

Water Management Plan

Revision 1

United States Environmental Protection Agency
Region 8 Laboratory

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September 5, 2012

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**U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 8 LABORATORY
GOLDEN, COLORADO**

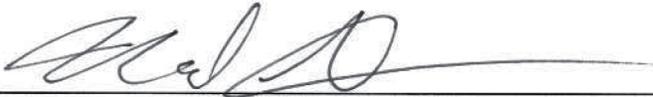
WATER MANAGEMENT PLAN, REVISION 1

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1.0 IDENTIFIED WATER CONSERVATION OPPORTUNITIES

A water use and conservation assessment was conducted at the U.S. Environmental Protection Agency's (EPA's) Region 8 Laboratory in Golden, Colorado, in July 2012. Under this Water Management Plan, the Region 8 Laboratory will consider implementing the potential water conservation opportunities identified during the water assessment, which are summarized in Table 1.

The rest of this Water Management Plan describes the facility's water reduction goals, water use trends, end uses of water, and drought management plans.

2.0 BACKGROUND AND PURPOSE

In 2007, *Executive Order (EO) 13423, Strengthening Federal Environmental, Energy, and Transportation Management*, called for federal agencies to reduce water use intensity by 2 percent per year between fiscal year (FY) 2007 and FY 2015, for a total reduction of 16 percent compared to a FY 2007 baseline. This goal was revised and extended by *EO 13514, Federal Leadership in Environmental, Energy, and Economic Performance*. EO 13514 calls for reducing potable water consumption intensity by 2 percent annually through FY 2020, relative to the FY 2007 baseline, for a 26 percent total reduction. Water use intensity is measured on a gallon/gross square foot (gsf) basis.

In addition to the potable water use reduction requirements in EO 13514, the order requires that agencies reduce industrial, landscaping, and agricultural (ILA) water consumption by 2 percent annually or 20 percent by the end of fiscal year 2020 relative to a FY 2010 baseline (even if it is from nonpotable sources). Agencies also should identify, promote, and implement water reuse strategies that reduce potable water consumption.

The implementing instructions of EO 13423, which remain in effect, require that where applicable, agencies should purchase WaterSense[®] labeled products and choose irrigation contractors who are certified through a WaterSense labeled program. EO 13423 also requires agencies to audit 10 percent of facility square footage each year.

The Energy Independence and Security Act of 2007 (EISA 2007) added to these requirements, directing agencies to complete comprehensive energy and water evaluations of 25 percent of covered facilities each year (covered facilities are those that account for 75 percent of total energy use), implement cost-effective measures identified through life-cycle analyses, and measure and verify water savings.

In summary, existing executive orders and federal law require substantial reductions in all forms of water use, as well as ongoing, regular assessment of facility water use to identify and implement saving opportunities.

This facility-specific Water Management Plan has been developed to document and promote the efficient use of water at EPA's Region 8 Laboratory, so that the facility can contribute to meeting these Agency wide objectives.

Table 1. Potential Water Conservation Opportunities, Region 8 Laboratory

Suggested Priority	Project Description	Project Cost	Potential Water Savings (gallons)	Potential Energy Savings (Mcf)	Potential Utility Cost Savings*	Potential Payback (years)
1	Following the one-year warranty on the irrigation system efficiency upgrades, ensure that the designated person managing the system properly maintains the system, checks for leaks and other malfunctions bi-weekly, and changes the irrigation schedule at least monthly. More information on this is available in Section 5.4 of this Plan.	The system upgrade cost \$60,000 and savings will only be realized if the system is properly managed and the schedule is regularly updated after the warranty period.	730,000	0	\$4,000	15
2	Ensure that diaphragm inserts in toilets in the men's rooms are 1.6 gallons per flush (gpf) and urinal inserts are 1.0 gpf. Ensuring that the fixture and valve insert match will maximize performance.	No additional cost.	No water savings associated. This is a best practice that should improve performance.	0	0	0
3	Consider significantly reducing irrigation on zones between the South parking lot and the adjacent property. More information is available in Section 5.4 of this Plan.	\$0	100,000	0	\$600	Immediate
4	Increase cooling tower cycles of concentration from four to six. Raise the blow down set point from 1,000 μ S/cm to 1,500 μ S/cm.	Potentially some cost for increased chemical use.	50,000	0	\$600	<1
5	Install water meters on the make-up and blow down water lines of the cooling tower system. This can create an opportunity to obtain a deduct credit for sewer fees currently charged on water evaporated from the cooling tower.	\$1,000	Installing water meters on the make-up and blow down water lines will improve system monitoring and will ensure leaks or other problems are quickly identified.	0	\$2,700	<1
6	Replace 2.5 gallons per minute (gpm) showerheads with WaterSense [®] labeled models.	\$60	1,000	1	\$20	3
7	Retrofit 1.6 gpf toilets in women's restrooms with dual-flush handles and flush valves.	\$900	8,000	0	\$100	9

Table 1. Potential Water Conservation Opportunities, Region 8 Laboratory

Suggested Priority	Project Description	Project Cost	Potential Water Savings (gallons)	Potential Energy Savings (Mcf)	Potential Utility Cost Savings*	Potential Payback (years)
8	Replace all urinals with 0.25 gpf, WaterSense labeled models.	\$2,000	12,000	0	\$100	20
9	Implement a full landscape xeriscaping project.	\$100,000+	1,891,000	0	\$10,400	10+

*Utility cost savings are calculated using the most current water, sewer, and natural gas rates available. As of 2012, the Region 8 Laboratory's water rate falls between two tiers, \$4.84 per 1,000 gallons and \$6.20 per 1,000 gallons. The water rate used here is an average of these two. The sewer rate is 1.3 times the water rate. In the first and second quarters of fiscal year (FY) 2012, the natural gas rate was \$0.748 per hundred cubic feet.

3.0 FACILITY INFORMATION

The Region 8 Laboratory, occupied in 1998, is a 50,839 square-foot facility located in Golden, Colorado. The building is leased by the U.S. General Services Administration (GSA) from REIT Management, Inc., and is assigned to EPA by GSA. The building lease runs through 2017. EPA is responsible for all water, sewer, and other utility bills.

4.0 WATER MANAGEMENT GOALS

The Region 8 Laboratory achieves its resource conservation goals by implementing a facility-specific Environmental Management System (EMS) program. Within the EMS and otherwise, Region 8 Laboratory's water management goals include:

- Reducing total water use by 5 percent in FY 2012 and changing the flush mechanism on the toilets to dual flush.
- Achieving a 26 percent potable water reduction by the end of FY 2020, compared to a FY 2007 baseline of 70.04 gallons per gsf, as required by EO 13514.
- Implementing site-specific water conservation projects geared toward achieving the facility ConservW target (set annually by EPA's Sustainable Facilities Practices Branch).

5.0 WATER USE INFORMATION

The Region 8 Laboratory's water use has decreased since the last water use assessment in 2003. The facility has implemented effective changes such as modifying fish culturing procedures from continuous operation to batch operation, installing air-cooled point-of-use chillers instead of single-pass cooling systems where possible, and eliminating unnecessary tempering water flow in autoclaves and dishwashers. In addition, the facility implemented an irrigation system upgrade project in FY 2012 that should result in water savings.

The Region 8 Laboratory uses water for landscape irrigation, mechanical systems, sanitary needs, and laboratory processes.

The following sections provide additional details on facility water use.

5.1 Water Supply

Region 8 Laboratory's potable water is supplied by the North Table Mountain Water and Sanitation District.

Region 8 Laboratory does not have use any sources of nonpotable water.

All discussion of water use in this Plan refers to potable, city-supplied use.

5.2 Meters and Submeters

Incoming city water is supplied through two separate meters. Meter number 31242-01 measures water supplied for outdoor irrigation only. Meter number 31241-01 measures all other water supplied for facility use. Both meters are located in meter boxes in the east lawn of the facility behind the fence surrounding the cooling tower.

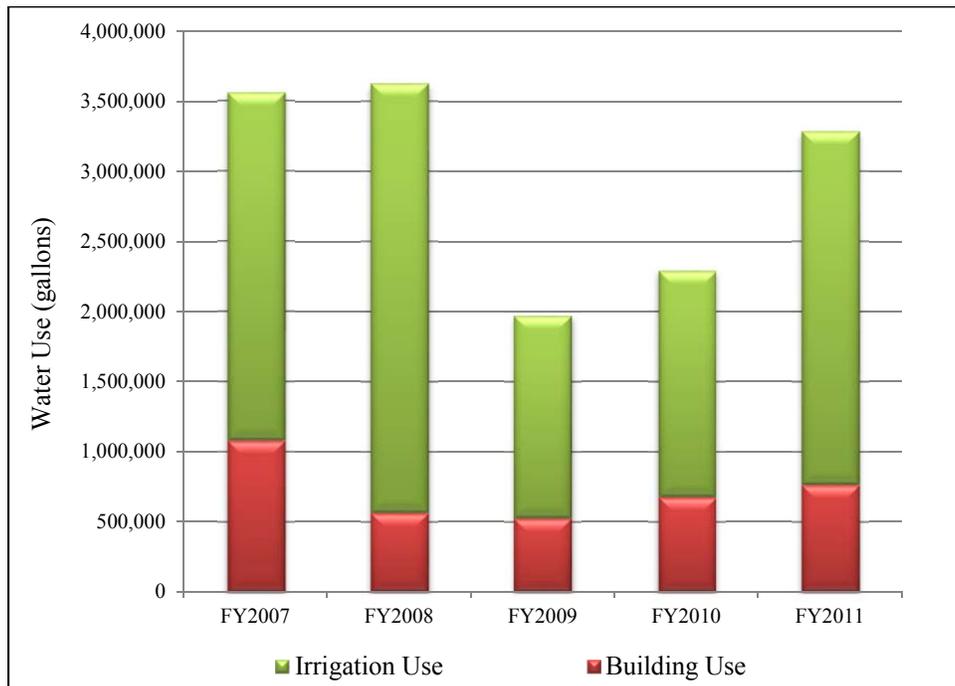
The facility does not have any submeters on specific end uses, but will consider installing submeters on the cooling tower make-up water and blowdown lines under this Water Management Plan.

5.3 Historical Water Use

During a previous water use assessment conducted in 2003, it was estimated that the Region 8 Laboratory was using 4,468,500 gallons of water per year. In FY 2011, the Region 8 Laboratory used 3,287,000 gallons of water—a reduction of approximately 26 percent since the last assessment.

In response to EO 13423, the Region 8 Laboratory set a FY 2007 water use intensity baseline of 70.04 gallons per gsf. In FY 2011, water use intensity was down to 64.66 gallons per gsf—a reduction of 7.7 percent compared to the FY 2007 baseline. Figure 1 provides a graph of the Region 8 Laboratory’s water use by meter from FY 2007 through FY 2011.

Figure 1. Water Use by Meter, Region 8 Laboratory, FY 2007 through FY 2011



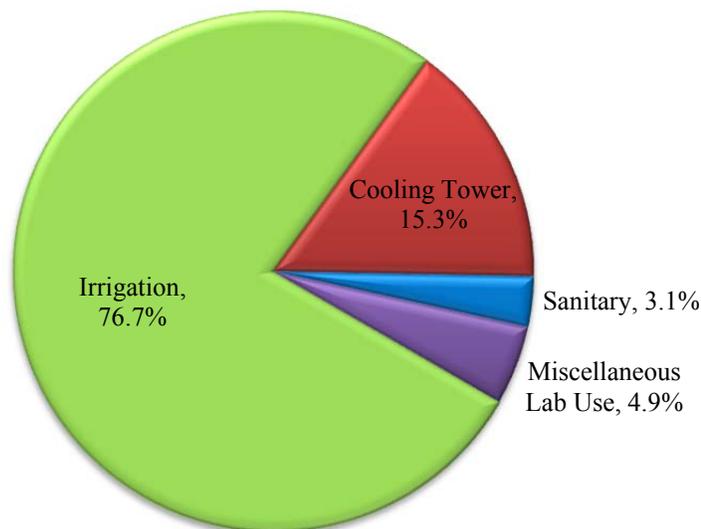
5.4 End Uses of Water

Table 2 and Figure 2 illustrate the end uses of water at the Region 8 Laboratory. The uses are described in more detail below. Potential projects discussed in this section are summarized in Table 1.

Table 2. Major Potable Water Uses, Region 8 Laboratory, FY 2011

Major Process	FY 2011 Annual Consumption (gallons)	Percent of Total Water Use (%)	Supporting Calculations and Source Documentation
Irrigation	2,521,000	76.7	Metered total from account # 31242-01.
Cooling tower make-up water	502,000	15.3	Engineering estimate based on seasonal water use pattern. Second quarter FY 2011 (winter time period) was the lowest quarter water use (66,000 gallons), so it is assumed this is the baseline indoor water use without cooling load. This is extrapolated to annual water use, and the seasonal water use (or cooling tower water use) is equal to the metered indoor water use minus the estimated baseline water use without cooling (766,000 gallons/year - 66,000 gallons/quarter indoor use x 4 quarters = 502,000 gallons/year).
Restroom and other sanitary fixtures	102,500	3.1	Engineering estimate based on restroom and other sanitary fixtures installed. Since fixtures are relatively efficient, it is assumed that each person uses 10 gallons of water per day. There are 41 employees and 250 working days per year. 10 gallons/person/day x 41 people x 250 days/year = 102,500 gallons/year.
Miscellaneous laboratory use	161,500	4.9	Calculated by difference from the sum of building metered totals and the other estimated and metered water uses.
Total Water Use	3,287,000	100.0	Sum of all building metered totals from accounts # 31242-01 and # 31241-01.

Figure 2. Percentage of Water End Uses, Region 8 Laboratory, FY 2011



Irrigation

The area surrounding the laboratory building consists of approximately 150,000 square feet of irrigated turf, interspersed with single coniferous and deciduous trees. In 2008, a WaterSense® irrigation partner audited the existing irrigation system and identified deficiencies. In May 2012,

the Region 8 Laboratory completed an irrigation system optimization project to implement the auditor's recommendations and improve the system's efficiency. The optimization project consisted of:

- Raising sprinkler heads to grade since they had sunk over time.
- Replacing sprinkler heads on the North and West sides of the property with new, properly spaced heads.
- Renozzling sprinkler heads to obtain a matched precipitation rate in each zone.
- Relocating and adding heads where necessary and repositioning spray arcs to reduce overspray on sidewalks.
- Cleaning nozzles and flushing the system.
- Installing a rain sensor on the irrigation controller.
- Implementing a new irrigation schedule.

As noted in Figure 2, irrigation water use is by far the most significant end use at the Region 8 Laboratory, comprising over 75 percent of the facility's total water use. Reducing irrigation water use represents the best opportunity for water savings.

Now that these improvements have been made, if the irrigation system is properly managed, irrigation water use could decrease by approximately 20 to 30 percent, or up to 730,000 gallons per year.

Currently, the system is being managed under a one-year warranty with the contractor who performed the upgrades. When the warranty runs out, it is imperative that a designated person be assigned responsibility for managing the system. During the irrigation season, the system should be turned on bi-weekly and checked for leaks, sunken and misaligned heads, and other malfunctions. The irrigation schedule should be updated at least monthly to ensure the least amount of water possible is applied while still achieving the desired landscape quality. The contractor who performed the upgrades included a base irrigation schedule as part of its close out package, and the 2008 irrigation auditor included a recommended percent up/down adjustment for the base schedule. As a starting point, the system manager should combine these two elements to adjust the schedule monthly, further adjusting if landscape quality is compromised or if the system appears to be watering too much.

When scheduling irrigation, the Region 8 Laboratory should pay close attention to the watering restrictions imposed by the water utility, which are published at <http://www.ntmwater.org/restrictions.html>.

In addition to ensuring proper system management, there are two other opportunities for the Region 8 Laboratory to reduce irrigation system water use. The facility could consider significantly reducing irrigation water applied to the zones between the South parking lot and the adjacent property. This area does not face any public streets and it is bordering an unirrigated area on the adjacent property. Irrigation water use could be decreased so that only enough water is applied to maintain the existing trees. This would reduce overall irrigation water use by an estimated 3 to 5 percent.

In addition, plans have been developed to xeriscape the entire landscape and install a drip irrigation system to maintain the xeriscaping. While expensive, these plans could be revisited and reconsidered. Xeriscaping could decrease irrigation water use by 75 percent.

Cooling Tower Make-Up

The cooling tower system is the second largest end use of water at the Region 8 Laboratory. The system is monitored and maintained regularly by the building engineer. A conductivity meter is used to automatically control cooling tower blow down. The blow down controller is set to achieve approximately three or four cycles of concentration within the cooling tower, maintaining a set point of 1,000 $\mu\text{S}/\text{cm}$ while the make-up water supply is approximately 250 to 300 $\mu\text{S}/\text{cm}$. Chemical treatment is provided to control scale and corrosion. The cooling tower media was replaced recently to reduce air blow-by and excessive water carry from the tower.

To further increase the water efficiency within the tower, the Region 8 Laboratory could consider increasing the cycles of concentration to six cycles (setting the blow down set point at 1,500 $\mu\text{S}/\text{cm}$) which could reduce the cooling tower make-up water use by approximately 10 percent. Also, for better system control, the Region 8 Laboratory should install submeters on the cooling tower make-up and blow down water lines. Reading the meters regularly will allow the facility to ensure that the cycles of concentration desired are achieved and any leaks, overflows, or other malfunctions are identified quickly. In addition, preliminary discussion with North Table Mountain Water and Sanitation District indicates it may be possible to get a sewer fee offset for water evaporated in the cooling tower. Metered data would be necessary to pursue this offset.

Restroom and Other Sanitary Fixtures

Region 8 Laboratory's restroom fixtures are compliant with 1992 Energy Policy Act (EPAct 1992) water efficiency requirements (1.6 gallons per flush [gpf] toilets, 1.0 gpf urinals, and 2.5 gallons per minute [gpm] or less showerheads). In the men's rooms, the facility should ensure that the correct valve inserts are being used—1.6 gpf inserts for toilets and 1.0 inserts for the urinals.

Faucet fixtures are water efficient, flowing at 0.5 gpm. This flow rate is lower than the EPAct 1992 standard for faucets and is compliant with the American Society of Mechanical Engineers (ASME) standard for lavatory faucets in public use. This flow rate is sufficient for hand washing and is considered a best practice for lavatory sinks in public settings.

Table 3 provides an inventory of sanitary fixtures.

Table 3. Sanitary Fixtures Inventory, Region 8 Laboratory

Fixture Type	Flow Rate	Total Number
Toilets	1.6 gpf	10
Urinals	1.0 gpf	2
Lavatory faucets	0.5 gallons per minute (gpm)	8
Showerheads	2.5 gpm	2
	2.0 gpm	2

To reduce water use in the restrooms, Region 8 Laboratory could install dual-flush retrofit kits on the 1.6 gpf toilets in the women's restrooms; replace urinals with 0.25 gpf, WaterSense labeled models; and replace the 2.5 gpm showerheads with WaterSense labeled models.

Miscellaneous Laboratory Use

The Region 8 Laboratory has a water purification system to provide purified water for laboratory use and for fish culturing. The water purification system consists of a water softener, canister filter, reverse osmosis (RO) membrane filters, ultraviolet light, additional filtration, ion exchange, and carbon filtration.

With the RO membranes, specifically, water efficiency is an important consideration. For every 6 gallons of RO permeate generated, approximated 3 gallons of reject water is generated and discharged to sewer. This level of efficiency is acceptable for water conservation. When the RO reject water quantity exceeds 3.5 gpm, the building engineer changes the RO membranes to ensure optimal efficiency.

One main use of the purified water is culture water for raising fish and other freshwater organisms for use in water quality toxicity testing. The culture water is supplied to the culture tanks on a batch basis and then discharged to sewer. Water used to be supply continuously, so the switch to batch use has saved water.

Two autoclaves are in use at the facility, but tempering water flow is controlled by temperature-activated sensors to ensure that flow is not continuous.

Laboratory glassware washing is also optimized to ensure that full loads are run.

6.0 DROUGHT CONTINGENCY PLAN

Information on drought restrictions can be found on the North Table Mountain Water and Sanitation District's website at: <http://www.ntmwater.org/restrictions.html>.

In the event of a drought or other water supply shortage, the Region 8 Laboratory will follow the water use recommendations and restrictions of the utility. As required, the building engineer, in consultation with the facilities manager, will implement these water use restrictions.