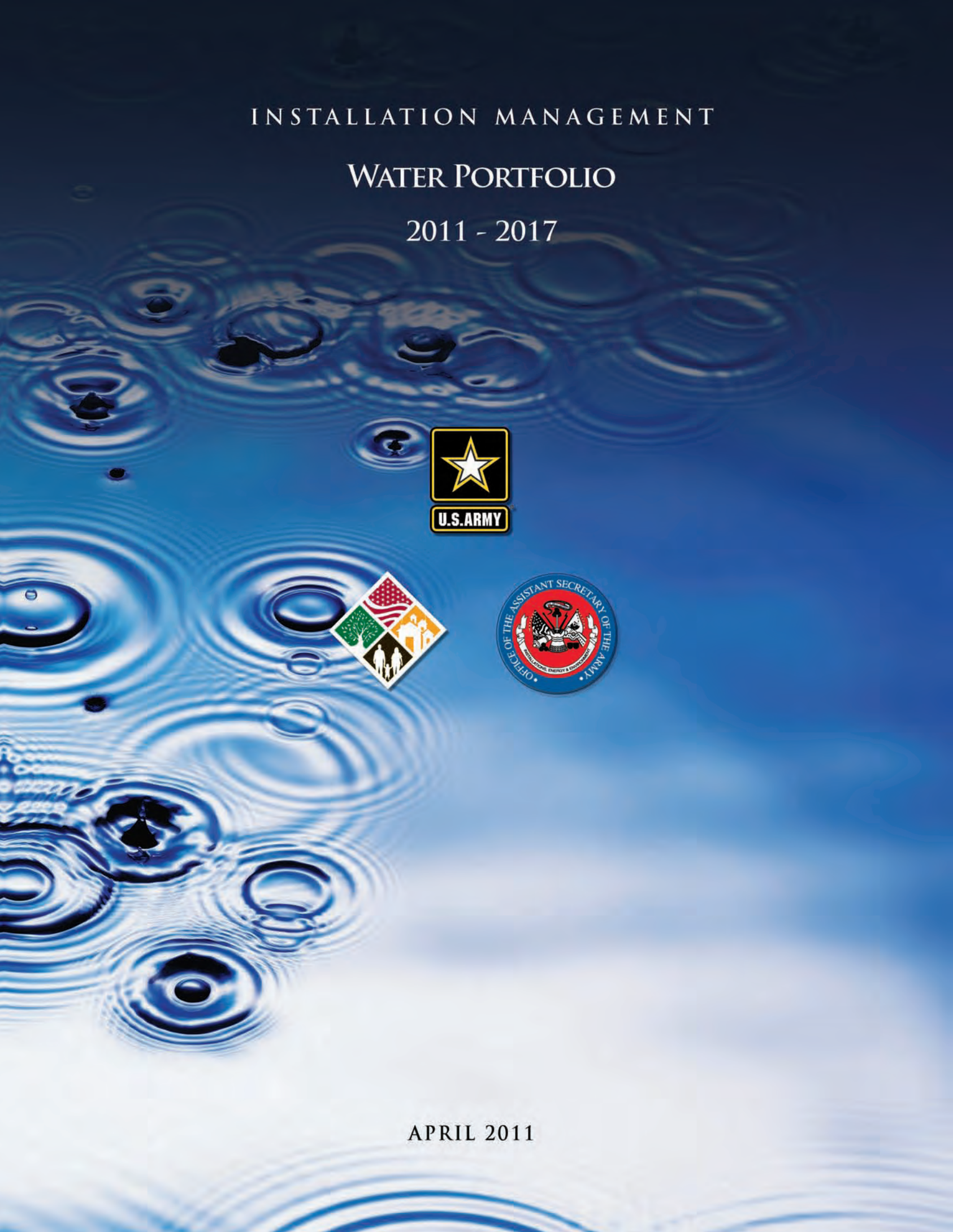
INSTALLATION MANAGEMENT

WATER PORTFOLIO

2011 - 2017



APRIL 2011

DEPARTMENT OF THE ARMY

SUBJECT: Installation Management Water Portfolio - Army Water Vision 2017

The Installation Management Water Management Portfolio is a companion to the Energy Portfolio, the Environmental Portfolio and the Army Energy Security Implementation Strategy. It also represents the vision of the entire Installation Management Community to achieve the objectives set by the Secretary of the Army to improve our Water Security posture.

The Portfolio is an overview of the Army's water management "toolbox" capabilities to be used to eliminate unnecessary consumption, increase efficiency, and expand use of recycled / reclaimed water. These actions are essential to reduce wasting of potable water, address deleterious environment effects from overstressed resources, and posture our installations to sustain operations in spite of extreme droughts, natural disasters or other disruptions. All commands are moving water programs forward with innovative installation-wide and regional planning as well as effective application of resources by making water conservation and management a consideration in all of their actions. Within the Installation Management Command (IMCOM), the Installation Management Campaign Plan is being implemented with a specific Line of Effort focused on Energy and Water which puts in motion a broad range of actions to move the Army forward by utilizing the capabilities in this Water Portfolio and the Energy Portfolio.

This Water Portfolio highlights many projects recently completed or currently underway using both conventional and innovative sources to help meet our commitment to achieve net zero water consumption, making the Army a leader in Water Management and Conservation. We strive to achieve operational security through greater efficiency in our facilities and water utility systems. The portfolio will guide us to answer three very important questions when assessing the progress of the water program at each of our installations: 1) Are we doing the right things? 2) Are we doing things right? 3) What are we missing?

This document is intended to be shared with Commanders at all levels, Defense Department, other government executives, our sister Services, enterprise partners, federal, state and local agencies, contractors, and utility providers who work with us to execute the programs and innovative solutions, securing the Army's future by utilizing all the tools, technologies, and authorities available to us.

ARMY STRONG!

Rick Lynch
Lieutenant General
Assistant Chief of Staff
for Installation Management

Katherine Hammack
Assistant Secretary of the Army
(Installations, Energy &
Environment)

ARMY WATER VISION 2017

This Portfolio embraces the Army Vision for a **"Net Zero Installation."** The vision is to appropriately manage the natural resources with a net zero strategy. To achieve a Net Zero Water Installation, efforts begin with conservation followed by efficiency in use and improved integrity of distribution systems. The vision empowers installations to seek effective and innovative solutions to ensure mission success while enhancing the quality of life for our Soldiers, Civilians and their Families. These solutions require **Leadership** to change Army culture, an **Enterprise-wide Partnership** to leverage investment opportunities combined with **Ownership** and **Accountability** for our water management decisions to serve as a model for the nation.

Net Zero Water Installation Definition:

An installation that limits the consumption of freshwater resources and returns water back to the same watershed so not to deplete the groundwater and surface water resources of that region in quantity or quality over the course of a year.

There is a correlation between freshwater consumption and installation energy usage. As an installation's freshwater demands increase, a greater quantity must be produced, treated, stored, and distributed to users resulting in a greater volume of wastewater to be collected, pumped, treated and disposed. All of these processes require energy. A net zero water installation will not reduce total energy consumption, unless the quantity of freshwater consumed is also significantly reduced. A downside of greatly reducing potable water consumption is the unintended impacts on water quality in water distribution pipe networks.

Water Management Security The Army is moving toward a water management Vision by providing guidance, prioritizing actions, identifying resource opportunities, and executing exemplary water conservation and management projects. The Army must access reliable, affordable, stable water supplies to provide safe, potable, environmentally compliant and cost-effective water services to Soldiers, Families and Civilians on installations worldwide. The disruption of critical water supplies will compromise the Army's ability to accomplish

Water Management Security

- ✓ ***SECURITY -*** Provide adequate water supplies for critical missions
- ✓ ***AVAILABILITY -*** Secure access to quality water sources
- ✓ ***AFFORDABILITY -*** Sufficient supplies at an affordable price
- ✓ ***SUSTAINABILITY -*** Promote support for the Army's mission, its community, and the environment

its missions. Such a risk exposes an Army's vulnerability that must be addressed by a more secure water management posture and outlook.

Net Zero Hierarchy Our installations must be enduring and sustainable. Reliable and secure access to water resources is essential to mission accomplishment and safety of our installations and must be a consideration in all future plans. The hydrologic or water cycle replenishes separate water resource systems at different rates, some in terms of months, others years or even decades. Installations must be stewards of their environment and natural water resources, preserving the future for tomorrow's Army. Installations will first work to reduce consumption by eliminating wasteful water usage that puts an unceasing demand on our limited resources. We will maximize the reuse or repurposing of water from rainwater and stormwater runoff, as well as HVAC system drains. Gray water systems recycle waste waters such as using sinks and showers to flush toilets or to irrigate landscaping. Energy can be recovered from water that is of higher or lower water temperature and used to pre-temper incoming water streams before water is disposed of or re-injected into the aquifer; it should have had several productive uses.

With our efficiency at its best, we will reduce as much as possible our dependency on the limited and stressed potable water sources. To meet these challenges, we will continue to execute programs that recognize water as a strategic resource. We have both the opportunity and obligation to address installation water resources. Enhancing water conservation and management is a basic responsibility of every Army Soldier and Civilian. Success depends on individual and organizational accountability for improved performance through implementation of solutions to meet today's water security challenges. Changing our behavior is central to success.

FUNDAMENTALS

Are we doing the right things?
This first fundamental question has everything to do with being a leader with strong character. Organizations and well-intentioned individuals throughout the Army are working to meet water conservation and water management mandates of executive orders, public law and Secretary of the Army's intent. However, we must also focus on the Army's unique water security requirements. Are we implementing the right water security actions and are we getting the appropriate value out of our installation Water Programs? Due to current energy and water management legislation, the water conservation requirements for the Army have increased with net zero being our ultimate goal. We must get out in front of the water conservation requirements process and focus on projects that provide the most value and return on investment for the Army.

Are we doing things right?
We must have an integrated approach that addresses water conservation and management without degrading water quality. At the same time, we must place greater emphasis on efficiently reducing our inventory of excess facilities and expanding potable and non-potable water sources to improve our water security posture. Are we developing an integrated holistic approach as we move toward improving our water management posture? We must make use of all available resources within the Army and capitalize on third-party funding opportunities, when proven to be cost-effective to the Army. To be doing things right, we must look beyond the first dollar cost of items and keep the emphasis on maximizing lifecycle cost benefits.

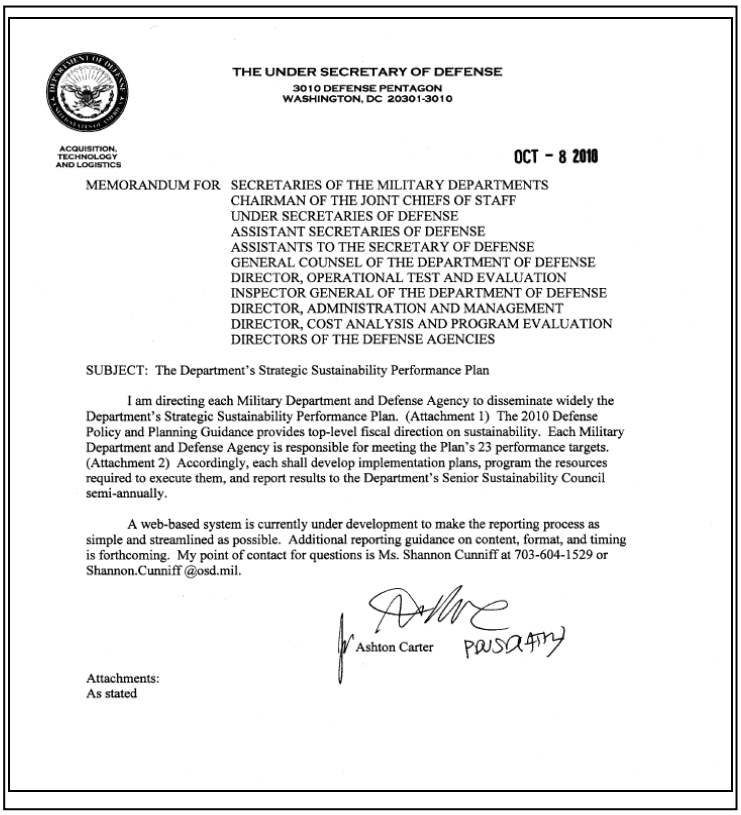
What are we missing?
Periodically, we should take a step back and think about what else we should do that is not being done already to improve our water security posture. Installations must identify viable water conservation, water efficiency, and water management projects, new approaches, and innovative funding solutions to maximize benefits to the Army. Effective and responsible leaders at all levels must ask these three questions so that we can better manage limited resources and reinforce the things that are being done well. With increased decision making opportunities at all levels, we can make a difference. Let's all take responsibility for improving our installation water security plans and the Installation Management Community.

CONTENTS

DEFENSE WATER GUIDANCE

Department of Defense Strategic Sustainability Performance Plan (SSPP)
The Under Secretary's 8 Oct 10 memo directed each Military Department and Defense Agency to disseminate the SSPP widely; review the 2010 Defense Policy and Planning Guidance for fiscal direction; to take responsibility for meeting the Plan's performance targets for water conservation; develop implementation plans, program resources to execute, and report results to the Senior Sustainability Council semi-annually, using the web-based Strategic Management System (SMS).

The SSPP lays out goals and performance expectations for the next 10-years and establishes a way forward. Sustainability is critical to DoD's mission. The DoD sustainability vision is to maintain the ability to operate into the future without decline in either the mission or in the natural or built infrastructure to support it.



THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

ACQUISITION, TECHNOLOGY AND LOGISTICS

OCT - 8 2010

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARIES OF DEFENSE
ASSISTANT SECRETARIES OF DEFENSE
ASSISTANTS TO THE SECRETARY OF DEFENSE
GENERAL COUNSEL OF THE DEPARTMENT OF DEFENSE
DIRECTOR, OPERATIONAL TEST AND EVALUATION
INSPECTOR GENERAL OF THE DEPARTMENT OF DEFENSE
DIRECTOR, ADMINISTRATION AND MANAGEMENT
DIRECTOR, COST ANALYSIS AND PROGRAM EVALUATION
DIRECTORS OF THE DEFENSE AGENCIES

SUBJECT: The Department's Strategic Sustainability Performance Plan

I am directing each Military Department and Defense Agency to disseminate widely the Department's Strategic Sustainability Performance Plan. (Attachment 1) The 2010 Defense Policy and Planning Guidance provides top-level fiscal direction on sustainability. Each Military Department and Defense Agency is responsible for meeting the Plan's 23 performance targets. (Attachment 2) Accordingly, each shall develop implementation plans, program the resources required to execute them, and report results to the Department's Senior Sustainability Council semi-annually.

A web-based system is currently under development to make the reporting process as simple and streamlined as possible. Additional reporting guidance on content, format, and timing is forthcoming. My point of contact for questions is Ms. Shannon Cunniff at 703-604-1529 or Shannon.Cunniff @osd.mil.

Ashton Carter

Attachments:
As stated

The delivery of potable water to the war fighter in theaters of operation come with a high costs in human and financial terms. The delivery of potable water to enduring installations cannot compare in terms of risk to life and limb, but the need to be mindful of wasteful uses of water shouldn't be any less whether on Fort Hood, Texas or a Forward Operating Base in Afghanistan.

The SSPP (http://www.acq.osd.mil/ie/) spanning the period 2010 – 2020, was developed to comply with requirements of E.O. 13514 and beyond. The plan embraces a wide range of sustainability factors, including water efficiency and reclaimed water.

The SSPP's Goal #2 – Water Resources Management Improvement has three sub-goals: a) Facility Potable Water Use, b) Irrigation & Industrial Water Use, and c) Storm Water Management (Shared with Environment).

ARMY WATER GUIDANCE

Secretary of the Army issued the *Army Energy Security Implementation Strategy (AESIS)* on January 13, 2009. The AESIS addresses the Army's energy and water security challenges through newly established central leadership and five integrated goal-driven energy activities. These goals implicitly incorporate the fundamental principle that the improvements achieved shall enhance our operational capability to ensure the ability of the Army to carry out its primary missions.

Water Security Mission

Make water a consideration in all Army activities in an effort to reduce demand, increase efficiency, seek alternative sources, and create a culture of water accountability while sustaining or enhancing operational capabilities.

IMCOM Energy Efficiency and Security Line of Effort (LOE) #6:

KEYS TO SUCCESS

1. Measure and reduce energy and water consumption
2. Increase energy and water efficiency and modernized infrastructure
3. Improve development of renewable and alternative energy, and access to energy and water supplies
4. Improve development of renewable and alternative energy for vehicle fleet mobility fuel
5. Reduce carbon "bootprint" on the environment

The Installation Management Command (IMCOM) has developed an *Installation Management Campaign Plan (IMCP)* which establishes an integrated plan with six essential Lines of Effort to execute key Family, facility, and mission initiatives to include addressing the overall Army Energy Security Strategy. The intent of IMCOM's Campaign Plan's Line of Effort 6 is to maintain energy and water efficient installations by holding users accountable, modernizing facilities, installing new technologies, and leveraging partnerships that will provide an increased level of energy security leading to sustainable and resilient infrastructure and mission assurance.

Comprehensive Energy and Water Management Plans (CEWMP): A CEWMP is a road map for each installation to attain and comply with the various provisions and recommendations of Energy Policy Act of 2005 (EPAct), Energy Independence and Security Act of 2007 (EISA), Executive Orders (EO) 13423 and 13514, and the Army Energy Security Implementation Strategy (AESIS). CEWMPs are a planning document for energy and water sustainability at the strategic level and establish a strategy for each Installation to achieve and sustain energy management goals. This results in a standardized framework for assessing, measuring, defining and implementing current and future energy and water strategies while making broad project recommendations for energy and water sustainability. It is a process of visioning, assessment, analysis, development of plan directives, and the implementation of those directives.

MOVING TO WATER SECURITY

The Army is taking advantage of new technologies to move toward a more secure and reliable water security future. We will pursue **Alternative Water Sources** including recycled graywater, reclaimed water, desalinated water, harvested rainfall, and storm water runoff. We are implementing the **Army Metering Implementation Plan** approved to install advanced utility meters on new and existing buildings in the Army, Army Reserve and Army National Guard. When the water metering is complete, approximately 6,700 Army, Army Reserve and Army National Guard facilities at over 480 sites worldwide will have the capability to track and trend consumption, detect and repair expensive leaks, make better decisions on energy and water use, and provide a baseline for developing new energy and water projects.

We will utilize **Sustainment, Restoration, and Modernization (SRM)** funded repair and modernization projects to incorporate the full range of technologies and include building features such as water management systems, sensor-activated flushometers, ultra-low flow toilets, non-water using urinals, cooling tower water blow down reuse, and weather-sensitive irrigation system improvements. Conversion of water-cooled equipment to air-cooled machinery will also be included.

We will incorporate the most efficient and cost-effective water technologies in new **Military Construction** projects. New holistic designs will consider all aspects of water, energy, and sustainable design features and will meet or exceed statutory requirements, following ASHRAE Standard 189.1 guidelines. More importantly, these projects will save water and energy, leverage alternative water sources, and reduce the Army's long-term operating costs.

Complementing our water security efforts are Army initiatives in **Low Impact Development (LID)** for storm water management, which also impacts water consumption reduction efforts. We are also expanding our programs to implement reduced water use for irrigation, improved cycles of concentration in cooling towers, low flow faucets and other fixtures, and application of low intensity development principles consistent with statute and industry standards per American Society of Heating, Air Conditioning, and Refrigeration Engineers (ASHRAE) Standard 189.1 and other applicable standards.

BEST MANAGEMENT PRACTICES & PROJECTS TO ACHIEVE SUCCESS

Federal Water Efficiency Best Management Practices

Federal Water Efficiency Best Management Practices (BMPs) were developed in response to Executive Order (E.O.) 13123, which required Federal agencies to reduce water use through cost-effective water efficiency improvements. To account for the superseded requirement changes, water use patterns, and advancing technologies, the Environmental Protection Agency's WaterSense Office updated the original BMPs when E.O. 13423 superseded E.O. 13123.

Executive Order 13514 dated 5 October 2009 requires installations to reduce water consumption intensity by 2 percent annually through fiscal year 2020 or 26 percent by the end of fiscal year 2020 using 2007 water data as the base year. The Army has implemented Federal Water Efficiency Best Management Practices to reduce water use through life-cycle cost-effective water efficiency improvements. ASHRAE 189.1 prescribes technical performance standards for development of water measures for inside buildings and outdoor use.

Completed Army Projects and Initiatives Exemplifying Water Efficiency Best Management Practices (BMPs)

Installations are pursuing many cost-effective water projects (like those in each following BMP) in a strategic manner towards achieving water conservation and management goals. Readers are encouraged to identify what is of most benefit to their installation and to share their experiences. The projects and programs can then be aligned with the BMP that best fits:

BMP #1 - Water Management Planning

BMP #2 - Information and Education Programs

BMP #3 - Distribution System Audits, Leak Detection, and Repair

BMP #4 - Water-Efficient Landscaping

BMP #5 - Water-Efficient Irrigation

BMP #6 - Toilets and Urinals

BMP #7 - Faucets and Showerheads

BMP #8 - Boiler/Steam Systems

BMP #9 - Single-Pass Cooling Equipment

BMP #10 - Cooling Tower Management

BMP #11 - Commercial Kitchen Equipment

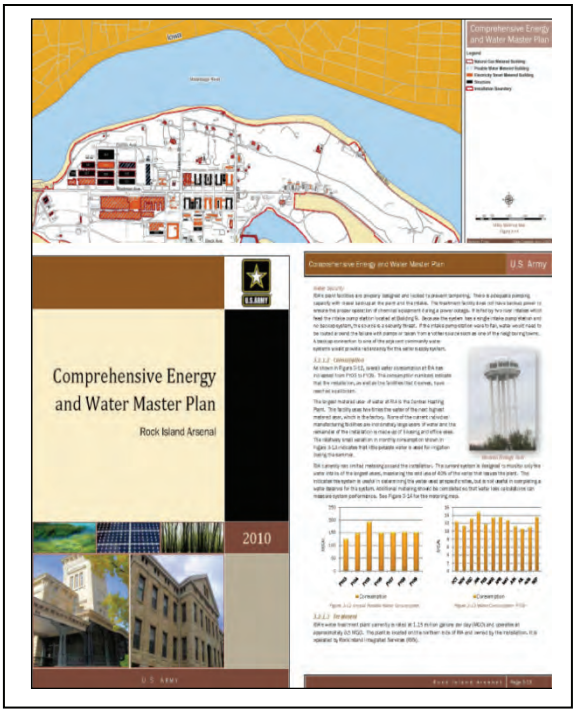
BMP #12 - Laboratory/Medical Equipment

BMP #13 - Other Water Intensive Processes

BMP #14 - Alternate Water Sources

BMP #1 – Water Management Planning

A successful water management program starts with a Water Management Plan (WMP) or a Comprehensive Energy and Water Management Plan (CEWMP)**.** CEWMP's are the road map for Installations to attain and comply with the various provisions and recommendations of Energy Policy Act of 2005 (EPAct), Energy Independence and Security Act of 2007 (EISA), Executive Order (EO) 13423 and the Army Energy Security Implementation Strategy (AESIS). CEWMPs are planning documents for energy and water sustainability at the strategic level; they establish for each Installation a strategy for achieving and sustaining energy management goals. The process is the standardized framework for assessing, measuring, defining and implementing current and future energy and water strategies and making broad project recommendations for energy and water sustainability. It is a process of visioning, assessment, analysis, development of plan directives, and the implementation of those directives.



The WMP details how the installation uses water from the source until ultimate disposal. Knowing how it's used and what it costs lets installations make appropriate water management decisions. The WMP must have specific water use reduction goals and include a water use policy statement endorsed by senior leadership.

The Army's current goals are:

- **Reduce potable** water use consumption intensity **2% annually** from a FY2007 baseline for a **total 26%** through FY2020. The Army achieved a 15.3% reduction in FY2010, exceeding the progressive reduction target of 6% by FY2010.

- Reduce **non-potable** industrial, landscape irrigation, and agricultural water use **2% annually** from a FY2010 baseline. The Army was not able to report separate industrial, landscape irrigation and any agricultural water usage for FY2010, but will for FY2011. These non-potable usages were reported as part of the FY2010 potable water consumption, as permitted by DoE/FEMP.

Additional elements of water management planning are discussed on the DOE/FEMP website (http://www1.eere.energy.gov/femp/program/waterefficiency_bmp.html).

An environmental management system (EMS) can serve as an excellent structure to establish policies and goals related to water use. Water management planning and implementation should not be separate and distinct from EMS. The approach you implement for water management should follow the "Plan, Do, Check, Act" model established under the EMS.

- **Plan**: Develop a water management plan, including establishing goals.
- **Do**: Implement the plan, including staff training and operational controls. This also includes implementation of projects identified in the opportunity assessment.
- **Check**: Measure plan implementation.
- **Act**: Review progress and update the plan as necessary.

List of Projects Exemplifying Best Management Practice #1

INSTALLATION	STATE	PROJECT DESCRIPTION
Camp Ederle	Italy	Install new water well
Camp Humphreys	Korea	Install water meters in all buildings
Camp Long	Korea	Replace water meter at water treatment plant
Carlisle Barracks	PA	Evaluate water treatment and distribution system for improvements
Fort Hamilton	NY	Install advance water meters post-wide
Fort Huachuca	AZ	Install water meters for recharge basin flow measurements
Fort Huachuca	AZ	Calibrate water well meters for flow usage
Fort Huachuca	AZ	Repair water system controls
Fort Meade	MD	Replace water well
Fort Sam Houston	TX	Repair water system controls
McAlester AAP	OK	Water Resource Management & Supply Contingency Plan: Describe & evaluate water supply system under various conditions; develop contingency plans - respond to system failures (age, natural and manmade disasters)
Roman Way Village	Italy	Inspect and report condition of rainwater lines

BMP #2 - Information and Education Programs

A public awareness and education program is essential to ensure that the users of new or retro-fitted water efficiency technologies are informed about the installation and taught how to use them properly. A positive opinion about the installation's water conservation efforts by the residents and employees is a good news story that the media is interested in reporting about. An installation should have an internal and external information and education program.

Key components of an internal information program:

- A hotline or other communication system to report water leaks or other energy wastes. Provide repair feedback promptly to encourage continued participation.
- Publicity about the installation's commitment to water efficiency, improvements, and program successes in a water conservation column in the Post newspaper.
- Information sharing with employees on how water is used and how it is used for each application. This lets employee know how they can reduce water use.
- Signage near new equipment informing about the new technology and how to use it properly.
- A suggestion and incentive system to recognize and encourage water conservation.
- Training workshops for implementing water efficiency best management practices. Train the trainer programs to monitor and communicate progress.

External information program elements:

- Work with local utilities and communities to develop comprehensive programs and to share successes with others.
- Invite local media to tour the installation to see first-hand the water efficiency program and achieved successes.
- Create exhibits and other display items presenting the installation water efficiency and savings for posting in public spaces, community activity areas, and installation main access points.
- Make use of Internet websites, brochures, and other materials to employees and the public at large describing the water program, goals, and successes.

List of Projects Exemplifying Best Management Practice #2

INSTALLATION	STATE	PROJECT DESCRIPTION
Fort Huachuca	AZ	Public outreach program, presentations, displays, and publicity from program educators reached about 1,000 military and civilian personnel in FY2010.

BMP #3- Distribution System Audit, Leak Detection, & Repair

A distribution system audit, leak detection, and repair program helps the installation reduce water loss and make better use of limited water resources. An aging military installation loses more than 10% of its total water produced or purchased to system leaks or poor metering practices (e.g., under registration, reading errors, poor installation, or wear). Before developing or procuring additional water supplies, conduct a survey of the distribution systems; the benefits include:

- **Reduced water losses**: Reducing water losses stretch existing supplies to meet increasing demand, deferring construction of new water facilities such as wells, reservoirs, or treatment plants.
- **Reduced operating costs**: Repairing leaks saves money by reducing power costs to deliver water and chemical costs to treat water.
- **Increased knowledge of the distribution system**: Gain familiarity of the system –know where mains and valves are -- personnel respond faster to emergencies.
- **Reduced property damage**: Repairing system leaks prevents damage to property and safeguards public health and safety.
- **Validated justification for water management**: Routine water audits verifies production, better accountability, and validates need to reduce water losses.

O&M Tips:

To maintain water efficiency in installation water distribution systems:

- Repair leaks or replace pipes when leaks are first found. Leaks do go away.
- Develop annual distribution flushing plans to minimize water usage.
- For specific issues, consult with your network of experts: regional or headquarters engineers, experienced contractors, other Government agencies, nearby installation or base civil engineers of other Military Services.

List of Projects Exemplifying Best Management Practice #3

Tooele Army Depot, UT Leak Detection Program: A Lean Six Sigma project was created in an effort to locate and repair water line breaks. A detection device that is a result of research performed by the Tooele Team saved 12,000,000 gallons of water during FY 2008 by use of subsurface leak detection equipment to locate broken water lines. The team won the 2009 FEMP, Small Group Category. The water detection

project evaluated the water system to determine sources of excess water use or loss, and had the added benefit of reducing water usage and updating the master planning maps. Root causes validated on this project included: leaks in aged system, overflowing of cattle tanks, and fire hydrants not closed properly. The leak detection device was purchased on a credit card for less than $1,000. Annual water consumption was reduced by over 86 million gallons with a cost savings of $70,000. Tooele Army Depot currently has 5 water projects, totaling $11.4M in the planning stages.

INSTALLATION	STATE	PROJECT DESCRIPTION
Aberdeen Proving Ground	MD	Replace chill water lines (4400/4500 blk)
Aberdeen Proving Ground	MD	Repair hot water lines (4300 blk)
Aberdeen Proving Ground	MD	Replace hot water heating/chilled water lines (4400 block)
Aberdeen Proving Ground	MD	Replace water main @ Rte 24 & Trimble Rd
Adelphi Laboratory Center	MD	Replace HTW lines (bldg #106-202)
Anniston Army Depot	AL	Repair potable & fire fighting water mains in ammo area
Baumholder QM Area	Germany	Replace water distribution mains (Wetzel Housing & Baumholder Military Community)
Benjamin Franklin Village	Germany	Install backflow preventer
Blue Grass Army Depot	KY	Repair/upgrade water distribution mains, line to water tower and fire reservoir.
Camp Carroll	Korea	Replace Cast Iron water line w/ PVC
Camp Casey	Korea	Repair leaking settling tank (bldg #2344)
Camp Ederle	Italy	Upgrade drinking water treatment plant
Camp Ederle	Italy	Replace water distribution pump (bldg #52/451)
Camp Ederle	Italy	Replace steam/condensate lines (bldg #302/ 308/395
Camp Henry	Korea	Replace water supply to 5 bldgs and old/rusty hot and cold water lines (bldg #1225)
Camp Henry	Korea	Replace entire installation water system
Camp Humphreys	Korea	Replace existing water & fire distribution mains
Camp Humphreys	Korea	Replace 6” A/C raw water line w/ 8” PVC (#797)
Camp Humphreys	Korea	Install water meters
Camp Humphreys	Korea	Replace hot water supply/return lines (700 blk)
Camp Jackson	Korea	Repair 150,000 gallon water tank
Camp Red Cloud	Korea	Repair leaking branch water lines
Camp Walker	Korea	Replace galvanized water pipes with PVC
Camp Walker	Korea	Replace hot and cold water lines
Conn Barracks	Germany	Replace water mains (bldg #9 & 10)
Detroit Arsenal	MI	Replace water supply lines (bldg #200A, B & C)
Detroit Arsenal	MI	Install potable/fire fighting water main to North Post.

INSTALLATION	STATE	PROJECT DESCRIPTION
East Camp Grafenwoehr	Germany	Replace water line at Camp Aachen
Fort Benning	GA	Inspect & test backflow/cross connection
Fort Bragg	NC	Replace hot water/chilled water lines (D-3952)
Fort Bragg	NC	Replace med temp hot water (C-1928, Faith Barracks)
Fort Carson	CO	Replace various water mains (Main cantonment; #1982-2082; Prussman line)
Fort Carson	CO	Replace corroded water tank (Area M, #07900)
Fort Drum	NY	Replace 12” water mains South Post
Fort Drum	NY	Repair water tank #3
Fort Drum	NY	Replace asbestos cement & cast iron water mains
Fort Greely	AK	Install backflow preventers installation-wide
Fort Hood	TX	Replace underground hot water lines
Fort Hood	TX	Upgrade water distribution system
Fort Huachuca	AZ	Replace HW heating and CW cooling lines, south of Central energy Plant and other areas
Fort Irwin & NTC	CA	Replace heating/cooling loop distribution lines (Barracks)
Fort Knox	KY	Replace 8000LF-water main (HRC/AAR) & 3000LF (5^{th} Av/ 1^{st} Cav Reg)
Fort Knox	KY	Repair corrosion on water tower #7100
Fort Leonard Wood	MO	Replace chilled water lines (Specker Barracks)
Fort Lewis	WA	Replace heat distribution lines (3100/3200)
Fort McCoy	WI	Replace A/C & sub-standard water lines (Wells-reservoir, reservoir- storage tank, and post-wide distribution system)
Fort McCoy	WI	Replace 70-year old 12” & 16” water mains
Fort McCoy	WI	Replace water main: reservoir to hi-level tank
Fort McNair	DC	Repair / replace water distribution lines
Fort Meade	MD	Reline Clear well Tank #3 – patch cracks & recoat water treatment plant clear well
Fort Monroe	VA	Clean / repair HVAC distribution lines
Fort Polk	LA	Repair hot water/steam/chilled water lines (Central plants 1172/1628/2271 + 23 bldgs)
Fort Sam Houston	TX	Repair heat distribution lines (bldg # 2248)
Fort Sam Houston	TX	Repair chilled water lines (bldg #4594)
Fort Sam Houston	TX	Repair water system control system
Fort Sill	OK	Replace heating/cooling distribution lines (#730)
Fort Stewart	GA	Repair / replace CW distribution system pipes
Ft Myer	VA	Repair / replace water distribution lines
Grafenwoehr Trng Area	Germany	Repair water system at TAC Site 17
Longare Comm Site	Italy	Replace A/C with cast iron water lines
Longare Comm Site	Italy	Install backflow preventers

INSTALLATION	STATE	PROJECT DESCRIPTION
McAlester AAP	OK	Replace 65-year old water lines (treatment works and ammo production areas)
Picatinny Arsenal	NJ	Repair non-potable water lines; Install potable water lines (RTDE 600 area)
Redstone Arsenal	AL	Replace water mains in 8 location (Martin Rd, Patton Rd, Buxton Rd, Redstone Rd)
Retreat Center	Korea	Replace water line (1919)
Sagamihara Family Hsg	Japan	Replace potable water lines
Sierra Army Depot	CA	Repair old/leaking water system valves
Smith Barracks	Germany	Replace water & heating lines in hospital hallway (8743-8748)
Smith Barracks	Germany	Replace water main (bldg #8104 to 8125)
Sungnam Golf Course	Korea	Replace fire water distribution piping
Tobyhanna Army Depot	PA	Add water supply line (bldg #1027 to #28/29)
Tooele Army Deport	UT	Replace 2.5 mi undersized water line (bldg 1400)
Vicenza Family Housing	Italy	Replace water distribution mains
West Point (USMA)	NY	Replace 4” with 8” water line, Camp Buckner (#1585)
West Point (USMA)	NY	Repair/recoat water tank interior (B1596)
White Sands Missile Rnge	NM	Repair water storage tank (#34258)
Wiesbaden	Germany	Replace main water supply lines – north side airfield
Yongsan Garrison	Korea	Replace cast iron with PVC water mains (Areas 1500, 2300, 2680, 4364, 4600, 4815, 5500 & 7200)
Yongsan Garrison	Korea	Replace various steam heating lines
Yongsan Garrison	Korea	Replace A/C water line w/ PVC (1525)
Yongsan Garrison	Korea	Replace water lines (#5701, 5702, 5711, 5712, 5713, 5716 & 5724)

BMP #4 - Water-Efficient Landscaping

Traditional landscapes require supplemental water to thrive in most locations. Kentucky bluegrass, for example, is native to regions that receive in excess of 40 inches per year of precipitation, but it is frequently planted in areas across the country that receive much less precipitation. Irrigation must make up the difference between landscape water requirements and the natural precipitation in the area. Depending on climate, water applied outdoors may be a substantial portion of total water usage at an installation. Installations that have irrigated landscape must include exterior water uses as an important part of an overall water efficiency program. This also applies to cemeteries, golf courses, and other nontraditional landscapes. Water-efficient landscapes using native and other "climate-appropriate" materials can reduce irrigation water use by more than 50%, stand up better to drought, reduce drought loss or damage, and require less time and money to maintain.

To achieve outdoor water use efficiency:

- Utilize natural or adapted plant species that do not require irrigation.
- Design the landscape to require minimal supplemental water.
- Design, install, and maintain the irrigation system that applies the appropriate amount of supplemental water in an efficient manner (see BMP #5).
- Design and connect to a municipal gray water or non-potable system, or repurpose water (such as condensate or for a cooling tower) for irrigation.

O&M Tips:

To maintain water use efficiency thru O&M, installations should:

- Review all landscaping service contracts or in-house SOPs to incorporate a high priority for water, chemical, and energy efficiency.
- Hire landscape contractors who focus on water-efficient or climate-appropriate landscaping and ensure that contractors attend courses or seminars to learn these techniques. In-house staffs should be similarly qualified and continuously trained.
- Encourage landscape contractors, who install and maintain landscape plantings and/or the irrigation system, to report / fix leaks or landscaping inefficiencies.
- Add mulch to plant beds, which decreases water lost from soil and helps reduce weed growth. Installations can make their own mulch by grinding wood waste and unusable lumber -- do not to use treated wood because of the toxic chemicals.
- Maintain a sufficient depth of good topsoil - four to six inches - to capture storm water as it falls and to release moisture back to plants over time, reducing irrigation requirements. This would be a good use for reclaimed contaminated soil.
- Recirculate water in decorative fountains, ponds, and waterfalls. Use non-potable water in these systems, if available, and be sure to provide necessary treatment to prevent public health concerns, such as aerosolized legionella. Shut off when evaporation losses are high. Check systems regularly for leaks and other damage.
- Alternate turf mowing height between low and high levels. This encourages roots to grow deeply and allows plants to go longer between watering sessions.

- Keep irrigated landscape weed free so valuable water is consumed only by decorative landscape.
- Stop using potable water to clean sidewalks, pavements, and other hard surfaces.

List of Projects Exemplifying Best Management Practice #4

White Sands Missile Range: WSMR has successfully completed some xeriscaping projects in the recent past. **Xeriscaping** refers to landscaping and gardening in ways that reduce or eliminate the need for supplemental water from irrigation. It is promoted in regions that do not have easily accessible, plentiful, or reliable supplies of fresh water, and is gaining acceptance in other areas as climate patterns shift. In some areas, terms such as water-conserving landscapes, *drought-*

tolerant landscaping, *zeroscaping,* and *smart scaping* are used instead. Plants whose natural requirements are appropriate to the local climate are emphasized, and care is taken to avoid losing water to evaporation and run-off. The specific plants used in xeriscaping depend upon the climate. Existing grass turf for the WSMR Community Center, 12 VIP Quarters Lodging DVQ and the Main Post Chapel Island was removed and replaced with Southwestern native plants as well as colored gravel. Weekly summer watering is no longer needed.

Artificial Turf Field reduces irrigation requirements. Grass athletic fields that require irrigation are being converted to artificial turf – side impacts are lower sports injury rates and also a quality of life, as they can be used for outdoor concerts instead of the old asphalt airfield.

INSTALLATION	STATE	PROJECT DESCRIPTION
Fort Belvoir	VA	Golf Course Water Conservation / Audubon Cooperative Sanctuary Program certification: enhances natural areas and wildlife habitats, reduces irrigation from well water and chemical treatment loads on environment

BMP #5 - Water-Efficient Irrigation

Integrate water efficiency into the initial irrigation system design to ensure optimal performance. Consistent management and maintenance is essential, otherwise up to 50% of irrigation water can be lost due to evaporation, wind, poor management, and/or improper system design, installation, or maintenance.

Assuming the irrigation system hardware is operating efficiently, next consider the irrigation schedule - the amount and timing of the water applied. Watering requirements change with the seasons and so should the irrigation schedule. Watering the landscape at the same level all year is unnecessary and can cause more damage to plant materials and streets, curbs, other paving, and building foundations.

Another important efficiency associated with irrigation systems is distribution uniformity - how evenly water is applied over the landscape. When water isn't applied evenly, the landscape is watered to keep the driest spot green, grossly over-irrigating and even damaging other areas.

Personal responsible for the irrigation system should be experienced and properly trained in system installation, maintenance, and management.

O&M Tips:

To maintain water use efficiency thru O&M, installations should:

- Verify that the irrigation schedule is appropriate for climate, soil conditions, plant materials, grading, and season.
- Change the schedule based upon changing weather conditions. Require the maintenance vendor to deliver options for automating schedule changes based on changing conditions.
- Break up irrigation periods into multiple applications depending on landscape conditions, called the "cycle and soak" methodology, because certain soil types and steep slopes can increase surface runoff. Replace currently installed irrigation controllers if not capable of such programming technology.
- Water deeply and less often than frequent light watering. Deep, less frequent schedule encourages deep roots resulting in healthy, more drought-resistant plants.
- Schedule irrigation at night to minimize evaporation.
- Inspect the system to insure it is not water sidewalks or parking areas.

Retrofit and Replacement Tips:

To attain water efficiency in installation irrigation systems:

- Replace existing irrigation system controllers with a more advanced control system that waters plants only when needed:
  - ✓ Weather-based irrigation controls are an irrigation controller or device that can be added to an existing controller.
  - ✓ Add or exchange to soil-moisture-based irrigation controls that are inserted into the soil to measure moisture and prevent system from operating during rain events.
  - ✓ Have central control systems utilizing demand-based controls that enable a water manager to centrally operate and manage multiple irrigation systems.
- Retrofitting a portion of your trees, shrubs, or plant beds with low-flow, low-volume (micro or drip) irrigation. In plant beds, drip irrigation can be more efficient; it slows and directs water application to plant root zones, minimizing evaporation and runoff.
- Increase the efficiency of the system's sprinkler heads. Replace existing sprinklers heads that apply a fine mist which is mostly lost in the wind or don't apply water evenly over the landscape, with more efficient heads designed to minimize water lost to wind and distribute water in a more uniform manner.
- Install rain-sensing technology on the system to prevent irrigation during periods of sufficient moisture. Some state and local jurisdictions may require rain-sensing technology by law.
- Install wind-sensing technology to interrupt irrigation cycles in the presence of significant wind. Install freeze-sensing technology to prevent irrigation during freeze conditions.
- When replacing or installing a new irrigation system, hire a design professional and experience contractors to do the installation and maintenances. Consider for optimal water efficiency:
  - ✓ Drip/micro irrigation for all areas suitable for such technology.
  - ✓ Check valves in all sprinklers to retain water in lateral pipes between cycles.
  - ✓ Demand based irrigation controls (i.e., weather or sensor based controls).
  - ✓ Rain, freeze, and wind sensors to interrupt irrigation during unfavorable weather conditions.
  - ✓ Flow rate monitoring equipment that can interrupt irrigation if excess flow is detected, caused by broken pipes, fittings, nozzles, emitters, sprinklers, etc.).

List of Projects Exemplifying Best Management Practice #5

INSTALLATION	STATE	PROJECT DESCRIPTION
Fort Huachuca	AZ	Install effluent reuse water holding pond and pumping facilities for irrigating the golf course

BMP #6 - Toilets and Urinals

In the U.S. 4.8 billion gallons of water every day is used to flush sanitary wastes. Toilets and urinals account for nearly one-third of a building's water consumption, making the savings potential in this area significant. In relatively new or recently refurbished facilities, the toilets and urinals will meet the current water usage federal guidelines. However, in older facilities which haven't been upgraded since the mid-1990's, the chances are that those toilets and urinals are consuming much more water than the mandatory limits of 1.6 gallons per flush (gpf) and 1.0 gpf, respectively.

Non-Water Using Urinals

Urinals in Army facilities will comply with ANSI/ASHRAE/USGBC/IES Standard 189.1-2009, Standard for the Design of High-Performance Green Buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 189.1 requires urinals use no more than 0.5 gpf or are non-water using urinals.

O&M Tips:

To maintain water use efficiency thru O&M, installations should:

- Check for leaks every six months.
- Establish a user-friendly method to report leaks and fix them immediately.
- Encourage cleaning or custodial crews to report problems.
- Periodically replace flush valves and fill valves in tank-type toilets.
- When performing maintenance, replace worn parts and adjust mechanisms to ensure that the water consumed per flush meets manufacturer's specifications.
- For non-water use urinals, clean and replace the seal cartridges or material in accordance with manufacturer recommendations.
- Correctly adjust and maintain automatic sensors to ensure proper operation.

Retrofit and Replacement Tips:

To attain water efficiency in installation sanitary systems:

- Do NOT retrofit tank-type toilets with displacement dams, bags, bottles or bricks. They will cause significant problems in O&M.
- Retrofit flushometer valve type toilets with hands-free devices that automatically flush when activated by an infrared or ultrasonic sensor. These devices need to be set properly and regularly maintained to avoid multiple flushing, otherwise any savings will be lost.

- Some commercial flushometer valve type toilets (diaphragm type only) can be retrofit with a dual-flush valve capable of delivering a reduced flush or a full flush depending upon the demand (liquid waste only or solid plus liquid waste). To be fully successful, the retrofit may require significant user education and the existing bowl must be compatible with the reduced flush volume.
- Consider using non-potable water for toilet and urinal flushing (see BMP #14). Package gray water treatment systems are now available that provide water filtered and treated sufficiently for these uses. If using non-potable water for toilet and urinal flushing, monitor flapper valves and seals to determine if there is an impact on their useful life.

Dual-flush valve

- Replace older toilets with flushometer valves and bowls with high-efficiency toilets (HET) that use no more than 1.28 gpf or are dual-flush. For maximum water savings and performance, match the valve and bowl in hydraulic combinations that are compatible in their designed flushing capacity. DO NOT replace only the flushometer valve or the tank with a more efficient one.
- If replacing tank-type toilets (gravity or pressure assist), select toilets with the WaterSense label (effective flush volume of 1.28 gallons or less) and have been independently tested and certified for performance. For a list of WaterSense labeled high-efficiency tank-type toilet models, visit the WaterSense Web site. (http://www.epa.gov/WaterSense)
- Follow manufacturer's instruction for installing and maintaining waterless urinals. Do not use with copper pipes because of potential for corrosion and ensure the drain meets minimum slope. Install at least one water-using urinal at the beginning of a long run of waterless urinals to provide some flushing action. Existing waste pipes should be routed out and cleaned before replacing water-using with waterless urinals.
- In remote areas, consider replacing water-using toilets with alternative technologies such as composting or incinerator toilets, powered by an alternative or renewable energy source.

Additional information about toilets and urinals is available at the DOE/FEMP website (http://www1.eere.energy.gov/femp/program/waterefficiency_bmp.html)

List of Projects Exemplifying Best Management Practice #6

INSTALLATION	STATE	PROJECT DESCRIPTION
Camp Humphreys	Korea	Replace existing plumbing fixtures in 67 facilities with low flow type
Fort Huachuca	AZ	Installed or retro-fitted nearly 500 waterless urinals
Presidio of Monterey	CA	Installed or retro-fitted over 300 waterless urinals

BMP #7 - Faucets and Showerheads

Federal guidelines mandate that all lavatory and kitchen faucets and faucet aerators use no more than 2.2 gallons per minute (gpm), self-activating faucets discharge no more than 0.25 gallons per cycle (gpc), and that all showerheads must use no more than 2.5 gpm. Advances in technology and a differentiation between faucets intended for public verses private use provide water and energy savings potential. Only lavatory faucets intended for private use (i.e., residential housing, barracks, and other dwelling units like hotel guest rooms and hospital rooms) are eligible for USEPA's WaterSense label. The Water Sense specification for residential bathroom lavatory faucets and faucet accessories (e.g., aerators or laminar devices) set a maximum flow rate of 1.5 gpm, a 32% decrease in flow rate over Federal guidelines.


Water-saving (1.5 gpm) "Feel-good" Showerheads

To address lavatory faucets intended for public use, the American Society of Mechanical Engineers (ASME) A112.18.1, Plumbing Supply Fittings specifies that public lavatory faucets (all faucets other than those defined as private above), other than "metering faucets", must have a maximum flow rate of 0.5 gpm. The EPA WaterSense Program released a specification for showerheads requiring a maximum flow rate of no more than 2.0 gpm.

An installation that has facilities which still use older faucets and showerheads or faucets with flow rates greater than 0.5 gpm in public restrooms, face significant opportunities to save both water and energy costs. Older faucets can be retrofitted with a simple aerator insert which restricts water flow.

List of Projects Exemplifying Best Management Practice #7

INSTALLATION	STATE	PROJECT DESCRIPTION
Fort Lesley McNair	DC	Preventive maintenance flush valves, faucets, sensors & replacement of leaking valves (bldgs #59, 61 & 62)
Fort Polk	LA	Renovate treatment plant laboratories, including water-efficient fixtures
Fort Carson	CO	Upgrade water plant including new plumbing fixtures
Fort Lewis	WA	Repair non-potable water system at wastewater treatment plant, including plumbing.
Camp Humphreys	Korea	Replace existing fixtures at 67 facilities with low flow
Detroit Arsenal	MI	Install adaptors (Aerators) on existing restroom faucets

BMP #8 - Boiler/Steam Systems

Boilers and steam generators are commonly used in large or central heating systems, institutional kitchens, or in facilities where large amounts of process steam are used. This equipment consumes varying amounts of water depending on system size (boiler capacity and steam/hot water distribution network), the amount of steam used, and the amount of condensate returned.

O&M Tips:

To maintain water efficiency in O&M, installations should:

- Develop and implement a routine inspection and maintenance program to check steam traps and steam lines for leaks. Repair leaks as soon as possible.
- Develop and implement a boiler tune-up program to complete a minimum of once per operating year.
- Provide and maintain proper insulation on piping and the central storage tank.
- Properly control blowdown from boiler operations to reduce contaminant build-up. Insufficient blowdown may lead to deposits or carryover, while excessive blowdown wastes water, energy, and chemicals.
- Hire or contract for the services of a water treatment specialist to prevent system scale and corrosion and to optimize cycles of concentration. Treatment programs should include periodic checks of boiler water chemistry and a quality assurance program. For systems with significant distribution systems, include condensate chemical treatment as part of the treatment program to reduce corrosion and leaks. Include monitoring of condensate chemistry in the treatment program to detect carryover and possible condensate contamination.
- Develop and implement routine inspections and maintenance programs on condensate pumps, manholes, vaults and the distribution system. Underground metal conduits (Class A systems) generally need cathodic protection and an active testing and maintenance program.
- Regularly clean and inspect boiler water and fire tubes. Reduce scale buildup to improve heat transfer and the system energy efficiency. Maintain chemistry control so that routine cleaning and acid cleaning is not required.
- Employ an expansion tank to temper boiler blowdown drainage rather than by cold water mixing.
- Install and maintain meters on boiler system make up lines and on make-up lines to recirculating closed water loop heating systems to help detect leaks more easily.

Retrofit and Replacement Tips:

To attain water efficiency in installation boiler and steam systems:

- Install and maintain a condensate return system, which reduces water supply, chemical use, and operating costs up to 70% by recycling condensate. A condensate return system also lowers energy costs as the condensate water is already hot and needs less heating to produce steam than colder make-up water.
- Install an automatic blowdown system based on boiler water quality to better manage the treatment of boiler make-up water.
- Add an automatic chemical feed system controlled by make-up water flow.
- Optimize cycles of concentration and reduce the frequency of blowdown, by measuring an inert ion like silica or chloride in the boiler and the concentration compared to the amount in the boiler feedwater. For example, a boiler with a silica concentration of 100 parts per million (ppm) and a feedwater silica concentration of 10 ppm is considered to be carrying 10 cycles of concentration. Chlorides are used more often since they are less likely to scale and give false readings. Continuous monitoring of the ion can allow better control and adjustment of the chemical feed rate to optimize the number of blowdown cycles.
- In large scale boilers, blowdown heat exchangers are a useful technology allowing the heat contained in boiler blowdown to be transferred to boiler feed water. This also allows for the production of low pressure steam, which can be returned to the steam system or used in the de-aeration of boiler feed water.
- Perform an energy audit to reduce heating loads and ensure that the system is sized appropriately. Reducing the size of the boiler system can reduce water requirements.
- Purchase the most life-cycle cost-effective boiler available for new installations or major renovations.
- Install a small summer boiler, distributed system, or heat-capture system for reheat or dehumidification requirements instead of running a large boiler at part load to produce hot water. Consider alternative technologies such as heat pumps.

List of Projects Exemplifying Best Management Practice #8

INSTALLATION	STATE	PROJECT DESCRIPTION
Aberdeen Proving Ground	MD	Repair steam leak in steam vault near Bldg E5100
Aberdeen Proving Ground	MD	Repair/replace boiler tubes, Central Heating Plant (4404)
Aberdeen Proving Ground	MD	Replace steam & condensate lines bldg E3516-E3550
Aberdeen Proving Ground	MD	Repair failed/failing steam distribution system (bldg 359)
Aberdeen Proving Ground	MD	Replace steam and condensate lines from Waehi Rd to Bldg E1675, E1677, and E1645.
Camp Carroll	Korea	Replace leaky hot water boilers (#608/#831) and circulations pump (#8310
Camp Ederle	Italy	Replace heating lines: Olsen Ave, Youth Center, Bldg 373/109

INSTALLATION	STATE	PROJECT DESCRIPTION
Camp Ederle	Italy	Replace steam & condensate lines: PX, PO, Library, CDC, Bldg 300, 302, 308 & 395
Camp Humphreys	Korea	Install low-flow plumbing fixtures in 67 facilities.
Camp Zama	Japan	Replace corroded/leaking domestic & heating hot water lines (bldg 121 & 123)
Camp Zama	Japan	Replace corroded/leaking steam condensate lines (bldg 121 & 123)
Camp Zama	Japan	Replace corroded/leaking steam condensate lines, DPW Fire Station (bldg 238)
Camp Zama	Japan	Replace corroded/leaking steam condensate lines, Outdoor Recreation (bldg 719)
Camp Zama	Japan	Replace corroded/leaking steam condensate lines, Bldg 278 & 425
Camp Zama	Japan	Replace corroded/leaking steam condensate lines, Main branch line from Mech Rm 455 to Bldg 551
Camp Zama	Japan	Replace corroded/leaking heating& domestic HW lines, 88th MP & 41st MI
Camp Zama	Japan	Replace corroded/leaking steam supply & lines, various locations
Camp Zama, East Side	Japan	Replace corroded/leaking steam condensate lines, Main branch line from Boiler Plant (bldg 350) to Bldg 332
Camp Zama, Southeast Side	Japan	Replace corroded/leaking steam condensate lines, Main branch line from Mech Rm 455 to Bldg 742
Daumerie Caserne	Belgium	Replace central heating & distribution system with distributed NG hi-efficiency heating system.
Detroit Arsenal	MI	Replace steam & condensate lines for bldgs 200A, 200B, 200C
Fort Belvoir	VA	Replace failed central steam plant (bldg 808) & distribution piping with individual plant at Hospital for heat, hot water, process steam.
Fort Belvoir	VA	Replace failed long distance steam lines along 12th Street with central in bldg 1199 to serve various bldgs along 12th Street
Fort Benning	GA	Replace Central Boiler Plant (Bldg 397) and steam distribution system with individual heating systems in 8 buildings.
Fort Bragg	NC	Repair/replace failed steam heating system, York Theater (Bldg C-7950) with more energy/water efficient system.
Fort Bragg	NC	Repair/replace failed chilled water/hot water distribution systems, Faith Barracks Complex.
Fort Bragg	NC	Retro -commission HQ & DFAC bldg, Faith Barracks Complex; modify secondary to tertiary HW/CW piping.

INSTALLATION	STATE	PROJECT DESCRIPTION
Fort Eustis	VA	Replace failed deaerators (bldgs 587, 801, & 2701)
Fort Eustis	VA	Replace Central Heating & Cooling Plant (Bldg 801) piping and deaerator
Fort Eustis	VA	Replace steam distribution and condensate return system in 1400 block and barracks mechanical rooms
Fort Gordon	GA	Repair Central Heating / Cooling Distribution System
Fort Jackson	SC	Replace failed HW heating distribution system, Central Plant #2 to Hospital Zone.
Fort Lesley McNair	DC	Replace Central Steam Plant (#34), steam distribution & condensate return lines with decentralized heating systems
Fort Lewis	WA	Replace heat distribution lines from Central Boiler Plant in 3400 Area
Fort Monmouth	NJ	Replace central steam plant with individual gas water boilers in Bldgs B-1201, B-1202, B-1207, B-1208, B-1209, & B-1210.
Fort Polk	LA	Repair Central Energy Plants (CEP #1172/1628/2271) & Distribution Systems
Fort Story	VA	Replace Central Heating Plant w/ decentralized heating in Bldg #804/808/810/1081/1082/1083/1088
Fort Wainwright	AK	Replace leaking and failed Fiberglass Reinforced condensate pipes (MH #H4-8-6 to MH # J5-1-1)
Hohenfels Training Area, Camp Nainhof	Germany	Repair damaged & corroded primary & secondary heat distribution lines serving Bldg 16-18, 20-23, 26-28, 30, 31-38, 58, 59, & 98
Hohenfels Training Area, Camp Albertshof	Germany	Repair damaged & corroded long distance primary & secondary heat distribution lines.
Hohenfels Training Area	Germany	Replace central heating plant (TAC Site 29, bldg 980) Replace hot water distribution lines.
Kawakami Ammunition Depot	Japan	Replace corroded/leaking steam supply & lines, ammo shop and boiler
McCully Barracks	Germany	Replace underground heat distribution lines
Panzer Kaserne (multiple projects)	Germany	Central heat plant: replace steam boilers & piping with hot water system. Convert steam distribution system to hot water.
Panzer Kaserne	Germany	Replace heat distribution lines: North & South Area
Pine Bluff Arsenal	AR	Replace central steam plant and distribution system with individual water boilers in various bldgs.
Redstone Arsenal	AL	Replace condensate lines for 11 buildings
Redstone Arsenal	AL	Replace steam & condensate lines under Martin Rd at Bldg 5250
Rock Island Arsenal	IL	Heating plant (227) replace generating and side wall tubes; repair feedwater heaters

INSTALLATION	STATE	PROJECT DESCRIPTION
Sagami General Depot	Japan	Replace corroded/leaking steam supply & lines.
Sierra Army Depot	CA	Construct new treatment facility to remove manganese and iron from well water supply.
Smith Barracks	Germany	Replace long distance heating lines bldg 8306-8405
Soldier Systems Center	MA	Replace steam absorption chiller plant (bldg #67)
West Point Military Academy	NY	Repair steam lines, vaults & tunnels
Yongsan Garrison	Korea	Replace failing steam heating branch lines, various locations
Yongsan Garrison	Korea	Replace failing pipes, steam traps, expansion joints in steam manholes

BMP #9 - Single-Pass Cooling Equipment

Single-pass or once-through cooling systems provide an opportunity for significant water savings. In these systems, water is circulated once through a piece of equipment and is then disposed down the drain. Types of equipment that typically use single-pass cooling include CAT scanners, degreasers, hydraulic equipment, condensers, air compressors, welding machines, vacuum pumps, ice machines, x-ray equipment, and air conditioners.

To remove the same heat load, single-pass systems use 40 times more water than a cooling tower operated at five cycles of concentration. To maximize water savings, single-pass cooling equipment should be either modified to recirculate water or, if possible, should be eliminated altogether.

O&M Tips:

To maintain water use efficiency thru O&M, installations should:

- Provide proper insulation on piping, chiller, or storage tanks.
- Inventory cooling equipment and identify all single-pass cooling systems.
- Check entering and leaving water temperatures and flow rates to ensure they are within the manufacturer's recommendations. For maximum water savings, water flow rates should be near the minimum allowed by the manufacturer.
- Keep coil loops clean to maximize heat exchange with the refrigerated enclosure.
- Check operation of water control valve. Water control valves adjust the flow rate of water based on demand. Regular valve maintenance ensures water is used as efficiently as possible.

Retrofit and Replacement Tips:

To attain water efficiency in installation boiler and steam systems:

- Eliminate single-pass cooling by modifying equipment to operate as a closed loop to recirculate the water instead of discharging, maximize water savings.
- Add an automatic control to shut off the entire system during unoccupied night or weekend hours, if modification to a closed-loop system is not feasible, but only considered this when shutdown has no adverse impact on indoor air quality.
- Find another use for the single-pass effluent as boiler make-up supply or landscape irrigation. Do not use equipment effluent that is contaminated, such as degreasers and hydraulic equipment, especially in boilers.
- Replace the once-through cooling systems with a multi-pass cooling tower or closed loop system.
- Install a chiller as an economical alternative. Excess cooling capacity may already exist within the building that can be utilized.
- Replace water-cooled equipment with air-cooled equipment or best available energy/water-efficient technology.

List of Projects Exemplifying Best Management Practice #9

INSTALLATION	STATE	PROJECT DESCRIPTION
Adelphi Laboratory Center	MD	Replace Chiller #3, Central CW Plant, Cooling tower and Pumps
Camp Ederle	Italy	Replace Chillers at Ederle Inn (#B345) with high efficiency water cooled chiller units, include heat recovery to heat swimming pool and hot water for Inn.
Camp Ederle	Italy	Replace two main chillers at #B-302 with high efficiency chiller units.
Fort Bragg	NC	Replace Air Atomization Compressor, S COSCOM CW Plant (N-6002)
Ft Huachuca	AZ	Replace Evaporative Coolers in Ten Test Area (Bldg #55332-55338) with Air Conditioning systems. Insulate facilities
Ft Huachuca	AZ	Replace Evaporative Coolers in Thunder Mountain Activity Center (Bldg #70525) with Air Conditioning system.
Ft Huachuca	AZ	Replace Evaporative Coolers in Bldg #50010 with Air Conditioning system.
Ft Huachuca	AZ	Replace Evaporative Coolers in Bldg #41407-41408 with Air Conditioning system.
Rock Island Arsenal	IL	Replace heating plant one-pass cooling water system with recirculating system (Bldg #227)

BMP #10 - Cooling Tower Management

Cooling towers regulate temperature by dissipating heat from recirculating water used to cool chillers, air-conditioning equipment, or other process equipment. Heat is rejected from the tower primarily through evaporation. Cooling towers, by design, consume significant amounts of water. Thermal efficiency and longevity of the cooling tower and equipment used to cool depend on the proper management of water recirculated through the tower.

Water leaves a cooling tower system in any one of four ways:

- **Evaporation**: This is the primary function of the tower and is the method that transfers heat from the cooling tower system to the environment. Improving the energy efficiency of the systems being cooled will reduce the evaporative load on the tower.
- **Blowdown or bleed-off**: As water evaporates, dissolved solids (calcium, magnesium, chloride, and silica) are left behind and as the concentration of dissolved solids increases, they can cause scale to form within the system or lead to corrosion. The concentration of dissolved solids is controlled by blowdown; carefully monitoring and controlling the quantity of blowdown provides the most significant opportunity to conserve water in cooling tower operations.
- **Drift**: A small quantity of water may be carried from the tower as mist or small droplets. Drift loss is small compared to evaporation and blow-down, and is controlled with baffles and drift eliminators.
- **Basin leaks or overflows:** Properly operated towers should not have leaks or overflows.

The sum of water that is lost from the tower must be replaced by make-up water:

Make-up = Evaporation + Blowdown + Drift

A key parameter used to evaluate cooling tower operation is "cycles of concentration" (or concentration ratio). This is the ratio of the concentration of dissolved solids (or conductivity) in the blowdown water compared to the make-up water. Since dissolved solids enter the system in the make-up water and exit the system in the blowdown water, the cycles of concentration are also approximately equal to the ratio of volume of make-up to blowdown water.

From a water efficiency standpoint, maximizing cycles of concentration will minimize blowdown water quantity and reduce make-up water demand. However, this is constrained by the make-up water and cooling tower water chemistry. Dissolved solids

increase as cycles of concentration increase and unless carefully controlled, can cause scale and corrosion problems.

Other water efficiency opportunities come from using alternate sources of make-up water, e.g., water from other equipment within a facility can sometimes be recycled and reused for cooling tower make-up with little or no pre-treatment, including the following:

- Air handler condensate (water that collects when warm, moist air passes over the cooling coils in air handler units). This reuse is particularly appropriate because the condensate has a low mineral content, and typically is generated in greatest quantities when cooling tower loads are the highest.
- Water used in a once through cooling system.
- Pretreated effluent from other processes, provided that any chemicals used are compatible with the cooling tower system.
- High-quality municipal wastewater effluent or recycled water (where available).

O&M Tips:

To maintain water use efficiency thru O&M, installations should:

- Calculate and understand "cycles of concentration." Check the ratio of conductivity of blowdown and make-up water. Many systems operate at three cycles of concentration, while six cycles or more may be possible. Increasing cycles from three to six reduces cooling tower make-up water by 20% and cooling tower blowdown by 50%.
- The actual number of cycles you can carry depend on your make-up water quality and cooling tower water treatment regimen. Depending on your make-up water, treatment programs may include corrosion and scaling inhibitors along with biological fouling inhibitors.
- Install a conductivity controller to automatically control blowdown. Determine the maximum cycles of concentration you can safely achieve and the resulting conductivity (typically measured as microSiemens per centimeter, uS/cm). A conductivity controller can continuously measure the conductivity of the cooling tower water and discharge water only when the conductivity set point is exceeded.
- Install flow meters on make-up and blowdown lines. Check the ratio of make-up flow to blowdown flow. Then check the ratio of conductivity of blowdown water and the make-up water using a handheld conductivity meter if the cooling tower is not equipped with permanent meters. These ratios should match your target cycles of concentration. If both ratios are not about the same, check the tower for leaks or other unauthorized draw-off or look for scaling. When flow meters are not available or not working, run chloride tests on the make-up and blowdown waters.
- Read conductivity and flow meters regularly to quickly identify problems. Keep a log of make-up and blowdown quantities, conductivity, and cycles of concentration. Monitor trends to spot deterioration in performance.
- Adding acid treatment such as sulfuric, hydrochloric, or ascorbic acid to recirculating water can improve the efficiency of a cooling system by controlling the scale buildup potential from mineral deposits. However, acid treatment systems

are risky and require close attention and workers fully trained in the proper handling of acids. Exercise caution against acid overdoses which can severely damage a cooling system, and use a timer or continuous pH monitoring via instrumentation. It is very important that the acid is added at a point where the flow of water promotes rapid mixing and distribution. May have to add a corrosion inhibitor when lowering pH.

- Alternatively, consider using a non-acid treatment process, which can achieve increased cycles of concentration without the risks of handling and storage of hazardous materials.
- Select your water treatment vendor with care. Tell vendors that water efficiency is a high priority and ask them to estimate the quantities and costs of treatment chemicals, volumes of blowdown water, and the expected cycles of concentration ratio. Some vendors may be reluctant to improve water efficiency because it means the facility will purchase fewer chemicals, and in some cases, saving on chemicals can outweigh the savings on water costs. A good water treatment program involves control of biological growths as well as control of scale and corrosion. Vendors should be selected based on "cost to treat 1,000 gallons make-up water," highest "recommended system water cycle of concentration," and acceptable corrosion rates.
- Measure or calculate the amount of water lost to evaporation and request the water utilities provider to credit the sewer charges for evaporative losses: the difference between metered make-up water minus metered blowdown water.
- Set up a comprehensive air handler coil maintenance program. As coils become dirty or fouled, there is increased load on the chilled water system to maintain conditioned air set point temperatures. Increased load on the chilled water system not only has an associated increase in electrical consumption, it also increases the load on the evaporative cooling process, which uses more water.

Retrofit and Replacement Options

To attain water efficiency in installation management of cooling towers:

- Install a sidestream filtration system (rapid sand filter or high-efficiency cartridge filter) to cleanse the water. The filtration system draws water from the sump, filters out sediments, and returns the filtered water to the tower. The cooling tower system will operate more efficiently with less water and chemicals. Sidestream filtration is particularly helpful if your system is subject to dusty atmospheric conditions, and can turn a troublesome system into a more trouble-free system.
- Install a make-up water softening system when hardness (calcium

High Efficiency Cooling Towers

and magnesium) is the limiting factor on cycles of concentration. Water softening removes hardness using an ion exchange resin and can allow you to operate at higher cycles of concentration.

- Install covers to block sunlight penetration. Reducing the amount of sunlight on tower surfaces can significantly reduce biological growth such as algae.
- Consider alternative water treatment options, such as ozonation or ionization, to reduce water and chemical usage. Be careful to consider the life-cycle cost impact of such systems.
- Install automated chemical feed systems on large cooling tower systems (over 100 tons). The automated feed system should control blowdown/bleed-off by conductivity and then add chemicals based on make-up water flow. These systems minimize water and chemical use while optimizing control against scale, corrosion, and biological growth.
- Get expert advice to help determine if a cooling tower replacement is appropriate. New cooling tower designs and improved materials can significantly reduce water and energy requirements for cooling. Installations should investigate every retrofit, operations, and maintenance option available and compare costs and benefits to a new tower.

List of Projects Exemplifying Best Management Practice #10

INSTALLATION	STATE	PROJECT DESCRIPTION
Aberdeen Proving Ground	MD	Replace central cooling tower in Bldg #4312
Adelphi Laboratory Ctr	MD	Replace failed Cooling Towers (#1, 2, 3, 4, 6 & 7) in Bldg #106 with new high energy efficient cooling towers, CW and condensate pumps, and assoc piping. CTs are the primary & supplement units for 8 buildings.
Detroit Arsenal	MI	Replace failing cooling tower in Research Laboratory (#200C) with new high energy efficient cooling tower, CW and condensate pumps, and assoc piping.
Detroit Arsenal	MI	Replace failing east and center cooling towers in Admin Bldg (#235) with new high energy efficient cooling towers, CW and condensate pumps, and assoc piping.
Fort Benning	GA	Replace Cooling Tower in Bldg # 398; Serves #399, 75, 73, 83, & 17.
Fort Gillem	GA	Replaced 180-ton rooftop Chiller, Circulating Pump, Associated Piping, Valves and Controls
Fort Huachuca	AZ	Repair HVAC controls within North, South, and West Central Energy Plants to reduce energy and water consumption.

INSTALLATION	STATE	PROJECT DESCRIPTION
Fort Jackson	SC	Replace failing cooling tower, Central Energy Plant #1 (Bldg #B2288)
Fort Jackson	SC	Replace 2 failing cooling towers and pumps in Bldg #B10000 with high efficiency cooling towers.
Fort Sam Houston	TX	Repair Cooling Tower in Bldg #2792: repair/replace gearbox, drive shaft, fan assembly, support brackets; balance system check; install new float valve and clean components.

BMP #11 - Commercial Kitchen Equipment

Commercial kitchen equipment in dining facilities other could represent a large set of water uses on the installation. Water efficiency for commercial kitchen equipment is especially important because high volume applications typically use mostly hot water. Making sure commercial kitchen equipment uses water efficiently affords both significant water and energy savings. Types of water-using commercial kitchen equipment include pre-rinse spray valves, wash tanks and sinks, commercial dishwashers, food steamers, steam kettles, commercial ice makers, and combination ovens (combination oven/steamer).

O&M Tips:

To maintain water use efficiency thru O&M, installations should:

- Educate staff about the benefits of water efficiency and the importance of hand scraping before loading a dishwasher.
- Establish a user-friendly method to report leaks and fix them immediately. Encourage cleaning or custodial crews to report problems.
- Only run dishwashers if they are full. Fill each rack to maximum capacity.
- Immediately replace any damaged dishwasher racks.
- Some pre-rinse spray valves may be easily taken apart to perform routine cleaning or to clean when performance is noticeably impacted. Replace plugged or poorly performing valves with new efficient models. If cleaning or maintenance is necessary, avoid drilling out holes to remove scale and buildup.

Low-flow Pre-Rinse Nozzle

- Check equipment water temperatures and flow rates to ensure each is within manufacturer recommendations. For maximum water savings, water flow rate should be near the minimum recommended by the manufacturer.
- Test system pressure to make sure it is between 20 and 80 psi. High-efficiency devices won't work properly if pressure is too low. If pressure is too high, they will consume more than their rated amount of water.
- For dishwashers, observe final rinse pressure to ensure it is within manufacture recommendations, typically 20 ± 5 psi. If the pressure is too low, the dishes may

not be rinsed and sanitized properly. If it is too high, they will require more than their rated amount of water.

- Ensure all equipment is installed and operated in accordance with manufacturer instructions.

ENERGY STAR® Food Steamer

- Use the combi-mode of combination ovens sparingly and appropriately as this mode consumes water and significantly increases energy usage. Combi-mode should be minimized and convection mode maximized. By moderating use at the beginning of the cook cycle, the benefit of the combi-mode can be achieved without using the mode for the entire cooking event. When adjusting the use of the combi-mode, consider the impact on cook times and product yield.

- For steam cooking, use batch production as opposed to staged loading of food pans (i.e., do not continuously open the door to load and unload food pans). This uses a lot of energy and wastes water. If possible, fill the steamer to capacity instead of cooking one pan in a five pan steamer.

- Garbage disposals can waste significant amounts of water. Eliminate or minimize the use of garbage disposals by using strainers or traps that employ a mesh screen to collect food waste.

Retrofit and Replacement Options

To attain water efficiency in installation management of commercial kitchen equipment:

- Install dishwashers with rack sensors to allow water flow only when dishes are present.

- If ice machines operate with single-pass cooling, modify the equipment, if possible, to operate on a closed loop that recirculates the water instead of discharging it, thereby maximize water savings. Otherwise, replace the ice-making head with an air-cooled unit.


ENERGY STAR® Commercial Icemaker

- Install flow restrictors in existing pre-rinse spray valves to reduce the flow rate to 1.6 gallons per minute (gpm) or less. Flow restrictors may not provide adequate performance in most situations. Purchasing new more efficient and inexpensive pre-rinse spray valves may provide a better alternative for saving water.


ENERGY STAR® Dishwasher

- For commercial dishwashers, check volume of service and size the dishwasher accordingly. Be sure to consider the energy tradeoff associated with increased tank heat that may be required for larger machines.

- Purchase high-efficiency commercial dishwashers with the ENERGY STAR® label. If possible, install low-temperature machines that rely on chemical sanitizing over high water temperature. If purchasing a low-temperature chemical sanitizing machine, carefully consider the cost of chemicals and verify water use with the distributor or manufacturer to ensure that the machine uses less water than an equivalent high-temperature machine.

- Replace water cooled commercial ice makers with high-efficiency air cooled commercial ice makers with the ENERGY STAR label.

ENERGY STAR® **Sanitizer**

- For low to medium volume steam cooking needs, purchase high-efficiency steam cookers with the ENERGY STAR label or purchase boilerless (connectionless) commercial steam cookers. Specifically look for steamers with improved insulation, standby mode, and closed-system design to ensure steamers are used most efficiently. Select a steamer based on projected use (i.e., balance production demand with steamer production capacity).

- Purchase high-efficiency pre-rinse spray valves. The Energy Policy Act of 2005 requires that pre-rinse spray valves manufactured after January 2006 have a maximum flow rate of 1.6 gpm. In 2007, FEMP released a purchasing specification for pre-rinse spray valves, which requires Federal agencies to

purchase pre-rinse spray valves that have flow rates of 1.25 gpm or less and that meet ASTM F2323-03, Standard Test Method for Performance of Pre-Rinse Spray Valves. For ease of maintenance and to increase operational life, purchase pre-rinse spray valves that can be easily taken apart and cleaned.

Food Waste Pulper

- Consider steaming needs when purchasing steam kettles. Direct steam kettles may be appropriate for bulk cooking (more than 50 servings at a time), but may require more maintenance as they are supplied with steam from an external boiler and may need to be "blown down" daily to eliminate condensate buildup in the steam supply line. For smaller steaming needs, purchase self-contained steam kettles. Self-contained kettles may require regular monitoring of water levels and maintenance of control components.

List of Projects Exemplifying Best Management Practice #11

INSTALLATION	STATE	PROJECT DESCRIPTION
Fort Lee	VA	Install ENERGY STAR® and water-saving kitchen equipment in Army Dining Facility
Fort Benning	GA	Install ENERGY STAR® and water-saving kitchen equipment in Army Dining Facility
Fort Bliss	TX	Install ENERGY STAR® and water-saving kitchen equipment in Army Dining Facility
Fort Sill	OK	Install ENERGY STAR® and water-saving kitchen equipment in Army Dining Facility
Fort Bragg	NC	Install ENERGY STAR® and water-saving kitchen equipment in Army Dining Facility
Fort Leonard Wood	MO	Install ENERGY STAR® and water-saving kitchen equipment in Army Dining Facility
Fort Sam Houston	TX	Install ENERGY STAR® and water-saving kitchen equipment in Army Dining Facility
Fort Jackson	SC	Install ENERGY STAR® and water-saving kitchen equipment in Army Dining Facility

BMP #12 - Laboratory/Medical Equipment

Equipment used in hospitals and laboratories can use significant amounts of water, but also offer the opportunity for substantial water savings by making a few small changes to how and when the water is used by the equipment.

By focusing on reducing water use from equipment such as water treatment systems, sterilization/disinfection systems, photographic and x-ray equipment, and vivarium equipment such as automatic animal watering systems and cage and rack washers, installations with scientific and medical laboratory facilities can go a long way towards achieving water efficiency goals.

The EPA and the DOE, recognizing the importance of incorporating water efficiency products and practices in laboratory settings, have teamed up under a program called Laboratories for the 21st Century (Labs 21) to provide architects, engineers, laboratory staff, and facility managers with information on technologies and practices used to create and maintain sustainable, high-efficiency laboratories.

O&M Tips:

To maintain water use efficiency thru O&M, installations should:

- Establish a user-friendly method to report leaks and fix them immediately.
- Encourage cleaning or custodial crews to report problems.
- When performing maintenance, replace worn parts and adjust mechanisms to ensure water consumption continues to meet manufacturer guidance.
- Shut off units that are not in use or install an automatic shut-off feature if it does not interfere with the unit's normal operation.
- Check solenoids or automatic shut-off valves regularly to ensure that they are working properly. Verify that water is not flowing when equipment is in standby mode.
- Install a pressure-reducing device on equipment that does not require high pressure. Lowering the pressure can reduce water use.
- Set equipment to the minimum flow rates acceptable or recommended by the manufacturer and post signs near equipment to increase employee awareness and discourage tampering with equipment flow rate.

Retrofit and Replacement Options

To attain water efficiency in installation management of laboratory and medical equipment:

- Evaluate laboratory requirements for high-quality water, including the total volume and the rate at which it will be needed, so that the system can be properly designed and sized.
- Choose systems with a higher recovery rate (the ratio of filtered purified water to the volume of feed water) – 75% to 95%.

- Determine the quality of water required in each application. Use the lowest appropriate level of quality to guide the system design. For example, reverse osmosis units should only be used in processes that require very pure water.
- Evaluate water supply quality for a period of time before the water purification system is designed. This evaluation allows designers to accurately characterize water supply quality and helps determine the best method for attaining the required quality level.

Disinfection/Sterilization Systems

- Replace older inefficient equipment with equipment designed to recirculate water or that allows the flow to be turned off when the unit is not in use, or both.
- An alternative to buying new equipment is to purchase a water efficiency retrofit kit. Many are now available for older units. These kits reduce water use by controlling the flow of tempering. Tempering kits sense the discharge water temperature and allow tempering water to flow only as needed. Check mixing valves to ensure there is no bleeding across the valve.
- Use high-quality steam for improved efficiency and maintain the steam systems properly.
- Use uncontaminated, noncontact steam condensate and cooling water as make-up for non-potable uses, such as in cooling towers and boilers.

Photographic and X-Ray Equipment

- Replace older equipment with digital x-ray and photography equipment and computerized printing.

Vivarium Equipment

- Replace older inefficient cage and rack washers with more efficient models. Look for models that recycle water through four cleaning stages using a counter-current rinsing process. In counter-current rinsing, the cleanest water is used only for the final rinsing stage. Water for early rinsing tasks (when the quality of rinse water is not as important) is water that was previously used in the later stages of rinsing operations.
- Retrofit existing cage and rack washers to make use of counter-current flow system to reuse final rinse water from one cage-washing cycle in earlier rinses in the next washing cycle.
- Use tunnel washers for small cage cleaning operations.
- Sterilize and recirculate water used in automatic animal watering systems instead of discharging water to the drain. Consider using water that cannot be recycled for drinking due to purity concerns in other non-potable applications, such as cooling water make-up or for cleaning cage racks and washing down animal rooms.

List of Projects Exemplifying Best Management Practice #12

INSTALLATION	STATE	PROJECT DESCRIPTION
	Korea	Install Digital Mammography unit
	Korea	Replace Mobile X-Ray Units
Fort Benning	GA	Install Digital Mammography; replace Mobile X-Ray
Fort Bliss	TX	Replace Mobile X-Ray Units
Fort Bragg	NC	Install Digital Mammography; replace Mobile X-Ray
Fort Campbell	KY	Install Digital Mammography; replace Mobile X-Ray
Fort Carson	CO	Replace Mobile X-Ray Units
Fort Eustis	VA	Replace Mobile X-Ray Units
Fort George Meade	MD	Install Digital Mammography; replace Mobile X-Ray
Fort Gordon	GA	Install Digital Mammography; replace Mobile X-Ray
Fort Hood	TX	Install Digital Mammography; replace Mobile X-Ray
Fort Huachuca	AZ	Install Digital Mammography; replace Mobile X-Ray
Fort Irwin	CA	Install Digital Mammography; replace Mobile X-Ray
Fort Jackson	SC	Install Digital Mammography; replace Mobile X-Ray
Fort Knox	KY	Install Digital Mammography; replace Mobile X-Ray
Fort Leavenworth	KS	Install Digital Mammography; replace Mobile X-Ray
Fort Lee	VA	Replace Mobile X-Ray Units
Fort Leonard Wood	MO	Install Digital Mammography; replace Mobile X-Ray
Fort Lewis	WA	Replace Mobile X-Ray Units
Fort Polk	LA	Install Digital Mammography; replace Mobile X-Ray
Fort Riley	KS	Install Digital Mammography; replace Mobile X-Ray
Fort Rucker	AL	Install Digital Mammography; replace Mobile X-Ray
Fort Sill	OK	Install Digital Mammography; replace Mobile X-Ray
Fort Stewart	GA	Install Digital Mammography; replace Mobile X-Ray
Fort Wainwright	AK	Install Digital Mammography; replace Mobile X-Ray
Heidelberg	Germany	Install Digital Mammography; replace Mobile X-Ray
Landstuhl	Germany	Replace Mobile X-Ray Units
Tripler AMC	HI	Replace Mobile X-Ray Units
West Point MA	NY	Install Digital Mammography unit

BMP #13 - Other Water Intensive Processes

Many water using processes beyond the previously covered best management practices may be found at Installations, including vehicle wash facilities, maintenance shops, dry cleaning and laundry services, water softening systems, and many others. Identify and analyze all water intensive processes for potential efficiency improvements.

Laundry facilities are often found on installations. They may be a self-serve laundry, a commercial-type laundry service where laundry is dropped off, an industrial laundry facility where large volumes of soldier-owned uniforms or hospital linens and medical garb are cleaned. Large amounts of water are regularly used in industrial laundries, making them highly suitable for a water efficiency program.

Evaporative coolers, also known as swamp coolers and desert coolers, work on the same principle as cooling towers. Air is cooled and humidified as it passes through porous pads, kept moist by dripping water. Un-evaporated water trickles down through pads and collects in a pan for either discharge or recirculation. Since cooling relies on evaporation, these coolers work best in arid climates. When water evaporates, it leaves behind scale and mineral deposits on the pads, reducing the volume of air flowing through the pads and compromising cooler performance. Bleed-off water dilutes the mineral concentration of pan water and reduces scale and dirt build-up on the pads. There are two types of bleed-off systems: once-through and recirculating. The once-through type is simpler and less expensive than the recirculating, or pump, type but consumes more water and requires constant drainage. In many areas of the country, additional water softening should not be necessary for most operations. When required, use water softeners that generate a minimal amount of waste brine per gallon of water.

The military maintains facilities for washing and rinsing aircraft and vehicles. These washrack facilities are an excellent candidate for water efficiency. There are five typical washrack groups based on the type of wastewater emitted:

- Aircraft rinsing
- Aircraft washrack platform
- Automotive vehicle washrack
- Tracked vehicle washrack
- Automotive vehicle maintenance

The amount of water used per item washed varies from approximately 100 to 3,000 gallons. Newer, commercially available washrack equipment usually includes some retrofit and recycling options that significantly reduces the amount of water used per item washed.

Get expert advice to help determine if water efficiency improvements of other water intensive processes are appropriate. New system designs and improved materials can significantly reduce water and energy requirements. However, since this may involve significant capital costs, first investigate every retrofit or operations and maintenance option. Your first resource should be local or headquarters engineers, but do not overlook input from experienced energy consultants, contractors or subject matter specialist / experts in your chain of command, and even other Government agencies.

O&M Tips:

To maintain water use efficiency thru O&M, installations should:

- Metering or otherwise measuring the amount of water used in other water intensive processes.
- As with all water-using equipment, locate and repair leaks in plumbing connections.
- Ensure procedures are in place to turn off the water supply when equipment is not in operation. Some equipment allows water to constantly run even when the equipment is turned off.
- Check flow rates to ensure they are within manufacturer recommendations. For maximum water savings, the flow rate should be near the minimum allowed by the manufacturer.
- To reduce water used by evaporative coolers, keep a tight rein on bleed-off water amounts. For most small coolers, bleed-off volumes should be less than a few gallons per hour for each 1,000 cubic feet per minute of air flow. Also replace worn or torn pads and inspect the recirculation pump and reservoir level controls periodically during warm months when the system is running.
- For water softeners, set the controls to start softening and regeneration processes only when needed. Softeners with timers should be avoided.
- For washing machines, encourage users to wash only full loads. If the water level is able to be set by the user, encourage using only as much water as needed for that load. Also consider separating laundry by the number of cycles needed.
- Large commercial laundry equipment should be easily programmable to use no more water than required for the degree of soiling of the items being washed.
- For washrack cleaning facilities that use detergents, use high quality detergents to shorten the length of time required to clean each vehicle or aircraft.

Retrofit and Replacement Options

To attain water efficiency in the management of water intensive equipment:

- When able, replace water-cooled equipment with air-cooled equipment or the best available technology for achieving energy and water efficiency.
- Avoid single-pass or pumpless coolers. Recirculation saves water and increases thermal efficiency.
- New water softener models may come with water-efficient regeneration cycles.
- Low-cost measures that can save significant amounts of water at existing washrack cleaning facilities include:
  - ✓ Timers and automatic spray heads for aircraft rinsing facilities, but not for washrack units since vehicles must be washed until sufficiently clean.
  - ✓ Automatic shutoff nozzles for facilities with manual rinsing can save tens to hundreds of gallons per run.
  - ✓ Low-flow and high-pressure hot water units can reduce the amount of water and solvents for cleaning engine components.
  - ✓ Pre-wash areas for tracked vehicle using washracks with recycling systems to eliminate most of the coarse dirt to keep it from clogging the treatment system.
  - ✓ Water reuse/recycling equipment on vehicle washing equipment.
  - ✓ Self-closing valves on chamois wringers.
- For washrack cleaning facilities, choose new rollover and conveyor equipment that uses less than 35 gallons per vehicle for automobiles and light trucks and less than 75 gallons per vehicle for bus and large truck washes.
- A costliest but most highly effective way to reduce water usage at wash and rinse facilities is to implement a wastewater recycling system. Where possible reuse reverse osmosis or nanofiltration reject water for vehicle washing in rollover and conveyor type systems.
- Replace old commercial clothes washers (vertical axis) with high-efficiency washers (horizontal axis) that use significantly less energy, water, and detergent. Look for ENERGY STAR®-labeled washers with a water factor of 8.5 gallons of water used per cubic foot or less. Most full-sized ENERGY STAR-labeled washers use 18-25 gallons of water per load compared to the 40 gallons used by standard machines, potentially reducing combined utility costs by as much as 50%.
- For large industrial or commercial type laundries, replace old washers with tunnel washers or ozone laundering. Tunnel washers, also known as continuous batch washers, are heavy-duty, multi-tank systems for use in large industrial laundries. They are capable of handling up to 2,000 pounds of laundry per hour. Tunnel washers use counter current wash methods to maximize water efficiency. While costly to install, they are capable of saving up to 70% of the water used with a washer-extractor and require less operating and maintenance labor. Tunnel washers typically use two gallons of water or less per pound of laundry.
- Ozone laundering process uses no detergent, only cold water, and recycles the water, is suited for light-to-moderately soiled laundry. Ozone-generating equipment is attached to the washer as a closed-loop system.

- In laundries, the last rinse in the wash cycle can be stored to supply wash water in subsequent loads thus reducing water usage.

List of Projects Exemplifying Best Management Practice #13

INSTALLATION	STATE	PROJECT DESCRIPTION
Fort Lewis (3 locations)	WA	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Yakima Firing Range	WA	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Polk (2 locations)	LA	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Hood (4 locations)	TX	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Knox (2 locations)	KY	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Bragg	NC	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Benning (2 locations)	GA	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Stewart (2 locations)	GA	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Carson	CO	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Bliss (2 locations)	TX	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Sill (2 locations)	OK	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Gordon	GA	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Jackson	SC	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Riley (2 locations)	KS	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Lee	VA	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Aberdeen Proving Ground	MD	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Irwin National Training Center	CA	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Drum	NY	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Leonard Wood	MO	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge

INSTALLATION	STATE	PROJECT DESCRIPTION
Fort McCoy	WI	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort AP Hill	VA	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Schofield Barracks	HI	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Kahuku Training Area	HI	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Fort Indiantown Gap	PA	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Camp Atterbury	IN	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Camp Shelby	MS	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge
Pohakuloa Training Area	HI	Central Vehicle Wash Facilities with Wastewater Treatment for Recycling and/or Discharge

BMP #14 - Alternate Water Sources

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 captured storm water runoff. On-site alternative water sources are most economic if included in the original design for the facility. Common uses for these sources include landscape irrigation, ornamental pond and fountain filling, cooling tower make-up, and toilet and urinal flushing.

SOURCES:

Municipal-Supplied Reclaimed Water

Municipal supplied reclaimed water comes from treated wastewater that is recycled for non-potable use. This water is often available at a significantly lower rate than potable water; however, use of reclaimed water is often restricted by state and 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.

Treated Gray Water

Sanitary gray water is water that is generated by bathroom sinks, showers, and clothes washing machines. These water sources can contain pathogens. Non-sanitary gray water is water generated by industrial processes or equipment such as reverse osmosis reject water and cooling tower bleed water. These water sources can contain chemicals, minerals, and solids.

In a typical gray water recycling system, water that would normally be discharged to the municipal sewage system is collected, treated to remove suspended solids and contaminants, and reused. On-site wastewater recycling applications are currently found in states with persistent drought conditions. However, all arid, semiarid, and coastal areas that have experienced water shortages, as well as major urban areas where sewage treatment plants are overloaded and expansion is constrained, are potential candidates for on-site recycling. The recycled water is typically used as flush water for toilets and urinals, landscape irrigation, supply water for ornamental ponds, and make-up water for cooling towers.

At its most basic, gray water treatment consists of removing suspended solids from the water. Filtering with no additional treatment may be applicable for rinse water from laundries or car washes and air handler condensate. At its most sophisticated, treatment may consist of biological treatment with membrane filtration, activated carbon, and ultraviolet light or ozone disinfection to destroy pathogens. The basic gray water system includes storage tanks, color-coded piping, filters, pumps, valves, and controls.

The Federal government, DoD, and the Army have not established standards, guidelines or criteria for the reuse of Gray Water.

Harvested rainwater vehicle washing Fort Bragg Community Emergency Services Building

Rain Water
Rain water harvesting captures, diverts, and stores rain water for later use. Captured rain water is often used in landscaping, because the water is usually free of salts and other harmful minerals and does not have to be treated. Rain water harvesting can also help prevent flooding and erosion, turning storm water problems into water supply assets by slowing runoff and allowing it to soak into the ground. Reducing run-off also helps reduce contamination of surface water with sediments, fertilizers, and pesticides in rainfall run-off.

Harvested rainwater toilet flushing - Fort Bragg Community Emergency Services Building

Rain water can be collected directly from rooftop surfaces into cisterns and used with little or no treatment for a variety of non-potable purposes. The major components of a rain water harvesting system include:

- Catchment area/roof or surface upon which the rain falls
- Gutters and downspouts to carry the water to storage
- Leaf screens to remove debris
- Cisterns/storage tanks to store the harvested rain water
- Conveyances to deliver the stored water either by gravity or pump
- Water treatment system to settle, filter, and disinfect the water, if required

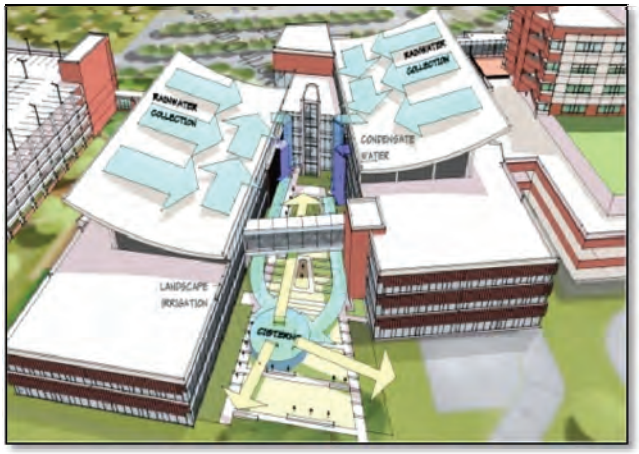
VEGETATIVE ROOF

Tobyhanna Army Depot, PA, **Vegetative Roof Project:** The vegetative roof reduces energy consumption costs by 25 percent, according to data collected by the installation's environmental management division. The depot installed plant modules atop one wing of its headquarters building in 2006. The entire roof was covered by late 2008. The roofing modules contain plants that are able to thrive in Pennsylvania's northeastern climate. The roof improves energy efficiency, reduces

storm water runoff and protects storm water quality. It adds a layer of insulation during the heating and cooling seasons, and becomes more efficient as the plants grow. This shielding also extends the roof life by stopping ultraviolet rays from breaking down the adhesive at the seams, which are the roof's weakest points.

ROOF RUNOFF HARVESTING

Low Impact Development at Fort Belvoir, VA: Rain-water "harvesting" captures rainfall runoff from roofs that would normally escape to storm sewers or overland flow that can be used to extend an installation's water supply. The new community hospital at Ft Belvoir will collect and store up to 140,000 gallons of rainwater for reuse. Roofs over each outpatient clinic will collect rainwater into cisterns which will be used to irrigate areas of the courtyards and landscaping around the hospital.



Storm Water Runoff

Like rain water, storm water can be harvested and reused for washdown, cooling tower make-up or process water, dust suppression, and vehicle washing. Storm water harvesting differs from rain water harvesting as the runoff is collected from drains or creeks, rather than roofs. The characteristics of storm water harvesting and reuse schemes vary considerably between projects, but most schemes include collection, storage, treatment, and distribution.

Storm water is generally collected from a drain, creek, or pond and then stored temporarily in dams or tanks to balance supply and demand. Storage can be on-line (constructed on the creek or drain) or off-line (constructed some distance from the creek or drain). Captured water is typically treated to reduce pathogens and pollution levels through the use of constructed wetlands, sand filters, and disinfection techniques including chlorine, ultraviolet radiation, and membrane filtration. The degree of treatment required depends on the proposed use and the level of public exposure.

Detention basin to detain and recharge storm-water - Ft Huachuca

Urban storm water harvesting and reuse is a relatively new field of water management and most of the projects constructed to date have been pilot projects in drought areas. Successful storm water harvesting and reuse plans need specialist input from a number of areas, including storm water management, water supply management, environmental management, and public health. The potential limitations and disadvantages to storm water harvesting and reuse include variable rainfall patterns, environmental impacts of storages, potential health risks, and high relative unit costs of treated storm water. Although this is not a practice that would be feasible at many Federal facilities, storm water harvesting and reuse is an emerging practice that may be useful in specific situations.

To develop an efficient and successful reclaimed water project you must have a reliable source of wastewater of adequate quantity and quality to meet your non-potable water needs. These projects are economically more viable when:

- The cost of water is high
- There is a lack of high-quality freshwater supply
- Reuse is the most cost-effective way to dispose of wastewater effluent
- There are local policies that encourage the use of reclaimed water, or water efficiency

O&M Tips:

To maintain water efficiency in operations and maintenance, installations should:

- Identify potential non-potable water use while reviewing current water use practices. The use of non-potable water is generally most cost-effective when included in the design of new facilities.
- Consult with experts in the field. Your first resource should be local or headquarters engineers, but do not rule out input from contractors or other Government agencies.
- Facilities using alternative on-site water sources must comply with all applicable backflow prevention requirements.

Municipal Supplied Reclaimed Water

- Municipal supplied reclaimed water pipes must be color coded with purple tags or tape according to standards set by the American Water Works Association to minimize cross-connection problems.
- Signs should be used liberally to indicate that reclaimed water is non-potable. Place them in public places such as in front of a fountain and on valves, meters, and fixtures.
- Keep the pressure of reclaimed water 10 psi lower than potable water mains to prevent backflow and siphonage in case of accidental cross-connection.
- Run reclaimed water mains at least 12 inches lower in elevation than potable water mains and horizontally at least five feet away.
- Review the quality of reclaimed water to ensure there will be no harmful effects, such as salt buildup, from long-term use.

Gray Water Recycling Systems

- The pathogenic organisms in sanitary gray water must not come into contact with either humans or animals. This can be accomplished by treating the water to eliminate pathogens or avoiding their introduction into water by not mixing sanitary gray water with any potable water source. Human exposure can be prevented by not collecting or storing it in an open container.
- Sanitary gray water used for irrigation should not be applied through a spraying device, but rather injected directly into the soil through drip irrigation. Drip irrigation allows you to receive the benefits of using recycled water and at the same time avoid contaminating animals, humans, and edible plants.
- If you install a gray water recycling system, consider using biodegradable cleaning products that do not contain sodium, chlorine, or boron. Cleaning products that contain high chemical levels may make their way into the gray water recycling system and could poison plants or damage soil through the buildup of inorganic salts.

Treated effluent used to irrigate Fort Huachuca Golf Course

- Rain or excessive irrigation could cause ground saturation and result in pools of gray water on the surface. To help eliminate this situation, turn the gray water system off and divert the gray water to the sanitary sewer line during rainy periods.
- Maintenance programs for a gray water system must include the following steps, all of which must be performed regularly:
  - ✓ Inspecting the system for leaks and blockages
  - ✓ Cleaning and replacing the filter bimonthly
  - ✓ Replacing the disinfectant
  - ✓ Ensuring that controls operate properly
  - ✓ Periodically flushing the entire system

Retrofit and Replacement Options

The following retrofit and replacement options help Federal agencies implement gray water recycling systems and rain water harvesting:

Gray Water Recycling System

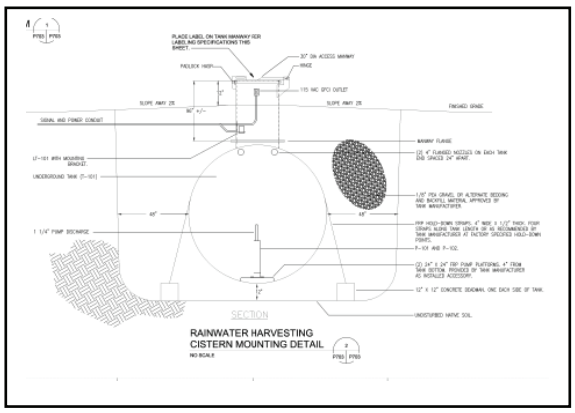
- The use of on-site wastewater recycling systems should be considered when constructing new buildings. Even though many of these systems are costly to purchase, the payback period in savings from discharging less wastewater can be as little as 10 years or less.

- Gray water systems must be installed in accordance with local plumbing codes and by professional, licensed plumbing contractors. Installing a gray water system requires the retrofitting of existing plumbing and all alterations to the plumbing system must be approved by local authorities.
- All counties and cities that permit gray water recycling require building inspections to inspect sites and, after the installation, verify compliance and proper operation of the gray water system.
- Local authorities may require that gray water supply systems be clearly distinguished from potable water supplies. Methods of doing so include extensive labeling of the system or the use of different piping materials for the different systems. All gray water outlets must be clearly labeled to indicate that they dispense non-potable water. Local codes may also require marking gray water supplies by adding biodegradable dye. Additionally, backflow preventers also must be installed to ensure the proper separation of potable water and gray water supply system.
- For buildings with slab foundations, recoverable gray water may be limited to washing machine discharge because most drain pipes, such as for sinks, are buried beneath the slab and thus not easily accessible without a significant additional expense.
- For buildings with perimeter foundations, gray water may be recoverable from most sources due to accessibility to piping from crawl spaces.
- Depending on the gray water source, application, recycling scheme, and economics, one gray water treatment method (e.g., media filtration, collection and settling, biological treatment units, reverse osmosis, sedimentation/filtration, physical/chemical treatment) may be more appropriate than another.

Rain Water Harvesting

- Rain water collection and distribution systems can be incorporated into almost any existing site, although it is easier to incorporate them into new construction.
- According to The Texas Manual on Rain Water Harvesting, you can collect 600 gallons of water per inch of rain per 1,000 square feet of catchment area. To determine how much water you could collect in a year:

Rooftop Capture at Barnes Field House, Ft Huachuca



- Calculate the roof catchment area
- Multiply the collection area in square feet by 0.6 gallons per square foot per inch of rain times the collection factor (which measures your collection efficiency; 80% or 0.8, would be a good efficiency)
- Times the average rainfall.
- Roof systems are used to collect storm-water for recharge to the aquifer.

Fort Bliss, TX Partners with El Paso Water Utilities Desalination Plant

A joint project of El Paso Water Utilities and Ft. Bliss as a public-public partnership to sustain the growth in water demand, which resulted in the world's largest inland desalination plant with a capacity of 27.5 million gallons of fresh water daily (MGD) to meet the needs of both Ft. Bliss and El Paso Water Utilities. This is the largest public-public project of its kind in the country involving the Defense Department and a local community. Fort Bliss is saving $200,000 monthly on credit for water utility bills. The facilities included in the El Paso/Ft. Bliss Desalination Project are:

- Rehabilitation/replacement of 17 existing wells.
- The desalination plant producing 15.5 MGD of permeate.
- 16 new blend wells producing 12 MGD.
- Total Supply: 27.5 MGD.
- Concentrate disposal facilities: 3 MGD.
- Pipelines for collection, transmission and concentrate disposal.

Kwajalein Atoll Kwajalein's potable water source comes from two sources. The first is the water catchment area between taxiway “Echo” and the aircraft runway. The second is several lens wells located throughout the island. Kwajalein receives about 100 inches of rain per year. Rainwater is collected in two concrete catchment areas covered with a flexible membrane liner. Catchment #1 and Catchment #2 collect water from approximately 52 acres of surfaced area, including the adjacent portions of the runway and taxiway, which slope toward the trough in the center of the two catchments. A third catchment area, has very little concrete and has no flexible membrane liner installed in it, and is covered with grass. Water flowing into Catchment #3 percolates

into the porous soil to recharge Lens wells 1A & 1B. All of the potable water is run through a filtration system, a reverse osmosis process and finally treated with chlorine. The water catchment area can store a maximum of about five million gallons of water before it begins to overflow onto the runway and taxiway. Catchment #1 and Catchment #2 have a combined theoretical yield of approximately one million gallons of water per inch of rain; however, loss from leakage and evaporation result is an actual yield of about 800,000 gallons of water per inch of rainfall.

List of Projects Exemplifying Best Management Practice #14

INSTALLATION	STATE	PROJECT DESCRIPTION
Camp Casey	Korea	Upgrade membrane filtering system to treat effluent of Camp Casey Wastewater Treatment Plant for recycling to use to irrigate landscaping and for vehicle washing.
Camp Casey	Korea	Replace potable water source for irrigating Camp Casey Golf Course with ground water source; install 2 wells, storage tanks, booster pumps and piping.
Fort Huachuca	AZ	Connect overflow pipe from 1.5 MG reservoir to sewer to capture spillage during reservoir cleaning. After processing at the wastewater treatment plant, this water will be recycled for irrigation and other non-potable uses
Fort Huachuca	AZ	Repair/restore existing rainfall recharge basins #1, 2, 3, 4, 6, & 7
Natick Soldier System Center	MA	Forty-six percent of the water used on the installation is (non-potable) treated contaminated groundwater.
Scranton AAP	PA	Replace Production Shop Roof and install a rainwater collection system (2.2 acres rooftop + 23,700 gal storage tanks) for use as make-up water for shop cooling tower. Saved 1.5 million gallons of water and $23,000 in operating cost during 2010
Fort Bragg	NC	Community Emergency Services Center
Fort Belvoir	VA	Rainwater capture system for irrigation water from new hospital roof

Installations are pursuing many cost-effective water projects in a strategic manner towards achieving our water conservation and management goals. The water projects , like those shown highlighted above, use appropriated funding sources such as the Energy Conservation Investment Program (ECIP), Operations and Maintenance Army (OMA), and Military Construction (MILCON) Program, and third-party financing opportunities.

For additional information on how these projects could be replicated at your installation, submit your request through the Policy/Program Issues Form on the Army Energy Program web site at:
http://army-energy.hqda.pentagon.mil/contact/form.asp

MAJOR WATER PROGRAMS

NET ZERO WATER INSTALLATION: The Net Zero Water Installation Strategy is of increasing importance since scarcity of clean potable water is quickly becoming a serious issue in many parts of the United States and around the world. The continued draw-down of major aquifers, such as what was happening at Fort Bliss, TX, results in significant problems for our future. Strategies such as harvesting rain water and recycling discharge water for reuse can reduce or eliminate the need for purchasing municipal water, and highly treated wastewaters or captured storm water.

ACTION: To achieve Net Zero Water, Installations will maximize conservation measures, increase water use efficiency, and improve the integrity of water distribution systems. Discharge water is repurposed by recycling gray water from sources such as showers, sinks, and laundries, as well as cooling towers, and by capturing rainfall and storm runoff. Treated wastewater is reclaimed for other uses (irrigation or industrial process & cooling) or recharged into groundwater aquifers.

METERING PROGRAM: The Army Metering Program executes the provision of the Energy Policy Act of 2005 (EPACT 2005). Our program requires installation to install water meters by 2016. Meters will be connected to the Army Meter Data Management System and the procedures established to use the data to track and trend energy use, enabling identification and improvement of energy efficiency. This program will enable installations to review water consumption trends and identify energy reduction opportunities. Under the Residential Community Initiative (RCI) Energy Conservation Program, a metering policy is set which establishes an energy baseline for each occupant. On average 70 percent of residents are at or below the calculated baseline. While monthly water consumption is not normally part of the program, many RCI Partners provide this information to residents monthly as a means of educating them on how their actions impact water usage.

ACTION: Installations will install advanced meters on all appropriate buildings. Meters will be connected to a Meter Data Management System to facilitate management decision and real-time energy and water management actions.

ENERGY AND WATER MANAGER: To implement the Army Installation Water Management Program, it is essential that each installation have a full-time Energy and Water Manager to lead its efforts in energy awareness, efficiency, and project development. Energy & Water Managers develop the energy and water awareness program for their installation -- to educate Soldiers, Families, and Civilians -- on the importance of energy conservation. They implement the energy policies established by the Army and develop long-range plans for implementing energy projects. They spearhead an aggressive program to reduce energy consumption and costs. In addition, they are responsible for compiling, maintaining, and submitting all energy reports in the Army Energy and Water Reporting

ACTION: Each Army installation will designate an on site Energy & Water Manager.

System (AEWRS) which is used to monitor performance at each installation. Their expertise is critical in proposing energy and water features in all facility designs, construction, and renovation activities.

ARMY SUSTAINABLE DESIGN AND DEVELOPMENT (SDD) PROGRAM:

Army policy currently incorporates the US Green Building Council's Leadership in Energy and Environmental Design (LEED) performance rating system as the Army standard. As of the 2008 MILCON Program, all new construction and major renovation projects are evaluated using the Green Building Certification Institute (GBCI) criteria and must achieve the LEED SILVER rating or higher. In order to achieve LEED SILVER rating, a project must meet the criteria for the following six areas: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, and Innovation in Design. Beginning with FY2013, all Army Family Housing new construction residential housing will be certified by the GBCI at the LEED SILVER for Homes level or higher, and Energy Star Qualified New Homes. All major renovations will also achieve the LEED-New Construction/Major Renovations SILVER level or higher. We are expanding our programs to implement reduced water use for irrigation, improved cycles in cooling towers, low flow faucets and other fixtures, and application of low intensity development principles consistent with statute and industry standards such as American Society of Heating, Air Conditioning, and Refrigeration Engineers (ASHRAE) Standard 189.1.

ACTION: Installations will incorporate sustainable design principles into the siting of new facilities, project design, and execution of new construction and renovation projects to achieve the LEED SILVER rating.

UTILITY INCENTIVES: Most states have Utility Incentive Programs that help Army installations offset energy costs while promoting energy and water efficiency and technologies. Programs allow the reduction of installation utility bills through innovative agreements involving water conserving fixtures, landscape Xeriscaping, and other aggressive conservation measures. Installations should take advantage of the types of programs available.

ACTION: Installations must work with the local utility company in taking advantage of Utility Incentive Programs.

AWARDS: The Secretary of the Army Energy and Water Management Awards Program recognize installations and individuals who make significant achievements in energy conservation and water management. AR 420-1, Army Facilities Management, Chapter 22, Army Energy Program describe the process to recognize individuals, small groups and

ACTION: Installations will identify and nominate employees, teams, and installations deserving of recognition under the Secretary of the Army Energy and Water Management Awards Program, the White House Council of Environmental Quality GreenGov Presidential Awards and the Federal Energy and Water Management Awards Program sponsored by Department of Energy.

installations from the Army, Army Reserve, and Army National Guard. The White House Council of Environmental Quality GreenGov Presidential Awards is another opportunity to recognize our employees for their support, leadership, and efforts in promoting and improving energy and water management. GreenGov Presidential Awards were initiated to encourage the Federal Government to lead by example in promoting a clean energy economy that will increase our Nation's prosperity, promote energy security, protect the interests of taxpayers, and safeguard the health of our environment.

ARMY UTILITY PRIVATIZATION (UP) PROGRAM: Utilities Privatization (UP) is a method for improving utility systems and services by allowing Army installations the option to leverage private capital to make project investments needed for water efficiency, secure, reliable, and sustainable utility systems. The private company can also finance to own, operate, and maintain, advanced water meters and integrate the meters into the existing garrison metering system(s). Metered data must belong to the Army for its use. Army installations have been unable to upgrade and maintain reliable utility systems fully due to inadequate funding and competing installation management priorities. The objective of UP is to better meet mission needs, protect life, health, safety, and the environment by bringing utilities up to industry standards and sustaining operations at that level. The Army has aggressively pursued UP whenever cost-effective, as the preferred investment strategy to repair and upgrade deficient utility systems. UP evaluations find the most cost-effective way to bring a utility up to industry standards and be able to operate at that level.

ACTION: Consistent with the Army Installation Management Campaign Plan, installations will leverage UP to improve energy and water efficiency, infrastructure, and technology.

IMPROVING WATER SYSTEM SECURITY: In concert with the Department of Energy, Homeland Security, and the Department of Defense, the Army will work to improve security of public water systems and on-post distribution systems supporting critical installations. Actions must prevent contamination of the water supply, interruption of service or destruction of equipment from accidental or intentional interdiction that results in inappropriate closing of valves or adulteration of water source. The security of the nation's water supply is dependent on the vulnerability of the infrastructure to natural disaster and manmade disruptions.

ACTION: Each Installation will develop and implement their water management plan. This plan will provide clear information about how a facility uses its water, specific conservation measures that must be taken, and management practices from the time it is piped onto the facility through its ultimate disposal.

WAY AHEAD

The Army must execute a comprehensive and enterprise approach in order to meet our water conservation and water management goals. To achieve these goals installations will:

- *Develop a Comprehensive Energy and Water Master Plan to achieve the Army Energy Security Implementation Strategy, Installation Management Campaign Plan, and installation-level water conservation and water management security goals.*

- *Commit to become a Net Zero Water Installation:*

  - *Limit the use of potable fresh water; then capture, repurpose or recharge an amount of water equal to or greater than the amount consumed.*
  - *Eliminate or reduce the amount of purchased municipal water or exported sewage.*
  - *Strategies include rainwater harvesting, and recycling gray water from showers, sinks, laundries or cooling towers.*

- *Develop energy and water management accountability in key positions throughout the chain of command.*

- *Establish full-time energy and water manager positions to lead their energy and water programs.*

- *Use innovative and creative leadership to leverage the full range of available funding programs and third party financing to:*

  - *Implement cost-effective water efficiency solutions to provide reliable and stable water supplies to Army installations.*
  - *Achieve higher water efficiency by incorporating enhanced water conservation and sustainable features in building renovations and new construction.*
  - *Ensure that all new water projects are assessed in accordance with current policy and Governance Board procedures to ensure that Army investments of land and resources are consistent with Army water conservation and water management security goals and priorities*.

For more information or to submit comments visit:
http://army-energy.hqda.pentagon.mil/contact/form.asp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