



Army Green and Sustainable Remediation: Policy and Implementation



Environment, Energy & Sustainability Symposium and Exhibition (E2S2)

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Overview

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A former DERP site, Fort Bragg promotes public access to the installation by providing a number of recreational opportunities, such as bird-watching, on its 18-mile All-American Trail, a registered North Carolina Birding Trail, located on remediated land.

Photo: Elizabeth Evans, Fort Bragg

www.army.mil/-images/2010/04/20/70522/



OSD GSR Policy

- August 2009 Office of the Secretary of Defense (OSD) Policy Memo:
 - Consider and implement Green and Sustainable Remediation (GSR) practices “where and when they make sense” (August 10, 2009)
 - DoD Components requested to brief OSD on current efforts, strategies, and future plans

Green and Sustainable Remediation

Minimize the overall environmental footprint through the following activities:

- Evaluate sustainability during remedy selection
- Evaluate sustainability of existing remediation systems
- Preserve natural resources
- Minimize energy use and increase energy efficiency
- Minimize emissions
- Use passive sampling
- Minimize fresh water consumption and maximize water reuse
- Maximize recycling, reuse, and reduction of materials
- Consider use of environmental remediation technologies with inherently sustainable aspects



Headquarters GSR Overview

- Army GSR Strategy:
 - Sustainability concepts addressed in the 2004 Army Strategy for the Environment
 - Green remediation specifically included in FY10-11 Army Environmental Cleanup Strategic Plan
- Ongoing efforts:
 - Participate and partner with other agencies
 - Conduct Pilot Projects
 - Optimize Existing Remedies
 - Utilize Sustainability Tools



Colorado Gov. Bill Ritter Jr. and Maj. Gen. Mark A. Graham, commanding general, Division West, First Army and Fort Carson, prepare to cut the ribbon on the 15-acre Fort Carson solar array.

Photo: Michael J. Pach

www.army.mil/-images/2008/01/17/12170/

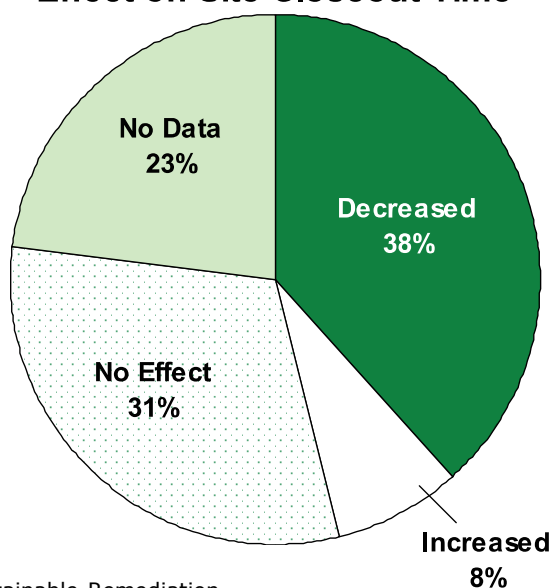


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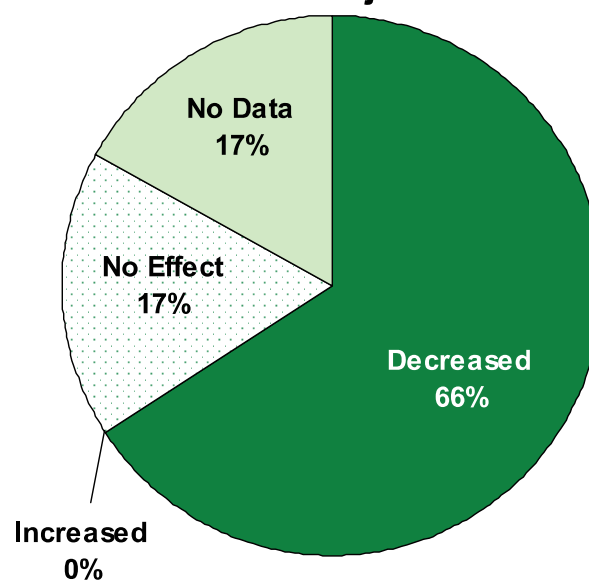
GSR In Practice: Field Survey

- Army HQ developed a field survey to capture the broad nature and scope of Army GSR practices
- Initial scope: Tasked to all Army Commands (AEC, BRAC-D, HQUSACE, NGB) for distribution to field.
- Received 47 survey responses from 28 installations
- Installations: 12 Active, 8 BRAC, 6 FUDS, 2 NGB

Effect on Site Closeout Time



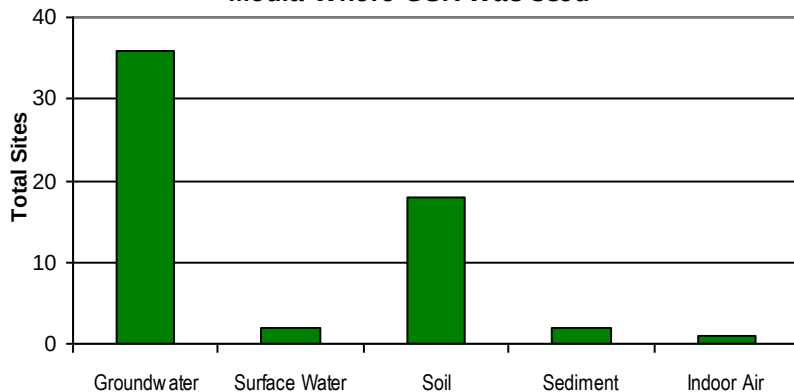
Effect on Project Cost



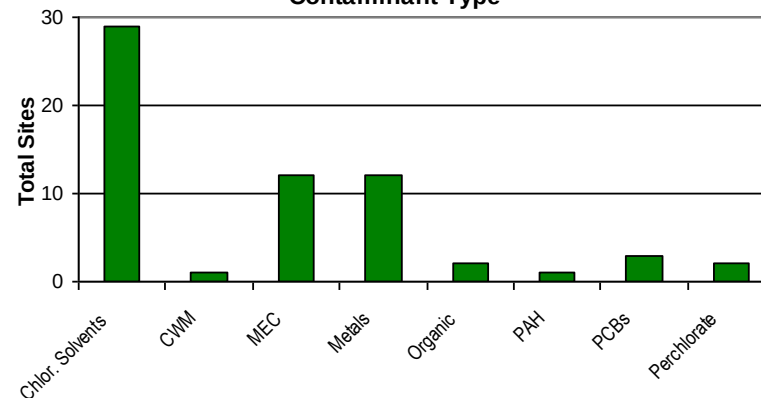


GSR Remedies and Best Practices

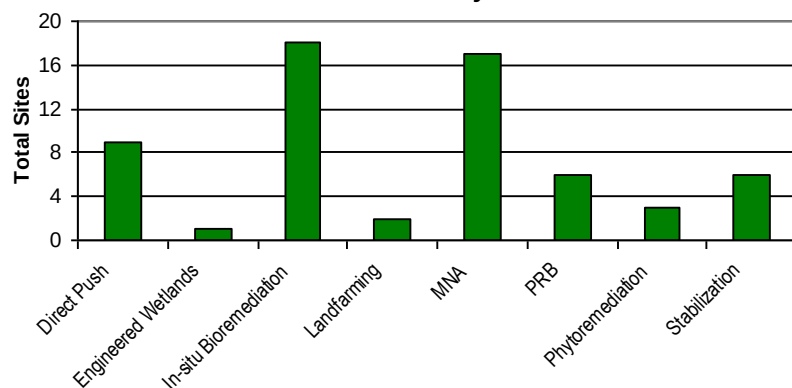
Media Where GSR Was Used



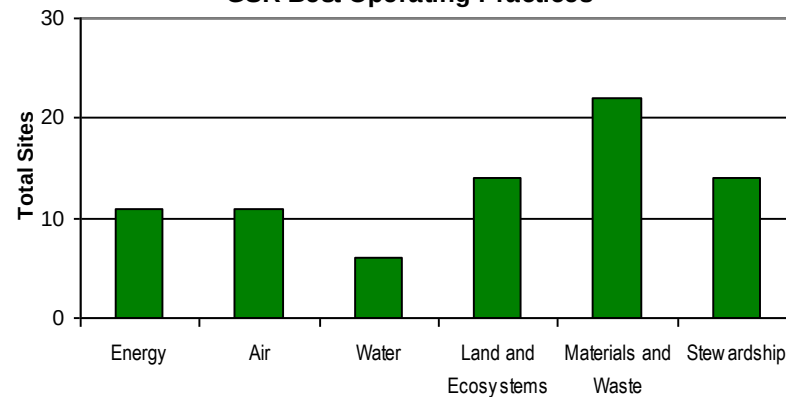
Contaminant Type



GSR Remedy



GSR Best Operating Practices



* Survey respondents were asked to check all that apply, so the sum within each table may be higher than the total number of surveys received.



Army Database Analysis

Active and BRAC Sites

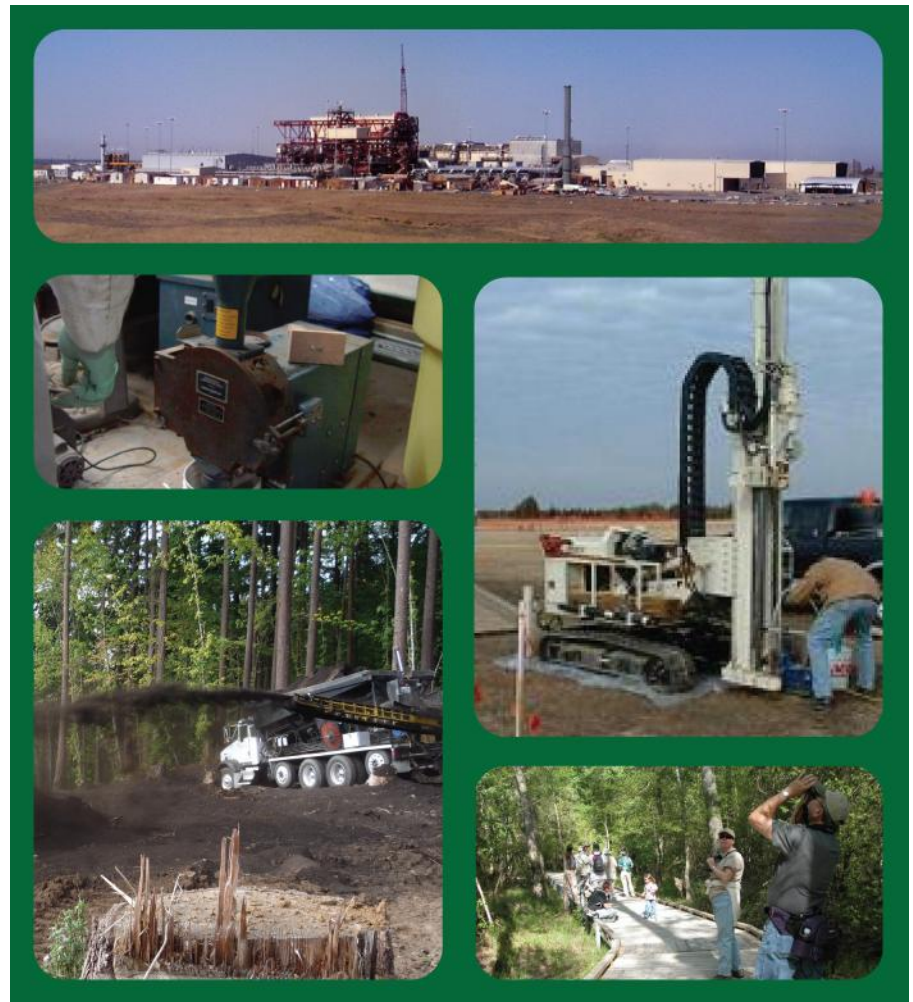
- Most widely used GSR Remedies include the following:
 - On-Site Treatment
 - In-Situ Soil Treatment (133 sites)
 - Ex Situ Soil Treatment (114 sites)
 - Solidification/Stabilization (58 sites)
 - Soil Washing (9 sites)
 - Treatment that Mimics a Natural Process
 - Natural Attenuation (501 sites)
 - Bioremediation (154 sites)
 - Bioremediation – In Situ Groundwater (126 site)
 - Bioremediation – In Situ (62 sites)
 - Bioventing (41 sites)
 - Passive Treatment Wells (33 sites)
 - Composting (32 sites)
 - Landfarming (12 sites)
 - Alternate Habitat (3 sites)
 - Slurry-Phase Bioremediation (3 sites)

Because of limited GSR data reported in current data systems, not all sites using green or sustainable remedies are reflected in this list.



Case Studies

- Camp Crowder
- Camp Edwards (MMR)
- Camp Withycombe
- Seneca Army Depot
- Volunteer Army Depot





Camp Crowder

- **Background:** Contaminants in soil and groundwater include chlorinated solvents, petroleum hydrocarbons, and PCBs
- **GSR Approaches:**
 - Soil remediated using landfarming and ex-situ chemical oxidation
 - Landfarming reduced TCE concentrations from > 10,000 ppm to less than 1 ppm
 - Additional treatment by chemical oxidation reduced levels to < 0.3 ppm
 - Groundwater remediated using mobile SVE/DPVE
 - Removed approximately 80 to 190 pounds of predominantly TCE at 3 soil source areas.
 - Used at a fourth site for approximately six months and recovered approximately 30,000 gallons of groundwater and LNAPL
- **Footprint reduction:**
 - Landfarming site reduced transportation needs
 - Mobile SVE equipment eliminated construction of permanent treatment facility



Area slated for redevelopment at Camp Crowder



Abandoned buildings at Camp Crowder



Camp Edwards (MMR)

- **Background:** >70,000 cubic yards of soil contaminated and >10 billion gallons of groundwater contaminated with metals, explosives, and perchlorate
- **GSR Approaches:**
 - Base-wide energy optimization and 1.5-MW onsite wind turbine
 - On-site soil treatment with low-temperature thermal desorption
 - Treatment with alkaline hydrolysis using recycled carbon
 - Reusing and recycling of retrieved lead fragments, removed top soil, and use of recycled carbon
 - Use of modular pump and treat system
 - In-situ pilot study using bacteria to treat perchlorate in groundwater
 - Targeted species removal and use of native plants and grass seed for restoration
- **Footprint Reduction:**
 - Reduced energy use and increased use of renewable energy
 - On-site and passive treatment methods
 - Use of recycled materials
 - Reduced construction with mobile treatment systems
 - Minimized impact on wildlife and native species



The sleek new 1.5 megawatt wind turbine at Camp Edwards, MA, reaches nearly 390 feet up into the sky.

Photo: Maj. James Sahady, U.S. Army

<http://states.ng.mil/sites/MA/News/Pages/Cape%20Wind%20Turbine%20on%20Line%20for%20Base%20Cleanup.aspx>



Camp Withycombe

- **Background:** Wetlands and soil were contaminated with a high concentration of metals from small arms training. Received an Environmental Stewardship award from the National Guard.
- **GSR Approaches:**
 - Soil Treatment Process
 - Dry particle separation to remove bullets from soil
 - Wet soil washing process
 - All water involved in the treatment process was reclaimed for reforestation irrigation
 - More than 30,000 tons of soil remediated and 270 tons of lead bullet fragments were reclaimed for recycling
- **Footprint Reduction:**
 - Shorter project lifespan and reduced cost
 - Eliminated 914 pounds of PM, 1.8 million pounds of CO₂, 141,605 pounds of CO, 36,543 pounds of NO_x, and 1,672 pounds of SO_x



The treatment system processed around 300 tons of soil daily.



Bullets were collected in reused one-ton capacity sugar sacks.



Seneca Army Depot

- **Background:** 60,000 cubic yards of groundwater contaminated with chlorinated solvents and metals
- **GSR Approaches:**
 - Consisted of three bio-walls of mulch infused with vegetable oil (as a carbon source)
 - Reduced the TCE and chlorinated byproducts through anaerobic processes
- **Footprint Reduction:**
 - Low energy, passive remedy was a cost-effective solution to reduce TCE levels
 - Lower pollutant emissions and fossil fuel use output than standard pump-and-treat technologies



Aerial view of the
Seneca Army Depot



Volunteer Army Ammunition Plant

- **Background:** TNT and DNT contamination in soil as high as 10% concentration, impacting both soil and groundwater
- **GSR Approaches:** On-Site Alkaline Hydrolysis
 - Soils were excavated and treated on-site within a contained asphalt-lined former pH control pond
 - Soil treated in 300 yard increments with caustic soda
 - More than 112,000 cubic yards of soil treated using alkaline hydrolysis
 - Total TNT/DNT mass removed is more than 75 tons
 - Average contaminant mass reduction is >93%
- **Footprint Reduction:**
 - No hazardous waste disposal, landfill space, or off-site backfill
 - Reduced transportation/ lowered fossil fuel use
 - Recycled water was used to maintain optimum soil moisture during treatment
 - No risk from breakdown products



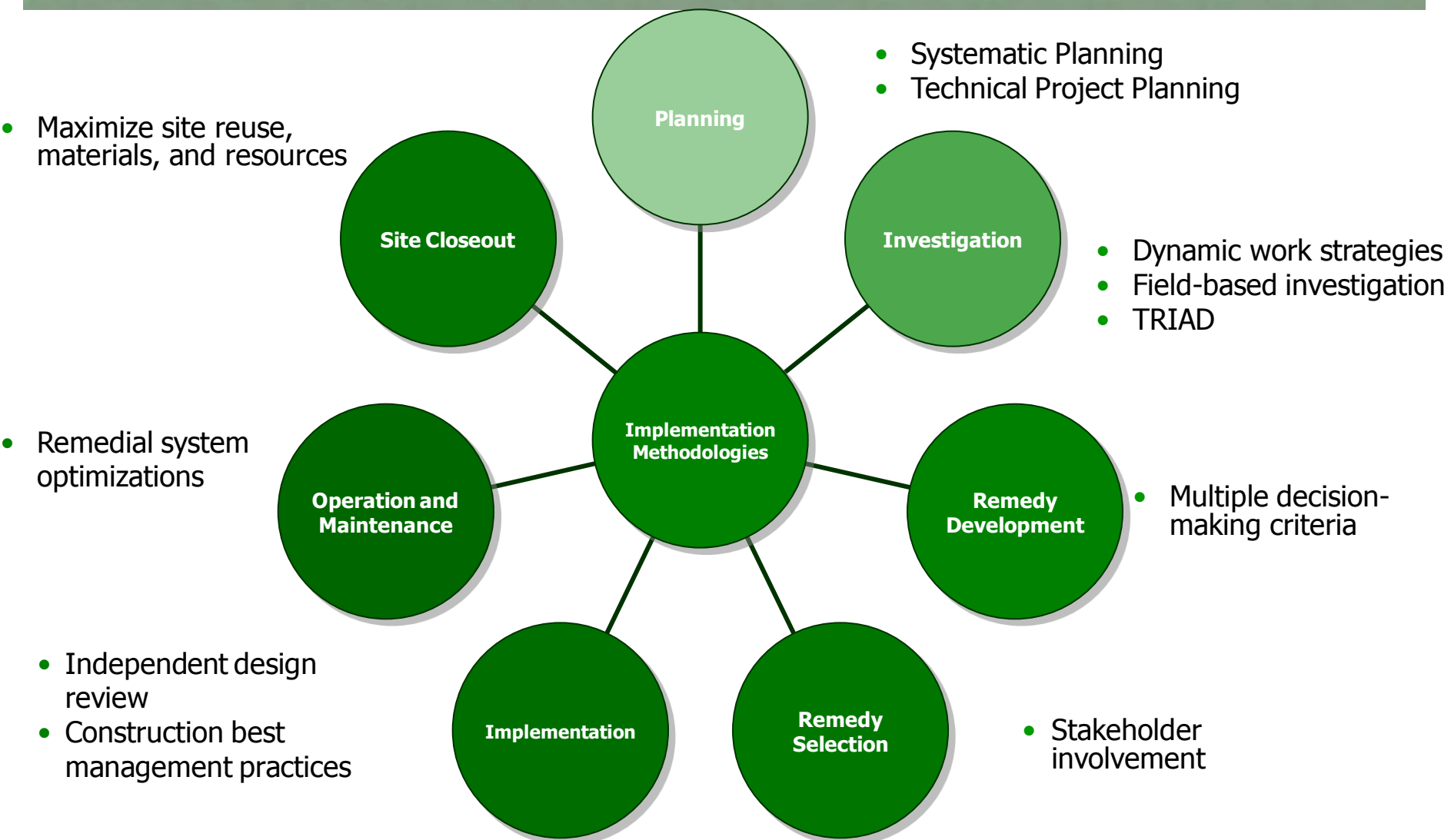


USACE Decision Framework

- Outlines process for incorporating GSR practices across entire project life cycle
- Applies directly to FUDS sites; can be applied to other sites
- Process differentiates between the statutory CERCLA requirements and optional GSR considerations
- Ways to incorporate the Decision Framework:
 - Methodologies
 - Consideration of GSR Technologies
 - Best Management Practices (BMPs)
 - Compare Remedial Options with Sustainability Evaluation Tools
 - Contract language (including performance-based contracts)
- Interim Decision Framework (March 2010) available at:
www.environmental.usace.army.mil/corpguide.htm



Recommended Approach: Ways to Include GSR





Recommended Approach: BMPs and Sustainability Tools

BMPs

- Examples: Passive sampling devices, grey water use, native plants for landscaping
- Multiple BMP resources listed in USACE Decision Framework
- BMPs may not always be the most sustainable option

Sustainability Tools

- Compare remedial options for lowest environmental footprint
- Recommended publicly available tools:
 - Air Force Sustainable Remediation Tool (SRT)
 - Battelle SiteWise™ Sustainable Environmental Remediation (SER) Tool



Army HQ Next Steps

Guidance

- Incorporate GSR guidance into the Army DERP manuals
- Evaluate need for specific Army GSR guidance
- Determine applicability of USACE Decision Framework to larger Army environmental remediation program

Resources and Case Studies

- Create a information exchange through Army Sustainability Web site housing GSR guidance, practices, tools and other available resources
- Develop and test process for GSR consideration and implementation
- Develop and standardize GSR contract language

Performance Measures

- Continue developing standardized performance measures (metrics)
- Incorporate metrics in revised and new Army databases



Questions?

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