

Irrigation Alternatives to Meet Army Net Zero Water Goals

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Overview

- **Background**
- **Water issues**
- **Water efficient landscaping**
- **Water efficient irrigation**
- **Summary**



Background

- Drivers

- ▶ Executive Orders 13423, 13514 **require reductions in water use**
- ▶ Incorporate water efficiency/conservation measures
- ▶ EISA Section 438
- ▶ Green Building Initiative
- ▶ Army sustainable design and development policy
- ▶ ASHRAE 189.1-2009
- ▶ Net Zero Water Installations Initiative



Army Installations

- Cantonments are like small cities, up to 50,000 population
- Directorate of Public Works – responsible for all real estate, easier to implement changes
- Have all the amenities – schools, housing (barracks and family), hospitals, restaurants, commissaries, service stations, heating plants, hotels, industry
- Large amounts of green space – parade grounds, athletic fields, parks, cemeteries
- Thousands of acres of undeveloped area
- Self-contained, but dependent on surrounding region for support
- Usually senior water rights, but follow a good neighbor policy and take stewardship of natural resources seriously



Installation Greenspace



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Best Management Practices

- There are a variety of BMPs (14) related to water efficiency for feds, other orgs. vary
- Our focus is two of those
- Water Efficient Landscaping
- Water Efficient Irrigation



Water Efficient Landscaping

- **Design landscape requiring minimal supplemental water**
- **Design, install and maintain irrigation system that delivers appropriate quantities of water efficiently.**



Water Efficient Landscaping

- **Traditional landscaping requires supplemental water to thrive.**
- **Irrigation is need to make up the difference between landscape water requirements and natural precipitation.**
- **Use native or “climate-appropriate” material**
- **Can reduce irrigation water by 50%, stands up better to drought, less resources needed for maintenance**



Design Phase

- **Assess soils and amend to maximize water holding capacity**
- **Design plant groupings based on similar water requirements and rooting depths (hydrozoning)**
- **Design with water use efficiency, potential for water harvesting, and delivery of irrigation in mind**
- **Plant trees properly**
- **Avoid ornamental water features in new landscape development**
- **Use turf only when needed and avoid planting in long narrow strips**



Low Impact Development (LID)

- Capture and use rainfall where it lies
- Parking lot islands use depressions instead of raised
- Eliminate “strip grass”
- Use bushes, mulch or permeable hardscape

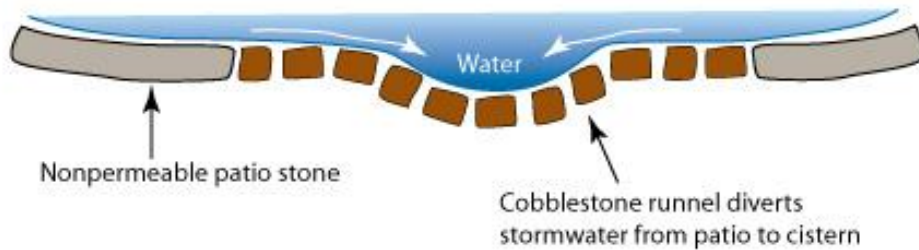


O&M Considerations

- **Review landscape service and maintenance agreements**
- **Incorporate high priority for efficiency of water, energy and chemicals**
- **Consider landscapers trained in water efficiency and climate- appropriate approaches**



Landscape Techniques



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Water-wise Landscaping

- **Group plants according to their water needs**
- **Use native and low-water-use plants**
- **Limit turf areas to those needed for practical use**
- **Use efficient irrigation systems**
- **Schedule irrigation wisely**
- **Make sure soil is healthy**
- **Remember to mulch**
- **Provide regular maintenance**



Xeriscape Principles

- **Proper planning and design**
- **Soil analysis and improvement**
- **Appropriate plant selection**
- **Practical turf areas**
- **Efficient irrigation**
- **Use of mulches**
- **Appropriate maintenance**



Soil Additives/Amendments

- Maximize soil moisture retention
 - ▶ Compost to improve water holding capacity
 - ▶ Polyacrylamides to prolong soil moisture release
 - ▶ Ideal soil texture (mix of clay, silt, and sand) maintained to adequate depths for efficiently storing water
 - ▶ Use of drought tolerant, native plant species
 - ▶ Use of plant growth regulators to minimize growth and evapotranspiration
 - ▶ Use of mulches



Mulch

- Add to plant beds
- Decreases water lost from soil through evaporation, helps reduce weed growth

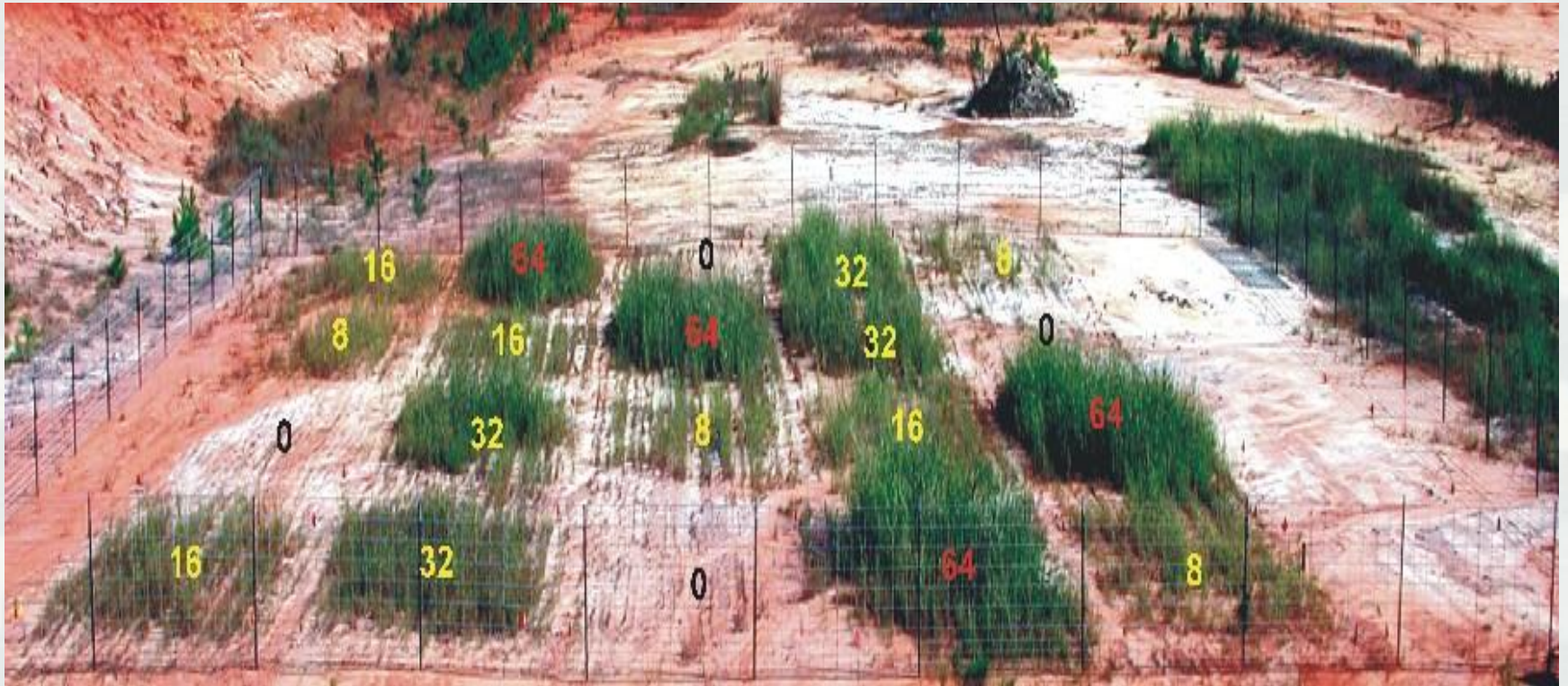


Mulches

- **Organic**
 - ▶ **Compost**
 - ▶ **Shredded barks and other landscape wastes**
- **Inorganic**
 - ▶ **Gravel**
 - ▶ **Rock**
 - ▶ **Crumb rubber**
 - ▶ **Fabrics and plastics**



Effect of Compost on Soil Water Content and Plant Growth



Compost application to very sandy soils at rates of 0, 8, 16, 32, and 64 tons/acre. Note improved plant growth with increasing application rates due to drastically improved soil water holding capacity. Fort Benning, Georgia

Turf Choices

- **Choose low growing varieties**
 - ▶ **Reduces maintenance requirements (mowing) and potential for excessive landscape waste**
- **Choose varieties with reduced leaf surface area**
 - ▶ **Reduces evapotranspiration and potential for excessive landscape waste**
 - ▶ **Zoysia, paspalum, bermudagrass, buffalograss varieties are available for many parts of the USA**



Turf species best adapted to most California conditions								
Turf species	Tolerance						Temperature adaptation	Planting method
	Heat	Cold	Drought	Shade	Salinity	Wear/ Traffic		
<u>Bermudagrass</u>	High	Low	High	Low	High	High	Warm-season	Seed, sod, stolons, sprigs, plug
<u>Kentucky bluegrass</u>	Low	High	Low	Mod	Low	Mod	Cool-season	Seed, sod
<u>Perennial ryegrass</u>	Low	High	Low	Low	Mod	High	Cool-season	Seed, sod
<u>Red fescue</u>	Low	High	Mod	High	Low	Mod	Cool-season	Seed, sod
<u>St. Augustinegrass</u>	High	Low	Mod	High	High	Mod	Warm-season	Sod, stolons
<u>Tall fescue</u>	Mod-high	Mod	Mod	Mod	Mod	Mod-high	Cool-season	Seed, sod

From: [http://anrcatalog.
ucdavis.edu/pdf/8035.pdf](http://anrcatalog.ucdavis.edu/pdf/8035.pdf)



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Artificial Turf



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Water Efficient Irrigation

Proper training in system installation, maintenance and management

Review service agreements to incorporate high priority for water efficiency

Immediate reporting and repair of problems

Irrigation system audit every three years

Irrigation meter

Proper scheduling of water application

Shutoff nozzles on handheld hoses

Consider weather-based irrigation controls

Soil-moisture-based irrigation controls

Central systems with demand-based controls

Micro or drip irrigation where appropriate

Proper sprinkler heads and placement

Rain-sensing technology

Freeze-sensing technology

Flow rate monitoring equipment



How Much Water Does Irrigation Use?

- **Varies with location**
- **Varies with rainfall**
- **Climate, geography**
- **Type of planting**
- **Soil type**
- **Season**



Technology

- **Controllers**

- ▶ **Replace existing irrigation system controllers with more advanced control systems that water plants only as needed**
- ▶ **Weather-based irrigation control systems can be added to existing controllers. Use real-time or historical weather information along with landscape parameters entered by vendor to schedule**
- ▶ **Soil-moisture based controls are inserted into the soil to measure moisture. Can be connected to controller or add-on device to irrigate when the plants need water**
- ▶ **Complete central control systems utilize demand-based controls and enable a water manager to centrally operate and manage multiple irrigation systems at multiple locations using various means of communication**



Technology

- **Sensors**
 - ▶ **Soil-moisture sensors**
 - ▶ **Rain-sensing technology**
 - **Required in some states and cities**
 - ▶ **Wind-sensing technology**
 - ▶ **Freeze-sensing technology**



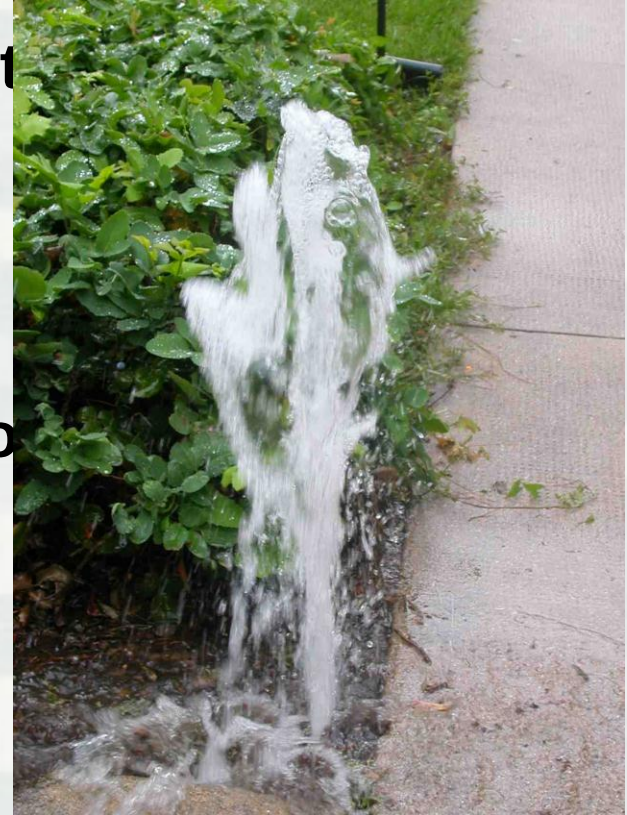
Rain/Freeze Sensors



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Technology

- Flow rate monitoring equipment that can interrupt irrigation if excess water is detected (broken pipes, sprinklers, etc)
- Check valves in all sprinklers to retain water in lateral pipes between cycles



Options to Irrigate Water Efficiently

- **Responsible person should have proper training in system installation, maintenance and management**
- **Distribution Uniformity –spread water evenly**
- **Make sure your vendors/contractors have been trained in water efficiency; many sources of info – county extension services, colleges, irrigation trade associations, WaterSense**
- **Review all irrigation service agreements/contracts, make water efficiency a priority**



Reviewing Irrigation Agreements

- **Incorporate water budget**
- **Full audit of system every 3 years**
- **Immediate reporting and repair of problems**
- **Periodic maintenance routines**
- **Install irrigation meter**
- **Verify irrigation schedule appropriate for climate, soil conditions, plant materials, grading and season**
- **Change schedule based upon changing weather**
- **Require replacement equipment to be compatible with existing equipment**
- **Periodic monitoring through year**



Irrigation Considerations

- **Must be considered from initial system design phase through installation to ensure optimal performance**
- **Consistent management and maintenance essential**
 - ▶ **Otherwise can lose 50% of water to evaporation, wind, poor management, improper design or maintenance**
 - ▶ **Consider irrigation schedule**
 - ▶ **Change with seasons**
 - ▶ **Overwatering can cause more damage than underwatering, damage streets, curbs, paving, building foundations**



Water Delivery

- **Consider low-flow, low-volume irrigation, i.e. drip irrigation or micro-irrigation**
 - ▶ **May be appropriate for some trees, shrubs, or plant beds**
 - ▶ **Efficient as water is directly applied to root zones**
- **Increase sprinkler head efficiency**
 - ▶ **Fine mist may be susceptible to wind drift**
 - ▶ **Efficient heads can also distribute water more evenly**



Drip Irrigation



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Drip irrigation equipment



Irrigation Audit



Use Alternate Water Resources

- **Rainwater harvesting**
- **Stormwater harvesting**
- **Graywater use**
- **Water reuse – take advantage of “purple pipe” networks when available for irrigation as well as recycling of other used water which is still of acceptable quality for irrigation such as cooling tower water blowdown or air handling unit water**



Ordinances and Policies

- **Can impact how water is used for irrigation**
- **Model ordinances available**
- **Must have “teeth” to be effective**



Example of Appropriate Design



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Water Efficient Landscaping



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Options for the Reduction of Outdoor Garden/Landscape Water Use

Management Options

	Potential Savings (Percent)
Turf maintenance	10
Turf maintenance, irrigation system	20
Maintenance, Irrigation Scheduling	
Mulching in Ornamental Gardens	20
Soil Amendments (Compost)	20
Irrigation Scheduling	25
Irrigation/Soil maintenance	65 to 75
Lawn to go Dormant	90

Hardware Options

Auto rain Shut Off	10
Soil Moisture Sensors; Soil Probes	10 to 30
Improve Performance	40
Drip/Bubbler Irrigation	50
Gray Water	Up to 100
Rain Barrel Catchment	Up to 100

Landscape Design Options

Landscape Design	19 to 55
Turf Reduction	19 to 35
Choice of Plants	30 to 80

From Gleick et al.



Conclusions

- Many drivers are contributing towards the demand for net zero water installations
- While irrigation is a major water consumer on installations, many options are available to reduce water consumption and wastage
- Design including plant selection can have a major impact
- Technology is constantly improving providing increased efficiency at getting water to plants from better controllers and sensors to improved watering techniques like micro and drip irrigation



Questions?

**Contact information or for additional information or
resources**

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