Water Management Plan
Revision 1

United States Environmental Protection Agency
National Health and Environmental Effects Research Laboratory
Mid-Continent Ecology Division
6201 Congdon Boulevard
Duluth, Minnesota 55804

21 August 2009

Point of Contact:
Rodney Booth, Facilities Manager
218-529-5040

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HEALTH AND ENVIRONMENTAL RESEARCH LABORATORY
MID-CONTINENT ECOLOGY DIVISION
DULUTH, MINNESOTA

WATER MANAGEMENT PLAN

Approved by:

Rodney Booth, Facilities Manager — Date 8/24/09

Carl Richards, Division Director — Date 8/26/09

TABLE OF CONTENTS

Page

LIST OF TABLES

1.0 EPA'S STATEMENT OF PRINCIPLES ON EFFICIENT WATER USE

In order to meet the needs of existing and future populations and ensure that habitats and ecosystems are protected, the nation's water 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 we face 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 the sustainability of our 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.*

This Water Management Plan has been established to document and promote the efficient use of water at the U.S. EPA Mid-Continent Ecology Division Laboratory (MED) facility located in Duluth, Minnesota. The plan is organized according to the Federal Energy Management Program (FEMP) Facility Water Management Planning Guidelines.

2.0 FACILITY DESCRIPTION

The Duluth laboratory houses five of the Mid-Continent Ecology Division's six branch activities:

- Ecosystem Assessment Research
- Ecotoxicity Analysis Research
- Molecular and Cellular Mechanisms Research
- Toxic Effects Characterization Research
- Watershed Diagnostics Research

The laboratory was originally constructed as the National Water Quality Laboratory in 1967, part of the Department of the Interior, Federal Water Quality Administration. In 1970 the laboratory joined the newly formed U.S. EPA. The laboratory facilities are located on a 13.2 acre site located near the Lester River on the east side of Duluth on the shore of Lake Superior. The facilities are owned and operated by EPA. The site consists of ten buildings with 88,577 gross square feet of conditioned space.

The main laboratory building was finished in 1967, with additions constructed in 1984 and 2001. Construction is of reinforced concrete and masonry curtains; the two-story structure is built around a central mechanical core that extends up to a third floor penthouse. The building houses both biology and chemistry labs and a large aquatic culture unit. Significant features include 50 laboratory rooms, seven constant temperature rooms, a digital control facility management system (Metasys) and a lake water supply system. The building also houses the administrative offices and library for the Division.

The Annex building was constructed in 1971 and modified in the late 1980s to provide office and support space for 50 staff. Other support buildings and structures include a shop/storage building, several storage buildings, pump house, water tower, emergency generator building, and a modular hazardous material storage building.

Duluth was selected as the site for this research facility because of the need for an uncontaminated source of natural fresh water (Lake Superior) to conduct its research. The lake's unchanging water quality over the past 30 years has been essential to the ongoing ecotoxicology research performed at MED. The facility uses Lake Superior water for research and non-contact cooling of building air conditioning and other mechanical equipment.

3.0 FACILITY WATER MANAGEMENT GOALS

Since 1993, MED has embarked on a comprehensive program to reduce consumption of potable water. Between fiscal year (FY) 1993 and FY 2003, potable water consumption was reduced by 90 percent, as illustrated in Figure 1. MED took advantage of its proximity to Lake Superior and eliminated reliance on potable water by using the lake water for non-contact cooling water, research water, aquatic culture laboratory practices, and the reverse osmosis (RO) system. Potable water is now used primarily for sanitary requirements, janitorial needs, and some other miscellaneous uses.

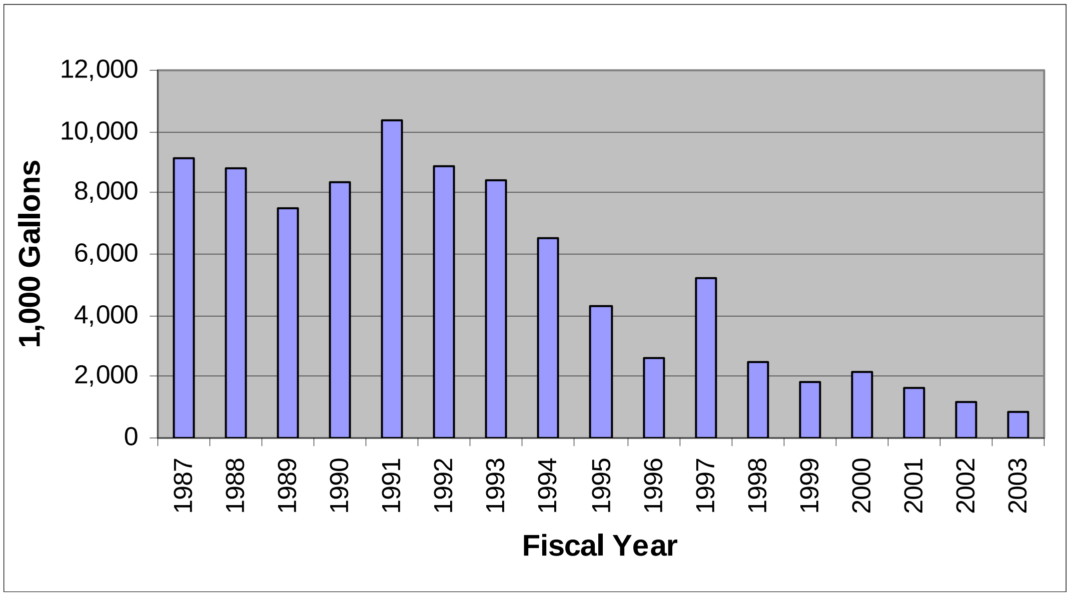

Figure 1. Duluth Laboratory City Water Use, FY 1987 to FY 2003

Continued further definition and achievement of water management goals is accomplished through the implementation of the MED Environmental Management System (EMS). MED's Environmental Management System Implementation Policy (27 September 2007) and September 2008 water conservation goals are provided below.

Environmental Management System Implementation Policy

The US Environmental Protection Agency's Office of Research and Development (ORD) mission is to perform state-of-the art research to identify, understand, and solve current and future environmental problems, provide responsive technical support to EPA's mission, integrate the work of ORD's scientific partners (other agencies, nations, private sector organizations, and academia), provide leadership in addressing emerging environmental issues, and advance the science and technology of risk assessment and risk management.

ORD continues to encourage and set an example of research and development activities which use effective environmental management systems (EMS) that focus on regulatory compliance, pollution prevention, resource preservation, and public outreach. With this policy, the National Health and Environmental Effects Research Laboratory – Mid-Continent Ecology Division joins other ORD sites in committing to implement EMS for our own employees, operations, and facilities. Collectively, ORD will become a leader in executing a model environmental management system within the Agency.

At MED, we commit to reduce the environmental impacts and consumption of natural resources from our facility operations and comply with all legal and applicable requirements. Our environmental management system will be designed to meet the following goals:

- Ensure compliance by meeting or exceeding all applicable environmental requirements while conducting research activities;

- Strive to continuously improve environmental management system performance;
- Integrate source reduction and other pollution prevention approaches into day to day research activities;
- Consider the environment when making all planning, purchasing and operating decisions;
- Establish, track and review specific environmental performance goals and employee awareness; and
- Share performance information with our research partners and other interested parties.

Environmental Management System Aspects, Objectives and Targets

In view of this environmental policy, MED has reviewed its water consumption and wastewater discharges. In September 2008, MED identified aquatic culture lab discharge, non-contact cooling water discharge, and domestic water use in toilets, sinks, and lab sinks as significant environmental aspects. The following objectives have been established related to these aspects:

- Reduce city water consumption.
- Seek further opportunities to reduce water consumption intensity by 16 percent by FY 2015 over FY 2007 baseline year.
- Reduce wet lab water discharge to the sanitary sewer.
- Maintain regulatory compliance with non-contact cooling water discharge and pre-treatment permits.

To meet these objectives, MED established the following specific targets:

- Reduce city water consumption by two percent by the end of FY 2009 from a FY 2007 baseline.
- Continue to seek and maintain a list of potential options to reduce water consumption intensity and explore feasibility of these options for conservation versus research and mission needs of MED. For opportunities identified as feasible, prepare and submit funding requests.
- Perform annual review of Water Management Plan and update, as necessary.
- Reduce discharge to sanitary sewer by 80% by December 2008 from baseline year of FY 2004.
- Maintain annual compliance with permit monitoring requirements.
- Provide annual laboratory employee training on permit requirements for wastewater.

Objectives and targets are reviewed annually as part of the EMS goal of continual improvement.

4.0 UTILITY INFORMATION

Contact Information

Potable water and sewer service is provided by:

City of Duluth
Public Works and Utilities Department
414 West First Street
PO Box 169001
Duluth, Minnesota 55816-9001

218-723-3333

Rate Schedule

Monthly water billing is based on a tiered rate structure, provided in Table 1.

Table 1. Water Use Fee Structure (effective 1 February 2009)

Monthly Fee Structure per 100 Cubic Feet (ccf)	Cost per ccf
First 40 ccf water use	$2.56
Next 960 ccf water use	$1.67
Next 9,000 ccf water use	$1.39
Over 10,000 ccf water use	$1.15

The utility also charges a fixed rate between $3.50 and $133 for each installed water meter.

Effective 1 February 2009, the sewer use fee is $5.02 per 100 cubic feet. The utility also charges a fixed rate of $5.89 per month for sewer use and a $5.57 Clean Water Surcharge, which will be used to construct additional sanitary sewer overflow storage tanks.

The stormwater fee is $470 per month (calculated as 77.3 residential units at $6.08 per unit).

Payment Office

MED's facilities manager approves utility invoices and sends them to EPA's Research Triangle Park facility for payment.

Research Triangle Park Finance Center (RTP-FC)
Gloria Owens, 919-541-0052

(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 INFORMATION

The predominant feature of the MED Duluth Laboratory from a water management perspective is its proximity to Lake Superior. Lake water is used as aquatic culture water in the wet lab, research water in various laboratories, and non-contact cooling water for air conditioning and to cool other mechanical equipment.

All lake water passes through a primary lake bottom sand filter. The filter is designed to filter particulate matter down to five microns. Water flows by gravity through the sand filter into a wet well and is then pumped to a 40,000 gallon capacity water tower. As needed, water flows into the main building by gravity through two separate lines: research and process cooling water. This system was designed to provide a reliable source of lake water with minimum operating and maintenance costs. During extremely cold weather, water is pumped continuously to the water tower and allowed to overflow via a return line to the lake to prevent the water in the tower from freezing.

Lake water used for research flows through in-house sand filters designed to filter particles down to two microns. The research water then passes through a ultraviolet (UV) light disinfection system before being supplied to the various laboratories, unchanged in chemical makeup from the raw lake water. This system is capable of producing 100,000 gallons of water per day. Some research activity requires heating or cooling the lake water, which is accomplished by routing the water through stainless steel heat exchangers.

Some lake water required for research purposes is further processed through two RO filter units, followed by deionization units. This water is stored in polyvinyl chloride (PVC) storage tanks and treated with UV light to generate Type II pure water for laboratory water use. Design capacity of this system is approximately 600 gallons per day. Water rejected from the RO unit is returned to the lake.

In mid-March 2009 a treatment and return system for the lake water used in the aquatic culture wet lab came online. Prior to installation of the treatment system, approximately 18 million gallons per year of lake water used in the aquatic culture system was discharged to the sanitary sewer. With the treatment and system in place, lake water used for aquatic culture is now treated by cartridge filtration, ozonation, sand filtration, and UV light disinfection, and returned to the lake. Sanitary sewer discharge has been reduced by almost 80 percent, saving the facility in utility costs and decreasing the load on the local wastewater treatment plant. Lake water used for other research purposes still flows to sanitary sewer.

Lake water used for non-contact cooling receives no additional treatment. After non-contact use, the water is returned to Lake Superior. This system is capable of supplying 300,000 gallons of water per day.

By taking advantage of its proximity to Lake Superior and eliminating reliance on potable water for non-contact cooling water, research water, aquatic culture laboratory practices, and the RO system, use of potable water supplied by the city has been reduced significantly since the early 1990s (see Section 3). Potable city water is now used primarily for sanitary requirements, janitorial needs, and some other miscellaneous uses. Water for these uses is discharged to the city sewer. The facility is not equipped with an irrigation system; therefore, virtually no water is used for landscape irrigation.

Major Water Using Processes

Average water use in FY 2008 by major process is shown in Table 2. The source of water for each purpose, either city or lake, is indicated on the table, as well as whether the water is discharged to the city sewer or returned to the lake.

Table 2. Major Water-Using Processes, MED

Process	Water Source	FY 2008 Annual Consumption (gallons)	Percent of City Water Use	Percent of Total Water Use	Discharge Method	Comments
Sanitary (main building) and miscellaneous water uses	City	585,000	59.5	0.6	Sewer	Calculated as remaining difference from metered subtotal
Sanitary (annex)	City	115,000	11.7	0.1	Sewer	Metered
Ice maker cooling water (potable water ice maker)	City	283,000	28.8	0.3	Sewer	Engineering estimate
City water subtotal	City	983,000	100.0	1.0	Sewer	Metered
Aquatic culture water (wet lab)	Lake	18,343,000	NA	18.4	Sewer [a]	Calculated from monthly metered total
Research water	Lake	3,876,000	NA	3.9	Sewer	Calculated as remaining difference from metered sewered subtotal
Reverse osmosis permeate	Lake	43,000	NA	<0.1	Sewer	Metered
Sewered water subtotal	City & Lake	23,245,000	NA	23.3	Sewer	Metered
Reverse osmosis reject	Lake	174,000	NA	0.2	Returned to lake	Calculated from metered flow rates
Non-contact cooling water (building and equipment cooling)	Lake	64,289,000	NA	64.5	Returned to lake	Calculated as remaining difference from metered subtotal
Water tower overflow (to prevent freezing in winter)	Lake	12,000,000	NA	12.0	Returned to lake	Engineering estimate
Lake water subtotal	Lake	98,725,000	NA	99.0	Sewer or returned to lake	Metered
Total water use	**City & Lake**	**99,708,000**	**NA**	**100.0**	**Sewer or returned to lake**	**Sum of metered subtotals**

[a] As of mid-March 2009, aquatic culture water discharge is routed through a water treatment system and returned back to Lake Superior instead of discharged to sanitary sewer.
NA – Not applicable.
Additional details on assumptions and calculations supporting these water use estimates are provided in Appendix A.

Measurement Devices

Incoming city water supply and lake water supply are both metered. Flow totalizing meters are also installed on many of the subsystem flows. An inventory of metered flows (with meter number) is provided below:

- City water supply, main building (#049209-9)
- City water supply, annex (#049207-5)
- Domestic hot water (#7)
- Lake water supply (#1)
- Lake water to research use (#2, #3)
- Wet lab warm water supply (#12)
- Wet lab cold water supply (#13)
- Process cooling water (#6)
- Non-contact water for chiller (unnumbered)
- RO system total consumption (2 meters, unnumbered)
- RO system permeate (2 meters, unnumbered)
- As of mid-March 2009, water treatment system flow to lake (not numbered)
- Sewer flow (#049210-2)

Flow totalizer readings on each meter are recorded monthly and reported to the facilities manager. Water use trends are monitored on an ongoing basis and unexpected changes in water use are investigated and resolved.

The city of Duluth calibrates the incoming city water supply meters. MED calibrates sewer discharge flow meters annually.

Shut-off Valves

City water supply line shutoffs are located in the boiler room of the main building (Room 200) and annex building (Room A-108). Lake water supply can be shut off at the pump house.

Occupancy and Operating Schedules

Approximately 175 employees work at the Duluth laboratory. The laboratory operates on a flex time schedule and is typically occupied between 6 a.m. and 6 p.m., Monday through Friday.

6.0 BEST MANAGEMENT PRACTICE SUMMARY AND STATUS

Former President Bush established Water Reduction Goals under EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*. Under the EO, Agencies must establish a FY 2007 water use baseline, and then reduce water use intensity by two percent annually through the end of FY 2015, for a total reduction of 16 percent. This goal is incorporated into the MED EMS, as noted in Section 3. Facilities should implement BMPs related to water use, considering life-cycle cost effectiveness, to achieve these water reduction goals. FEMP has identified BMPs in 14 possible areas to help facilities identify and target water use reductions. MED has adopted BMPs in eight of the areas, and three areas are deemed inapplicable, as checked below:

☑ 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
NA Cooling Tower Management
NA Commercial Kitchen Equipment
☑ Laboratory/Medical Equipment
NA Other Water Use
☑ Alternate Water Sources

Information and Education Programs

MED prepared an educational poster on their native landscaping project for display in the facility lobby for staff and visitors. EMS results are displayed on a poster in the lobby as well. Through annual EMS training, employees are being educated on water and other resource conservation topics. BMP status has been achieved in this area.

Distribution System Audits, Leak Detection and Repair

Water supply piping within the facility is exposed and accessible.

Operations and maintenance (O&M) contractor staff perform a daily walk through of mechanical spaces to check for leaks or equipment malfunctions. Leak detection sensors (water bugs) are installed in strategic areas within the facility to detect leaks. Their signal feeds into the building automation system (BAS) which alerts the onsite O&M contractor or an after-hours guard if an issue is detected.

Facility staff are trained to report leaks and malfunctioning water-using equipment to the facilities manager via email or phone. Any request deemed significant by the facilities manager is assigned a work order, which is completed by the facility O&M contractor.

The facilities manager reviews water consumption data to identify outlying water use spikes and determine the cause or issue. BMP status has been achieved in this area.

Water-Efficient Landscaping

MED is located on a 13.2 acre parcel, with four acres developed to include the laboratory buildings, parking, and landscaped areas. In 2003, two acres of lawn in front of the laboratory were converted to northern boreal meadow, native to northeastern Minnesota. Twice a summer, a landscape contractor performs exotic species control. The meadow grass is mowed one time per year in the fall. An annual mow is required in lieu of burning to remove unwanted plants, trees, and seeds. BMP status has been achieved in this area.

Water-Efficient Irrigation

No installed irrigation is used to maintain facility landscaping. BMP status has been achieved in this area.

Toilets and Urinals

Energy Policy Act of 1992 (EPAct 1992)-compliant sanitary fixtures (1.6 gallons per flush (gpf) toilets and 1.0 gpf urinals) have been installed in the administrative wing of the laboratory, the research storage building, and in some locations in the annex building. Older style toilets and urinals (with flow rates estimated to be 4.5 gpf), installed as part of the original laboratory construction, are still in use in the main laboratory area and the rest of the annex building. In total, 10 of 21 toilets and three of five urinals are EPAct 1992-compliant. A complete inventory of sanitary fixtures is provided in Table 3.

Table 3. Inventory of Sanitary Fixtures, MED

Fixture Type	Flow Rate	Total Number
Toilets	4.5 gpf	13
	1.6 gpf	10
Urinals	4.5 gpf	2
	1.0 gpf	3
Lavatory faucets	2.2/2.0 gallons per minute (gpm)	10
	0.5 gpm	11
Showerheads	2.5 gpm	7

BMP status can be achieved in this area by upgrading the sanitary fixtures to more water-efficient models. Under this plan, MED will consider replacing older, higher-flowing sanitary fixtures with high-efficiency models (dual-flush toilets with 1.6 gpf and 1.1 gpf flushing options and high-efficiency urinals with 0.25 gpf or less). MED will also consider retrofitting the current 1.6 gpf toilets equipped with flushing handles with dual-flush handles offering a 1.1 gpf flushing option.

Janitorial staff and employees are trained to report leaks or other maintenance problems, which are immediately corrected by the O&M contractor.

Faucets and Showerheads

High-efficiency lavatory faucets (0.5 gallons per minute (gpm) with automatic sensors to control flow) have been installed in part of the laboratory facility to conserve water. A total of 11 of 21 lavatory sinks have been retrofit to flow at 0.5 gpm. BMP status can be achieved in this area by retrofitting or replacing the remaining 10 lavatory faucets to flow at 0.5 gpm.

EPAct 1992-compliant showerheads (2.5 gpm) are installed in all seven shower stalls. System pressure is maintained between 20 to 80 pounds per square inch.

A complete inventory of faucets and showerheads can be found in Table 3.

Janitorial staff and employees are trained to report leaks or other maintenance problems, which are immediately corrected by the O&M contractor.

Boiler/Steam Systems

Boilers produce recirculating hot water, rather than steam. No steam condensate is generated. A steam generator used to supply distilled water was removed in 1998 and replaced with the current RO system. BMP status has been achieved in this area.

Single-Pass Cooling Equipment

Since the early 1990s, MED has made a concentrated effort to eliminate all uses of potable water for single-pass cooling. This is one of the primary reasons for the significant reduction in potable water use over the past decade. Non-contact cooling water needs are all supplied by recycled lake water.

Potable city water is still used to supply single-pass cooling on an ice maker in the mechanical room that supplies ice made with potable water. In FY 2009, the cooling water control valve was recalibrated to only allow water to flow when needed for cooling. When cooling is required, single-pass cooling water flows at approximately 0.54 gpm and is discharged to sanitary sewer. BMP status can be achieved in this area by considering alternate cooling or replacing equipment. Under this plan, MED will consider replacing the water-cooled ice maker with an air-cooled model. As an alternate, MED may consider using lake water for ice maker cooling, though this would not reduce the sanitary sewer discharge and could present the risk of cross contamination of the ice used for human consumption.

Cooling Tower Management

Cooling water requirements are supplied by lake water; the laboratory is not equipped with a cooling tower. BMP status is not applicable in this area.

Commercial Kitchen Equipment

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

Laboratory/Medical Equipment

Purified water for laboratory use is generated by RO using water from Lake Superior. The RO reject water is recycled back to the lake. The RO system is equipped with flow meters and readings are recorded monthly.

Approximately 35 to 40 gpm of lake water is used for aquatic culture in the wet lab. Water is provided to each culture tank in a constant overflow mode to keep the tanks aerated and carry away waste products. Prior to March 2009, all aquatic culture water discharge was sent to the sanitary sewer. Since March 2009, the discharge water is treated and returned to the lake, significantly decreasing MED's sanitary sewer discharge. Approximately 55,000 gallons per day are treated using cartridge filtration, ozonation, sand filtration, and UV light disinfection. Two systems with the same design are available; one operates as the primary system and the other is held in standby reserve. The facility holds a discharge permit that requires monitoring of pH and temperature. The treated water is metered prior to return to the lake. Under this plan, the facility will continue to monitor and maintain the treatment system in accordance with the discharge permit.

BMP status has been achieved in this area.

Other Water Use

MED does not have any other significant water uses other than those described above. The facility is equipped with tabletop, hand-filled steam sterilizers that are not connected directly to potable water supply. Humidity in three laboratory spaces is controlled in the winter with direct injection steam humidification. The steam humidifiers are supplied with filtered lake water. BMP status is not applicable in this area.

Alternative Water Sources

MED took advantage of its proximity to Lake Superior and eliminated reliance on potable water by using the lake water for non-contact cooling water, research water, aquatic culture laboratory practices, and the RO system. Potable water is now used primarily for sanitary requirements, janitorial needs, and some other miscellaneous uses. No alterative water sources have been identified for the remaining potable water uses at this time.

BMP status has been achieved in this area.

7.0 DROUGHT CONTINGENCY PLAN

Water shortages are uncommon in Duluth due to an abundant water supply from Lake Superior. The City of Duluth does not have an official water management plan specifically for droughts.

In the event that voluntary or mandatory water consumption reductions are instituted by Minnesota Department of Natural Resources or City of Duluth Public Works and Utilities Department, MED will form a task force of facility and operating personnel to identify and implement modifications to facility operations to achieve additional specified reductions in water consumption.

Minnesota drought information resources, including the 29 April 2009 Minnesota Statewide Drought Plan, are available at:

http://climate.umn.edu/doc/journal/drought_information_resources.htm

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, WaterSense-labeled products (www.epa.gov/watersense) will be purchased or specified.

9.0 STATUS UNDER GUIDING PRINCIPLES FOR HIGH PERFORMANCE AND SUSTAINABLE BUILDINGS

The Interagency Sustainability Working Group (ISWG), formed as a subcommittee of the EO 13423 Steering Committee, has established guiding principles to assist agencies in meeting the high performance and sustainable buildings goals of EO 13423, section 2(f). In the 1 December 2008 *Guiding Principles for Sustainable Existing Buildings*, ISWG established six supporting principles for protecting and conserving water. The status of MED with respect to the supporting principles for protecting and conserving water at existing buildings is documented in Table 4.

Table 4. Status of Guiding Principle to Protect and Conserve Water

Topic	Status
Indoor Water	Option 1: Comparison to 2006 Plumbing Codes MED potable water use is 39 percent greater than the calculated water use baseline. The baseline for portions of the facility constructed in 1994 and later was established as 120 percent of Uniform Plumbing Code 2006 under the Guiding Principles, Indoor Water Option 1. For portions constructed prior to 1994, the baseline was 160 percent of the Uniform Plumbing Code. About half of the facility has older, higher-flow style sanitary fixtures, while the other half is equipped with EPAct 1992 compliant toilets and urinals and 0.5 gpm lavatory faucets. Option 2: Comparison to FY 2003 or year thereafter: Draft water use intensity data show an increase of 1 percent between FY 2003 and FY 2008. Water use intensity was 11.08 gallons/gsf in FY 2003 and 11.19 gallons/gsf in FY 2008.
Outdoor Water	The facility does not have an in-ground or permanent irrigation system. In FY 2003, two acres of the site were converted from grass to native plant meadow, further increasing the sustainability of the site landscape. Remaining turf is not watered and is allowed to brown during dry periods.
Water Metering	A domestic water meter measures all onsite city water use. City sewer water is also metered. Flow totalizing meters are also installed on many of the major subsystem flows.
Stormwater Management	Stormwater runoff from the site flows into the onsite creek which discharges to Lake Superior, either directly or first through a small pond on the western portion of the site and then into the creek. Conveyance of runoff is achieved through overland flow and through a limited number of stormwater pipes in the parking areas and from roof downspouts. Porous pavers have been installed on various pathways and sidewalks on site.
Process Water	Potable water is not used to improve the facility’s energy efficiency at the expense of water efficiency.
Water-Efficient Products	Green procurement and affirmative procurement training materials include information on water-efficient and WaterSense products. About half the facility’s sanitary fixtures are older, high flow models, and about half are EPAct 1992-compliant toilets and urinals and 0.5 gpm faucets. Showerheads throughout the facility are EPAct compliant. The facility has a water-cooled ice maker in the mechanical room. The facility will consider the cost-effectiveness of replacing non-efficient equipment under this plan. Purchase of WaterSense-labeled products, where available, is included as part of this plan.

10.0 OPPORTUNITIES FOR FURTHER WATER CONSERVATION

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

1) Replace toilets and urinals with high-efficiency models and retrofit applicable toilets to dual flush. MED will consider replacing originally-installed toilets and urinals with high-efficiency models (dual-flush toilets (1.6 gpf and 1.1 gpf flushing options) and 0.25 gpf or less urinals). Up to 13 toilets and five urinals could be upgraded. At an installed cost of $1,000 per fixture, simple payback on each fixture upgraded is approximately four to six years at current water and sewer rates. Total annual savings are projected to be 309,000 gallons and $3,100 from the toilets and urinals replacement project.

In addition, MED will consider retrofitting eight 1.6 gpf toilets equipped with flushing handles with dual-flush handles that offer a 1.1 gpf flushing option. Dual-flush handle retrofits are estimated at $75 per handle. Total annual savings are projected to be 11,000 gallons and $100, with a payback period of approximately six years.

2) Retrofit faucets to high-efficiency. MED will consider replacing or retrofitting the remaining 10 2.0 gpm or higher faucets to flow at 0.5 gpm. This project could save 25,000 gallons and $380 per year.

3) Eliminate Single-Pass Cooling. Single-pass cooling is currently applied to the ice maker in the mechanical room. MED will consider replacing the ice maker with an air-cooled model, such as the Scotsman AFE400A-1H. With an equipment cost of $3,500, payback on the appliance would be one to two years. Potential savings from eliminating single-pass cooling on the ice maker is estimated to be 280,000 gallons and $2,800 per year.

Appendix A

WATER BALANCE SUPPORTING CALCULATIONS

Table A-1. Water Balance Supporting Calculations – FY 2008, Mid-Continent Ecology Division Laboratory, Duluth, Minnesota

Major Process	Annual Consumption (gallons)	Supporting Calculations and Source Documentation
Sanitary (main building) and miscellaneous water uses	585,000	Engineering estimate, by difference: total metered city water use minus all other calculated city water uses: 982,940 gallons – 115,000 gallons – 283,000 gallons = 584,940 gallons
Sanitary (annex)	115,000	City metered total
Ice maker cooling water (potable water ice maker)	283,000	Estimate based on 0.54 gallons/minute × 60 minutes/hour × 24 hours/day × 365 days/year = 283,824; 0.54 gallons/minutes measured reading during FY 2009 water assessment; flow is continuous
City water subtotal	983,000	City metered total (actual 982,940)
Aquatic culture water (wet lab)	18,343,000	Calculated using FY 2009 metered reading for April 2009 (1,528,619 gallons), multiplied by 12 to project to annual water use: 1,528,619 gallons/month × 12 months/year = 18,343,428 gallons/year
Research water	3,876,000	Engineering estimate, by difference from total sewered water discharge: sewered water subtotal – city water subtotal – aquatic culture water – RO permeate = research water: 23,244,848 gallons – 982,940 gallons – 18,343,000 gallons – 43,173 gallons = 3,875,735 gallons
RO permeate	43,000	Facility metered total (actual 43,173)
Sewered water subtotal	23,245,000	City metered total (actual 23,244,848)
RO reject	174,000	Engineering estimate, by difference from RO metered totals, RO make up – RO permeate = RO reject: 217,324 gallons – 43,173 gallons = 174,151 gallons
Non-contact cooling water (building and equipment cooling)	64,289,000	Engineering estimate, by difference from total lake water use: lake water subtotal – water total overflow – research water – aquatic culture water – RO permeate – RO reject water = non-contact cooling water: 98,725,000 gallons – 12,000,000 gallons – 3,876,000 gallons – 18,343,000 gallons – 43,173 gallons – 174,151 gallons = 64,288,676
Water tower overflow (to prevent freezing in winter)	12,000,000	Engineering estimate based on winter of FY 2008. Assume baseline lake water use in non-cooling season is 5,000,000 gallons per month, based on December and April data. Assume spike load for January-March over baseline is water tower overflow. 27,000,000 gallons total January-March lake water use - 15,000,000 baseline use = 12,000,000 gallons overflow.
Lake water subtotal	98,725,000	Metered total
Total water use	**99,708,000**	**Sum of lake water and city water metered subtotals**