

This is a guidance document with sample specification language intended to be inserted into project specifications on this subject as appropriate to the agency's environmental goals. Certain provisions, where indicated, are required for U.S. federal agency projects. Sample specification language is numbered to clearly distinguish it from advisory or discussion material. Each sample is preceded by identification of the typical location in a specification section where it would appear using the SectionFormat™ of the Construction Specifications Institute; the six digit section number cited is per CSI Masterformat™ 2004 and the five digit section number cited parenthetically is per CSI Masterformat™ 1995.

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SECTION 44 40 10 (SECTION 11202) – WATER REUSE SYSTEMS

SPECIFIER NOTE:

resource management: Water reuse offers a climate independent water source that is locally-controlled and generally beneficial to the environment. Water reuse allows communities to become less dependent on groundwater and surface water sources and can decrease the diversion of water from sensitive ecosystems. Additionally, water reuse may reduce the nutrient loads from wastewater discharges into waterways, thereby reducing and preventing pollution.

toxicity/IEQ: Through the natural water cycle, the earth has recycled and reused water for millions of years. Water utilities use technology to speed up these natural processes. Utilities generally describe the various stages of treatment rather than the technologies utilized when referring to water quality, as there are multiple treatment techniques for achieving essentially the same result. Generally speaking, the four core stages of treatment are: Primary Treatment, Secondary Treatment, Tertiary or Advanced Treatment, and Disinfection.

Reclaimed water is highly engineered for safety and reliability so that the quality of reclaimed water is more predictable than many existing surface and groundwater sources. Reclaimed water is considered safe when appropriately used. Although reclaimed water is of very high quality, it is not used directly for drinking water in the United States.

Reclaimed water is often distributed with a dual piping network that keeps reclaimed water pipes completely separate from potable water pipes. In the United States, reclaimed water is always distributed in lavender (light purple) pipes to distinguish it from potable water.

performance: Within the federal sector, it is estimated that expenditures for water and sewer services reach up to \$1 billion annually. Further, it is estimated that through moderate gains in water efficiency the federal government could save as much as \$240 million per year. Water savings at these levels, approximately 40%, could provide enough water to supply a population of approximately 1.8 million.

Water reuse is a proven technology that has been used for more than 40 years across the U.S. Reclaimed water can be used in numerous applications to satisfy most water demands, depending on the level of treatment. The water is treated to meet regulatory guidelines for the intended end use. Typical uses for reclaimed water include:

- Irrigation
- Groundwater recharge
- Industrial cooling processes
- Toilet flushing
- Vehicle washing

The US Environmental Protection Agency regulates many aspects of wastewater treatment and drinking water quality, and the majority of states in the US have established criteria or guidelines for the beneficial use of reclaimed water. In 2004, EPA developed a technical document entitled "Guidelines for Water Reuse," which contains such information as a summary of state requirements, and guidelines for the treatment and uses of recycled water. EPA/625/R-92/004; <http://www.epa.gov/region09/water/recycling/>

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes water reuse systems for:
 - 1. municipal-supplied reclaimed water
 - 2. in situ water reclamation
 - a. rain water
 - b. gray water
 - c. black water

SPECIFIER NOTE:

Coordinate requirements specified under this section with work specified under related sections. Edit below to suit project.

- B. Related Sections:
 - 1. 01 41 00 (01411) Regulatory Requirements
 - 2. 33 16 20 (11201) Rainwater Harvesting

1.2 DEFINITIONS

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114 and as specified herein.
- B. Definitions pertaining to water reuse: As defined in ASTM E2635 and as specified herein.
- C. Black water: untreated wastewater from urinals and water closets.
- D. Gray water: untreated wastewater from bathtubs, showers, bathroom wash basins, clothes washing machines, and laundry tubs. It may also include condensation pan water from refrigeration equipment and air-conditioners, hot tub drain water, pond and fountain drain water, and cistern drain water.
- E. Reclaimed water: Water that is used more than one time before it passes back into the natural water cycle. Reclaimed water is considered nonpotable but may be highly treated and used for approved purposes other than drinking water.
- F. Recycled water: See reclaimed water.
- G. Water reuse: cycling water one or more times for beneficial use as reclaimed water.

1.3 SUBMITTALS

- A. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

SPECIFIER NOTE:

USGBC-LEED™ v3 includes credit for water use reduction and innovative wastewater technologies, including water reuse.

Federal Water Efficiency Best Management Practices (BMPs) provide guidance for water efficient facility design, construction, and operation.

http://www1.eere.energy.gov/femp/program/waterefficiency_bmp.html

According to FEMP BMP #14, "Many Federal facilities may have water uses that can be met with non-potable water from alternate water sources. Potentially available alternative water sources for Federal sources include municipal-supplied reclaimed water, treated gray water from on-site sanitary sources, and storm water."

FEMP originally developed the BMPs in response to EO 13123 requirements, which required Federal agencies to reduce water use through cost-effective water efficiency improvements. EO 13423 supersedes EO 13123. To account for the superseded requirement changes, water use patterns, and advancing technologies, the Environmental Protection Agency's WaterSense Office updated the original BMPs.

1. Water efficiency:
 - a. Indicate water reuse rates in gallons per day (gpd) per unit for the following:
 - 1) municipal-supplied reclaimed water
 - 2) in situ water reclamation
 - b. Water Budget: Submit water budget statement; **[include calculations used in development of water budget]**. Indicate how approved water budget increases water efficiency over baseline; and, indicate how water reuse system(s) complies with approved water budget.
 - 1) Baseline: Calculate baseline water budget using occupancy rate and **[EPA 1992 standards for water fixtures] [xxxx]**.

B. Designer/Installer Qualifications.

1.4 QUALITY ASSURANCE

SPECIFIER NOTE:

The National Environmental Services Center (NESC) assists small and rural communities with their drinking water, wastewater, environmental training, infrastructure resilience, and utility management needs and helps them find solutions to problems they face. The NESC provides a database of Onsite Wastewater Regulations and System Resources; refer to http://www.nesc.wvu.edu/subpages/onsite_systems.cfm

Gray water is regulated locally. An example of best practices is the Arizona gray water regulations which use a three-tiered system.

Tier 1 - Reclaimed Water General Permit allows private residential direct reuse of gray water for a flow of less than 400 gallons per day if certain conditions limiting human contact with the gray water are met.

Tier 2 - Systems that process over 400 gpd, don't meet the list of requirements, and/or commercial, multi-family, and institutional systems require a standard permit under the second tier.

Tier 3 - Systems over 3,000 gpd are given attention by regulators on an individual basis.

The National Database of Water Reuse Facilities is a comprehensive web database of U.S. water reuse facilities and programs. The database is segregated into key topic areas including Utilities, Facilities, Treatment Technologies, and End Use with the capability to query information by individual states as well as nationwide. <http://watereuse.org/info/nwrdb>

The International Plumbing Code 2009 includes an Appendix on Gray Water Systems for flushing of water closets and urinals and subsurface landscape irrigation.

- A. Regulatory Requirements: Conform to **[the International Plumbing Code and]** applicable codes, rules, and regulations.
- B. Designer/Installer Qualifications: For work of this Section, engage an experienced licensed plumbing contractor who has specialized in systems similar to those required for this Project and with a record of successful in-service performance. Contractor shall:
 1. have a minimum **[3] [5] [xxxx]** years experience designing, constructing, and installing water reuse systems similar to requirements for this Project.
- C. Pre-Installation Meetings:
 1. Convene a pre-installation meeting minimum one week prior to commencing work of this Section.

2. Require attendance of parties directly affecting Work of this Section.
 - a. Coordinate with installation of plumbing fixtures, equipment, and piping.
 - b. Coordinate with rainwater harvesting system.
 - c. Coordinate with municipal supplier.
 3. Review conditions of operations, procedures and coordination with related Work.
 4. Agenda:
 - a. Tour, inspect, and discuss conditions of work.
 - b. Review installation schedule.
 - c. Review required permits and inspections.
 - d. Review monitoring and maintenance.
 - e. Review environmental procedures.
- D. Operation and Maintenance Manuals Submittals:
1. Instructions indicating procedures for routine operation and maintenance of the water reuse system(s) as appropriate to:
 - a. municipal-supplied reclaimed water
 - b. in situ water reclamation utilizing:
 - 1) rain water
 - 2) gray water
 - 3) black water
 2. Instructions indicating procedures for normal and peak loading conditions, and periods of shutdown.
 - a. Peak loading conditions shall include peak hydraulic loading and pollutant loading conditions.
 - b. Periods of shutdown shall include: power failures, equipment failure, and normal maintenance shutdowns.
 3. Instructions indicating procedures for emergency response in the event of a failure of the system.

1.4 MONITORING AND MAINTENANCE

- A. Provide regular maintenance for minimum one year from date of **[Substantial Completion] [initial acceptance] [xxxx]**.
1. Monitor system **[daily] [weekly] [monthly] [quarterly] [xxxx]** to assess performance.
 - a. Verify components are adjusted and functioning properly.
 - b. Verify water quality is satisfactory for intended use. If in situ water reuse systems are used, monitor and test water quality in accordance with ASTM E2635.
 - c. Verify water reuse rate is consistent with water budget.
 2. Make minor adjustments, if any, as necessary.
 3. Document system performance including:
 - a. Rate and amount of water reuse.
 - b. Quality of reclaimed water. If in situ water reuse systems are used, document quality of reclaim water before and after treatment.
 - c. Adjustments, if any, to system.
 4. Provide recommendations for improvements to the system.

PART 2 - PRODUCTS

SPECIFIER NOTE:

EO 13423 includes requirements for Federal Agencies to use "sustainable environmental practices, including acquisition of biobased, environmentally preferable, energy-efficient, water-efficient, and recycled-content products"

EO 13423 directs Federal Agencies "... beginning in FY 2008, reduce water consumption intensity, relative to the baseline of ... year 2007 ... by 2 percent annually through the end of fiscal year 2015 or 16 percent by the end of fiscal year 2015"

Specifically, under the Sustainable Building requirements per Guiding Principle #3 Protect and Conserve Water, EO 13423 directs Federal agencies to "Use water efficient landscape and irrigation strategies, including water reuse and recycling, to reduce outdoor potable water consumption by a minimum of 50 percent over that consumed by conventional means (plant species and plant densities)."

Executive Order 13514; *Federal Leadership in Environmental, Energy, and Economic Performance*; was signed on October 5, 2009. <http://www.ofee.gov/execorders.asp> It expands upon the energy reduction and environmental performance requirements of EO 13423.

http://www1.eere.energy.gov/femp/regulations/printable_versions/eo13423.html

EO 13514 sets numerous Federal requirements in several areas, including:

- Reducing potable water consumption intensity 2% annually through fiscal year 2020, or 26% by the end of fiscal year 2020, relative to a fiscal year 2007 baseline.
- Reducing agency industrial, landscaping, and agricultural water consumption 2% annually, or 20% by the end of fiscal year 2020, relative to a fiscal year 2010 baseline.
- Identifying, promoting, and implementing water reuse strategies consistent with state law that reduce potable water consumption.

2.1 WATER REUSE SYSTEM

SPECIFIER NOTE:

GSA developed guidelines for water conservation in buildings. The guidelines, *Water Management: A Comprehensive Approach for Facilities Managers*, include a chapter describing basic design components of onsite wastewater recycling, reclaimed water, and rainwater harvesting.

http://www.gsa.gov/gsa/cm_attachments/GSA_DOCUMENT/waterguide_new_R2E-c-t-r_0Z5RDZ-i34K-pR.pdf

- A. General:
1. Provide system design with easy access for effective monitoring program and for effective maintenance and process control program.
 2. Provide dual distribution systems to prevent cross-connections of reclaimed water and potable water lines and the misuse of reclaimed water.
 - a. Marking: Clearly mark distribution piping and use lavender (light purple) pipes to distinguish it from potable water. Provide piping certified and labeled "NSF-rw" in accordance with NSF Pipe Certification for Reclaimed Water End Use protocols.
 - [b. Dye gray water blue or green with a food-grade vegetable dye.]**
 3. Provide backflow prevention devices on reclaimed water lines to preclude the likelihood of incidental human misuse.

SPECIFIER NOTE:

Municipal supplied reclaimed water has been treated and recycled for non-potable use. This water is often available at a significantly lower rate than potable water; however, use of reclaimed water may be restricted by local codes.

Traditionally, centralized municipal sewage treatment facilities have been the primary source of water disposal for Federal facilities. However, heightened concerns about water supply availability have encouraged facility managers to consider on-site recycling of wastewater or gray water.

- B. Municipal-supplied reclaimed water:
1. Provide system design so that the pressure of reclaimed water 10 psi lower than potable water mains to prevent backflow and siphonage in case of accidental cross-connection.
 2. Run reclaimed water mains at least 12 inches lower in elevation than potable water mains and horizontally at least five feet away.

3. Review the quality of reclaimed water to ensure there will be no harmful effects, such as salt buildup, to piping or equipment from long-term use. Adjust design as necessary.

SPECIFIER NOTE:

ASTM E2635, Standard Practice for Water Conservation in Buildings Through In-Situ Water Reclamation, specifies parameters for substituting reclaimed water in place of potable water supplies where potable water quality is not required.

- C. In situ water reclamation: Comply with requirements of ASTM E2635 and as follows:
 1. Water reclamation system shall be designed and implemented to provide for reliability and redundancy. System design shall take into account operations and treatment during normal and peak loading conditions, and periods of shutdown.
 2. Source water: Water captured from one or more of the following:
 - a. rain water, including snowmelt and stormwater runoff.
 - b. gray water
 - c. black water

PART 3 - EXECUTION

3.X FIELD QUALITY CONTROL

- A. Water: Coordinate with work specified in Section 01 57 19.13 (01354) – Environmental Management to provide water monitoring for surface and groundwater.
- B. Field Inspection: Verify installation conforms with approved system design and applicable codes, rules, and regulations.
 1. Confirm the reclaim water is disinfected by an approved method that employs one or more disinfectants such as chlorine, iodine, or ozone.
 2. Confirm the distribution piping and reservoirs are identified as containing nonpotable water.
 - [3. Confirm the gray water is dyed blue or green with a food-grade vegetable dye.]**

END OF SECTION