



DEC Sustainability Policy Summary

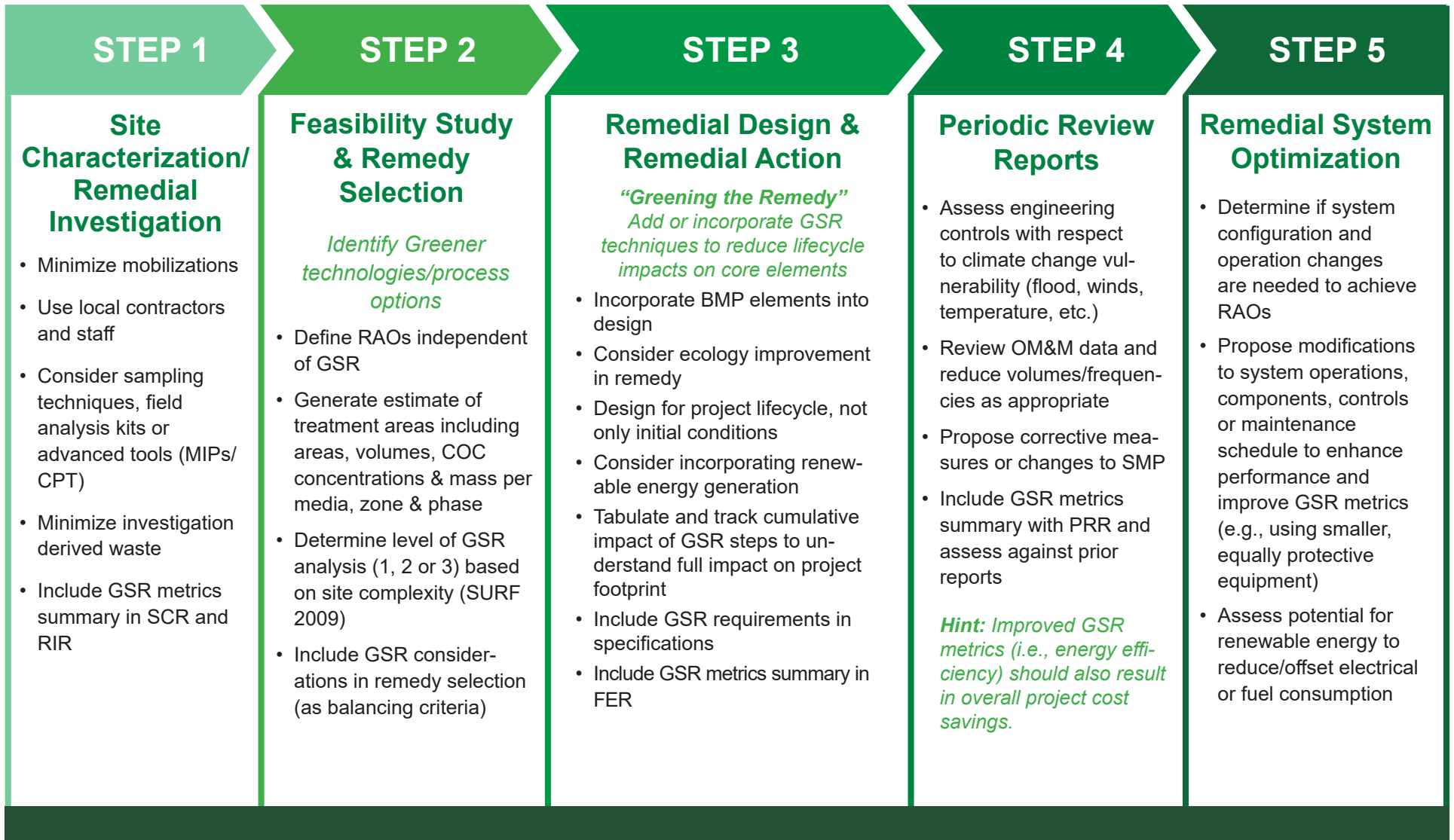
Policy Goals and Actions

Materials and Waste	Energy	Air Emissions	Water Consumption	Land and Ecosystems
<p>Goals:</p> <ul style="list-style-type: none"> • Strive for Zero Waste • Minimize the use of hazardous wastes and material <p>Actions:</p> <ul style="list-style-type: none"> • Recycle on-Site waste • Use Green Products • Regenerate Carbon • Use pre-excavation sampling to minimize volume of soils transported to landfills • Consider rail transport for soil disposal with long transportation distances • Purchase products from ethical sources 	<p>Goals:</p> <ul style="list-style-type: none"> • 100% Renewable by 2040 • Carbon neutral by 2050 <p>Actions:</p> <ul style="list-style-type: none"> • Use variable speed drives • Install solar panels, wind turbines or geothermal heat exchangers • Use high efficiency equipment • Consider pulsed operation of equipment as possible • Consider energy consumption in remedy selection 	<p>Goals:</p> <ul style="list-style-type: none"> • 85% Decrease by 2050 • 100% Electrified light duty auto fleet by 2035 <p>Actions:</p> <ul style="list-style-type: none"> • Monitor & reduce GHG emissions • Use equipment with exhaust filtration • Incorporate fuel efficient or electric vehicles into fleets • Encourage the use of renewable fuels, such as bio-diesel for heavy equipment 	<p>Goals:</p> <ul style="list-style-type: none"> • Minimize water usage • Restrict use of bottled water at State facilities <p>Actions:</p> <ul style="list-style-type: none"> • Reuse extracted groundwater for irrigation/cooling • Use treated groundwater for injections • Consider groundwater sampling techniques that minimize purging 	<p>Goals:</p> <ul style="list-style-type: none"> • Species and Habitat Protection • Promote Green & Resilient Infrastructure <p>Actions:</p> <ul style="list-style-type: none"> • Incorporate pollinator friendly plants into restoration • Maintain & enhance existing habitat • Minimize habitat destruction during investigation and remediation • Encourage on-site stormwater infiltration when possible



Guide for Implementing Green & Sustainable Remediation In Project Lifecycle*

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

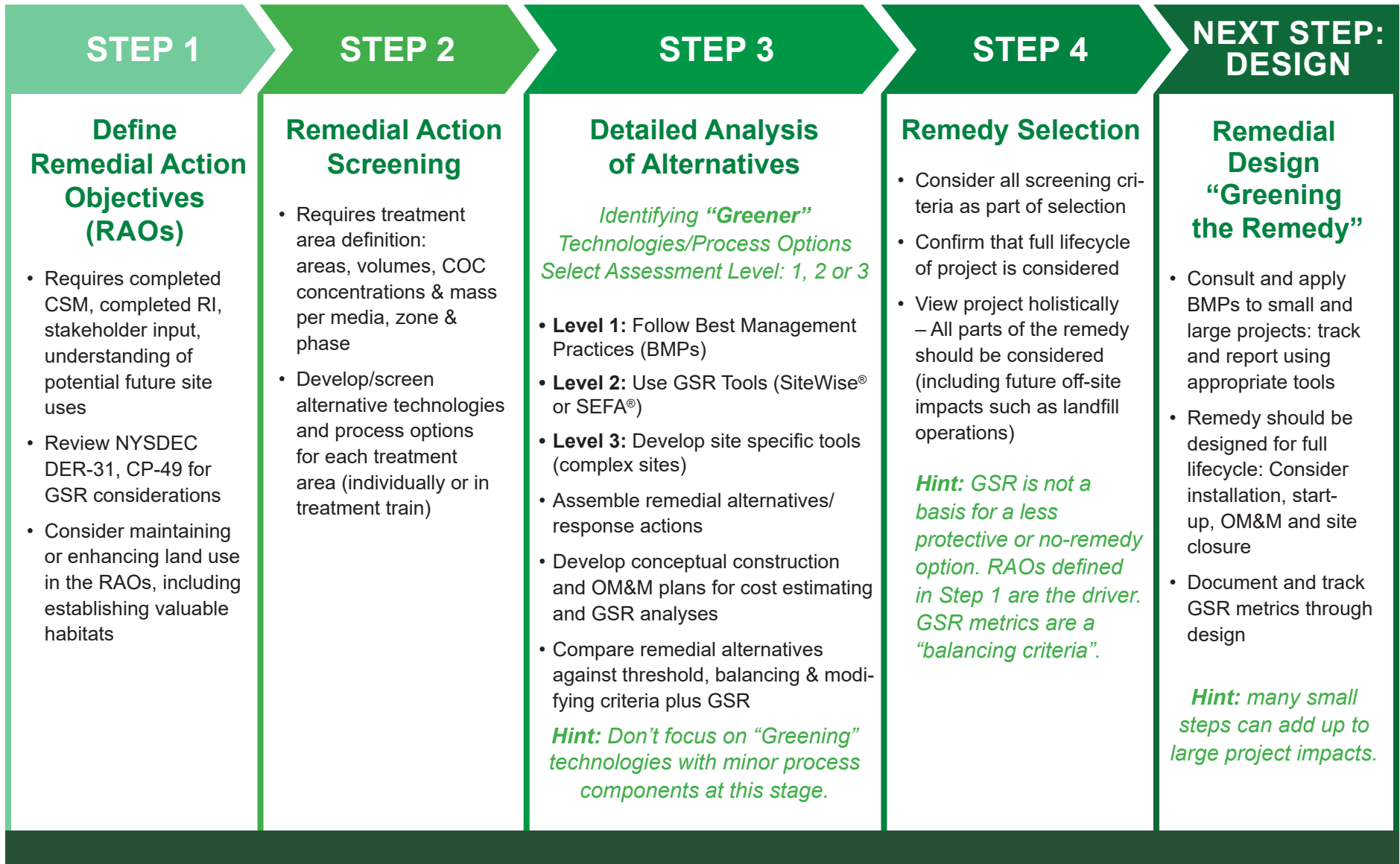


* Not intended to be comprehensive. DER-31 and CP-49 should be consulted for additional guidance, strategies and tactics.



Guide For Implementing Green and Sustainable Remediation In Feasibility Studies*

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems



* Not intended to be comprehensive. DER-31 and CP-49 should be consulted for additional guidance, strategies and tactics.



Guide for Implementing Green and Sustainable Remediation in Site Management Plans (SMPs)

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

Engineering Controls	Remediation Systems and Controls	Building Operations	Inspection	Metrics & Reporting
<ul style="list-style-type: none"> • As possible, incorporate vegetated caps over gravel or concrete, based on site conditions • Use capped areas for ecosystems or habitat enhancement • Consider remote monitoring for engineering controls as applicable • Use renewable energy sources for active mitigation systems 	<ul style="list-style-type: none"> • Effectiveness & Protectiveness highest priority • Perform routine monitoring and evaluations to minimize inefficiencies • Reduce waste (e.g., reuse treated water, regenerate carbon) • Use renewable energy to power portions of systems • Use wind turbines on passive venting stacks to enhance flows 	<ul style="list-style-type: none"> • Use high efficiency HVAC equipment • Maintain modest HVAC setpoints • Ensure proper building insulation • Consider on-Site renewable energy generation • Use timers on lights and use LED bulbs • Collect stormwater for irrigation use • Use solar power for exterior lighting 	<ul style="list-style-type: none"> • Install Telemetry for remediation and monitoring systems • Reduce inspection frequency as appropriate • Reduce number of sampling points and sampling frequency, as appropriate • Use efficient vehicles/ mass transit for travel • Consider passive samplers to reduce purging 	<ul style="list-style-type: none"> • Be accurate in GSR reporting • Identify multiple small GRS actions in routine activities • Update current GSR measures in Periodic Review Reports (PRR) and Remedial System Optimization (RSO) • Consider land and ecosystem use

Not all GSR options are included in this graphic

Further Reference: USEPA Green Remediation Best Management Practice: Site Investigation and Environmental Monitoring



Guide for Implementing Green and Sustainable Remediation in Excavation Projects

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

Planning	Equipment	Disposal	Water	Restoration
<ul style="list-style-type: none"> • Complete comprehensive delineation to limit the excavation volume • Incorporate direct push sampling to save energy • Use field test kits on-Site or nearby laboratories • Identify local sources for backfill • Establish staging areas to minimize disruption • Perform reuse sampling to minimize imported backfill 	<ul style="list-style-type: none"> • Select suitably sized equipment • Use surveyors/on-board GPS to minimize over excavation • Prevent engine idling • Retrofit equipment with additional exhaust filters • Use ultra-low sulfur or bio-diesel • Use wheel cleaning stations with recycled water • Conduct maintenance on-time • Minimize noise and vibrations 	<ul style="list-style-type: none"> • Use local disposal facilities when possible to minimize transportation • Use treatment facilities as possible to minimize long term monitoring requirements • Allow for solids to dewater prior to shipping off-site to minimize transportation weight • Minimize volumes going to hazardous waste landfills 	<ul style="list-style-type: none"> • Use treated water for dust suppression and other on-site needs • Cover soils with tarps/ mats for dust • Minimize off-site disposal of water • Control/capture stormwater runoff before entering excavation • Restore surface to allow for stormwater infiltration • Consider remediation amendment blending in bottom of excavations to reduce groundwater impacts 	<ul style="list-style-type: none"> • Minimize ecosystem disturbance • Re-use uncontaminated organic debris for mulch, in-fill or compost • Encourage landscaped caps, with pollinator friendly vegetation • Use native species • Incorporate green infrastructure into restoration • Source topsoil locally • Use local labor to monitor restoration

Not all GSR options are included in this graphic

Further Reference: USEPA Green Remediation Best Management Practices for Excavation and Surface Restoration



Guide for Implementing Green and Sustainable Remediation in Pump & Treat Projects

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

Planning & Installation	Materials & Waste	Operation & Monitoring	Energy	Retrofits & Optimization
<ul style="list-style-type: none"> • Collect site specific design data for capture zones and flow rates (aquifer tests) • Design efficient extraction wells • Flow rates are most critical design criteria • Plan for later project stages: • Leave additional capacity in system • Scale back as influent concentrations decrease 	<ul style="list-style-type: none"> • Consider groundwater re-injection/reuse • Consider discharge options (POTW, Surface water, Groundwater) • Use filters that can be backwashed to avoid filter disposal • Consider sequestering agents to avoid excess filtering and solids disposal • Use re-generated GAC when possible, and send spent GAC for regeneration 	<ul style="list-style-type: none"> • Automate the system and use telemetry systems to reduce site visits as much as practical • Use local staff for routine inspections • Incorporate dewatering in waste treatment to reduce weight • Conduct energy intensive operations as batch processes, operate at off-peak hours • Incorporate battery backup to provide uninterrupted remote monitoring capabilities during power outages 	<ul style="list-style-type: none"> • Install renewable energy on site to provide supplemental system power • Use variable frequency drives to reduce pump throttling • Use high efficiency pumps for extraction and processes • Use solar heating or heat exchangers to reduce HVAC costs • Consider pulsed pumping to reduce overall energy use 	<ul style="list-style-type: none"> • Adjust operations for actual influent concentrations, not historic values • Switch to less energy intensive processes as concentrations diminish • Look for opportunities for in-situ treatment in portions of plume • Conduct bench scale testing for alternate chemicals/loading rates to maintain minimal dosage rates

Not all GSR options are included in this graphic

Further Reference: USEPA Green Remediation Best Management Practices: Pump and Treat Technologies



Guide for Implementing GSR in Soil Vapor Extraction (SVE) Projects

STEP 1

Define Treatment Objectives

- Determine the treatment objectives: Timeframe, Prevention of Contaminant Migration, Continued Site Use
- Is the treatment zone understood? Are pre-design investigations needed to refine extent of treatment?
- Are non-aqueous phase liquids present? Consider sequenced effluent treatment (e.g., oxidizer for initial operation)

Note: Electrical consumption from a typical SVE system will be equivalent to powering 7 homes for a year

STEP 2

Design GSR Into the Remedy – Optimize Use of “Greener” Process Options

- Minimize mobilizations/demobilizations during PDI & pilot testing
- Conduct pilot tests whenever possible
- Ensure efficient system design (consult BMPs)
- Design for the entire SVE system lifetime
 - Select blowers that are appropriate for lifecycle
 - Incorporate VFDs into system design
- Consider horizontal wells for shallow applications
- Include automation when possible
- Use regenerated/reactivated vs. virgin GAC
- Consider multiple effluent treatment options
 - Establish triggers to change to lower energy technologies
- Balance number of wells with operating duration
- Minimize aboveground enclosure size

STEP 3

Construction BMPs

Piping Network:

- Overhead piping indoors when possible
- Reduce friction losses by increasing pipe diameter
- Reduce pipe lengths by manifolding wells
- Pitch pipes to reduce condensate production

Well Drilling:

- Use emission control technologies
- Ensure good well seals: prevent short circuiting
- Reduce equipment mobilizations
- Avoid using drilling fluids if possible
- Reduce concrete/asphalt removal & replacement
- Reuse native soils to the extent possible
- Recycle asphalt and concrete rather than offsite landfilling
- Consider sharing trenches with other utilities as possible

Treatment System Enclosure:

- Use insulation to reduce heating/cooling costs
- Consider solar/wind energy for lighting, cooling
- Consider tall stack to reduce treatment requirements
- Protect effluent stack from rain water

STEP 4

OM+M BMPs

- Consider treatment/reuse/recharge of treated condensate
- Target portions of operations with largest footprint
- Focus operations on wells with high VOC yield
- Pulsing/Cycling Operations:
 - Group SVE Wells into zones
 - Rotate to optimize VOC mass removal
 - Potential for reduced GAC consumption
- Reduce site visit frequency after optimization
- Use local staff for site visits
- Plan for system shut-off/conversion to passive (e.g., wind turbine)
- Consider procurement of renewable energy credits
- Track GSR metrics during operations:
 - Check against design & construction phase projections
 - Document reductions in energy & material consumption
 - Assess in PRR and RSO phase

Not all GSR options are included in this graphic.

Further Reference: USEPA Green Remediation Best Management Practices: Soil Vapor Extraction



Guide for Implementing Green and Sustainable Remediation in Injection Projects

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems

Planning & Scoping	Materials	Means and Methods	Equipment and Waste	Monitoring
<ul style="list-style-type: none">• Conduct pre-design investigation (PDI) to define treatment area well before injection design• Incorporate direct sensing equipment in PDI• Conduct bench or pilot scale testing as possible to gain site specific design data including flow rates, loading rates and radius of influence (ROI)• Consider use of mobile renewable energy generating equipment	<ul style="list-style-type: none">• Use groundwater for injections• When possible, select amendments made from recycled materials or renewable resources• Decontaminate hoses and pumps after projects and reuse in subsequent events• Use long lasting amendments if using temporary injection points• Use recovered stormwater, as possible	<ul style="list-style-type: none">• Use permanent injection wells in source areas/zones where multiple rounds of injections are expected• Recirculate groundwater to improve distribution, contact, treatment control/efficiency• Use gravity feed when appropriate to reduce operating equipment• Evaluate delivery approaches to overcome access limitations, including: horizontal & angled wells or hydraulic manipulation	<ul style="list-style-type: none">• Avoid idling drill rigs/ Geoprobos™ during injections• Do not run generators or compressors when not in use/under load• Recover any surfaced injection fluid and prevent it from entering stormwater infrastructure• Reuse recovered injection fluid as possible• Retrofit equipment to reduce emissions	<ul style="list-style-type: none">• Sample only wells that will provide actionable data• Collect sufficient data to understand remediation progress, or lack there of• Use passive samplers when COCs allow• Use local resources/ staff for monitoring events• Monitor wetlands/ surface waters during injections to prevent impacting natural receptors

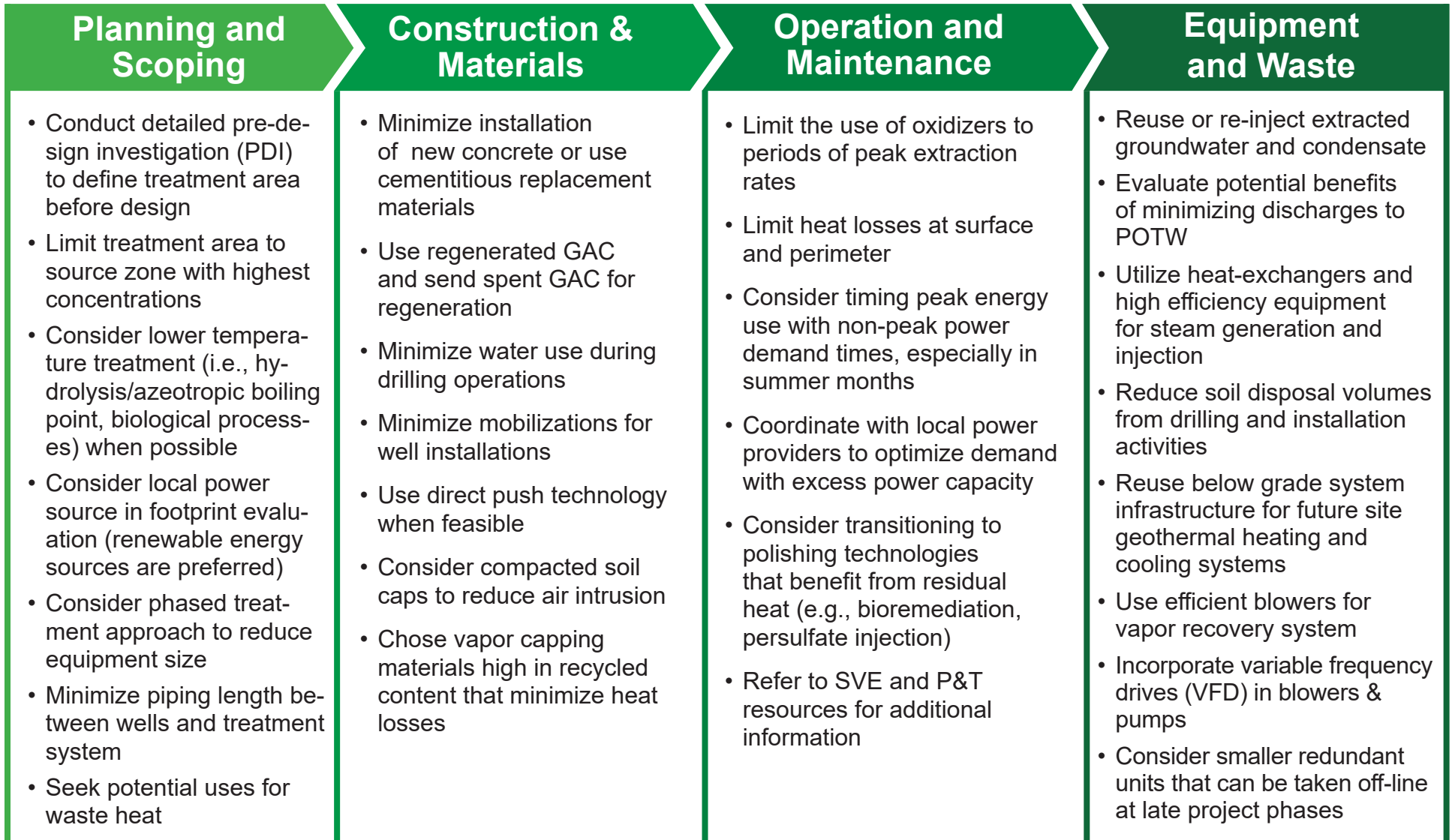
Not all GSR options are included in this graphic

Further Reference: USEPA Green Remediation Best Management Practices: Bioremediation



Guide for Implementing Green and Sustainable Remediation in Thermal Remediation Projects

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land and Ecosystems



Not all GSR options are included in this graphic.

Further Reference: USEPA Green Remediation Best Management Practices: Implementing In Situ Thermal Technologies



Guide for Implementing Green and Sustainable Remediation in Landfill Projects

Core Elements: 1. Materials & Waste; 2. Energy; 3. Air Emissions; 4. Water Consumption; and, 5. Land & Ecosystems

GSR Opportunities on Landfills: Energy Generation (landfill gas, solar or wind), Ecosystem Creation/Enhancement, Community Use & Passive Recreation

Note: This document is intended for legacy landfills and not for the closure of modern operating landfills

Landfill Closure & Capping	Landfill Gas (LFG) and Leachate	Maintenance	Monitoring
<ul style="list-style-type: none"> • Ensure proposed cap area covers all waste • Relocate and consolidate waste and minimize land use restrictions, when possible • Source capping material locally • Re-use soils/dredge materials in or under cap for grading • Use permeable caps if appropriate: <ul style="list-style-type: none"> - Reduce LFG management - Allow for deep rooted plants - Reduce stormwater runoff • Plant native species on cap that require minimal maintenance • Create high value habitat on/ around cap • Consider incorporating renewable energy generation into closure plan • Minimize the use of synthetic materials in cap construction 	<ul style="list-style-type: none"> • Prevent uncontrolled/fugitive emissions • Design leachate and LFG management systems based on site specific data • Use LFG for energy generation if viable • Consider passive venting if methane levels are low • Power LFG and leachate recovery with renewable energy • Operate active LFG systems intermittently, if appropriate, to reduce energy use • Maintain leachate extraction at lowest flow rates for hydraulic control • Consider constructed wetlands for leachate treatment • Re-use treated leachate, or allow to infiltrate outside of landfill footprint 	<ul style="list-style-type: none"> • Use local contractors to conduct routine landscaping work • Maintain & enhance high value ecosystems • Prohibit the use of pesticides & herbicides on the cap • Source cap repair material locally • Minimize disposal of landscaping waste, re-use for mulch. • Incorporate habitat areas that require minimal maintenance • Minimize use of fossil fuel powered equipment (use battery powered equipment) 	<ul style="list-style-type: none"> • Reduce monitoring frequency over time, as appropriate • Focus on collecting actionable data • Use local staff and high efficiency, low emission vehicles for routine monitoring • Use remote sensors and telemetry to collect data, reducing site visits • Monitor habitat areas in addition to engineering controls • Continue to seek footprint reductions during monitoring • Use low-flow sampling techniques when possible to minimize purge volumes

Not all GSR options are included in this graphic.

Further Reference: USEPA Green Remediation Best Management Practices: Landfill Cover Systems & Energy Production