Water Management Plan

Revision 2

United States Environmental Protection Agency
Region 1
New England Regional Laboratory
Office of Environmental Measurement and Evaluation
11 Technology Drive
North Chelmsford, Massachusetts 01863

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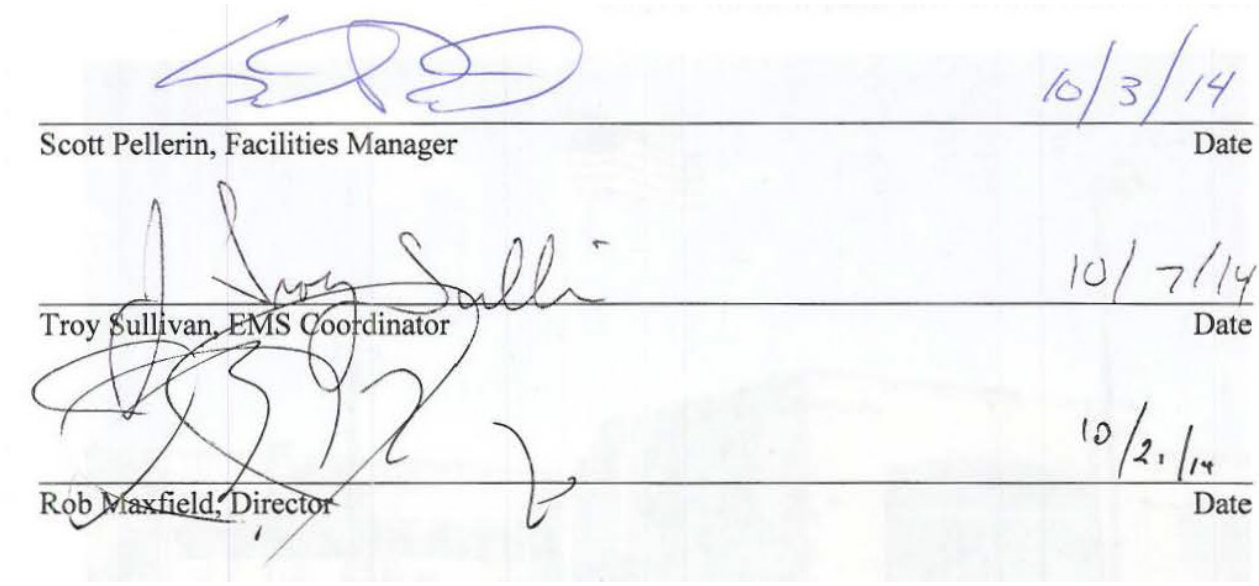
Point of Contact:
Scott Pellerin
Facilities Manager
617-918-8678

EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, REGION 1
NEW ENGLAND REGIONAL LABORATORY
OFFICE OF ENVIRONMENTAL MEASUREMENT AND EVALUATION
NORTH CHELMSFORD, MASSACHUSETTS

WATER MANAGEMENT PLAN, REVISION 2

Approved by:



Scott Pellerin, Facilities Manager — Date: 10/3/14

Troy Sullivan, EMS Coordinator — Date: 10/7/14

Rob Maxfield, Director — Date: 10/21/14

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1.0 IDENTIFIED WATER CONSERVATION OPPORTUNITIES

In May 2014, a water use and conservation assessment was conducted at the U.S. Environmental Protection Agency's (EPA's) Region 1 New England Regional Laboratory (NERL) in North Chelmsford, Massachusetts. Under this Water Management Plan, NERL will consider implementing the potential water conservation and management opportunities identified during the water assessment, which are summarized in Table 1.

The rest of this Water Management Plan describes NERL's water reduction goals, water use trends, end uses of water, completed water efficiency projects, 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 use 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 in gallons per gross square feet (gsf).

The implementation instructions for water efficiency and management provisions of EO 13514 direct that agencies replacing fixtures or other water-using products should purchase Federal Energy Management Program-designated or WaterSense® labeled products.

In addition to the potable water use reduction requirements, EO 13514 requires agencies to reduce industrial, landscaping, and agricultural (ILA) water use by 2 percent annually or 20 percent by the end of FY 2020, relative to an FY 2010 baseline (including non-potable sources). The EO also directs agencies to identify, promote, and implement water reuse strategies that reduce potable water use.

The Energy Independence and Security Act of 2007 directs agencies to complete comprehensive energy and water evaluations of 25 percent of covered facilities (i.e., those accounting for 75 percent of total energy use) each year; implement cost-effective measures identified through life cycle analyses; and measure and verify water savings.

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

This Water Management Plan has been developed to document and promote the efficient use of water at NERL, so that the facility can contribute to meeting these Agency-wide objectives.

Table 1. Potential Water Conservation Opportunities, NERL

Suggested Priority	Project Description	Project Cost	Potential Water Savings (gallons)	Potential Energy Savings (MMBtus)	Potential Utility Cost Savings	Potential Payback (years)
1	Replace eight existing 2.5-gallons per minute (gpm) showerheads with WaterSense labeled models flowing at 1.75 gpm or less.	$240	11,000	7	$180	1.3
2	Replace two existing urinals that flush at 1.0 gallons per flush (gpf) with WaterSense labeled models flushing at 0.125 gpf.	$2,000	13,000	N/A	$140	14.3
3	Install an alarm on the overflow drain from the cooling towers to ensure operations and maintenance (O&M) staff are notified when overflow is occurring.	$5,000	100,000 to 200,000 per incident avoided	N/A	$1,100 to $2,200 per incident avoided	See Note 1

Note 1: If an alarm system prevents one 150,000-gallon cooling tower overflow or leak every five years, the resulting payback period would be approximately 15 years.

3.0 FACILITY INFORMATION

NERL opened in September 2001. Situated on 11.97 acres, the 69,349-square foot laboratory is a showcase for environmental and energy-efficient technologies. The laboratory includes state-of-the-art lighting, heating, cooling, plumbing, and waste handling systems. NERL received Leadership in Energy and Environmental Design (LEED) Version 1.0 Gold certification in 2003, making it the first EPA building in the nation to become LEED certified. NERL also received a 2002 White House Closing the Circle Award for its proactive recycling program and integrated sustainable design. NERL has welcomed over 2,500 visitors on "green tours" since opening.

The laboratory building is divided into two halves: an office wing and a laboratory wing. The laboratory wing includes four laboratory sections, divided by interstitial utility chases and hallways. The building is leased by the U.S. General Services Administration (GSA) from IStar and is assigned to EPA by GSA. The building lease runs through 2021. EPA is responsible for all water, sewer, and other utility bills.

NERL is occupied by 60 EPA employees and and 16 contractors, and it operates on a flex time schedule, one shift per day from 6 a.m. to 6 p.m., Monday through Friday.

4.0 WATER MANAGEMENT GOALS

NERL achieves its resource conservation goals by implementing its Environmental Management Program (EMP). Within the EMP, NERL's water management goal is to reduce total water use by 26 percent by FY 2020 (using a FY 2007 baseline). Although not expressly stated, the desire to meet annual facility-specific goals set by EPA's Sustainable Facilities Practices Branch

(SFPB) under its ConservW program is implied in NERL's EMP. These ConservW goals are calculated for each EPA facility based on the facility's previous water use reduction and its potential identified projects.

5.0 WATER USE INFORMATION

NERL uses potable water primarily for cooling tower make-up, research, and restroom use. Discussed further in Section 5.3, NERL's potable water use has decreased since the last water assessment in 2010. The following sections provide additional details on NERL's water use.

5.1 Water Supply

North Chelmsford Water District provides NERL's potable water service, and the Town of Chelmsford provides NERL's sewer service.

Water for specialized laboratory investigations is supplied by an onsite well. The well provides less than 1 percent of NERL's water supply (1,300 gallons in FY 2013). Onsite well water use is reported as industrial, landscaping, and agricultural (ILA) water use.

5.2 Meters and Submeters

Incoming city water supply is metered through a combination low-flow/high-flow metering device, where the total flow is the sum of both meter readings. During the May 2014 water assessment, it was noted that the North Chelmsford Water District was not billing NERL correctly for its quarterly water use. As of 1st Quarter FY 2012, the North Chelmsford Water District was only billing NERL for the low-flow meter reading and is not accounting for water use registered on the high-flow meter. This change in billing may have occurred when the low-flow meter was replaced in December 2011. Following the water assessment, NERL contacted the North Chelmsford Water District to resolve the billing discrepancy and ensure accurate quarterly water use data moving forward. As of July 2014, the billing error was corrected and the utility was invoicing NERL for its complete water consumption.

Onsite well water supply is also metered. Flow totalizing meters are also installed on many of the subsystem water supply lines. An inventory of metered flows is provided below:

- Potable water supply to laboratory (account #2947)
- Onsite well water
- Cooling tower make-up water
- Cooling tower blowdown
- Reverse osmosis (RO) system permeate
- RO system reject water
- Recovered air handler condensate

Readings from all meters are recorded at least monthly and water use trends are monitored on an ongoing basis. Unexpected changes in water use are investigated and resolved.

In addition to the water supply meters and submeters, the discharge line for the pH neutralization system (laboratory acid sewer) is equipped with a flow meter, and meter readings are recorded daily in the treatment system log book.

5.3 Historical Water Use

In response to EO 13423, NERL set a FY 2007 potable water use intensity baseline of 16.82 gallons per gsf. In FY 2013, water use intensity had decreased to 16.67 gallons per gsf—a 0.9 percent reduction compared to the FY 2007 baseline. Figure 1 illustrates NERL's potable water use intensity from FY 2007 to FY 2013.

As described in Table 2, NERL has completed two water efficiency projects to reduce its water use.

Figure 1. Annual Water Use Intensity, NERL, FY 2007–FY 2013

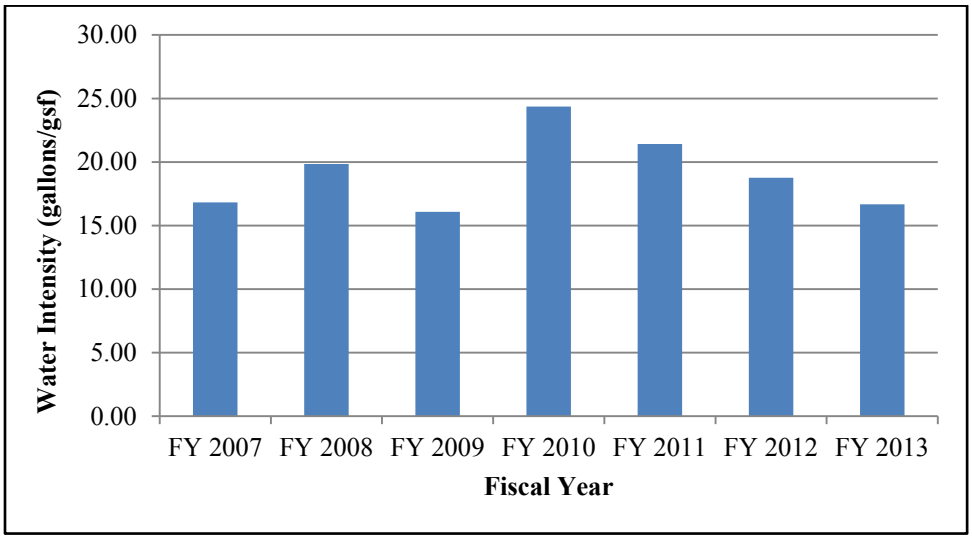


Table 2. Completed Water Efficiency Projects Since FY 2007, NERL

Project	Implementation Cost	Estimated Annual Water Savings (gallons)	Completion Year	Additional Notes
Faucets	$7,400	19,000	FY 2013	As of May 2013, all 14 lavatory faucets at NERL had been replaced with faucets that flow at 0.5 gpm.
Air handler condensate recovery	$50,000	140,000	FY 2013	In October 2012, NERL installed an air handler condensate recovery system to capture condensate from its air handlers and route it to the cooling tower as make-up water. In FY 2013, NERL collected and reused approximately 139,000 gallons of condensate.

5.4 End Uses of Water

Table 3 and Figure 2 describe the end uses of water at NERL. Figure 3 illustrates NERL's water use by source.

Figure 4 provides a graph of NERL's monthly potable water use in FY 2013, which illustrates NERL's seasonal water use pattern that can be attributed to cooling tower make-up water use in the summer months.

NERL's end uses of water are described in more detail in this section. Potential projects discussed in this section are summarized in Table 1.

Table 3. Major Water Uses, NERL, FY 2013

Major Process	FY 2013 Annual Water Use (gallons)	Percent of Total Potable Water Use (%)	Estimated Utility Costs[a]	Supporting Calculations and Source Documentation
Potable Water Use				
Cooling tower make-up (potable water)	694,000	60.0	$7,500	FY 2013 meter readings.
Miscellaneous laboratory use	267,550	23.1	$2,900	Calculated by difference from known total water use and all other calculated water uses.
Restroom fixtures	144,000	12.5	$1,600	Engineering estimate based on fixtures installed, occupancy, and daily usage factors.
RO system reject	25,970	2.2	$300	FY 2013 meter readings.
RO system permeate	24,530	2.1	$300	FY 2013 meter readings.
Total Potable Water Use	**1,156,050**	**100**		FY 2013 meter readings.
Onsite Alternative Water Use				
Cooling tower make-up (air handler condensate)	139,000	-	-	FY 2013 meter readings.
Well Water (ILA Water) Use				
Specialized laboratory investigations	1,300	-	-	FY 2013 meter readings.
Total Water Use	**1,296,350**	**100**		

[a] Utility cost is calculated using the most current water and sewer rates available. Water service is provided at a rate of $5.50 per 1,000 gallons after the first 50,000 gallons used quarterly. Sewer service is provided at an incremental rate of $4.25 per 1,000 gallons registered on the water meter, with an additional $1.05 per 1,000 gallons assessed as a capital construction fee.

Figure 2. Percentage of Potable Water End Uses, NERL, FY 2013

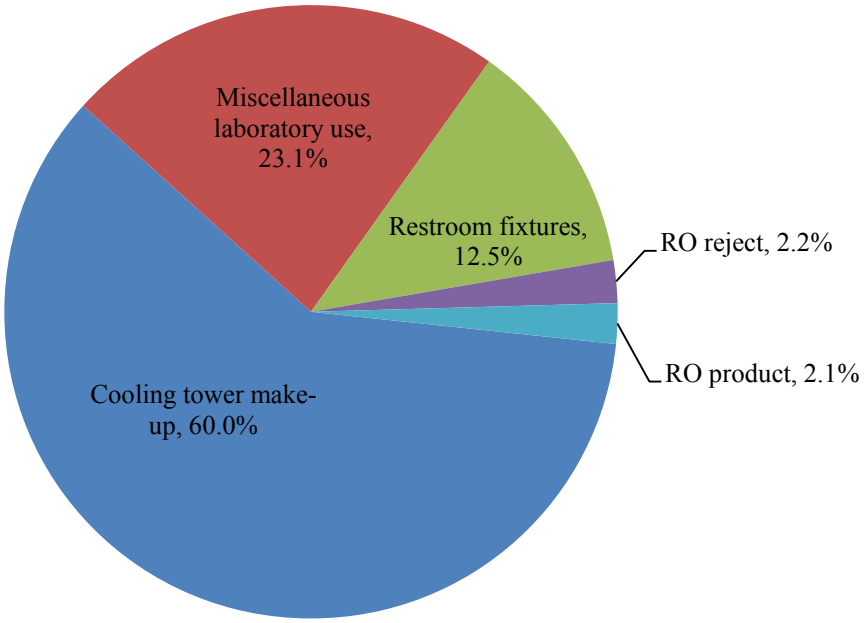


Figure 3. Percentage of Water Use by Source, NERL, FY 2013

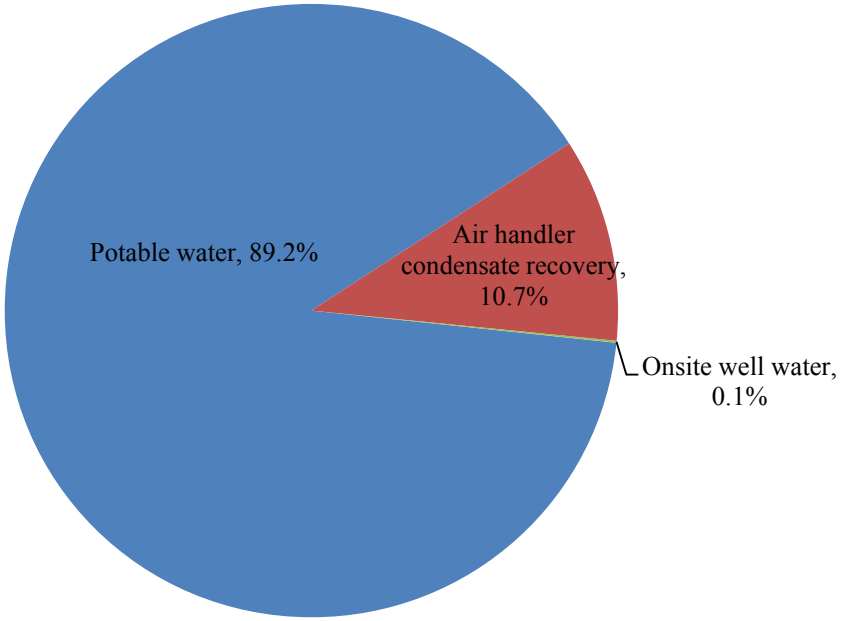
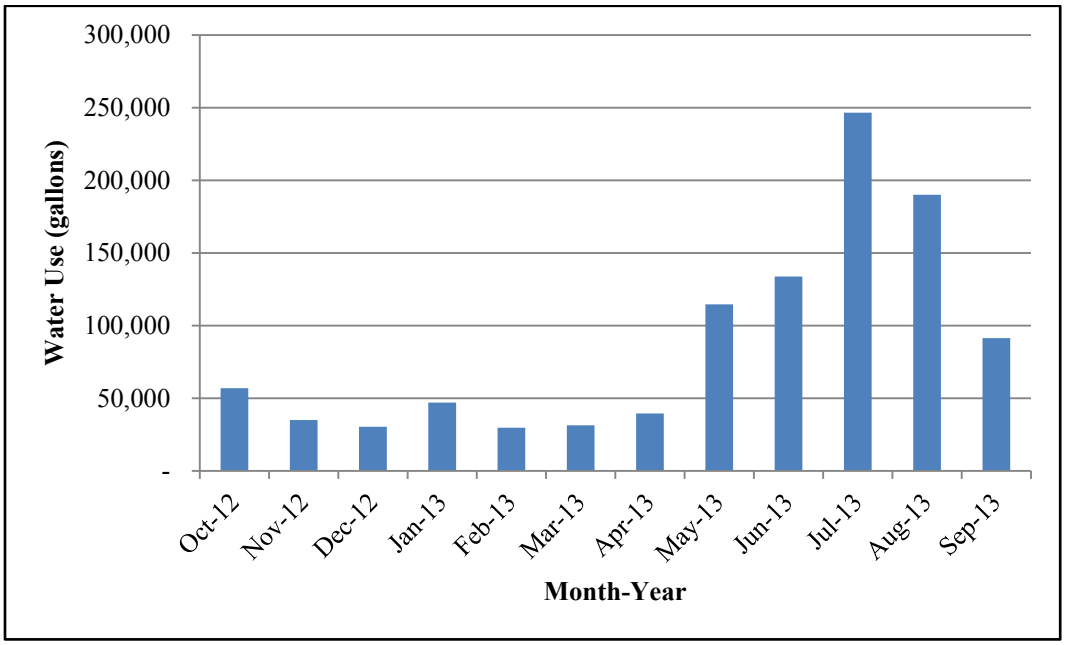


Figure 4. Monthly Water Use, NERL, FY 2013



Cooling Tower Make-Up

NERL is equipped with one cooling tower, which provides condenser water cooling for the building chillers. Cooling tower make-up water is the largest use of water at the laboratory, accounting for approximately 60 percent of NERL's water use in FY 2013. The make-up water is needed to replenish water lost to evaporation and to replace water blown down from the condenser water loop to control dissolved solids and associated scale buildup.

NERL uses traditional chemical treatment on the cooling tower. In FY 2004, cooling tower system quality and performance was evaluated because the cooling tower was operating at less than 1.5 cycles of concentration. After sampling the incoming city water, a cooling tower chemistry consultant determined that chloride levels are too high to operate at more than 3 cycles of concentration due to risk of corrosion. NERL has contacted the City of Chelmsford to report the issue with high chlorides, but no action has been identified to resolve the issue.

Blowdown water chemistry is evaluated monthly by a service contractor. Full quality and performance evaluations are performed periodically on blowdown water and incoming city water. A conductivity meter is used to automatically control cooling tower blowdown at approximately 2,200 to 2,600 microsiemens per centimeter (*u*S/cm). Incoming city water is at approximately 800 to 1000 *u*S/cm. This conductivity control range provides for approximately 2.0 to 3.0 cycles of concentration, constrained by the high chloride levels in city make-up water described above.

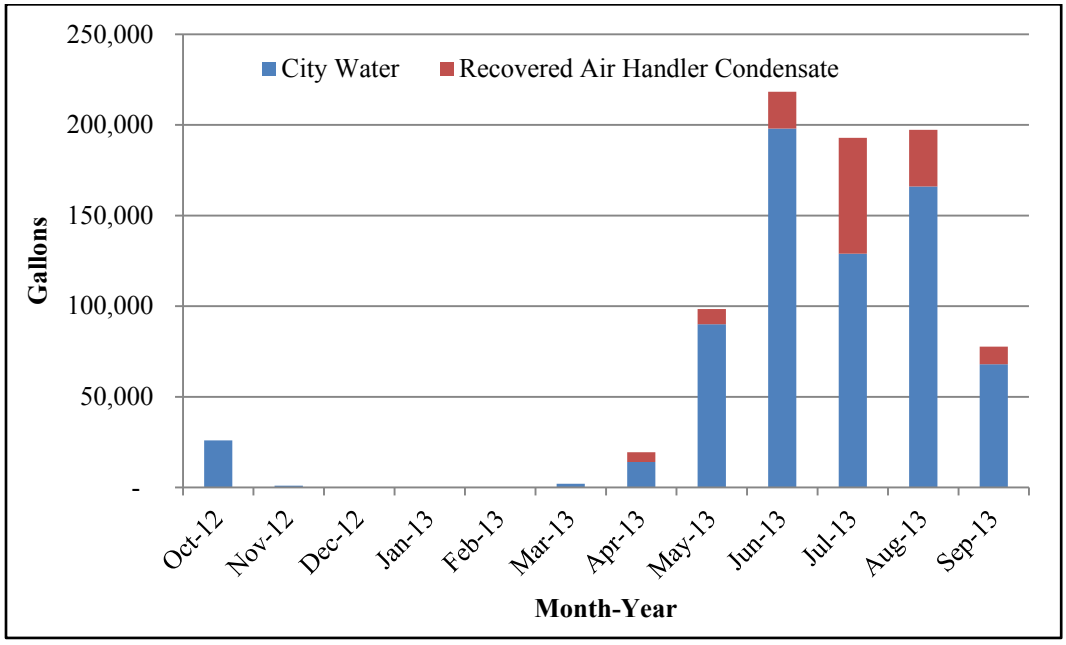
In October 2012, NERL implemented a project to capture condensate from the air handlers located in the mechanical room and route it to the cooling tower to use as make-up water. The collected condensate is metered and readings are recorded weekly. In FY 2013, approximately

139,000 gallons of air handler condensate was collected for use as cooling tower make-up water. Figure 5 illustrates the sources of NERL's cooling tower make-up water during FY 2013.

The use of the recovered air handler condensate also increased the cycles of concentration under which the cooling tower was able to operate. The cycles increased from an average of 2.4 to approximately 2.9 following the use of recovered air handler condensate as make-up water. This increase in cycles reduced the amount of required blowdown by approximately 58,000 gallons in FY 2013, subsequently reducing the amount of make-up water needed within the cooling tower system.

NERL has experienced a limited number of cooling tower system upsets where a stuck fill valve caused the tower basin to overflow to a drain. Because of the cooling tower configuration, these upset conditions can go undetected. One incident in 2010 caused the loss of over 200,000 gallons of water. One incident earlier in 2014 caused the loss of 130,000 gallons of water. Installation of an overflow alarm system could help identify and quickly resolve any future incidents without the loss of a significant quantity of water.

Figure 5. Sources of Cooling Tower Make-Up Water, NERL, FY 2013



Miscellaneous Laboratory Uses

Miscellaneous laboratory uses account for approximately 23 percent of NERL's annual water use.

In Lab 206, there are two Gentinge Model 422LS steam sterilizers. Both sterilizers have integral control of tempering water, and therefore only apply tempering water when the equipment is operational and discharges exceed 140° Fahrenheit.

Water is used as necessary in individual laboratories for bench-scale experimentation and glassware preparation. Occasionally, laboratory scientists test safety showers and eyewashes to assure proper functionality.

There are three steam humidifiers located in the NERL mechanical room. Each humidifier is associated with an air handling unit. Two of the humidifiers are Dristeem Model GTS 99-800 and one is a Dristeem Model GTS 99-300 unit.

Restroom Fixtures

Energy Policy Act of 1992 (EPAct 1992)-compliant restroom fixtures [1.6 gallons per flush (gpf) toilets and 1.0 gpf urinals] with automatic flush valves have been installed throughout the facility. Half of the urinals are a non-water design, installed around 2006. The non-water urinals are maintained by the janitorial staff using an aggressive cleaning, snaking, and cartridge changing regimen.

High-efficiency faucets with a maximum flow rate of 0.5 gallons per minute (gpm) are used throughout the facility. The 0.5 gpm flow rate is lower than the EPAct requirement for faucets and is compliant with the American Society of Mechanical Engineers/Canadian Standards Association (ASME/CSA) 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.

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

System pressure is maintained between 20 to 80 pounds per square inch, which is necessary for adequate restroom fixture performance.

Janitorial staff and employees are trained to report leaks or other maintenance problems to the building management contractor who immediately corrects them.

Table 4 provides a complete inventory of restroom fixtures.

Table 4. Restroom Fixtures Inventory, NERL

Fixture Type	Flow Rate	Total Number
Toilets	1.6 gpf	13
Urinals	1.0 gpf	2
	Non-water	2
Lavatory faucets	0.5 gpm	14
Showerheads	2.5 gpm	8

To reduce restroom water use, NERL will consider replacing the two existing 1.0 gpf urinals with WaterSense labeled models flushing at 0.125 gpf and will consider replacing the eight existing showerheads with WaterSense labeled models flowing at 1.75 gpm or less.

Reverse Osmosis System

Purified water for laboratory use is generated by RO. The RO reject water is discharged to the drain. The RO system permeate and reject water lines are equipped with flow meters that are recorded at least monthly. The ratio of RO reject water to RO produced is approximately 1 to 1, which is considered efficient operation.

6.0 DROUGHT CONTINGENCY PLAN

NERL will follow the water use recommendations of the Massachusetts Department of Environmental Management Office of Water Resources, which coordinates the drought response within Massachusetts.

The City of North Chelmsford does not have a water management plan specifically for droughts. However, as conditions warrant, NERL is prepared to follow the water use recommendations and restrictions outlined under the Massachusetts Drought Management Plan, dated May 21, 2013. Massachusetts has defined five levels of drought response: normal phase, advisory phase, watch phase, warning phase, and emergency phase.

Details of the May 2013 Massachusetts Drought Management Plan are available at: http://www.mass.gov/eea/docs/eea/wrc/droughtplan.pdf.

In the event that voluntary or mandatory water consumption reductions are instituted by Massachusetts Department of Environmental Management or the North Chelmsford Water District, these requirements will be communicated by the Water District to the building owner. In turn, the owner's representative will communicate the requirements to the NERL facilities staff. NERL will then form a task force of facility and operating personnel to identify and implement modifications to facility operations to achieve specified water use reductions.