DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CIVIL ENGINEER SUPPORT AGENCY

OCT 25 2002

FROM: HQ AFCESA/CESC
139 Barnes Drive, Suite 1
Tyndall AFB FL 32403-5319

SUBJECT: **Engineering Technical Letter (ETL) 02-17: Use of Non-Potable Water To Replace Potable Water**

1. Purpose. This ETL provides the technical requirements for using non-potable water (reclaimed wastewater, gray water, captured rainwater) to replace potable water in Air Force facilities. The requirements in this ETL do not apply to the use of non-potable well water, non-potable water used for fire protection, closed-loop water-recycling systems, or non-potable surface water used for cooling, industrial processes, or irrigation.

Note: The requirements of this ETL apply to all reclaimed water systems, gray water systems, and rainwater systems that have not reached 35% design stage as of the date of this ETL.

2. Application: Applies to all Air Force facilities (continental United States [CONUS] and overseas), regardless of fund source.

2.1. Authority: Air Force Instruction (AFI) 32-1066, *Plumbing Systems*.

2.2. Effective Date: Immediately.

2.3. Ultimate Recipients:
- Installation civil engineer (CE) personnel
- Project managers (PM)
- Design consultants
- Design agents

2.4. Coordination:
- Office of the Air Force Civil Engineer, Environmental Division and Housing Division (HQ USAF/ILEV/ILEH)
- MAJCOM/CE points of contact (POC) for potable water issues
- Air Force Center for Environmental Excellence, Environmental Quality Division (HQ AFCEE/EQT)
- Air Force Medical Operations Agency, Environmental and Occupational Health Division (AFMOA/SGZE)
- Air Force Institute for Environment, Safety and Health Risk Analysis, Environmental Analysis Division (AFIERA/RSE)

3. References:

3.1. Public Law (PL):

- Safe Drinking Water Act, PL 93-523 (including amendments)
- Clean Water Act (Water Pollution Control Act), PL 845 (including amendments)

3.2. Air Force:

- AFI 32-1066, *Plumbing Systems*, available at http://www.e-publishing.af.mil/.
- Technical Order [T.O.] 1-1-691, *Aircraft Weapons Systems - Cleaning and Corrosion Control*, available at https://www.toindex-s.wpafb.af.mil/.

3.3. Private Industry:

- Uniform Plumbing Code (UPC), published by the International Association of Plumbing and Mechanical Officials, 2001 Walnut Drive South, Walnut, CA 91789-2825, http://www.iapmo.org/.
- International Plumbing Code (IPC), published by International Code Council, 5203 Leesburg Pike Suite 708, Falls Church, VA, 22041-3401, http://www.intlcode.org/.

4. Acronyms:

AFI	- Air Force Instruction
AFIERA/RSE	- Air Force Institute for Environment, Safety and Health Risk Analysis, Environmental Analysis Division
AFMOA/SGZE	- Air Force Medical Operations Agency, Environmental and Occupational Health Division
BEF	- Bioenvironmental Flight
CE	- Civil Engineer
CONUS	- continental United States
ETL	- Engineering Technical Letter
HQ AFCEE/EQT	- Air Force Center for Environmental Excellence, Environmental Quality Division
HQ USAF/ILEH	- Office of the Air Force Civil Engineer, Housing Division
HQ USAF/ILEV	- Office of the Air Force Civil Engineer, Environmental Division
IPC	- International Plumbing Code
MAJCOM	- major command
MFH	- military family housing
PM	- project manager
POC	- point of contact
ppm	- part per million
TLF	- temporary lodging facility
T.O.	- Technical Order
UPC	- Uniform Plumbing Code

5. Definitions:

5.1. *Reclaimed water* is effluent from wastewater treatment plants following treatment to very high standards and approval for non-potable use. Treatment includes primary treatment, secondary treatment, advanced treatment, and disinfection. Treatment plants have permits, usually treat several thousand to several million gallons of water per day, are manned by trained and certified operators, and are operated in accordance with state and Federal standards. In some instances the reclaimed water may even meet many drinking water standards, but, due to public perception and regulations, is restricted to non-potable uses. In some locations reclaimed water may be referred to as "reclaimed wastewater." Some off-base providers may refer to reclaimed water as "recycled water"; however, it is important to avoid confusing reclaimed water with the Air Force definition of recycled water (see paragraph 5.4).

5.2. *Gray water* is water collected from sinks, showers/baths, and clothes washers (excluding water used to wash diapers), and excludes water from toilets, kitchen sinks, dishwashers, or any other source that includes human or food wastes. Gray water systems are small (usually limited to a single building) and normally treat and store several hundred gallons of water or less. Gray water has a high potential for contamination and its treatment and reuse must be carefully controlled.

5.3. *Rainwater* can be collected using a collection system and cisterns and used to replace potable water in various applications. While rainwater is fairly pure, it is subject to contamination by the collection system from bird droppings, animals, and chemical spills; therefore, the reuse of rainwater must be carefully controlled.

5.4. *Recycled water* is water used, collected, treated, and used again for the same purpose, typically in a closed-loop or semi-closed-loop system. An example might be an automatic car wash system where the water is collected and used for the next wash cycle (this application is not covered in this ETL). Recycled water should not be confused with reclaimed water (see paragraph 5.1).

6. Approved Uses and Requirements. All uses of non-potable water must meet all Federal, state, and local regulations. Where one of these regulations is in conflict with the requirements of this ETL, the more stringent requirement will apply. Any uses not specifically listed as approved uses for reclaimed water, gray water, and rainwater are prohibited. Always check to ensure the quality of the non-potable water (e.g., dissolved solids, salts, pH, biological nutrients) is suitable for the intended use.

6.1. Reclaimed Water.

6.1.1. Approved uses for reclaimed water include:

- Irrigation (spray, subsurface, and drip systems)
- Toilet and urinal flushing
- Cooling tower makeup
- Single-pass cooling equipment

- Decorative uses (e.g., fountains, ponds)
  Note: Use of reclaimed water for filling swimming pools or as makeup water for swimming pools is strictly prohibited.
- Vehicle and equipment washing (comply with Technical Order [T.O.] 1-1-691, *Aircraft Weapons Systems - Cleaning and Corrosion Control,* when applicable*)*
- Environmental restoration/habitat improvement
- Industrial processes

6.1.2. Reclaimed water distribution systems and use in facilities will comply with the requirements of Appendix J of the Uniform Plumbing Code (UPC). Some key requirements of Appendix J for reclaimed water systems are:

- Minimum treatment standards (Minimum treatment standards in the UPC apply only to on-base reclaimed water production where no local or state standards for reclaimed water exist. These UPC treatment standards do not apply to reclaimed water purchased from off-base sources.)
- Signs in bathrooms and equipment rooms where reclaimed water is used
- Initial and periodic inspection and cross-connection testing
- Piping and valve identification requirements
- Piping separate from the potable water system
- Prohibition of hose bibs on reclaimed water systems (See paragraph 6.1.4 of this ETL for an exception to this UPC requirement.)

Note: This list is not inclusive of all UPC requirements for reclaimed water used in Air Force systems.

6.1.3. Reclaimed water may contain higher dissolved solids, salts, and/or biological nutrients, so its use in cooling towers requires the approval of the base corrosion engineer. The use of reclaimed water in boilers is prohibited. Exception: MAJCOMs may grant waivers to allow the use of reclaimed water in boilers at total energy power plants, or where water is treated by demineralization or reverse osmosis before being used in boilers.

6.1.4. Reclaimed water may not be piped inside or connected to any military family housing (MFH) or used inside the dwelling for any purpose. Use of reclaimed water in MFH is limited to permanently installed irrigation systems; however, MAJCOMs may grant waivers to allow reclaimed water hose bibs in MFH for irrigation with portable sprinklers if the following criteria are met (see Figure 1):

- Hose bibs are located away from buildings in a below-grade valve box (more than one hose bib per valve box is allowed)
- Use-freeze-proof hose bibs if the climate dictates
- Valve box must be labeled *Reclaimed Water*
- Valve box lid must be permanently attached with a cable or hinge
- Valve box lid color must be lavender (light purple)
- Hoses, when not in use, should not be connected to reclaimed water hose bibs
- Shutoff devices (i.e., nozzles) should not be used on hoses connected to the reclaimed water system

- MAJCOMs may impose additional requirements on reclaimed water use when granting waivers for hose bibs in MFH (e.g., special hose connectors, or “quick-connect fittings”; childproof locking device on valve boxes; rules for use)

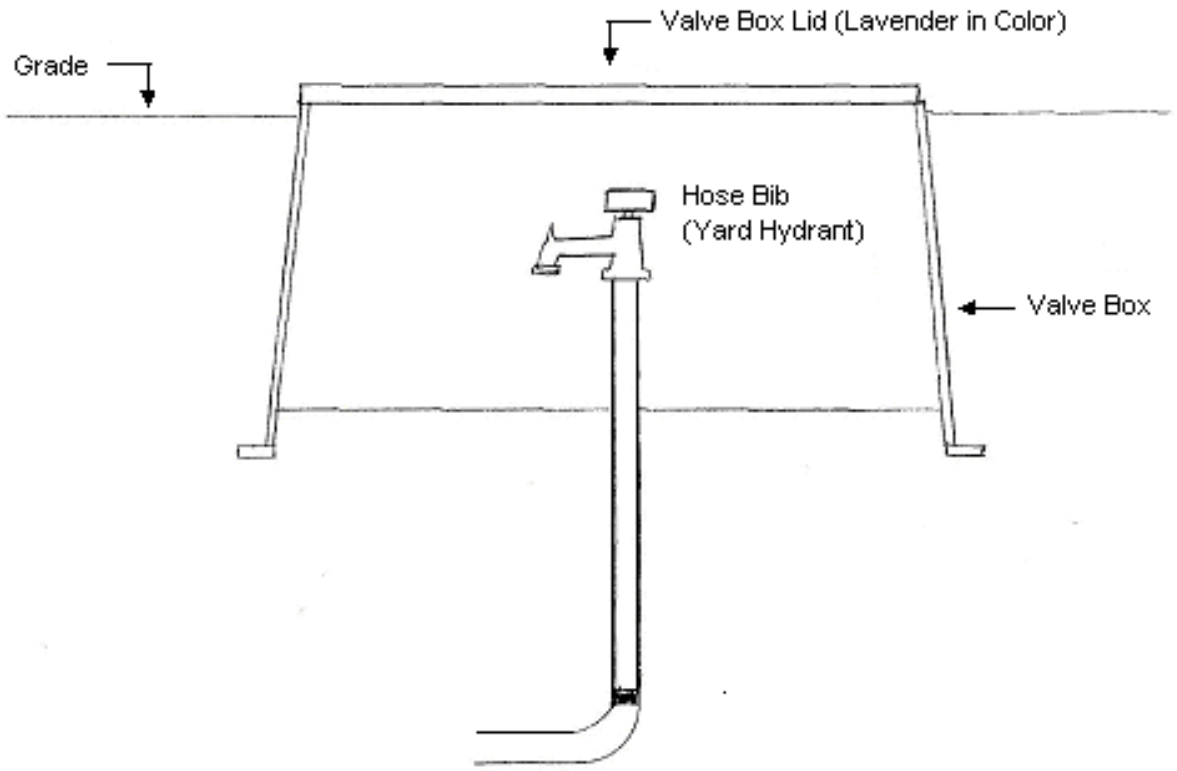

Figure 1. MFH Reclaimed Water Hose Bib

6.1.5. Potable water connections to systems, fixtures, or devices that use reclaimed water must have an approved backflow preventor.

6.1.6. When designing new facilities, consideration should be given to toilet, urinal, and irrigation system piping to allow easy conversion to reclaimed water should such a source become available in the future.

6.2. Gray Water Systems.

6.2.1. Approved uses for gray water include:
- Toilet and urinal flushing
- Subsurface irrigation only (i.e., no potential for human contact)

6.2.2. Use of gray water in facilities will comply with the requirements of Appendix C of the International Plumbing Code (IPC). (This is an exception to the requirement to comply with the UPC as mandated by AFI 32-1066.) Some key aspects of the requirements of Appendix C of the IPC are:
- Piping requirements

- Identification
- Filtration (media, sand, or diatomaceous earth filter)
- Disinfection
- Coloring (water must be dyed either blue or green before reuse)
- Makeup water supply with a backflow protection device

Note: This list is not inclusive of all IPC Appendix C requirements for gray water used in Air Force systems.

6.2.3. In addition to the IPC requirements in paragraph 6.2.2, the following requirements also apply to gray water systems:

6.2.3.1. The gray water system piping must be completely separate from the potable water system. Any potable water connection to systems, fixtures, or devices that are part of the gray water system must have an approved backflow preventor.

6.2.3.2. A cross-connection test will be performed upon installation of the system and once every two years. As a minimum, the test will consist of the following steps:

1. The potable water system will be pressurized and the gray water system depressurized for a minimum of 1 hour.
2. Each fixture and access point on the gray water system will be checked for water pressure.
3. The gray water system will be pressurized (use potable water for the initial test) and the potable water system depressurized for a minimum of 1 hour.
4. Each potable fixture in the facility will be checked for water pressure.

6.2.3.3. CE will coordinate with the base Bioenvironmental Flight (BEF) to determine if sampling for disease vectors is required for the gray water system. Sampling frequency will be at the discretion of the BEF. Based on the sample results, the system will be superchlorinated at the discretion of the bioenvironmental engineer.

6.2.3.4. The minimum residual disinfection level in the gray water storage tank will be maintained at an average 1 part per million (ppm) of free chlorine (or equivalent residual levels for other forms of disinfection); however, higher residual disinfection levels will be maintained if required by the bioenvironmental engineer.

6.2.3.5. The system will be inspected bi-weekly by CE, which includes checking residual disinfection levels, disinfection chemical supply, and dye supply.

6.2.3.6. All bathrooms using gray water will be identified with signs stating:

To Conserve Water, This Building Uses Non-Potable Water
To Flush Toilets and Urinals

6.2.3.7. Tank-type toilets flushed with gray water will be labeled:

Non-Potable Water – Do Not Drink

6.2.3.8. Gray water systems used solely for subsurface irrigation are exempt from disinfection, dyeing, and BEF sampling requirements. Holding tanks for these irrigation systems will be marked:

Gray Water Irrigation System
Danger - Unsafe Water

6.2.3.9. Gray water may not be used inside MFH, temporary lodging facilities (TLF), schools, youth centers, daycare facilities, or any other facility where significant numbers of children are present. Gray water systems in these types of facilities are limited to subsurface irrigation systems only.

6.2.3.10. Hose bibs are prohibited on gray water systems.

6.3. Captured Rainwater.

6.3.1. Approved Uses:

- Irrigation (subsurface, spray, and drip systems)
- Toilet and urinal flushing

6.3.2. System Requirements.

6.3.2.1. Vehicle parking areas or other areas subject to chemical contamination must not be used for collecting rainwater used for toilet and urinal flushing.

6.3.2.2. A cross-connection test will be performed upon installation of the system and once every two years. As a minimum the test will consist of the following steps:

1. The potable water system will be pressurized and the captured rainwater system depressurized for a minimum of 1 hour.
2. Each fixture and access point on the rainwater system will be checked for water pressure.
3. The rainwater system will be pressurized (use potable water for the initial test) and the potable water system depressurized for a minimum of 1 hour.
4. Each potable fixture in the facility will be checked for water pressure.

6.3.2.3. Piping must be identified as non-potable. Pipe and valve identification will comply with Section 608.8 of the IPC.

6.3.2.4. Water used for toilet and urinal flushing must be filtered (media filter, diatomaceous earth filter, or sand filter) and disinfected.

6.3.2.5. The system will be inspected monthly by CE, which will include checking residual disinfection levels and disinfection chemical supply.

6.3.2.6. Consider using a “roof washer” or other similar device that diverts the first few gallons of rainwater away from the storage tank. This first flush of water will remove

most of the dirt, debris, and contaminants (such as bird droppings) that may have been deposited on the collection area since the previous rain.

6.3.2.7. Systems used to flush toilets and urinals will have provisions for makeup water in case of drought. Makeup supply must be protected against backflow with an approved device.

6.3.2.8. CE will coordinate with the BEF to determine if sampling for disease vectors is required. Sampling frequency will be at the discretion of the BEF. Based on the sample results, the system will be superchlorinated at the discretion of the bioenvironmental engineer.

6.3.2.9. The minimum residual disinfection level in the rainwater storage tank will be maintained at an average 0.25 ppm of free chlorine (or equivalent residual levels for other forms of disinfection); however, higher residual disinfection levels will be maintained if required by the bioenvironmental engineer.

6.3.2.10. All bathrooms using captured rainwater will be identified with signs stating:
To Conserve Water, This Building Uses Non-Potable Water
To Flush Toilets and Urinals

6.3.2.11. Tank-type toilets flushed with captured rainwater will be labeled:
Non-Potable Water – Do Not Drink

6.3.2.12. Hose bibs are prohibited on rainwater systems.

6.3.2.13. Rainwater systems used solely for irrigation and use open ponds (lined or unlined) for water storage are exempt from the sampling and disinfection requirements of this ETL. These systems also may use vehicle parking areas or other paved surfaces for water collection.

7. POC. Recommendations for improvements to this ETL are encouraged and should be furnished to: HQ AFCESA/CESC, 139 Barnes Drive, Suite 1, Tyndall AFB, 32403-5319, Attention: Mr. Michael Clawson, DSN 523-6362, (850) 283-6362, email michael.clawson@tyndall.af.mil.

MICHAEL J. COOK, Colonel, USAF
Director of Technical Support

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