Water Management Plan

Revision 1

U.S. Environmental Protection Agency
National Health and Environmental Effects Research Laboratory
Western Ecology Division

Corvallis Main Laboratory
200 SW 35th Street
Corvallis, Oregon 97333

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Point of Contact:
Mr. Primo Knight, Facilities Manager
541-754-4418

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HEALTH AND ENVIRONMENTAL RESEARCH LABORATORY
WESTERN ECOLOGY DIVISION
CORVALLIS MAIN LABORATORY
CORVALLIS, OREGON

WATER MANAGEMENT PLAN, REVISION 1

Approved by:

Mr. Primo Knight, Facilities Manager — Date 11-1-11

Mr. Thomas Connolly, Associate Director for Program Operations — Date 11-1-11

Mr. David Burr, EMS Coordinator — Date 11-3-11

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1.0 EPA'S STATEMENT OF PRINCIPLES ON EFFICIENT WATER USE

To meet the needs of existing and future populations and ensure that habitats and ecosystems are protected, the nation's water resources must be sustainable and renewable. Sound water resource management, which emphasizes wise, efficient use of water, is essential to achieve these objectives.

Efficient water use can have major environmental, public health, and economic benefits by helping to improve water quality, maintain aquatic ecosystems, and protect drinking water resources. As the country faces increasing risks to ecosystems and their biological integrity, the inextricable link between water quality and water quantity becomes more important. Water efficiency is one way of addressing water quality and quantity goals. The efficient use of water can prevent pollution by reducing wastewater flows, recycling process water, reclaiming wastewater, and using less energy. As municipalities and regions deal with chronic drinking water shortages due to drought and changes in climate patterns, water conservation becomes even more important to EPA's mission.

EPA recognizes that regional, state, and local differences exist regarding water quality, quantity, and use. Differences in climate, geography, and local requirements influence the water efficiency programs applicable to specific facilities. Therefore, EPA is establishing facility-specific Water Management Plans to promote the efficient use of water and meet the water conservation requirements under Executive Order (EO) 13423, *Strengthening Federal Environmental, Energy, and Transportation Management,* and EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance.*

This Water Management Plan has been established to document and promote the efficient use of water at EPA's National Health and Environmental Effects Research Laboratory (NHEERL) within its Office of Research and Development (ORD), at the Western Ecology Division Main Laboratory (hereafter referred to as Corvallis Main) located in Corvallis, Oregon. The plan is organized according to the Federal Energy Management Program (FEMP) Facility Water Management Planning Guidelines.

2.0 FACILITY DESCRIPTION

Corvallis Main is located on 14 acres in Corvallis, Oregon, surrounded by the campus of Oregon State University. It includes a variety of laboratories, plant and animal research facilities, a library, a computer center, and office buildings.

Within Corvallis Main are a number of greenhouse and field research modules known as Terrestrial Effects Research Facilities (TERF). These units provide the capability for research on: 1) effects of gaseous air pollution, 2) effects of heavy metals, 3) effects of toxic substances, and 4) plant propagation and growth assessments. Corvallis Main also houses a field exposure facility with 21 large open-top exposure chambers, a nursery site, an automated irrigation system, an experimental rhizotron site, and a control center containing automated pollutant delivery-control and data-acquisition/management systems.

To complement the plant exposure facilities described above, Corvallis Main constructed a highly sophisticated Terrestrial Ecophysiology Research Area (TERA) in 1994. The facility consists of a large polyhouse to shelter the data acquisition and control computers and a field of sunlit plant growth chambers. Programmable microprocessors carefully control ambient temperature, dewpoint, and carbon dioxide concentration in each outdoor enclosure. These facilities are used to conduct long-term studies on conifers and hardwoods, with experiments designed to evaluate the response of forests to climate change.

Built in 1966, the main laboratory building at Corvallis Main was operated by the U.S. Public Health Service before being transferred to EPA when the Agency was established in 1970. The research complex has been developed over the years. In addition to the facilities described above, an annex, greenhouses, and office trailers were added in the 1970s. A chemical storage building was added in the 1980s and a plant ecology building (PEB) was constructed in 1990. The laboratory complex is owned and operated by EPA, and it comprises 96,643 square feet of conditioned space.

3.0 FACILITY WATER MANAGEMENT GOALS

As of October 2010, Corvallis Main's resource conservation goals are achieved through the implementation of the ORD-wide Environmental Management System (EMS) program. The Water Management Environmental Management Program (EMP) within ORD's EMS sets objectives and targets related to water use to reduce the impact on natural resources by reducing the consumption of water from facility and laboratory operations and by properly managing stormwater runoff.

The primary objective of the Water Management EMP is to improve water use efficiency and stormwater management. Targets established under this objective call for:

> Achieving annual facility-specific goals set by EPA's Sustainable Facilities Practices Branch (SFPB) under its ConservW program (these ConservW goals are calculated for each EPA facility based on the facility's previous water use reduction and its potential identified projects);
>
> Establishing an ORD fiscal year (FY) 2010 baseline for industrial, landscaping, and agricultural (ILA) water use by March 31, 2011; and
>
> Evaluating the potential to improve stormwater management at each ORD facility by September 30, 2011.

Although not expressly stated, ORD's objectives and targets for water management imply a goal of achieving a 26 percent potable water reduction by the end of 2020, compared to a 2007 baseline, and of achieving a 20 percent ILA water reduction by the end of 2020, compared to a 2010 baseline, as set forth in EO 13514.

Corvallis Main's FY 2007 potable water intensity baseline (in gallons per gross square foot [gal/GSF]) is 63.94 gal/GSF.

To continue progress toward meeting federal requirements and EMS goals, ORD facilities are to implement site-specific water conservation projects geared towards achieving the facility

ConservW target, and to investigate and install corrective actions to maintain cooling towers, restrooms, autoclaves, dishwashers, and other water-using equipment, among other tasks outlined under the Water Management EMP.

4.0 UTILITY INFORMATION

Contact Information

Potable water supply and sewer service is provided by:

City of Corvallis
500 SW Madison Avenue
P.O. Box 3015
Corvallis, OR 97339-3015
541-766-6949

Rate Schedule

Monthly water bills are based on a tiered rate structure, provided in Table 1.

Table 1. Water Use Rate Structure (Effective February 1, 2011)

Meter Size	1.5-inch	2-inch	4-inch
Tier 1 at $1.61 per hundred cubic feet (ccf)	0-67 ccf	0-179 ccf	0-341 ccf
Tier 2 at $1.99 per ccf	68+ ccf	180+ ccf	342+ ccf
Base rate per month	$32.72	$42.62	$98.86

As identified in Section 5.0, Corvallis Main has one 1.5-inch meter, two 2-inch meters, and one 4-inch meter compound high/low meter.

The sewer use fees for Corvallis Main are based on the water used through the 4-inch meter and one of the 2-inch meters (account number 159325-128770). Corvallis Main is charged a base rate of $10.07 per month and $3.49 per ccf water use from both meters. The irrigation system at the main building is submetered and serves as a sewer deduct meter. The water use from this meter is deducted from Corvallis Main's water bill before sewer costs are applied.

In addition to the four main supply meters, Corvallis Main has one ¾-inch irrigation meter which is used at TERF for research. The tiered rate structure for this meter is provided in Table 2.

Table 2. Irrigation Use Rate Structure (Effective February 1, 2011)

Meter Size	5/8-inch or 3/4-inch
Tier 1 at $1.27 per ccf	0-7 ccf
Tier 2 at $1.67 per ccf	8-13 ccf
Tier 3 at $2.23 per ccf	14+ ccf
Base rate per month	$12.17

The facility is also billed $426.84 per month for stormwater drainage, $140.41 per month for a transportation maintenance fee, and $12.00 per month for fire lines.

Payment Office

Research Triangle Park Finance Center (RTP-FC)

(Pouch and Regular Mail)
Environmental Protection Agency
Mail Code - D143-02
Research Triangle Park, NC 27711

(FEDEX)
Environmental Protection Agency
Mail Code - D143-02
4930 Page Road
Research Triangle Park, NC 27711

The fax number for RTP-FC is 919-541-4975.

5.0 FACILITY WATER USE INFORMATION

Corvallis Main consists of multiple research buildings housing laboratory, office, and sample preparation space. The predominant features are the greenhouses and various field test chambers used to conduct controlled experiments on ecosystem stressors. Water is used as an input for environmental test chambers, landscape irrigation, mechanical systems, sanitary needs, and laboratory processes. Additional details on facility water use are provided in the following sections.

Potable Water Use

Average potable water use in FY 2010 by major process is shown in Table 3.

Table 3. Major Potable Water Using Processes, Corvallis Main

Major Process	FY 2010 Annual Consumption (gallons)	Percent of Total Corvallis Main Water Use	Comments
TERF			
Reverse osmosis (RO) permeate	27,400	0.8	Submetered
RO reject	61,710	1.8	Calculated from meter readings
Evaporative coolers	590,000	17.7	Engineering estimate
Miscellaneous (steam sterilizer, cooling tower, sanitary, etc.)	560,412	16.8	Calculated as remaining difference from metered TERF total
Total Water Use at TERF	1,239,522	37.2	Metered

Table 3. Major Potable Water Using Processes, Corvallis Main

Major Process	FY 2010 Annual Consumption (gallons)	Percent of Total Corvallis Main Water Use	Comments
TERA			
Research process water (including bubble irrigation)	432,374	13.0	Metered
Total Water Use at TERA	432,374	13.0	Metered
PEB			
Process and sanitary water	3,740	0.1	Metered
Total Water Use at PEB	3,740	0.1	Metered
Main Building			
RO permeate	830	0.0	Submetered
RO reject	103,760	3.1	Calculated from meter readings
Steam sterilizer	290,000	8.7	Engineering estimate
Sanitary	250,000	7.5	Engineering estimate
Irrigation	240,873	7.2	Submetered
Cooling tower	725,213	21.7	Calculated as remaining difference from metered Main Building total
Miscellaneous water use	50,000	1.5	Estimate
Total Water Use at Main Building	1,660,675	49.8	Metered
Total Water Use at Corvallis Main	**3,336,312**		**Sum of metered totals**

Additional details on assumptions and calculations supporting these water use estimates are provided in Appendix A. Estimated monthly total water use in FY 2010 is provided in Appendix B.

Industrial, Landscaping, and Agricultural Water Use

Corvallis Main does not use any non-potable water for ILA purposes.

Measurement Devices

Incoming water is supplied through five separate metered lines. The meter numbers, account numbers, and corresponding area serviced by the meter are listed below:

4" Meter 720426 (Account 159245-128690): Main building and annex indoor use.

1.5" Meter 850421 (Account 159265-128710): PEB.

2" Meter 870493 (Account 159275-128720): TERA.

¾" Meter 900510 (Account 455-380) (Irrigation): TERA (including bubble irrigation and irrigation around the chemical storage building).

2" Meter 61026860 (Account 159325-128770): TERF.

An irrigation line, stemmed off the main building's 4" water line, has a sewer deduct submeter: Meter 2678 (Account 159-245-128690). This sewer deduct meter captures all water used by the irrigation system around the main building and annex.

Flow totalizing meters are also installed on the make-up water lines to the steam boiler and the hot water recycle loop. Supply water to RO systems and permeate water from the RO systems in the main building and TERF is submetered.

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

Shut-off Valves

Shut off valves are co-located at each meter in the respective below grade meter boxes. Meter box locations are as follows:

Meter 720426: By sidewalk on 35th Street in front of main building.

Meter 2678: By sidewalk on walkway to the main entrance of main building from parking lot.

Meter 850421: On east side of PEB.

Meter 870493: On north property line.

Meter 61026860: Adjacent to southeast corner of TERF building.

Meter 900510 (Irrigation): Adjacent to east side of chemical storage building.

Occupancy and Operating Schedules

Corvallis Main is occupied by approximately 160 personnel, including EPA employees, contractors, and senior environmental employees (SEEs). Typical operating hours are from 7:30 a.m. to 4:30 p.m. Monday through Friday, with occasional use during nights and weekends.

6.0 BEST MANAGEMENT PRACTICE SUMMARY AND STATUS

EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, signed in January 2007, calls for federal agencies to reduce potable water use intensity by 2 percent per year between FY 2007 and FY 2015, for a total reduction of 16 percent. This goal was extended by EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, signed in October 2009. EO 13514 calls for reducing potable water consumption

intensity by 2 percent annually through the end of FY 2020, for a total reduction of 26 percent. It also calls for reducing ILA water use (including non-potable water use) by 2 percent annually through the end of FY 2020, for a total reduction of 20 percent. Facilities should implement best management practices (BMPs) related to water use, taking life-cycle cost effectiveness into consideration, to achieve these water reduction goals. FEMP has identified BMPs in 14 areas to help facilities identify and target water use reductions. Corvallis Main has adopted BMPs in nine of the areas, designated by checkmarks in the list below. One other area is deemed inapplicable for Corvallis Main, designated by "NA" in the list below. The status of each BMP at Corvallis Main is as follows:

☑ Water Management Planning
☑ Information and Education Programs
☑ Distribution System Audits, Leak Detection and Repair
☐ Water-Efficient Landscaping
☑ Water-Efficient Irrigation
☑ Toilets and Urinals
☑ Faucets and Showerheads
☑ Boiler/Steam Systems
☑ Single-Pass Cooling Equipment
☐ Cooling Tower Management
NA Commercial Kitchen Equipment
☑ Laboratory/Medical Equipment
☐ Other Water Use
☐ Alternate Water Sources

Information and Education Programs

Corvallis Main currently tracks water use on a monthly basis. All staff members are required to take annual EMS awareness training. Water conservation goals, as defined within the annually updated Water Management EMP, are covered during the training.

Corvallis Main promotes water conservation and awareness using the EPA laboratory "Every Drop Counts" water conservation poster series. Conservation posters are displayed in prominent locations within the laboratory.

Corvallis Main has achieved BMP status in this area.

Distribution System Audits, Leak Detection and Repair

Facility staff submit maintenance requests through work order requests that are logged in the existing computerized management maintenance system (CMMS). The requests go to the facilities manager for approval before being directed to the operation and maintenance (O&M) contractor. Work order requests cover a broad range of requests, including leaks and malfunctioning water-using equipment. The work order requests are tracked in CMMS through to completion.

O&M contractor staff make a daily walk-through inspection of all mechanical spaces. They also identify any wet spots in the landscape that may indicate a leak in the irrigation system. Any

problems or leaks identified are addressed immediately. Janitors are trained to report any observed problems to the facilities manager.

A screening-level system review was conducted in November 2010. Known water uses account for over 90 percent of water consumption.

Under this plan, the facilities manager will monitor trends in monthly water use. Changes that are not understood or expected will be investigated and resolved.

Corvallis Main has achieved BMP status in this area.

Water-Efficient Landscaping

The laboratory facility maintains 2.7 acres of landscaping, half covered with turf and half planted beds. To reduce irrigation water use, Corvallis Main plans to eliminate a large portion of the turf area on the complex and make continuous progress towards xeriscaping the landscape. Planned landscaping changes are detailed in a 2009 Landscaping Master Plan.

Once Corvallis Main implements plans from its 2009 Landscaping Master Plan, it can achieve BMP status in this area.

Water-Efficient Irrigation

In 2008, Corvallis Main's irrigation system was audited by a WaterSense® irrigation partner. Since the audit, Corvallis Main has been working to eliminate irrigation in zones where supplemental irrigation is no longer necessary, replace broken sprinkler heads, and adjust sprinkler head delivery to ensure optimal landscape coverage.

Irrigation occurs twice at night, three times a week, using multiple zones, each controlled by a separate time clock. Irrigation frequency and duration is established to provide the minimum quantity of water necessary to avoid the appearance of stressed vegetation. To further reduce unnecessary water use, Corvallis Main changed the start of its irrigation season from April to June of each year to shorten its irrigation season.

Because of the work to optimize the irrigation system and reduce water use, Corvallis Main has achieved BMP status in this area.

Toilets and Urinals

Toilets are compliant with 1992 Energy Policy Act (EPAct 1992) water efficiency requirements (1.6 gallons per flush [gpf]), and one toilet is a dual-flush model. Most urinals installed at Corvallis Main exceed the EPAct 1992 requirement for urinals of 1.0 gpf as they are non-water-using models. One urinal has not been converted to high-efficiency because its full-length, floor-mount design made conversion impractical. An inventory of sanitary fixtures is provided in Table 4.

Table 4. Corvallis Main Inventory of Sanitary Fixtures

Fixture Type	Flow Rate	Total Number
Toilets	1.6 gpf	23
	Dual flush (1.6 / 1.1 gpf)	1
Urinals	Non-water (0 gpf)	5
	3.0 gpf	1
Lavatory faucets	0.5 gallons per minute (gpm)	20
	2.5 gpm	1
Showers	2.5 gpm	4

Janitorial staff and employees are trained to report leaks or other maintenance problems in the CMMS or directly to the facilities manager or O&M contractor staff. Leaks or other problems are immediately corrected.

Corvallis Main has achieved BMP status in this area.

Faucets and Showerheads

Table 4 provides an inventory of faucets and showerheads installed at Corvallis Main. Almost all faucets are compliant with the American Society of Mechanical Engineers (ASME) standard for lavatory faucets in public use (captured in ASME A112.18.1), which sets a maximum flow rate of 0.5 gpm. This flow rate is sufficient for hand washing and is considered a best practice for lavatory sinks in public settings.

EPAct 1992-compliant showerheads (2.5 gpm) are installed in all shower stalls available for use.

System pressure is maintained between 20 to 80 pounds per square inch.

Janitorial staff and employees are trained to report leaks or other maintenance problems in the CMMS or directly to the facilities manager or O&M contractor staff. Leaks or other problems are immediately corrected.

Corvallis Main has achieved BMP status in this area.

Boiler/Steam Systems

Building heat is supplied by two 80 horsepower (hp) hot water boilers. One 150 hp steam boiler supplies steam to the steam sterilizers and dishwashers and to preheat air in the air handling units in the winter. Corvallis Main only turns on the steam boiler when necessary, approximately once a week. Steam is no longer used for domestic hot water production; an electric hot water heater was installed for this purpose. Since the remaining two steam sterilizers at Corvallis Main are being replaced with new systems that include onboard steam generation, Corvallis Main plans to re-size the steam boiler for the preheat function only.

Steam condensate is collected and returned to the boiler. The boiler water system is monitored and maintained once per month by a water treatment vendor to prevent scale and corrosion and optimize condensate reuse. Boiler water quality parameters such as alkalinity, chlorides,

hardness, pH, sulfite, total dissolved solids, and biological growth are monitored and controlled through periodic testing and chemical treatment.

Target conductivity of the boiler water is <2,000 microSiemens per centimeter (*u*S/cm), and it is operated slightly high, averaging approximately 3,350 *u*S/cm. Under this plan, Corvallis Main will blowdown the boiler more consistently, per recommendation from the water treatment vendor.

Because Corvallis Main is actively working to reduce the load on the steam boiler system, it has achieved BMP status in this area.

Single-Pass Cooling Equipment

Corvallis Main plans to install a piece of water-cooled X-ray equipment at the end of 2011 for a research project. The cooling load will be supplied by the existing chilled water loop; the equipment will not use single-pass cooling.

Corvallis Main has achieved BMP status in this area because it has eliminated all single-pass cooling.

Cooling Tower Management

The laboratory is equipped with four cooling towers, three of which are operational. A 30-ton unit installed at the Annex in 2003 is currently off line. A 40-ton unit at TERF was installed when the building was constructed in 1970s. Corvallis Main is considering replacing this unit. Two 380-ton units are mounted on the roof of the main laboratory; these units are operated in sequence, one each during alternate cooling seasons. If the cooling demand is high enough, Corvallis Main can utilize both cooling towers. Cooling tower blowdown from each tower is controlled manually, based on the recommendations of a water treatment vendor. Cooling tower water chemistry is tested monthly for alkalinity, chlorides, hardness, pH, total dissolved solids, biological growth, and phosphonate to control scale and corrosion.

Because the cooling tower water loops at TERF and the main building are manually controlled only once a month, the conductivity of the circulating water varies significantly, from about 100 to about 5,000 *u*S/cm. City make-up water has a relatively low dissolved solids load, with a resultant conductivity of 51 *u*S/cm. Therefore, the cooling tower systems achieve variable cycles of concentration, ranging between 2 and 100.

Corvallis Main does not achieve BMP status in this area at this time. Installing an automatic conductivity and blowdown control system could help better maintain the cooling towers at Corvallis Main.

Commercial Kitchen Equipment

Corvallis Main does not operate commercial kitchen equipment. BMP status is not applicable in this area.

Laboratory/Medical Equipment

Purified water for laboratory use is generated in two systems, both of which were installed in October 2010 to replace less efficient systems. One is located in the main building and the other in TERF. In each case, purified water is generated through a multi-step process consisting of cartridge filtration, carbon adsorption, and RO. Both are anticipated to reject approximately 1 to 1.5 gallons of water for every gallon of RO permeate produced—an upgrade from the previous systems which rejected 2 to 3 gallons per gallon produced. A new RO system was also installed in the PEB in case its use becomes necessary; it is currently not operational.

The main building has a wash room (Room 200) that contains a glassware washer and two steam sterilizers. A third steam sterilizer is located in the adjacent room (Room 202). Tempering water flowed continuously to the discharge drain of one of the steam sterilizers in Room 200 during the time period reflected by the water balance in Table 3. Corvallis Main has replaced that steam sterilizer with a new steam sterilizer that generates its own steam and uses tempering water only when operating. The second steam sterilizer in Room 200 is already equipped to control tempering water to run only when needed. Because the steam sterilizer in Room 202 also generates its own steam, the load on the steam boiler is reduced. One steam sterilizer is in operation at TERF with onboard steam generation and tempering water flowing only when needed.

Because the RO systems were replaced with more efficient systems, a new steam sterilizer was installed to replace one that previously constantly discharged tempering water, and the remaining steam sterilizers have tempering water flowing only when needed, Corvallis Main has achieved BMP status in this area.

Other Water Use

The greenhouse at TERF is divided into four bays, with a central hallway connecting the bays. Each bay is equipped with two evaporative coolers, to cool and humidify greenhouse air during hot weather. The central connecting hallway is also equipped with an evaporative cooler. Water use from the evaporative coolers captured in Table 3 reflects some leakage from the evaporative coolers.

To achieve BMP status in this area, Corvallis Main will develop a more comprehensive preventative maintenance (PM) program for the evaporative coolers to ensure they are functioning properly and not leaking.

Alternative Water Sources

Corvallis Main does not use any rain water, air handler condensate, reverse osmosis reject water, or other onsite alternative water sources to offset its use of potable water. It is considering acquiring cisterns to collect roof stormwater to use for irrigation.

Corvallis Main can achieve BMP status in this area by further evaluating the potential to collect and reuse air handler condensate and RO reject water and by installing cisterns to collect roof stormwater for irrigation use.

7.0 DROUGHT CONTINGENCY PLAN

In the event of a drought or other water supply shortage, Corvallis Main will follow the water use recommendations and restrictions of the City of Corvallis. The City has a Water Supply Emergency Curtailment Plan, late updated in April 2010, available on its website at: http://www.ci.corvallis.or.us/index.php?option=com_content&task=view&id=842&Itemid=2942

This plan has four defined response levels:

Stage 1 - Early Warning for a Potential Water Supply Shortage
The Stage 1 warning is reached when maximum daily production is just meeting the daily demand, or when there is expectation of a potential supply deficiency. The City will request that customers voluntarily reduce or eliminate nonessential water use, follow odd/even outdoor watering schedules based on address, and limit outdoor watering to the early morning or late evening. Corvallis Main's irrigation system already operates at night, two nights per week, and will be operated consistent with Stage 1 requirements.

Stage 2 - Water Supply Shortage
A Stage 2 water shortage is reached when maximum production is not meeting daily demand and reservoir storage falls to 90 percent capacity. The City may ask customers to voluntarily restrict all irrigation and other nonessential outdoor water use.

Stage 3 - Severe Water Supply Shortage
A Stage 3 water shortage is reached when maximum production is not meeting daily demand and reservoir storage falls to 80 percent capacity. All nonessential outdoor water use, including irrigation, is prohibited.

Stage 4 - Critical Water Shortage
A Stage 4 water shortage is reached when maximum production is not meeting daily demand and reservoir storage falls to 60 percent capacity. All nonessential outdoor water use is prohibited. All large industrial and institutional accounts shall restrict water use to fire protection and other critical functions only.

When voluntary or mandatory water use restrictions are instituted by the City of Corvallis under its Water Supply Emergency Curtailment Plan, the requirements are communicated through public announcements. The facilities manager will assemble a task force of facility and O&M personnel to identify and implement modifications to facility operations to achieve additional specified reductions in water consumption if a water supply emergency at Stage 2 or higher is enacted.

8.0 COMPREHENSIVE PLANNING

The facilities manager will ensure the water supply, wastewater generation, and water efficiency BMPs are taken into account during the initial stages of planning and design for any facility renovations or new construction. These factors will also be considered prior to the purchase and installation of any equipment that would measurably change facility water consumption. Where available, Corvallis Main will purchase or specify WaterSense labeled products and use WaterSense irrigation partners (see <www.epa.gov/watersense> for more information about WaterSense).

9.0 STATUS UNDER GUIDING PRINCIPLES FOR FEDERAL LEADERSHIP IN HIGH PERFORMANCE AND SUSTAINABLE BUILDINGS

The Interagency Sustainability Working Group (ISWG), formed as a subcommittee of the EO 13423 Steering Committee, established *the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings (Guiding Principles)* to assist agencies in meeting the high performance and sustainable buildings goals of EO 13423, section 2(f). The December 1, 2008, version of the ISWG's *Guiding Principles for Sustainable Existing Buildings*, a subset of the *Guiding Principles* targeting existing buildings, established six supporting principles for protecting and conserving water. Corvallis Main's status toward achieving the supporting principles for protecting and conserving water at existing buildings is documented in Table 5.

Table 5. Status of Guiding Principle to Protect and Conserve Water, Corvallis Main

Topic	Status
Indoor Water	EPA Headquarters tracks quarterly and annual water usage and intensity for each of its reporting facilities. Annual water tracking data (water consumption in gallons per gsf per year) shows that Corvallis Main's water use intensity decreased by 66 percent between FY 2003 and FY 2010.
Outdoor Water	Corvallis Main has an in-ground irrigation system which irrigates turf from June to October per the director's instructions. An irrigation system audit was performed in 2008. The majority of Corvallis Main's sprinkler heads have been replaced with more-efficient models since the audit; however, no changes have been made to the irrigation control system. The facility has a goal of implementing xeriscaping. Landscaping changes associated with the master plan are designed to facilitate xeriscaping and are detailed in a 2009 Landscaping Master Plan.
Water Metering	Corvallis Main meters all water provided by the city. In addition, Corvallis Main submeters water use by several processes for tracking purposes, including RO supply and reject water, steam boiler make-up water, and hot water recycle loop make-up water.
Stormwater Management	Stormwater collection systems at Corvallis Main receive stormwater runoff through inlets. The systems discharge off site. Many paved surfaces at Corvallis Main were constructed without curbs, allowing stormwater to sheet-flow onto adjacent vegetation before entering the storm sewer system in some areas, while in other areas storm drains collect stormwater runoff directly. At Corvallis Main, some buildings' roof downspouts are directly connected to the storm sewer system, while the remaining buildings use downspouts that discharge to vegetation next to the buildings. Corvallis Main is in the process of acquiring cisterns to collect roof stormwater for irrigation.
Process Water	Corvallis Main does not use potable water to improve the facility's energy efficiency at the expense of water efficiency.
Water-Efficient Products	The Sustainable Acquisitions EMP requires the purchase of water-efficient products. Corvallis Main retrofitted its bathrooms with non-water urinals and low-flow faucets, with the exception of one 3 gpf urinal and one 2.5 gpm faucet. In addition, one toilet was replaced with a dual-flush (1.6 and 1.1 gpf) model. The O&M, janitorial, and landscaping contracts do not reference water-efficient products.

10.0 OPPORTUNITIES FOR FURTHER WATER CONSERVATION

Corvallis Main is pursuing the following projects to achieve additional reductions in water use:

1) **Install a new steam sterilizer.** Corvallis Main purchased a new steam sterilizer with onboard steam generation and a control scheme to only allow tempering water to flow when needed. The equipment cost approximately $53,000. By installing this new system (which was done prior to May 2011), Corvallis Main will save an estimated 237,000

gallons of water per year, resulting in approximately $1,700 per year in water and sewer bill savings.

2) **Install and monitor make-up and blowdown flow meters on all cooling towers.** The cooling towers are significant consumers of water at the Corvallis Main. Make-up meters are not installed on the two cooling towers of the main building, nor on the cooling tower at TERF. Corvallis Main will consider installing meters on the make-up water lines in order to better track the usage of cooling tower make-up water and ensure better management of the cooling towers, in general. Corvallis Main also will consider installing blowdown water meters as this could allow for better tracking of blowdown water quantity and better manual control of the system. Make-up and blowdown meters could be installed for approximately $500 each.

3) **Install automatic conductivity controller on all cooling towers.** To automatically control blowdown, Corvallis Main will consider installing conductivity controllers, which can continuously measure the conductivity of the cooling tower water and initiate blowdown only when the conductivity set point is exceeded. Working with the water treatment vendor, Corvallis Main will determine the maximum cycles of concentration that the cooling towers can sustain, then identify and program the conductivity controller to the associated conductivity set point necessary to achieve that number of cycles. Since the cooling towers are already operating at 20-30 cycles of concentration, on average, this installation may not necessarily reduce water use, but it will provide for a better maintained cooling tower system and associated water loops. Conductivity controllers can be installed for approximately $10,000 each.

4) **Record, Monitor, and Evaluate Changes in Water Consumption.** Existing submeters are not currently read regularly for steam boiler make-up water and hot water recycle loop make-up water. Corvallis Main will ensure that these meters are read and the water consumption recorded monthly. Monthly, Corvallis Main will evaluate the water use data to monitor trends in water consumption and investigate and resolve unexpected changes. As additional meters are added, these will also be recorded and monitored. This project has no additional associated capital cost and will help ensure that existing systems are operated in the most efficient manner possible.

5) **Develop an effective preventive maintenance program to ensure evaporative coolers operating properly.** To ensure that water is not being wasted due to improper control of the evaporative cooling systems at TERF (which have a tendency to leak and produce soggy ground nearby), Corvallis Main will develop and implement a PM program for the evaporative coolers to check for leaks and ensure proper operation regularly. This low- to no-cost project may reduce water use from the evaporative coolers by approximately 130,000 gallons and result in $1,000 in water and sewer cost savings.

6) **Consider capturing and reusing air handler condensate.** Corvallis Main will evaluate capturing air handler condensate and routing it to the cooling towers. Corvallis Main may be able to collect air handler condensate from the air handling units in the main building and route it to the cooling towers there. An initial engineering evaluation indicates that it may be possible to capture up to 89,000 gallons per year of condensate. However, before moving forward with this project, Corvallis Main will monitor the rate of condensate

production during the hot summer months to develop a more accurate estimate of potential capture. If approximately 89,000 gallons of water could offset the consumption of potable water for cooling tower make-up, it would result in savings of approximately $650 per year. This project is estimated to cost up to $20,000.

7) **Consider routing RO reject water to the cooling tower for make-up.** Currently the RO reject is discharged to the sewer. Since a new, more efficient RO system was installed in October 2010 and the reject water use from that system is not reflected in this plan, the amount of RO reject water that has the potential to offset cooling tower make-up water cannot be accurately calculated. An engineering estimate suggests that the amount of reject may be up to 50,000 gallons per year. Corvallis Main will evaluate the amount of reject water from the new system over several months once it is fully operational. If sufficient water is generated, this project will be evaluated more fully.

Appendix A

WATER BALANCE SUPPORTING CALCULATIONS

Table A-1. Water Balance Supporting Calculations – FY 2010, Corvallis Main

Major Process	Annual Consumption (gallons)	Supporting Calculations and Source Documentation
TERF		
RO permeate	27,400	Meter readings of 73,790 (10/22/2010) and 46,390 (10/27/2009) were used to calculate one year of RO permeate. RO permeate = 73,790 gallons - 46,390 gallons = 27,400 gallons / year.
RO reject	61,710	Meter readings of 356,470 (10/22/2010) and 267,360 (10/27/2009) were used to calculate one year of supply water to the RO system. RO supply = 356,470 gallons - 267,360 gallons = 89,110 gallons / year. The RO reject water was calculated by difference from the RO supply water and the RO permeate. RO reject = 89,110 gallons / year - 27,400 gallons / year = 61,710 gallons / year.
Evaporative coolers	590,000	Average water use during the winter months (November through February) when the evaporative coolers were not in use is 72.5 ccf. The estimated annual water use without evaporative coolers is = 72.5 ccf / month * 12 months / year * 748 gallons / ccf = 650,760 gallons / year. The use from the evaporative coolers can be calculated by subtracting the annual water use estimate without the evaporative coolers from the total metered water use for FY 2010. Evaporative cooler use = 1,239,436 gallons / year - 650,760 gallons / year = 588,676 gallons / year.
Miscellaneous (steam sterilizer, cooling tower, sanitary, etc.)	560,412	Calculated by difference from TERF's metered total and the RO water use and evaporative coolers. Miscellaneous = 1,239,522 gallons – 590,000 gallons – 27,400 gallons – 61,710 gallons = 560,412 gallons / year.
Total Water Use at TERF	1,239,522	Metered and reported on city water bills.
TERA		
Research process water (including bubble irrigation)	432,374	Metered and reported on city water bills.
Total Water Use at TERA	432,374	Metered and reported on city water bills.
PEB		
Process & sanitary water	3,740	Metered and reported on city water bills.
Total Water Use at PEB	3,740	Metered and reported on city water bills.
Main Building		
RO permeate	830	Meter readings of 2,740 (10/20/2010) and 1,910 (10/20/2009) were used to calculate one year of RO permeate. RO permeate = 2,740 gallons - 1,910 gallons = 830 gallons / year.
RO reject	103,760	Meter readings of 371,450 (10/20/2010) and 266,860 (10/20/2009) were used to calculate one year of supply water to the RO system. RO supply = 371,450 gallons - 266,860 gallons = 104,590 gallons / year. The RO reject water was calculated by difference from the RO supply water and the RO permeate. RO reject = 104,590 gallons / year - 830 gallons / year = 103,760 gallons / year.

Table A-1. Water Balance Supporting Calculations – FY 2010, Corvallis Main

Major Process	Annual Consumption (gallons)	Supporting Calculations and Source Documentation
Steam sterilizer	290,000	Two steam sterilizers are in use. One uses tempering water running consistently at approximately 0.5 gallon / minute (0.5 gallon / minute * 60 minutes / hour * 24 hours / day * 365 days / year = 262,800 gallons / year). The other uses tempering water running at a trickle of approximately 0.05 gallons / minute (0.05 gallon / minute * 60 minutes / hour * 24 hours / day * 365 days / year = 26,280 gallons / year). The total flow from the steam sterilizer tempering water is approximately 262,800 gallons / year + 26,280 gallons / year = 289,080 gallons / year.
Sanitary	250,000	Engineering estimate based on 100 people using the main building using 10 gallons / day for 250 operating days / year. 100 people * 10 gallons / person / day * 250 days / year = 375,000 gallons / year.
Irrigation	240,873	Meter readings of 3,693,500 cf (10/8/2010) and 3,661,300 cf (10/7/2009) were used to calculate the irrigation water use in FY 2010. Irrigation water = (3,693,500 cf - 3,661,300 cf) * (7.48052 gallons / cf) = 240,873 gallons / year.
Cooling tower	725,213	Calculated by difference, subtracting all other estimated water uses from the total water use.
Miscellaneous water use	50,000	Estimated to account for miscellaneous water use.
Total Water Use at Main Building	1,660,675	Metered and reported on city water bills.
Total Water Use at Corvallis Main	**3,336,312**	**Sum of metered totals.**

Appendix B

MONTHLY WATER USE IN FY 2010

Table B-1. Monthly Water Use in FY 2010, Corvallis Main

Month	TERF Water Use (gallons)	TERA Water Use (gallons)	PEB Water Use (gallons)	Main Building Water Use (gallons)	Irrigation Submeter Water Use (gallons) (Part of Main Building Total Water Use)	Total Water Use (gallons)
October 2009	77,049	37,403	0	88,270	0	202,722
November 2009	56,852	46,379	748	97,995	0	201,974
December 2009	56,104	20,945	0	264,810	0	341,860
January 2010	41,891	30,670	0	60,592	0	133,153
February 2010	62,088	18,701	748	56,104	0	137,642
March 2010	77,049	26,930	0	68,821	0	172,800
April 2010	101,735	23,938	0	67,325	0	192,997
May 2010	121,932	61,340	748	60,592	0	244,613
June 2010	169,060	48,623	0	136,145	20,945	353,829
July 2010	201,974	70,317	748	350,088	112,208	623,127
August 2010	154,847	24,686	0	267,803	77,797	447,335
September 2010	118,940	22,442	748	142,130	29,922	284,260
Total	1,239,522	432,374	3,740	1,660,675	240,873	3,336,312

Figure B-1. Water Use from FY 2007 through FY 2010, Corvallis Main