3.35	8.38	19.38	10.36	4.97	9.21	2.39	0.72	0.97	0.29	0.29	0.71
2017	13.19	10.43	7.82	6.41	14.24	9.75	5.99	1.85	0.86	0.00	0.15	1.74
MIN	0.23	1.65	1.54	0.37	0.70	1.16	0.32	0.09	0.20	0.00	0.00	0.03
MAX	13.19	18.05	20.40	15.85	19.20	11.32	9.23	4.56	3.98	2.73	2.99	7.10
MEDIAN	3.43	7.24	9.50	8.16	5.78	5.39	2.94	2.11	1.18	0.26	0.46	0.99
MEAN	3.71	7.83	9.33	7.87	6.29	5.80	3.47	2.17	1.47	0.42	0.65	1.52

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.


SCOO – Scoggins Creek below Henry Hagg Lake Precipitation Station
Monthly Precipitation (inches)
0
4
8
12
16
20
24
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Statistics
(period of record: 1970–2017)
Maximum
90th-Pctl
75th-Pctl
Median
25th-Pctl
10th-Pctl
Minimum
WY 2017


SCOO – Scoggins Creek below Henry Hagg Lake Precipitation Station
Total Annual Precipitation (inches/water year)
0
20
40
60
80
median value
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
Water Year

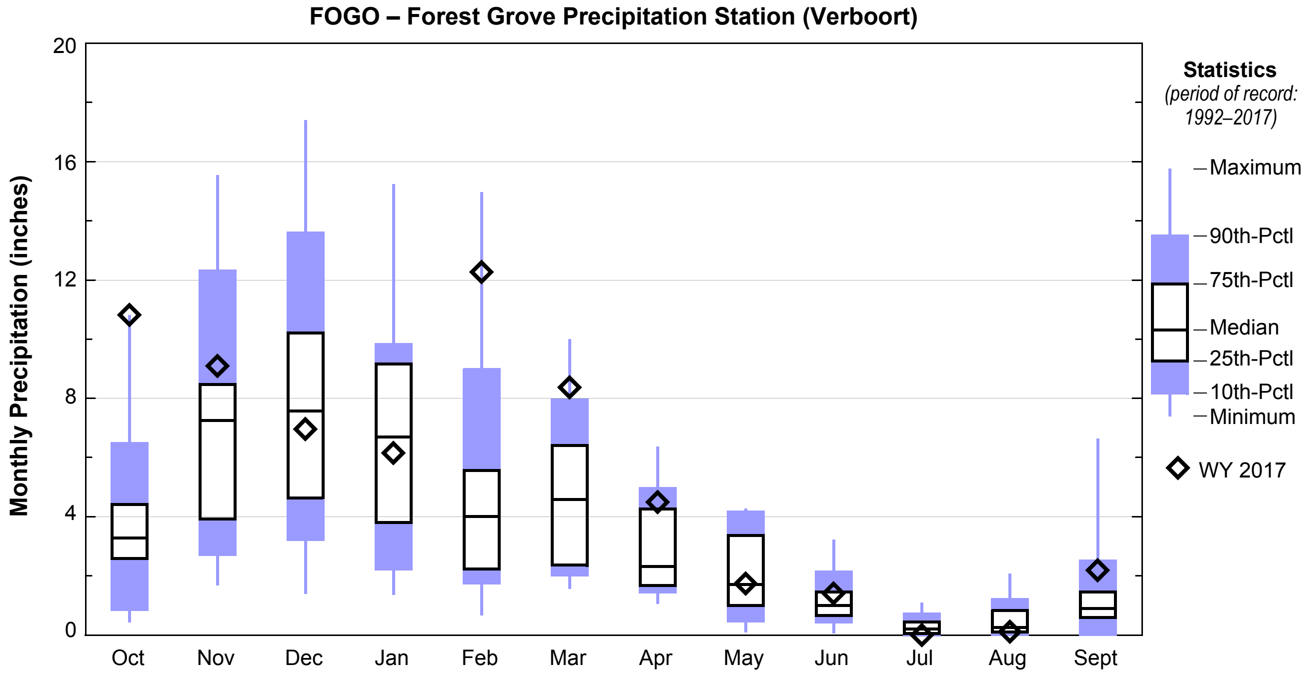
FOGO – FOREST GROVE PRECIPITATION STATION (VERBOORT)

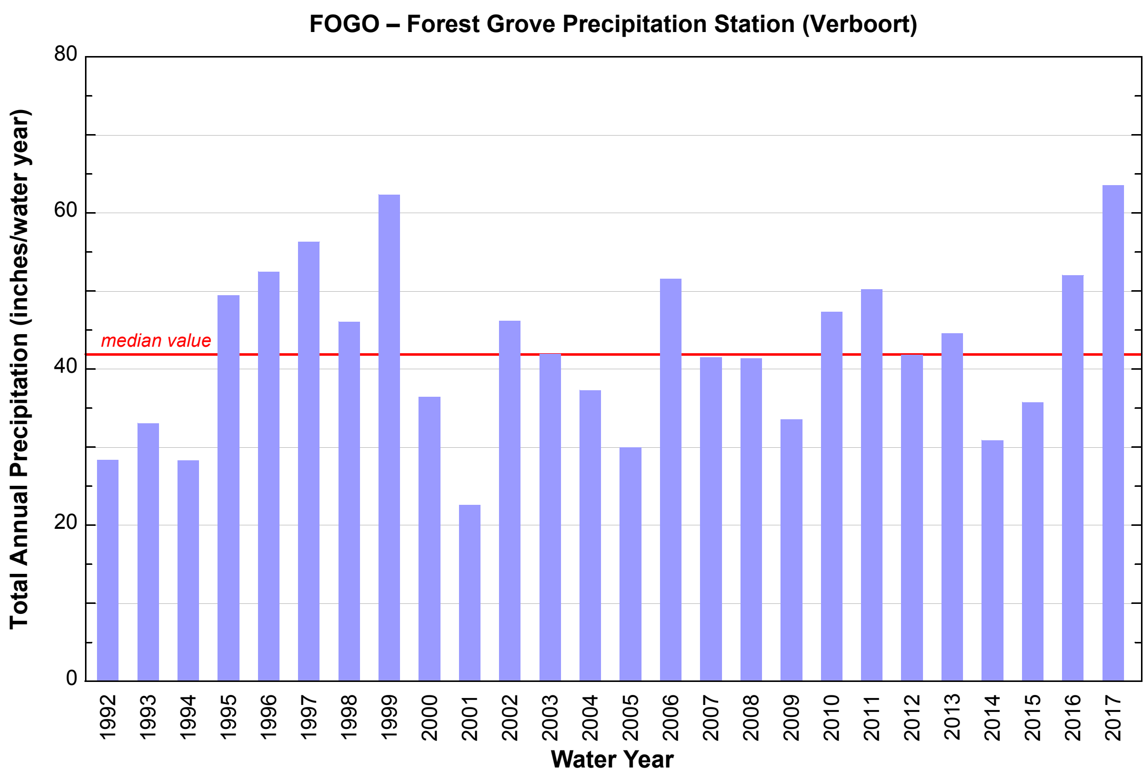
Elevation: 180 ft
Latitude: 45 33 11   Longitude: 123 05 01

Source Agency: US Bureau of Reclamation – Agrimet
https://www.usbr.gov/pn/agrimet/webarcread.html

Water Year*	Total Monthly Precipitation (inches)											
	OCT	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**
1992	1.50	5.10	3.68	5.93	3.56	1.56	4.35	0.10	0.94	0.26	0.28	1.08
1993	2.41	4.17	6.00	3.20	2.22	4.15	4.88	4.22	0.57	1.09	0.14	0.00
1994	1.08	1.68	7.61	4.95	5.75	2.34	1.49	1.31	1.04	0.02	0.23	0.77
1995	6.26	7.51	7.56	9.72	4.05	5.78	3.09	1.57	1.23	0.53	0.50	1.62
1996	3.08	11.72	8.55	9.06	3.63	2.33	6.37	4.14	0.85	0.48	0.26	1.99
1997	4.53	7.99	14.96	7.64	1.78	7.76	3.27	1.83	1.80	0.18	1.32	3.25
1998	6.99	7.08	3.47	9.12	7.20	4.57	1.44	4.28	1.06	0.07	0.00	0.80
1999	3.44	13.67	9.83	9.65	14.97	5.39	1.69	1.68	0.98	0.35	0.66	0.02
2000	2.78	7.84	5.89	7.72	3.99	2.37	1.05	2.06	1.58	0.09	0.13	0.92
2001	3.08	2.63	4.30	1.66	1.74	2.13	1.68	1.07	2.11	0.44	1.15	0.63
2002	2.79	11.22	9.74	9.30	3.45	4.60	1.61	1.16	1.20	0.20	0.03	0.90
2003	0.43	3.02	12.24	10.06	3.18	6.19	5.13	0.55	0.07	0.00	0.35	0.73
2004	3.49	4.62	7.87	6.09	5.23	1.93	2.55	1.10	0.81	0.00	2.08	1.50
2005	3.80	2.78	4.38	2.47	0.67	6.00	2.60	4.08	1.56	0.21	0.11	1.28
2006	4.32	7.44	11.35	15.24	2.15	4.38	2.19	2.91	0.69	0.20	0.07	0.58
2007	0.95	15.55	8.57	3.88	4.24	2.45	2.12	0.78	0.59	0.57	0.50	1.32
2008	3.14	4.51	13.01	8.81	2.70	4.13	2.46	0.71	0.78	0.01	0.97	0.11
2009	2.66	5.69	4.73	6.06	1.91	3.69	1.77	3.43	1.17	0.13	1.06	1.28
2010	3.78	7.70	5.34	7.44	4.78	5.28	4.24	3.37	3.23	0.51	0.23	1.46
2011	4.39	7.42	11.53	5.08	5.52	7.35	4.38	2.37	0.62	1.05	0.00	0.48
2012	2.75	8.28	2.66	7.25	4.17	10.00	2.16	2.15	2.22	0.08	0.08	0.02
2013	6.25	9.20	9.56	1.36	2.24	2.08	1.67	3.36	1.44	0.00	0.78	6.63
2014	0.68	2.96	1.39	2.98	7.57	7.73	3.70	1.30	0.87	0.29	0.10	1.30
2015	6.13	3.19	7.45	3.61	5.90	4.67	1.48	0.80	0.44	0.28	1.02	0.79
2016	4.12	5.50	17.40	9.42	4.58	7.09	1.97	0.31	0.46	0.24	0.32	0.61
2017	10.82	9.09	6.96	6.15	12.26	8.37	4.49	1.74	1.41	0.00	0.11	2.19
MIN	0.43	1.68	1.39	1.36	0.67	1.56	1.05	0.10	0.07	0.00	0.00	0.00
MAX	10.82	15.55	17.40	15.24	14.97	10.00	6.37	4.28	3.23	1.09	2.08	6.63
MEDIAN	3.29	7.25	7.59	6.70	4.02	4.59	2.33	1.71	1.01	0.21	0.27	0.91
MEAN	3.68	6.83	7.92	6.69	4.59	4.78	2.84	2.01	1.14	0.28	0.48	1.24

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.


FOGO – Forest Grove Precipitation Station (Verboort)
Monthly Precipitation (inches)
0
4
8
12
16
20
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Statistics
(period of record: 1992–2017)
Maximum
90th-Pctl
75th-Pctl
Median
25th-Pctl
10th-Pctl
Minimum
WY 2017


FOGO – Forest Grove Precipitation Station (Verboort)
Total Annual Precipitation (inches/water year)
0
20
40
60
80
median value
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Water Year

DLLP – DILLEY PRECIPITATION STATION (ID# 352325)

Elevation: 170 ft — Source Agency: Western Climatic Data Center
Latitude: 45 29 Longitude: 123 07 — www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?or2325

Water Year*	Total Monthly Precipitation (inches)											
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1944			4.08	5.12	3.98	3.22	3.93	0.94	0.74	1.06	0.20	2.80
1945	1.56	5.5	2.74	4.13	6.99	7.18	2.09	3.71	0.22	0.20	0.13	3.17
1946	1.45	11.82	7.56	7.21	7.61	6.09	1.41	1.51	1.74			
1947		10.27	5.38	5.47	4.46	4.69	1.30	0.09	3.12	0.86	0.50	1.28
1948	9.68	4.08	4.99	7.28	7.52	4.55	3.97	4.92	0.90	0.59	1.35	2.72
1949	2.52	8.69	10.59	2.06	11.83	2.99	0.55	2.98	0.55	0.82	0.03	0.58
1950	2.48	7.55	5.93	10.43	6.58	6.77	1.46	0.48	2.19	0.54	0.84	1.13
1951	9.62	9.55	8.93	11.03	5.01	4.74	0.88	1.67	0.15	0.11	0.15	2.38
1952	6.96	7.89	9.70	7.08	5.65	4.20	1.35	0.77	2.62	0.00	0.03	0.38
1953	0.61	2.29	9.28	14.98	4.86	5.36	2.74	2.87	1.25	0.10	1.51	1.60
1954	3.55	7.37	7.48	13.80	7.32	2.95	3.26	1.33	2.06	0.56		1.97
1955	3.92	7.61	7.66	4.41	4.36	5.55	4.56	0.77	1.78	1.41	0.00	2.65
1956	6.97	10.49	12.90	13.36	4.43	7.27	0.64	1.42	1.29	0.03	1.32	1.84
1957	4.83	1.98	4.69	3.02	5.77	7.09	2.09	3.03	1.52	0.27	0.47	0.75
1958	3.55	3.77	10.90	9.29	8.50	2.62	4.24	1.05	2.96	0.02	0.00	0.59
1959	2.34	8.74	6.09	12.18	5.10	4.42	1.76	2.55	2.57	0.92	0.08	2.75
1960	2.71	4.44	4.86	6.56	6.94	7.27	4.65	4.37	0.43	0.00	0.74	0.53
1961	4.24	10.95	3.64	7.05	11.15	10.02	2.94	2.36	0.24	0.48	0.52	0.46
1962	5.98	4.95	7.67	1.61	4.14	5.78	4.79	2.43	0.44	0.00	1.43	2.08
1963		11.23	3.48	1.91	5.39	6.65	4.03	2.82	1.94	1.01	1.64	1.42
1964	3.68	7.10	5.24	16.01	1.47	5.23	1.34	0.85	1.53	0.66	0.54	0.23
1965	1.87	9.80	14.38	9.04	2.72	0.69	2.21	1.14	0.91	1.02	0.87	0.00
1966	1.92	8.73	9.87	9.62	2.67	8.47	0.66	1.28	1.84	1.10	0.46	1.39
1967	3.62	6.98	11.57	10.14	1.83	6.07	2.63	0.64	0.76	0.00	0.00	0.65
1968	6.35	3.28	7.17	7.94	9.00	5.53	1.41	3.01	2.10	0.11	4.01	2.08
1969	5.45	7.48	12.91	9.61	4.33	1.21	2.19	1.72	2.01	0.02	0.00	2.14
1970	4.64	3.26	11.18	14.21	5.81	3.12	2.64	1.26	0.57	0.01	0.00	1.26
1971	4.01	5.89	14.28	8.96	4.74	8.29	3.68	1.22	1.61	0.13	0.36	3.19
1972	3.21	8.35	10.45	8.19	4.90	7.32	4.41	1.39	0.56	0.28	0.25	3.12
1973	0.61	4.78	11.33	5.37	2.18	3.40	1.57	1.40	1.27	0.05	0.76	3.30
1974	3.36	16.59	12.01	11.25	6.75	8.51	2.96	1.46	0.65	1.25	0.00	0.07
1975	1.32	7.50	8.64	8.99	7.00	4.86	1.75	1.94	0.62	0.44	1.60	0.00
1976	6.42	5.16	8.59	6.85	7.20	5.54	2.31	1.30	0.39	0.82	2.41	0.79
1977	1.30	1.32	1.60	1.05	2.98	4.46	0.51	2.50	1.12	0.60	3.07	3.18
1978	2.94	7.21	11.39	7.37	5.92	2.27	3.70	2.67	0.99	0.99	1.65	3.23
1979	0.71	3.85	3.77	3.06	8.00	2.49	2.41	2.07	0.58	0.13	0.94	2.54
1980	6.67	3.93	7.50	8.14	6.25	4.02	3.70	1.21	2.24	0.22	0.06	1.36
1981	1.63	8.35	11.43	2.65	5.17	2.98	2.17	1.96	3.00	0.15	0.05	3.83
1982	5.90	5.89	12.15	5.82	7.75	3.89	4.83	0.44	1.31	0.36	1.24	2.40
1983	4.87	5.36	11.31	7.40	12.20	8.23	2.49	1.40	1.65	2.74	1.38	0.54
1984	1.32	13.07	6.87	2.70	5.95	4.29	3.95	3.36	3.88	0.00	0.00	1.21
1985	4.63	12.83	3.87	0.27	3.18	4.56	1.20	0.36	2.94	0.45	1.45	1.63
1986	3.97	3.95	2.77	8.38	7.35	3.81	1.59	1.99	0.37	0.85	0.00	2.74
1987	3.31	6.52	5.47	8.25	5.18	7.47	1.72	1.85	0.19	0.85	0.15	0.20
1988	0.20	3.66	10.41	8.14	1.16	3.67	2.6	2.23	2.27	0.07	0.17	1.16
1989	0.14	10.98	3.81	4.14	3.51	7.05	0.81	1.62	0.78	0.36	0.93	0.51
1990	2.47	4.02	3.47	10.42	7.14	2.08	1.71	2.98	1.82	0.27	0.93	0.72
1991	4.14	4.15	3.36	3.97	4.46	5.07	6.36	2.19	1.39	0.29	0.39	0.24
1992	1.91	6.26	4.91	6.62	3.97	1.19	4.79	0.07	0.80	0.31	0.51	1.28
1993	2.79	5.44	7.42	5.39	0.78	5.00	6.76	3.79	1.95	1.76	0.08	0.00

–continued on following page –

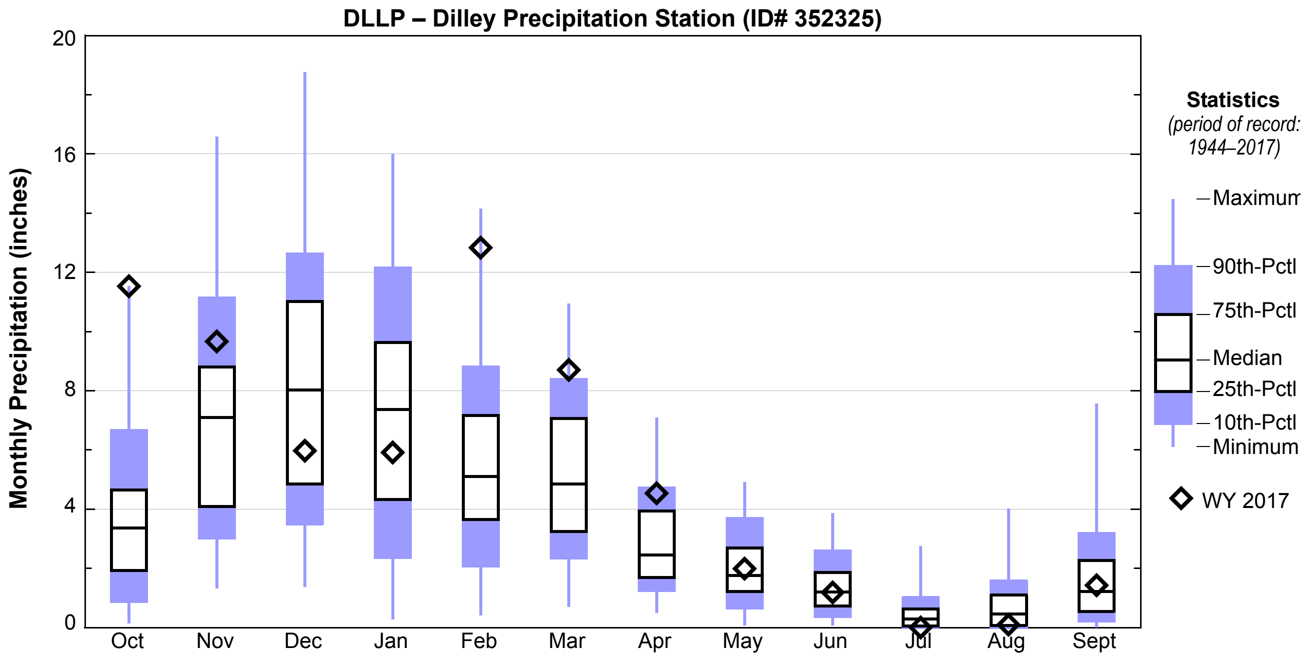
DLLP – DILLEY PRECIPITATION STATION (ID# 352325)

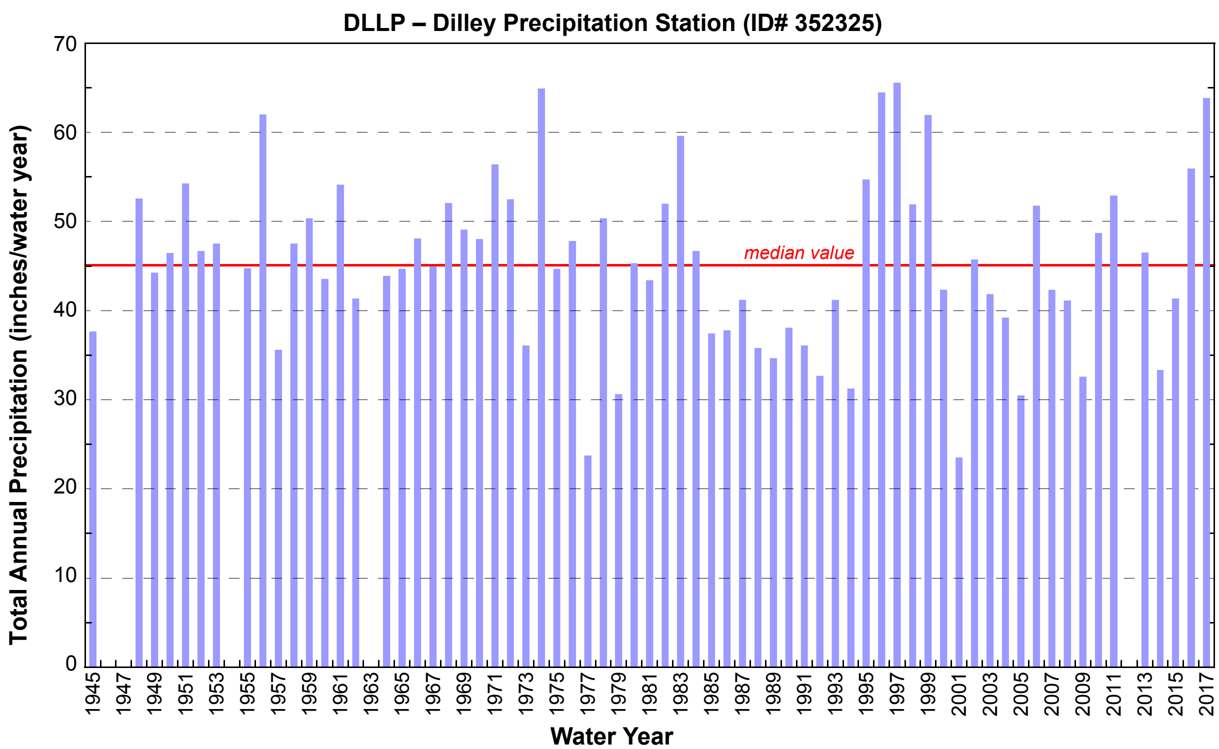
Elevation: 170 ft
Latitude: 45 29   Longitude: 123 07

Source Agency: Western Climatic Data Center
www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?or2325

Water Year*	Total Monthly Precipitation (inches)											
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1994	1.26	1.49	9.12	5.67	6.45	3.14	1.41	0.89	0.95	0.00	0.24	0.58
1995	4.64	8.12	10.29	10.56	5.02	6.53	3.74	1.29	1.76	0.45	0.49	1.74
1996	3.41	9.78	10.09	9.69	12.68	2.46	7.09	4.84	1.12	0.60	0.26	2.43
1997	5.37	8.05	18.46	9.63	2.51	8.29	2.98	2.65	2.38	0.47	1.38	3.33
1998	6.58	8.36	3.54	12.10	7.66	5.20	1.76	4.82	1.05	0.09	0.00	0.73
1999	3.24	13.00	10.81	10.29	14.15	4.85	1.90	1.71	0.76	0.02	1.14	0.04
2000	2.55	10.10	7.10	7.81	5.46	3.25	1.52	2.15	1.21	0.00	0.22	0.89
2001	3.09	2.46	4.20	2.17	1.98	2.25	1.72	1.60	1.84	0.32	1.27	0.54
2002	2.91	10.26	10.66	9.00	3.61	4.04	1.93	1.14	1.32	0.19	0.07	0.57
2003	0.59	3.35	12.22	8.61	3.69	7.41	4.24	0.46	0.07	0.01	0.32	0.79
2004	2.87	4.10	9.01	7.70	5.21	2.32	2.24	1.25	1.21	0.00	1.66	1.56
2005	3.80	2.53	3.89	4.25	0.41	5.97	2.79	4.26	1.84	0.29	0.13	0.24
2006	4.16	7.58	11.79	14.09	3.38	4.21	2.58	2.26	0.92	0.17	0.00	0.63
2007	1.01	15.05	8.03	4.03	4.62	2.48	2.32	1.22	0.83	0.82	0.63	1.21
2008	3.80	4.35	10.41	7.03	2.93	4.66	2.91	2.72	0.97	0.00	0.96	0.32
2009	2.42	6.01	4.85	5.53	2.04	3.43	1.72	3.53	0.23	0.17	1.29	1.32
2010	3.67	8.41	4.48	8.95	4.91	5.26	4.82	3.36	3.03	0.16	0.08	1.50
2011	4.00	7.00	13.55	5.63	4.36	8.93	4.62	2.47	0.84	0.98	0.07	0.42
2012	2.56	8.00				10.95	2.54	2.3	2.48	0.41	0.07	0.04
2013	5.85	8.87	11.15	1.49	2.17	2.38	1.66	3.66	1.17	0.00	0.54	7.57
2014	0.85	2.92	1.37	2.87	7.64	8.69	3.98	1.80	1.05	0.37	0.54	1.23
2015	7.66	3.21	8.18	3.91	7.9	4.87	1.96	0.87	0.59	0.43	0.66	1.09
2016	2.71	6.52	18.77	10.09	4.22	7.54	3.22	0.71	0.69	0.35	0.27	0.82
2017	11.53	9.66	5.97	5.91	12.83	8.70	4.53	1.99	1.18	0.00	0.09	1.42
MIN	0.14	1.32	1.37	0.27	0.41	0.69	0.51	0.07	0.07	0.00	0.00	0.00
MAX	11.53	16.59	18.77	16.01	14.15	10.95	7.09	4.92	3.88	2.74	4.01	7.57
MEDIAN	3.36	7.10	8.03	7.37	5.10	4.86	2.45	1.76	1.20	0.29	0.47	1.23
MEAN	3.65	6.99	8.17	7.33	5.55	5.11	2.76	1.99	1.36	0.43	0.66	1.47

*Water Year (WY) begins October 1st of the previous calendar year and ends September 30th of current year.

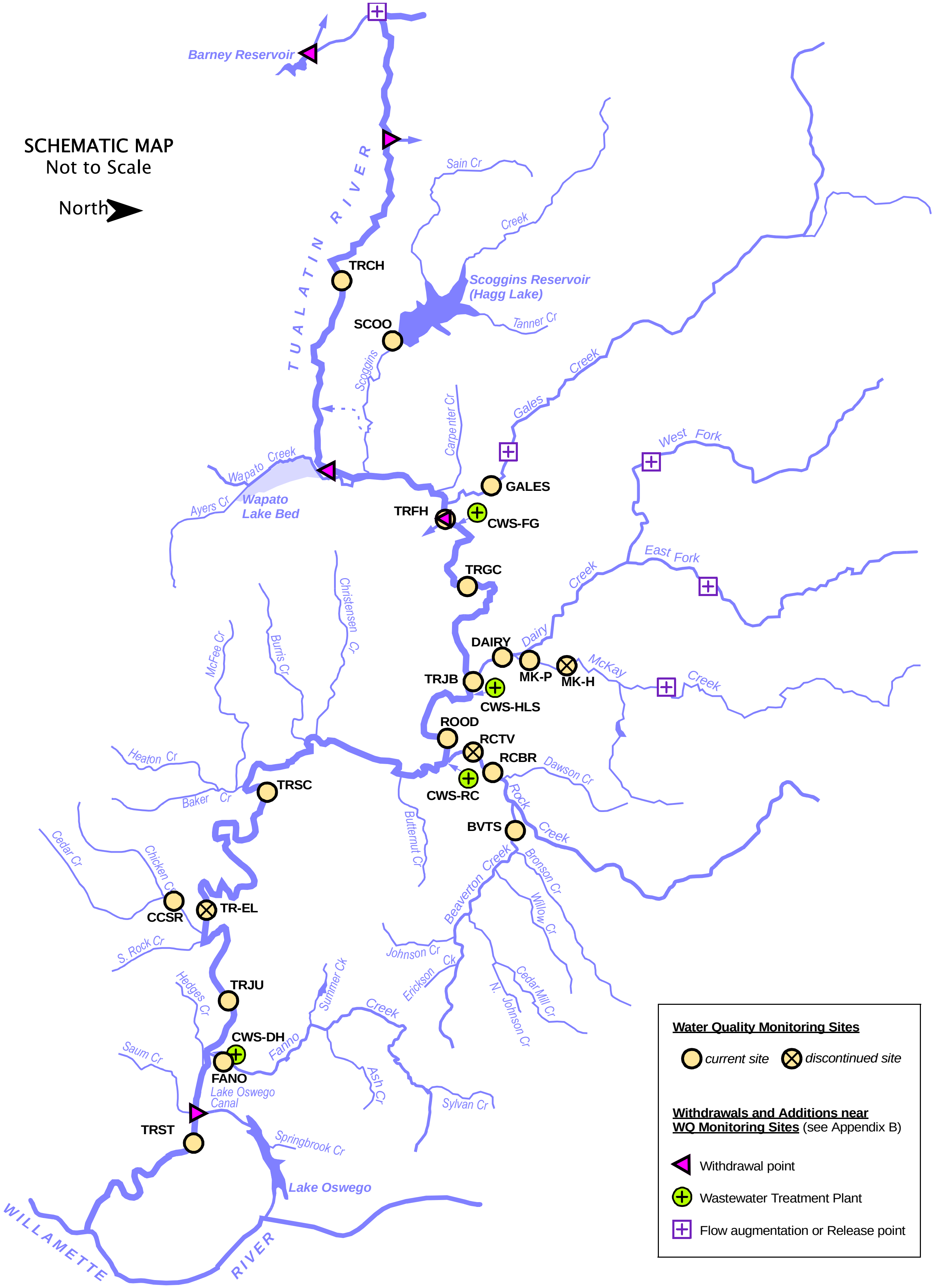

DLLP – Dilley Precipitation Station (ID# 352325)
Monthly Precipitation (inches)
0
4
8
12
16
20
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sept
Statistics
(period of record: 1944–2017)
Maximum
90th-Pctl
75th-Pctl
Median
25th-Pctl
10th-Pctl
Minimum
WY 2017


DLLP – Dilley Precipitation Station (ID# 352325)
Total Annual Precipitation (inches/water year)
0
10
20
30
40
50
60
70
median value
Water Year
1945
1947
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017

Appendix H

Water Quality Data: Total Phosphorus

MAP OF TOTAL PHOSPHORUS MONITORING SITES



TOTAL PHOSPHORUS WATER QUALITY SITES — ALPHABETICAL LISTING BY SITE CODE

SITE CODE	SITE NAME	RIVER MILE	PAGE
BVTS	Beaverton Creek near Orenco / at Guston Ct	1.2 / 1.2	H-31
CCSR	Chicken Creek at Scholls-Sherwood Rd (Roy Rogers Rd)	2.3	H-33
DAIRY	Dairy Creek at Hwy 8	2.06	H-25
FANO	Fanno Creek at Durham Rd	1.2	H-35
GALES	Gales Creek at New Hwy 47	2.36	H-23
MK-H & MK-P	McKay Creek at Hornecker Rd / Padgett Rd	2.2 / 1.3	H-27
RCTV & RCBR	Rock Creek at Hwy 8 / Brookwood	1.2 / 2.4	H-29
SCOO	Scoggins Creek below Lake below Hagg Lake	4.8	H-5
TRJB	Tualatin River at Hwy 219	44.4	H-13
TRSC	Tualatin River at Hwy 210 (Scholls Bridge)	26.9	H-17
TRCH	Tualatin River at Cherry Grove (South Rd Bridge)	67.83	H-7
TRGC	Tualatin River at Golf Course Rd	51.5	H-11
TRFH	Tualatin River at Spring Hill Pump Plant / Fern Hill Rd	55.3	H-9
TREL & TRJU	Tualatin River at Elsner Rd / Jurgens Park	16.2 / 10.8	H-19
ROOD	Tualatin River at Rood Bridge Rd	38.4	H-15
TRST	Tualatin River at Stafford	5.38	H-21

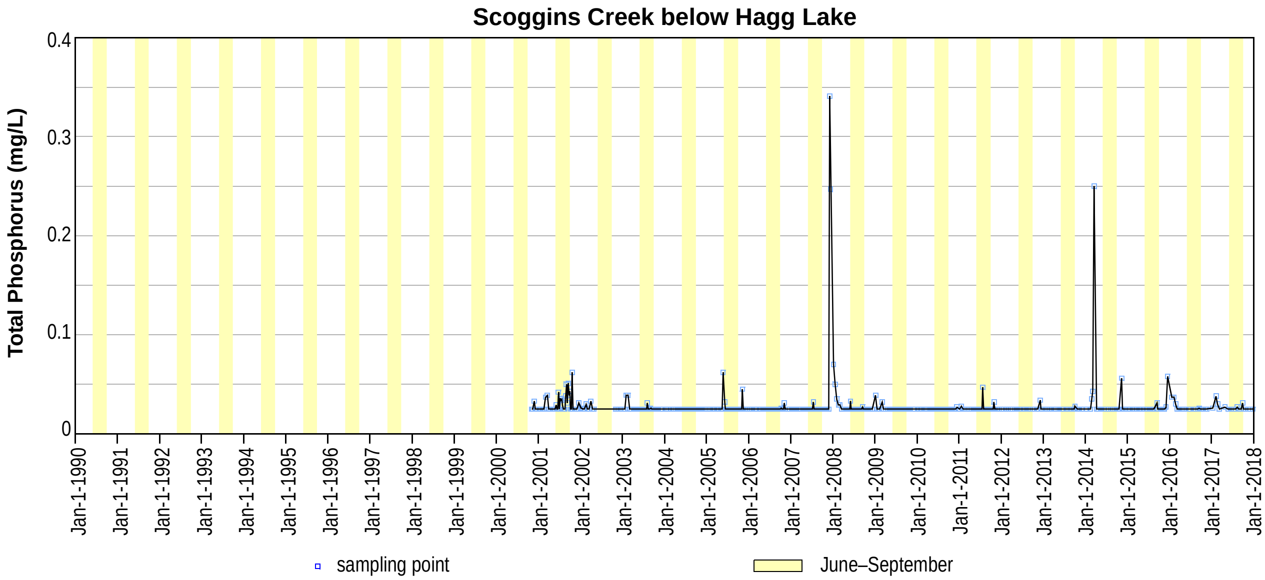
Data for this section were obtained from Clean Water Services. For some sites, the exact sampling location changed over the period of record. Analytical methods also may have changed. It is not known if these data are fully comparable with one another.

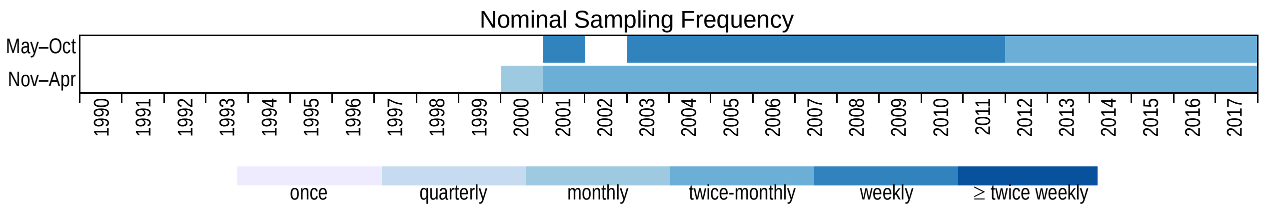
Discussion

- *All sites*—Short-lived spikes in total phosphorus (totP) were relatively common, although the timing of spikes varied among sites. Most totP spikes in the Tualatin River occurred November–March, whereas in the tributaries, many occurred near the end of summer through early fall. In Fanno Creek, spikes in totP occurred frequently throughout the year. Spikes in totP generally occurred during or shortly after a storm. Storms cause high flows that can resuspend bed sediment and include runoff that increases the transport of material from landscape to stream. Sediment and particulate from runoff are associated with phosphorus.
- *All Tualatin River sites except Cherry Grove*— Winter concentrations of totP were higher than summer. Baseline summer concentrations at Golf Course Rd and Fern Hill were at or near the detection limit of 0.025 mg/L. Downstream of Golf Course Rd, baseline summer concentrations were higher, but still relatively low (0.06–0.08 mg/L). They did not vary much with downstream location. Flow augmentation water from Hagg Lake and low-phosphorous effluent from the WWTFs probably account for the low and near-constant concentrations in the lower Tualatin River.
- *All tributary sites*—Total phosphorus concentrations have a distinct seasonal baseline pattern that is superimposed with higher-concentrations spikes. The baseline pattern generally is lowest around mid-winter to early-spring, increases steadily through the summer, reaches a maximum near September, and then begins to decrease through late fall and into winter. This pattern is consistent with soluble reactive phosphorus (SRP) entering the creek from groundwater. Concentrations of SRP in groundwater are relatively constant and range from 0.1–0.3 mg/L in shallow groundwater and as high as 1–3 mg/L in deeper regional groundwater. Rainfall contains almost no phosphorus. As rainfall decreases in early summer, groundwater accounts for an increasing fraction of the water in the tributary and the totP concentration increases. The concentration reaches a maximum in late summer when almost all of the water in the stream is from groundwater. Once the rainy season begins, groundwater becomes diluted with rain water and totP decreases. The lowest totP occurs when groundwater makes up the smallest fraction of the streamflow.
- The inconsistent sampling frequency complicates any analysis of trends because only the coarsest sampling frequency in the period of record can be used in the analysis. In the case of a constituent like totP that has short-lived concentration spikes, frequent and consistent sampling is needed to characterize any change related to the incidence or magnitude of spikes over time.

Discussion

- The period of record is November 2000 through present. No data were collected in the summer of 2002. Sampling frequency varied, but mostly was about every two weeks.
- Total phosphorus (totP) concentrations in Scoggins Creek were generally very low, with most values at or below the detection limit (0.025 mg/L).
- Spikes in totP concentration generally occurred from November through March and were probably due to an increase in the particulate form of phosphorus that occurred during or shortly after a storm. During heavy rains, landslides have occurred in the Scoggins Creek drainage that transport extra sediment to Hagg Lake and then to Scoggins Creek.
- The highest concentrations coincided with a large storm in early December 2007. Elevated concentrations persisted for weeks afterward due to storm-derived suspended sediment in Hagg Lake.
- Because the high flows that trigger the concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency, especially November–April and from 2012 to present.
- Other than spikes that occurred during high flow, phosphorus concentrations in Scoggins Creek do not appear to have any seasonal pattern.





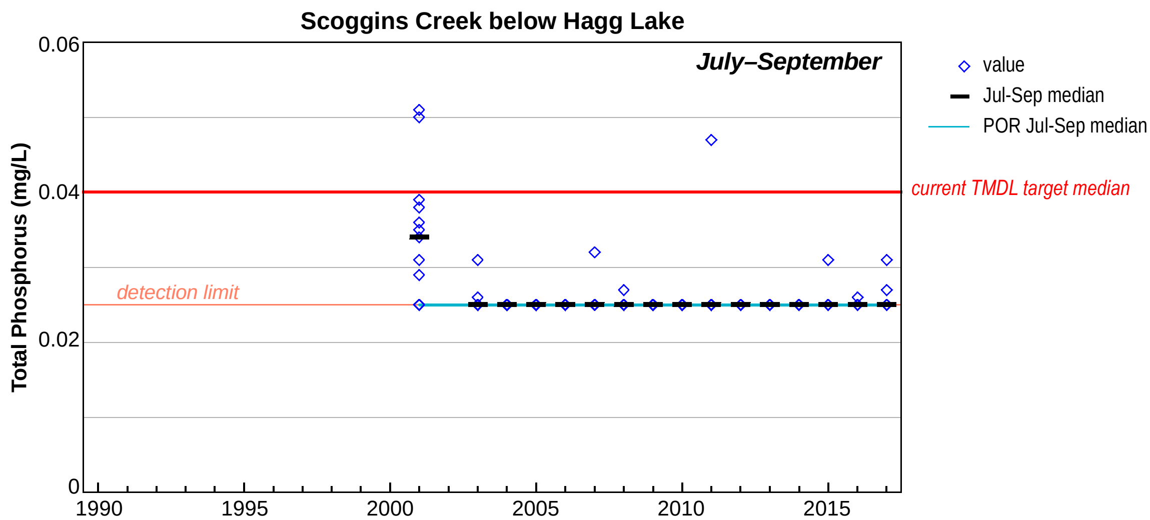
SCOGGINS CREEK BELOW HAGG LAKE
Total Phosphorus

Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

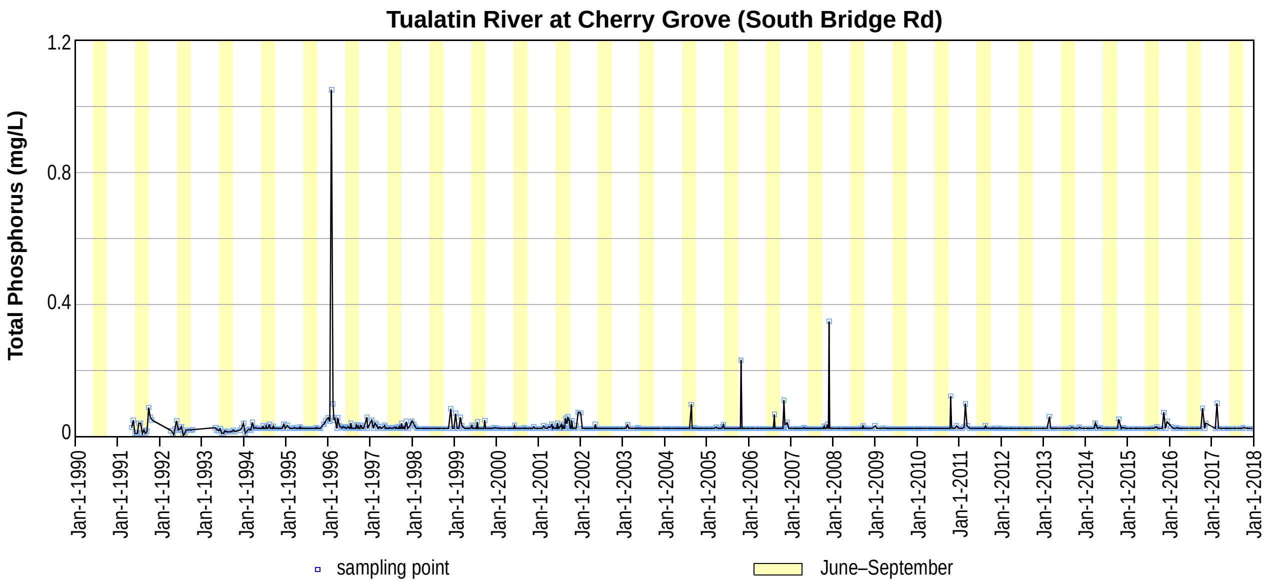
	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	5											<0.025	<0.025
2001	39	<0.025	<0.025	0.038	<0.025	<0.025	0.027	0.034	<0.025	0.045	<0.025	<0.025	0.028
2002	13	0.026	0.028	<0.025	<0.025							<0.025	<0.025
2003	38	<0.025	0.039	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2004	38	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2005	39	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2006	39	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2007	40	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.294
2008	38	0.060	0.032	0.027	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2009	37	0.032	<0.025	0.029	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2010	37	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.026
2011	39	0.027	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2012	24	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.030
2013	23	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.027	<0.025	<0.025
2014	24	<0.025	0.030	0.147	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.041	<0.025
2015	23	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.028	<0.025	<0.025	0.043
2016	20	0.037	0.034	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	
2017	20	0.026	0.034	<0.025	0.027	<0.025	<0.025	<0.025	0.026	0.028	<0.025	<0.025	<0.025
POR Median		<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025

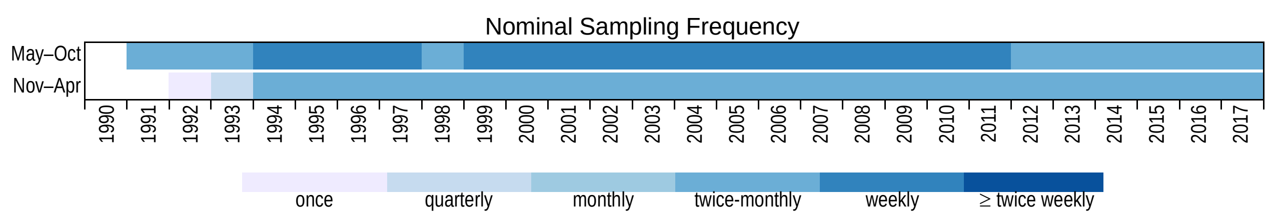
Key
total P in mg/L
$TP \leq 0.025$
$0.025 < TP \leq 0.030$
$0.03 < TP \leq 0.05$
$0.05 < TP \leq 0.08$
$TP > 0.08$



Discussion

- The period of record is May 1991 through present. Sampling frequency varied, but mostly was about every two weeks.
- Total phosphorus (totP) concentrations at Cherry Grove were generally very low, with most values at or below the detection limit (0.025 mg/L).
- Spikes in totP concentration generally occurred from November through March and were probably due to an increase in the particulate form of phosphorus that occurred during or shortly after a storm.
- The highest concentration was measured on February 6, 1996 and coincided with large storms that caused major flooding downstream. The second highest concentration coincided with the large storm in early December 2007.
- Because the high flows that trigger the concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency, especially during May–October since 2012 and November–April for the entire period of record.
- Other than spikes that occurred during high flow, phosphorus concentrations in the Tualatin River at Cherry Grove do not appear to have any seasonal pattern.





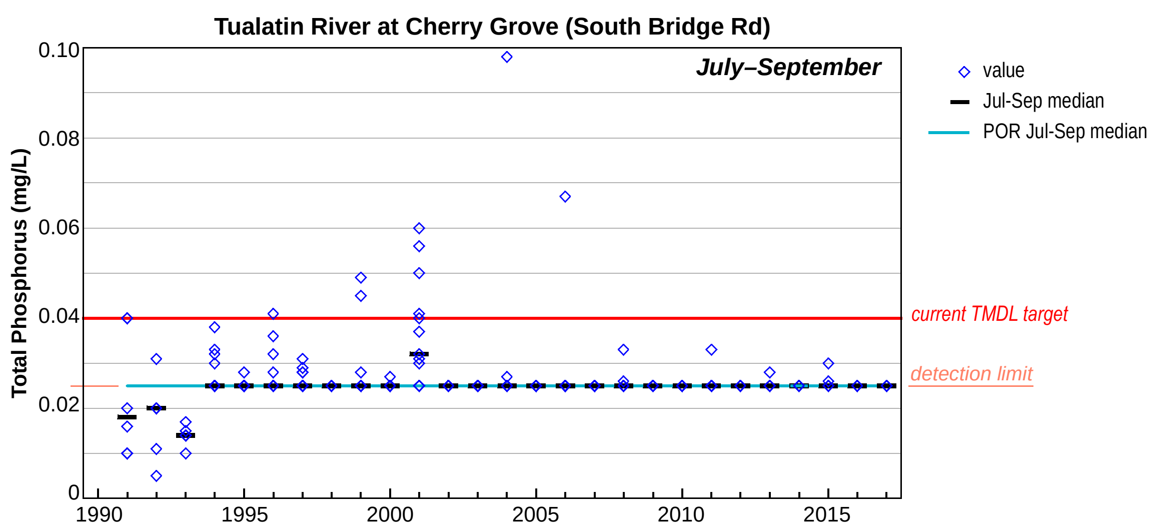
TUALATIN RIVER AT CHERRY GROVE (South Bridge Rd)
Total Phosphorus

Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	14					0.039	0.010	0.040	0.015	0.013	0.059		
1992	14				0.018	0.015	0.022	0.018	0.016	0.020	0.021		
1993	15					0.024	0.018	0.014	0.014	0.015	0.018		0.024
1994	37	<0.025	0.022	0.032	0.026	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.031
1995	38	0.030	<0.025	0.026	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.038	0.043
1996	37	0.052	0.099	0.042	0.045	0.028	0.027	<0.025	<0.025	0.030	<0.025	<0.025	0.042
1997	37	0.046	0.033	0.030	<0.025	0.029	<0.025	<0.025	0.027	<0.025	0.027	0.036	0.029
1998	24	0.043	0.027	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.055
1999	37	0.048	<0.025	0.046	<0.025	<0.025	<0.025	0.027	<0.025	<0.025	<0.025	<0.025	0.026
2000	38	0.026	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.028	<0.025
2001	40	<0.025	0.029	<0.025	0.029	<0.025	0.026	0.030	0.029	0.046	<0.025	<0.025	0.053
2002	39	0.049	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2003	38	<0.025	0.031	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2004	37	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2005	40	<0.025	<0.025	0.027	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2006	38	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.074	0.034
2007	38	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.187
2008	37	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2009	39	0.029	<0.025	0.026	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2010	38	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.033
2011	40	<0.025	0.027	0.066	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.026
2012	24	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
2013	23	<0.025	0.043	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.027	<0.025	0.027	<0.025
2014	24	<0.025	<0.025	<0.025	0.033	0.027	<0.025	<0.025	<0.025	<0.025	0.039	0.027	0.026
2015	23	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.026	0.028	<0.025	0.049	0.036
2016	20	0.031	<0.025	0.026	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.056	0.033	
2017	18		0.063	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.027	<0.025	<0.025
POR Median		<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.026

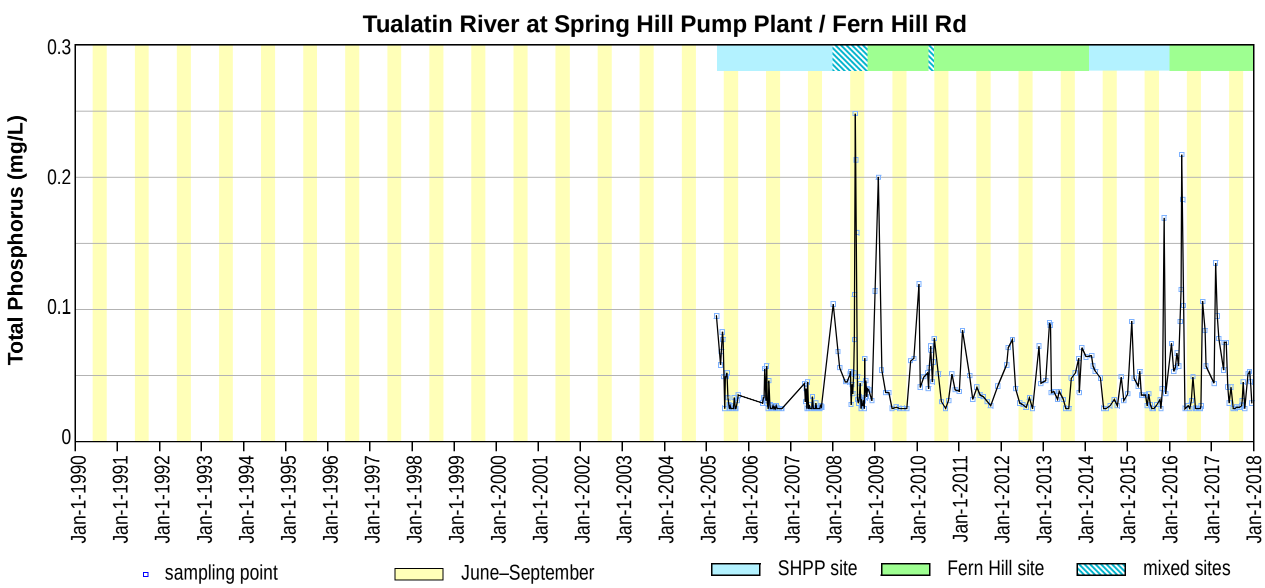
Key
total P in mg/L
$TP \le 0.025$
$0.025 < TP \le 0.030$
$0.03 < TP \le 0.05$
$0.05 < TP \le 0.10$
$TP > 0.10$

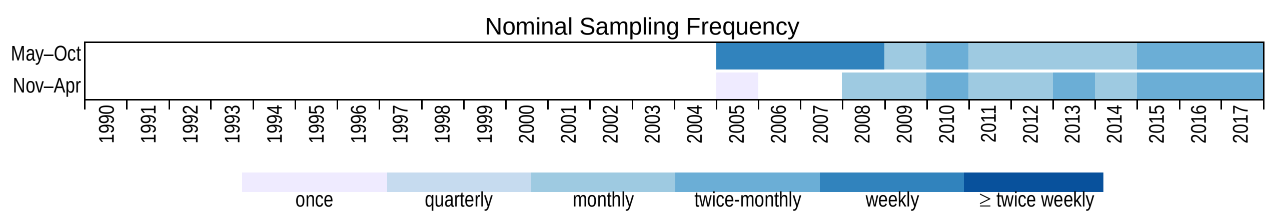


Data source: Clean Water Services

Discussion

- The period of record is March 2005 through present. Sampling frequency was variable and except for May–October 2005–2008, no more than twice a month and often less.
- The sampling location switched between two sites, sometimes as often as every other sample. These two sites are close to each other, so the site changes may not be important.
- Total phosphorus (totP) concentrations in the Tualatin River at Fern Hill Rd were generally low, and values values at or below the detection limit (0.025 mg/L) were not uncommon.
- In general, totP concentrations were higher in the high flow season (November through May). The highest totP spike, however, occurred in July 2008, associated with unusual discharges from Wapato Lake.
- Spikes in totP concentration typically are due to an increase in the particulate form of phosphorus that occurs during or shortly after a storm.
- Because the high flows that trigger concentration spikes are shorter-lived than the usual sampling frequency for this site, the graph below likely under-represents spike frequency, especially in 2009–2014.





TUALATIN RIVER AT SPRING HILL PUMP PLANT / FERN HILL RD
Total Phosphorus

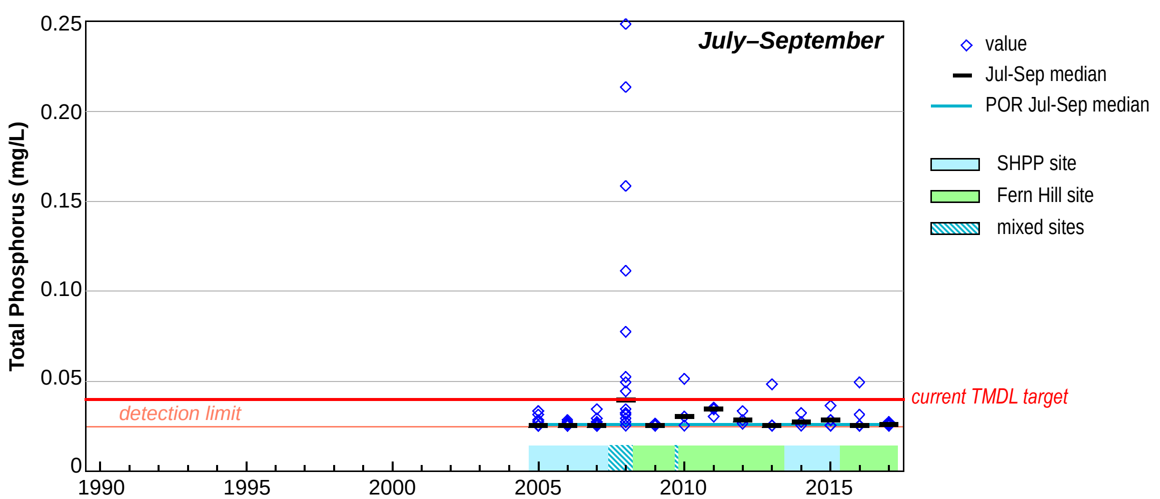
Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	23			0.095		0.073	0.049	0.028	<0.025	<0.025	0.035		
2006	24					0.033	0.031	<0.025	0.026	<0.025	<0.025		
2007	22					0.040	<0.025	<0.025	<0.025	0.026			
2008	34	0.104	0.068	0.056	0.045	0.045	0.043	0.135	0.034	0.027	0.037	0.039	0.031
2009	12	0.114	0.200	0.054	0.037	0.037	<0.025	0.026	<0.025	<0.025	<0.025	0.061	0.063
2010	17	0.119	0.041	0.049	0.052	0.065	0.078	0.051	0.030	<0.025	0.031	0.045	
2011	10	0.038	0.084		0.050	0.032	0.041	0.035	0.034	0.030	0.027		0.042
2012	11		0.058	0.071	0.077	0.040	0.029	0.028	0.026	0.033	<0.025	0.072	0.044
2013	15	0.046	0.090	0.063	0.038	0.035	0.032	<0.025	<0.025	0.048	0.052	0.050	0.071
2014	12	0.064	0.065	0.057	0.053	0.048	<0.025	<0.025	0.027	0.032	0.027	0.049	0.031
2015	19	0.036	0.091	0.048	0.048	0.035	0.031	0.032	<0.025	0.028	0.029	0.105	0.036
2016	23	0.074	0.055	0.062	0.149	0.064	0.026	0.040	<0.025	<0.025	0.067	0.071	
2017	23	0.044	0.115	0.078	0.065	0.058	0.035	<0.025	0.026	0.029	0.035	0.052	0.037
POR Median		0.064	0.076	0.060	0.051	0.040	0.031	0.028	0.026	0.027	0.030	0.052	0.040

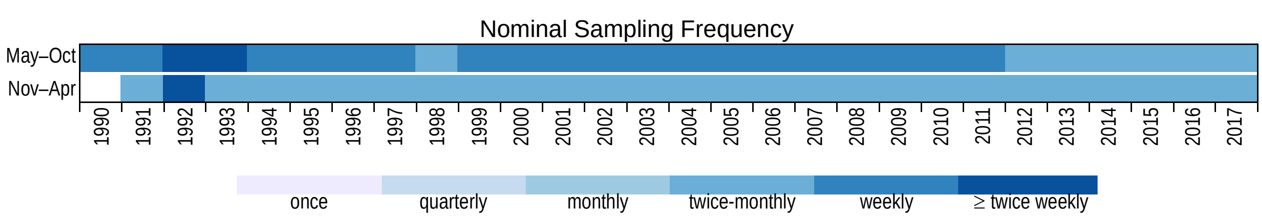
Key
total P in mg/L
TP ≤ 0.03
0.03 < *TP* ≤ 0.04
0.04 < *TP* ≤ 0.06
0.06 < *TP* ≤ 0.10
TP > 0.10

Tualatin River at Spring Hill Pump Plant / Fern Hill Rd



Discussion

- The period of record is May 1990 through present. Sampling frequency was quite varied, with dense sampling for a couple of years and less frequent sampling at other times.
- In general, totP concentrations were higher in the high flow season (November through May). The third highest totP spike in the period of record occurred in July 2008, associated with unusual discharges from Wapato Lake.
- The highest concentration coincided with a very large storm in early December 2007.
- Spikes in totP concentration typically are due to an increase in the particulate form of phosphorus that occurs during or shortly after a storm.
- Because the high flows that trigger the concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency especially during May–October since 2012 and November–April since 1993.
- Concentrations of totP in July–September appear to have decreased. Samples from the early to mid-1990s were generally greater than those from 2000 and later. The decrease is statistically significant and occurred when the sampling frequency was mostly constant (weekly). Since the late 2000s, the totP concentration has not changed.



TUALATIN RIVER AT GOLF COURSE RD
Total Phosphorus

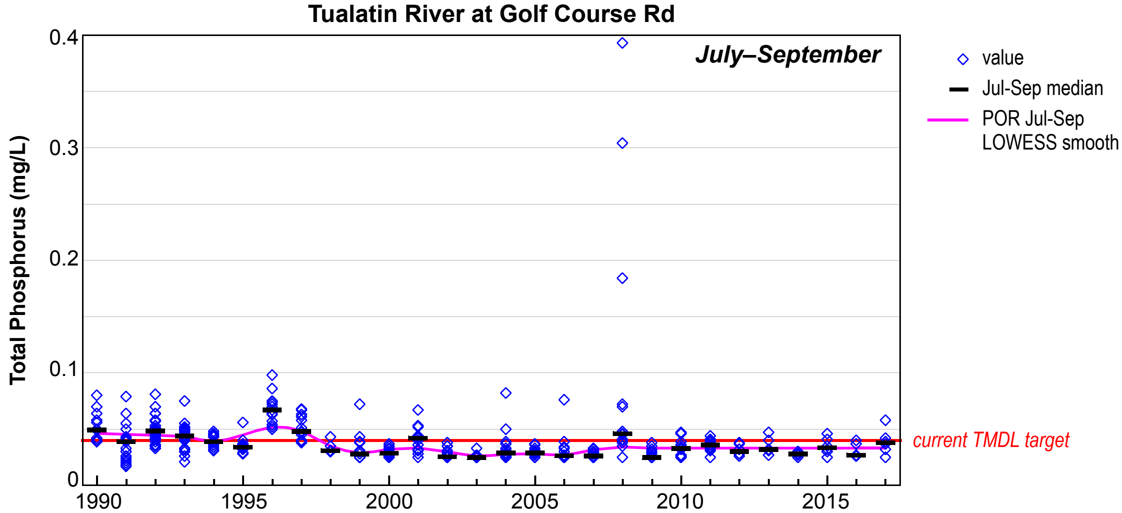
Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	25					0.047	0.064	0.064	0.042	0.054	0.053		
1991	45		0.124			0.084	0.037	0.033	0.036	0.039	0.039	0.141	0.050
1992	88	0.091	0.080	0.082	0.090	0.040	0.043	0.050	0.044	0.051	0.038	0.059	0.103
1993	68	0.068	0.063	0.088	0.067	0.083	0.058	0.050	0.033	0.044	0.038	0.047	0.081
1994	39	0.118	0.074	0.098	0.075	0.052	0.043	0.041	0.034	0.045	0.044	0.068	0.094
1995	40	0.072	0.078	0.065	0.057	0.051	0.051	0.035	0.036	0.034	0.039	0.099	0.084
1996	38	0.141	0.236	0.127	0.116	0.105	0.121	0.081	0.064	0.057	0.057	0.055	0.092
1997	38	0.093	0.101	0.078	0.059	0.052	0.066	0.047	0.055	0.048	0.061	0.065	0.079
1998	24	0.129	0.061	0.053	0.057	0.061	0.052	0.037	0.033	0.031	0.031	0.040	0.074
1999	38	0.115	0.065	0.107	0.046	0.041	0.040	0.028	<0.025	0.029	0.029	0.040	0.053
2000	39	0.049	0.049	0.052	0.046	0.040	0.038	0.031	0.026	0.029	0.027	0.046	0.047
2001	40	0.042	0.065	0.041	0.060	0.059	0.039	0.032	0.040	0.048	0.032	0.042	0.139
2002	39	0.173	0.056	0.067	0.048	0.029	0.027	<0.025	0.028	<0.025	0.027	0.027	0.076
2003	38	0.058	0.158	0.059	0.063	0.044	0.029	<0.025	<0.025	<0.025	0.034	0.037	0.062
2004	39	0.065	0.078	0.060	0.043	0.035	<0.025	0.029	0.027	0.035	0.033	0.037	0.050
2005	39	0.059	0.026	0.140	0.062	0.074	0.037	0.031	0.029	0.027	0.029	0.068	0.082
2006	38	0.070	0.073	0.115	0.065	0.038	0.031	0.033	<0.025	0.026	0.027	0.163	0.058
2007	41	0.062	0.066	0.067	0.060	0.036	<0.025	0.028	<0.025	0.027	0.029	0.062	0.645
2008	37	0.085	0.071	0.072	0.057	0.066	0.037	0.244	0.047	0.038	0.037	0.041	0.071
2009	39	0.078	0.154	0.132	0.043	0.043	0.031	0.034	<0.025	<0.025	0.026	0.038	0.075
2010	38	0.103	0.059	0.057	0.062	0.062	0.113	0.033	0.027	0.038	0.029	0.049	0.197
2011	40	0.073	0.135	0.105	0.058	0.064	0.071	0.040	0.034	0.034	0.028	0.033	0.044
2012	24	0.079	0.057	0.067	0.069	0.047	0.031	0.029	0.028	0.038	0.028	0.051	0.084
2013	22	0.067	0.079	0.102	0.041	0.047	0.028	0.027	0.040	0.036	0.035	0.047	0.090
2014	24	0.075	0.060	0.080	0.102	0.039	<0.025	0.026	0.029	0.029	0.045	0.038	0.080
2015	24	0.064	0.081	0.100	0.570	0.035	0.036	0.044	0.028	0.034	0.030	0.084	0.094
2016	21	0.076	0.064	0.066	0.159	0.088	0.029	0.040	0.032	0.027	0.068	0.070	
2017	20		0.132	0.074	0.070	0.070	0.037	0.045	0.038	0.034	0.032	0.056	0.044
POR Median		0.075	0.073	0.076	0.061	0.049	0.037	0.033	0.032	0.034	0.032	0.049	0.079

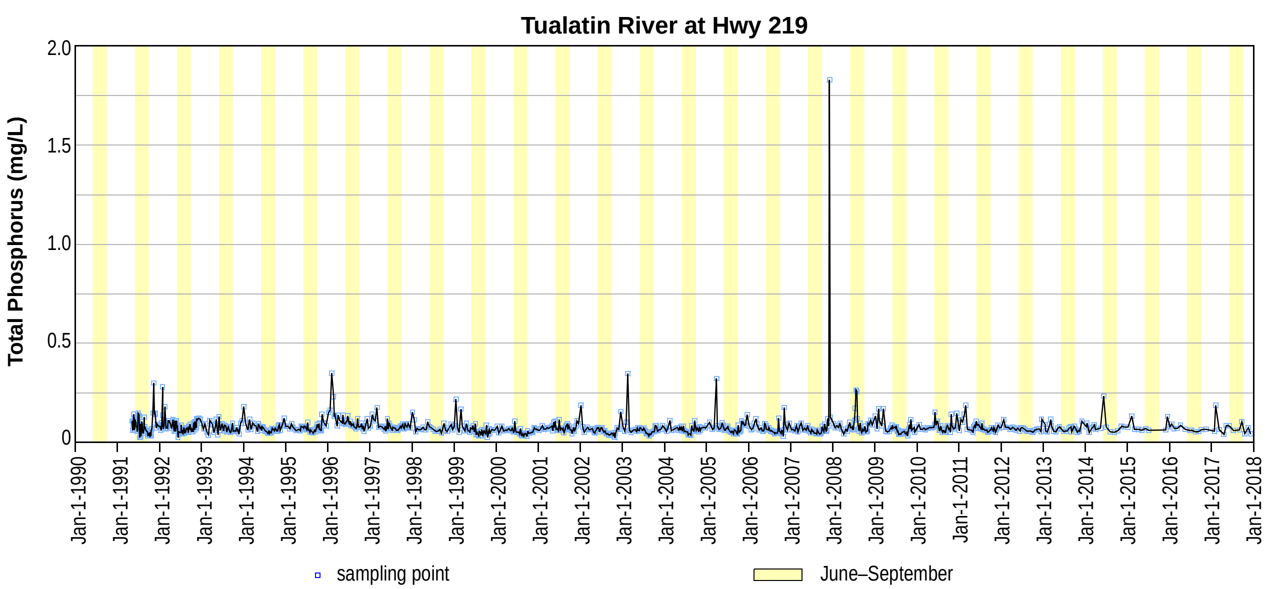
Key
total P in mg/L
TP ≤ 0.03
0.03 < *TP* ≤ 0.04
0.04 < *TP* ≤ 0.07
0.07 < *TP* ≤ 0.1
TP > 0.1

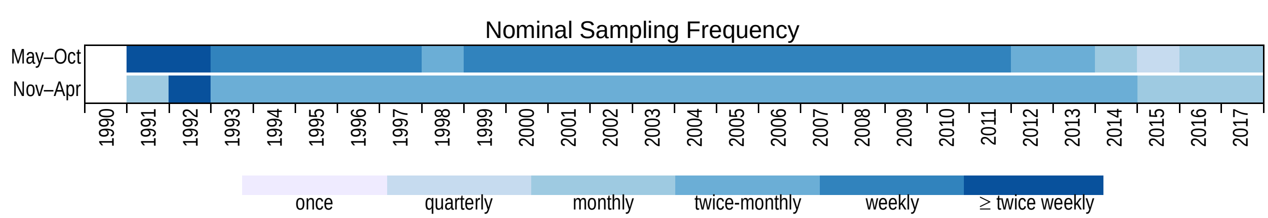
Tualatin River at Golf Course Rd



Discussion

- The period of record is May 1991 through present. Sampling frequency was quite variable—from every few days in 1991–1992 to only once a month or less in recent years.
- In general, totP concentrations were higher in the high flow season (November through May). One of the highest totP spikes in the period of record, however, occurred in July 2008 associated with unusual discharges from Wapato Lake, indicating that totP spikes can occur any time of the year.
- The highest concentration coincided with a very large storm in early December 2007.
- Spikes in totP concentration typically are due to an increase in the particulate form of phosphorus that occurs during or shortly after a storm.
- Many more moderately sized totP spikes were captured during the periods with more dense sampling frequency than in recent years when samples were only collected monthly. Relatively few large totP spikes were observed with a monthly sampling frequency.
- Because the high flows that trigger the concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency during most of the November–April period and all times of the year since 2015.
- Concentrations of totP in July–September do not show a trend.

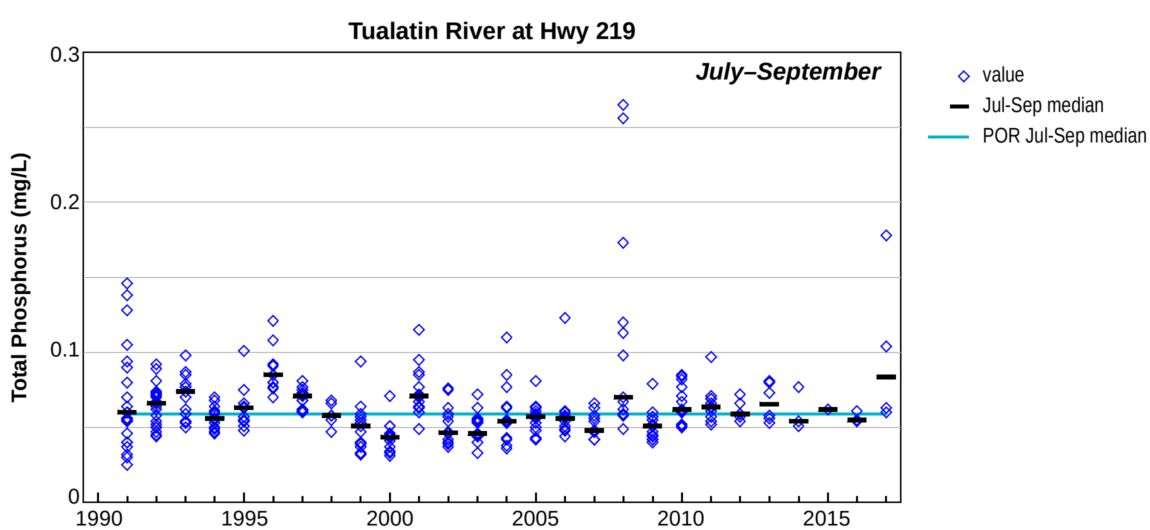




MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	52					0.108	0.082	0.058	0.070	0.047	0.045	0.147	0.086
1992	89	0.081	0.081	0.094	0.090	0.085	0.054	0.056	0.066	0.069	0.066	0.092	0.121
1993	40	0.082	0.073	0.074	0.070	0.077	0.091	0.081	0.070	0.064	0.058	0.063	0.104
1994	39	0.139	0.090	0.082	0.085	0.079	0.074	0.056	0.049	0.066	0.066	0.077	0.106
1995	40	0.082	0.082	0.073	0.063	0.078	0.078	0.064	0.056	0.061	0.080	0.100	0.089
1996	38	0.158	0.231	0.111	0.126	0.098	0.108	0.092	0.083	0.077	0.081	0.070	0.096
1997	38	0.112	0.114	0.082	0.079	0.070	0.091	0.072	0.066	0.072	0.081	0.084	0.084
1998	24	0.134	0.062	0.065	0.070	0.084	0.078	0.062	0.057	0.058	0.079	0.064	0.078
1999	38	0.151	0.064	0.125	0.078	0.059	0.068	0.048	0.053	0.049	0.043	0.064	0.062
2000	39	0.065	0.073	0.061	0.066	0.063	0.059	0.051	0.036	0.043	0.048	0.052	0.069
2001	40	0.066	0.076	0.073	0.077	0.089	0.067	0.071	0.067	0.086	0.061	0.077	0.102
2002	39	0.133	0.060	0.070	0.066	0.062	0.069	0.063	0.046	0.040	0.040	0.060	0.112
2003	38	0.069	0.224	0.056	0.064	0.060	0.066	0.060	0.044	0.053	0.078	0.061	0.075
2004	39	0.063	0.095	0.062	0.074	0.070	0.059	0.053	0.043	0.071	0.065	0.073	0.075
2005	39	0.093	0.067	0.199	0.075	0.079	0.066	0.062	0.056	0.053	0.060	0.095	0.114
2006	39	0.073	0.085	0.107	0.069	0.064	0.067	0.058	0.049	0.057	0.053	0.133	0.081
2007	41	0.065	0.073	0.067	0.072	0.071	0.058	0.056	0.051	0.048	0.077	0.072	0.980
2008	37	0.085	0.080	0.082	0.055	0.073	0.074	0.215	0.084	0.059	0.057	0.095	0.089
2009	39	0.101	0.141	0.127	0.056	0.067	0.076	0.059	0.047	0.050	0.061	0.069	0.065
2010	37	0.091	0.067	0.069	0.074	0.075	0.107	0.072	0.060	0.074	0.070	0.078	0.147
2011	38	0.088	0.123	0.127	0.062	0.079	0.088	0.070	0.064	0.056	0.065	0.063	0.080
2012	25	0.096	0.077	0.072	0.074	0.067	0.073	0.069	0.058	0.057	0.057	0.068	0.085
2013	23	0.075	0.073	0.101	0.056	0.076	0.061	0.057	0.077	0.067	0.062	0.059	0.107
2014	15	0.089	0.061	0.085	0.065	0.072	0.234	0.077	0.054	0.051	0.059	0.082	0.078
2015	9	0.077	0.134	0.066	0.067	0.061	0.071	0.062					0.097
2016	12	0.086	0.070	0.071	0.088	0.066	0.060	0.061	0.054	0.055	0.065	0.067	
2017	12	0.056	0.187	0.065	0.040	0.086	0.083	0.060	0.063	0.104	0.045	0.076	0.044
POR Median		0.086	0.079	0.074	0.070	0.073	0.073	0.062	0.056	0.057	0.061	0.073	0.088

Key
total P in mg/L
TP ≤ 0.055
0.055 < *TP* ≤ 0.065
0.065 < *TP* ≤ 0.09
0.09 < *TP* ≤ 0.11
TP > 0.11



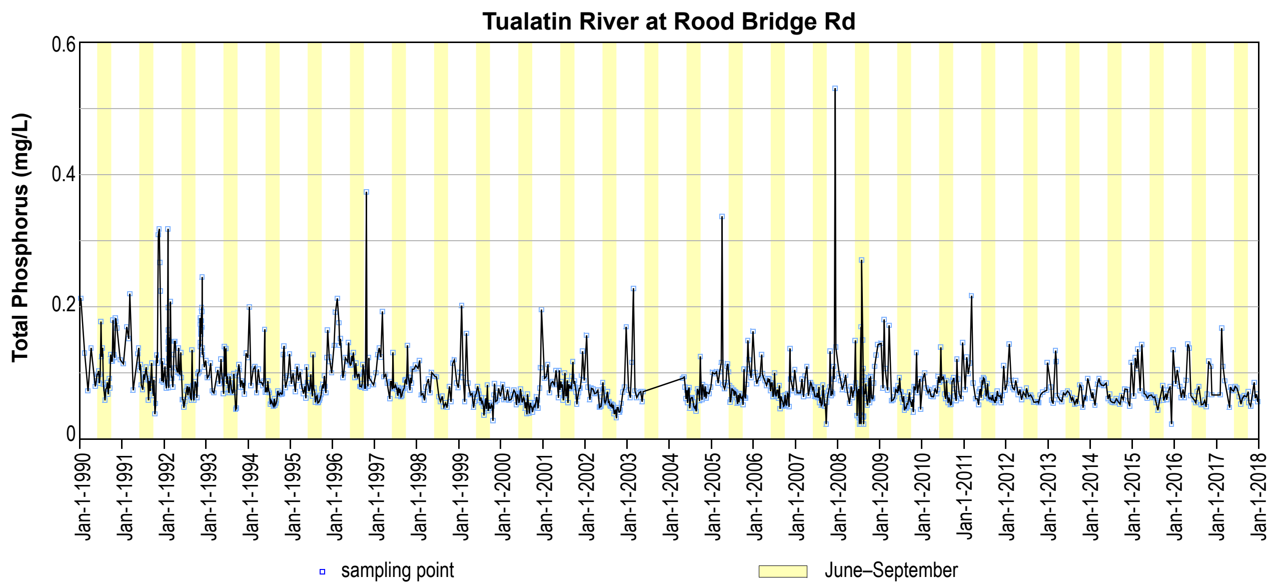
TUALATIN RIVER AT ROOD BRIDGE RD

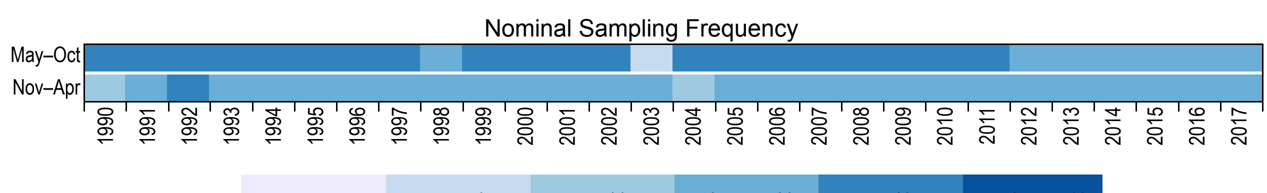
Total Phosphorus

Data source: Clean Water Services

Discussion

- The period of record is January 1990 through present, except for June-2003 through March-2004 when sampling was suspended due to bridge construction. Sampling frequency was quite variable.
- In general, totP concentrations were higher in the high flow season (November through May). One of the highest totP spikes in the period of record, however, occurred in July 2008 associated with unusual discharges from Wapato Lake, indicating that totP spikes can occur any time of the year.
- The highest concentration coincided with a very large storm in early December 2007.
- Spikes in totP concentration typically are due to an increase in the particulate form of phosphorus that occurs during or shortly after a storm.
- Relatively few large totP spikes occurred since 2012 when the sampling density decreased. Because the high flows that trigger the concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency since 2012 and during winter months for the entire period of record.
- The highest median concentrations of totP in July–September occurred in the earlier part of the period of record (2001 and earlier), but determining a trend is compromised by the high variability in the data and the inconsistent sampling frequency.





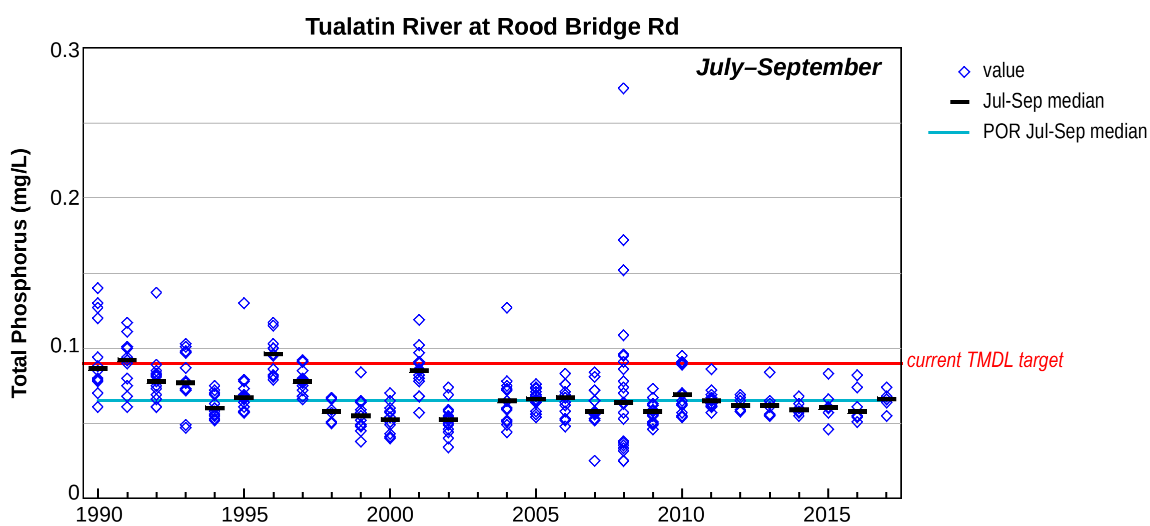
TUALATIN RIVER AT ROOD BRIDGE RD
Total Phosphorus

Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	32	0.215	0.132	0.075	0.140	0.095	0.103	0.106	0.079	0.107	0.130	0.175	0.122
1991	35	0.116	0.163	0.222	0.076	0.131	0.084	0.100	0.083	0.086	0.087	0.290	0.090
1992	63	0.112	0.131	0.112	0.125	0.102	0.061	0.078	0.078	0.079	0.102	0.171	0.116
1993	39	0.097	0.096	0.072	0.097	0.094	0.097	0.082	0.073	0.074	0.098	0.084	0.129
1994	39	0.143	0.110	0.090	0.088	0.087	0.075	0.057	0.056	0.071	0.072	0.088	0.115
1995	40	0.094	0.093	0.098	0.077	0.082	0.081	0.073	0.062	0.067	0.082	0.126	0.111
1996	37	0.169	0.178	0.125	0.113	0.119	0.124	0.098	0.091	0.086	0.093	0.110	0.084
1997	38	0.116	0.133	0.100	0.087	0.084	0.082	0.075	0.072	0.085	0.093	0.095	0.111
1998	23	0.115	0.070	0.071	0.083	0.103	0.097	0.063	0.059	0.054	0.071	0.120	0.084
1999	38	0.154	0.077	0.125	0.070	0.064	0.073	0.058	0.055	0.049	0.053	0.061	0.073
2000	39	0.074	0.070	0.062	0.073	0.068	0.067	0.059	0.048	0.051	0.053	0.061	0.154
2001	40	0.096	0.094	0.088	0.084	0.083	0.074	0.068	0.081	0.094	0.072	0.079	0.113
2002	39	0.120	0.071	0.075	0.072	0.059	0.061	0.059	0.053	0.044	0.045	0.065	0.127
2003	10	0.071	0.174	0.070	0.073	0.067							
2004	32				0.094	0.079	0.063	0.062	0.052	0.074	0.071	0.073	0.076
2005	41	0.102	0.096	0.118	0.081	0.104	0.069	0.074	0.065	0.065	0.085	0.122	0.130
2006	39	0.095	0.096	0.116	0.087	0.088	0.079	0.071	0.065	0.056	0.056	0.116	0.091
2007	41	0.072	0.083	0.082	0.083	0.083	0.067	0.065	0.064	0.054	0.075	0.083	0.337
2008	49	0.096	0.082	0.088	0.069	0.076	0.071	0.038	0.074	0.063	0.065	0.112	0.145
2009	39	0.113	0.146	0.125	0.061	0.074	0.075	0.061	0.055	0.059	0.069	0.080	0.070
2010	38	0.098	0.076	0.072	0.073	0.083	0.095	0.080	0.062	0.090	0.073	0.070	0.148
2011	40	0.102	0.109	0.153	0.063	0.074	0.089	0.070	0.063	0.061	0.067	0.068	0.095
2012	23	0.116	0.086	0.084	0.073	0.068	0.073	0.068	0.062	0.059	0.063	0.073	0.097
2013	23	0.071	0.096	0.094	0.061	0.071	0.074	0.063	0.059	0.070	0.065	0.064	0.094
2014	24	0.069	0.069	0.091	0.084	0.075	0.065	0.058	0.062	0.062	0.070	0.069	0.085
2015	24	0.096	0.124	0.110	0.070	0.066	0.067	0.062	0.053	0.072	0.067	0.079	0.081
2016	22	0.097	0.074	0.071	0.119	0.104	0.060	0.078	0.055	0.056	0.095	0.091	
2017	22	0.069	0.141	0.090	0.066	0.076	0.081	0.061	0.066	0.070	0.055	0.076	0.065
POR Median		0.098	0.096	0.090	0.079	0.082	0.074	0.068	0.062	0.067	0.071	0.083	0.104

Key
total P in mg/L
$TP \leq 0.06$
$0.06 < TP \leq 0.07$
$0.07 < TP \leq 0.11$
$0.11 < TP \leq 0.13$
$TP > 0.13$

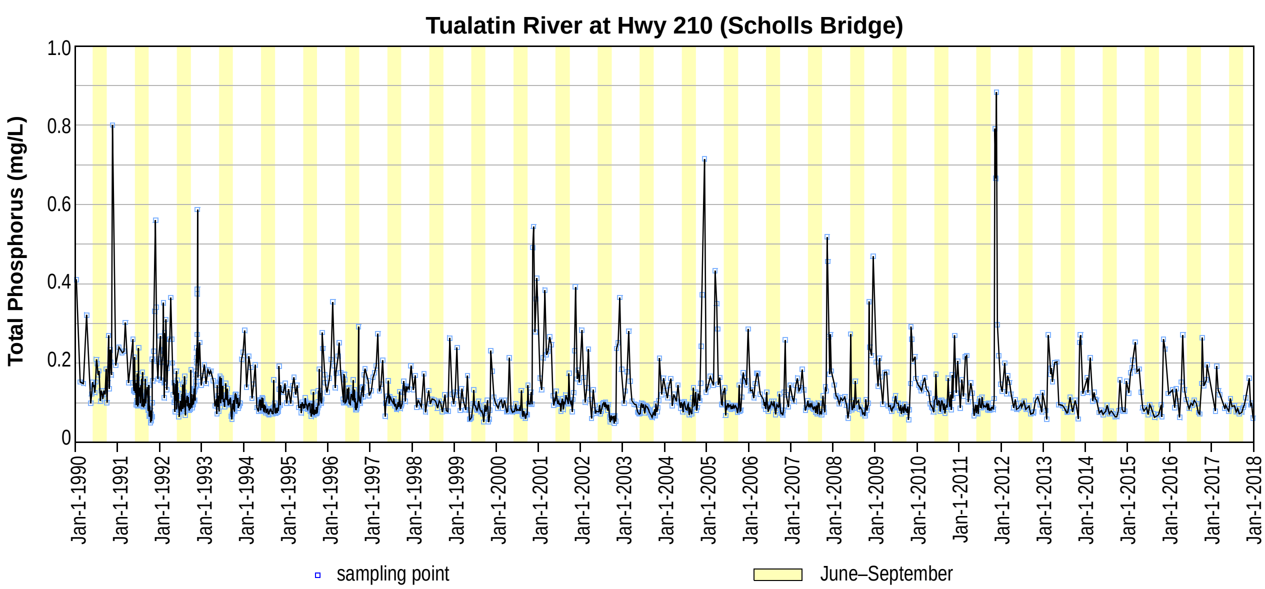


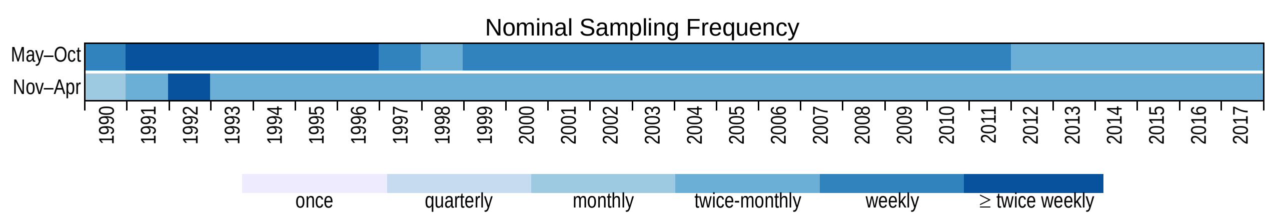
TUALATIN RIVER AT HWY 210 (Scholls Bridge)
Total Phosphorus

Data source: Clean Water Services

Discussion

- The period of record is January 1990 through present. Sampling frequency was quite variable over the period of record, especially during May–October.
- In general, totP concentrations were higher in the high flow season (November through May). Spikes can occur at any time of the year; a moderate one occurred in September 1996.
- Spikes in totP concentration were probably due to an increase in the particulate form of phosphorus that occurred during or shortly after a storm.
- Because the high flows that trigger the concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency.
- Although the highest median concentrations of totP in July–September occurred before 2002, a trend cannot be determined because of the inconsistent sampling frequency. In the early 1990s, sampling was at least twice a week, while since 2012 it has been every 2 weeks—a four-fold difference. As sampling becomes less dense, the data would be expected to capture fewer concentration spikes and therefore have a lower median, meaning that the apparent decrease in the totP median over time could reflect the decreasing sampling density rather than a decrease in ambient concentrations.





TUALATIN RIVER AT HWY 210 (Scholls Bridge)
Total Phosphorus

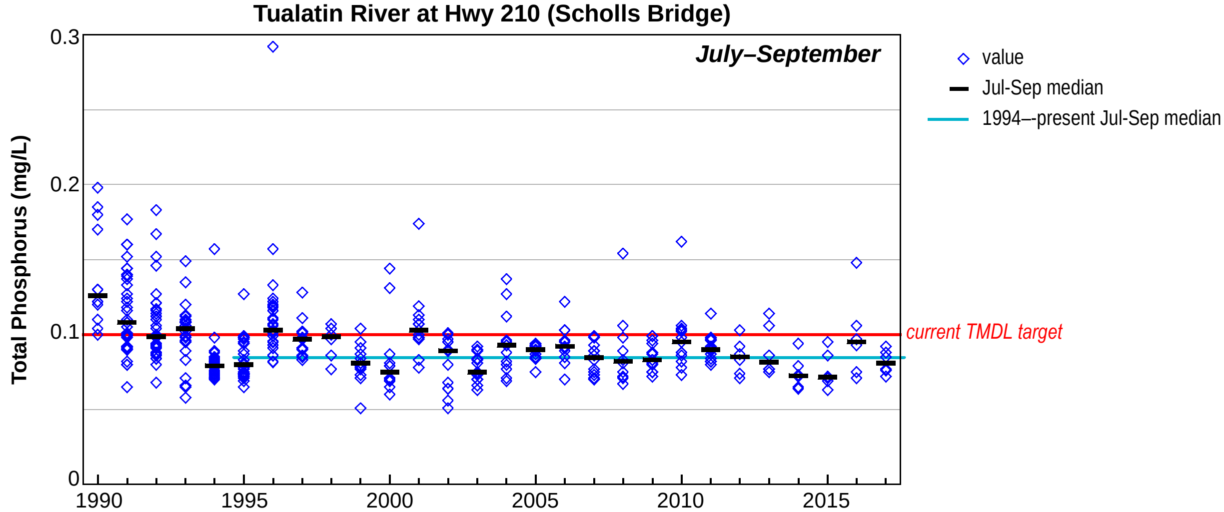
Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	32	0.410	0.152	0.148	0.321	0.131	0.149	0.175	0.125	0.122	0.203	0.485	0.194
1991	76	0.240	0.228	0.302	0.150	0.133	0.105	0.126	0.101	0.092	0.071	0.336	0.204
1992	114	0.230	0.179	0.230	0.200	0.122	0.086	0.108	0.100	0.094	0.105	0.214	0.198
1993	68	0.183	0.166	0.177	0.123	0.105	0.142	0.108	0.104	0.083	0.109	0.100	0.218
1994	66	0.211	0.203	0.129	0.142	0.099	0.088	0.079	0.079	0.084	0.086	0.129	0.137
1995	66	0.117	0.121	0.142	0.116	0.093	0.095	0.095	0.074	0.076	0.105	0.204	0.138
1996	68	0.186	0.193	0.196	0.214	0.106	0.114	0.116	0.099	0.107	0.126	0.178	0.137
1997	38	0.147	0.185	0.146	0.207	0.105	0.113	0.100	0.092	0.091	0.131	0.139	0.164
1998	23	0.151	0.097	0.094	0.125	0.131	0.103	0.104	0.095	0.087	0.100	0.171	0.109
1999	38	0.183	0.100	0.121	0.125	0.062	0.096	0.086	0.079	0.076	0.072	0.179	0.107
2000	39	0.094	0.097	0.092	0.146	0.078	0.085	0.084	0.069	0.071	0.097	0.491	0.388
2001	40	0.148	0.299	0.226	0.246	0.106	0.100	0.098	0.107	0.107	0.102	0.231	0.167
2002	39	0.223	0.119	0.172	0.093	0.078	0.079	0.097	0.092	0.064	0.059	0.244	0.275
2003	38	0.114	0.229	0.129	0.096	0.074	0.093	0.090	0.078	0.070	0.082	0.159	0.141
2004	39	0.121	0.153	0.107	0.124	0.098	0.092	0.088	0.088	0.094	0.109	0.242	0.421
2005	40	0.153	0.144	0.350	0.155	0.127	0.090	0.092	0.092	0.087	0.114	0.162	0.216
2006	38	0.131	0.130	0.174	0.121	0.101	0.089	0.096	0.088	0.090	0.074	0.189	0.117
2007	40	0.107	0.153	0.134	0.132	0.092	0.094	0.086	0.096	0.073	0.117	0.361	0.226
2008	35	0.131	0.106	0.109	0.104	0.085	0.087	0.126	0.089	0.072	0.093	0.240	0.469
2009	39	0.172	0.189	0.136	0.134	0.087	0.099	0.093	0.083	0.082	0.086	0.260	0.189
2010	38	0.142	0.141	0.149	0.111	0.087	0.105	0.095	0.088	0.100	0.105	0.124	0.205
2011	40	0.122	0.166	0.161	0.137	0.079	0.095	0.094	0.091	0.083	0.088	0.666	0.182
2012	24	0.164	0.145	0.137	0.098	0.085	0.094	0.093	0.090	0.073	0.092	0.105	0.101
2013	23	0.069	0.222	0.170	0.202	0.095	0.089	0.076	0.100	0.092	0.076	0.262	0.123
2014	24	0.144	0.159	0.118	0.091	0.076	0.077	0.083	0.076	0.065	0.119	0.080	0.116
2015	23	0.150	0.198	0.216	0.156	0.083	0.079	0.091	0.068	0.070	0.080	0.248	0.123
2016	21	0.133	0.111	0.084	0.212	0.120	0.092	0.100	0.086	0.110	0.203	0.177	
2017	22	0.079	0.162	0.120	0.090	0.082	0.101	0.085	0.079	0.082	0.103	0.128	0.080
POR Median		0.147	0.156	0.144	0.133	0.094	0.094	0.094	0.089	0.084	0.101	0.197	0.167

Key
total P in mg/L
$TP \leq 0.08$
$0.08 < TP \leq 0.09$
$0.00 < TP \leq 0.15$
$0.15 < TP \leq 0.20$
$TP > 0.20$

Tualatin River at Hwy 210 (Scholls Bridge)

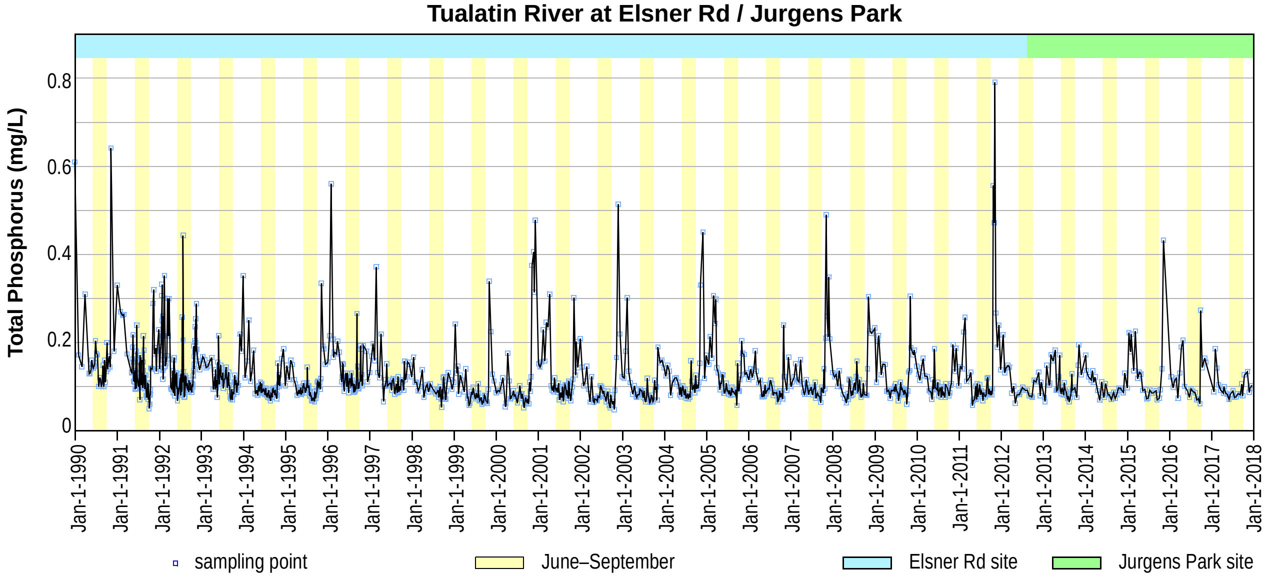


TUALATIN RIVER AT ELSNER RD / JURGENS PARK
Total Phosphorus

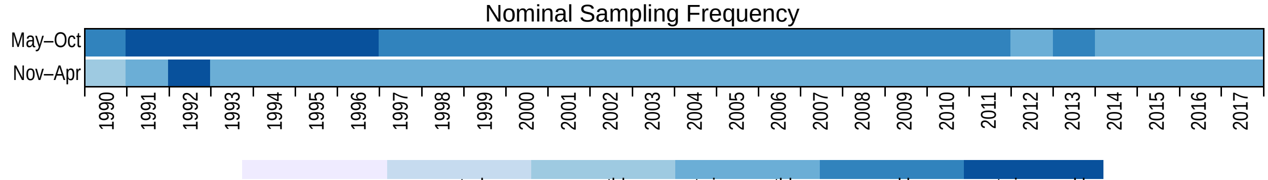
Discussion

- The period of record is January 1990 through present. Sampling frequency was quite variable over the period of record, especially during May–October.
- In 2012, the site location moved from Elsner Road (RM 16.2) to Jurgens Park (RM 10.8). Two tributaries (Chicken and South Rock Creeks) enter the Tualatin River between the two sites. In addition, the Tualatin River flows past a National Wildlife Refuge that supports wetland areas used by migratory birds and under a major road (US Hwy 99). The extent to which the tributaries, the wetland, or the highway affect nutrient concentrations in the river is unknown.
- In general, totP concentrations were higher in the high flow season (November through May). A moderately high spike occurred in late July 1992, indicating that totP spikes can occur any time of the year.
- Spikes in totP concentration are probably due to an increase in the particulate form of phosphorus that occurs during or shortly after a storm.
- Because the high flows that trigger concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency.
- Although the highest median concentrations of totP in July–September occurred before 1998, a trend cannot be determined because of the inconsistent sampling frequency. In the early 1990s, sampling was at least twice a week, while since 2012 it has been every 2 weeks—a four-fold difference. As sampling becomes less dense, the data would be expected to capture fewer concentration spikes and therefore have a lower median, meaning that the apparent decrease in the totP median over time could reflect the decreasing sampling density rather than a decrease in ambient concentrations.

Tualatin River at Elsner Rd / Jurgens Park



Nominal Sampling Frequency



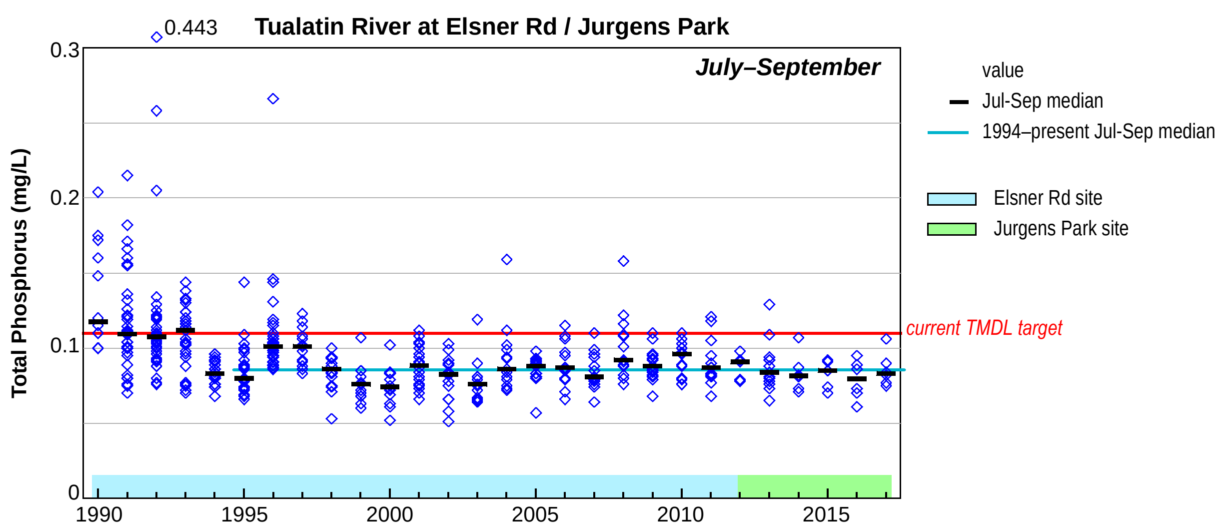
TUALATIN RIVER AT ELSNER RD / JURGENS PARK
Total Phosphorus

Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

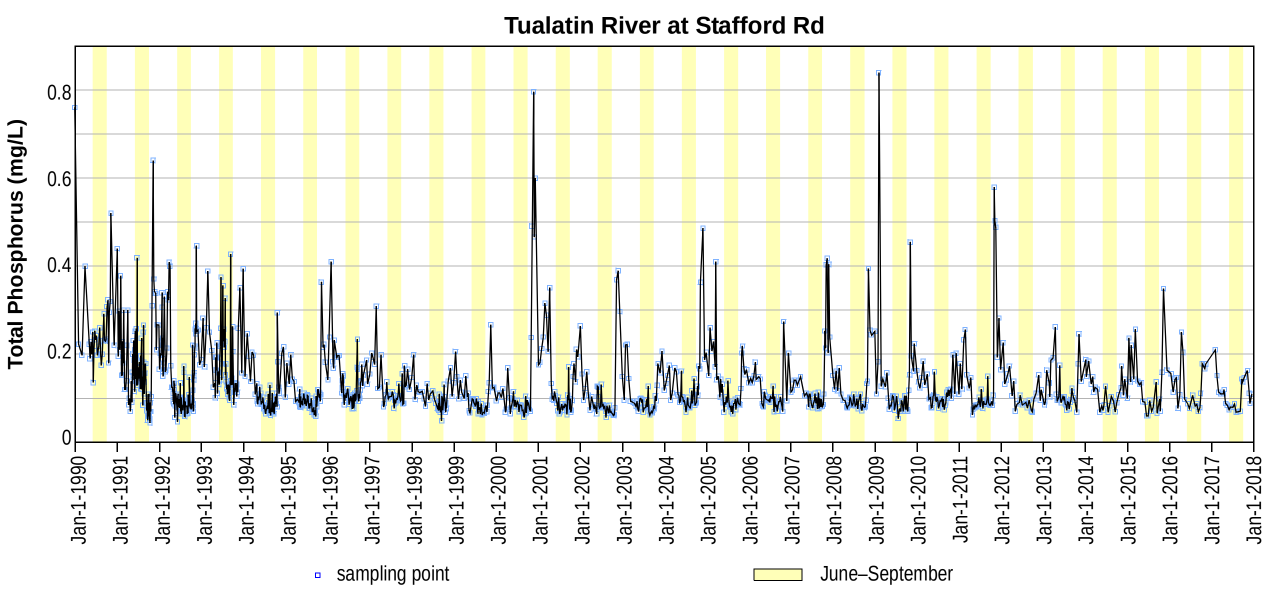
	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	32	0.610	0.172	0.145	0.310	0.135	0.148	0.174	0.113	0.129	0.160	0.393	0.180
1991	75	0.330	0.266	0.264	0.174	0.156	0.130	0.113	0.122	0.082	0.082	0.232	0.180
1992	115	0.230	0.161	0.193	0.115	0.122	0.097	0.121	0.109	0.101	0.102	0.185	0.148
1993	68	0.160	0.152	0.150	0.130	0.110	0.133	0.116	0.124	0.077	0.096	0.102	0.200
1994	66	0.236	0.205	0.124	0.133	0.093	0.095	0.084	0.080	0.086	0.084	0.104	0.175
1995	66	0.125	0.138	0.133	0.093	0.088	0.098	0.100	0.078	0.074	0.101	0.155	0.169
1996	68	0.186	0.207	0.176	0.191	0.116	0.117	0.104	0.099	0.100	0.112	0.148	0.146
1997	38	0.151	0.179	0.132	0.220	0.101	0.106	0.111	0.100	0.091	0.113	0.123	0.153
1998	41	0.145	0.110	0.095	0.107	0.101	0.097	0.091	0.084	0.084	0.082	0.111	0.105
1999	40	0.176	0.130	0.120	0.114	0.068	0.088	0.077	0.076	0.066	0.067	0.225	0.121
2000	39	0.089	0.097	0.087	0.119	0.079	0.081	0.081	0.078	0.065	0.072	0.375	0.396
2001	47	0.148	0.193	0.202	0.235	0.097	0.094	0.076	0.100	0.087	0.087	0.126	0.173
2002	39	0.177	0.107	0.120	0.069	0.071	0.075	0.092	0.077	0.066	0.064	0.129	0.367
2003	38	0.121	0.241	0.122	0.093	0.080	0.090	0.074	0.080	0.067	0.097	0.130	0.157
2004	39	0.133	0.142	0.094	0.120	0.100	0.088	0.082	0.081	0.096	0.100	0.153	0.285
2005	41	0.161	0.190	0.298	0.137	0.108	0.090	0.091	0.088	0.082	0.116	0.176	0.130
2006	39	0.128	0.130	0.158	0.112	0.078	0.092	0.106	0.086	0.075	0.078	0.181	0.129
2007	41	0.106	0.137	0.113	0.106	0.098	0.092	0.094	0.082	0.077	0.095	0.237	0.279
2008	39	0.127	0.115	0.118	0.078	0.077	0.091	0.105	0.104	0.082	0.081	0.226	0.221
2009	42	0.172	0.209	0.139	0.120	0.089	0.091	0.088	0.095	0.086	0.087	0.188	0.178
2010	40	0.137	0.129	0.144	0.107	0.088	0.095	0.097	0.085	0.098	0.088	0.134	0.187
2011	40	0.124	0.182	0.185	0.127	0.070	0.085	0.089	0.081	0.107	0.090	0.472	0.215
2012	23	0.178	0.137	0.146	0.093	0.072	0.084	0.098	0.092	0.079	0.095	0.122	0.095
2013	35	0.071	0.126	0.141	0.171	0.094	0.093	0.088	0.075	0.093	0.087	0.172	0.127
2014	24	0.155	0.118	0.123	0.107	0.090	0.081	0.094	0.077	0.080	0.090	0.094	0.109
2015	22	0.160	0.199	0.181	0.126	0.110	0.083	0.083	0.085	0.081	0.084	0.287	
2016	21	0.123	0.107	0.097	0.161	0.153	0.082	0.092	0.078	0.067	0.208	0.161	
2017	23	0.088	0.164	0.098	0.093	0.084	0.077	0.083	0.081	0.094	0.103	0.111	0.100
POR Median		0.149	0.147	0.136	0.119	0.094	0.091	0.092	0.084	0.082	0.090	0.158	0.171

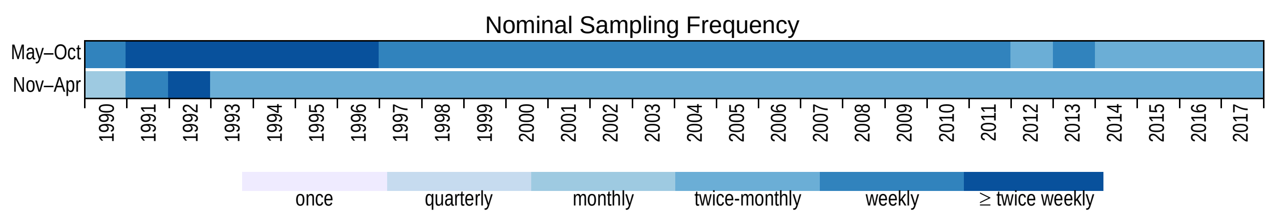
Key
total P in mg/L
$TP \leq 0.08$
$0.08 < TP \leq 0.09$
$0.09 < TP \leq 0.14$
$0.14 < TP \leq 0.20$
$TP > 0.20$



Discussion

- The period of record is January 1990 through present. Sampling frequency was quite variable over the period of record, especially during May–October.
- In general, totP concentrations were higher in the high flow season (November through May). A moderately high totP spike, however, occurred in late July 1992, indicating that totP spikes can occur any time of the year.
- Spikes in totP concentration were probably due to an increase in the particulate form of phosphorus that occurs during or shortly after a storm.
- The data captured many totP spikes in winter 1991–1992 when the sampling frequency was the most dense. Comparatively fewer such spikes were captured in winter months after 1992 when samples were only collected every two weeks. Because the high flows that trigger the concentration spikes are short-lived, the graph below likely under-represents spike frequency, especially since 2012 and during winter months for most of the period of record.
- The summer sampling density in 1990–1996 was relatively constant, but the range of totP in July–September was greater in 1990–1993 than in 1994–1996. The highest median concentration of totP in July–September occurred in 1990. The greater variability and higher concentrations of totP during July–September in the early1990s was probably related to changes in phosphorus treatment at the WWTFs. Upgrades for phosphorus treatment at the WWTFs began in 1991 and were being tested and adjusted for the next couple of years. By the mid-1990s, summer phosphorus control at the WWTFs was routine.



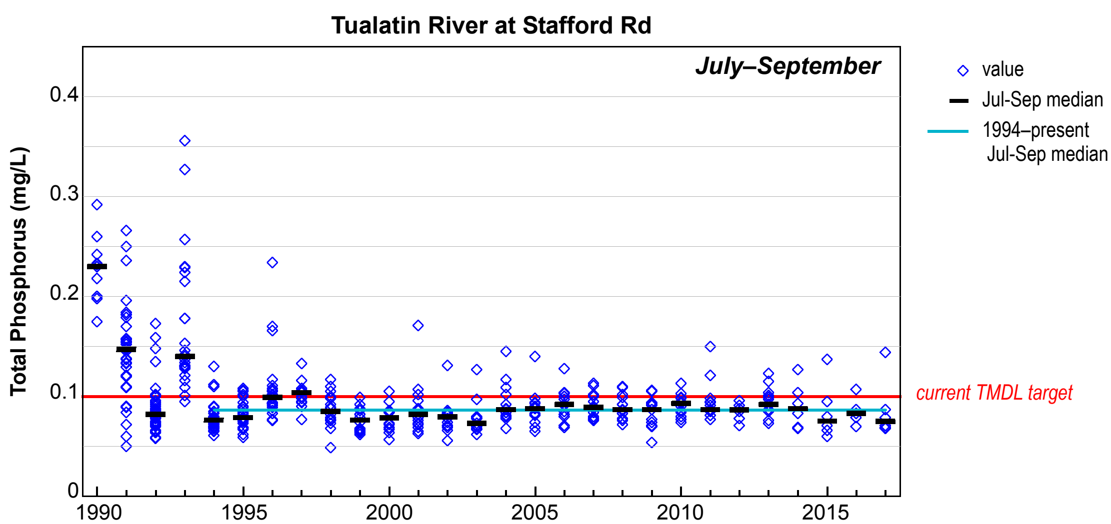


MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	32	0.760	0.223	0.198	0.400	0.211	0.229	0.226	0.200	0.231	0.295	0.420	0.220
1991	88	0.254	0.180	0.130	0.100	0.151	0.186	0.151	0.148	0.090	0.069	0.357	0.267
1992	115	0.230	0.190	0.269	0.174	0.104	0.095	0.079	0.084	0.082	0.085	0.246	0.216
1993	67	0.235	0.216	0.320	0.167	0.161	0.205	0.229	0.130	0.131	0.120	0.128	0.254
1994	66	0.272	0.221	0.172	0.154	0.103	0.092	0.076	0.077	0.074	0.095	0.117	0.210
1995	66	0.141	0.166	0.141	0.095	0.090	0.097	0.092	0.078	0.069	0.103	0.162	0.202
1996	65	0.191	0.183	0.213	0.197	0.119	0.108	0.099	0.100	0.106	0.128	0.141	0.160
1997	38	0.179	0.185	0.126	0.199	0.097	0.109	0.107	0.093	0.105	0.093	0.130	0.143
1998	41	0.173	0.114	0.115	0.107	0.108	0.104	0.108	0.077	0.082	0.090	0.108	0.137
1999	39	0.171	0.124	0.128	0.126	0.088	0.094	0.084	0.077	0.067	0.081	0.135	0.124
2000	39	0.103	0.107	0.095	0.123	0.087	0.089	0.086	0.079	0.066	0.087	0.491	0.533
2001	47	0.179	0.226	0.302	0.206	0.102	0.093	0.079	0.082	0.084	0.082	0.149	0.203
2002	40	0.210	0.109	0.134	0.086	0.077	0.104	0.083	0.077	0.071	0.064	0.224	0.344
2003	38	0.123	0.222	0.119	0.090	0.080	0.097	0.078	0.089	0.067	0.088	0.154	0.182
2004	39	0.126	0.164	0.104	0.165	0.100	0.102	0.084	0.084	0.099	0.099	0.173	0.337
2005	41	0.178	0.234	0.229	0.146	0.113	0.089	0.092	0.082	0.091	0.088	0.203	0.160
2006	38	0.140	0.144	0.163	0.147	0.088	0.097	0.100	0.092	0.084	0.092	0.274	0.149
2007	36	0.117	0.141	0.130	0.149	0.109	0.107	0.088	0.096	0.090	0.098	0.309	0.322
2008	38	0.136	0.140	0.140	0.096	0.082	0.089	0.089	0.096	0.083	0.088	0.254	0.244
2009	40	0.181	0.511	0.136	0.142	0.084	0.089	0.089	0.077	0.083	0.090	0.196	0.193
2010	38	0.150	0.135	0.157	0.127	0.091	0.103	0.090	0.093	0.097	0.119	0.110	0.202
2011	40	0.144	0.177	0.205	0.135	0.078	0.086	0.091	0.087	0.095	0.088	0.503	0.238
2012	24	0.196	0.137	0.165	0.123	0.079	0.099	0.087	0.085	0.084	0.083	0.133	0.107
2013	35	0.089	0.150	0.145	0.227	0.104	0.098	0.087	0.091	0.108	0.082	0.212	0.138
2014	24	0.169	0.159	0.132	0.123	0.076	0.080	0.098	0.094	0.081	0.099	0.149	0.125
2015	23	0.169	0.179	0.200	0.135	0.114	0.076	0.078	0.076	0.102	0.085	0.254	0.164
2016	20	0.156	0.129	0.112	0.179	0.151	0.082	0.107	0.085	0.075	0.145	0.173	
2017	22		0.181	0.112	0.115	0.086	0.077	0.083	0.069	0.108	0.142	0.137	0.099
POR Median		0.171	0.171	0.140	0.139	0.098	0.097	0.089	0.085	0.084	0.090	0.173	0.202

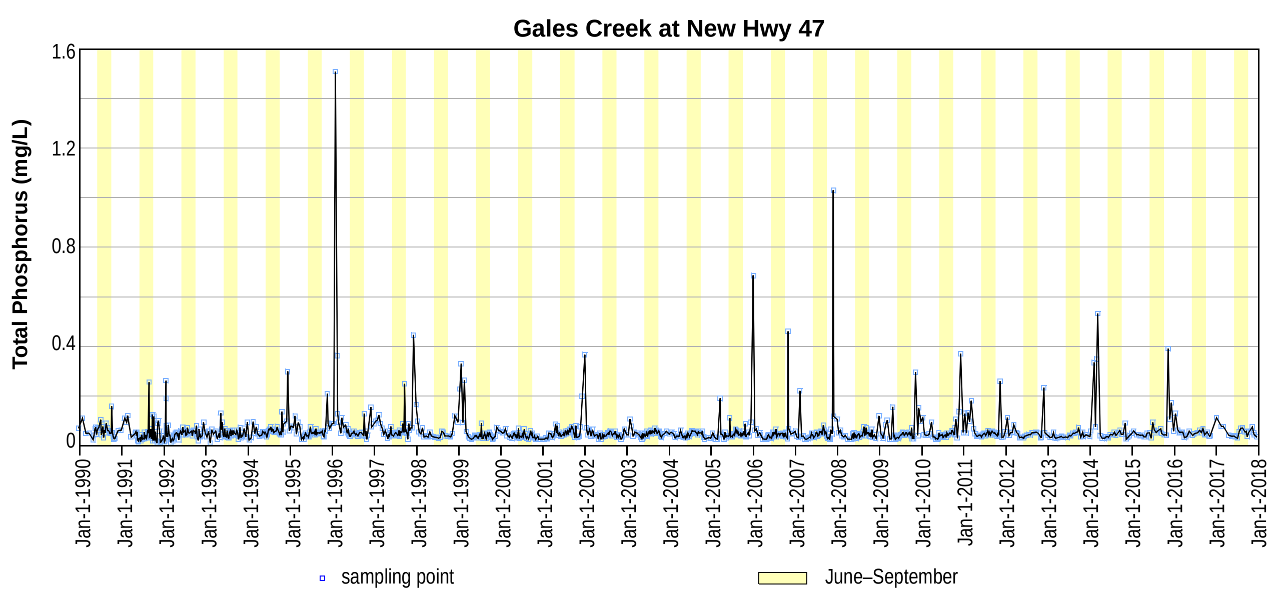
Key

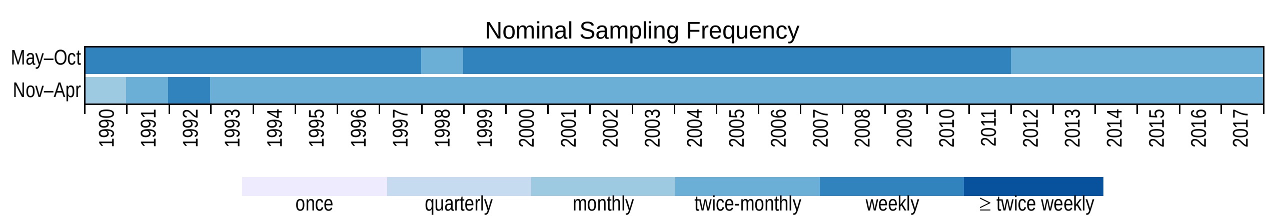
total P in mg/L
$TP \leq 0.08$
$0.08 < TP \leq 0.09$
$0.09 < TP \leq 0.15$
$0.15 < TP \leq 0.23$
$TP > 0.23$



Discussion

- The period of record is January 1990 through present. The sampling frequency was mostly weekly for May–October and every two weeks for November–April. Since 2012, the May–October sampling frequency decreased to every two weeks.
- Total phosphorus concentrations in Gales Creek are generally low, but not as low as in Scoggins Creek or the upstream Tualatin River sites from Cherry Grove to Golf Course Road.
- Spikes in totP concentration generally occurred from November through March and were probably due to an increase in the particulate form of phosphorus that occurred during or shortly after a storm.
- The highest concentration was measured on February 6, 1996 and coincided with large storms that caused major flooding downstream. The second highest concentration coincided with the large storm in early December 2007.
- Because the high flows that trigger concentration spikes are short-lived, the graph below likely under-represents spike frequency, especially since 2012 and during winter months for most of the period of record.
- The concentration spikes are superimposed on a small, but distinct, seasonal baseline pattern. The baseline pattern generally is lowest around mid-winter to early-spring, increases steadily through the summer, reaches a maximum near September, and then begins to decrease through late fall and into winter. This pattern is consistent with soluble reactive phosphorus (SRP) entering the creek from groundwater. The difference between the pattern's minimum and maximum is only about 0.03 mg/L at this site.
- Concentrations of totP in July–September do not show a trend.





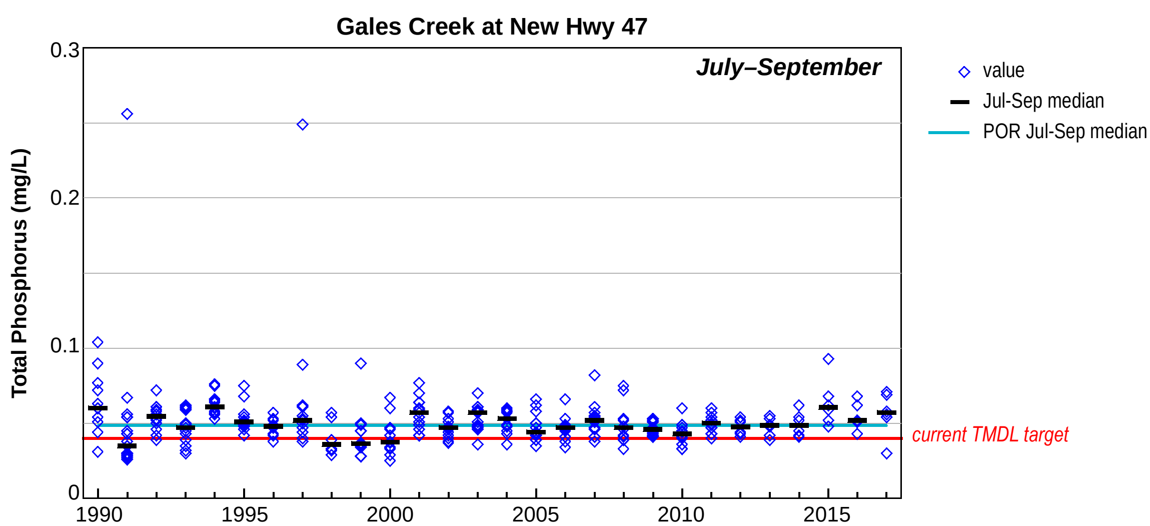
GALES CREEK AT NEW HWY 47
Total Phosphorus

Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	31	0.070	0.110	0.048	0.050	0.055	0.065	0.074	0.063	0.060	0.050	0.027	0.060
1991	49	0.062	0.102	0.121	0.035	0.049	<0.025	0.029	0.044	0.037	0.030	0.054	0.015
1992	57	0.040	0.053	0.028	0.042	0.045	0.055	0.052	0.053	0.059	0.053	0.039	0.067
1993	40	0.044	0.034	0.056	0.043	0.057	0.044	0.034	0.050	0.048	0.043	0.040	0.052
1994	39	0.058	0.064	0.062	0.043	0.047	0.045	0.065	0.056	0.061	0.049	0.088	0.199
1995	40	0.069	0.096	0.070	0.051	0.041	0.039	0.052	0.050	0.052	0.051	0.060	0.080
1996	35	0.089	0.363	0.072	0.093	0.064	0.040	0.049	0.043	0.053	0.043	0.033	0.114
1997	38	0.094	0.114	0.080	0.052	0.041	0.041	0.049	0.050	0.062	0.052	0.071	0.259
1998	23	0.131	0.051	0.054	0.037	0.047	0.035	0.031	0.054	0.039	0.038	0.042	0.119
1999	37	0.161	0.211	0.160	0.032	0.030	0.037	0.045	0.036	0.040	0.040	0.029	0.067
2000	39	0.053	0.059	0.037	0.036	0.044	0.037	0.037	0.038	0.038	0.038	0.028	<0.025
2001	40	<0.025	0.029	0.049	0.036	0.051	0.043	0.049	0.056	0.067	0.044	0.036	0.138
2002	39	0.220	0.054	0.051	0.042	0.034	0.039	0.042	0.055	0.047	0.040	0.035	0.051
2003	38	0.043	0.093	0.046	0.047	0.036	0.039	0.051	0.059	0.059	0.052	0.037	0.053
2004	38	0.050	0.050	0.035	0.049	0.039	0.041	0.047	0.058	0.049	0.051	0.032	0.031
2005	39	0.039	0.030	0.108	0.044	0.036	0.039	0.042	0.058	0.043	0.045	0.049	0.067
2006	39	0.374	0.055	0.048	0.026	0.032	0.032	0.050	0.041	0.048	0.045	0.068	0.048
2007	40	0.047	0.127	0.038	<0.025	0.031	0.041	0.047	0.053	0.056	0.032	0.047	0.574
2008	38	0.079	0.051	0.038	<0.025	0.026	0.037	0.042	0.047	0.052	0.044	0.044	0.029
2009	38	0.083	0.033	0.093	0.026	0.040	0.032	0.044	0.048	0.047	0.037	0.162	0.096
2010	37	0.105	0.042	0.044	0.065	0.028	0.040	0.038	0.042	0.049	0.057	0.069	0.254
2011	39	0.091	0.092	0.139	0.057	0.039	0.041	0.047	0.052	0.052	0.045	0.052	0.034
2012	24	0.085	0.047	0.068	0.050	0.033	0.034	0.043	0.048	0.053	0.052	0.032	0.142
2013	23	0.037	0.043	0.032	0.033	0.035	0.033	0.041	0.049	0.054	0.054	0.045	0.043
2014	24	0.048	0.205	0.441	0.035	0.033	0.034	0.044	0.048	0.057	0.045	0.059	0.037
2015	23	0.054	0.044	0.042	0.039	0.042	0.041	0.078	0.056	0.058	0.043	0.216	0.140
2016	21	0.094	0.058	0.054	0.034	0.050	0.044	0.051	0.062	0.052	0.051	0.038	
2017	19	0.112	0.077	0.077	0.041	0.037	0.037	0.043	0.070	0.056	0.045	0.063	0.039
POR Median		0.069	0.056	0.054	0.042	0.039	0.039	0.046	0.051	0.052	0.045	0.045	0.067

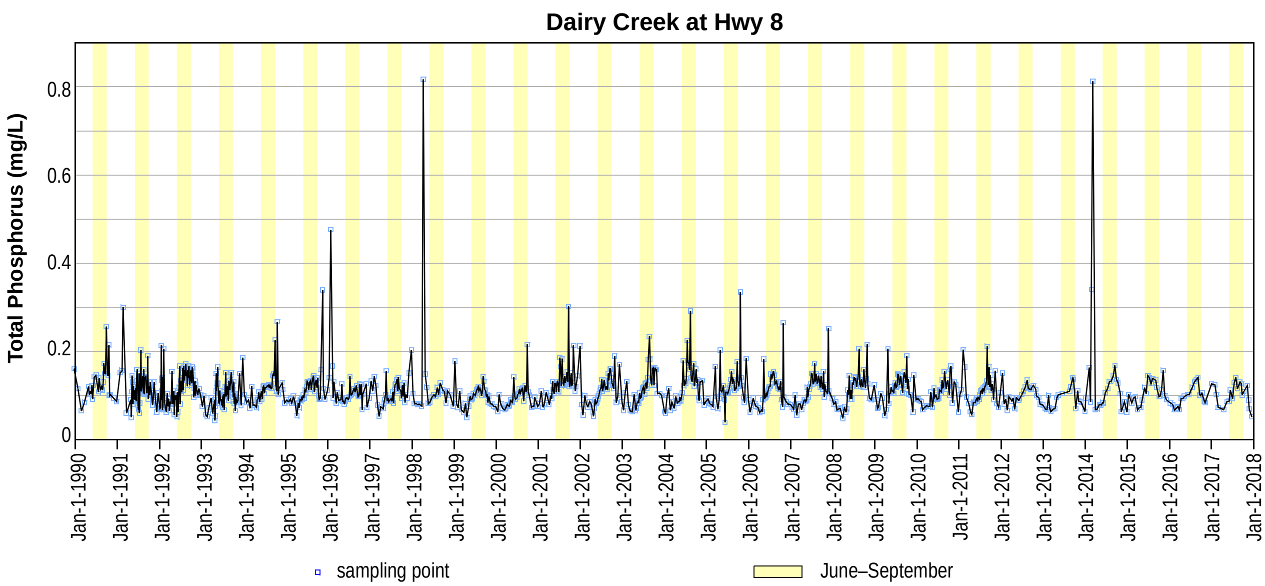
Key
total P in mg/L
TP ≤ 0.035
0.035 < *TP* ≤ 0.045
0.045 < *TP* ≤ 0.06
0.06 < *TP* ≤ 0.09
TP > 0.09

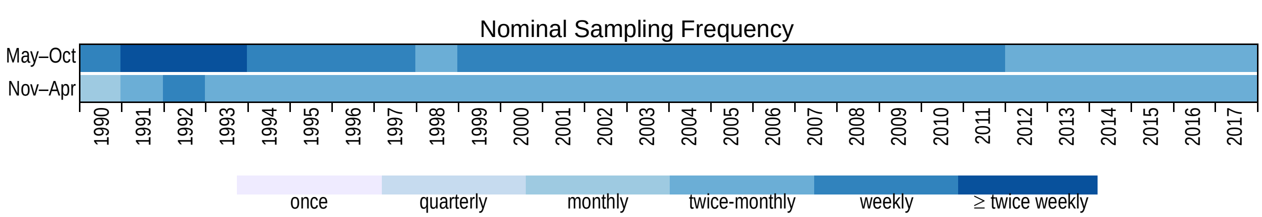


Data source: Clean Water Services

Discussion

- The period of record is January 1990 through present. Sampling frequency varied.
- Total phosphorus concentrations (totP) show a distinct seasonal baseline pattern that is superimposed with concentrations spikes.
- The baseline pattern generally is lowest around mid-winter to early-spring, increases steadily through the summer, reaches a maximum near September, and then begins to decrease through late fall and into winter. This pattern is consistent with soluble reactive phosphorus (SRP) entering the creek from groundwater. The difference between the pattern's minimum and maximum is on the order of 0.06–0.08 mg/L.
- Most spikes in totP concentration occurred from September through March; many were in the fall. Concentration spikes were probably due to an increase in the particulate form of phosphorus that occurred during or shortly after a storm.
- Because the high flows that trigger concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency. Since 2012, only one concentration spike was captured by the data, suggesting that the decrease in May–October sampling resulted in missing any concentration spikes that occurred in the fall.
- Concentrations of totP in July–September do not show a trend.





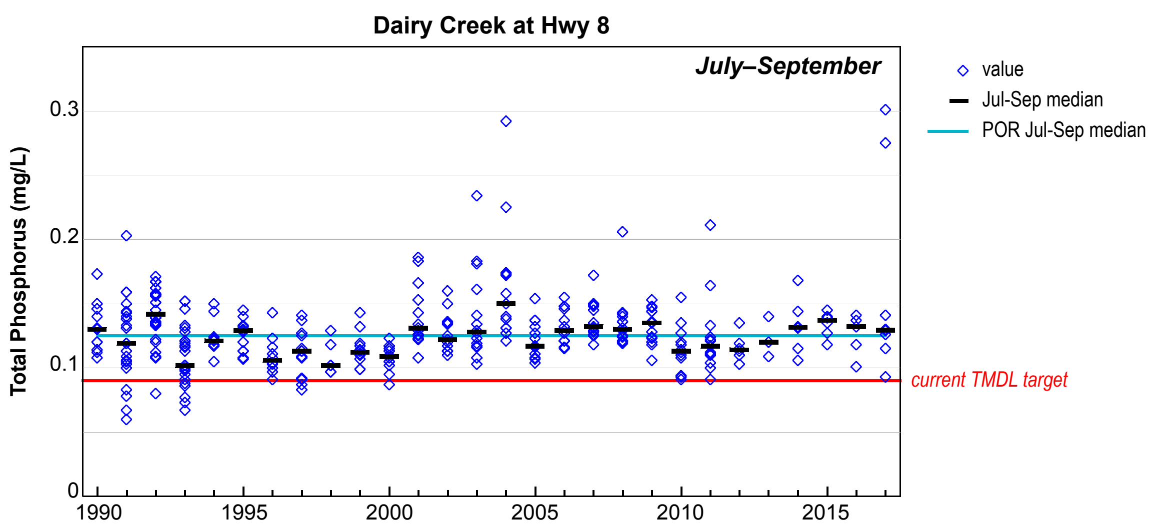
DAIRY CREEK AT HWY 8
Total Phosphorus

Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	31	0.160	0.116	0.065	0.084	0.107	0.123	0.131	0.120	0.140	0.150	0.101	0.094
1991	56	0.086	0.155	0.300	0.060	0.108	0.099	0.092	0.133	0.125	0.120	0.098	0.086
1992	82	0.106	0.090	0.074	0.086	0.091	0.095	0.127	0.156	0.151	0.144	0.121	0.109
1993	68	0.088	0.078	0.062	0.077	0.100	0.103	0.091	0.102	0.128	0.108	0.087	0.114
1994	39	0.144	0.087	0.096	0.078	0.090	0.103	0.118	0.122	0.131	0.135	0.116	0.121
1995	40	0.086	0.089	0.091	0.068	0.088	0.098	0.124	0.129	0.135	0.118	0.158	0.104
1996	36	0.126	0.167	0.107	0.098	0.089	0.091	0.099	0.108	0.116	0.101	0.085	0.100
1997	38	0.114	0.127	0.101	0.064	0.087	0.092	0.092	0.119	0.115	0.104	0.102	0.123
1998	23	0.154	0.082	0.080	0.447	0.133	0.084	0.100	0.102	0.129	0.111	0.097	0.101
1999	37	0.127	0.077	0.089	0.072	0.076	0.094	0.107	0.114	0.121	0.106	0.084	0.078
2000	37	0.069	0.092	0.069	0.075	0.084	0.095	0.102	0.115	0.111	0.112	0.075	0.087
2001	40	0.079	0.092	0.093	0.087	0.104	0.127	0.126	0.134	0.133	0.124	0.128	0.132
2002	39	0.146	0.078	0.077	0.079	0.077	0.095	0.117	0.124	0.142	0.127	0.137	0.135
2003	38	0.076	0.120	0.072	0.083	0.077	0.095	0.117	0.135	0.161	0.161	0.132	0.102
2004	39	0.062	0.108	0.076	0.085	0.086	0.107	0.135	0.173	0.141	0.137	0.095	0.106
2005	39	0.090	0.081	0.120	0.083	0.109	0.099	0.108	0.137	0.117	0.135	0.132	0.134
2006	39	0.076	0.086	0.079	0.067	0.090	0.102	0.121	0.146	0.125	0.117	0.096	0.083
2007	40	0.077	0.085	0.068	0.075	0.089	0.116	0.138	0.132	0.132	0.118	0.109	0.181
2008	38	0.087	0.077	0.071	0.061	0.086	0.102	0.136	0.137	0.125	0.136	0.126	0.090
2009	38	0.108	0.072	0.100	0.061	0.105	0.110	0.124	0.140	0.136	0.133	0.102	0.104
2010	37	0.092	0.087	0.070	0.076	0.084	0.096	0.094	0.118	0.127	0.128	0.125	0.127
2011	38	0.083	0.159	0.131	0.072	0.083	0.090	0.105	0.117	0.149	0.123	0.113	0.077
2012	24	0.129	0.086	0.082	0.091	0.082	0.091	0.107	0.127	0.114	0.121	0.106	0.088
2013	19	0.074	0.084	0.068	0.070	0.098	0.104		0.109	0.130	0.103	0.099	0.085
2014	24	0.079	0.124	0.577	0.069	0.079	0.084	0.111	0.132	0.156	0.133	0.084	0.080
2015	23	0.083	0.083	0.096	0.070	0.081	0.111	0.143	0.133	0.127	0.098	0.135	0.095
2016	20	0.083	0.073	0.073	0.081	0.096	0.102	0.118	0.132	0.137	0.103	0.086	
2017	20	0.126	0.114	0.073	0.068	0.086	0.100	0.111	0.128	0.128	0.105	0.106	0.061
POR Median		0.087	0.087	0.079	0.076	0.088	0.099	0.117	0.129	0.130	0.120	0.104	0.101

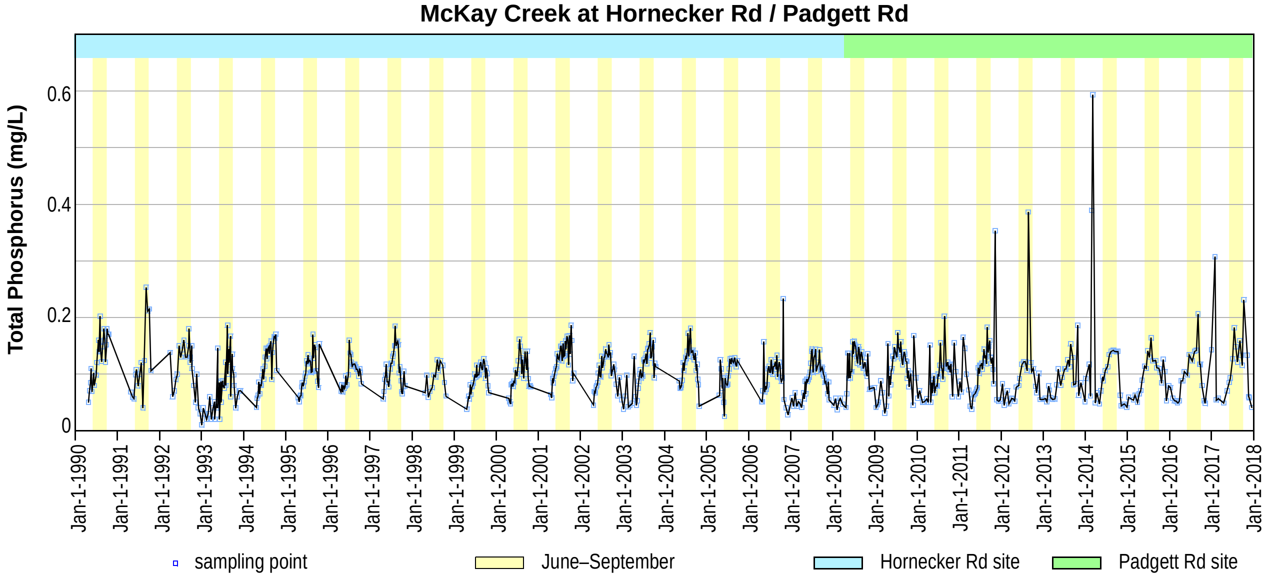
Key
total P in mg/L
TP ≤ 0.09
0.09 < *TP* ≤ 0.10
0.10 < *TP* ≤ 0.13
0.13 < *TP* ≤ 0.15
TP > 0.15



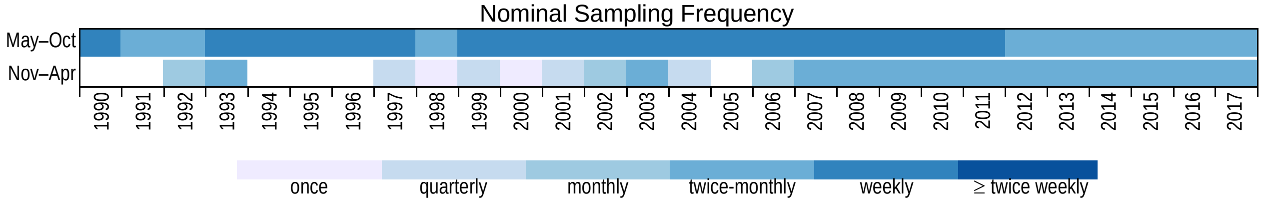
Discussion

- The period of record is May 1990 through present. Sampling frequency varied, ranging from weekly to twice monthly for May–October. Sampling for November–April was intermittent.
- The site location changed during 2008. The distance between the sites is about one mile. The data show no obvious difference between sites with regard to totP.
- Total phosphorus concentrations (totP) show a distinct seasonal baseline pattern with a few superimposed concentration spikes.
- The baseline pattern generally is lowest around mid-winter to early-spring, increases steadily through the summer, reaches a maximum near September, and then begins to decrease through late fall and into winter. This pattern is consistent with soluble reactive phosphorus (SRP) entering the creek from groundwater. The difference between the pattern's minimum and maximum is on the order of 0.1 mg/L.
- Because sampling in November–April was sparse, the data captured very few spikes in totP concentration. Those that appear in the graph below were mostly in September and November. Concentration spikes were probably due to an increase in the particulate form of phosphorus that occurred during or shortly after a storm.
- Concentrations of totP in July–September do not show a trend.

McKay Creek at Hornecker Rd / Padgett Rd



Nominal Sampling Frequency



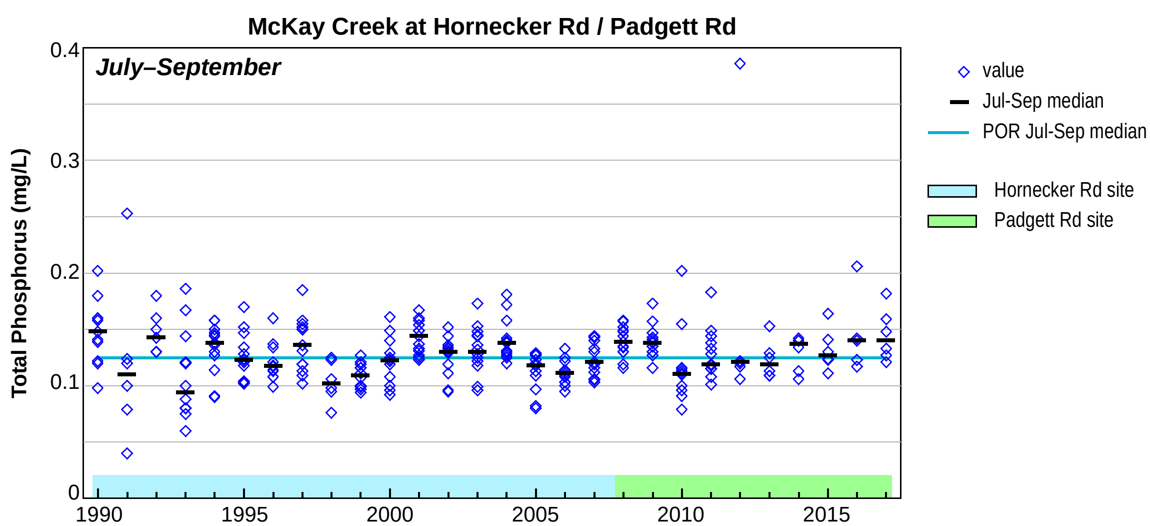
McKAY CREEK AT HORNECKER RD / PADGETT RD
Total Phosphorus

Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

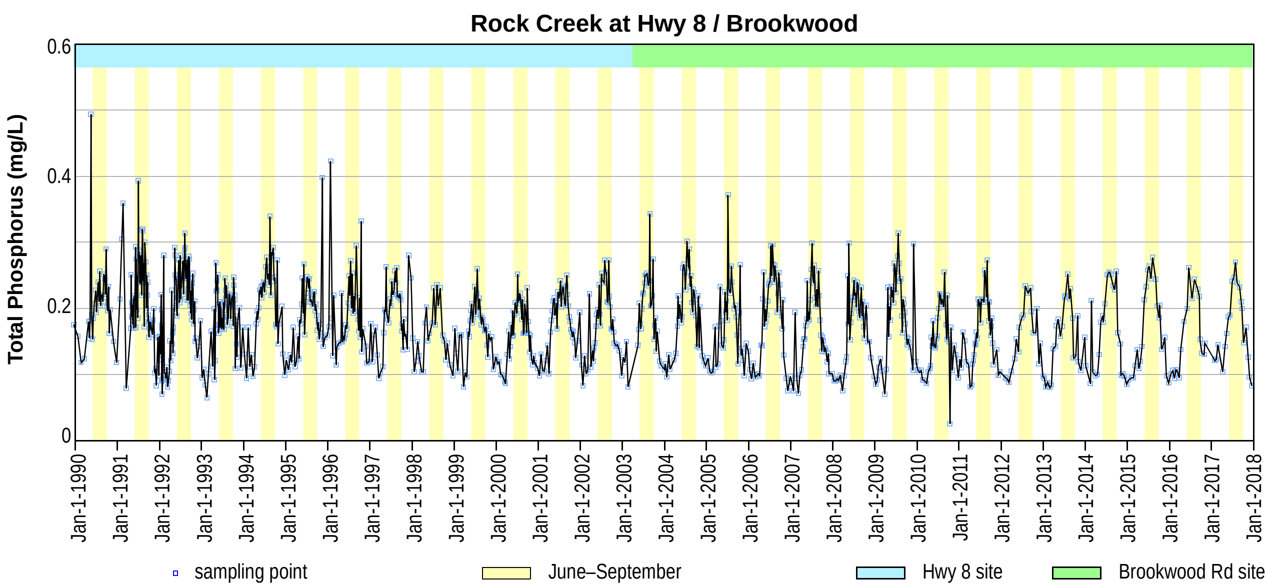
	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	24					0.077	0.080	0.109	0.141	0.159	0.170		
1991	14					0.064	0.099	0.090	0.080	0.189	0.211		
1992	22				0.138	0.065	0.100	0.136	0.145	0.150	0.125	0.065	0.040
1993	38	0.025	0.025	0.045	0.030	0.044	0.068	0.080	0.111	0.132	0.105	0.050	0.070
1994	26					0.062	0.089	0.122	0.144	0.148	0.165		
1995	27					0.061	0.086	0.121	0.121	0.150	0.105		
1996	25					0.075	0.080	0.136	0.118	0.111	0.103		
1997	27					0.080	0.086	0.119	0.150	0.152	0.074	0.092	
1998	13					0.083	0.064	0.087	0.106	0.123	0.100	0.061	
1999	26					0.056	0.079	0.100	0.099	0.115	0.106	0.073	
2000	27					0.057	0.086	0.108	0.129	0.121	0.092	0.077	
2001	29					0.084	0.112	0.137	0.132	0.159	0.159	0.095	
2002	30					0.068	0.094	0.111	0.133	0.134	0.108	0.095	0.078
2003	34	0.046	0.080	0.044	0.090	0.057	0.097	0.122	0.140	0.148	0.116		
2004	26					0.082	0.089	0.129	0.158	0.134	0.112	0.062	
2005	22					0.092	0.083	0.090	0.123	0.118	0.124		
2006	31					0.061	0.079	0.109	0.113	0.110	0.104	0.093	0.034
2007	39	0.058	0.055	0.047	0.044	0.067	0.093	0.130	0.130	0.119	0.107	0.085	0.070
2008	36	0.045	0.047	0.055	0.046	0.079	0.104	0.152	0.137	0.132	0.113	0.096	0.075
2009	38	0.059	0.048	0.078	0.037	0.089	0.127	0.138	0.145	0.130	0.114	0.089	0.107
2010	36	0.075	0.071	0.051	0.053	0.076	0.080	0.098	0.110	0.116	0.112	0.089	0.130
2011	39	0.074	0.117	0.123	0.058	0.060	0.073	0.115	0.128	0.144	0.130	0.108	0.053
2012	24	0.069	0.053	0.059	0.057	0.065	0.086	0.120	0.114	0.253	0.107	0.073	0.078
2013	23	0.056	0.065	0.065	0.056	0.095	0.087	0.109	0.119	0.141	0.082	0.124	0.085
2014	24	0.072	0.089	0.491	0.058	0.059	0.092	0.110	0.137	0.141	0.140	0.053	0.047
2015	22	0.050		0.059	0.058	0.080	0.112	0.136	0.144	0.118	0.107	0.105	0.079
2016	21	0.078	0.055	0.051	0.071	0.096	0.116	0.123	0.140	0.142	0.099	0.051	
2017	20	0.143	0.181	0.057	0.049	0.070	0.089	0.155	0.135	0.146	0.173	0.097	0.050
POR Median		0.059	0.060	0.057	0.056	0.069	0.088	0.119	0.131	0.138	0.110	0.089	0.073

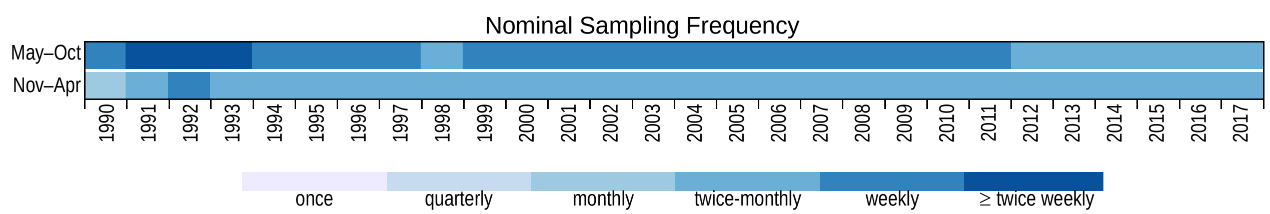
Key
total P in mg/L
TP ≤ 0.07
0.07 < *TP* ≤ 0.09
0.09 < *TP* ≤ 0.13
0.13 < *TP* ≤ 0.15
TP > 0.15



Discussion

- The period of record is January 1990 through present. Sampling frequency varied.
- The site location changed during 2003. The distance between the sites is about 1.2 miles. The data show no obvious difference between sites with regard to totP.
- Total phosphorus concentrations (totP) show a distinct seasonal baseline pattern that is superimposed with concentrations spikes. The magnitude of the spikes was smaller than at other tributaries.
- The baseline pattern generally is lowest around mid-winter to early-spring, increases steadily through the summer, reaches a maximum near September, and then begins to decrease through late fall and into winter. This pattern is consistent with soluble reactive phosphorus (SRP) entering the creek from groundwater. The difference between the pattern's minimum and maximum is on the order of 0.15 mg/L.
- Most spikes in totP concentration occurred from September through March; many were in the fall. Concentration spikes were probably due to an increase in the particulate form of phosphorus that occurred during or shortly after a storm.
- Because the high flows that trigger concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency. Data from the period with twice-weekly sampling captured many more spikes than data with weekly sampling. Since 2012 (twice a month frequency), no concentration spikes were captured by the data, suggesting that the decrease in May–October sampling resulted in missing any concentration spikes that occurred in the fall.
- Concentrations of totP in July–September do not show a trend.





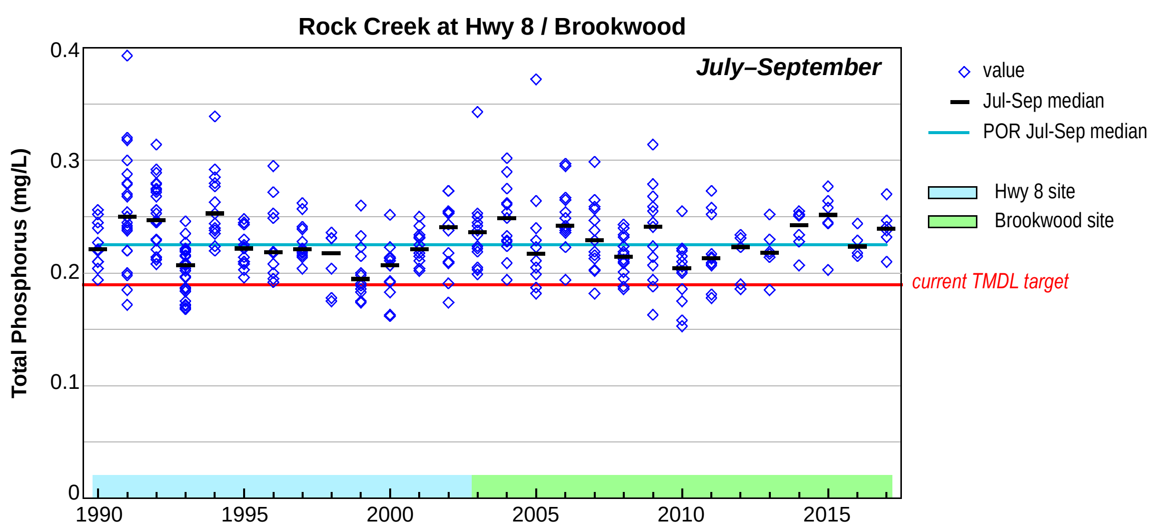
ROCK CREEK AT HWY 8 / BROOKWOOD
Total Phosphorus

Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	31	0.175	0.158	0.118	0.124	0.181	0.188	0.227	0.215	0.233	0.221	0.180	0.150
1991	57	0.118	0.260	0.359	0.079	0.200	0.215	0.244	0.254	0.235	0.180	0.176	0.102
1992	83	0.158	0.122	0.097	0.121	0.183	0.241	0.238	0.256	0.257	0.227	0.187	0.134
1993	68	0.138	0.096	0.083	0.139	0.213	0.203	0.186	0.219	0.208	0.217	0.161	0.156
1994	39	0.151	0.133	0.121	0.105	0.196	0.227	0.239	0.253	0.283	0.208	0.177	0.167
1995	40	0.111	0.119	0.145	0.117	0.177	0.219	0.233	0.214	0.213	0.179	0.176	0.149
1996	36	0.166	0.185	0.167	0.144	0.153	0.165	0.234	0.209	0.245	0.183	0.152	0.130
1997	38	0.148	0.140	0.150	0.098	0.179	0.189	0.218	0.234	0.219	0.172	0.161	0.209
1998	23	0.201	0.112	0.139	0.104	0.190	0.157	0.205	0.204	0.231	0.155	0.135	0.115
1999	37	0.134	0.119	0.160	0.092	0.157	0.187	0.223	0.200	0.179	0.167	0.152	0.133
2000	39	0.122	0.110	0.094	0.108	0.158	0.194	0.211	0.213	0.178	0.163	0.125	0.123
2001	40	0.104	0.119	0.113	0.123	0.196	0.191	0.221	0.225	0.228	0.180	0.156	0.138
2002	38	0.154	0.106	0.104	0.136	0.144	0.195	0.217	0.255	0.214	0.169	0.145	0.141
2003	32	0.112	0.134	0.081		0.144	0.173	0.224	0.248	0.219	0.180	0.150	0.117
2004	38	0.112	0.113	0.108	0.127	0.195	0.195	0.258	0.261	0.217	0.182	0.202	0.124
2005	36	0.119	0.104	0.138	0.114	0.178	0.173	0.220	0.240	0.199	0.165	0.134	0.123
2006	39	0.121	0.105	0.098	0.100	0.172	0.195	0.240	0.265	0.233	0.218	0.169	0.085
2007	40	0.093	0.135	0.083	0.103	0.154	0.189	0.253	0.229	0.211	0.151	0.138	0.117
2008	37	0.096	0.092	0.095	0.087	0.152	0.186	0.219	0.218	0.209	0.180	0.150	0.125
2009	38	0.091	0.102	0.115	0.089	0.193	0.228	0.257	0.257	0.194	0.155	0.145	0.202
2010	37	0.113	0.105	0.092	0.095	0.128	0.144	0.193	0.210	0.175	0.154	0.139	0.137
2011	38	0.109	0.137	0.135	0.098	0.119	0.155	0.208	0.214	0.213	0.179	0.131	0.119
2012	20	0.104	0.095	0.091	0.105	0.139	0.153	0.188	0.234	0.227	0.179	0.182	0.132
2013	23	0.096	0.085	0.082	0.141	0.179	0.166	0.218	0.233	0.208	0.126	0.154	0.106
2014	23	0.135	0.086	0.158	0.099	0.155	0.184	0.229	0.254	0.231	0.210	0.123	0.099
2015	23	0.089	0.095	0.104	0.124	0.131	0.223	0.261	0.261	0.224	0.196	0.141	0.127
2016	19	0.094	0.100	0.106	0.117	0.180	0.231	0.215	0.244	0.224	0.143	0.139	
2017	20		0.122	0.145	0.104	0.152	0.189	0.244	0.254	0.221	0.174	0.149	0.090
POR Median		0.118	0.113	0.111	0.105	0.175	0.189	0.224	0.234	0.219	0.179	0.151	0.127

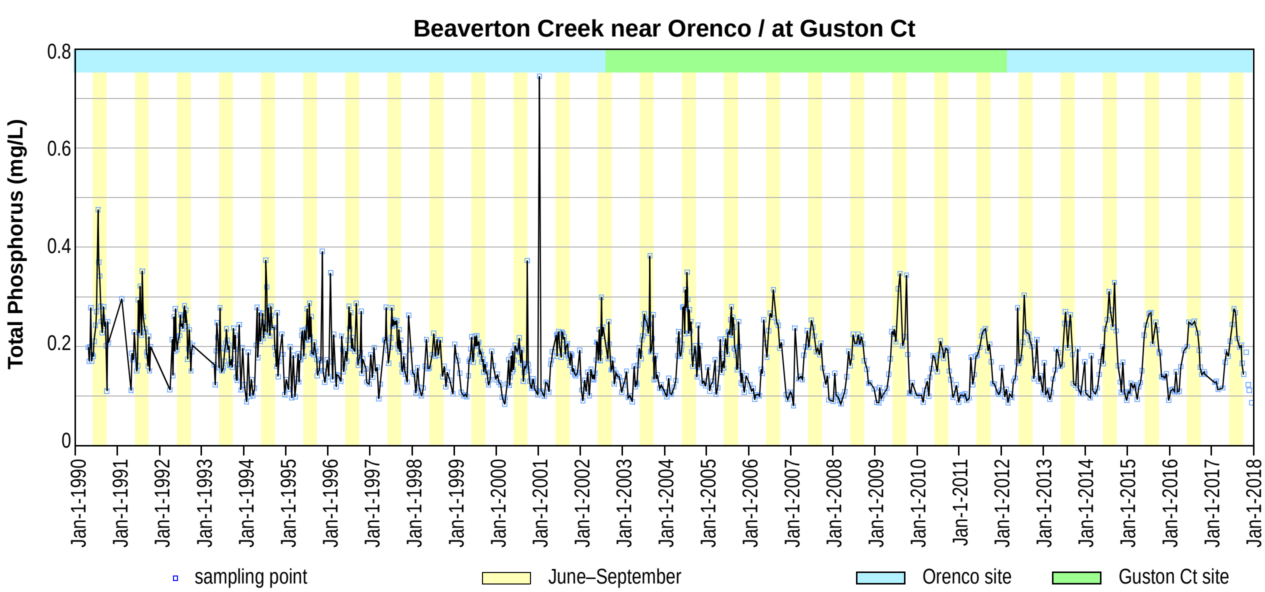
Key
total P in mg/L
$TP \le 0.12$
$0.12 < TP \le 0.17$
$0.17 < TP \le 0.23$
$0.23 < TP \le 0.25$
$TP > 0.25$

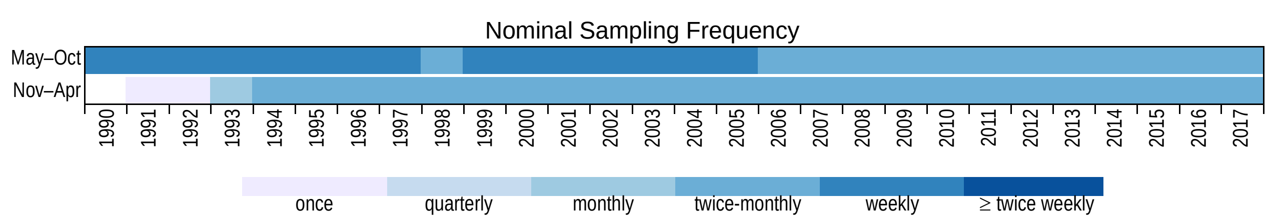


Data source: Clean Water Services

Discussion

- The period of record is May 1990 through present. Sampling frequency was usually every week or every 2 weeks.
- The site location changed twice. The distance between the sites is very small. The data show no obvious difference between sites with regard to totP.
- Total phosphorus concentrations (totP) show a distinct seasonal baseline pattern that is superimposed with concentrations spikes.
- The baseline pattern generally is lowest around mid-winter to early-spring, increases steadily through the summer, reaches a maximum near September, and then begins to decrease through late fall and into winter. This pattern is consistent with soluble reactive phosphorus (SRP) entering the creek from groundwater. The difference between the pattern's minimum and maximum is on the order of 0.1–0.15 mg/L.
- Spikes in totP concentration occurred from September through March with most in the fall. Concentration spikes were probably due to an increase in the particulate form of phosphorus that occurred during or shortly after a storm.
- Because the high flows that trigger concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency. Data from the period with weekly sampling captured some spikes, while data from the twice-a-month sampling (since 2006) captured almost none.
- Concentrations of totP in July–September do not show a trend.





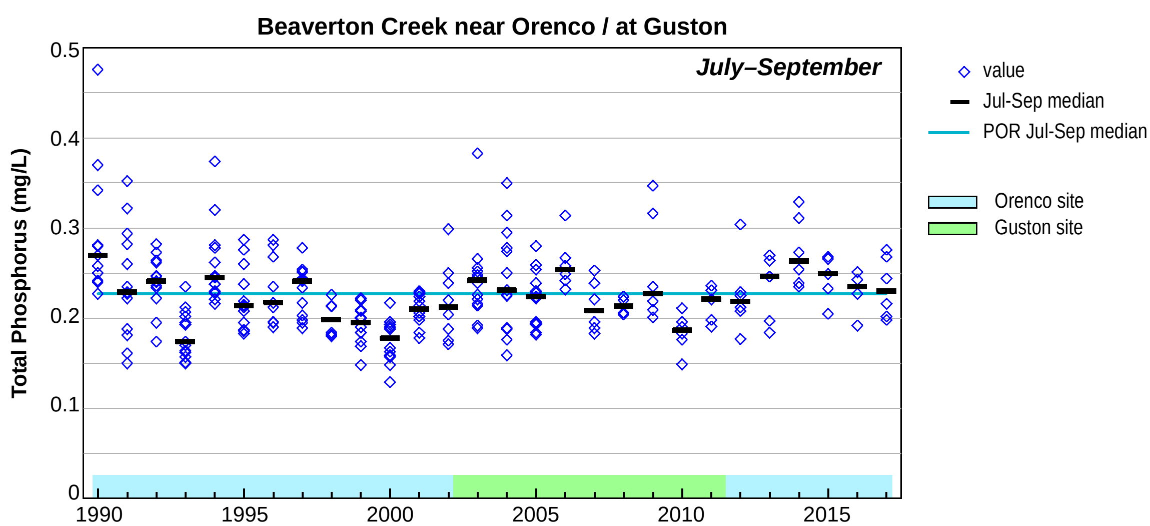
BEAVERTON CREEK NEAR ORENCO / AT GUSTON
Total Phosphorus

Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	24					0.199	0.182	0.270	0.312	0.249	0.207		
1991	24		0.296			0.173	0.180	0.227	0.271	0.209	0.180		
1992	26				0.112	0.202	0.216	0.244	0.262	0.215	0.196		
1993	31					0.177	0.197	0.154	0.207	0.169	0.194	0.151	0.178
1994	39	0.160	0.138	0.116	0.108	0.217	0.240	0.238	0.247	0.250	0.191	0.170	0.205
1995	40	0.118	0.156	0.139	0.117	0.174	0.216	0.227	0.219	0.191	0.151	0.173	0.139
1996	35	0.156	0.169	0.171	0.142	0.172	0.172	0.252	0.196	0.239	0.176	0.160	0.142
1997	36	0.154	0.168	0.154	0.109	0.213	0.201	0.229	0.248	0.203	0.162	0.153	0.196
1998	23	0.170	0.125	0.138	0.108	0.187	0.156	0.205	0.182	0.213	0.150	0.133	0.132
1999	37	0.154	0.176	0.127	0.102	0.141	0.180	0.220	0.201	0.172	0.156	0.131	0.176
2000	38	0.139	0.125	0.090	0.110	0.149	0.182	0.193	0.188	0.153	0.163	0.125	0.122
2001	35	0.424	0.108	0.114	0.117	0.172	0.202	0.213	0.223	0.200	0.181	0.149	0.144
2002	34	0.152	0.111	0.129	0.135	0.145	0.209	0.220		0.204	0.155	0.135	0.139
2003	38	0.114	0.141	0.099	0.124	0.126	0.185	0.245	0.244	0.216	0.178	0.139	0.119
2004	39	0.108	0.117	0.105	0.125	0.200	0.205	0.296	0.250	0.182	0.171	0.201	0.128
2005	38	0.139	0.117	0.151	0.110	0.170	0.189	0.211	0.254	0.195	0.180	0.126	0.124
2006	22	0.123	0.113	0.098	0.102	0.154	0.193	0.250	0.286	0.246	0.202		0.098
2007	22	0.105	0.159	0.134	0.137	0.191	0.215	0.246	0.205	0.190	0.182	0.132	0.092
2008	23	0.118	0.100	0.087	0.105	0.165	0.170	0.215	0.215	0.212	0.189	0.140	0.127
2009	23	0.101	0.102	0.098	0.112	0.160	0.227	0.222	0.332	0.210	0.264	0.106	0.127
2010	23	0.101	0.101	0.100	0.115	0.147	0.179	0.166	0.201	0.186	0.171	0.115	0.114
2011	23	0.094	0.101	0.098	0.137	0.133	0.182	0.210	0.234	0.191	0.187	0.125	0.105
2012	24	0.134	0.106	0.095	0.114	0.153	0.222	0.193	0.267	0.219	0.168	0.193	0.135
2013	23	0.137	0.107	0.100	0.143	0.191	0.161	0.258	0.222	0.224	0.123	0.155	0.104
2014	23	0.138	0.096	0.146	0.110	0.156	0.183	0.245	0.292	0.284	0.196	0.118	0.138
2015	23	0.100	0.116	0.120	0.106	0.139	0.233	0.266	0.237	0.241	0.188	0.140	0.141
2016	19	0.101	0.111	0.129	0.135	0.192	0.225	0.243	0.251	0.210	0.151	0.147	
2017	20		0.128	0.113	0.116	0.179	0.195	0.260	0.242	0.200	0.155	0.156	0.099
POR Median		0.134	0.117	0.115	0.114	0.172	0.194	0.228	0.242	0.209	0.179	0.140	0.130

Key
total P in mg/L
TP ≤ 0.12
0.12 < *TP* ≤ 0.12
0.16 < *TP* ≤ 0.23
0.23 < *TP* ≤ 0.25
TP > 0.25

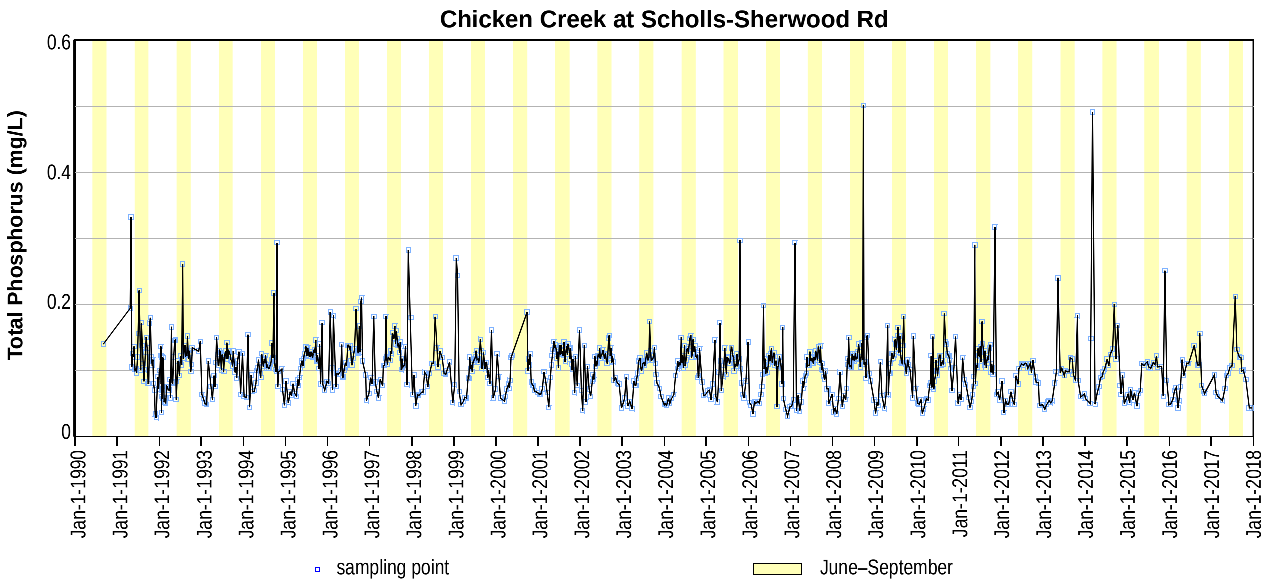


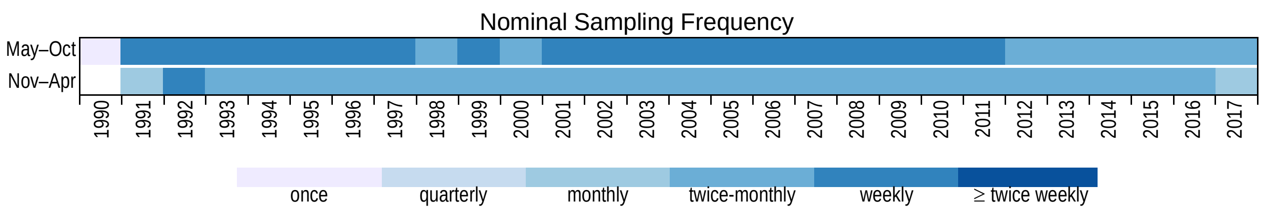
CHICKEN CREEK AT SCHOLLS-SHERWOOD RD
Total Phosphorus

Data source: Clean Water Services

Discussion

- The period of record is August 1990 through present. Sampling frequency was usually every week or every 2 weeks.
- Total phosphorus concentrations (totP) show a distinct seasonal baseline pattern that is superimposed with concentrations spikes.
- The baseline pattern generally is lowest around mid-winter to early-spring, increases steadily through the summer, reaches a maximum near September, and then begins to decrease through late fall and into winter. This pattern is consistent with soluble reactive phosphorus (SRP) entering the creek from groundwater. The difference between the pattern minimum and maximum is on the order of 0.1 mg/L.
- Spikes in totP concentration occurred from September through March with most in the fall. Concentration spikes were probably due to an increase in the particulate form of phosphorus that occurred during or shortly after a storm.
- Because the high flows that trigger concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency. Data from the period with weekly sampling captured some spikes, while data from the twice-a-month sampling (since 2012) captured considerably fewer.
- Concentrations of totP in July–September do not show a trend.





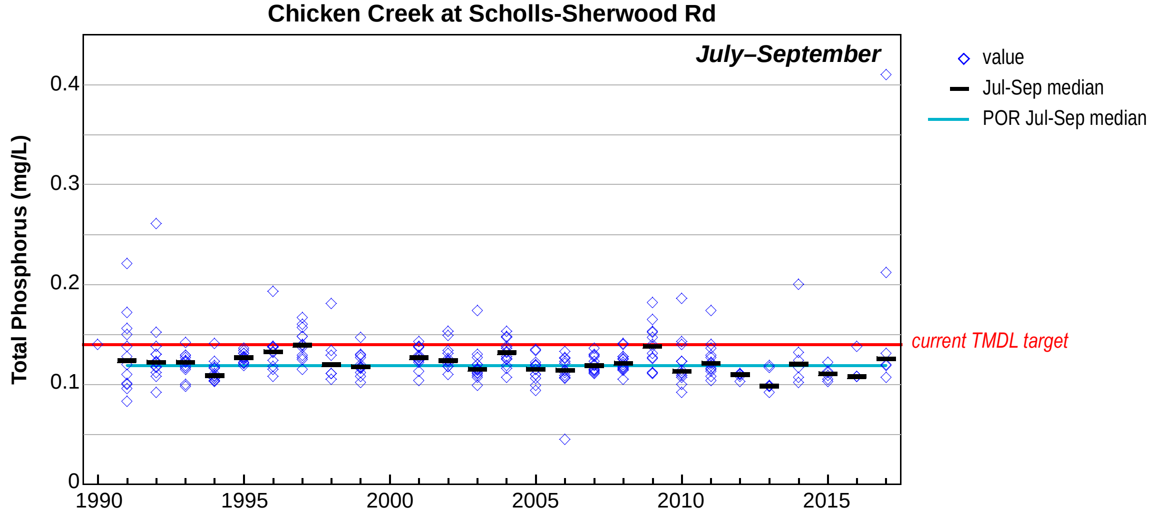
Data source: Clean Water Services

MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	1									0.140			
1991	32					0.160	0.111	0.138	0.124	0.115	0.134	0.112	0.034
1992	50	0.100	0.065	0.067	0.070	0.101	0.099	0.110	0.134	0.123	0.118		0.129
1993	40	0.104	0.054	0.081	0.066	0.102	0.124	0.110	0.122	0.125	0.112	0.101	0.096
1994	39	0.093	0.107	0.069	0.069	0.104	0.106	0.114	0.104	0.118	0.107	0.098	0.087
1995	40	0.066	0.059	0.071	0.063	0.089	0.116	0.133	0.125	0.127	0.115	0.140	0.075
1996	36	0.082	0.104	0.129	0.095	0.095	0.106	0.138	0.117	0.163	0.129	0.162	0.074
1997	37	0.077	0.131	0.075	0.072	0.107	0.120	0.127	0.148	0.139	0.112	0.107	0.180
1998	23	0.122	0.070	0.063	0.067	0.095	0.085	0.111	0.134	0.129	0.107	0.097	0.113
1999	37	0.065	0.257	0.058	0.056	0.088	0.108	0.120	0.117	0.118	0.112	0.089	0.110
2000	21	0.099	0.074	0.053	0.067	0.085					0.113	0.082	0.073
2001	40	0.065	0.068	0.092	0.055	0.122	0.133	0.128	0.127	0.126	0.133	0.101	0.099
2002	39	0.115	0.089	0.079	0.072	0.100	0.117	0.124	0.121	0.135	0.121	0.087	0.080
2003	38	0.047	0.074	0.050	0.063	0.083	0.114	0.109	0.118	0.120	0.120	0.088	0.067
2004	39	0.049	0.053	0.054	0.078	0.109	0.112	0.124	0.136	0.127	0.123	0.092	0.072
2005	39	0.066	0.063	0.113	0.057	0.106	0.110	0.117	0.122	0.108	0.115	0.092	0.071
2006	39	0.097	0.041	0.052	0.052	0.094	0.101	0.119	0.121	0.110	0.110	0.079	0.036
2007	40	0.046	0.174	0.051	0.045	0.085	0.108	0.117	0.120	0.122	0.101	0.086	0.061
2008	38	0.051	0.038	0.077	0.054	0.091	0.107	0.122	0.123	0.120	0.111	0.150	0.084
2009	38	0.045	0.050	0.088	0.053	0.096	0.122	0.144	0.140	0.112	0.107	0.105	0.105
2010	37	0.062	0.052	0.039	0.056	0.079	0.092	0.106	0.112	0.143	0.123	0.086	0.128
2011	39	0.057	0.088	0.082	0.052	0.070	0.107	0.122	0.129	0.116	0.122	0.104	0.065
2012	24	0.070	0.045	0.049	0.061	0.070	0.091	0.109	0.111	0.107	0.106	0.087	0.064
2013	23	0.045	0.050	0.053	0.068	0.169	0.100	0.096	0.098	0.118	0.090	0.134	0.060
2014	23	0.061	0.050	0.320	0.058	0.082	0.095	0.110	0.116	0.166	0.143	0.071	0.072
2015	23	0.061	0.061	0.061	0.056	0.090	0.109	0.109	0.108	0.116	0.105	0.084	0.168
2016	19	0.049	0.063	0.059	0.065	0.104	0.111		0.138	0.108	0.117	0.067	
2017	18		0.080	0.061	0.054	0.083	0.100	0.107	0.172	0.120	0.100	0.086	0.043
POR Median		0.065	0.064	0.065	0.062	0.095	0.108	0.117	0.122	0.120	0.113	0.092	0.074

Key
total P in mg/L
$TP \le 0.07$
$0.07 < TP \le 0.10$
$0.10 < TP \le 0.13$
$0.13 < TP \le 0.15$
$TP > 0.15$

Chicken Creek at Scholls-Sherwood Rd

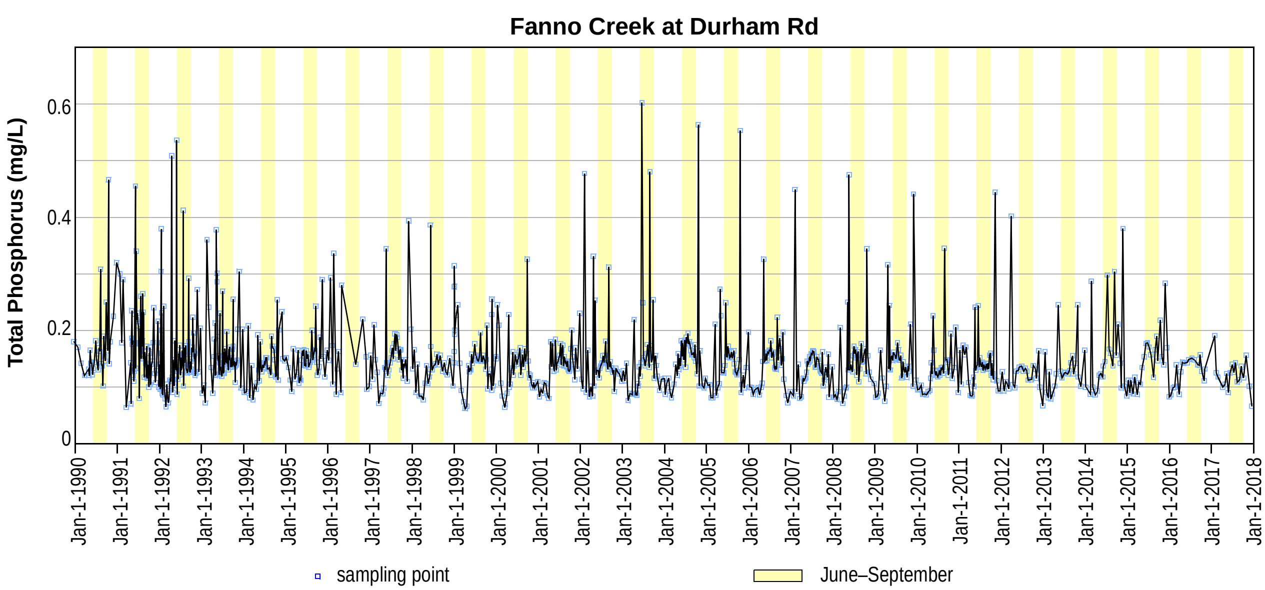


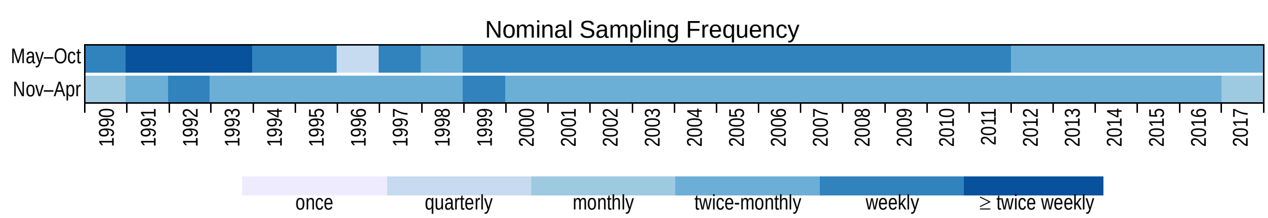
FANNO CREEK AT DURHAM RD
Total Phosphorus

Data source: Clean Water Services

Discussion

- The period of record is January 1990 through present. Sampling frequency varied.
- Total phosphorus concentrations (totP) show a distinct seasonal baseline pattern that is superimposed with concentrations spikes.
- The baseline pattern generally is lowest around mid-winter to early-spring, increases steadily through the summer, reaches a maximum near September, and then begins to decrease through late fall and into winter. This pattern is consistent with soluble reactive phosphorus (SRP) entering the creek from groundwater. The difference between the pattern minimum and maximum is on the order of 0.1 mg/L.
- Unlike other sites, totP concentration spikes at Fanno Creek occurred throughout the year and were not predominantly in fall or winter. Fanno Creek also appears to have more frequent concentration spikes than other tributary sites. The timing and prevalence of totP spikes at this site may be due to the extreme flashy nature of this highly urban stream. Concentration spikes were probably due to an increase in the particulate form of phosphorus that occurred during or shortly after a storm.
- Because the high flows that trigger concentration spikes are shorter-lived than the usual sampling frequency, the graph below likely under-represents spike frequency, especially 2012 and later and in November–April most years. The number of spikes captured by data from the period with twice-weekly sampling is striking. As the sampling density decreased, fewer spikes were captured by the data.
- Concentrations of totP in July–September do not show a trend.





FANNO CREEK AT DURHAM RD

Total Phosphorus

Data source: Clean Water Services

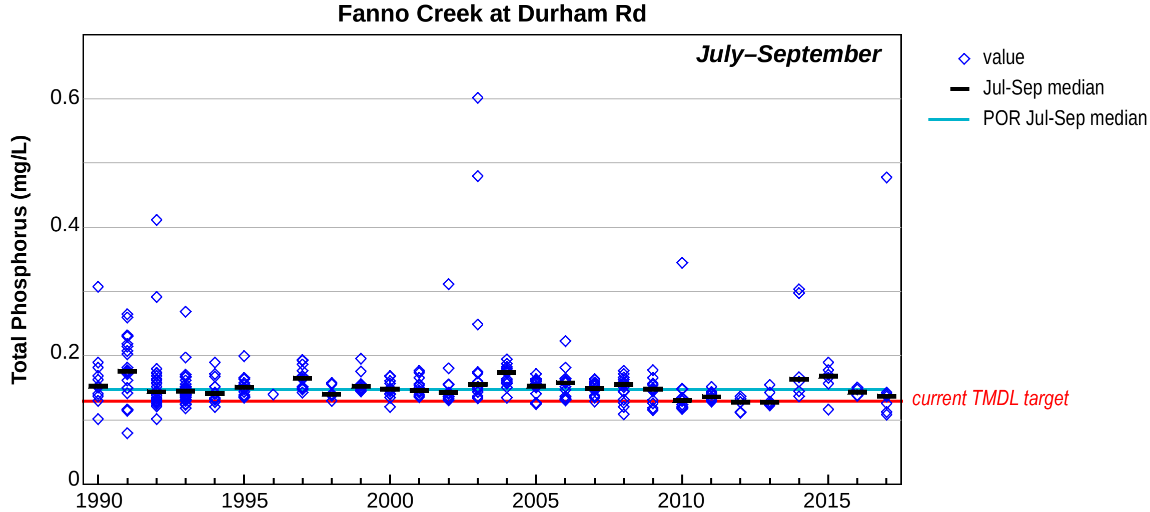
MEDIAN MONTHLY TOTAL PHOSPHORUS CONCENTRATION (mg/L) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	31	0.180	0.170	0.142	0.120	0.137	0.138	0.151	0.166	0.145	0.190	0.161	0.225
1991	57	0.320	0.239	0.290	0.064	0.175	0.133	0.206	0.182	0.130	0.127	0.163	0.124
1992	83	0.200	0.121	0.081	0.110	0.124	0.132	0.145	0.158	0.134	0.145	0.155	0.200
1993	68	0.147	0.088	0.301	0.112	0.199	0.146	0.125	0.152	0.148	0.145	0.142	0.201
1994	39	0.146	0.150	0.110	0.090	0.111	0.137	0.142	0.132	0.170	0.134	0.201	0.192
1995	40	0.149	0.123	0.130	0.120	0.115	0.160	0.154	0.144	0.160	0.136	0.188	0.136
1996	15	0.156	0.173	0.212	0.148	0.185				0.140		0.220	0.125
1997	38	0.129	0.162	0.137	0.080	0.115	0.137	0.158	0.171	0.168	0.140	0.141	0.252
1998	26	0.167	0.128	0.112	0.081	0.123	0.131	0.134	0.141	0.156	0.136	0.124	0.151
1999	46	0.197	0.236	0.118	0.068	0.127	0.142	0.156	0.150	0.148	0.148	0.123	0.131
2000	40	0.154	0.158	0.074	0.080	0.130	0.147	0.148	0.157	0.147	0.146	0.104	0.104
2001	40	0.097	0.093	0.107	0.083	0.143	0.141	0.150	0.160	0.144	0.131	0.140	0.151
2002	39	0.172	0.287	0.128	0.084	0.188	0.129	0.141	0.150	0.139	0.133	0.113	0.125
2003	38	0.120	0.127	0.083	0.153	0.089	0.128	0.152	0.160	0.151	0.153	0.129	0.104
2004	39	0.101	0.112	0.087	0.123	0.141	0.154	0.180	0.176	0.158	0.149	0.164	0.100
2005	39	0.109	0.093	0.146	0.092	0.176	0.132	0.157	0.153	0.134	0.130	0.113	0.116
2006	39	0.149	0.093	0.096	0.093	0.145	0.153	0.165	0.152	0.142	0.166	0.150	0.079
2007	39	0.092	0.267	0.116	0.082	0.116	0.145	0.158	0.153	0.144	0.124	0.126	0.120
2008	38	0.109	0.083	0.149	0.078	0.115	0.137	0.159	0.152	0.145	0.156	0.155	0.114
2009	38	0.094	0.087	0.141	0.088	0.188	0.156	0.156	0.152	0.126	0.131	0.170	0.271
2010	37	0.104	0.100	0.088	0.089	0.119	0.130	0.122	0.131	0.149	0.136	0.155	0.170
2011	39	0.128	0.140	0.164	0.097	0.094	0.139	0.139	0.135	0.137	0.149	0.123	0.102
2012	24	0.110	0.102	0.101	0.253	0.114	0.133	0.133	0.131	0.113	0.126	0.123	0.132
2013	23	0.115	0.086	0.103	0.095	0.184	0.122	0.126	0.126	0.149	0.133	0.182	0.101
2014	23	0.133	0.087	0.194	0.090	0.123	0.128	0.222	0.164	0.221	0.184	0.120	0.241
2015	24	0.098	0.101	0.103	0.098	0.120	0.165	0.175	0.137	0.178	0.182	0.147	0.226
2016	20	0.085	0.100	0.121	0.107	0.143	0.146	0.151	0.148	0.139	0.143	0.122	
2017	19		0.158	0.118	0.100	0.115	0.108	0.133	0.126	0.125	0.122	0.156	0.084
POR Median		0.129	0.122	0.118	0.092	0.125	0.137	0.151	0.152	0.145	0.140	0.144	0.131

Key

total P in mg/L
TP ≤ 0.11
0.11 < *TP* ≤ 0.13
0.13 < *TP* ≤ 0.17
0.17 < *TP* ≤ 0.20
TP > 0.20

Fanno Creek at Durham Rd



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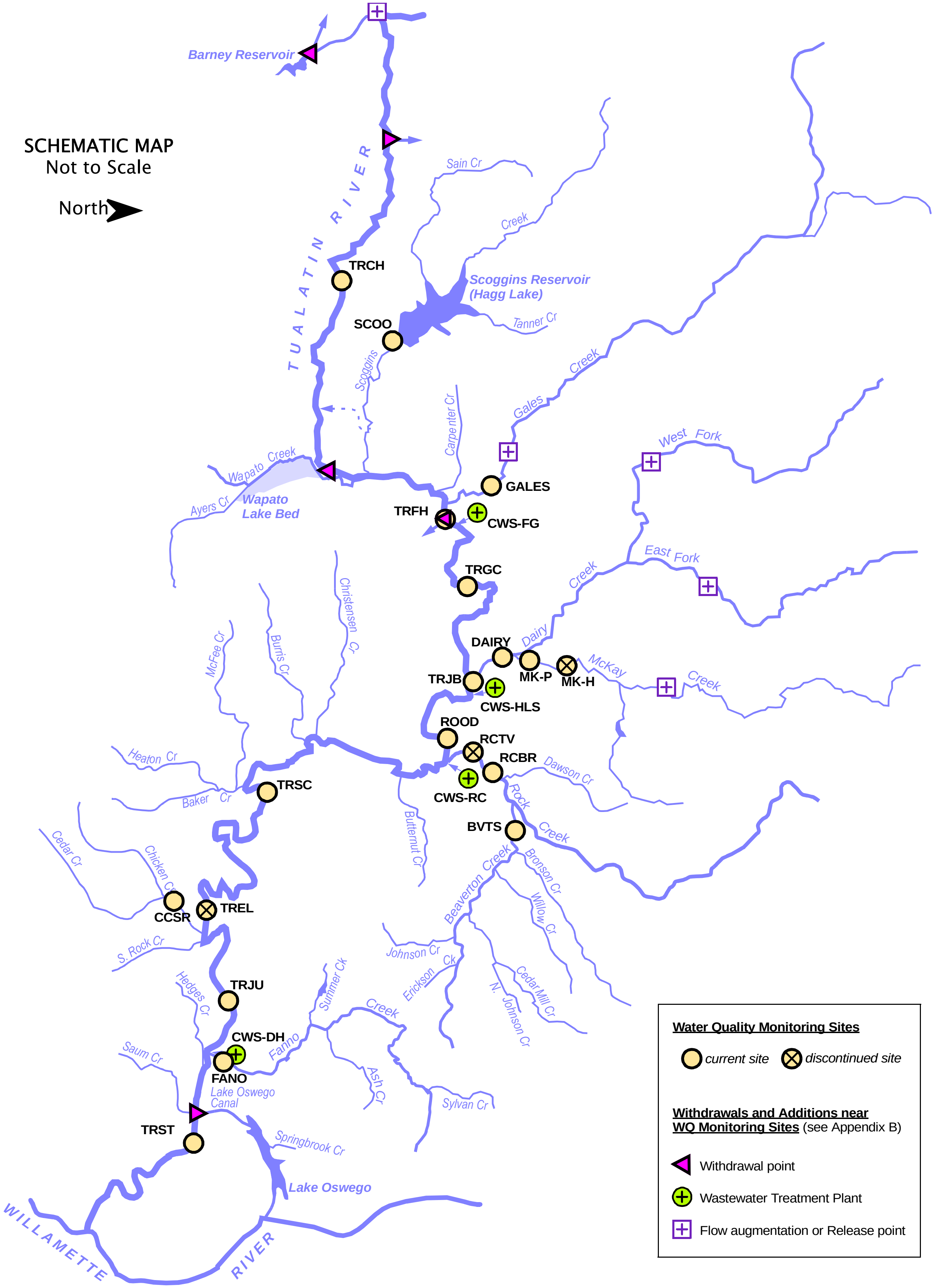
Appendix I

Water Quality Data: Nitrate/Nitrite

MAP OF NITRATE/NITRITE MONITORING SITES



WATER QUALITY SITES — ALPHABETICAL LISTING BY SITE CODE

SITE CODE	SITE NAME	RIVER MILE	PAGE
BVTS	Beaverton Creek near Orenco / at Guston Ct	1.2 / 1.2	I-31
CCSR	Chicken Creek at Scholls-Sherwood Rd (Roy Rogers Rd)	2.3	I-33
DAIRY	Dairy Creek at Hwy 8	2.06	I-25
FANO	Fanno Creek at Durham Rd	1.2	I-35
GALES	Gales Creek at New Hwy 47	2.36	I-23
MK-H & MK-P	McKay Creek at Hornecker Rd / Padgett Rd	2.2 / 1.3	I-27
RCTV & RCBR	Rock Creek at Hwy 8 / Brookwood	1.2 / 2.4	I-29
SCOO	Scoggins Creek below Lake below Hagg Lake	4.8	I-5
TRJB	Tualatin River at Hwy 219	44.4	I-13
TRSC	Tualatin River at Hwy 210 (Scholls Bridge)	26.9	I-17
TRCH	Tualatin River at Cherry Grove (South Rd Bridge)	67.83	I-7
TRGC	Tualatin River at Golf Course Rd	51.5	I-11
TRFH	Tualatin River at Spring Hill Pump Plant / Fern Hill Rd	55.3	I-9
TREL & TRJU	Tualatin River at Elsner Rd / Jurgens Park	16.2 / 10.8	I-19
ROOD	Tualatin River at Rood Bridge Rd	38.4	I-15
TRST	Tualatin River at Stafford	5.38	I-21

Data for this section were obtained from Clean Water Services. For some sites, the exact sampling location changed over the period of record. Analytical methods also may have changed. It is not known if these data are fully comparable with one another.

Discussion

- *All sites except Tualatin River at Hwy 210, Jurgens Park & Stafford*— Nitrate (NO3-N) concentrations at most sites had a characteristic seasonal pattern with some site-specific variation. The lowest values usually occurred in October and lasted only a few weeks. The minimum concentration typically was followed by a sharp increase to the seasonal maximum which occurred in November or a bit later. Concentrations then dropped quickly through winter and were much lower by spring. They continued to decline through summer and early fall, but at a slower rate. This pattern was probably caused by two competing processes: the influx of NO3-N by leaching from soil, and the consumption of NO3-N by plants.

  The primary source of NO3-N to most of these streams is rainfall that leaches NO3-N as it passes through soil. The earliest storms in the fall may produce only enough rain to wet the soil. Once the soil is saturated, the next storm quickly transports NO3-N to the stream causing the sharp late-fall increase in NO3-N concentration. As the winter progresses, NO3-N decreases due to higher streamflow and depleted soil-nitrogen stores. Once the dry season arrives, little NO3-N is transported to the stream. At that time, warm weather and long days encourage the growth of phytoplankton and other aquatic plants that require nitrogen. The NO3-N concentration decreases further and remains low until it is replenished in the next rainy season.

  The maximum concentration often appeared as a short-lived spike corresponding to the first major rain storm of the season. Frequent sampling is needed to characterize these spikes. The sampling frequency of these data often was not sufficient to reliably assess spike magnitude. Very infrequent sampling resulted in data that missed concentration spikes and inconsistent sampling frequency compromised trend analyses.

- *Tualatin River at Hwy 210, Jurgens Park and Stafford*— These sites were strongly influenced by effluent from wastewater treatment facilities (WWTFs). The highest concentrations at these sites were in summer when dilution was at a minimum and nitrification was occurring at the WWTFs. The lowest concentrations were in winter when effluent was more diluted by streamflow and much of the nitrogen in effluent was ammonia rather than nitrate.

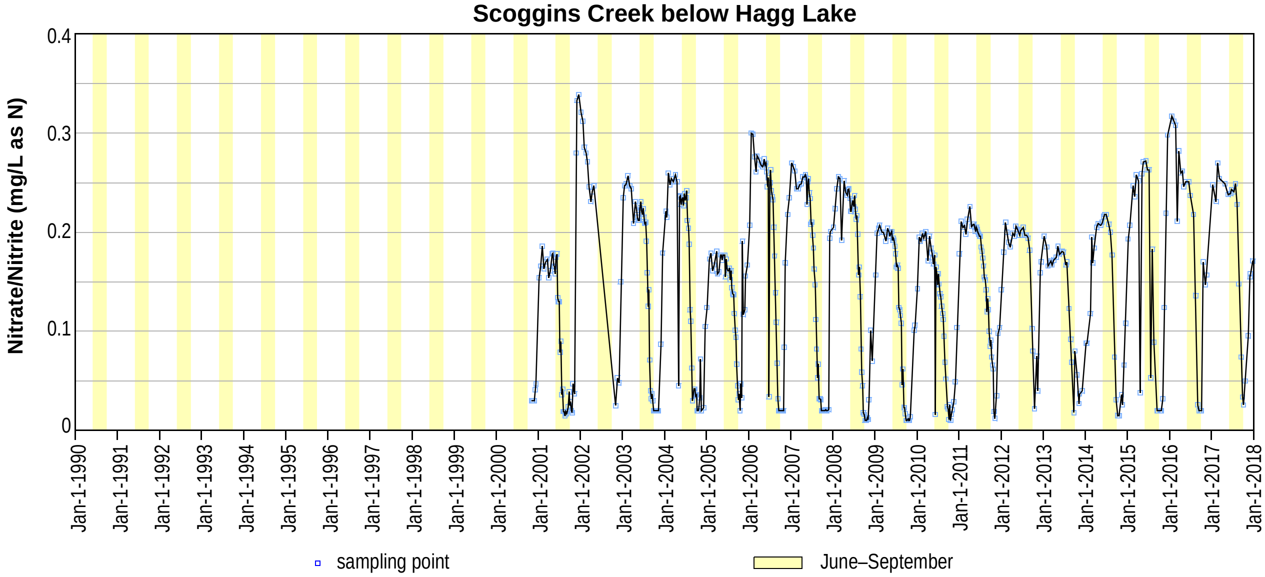
- *Beaverton and Fanno Creeks*—Short-lived spikes in NO3-N concentration were especially common at these two flashy, urban sites, and occurred throughout the year, not just in the rainy season.

- *Chicken Creek*—The seasonal pattern at this site was slightly different in that NO3-N concentrations increased slightly in late summer and early fall and is indicative of a low-flow season NO3-N source.

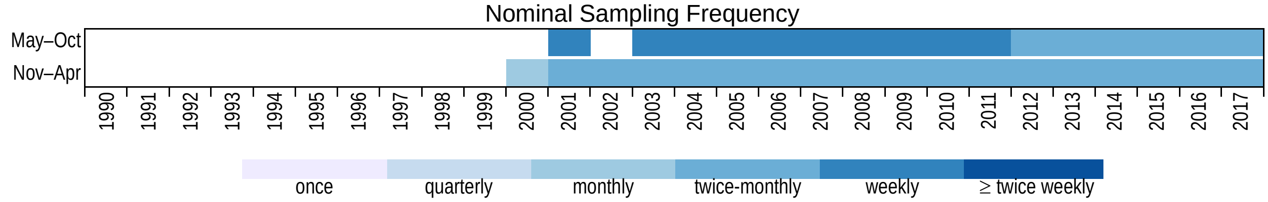
Discussion

- The period of record is November 2000 through present. No data were collected in the summer of 2002. Sampling frequency varied, but mostly was about every two weeks.
- Nitrate (NO3-N) concentrations in Scoggins Creek were seasonal. The lowest values (often near the detection limit of 0.02 mg/L) usually occurred in September and October and lasted for only a few weeks. Concentrations increased sharply through late fall and early winter, and usually reached a maximum in January or February. NO3-N gradually decreased through spring and early summer and then precipitously dropped, usually in late July or early August. This pattern was probably caused by the balance between the influx of NO3-N by leaching from soil and the consumption of NO3-N by phytoplankton and aquatic plants. The same general pattern occurred at the other Tualatin basin sites. At this site, however, the high concentration period was much longer—about 6 months at Scoggins Creek compared to less than a month at other sites. The prolonged maximum was because water that contains NO3-N enters the lake during winter and remains there through the summer.
- The concentration during the annual maximum period was usually 0.2–0.25 mg/L and never exceeded 0.3 mg/L.
- No trends are evident.

Scoggins Creek below Hagg Lake



Nominal Sampling Frequency



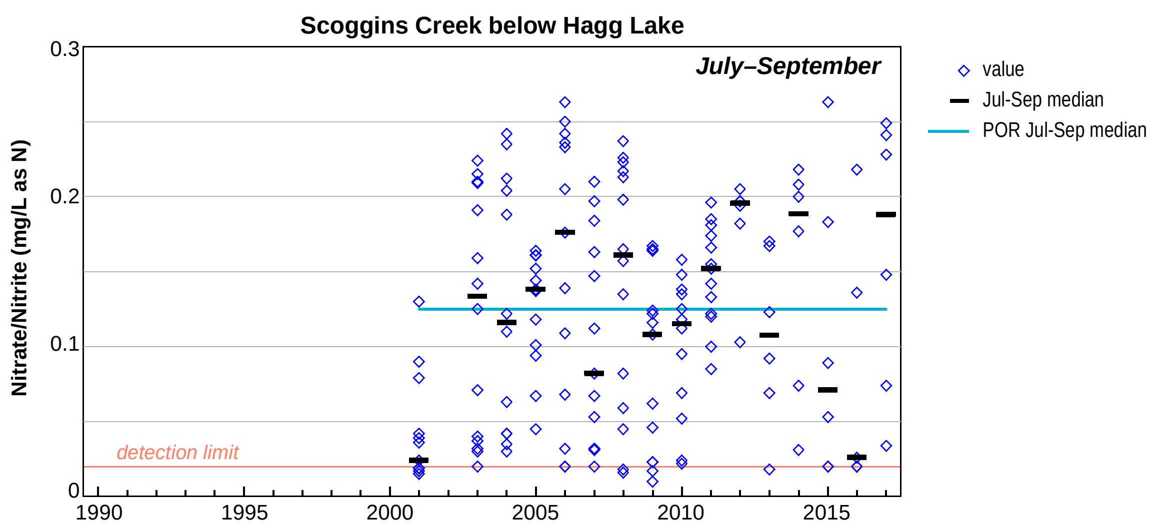
SCOGGINS CREEK BELOW HAGG LAKE
Nitrate/Nitrite

Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

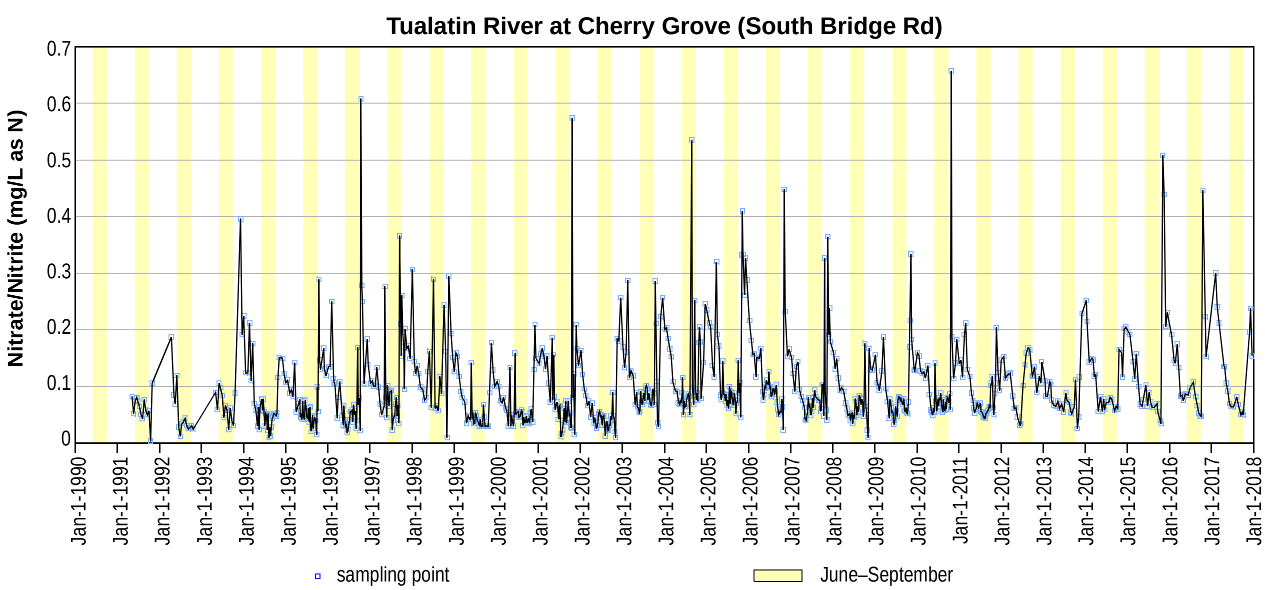
	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	5											0.03	0.04
2001	39	0.16	0.17	0.17	0.16	0.17	0.15	0.08	0.02	0.02	0.03	0.16	0.34
2002	13	0.32	0.28	0.26	0.24							0.04	0.10
2003	38	0.24	0.25	0.25	0.22	0.21	0.22	0.21	0.13	0.03	0.02	0.02	0.13
2004	38	0.22	0.25	0.25	0.25	0.23	0.23	0.22	0.11	0.04	0.02	0.03	0.06
2005	39	0.15	0.17	0.17	0.16	0.18	0.17	0.16	0.14	0.08	0.03	0.12	0.16
2006	39	0.25	0.29	0.27	0.27	0.27	0.25	0.25	0.18	0.03	0.02	0.08	0.23
2007	40	0.27	0.25	0.25	0.25	0.26	0.24	0.19	0.08	0.03	0.02	0.02	0.20
2008	38	0.21	0.25	0.22	0.25	0.24	0.23	0.22	0.16	0.05	0.01	0.03	0.07
2009	37	0.18	0.21	0.20	0.20	0.20	0.19	0.16	0.11	0.02	0.01	0.01	0.10
2010	37	0.17	0.20	0.20	0.18	0.18	0.16	0.14	0.11	0.02	0.01	0.03	0.08
2011	39	0.19	0.21	0.21	0.22	0.21	0.20	0.18	0.15	0.11	0.07	0.02	0.10
2012	24	0.16	0.21	0.19	0.20	0.20	0.20	0.20	0.20	0.14	0.05	0.06	0.16
2013	23	0.19	0.17	0.17	0.17	0.18	0.18	0.17	0.11	0.04	0.07	0.03	0.04
2014	24	0.09	0.16	0.18	0.21	0.21	0.22	0.21	0.19	0.05	0.02	0.03	0.09
2015	23	0.20	0.25	0.25	0.15	0.27	0.27	0.16	0.14	0.02	0.02	0.08	0.26
2016	20	0.32	0.31	0.25	0.26	0.25	0.24	0.22	0.14	0.02	0.10	0.15	
2017	20	0.25	0.25	0.25	0.25	0.24	0.24	0.25	0.19	0.05	0.04	0.13	0.16
POR Median		0.20	0.25	0.22	0.22	0.21	0.22	0.20	0.14	0.04	0.02	0.03	0.10

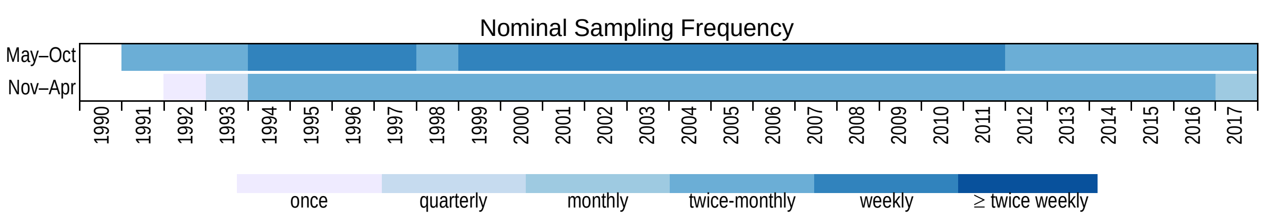
Key
nitrate in mg/L as N
$N \leq 0.03$
$0.03 < N \leq 0.16$
$0.16 < N \leq 0.22$
$0.22 < N \leq 0.25$
$N > 0.25$



Discussion

- The period of record is May 1991 through present. Sampling frequency varied, but mostly was about every two weeks.
- Nitrate (NO3-N) concentrations in the Tualatin River at Cherry Grove showed a seasonal pattern that was superimposed with short-lived higher concentration spikes.
- The lowest values (0.01–0.05 mg/L) usually occurred in October and lasted only a few weeks at most. The minimum concentration typically was followed by a sharp increase to the seasonal maximum which often occurred in November. After the maximum, concentrations dropped quickly through winter, although with considerable fluctuation. By spring, concentrations were below 0.1 mg/L and continued to slowly decline through the summer. This pattern was probably caused by the balance between the influx of NO3-N by leaching from soil and the consumption of NO3-N by phytoplankton and aquatic plants. The same general pattern occurred at the other Tualatin basin sites. At this site, however, the high concentration spikes at the beginning of the rainy season were pronounced, probably indicating the importance of the first major rain storm of the season.
- About half the years had a very sharp NO3-N concentration spike immediately after the seasonal minimum. In some years, the spike concentration exceeded 0.5 mg/L. Because spikes are shorter-lived than the usual sampling frequency for this site, the graph below likely under-estimates the concentration maximum and may have missed the spikes in 2012–2015.
- The years before 2003 appear to have lower July–September NO3-N concentrations than the years after 2003, but the difference is small and not statistically significant. More years will be needed to determine if a trend exists.





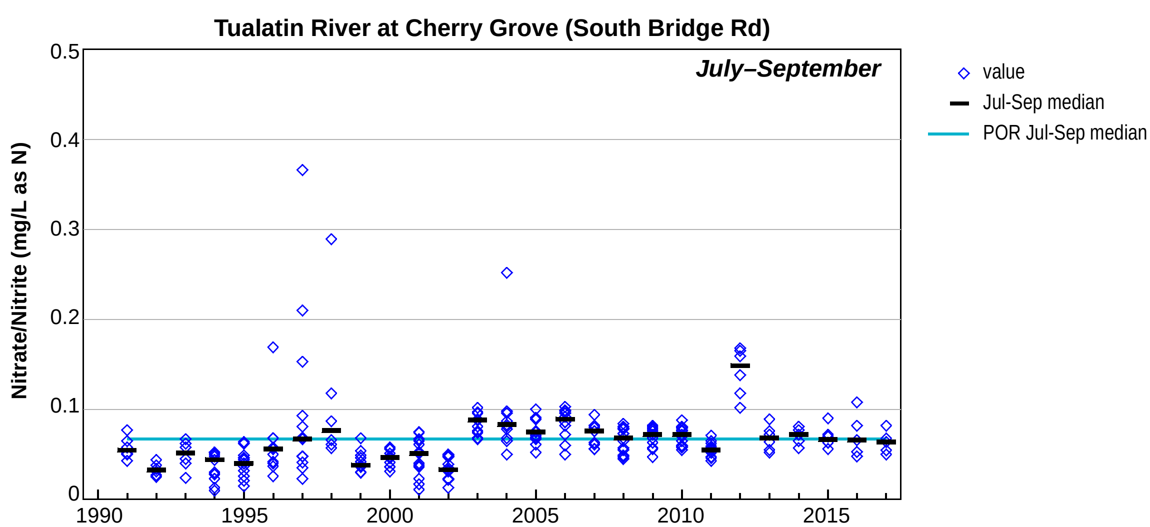
TUALATIN RIVER AT CHERRY GROVE (South Bridge Rd)
Nitrate/Nitrite

Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

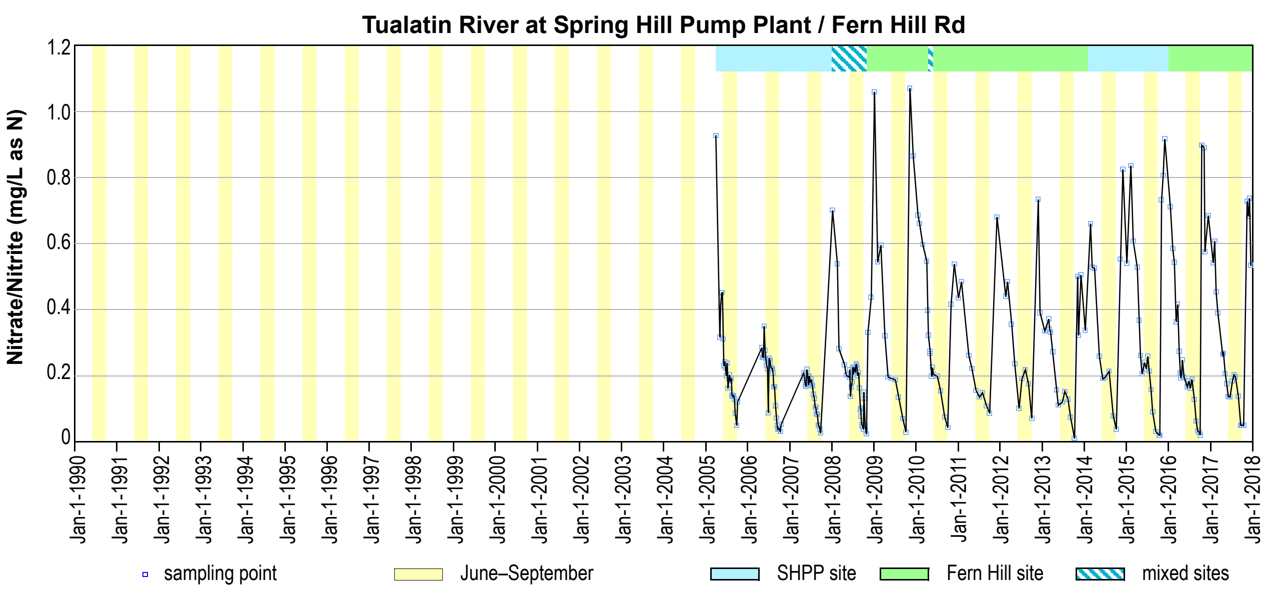
	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	14					0.07	0.08	0.06	0.06	0.05	0.06		
1992	14				0.19	0.08	0.03	0.04	0.04	0.03	0.03		
1993	15					0.07	0.10	0.06	0.04	0.05	0.06		0.29
1994	36	0.17	0.17	0.14	0.06	0.05	0.07	0.04	0.03	0.05	0.05	0.15	0.14
1995	38	0.11	0.09	0.11	0.06	0.05	0.05	0.05	0.03	0.04	0.13	0.17	0.13
1996	37	0.14	0.11	0.07	0.10	0.05	0.03	0.06	0.05	0.05	0.25	0.11	0.16
1997	37	0.11	0.10	0.10	0.05	0.07	0.08	0.04	0.06	0.15	0.18	0.18	0.16
1998	24	0.23	0.13	0.11	0.09	0.10	0.11	0.18	0.06	0.10	0.20	0.15	0.17
1999	37	0.14	0.14	0.09	0.05	0.05	0.04	0.05	0.03	0.04	0.03	0.13	0.11
2000	38	0.10	0.07	0.07	0.04	0.04	0.05	0.05	0.05	0.04	0.04	0.08	0.18
2001	40	0.15	0.16	0.14	0.09	0.08	0.07	0.02	0.05	0.05	0.05	0.12	0.15
2002	39	0.14	0.09	0.07	0.05	0.03	0.05	0.05	0.03	0.03	0.04	0.10	0.22
2003	38	0.15	0.22	0.12	0.09	0.06	0.07	0.09	0.09	0.08	0.16	0.03	0.24
2004	37	0.20	0.18	0.13	0.09	0.07	0.07	0.08	0.09	0.10	0.08	0.18	0.19
2005	40	0.22	0.17	0.22	0.18	0.09	0.08	0.07	0.09	0.07	0.11	0.33	0.31
2006	38	0.20	0.16	0.13	0.16	0.09	0.11	0.10	0.09	0.06	0.06	0.34	0.16
2007	38	0.14	0.11	0.12	0.08	0.05	0.07	0.08	0.08	0.07	0.10	0.13	0.21
2008	37	0.15	0.13	0.10	0.08	0.05	0.05	0.06	0.07	0.07	0.06	0.13	0.13
2009	39	0.13	0.10	0.16	0.08	0.06	0.05	0.07	0.08	0.06	0.06	0.22	0.13
2010	38	0.16	0.12	0.12	0.11	0.06	0.07	0.08	0.06	0.08	0.08	0.14	0.18
2011	40	0.14	0.15	0.17	0.10	0.06	0.07	0.06	0.05	0.06	0.10	0.11	0.11
2012	24	0.15	0.12	0.12	0.07	0.05	0.03	0.12	0.16	0.14	0.13	0.10	0.13
2013	23	0.10	0.10	0.09	0.07	0.07	0.06	0.08	0.06	0.06	0.07	0.08	0.23
2014	24	0.23	0.15	0.13	0.09	0.07	0.07	0.07	0.08	0.06	0.11	0.14	0.20
2015	23	0.19	0.14	0.14	0.08	0.07	0.08	0.08	0.06	0.06	0.04	0.47	0.22
2016	20	0.19	0.14	0.15	0.08	0.08	0.09	0.11	0.07	0.05	0.25	0.19	
2017	18		0.27	0.21	0.14	0.10	0.07	0.06	0.07	0.05	0.05	0.20	0.20
POR Median		0.15	0.13	0.12	0.08	0.07	0.07	0.06	0.06	0.06	0.07	0.14	0.18

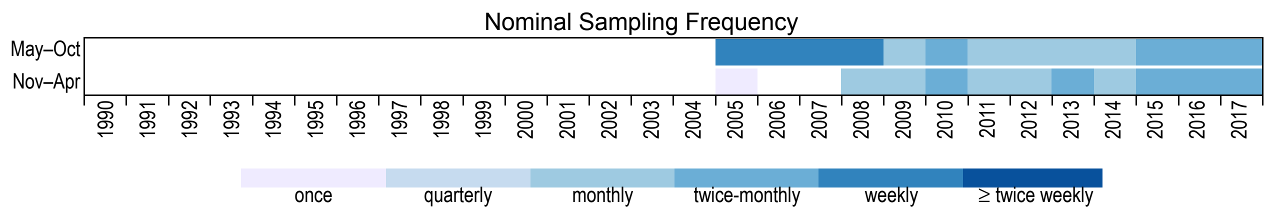
Key
nitrate in mg/L as N
$N \leq 0.05$
$0.05 < N \leq 0.07$
$0.07 < N \leq 0.15$
$0.15 < N \leq 0.20$
$N > 0.20$



Discussion

- The period of record is March 2005 through present. Sampling frequency was variable and except for May–October 2005–2008, no more than twice a month and often less.
- The sampling location switched between two sites, sometimes as often as every other sample. These two sites are close to each other, so the site changes may not be important.
- Nitrate (NO3-N) concentrations in the Tualatin River at Fern Hill were seasonal. The lowest values (0.01–0.05 mg/L) usually occurred in October and for only one sample in the year. Concentrations at the next sampling were sharply higher and almost always the seasonal maximum. After the maximum, concentrations dropped quickly through winter and spring. By June, concentrations were below 0.2 mg/L and continued to decline through the summer. This pattern was probably caused by the balance between the influx of NO3-N by leaching from soil and the consumption of NO3-N by phytoplankton and aquatic plants. The same general pattern occurred at the other Tualatin basin sites.
- No spikes in the NO3-N concentration were observed at this site. That could be because they didn't exist or because the sampling frequency was not sufficient to capture them.
- No trends are evident.





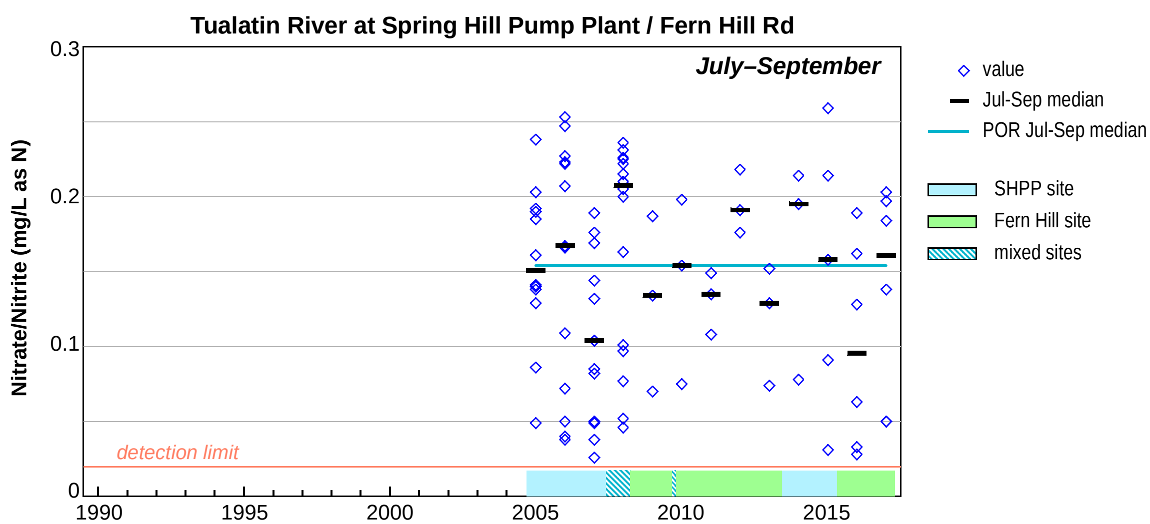
TUALATIN RIVER AT SPRING HILL PUMP PLANT / FERN HILL RD
Nitrate/Nitrite

Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	23			0.93		0.43	0.23	0.20	0.14	0.09	0.12		
2006	24					0.27	0.23	0.24	0.17	0.05	0.04		
2007	22					0.19	0.19	0.17	0.10	0.04			
2008	34	0.70	0.54	0.28	0.23	0.20	0.18	0.22	0.21	0.08	0.04	0.33	0.44
2009	12	1.06	0.54	0.60	0.32	0.20	0.19	0.19	0.13	0.07	0.03	1.07	0.87
2010	17	0.69	0.66	0.60	0.40	0.25	0.20	0.20	0.15	0.08	0.04	0.48	
2011	10	0.44	0.49		0.26	0.22	0.16	0.14	0.15	0.11	0.09		0.68
2012	11		0.44	0.49	0.36	0.24	0.10	0.19	0.22	0.18	0.07	0.73	0.39
2013	15	0.34	0.37	0.34	0.27	0.13	0.12	0.15	0.13	0.07	0.01	0.41	0.51
2014	12	0.34	0.66	0.53	0.53	0.26	0.19	0.20	0.21	0.08	0.04	0.55	0.83
2015	19	0.54	0.84	0.61	0.45	0.23	0.23	0.24	0.12	0.03	0.02	0.77	0.92
2016	24	0.71	0.56	0.39	0.21	0.22	0.18	0.18	0.10	0.03	0.46	0.73	0.69
2017	22	0.54	0.53	0.39	0.27	0.19	0.14	0.19	0.17	0.05	0.05	0.71	0.64
POR Median		0.54	0.54	0.51	0.30	0.22	0.19	0.19	0.15	0.07	0.04	0.71	0.68

Key
nitrate in mg/L as N
$N \le 0.1$
$0.1 < N \le 0.2$
$0.2 < N \le 0.4$
$0.4 < N \le 0.6$
$N > 0.6$



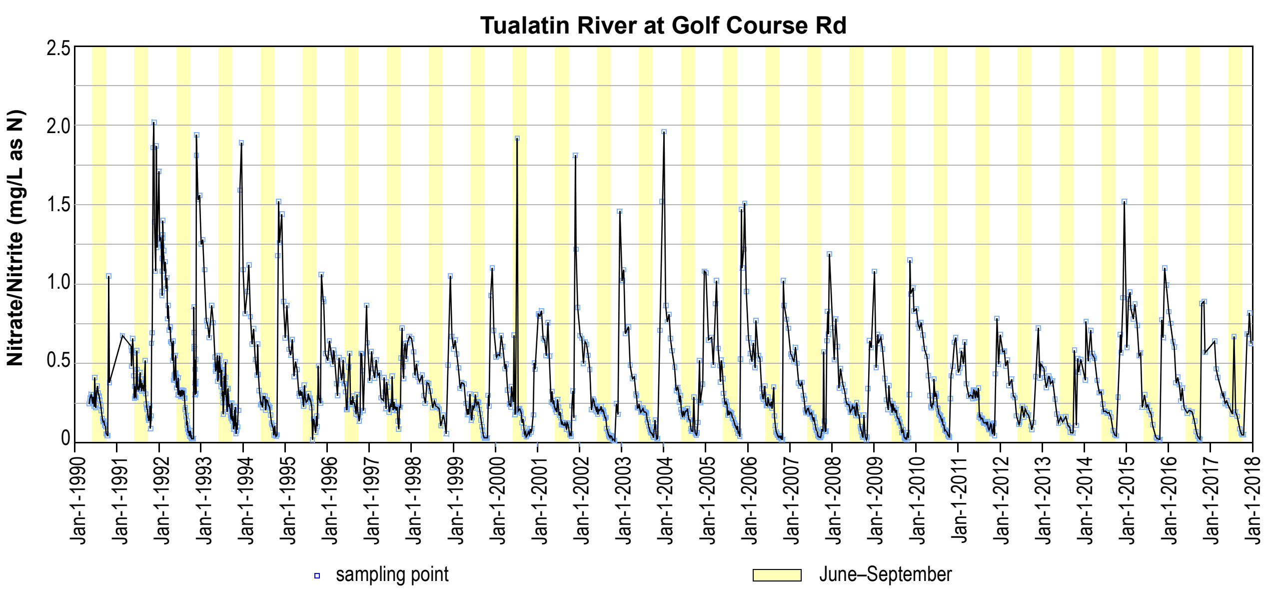
TUALATIN RIVER AT GOLF COURSE RD

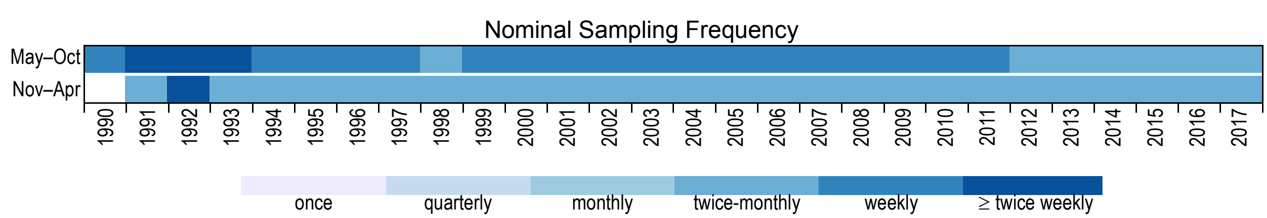
Nitrate/Nitrite

Data source: Clean Water Services

Discussion

- The period of record is May 1990 through present. Sampling frequency was quite varied, with dense sampling for a couple of years and less frequent sampling at other times.
- Nitrate (NO3-N) concentrations in the Tualatin River at Golf Course Rd were seasonal. The lowest values (0.01–0.05 mg/L) usually occurred in October and lasted only a few weeks at most. The minimum concentration typically was followed by a sharp increase to the seasonal maximum which often occurred in November. After the maximum, concentrations dropped quickly through winter, although with considerable fluctuation. By spring, concentrations were below 0.3 mg/L and continued to slowly decline through the summer. This pattern was probably caused by the balance between the influx of NO3-N by leaching from soil and the consumption of NO3-N by phytoplankton and aquatic plants. The same general pattern occurred at the other Tualatin basin sites.
- A high concentration spike occurred in July 2000 that did not appear at other sites.
- The seasonal maximum concentration was generally pronounced and occurred at the beginning of the rainy season which indicates the importance of the first major rainstorm of the season. Because the maximum concentration spikes are shorter-lived than the usual sampling frequency for this site, the graph below likely under-represents spike frequency and magnitude.
- July–September NO3-N concentrations show a statistically significant decreasing trend from 1990 to 2001. After 2001, the concentrations were relatively constant. This could be related to increased flow augmentation in July that began in the early 2000s.





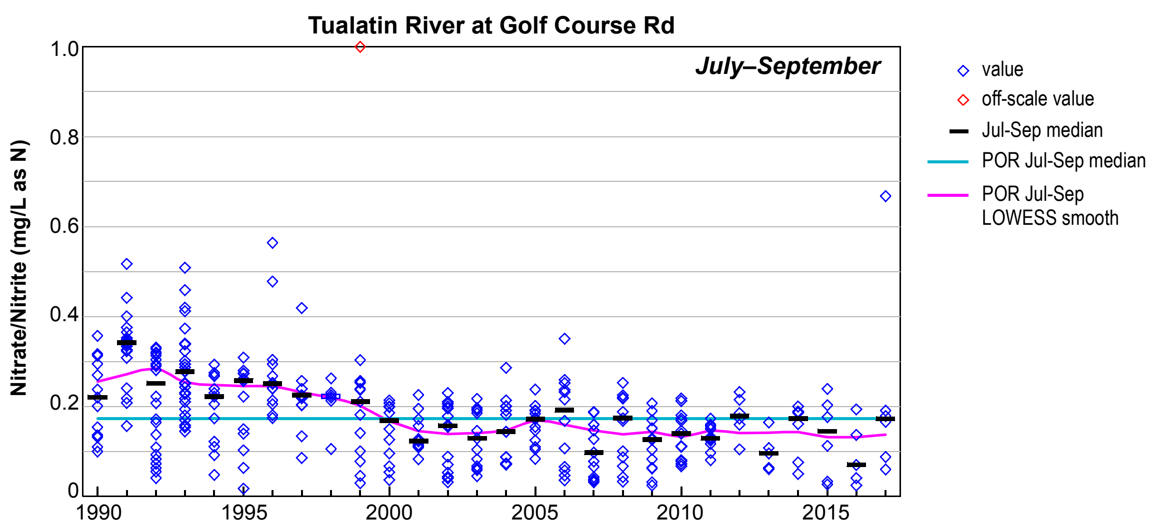
TUALATIN RIVER AT GOLF COURSE RD
Nitrate/Nitrite

Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990						0.28	0.27	0.32	0.24	0.12	0.06		
1991	47		0.67			0.57	0.35	0.35	0.34	0.23	0.17	1.63	1.23
1992	88	1.26	1.23	0.92	0.64	0.44	0.36	0.32	0.22	0.07	0.03	0.52	1.55
1993	68	1.27	0.93	0.70	0.81	0.49	0.46	0.30	0.29	0.21	0.15	0.09	1.74
1994	38	0.95	1.04	0.71	0.62	0.43	0.24	0.27	0.23	0.10	0.05	1.39	1.17
1995	40	0.76	0.57	0.53	0.49	0.31	0.28	0.27	0.24	0.12	0.27	0.91	0.73
1996	38	0.58	0.57	0.47	0.42	0.41	0.26	0.37	0.25	0.21	0.38	0.33	0.75
1997	38	0.48	0.44	0.44	0.28	0.29	0.31	0.23	0.22	0.22	0.51	0.60	0.65
1998	24	0.61	0.46	0.40	0.36	0.31	0.35	0.24	0.23	0.16	0.16	0.27	0.86
1999	38	0.62	0.51	0.36	0.31	0.19	0.19	0.25	0.21	0.06	0.03	0.30	0.90
2000	39	0.55	0.61	0.53	0.41	0.25	0.22	0.21	0.17	0.06	0.06	0.09	0.48
2001	40	0.80	0.74	0.60	0.55	0.26	0.21	0.17	0.12	0.11	0.06	0.33	1.04
2002	39	0.67	0.57	0.59	0.27	0.23	0.21	0.21	0.16	0.04	0.02	0.13	0.82
2003	38	1.06	0.70	0.61	0.41	0.26	0.21	0.20	0.14	0.06	0.08	0.02	1.11
2004	39	1.41	0.79	0.62	0.40	0.31	0.19	0.20	0.14	0.08	0.06	0.26	0.72
2005	39	0.86	0.66	0.68	0.81	0.49	0.26	0.19	0.18	0.11	0.07	1.22	1.23
2006	38	0.61	0.57	0.62	0.54	0.31	0.25	0.24	0.17	0.05	0.03	0.94	0.75
2007	41	0.55	0.56	0.44	0.36	0.20	0.21	0.16	0.09	0.04	0.09	0.36	0.94
2008	37	0.62	0.69	0.41	0.35	0.24	0.21	0.20	0.20	0.07	0.05	0.34	0.60
2009	39	0.78	0.65	0.63	0.34	0.25	0.22	0.18	0.13	0.05	0.03	0.94	0.90
2010	38	0.80	0.74	0.64	0.48	0.24	0.29	0.20	0.14	0.08	0.05	0.48	0.66
2011	40	0.46	0.54	0.50	0.30	0.30	0.32	0.16	0.13	0.11	0.09	0.12	0.64
2012	24	0.63	0.53	0.44	0.35	0.23	0.12	0.20	0.20	0.14	0.10	0.57	0.45
2013	22	0.44	0.38	0.39	0.33	0.15	0.15	0.17	0.10	0.06	0.35	0.49	0.53
2014	24	0.58	0.61	0.55	0.46	0.32	0.22	0.19	0.18	0.06	0.16	0.62	1.22
2015	24	0.75	0.90	0.83	0.64	0.39	0.26	0.22	0.15	0.03	0.02	0.72	1.05
2016	21	0.79	0.62	0.40	0.31	0.28	0.20	0.19	0.10	0.03	0.45	0.73	
2017	20		0.55	0.41	0.30	0.26	0.23	0.42	0.18	0.07	0.05	0.68	0.72
POR Median		0.67	0.61	0.54	0.41	0.29	0.24	0.21	0.18	0.07	0.07	0.49	0.84

Key
nitrate in mg/L as N
$N \le 0.1$
$0.10 < N \le 0.25$
$0.25 < N \le 0.60$
$0.6 < N \le 0.9$
$N > 0.9$

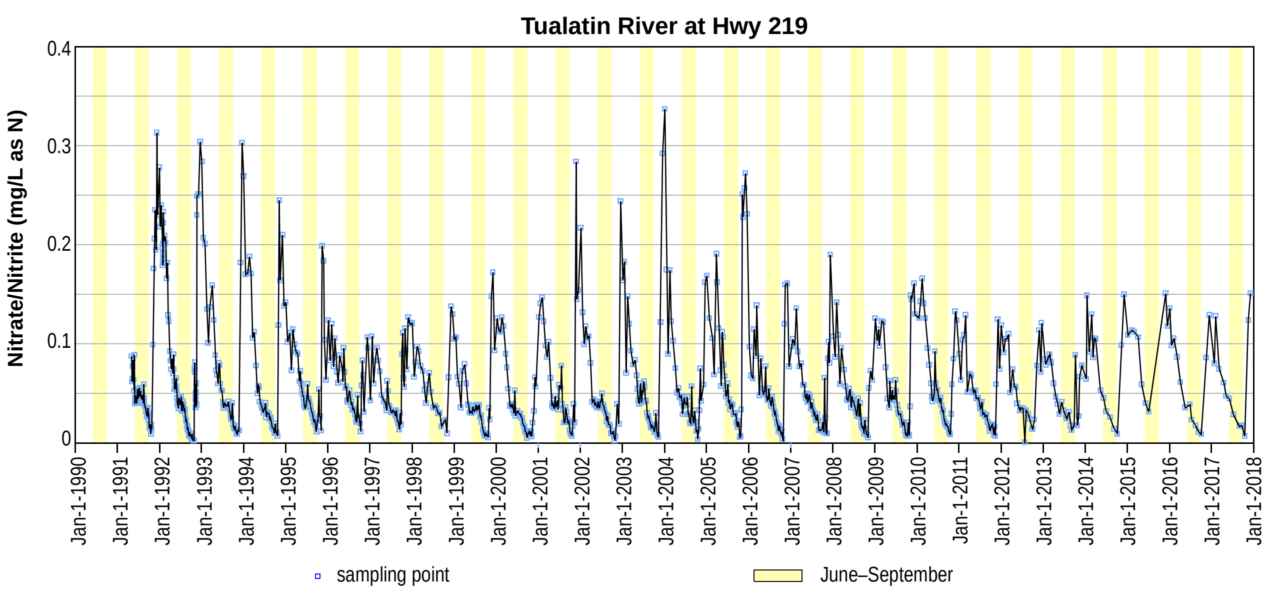


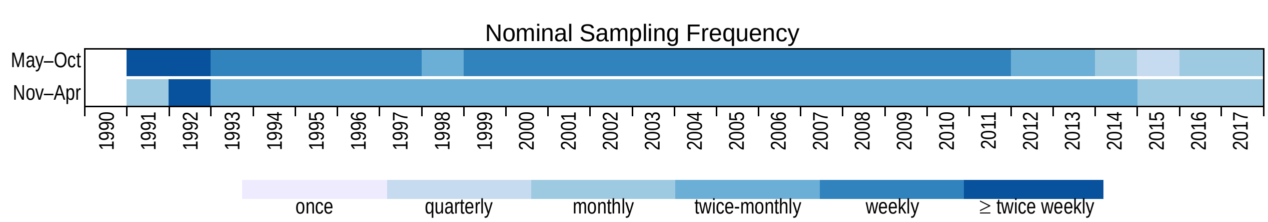
TUALATIN RIVER AT HWY 219
Nitrate/Nitrite

Data source: Clean Water Services

Discussion

- The period of record is May 1991 through present. Sampling frequency was quite variable—from every few days in 1991–1992 to only once a month or less in recent years.
- Nitrate (NO3-N) concentrations in the Tualatin River at Hwy 219 were seasonal. The lowest values (0.05–0.1 mg/L) usually occurred in October and lasted only a few weeks. The minimum concentration typically was followed by a sharp increase to the seasonal maximum which occurred anytime in November–January. After the maximum, concentrations dropped quickly through winter, although with considerable fluctuation. By spring, concentrations were below 0.5 mg/L and continued to slowly decline through the summer. This pattern was probably caused by the balance between the influx of NO3-N by leaching from soil and the consumption of NO3-N by phytoplankton and aquatic plants. The same general pattern occurred at other Tualatin basin sites.
- Many small concentration spikes occurred throughout the year, although fewer occurred in summer. Because these spikes are shorter-lived than the usual sampling frequency for this site, the graph below likely under-represents their frequency. This is especially true for recent years when the sampling frequency is only monthly.
- The graph below suggests that peak NO3-N concentrations may have decreased in recent years. That conclusion is probably incorrect. Because peak NO3-N concentrations do not last long and occur in the November–April coarser sampling period, the chances of sampling exactly on the peak day are remote. If so, the graph below underestimates the magnitude of the high concentrations in general. In recent years, the once-a-month sampling may have missed the peak concentrations altogether.
- No trends are evident for the July–August period.





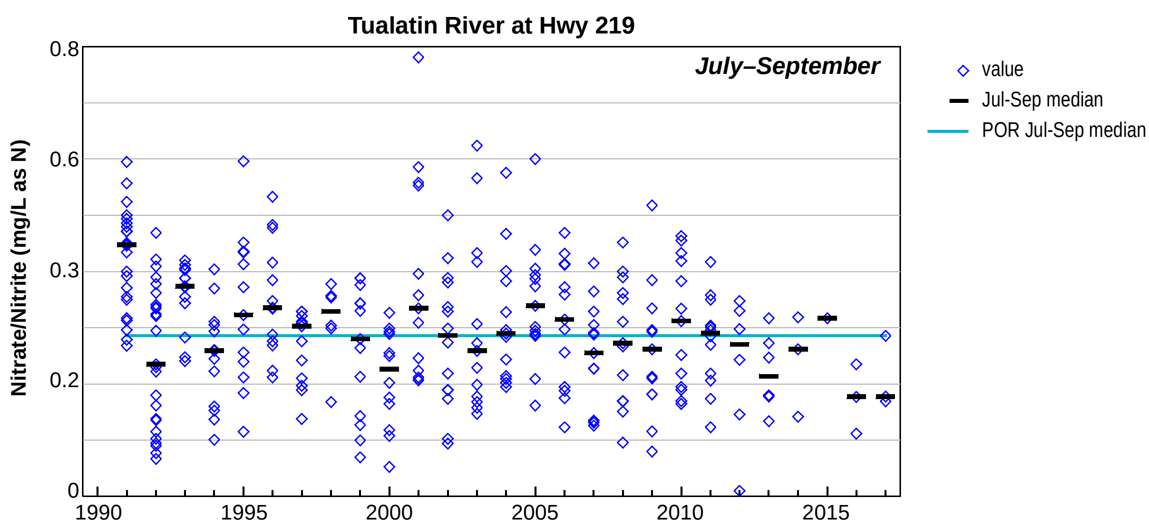
TUALATIN RIVER AT HWY 219
Nitrate/Nitrite

Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	55					0.71	0.44	0.49	0.45	0.31	0.16	1.91	2.30
1992	89	2.18	2.03	1.48	0.83	0.60	0.42	0.38	0.24	0.10	0.04	0.60	2.78
1993	40	2.46	1.68	1.19	1.42	0.71	0.60	0.40	0.37	0.27	0.16	0.11	2.43
1994	38	2.20	1.80	1.39	0.95	0.53	0.34	0.34	0.26	0.15	0.11	2.05	1.74
1995	40	1.22	0.92	1.07	0.91	0.60	0.38	0.44	0.31	0.20	0.27	1.84	0.84
1996	38	1.04	0.86	0.89	0.75	0.73	0.49	0.45	0.34	0.27	0.39	0.50	1.02
1997	38	0.76	0.72	0.83	0.48	0.40	0.45	0.32	0.29	0.20	0.77	0.94	1.24
1998	24	0.94	0.90	0.85	0.63	0.49	0.61	0.37	0.33	0.24	0.23	0.38	1.34
1999	38	1.06	0.63	0.54	0.70	0.35	0.33	0.36	0.28	0.11	0.08	0.36	1.33
2000	39	1.20	1.20	1.04	0.66	0.38	0.30	0.30	0.23	0.11	0.10	0.20	0.62
2001	40	1.34	1.35	0.92	0.66	0.38	0.37	0.56	0.27	0.24	0.10	0.39	1.50
2002	39	1.75	1.09	1.07	0.44	0.38	0.40	0.39	0.29	0.17	0.08	0.23	1.32
2003	38	1.74	1.09	1.07	0.82	0.49	0.51	0.50	0.27	0.17	0.15	0.07	2.07
2004	39	2.56	1.32	1.13	0.64	0.47	0.40	0.39	0.28	0.23	0.12	0.43	1.10
2005	39	1.48	1.06	1.30	1.39	0.79	0.52	0.42	0.37	0.25	0.19	2.51	2.52
2006	39	0.83	0.90	1.13	0.67	0.53	0.47	0.41	0.31	0.18	0.10	1.40	1.19
2007	41	1.01	1.17	0.85	0.59	0.46	0.45	0.33	0.24	0.13	0.22	0.48	1.35
2008	37	0.97	1.26	0.78	0.65	0.44	0.43	0.33	0.38	0.17	0.12	0.56	0.64
2009	39	1.15	1.07	1.23	0.61	0.44	0.48	0.36	0.26	0.15	0.09	1.45	1.46
2010	37	1.26	1.55	1.34	0.87	0.46	0.54	0.44	0.31	0.18	0.11	0.85	1.24
2011	38	0.77	1.07	0.90	0.69	0.53	0.45	0.35	0.29	0.19	0.15	0.17	1.00
2012	24	1.05	1.05	0.80	0.66	0.48	0.34	0.18	0.31	0.19	0.19	0.96	0.96
2013	23	0.82	0.87	0.82	0.54	0.34	0.38	0.26	0.25	0.16	0.53	0.47	0.78
2014	15	1.07	1.11	0.96	1.05	0.53	0.46	0.32	0.26	0.14	0.09	0.99	1.50
2015	9	1.09	1.14	1.12	1.07	0.59	0.40	0.32					1.35
2016	13	1.17	1.06	0.87	0.61	0.36	0.39	0.24	0.18	0.11	0.09	0.86	1.29
2017	12	0.80	1.28	0.75	0.61	0.48	0.45	0.29	0.17	0.18	0.07	1.24	1.51
POR Median		1.12	1.09	1.00	0.66	0.48	0.44	0.36	0.29	0.18	0.12	0.58	1.33

Key
nitrate in mg/L as N
$N \le 0.2$
$0.2 < N \le 0.4$
$0.4 < N \le 0.8$
$0.8 < N \le 1.3$
$N > 1.3$

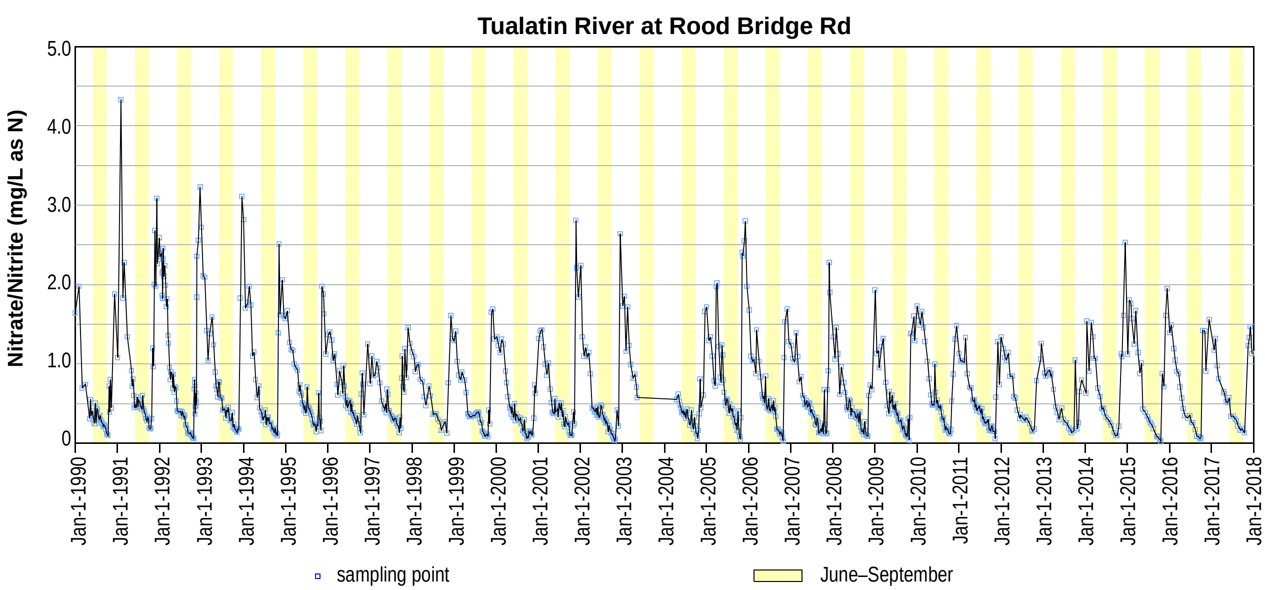


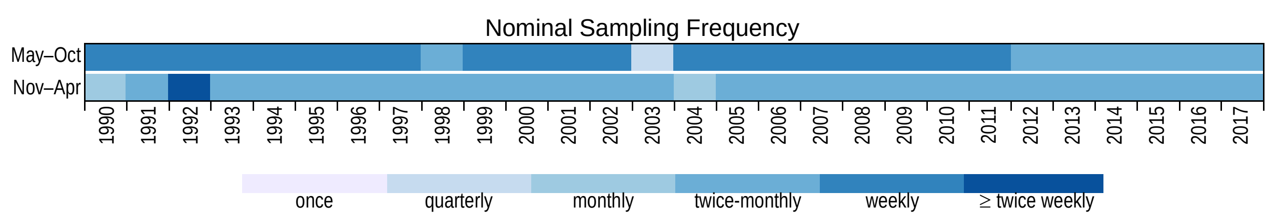
TUALATIN RIVER AT ROOD BRIDGE RD
Nitrate/Nitrite

Data source: Clean Water Services

Discussion

- The period of record is January 1990 through present, except for June-2003 through March-2004 when sampling was suspended due to bridge construction. Sampling frequency was quite variable.
- Nitrate (NO3-N) concentrations in the Tualatin River at Rood Bridge Rd were seasonal. The lowest values (0.05–0.1 mg/L) usually occurred in October and lasted only a few weeks at most. Concentrations increased, often sharply, after the minimum. The seasonal maximum usually occurred November or December. After the maximum, concentrations dropped quickly through winter, although with considerable fluctuation. By spring, concentrations were below 0.5 mg/L and continued to slowly decline through the summer. This pattern was probably caused by the balance between the influx of NO3-N by leaching from soil and the consumption of NO3-N by phytoplankton and aquatic plants. The same general pattern occurred at other Tualatin basin sites.
- The seasonal maximum concentration was generally pronounced and occurred at the beginning of the rainy season which indicates the importance of the first major rainstorm of the season. Because the peak concentrations are shorter-lived than the usual sampling frequency for this site, the graph below likely under-represents their magnitude. Targeted sampling of the first major rainstorm could determine if that is the case.
- The graph below suggests that peak NO3-N concentrations may have decreased in recent years. That conclusion is complicated by changes in sampling frequency. A longer period of record will be needed.
- July–September NO3-N concentrations show a statistically significant decreasing trend. Interpretation is complicated because the lower concentrations occurred since 2013 when sampling was less frequent than in previous years. The medians in recent years may be lower because the less frequent sampling missed short-lived spikes in NO3-N concentrations that, although small, still occur during the summer.

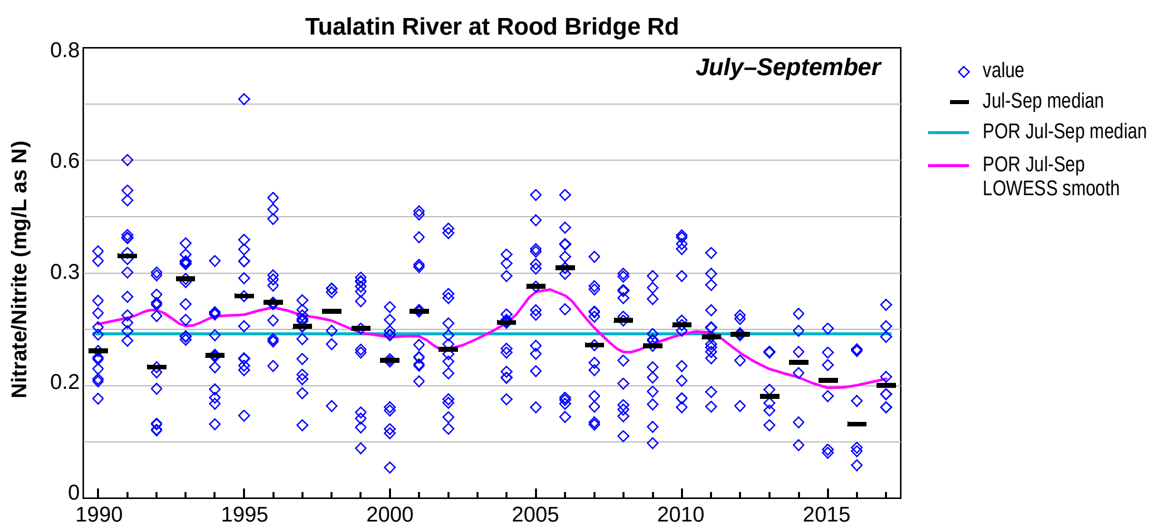




MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	33	1.64	1.98	0.69	0.74	0.38	0.33	0.33	0.28	0.21	0.13	0.62	1.88
1991	38	1.08	3.08	2.28	1.34	0.76	0.47	0.47	0.43	0.31	0.19	1.60	2.26
1992	64	2.35	2.17	1.54	0.87	0.71	0.41	0.38	0.23	0.13	0.08	0.64	2.90
1993	40	2.42	1.76	1.21	1.42	0.70	0.58	0.42	0.39	0.29	0.19	0.17	2.47
1994	38	2.26	1.88	1.42	0.98	0.61	0.34	0.33	0.26	0.17	0.13	2.07	1.83
1995	40	1.62	1.23	1.08	0.94	0.63	0.44	0.44	0.33	0.23	0.28	1.88	1.38
1996	37	1.39	1.10	0.93	0.76	0.74	0.51	0.50	0.36	0.28	0.40	0.55	1.25
1997	38	0.93	0.86	0.95	0.53	0.43	0.51	0.32	0.31	0.21	0.77	0.96	1.36
1998	23	1.12	0.94	0.90	0.68	0.48	0.66	0.37	0.34	0.22	0.26	0.44	1.47
1999	38	1.35	0.95	0.84	0.72	0.35	0.35	0.38	0.30	0.13	0.10	0.42	1.50
2000	39	1.29	1.23	1.08	0.68	0.44	0.35	0.30	0.20	0.12	0.13	0.11	0.68
2001	40	1.37	1.32	0.93	0.68	0.39	0.40	0.46	0.29	0.25	0.11	0.40	2.03
2002	39	1.79	1.16	1.12	0.45	0.40	0.35	0.36	0.27	0.17	0.07	0.24	1.43
2003	10	1.79	1.44	1.11	0.85	0.64							
2004	32				0.55	0.50	0.38	0.36	0.27	0.21	0.13	0.45	1.13
2005	41	1.51	1.22	0.79	1.62	0.84	0.54	0.47	0.41	0.24	0.15	2.40	2.39
2006	39	1.39	1.04	1.15	0.93	0.59	0.48	0.43	0.43	0.17	0.12	1.31	1.49
2007	41	1.15	1.21	0.93	0.60	0.49	0.48	0.37	0.26	0.15	0.23	0.40	2.09
2008	37	1.20	1.29	0.79	0.70	0.45	0.42	0.35	0.36	0.16	0.13	0.60	0.68
2009	39	1.53	1.06	1.27	0.62	0.52	0.49	0.36	0.27	0.16	0.10	1.38	1.45
2010	38	1.67	1.58	1.37	0.92	0.49	0.55	0.46	0.31	0.18	0.13	0.87	1.48
2011	40	1.09	1.03	1.10	0.70	0.53	0.44	0.39	0.27	0.23	0.16	0.15	1.01
2012	23	1.27	1.07	0.99	0.72	0.49	0.33	0.30	0.31	0.20	0.16	0.79	1.16
2013	23	0.86	0.91	0.87	0.57	0.34	0.38	0.26	0.18	0.14	0.61	0.46	0.80
2014	24	1.08	1.21	1.21	0.88	0.51	0.41	0.31	0.24	0.12	0.16	1.11	2.07
2015	24	1.47	1.67	1.46	1.01	0.72	0.36	0.28	0.21	0.08	0.03	0.79	1.78
2016	23	1.44	1.12	0.89	0.64	0.39	0.33	0.26	0.13	0.07	0.75	1.16	1.56
2017	22	1.17	1.15	0.81	0.64	0.52	0.46	0.33	0.25	0.17	0.15	1.28	1.30
POR Median		1.39	1.21	1.08	0.72	0.51	0.42	0.36	0.28	0.17	0.15	0.64	1.48

Key
nitrate in mg/L as N
N ≤ 0.25
0.25 < *N* ≤ 0.4
0.4 < *N* ≤ 0.9
0.8 < *N* ≤ 1.5
N > 1.5



TUALATIN RIVER AT HWY 210 (Scholls Bridge)

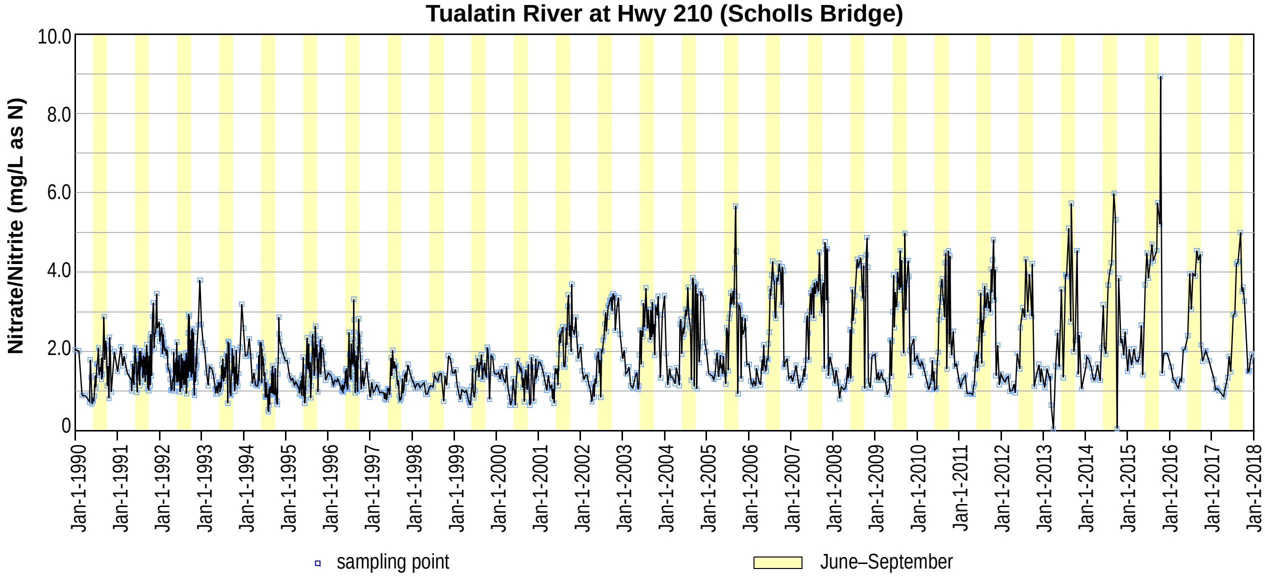
Nitrate/Nitrite

Data source: Clean Water Services

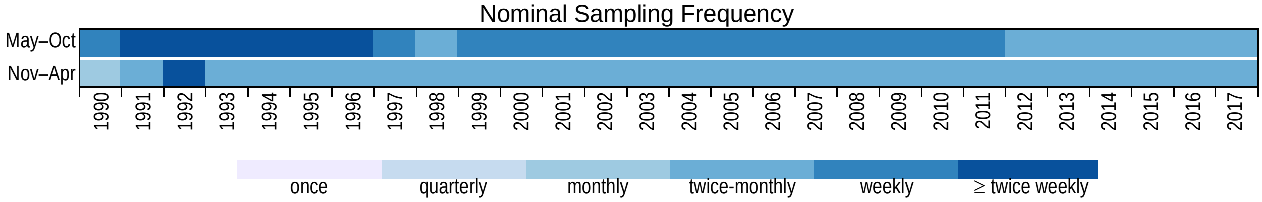
Discussion

- The period of record is January 1990 through present. Sampling frequency was quite variable over the period of record, especially during May–October.
- Nitrate (NO3-N) concentrations in the Tualatin River at Hwy 210 were considerably higher than those at upstream sites. The seasonal pattern differs from upstream sites, and has changed over the period of record. This site is strongly influenced by effluent from the Rock Creek WWTF (RC-WWTF).
- Before 1997, the data show a very noisy seasonal pattern in which the lowest NO3-N concentrations occurred in late spring, increased to a maximum in early winter and then decreased. The sample-to-sample variability was considerable, often nearly as much as the seasonal variation. At this time, the RC-WWTF had not yet been expanded. The pre-1997 pattern at Hwy 210 can be explained by the NO3-N in effluent being sufficiently large and variable to mask the decreasing summer concentrations found in summer at upstream sites. Concentrations increase in the fall because the NO-3 leached by the first rainstorms was still significant relative to effluent. The high variability was likely due to WWTF operations.
- From 1997 through 2001, the data have no obvious seasonal pattern. The RC-WWTF was being expanded.
- Beginning in 2001, the seasonal pattern shifted to one in which the highest NO3-N concentrations were in summer and the lowest were in winter. By this time, flows from the RC-WWTF had doubled and effluent accounted for about 20% of the total river flow. NO3-N from the RC-WWTF completely swamped any contribution of NO3-N from soil leaching by rainfall. The seasonal pattern reflects dilution of effluent by river flow and summertime nitrification at the RC-WWTF.
- The July–September NO3-N concentration shows a marked increase over the period of record that can be explained by the expansion of the RC-WWTP. The low NO3-N concentrations in 2010–2012 were because wet spring weather caused higher river flows which increased the dilution of RC-WWTF effluent.

Tualatin River at Hwy 210 (Scholls Bridge)



Nominal Sampling Frequency



TUALATIN RIVER AT HWY 210 (Scholls Bridge)
Nitrate/Nitrite

Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

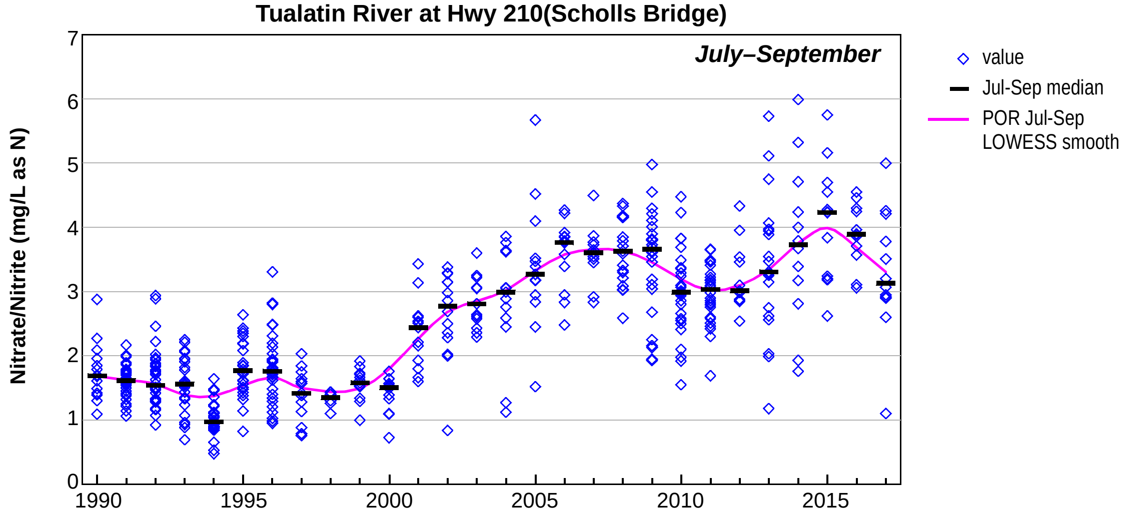
	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	34	2.04	2.01	0.88	0.89	1.03	0.83	1.68	1.49	2.12	1.63	1.52	1.99
1991	80	1.49	1.88	1.88	1.47	1.25	1.70	1.57	1.63	1.58	1.56	2.66	2.58
1992	114	2.43	2.17	1.76	1.30	1.47	1.43	1.40	1.42	1.84	1.82	1.50	3.24
1993	68	2.45	1.75	1.38	1.46	1.04	1.20	1.51	1.91	1.35	1.45	1.39	2.65
1994	64	2.23	2.13	1.54	1.31	1.43	1.73	0.97	0.90	1.00	0.98	2.44	1.96
1995	65	1.76	1.33	1.24	1.19	1.08	1.06	1.69	1.58	1.97	1.82	2.05	1.48
1996	70	1.44	1.20	1.26	1.26	1.09	1.23	1.82	1.74	1.76	1.57	1.32	1.57
1997	38	1.04	1.00	1.08	0.97	0.88	0.97	1.71	1.62	0.88	1.02	1.42	1.58
1998	24	1.23	1.13	1.14	1.19	0.92	1.10	1.25	1.28	1.44	1.06	1.52	1.62
1999	38	1.50	1.05	0.91	0.99	0.75	1.08	1.53	1.66	1.56	1.72	1.51	1.65
2000	41	1.45	1.43	1.27	1.34	0.73	1.04	1.64	1.41	1.25	1.03	1.60	1.46
2001	40	1.72	1.51	1.12	1.15	0.92	1.50	2.44	1.73	2.87	2.56	2.54	2.13
2002	39	1.82	1.35	1.30	1.04	1.25	1.82	2.02	2.78	3.28	3.38	2.81	2.90
2003	38	1.92	1.46	1.38	1.20	1.30	2.37	3.14	2.73	2.43	2.89	3.15	2.13
2004	39	2.68	1.36	1.35	1.39	2.01	2.43	3.06	2.59	3.70	3.05	2.11	2.80
2005	40	1.72	1.38	1.44	1.66	1.63	1.44	2.65	3.27	4.31	3.03	2.55	2.26
2006	39	1.47	1.20	1.36	1.21	1.66	1.81	3.58	3.36	3.86	4.03	1.65	1.57
2007	40	1.31	1.55	1.20	1.26	2.29	2.74	3.55	3.63	3.87	3.67	3.94	1.75
2008	35	1.33	1.38	0.96	1.06	1.40	2.55	3.22	4.18	4.16	4.01	1.25	1.88
2009	38	1.61	1.38	1.38	1.09	1.37	3.00	3.50	3.82	3.34	3.87	2.01	2.03
2010	38	1.80	1.69	1.53	1.10	1.29	1.07	2.91	3.37	4.03	3.46	1.90	1.69
2011	40	1.20	1.30	1.17	0.94	1.18	1.91	2.78	3.10	3.34	4.07	3.30	1.66
2012	24	1.36	1.28	1.18	1.10	1.45	2.08	2.98	3.66	3.42	2.66	1.54	1.40
2013	23	1.16	1.45	1.01	0.84	2.04	2.46	3.92	3.93	3.86	3.42	1.92	1.05
2014	24	1.75	1.69	1.32	1.51	1.68	2.66	2.80	4.12	5.66	1.95	2.27	2.20
2015	25	1.78	1.72	1.93	1.82	2.03	4.08	4.04	4.49	5.15	7.07	1.95	1.93
2016	42	1.62	1.34	1.14	1.32	2.27	3.19	3.77	4.26	4.03	1.96	1.77	1.77
2017	44	1.30	1.08	1.05	1.00	1.24	2.00	3.09	4.11	3.61	3.76	1.51	1.82
POR Median		1.61	1.38	1.27	1.19	1.30	1.77	2.71	2.75	3.31	2.61	1.91	1.85

Key

nitrate in mg/L as N

- $N \leq 1.2$
- $1.2 < N \leq 1.5$
- $1.5 < N \leq 2.1$
- $2.1 < N \leq 3.5$
- $N > 3.5$

Tualatin River at Hwy 210(Scholls Bridge)



TUALATIN RIVER AT ELSNER RD / JURGENS PARK

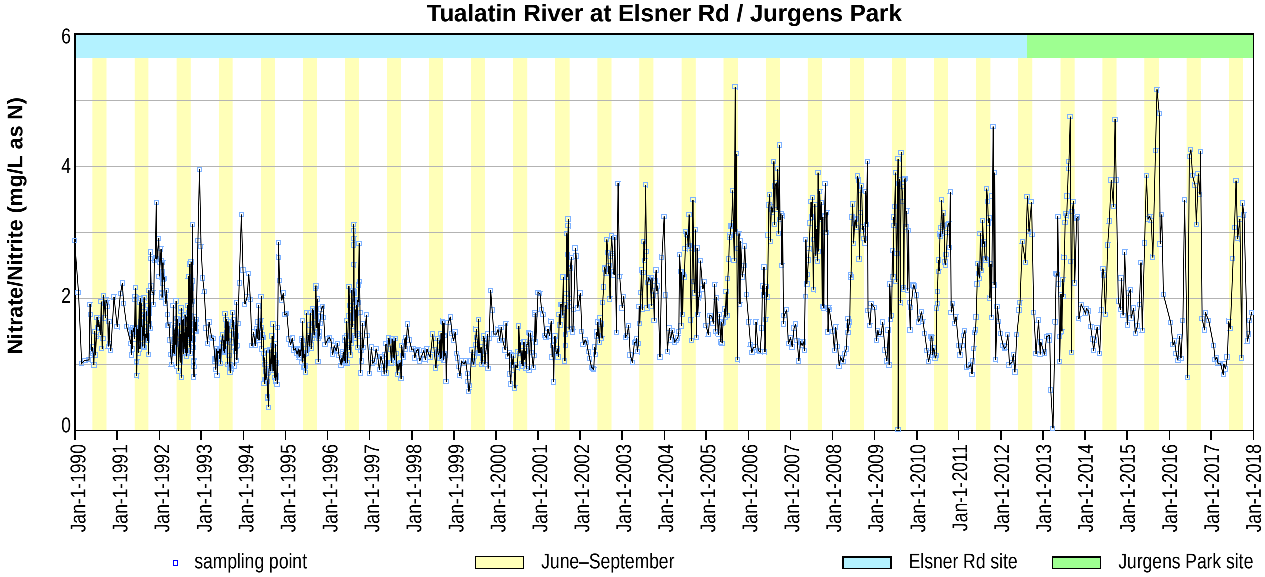
Nitrate/Nitrite

Data source: Clean Water Services

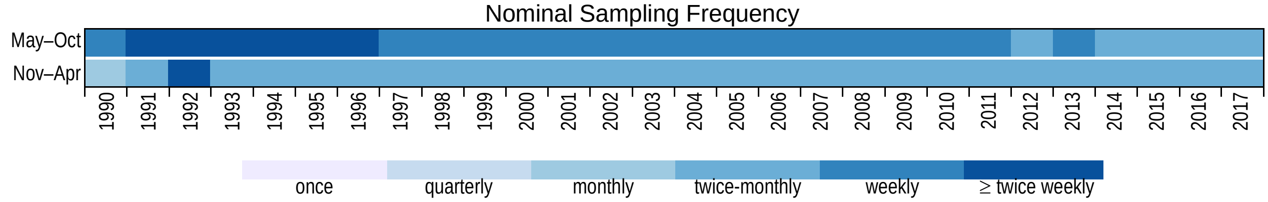
Discussion

- The period of record is January 1990 through present. Sampling frequency was quite variable over the period of record, especially during May–October.
- Nitrate (NO3-N) concentrations in the Tualatin River at Elsner/Jurgens Park were very similar to those at Hwy 210. The seasonal pattern and changes over time also mimic those at Hwy 210. This site is strongly influenced by effluent from the Rock Creek WWTF (RC-WWTF).
- Before 1997, the data show a very noisy seasonal pattern in which the lowest NO3-N concentrations occurred in late spring, increased to a maximum in early winter and then decreased. The sample-to-sample variability was considerable, often nearly as much as the seasonal variation. At this time, the RC-WWTF had not yet been expanded. The pre-1997 pattern can be explained by the NO3-N in effluent being sufficiently large and variable to mask the decreasing summer concentrations found in summer at upstream sites. Concentrations increase in the fall because the NO-3 leached by the first rainstorms was still significant relative to effluent. The high variability was likely due to WWTF operations.
- From 1997 through 2001, the data have no obvious seasonal pattern. The RC-WWTF was being expanded.
- Beginning in 2001, the seasonal pattern shifted to one in which the highest NO3-N concentrations were in summer and the lowest were in winter. By this time, flows from the RC-WWTF had doubled and effluent accounted for about 20% of the total river flow. NO3-N from the RC-WWTF completely swamped any contribution of NO3-N from soil leaching by rainfall. The seasonal pattern reflects dilution of effluent by river flow and summertime nitrification at the RC-WWTF.
- The July–September NO3-N concentration shows a marked increase over the period of record that can be explained by the expansion of the RC-WWTP. The low NO3-N concentrations in 2010–2012 were because wet spring weather caused higher river flows which increased the dilution of RC-WWTF effluent.

Tualatin River at Elsner Rd / Jurgens Park



Nominal Sampling Frequency



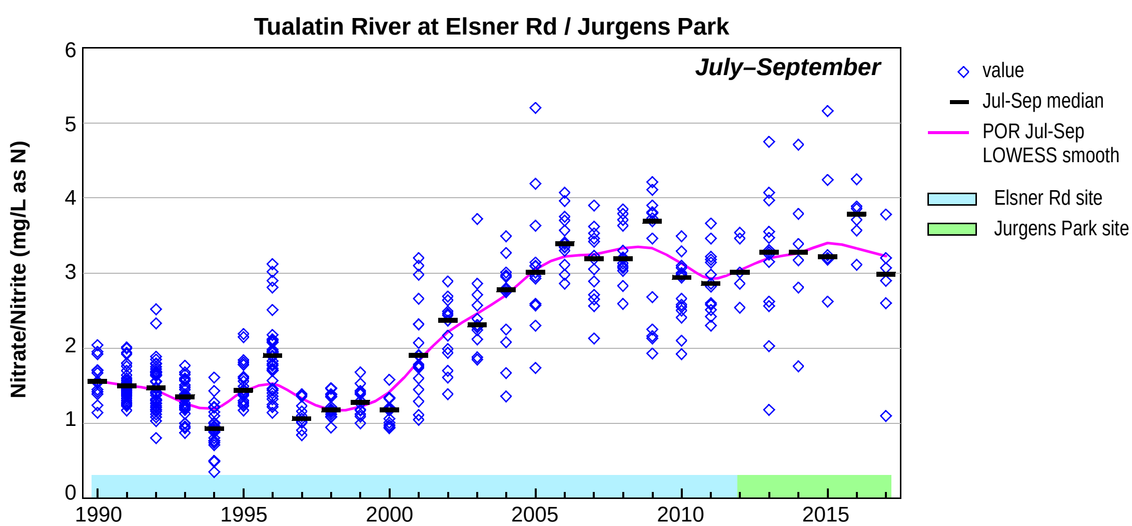
TUALATIN RIVER AT ELSNER RD / JURGENS PARK
Nitrate/Nitrite

Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

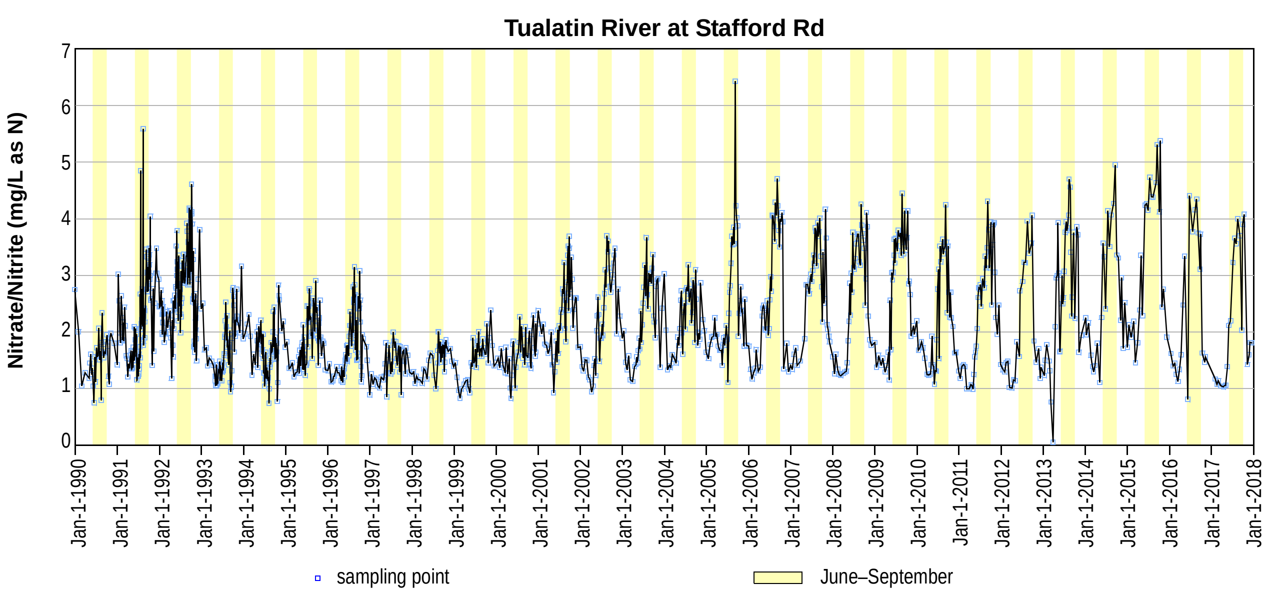
	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	33	2.87	2.09	1.01	1.06	1.48	1.21	1.56	1.50	1.81	1.87	1.27	2.02
1991	79	1.57	2.15	1.92	1.57	1.48	1.53	1.52	1.60	1.44	1.82	2.09	2.61
1992	115	2.54	2.29	1.84	1.18	1.34	1.52	1.39	1.48	1.55	1.90	1.51	3.41
1993	68	2.55	1.83	1.48	1.40	1.07	1.19	1.32	1.48	1.13	1.52	1.36	2.75
1994	64	2.17	2.20	1.63	1.39	1.49	1.43	0.85	0.88	1.15	0.82	2.62	2.03
1995	65	1.76	1.34	1.31	1.20	1.22	1.10	1.34	1.38	1.59	1.55	1.78	1.51
1996	70	1.40	1.22	1.24	1.23	1.08	1.31	1.73	2.08	1.77	1.61	1.44	1.60
1997	38	1.06	1.04	1.12	1.12	1.07	1.19	1.17	1.26	1.01	1.12	1.34	1.49
1998	41	1.23	1.16	1.14	1.18	1.15	1.14	1.34	1.16	1.17	1.17	1.18	1.60
1999	40	1.43	1.10	0.94	1.03	0.71	1.05	1.36	1.22	1.24	1.26	1.39	1.64
2000	41	1.50	1.46	1.29	1.37	0.99	0.95	1.18	1.11	1.13	1.30	1.18	1.55
2001	47	2.08	1.80	1.43	1.54	1.20	1.22	1.76	1.74	2.49	2.00	1.83	2.25
2002	39	1.79	1.34	1.26	0.96	1.21	1.44	1.70	2.45	2.49	2.54	2.20	3.04
2003	38	1.94	1.43	1.37	1.18	1.33	1.88	2.72	2.28	2.28	2.15	2.15	1.87
2004	39	2.65	1.37	1.44	1.35	1.96	2.32	2.96	2.78	2.50	2.26	2.05	2.20
2005	41	1.52	1.74	1.62	1.73	1.62	1.78	2.45	3.10	3.60	2.75	2.49	2.43
2006	39	1.47	1.22	1.45	1.20	2.05	2.10	3.39	3.50	3.55	3.25	1.68	1.57
2007	41	1.34	1.58	1.21	1.34	2.13	2.67	3.23	2.85	3.41	3.23	3.15	1.85
2008	38	1.36	1.42	1.04	1.11	1.54	2.35	3.10	3.50	3.30	3.02	1.81	1.92
2009	42	1.61	1.48	1.55	1.14	1.60	2.91	2.68	3.73	3.46	3.06	1.86	2.20
2010	40	1.85	1.75	1.56	1.13	1.29	1.21	2.41	3.09	2.61	3.13	1.79	1.72
2011	40	1.21	1.36	1.23	0.98	1.24	2.30	2.47	2.82	3.34	2.52	2.20	1.77
2012	23	1.38	1.25	1.22	1.09	1.17	1.88	2.86	3.04	3.24	2.38	1.42	1.25
2013	35	1.18	1.43	0.99	0.84	2.36	1.78	3.15	4.02	2.94	2.72	2.46	1.91
2014	24	1.81	1.69	1.30	1.47	1.49	2.40	2.29	3.48	4.05	2.88	2.07	2.22
2015	22	1.84	1.92	1.66	1.75	2.03	3.35	3.22	2.90	4.70	3.81	2.67	
2016	22	1.63	1.33	1.12	1.26	2.58	2.47	4.06	3.41	3.73	2.96	1.66	1.66
2017	23	1.28	1.09	1.01	0.93	1.02	1.60	2.84	3.34	2.15	3.35	1.41	1.73
POR Median		1.59	1.43	1.29	1.19	1.34	1.56	2.35	2.62	2.49	2.32	1.80	1.87

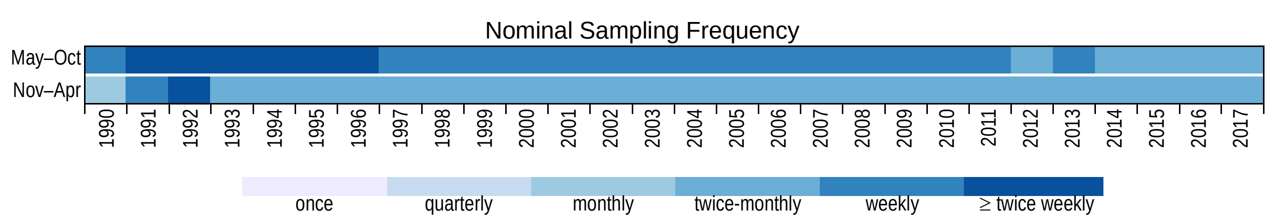
Key
nitrate in mg/L as N
$N \le 1.2$
$1.2 < N \le 1.5$
$1.5 < N \le 2.0$
$2.0 < N \le 3.0$
$N > 3.0$



Discussion

- The period of record is January 1990 through present. Sampling frequency was quite variable over the period of record, especially during May–October.
- Nitrate (NO3-N) concentrations in the Tualatin River at Stafford were very similar to those at Hwy 210 and Jurgens Park. This site is strongly influenced by effluent from the Rock Creek WWTF (RC-WWTF) and the Durham WWTF (D-WWTF).
- From 1991 through 2005, the data show a very noisy seasonal pattern in which the lowest NO3-N concentrations usually occurred in late spring, increased through summer to a maximum in the fall and then decreased. The sample-to-sample variability was considerable, often nearly as much as the seasonal variation. Because of effluent from the D-WWTF, NO3-N concentrations at Stafford Rd were higher than at Hwy 210 or Jurgens Park. The NO3-N concentration increased during summer because nitrification was occurring at the D-WWTF and the effluent was less diluted by low summer river flow. NO3-N leaching by the first seasonal rainstorms was insignificant relative to NO3-N from effluent. The high variability was likely due to WWTF operations.
- Beginning in 2001, the seasonal pattern had less noise and a greater difference between winter and summer. The minimum concentrations increased a few years later. The decreased noise was probably because of a decrease in sampling frequency. The wider amplitude and increase in minimum concentrations were due to NO3-N from the recently-expanded RC-WWTF.
- The July–September NO3-N concentration shows a marked increase over the period of record that can be explained by a greater volume of treated effluent, mostly from the RC-WWTF. The low NO3-N concentrations in 2010–2012 were because wet spring weather caused higher river flows which increased the dilution of effluent.





TUALATIN RIVER AT STAFFORD RD
Nitrate/Nitrite

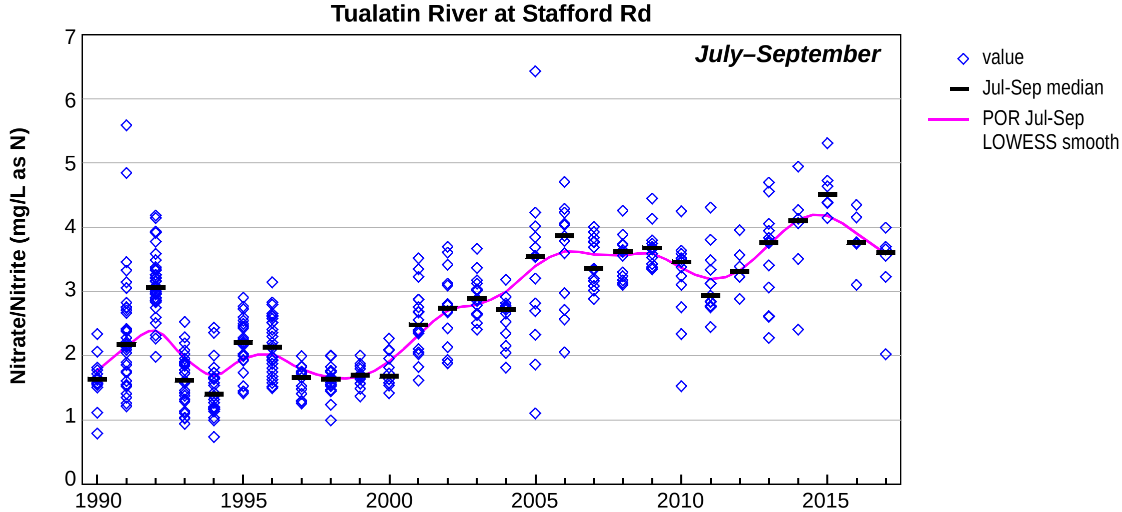
Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	34	2.75	2.01	1.05	1.28	1.35	1.21	1.58	1.66	1.64	1.75	1.94	1.80
1991	92	2.27	2.17	1.98	1.44	1.44	1.65	1.55	2.19	2.79	3.03	2.09	3.04
1992	115	2.46	2.16	2.12	2.21	2.45	2.93	2.81	3.09	3.49	3.43	1.88	3.37
1993	68	2.46	1.71	1.47	1.45	1.15	1.32	1.46	1.87	1.32	2.34	2.21	2.58
1994	64	1.93	2.23	1.59	1.52	1.85	1.74	1.24	1.20	1.74	1.65	2.64	2.11
1995	65	1.78	1.38	1.34	1.29	1.57	1.59	2.19	2.11	2.47	2.16	1.88	1.57
1996	65	1.38	1.14	1.31	1.28	1.29	1.52	1.98	2.55	1.94	2.30	1.92	1.62
1997	38	1.07	1.14	1.05	1.20	1.33	1.44	1.39	1.78	1.66	1.58	1.48	1.44
1998	41	1.28	1.16	1.16	1.22	1.24	1.57	1.41	1.67	1.65	1.71	1.72	1.60
1999	39	1.43	1.09	0.91	1.11	1.02	1.46	1.60	1.71	1.70	1.73	1.90	1.58
2000	41	1.51	1.54	1.35	1.50	1.24	1.43	1.73	1.80	1.66	1.58	1.96	1.69
2001	47	2.26	2.06	1.78	1.71	1.36	1.70	2.11	2.68	2.79	3.00	2.40	2.17
2002	39	1.57	1.41	1.35	1.05	1.47	2.30	1.94	2.95	3.13	3.12	2.73	2.52
2003	38	1.96	1.40	1.37	1.26	1.51	1.89	2.72	2.85	3.02	2.23	2.93	1.90
2004	39	2.53	1.37	1.49	1.49	1.99	2.35	2.74	2.66	2.59	2.29	1.98	2.12
2005	41	1.59	1.85	1.93	1.86	1.68	1.91	2.10	3.54	4.13	2.55	2.37	2.18
2006	38	1.55	1.23	1.53	1.35	2.42	2.21	2.72	3.96	4.15	3.95	1.35	1.55
2007	36	1.38	1.67	1.41	1.49	2.36	2.79	3.09	3.81	3.73	2.59	2.90	1.88
2008	38	1.41	1.48	1.24	1.28	1.66	2.86	3.22	3.69	3.74	3.21	2.28	1.77
2009	40	1.60	1.54	1.48	1.35	1.67	3.14	3.60	3.70	3.64	3.56	2.66	2.04
2010	38	1.94	1.78	1.63	1.25	1.42	1.32	2.94	3.46	3.55	2.70	2.10	1.64
2011	40	1.25	1.42	1.19	1.04	1.25	2.34	2.77	2.94	3.65	3.54	3.06	2.22
2012	24	1.38	1.38	1.25	1.09	1.49	2.15	3.06	3.60	3.48	2.95	1.59	1.28
2013	35	1.37	1.64	1.04	1.07	3.00	2.50	3.76	4.31	3.02	3.05	2.68	1.94
2014	24	2.10	1.88	1.35	1.61	1.69	3.45	3.28	3.79	4.61	3.34	2.59	2.12
2015	23	1.93	1.94	1.83	2.10	2.82	4.26	4.44	4.39	4.98	4.75	2.60	1.91
2016	20	1.62	1.43	1.19	1.47	2.91	2.61	3.77	4.26	3.43	2.68	1.52	
2017	22		1.13	1.10	1.04	1.23	2.16	3.45	3.78	2.87	3.99	1.52	1.82
POR Median		1.60	1.51	1.35	1.32	1.50	2.03	2.72	2.94	3.02	2.69	2.09	1.90

Key
nitrate in mg/L as N
$N \leq 1.4$
$1.4 < N \leq 1.8$
$1.8 < N \leq 2.7$
$2.7 < N \leq 3.5$
$N > 3.5$

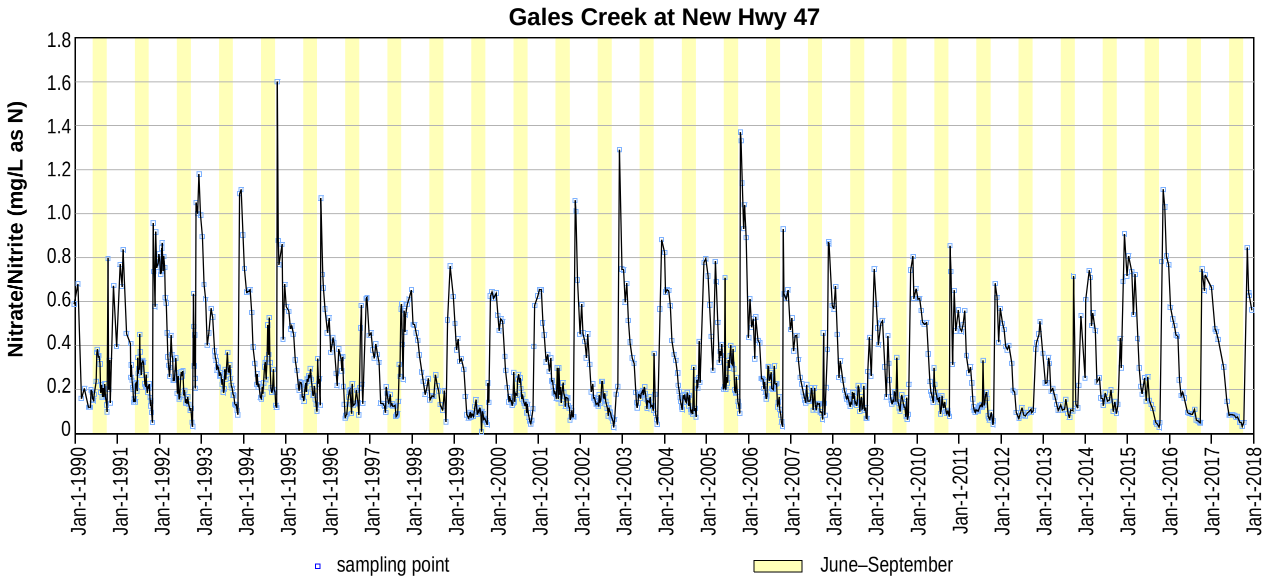
Tualatin River at Stafford Rd

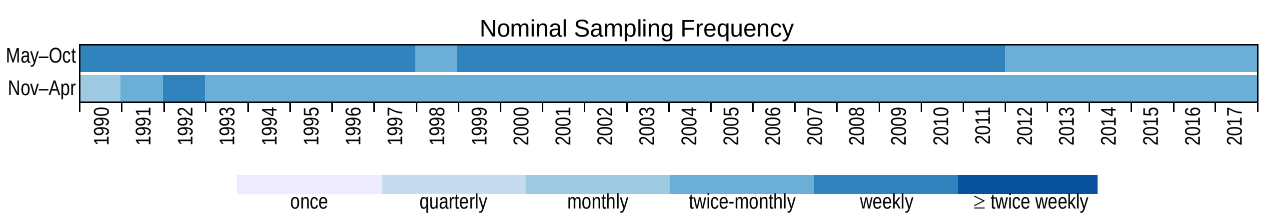


Data source: Clean Water Services

Discussion

- The period of record is January 1990 through present.
- Nitrate (NO3-N) concentrations in Gales Creek were seasonal. The lowest values (about 0.1 mg/L) usually occurred in October and lasted only a few weeks at most. Concentrations increased, often sharply, after the minimum. The seasonal maximum usually occurred in November or December. After the maximum, concentrations dropped quickly through winter, although with considerable fluctuation. By spring, concentrations were below 0.3 mg/L and continued to slowly decline through the summer. This pattern was probably caused by the balance between the influx of NO3-N by leaching from soil and the consumption of NO3-N by phytoplankton and aquatic plants. The same general pattern occurred at many other Tualatin basin sites.
- The seasonal maximum concentration was generally pronounced and occurred at the beginning of the rainy season which indicates the importance of the first major rainstorm of the season. Because the peak concentrations are shorter-lived than the usual sampling frequency for this site, the graph below likely under-represents their magnitude. Targeted sampling of the first major rainstorm could determine if that is the case.
- July–September NO3-N concentrations show a statistically significant decreasing trend. The reason is unknown.





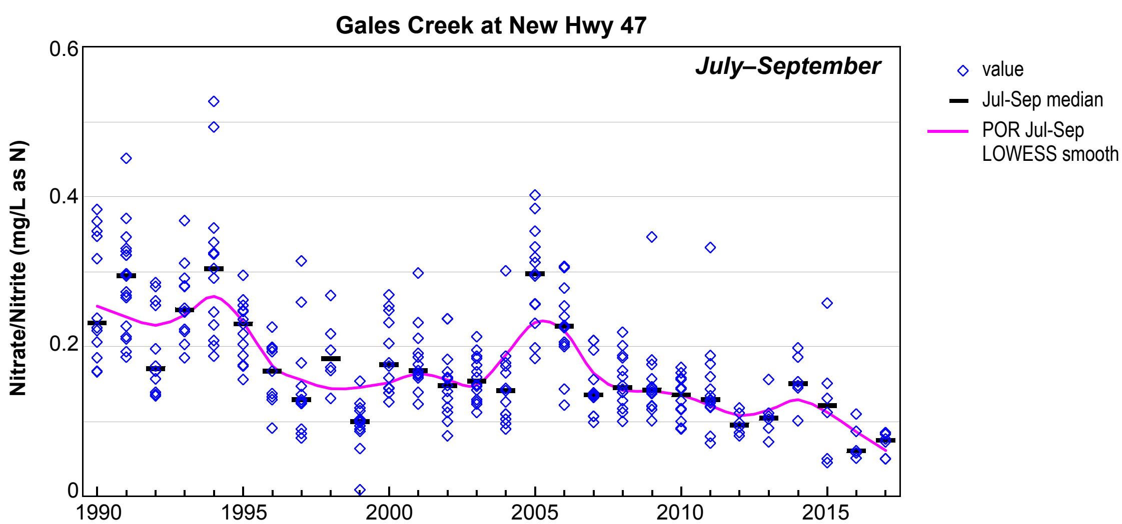
GALES CREEK AT NEW HWY 47
Nitrate/Nitrite

Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

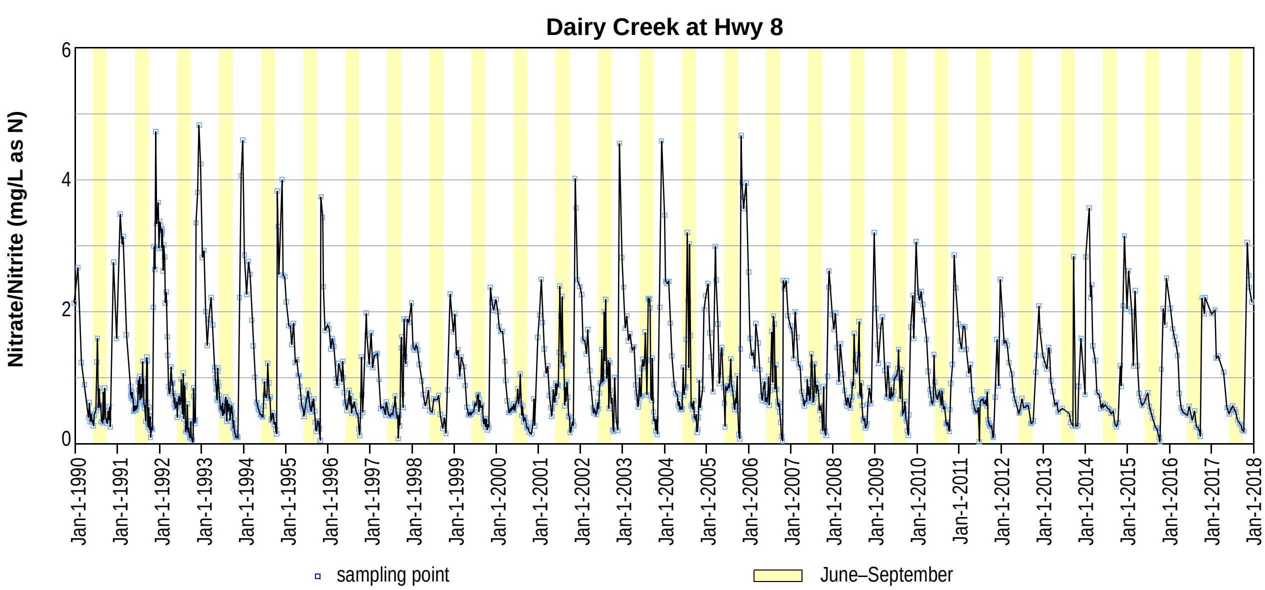
	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	32	0.59	0.68	0.16	0.21	0.12	0.17	0.37	0.32	0.19	0.17	0.24	0.67
1991	50	0.40	0.72	0.84	0.46	0.25	0.16	0.30	0.32	0.21	0.21	0.42	0.76
1992	58	0.78	0.78	0.53	0.31	0.26	0.26	0.26	0.17	0.14	0.08	0.45	1.09
1993	39	0.94	0.65	0.43	0.55	0.34	0.28	0.21	0.29	0.27	0.17	0.12	1.10
1994	38	0.83	0.64	0.60	0.36	0.22	0.17	0.28	0.36	0.20	0.16	0.88	0.64
1995	40	0.63	0.52	0.47	0.31	0.22	0.17	0.23	0.26	0.17	0.23	0.72	0.61
1996	35	0.49	0.41	0.34	0.30	0.31	0.09	0.18	0.13	0.17	0.21	0.18	0.62
1997	38	0.45	0.36	0.38	0.23	0.13	0.17	0.13	0.13	0.15	0.49	0.54	0.60
1998	23	0.58	0.48	0.39	0.26	0.19	0.20	0.17	0.22	0.13	0.15	0.29	0.76
1999	37	0.56	0.41	0.33	0.23	0.08	0.09	0.12	0.10	0.08	0.06	0.23	0.63
2000	39	0.59	0.50	0.43	0.25	0.15	0.16	0.25	0.20	0.14	0.09	0.06	0.49
2001	40	0.64	0.58	0.39	0.32	0.24	0.18	0.18	0.19	0.16	0.11	0.08	0.85
2002	39	0.52	0.44	0.40	0.23	0.16	0.14	0.17	0.15	0.11	0.07	0.12	0.75
2003	38	0.75	0.64	0.47	0.33	0.14	0.18	0.19	0.15	0.13	0.14	0.05	0.72
2004	38	0.73	0.65	0.50	0.35	0.21	0.15	0.16	0.13	0.11	0.16	0.25	0.78
2005	39	0.76	0.51	0.53	0.60	0.36	0.21	0.28	0.35	0.23	0.14	1.24	0.97
2006	39	0.52	0.50	0.43	0.42	0.25	0.18	0.27	0.21	0.18	0.10	0.63	0.63
2007	39	0.50	0.41	0.39	0.24	0.17	0.15	0.18	0.14	0.13	0.10	0.21	0.87
2008	38	0.57	0.56	0.29	0.22	0.16	0.14	0.16	0.17	0.12	0.11	0.28	0.26
2009	38	0.67	0.44	0.51	0.23	0.28	0.15	0.16	0.13	0.14	0.08	0.48	0.71
2010	37	0.64	0.59	0.50	0.43	0.18	0.19	0.16	0.12	0.10	0.10	0.53	0.56
2011	39	0.52	0.48	0.46	0.29	0.14	0.10	0.13	0.14	0.12	0.07	0.06	0.52
2012	24	0.54	0.43	0.39	0.26	0.14	0.07	0.10	0.09	0.10	0.10	0.40	0.48
2013	23	0.30	0.29	0.26	0.19	0.12	0.12	0.13	0.08	0.11	0.43	0.17	0.54
2014	24	0.43	0.73	0.52	0.35	0.21	0.14	0.17	0.18	0.12	0.11	0.37	0.80
2015	42	0.76	0.74	0.72	0.60	0.40	0.45	0.41	0.26	0.14	0.04	1.12	1.42
2016	41	0.77	1.07	0.89	0.39	0.33	0.26	0.22	0.31	0.12	0.43	1.35	
2017	40	1.32	0.89	0.88	0.69	0.35	0.27	0.30	0.22	0.16	0.12	1.70	1.39
POR Median		0.59	0.54	0.45	0.31	0.21	0.17	0.18	0.17	0.14	0.12	0.33	0.71

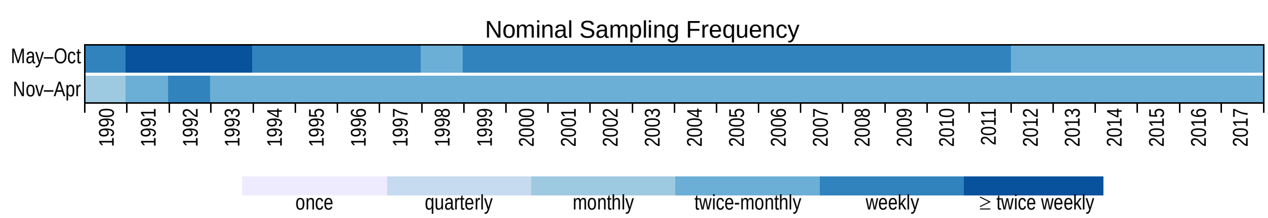
Key
nitrate in mg/L as N
$N \le 0.13$
$0.13 < N \le 0.2$
$0.2 < N \le 0.5$
$0.5 < N \le 0.7$
$N > 0.7$



Discussion

- The period of record is January 1990 through present. Sampling frequency varied.
- Nitrate (NO3-N) concentrations in Dairy Creek were seasonal. The lowest values (0.1–0.2 mg/L) usually occurred in October and lasted only a few weeks at most. Concentrations increased, often sharply, after the minimum. The seasonal maximum usually occurred in November or December. After the maximum, concentrations dropped quickly through winter, although with considerable fluctuation. By spring, concentrations were below 1 mg/L and continued to slowly decline through the summer. This pattern was probably caused by the balance between the influx of NO3-N by leaching from soil and the consumption of NO3-N by phytoplankton and aquatic plants. The same general pattern occurred at many other Tualatin basin sites.
- The seasonal maximum concentration was generally pronounced and occurred at the beginning of the rainy season which indicates the importance of the first major rainstorm of the season. Because the peak concentrations are shorter-lived than the usual sampling frequency for this site, the graph below likely under-represents their magnitude. Targeted sampling of the first major rainstorm could determine if that is the case.
- The seasonal maximum concentrations at Dairy Creek were the highest among the tributary sites.
- Many small concentration spikes occurred throughout the year, although fewer occurred in summer. Because these spikes are shorter-lived than the usual sampling frequency for this site, the graph below likely under-represents their frequency. This is especially true for recent years when the sampling frequency is only twice-a-month.
- July–September NO3-N concentrations were higher from 2001–2009 compared to the years before or since. The difference is statistically significant. The reason is unknown.





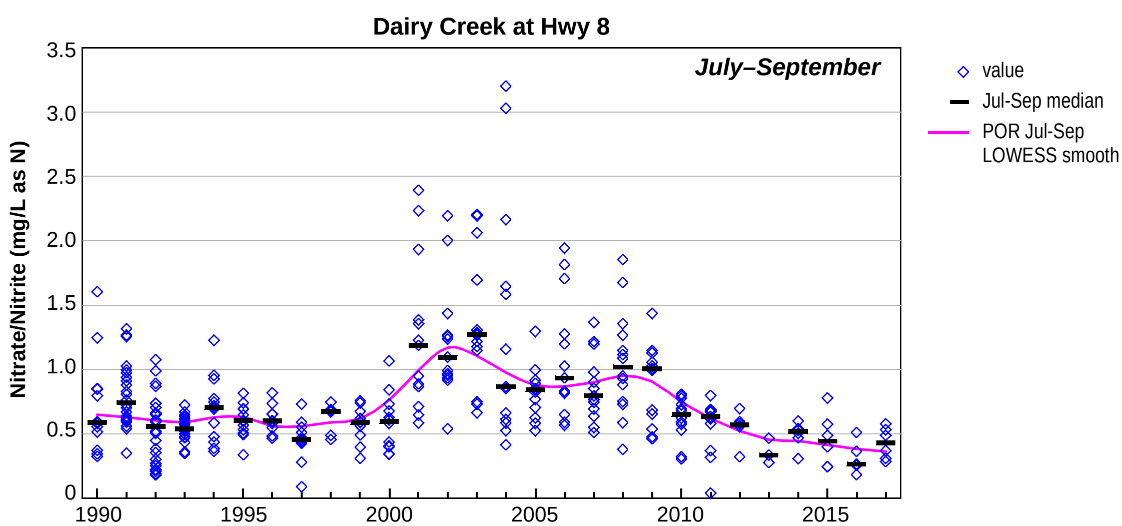
DAIRY CREEK AT HWY 8
Nitrate/Nitrite

Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

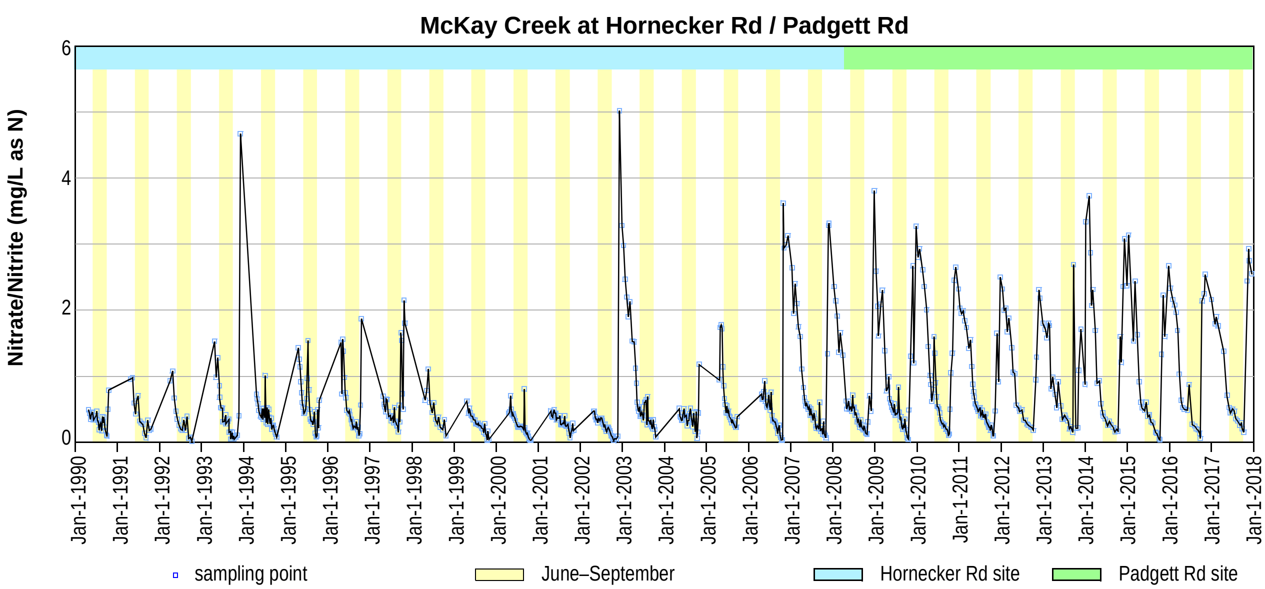
	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	32	2.13	2.67	1.23	0.89	0.43	0.35	0.89	0.58	0.58	0.36	0.41	2.75
1991	60	1.59	3.25	3.14	1.65	0.71	0.52	0.79	0.80	0.59	0.30	1.15	3.33
1992	83	3.25	3.17	1.88	0.87	0.71	0.57	0.65	0.65	0.24	0.09	0.36	4.32
1993	68	3.53	2.47	1.69	2.01	0.90	0.73	0.49	0.59	0.54	0.25	0.10	3.14
1994	38	3.73	2.51	2.22	1.25	0.58	0.42	0.72	0.77	0.40	0.25	3.29	3.28
1995	40	2.34	1.79	1.67	1.25	0.87	0.51	0.68	0.60	0.53	0.24	3.43	2.05
1996	36	1.77	1.55	1.23	1.05	1.04	0.61	0.69	0.57	0.52	0.42	0.61	1.81
1997	38	1.44	1.25	1.36	0.75	0.51	0.54	0.45	0.56	0.42	1.10	1.31	1.87
1998	23	1.80	1.46	1.31	0.85	0.62	0.66	0.58	0.67	0.45	0.32	0.49	2.27
1999	37	1.83	1.38	1.17	1.02	0.46	0.48	0.61	0.67	0.47	0.32	0.30	2.08
2000	37	2.10	1.74	1.48	0.80	0.50	0.55	0.67	0.62	0.36	0.24	0.23	0.48
2001	40	1.78	2.17	1.25	0.96	0.55	0.81	1.38	1.27	0.78	0.28	0.34	3.03
2002	39	2.32	1.57	1.55	0.84	0.48	0.58	0.95	1.63	1.16	0.60	0.68	2.38
2003	38	2.60	1.85	1.62	1.45	0.74	0.72	1.21	1.27	1.30	0.36	0.26	3.33
2004	39	2.96	2.45	1.58	0.83	0.61	0.57	1.22	1.64	0.56	0.30	0.54	1.43
2005	39	2.34	1.50	1.89	2.15	1.21	0.73	0.84	0.91	0.59	0.32	3.76	3.84
2006	39	2.10	1.36	1.48	1.33	0.80	0.67	0.91	1.70	0.73	0.40	2.35	2.21
2007	40	1.76	1.65	1.41	0.97	0.65	0.80	0.96	0.90	0.67	0.37	0.19	2.50
2008	38	1.85	1.72	1.22	0.94	0.64	0.63	1.14	1.23	0.72	0.31	0.60	0.61
2009	38	2.63	1.36	1.85	0.91	0.83	0.80	1.04	0.99	0.53	0.27	1.11	1.92
2010	37	2.68	2.24	1.99	1.34	0.68	0.73	0.74	0.61	0.31	0.28	1.06	2.61
2011	38	1.69	1.61	1.60	1.13	0.62	0.50	0.64	0.67	0.47	0.27	0.10	1.23
2012	24	2.23	1.55	1.36	0.94	0.64	0.47	0.62	0.57	0.44	0.33	1.21	1.90
2013	19	1.28	1.30	1.18	0.69	0.56	0.54		0.46	0.30	1.55	0.57	1.60
2014	24	1.79	2.90	1.95	1.02	0.63	0.59	0.56	0.49	0.40	0.29	1.03	2.62
2015	23	2.33	2.00	1.75	0.97	0.62	0.68	0.67	0.43	0.24	0.06	1.59	2.16
2016	20	2.05	1.68	1.43	0.65	0.48	0.50	0.36	0.50	0.25	1.16	2.10	
2017	20	1.97	1.67	1.33	1.08	0.55	0.48	0.55	0.42	0.29	0.20	2.80	2.26
POR Median		2.10	1.70	1.51	0.97	0.63	0.58	0.69	0.66	0.50	0.31	0.65	2.26

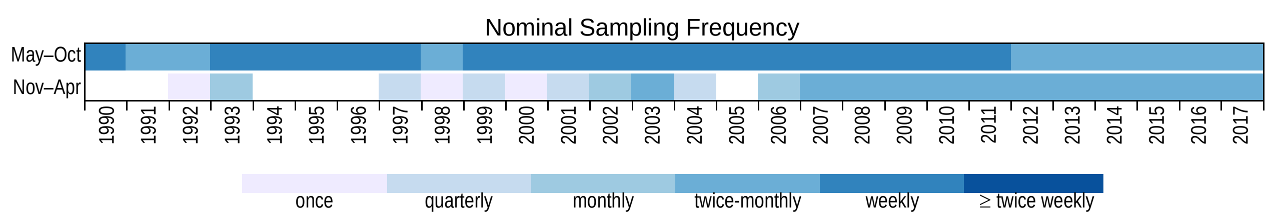
Key
nitrate in mg/L as N
$N \le 0.4$
$0.4 < N \le 0.6$
$0.6 < N \le 1.2$
$1.2 < N \le 2.2$
$N > 2.2$



Discussion

- The period of record is May 1990 through present. Sampling frequency varied, ranging from weekly to twice monthly for May–October. Sampling for November–April was intermittent.
- The site location changed during 2008. The distance between the sites is about one mile. The data show no obvious difference between sites with regard to NO3-N.
- Nitrate (NO3-N) concentrations in McKay Creek were seasonal. The lowest values (0.05–0.1 mg/L) usually occurred in October and lasted only a few weeks at most. Concentrations increased, often sharply, after the minimum. The seasonal maximum usually occurred in November or December. After the maximum, concentrations dropped quickly through winter. By spring, concentrations were below 0.5 mg/L and continued to slowly decline through the summer. This pattern was probably caused by the balance between the influx of NO3-N by leaching from soil and the consumption of NO3-N by phytoplankton and aquatic plants. The same general pattern occurred at many other Tualatin basin sites.
- The seasonal maximum concentration was generally pronounced and occurred at the beginning of the rainy season which indicates the importance of the first major rainstorm of the season. Because the peak concentrations are shorter-lived than the usual sampling frequency for this site, the graph below likely under-represents their magnitude. Targeted sampling of the first major rainstorm could determine if that is the case.
- No trends are evident for the July–September period.



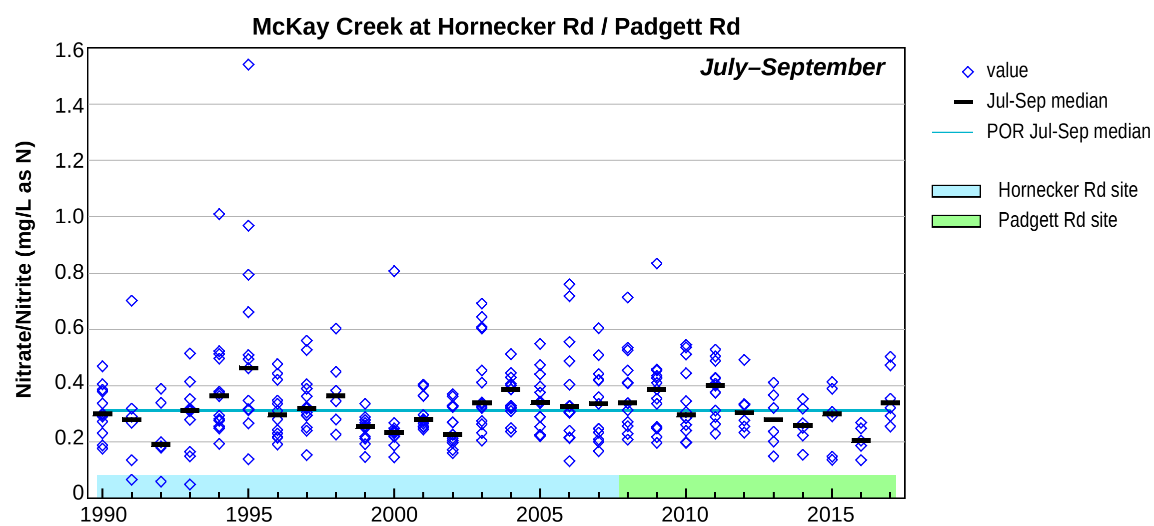


Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	25					0.43	0.41	0.41	0.27	0.34	0.18		
1991	14					0.97	0.60	0.51	0.28	0.10	0.20		
1992	14				0.93	0.88	0.35	0.19	0.26	0.23	0.05		
1993	25					1.26	0.68	0.32	0.32	0.16	0.07	0.10	2.54
1994	25					0.62	0.39	0.44	0.38	0.25	0.14		
1995	27					1.14	0.49	0.81	0.35	0.29	0.22		
1996	25					1.45	0.71	0.43	0.26	0.22	0.23		
1997	27					0.56	0.55	0.38	0.31	0.25	1.14	1.98	
1998	13					0.71	0.86	0.53	0.35	0.23	0.27	0.10	
1999	26					0.52	0.39	0.28	0.26	0.20	0.12	0.11	
2000	27					0.47	0.38	0.24	0.24	0.20	0.09	0.03	
2001	29					0.44	0.40	0.37	0.29	0.25	0.16	0.23	
2002	30					0.43	0.35	0.33	0.21	0.21	0.09	0.05	2.56
2003	34	3.13	2.34	2.02	1.53	0.75	0.44	0.45	0.49	0.28	0.22		
2004	26					0.45	0.38	0.39	0.39	0.32	0.16	0.81	
2005	22					1.73	0.66	0.46	0.34	0.23	0.39		
2006	31					0.70	0.61	0.64	0.33	0.22	0.09	2.94	3.06
2007	39	2.64	2.18	1.93	1.36	0.61	0.52	0.42	0.25	0.22	0.20	0.11	3.30
2008	36	2.36	2.03	1.51	1.32	0.59	0.51	0.53	0.33	0.24	0.19	0.31	0.47
2009	38	3.20	1.84	2.20	1.08	0.75	0.53	0.43	0.42	0.25	0.10	0.90	1.94
2010	36	3.04	2.93	2.49	1.73	0.79	0.90	0.52	0.29	0.20	0.15	1.20	2.55
2011	39	2.18	1.97	1.79	1.49	0.82	0.53	0.47	0.41	0.28	0.21	0.10	1.28
2012	24	2.41	2.02	1.78	1.25	0.80	0.49	0.41	0.30	0.24	0.20	1.12	2.25
2013	23	1.76	1.69	1.29	0.86	0.72	0.45	0.39	0.26	0.19	1.45	0.65	1.71
2014	24	2.11	3.30	2.19	1.29	0.76	0.42	0.30	0.29	0.19	0.18	1.41	2.72
2015	21	2.76		1.99	1.27	0.56	0.54	0.40	0.30	0.14	0.04	1.78	1.60
2016	21	2.50	2.12	1.83	0.83	0.51	0.68	0.27	0.25	0.19	1.10	2.40	
2017	20	2.16	1.85	1.76	1.38	0.71	0.48	0.49	0.34	0.27	0.18	2.69	2.65
POR Median		2.46	2.03	1.88	1.29	0.71	0.50	0.42	0.30	0.23	0.18	0.73	2.54

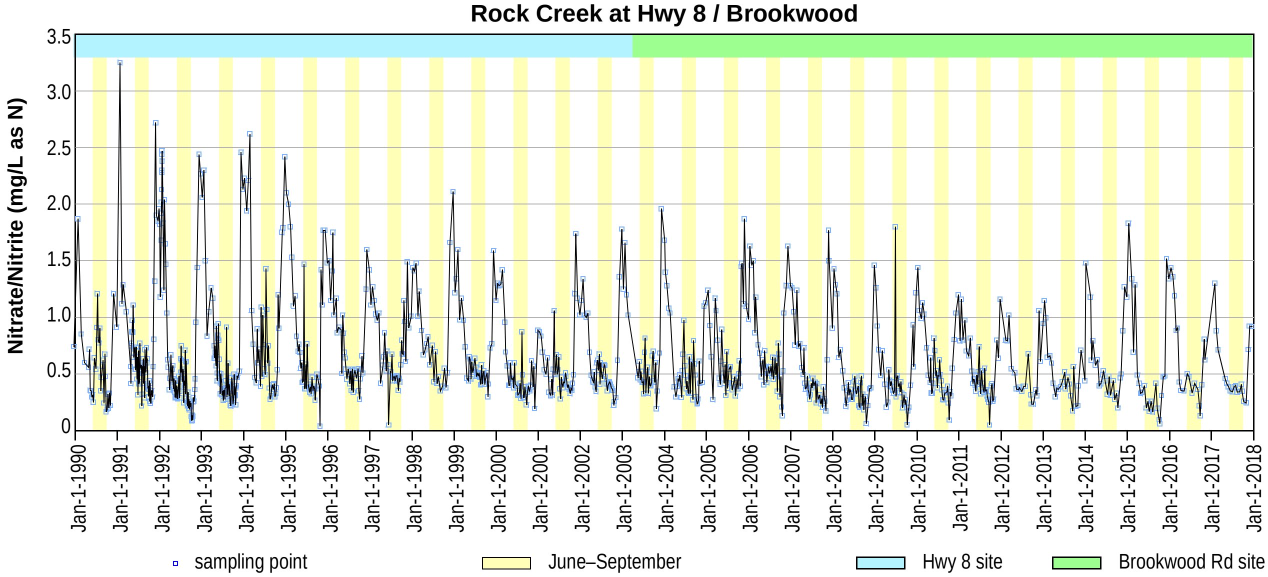
Key
nitrate in mg/L as N
$N \le 0.2$
$0.2 < N \le 0.4$
$0.4 < N \le 0.7$
$0.7 < N \le 1.8$
$N > 1.8$



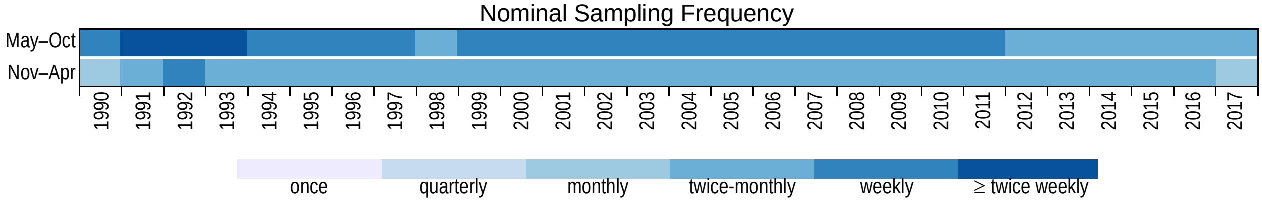
Discussion

- The period of record is January 1990 through present. Sampling frequency varied.
- The site location changed during 2003. The distance between the sites is about 1.2 miles.
- Nitrate (NO3-N) concentrations in Rock Creek were seasonal. The lowest values (0.2–0.3 mg/L) usually occurred in October and lasted only a few weeks at most. Concentrations increased, often sharply, after the minimum. The seasonal maximum usually occurred in November or December. After the maximum, concentrations dropped quickly through winter, although with considerable fluctuation. By spring, concentrations were below 0.5 mg/L and continued to slowly decline through the summer. This pattern was probably caused by the balance between the influx of NO3-N by leaching from soil and the consumption of NO3-N by phytoplankton and aquatic plants. The same general pattern occurred at most other Tualatin basin sites.
- The graph below suggests that peak NO3-N concentrations may have decreased in recent years. That conclusion is probably incorrect. The peak NO3-N concentrations in the graph below correlate with the sampling frequency. Peak NO3-N concentrations are short-lived, so more frequent sampling is more likely to capture the peak concentration.
- Many small concentration spikes occurred throughout the year, although fewer occurred in summer. Because these spikes are shorter-lived than the usual sampling frequency for this site, the graph below likely under-represents their frequency, especially since 2012 when the sampling frequency decreased.
- July–September NO3-N concentrations show a small, but statistically significant decreasing trend. The reason is unknown. The timing of site change and concentration decrease do not exactly coincide.

Rock Creek at Hwy 8 / Brookwood



Nominal Sampling Frequency



ROCK CREEK AT HWY 8 / BROOKWOOD

Nitrate/Nitrite

Data source: Clean Water Services

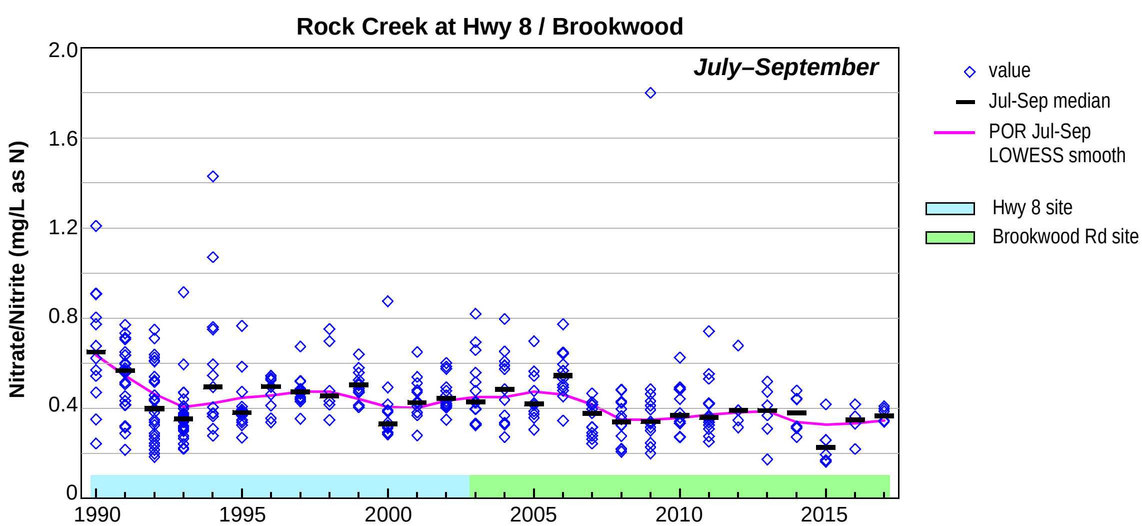
MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	32	0.74	1.87	0.85	0.60	0.46	0.31	0.86	0.62	0.60	0.20	0.28	1.21
1991	60	0.92	2.19	1.29	1.05	0.82	0.67	0.53	0.56	0.60	0.37	0.46	1.90
1992	83	1.85	2.28	1.26	0.46	0.39	0.36	0.49	0.44	0.25	0.14	0.33	1.94
1993	68	2.17	1.90	0.94	1.22	0.65	0.63	0.35	0.38	0.35	0.33	0.39	1.49
1994	38	2.18	2.08	1.84	0.62	0.66	0.75	0.65	0.60	0.37	0.35	0.90	1.77
1995	40	2.26	1.90	1.32	1.01	0.69	0.43	0.50	0.38	0.36	0.43	1.11	1.77
1996	36	1.49	1.41	1.10	0.89	0.88	0.59	0.51	0.43	0.50	0.46	0.58	1.43
1997	38	1.27	1.21	1.00	0.73	0.66	0.56	0.52	0.48	0.45	0.68	0.96	1.20
1998	23	1.23	1.45	1.12	0.78	0.74	0.71	0.59	0.48	0.35	0.47	0.45	1.66
1999	37	1.67	1.47	1.07	0.86	0.46	0.53	0.56	0.49	0.52	0.47	0.41	1.18
2000	39	1.23	1.29	1.19	0.63	0.45	0.44	0.32	0.42	0.31	0.35	0.40	0.38
2001	40	0.88	0.77	0.52	0.49	0.45	0.52	0.47	0.42	0.44	0.36	0.49	1.46
2002	38	1.09	1.18	1.02	0.49	0.41	0.61	0.48	0.53	0.41	0.37	0.28	0.99
2003	32	1.52	1.43	1.02		0.47	0.52	0.43	0.43	0.43	0.54	0.27	1.32
2004	38	1.54	1.18	1.04	0.34	0.45	0.53	0.46	0.34	0.59	0.27	0.42	0.76
2005	36	1.19	0.79	0.72	0.93	0.54	0.46	0.48	0.41	0.39	0.48	1.29	1.49
2006	39	1.31	1.48	1.02	0.72	0.59	0.52	0.55	0.55	0.54	0.39	0.53	1.46
2007	40	1.27	0.90	0.99	0.66	0.42	0.35	0.40	0.42	0.28	0.28	0.26	1.64
2008	37	1.17	1.25	0.68	0.45	0.31	0.32	0.35	0.35	0.32	0.22	0.30	0.38
2009	38	1.36	0.82	0.60	0.31	0.42	0.36	0.47	0.40	0.25	0.19	0.30	0.75
2010	37	1.33	1.03	1.08	0.61	0.38	0.53	0.48	0.36	0.33	0.29	0.43	0.92
2011	38	1.00	0.98	0.84	0.74	0.46	0.41	0.48	0.37	0.29	0.33	0.27	0.72
2012	20	1.16	0.80	0.91	0.55	0.44	0.37	0.37	0.39	0.50	0.23	0.34	0.84
2013	23	1.05	0.82	0.63	0.36	0.37	0.41	0.44	0.44	0.24	0.39	0.31	0.71
2014	23	0.96	1.18	0.71	0.60	0.41	0.51	0.38	0.40	0.36	0.26	0.48	1.08
2015	23	1.51	1.34	0.99	0.45	0.33	0.30	0.22	0.21	0.31	0.08	0.39	1.00
2016	19	1.39	1.28	0.90	0.39	0.35	0.49	0.33	0.42	0.29	0.27	0.72	
2017	19		1.09	0.71		0.44	0.37	0.37	0.37	0.38	0.30	0.48	0.92
POR Median		1.27	1.26	1.00	0.61	0.45	0.50	0.47	0.42	0.37	0.34	0.42	1.20

Key

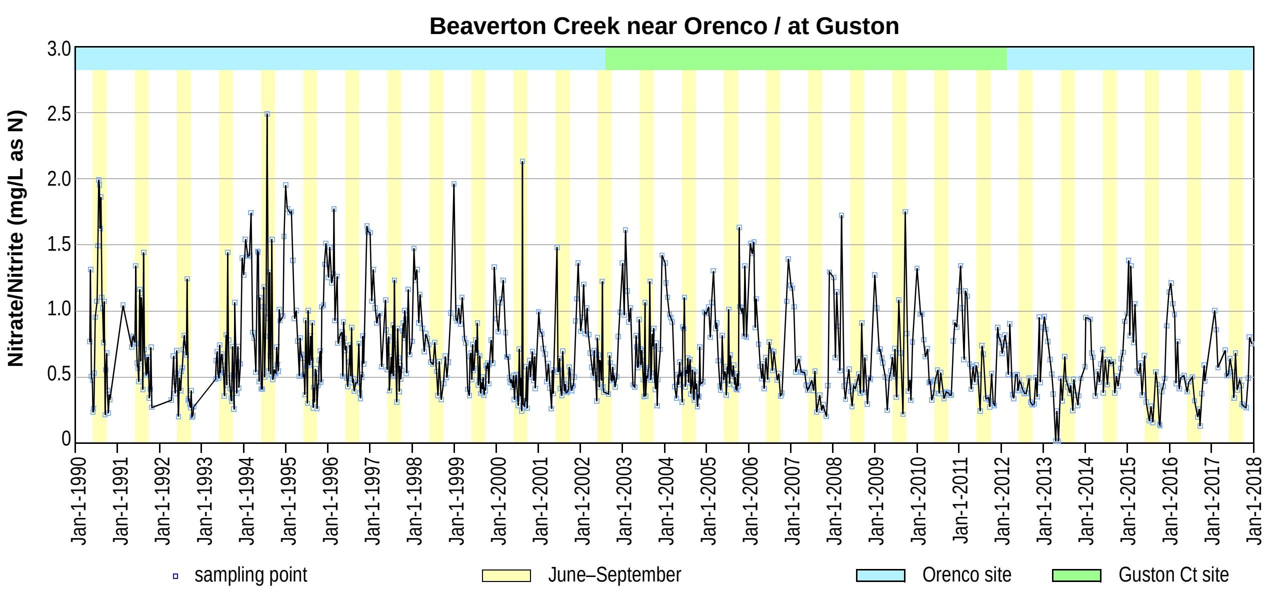
nitrate in mg/L as N

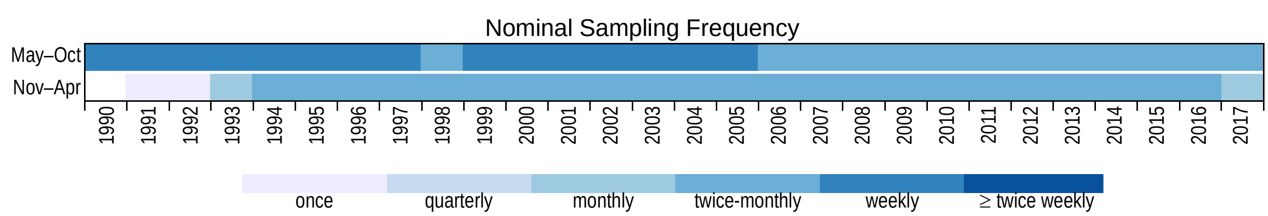
- $N \leq 0.3$
- $0.3 < N \leq 0.4$
- $0.4 < N \leq 0.8$
- $0.8 < N \leq 1.3$
- $N > 1.3$



Discussion

- The period of record is May 1990 through present. Sampling frequency was usually every week or every 2 weeks.
- The site location changed twice. The distance between the sites is very small.
- Nitrate (NO3-N) in Beaverton Creek is characterized by numerous, short-lived concentration spikes. Beaverton Creek does have a seasonal pattern, with higher concentrations in winter and lower concentrations in summer, but its pattern was much less pronounced and much more noisy than the pattern that was common to many other tributaries.
- Maximum concentrations in Beaverton Creek were short lived spikes that occurred throughout the year, including spring and summer. The two spikes with the highest concentrations shown in the graph below both occurred in August. This behavior is consistent with the flashy nature of this urban stream. Because the spikes are shorter-lived than the usual sampling frequency for this site, the graph below likely underrepresents their frequency. Data from weekly sampling captured numerous spikes; data from twice-a-month sampling captured far fewer.
- July–September NO3-N concentrations show a decreasing trend. Interpretation is complicated because both the sampling frequency and site location changed over time. Most of the lower concentrations occurred since 2006 when the sampling frequency decreased. The medians since 2006 may be lower because the less frequent sampling missed short-lived spikes in NO3-N concentrations that are common in the summer at this site. It is also possible that fewer spikes actually occurred at the new site. The data do not provide a way to disentangle the effects of sampling frequency changes from any effects of site location changes.





BEAVERTON CREEK NEAR ORENCO / AT GUSTON

Nitrate/Nitrite

Data source: Clean Water Services

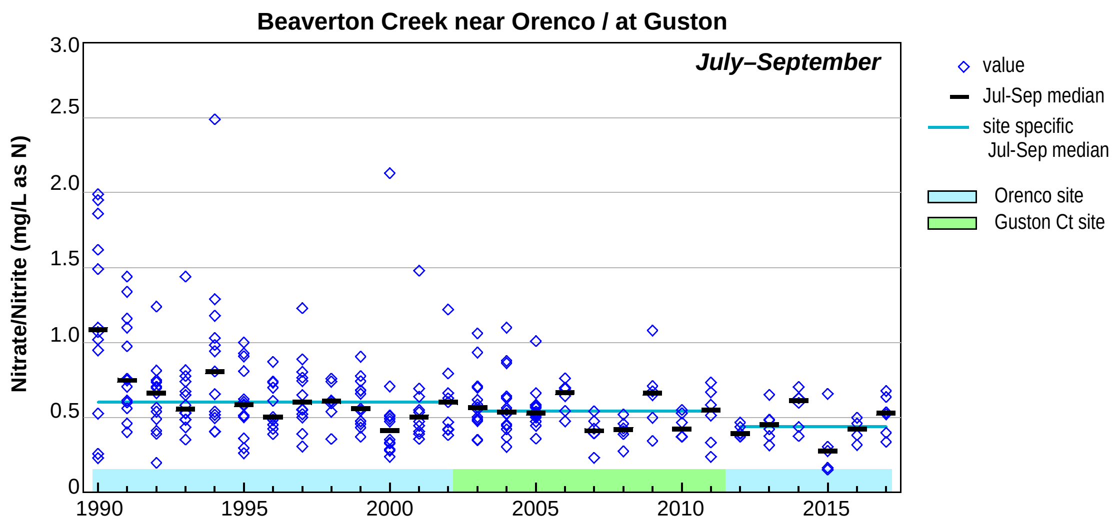
MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	25					0.63	0.39	1.72	1.36	0.65	0.36		
1991	26		1.04			0.78	0.75	0.61	0.84	0.58	0.37		
1992	26				0.32	0.49	0.45	0.55	0.75	0.30	0.24		
1993	32					0.58	0.65	0.53	0.78	0.37	0.55	0.51	1.00
1994	38	1.41	1.42	1.29	0.66	1.27	0.72	0.90	0.66	0.53	0.56	0.92	1.26
1995	40	1.86	1.75	1.16	0.88	0.66	0.51	0.59	0.62	0.47	0.45	1.03	1.43
1996	35	1.37	1.28	1.09	0.78	0.81	0.59	0.68	0.45	0.45	0.49	0.70	1.62
1997	36	1.33	1.17	0.93	0.78	0.97	0.66	0.59	0.65	0.58	0.82	0.93	0.91
1998	23	1.12	1.27	1.01	0.78	0.81	0.67	0.68	0.54	0.33	0.55	0.55	0.98
1999	37	1.45	0.97	1.00	0.77	0.40	0.56	0.78	0.46	0.41	0.57	0.59	0.97
2000	38	0.89	1.08	1.03	0.65	0.46	0.49	0.33	0.35	0.32	0.51	0.58	0.53
2001	35	0.92	0.77	0.57	0.51	0.37	1.01	0.48	0.46	0.38	0.43	0.50	1.23
2002	34	0.90	1.01	0.92	0.57	0.52	0.65	0.47		0.60	0.47	0.46	0.89
2003	38	1.16	1.38	0.97	0.43	0.66	0.70	0.48	0.53	0.73	0.61	0.38	1.06
2004	39	1.29	1.04	0.93	0.38	0.52	0.86	0.54	0.45	0.45	0.38	0.45	0.72
2005	38	1.00	0.93	1.08	0.76	0.45	0.49	0.55	0.57	0.42	0.78	0.99	1.07
2006	22	1.51	1.48	0.98	0.66	0.48	0.56	0.73	0.62	0.50	0.36		1.23
2007	22	1.18	0.78	0.64	0.53	0.48	0.41	0.43	0.39	0.33	0.27	0.32	1.29
2008	23	0.95	1.01	1.13	0.38	0.51	0.33	0.42	0.49	0.64	0.51	0.39	0.48
2009	23	1.15	0.70	0.62	0.37	0.51	0.57	0.53	0.88	0.98	0.61	0.40	0.76
2010	23	1.32	0.97	0.72	0.58	0.39	0.42	0.46	0.45	0.36	0.37	0.56	0.89
2011	24	1.25	0.82	1.13	0.50	0.52	0.55	0.49	0.50	0.33	0.40	0.29	0.84
2012	24	0.72	0.78	0.71	0.35	0.51	0.43	0.42	0.37	0.40	0.29	0.42	0.70
2013	23	0.91	0.81	0.58	0.19	0.12	0.40	0.57	0.40	0.34	0.42	0.32	0.49
2014	23	0.76	0.93	0.66	0.45	0.53	0.54	0.53	0.61	0.49	0.47	0.60	0.80
2015	23	1.18	1.08	0.90	0.53	0.48	0.48	0.17	0.21	0.49	0.13	0.41	0.68
2016	19	1.18	1.01	0.61	0.45	0.51	0.42	0.50	0.32	0.22	0.25	0.53	
2017	19		0.93	0.57		0.60	0.58	0.44	0.54	0.45	0.28	0.38	0.77
POR Median		1.18	1.01	0.93	0.53	0.51	0.56	0.53	0.53	0.45	0.44	0.50	0.90

Key

nitrate in mg/L as N

- $N \leq 0.4$
- $0.4 < N \leq 0.5$
- $0.5 < N \leq 0.8$
- $0.8 < N \leq 1.2$
- $N > 1.2$



CHICKEN CREEK AT SCHOLLS-SHERWOOD RD
Nitrate/Nitrite

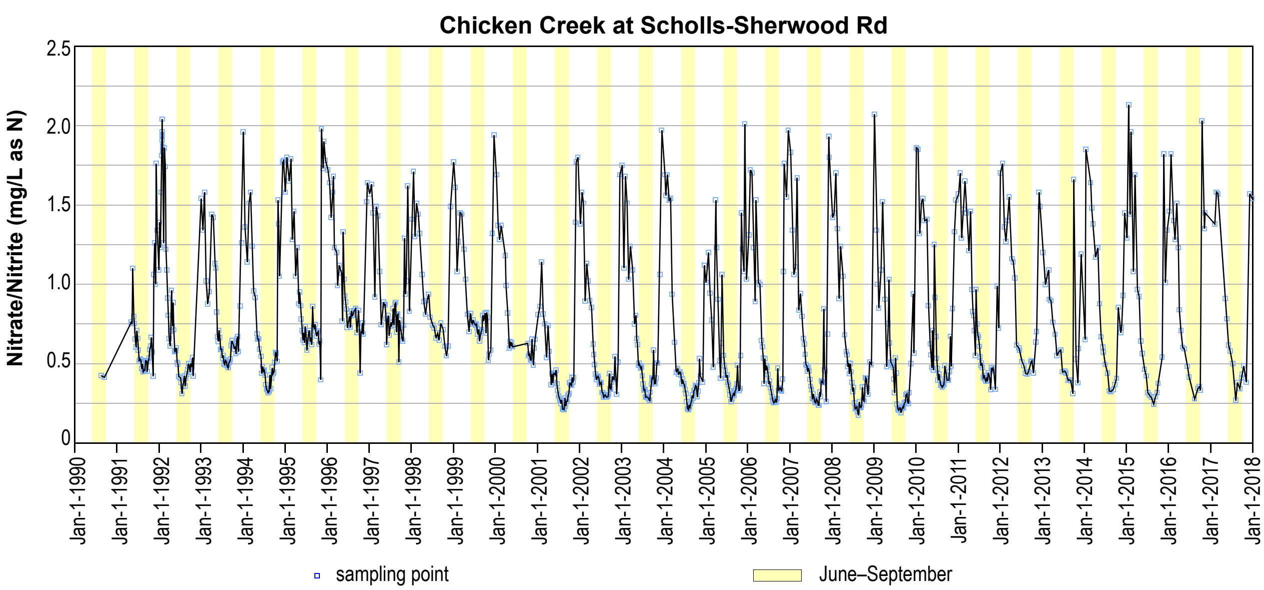
Data source: Clean Water Services

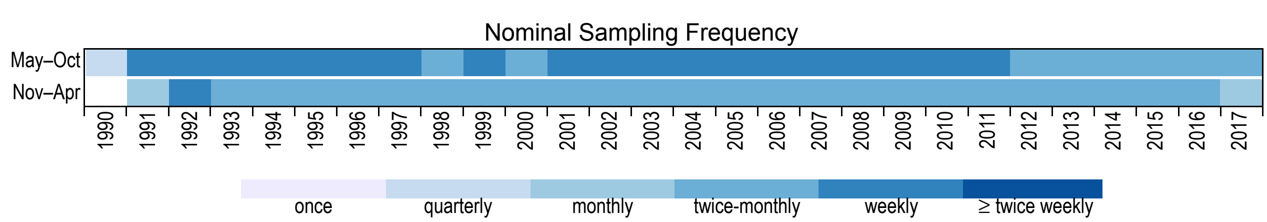
Discussion

- The period of record is August 1990 through present. Sampling frequency was usually every week or every 2 weeks.
- Nitrate (NO3-N) concentrations in Chicken Creek were seasonal. The minimum concentrations (0.2–0.3 mg/L) usually occurred in August and then slowly increased through October. A sharp increase to the seasonal maximum generally occurred in November or December. After the maximum, concentrations dropped quickly through winter, although with considerable fluctuation. By spring, concentrations were below 0.5 mg/L and continued to slowly decline until they reached the minimum. The pattern is similar to that at other tributaries, except for the August–November period—when NO3-N continued to decline at other sites, they increased at Chicken Creek. This increase occurred when flows were at their lowest and suggests a source of NO3-N that doesn't exist at other sites. The area around Chicken Creek is historically agricultural; tile drains could have transported NO3-N, or groundwater at this site might have higher NO3-N concentrations than at other sites.
- July–September NO3-N concentrations were unusual in that they differed among distinct time periods.The median concentrations were:

1991–1994	1995–1999	2001–2009	2010	2011–2017
0.46 mg/L	0.72 mg/L	0.28 mg/L	not sampled	0.39 mg/L

The difference between the 1995–1999 and other three periods was statistically significant. The difference among time periods cannot be explained by a change in site location (none) or analytical method (no evidence at other sites). Although sampling frequency changed over the period of record, the summer concentration spikes at this site were uncommon and the higher median concentration could not be explained by a greater sampling frequency. The summer NO3-N concentrations at Chicken Creek are a mystery.





CHICKEN CREEK AT SCHOLLS-SHERWOOD RD

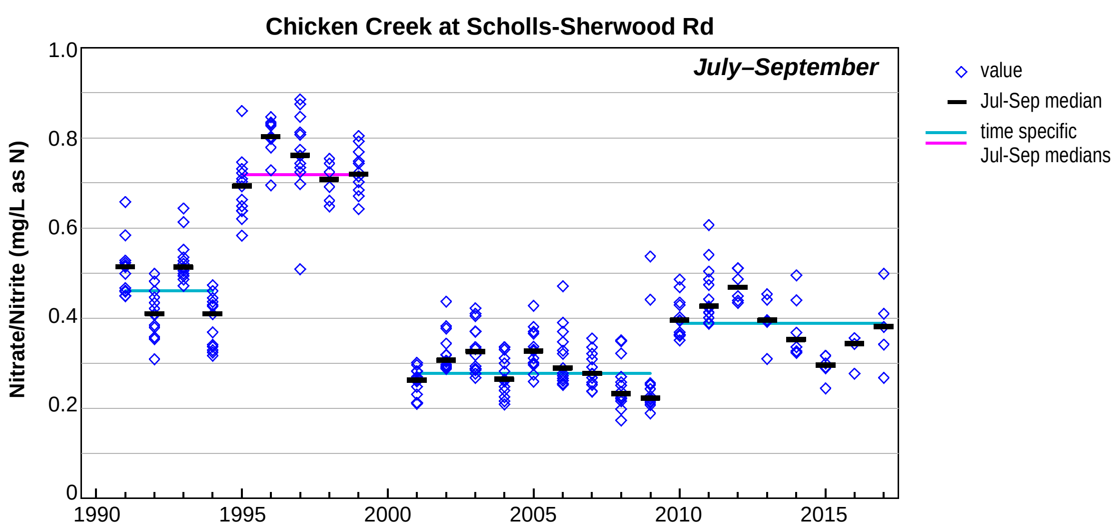
Nitrate/Nitrite

Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	2								0.42	0.41			
1991	33					0.78	0.68	0.53	0.46	0.49	0.59	0.82	1.34
1992	49	1.58	1.87	1.00	0.70	0.65	0.50	0.37	0.40	0.46	0.49		
1993	40	1.44	1.30	0.91	1.43	0.96	0.64	0.52	0.51	0.57	0.61	0.62	1.06
1994	38	1.66	1.33	1.41	0.94	0.65	0.47	0.40	0.33	0.44	0.54	1.38	1.78
1995	40	1.69	1.72	1.37	1.14	0.87	0.67	0.64	0.66	0.73	0.67	1.73	1.84
1996	36	1.68	1.58	1.22	1.06	1.05	0.87	0.79	0.82	0.77	0.70	0.72	1.58
1997	38	1.60	1.18	1.46	0.91	0.87	0.73	0.76	0.81	0.77	0.68	1.02	1.22
1998	23	1.56	1.41	1.38	0.98	0.85	0.86	0.73	0.66	0.75	0.66	0.58	1.49
1999	37	1.69	1.18	1.45	1.13	0.78	0.76	0.74	0.68	0.78	0.80	0.56	1.63
2000	21	1.53	1.33	1.18	0.91	0.61					0.55	0.52	0.62
2001	40	0.83	0.98	0.64	0.66	0.43	0.40	0.27	0.21	0.26	0.37	0.41	1.79
2002	39	1.48	1.20	1.08	0.85	0.46	0.41	0.32	0.29	0.33	0.40	0.43	1.10
2003	38	1.43	1.60	1.14	0.92	0.64	0.48	0.34	0.29	0.37	0.39	0.50	1.52
2004	39	1.63	1.61	1.24	0.54	0.45	0.37	0.29	0.24	0.32	0.34	0.42	0.75
2005	39	1.11	0.86	1.00	1.07	0.57	0.47	0.37	0.30	0.33	0.36	1.15	1.52
2006	39	1.52	1.47	1.21	1.00	0.53	0.47	0.36	0.27	0.30	0.34	1.08	1.76
2007	40	1.59	1.09	1.25	0.87	0.56	0.45	0.32	0.27	0.26	0.39	0.45	1.87
2008	38	1.44	1.53	1.07	0.87	0.53	0.44	0.25	0.21	0.24	0.38	0.34	0.49
2009	38	1.71	0.93	1.31	0.69	0.69	0.48	0.34	0.21	0.23	0.28	0.41	0.75
2010	37	1.86	1.42	1.47	1.14	0.59	0.67	0.42	0.36	0.43	0.42	0.66	1.43
2011	39	1.64	1.38	1.55	1.34	0.81	0.68	0.52	0.41	0.42	0.43	0.45	0.86
2012	24	1.73	1.32	1.48	1.15	0.83	0.59	0.50	0.44	0.48	0.48	0.67	1.54
2013	23	1.10	1.07	0.90	0.72	0.56	0.52	0.45	0.40	0.35	1.09	0.49	1.19
2014	23	1.25	1.64	1.43	1.20	0.77	0.59	0.47	0.33	0.35	0.63	0.71	1.19
2015	23	1.71	1.70	1.39	0.94	0.60	0.44	0.31	0.27	0.30	0.38	1.18	1.18
2016	19	1.64	1.34	1.37	0.77	0.60	0.45		0.28	0.35	1.18	1.40	
2017	17		1.48	1.57		0.85	0.60	0.50	0.32	0.38	0.46	0.38	1.56
POR Median		1.59	1.36	1.28	0.94	0.65	0.51	0.42	0.33	0.38	0.48	0.60	1.43

Key
nitrate in mg/L as N
$N \le 0.4$
$0.4 < N \le 0.5$
$0.5 < N \le 1.0$
$1.0 < N \le 1.5$
$N > 1.5$



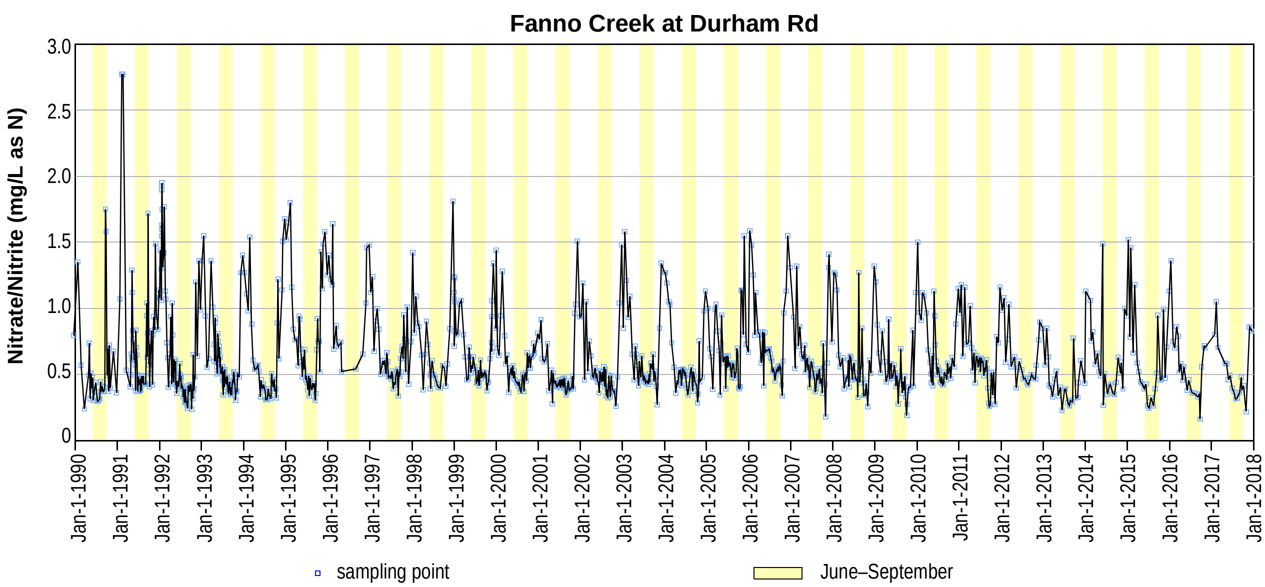
FANNO CREEK AT DURHAM RD

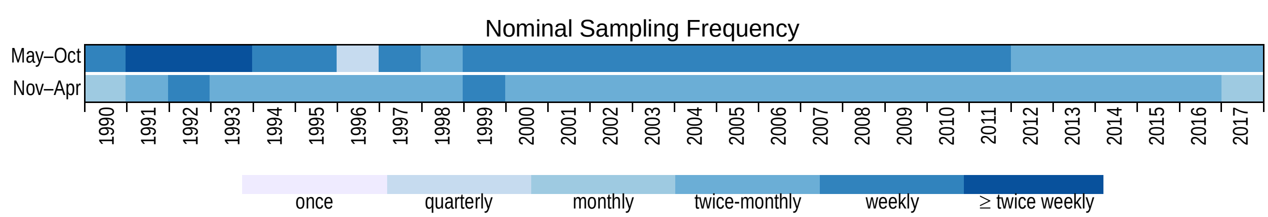
Nitrate/Nitrite

Data source: Clean Water Services

Discussion

- The period of record is January 1990 through present. Sampling frequency varied.
- Nitrate (NO3-N) concentrations in Fanno Creek were seasonal. The lowest values (0.2–0.5 mg/L) usually occurred in October. Concentrations in the fall and early winter were highly variable with sharp increases and decreases imposed on an overall increasing trend. The seasonal maximum usually occurred in January. After the maximum, concentrations dropped quickly through winter, although with considerable fluctuation. By spring, concentrations were below 0.6 mg/L and continued to slowly decline through the summer. The general pattern at Fanno Creek was similar to that at most other Tualatin basin sites, except the pattern at Fanno Creek was much noisier.
- Short-lived spikes in NO3-N concentration were prevalent at Fanno Creek. They occurred throughout the year, although they were smaller in the summer. This behavior is consistent with the flashy nature of this urban stream. Because the spikes are shorter-lived than the usual sampling frequency for this site, the graph below likely under-represents their frequency, especially in recent years when the sampling frequency decreased to twice-a-month. The graph below shows how the number of spikes captured by the data decreases as the sampling frequency decreases.
- July–September NO3-N concentrations appear to be decreasing, but the trend is not significant and likely related to the decrease in sampling frequency that occurred in 2012. The medians since 2012 may be lower because less frequent sampling missed short-lived spikes in NO3-N concentrations that, although small, still occur during the summer.





FANNO CREEK AT DURHAM RD

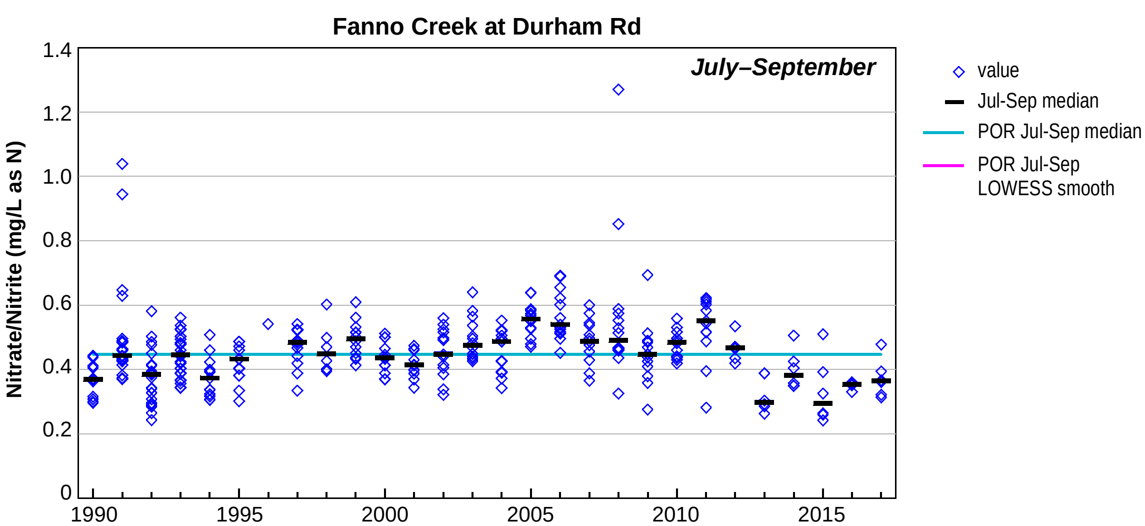
Nitrate/Nitrite

Data source: Clean Water Services

MEDIAN MONTHLY NITRATE/NITRITE CONCENTRATION (mg/L as N) BY MONTH AND YEAR

	samples	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	32	0.80	1.35	0.57	0.24	0.50	0.39	0.33	0.34	0.39	0.69	0.56	0.68
1991	60	0.36	1.92	2.77	0.53	0.71	0.64	0.45	0.44	0.43	0.71	0.82	0.97
1992	83	1.14	1.75	0.91	0.63	0.54	0.42	0.46	0.34	0.31	0.39	0.48	1.00
1993	68	1.17	1.25	0.59	1.19	0.66	0.66	0.50	0.48	0.39	0.44	0.37	0.88
1994	38	1.34	1.05	1.21	0.57	0.55	0.40	0.38	0.34	0.43	0.38	0.89	1.33
1995	40	1.60	1.73	1.00	0.76	0.70	0.59	0.45	0.41	0.42	0.75	1.15	1.54
1996	15	1.33	1.22	0.78	0.73	0.63				0.54		0.65	1.25
1997	38	1.30	0.96	0.95	0.67	0.59	0.55	0.49	0.43	0.52	0.65	0.77	0.72
1998	26	1.08	0.95	0.88	0.52	0.78	0.51	0.55	0.43	0.40	0.56	0.50	0.85
1999	46	1.10	0.81	1.05	0.72	0.47	0.57	0.52	0.45	0.50	0.50	0.44	0.94
2000	40	0.85	0.79	1.04	0.61	0.50	0.50	0.43	0.41	0.48	0.64	0.63	0.70
2001	40	0.79	0.77	0.61	0.55	0.45	0.42	0.43	0.44	0.38	0.39	0.49	1.27
2002	39	0.94	0.83	0.79	0.64	0.50	0.45	0.50	0.47	0.40	0.38	0.32	0.76
2003	38	1.17	1.40	1.01	0.56	0.61	0.50	0.48	0.44	0.54	0.51	0.34	1.09
2004	39	1.27	1.12	0.88	0.46	0.48	0.53	0.46	0.43	0.50	0.42	0.45	0.73
2005	39	1.07	0.66	0.69	0.93	0.71	0.60	0.60	0.57	0.51	0.53	0.97	1.14
2006	39	1.13	1.37	0.96	0.81	0.62	0.68	0.67	0.52	0.53	0.54	0.60	1.34
2007	39	1.31	0.74	1.02	0.76	0.62	0.56	0.56	0.48	0.48	0.48	0.42	1.36
2008	37	1.01	1.20	0.60	0.51	0.48	0.59	0.51	0.47	0.53	0.34	0.37	0.51
2009	38	1.26	0.77	0.67	0.52	0.54	0.51	0.46	0.46	0.43	0.30	0.40	0.62
2010	37	1.31	0.94	1.11	0.82	0.55	0.72	0.51	0.44	0.49	0.55	0.55	0.72
2011	39	1.06	0.91	0.94	0.88	0.64	0.57	0.62	0.55	0.47	0.37	0.34	0.76
2012	24	1.07	0.84	0.90	0.58	0.52	0.58	0.50	0.45	0.45	0.49	0.52	0.83
2013	23	0.71	0.74	0.41	0.40	0.43	0.32	0.39	0.27	0.30	0.55	0.38	0.61
2014	23	0.78	1.06	0.79	0.62	0.50	0.88	0.43	0.42	0.35	0.53	0.55	0.69
2015	24	1.23	1.12	0.92	0.55	0.44	0.41	0.25	0.29	0.45	0.70	0.73	0.59
2016	20	1.25	0.72	0.83	0.55	0.51	0.42	0.36	0.36	0.34	0.36	0.71	
2017	18		0.93	0.70		0.58	0.48	0.38	0.32	0.42	0.40	0.22	0.84
POR Median		1.13	0.96	0.89	0.61	0.54	0.53	0.46	0.44	0.44	0.50	0.51	0.84

Key	
nitrate in mg/L as N	
$N \le 0.4$	
$0.4 < N \le 0.5$	
$0.5 < N \le 0.8$	
$0.8 < N \le 1.1$	
$N > 1.1$	



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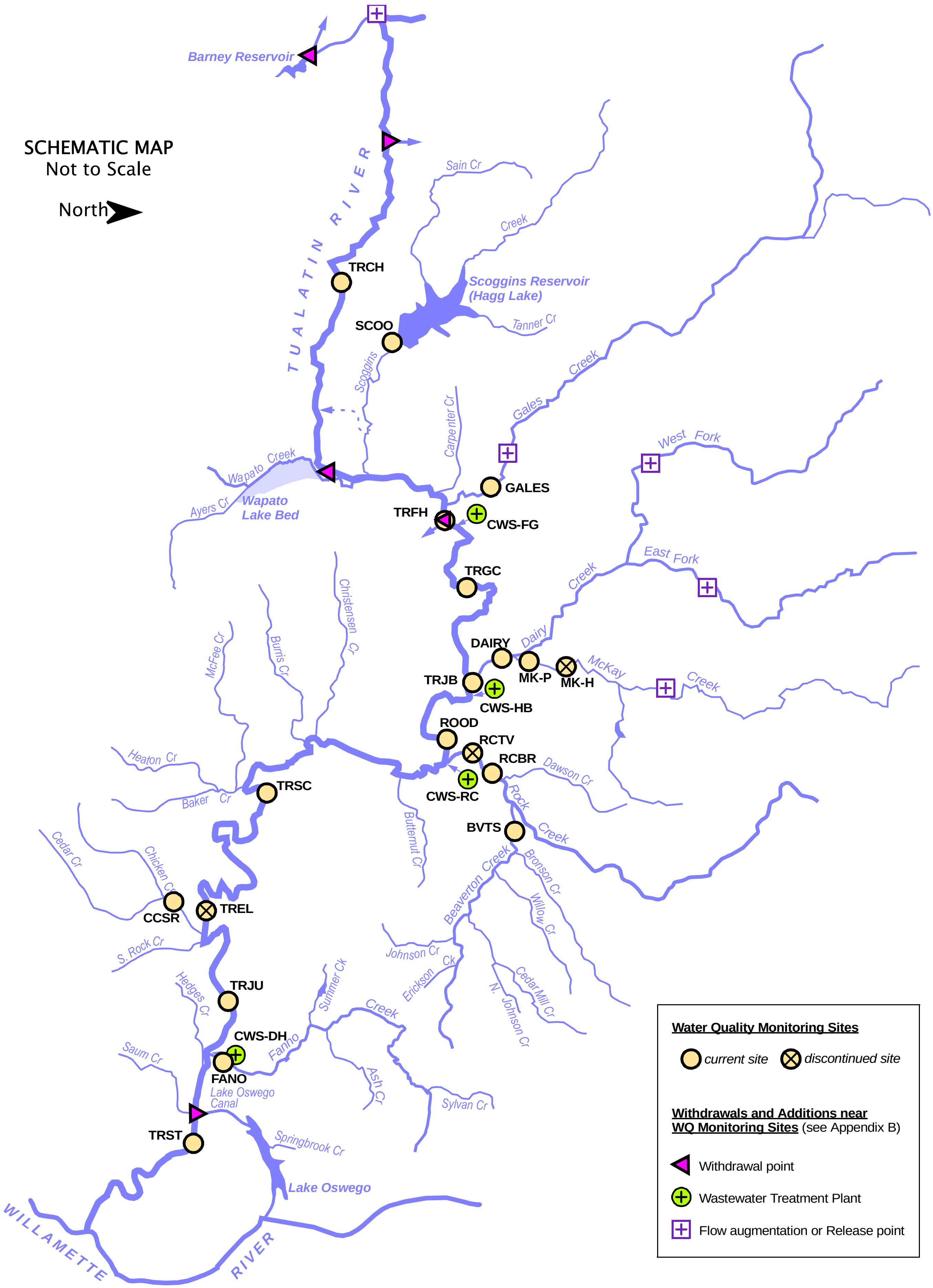
Appendix J

Water Quality Records: Copper & Zinc

MAP OF COPPER AND ZINC MONITORING SITES



COPPER & ZINC WATER QUALITY SITES — ALPHABETICAL LISTING BY SITE CODE

SITE CODE	SITE NAME	RIVER MILE	PAGE
BVTS	Beaverton Creek near Orenco / at Guston Ct	1.2 / 1.2	J-15
CCSR	Chicken Creek at Scholls-Sherwood Rd (Roy Rogers Rd)	2.3	J-16
DAIRY	Dairy Creek at Hwy 8	2.06	J-12
FANO	Fanno Creek at Durham Rd	1.2	J-17
GALES	Gales Creek at New Hwy 47	2.36	J-11
MK-H & MK-P	McKay Creek at Hornecker Rd / Padgett Rd	2.2 / 1.3	J-13
RCTV & RCBR	Rock Creek at Hwy 8 / Brookwood	1.2 / 2.4	J-14
SCOO	Scoggins Creek below Lake below Hagg Lake	4.8	J-4
TRJB	Tualatin River at Hwy 219	44.4	J-7
TRSC	Tualatin River at Hwy 210 (Scholls Bridge)	26.9	J-9
TRCH	Tualatin River at Cherry Grove (South Rd Bridge) *[not done in 2017]*	67.83	—
TRGC	Tualatin River at Golf Course Rd	51.5	J-6
TRFH	Tualatin River at Spring Hill Pump Plant / Fern Hill Rd	55.3	J-5
TREL & TRJU	Tualatin River at Elsner Rd / Jurgens Park	16.2 / 10.8	J-10
ROOD	Tualatin River at Rood Bridge Rd	38.4	J-8
TRST	Tualatin River at Stafford *[not done in 2017]*	5.38	—

Data for this section were obtained from Clean Water Services. For some sites, the exact sampling location changed over the period of record. Analytical methods also may have changed. It is not known if these data are fully comparable with one another.

Discussion

- In general, concentrations of total recoverable copper and zinc (TotCu and TotZn) are much more variable than the dissolved concentrations. Greater sampling frequency will be required to distinguish patterns and trends for TotCu and TotZn.
- *All Tualatin River sites, Beaverton Ck, Dairy Ck, Fanno Ck and Rock Ck*— Dissolved zinc shows a clear seasonal pattern in 2008–2011 with the lowest concentrations at the end of the summer and highest concentrations in late winter. In later years, sampling is not frequent enough to determine if the pattern persists.
- *Tualatin River sites at Fern Hill, Rood Bridge, Hwy 210 and Jurgens Park*—Recent more-frequent sampling at these sites (beginning June 2016) suggests that a similar seasonal pattern in dissolved copper concentrations (lower in summer, higher in winter) may be present. A longer record with frequent sampling would be needed to confirm this.
- *Tualatin River sites at Fern Hill, Golf Course Rd and Hwy 219, Dairy Ck and Gales Ck*—Samples from 2008–2011 suggest that TotCu may have a seasonal pattern similar to that previously described for dissolved copper and zinc. TotCu is highly variable and a greater sampling frequency would be needed to distinguish a pattern, if one exists, from the noise.
- *At all sites (except Scoggins Ck)*—The frequency of high concentrations of TotCu and TotZn before 2012 is greater than that after 2012. Had the sampling frequency been constant, this difference would indicate a decreasing trend, but the sampling frequency decreased by a factor of 3. Based on the earlier more frequent sampling, high concentrations are less common than low concentrations. This means that the lower frequency of high values after 2012 could easily have occurred by chance and no conclusions about trends can be made.
- The lowest concentrations of dissolved Cu and Zn, TotCu and TotZn were at the Scoggins Creek site. No patterns in concentrations were observed at this site.
- The highest concentrations overall were at the Beaverton Creek and Fanno Creek sites.
- In some instances, dissolved concentrations exceeded total recoverable concentrations, indicating that the reported values may have significant uncertainty.

SCOGGINS CREEK BELOW HAGG LAKE
Copper and Zinc

Data source: Clean Water Services

Discussion

- The period of record is March 2013 through present.
- Sampling frequency was:
  2013, biannual
  2014–2017, quarterly

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	0.57	0.90
Zinc	0.50	0.68

TUALATIN RIVER AT SPRING HILL PUMP PLANT / FERN HILL RD
Copper and Zinc

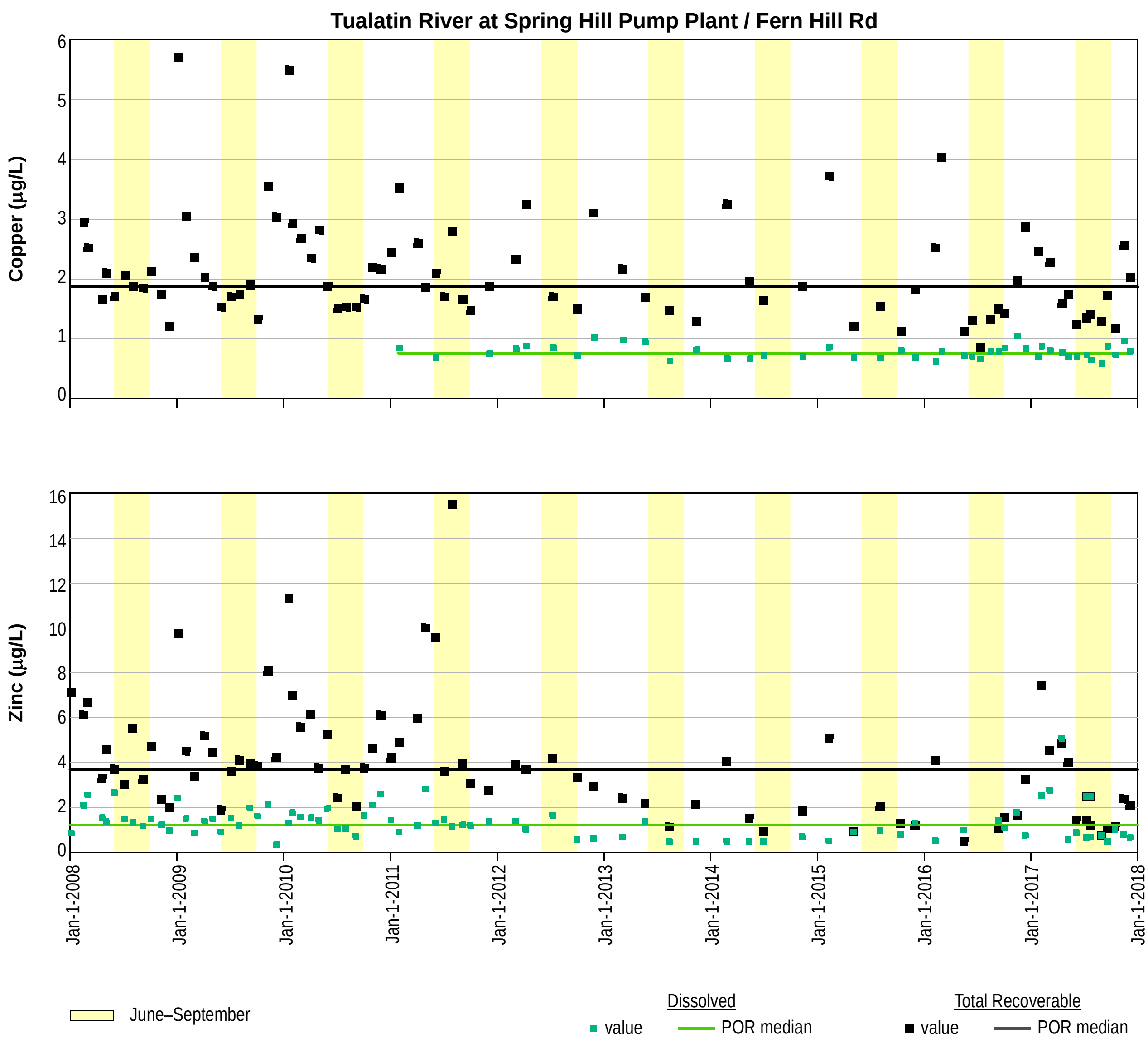
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in February 2011.
- Sampling frequency was:
  2008–2011, monthly
  2012–2015, approximately quarterly
  2016–present, approximately monthly
- Dissolved copper has fewer data than total recoverable copper.

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	0.76	1.87
Zinc	1.22	3.70



TUALATIN RIVER AT GOLF COURSE RD
Copper and Zinc

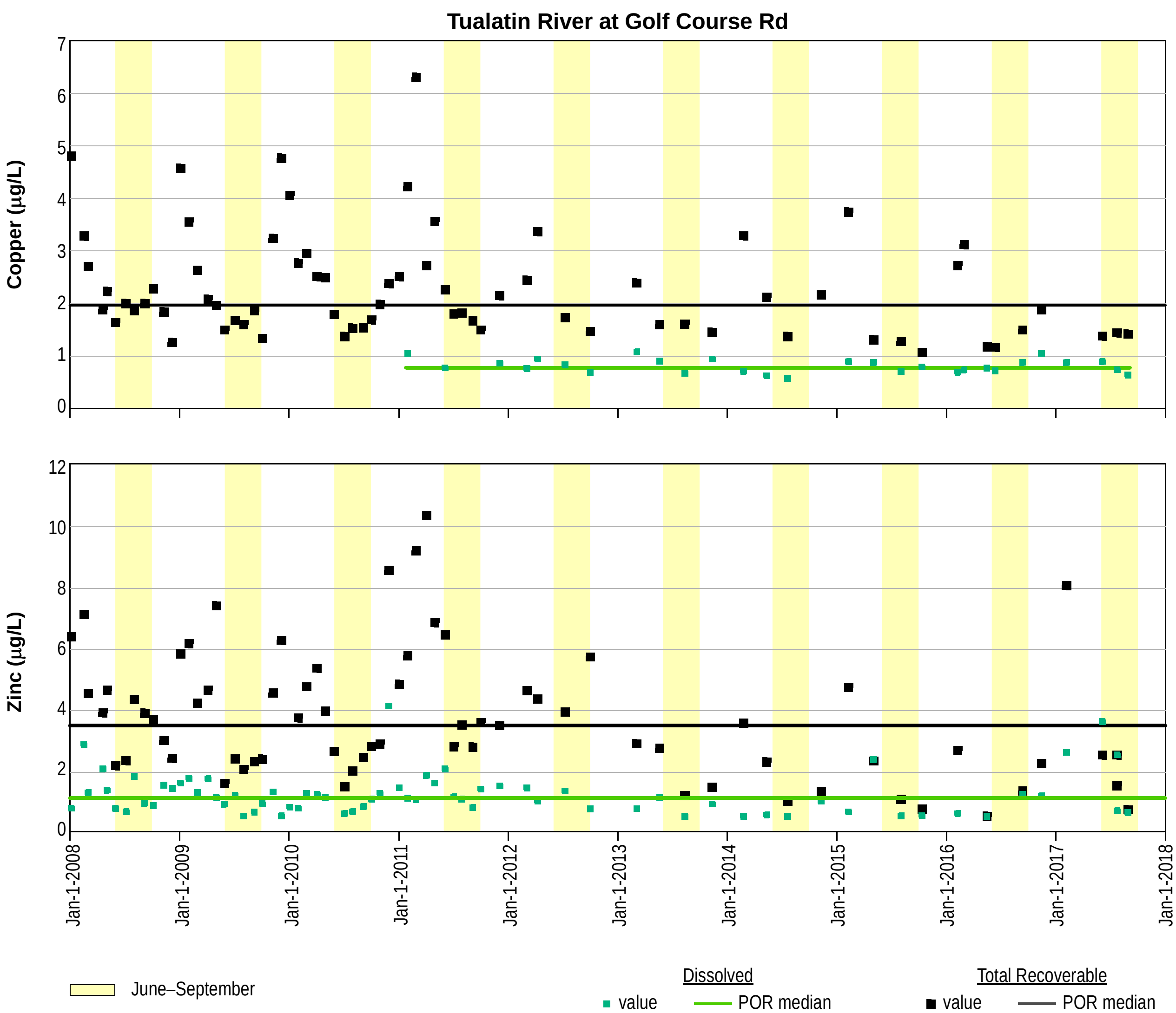
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in February 2011.
- Sampling frequency was:
  2008–2011, monthly
  2012–2017, approximately quarterly
- Dissolved copper has fewer data than total recoverable copper.

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	0.78	1.97
Zinc	1.09	3.46



TUALATIN RIVER AT HWY 219
Copper and Zinc

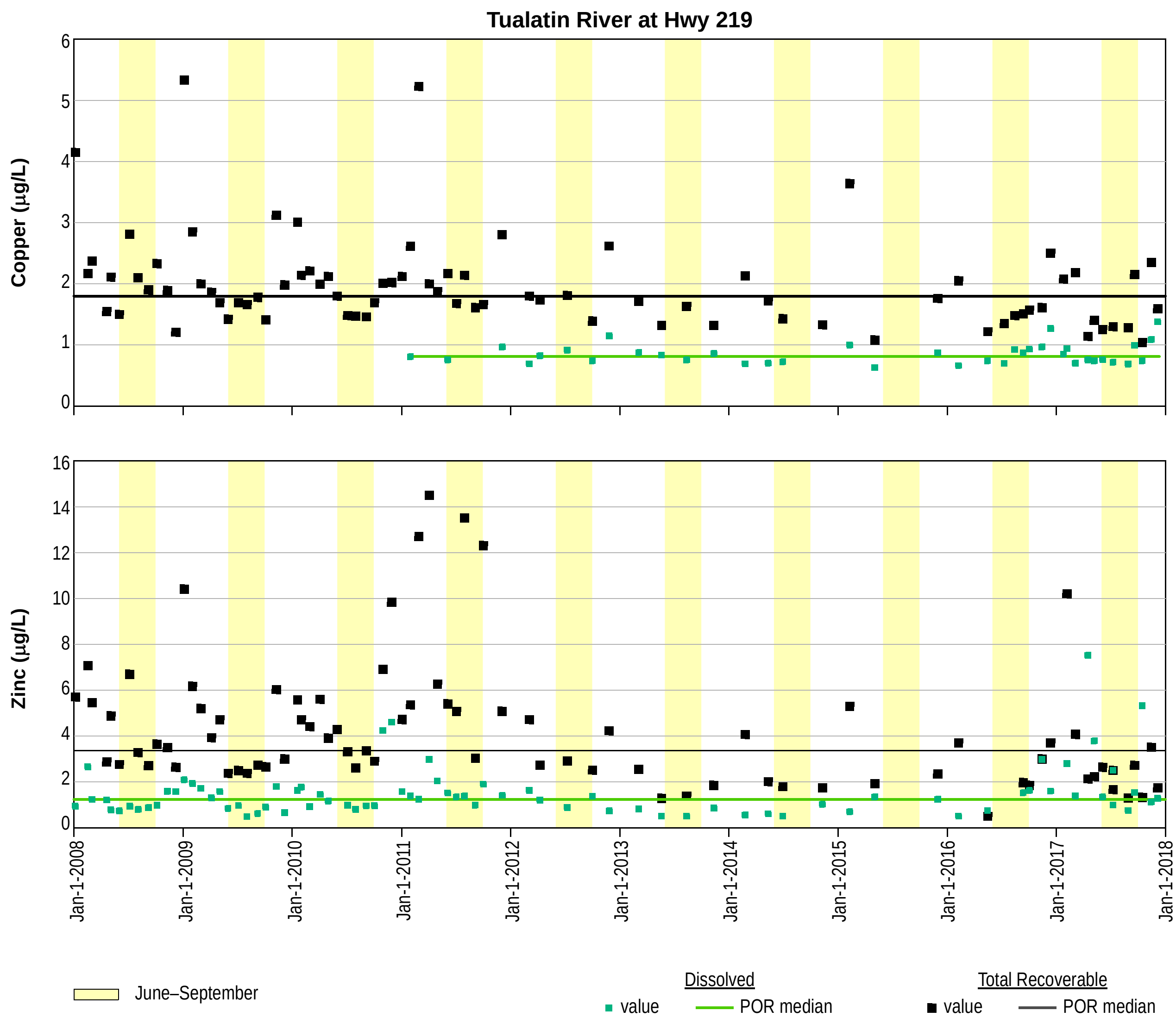
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in February 2011.
- Sampling frequency was:
  2008–2011, monthly
  2012–2015, approximately quarterly
  2016–2017, approximately monthly
- Dissolved copper has fewer data than total recoverable copper.

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	0.81	1.80
Zinc	1.24	3.35



TUALATIN RIVER AT ROOD BRIDGE RD
Copper and Zinc

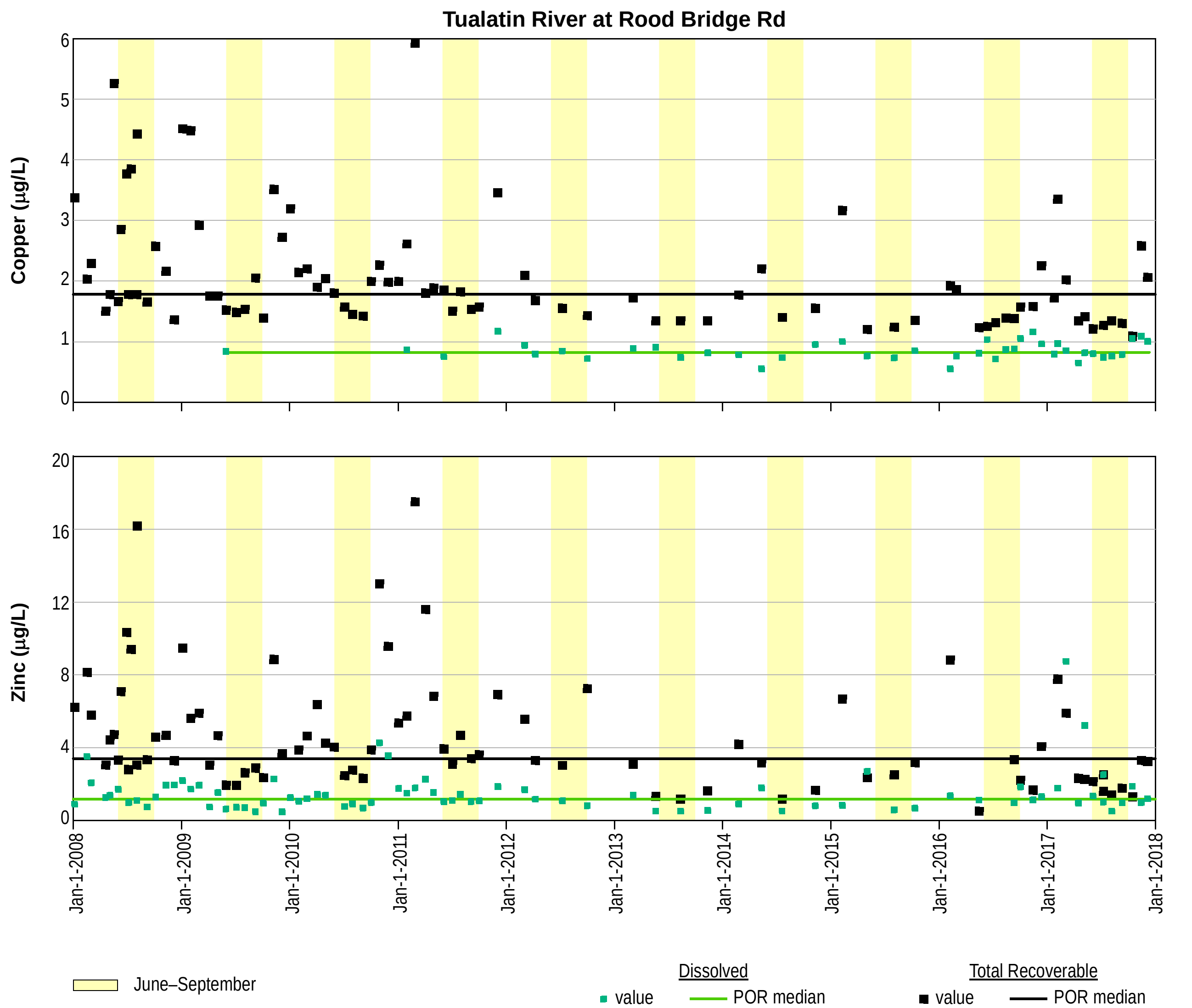
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in February 2011.
- Sampling frequency was:
  2008–2011, monthly
  2012–2015, approximately quarterly
- Dissolved copper has fewer data than total recoverable copper.

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	0.825	1.78
Zinc	1.16	3.39



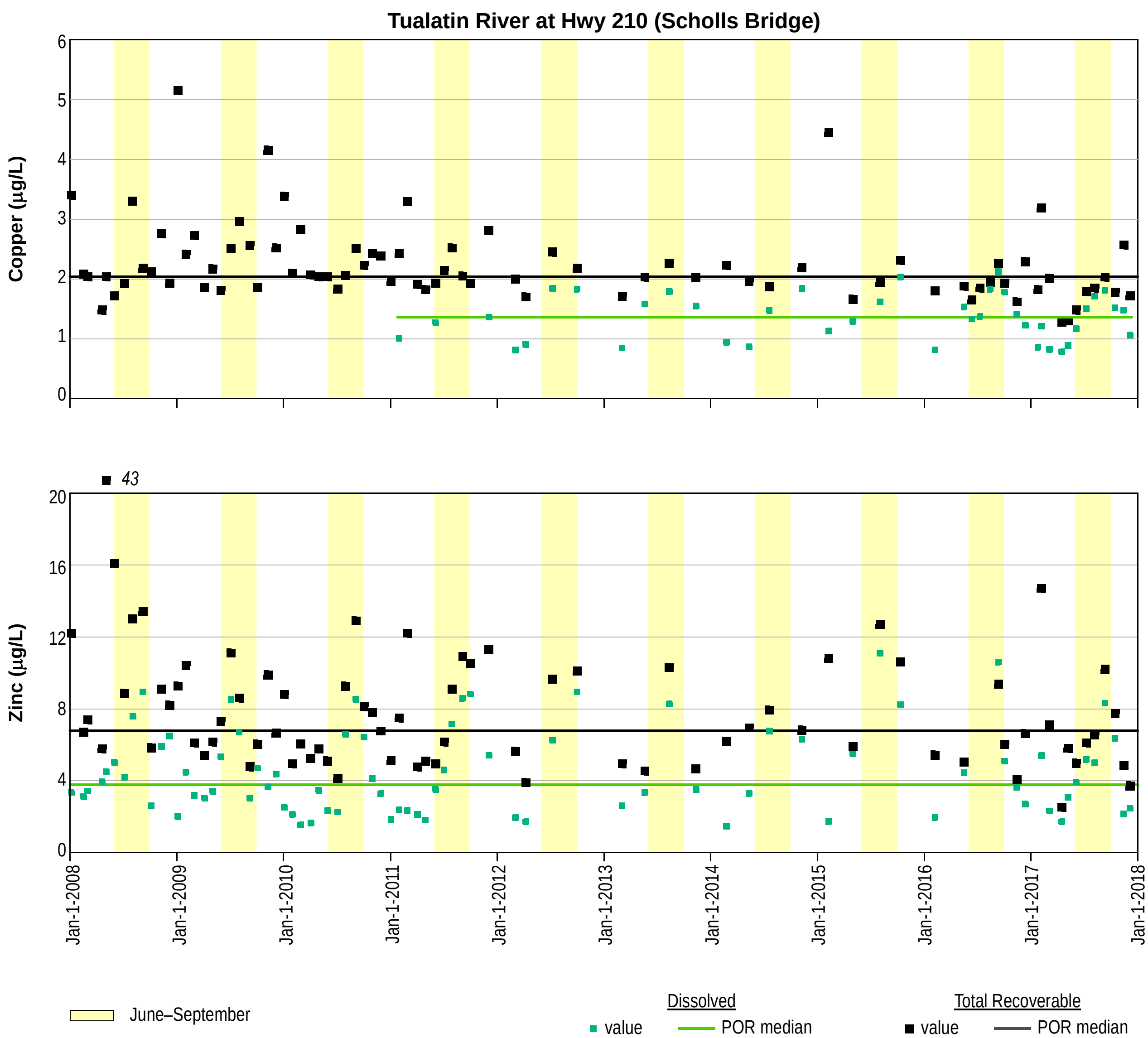
TUALATIN RIVER AT HWY 210 (Scholls Bridge)
Copper and Zinc.

Data source: Clean Water Services

- The period of record is January 2008 through present, except for dissolved copper which began in February 2011.
- Sampling frequency was:
  2008–2011, monthly
  2012–2015, approximately quarterly
- Dissolved copper has fewer data than total recoverable copper.

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	1.36	2.04
Zinc	3.78	6.78



TUALATIN RIVER AT ELSNER RD / JURGENS PARK
Copper and Zinc

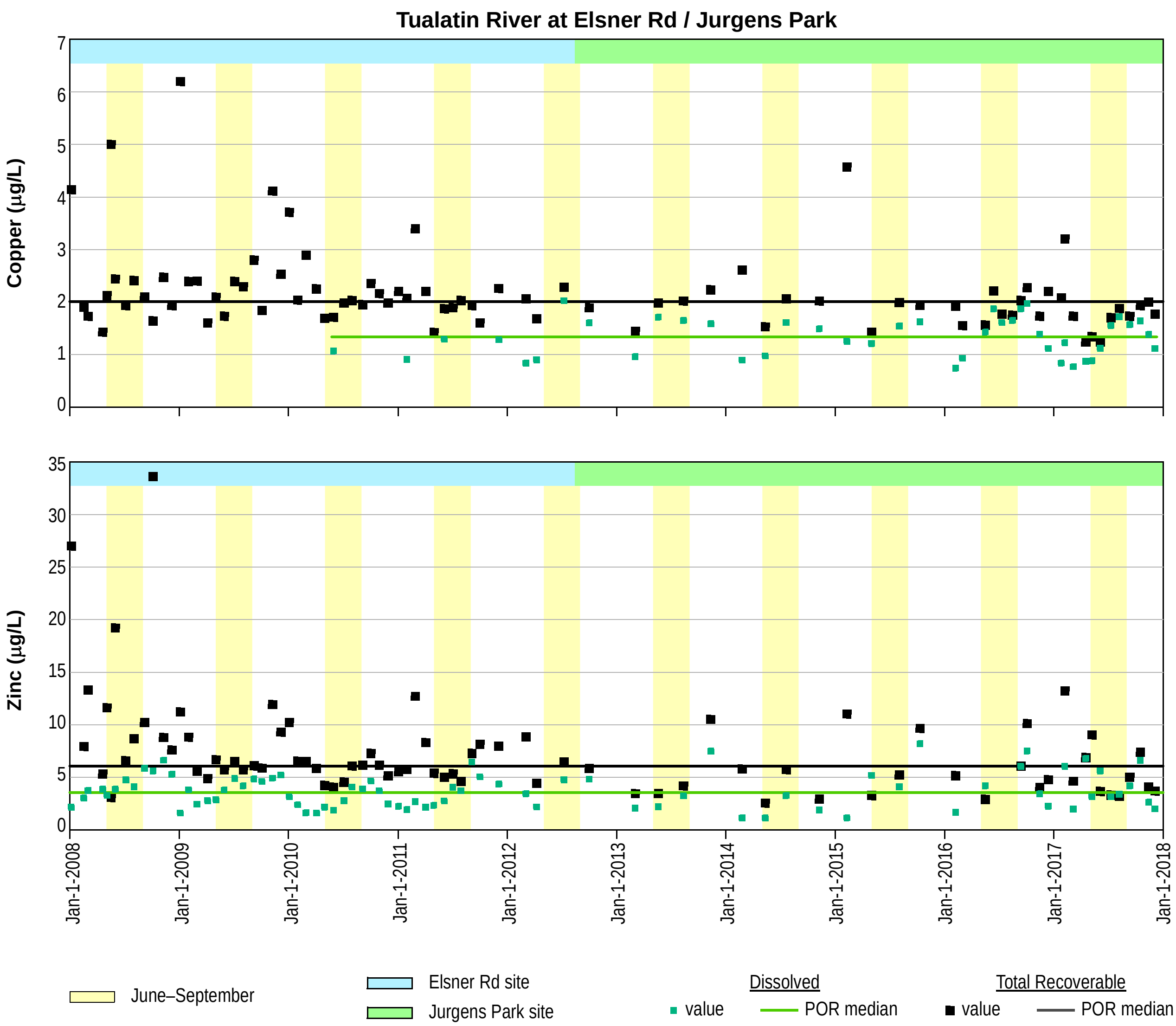
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in June 2010.
- Sampling frequency was:
  2008–2011, monthly
  2012–2015, approximately quarterly
  2016–2017, approximately monthly
- Dissolved copper has fewer data than total recoverable copper.

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	1.34	2.01
Zinc	3.56	6.05



GALES CREEK AT NEW HWY 47
Copper and Zinc

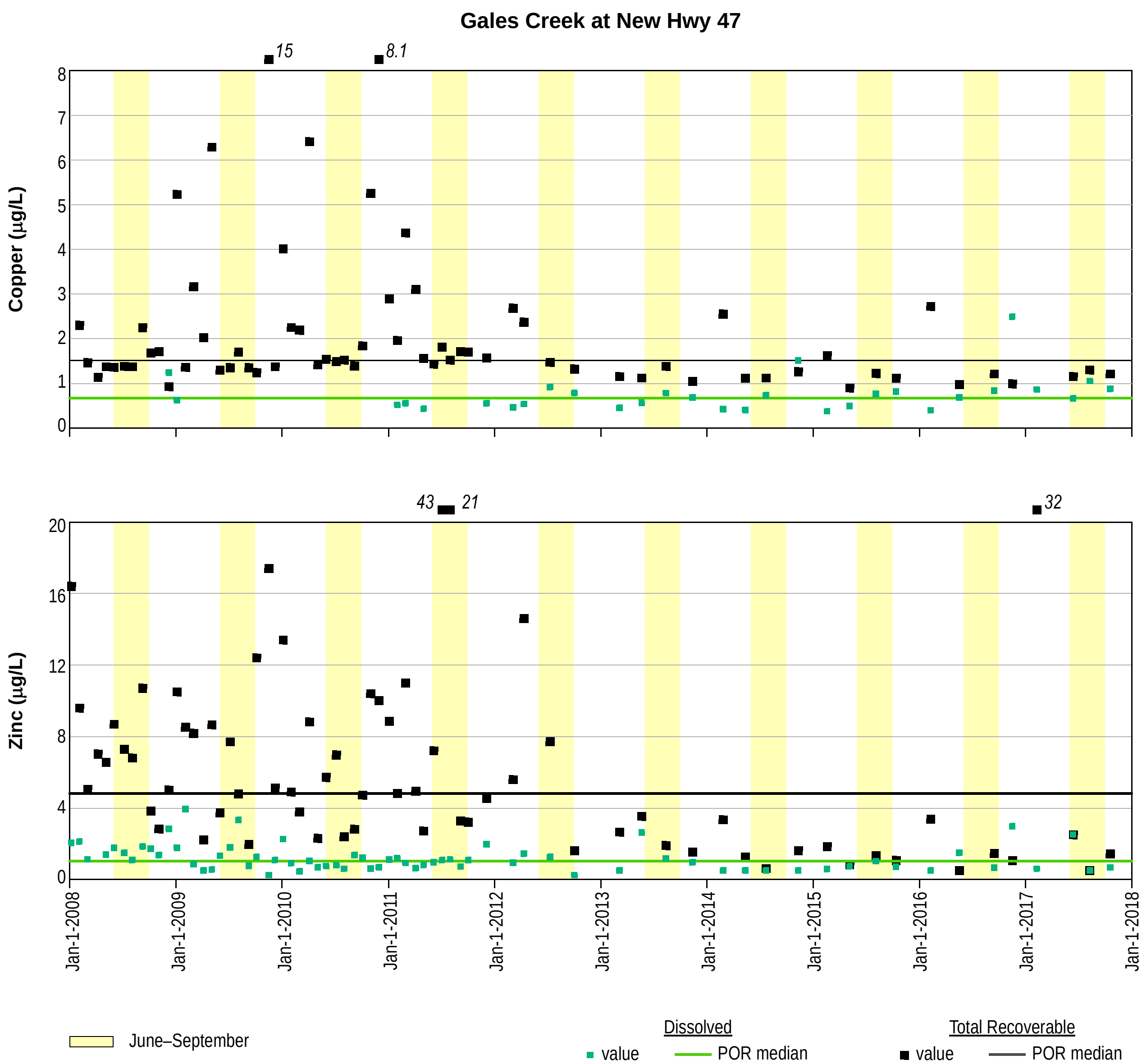
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in February 2011.
- Sampling frequency was:
  2008–2011, monthly
  2012–2017, approximately quarterly
- Dissolved copper has fewer data than total recoverable copper.
- Some values are off scale and noted above the graphs.

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	0.67	1.50
Zinc	1.02	4.81



DAIRY CREEK AT HWY 8
Copper and Zinc

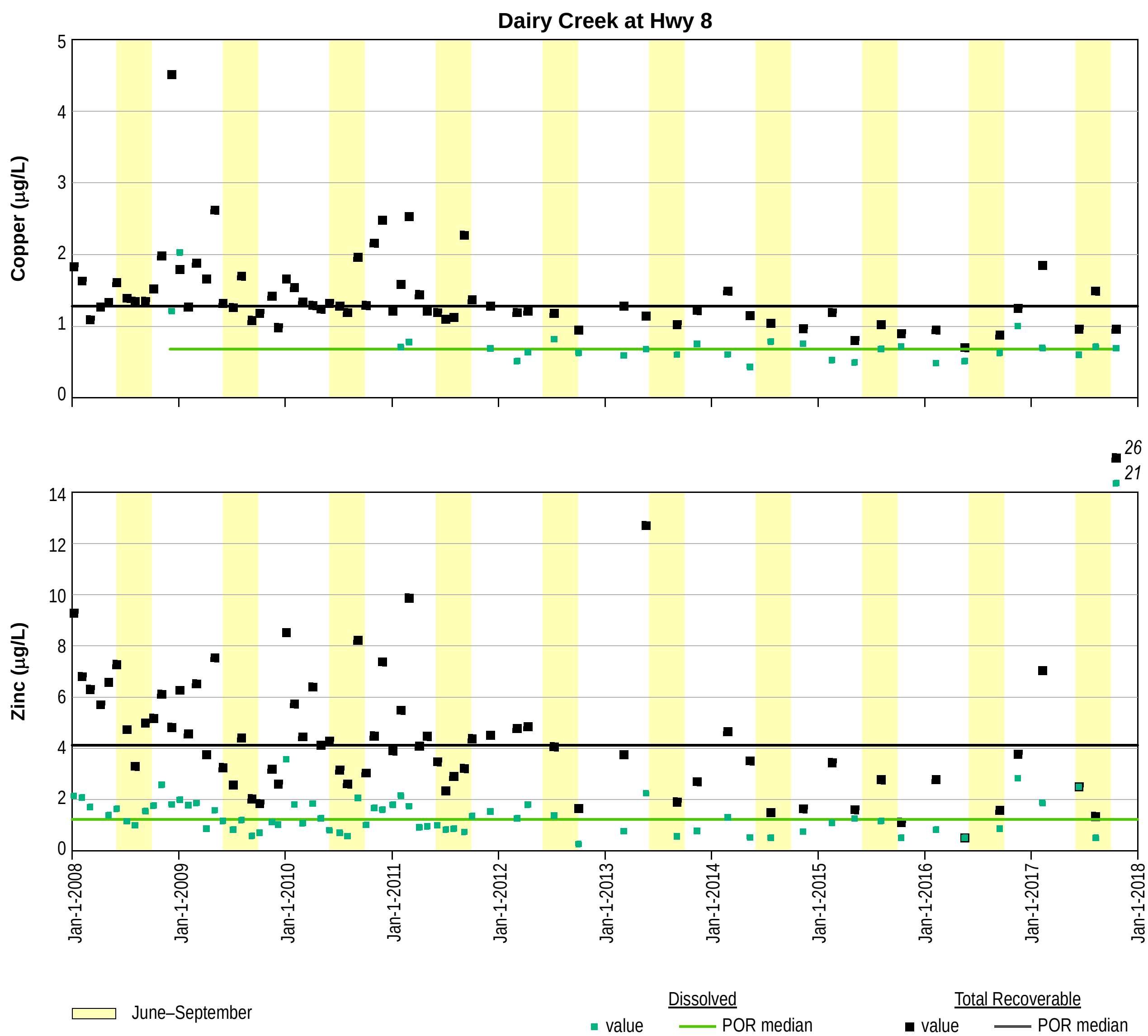
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in December 2008.
- Sampling frequency was:
  2008–2011, monthly
  2012–2015, approximately quarterly
- Dissolved copper has fewer data than total recoverable copper.
- Some values are off scale and noted above the graphs.

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	0.68	1.28
Zinc	1.225	4.12



McKAY CREEK AT HORNECKER RD / PADGETT RD
Copper and Zinc

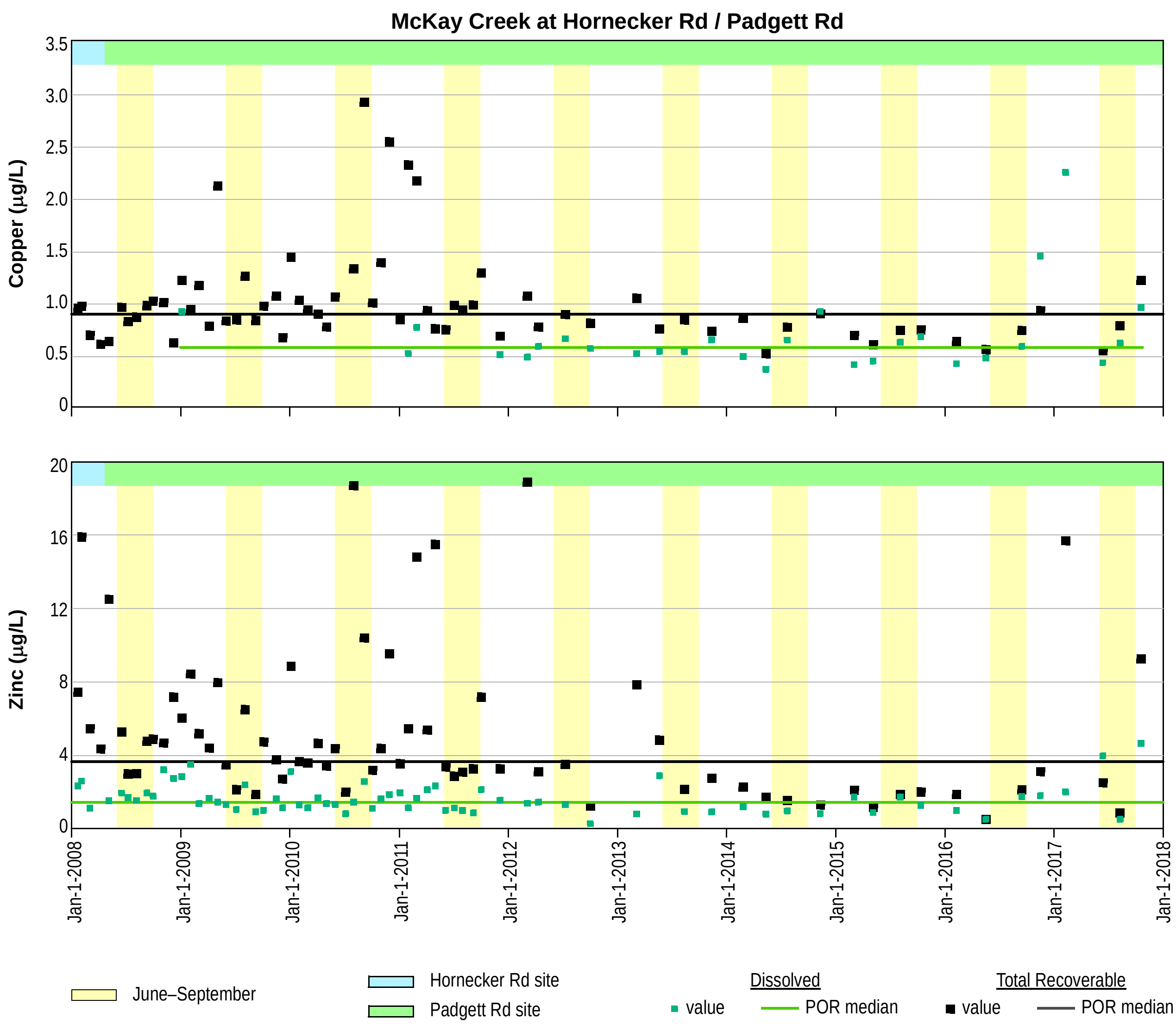
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in February 2011.
- Sampling frequency was:
  2008–2011, monthly
  2012–2017, approximately quarterly

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	0.571	0.89
Zinc	1.44	3.65



ROCK CREEK AT HWY 8 / BROOKWOOD
Copper and Zinc

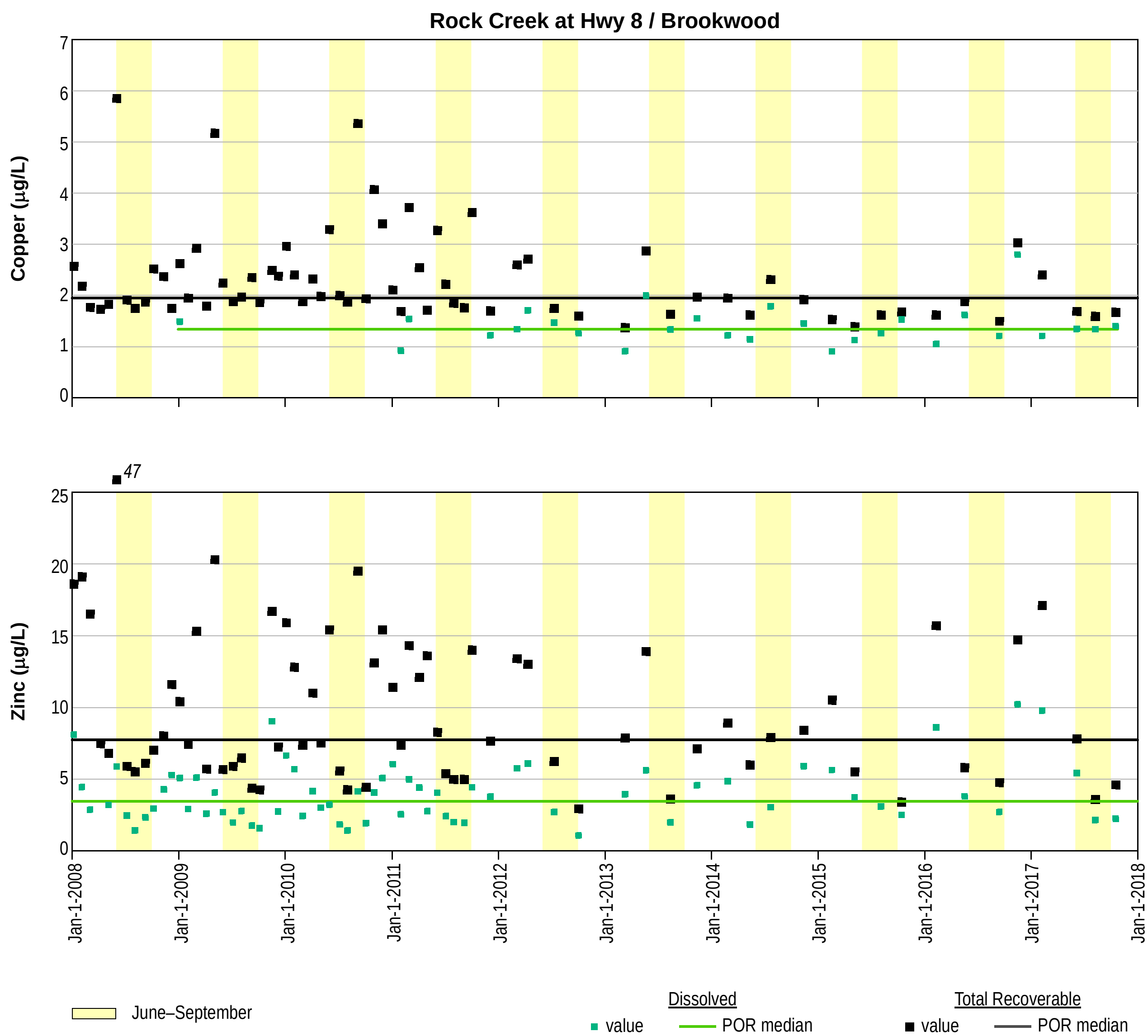
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in January 2009.
- Sampling frequency was:
  2008–2011, monthly
  2012–2017, approximately quarterly
- Dissolved copper has fewer data than total recoverable copper.
- Some values are off scale and noted above the graphs.

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	1.34	1.95
Zinc	3.47	7.72



BEAVERTON CREEK NEAR ORENCO / AT GUSTON CT
Copper and Zinc

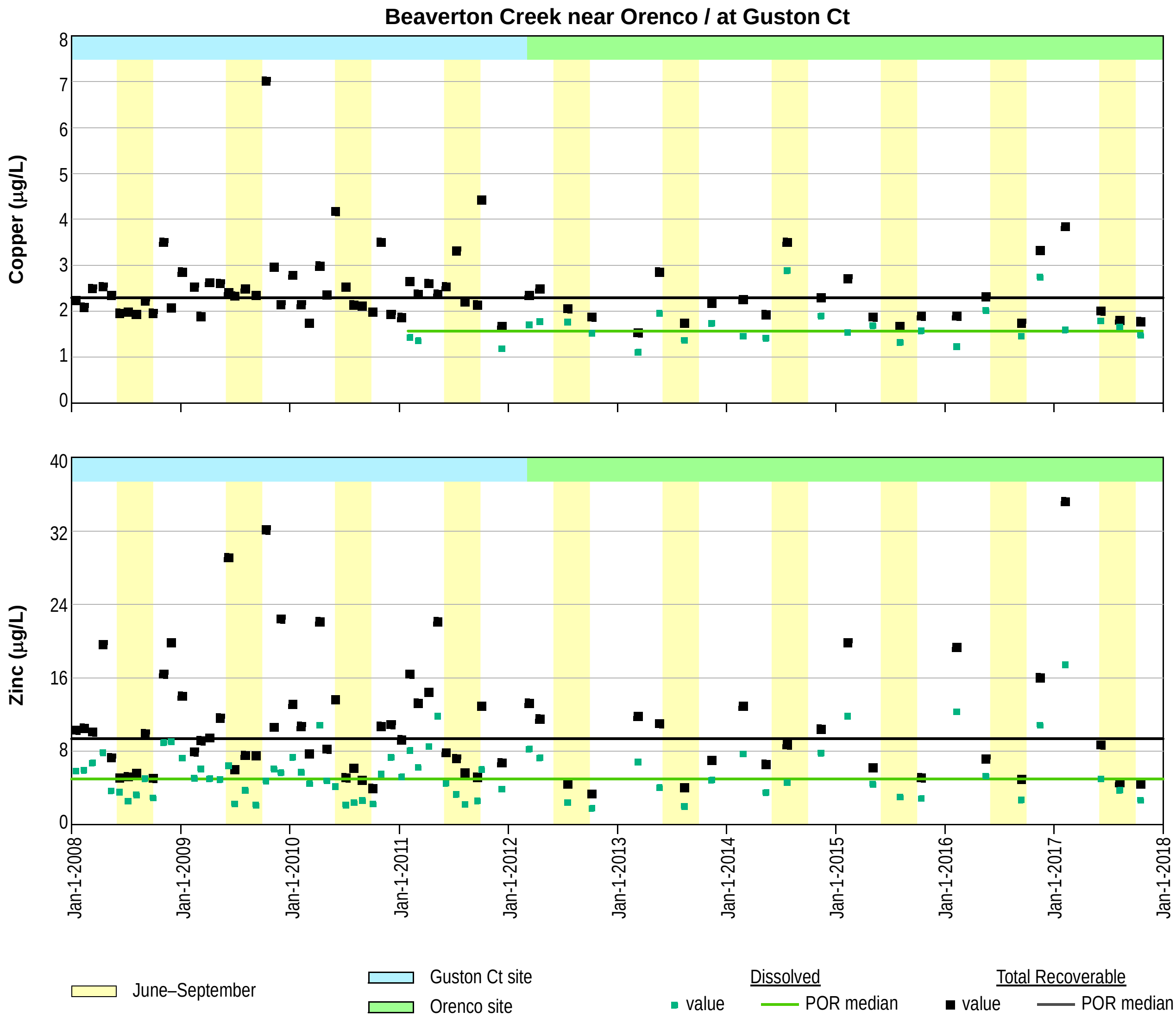
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in February 2011.
- Sampling frequency was:
  2008–2011, monthly
  2012–2017, approximately quarterly
- Dissolved copper has fewer data than total recoverable copper.

MEDIAN CONCENTRATION

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	1.57	2.29
Zinc	4.96	9.36



CHICKEN CREEK AT SCHOLLS-SHERWOOD RD (ROY ROGERS RD)
Copper and Zinc

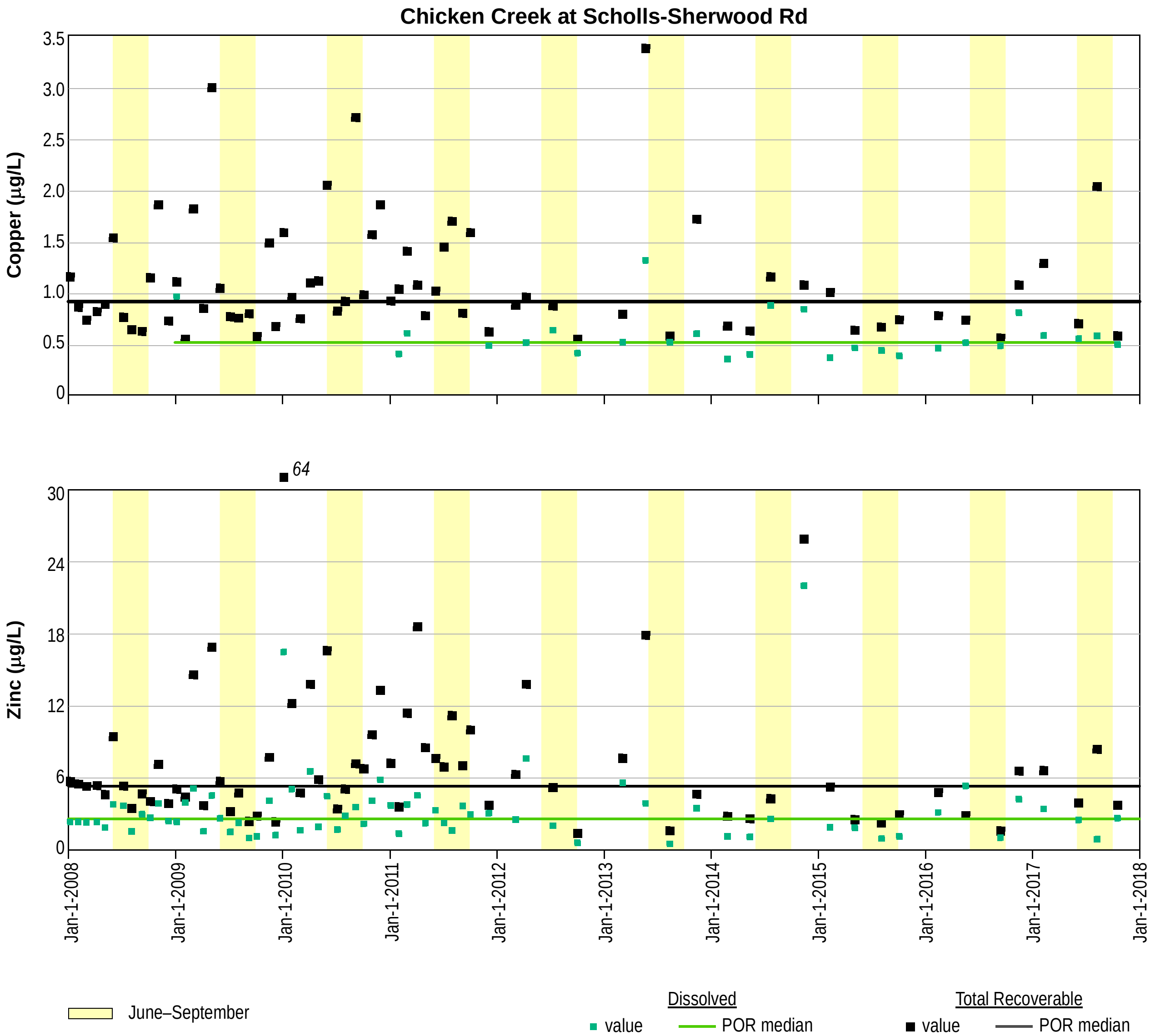
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in January 2009.
- Sampling frequency was:
  2008–2011, monthly
  2012–2017, approximately quarterly
- Dissolved copper has fewer data than total recoverable copper.
- Some values are off scale and noted above the graphs.

MEDIAN CONCENTRATIONS

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	0.51	0.911
Zinc	2.59	5.32



FANNO CREEK AT DURHAM RD
Copper and Zinc

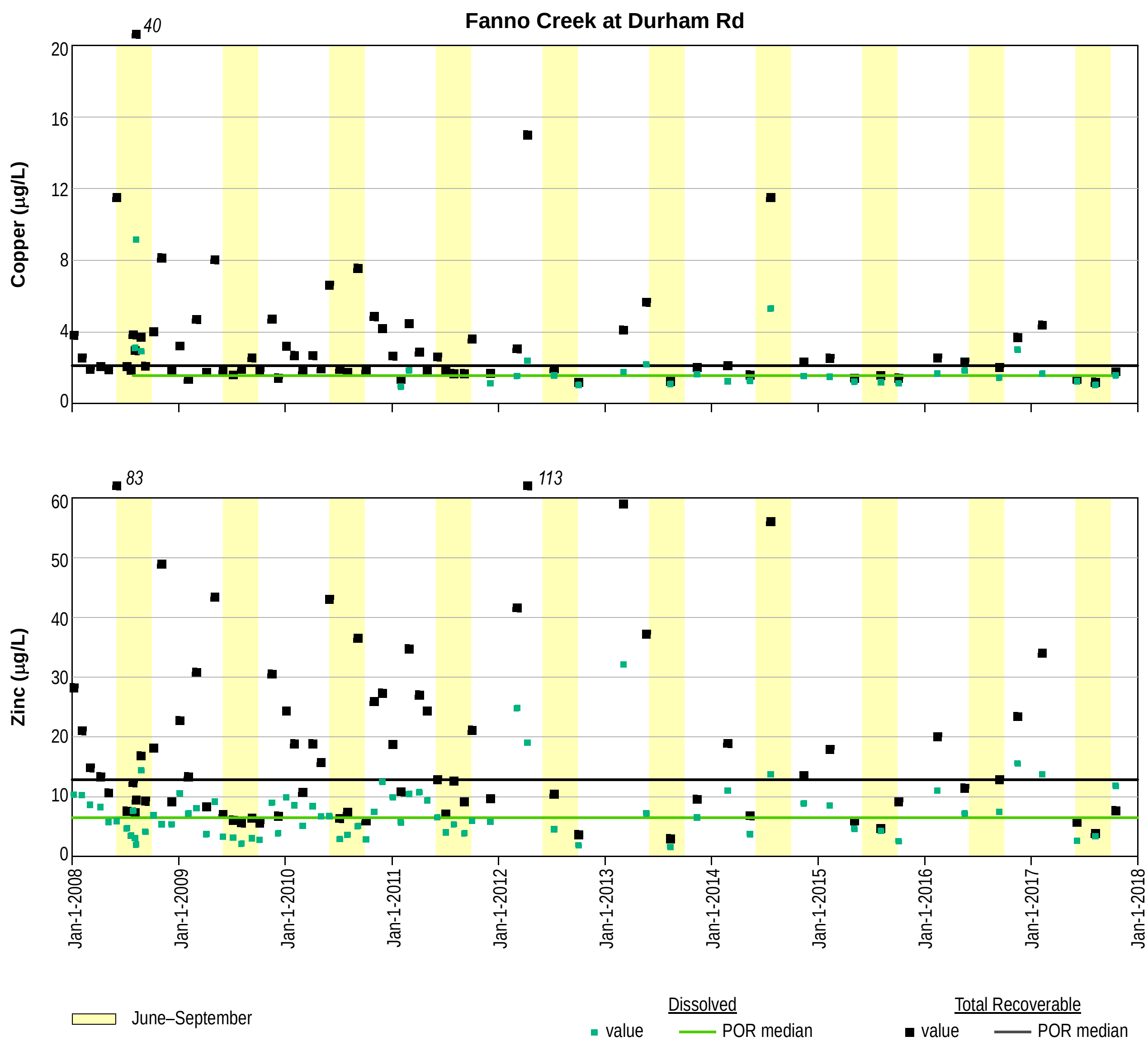
Data source: Clean Water Services

Discussion

- The period of record is January 2008 through present, except for dissolved copper which began in August 2008.
- Sampling frequency was:
  2008–2011, monthly with some extra in 2008
  2012–2017, approximately quarterly
- Dissolved copper has fewer data than total recoverable copper.
- Some values are off scale and noted above the graphs.

MEDIAN CONCENTRATIONS

	Dissolved (µg/L)	Total Recoverable (µg/L)
Copper	1.55	2.12
Zinc	6.48	12.8



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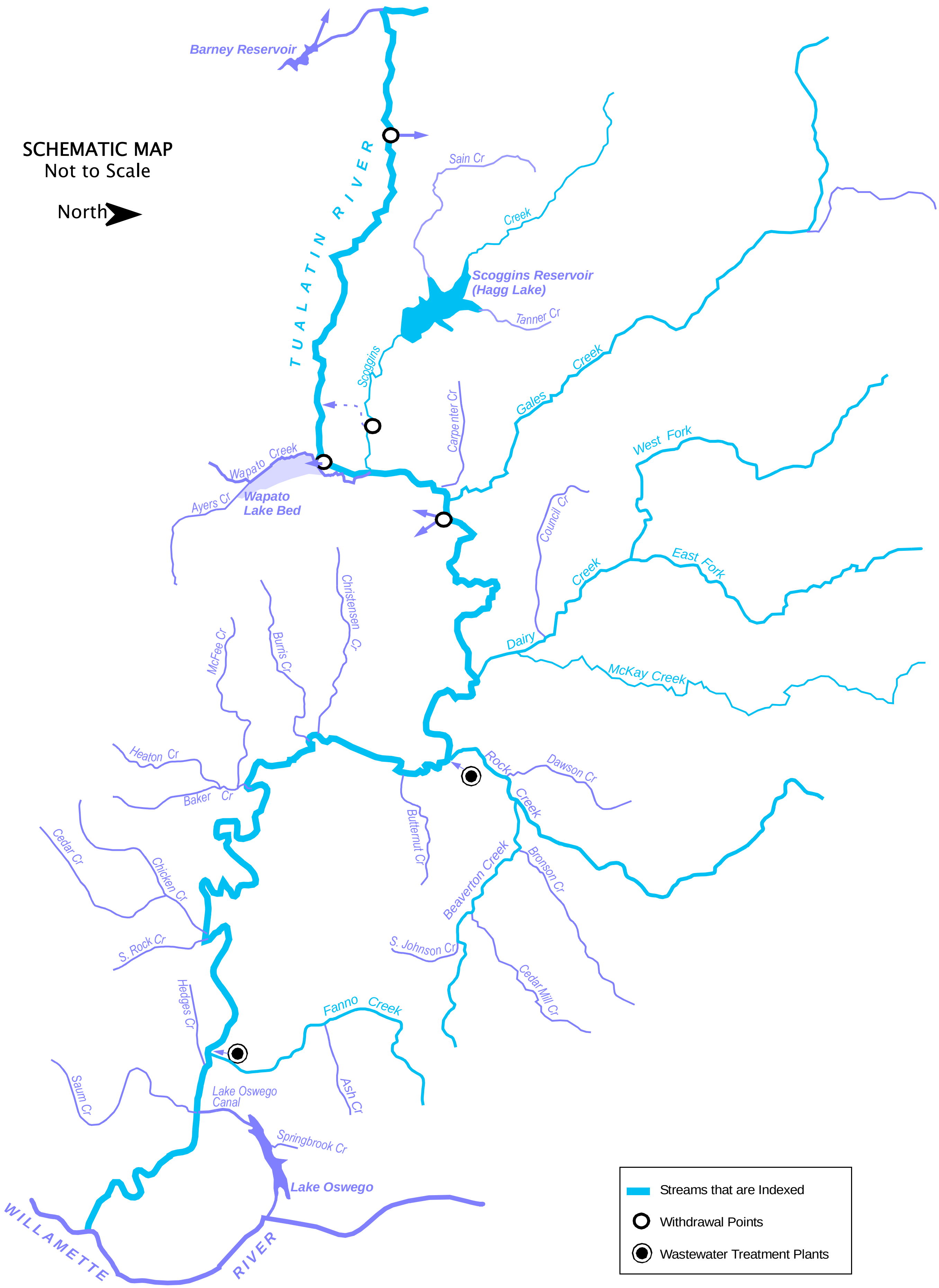
Appendix K

River Mile Indices

STREAMS INDEXED



STREAMS INDEXED

TUALATIN RIVER — RIVER MILE INDEX

HUC: 211400300

[Elevation measured relative to 0.00 gage datum; Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code]

River Mile	Bank	Description	Drainage Area (square miles)	Elevation (feet)
0.00		Mouth of Tualatin River at Willamette River (LB of Willamette River @ River Mile 28.5)	712	
0.20		Weiss Bridge – Petes Mtn Rd.		
1.60	RB	Fields Creek (HUC: 02114003000010)		
1.69		State Hwy 212 Bridge (Fields Bridge)		
1.75	LB	West Linn Stream Gage Station – USGS #14207500	706	85.61
2.40	LB	Tate Creek (HUC: 02114003000020)		
3.45		Lake Oswego Corp. Diversion Dam		
4.25		Interstate 205 Bridge		
4.56	LB	Wilson Creek (HUC: 02114003000080)		
5.34	LB	Boat Launch		
5.36	LB	Shipley Creek (HUC: 02114003000100)		
5.38		Shipley Bridge– Stafford Rd. NWS Wire Weight Gage		
5.62	LB	Pecan Creek (HUC: 02114003000120)		
6.02	RB	Athey Creek (HUC: 02114003000123)		
6.70	RB	Saum Creek (HUC: 02114003000130)		
6.70	LB	Oswego Canal Diversion River Elevation Recording Gage #14206990, Headgate, and Canal Recording Gage #14207000		
7.36	LB	Boat Launch – Dogwood Drive		
7.67	RB	Browns Ferry Park Canoe Launch		
7.83		Clackamas County – Washington County Boundary (Underground Cable Crossing Sign)		
8.18		Interstate 5 Bridge		
8.60		Boones Ferry Road Bridge		
8.64	RB	Hedges Creek (HUC: 02114003000150)		
8.90	RB	Tualatin Park Boat Launch		
8.91	RB	Southern Pacific RR Bridge Tualatin River at Tualatin Elevation Recording Station #14206956 (formerly #14206960)		
9.32	LB	Fanno Creek (HUC: 02114003000180) *[Index on page I-13]*	26.8	
9.33	LB	Durham Wastewater Treatment Plant Outfall (9.2 on NPDES permit)		
9.34		Oregon Electric RR Bridge		
9.80	LB	Cook Park Boat Launch		
11.50	LB	US Hwy. 99W Bridge (Pacific Highway) Canoe Launch(access from southeast of bridge)		
12.68		Overhead BPA Transmission Line; Vancouver–Eugene		
12.80	LB	Rivermeade Boat Launch (Private)		
15.20	RB	Rock Creek–South (HUC: 02114003000250)	13.7	
15.50	RB	Chicken Creek (HUC: 02114003000270)		
16.09	RB	Chicken Creek Drainage Ditch		
16.22	RB	Shamberg Bridge (Elsner Road) Rated Staff Gage for Stream Flow		

TUALATIN RIVER — RIVER MILE INDEX

HUC: 211400300

[Elevation measured relative to 0.00 gage datum; Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code]

River Mile	Bank	Description	Drainage Area (square miles)	Elevation (feet)
21.12		Overhead BPA Transmission Line; Big Eddy–Keeler		
26.90		State Hwy. 210 bridge (Scholls)		
28.20	RB	McFee Creek (HUC: 02114003000310)		
30.76	LB	Unnamed Stream (HUC: 02114003000320) (Jacktown)		
31.62	RB	Burris Creek (HUC: 02114003000330)		
31.92	RB	Christensen Creek (HUC: 02114003000350)		
33.30		Harris Bridge (State Highway 208)	568	100.42
	LB	Farmington Recording Stream Gage #14206500		
35.68	LB	Butternut Creek (HUC: 02114003000380)		
37.38	LB	Gordon Creek (HUC: 02114003000400)		
38.08	LB	Rock Creek Wastewater Treatment Plant Outfall (37.7 on NPDES permit)		
38.09	LB	Rock Creek (HUC: 02114003000420	74.6	
		Beaverton Creek (HUC:02114003000420060)	36	
38.44	LB	Rood Bridge Small Watercraft Launch		
		Rood Bridge Road Bridge		
	LB	Recording Stream Gage #14206295		105.16
40.44	RB	Davis Creek (HUC: 02114003000430)		
41.64		Minter Bridge Road Bridge		
43.88	LB	Jackson Slough		
		Jackson Bottom Wetlands		
	LB	Hillsboro Wastewater Treatment Plant Effluent Outfall (42.9 and 43.3 on NPDES permit)		
44.40		State Highway 219 Bridge		
	RB	Recording Stream Gage #14206241		
44.73	LB	Dairy Creek (HUC: 02114003000480) *[Index on page I-9]*	226	
		McKay Creek (LB) (HUC: 02114003000480020) *[Index on page I-10]*	63.4	
		East Fork Dairy Creek (HUC: 02114003000480080) *[Index on page I-11]*		
		West Fork Dairy Creek (HUC: 02114003000480090) *[Index on page I-12]*		
51.54		Golf Course Road Bridge		
	RB	Golf Course Recording Stream Gage #14204800		
53.74		LaFollett Road (Bridge removed)		
55.24	LB	Forest Grove Wastewater Treatment Plant Outfall (53.8 on NPDES permit)		
		Fern Hill Wetlands		
55.32		Fernhill Road Bridge		
56.10		Springhill Pump Plant Intake		
56.80	LB	Gales Creek (HUC: 02114003000560) *[Index on page I-8]*	78.6	
57.38	LB	Carpenter Creek (HUC: 02114003000580)		
57.84	LB	Dilley Creek (HUC: 02114003000600)		
58.04	LB	Johnson Creek (HUC: 02114003000602)		
58.82		Springhill Road Bridge	125	147.57
	LB	Tualatin River at Dilley Stream Gage; USGS #14203500		
59.02	LB	O'Neil Creek (HUC: 02114003000620)		
60.00	LB	Scoggins Creek (HUC: 02114003000640) *[Index on page I-7]*		
60.80	RB	Wapato Creek (HUC: –02114003000670)		
		Wapato Creek Improvement District Return Flow		

TUALATIN RIVER — RIVER MILE INDEX

HUC: 211400300

[Elevation measured relative to 0.00 gage datum; Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code]

River Mile	Bank	Description	Drainage Area (square miles)	Elevation (feet)
62.00	RB	Wapato Improvement District Headgate)		
62.24		Southern Pacific RR Bridge		
62.25		State Highway 47 Bridge (Gaston) New Tualatin River at Gaston Recording Stream Gage #14202510		
62.30		Bates Road Bridge		
62.80	LB	Black Jack Creek (HUC: 02114003000700)		
62.90		Overhead BPA Transmission Line; Forest Grove–McMinnville		
63.13		TVID Patten Valley Pump Station Outfall #1		
63.87	RB	Discontinued Tualatin River at Gaston Recording Stream Gage	48.5	
64.26		TVID Patten Valley Pump Station Outfall #2		
65.34	RB	Williams Canyon (HUC: 02114003000730)		
65.90		Mt. Richmond Road Bridge		
67.30	LB	Hering Creek (HUC: 02114003000760)		
67.83		South Road Bridge (Cherry Grove)		
68.44	RB	Roaring Creek (HUC: 02114003000790)		
69.42		Little Lee Falls		
70.70	LB	Raines Bridge– Tualatin River below Lee Falls Rated Staff Gage for Stream Flow		
71.07		Lee Falls		
73.28		Haines Falls		
73.30	LB	City of Hillsboro Haines Falls Intake		
74.00	LB	Lee Creek (LB–02114003000860)		
74.05	RB	Patten Creek (HUC: 02114003000870)		
75.70	LB	Sunday Creek (HUC: 02114003000900)		
76.60	LB	Maple Creek (HUC: –02114003000940)		
76.95		Ki–A–Cut Falls		
78.00	RB	Barney Reservoir Aqueduct Outfall		
79.3+		Headwaters of Tualatin River		

FANNO CREEK — STREAM MILE INDEX

HUC: 2114003000180

[Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code, ISWR= Instream Water Right]

River Mile	Bank	Description
0.00		Confluence with the Tualatin River (HUC: 02114003000) at River Mile 9.32
0.86		Oregon Electric RR Bridge
1.19		Durham Road Bridge USGS Gage #14206950
2.00	LB	Ball Creek (HUC: 02114003000180020)
2.12		Bonita Street Bridge – Rated Staff Gage
3.28		SW Hall Blvd Bridge
3.95		SW Ash Avenue Bridge
4.28		SW Main St Bridge
4.30		State Hwy 99W Bridge
4.49		SW Grant Ave Bridge
5.07		SW Tiederman Ave. Bridge
5.08	RB	Summer Creek (HUC: 02114003000180070) Rated Staff Gage at Fowler School
5.32		SW Tigard Ave Bridge
5.53		SW North Dakota St Bridge
5.54	LB	Ash Creek (HUC: 02114003000180080) Rated Staff Gage at Greenburg Road
6.38		Scholls Ferry Road Bridge
7.30		Tuckerwood – Rated Staff Gage
7.66		SW Hall Blvd Bridge
8.40		SW Denny Rd Bridge
8.60		Oregon Electric RR Bridge
8.70		State Hwy 217 Bridge
9.42		Scholls Ferry Road Bridge Rated Staff Gage
9.66		SW 92nd Ave Bridge
9.90		SW Bohmann Parkway Bridge
10.16		SW 86th Ave Bridge
10.78		SW Nicol Road Bridge
11.76		Olson Road Bridge
11.96	RB	Sylvan Creek (HUC: 02114003000180190)
11.98		SW Beaverton–Hillsdale Hwy (State Hwy 10)
12.10		Washington County – Multnomah County Line
12.58		SW 56th Ave Bridge USGS Gage #14206900
12.81		SW Shattuck Road Bridge
13.22		SW 45th Ave Bridge
13.23	RB	Ivey Creek (HUC: 02114003000180250)
13.32		SW 43rd Ave Bridge
13.38		SW 42nd Ave Bridge
13.48		SW 39th Ave Bridge
13.98		SW Beaverton–Hillsdale Hwy (State Hwy 10)
14.10		SW 30th Ave Bridge

ROCK CREEK — STREAM MILE INDEX

HUC: 2114003000420

[Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code]

River Mile	Bank	Description
0.8		River Road Bridge
1.2		Southern Pacific RR Bridge
1.2+		State Highway 8 Bridge – Rated Staff Gage for Stream Flow
2.4		SW Brookwood Avenue Bridge
3.1	RB	Dawson Creek
4.4	LB	Beaverton Creek
4.5		Baseline Road Bridge
4.9		NW Quatama Road Bridge – Rated Staff Gage for Stream Flow
5.5		Oregon Electric RR Bridge
5.7		NW 216th Avenue Bridge
6.7		NW Cornell Road Bridge
7.8		US Highway 26 Bridge
9.0		West Union Road Bridge – Rated Staff Gage for Stream Flow
9.3	RB	Holcomb Creek
10.0		NW 185th Avenue Bridge
10.9	LB	Abbey Creek
11.0		Germantown Road Bridge
11.9		Cornelius Pass Road Bridge
13.0		Old Cornelius Pass Road Bridge
14.1		Burlington Northern RR Bridge
15.1		Rated Staff Gage for Stream Flow
16.4		Rock Creek Road Bridge
16.5		Van Raden Reservoir
19.1		Headwaters

BEAVERTON CREEK — STREAM MILE INDEX

HUC: 2114003000420060
[Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code]

River Mile	Bank	Description
0.00		Confluence with Rock Creek (LB, HUC: 02114003000480080260) @ River Mile 4.3
0.40		Southwest Baseline Road
1.16		Southwest 216th Avenue Road Bridge– Rated Staff Gage for Stream Flow
2.20	RB	Bronson Creek (HUC: 02114003000420060010)
3.32	RB	Willow Creek (HUC: 02114003000420060050)
4.90		Southwest 170th Avenue Road Bridge– Rated Staff Gage for Stream Flow
5.47	LB	Unnamed Stream (HUC: 02114003000420060096)
6.06	LB	Johnson Creek (HUC: 02114003000420060100)
6.30	LB	Unnamed Stream (HUC: 02114003000420060120)
6.66		Oregon Electric Railroad
7.45		Cedar Hills Boulevard
7.90	RB	Reasoners Creek (HUC: 02114003000420060130)
8.75+		Headwaters

DAIRY CREEK — STREAM MILE INDEX

HUC: 02114003000480
[Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code]

River Mile	Bank	Description
0.00		Confluence with Tualatin River (HUC: 0211400300) @ River Mile 44.73
1.65		Southern Pacific RR Bridge
2.06		State Highway 8 Bridge Dairy Creek at TV Hwy Recording Stream Gage #14206200
2.20		Oregon Electric RR Bridge
2.26	LB	McKay Creek (HUC: 02114003000480020)
3.53	RB	Council Creek (HUC: 02114003000480040)
6.02		Susbauer Road Bridge (County Road 196)
7.39		BPA Power Line Crossing
8.51		Cornelius–Schefflin Road Bridge (County Road 2161) Rated Staff Gage for Stream Flow
10.55		Confluence of East Fork Dairy Ck (HUC: 02114003000480080) & West Fork Dairy Ck (02114003000480090)

McKAY CREEK — STREAM MILE INDEX

HUC: 2114003000480020
[Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code]

River Mile	Bank	Description
0.00		Confluence with Dairy Creek (HUC: 02114003000480) @ River Mile 2.26
1.31		Padgett Road Bridge (County Road 2245)
2.25		Hornecker Road Bridge (County Road 2393) Rated Staff Gage for Stream Flow
2.30		Southern Pacific RR Crossing
4.32		Glencoe Road Bridge (County Road A–146½) Rated Staff Gage for Stream Flow
4.46		BPA Transmission Line Crossing
5.34	LB	Waible Creek (HUC: 02114003000480020040)
6.30		NW Old Scotch Church Road Bridge (County Road A–66)
8.00		US Hwy 26 Bridge – Sunset Highway
9.36		NW West Union Road Bridge (County Road 2496) City of North Plains to West
9.38		Southern Pacific RR Crossing
10.94	LB	Jackson Creek (HUC: 02114003000480020100)
12.80		NW Shadybrook Road Bridge (County Road A–110)
15.56		NW Collins Road Bridge (County Road 1889) Rated Staff Gage for Stream Flow
16.56	RB	Brunswick Canyon (HUC: 02114003000480020179)
16.66	LB	East Fork McKay Creek (HUC: 02114003000480020180)
24.0+		Headwaters

EAST FORK DAIRY CREEK — STREAM MILE INDEX

HUC: 2114003000480080

[Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code, ISWR= Instream Water Right]

River Mile	Bank	Description
0.00		Confluence with West Fork Dairy Creek (HUC: 02114003000480090) @ River Mile 10.56 of Dairy Creek (HUC: 02114003000480)
1.24		Roy Road Bridge (County Road A–159) Rated Staff Gage for Stream Flow
2.34		Port of Tillamook Bay RR Bridge
3.04	RB	Bledsoe Creek (HUC: 02114003000480080030)
3.20		Harrington Road Bridge (County Road 1989)
4.80		SP&S RR Bridge
5.56		US Highway 26 Bridges
6.91		Mountaindale Road Bridge (County Road 12)
6.97	LB	Baker Creek (HUC: 02114003000480080080)
8.44		Dairy Creek Road Bridge (County Road 2067) Rated Staff Gage for Stream Flow
8.55		East Fork Dairy Creek at Mountaindale, OR – Former USGS Gage #14205500 (10/40–9/51) Drainage Area = 43.0 square miles
9.62		NW Uebel Road Bridge (County Road 304)
12.50		Murphy Lane Bridge (Private) Rated Staff Gage for Stream Flow
12.82	RB	Big Canyon (HUC: 02114003000480080150)
13.00		***ISWR:*** C–59525 5/25/66
13.95	RB	Murtaugh Creek (HUC: 02114003000480080170)
14.04	LB	Meadow Brook Creek (HUC: 02114003000480080180)
14.17		Meacham Road Bridge (County Road 742)
15.55	LB	Plentywater Creek (HUC: 02114003000480080200) ***ISWR:*** C–59527 5/25/66
16.52	RB	Denny Creek (HUC: 02114003000480080210) ***ISWR:*** C–59526 5/25/66
16.56		Bacona Road Bridge (County Road 422) Snooseville Corner
17.21		Greener Road Bridge (County Road 1990)
17.34	LB	Rock Creek (HUC: 02114003000480080260)
17.50		Little Bend Park
17.60		Fern Flat Road Crossing (County Road 241)
18.15	LB	Panther Creek (HUC: 02114003000480080280)
18.31		Fern Flat Road Crossing (County Road 241)
18.84	RB	Roundy Creek (HUC: 02114003000480080290)
19.10	RB	Campbell Creek (HUC: 02114003000480080310)
21.30		Washington County – Columbia County Boundary
21.48		BPA Power Line Crossing
22.0+		Headwaters

WEST FORK DAIRY CREEK — STREAM MILE INDEX

HUC: 2114003000480090
[Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code]

River Mile	Bank	Description
0.00		Confluence with East Fork Dairy Creek (HUC: 02114003000480080) @ River Mile 10.56 of Dairy Creek (HUC: 02114003000480)
1.96		Evers Road Bridge (County Road A–187) Rated Staff Gage for Stream Flow
2.09	RB	Lousignant Canal (HUC: 02114003000480090010)
2.82		State Highway 47 Bridge
5.28		Greenville Road Bridge (County Road A–159)
6.20		State Highway 6 Bridge
6.22	RB	Cedar Canyon Creek (HUC: 02114003000480090110)
7.53		Cedar Canyon Road Bridge (County Road 1938) City of Banks to SE
7.70		State Hwy 47 Bridge – Rated Staff Gage for Stream Flow West Fork Dairy Creek at Banks, OR –Former USGS Gage #14205000 (10/40 – 9/43) Drainage Area = 47.5 square miles
7.72		Port of Tillamook Bay RR Bridge
9.30		US Highway 26 Bridge
10.60		NW Green Mountain Road Bridge (County Road 127)
11.02	LB	Garrigus Creek (HUC: 02114003000480090180)
12.19		NW Turk Road Bridge (County Road 233)
12.36	RB	Kuder Creek (HUC: 02114003000480090190)
12.90		NW Pihl Road Bridge (County Road 1045) Community of Manning
13.33		Port of Tillamook Bay RR Bridge
13.48		Port of Tillamook Bay RR Bridge
13.58	LB	Witcher Creek (HUC: 02114003000480090200)
14.37		Port of Tillamook Bay RR Bridge
14.50		US Highway 26 Bridge
15.00		NW Fisher Road Bridge (County Road 394)
15.11	LB	Mendenhall Creek (HUC: 02114003000480090220)
15.58	RB	Burgholzer Creek (HUC: 02114003000480090230)
15.60		US Highway 26 Bridge
16.00		Community of Buxton – ½ mile east
17.02	LB	Williams Creek (HUC: 02114003000480090240)
17.98	RB	Cummings Creek (HUC: 02114003000480090250)
18.10		State Highway 47 Bridge
18.85		Port of Tillamook Bay RR Bridge
22+		Headwaters

GALES CREEK — STREAM MILE INDEX

HUC: 2114003000560
[Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code, ISWR= Instream Water Right]

River Mile	RB	Description
0.00		Confluence with Tualatin River (HUC: 0211400300) @ River Mile 56.80 ***ISWR:*** C–59523 5/25/66
1.63		Southern Pacific RR Bridge
1.75		Forest Grove Bypass Bridge – State Highway 47 to State Highway 8
2.36		State Highway 47 Bridge Gales Creek Recording Stream Gage #14204530
3.66		Ritchey Road Bridge (County Road 461)
6.53	RB	Prickett Creek (HUC: 02114003000560090)
6.98		Stringtown Road Bridge (County Road A–176)
7.70	RB	Roderick Creek (HUC: 02114003000560110)
8.56		Roderick Road Bridge (County Road 395) Gales Creek near Forest Grove Oregon – Former USGS Gage #14204500 (10/40–9/56 & 10/70–9/81)
8.94	RB	Godfrey Creek (HUC: 02114003000560130)
9.22	LB	Kelly Creek (HUC: 02114003000560120)
10.68	RB	Clear Creek (HUC: 02114003000560150)
11.44	RB	Iler Creek (HUC: 02114003000560170)
11.46		NW Gales Creek Road (County Road 1312) Community of Gales Creek
11.47	RB	Fir Creek (HUC: 02114003000560190)
12.00		***ISWR:*** C–59509 5/25/66 above this point
12.36		Clapshaw Hill Road Bridge (County Road 2037) Rated Staff Gage for Stream Flow
12.40	LB	Little Beaver Creek (HUC: 02114003000560200)
		ISWR: C–59512 5/25/66
12.92		Parson Road Bridge
14.44	RB	White Creek (HUC: 02114003000560210)
14.68		NW Wilson River Highway Bridge (State Highway 6)
15.74	RB	Lyda Creek (HUC: 02114003000560230)
16.26	RB	Bateman Creek (HUC: 02114003000560250)
17.50		Gales Creek near Gales Creek, OR – Former USGS Gage #1420400 (10/35–9/45 & 10/639/70)
18.00	LB	Beaver Creek (HUC: 02114003000560280) Community of Glenwood ***ISWR:*** C–59524 5/25/66
18.45		NW Timber Road Bridge (County Road 374)
18.65		Wilson River Highway Bridge (State Highway 6)
19.70		Wilson River Highway Bridge (State Highway 6)
19.88	LB	Coffee Creek (HUC: 02114003000560300)
20.07	LB	Finger Creek (HUC: 02114003000560305)
20.70	RB	South Fork Gales Creek (HUC: 02114003000560310) ***ISWR:*** C–59514 5/25/66
21.60	LB	North Fork Gales Creek (HUC: 02114003000560320) ***ISWR:*** C–59513 5/25/66
22.76	RB	Low Divide Creek (HUC: 02114003000560330)
		Gales Creek Forest Park
23.20		Gales Creek near Glenwood, OR – USGS Gage #14203750 (7/94 – present)

SCOGGINS CREEK — STREAM MILE INDEX

HUC: 2114003000640
[Abbreviations: RB= right bank, LB= left bank, HUC= Hydrologic Unit Code]

River Mile	Bank	Description
0.00		Confluence with Tualatin River (HUC: 0211400300) @ River Mile 60.00
0.94		RR Bridge
1.00		State Highway 47 Bridge
1.70		Old State Highway 47 Bridge
1.71		Scoggins Creek near Gaston, OR – Former USGS Gage #14203000 (10/1940 – 9/1974) Drainage Area = 43.3 square miles
4.80		Scoggins Creek below Henry Hagg Lake, near Gaston, OR – USGS Gage #14202980 (1/1975 –present) Drainage Area = 38.8 square miles
5.10		Scoggins Dam
7.00	RB	Sain Creek (HUC: 02114003000640170)
7.62	LB	Tanner Creek (HUC: 02114003000640200)
8.40	LB	Wall Creek (HUC: 02114003000640220)
9.00		Lake Loop Road Bridge
9.30		Scoggins Creek above Henry Hagg, near Gaston, OR – Gage #14202850 (10/1972 – present) Drainage Area = 15.9 square miles
10.52	LB	Parson Creek (HUC: 02114003000640240)
15.50	LB	Fisher Creek (HUC: 02114003000640300)