Net Zero Water for U.S. Army Installations

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US Army Corps of Engineers
BUILDING STRONG®

Corporate Comparison

The US Army is comparable to a major corporation in terms of funding, assets and global reach. The Army would rank 5th in comparison to Fortune 500 companies based on funding alone.

Army Demographics

Mission: "To fight and win our nation's wars."
Operating Locations: worldwide
Funding: **$245.6 Billion**
Personnel

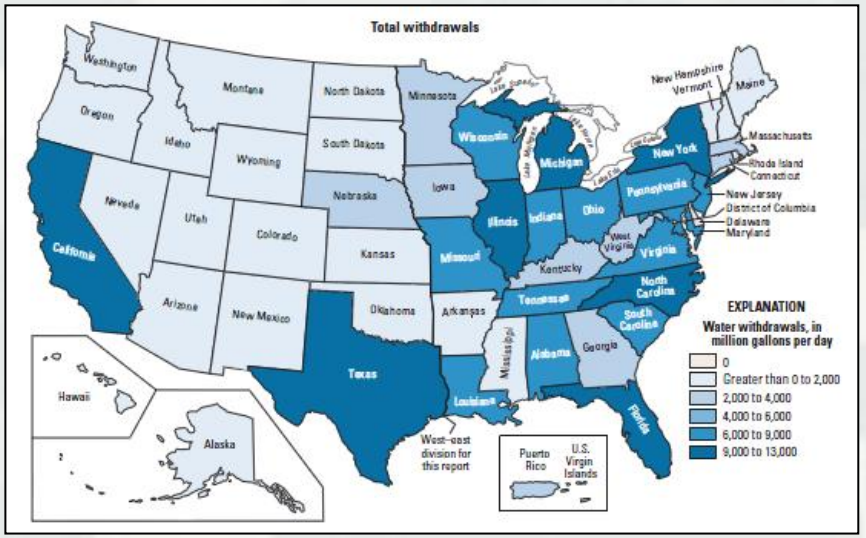
Active:	547,400
Guard:	358,200
Reserve:	205,000
Civilian:	300,000
TOTAL:	**1,410,600**

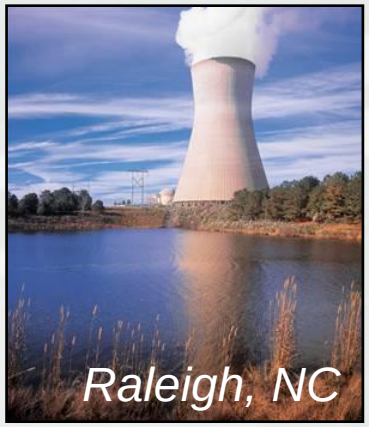
Top 5 Fortune 500 Companies (2009)

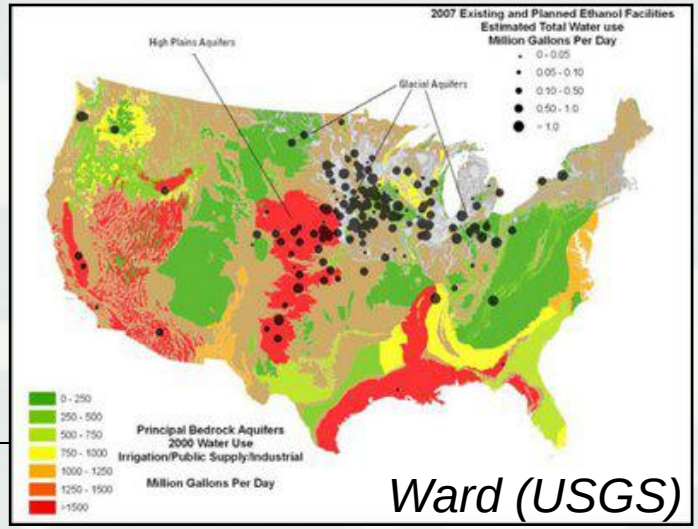
Company	Revenue ($B)
1. Wal-Mart Stores	421.85
2. Exxon Mobil	354.67
3. Chevron	196.34
4. ConocoPhillips	184.97
5. Fannie Mae	153.83

Increasing Demand

- Population growth
- Migration
- Aging infrastructure
- Increased energy use
- Army transformation
- Carbon Capture







Kenney et al 2009 (USGS)

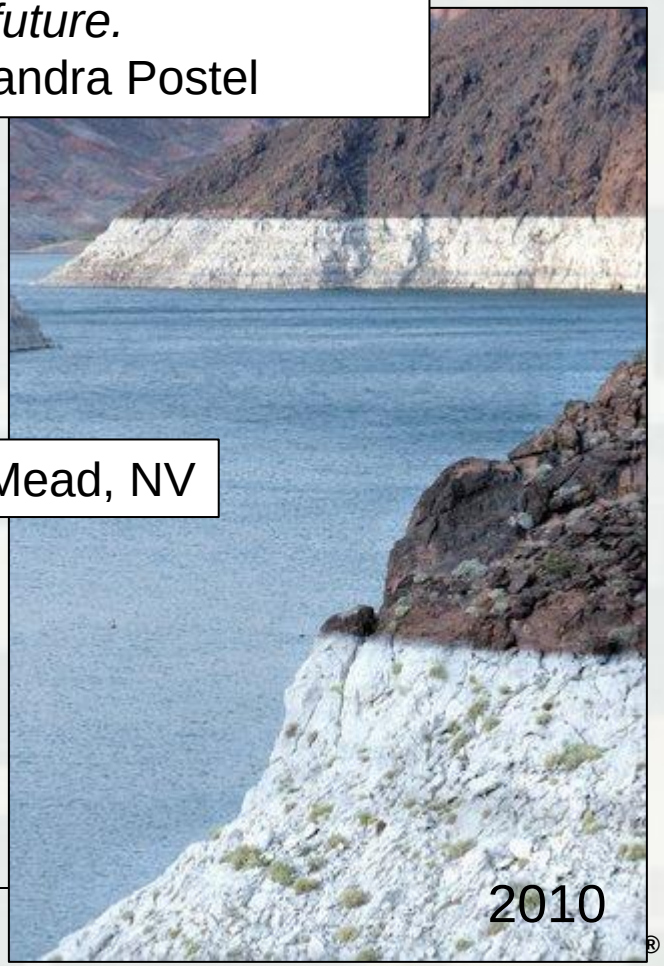
Ward (USGS)

Decreasing Supply

- Over Withdrawal
- Complex Water Rights
- Quality Degradation
- Cost and Financing
- Climate Change

When it comes to water, the past is no longer a reliable guide to the future.
~ Sandra Postel

Lake Mead, NV



Galloway et. al. 1999, Life, Inc., SunsetCities.com & Las Vegas Sun

Current Mandates

Federal Mandate	Water Topic	Water Performance Target
Executive Order 13423	Water Consumption	• Reduce consumption by 2% annually for 16% total by FY2015 (FY2007 baseline)
	Water Audits	• At least 10% per year every 10 years
	Products and Services	• Procurement of water efficient products and services; WaterSense
Energy Independence and Security Act of 2007	Covered Facilities (75%)	• Comprehensive evaluations, project implementation, and follow-up
	Post-Construction Stormwater	• Restore to pre-development hydrology
Executive Order 13514	Water Consumption	• Reduce consumption by 2% annually for 26% total by FY2020 (FY2007 baseline)
	Industrial, Landscape, Agricultural	• Agencies reduce consumption by 2% annually for 20% total by FY2020 (FY2010 baseline)
	Water Reuse	• Identify, promote, and implement water reuse strategies
	Stormwater Management	• Implement and achieve objectives from EPA
Army Sustainable Design and Development Policy	New Construction and Renovation	• Achieve 30% reduction compared to baseline IAW ASHRAE • Outdoor use achieve a 50% reduction " "

Army Vision for Net Zero

The primary goal is a focus toward net zero and when we talk about net zero, it's not only net zero energy, but it's net zero energy, water, and waste. When you look at the term "net zero" or a hierarchy of net zero you must start with reduction, then progress through repurposing, recycling, energy recovery, disposal being the last.

Ms. Katherine Hammack
Assistant Secretary of the Army
Installations, Energy and Environment
10 October 2010

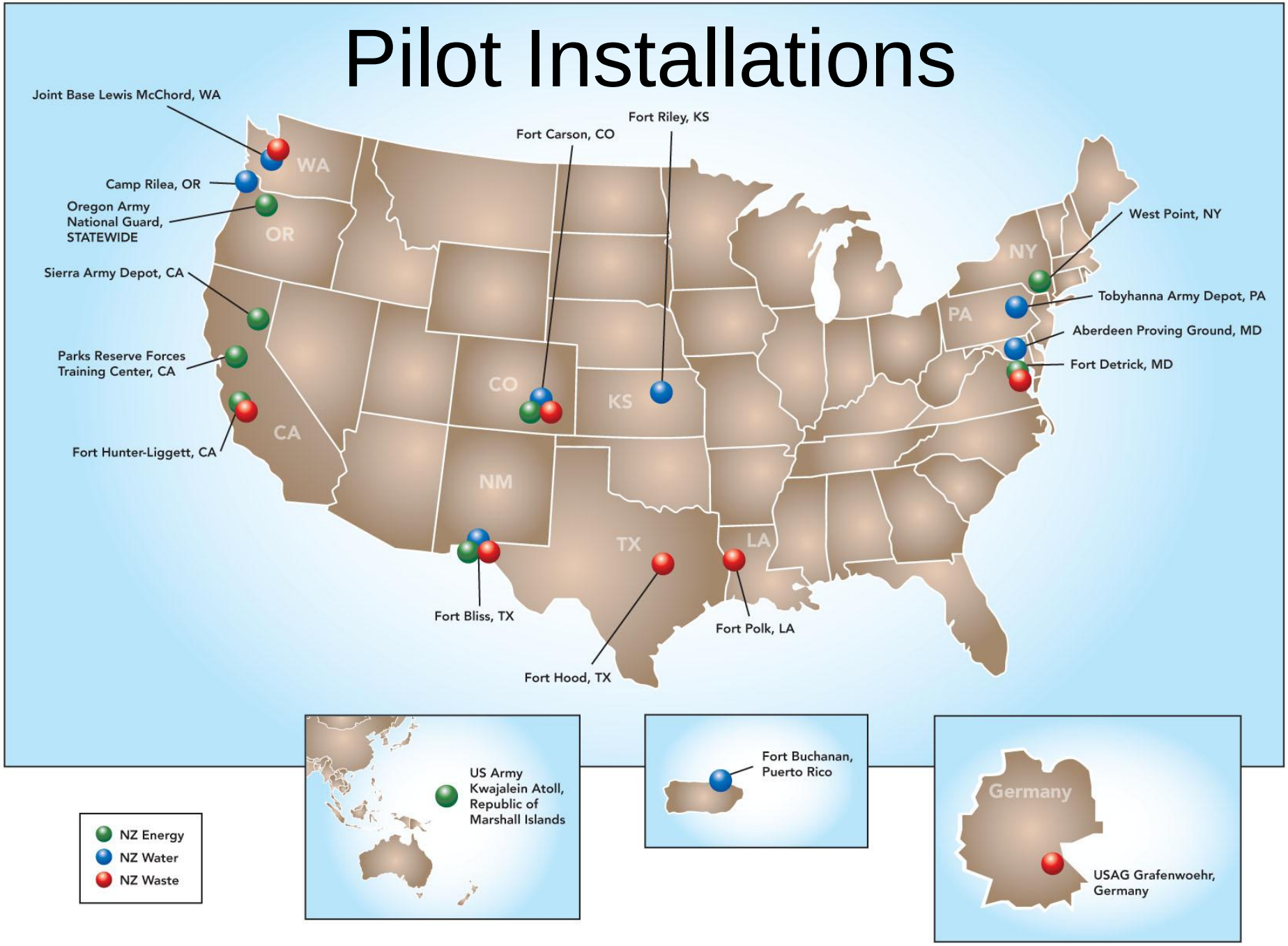
Net Zero is a Force Multiplier

Net Zero Water Definition

- **Watershed Concept** - water consumed should not exceed the water availability of the water resource.
- **Consumptive vs. Non-Consumptive** - a Net Zero Water installation strives to minimize consumptive losses.
- **Water Efficiency and Conservation** - core components are leak detection, irrigation, plumbing fixtures and appliances, utilities, industrial, labs, laundries, and kitchens.
- **Alternate Water Sources** - replace the use of surface or groundwater sources: reclaimed wastewater, graywater, condensate.
- **Green Infrastructure & Low Impact Development** – retain 95% storm on site.

A Net Zero Water Installation 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 and quality over the course of a year.

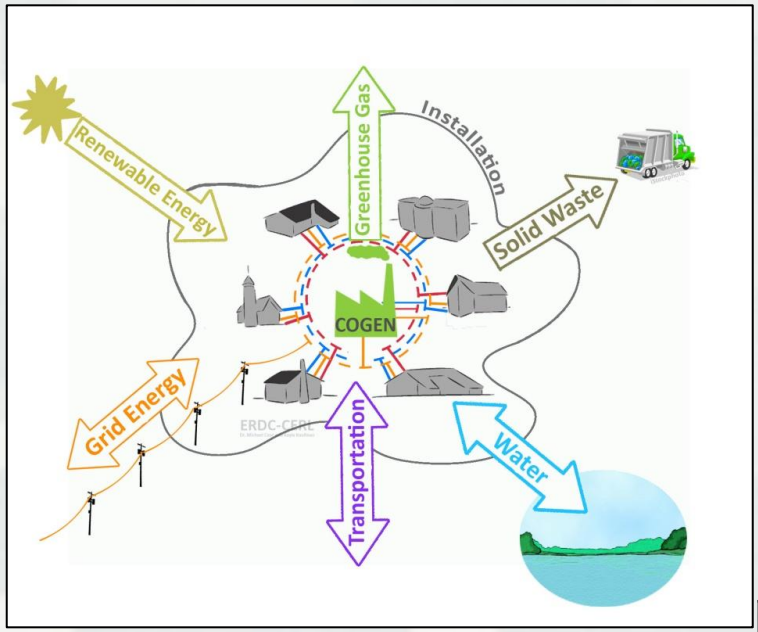
Pilot Installations



Collaboration

- USACE
  - Engineer Research Development Center
  - Huntsville Division
- Department of Energy
  - Pacific Northwest National Laboratory
- EPA
  - Demonstrations
  - Technical assistance

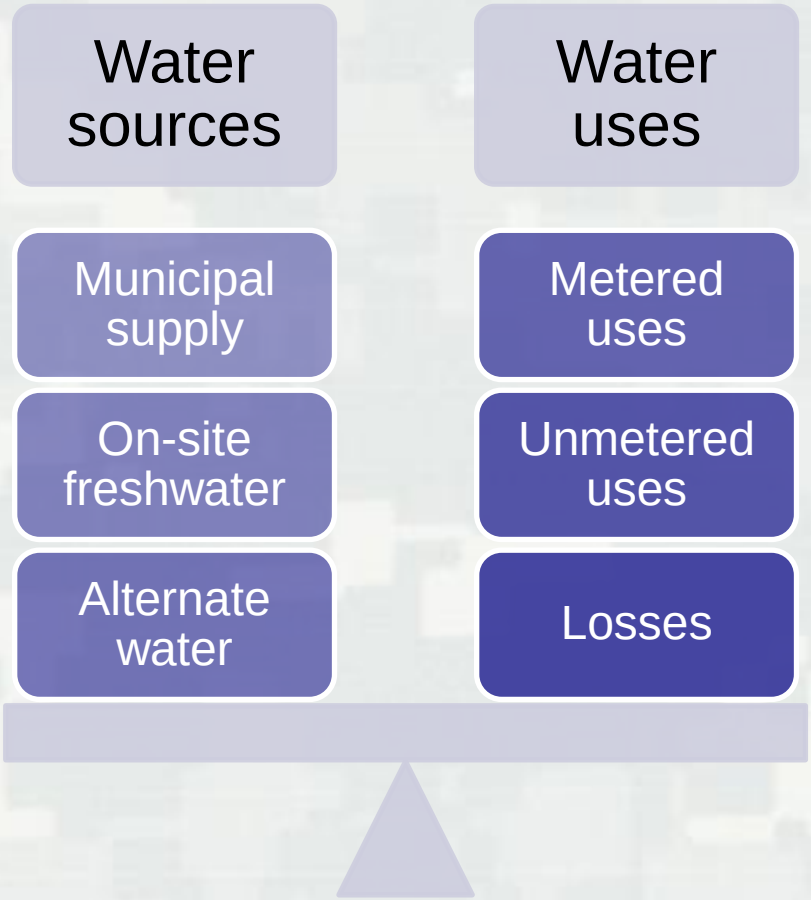
Integrated Installation Energy, Water and Waste Modeling



Schedule

Milestones	FY12	FY13	FY14	FY15
Select/Develop resource component models	3 — 5			
Implement comprehensive model with cross-model interactions	3 — 5			
Determine impacts of regional conservation measure packages		3 — 5		
Incorporate EW2 models into NZI optimization algorithms			4 — 5	

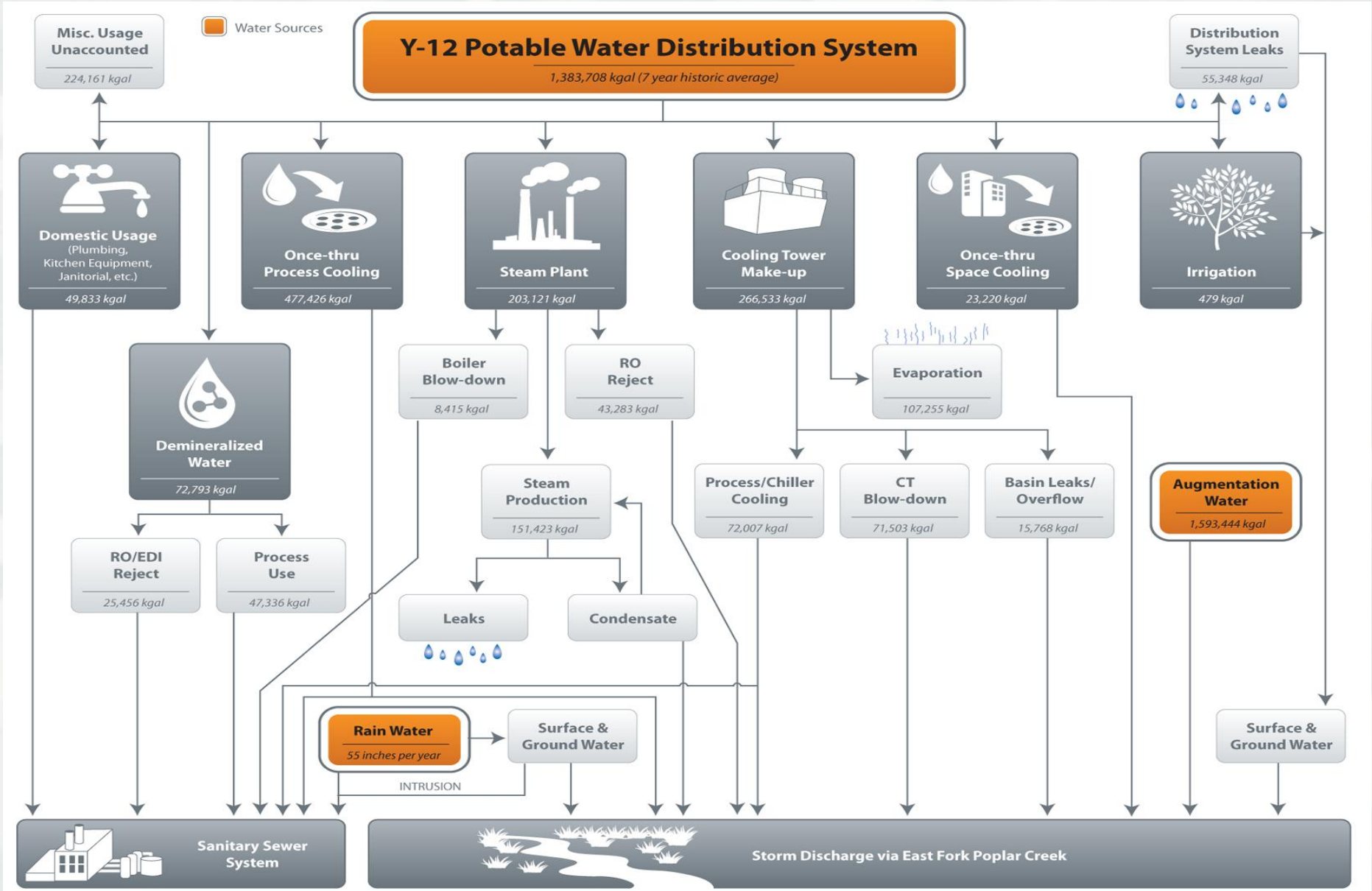
Water Balance



Maximize Alternate Water Sources

Reduce Freshwater Demand & Increase Efficiency

Y-12 Water Balance Example



FEMP Water Efficiency BMPs

1. Water Management Planning
2. Information and Education
3. Leak Detection
4. Water-Efficient Landscape
5. Water-Efficient Irrigation
6. Toilets & Urinals
7. Faucets & Showerheads
8. Boiler/Steam Systems
9. Single Pass Cooling
10. Cooling Towers
11. Commercial Kitchens
12. Lab/Medical Equipment
13. Other Intensive Equip.
14. Alternate Water Sources

For more information – go to the FEMP BMP Website:
http://www1.eere.energy.gov/femp/program/waterefficiency_bmp.html

Related Projects

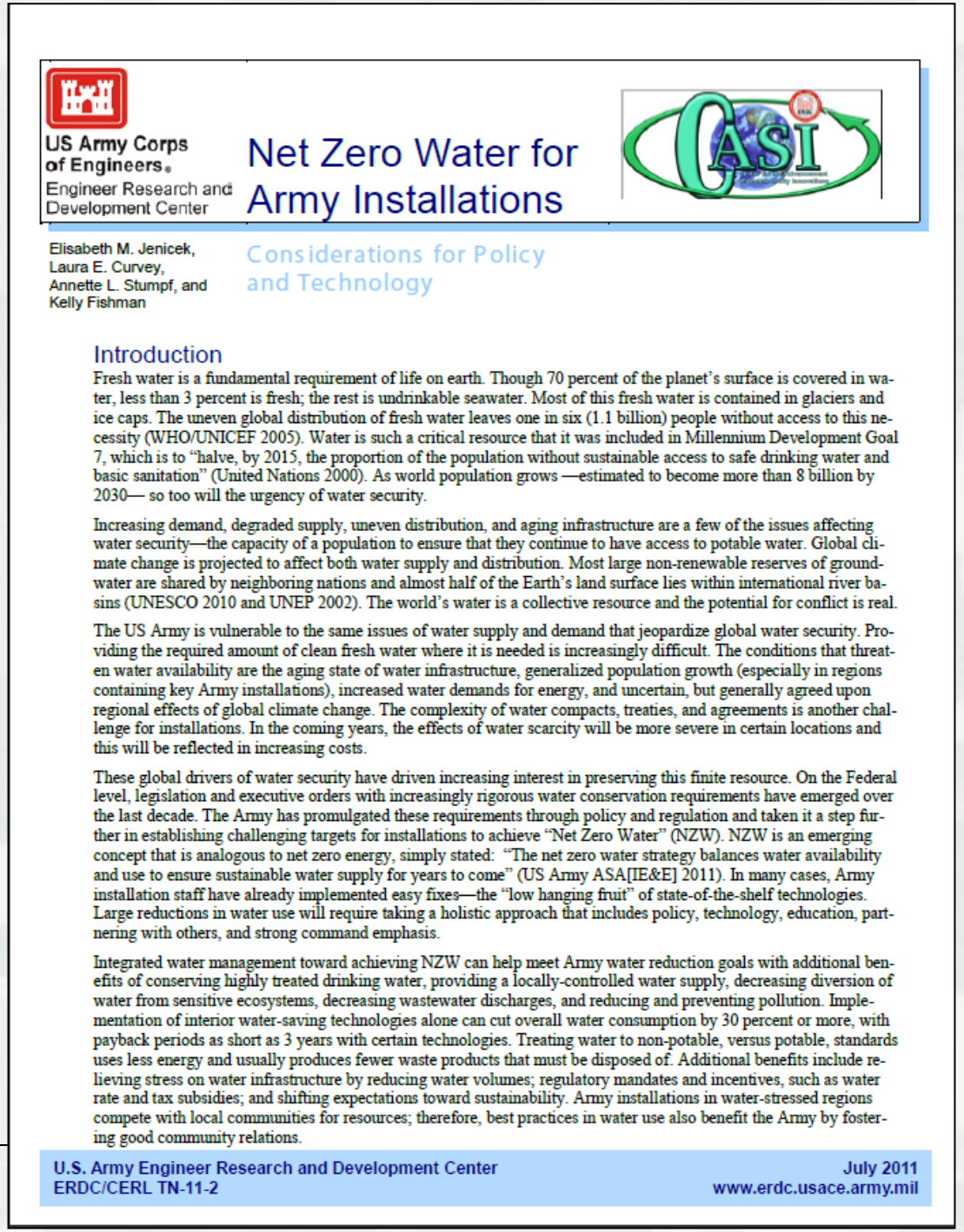
- Modeling Net Zero Installations (Army RDTE)
- Army ACSIM Technology Transition
  - Training Area Water Conservation (Camp Atterbury)
  - Modular Wetland Treatment System (Fort Hood)
- DoD ESTCP DemVal
  - Within Building Graywater Reuse (Fort Irwin)
  - Smart Irrigation Systems (Fort Hood)
  - Tertiary Treatment & Recycling of WW (USMC)
- Anaerobic Wastewater Treatment (SERDP)

Leveraging Private Investments

- Authorities from Congress (underutilized)
  - Energy Savings Performance Contracts (ESPC)
  - Utility Energy Service Contracts
  - Enhanced Use Lease (EUL)
  - Power Purchase Agreement (PPA)
- Other authorities (well utilized)
  - Residential Community Initiative (RCI)
  - Privatized Army Lodging (PAL)
  - Utility Privatization (UP)

Center for the Advancement of Sustainability Innovations

https://casi.erdc.usace.army.mil/



US Army Corps of Engineers
Engineer Research and Development Center

Net Zero Water for Army Installations

Considerations for Policy and Technology

Elisabeth M. Jenicek,
Laura E. Curvey,
Annette L. Stumpf, and
Kelly Fishman

Introduction

Fresh water is a fundamental requirement of life on earth. Though 70 percent of the planet's surface is covered in water, less than 3 percent is fresh; the rest is undrinkable seawater. Most of this fresh water is contained in glaciers and ice caps. The uneven global distribution of fresh water leaves one in six (1.1 billion) people without access to this necessity (WHO/UNICEF 2005). Water is such a critical resource that it was included in Millennium Development Goal 7, which is to "halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation" (United Nations 2000). As world population grows —estimated to become more than 8 billion by 2030— so too will the urgency of water security.

Increasing demand, degraded supply, uneven distribution, and aging infrastructure are a few of the issues affecting water security—the capacity of a population to ensure that they continue to have access to potable water. Global climate change is projected to affect both water supply and distribution. Most large non-renewable reserves of groundwater are shared by neighboring nations and almost half of the Earth's land surface lies within international river basins (UNESCO 2010 and UNEP 2002). The world's water is a collective resource and the potential for conflict is real.

The US Army is vulnerable to the same issues of water supply and demand that jeopardize global water security. Providing the required amount of clean fresh water where it is needed is increasingly difficult. The conditions that threaten water availability are the aging state of water infrastructure, generalized population growth (especially in regions containing key Army installations), increased water demands for energy, and uncertain, but generally agreed upon regional effects of global climate change. The complexity of water compacts, treaties, and agreements is another challenge for installations. In the coming years, the effects of water scarcity will be more severe in certain locations and this will be reflected in increasing costs.

These global drivers of water security have driven increasing interest in preserving this finite resource. On the Federal level, legislation and executive orders with increasingly rigorous water conservation requirements have emerged over the last decade. The Army has promulgated these requirements through policy and regulation and taken it a step further in establishing challenging targets for installations to achieve "Net Zero Water" (NZW). NZW is an emerging concept that is analogous to net zero energy, simply stated: "The net zero water strategy balances water availability and use to ensure sustainable water supply for years to come" (US Army ASA[IE&E] 2011). In many cases, Army installation staff have already implemented easy fixes—the "low hanging fruit" of state-of-the-shelf technologies. Large reductions in water use will require taking a holistic approach that includes policy, technology, education, partnering with others, and strong command emphasis.

Integrated water management toward achieving NZW can help meet Army water reduction goals with additional benefits of conserving highly treated drinking water, providing a locally-controlled water supply, decreasing diversion of water from sensitive ecosystems, decreasing wastewater discharges, and reducing and preventing pollution. Implementation of interior water-saving technologies alone can cut overall water consumption by 30 percent or more, with payback periods as short as 3 years with certain technologies. Treating water to non-potable, versus potable, standards uses less energy and usually produces fewer waste products that must be disposed of. Additional benefits include relieving stress on water infrastructure by reducing water volumes; regulatory mandates and incentives, such as water rate and tax subsidies; and shifting expectations toward sustainability. Army installations in water-stressed regions compete with local communities for resources; therefore, best practices in water use also benefit the Army by fostering good community relations.

U.S. Army Engineer Research and Development Center
ERDC/CERL TN-11-2

July 2011
www.erdc.usace.army.mil

EKO Public NZ Web Site

ENGINEERING KNOWLEDGE ONLINE™

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eko.usace.army.mil/public/fa/netzero

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Net Zero Installations

Army Net Zero Installations functional area page. This page is sponsored by the Office of the Assistant Secretary of the Army (Installations, Energy & Environment).

The Army's vision is to appropriately manage our natural resources with a goal of net zero installations. Today the Army faces significant threats to our energy and water supply requirements both home and abroad. Addressing energy security and sustainability is operationally necessary, financially prudent, and essential to mission accomplishment. The goal is to manage our installations not only on a net zero energy basis, but net zero water and waste as well. We are creating a culture that recognizes the value of sustainability measured not just in terms of financial benefits, but benefits to maintaining mission capability, quality of life, relationships with local communities, and the preservation of options for the Army's future. The Army is leveraging available authorities for private sector investment, including using power purchase agreements (PPA), enhanced-use leases (EUL), energy savings performance contracts (ESPC), and utilities energy service contracts (UESCs) as tools to achieve these objectives. The Army must invest in its installations and improve efficiencies in energy, water and waste for the benefit of our current and future missions.

The Army is piloting six installations to be Net Zero Energy, six installations to be Net Zero Waste, six installations to be Net Zero Water, and two installations to be all three by 2020. The Army goal is to have 25 Net Zero Installations by 2030.

The installations are as follows:

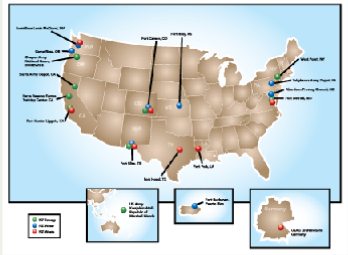
NET ZERO ENERGY PILOT SITES:
- Fort Detrick, MD
- Fort Hunter Liggett, CA
- Kwajalein Atoll, Republic of the Marshall Islands
- Parks Reserve Forces Training Area, CA
- Sierra Army Depot, CA
- West Point, NY

NET ZERO WATER PILOT SITES:
- Aberdeen Proving Ground, MD
- Camp Rilea, OR
- Fort Buchanan, PR
- Fort Riley, KS
- Joint Base Lewis-McChord, WA
- Tobyhanna Army Depot, PA

NET ZERO WASTE PILOT SITES:
- Fort Detrick, MD
- Fort Hood, TX
- Fort Hunter Liggett, CA
- Fort Polk, LA
- Joint Base Lewis-McChord, WA
- U.S. Army Garrison, Grafenwoehr, Germany

NET ZERO OVER-ALL PILOT SITES:
- Fort Bliss, TX
- Fort Carson, CO

STATE-WIDE ENERGY INITIATIVE:
- Oregon Army National Guard



Best Practices

Whole Building Design Guide (WBGD) Portal

The WBDG is a Web portal providing government and industry practitioners with one-stop access up-to-date information on a wide range of building-related guidance, criteria and technology from a 'whole buildings' perspective. WBDG is a collaborative effort among federal agencies, private sector companies, non-profit organizations and educational institutions.

Announcements

Sep. 15, 2011

News Preliminary GreenGov Symposium Draft Agenda Released

Upcoming Events

No Items Available

Items Recently Posted

- Army Vision for Net Zero, October 2011
- Public Works Digest, September / October 2011
- Preliminary GreenGov Symposium Draft Agenda Released
- DoD Energy Handbook (March 2011)

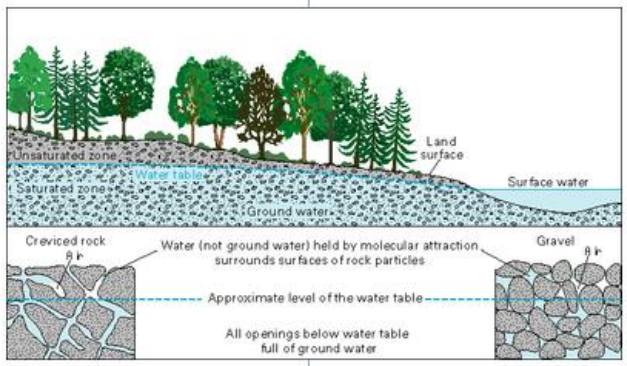
Water Management Imperative

Water issues are impacting Army installations and operations in many locations across the nation. Concerns including supply variability, increased cost of purchase or production, quality, habitat degradation, and salinity issues have prompted a new focus on water resources on the installation, national, and global level.

Recent national policy that establishes water conservation targets includes codified national goals for DoD installations to design and implement water efficiency Best Management Practices (BMPs) and develop a water management plan.

containing Army installations, make it imperative for installation staff to have ready access to the wide range of web resources, reports, and tools

Ground and Surface Water



Source: USGS

U.S. EPA Water News

EPA to Hold Listening Sessions on Potential Chesapeake Bay Stormwater Rule

Science and Engineering Festival / Encouraging the interest of our nation's youth in science, technology, engineering and math

Water-management-toolbox.com/

EKO Public Page for Net Zero Installations
http://eko.usace.army.mil/public/fa/netzero/

White Paper
http://www.cecer.army.mil/techreports/erdc-cerl_tn-11-2/erdc-cerl_tn-11-2.pdf

http://water-management-toolbox.com/

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