WATER MANAGEMENT PLAN, REVISION 2

Pacific Coastal Ecology Branch, Newport, Oregon

OARM Sustainable and Transportation Solutions Branch (STSB) **September 2016**

Overview

This report summarizes the findings and recommendations associated with a water use and conservation assessment conducted in May 2016 at the U.S. Environmental Protection Agency's (EPA's) Office of Research and Development (ORD) National Health and Environmental Effects Research Laboratory (NHEERL) Pacific Coastal Ecology Branch (PCEB) in Newport, Oregon. Under this Water Management Plan revision, PCEB will consider implementing the potential water conservation opportunities identified during the water assessment, which are summarized in Table 1. This Water Management Plan also describes the facility's water reduction goals, water use trends, end uses of water, drought management plans, and stormwater management efforts.

Background

Executive Order (EO) 13693, Planning for Federal Sustainability in the Next Decade, signed in March 2015, requires agencies to reduce potable water consumption intensity, measured in gallons per gross square foot (gsf), by 36 percent by fiscal year (FY) 2025. Reductions are measured relative to the Agency's baseline water consumption in FY 2007, through reductions of 2 percent annually. In addition to the potable water use reduction requirements in EO 13693, the order requires that agencies reduce industrial, landscaping, and agricultural (ILA) water consumption by 2 percent annually, or 30 percent by the end of FY 2025, relative to an FY 2010 baseline (including nonpotable sources). Agencies also should install water meters and utilize building and facility water balance data to improve water conservation and management.

The implementing instructions of EO 13693 require that, where applicable, agencies should purchase WaterSense® labeled products and choose irrigation contractors who are certified by a WaterSense labeled program.[1]

The Energy Independence and Security Act (EISA) of 2007 directs agencies to complete comprehensive energy and water evaluations for 25 percent of covered facilities (i.e., those accounting for 75 percent of total agency energy use) each year, resulting in each covered facility being assessed once every four years. It also directs agencies to implement cost-effective measures identified through life-cycle analyses and measure and verify water savings.

Figure 1: Panoramic view of PCEB laboratory in Newport, Oregon.

[1] WaterSense is a partnership program established by the EPA to promote water efficiency. Products and services that have earned the WaterSense label have been certified for efficiency and performance. The growing list of products that are eligible for the label include toilets, flushing urinals, showerheads, private lavatory faucets, pre-rinse spray valves, and irrigation controllers.

To achieve greater Agencywide water efficiency and to meet EISA requirements, a water assessment was conducted at PCEB on May 19, 2016. Since 2002, the SSD's Sustainable & Transportation Solutions Branch and its contractor, Eastern Research Group, Inc. (ERG), has conducted water assessments at EPA-owned and operated laboratories to improve water efficiency and comply with EO 13693 and EISA 2007. The assessment team (Angela F. Nunez Matos, STSB; Rafael Hernandez, STSB; and Robert Pickering, ERG) conducted the water assessment at PCEB to review existing conditions and update the previous 2011 Water Management Plan.

Table 1. Potential Water Conservation Opportunities at PCEB

Suggested Priority	Project Description	Project Cost	Potential Annual Water Savings (Gallons)	Potential Annual Energy Savings (Million Btu)	Potential Annual Utility Cost Savings[2]	Potential Payback (Years)	Notes
1	Use rainwater collected in 300-gallon tank in courtyard as make-up water for the water feature. Chlorine tablets may need to be used to control biological growth in the rainwater collection tank.	$0	900	0	$10	Immediate	None
2	Install 0.5 gallon per minute (gpm) aerators on two remaining faucets (one in each men's restroom) with flow rates currently exceeding 0.5 gpm.	$20	8,000	3	$140	0.1	None
3	Replace two existing non-water urinals with 0.125 gallon per flush (gpf) WaterSense labeled models.	$2,000	160[3]	0	$470[4]	4.2	Non-water urinal replacement would also result in time saved for the operations and maintenance (O&M) contractors to work on other tasks.
4	Replace two existing pre-rinse spray valves in Room S115 with WaterSense labeled models flowing at 1.28 gpm or less.	$160	2,000	0	$23	7.0	None

[2] Utility cost savings are calculated using the most current water, sewer, electricity, and natural gas costs available. As of 2015, PCEB's water rate is approximately $3.85 per 1,000 gallons (Kgal) and the sewer rate is $7.55 per Kgal, as provided by the City of Newport. Combined, this rate is equal to $11.40 per Kgal. Natural gas costs $8.204 per thousand cubic feet (Mcf) and electricity costs $0.0567 per kilowatt hour (kWh), as determined by averaging the costs from recent utility bills.

[3] Water savings from installing 0.125 gpf urinals in place of non-water urinals are from the elimination of weekly drainline flushing that is currently conducted by the O&M contractor.

[4] Purchasing of non-water urinal cartridges and trap seal fluid would be eliminated as a result of this project. Cartridges cost approximately $10 each and require replacement every 6 weeks. Trap seal fluid costs approximately $25 per quart, with a quart lasting approximately one month.

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Suggested Priority	Project Description	Project Cost	Potential Annual Water Savings (Gallons)	Potential Annual Energy Savings (Million Btu)	Potential Annual Utility Cost Savings[2]	Potential Payback (Years)	Notes
5	Replace six existing showerheads in analytical laboratory restrooms and dive locker with WaterSense labeled models flowing at 1.75 gpm or less.	$180	1,000	0.4	$17	10.4	None
6	Reinstall submeter on reverse osmosis (RO) system supply line.	$0	0	0	$0	Not quantified	Installing and monitoring supply submeter will help the facility track total system water use and efficiency. The meter is already existing, and therefore can be installed at no cost under the existing O&M contract.

Facility Information

PCEB is housed in a state-of-the-art laboratory complex on the Hatfield Marine Science Center (HMSC) campus, situated on the shore of Yaquina Bay in Newport, Oregon. The laboratory, owned and operated by EPA, was occupied in 1994 and is designed for marine and estuarine research. The laboratory is made up of three main structures: the main building, which includes all laboratory and office space; the Annex, used for boat repairs, maintenance, and storage; and a hazardous waste storage building. Collectively, the buildings contain 38,851 gross square feet (GSF) of conditioned space, with the vast majority contained within the main laboratory building. PCEB also utilizes an 800,000-gallon seawater pumping and storage reservior that is shared by other laboratory occupants of the HMSC campus. This reservoir is filled twice daily at each high tide. EPA is allocated 12 percent of the seawater per day.

PCEB has approximately 41 occupants, including 14 EPA employees. The facility operates on a flex time schedule and is typically occupied Monday through Friday between the hours of 7:30 a.m. and 4:30 p.m. EPA does not currently have any plans to vacate the facility.

Water Management Goals

PCEB achieves its resource conservation goals by implementing the EPA ORD-wide Environmental Management System (EMS). The Water Management Environmental Management Program (EMP) within the ORD's EMS sets objectives and targets related to water use to reduce the impact on natural resources. It does so by reducing the consumption of water from facility and laboratory operations and by properly managing stormwater runoff. Targets established under this objective call for ORD facilities to:

- Achieve the agency ConservW targets (set annually by EPA's Sustainable and Transportation Solutions Branch) as a cumulative total of all seven locations.
- Identify potential water conservation or stormwater management projects for their sites to be completed by FY 2017.

Although not expressly stated, the ORD's objectives and targets for water management imply a 36 percent potable water reduction goal by the end of FY 2025, compared to an FY 2007 baseline, and a 30 percent ILA water reduction goal by the end of FY 2025, compared to an FY 2010 baseline, consistent with EO 13693.

Water Supply, Measurement, and Historical Use

PCEB's water use has decreased since the last water use assessment in 2011, as the facility has implemented many effective changes. PCEB uses water for: miscellaneous laboratory and research purposes; sanitary needs (including drainline flushing); and water feature make-up. The following sections provide additional details on the facility's water use.

Water Supply

PCEB's potable water and sewer service is provided by City of Newport. Potable water is billed at a rate of $3.85 per thousand gallons (Kgal) and sewer service is billed at $7.55 per Kgal.

PCEB also collects rainwater from the main building roof as an alternative water source. This water is collected in three 2,500-gallon cisterns connected in parallel that, when available, supply water for boat, vehicle, and equipment washing. Reject water from PCEB's reverse osmosis (RO) system is also collected and pumped to these cisterns. PCEB also collects rainwater in a 300-gallon tank in the main building's courtyard. This water does not have a regular use; however, it is sometimes used for pavement and window cleaning within the courtyard.

Meters and Submeters

Incoming water supplied by the City of Newport is metered through a 4-inch supply line. This meter provides a high-flow and a low-flow component reading. The sum of the two readings (high- and low-flow) is the measured total for PCEB. The city meter is located in the front of the main building.

Permeate water from the laboratory's RO system is submetered to determine how much permeate is used. The meter is read by the facility O&M contractor daily. A submeter was previously installed on the supply line to the RO system, but was removed due to the perception that it was impeding flow to the system. As part of this water management plan, the submeter on the RO system supply line will be reinstalled.

Under this plan, water use on each meter will be recorded monthly. Water use trends will be evaluated by the facility manager, and unanticipated usage trends will be investigated and resolved.

Figure 2: A flow totalizing submeter is installed on the permeate line of PCEB's RO system, which measures total laboratory RO use.

Historical Water Use

In response to EO 13693 and the executive orders that preceded it, PCEB established an FY 2007 water use intensity baseline of 9.21 gallons per gsf based on 358,000 gallons of water used that fiscal year. In FY 2015, water use intensity was reduced to 4.27 gallons per gsf, or 166,000 gallons of water—a decrease of 54 percent compared to the FY 2007 baseline. Figure 3 provides a graph of PCEB's water use from FY 2007 through FY 2015.

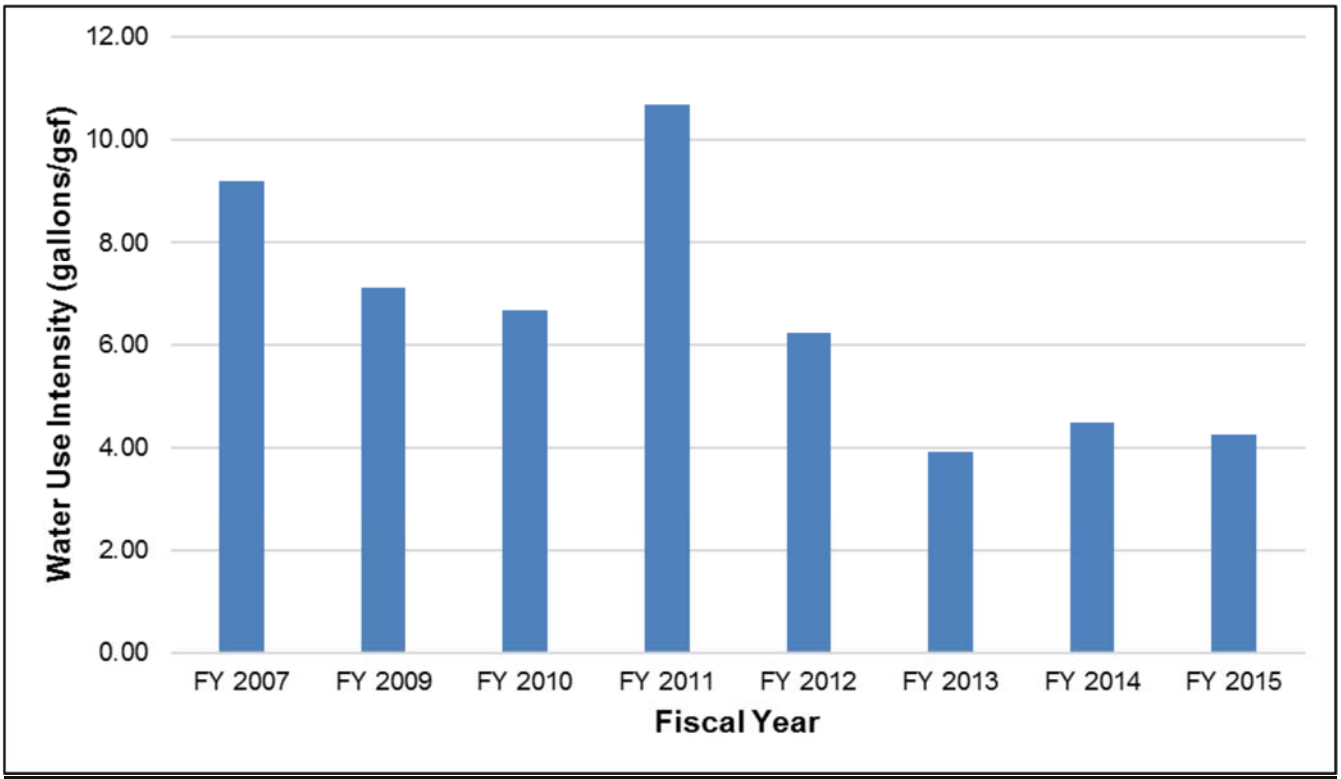

Figure 3: PCEB's Water Use Intensity, FY 2007 to FY 2015. FY 2008 water use intensity data was removed since water use that year uncharacteristically increased more than 600 percent, which skewed the data represented in this figure.

End Uses of Water

Table 2 and Figure 4 identifies the end uses of water at PCEB based on the facility's water use in FY 2015. The uses are described in more detail below.

Table 2. Major Potable Water Uses at PCEB, Fiscal Year 2015

Major Process	FY 2015 Annual Water Use (gallons)	Total Water Use (%)	Basis of Estimate
Potable City Water			
Miscellaneous laboratory and process water use	99,190	59.8	Calculated by subtracting all other estimated and known water uses from PCEB's metered total
Sanitary	53,000	31.9	Engineering estimate based on sanitary fixtures installed, occupancy, and daily usage factors
RO system reject	4,620	2.8	Engineering estimate based on RO permeate meter readings and estimated system efficiency
RO system permeate	2,890	1.7	Meter readings
Pre-rinse spray valves (PRSVs) in Room S115	3,400	2.0	Engineering estimate based on measured flow rate and usage estimate
Non-water urinal drainling flushing	2,000	1.2	Engineering estimate based on O&M flushing schedule
Water feature make-up water	900	0.5	Engineering estimate based on local evaporation rate and water feature size
Total Potable Water Use	**166,000**	**100.0**	**FY 2015 total water use from metered sources**

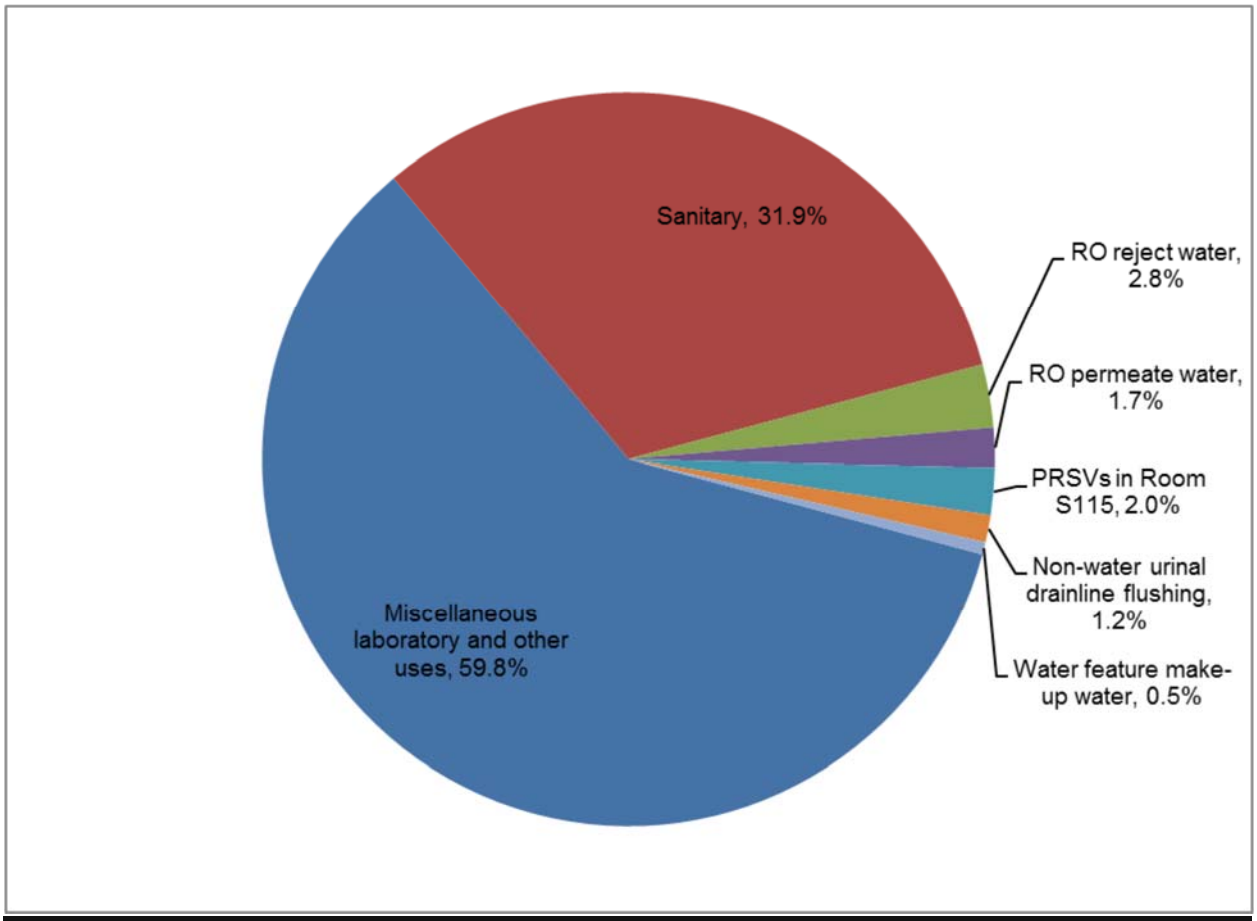

Figure 4: Water end uses at PCEB for FY 2015.

Laboratory Water Uses

PCEB has a wet laboratory and mesocosm facilities where research is conducted on aquatic species and systems. Water-using equipment and appliances that support this research include a glassware washer; two PRSVs for field material preparation and cleaning; and an RO system.

The two PRSVs and the glassware washer are located in Room S115. The glassware washer is a Napco NLW-400 laboratory glassware washer, which was installed recently to replace an outdated model. PCEB also used to have two autoclaves, but they were removed due to lack of use. The two PRSVs had a measured flow rate of 3.3 gpm each. Laboratory staff indicated these spray valves are used mostly in the summer months, when more field activity is conducted. To reduce facility water use, PCEB will consider replacing these PRSVs with WaterSense labeled models, which flow at 1.28 gpm or less.

Figure 5: PCEB could replace two PRSVs flowing at 3.3 gpm with WaterSense labeled models to reduce facility water use.

De-ionized (DI) water for laboratory use is generated through a centralized RO system. Product water from the RO unit is used as feed water to the DI water recirculating loop. Because the supply meter for this system was removed, the reject-to-product ratio for the RO system was not able to be determined. However, the system that is installed is the same model as the two RO systems in use at the Western Ecology Division Main Laboratory in Corvallis, Oregon. These systems reject an average of 1.6 gallons of water for every 1.0 gallon of product water. It is assumed PCEB's RO system has a similar reject-to-product ratio. The DI water is circulated from a holding tank through an ion exchange bed and ultraviolet disinfection unit and out to the laboratories through a header system. The circulated water that goes unused is returned to the holding tank. Reject water from the RO system is collected in a 1,750-gallon holding tank. When the tank is full, this water is pumped to the rainwater collection system at the exterior of the main laboratory building. More information about this system is included in the Alternative Water Sources section below.

Figure 6. Reject water from PCEB's RO system is pumped to the facility s rainwater collection system for other uses.

Restroom and Other Sanitary Fixtures

PCEB's toilets and urinals are compliant with 1992 Energy Policy Act (EPAct 1992) water efficiency requirements (1.6 gpf for toilets; 1.0 gpf for urinals). Toilets at PCEB flush at 1.6 gpf, while the two urinals are non-water models. The non-water urinals require frequent preventative maintenance to clean drainlines and eliminate potential for odors. O&M staff flush the drainlines weekly by attaching a hose to a faucet in each men's restroom and allowing water to flow directly through the drainline for 5 minutes. In addition, non-water urinal cartridges are replaced every 4 to 6 weeks. Finally, trap seal fluid intended to sustain the functionality of the non-water urinal cartridges is applied on a weekly basis. As part of this plan, PCEB will consider replacing existing non-water urinals with WaterSense labeled models flushing at 0.125 gpf. This project will reduce maintenance costs for maintaining the non-water urinals, and could reduce the overall water consumption associated with urinal use, since the weekly drainline flushing would be eliminated.

The majority of lavatory faucets installed throughout PCEB have a flow rate of 0.5 gpm; however two faucets with flow rates of 1.5 gpm and 2.0 gpm remain. The American Society of Mechanical Engineers (ASME) has established 0.5 gpm as the standard maximum flow rate for public-use (e.g., all non-residential applications) lavatory faucets. This flow rate is sufficient for hand-washing and is considered a best practice for lavatory sinks in public settings. To reduce facility water consumption, PCEB will consider installing 0.5 gpm aerators on the two lavatory faucets.

PCEB also has six showerheads installed throughout the facility: two in the main building and four in the dive locker. These showerheads have flow rates of 2.5 gpm, which meets the EPAct 1992 requirements; however, this flow rate exceed the maximum flow rate labeling criteria established by WaterSense and adopted by EPA as best practice. PCEB will also consider installing WaterSense labeled showerheads flowing at 1.75 gpm or less as a water efficiency project.

Table 3 provides an inventory of sanitary fixtures.

Table 3. PCEB Sanitary Fixtures Inventory

Fixture Type	Flow Rate	Total Number
Toilets	1.6 gpf	8
Urinals	Non-water	2
Lavatory faucets	2.0 gpm	1
	1.5 gpm	1
	0.5 gpm	4
Showerheads	2.5 gpm	6

Water Feature and Landscape

The PCEB site is made up of approximately one acre of buildings and two acres of grounds. Most of the two acres of grounds is covered with natural vegetation. The main laboratory building has an inner courtyard and entry courtyard totaling approximately 0.2 acres. The courtyard areas are landscaped with native vegetation. The inner courtyard is equipped with a spray and drip irrigation system; however, because plantings are native and well established, the irrigation system has not been used in years.

The inner courtyard includes a water feature. According to PCEB O&M staff, the feature is refilled approximately every two weeks to account for evaporative water losses.

Alternate Water Sources

PCEB collects rainwater from the main laboratory's roof into three 2,500-gallon cisterns connected in parallel located on the exterior fo the building. Reject water from the RO system is also collected in a 1,750-gallon tank, which is then pumped to the three rainwater cisterns for further storage and use. This water is used for equipment and boat washing.

PCEB also collects rainwater in a 300-gallon tank located in the main laboratory's inner courtyard. Water from this tank is used infrequently, and is mostly used for window and hard surface washdown. PCEB will consider using the collected rainwater in the inner courtyard to refill the water feature. Chlorine tablets could be used to prevent biological growth in the tank.

Figure 7: Rainwater collected in the inner courtyard could be used to refill the water feature.

Completed Water Efficiency Projects

PCEB's water use has decreased since the last water use assessment in 2011, as the facility has implemented many effective changes. As described in Table 4, PCEB completed five water efficiency projects since FY 2007.

Table 4. Completed Water Efficiency Projects at PCEB Since FY 2007

Project	Estimated Annual Water Savings (Gallons)	Completion Year	Additional Notes
RO system	4,000	FY 2011	A more efficient RO system was installed, which reduced the amount of reject water generated.
Rainwater collection	50,000	FY 2010	Three 2,500-gallon cisterns are used to collect rainwater and RO reject to use for boat and equipment washing.
Faucet aerators	11,000	FY 2008	Four of the six faucet aerators at PCEB were retrofit with 0.5 gpm aerators.
Non-water urinals	20,000	FY 2008	Two urinals flushing at 1.0 gpf were replaced with non-water models; however the PCEB is considering replacing these with 0.125 gpf models to address maintenance concerns.

Drought Contingency Plan

Drought Risk

PCEB is located in an area that periodically experiences drought; however; due to its proximity to the Pacific Ocean, rainfall is more substantial than the central and eastern part of Oregon. In 2015, the governor of Oregon declared drought in 19 of Oregon's 36 counties; however, Lincoln County where PCEB is located was not in the affected area. PCEB's water is supplied by the City of Newport, which obtains water from three streams in the region: Blattner Creek, Siletz River, and Big Creek. The City of Newport also maintains two reservoirs that are filled during the wetter months to provide supplemental water for city consumption in the drier months of summer.

Figure 8. Three 2,500-gallon cisterns collect rainwater and RO reject to use for boat and equipment washing.

The City of Newport has not imposed mandatory water restrictions in recent years. The City of Newport does not have an official water conservation plan that specifically addresses drought, but the Oregon Water Resources Department (WRD) coordinates with municipalities to implement water conservation and curtailment plans when drought emergencies are declared.

Recent Contributions to Drought Contingency

PCEB has reduced its water use intensity baseline of 9.21 gallons per gsf, set in FY 2007, to 4.27 gallons per gsf in FY 2015—a 54 percent reduction. PCEB plans to pursue projects to continue to reduce facility water use. PCEB staff will monitor water meters and submeters so that leaks or other malfunctions resulting in increased water use can be identified and resolved.

Potential Capital Improvement Projects to Reduce Water Use

Potential capital improvement projects are identified in Table 1. These projects represent PCEB's plan to further reduce facility water use, particularly if the facility is faced with water supply limitations. If necessary, all of the projects could be implemented relatively quickly, although some do not have short-term payback periods. If fully implemented, these projects are estimated to reduce facility water use by approximately 7 percent.

Opportunities for Short-Term Response to Local Drought

In the event of a drought or other water supply shortage, PCEB will follow the water use recommendations and restrictions of the City of Newport and the Oregon WRD. Regional drought conditions and general information on water supply management can be found on the Oregon WRD Drought Watch Web page, http://www.oregon.gov/owrd/pages/wr/drought.aspx.

Because the majority of the laboratory's water usage is for sanitary and laboratory functions which are critical to PCEB's mission, there is not much opportunity for short-term response to local drought. However, the facility will eliminate potable water supply to the water feature if watering restrictions are implemented. In addition, facility O&M staff could utilize water within the rainwater collection system for drainline flushing rather than using water from the lavatory faucets.

Considerations for New Construction

PCEB's current facility includes many aspects that are considered water efficiency best practices. However, if EPA decides to pursue expansion of PCEB through new construction or major renovations, the design choices listed below could be considered to further reduce water use:

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Table 5. Requirements for Restroom Fixtures in New Laboratory Construction

Fixture Type	Maximum Flow Rate	Performance Requirement
Toilets	1.28 gpf	WaterSense labeled
Urinals	0.125 gpf	WaterSense labeled
Lavatory faucets	0.5 gpm	None
Showerheads	1.75 gpm	WaterSense labeled

Install restroom fixtures with maximum flow rate and performance requirements provided in Table 5.

Incorporate rainwater collection into the initial design to use for toilet and urinal flushing.

Stormwater Management

Stormwater generated at PCEB collects in stormwater culverts and is discharged directly into the Yaquina Bay. PCEB has not had any issues with onsite flooding or drainage, as the gradient directs all stormwater to the bay.

PCEB does not have any onsite green infrastructure for managing stormwater. However, some stormwater that would have been generated at the facility is instead captured in cisterns for other uses.