

Green and Sustainable Remediation: Beyond Traditional Cleanups

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WDNR



Brownfields



Abandoned Drums



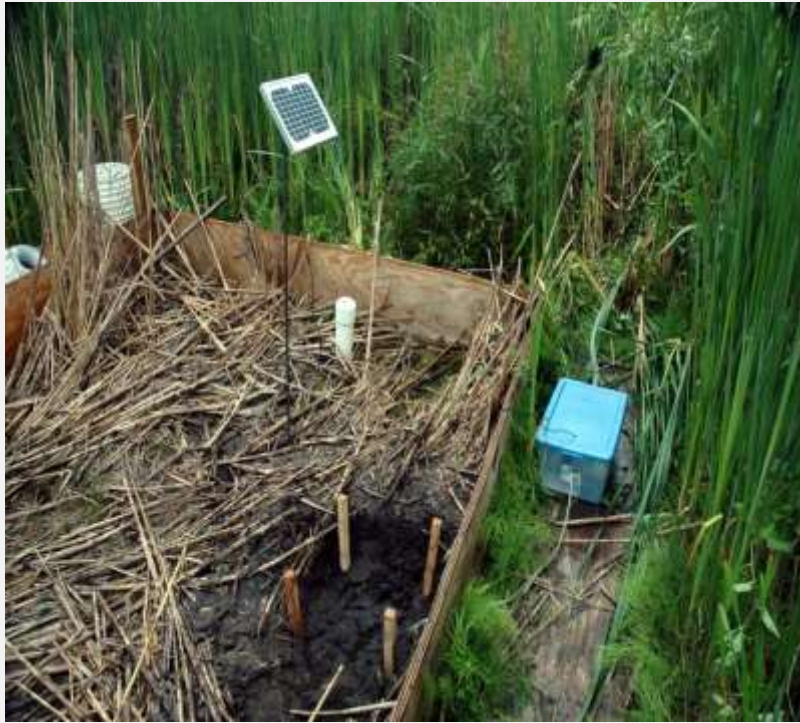
Site in Jefferson, WI

Why are Brownfields an Issue?

- Contribute to neighborhood deterioration & decreased values
- Often serve as barriers to economic growth in older neighborhoods
- Pose environmental and public health threats
- Attract vandals and open dumping
- Disproportionally affect low-income and minority neighborhoods



Benefits of Redeveloping Brownfields



Solar pump (Kewaunee Marsh)

- Encourage smart land use and green space conservation
- Add to tax base and spur economic development
- Revitalize neighborhoods
- Opportunities for community buy-in

Benefits of Sustainable Cleanups



Wisconsin Initiative for Sustainable Remediation & Redevelopment

- DNR Remediation and Redevelopment Team
- Promote Environmentally & Socioeconomically responsible practices

Central Office

- Tom Coogan, Team Leader
- Chris Zenchenko, IT
- Judy Fassbender, Technical Section Chief

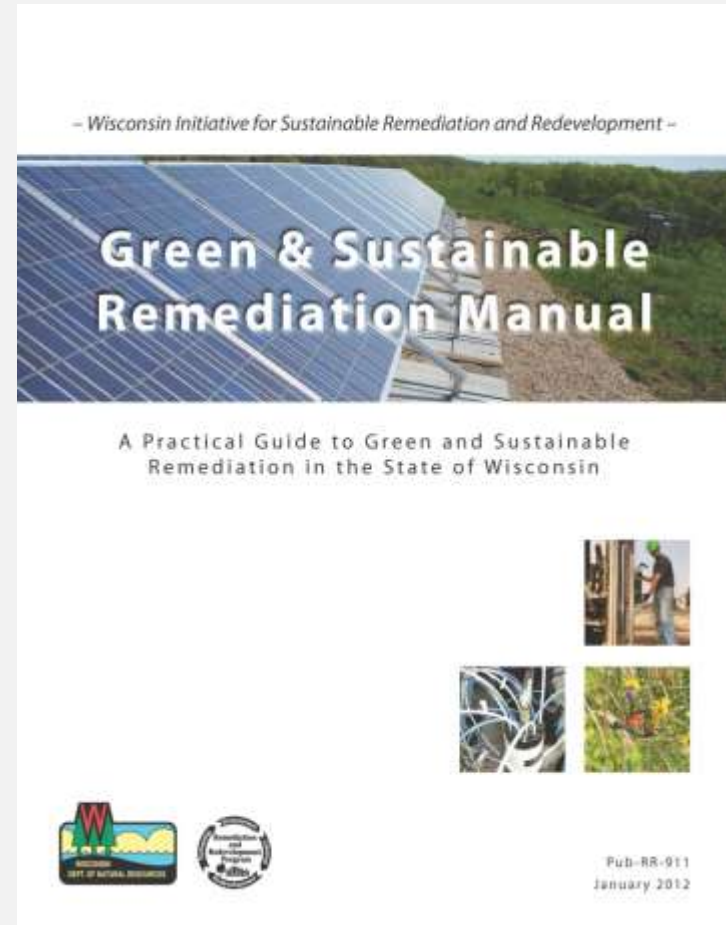
Regional Project Managers

- Jennifer Borski, NER
- Mark Drews, SER
- Erin Endsley, NOR
- Gina Keenan, WCR
- Larry Lester, SCR



Resources

- Main Reference Document
- Guide staff and Responsible Party (RP) thought process
- Consultant/RP – sustainable ideas
- Community – help with planning for Brownfield sites



Inside the GSR Manual

- GSR Overview
- Integrating GSR into all Phases of the Project Life Cycle
- Sustainability Baseline Development
- Remedial Process Optimization
- Alternative Energy
- Sustainability Options Evaluation
- Appendix A – Example Qualitative Checklist and Carbon Footprint Calculations
- Appendix B – Life Cycle Cost Analysis



Quick Reference Guides

QUICK REFERENCE GUIDE:
Greener Remediation Optimization Techniques

PUB RR-037 March 2013

This quick reference guide is intended to supplement Wisconsin DNR's Green & Sustainable Remediation Manual (PUB-RR-011). For more information about optimization techniques and strategies, see U.S. EPA's Green Remediation (GR) Best Management Practices (BMP) fact sheets, available at chem.org/greenremediation.

Optimization Techniques for all remediation technologies

- Perform adequate site investigation to develop good conceptual site model
- Perform semi-annual evaluation of system efficiencies. Make changes or shut system down as appropriate
- Evaluate the concurrent use of phytoremediation
- Evaluate natural attenuation
- Use renewable energy (e.g. solar, wind) to power equipment
- Minimize land disturbance
- Implement idling policies to reduce fuel consumption

REMEDIATION TECHNOLOGY	OPTIMIZATION TECHNIQUES	REMEDIATION TECHNOLOGY	OPTIMIZATION TECHNIQUES	
Pump & Treat	<ul style="list-style-type: none"> Design system for easy modification as site conditions change Automated pumping The real-time monitoring to identify influent changes and modify treatment accordingly Discharge to surface water or groundwater Evaluate concurrent use of in situ chemical oxidation, thermal remediation, or bioremediation in source area Exclude chemicals and process materials for carbon footprint Minimize process-derived solid waste Evaluate beneficial reuse of treated water Use appropriately sized (i.e. not oversized) pumps, fans, and motors Use green building methods for construction of Pump & Treat building Use existing building to house Pump & Treat equipment Perform routine system maintenance to optimize equipment efficiency Use real-time monitoring techniques and alarms for off-site system monitoring 	<p>In Situ Thermal Technologies</p> <ul style="list-style-type: none"> Minimize piping runs from extraction well field to treatment system Cyclical phased approach to reduce equipment needs Use direct-push technology for well installation to minimize waste Warm-up divergent piping Reclaim treated groundwater for use onsite Choose materials with recycled content 	Soil Vapor Extraction & Air Sparging	<ul style="list-style-type: none"> Select vacuum pumps and blowers that accommodate changes in operating parameters Use variable frequency drive motors Use pulsed instead of continuous air exchange processes if possible Change vapor treatment approach when appropriate Conduct energy pilot test to determine equipment needs, air flow rates, and efficiency of air/vapor treatment Treat condensate as on-site water Reclaim uncontaminated water for on-site use Use direct-push technology for well installation to minimize waste Evaluate use of thermal destruction of condensate discharged to air
	Groundwater	<ul style="list-style-type: none"> Conduct bench-scale well instability tests Conduct on-site pilot tests to evaluate methods of delivering substrate or amendment Use operational requests and advice, such as source control, managed headwells, wood ads, and paper sludge Use direct-push technology for construction of wells Maximize reuse of existing or new wells and boreholes for injection 		<p>Soil Vapor Extraction & Air Sparging</p> <ul style="list-style-type: none"> Evaluate on-site vs. off-site treatment of extracted material Obtain bulk fill material from nearby source immediately after well disposal or reuse trip Evaluate in situ treatment or landfilling of some sites Select the closest disposal location Recycle uncontaminated soil for use as fill or other purpose Advise uncontaminated material for recycling, reuse, or reuse contained, concrete, granite, wood, etc.

Wisconsin Department of Natural Resources P.O. Box 7920 Madison, WI 53707 dnr.wisconsin.gov www.dnr.wisconsin.gov

This document contains information that relates site safety and related activities, but does not necessarily include all of the details that are critical to site safety. It is intended to be used in conjunction with the Wisconsin Green Remediation Manual (PUB-RR-011). For more information about optimization techniques and strategies, see U.S. EPA's Green Remediation (GR) Best Management Practices (BMP) fact sheets, available at chem.org/greenremediation.

QUICK REFERENCE GUIDE:
Greener Site Investigation Techniques

PUB RR-038 March 2013

This quick reference guide is intended to supplement Wisconsin DNR's Green & Sustainable Remediation Manual (PUB-RR-011). For more information about greener site investigations, see U.S. EPA's Green Remediation (GR) Best Management Practices (BMP) Site Investigation fact sheet (EPA 542-F-09-004, December 2009), available at chem.org/greenremediation.

BMPs for all Site Investigations

- Evaluate feasibility of remote lab, field analytical methods or direct sensing tools
- Identify options for integrating renewable energy resources throughout the project
- Incorporate green specifications into solicitations and contracts
- Select local service providers, product suppliers, and analytical labs
- Specify lab analytical methods that generate less waste and solvents
- Select accommodation facilities with green policies

Energy
Reduce total energy & increase efficiency

Material & Waste
Reduce waste management & enhance safety

Land & Ecosystems
Reduce land management & ecosystem protection

Air
Reduce pollution & greenhouse gas emissions

Water
Reduce usage & improve water quality

CORE ELEMENT	GREENER SITE INVESTIGATION TECHNIQUES	CORE ELEMENT	GREENER SITE INVESTIGATION TECHNIQUES
Energy	<ul style="list-style-type: none"> Use real-time data collection technologies to reduce the number of field modifications needed to complete the site investigation Limit the number of vehicles deployed to the site, favor electric, hybrid, or hydrogen fuel cell vehicles Install solar collection panels Use in-site data loggers to monitor water levels and water quality parameters Use solar-powered telemetry systems to monitor ground logging data Use rechargeable batteries for handheld field instruments Use direct-push technology for well drilling and well sampling Dispose of non-hazardous-derived waste (DHW) at the nearest permitted facility 	Water	<ul style="list-style-type: none"> Use wettable drilling techniques (such as direct-push technology) Reuse operations groundwater and capture rainwater for irrigation or that onsite Feature closed drain water to surface water bodies or groundwater vs. discharge to public sewer system Use low-flow sampling equipment Use steam-cleaning or phosphate-free detergents for equipment decontamination Quickly remove damaged equipment areas to control groundwater runoff and prevent soil erosion
	Land & Ecosystems		<ul style="list-style-type: none"> Use real-time data collection technologies to reduce the number of field modifications needed to complete the site investigation Limit the number of vehicles deployed to the site, favor electric, hybrid, or hydrogen fuel cell vehicles Install solar collection panels Use in-site data loggers to monitor water levels and water quality parameters Use solar-powered telemetry systems to monitor ground logging data Use rechargeable batteries for handheld field instruments Use direct-push technology for well drilling and well sampling Dispose of non-hazardous-derived waste (DHW) at the nearest permitted facility
Air		<ul style="list-style-type: none"> Reduce air pollutants and Greenhouse Gas (GHG) emissions by: <ul style="list-style-type: none"> Installing direct emissions control filters on equipment Using alcohol-water fuels Reducing duration of drilling by employing water drilling techniques Reduce duration of groundwater pumping by using priority sampling devices 	Material & Waste

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Site Specific Analyses



- Detailed Analysis of GSR potential:
 - N.W. Mauthe, Appleton, WI
 - Delafield Landfill, Delafield, WI
 - Refuse Hideaway, Middleton, WI
 - Penta Wood, Siren, WI

Evaluation of GSR Principles



Photos courtesy of Google

WI Cleanup Rules (NR 722)

Upon selection of the Remedial Action, RP must address the following criteria:

- 1. Energy Use**
- 2. Generation of Air Pollution**
- 3. Water Use**
- 4. Future Land Use**
- 5. Materials and waste**
- 6. Long Term Sustainable Management**



We're Not Alone

- American Society for Testing and Materials (ASTM) Greener Cleanups Standard
- Environmental Protection Agency
 - <http://www.clu-in.org/remediation/>
- Neighboring States
 - IL: Matrix for selection of sustainable practices
 - MN: Greener Practices Toolkit



What GSR Can Look Like



American Quality Fibers, Menasha (before and after remediation)



Traditional Cleanup vs. GSR

Traditional Cleanup:

- Focus on the property
- Excavation
- Groundwater pump & treat



Excavation - Photo by J. Borski, WDNR, Sept 2010



Traditional Cleanup vs. GSR

Green & Sustainable Remediation (GSR):

- Environmental (energy, water, waste, air & land)
- Economic (life cycle cost)
- Social (community impact - considers end land use)



N. W. Mauthe Superfund Site



Figure by OMNI Associates, *Operation & Maintenance Report*, October 2011

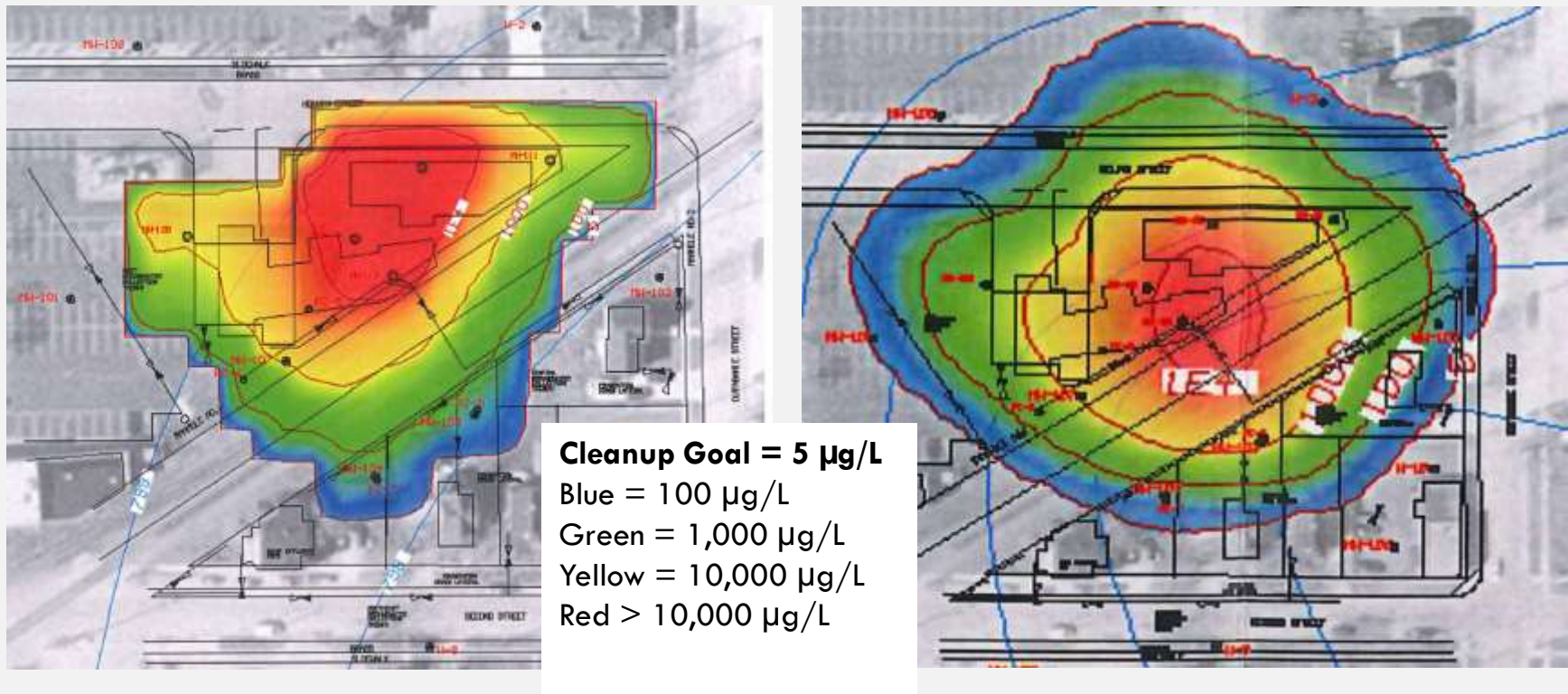


N. W. Mauthe Superfund Site

Chromium plume in groundwater

2007 extent

Estimated extent in 500 years



Figures by OMNI Associates, *Simulation of Solute Movement*, March 2007



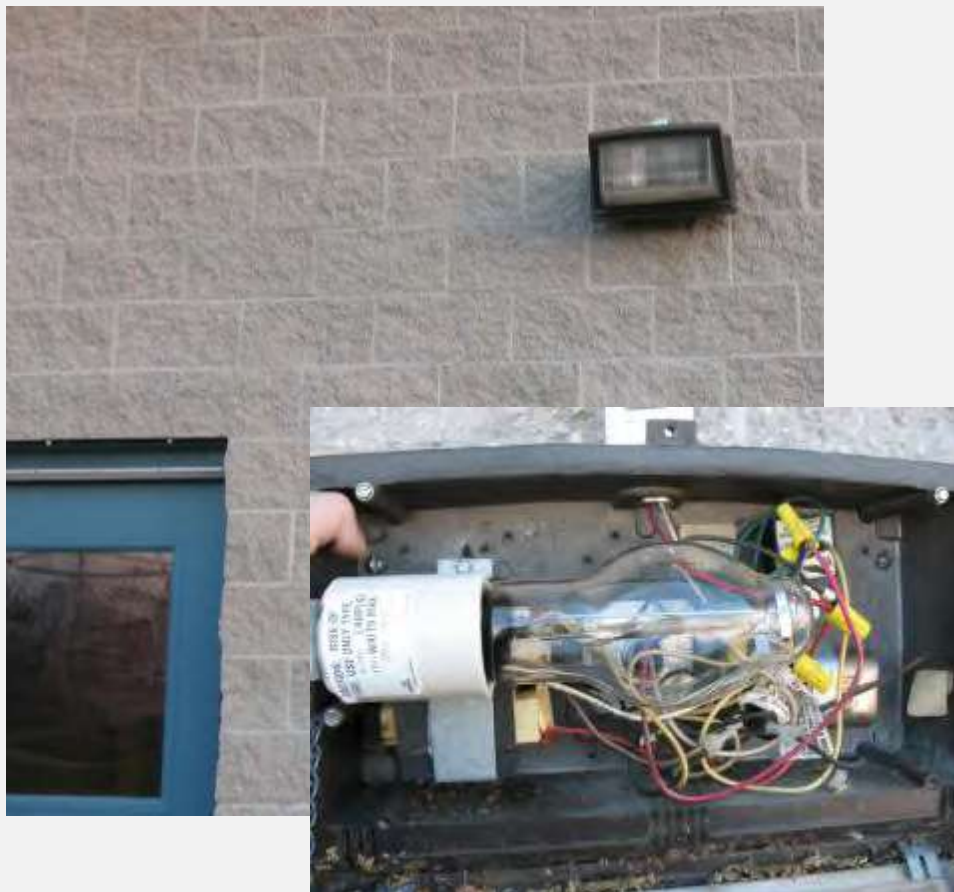
N. W. Mauthe Superfund Site



N. W. Mauthe Treatment Building - Photo by J. Borski, WDNR, Nov 2005



N. W. Mauthe Superfund Site



N. W. Mauthe Treatment Building - Photos by OMNNI Associates, 2010



N. W. Mauthe Superfund Site

Yearly Operating Cost							
Lamp type	Average hours/day operation	Electrical charge (\$/kwhr)	Yearly operating cost/lamp	Number of lamps	Yearly operating cost	Yearly operating savings/ fixture	Years to payoff initial investment of both fixtures
20W LED	12	\$0.126110	\$11.05	2	\$22.09	\$71.81	2.60
150W Metal Halide Lamp	12	\$0.126110	\$82.85	2	\$165.71	\$0.00	

Maintenance and Operating Cost over 50,000 hours* of operation (Two Fixtures)							
Lamp type	Fixture installation cost	Relamping cost initial	Relamping cost	Labor cost	Operating cost	Cost of ownership	
20W LED	\$610	\$0	\$0	\$0	\$252.22	\$862	
150W Metal Halide Lamp	\$0	\$237	\$50	\$95	\$1,891.65	\$2,274	

*50,000 hours @12 hours/day = 11.4 years

Years to payoff initial investment of both fixtures:
 $(\$610-\$237)/(\$165.71-\$22.09) = 2.39$
 years

Table by OMNNI Associates, 2010



N. W. Mauthe Superfund Site



N. W. Mauthe Pumps at Manhole No. 2 - Photos by J. Borski, WDNR, Oct 2012

Refuse Hideaway Landfill, Middleton



- Superfund site that DNR now manages
- Redevelopment not likely
- DNR Pilot Project under WISRR
- Showcases renewable energy

Photo by WDNR



For More Information

- **WISRR Homepage**

- dnr.wi.gov/topic/brownfields/rrprogram.html

- **EPA Webpage**

- [EPA: www.clu-in.org/greenremediation](http://www.clu-in.org/greenremediation)

- <http://www.epa.gov/oswercpa/>

- **Questions**

- Tom Coogan, 608/267-7560 or Thomas.Coogan@wi.gov
- Jennifer Borski, 920/424-7887 or Jennifer.Borski@wi.gov

