



Portland Water Bureau Triannual Water Quality Analysis April 2018

Bull Run Water

The Portland Water Bureau supplies water to over 970,000 people in the Portland metropolitan area. The primary water source is the protected Bull Run watershed 26 miles east of Portland. The water from Bull Run is low in dissolved minerals and meets or exceeds all drinking water quality standards as measured at the entry point to the distribution system.

Water Treatment

Chlorine is used as the primary raw water disinfectant. The chlorine concentration entering the distribution system is adjusted seasonally to account for changes in water quality. Since September 2014, the target chlorine concentration has ranged from 2.2 to 2.5 parts per million (ppm). Once primary disinfection is complete, ammonium hydroxide (aqueous ammonia) is added to the chlorinated water. Ammonia reacts with chlorine to form a long-lasting chloramine disinfectant residual. Chlorine and ammonia are used in a ratio of approximately 4.9 to 1 by weight. At the end of the disinfection process, sodium hydroxide (NaOH) is added to the water at a dose of 3 to 5 ppm to raise the pH of the water to approximately 8.2 pH units. The addition of NaOH helps prevent corrosion of system piping and household plumbing, which in turn reduces the amount of lead, copper and other metals that can leach into the water from pipes, solder joints and plumbing fixtures.

Water Quality Standards

The U.S. Environmental Protection Agency (EPA) and the Oregon Health Authority-Drinking Water Services (OHA-DWS) set water quality standards for public water supplies.

Primary standards are set by federal and state regulations to protect public health, and are usually given as Maximum Contaminant Levels (MCLs). Lead and copper have action levels which cannot be exceeded at selected water customers' taps.

Secondary standards are federal and state guidelines set to assure aesthetic water quality and are given as Secondary Maximum Contaminant Levels (SMCLs).

The secondary standards apply to substances that may affect water taste, odor, or color; may stain sinks, bathtubs, or laundry; or may interfere with treatment processes.

About This Report

This report presents analytical results for Portland's water to those needing technical data on water quality. The report covers results for treated Bull Run water from May 2017 through April 2018, emphasizing results from **April 3, 2018**. Analytical results for groundwater from the Columbia South Shore Well Field, which was operated from March 12th to 21st, 2018, are also included.

Please feel free to provide feedback on the report; contact information is provided at the bottom of the report. Additional background information is available in the annual Water Quality Report, delivered to Portland customers in early June and posted at:
www.portlandoregon.gov/water/waterqualityreport.

Most analytical results in this document are reported in parts per million (ppm), which is equivalent to milligrams per liter (mg/L). One part per million corresponds to one penny in \$10,000. When other units are used, they are displayed adjacent to the analytical results.

Many substances were either present at levels below the reporting limits of the prescribed method or were not detected. These results are shown as less than the Method Reporting Limit (<MRL). The MRL is the lowest concentration that can be reliably reported for the test method.

Abbreviations:

<	Less Than
MRL	Method Reporting Limit
ppm	Parts Per Million (equivalent to Milligrams per Liter [mg/L])
MCL	Maximum Contaminant Level
SMCL	Secondary Maximum Contaminant Level
--	No Sample Result
N/A	Not Applicable

Treated Bull Run Water

Samples of treated water were collected at the outlet of the Lusted Hill Treatment Facility on **April 3, 2018**.

Physical Characteristics include temperature, pH, specific conductance, color, and solids. Results are reported in ppm unless otherwise noted.

Physical Characteristics	12-Month Range	April 3, 2018	MRL*	EPA Standard
With Secondary Standards				SMCL
pH, Field (Standard pH Units)	7.7 – 8.7	8.19	0.1	6.5 – 8.5
Total Dissolved Solids (TDS)	23 – 31	31	5	500
Color (Color Units)	5 – 10	5	5	15
Hardness (as CaCO ₃)	6.8 – 7.8	6.8	0.5	250**
Unregulated				
Specific Conductance (µmhos/cm @25°C)	29.0 – 34.4	29.0	1	Not regulated
Water Temperature, Field (°C)	5.0 – 17.8	6.1	0.1	Not regulated
Total Suspended Solids (TSS)	<0.5 – 0.5	<0.5	0.5	Not regulated
Total Solids (TS @180°C)	23 – 31	31	5	Not regulated
Turbidity (Nephelometric Turbidity Units; NTU)	0.16 – 2.63	<0.3	0.30/0.05	Not regulated at this point in system

* Method Reporting Limits may vary over time; thus, for some analytes, more than one MRL is listed.

**The SMCL for hardness is a secondary standard set by the State of Oregon; there is no secondary standard set by the EPA.

Nutrients are chemicals that plants and bacteria need to grow. All results are reported in ppm.

Nutrients	12-Month Range	April 3, 2018	MRL	EPA Standard
With Primary Standards				MCL
Nitrate Nitrogen (NO ₃ ⁻ as N)	0.013 – 0.066	0.026	0.010	10
Nitrite Nitrogen (NO ₂ ⁻ as N)	<0.005	<0.005	0.005	1
Unregulated				
Ammonia Nitrogen, Total (NH ₃ as N)	0.34 – 0.51	0.36	0.01	Not regulated
Ammonia Nitrogen, Free (NH ₃ as N)	0.025 – 0.044	0.030	0.01	Not regulated
Nitrogen, Organic (N)	<0.05	<0.05	0.05	Not regulated
Nitrogen, Total (N)	0.30 – 0.34	0.30	0.05	Not regulated
Phosphorus, Reactive (PO ₄ ³⁻ as P)	<0.003 – 0.004	0.004	0.003	Not regulated
Phosphorus, Total (P)	<0.01	<0.01	0.01	Not regulated
Silica (SiO ₂ as Si)	4.0 – 4.2	4.0	1	Not regulated
Total Organic Carbon (TOC as C)	0.66 – 0.80	0.66	0.30	Not regulated

Anions and cations are negative and positive ions, respectively. When water flows over or through soil and rocks, minerals dissolve in the water where they form anions and cations. All results are reported in ppm.

Anions and Cations	12-Month Range	April 3, 2018	MRL*	EPA Standard
With Primary Standards				MCL
Cyanide (CN ⁻)	<0.005 - <0.025	<0.005	0.025/0.005	0.2
Fluoride (F ⁻)	<0.025	<0.025	0.025	4.0
With Secondary Standards				SMCL
Chloride (Cl ⁻)	2.8 – 3.5	2.8	0.25	250
Fluoride (F ⁻)	<0.025	<0.025	0.025	2.0
Sulfate (SO ₄ ²⁻)	0.35 – 0.43	0.42	0.25	250
Unregulated				
Total Alkalinity (as CaCO ₃)	7.3 – 13.0	9.4	1.0	Not regulated
Hydroxide Alkalinity (OH ⁻ as CaCO ₃)	<0.1	<0.1	0.1	Not regulated
Carbonate Alkalinity (CO ₃ ²⁻ as CaCO ₃)	<0.1	<0.1	0.1	Not regulated
Bicarbonate Alkalinity (HCO ₃ ⁻ as CaCO ₃)	8.9 – 11.0	9.3	0.1	Not regulated
Carbon Dioxide, Total (CO ₂)	8.5 – 10.0	8.6	0.1	Not regulated
Carbon Dioxide, Free (CO ₂)	0.28 – 0.66	0.35	0.1	Not regulated
Bromide (Br ⁻)	<0.01	<0.01	0.01	Not regulated
Calcium (Ca ²⁺)	1.6 – 1.9	1.7	0.050	Not regulated
Magnesium (Mg ²⁺)	0.65 – 0.73	0.65	0.050	Not regulated
Potassium (K ⁺)	0.19 – 0.23	0.19	0.10	Not regulated
Sodium (Na ⁺)	3.4 – 4.1	3.4	1.0	Not regulated

* Method Reporting Limits may vary over time; thus, for some analytes, more than one MRL is listed.

Treated Bull Run Water (cont.)

Metals are a group of similar elements that occur naturally in the earth's crust. Many have potential health effects at low levels and are considered primary contaminants by the EPA. Other metals, such as iron, are not generally considered harmful to health at low concentrations but can cause nuisance effects, such as discolored water. These are considered secondary contaminants. All results are reported in ppm.

Metals*	12-Month Range	April 3, 2018	MRL	EPA Standard
With Primary Standards				MCL
Antimony (Sb)	<0.00050	<0.00050	0.00050	0.006
Arsenic (As)	<0.00050	<0.00050	0.00050	0.010
Barium (Ba)	0.00074 – 0.00106	0.00074	0.00050	2
Beryllium (Be)	<0.00050	<0.00050	0.00050	0.004
Cadmium (Cd)	<0.00050	<0.00050	0.00050	0.005
Chromium (Cr)	<0.00050	<0.00050	0.00050	0.1
Copper (Cu)	<0.00050 – 0.00101	<0.00050	0.00050	Treatment technique**
Lead (Pb)	<0.00005 – 0.00011	<0.00005	0.00005	Treatment technique**
Mercury (Hg)	<0.0001	<0.0001	0.0001	0.002
Selenium (Se)	<0.0025	<0.0025	0.0025	0.05
Thallium (Tl)	<0.00050	<0.00050	0.00050	0.002
With Secondary Standards				SMCL
Aluminum (Al)	0.0146 – 0.0544	0.0187	0.0020	0.05 – 0.2
Copper (Cu)	<0.00050 – 0.00101	<0.00050	0.00050	1
Iron (Fe)	0.0197 – 0.0480	0.0197	0.0050	0.3
Manganese (Mn)	0.00156 – 0.00637	0.00156	0.00050	0.05
Silver (Ag)	<0.00050	<0.00050	0.00050	0.1
Zinc (Zn)	<0.00050 – 0.00121	<0.00050	0.00050	5
Unregulated				
Nickel (Ni)	<0.00050	<0.00050	0.00050	Not regulated
Vanadium (V)	<0.00050	Not Tested	0.00050	Not regulated

*All metals results represent the total concentration rather than constituent parts, such as the dissolved fraction or components with specific valences.

**Instead of an MCL, EPA requires a treatment technique to address copper and lead above their respective action levels of 1.3 and 0.015 mg/L in drinking water, as measured at the point of use.

Volatile Organic Chemicals (VOCs) include solvents, disinfection by-products, and industrial and commercial products. The test measures the concentration of 60 VOCs, of which 23 are regulated and have state and federal MCLs. All results are reported in ppm.

VOCs	12-Month Range	April 3, 2018	MRL	EPA Standard
With Primary Standards				MCL
21 Volatile Organic Chemicals	All <MRL	All <MRL	0.00050 – 0.002*	Various*
Bromodichloromethane**	<0.00050 – 0.00073	<0.00050	0.00050	0.080 mg/L for Total Trihalomethanes
Chloroform**	0.00793 – 0.03100	0.00793	0.00050	0.080 mg/L for Total Trihalomethanes
Unregulated				
37 Volatile Organic Chemicals	All <MRL	All <MRL	0.00050 – 0.002*	Not regulated

*Each individual chemical compound has its own MRL and/or MCL values.

**Bromodichloromethane and chloroform are the most commonly occurring trihalomethane disinfection by-products. Disinfection by-products are formed when naturally occurring organic and inorganic materials in the water react with chlorine and other disinfectants.

Groundwater Operations

The Columbia South Shore Well Field was operated from March 12th to 21st, 2018, and provided about 20 to 25% of PWB's water supply during this time period. Groundwater is drawn from 26 wells completed in three aquifers: Blue Lake Aquifer (BLA), Sand and Gravel Aquifer (SGA), and Troutdale Sandstone Aquifer (TSA).

When Groundwater is operated, water quality is monitored both at individual wellheads (raw groundwater) and at the Groundwater Pump Station (GWPS) outlet (treated groundwater). Samples are tested for regulated and unregulated parameters, including physicals, solids, nutrients, anions, cations, metals, and organics. The Portland Water Bureau's groundwater surpasses federal and state water quality requirements; analytical results are presented on the following pages.

In the following tables, the range of values for raw water samples collected at individual wellheads during groundwater operations in March 2018 is shown in the 'Wellheads' column. The 'GWPS' column shows treated groundwater quality at the entry point to the distribution system emphasizing results from a sample collected **March 15, 2018**. The GWPS results represent blended water from wells in all three aquifers; blended groundwater quality is dependent upon the amount of water contributed by individual wells in operation at the time of sampling, and may vary over time depending on which wells are in operation.

Groundwater

Physical characteristics include temperature, pH, specific conductance, color, and solids. Results are reported in ppm unless otherwise noted.

Physical Characteristics	Wellheads (Raw Water)	GWPS Outlet (Treated Water)	MRL*	EPA Standard
<i>With Secondary Standards</i>				SMCL
pH, Field (Standard pH Units)	6.75 – 9.07	8.29	0.1	6.5 – 8.5
Total Dissolved Solids (TDS)	98 – 320	150	5	500
Color (Color Units)	<5	<5	5	15
Hardness (as CaCO ₃)	43 – 260	78	0.5	250*
<i>Unregulated</i>				
Specific Conductance (µmhos/cm @25°C)	140.2 – 528.2	217.2	0.1	Not regulated
Water Temperature, Field (°C)	11.8 – 15.3	13.3	0.1	Not regulated
Total Suspended Solids (TSS)	<0.5 – 7.3	<0.5	0.5	Not regulated
Total Solids (TS @180°C)	98 – 320	150	5	Not regulated
Turbidity (Nephelometric Turbidity Units; NTU)	<0.30	<0.30	0.30	Not regulated at this point in system

*The SMCL for hardness is a secondary standard set by the State of Oregon; there is no secondary standard set by the EPA.

Nutrients are chemicals that plants and bacteria need to grow. All results are reported in ppm.

Nutrients	Wellheads (Raw Water)	GWPS Outlet (Treated Water)	MRL	EPA Standard
<i>With Primary Standards</i>				MCL
Nitrate Nitrogen (NO ₃ ⁻ as N)	<0.010 – 0.68	0.45	0.010	10
Nitrite Nitrogen (NO ₂ ⁻ as N)	<0.005	<0.005	0.005	1
<i>Unregulated</i>				
Ammonia Nitrogen, Total (NH ₃ as N)	<0.01 – 0.12	0.5	0.01	Not regulated
Ammonia Nitrogen, Free (NH ₃ as N)	<0.01 – 0.12	0.072	0.01	Not regulated
Phosphorus, Reactive (PO ₄ ³⁻ as P)	0.053 – 0.170	0.086	0.003	Not regulated
Phosphorus, Total (P)	0.05 – 0.16	0.08	0.01	Not regulated
Silica (SiO ₂ as Si)	13.7 – 22.6	17.8	1.0	Not regulated
Total Organic Carbon (TOC as C)	<0.3 – 1.40	0.41	0.30	Not regulated

Groundwater (cont.)

Anions and cations are negative and positive ions. When water flows over or through soil and rocks, minerals dissolve in the water where they form anions and cations. All results are reported in ppm.

Anions and Cations	Wellheads (Raw Water)	GWPS Outlet (Treated Water)	MRL*	EPA Standard
With Primary Standards				MCL
Cyanide (CN ⁻)	<0.005	<0.005	0.005	0.2
Fluoride (F ⁻)	0.12 – 0.20	0.14	0.025	4.0
With Secondary Standards				SMCL
Chloride (Cl ⁻)	1.2 – 9.1	6.8	0.25	250
Fluoride (F ⁻)	0.12 – 0.20	0.14	0.025	2.0
Sulfate (SO ₄ ²⁻)	1.1 – 10.0	8.6	0.25	250
Unregulated				
Total Alkalinity (as CaCO ₃)	69 – 270	92	1.0	Not regulated
Hydroxide Alkalinity (OH ⁻ as CaCO ₃)	<0.1 – 0.8	<0.1	0.1	Not regulated
Carbonate Alkalinity (CO ₃ ²⁻ as CaCO ₃)	<0.1 – 14.0	1.0	0.1	Not regulated
Bicarbonate Alkalinity (HCO ₃ ⁻ as CaCO ₃)	68 – 270	91	0.1	Not regulated
Calcium (Ca ²⁺)	12 – 58	19	0.05	Not regulated
Magnesium (Mg ²⁺)	3.2 – 27.0	7.6	0.05	Not regulated
Potassium (K ⁺)	1.9 – 4.0	2.3	0.10	Not regulated
Sodium (Na ⁺)	6.9 – 32.0	16	1.0	Not regulated

Metals are a group of similar elements that occur naturally in the earth's crust. Many have potential health effects at low levels and are considered primary contaminants by the EPA. Other metals, such as iron, are not generally considered harmful to health at low concentrations but can cause nuisance effects, such as discolored water. These are considered secondary contaminants. All results are reported in ppm.

Metals*	Wellheads (Raw Water)	GWPS Outlet (Treated Water)	MRL	EPA Standard
With Primary Standards				MCL
Antimony (Sb)	<0.00050	<0.00050	0.00050	0.006
Arsenic (As)	<0.00050 – 0.00240	<0.00050	0.00050	0.010
Barium (Ba)	0.00278 – 0.02350	0.00797	0.00050	2
Beryllium (Be)	<0.00050	<0.00050	0.00050	0.004
Cadmium (Cd)	<0.00050	<0.00050	0.00050	0.005
Chromium (Cr)	<0.00050	<0.00050	0.00050	0.1
Copper (Cu)	<0.00050 – 0.03310	0.00059	0.00050	Treatment technique**
Lead (Pb)	<0.00005 – 0.0014	<0.00005	0.00005	Treatment technique**
Mercury (Hg)	<0.0001	<0.0001	0.00010	0.002
Selenium (Se)	<0.0025	<0.0025	0.0025	0.05
Thallium (Tl)	<0.00050	<0.00050	0.00050	0.002
With Secondary Standards				SMCL
Aluminum (Al)	<0.0020 – 0.0125	0.00268	0.0020	0.05 – 0.2
Copper (Cu)	<0.00050 – 0.03310	0.00059	0.00050	1
Iron (Fe)	<0.0050 – 0.1180	0.0166	0.0050	0.3
Manganese (Mn)	<0.00050 – 0.6610	0.0171	0.00050	0.05
Silver (Ag)	<0.00050	<0.00050	0.00050	0.1
Zinc (Zn)	<0.00050 – 0.01940	<0.00050	0.00050	5
Unregulated				
Nickel (Ni)	<0.00050 – 0.00117	<0.00050	0.00050	Not regulated
Vanadium (V)	<0.00050 – 0.00936	0.00145	0.00050	Not regulated

*All metals results represent the total concentration rather than constituent parts, such as the dissolved fraction or components with specific valences.

** Instead of an MCL, EPA requires a treatment technique to address copper and lead above their respective action levels of 1.3 and 0.015 mg/L in drinking water, as measured at the point of use.

Groundwater (cont.)

Volatile Organic Chemicals (VOCs) include solvents, disinfection by-products, and industrial and commercial products. The test measures the concentration of 60 VOCs, of which 23 are regulated and have state and federal MCLs.

VOCs	Wellheads (Raw Water)	GWPS Outlet (Treated Water)	MRL	EPA Standard MCL
<i>With Primary Standards</i>				
21 Volatile Organic Chemicals	All <MRL	All <MRL	0.00050 – 0.002*	Various*
Bromodichloromethane**	<0.00050	0.00086	0.00050	0.080 mg/L for Total Trihalomethanes
Chloroform**	<0.00050	0.00110	0.00050	0.080 mg/L for Total Trihalomethanes
<i>Unregulated</i>				
37 Volatile Organic Chemicals	All <MRL	All <MRL	0.00050 – 0.002*	Not regulated

*Each individual chemical compound has its own MRL and/or MCL values.

**Bromodichloromethane and chloroform are the most commonly occurring trihalomethane disinfection by-products. Disinfection by-products are formed when naturally-occurring organic and inorganic materials in the water react with chlorine and other disinfectants.

Would you like to access the Triannual Water Quality Report electronically?

Contact Randy Albright by email at randy.albright@portlandoregon.gov to be added to the electronic mailing list for the Triannual Water Quality report, which is compiled three times a year. The Portland Water Bureau's general web address is www.portlandoregon.gov/water. The web site includes a wealth of historical information, reference material, and updates on current issues. Click the [What We Do](#) link for information on water quality reports, state and federal drinking water regulations, source waters, water treatment and more. The past year's Triannual Water Quality Reports can be found at: www.portlandoregon.gov/water/triannual, and additional water quality information can be found at: www.portlandoregon.gov/water/waterquality.