

Water Management and Conservation Plan for the City of Portland, Oregon

Executive Summary of Final Plan

July 2010



Executive Summary

Context of this Water Management Conservation Plan

This Water Management Conservation Plan (WMCP) is based on the requirement of the Oregon Administrative Rules Chapter 690 Division 86 (Division 86 rules). This plan 1) updates the City of Portland's expired 2000 WMCP, 2) fulfills a condition placed on the City of Portland's assumed Powell Valley Road Water District groundwater right (#G-14007) and other rights granted to the City for wells under the administration of Portland Parks & Recreation (PP&R), and 3) fulfills any WMCP requirements that might be placed on extensions of other groundwater rights that the City of Portland owns or may apply for in the future during the period covered by this plan.

In May 2008, the Portland Water Bureau (PWB) submitted the Final Draft WMCP to the Oregon Water Resources Department (OWRD). After the public comment and review period, PWB received comments from WaterWatch of Oregon and a sufficiency review of the plan from OWRD.

2008 Final Draft WMCP Comments and Sufficiency Review

The comments received from WaterWatch Oregon covered five major areas:

1. The relationship of the WMCP to permit extensions and "green light" water
2. The relationship of the WMCP to requirements for groundwater rights that the City owns or may apply for in the future
3. Demand forecasting and projections
4. Water reuse and recycling opportunities
5. Bull Run surface water rights

One of WaterWatch's key comments was a concern regarding the request in the 2008 WMCP draft to develop additional water supply under groundwater permits for which it did not, at the time, have valid extension orders. The City of Portland had already submitted completed permit extensions for the four groundwater rights relied upon for the "green light" water request in the WMCP. In July 2008, PWB requested an administrative hold on completing the WMCP, per OAR 690-86-910, until PWB received a final order on the four pending water rights permit extensions. PWB received the final orders on October 6, 2009.

The other comments of WaterWatch have been addressed in the body of this WMCP. Details regarding the "green light" water and final orders issues are covered in sections 1.1.1, 1.1.2, and 5.6. The demand forecasting and projection comments have been addressed in sections 1.1.2, 5.1, and 5.3. The water reuse and recycling comment is covered in section 1.1.2, and the Bull Run surface water clarification is covered in a footnote in section 5.2.1.

The sufficiency review from OWRD covered seven major areas:

1. Water rights
2. The system schematic and interconnections
3. Current and future service areas
4. PWB's retrofit and replacement programs
5. The rate structure

6. Water reuse and recycling
7. Other conservation measures to improve water use efficiency

The two major issues of OWRD's sufficiency review involved providing information on average monthly and daily diversions under each water right and providing more information on PWB's rate structure. Section 2.3, Summary of Water Rights Held, includes additional tables that delineate monthly water use by right for the City of Portland's Columbia South Shore Well Field (CSSWF) and for the Portland Parks and Recreation (PPR) wells.

PWB's rate structure is discussed in two sections in Final WMCP. Section 3.4.4 discusses PWB's participation in, and the results of, an Environmental Protection Agency (EPA) submetering study. Section 3.5.4 describes the recent history of PWB's rates and rate structure, and provides comparisons to national and regional water providers. This section includes the results of a survey conducted by the Regional Water Providers Consortium on the rate structures of 23 regional water providers.

Clarifying and additional information for all additional OWRD sufficiency review comments have been integrated into the body of this WMCP as appropriate. Additional information on water rights is provided in section 2.3; system interconnections are shown in a new figure in section 2.9; PWB's current and future service areas are discussed in section 5.1 and 5.3; PWB's rate structure is discussed in section 3.4.4, 3.5.4, and 3.5.7; additional discussion of water reuse and recycling was added to sections 3.5.5 and 3.5.6; and other conservation measures (particularly PWB's requirement that its wholesale customers produce a WMCP) are outlined in section 3.5.4 and 3.5.6.

Changes Since 2008

Since the submittal of the Final Draft Report WMCP in March 2008, several key events and changes have had an effect on PWB's water supply program. The three most significant events that affect supply planning are 1.) OWRD's issuance of final orders for four groundwater rights permit extensions and a permit amendment in the CSSWF, 2.) the approval of the Bull Run Water Supply Habitat Conservation Plan (HCP), and 3.) the City's pursuit of dual tracks for compliance with the Long Term 2 Enhanced Surface Water Treatment Rule (LT2). In addition, PWB has changed its conservation program and accumulated more years of data on demand and consumption and the use of the groundwater supply.

In October 2009, OWRD provided the Final Orders on the extension of four primary groundwater rights and a permit amendment. Once PWB received these final orders, it began work on the addendum to the draft WMCP. The addendum responded to WaterWatch of Oregon and OWRD sufficiency review documents and was the source for the additions to this final plan.

The Bull Run Watershed Habitat Conservation Plan (HCP) provides for the implementation of 49 measures to conserve habitat for endangered fish. Key among those measures is a measure that provides instream flows in the lower Bull Run River (explained in greater detail in the next section). In April 2009, the Commissioner-in-Charge of the Water Bureau and the Acting Regional Administrator for the National Marine Fisheries Service signed an Incidental Take Permit (ITP), which was the final step in the development of the HCP.

Since 2008, Portland City Council has directed PWB to pursue two parallel tracks with regard to compliance with the EPA's Long Term 2 Enhanced Surface Water Treatment (LT2) Rule. A conventional treatment track would achieve compliance with the treatment portion of the LT2 rule as written. This includes the design of an ultraviolet (UV) water treatment facility for the Bull Run water source as directed by the Portland City Council in July 2009.¹ Under the treatment variance track, PWB seeks a variance to the treatment requirement of the LT2 rule under the Safe Drinking Water Act (SDWA). Under the conventional treatment track, PWB anticipates completion of the design for UV treatment facility in the first half of 2011. However, progressing to the construction phase is contingent on EPA's decision regarding PWB's application for a variance under the treatment variance track. Should the EPA deny the variance to PWB, construction of the UV treatment facility in the Bull Run watershed will move forward.

Although the UV treatment method is effective at disinfecting water for *Cryptosporidium*, it does not protect the water supply from elevated turbidity levels, as filtration would. Turbidity above a certain level requires that PWB discontinue use of Bull Run water and rely on groundwater from the CSSWF. The decision to implement UV treatment as part of PWB's conventional treatment track, therefore, means continued reliance on the CSSWF groundwater water supply when turbidity levels are elevated in the Bull Run watershed. The decision not to build filtration of the Bull Run also is likely to limit access to further supplies in the existing reservoirs and to make building further storage in the watershed a significant engineering challenge. As a result, as water demand increases over the next several decades within the retail and wholesale service areas, PWB's reliance on groundwater sources will also increase.

Municipal Water Supplier Description

Approximately 860,000 people living within a 225-square-mile service area around Portland are served by the Water Bureau's retail and wholesale water system. The Water Bureau delivered 36 billion gallons (BG) to customers during fiscal year (FY) 2006-2007. The bureau's 19 wholesale water customers are mostly contiguous to the retail service area and serve parts of Multnomah, Clackamas, and Washington counties. In FY 2006-2007, the Water Bureau supplied approximately 60 percent of its water to retail accounts and approximately 40 percent to wholesale customers.

Water Sources

The primary drinking water source for Portland is the Bull Run watershed, seasonally augmented by a groundwater supply from the Columbia South Shore Well Field (CSSWF) and potentially by wells in the former Powell Valley Road Water District (PVRWD). The Bull Run watershed is located approximately 30 miles east of Portland. The CSSWF is on the south shore of the Columbia River between the airport and Blue Lake Park; the former PVRWD is located in southeast Portland, west and north of Powell Butte.

¹ Portland City Council Resolution No. 36720 As Amended. July 29, 2009.

Bull Run Watershed

The Bull Run watershed provides the majority of Portland's total water supply. The water of the Bull Run River is primarily impounded in reservoirs 1 and 2. Periodically, the Water Bureau relies on storage capacity in Bull Run Lake to enhance the supply of the two reservoirs.

Regulations Affecting the Use of Bull Run Water

Provisions of a 1997 U.S. Forest Service easement, the Safe Drinking Water Act (SDWA), the Endangered Species Act, and the Clean Water Act are the four regulations that primarily affect the use of Bull Run water.

The provisions of a **1997 easement with the U.S. Forest Service** restrict the available capacity of Bull Run Lake through requirements that create incentives to limit the volume available, the timing of use, and the mitigation requirements for releases that limit the lake's refill the following spring.

The **Surface Water Treatment Rule (SWTR)** of the SDWA and SWTR enhancements require the Water Bureau to meet specific, measurable water treatment standards related to turbidity and other contaminants. Modifications that the bureau has made to the water treatment regime and the bureau's ability to use the City's groundwater supply have enabled Portland to remain in compliance with the SWTR.

Under the **Endangered Species Act (ESA)**, the Water Bureau is preparing a habitat conservation plan (HCP) that outlines how the bureau will avoid, minimize, or mitigate take of the four fish species that use the lower Bull Run River: the fall and spring races of Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River coho salmon (*O. kisutch*), Columbia River chum salmon (*O. keta*), and Lower Columbia River steelhead (*O. mykiss*) (Portland Water Bureau 2007c). Key proposals in the HCP that affect the bureau's management of the Bull Run water supply include measures to provide instream flows for fish in the lower Bull Run River. Under the proposed flow measures, the bureau will reduce the amount of Bull Run water that is diverted for municipal supply. This will increase the reliance on groundwater as a backup supply, especially during the period when the reservoirs are drawn down. The bureau plans to submit the HCP to the National Marine Fisheries Service in 2008.

The federal **Clean Water Act (CWA)** requires that states assess and regulate surface water quality according to the criteria outlined in the CWA. The Oregon Department of Environmental Quality (ODEQ) is responsible for monitoring water bodies according to the CWA. In a 2005 assessment called the Total Daily Maximum Load, ODEQ found the water in the lower Bull Run River (RM 0–RM 5.8) to be "water quality limited" with regard to the designated beneficial use as "core cold-water habitat" for salmonids. The Water Bureau has prepared a *Draft Temperature Management Plan (TMP)* for the lower Bull Run River. The TMP includes riparian forest protections, management measures for the temperature of the water, and measures to control the amount of flow released to the lower Bull Run River especially during the summer peak season. The TMP measures are included in the draft HCP. The TMP is anticipated to be submitted to ODEQ in 2008.

Hydrologic Limitations on Using Water from the Bull Run Watershed

The reservoirs in the Bull Run are recharged each year during the wet fall, winter, and spring. In the summer, when municipal water demand and releases into the lower Bull Run River are greater than the amount of water flowing into the reservoirs from tributaries and

rain, the surface elevation of the reservoirs is drawn down. During this time, the City may use its groundwater supply to augment the water from the Bull Run. During a long, dry season, the City may have to increase the proportion of groundwater that it uses to meet demand before the return of fall rains.

The City is preparing for climate change through research and monitoring, revising long-term planning models, working with other west coast cities on adaptation and mitigation strategies, developing its rights in the CSSWF to provide summer supply and emergency backup capacity, and implementing water conservation practices and programs.

Reliability of the Bull Run Supply

An analysis of seasonal (June-October) reservoir supply data from 1946-2004 shows a declining trend for total reservoir inflow for these months. The City is monitoring inflow data to determine whether the trend will continue.

Columbia South Shore Well Field

The CSSWF is the second-largest developed water source in the state, and the largest developed groundwater source. The wells in the 11-square-mile well field provide water when the Bull Run supply is shut down due to emergency conditions such as turbidity events, landslides, fires, or human-caused disruptions. The groundwater system is also a seasonal supply augmentation when the Bull Run supply cannot provide enough water to meet demands during the summer peak season. From 1985 to March 2008, the City used groundwater from CSSWF 7 times when the Bull Run supply was shut down, and 12 times to augment the Bull Run supply during the summer season.

As of December 2007, 26 active CSSWF wells draw on three aquifers: the Sand and Gravel Aquifer (SGA); the Troutdale Sandstone Aquifer (TSA), and the Blue Lake Aquifer (BLA). The sum of the nominal instantaneous pumping capacity for all of the active wells is approximately 103 to 118 million gallons a day (MGD). This figure is based on the maximum pumping rates of the individual wells. This rate is less than the four-hour pumping test rates which sum to approximately 136 MGD of four-hour instantaneous use. When all available wells are in use, the well field has an empirically determined initial 30-day operating capacity of approximately 102 MGD. A 112-MGD pump station moves the water 4.5 miles south and approximately 475 feet uphill to the City's Powell Butte Reservoir, where it is mixed with Bull Run water (unless the Bull Run supply is off-line).

In July 2005, the City annexed the former PVRWD. The installed capacity of the Powell Valley wells can be as much as 8.6 MGD, however, due to mechanical issues, only a portion of this capacity is currently available as noted in the 2007 Summer Supply Plan. Several capital improvement projects are planned to repair various facilities and fully integrate the wells into the Water Bureau system. These projects may be completed in three to ten years.

Groundwater Protection Programs

The Groundwater Protection Program for the CSSWF requires businesses and households that use, store, or transport hazardous material above a certain threshold amount to implement best management practices to prevent spills on the ground. The Wellhead Protection Program for the former Powell Valley Road Water District wells is being updated.

Regulations Affecting the Use of Groundwater

Although withdrawals from the CSSWF on the south shore of the Columbia River do not have a direct one-to-one relationship to the reduction in flow of the Columbia River, the City analyzed the potential effects from the long-term use of groundwater on flows in the river. The results of the analysis indicate that, under a worst-case scenario, the 151-day withdrawal rate is smaller than the margin of error for the U.S. Geological Survey gages that measure flows on the Columbia River. The use of CCSWF, therefore, does not measurably affect the flows in the Columbia River.

Operational Limitations and Reliability of the Current Groundwater System

There are three operational limitations on the reliability of the current groundwater operations at the Columbia South Shore Well Field: the pumping capacities of the aquifers that the wells draw from over extended periods of time, the mechanical reliability of the system and the need for continuing maintenance of the facilities, as well as the presence of manganese in some of the CSSWF wells. The presence of manganese reduces the value of the wells as a water supply; it is desirable to replace the capacity of these wells with new wells.

Although current well field capacity is sufficient to meet short-term (less than 30 days) emergency needs during the non-peak season, there is no additional reliable capacity. Depending on the demand pattern at the time of need, the current capacity of the well field system is not sufficient to meet demand during a full shutdown of the Bull Run system due to emergencies or catastrophic events, for events longer than 30 days.

The bureau has made assumptions about the ability to pump the well field over various periods based on drawdown data within the different aquifers utilized by the wells (Table ES-1). Pumping of the SGA may be limited in the future by the withdrawal from other users in Oregon and Washington.

Table ES-1. Potential Rate of Use and Peak-season Volume for CSSWF Wells^a

Number of days	Potential rate of use (MGD)	Potential peak-season volume (BG)
<30	102	3.01
30-90	92	8.6
More than 90	82 or less	More than 8.6

^aSGA, BLA, and TSA wells

High manganese concentrations in two of the BLA wells has limited the ability of the Water Bureau to utilize these wells. The Water Bureau avoids using the high-manganese wells unless no Bull Run supplies are available and the full capacity of the well field is needed.

System Service Area

Portland’s system service area is characterized by higher summer-season and peak demand compared with the average daily demand. The summer season demand, typically occurring May through October, is usually 25 to 33 percent higher than average daily demand. The peak or maximum daily demand (which only occurs a few days in any given year) is almost twice as high as the average daily demand in some years.

Per capita consumption of water has generally been decreasing since the late 1980s despite an increase in the population served. Although the average daily demand has hovered

around 100 million gallons a day (MGD) since calendar year 2002, the average per capita use has declined since FY 2001-2002.

Overall consumption has also been declining since the late 1980s due to reductions in per capita use, off-loading of wholesale demands to other non-Portland sources, the loss of some large customers in the retail system, and switching to non-potable supplies by some customers (for example, the Port of Portland and the Portland Parks & Recreation).

Retail Customers

In FY 2006-2007, Portland served an estimated 545,300 people and businesses through 180,100 services in the retail sector. The average daily consumption per service was 325 gallons. Portland's retail customers are a mix of single- and multi-family residential retail and industrial, commercial, and institutional (ICI) customers. The average per capita consumption for retail single-family residential customers was approximately 66 gallons a day for FY 2006-2007. More than half of the retail consumption in Portland is from residential users living in single- or multi-family homes. Summer water use varies by the type of residential property; water use is higher for customers living in single-family households than for customers living in multi-family residential households.

Approximately 19.5 thousand retail industrial, commercial, and institutional (ICI) customers purchased water from the Water Bureau in FY 2006-2007. Examples of Portland's retail ICI water customers include health-care and building facilities, light and heavy manufacturing, and food service companies. ICI users consume nearly two-fifths (39 percent) of all retail water.

Wholesale Customers

Currently, the Water Bureau provides water to an estimated population of 314,700 people in the Portland metropolitan area through wholesale contracts. During FY 2006-2007, the average per capita consumption for wholesale customers was approximately 127 gallons a day.

The wholesale contracts signed in July 2006 are 10- and 20-year terms. The primary difference between the two types of contracts is the rate-of-return cost factor. The wholesale contracts specify the amount of water service the City will provide and include terms on guaranteed purchase obligations or interruptible water supplies. In addition, each water contract requires that the wholesale purchaser create a conservation and curtailment plan to be reviewed and approved by the Water Managers Advisory Board. A copy of Portland's wholesale contract is included as Appendix B of this plan.

Interconnections with Other Water Providers

The Water Bureau maintains 46 interconnections with other water suppliers. All of the wholesale customer connections have master meters to quantify the amounts of water sold. Very few of these interconnections with wholesale providers are capable of passing supply to Portland, either due to infrastructure issues or because those wholesale customers do not have other supplies available.

There are a few interconnections with water providers with whom Portland does not have wholesale contracts: Clackamas River Water, the City of Lake Oswego, Beaverton, and the City of Milwaukie. These interconnections have been used in the past for emergency provision of water supplies either from or to Portland. The total amount of water that can

be passed between non-contract customers and Portland is fairly limited at this time (around 6.5 MGD).

The City has been discussing interconnections with wholesale customers to move water from the Joint Water Commission system to Portland for emergency purposes, as well as other discussions with entities on the east side of the Portland service area. No projects are proposed at this time and no specific agreements exist.

Water Conservation Programs

The Portland Water Bureau has implemented residential and ICI water conservation programs since 1990. Several of the bureau's conservation efforts have been collaborations with other agencies, water providers, and City bureaus.

Residential Conservation Program

Providing information to residential customers through print and electronic media has been a major component of the bureau's conservation program since its inception. Print media has included bill stuffers, brochures that address indoor and outdoor water conservation practices, and youth education materials. Much of this information is also available on the bureau's web site. Conservation staff work with education staff and other stakeholders to provide robust youth education activities around water conservation including a self water audit and school assemblies with a puppet show and music presentation. Conservation staff also make presentations to a variety of audiences and participate in community events such as neighborhood street fairs; the Yard, Garden, and Patio Show; the Salmon Festival; and Fix-it Fairs.

The bureau distributes conservation devices at school events and to customers when they call or order online. Conservation kits are also distributed to targeted customers through a partnership with the Portland Department of Transportation, which distributes the kits by bicycle. Conservation staff also provide technical assistance to customers through publications and the web, providing information on leak detection and fixing toilet and faucet leaks. Workshops offering self-help for leak repair are offered by conservation staff at annual Fix-it Fairs.

ICI Conservation Program

The Water Bureau's Business, Industry, and Government (BIG) program has provided technical assistance for ICI customers since 1993. BIG staff evaluate uses of water and suggest various ways to improve water efficiency, including retrofitting or changing out water-using fixtures, improving HVAC systems, and eliminating single-pass cooling. BIG program staff have offered classes to building maintenance staff on cooling tower operations; to food service workers to reduce water use; and have partnered with others to provide information to landscaping staff to use water more efficiently outdoors. Special assistance has also been offered to Portland Public Schools and Parks to help reduce water use and save money. BIG staff will conduct landscape audits upon request.

Water Audit, Metering, and Billing

The Water Bureau conducts an annual audit of water metered at the sources and water billed to customers. The amount of water unbilled is a little over 5 percent—on the low end of an American Water Works Association benchmarking study. The bureau has a strong

commitment to leak detection and repair with a performance measure of “less than 5 percent of customers experiencing a cumulative outage of water for more than 8 hours a year.”

All customers are fully metered and meter testing and maintenance is conducted on a periodic schedule. Customers receive bills based on metering. Billing is through a temporary uniform rate that was adopted in 2006 in conjunction with a new billing system. New rate structures are being studied for potential implementation as one of the 5-year benchmarks in this WMCP.

Technical Assistance, Retrofit, and Replacement Programs

As noted above, the Water Bureau provides technical assistance to both residential and ICI customers. Residential customers receive kits with indoor devices such as a low-flow showerhead (1.5 gallons per minute), a 5-minute shower timer, a 1.5 –gallon-per-minute kitchen faucet aerator and bathroom faucet aerators that flow between 0.6 gallons per minute (GPM) and 1.5 GPM. A toilet displacement bag and a fill-cycle diverter are also part of the kit. A recent study of customers who ordered and installed toilet displacement bags and aerators of almost 10,000 gallons per year.

In addition, the bureau offers brochures and web pages explaining how to use the household water meter to detect a leak, and how to repair some toilet and faucet leaks. In a partnership with another agency, the bureau is currently pilot-testing offering residential water surveys for its customers.

ICI customers receive detailed technical assistance, from leak identification to changing industrial processes to save or reuse water. Savings from this technical assistance varies by customer, depending on how they use water and how much water they use.

Much of the incentive to reduce indoor water use by both ICI and residential customer is due to the high rates associated with wastewater cleanup. The payback for these water savings, then, is the combination of savings from both water and wastewater (or sewer) charges—a much faster payback period than a payback period based on just water charges alone.

In the past, the Water Bureau has provided incentives to multi-family owners who provide housing to low-income customers. The incentives have been to replace high-flush-volume toilets (more than 1.5 gallons per flush) with low-flush models (1.6 gallons per flush). Evaluation of this program indicated a 25 percent reduction in water bills for multi-family units that took advantage of this program. Through the Customer Service work group, a low-income fixture repair program is also offered to customers who meet income guidelines.

The Water Bureau has also retrofitted municipal water fixtures to make them more efficient, including the free public drinking fountains—called “Benson Bubblers”—and City water fountains. The bureau has also worked closely with Portland Parks & Recreation (PP&R) to use non-potable water sources for irrigation of the many parks and golf courses in the City.

Curtailment Program

Portland has two high-quality sources of water: the Bull Run watershed and the Columbia South Shore Well Field. Each water source, however, is susceptible to different vulnerabilities. The Bull Run watershed is vulnerable to earthquakes, landslides, floods, droughts, wind or ice storms, forest fires, or acts of terrorism. Any of these could cause water quality problems including turbidity. Operations in the CSSWF are vulnerable to earthquakes, flooding of the Columbia River, fires, and acts of terrorism as well as

groundwater contamination and power outages. Because of these vulnerabilities and others, the bureau has an *Emergency Operations Plan*—last updated in 2002.

In addition, bureau staff also prepare an annual *Seasonal Water Supply Augmentation and Contingency Plan*—also referred to as the Summer Supply Plan (SSP). The SSP includes a tiered contingency plan. The contingency plan has been incorporated into the bureau's curtailment plan. The contingency plan and this curtailment plan take into account baseline primary supplies such as the Bull Run streamflow and water gained from conservation; augmentation resources such as the CSSWF supply and the first increment of Bull Run Lake; and contingency resources such as additional increments of Bull Run lake, voluntary curtailment, interconnections with area water providers, emergency wholesale demand offloads, and mandatory curtailment.

The tiered system describes the supply source, the potential rate of use, potential peak-season volume, and potential use period. The use of supply sources in the different tiers is tied to a measurable trigger that is associated with one of four stages of alert: Level 1–Mild Alert, Level 2–Voluntary Curtailment Measures, Level 3–Emergency Mandatory Curtailment Measures, and Level 4–Critical Water Shortage. The triggers are determined by the bureau's ability to meet the anticipated demand at the time of year and the terminal storage volume. See Tables 4-2 and 4-3 in the Curtailment section of the document for more detail.

The Water Bureau has had very few water shortages requiring the use of this curtailment plan—the most recent incident was in 1992 when Portland experienced a drought that drew the Bull Run reservoirs down to low levels at the same time that the groundwater supply was temporarily unavailable.

The most likely scenario that could disrupt distribution of water from both sources is a major earthquake. Seismic analyses of the Bull Run infrastructure indicate that the dams exceed requirements for safety. A project to protect a vulnerable conduit crossing of the Sandy River is currently underway. The project goal is to relocate the conduit under the Sandy River. An earthquake of sufficient magnitude to disrupt water service would affect all of the regional water providers. Therefore, Portland would have to rely more heavily on curtailment or alternate sources of water (e.g. bottled water or portable water distribution systems) to meet basic needs should both systems need repair.

The need to access more groundwater supplies for vulnerability purposes to meet the annual average demand is a significant conclusion of this WMCP.

Water Supply

The City of Portland is responsible for providing water to its retail and wholesale customers in the Portland metropolitan area. The purpose of this WMCP is to characterize Portland's population and water use to date, anticipate population growth and water use patterns, and plan for the anticipated growth through the use of water resources including conservation.

Population Growth and Water Use

Although the physical boundaries of the retail service area are not expected to be redefined beyond the limits of the urban growth boundary (UGB), vacant land and redevelopment lots within the retail service area are increasingly being developed with higher-density housing and more mixed-use development than in the past. In addition, several of the bureau's 19

wholesale customers have identified growth in existing service areas as well as some small additions to the UGB in 2004.

Historical water use, both retail-only and combined retail and wholesale demand, has not kept pace with the increase in the service area population. Since 1990, the number of gallons per capita per day for the entire retail and wholesale area has declined while the population has grown. Figures ES-1 and ES-2 show, respectively, the system service area population compared with the average daily demand and the demand in per capita gallons per day, for calendar years 1960–2007.

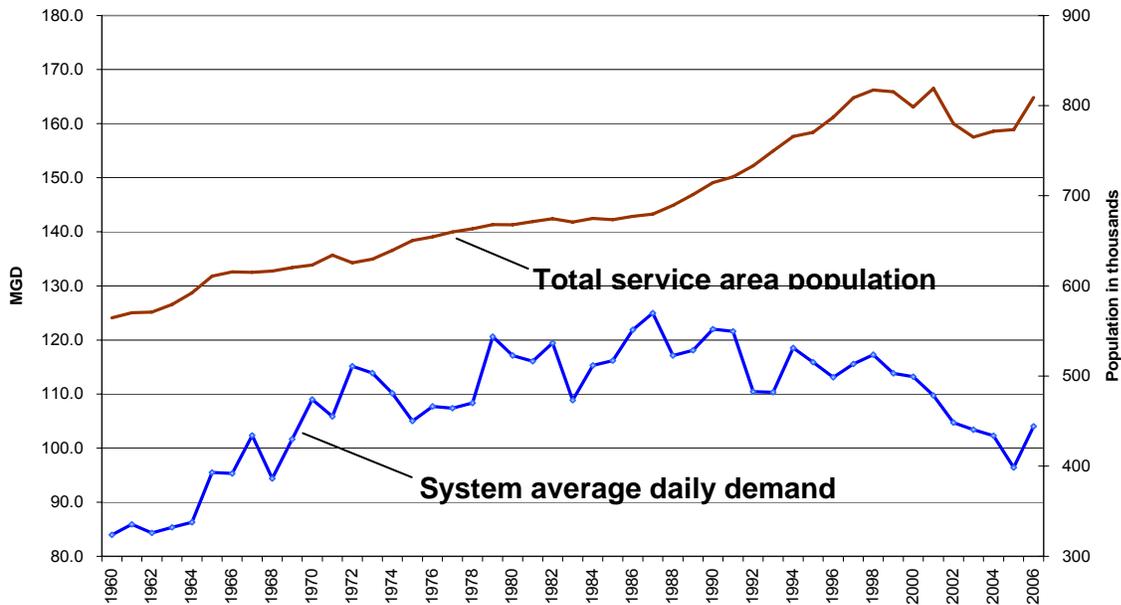


Figure ES-1. Historical Total System Service Area Population and Average Daily Demand, Calendar Years 1960-2006

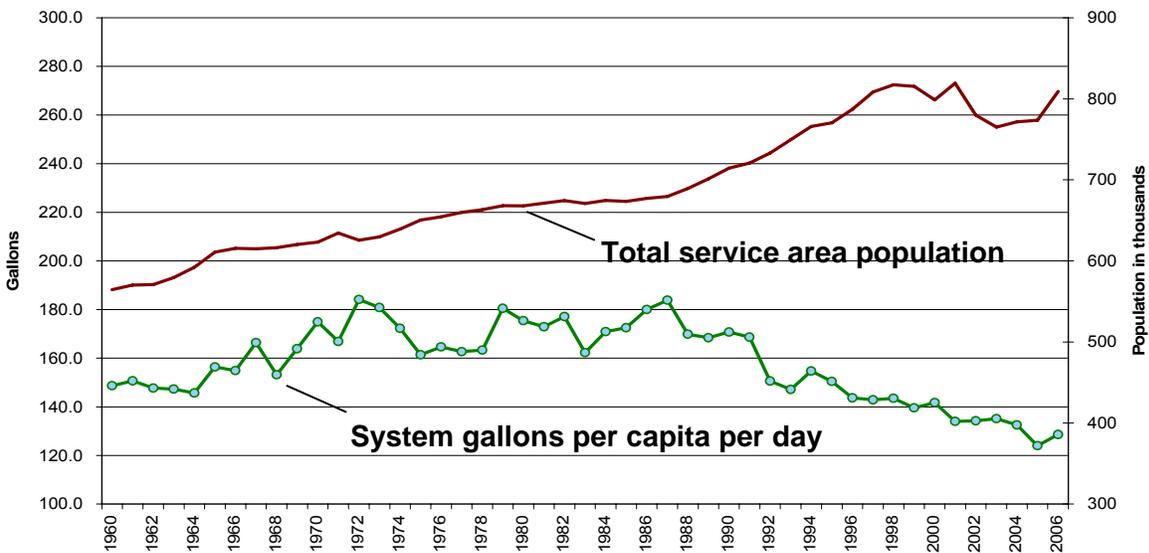


Figure ES-2. Historical Total System Service Area Population and Gallons per Capita per Day, Calendar Years 1960-2006

Demand Forecast

Using a single-equation econometric model, the Water Bureau has estimated the mathematical relationship between the overall demand for water and a series of explanatory variables including population change, weather factors such as precipitation and temperature, the average price of water, weekend use, and others. The result is a weather-normalized demand forecast for annual demand. The forecast also estimates demand under weather conditions that generated the highest average daily demand during the peak season (1967) and the highest single peak-day water demand (1981).

Although the growth in demand does not increase at the same rate as the growth in population, analysis of future demand and population shows that demand will increase over time. Figures ES-3 and ES-4 show forecasts for 2007-2030 of Portland’s retail and wholesale annual average daily demand (ADD) for both weather-normalized and 1967 weather conditions for the entire year and for the peak season, respectively.

Population estimates were obtained from Metro. These forecasts were generated as a part of the population and allocation forecasts prepared for the Regional Transportation Plan. Estimates were made based on approximate service territories of Portland and each wholesale customer. No estimate for future growth outside the existing service territories was included, although some growth outside the existing service territory is likely for some providers as the UGB is expanded to accommodate the required 20-year land supply.

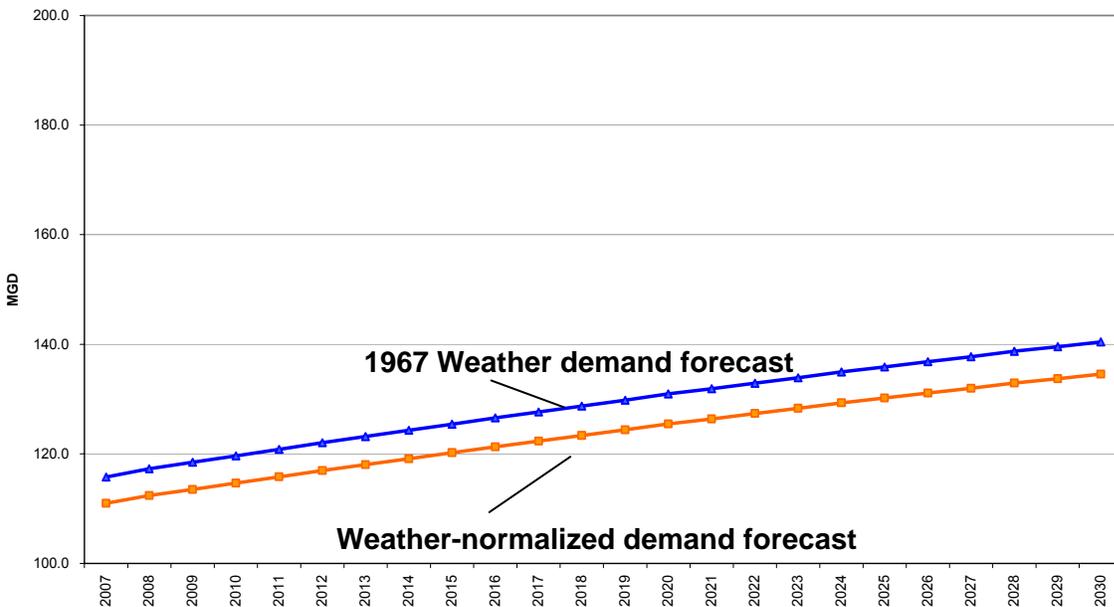


Figure ES-3. Total Annual Average Daily Demand Forecasts Under Weather-normalized and 1967 Weather Conditions, Calendar Years 2007-2030

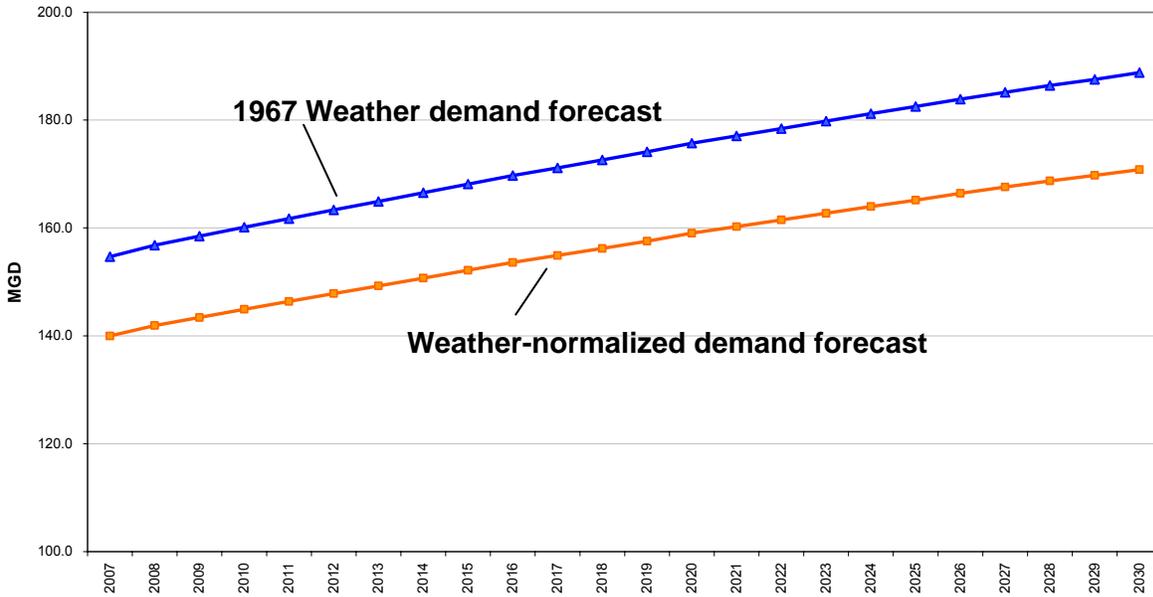


Figure ES-4. Total Peak-season Demand Forecasts Under Weather-normalized and 1967 Weather Conditions, Calendar Years 2007-2030

Table ES-2 shows the estimated demand and population for 2007 and the forecasted demand and population for 2028. The difference between the demand figures and the populations for 2028 and 2007 is the amount of the increase—labeled as 2028 Increase in the bottom row.

Table ES-2. Increase in Forecasted Retail-Wholesale Annual and Peak-season Demand—Calendar Years 2007 to 2028

Calendar Year	Annual (MGD)		Peak Season (MGD)			Population
	ADDWN	ADDW67	ADDWN	ADDW67	MDDW81	
2007	111.0	115.8	140.0	154.7	235.0	817,586
2028	132.9	138.7	168.7	186.4	282.8	982,442
2028 Increase	21.9	22.9	28.7	31.7	47.7	164,856

ADDWN - average daily demand, weather-normalized
 ADDW67 - average daily demand under 1967 weather conditions
 MDDW81 - maximum daily demand under 1981 weather conditions
 Peak Season – 122 days, June 1 to September 30

The average annual daily demand for 2028 under 1967 weather conditions is estimated to be 138.7 million gallons a day (MGD), an increase of 22.9 MGD over the current demand. The Bureau has chosen to use the 1967 weather effects to account for the slight increase in average daily demand (ADD) because of the longer peak-season extensions into the spring and fall months.

Alternative Sources of Supply

Given the likelihood that population growth and increased demand will occur by the year 2028, the Water Bureau analyzed additional supply from existing water rights and supply from sources outside of those owned by the City of Portland.

Table ES-3 shows the potential additional sources of water supply that the City considered and the conclusions the City reached about the feasibility of developing or using those resources.

Table ES-3. Alternative Sources for Water Supply and Conclusions Regarding Development or Use

Alternative Source of Supply	Conclusion Regarding Development or Use
Supply from City Sources	
Bull Run Dam 3 and Related Facilities	The costs to develop this resource and avoid the potential impacts on the natural resources are greater than is necessary to meet the demand anticipated at this time.
Additional Storage in Reservoirs 1 and 2	The storage gained by raising the levels of the dams is not enough to offset the anticipated future demand and would trigger additional environmental impacts and costs.
Former Powell Valley Road Water District (PVRWD) Groundwater Wells	The City is in the process of evaluating the use of former PVRWD wells to determine how they can be utilized within the Portland water system. The assumed capacity of former PVRWD wells is accounted for in future supply planning.
Bull Run Groundwater	The quality and/or temperature of the groundwater in the Bull Run watershed was found to be not suitable for instream fish flows and is not suitable for municipal supply without further treatment and/or blending.
Aquifer Storage and Recovery	Upon partial implementation of a pilot program, the potential water produced did not justify the cost of the continuing with the project at that particular time. This concept could be revisited at a later time.
Non-potable Supplies	The potential costs of treating and/or transporting all identified non-potable water supplies is not feasible for development for municipal water supply except in selected areas of the City. Some future development may occur by the Port of Portland in the Rivergate area.
Willamette River	Although the City has made claims to the Willamette River to protect past usage of this source, the Portland City Council determined in 1996 that the City will not use the Willamette River as a source of municipal water without further action by the Council.

Table continued on next page.

Table ES-3. Alternative Sources for Water Supply and Conclusions Regarding Development or Use

Alternative Source of Supply	Conclusion Regarding Development or Use
Supply from Non-City Sources	
Existing or Expanded Interconnections with Other Providers	The City’s Summer Supply Plan for 2007 identifies a total of 6.5 MGD as available through interconnections with other sources. However, reliable supplies through these interconnections is limited.
Columbia River	The City does not have water rights on the Columbia River. The CSSWF is a much more economical alternative.

Although there are some alternatives to the development of CSSWF groundwater rights to meet annual average demand, none of the alternative sources is feasible for reasons of cost, availability, environmental impacts, or quality of the water. Conservation savings are assumed to continue in the near future as a part of the demand forecast, but the per capita consumption rate will likely plateau as population growth continues.

Supply Management

Portland’s water supply planning takes into account the system vulnerabilities and the reliability of the water supply sources. The Bull Run surface water supply is unfiltered, which results in vulnerabilities to events that can cause temporary elevations in the turbidity levels. The capacity of the CSSWF to yield at a given rate is reduced with the duration of pumping. Table ES-4 shows the estimated reliability and volume of groundwater production under different assumptions of pumping.

Table ES-4. Estimated Reliability of Supplies of CSSWF Groundwater in the 2007 Summer Supply Plan^a

Number of Days of Pumping	Estimated Reliability in Millions of Gallons a Day	Estimated Volume in Billions of Gallons
Up to 30	102	3.1
30–90	92	8.6
More than 90	82 or less	More than 8.6

^aAssumes 100% mechanical operation of all facilities

The estimated reliability figures in Table ES-4 were calculated assuming 100 percent mechanical operation of all facilities. Patterns of past production indicate that a reduction of 10 percent from these figures would more realistically account for out-of-service components. Reducing the 30–90-day reliability figure by 10 percent results in an estimated rate of 82.8 MGD. The 30–90-day interval is selected by the bureau as the planning scenario for the pumping duration for the CSSWF in the year 2028.

Undeveloped, Expanded, and New Water Rights

Request to Develop Additional Water Under Existing Permits

The City of Portland is requesting additional water in the amount under existing permits for the Columbia South Shore Well Field for the next 20 years, from the present to 2028.² This request is to develop an additional 48.54 MGD/53.39 maximum MGD of supply from the CSSWF water rights shown in Table ES-5.

Table ES-5. Requested Groundwater Supplies by Permit, to 2028

Permit #	Monthly Volume ^a (in BG)	Millions of Gallons a Day	Maximum Diversion Rate ^b (in MGD)
G-10124 & G-10455	.54	17.84	19.62
G-8755 & G-10479	.92	30.7	33.77
Totals	1.46	48.54	53.39

^a30-90-day supply based on 30 days of pumping

^bThe maximum diversion rate is a 10 percent increase of the monthly volume to represent the capacity yield for a less-than-30-day pumping event.

The basis for the 48.54 MGD of additional supply comes from the materials presented in the supply and demand analysis (subsection 5.4) of this WMCP. This total is accounted for in Table ES-6.

Table ES-6. Accounting for Requested Groundwater Supplies

	Amounts in MGD	Maximum Diversion Rate
Total Annual ADD (1967 Weather Year) Demand Forecast for 2028	138.7 ^a	
Minus CSSWF 30–90-day Reliable Supply	-82.8 ^b	
Minus PVRWD Wells Supply Assumption	-7.36	
Total Requested over 20 Years (to 2028)	48.54	53.39 ^c

^aFrom the demand forecast for retail and wholesale service for the year 2028.

^bThis figure is based on a 10% reduction in yield capacity due to multiple well drawdown when all wells are in production, as well as a 10% out-of-service-calculation for mechanical or other operational considerations.

^cThe maximum diversion rate is a 10% increase over the total monthly volume requested to represent the capacity yield for a less-than-30-day pumping event.

The maximum diversion rate is 10 percent higher than the total volume requested to represent the less-than-30-day diversion amount. If the diversion amount is needed past 30 days, it will drop after the 30-day period to an average of the monthly production needed to meet 48.54 MGD of annual average supply. This is the same yield analysis that is applied to the reductions in overall CSSWF capacities in the summer supply planning process.

² On October 6, 2009, PWB received the Notice for Final Orders from OWRD for CSSWF permits G-8755, G-10479, G-10455, and G-10124 and for Permit Amendment T-10489 for Well #38 under G-8755.

Schedule and Budget for Development of New Water Rights

The amounts of the water supply will be developed over a 20-year period of time beginning in 2009 and progressing to 2028 at an estimated cost of \$29.5 million (or approximately \$750,000 per MGD). These estimates are in 2004 dollars. This \$29.5 million does not include the cost for added infrastructure associated with pumping, pipeline upgrades, storage, or other distribution system costs not directly associated with the specific well sites.

The amounts for added infrastructure will be evaluated in future WMCP plan updates and revised as needed based on the following three elements:

- The factors associated with defining the amount of supply from the Powell Valley well system
- The amount of actual demand increments based on weather effects and conservation savings
- The status of wholesale contracting beyond the expiration of the first set of 10-year contracts as well as any new contracts that might be signed in the future

Increased costs will be defined for other infrastructure projects associated with pumping, transmission, and storage that may be necessary with an increased supply of groundwater from the CSSWF.

Conclusions Regarding the Need for Development of Groundwater Rights

This updated WMCP represents a continuation of Portland's commitment to proper management of its water resources. The Water Bureau relies on the well field for summer supply augmentation and as an emergency backup supply when the Bull Run surface water supply is unavoidably limited or unavailable. The well field infrastructure represents supply capacity already in place and ready to use. Other water-supply options of similar capacities will not be needed until demand (as moderated by conservation programs) grows enough to enable financing and construction of new storage or supply. Other major sources of supply that could make any further development of Bull Run storage unnecessary for a long time are being evaluated within the Portland region. Given uncertainties about future per capita demand, the pace of urban growth, future wholesale water customer behavior, requirements to provide instream flows for fish, and changes in weather or climate patterns that may reduce Bull Run yields during the peak season, the City anticipates a continuing need for the groundwater system to meet its responsibilities to its customers.

The City must plan and manage its resources in the most cost-effective manner possible. The development of four existing groundwater rights in the CSSWF would best leverage the existing infrastructure and subsurface hydrology, would create the least environmental impacts, and would meet vulnerability needs making it the most cost-effective and responsible option. The development of the groundwater source in the CSSWF can be done incrementally as needed and as fits with actual water demand, future wholesale contracting, conservation program success, and the development of non-potable supplies over time. For these reasons, continuing to use the groundwater system as backup supply and developing the conservation programs are the methods of choice for meeting future needs.