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INTERSTATE TECHNOLOGY REGULATORY COUNCIL

Guidance for Characterization, Design, Construction and Monitoring of Mitigation Wetlands

ITRC Technical and Regulatory Guidance for Characterization, Design, Construction and Monitoring of Mitigation Wetlands

This training is co-sponsored by the EPA Office of Superfund Remediation and Technology Innovation

Presentation Overview:

Once regarded as wastelands, wetlands are now considered a valuable ecosystem. By the 1980s as much as 50% of the original wetlands resources in the United States had been lost and were disappearing at a rate of approximately 300,000 to 400,000 acres per year. Wetlands are among the most productive ecosystems in the world. Species of microbes, plants, insects, amphibians, reptiles, birds, fish, and mammals are part of wetland ecosystems. Physical and chemical features such as climate, topology, geology, and the movement and abundance of water help determine the plants and animals varieties that inhabit each wetland.

Mitigation (Restoration) wetlands are built to offset wetlands losses due to development or degradation. They are designed to return wetlands from a disturbed or altered condition to the previously existing condition or create new wetlands to compensate for the loss. Recent reports have highlighted the high failure rate of mitigation wetlands, with only 30%–50% of all projects considered successful. To improve the success of wetland mitigation projects, this training presents comprehensive guidance for regulators, environmental professionals, or owners to use to understand, characterize, design, construct, and monitor mitigation wetlands. The course is based on Characterization, Design, Construction, and Monitoring of Mitigation Wetlands (WTLND-2, 2005) by the ITRC Mitigation Wetlands Team.

This training is the second is a series of wetland trainings beginning with the ITRC Technical and Regulatory Guidance Document for Constructed Treatment Wetlands (December 2003, WTLND-1). For an archive of this previous training, please go to http://www.clu-in.org/conf/itrc/wetlands_061504/.

ITRC (Interstate Technology and Regulatory Council) www.itrcweb.org

Training Co-Sponsored by: EPA Office of Superfund Remediation and Technology Innovation (www.clu-in.org)

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ITRC (www.itrcweb.org) – Shaping the Future of Regulatory Acceptance

- Network
  - State regulators
  - Federal government
  - Industry
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  - Academia
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- Documents
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  - Technology overviews
  - Case studies
- Training
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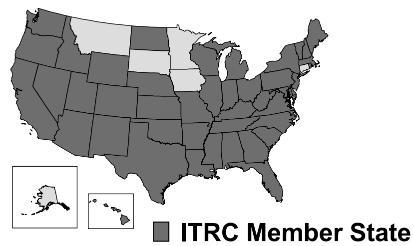

Federal Partners

DOE EPA DOD

The Interstate Technology and Regulatory Council (ITRC) is a state-led coalition of regulators, industry experts, citizen stakeholders, academia and federal partners that work to achieve regulatory acceptance of environmental technologies and innovative approaches. ITRC consists of more than 40 states (and the District of Columbia) that work to break down barriers and reduce compliance costs, making it easier to use new technologies and helping states maximize resources. ITRC brings together a diverse mix of environmental experts and stakeholders from both the public and private sectors to broaden and deepen technical knowledge and advance the regulatory acceptance of environmental technologies. Together, we're building the environmental community's ability to expedite quality decision making while protecting human health and the environment. With our network approaching 7,500 people from all aspects of the environmental community, ITRC is a unique catalyst for dialogue between regulators and the regulated community.

For a state to be a member of ITRC their environmental agency must designate a State Point of Contact. To find out who your State POC is check out the "contacts" section at www.itrcweb.org. Also, click on "membership" to learn how you can become a member of an ITRC Technical Team.

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•Although we discuss various technologies, processes, and vendor's products, we are not endorsing any of them.

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ITRC – Course Topics Planned for 2005

New in 2005

- Environmental Manag. at Operational Outdoor Small Arms Ranges
- Direct Push Wells for Long-term Monitoring
- What's New With In Situ Chemical Oxidation
- Mitigation Wetlands
- Permeable Reactive Barriers: Lessons Learn and New Direction
- Radiation Site Cleanup
- Site Investigation and Remediation for Munitions Response Projects
- More in development…….

Popular courses from 2004

- Alternative Landfill Covers
- Characterization and Remediation of Soils at Closed Small Arms Firing Ranges
- Constructed Treatment Wetlands
- Geophysical Prove-Outs for Munitions Response Projects
- Performance Assessment of DNAPL Remedies
- Radiation Risk Assessment
- Remediation Process Optimization
- Surfactant/Cosolvent Flushing of DNAPLs
- Triad Approach

Training dates/details at: www.itrcweb.org
Training archives at: http://cluin.org/live/archive.cfm

More details and schedules are available from www.itrcweb.org under "Internet-based Training."

4 **Guidance for Characterization, Design, Construction and Monitoring of Mitigation Wetlands**

Presentation Overview

- Historic concerns with mitigation wetlands success
- What is a mitigation wetland?
- Types of wetlands
- Characterizing the site
- Important parameters in design construction and monitoring
- Issues
- Questions and answers
- Links to additional resources
- Your feedback

Logistical Reminders

- Phone line audience
  - ✓ Keep phone on mute
  - ✓ “*6” to mute, “*7” to un-mute to ask question during designated periods
  - ✓ Do NOT put call on hold
- Simulcast audience
  - ✓ Use ? at the top of each slide to submit questions
- Course time = 2¼ hours

No associated notes.

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Meet the ITRC Instructors

Paul Eger
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Paul Eger is a principal engineer for the Minnesota Department of Natural Resources, Division of Lands and Minerals, where for over 25 years he has worked with environmental issues related to mining. He was a pioneer in the use of wetlands to remove trace metals from mine drainage, and much of his work has focused on the development of successful passive treatment systems to control mine drainage problems. He has also been a leader in the development of cost-effective and environmentally safe reclamation using waste products, such as municipal solid waste compost, paper processing waste, and dredge material from Lake Superior. He has served as an expert witness on water quality issues and at reclamation rules hearings and serves on the Department's hazardous waste team, where he has been responsible for the clean up of abandoned dump sites. In his spare time he tries to control and regulate his three daughters and to enjoy the outdoors by hiking, biking, canoeing and skiing.

Charles Harman is a Principal Ecologist with AMEC Earth & Environmental located in Somerset, New Jersey. A terrestrial ecologist, Mr. Harman has over 16 years of experience in the environmental consulting field. Mr. Harman specializes in natural resource related assessment and management activities, including wetlands management and ecological restorations, ecological risk assessments, and natural resource damage assessments. He is responsible for the completion of ecological risk assessment projects and wetlands evaluations at hazardous waste sites and industrial facilities around the country. Mr. Harman has delineated wetlands using both the 1987 and 1989 methods manuals and has designed and managed wetland restoration projects as part of remediation activities. He has designed and conducted detailed evaluations of the potential for ecological impacts to wetlands from the implementation of remedial actions, including pump and treat systems. He has evaluated wetlands and other ecological receptors at sites located in sensitive habitats, including the New Jersey Pinelands, the New Jersey Hackensack Meadowlands, coastal estuaries, and freshwater swamps and marshes. In a cooperative research venture with an industrial client, Mr. Harman has been evaluating the efficacy of constructed wetlands to remove arsenic, chromium and copper in stormwater. Mr. Harman is certified as a Professional Wetland Scientist. He has a Bachelor of Science Degree in Wildlife Ecology from Texas A&M University and a Master of Arts in Biology from Southwest Texas State University.

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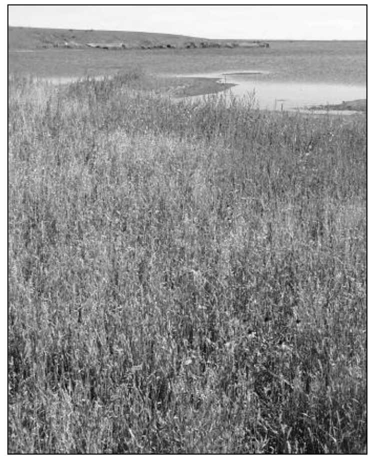
What you will learn…

- What is wetlands mitigation?
- Review of general wetland science
- Why is mitigation required?
- Site evaluation for planning and design purposes
- Construction methods appropriate for wetlands mitigation
- Learn to monitor for sustainability
- Issues



No associated notes.

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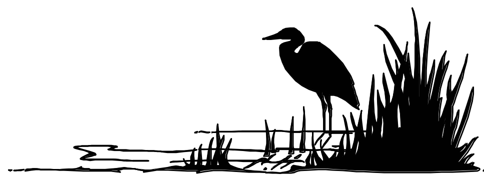
The Problem (Why the ITRC Team)

- Wetlands important ecosystem
  - Provide habitat for wide variety of species
  - Flood control
  - Improve water quality
- Large loss of wetlands
  - Over 100 million acres
  - Over 50% of original wetlands



Recent reports have highlighted the high failure rate of mitigation wetlands, with only 30-50% of all projects considered successful. (NJDEP 2000). The goal of the ITRC Mitigation Wetland Manual is to improve the success of wetland mitigation.

There is no single comprehensive guidance for regulators, environmental professionals or owners to use to appropriately characterize, design, construct and monitor mitigation wetlands. Wetlands are complex ecosystems which provide valuable habitat, can improve water quality, provide flood control, provide recharge to aquifers and support a variety of plants and animals.

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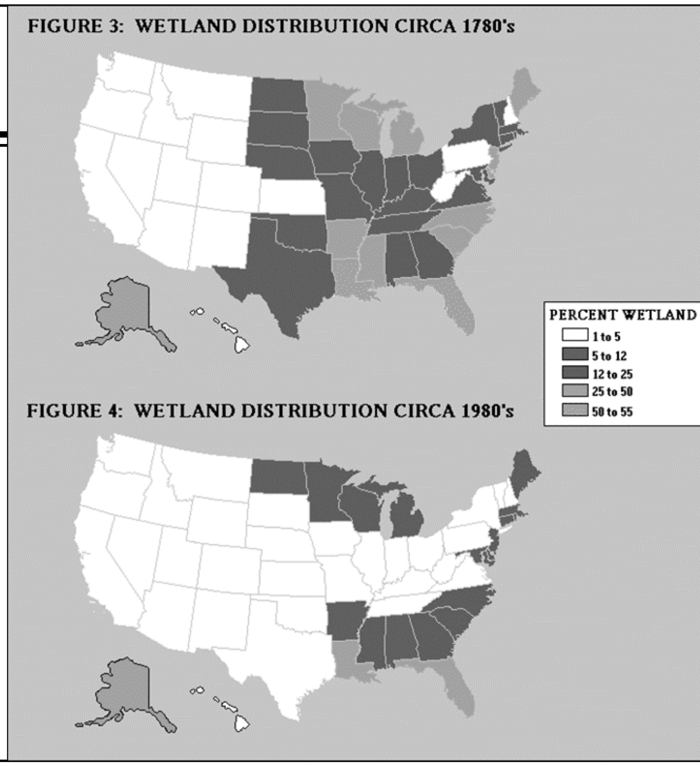

Once regarded as wastelands, wetlands are now considered a valuable ecosystem. By the 1980’s as much as 50% of the original wetlands resources in the United States had been lost and were disappearing at a rate of approximately 300,000 to 400,000 acres per year. (NJDEP, 2002). According to the Fish and Wildlife Service (FWS), 53% of the conterminous United States presettlement wetland area was lost between 1780 and 1980 (NRC 2002, Cited as Dahl 1990). The rate of loss has decreased over the past 20 years.

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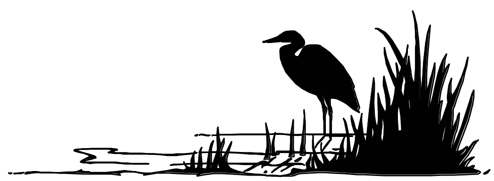
The Problem (continued)

- Laws required functions of wetlands be replaced
- Success rate abysmally low
  - 30-50%



No associated notes.

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The Goal

- Develop document to aid in design, construction, maintenance and monitoring of mitigation wetlands
- Improve success rate!

No associated notes.

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What is Wetlands Mitigation?

- Compensatory action
  - Off-set permitted wetland impacts
- Tied to either federal or state statute or both
- Reestablishes a desired set of wetland functions
- Amount of compensatory wetlands mitigation
  - Permit requirements
  - Type of mitigation

No associated notes.

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What is a Wetland?

- Wetlands
  - Productive ecosystems
  - Specific flora and fauna influenced by
    - Climate
    - Topography
    - Geology
    - Movement and abundance of water
- Wetlands are complex ecosystems which
  - Provide valuable habitat
  - Can improve water quality
  - Provide flood control
  - Provide recharge to aquifers
  - Support a variety of plants and animals

Wetlands are among the most productive ecosystems in the world. Species of microbes, plants, insects, amphibians, reptiles, birds, fish, and mammals are part of wetland ecosystems. Physical and chemical features such as climate, topology, geology, and the movement and abundance of water help determine the plants and animals varieties that inhabit each wetland. This is why wetlands in various geographic regions of the United States differ from one another.

Wetlands provide large volumes of food that attract various animal species. Dead plant debris break down in the water to form organic particles called detritus. This organic rich material feeds many small aquatic insects, shellfish, and fish that are food for larger predatory fish, reptiles, amphibians, birds, and mammals.

The functions of a wetland and the associated values depend on a complex set of relationships between the wetland and the other ecosystems in the watershed. A watershed is a geographic area in which water, sediments, and dissolved materials drain from higher elevations to a common low-lying outlet or basin a point on a larger stream, lake, underlying aquifer, or estuary. The combination of shallow water, high nutrients levels, and productivity is ideal for the development of organisms that form the foundation of the food chain. Birds and mammals rely on wetlands for food, water, and shelter, especially during migration and breeding.

The scientific literature notes that wetlands fill a valuable role in their niche as a transitional zone between terrestrial and aquatic ecosystems (Mitsch and Gosselink, 1992). Functionally, wetlands play a role in flood conveyance, flood storage, sediment control as barriers to waves and erosion, and as spawning grounds for fish and shellfish. Other functions include recreation, waterfowl and wildlife habitat, and improvement of water quality (NWPF, 1988). Both the lay public and the trained scientist recognize the importance of wetlands in the environment.

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Wetland Characteristics

- Hydrology
  - Interactions of groundwater and surface water
  - Influences chemical/physical properties
    - Nutrient availability
    - Substrate anoxia
    - pH
- Hydric Soils
  - Transformed by biogeochemical processes typical to wetlands
- Plants
  - Physiologically adapted for living in wetland environments

No associated notes.

Hydrology

- Key element in wetlands
  - Single most important factor
- Hydrologic budget
  - Balance between inflows and outflows of water

P + SWI + GWI = ET + SWO + GWO + S

Where

- **P = Precipitation**
- **SWI = Surface water input**
- **GWI = Groundwater input**
- **ET = Evapotranspiration**
- **SWO = Surface water outflow**
- **GWO = Groundwater outflow**
- **S = Change in storage**

Hydrology is the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes

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Hydric Soils

- Hydric soils
  - Saturated or flooded
  - Develop anaerobic conditions in the upper portion of the soil
  - Mineral or organic
  - Support wetland plants

Result in a reducing environment, thereby lowering the reduction/oxidation (redox) potential for a soil. This results in the chemical reduction of some of the soil components, such as iron and manganese, leading to the development of soil colors indicative of wetland soils.

Wetland Plants

- Permanent or periodic saturation
- Important functions in wetlands
  - Stabilize soil and sediment
  - Enhance the accretion of new sediments
  - Remove nutrients, trace elements, and organics through biological uptake and surface adsorption

No associated notes.

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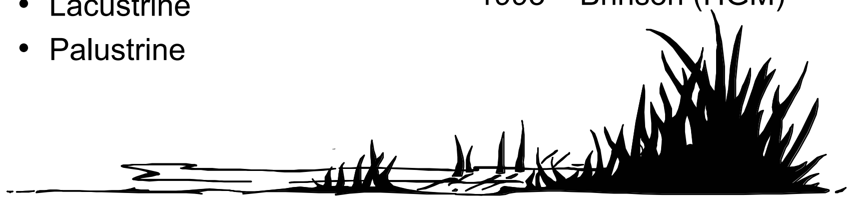
Wetland Classification

Understanding wetlands classification is usually required in evaluating permit conditions for the injury and the associated compensatory mitigation

- 1979 – Cowardin (system and subsystem)
  - Marine
  - Estuarine
  - Riverine
  - Lacustrine
  - Palustrine
- Examples of other systems
  - 1956 – USFWS Circular 39
  - 1974 – Golet and Larson (Wetland Class)
  - 1993 – Brinson (HGM)



No associated notes.

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Wetland Functions

- Groundwater recharge/discharge
- Floodflow alteration
- Fish/shellfish habitat
- Sediment/toxicant/ pathogen retention
- Nutrient removal/retention/ transformation
- Sediment/shoreline stablization
- Wildlife habitat
- Recreation
- Scientific value

No associated notes.

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Functional Evaluations

- Goal: replace wetland function
  - Not solely on an acreage basis
- Conduct functional evaluations of impacted wetland
  - Functional replacement considered in mitigation design
- Over 30 techniques in the scientific literature
  - Wetland Evaluation Technique (WET)

No associated notes.

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Why Mitigate?

- 1977 Clean Water Act (CWA)
  - Regulate discharges
  - Established NPDES program
  - Required mitigation in compensation for permitted action

The CWA prohibits discharges of material such as soil or sand into water of the US unless authorized by a permit issued under Section 404 of the CWA or by an equivalent state program. Under this approval no net loss policies require that damage be mitigated using wetland restoration, wetland creation, or wetlands enhancement. (NRC 2001)

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Regulatory Agencies

- Section 404 (40 CFR Part 230)
  - U.S Army Corp of Engineers – administers the permit program (36 District offices)
    - U.S. EPA
    - U.S. Fish and Wildlife Service
    - National Marine Fisheries Service
  - Assumed by two states
    - New Jersey
    - Michigan
- State and local units of government

Your friendly regulator

No associated notes.

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Section 404(b)(1) Guidelines

- Sequence
  - Avoidance
  - Minimization
  - Compensation
    - Last option
- ITRC guidance document focuses on compensation

No associated notes.

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Problem

Despite regulations, wetland success rate was only 30-50%

No associated notes.

24

National Research Council Report on Wetlands Mitigation

- "Compensating for Wetland Losses Under the Clean Water Act" – 2001
- Critical of compensatory mitigation accomplished for Section 404 permits
  - Unclear/unenforceable permit conditions
  - Poor tracking
  - Insufficient data
- Replacing acres does not equal replacing functions

No associated notes.

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Reasons for Mitigation Failure

- The mitigation was never done
- Improper hydrology
- Mitigation sites not built according to the plans
- Compacted soils
  - Adverse effect on wetland hydrology and plantings
- Invasive species colonized the site
  - Out-competed target plant community

The mitigation was never done. This suggests a lack of regulatory oversight.

Improper hydrology. If the hydrodynamics are not designed correctly the wetlands will never develop and survive.

Mitigation sites are not built according to the plans (e.g. are improper grading, soil amendments and/or planting).

Compacted soils which has an adverse effect on wetland hydrology and plantings.

Invasive species colonizing the site and out-competing target plant community.

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Reasons for Mitigation Failure (continued)

- Loss of plant material
  - Grazing by wildlife
    - Deer
    - Rodents
    - Geese
- Lack of clear performance standards
- Lack of maintenance of the mitigation site
- Soils not suitable for the desired species/community/ functions
- Ecological requirements not fully understood

Loss of plant material due to herbivory by wildlife such as deer, rodents and geese.

Lack of clear performance standards written in the permit document.

Lack of maintenance of the mitigation site. This results in problems such as illegal dumping in the mitigation area. ATV damage to the plant community and possibly causing erosion on the site.

Soils not suitable for the species/community/functions intended to be replaced, (DeWeerdt, 2004)

Ecological requirements not fully or correctly understood during the design process (DeWeerdt, 2004)

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National Research Council Factors that Affect Success

- Hydrology
  - Size
    - Smaller wetlands generally more successful
  - Placement on the landscape
    - Riverine and slope wetlands more difficult than depressional wetlands
- Ecoregion
  - Climatic conditions
- Types of plants present
  - Forested wetlands more difficult than herbaceous
- Time

No associated notes.

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National Wetlands Mitigation Action Plan (MAP)

- Multi-agency initiative
  - USACE lead
- Improve wetlands mitigation
  - Goal to achieve “no net loss”
- 17 action items
  - Publication of a Regulatory Guidance Letter
  - Interagency teams

No associated notes.

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Major Issues in Mitigation Regulatory Guidance Letter (RGL) 02-02

- Recommends implementation of National Research Council guidelines
- Watershed approach
- Functional assessment
- Stream mitigation
- Definitions of mitigation
- Preservation and buffers as mitigation
- Mitigation plans

No associated notes.

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Types of Wetlands Mitigation

- Restoration (re establishment and rehabilitation)
  - Return impacted wetland to its pre-disturbance state
  - Hydrology known
  - Requires baseline characterization
- Enhancement
  - Improve degraded wetland
  - Hydrology known
- Creation (establishment)
  - Create wetland in a position on the landscape not characterized as wetlands
  - Most difficult
    - Hydrology usually unknown

No associated notes.

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Other Types of Mitigation

- Mitigation banking
- In-lieu-fee program
- Preservation
- Upland buffers
  - Incorporate during design phase

Mitigation banking is designed to create, restore, and/or enhance large, ecologically important wetland tracts in advance of permitted impacts. Based upon the type, size, and function of the improvements, the developer of a bank is authorized by the regulatory/resource agencies to sell a certain number of credits. These credits can be authorized by permit to be designated as compensation for specific impacts to the aquatic environment.

In some states, money can be collected and deposited into the in-lieu-fee program. The program is responsible for the management and disbursement of dollars from the in-lieu-fee program to finance mitigation projects. The program with those funds has the power to purchase land to provide areas for enhancement or restoration of degraded wetlands, to engage in the enhancement or restoration of degraded wetlands on any public lands including public lands other than those acquired by the program, and to preserve wetlands and transition areas determined to be of critical importance in protecting wetlands.

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Mitigation Considerations

- On-site versus off-site mitigation
  - On-site
    - Mitigation adjacent to or contiguous with the compromised wetland
  - Off-site
    - Site locations range
      - Same watershed
      - Different watershed
- In-kind versus out-of-kind mitigation
  - In-kind
    - Same physical and functional type
  - Out-of-kind
    - Different physical and functional type
    - e.g., prairie pothole for scrub/shrub

Compensatory mitigation should first be considered adjacent to or contiguous with the compromised wetland site and within the same watershed where practicable. This arrangement is considered on-site mitigation. On-site mitigation is important to compensate for local flood control, unique wildlife habitat, or other locally important functions of the wetland. However, off-site compensatory mitigation can be used when it is otherwise impractical to attempt on-site compensatory mitigation or on-site mitigation doesn't appear beneficial or doesn't improve the ecological condition of the site. Off-site mitigation should be in the same general vicinity or close to the impacted wetlands site. A mixture of on-site and off-site compensatory wetlands can be considered as well; however, the functional scoring should be the basis for the type and amount of on-site and off-site compensatory mitigation. Choosing between the two or establishing the appropriate mix should consider

the likelihood of success,

ecological sustainability,

practicality of long-term monitoring,

maintenance or operation and maintenance, and

the relative cost of mitigation alternatives (USACE 2002).

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National Research Council (NRC) Criteria for Successful Mitigation

- Ten operational guidelines for creating or restoring wetlands that are ecologically self-sustaining
- Special attention must be paid to
  - Hydrological and topographic variability
  - Subsurface characteristics
  - Hydrogeomorphic and ecological landscape
  - Climate of site
- Systems designed to incorporate natural processes will be more likely to ensure long-term sustainability

No associated notes.

34 **Guideline #1: Consider the Hydrogeomorphic and Ecological Landscape and Climate**

- Do not generate wetland hybrids
  - Duplicate reference wetlands or enhance connectivity
- Locate mitigation site
  - In comparable landscape position and hydrogeomorpic class
- Consider conducting cumulative impact analysis
- Mitigation plan should describe response to natural disturbances
  - Floods, droughts, and storms

Do not generate wetland hybrids, instead duplicate reference wetlands or enhance connectivity

Whenever possible, locate mitigation site in setting of comparable landscape position and hydrogeomorpic class

Consider conducting cumulative impact analysis

Mitigation plan should indicate how well site will respond to natural disturbances such as floods, droughts, and storms

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Guideline #2: Adopt a Dynamic Landscape Perspective

- Consider current and future watershed hydrology
- Consider current and future wetland location
- Consider adjacent and planned land use
- Select resistant mitigation sites
  - Large buffers
  - Connectivity to other wetlands
- Design a system that use natural processes

Consider both current and future watershed hydrology

Consider both current and future wetland location

Consider surrounding land use and future plans for the land

Select mitigation sites that are resistant to disturbance

  Large buffers

  Connectivity to other wetlands

Design a mitigation system that utilizes natural processes

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Guideline #3: Restore or Develop Naturally Variable Hydrological Conditions

- Fluctuations in water flow and level
- Duration and frequency of change
- Represents other comparable wetlands in the same landscape setting
- Hydrology should be inspected during flood events
- Detailed hydrological study of the site should be undertaken
- Tidal cycles and stages should be understood

No associated notes.

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Guideline #4: Choose Wetland Restoration Over Creation

- Select site where wetlands previously existed or still exist
- Restoration of wetlands is more sustainable than creation

Select mitigation site where wetlands previously existed or where nearby wetlands still exist

Restoration of wetlands has been shown to be more sustainable than wetlands creation

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Guideline #5: Avoid Over-engineered Structures in the Wetland's Design

- Design project
  - Minimal maintenance
  - Self-sustaining
- Avoid hydraulic control structures
  - Susceptible to failure
- Use natural recruitment sources for vegetation
- Use native seed banks and plant mature plants as supplemental

Design the mitigation project for minimal maintenance

Mitigation project should be self-sustaining

Avoid hydraulic control structures that are susceptible to failure

Use natural recruitment sources for vegetative establishment

Take advantage of native seed banks and consider planting mature plants as supplemental

39 **Guideline #6: Pay Particular Attention to Appropriate Planting Elevation, Depth, Soil Type, and Seasonal Timing**

- During any species introduction select appropriate genotypes. Genotypes display differences
  - Stem density
  - Stem height
  - Rooting depth
  - Decomposition rate
  - Below ground root mass
- Consider reference area or adjacent wetlands for planting considerations
- Watering during
  - Initial planting
  - In drought conditions

When introduction of species is necessary, select appropriate genotypes

Genotypes display differences in stem density, stem height, rooting depth, decomposition rate, and below ground root mass

Consider reference area or adjacent wetlands for planting considerations

Watering should only be used for initial planting or in drought conditions

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Guideline #7: Provide Appropriately Heterogeneous Topography

- Incorporate appropriate elevations and topographic variations to support
  - Specific plants and specific hydroperiods
- Plan elevations appropriate for plants and animals in nearby natural systems
- Be aware of local variations in tidal systems

Appropriate elevations and topographic variations should be incorporated to support specific wetland plants and specific hydroperiods

Plan for elevations that are appropriate for plants and animals in adjacent or close-by natural systems

In tidal systems, be aware of local variations in tidal flooding regime that might affect flooding duration and frequency

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Guideline #8: Pay Attention to Subsurface Conditions

- Soil and sediment geochemistry, groundwater quantity and quality, and infaunal communities
  - Inspect and characterize soils
  - Characterize chemical structure of soils, surface water, groundwater, and tides
  - pH, redox, nutrients, organic content, and suspended matter

Pay attention to subsurface conditions, including soil and sediment geochemistry, groundwater quantity and quality, and infaunal communities

Inspect and characterize soils to determine permeability, texture, and stratigraphy

Characterize the general chemical structure of soils, surface water, groundwater, and tides

Minimum attributes should include pH, redox, nutrients, organic content, and suspended matter

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Guideline #9: Consider Complications

- Creation or restoration in degraded or disturbed sites
  - May require active management to sustain the wetland
  - Disturbances can promote invasion of exotic species
  - Reintroduce natural hydrology with minimal excavation

Consider complications associated with creation or restoration in seriously degraded or disturbed sites

Seriously degraded wetlands surrounded by extensively developed landscape may require active management to support the sustainability of the mitigation

Disturbances can promote extensive invasion of exotic species

Reintroduction of natural hydrology with minimal excavation of soils often promotes alternative pathways of wetland development

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Guideline #10: Monitor Early

- Adaptive management monitoring
  - Provide early indication of problems
  - Provide direction for corrective actions
- Important
  - Water-level monitoring
  - Process monitoring
- Monitoring and control of exotic species
- Integrate adaptive management with assessment of wetland performance
- Documentation of structure will not provide enough information to make adaptive corrections

No associated notes.

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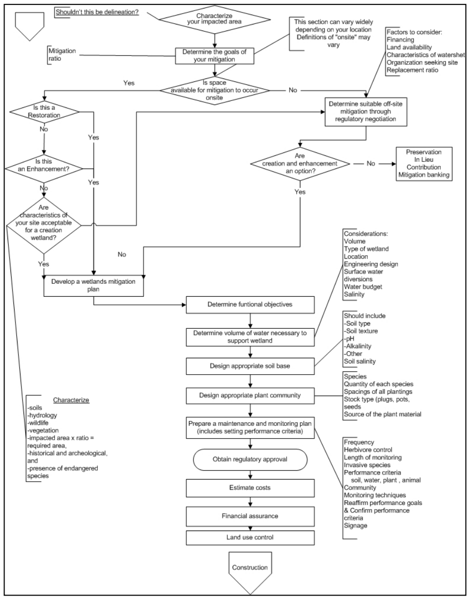
Beginning the Compensatory Mitigation Process

- Discussion with USACE district and/or appropriate state regulators
  - District checklists available for most Corps districts
  - State guidance documents also available
- How much and what type of compensatory mitigation will be determined as part of the overall permit process

No associated notes.

Decision Tree Figure 1-1



"Guidance for Characterization, Design Construction and Monitoring of Mitigation Wetlands"

Wetlands-2 on
www.itrcweb.org

No associated notes.

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Questions and Answers

No associated notes.

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The Mitigation Process

- What is being lost?
- How and where are you going to replace it?
  - On-site, off-site, watershed?
  - How? restoration, creation, enhancement
- Develop a proposal/plan
- Construct the mitigation wetland
- Monitoring for success

Once you have come to the point in the application process where you have defended that you cannot avoid impacting a wetland and you have minimized the wetland disturbance, then you need to figure out how you are going to mitigate for that unavoidable loss.

48

Design Considerations

- Hydrogeomorphic and ecological landscape
- Dynamic landscape perspective
- Restore or develop naturally variable hydrological conditions
- Wetland restoration over creation
- Avoid over-engineered structures
- Select appropriate planting elevation, depth, soil type, and seasonal timing

No associated notes.

49

Design Considerations

- Provide heterogeneous topography
- Appropriate subsurface soil and sediment geochemistry and physics, groundwater quality and quantity, and infaunal communities
- Beware of complications associated with creation or restoration in seriously degraded or disturbed sites

No associated notes.

50

Location, Location, Location

No associated notes.

51

Location

No associated notes.

52

Key Elements of a Wetland Mitigation Plan

- Characterization of baseline conditions of the impacted wetland
- Statement of intent and goals
- Characterization of baseline conditions of the mitigated wetland site
- Adaptive management planning
- Detailed planting plan
- Detailed grading plan
- Description of the soil to be used
- Schedule/construction timetable
- Maintenance and monitoring plan

Above is a list of key elements of a sound wetland mitigation plan. Further in the presentation we will go into detail about each of these elements as well as direct you to the manual where you can get further information.

53

Statement of Intent/Goals

For example, are you proposing to create a vernal pool, forested wetland, flood storage etc…? Clear goal/performance standards provide a clear avenue of how to prove success of the project. The clearer the goals the less chance there will be any disagreement between the regulator and the applicant of whether or not the mitigated wetland is in compliance with the issued permit.

54

Characterize the Baseline Conditions of the Mitigated Wetland Site

- The designer should always
  - Clearly understand the hydrology available at a wetland construction site prior to final site selection
  - Consider the impact that future land development will have on the quality or quantity of water over time
  - Confirm that the conveyance of tidal water to and from the site is unrestricted when constructing tidally supported wetlands
  - Determine the composition of soil at various proposed depths prior to final site selection
  - Consider costs in selecting a site

Once you have established what are the goals of the mitigated wetland next is to establish what are the baseline conditions of the site where you propose to replace these wetland functions. The greater the understanding of the site conditions the more accurate your assessment will be if the site will be able to provide the conditions necessary to replace those lost wetland functions. For example, if one of your goals of the mitigated wetland is to replace lost flood storage in a particular watershed then you will need to make sure that is possible based on the elevation of the mitigated site in relationship to that floodplain.

55

Characterize the Impacted Wetlands

- What is being lost?
  - Soils
  - Vegetative community
  - Hydrology
  - Wildlife habitat

Forested wetlands that store flood waters?

56

Site Selection and Suitability

- Availability of suitable sites
- Constructability
- Overall costs
- Technical requirements
- Logistics
- Likelihood of success
- Ecological sustainability
- Practicability for long-term monitoring and maintenance

No associated notes.

57

Components of the Mitigation Plan

- Hydrology
- Soils
- Vegetation
- Habitat

No associated notes.

58

Hydrology

- Maintain appropriate water
  - Depth
  - Duration
  - Flow
- Ensuring that timing of water levels is appropriate
- Mitigation wetlands should be allowed to develop naturally and should be maintenance free with regards to hydrology

No associated notes.

59

Soils

- Plans must detail
  - Cross-sectional elevations, both existing and final
  - Pre- and post-construction grades
  - Location of stockpile areas
  - Erosion and sediment control plans or permits
  - Stratification of soil layers
  - Equipment staging areas
  - Any if used, the location of borrow areas in the vicinity of the site

No associated notes.

60

Vegetation

Key	Botanical Name	Common Name	Quantity	Size/ Comments	Region 1 Wetlands Indicator
TREES					
AR	• *Acer rubrum*	Red Maple	631	3'-4'/POT	FAC
NS	*Nyssa sylvatica*	Black Gum	105	3'-4'/POT	FAC
PR	*Pinus rigida*	Pitch Pine	105	3'-4'/POT	FAC
MV	*Magnolia virginiana*	Sweetbay Magnolia	52	1'-1.5'/POT	FACW
AS	*Alnus serrulata*	Smooth Alder	52	1'-1.5'/POT	OBL
QB	*Quercus bicolor*	Swamp White Oak	105	2'-3'/POT	FACW
SHRUBS					
CA	• *Clethra alnifolia*	Coast Pepperbush	1473	1.5'-2'/POT	FAC+
VC	*Vaccinium corymbosum*	Common Highbush Blueberry	1497	1.5'-2'/POT	FACW
RV	*Rhododendron viscosum*	Swamp Azalea	1286	1'-1.5'/POT	OBL
HERBS					
JE	• *Juncus effusus*	Soft Rush	1304	2" PEAT/POT	FACW
GRASSES					
LO	• *Leersia oryzoides*	Rice Cutgrass	40 lbs./acre	SEED	OBL
PV	*Panicum virgatum*	Switchgrass	40 lbs./acre	SEED	FAC

See “ITRC Technical and Regulatory Guidance for Characterization, Design, Construction and Monitoring of Mitigation Wetlands” (Wetlands -2) www.itrcweb.org.

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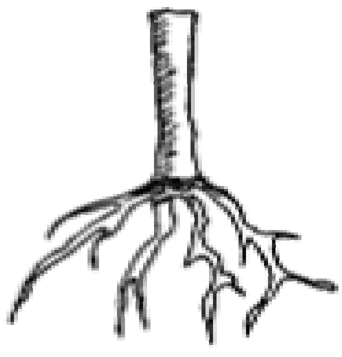
Planting Design Considerations

- Timing of planting to achieve maximum survival
- Proposed benefit of each plant species
- Methods of planting
- Proposed use of mulch (strongly encouraged in USACOE, New York District (2003))
  - Certified inert material straw mulch rather than hay which may bring in noxious weeds
- Description of potential soil amendment such as organic material or fertilizer
- Description of potential supplemental watering (should only be used for the establishment of the plant community and not as a long term tool to support the mitigation)

No associated notes.

62

Plant Stock



Bare Root

Pre-packaged
Bare Root

No associated notes.

63

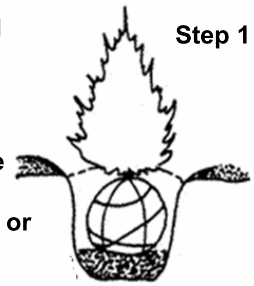
Explain Plant Installation

Step 1

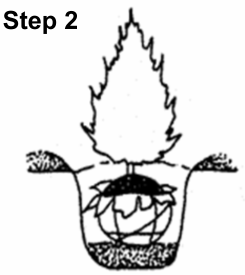
Set plant on good topsoil

Establish proper depth

Do not plant more than 1” deeper than ground level or top of ball



Step 2



Cut twine tie from around plant stem

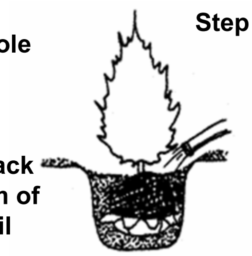
Loosen and fold back burlap

Step 3

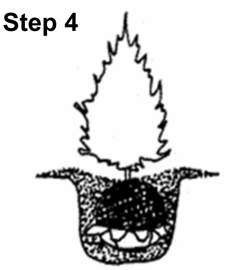
Partially fill in hole

Tamp firm

Carefully fold back burlap to bottom of hole for total soil contact



Step 4



Add more soil after settling

Reshape basin

Water regularly

Taken from an actual submittal in New Jersey

64

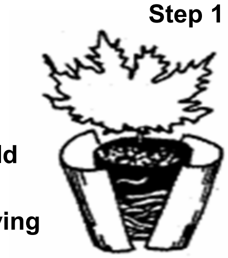
Explain Plant Installation (continued)

Step 1

Tapered cans: Turn upside down. Tap rim sharply on edge of a raised surface.

Straight cans: Cut on opposite sides and fold back metal.

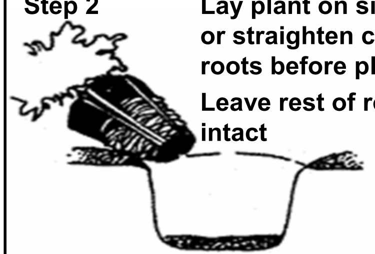
Dig hole before removing plant from container



Step 2

Lay plant on side. Cut or straighten circling roots before planting

Leave rest of roots intact

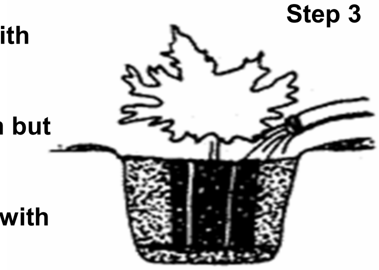


Step 3

Backfill with top soil

Tamp firm but not hard

Fill basin with water

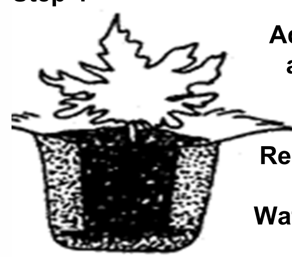


Step 4

Add more soil after settling

Reshape basin

Water regularly



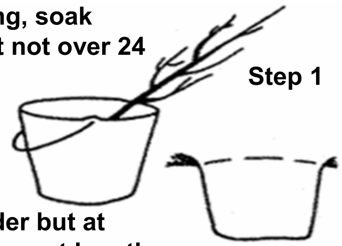
Taken from an actual submittal in New Jersey

65

Explain Plant Installation (continued)

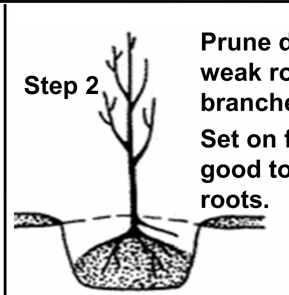
Before planting, soak overnight, but not over 24 hours

Step 1



Dig a hole wider but at same depth as root length

Step 2

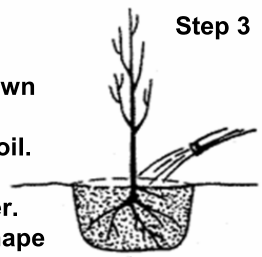


Prune damaged or weak roots and branches

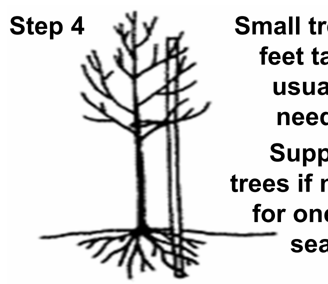
Set on firm mound of good topsoil, spread roots.

Plant at the same depth or slightly above the level grown in the nursery
Fill with good topsoil.
Tamp firm.
Fill basin with water.
Add topsoil to reshape basin

Step 3



Step 4



Small trees, eight feet tall or less, usually do not need support.

Support larger trees if necessary for one growing season only.

Taken from an actual submittal in New Jersey

Habitat

- Enhancements to the habitat may include
  - Woody debris such as logs, stumps, brush piles, and snags
  - Upland islands
  - Open water features such as tidal guts and small pools
  - Nesting boxes for waterfowl and roosting structures for other avian species
  - Open water structures such as wing deflectors, boulder clusters, and rock weirs
  - Vegetative buffers
- ITRC has established an Ecological Land Re Use Team that will be examining the use and installation of such structures during remediation

No associated notes.

67

No associated notes.

68

Wildlife Attractors

No associated notes.

69

Adaptive Management

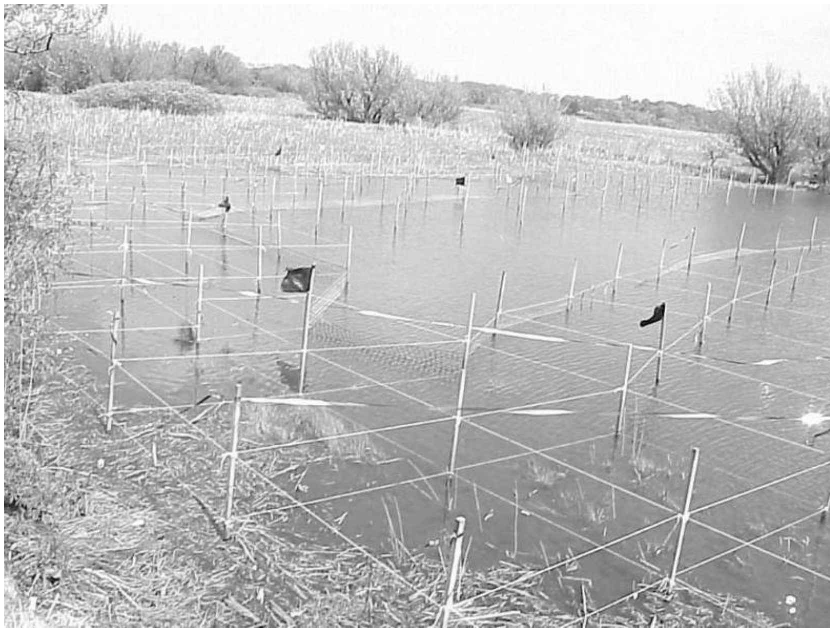
No associated notes.

70

Adaptive Management

No associated notes.

71



Example of some preventive methods to keep geese form plantings.

Adaptive Management

The other wildlife

Performance

- Performance standards are those metrics that will be measured to evaluate whether the mitigation is achieving its planned goals. Generally these include
  - Hydrological
  - Vegetative
  - Faunal
  - Soil

No associated notes.

Monitoring

- Surface water and groundwater elevations
- Elevation of wetland floor at critical points
- Physical integrity of inlet/outlet structures (if used)
- Vegetative community composition and coverage
- Plant health and vegetative success
- Presence of nuisance species
- Wildlife species present
- Water quality (pH, turbidity, dissolved oxygen, or salinity, as appropriate)
- Erosion of buffer zones
- Evidence of human disturbance

No associated notes.

75

Reporting

- List of parties responsible for the monitoring and preparation of the annual report
- Results of monitoring activities and quantitative analyses of the data
- Monitoring photographs
- Establishment of reference points
- Maps showing location where monitoring photographs were taken
- Maps showing monitoring areas
- Results of any remedial actions
- Copies of field data sheets

No associated notes.

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Construction Specifications

- At a minimum, construction specifications should include
  - Responsibilities and contact information of all parties involved with the mitigation project
  - Sources of plant materials (recommended local sources be utilized as much as possible)
  - Copies of contracts noting landscaper responsibilities such as fertilizations and irrigation, plant replacement, reseeding, temporary protection of vegetation from wildlife, and the number of site inspections

No associated notes.

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Construction Checklist

Required construction information	
Season	
Schedule	
Type of equipment	
Staging areas for equipment	
Spoil disposal	
Grading stakes and other necessary grading controls	
Adjacent upland slopes and grading control	
Quality control efforts	

Now the plans are completed you enter into the construction phase of the project. This is an example of a checklist you should incorporate into construction phase of the project to maintain quality control. In addition, most state and federal agencies will require you to prepare as-built plans and a summary detailing the construction process. Therefore good notes will be important when finalizing that documentation.

Following completion of the constructed wetlands, an As-Built Report detailing all construction activities should be prepared and submitted to the federal, state, or local regulatory agencies involved in overseeing the mitigation project. Notes and observations of the onsite Supervising Engineer, collected during grading and planting should be included. The report should include maps, data sheets, photographs, and available water budget data. See Section 4.4 for more details.

Table 5-1 Checklist of Construction Information Required for Impacted Wetlands and/or Mitigation Areas

Required construction information

Season

Schedule

Type of equipment

Staging areas for equipment

Spoil disposal

Grading stakes and other necessary grading controls

Adjacent upland slopes and grading control

Quality control efforts

Examples included - Control of invasive species by assuring heavy equipment tracks are free and clear of undesirable plants and preventing overcompacting during site grading, etc.

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Implementing the Mitigation Plan

- Soil erosion and sediment control
- Prepare grade
- Plant selection and staging
- Plant installation

Once you have the plans designed correctly the next critical step in establishing a successful mitigated wetland is successful execution of the plans.

Four critical steps during the construction process:

1. Sound sediment erosion and control plan
2. Proper grading
3. Plant selection and staging
4. Proper installation of the plants

If one of these steps is not executed correctly it can, and probably will, have an adverse impact on the mitigated wetland.

79

Interpreting Plans

- Operator usually views the project differently than a biologist
  - Difficult to show on paper such things as micro topography, loose friable soil

Making sure everyone is working towards the same goal is key. Respecting the background and what each of the players at the meeting will bring to the project is critical for its success. Traditional site plan design and interpretation must be overcome. Leaving a site messy (in the words of most operators) is difficult and, based on their interpretation of the plans, wrong. I always tell them do the opposite of what you were trained. The plans are a guide, a target elevation which will have undulations and ponding of water throughout. Use words everyone understands. When I used to say the soil is too compact operators as well as engineers would disagree. When I realized the word compact meant a specific condition in their world, I changed my words. I will say the soil is too compressed, the bulk density too high.

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Soil Erosion and Sediment Control

- Minimize disturbed area
- Divert runoff from work, storage, and borrow areas
- Construct roadways on contours to minimize erosion
- Minimize soil compaction
- Stage equipment away from aquatic resources
- Leave surrounding vegetation intact
- Use temporary settling basins, silt fences, and hay bales
- Comply with all government construction codes

Prior to beginning construction, which will result in the disturbance of the existing soils, soil erosion and sediment control measures should be constructed in accordance with the appropriate state, county, and/or conservation district standards for soil erosion and sediment control. The objective is to prevent sediment from being washed from excavated areas where it is needed, into undisturbed areas where it can result in sedimentation problems. All soil erosion and sediment control measures should be maintained in good condition and left in place until permanent vegetation cover is established

To ensure that erosion (and construction related pollution) is not a concern, the follow actions should be considered:

Minimize the area of disturbance;

Divert runoff from work, storage and borrow areas;

Construct roadways on contours to minimize erosion;

Minimize soil compaction by avoiding unnecessary vehicle traffic on saturated substrates;

Stage equipment away from areas that are under development as aquatic resources;

Leave as much of the surrounding vegetation intact as possible;

Use temporary settling basins, silt fences and hay bales to filter sediment;

Control engine fluids associated with heavy equipment;

Place sanitary facilities away from water sources;

Prevent the initiation and spreading of fires; and

Comply with all state and federal construction codes.

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Site Preparation and Grading

- Clear vegetation and debris
- Remove topsoil
- Grade subsoil
- Replace substrate
  - Uncompacted

Prior to grading or other construction activity, the construction location should be cleared of all unnecessary vegetation and debris. Cleared vegetation can be chipped and temporarily staged with other debris in an upland area. Chipped material can serve as mulch for planting operations depending on site circumstances, the type of material used and composition of the wood. Non-recyclable material should be disposed offsite. The boundaries of possible excavation should be marked to limit the potential for indirect or unintentional impacts to surrounding areas. Photo: Process of developing the grade of a site and in the background is an example of the equipment used for grading (photo from Charles Harman, AMEC Earth and Environmental, Inc 2004).

If the action is an enhancement or creation, the wetlands site should then be excavated to the contours outlined in the detailed specifications prepared during the design process. Cross-sections and contour drawings showing the current and finished grades should be completed. The cross-sections should be located throughout the construction area at fifty-yard intervals (recommended minimum) and display the current grade in all directions. Following removal of the topsoil, subsoil should be removed to a rough grade, approximately 12 inches below the final grade and consistent with the planned elevations. Upon completion of the excavation to the rough grade, a final inspection of the grades should be made by spot-checking the elevations. Since small variations in elevation create microtopography, which enhances the final wetland, the grade does not need to be perfectly level. In addition, if groundwater is a source of hydrology for the mitigation wetland, sub-grade compaction, which may interfere with the free exchange of water, must be addressed before final grading may commence.

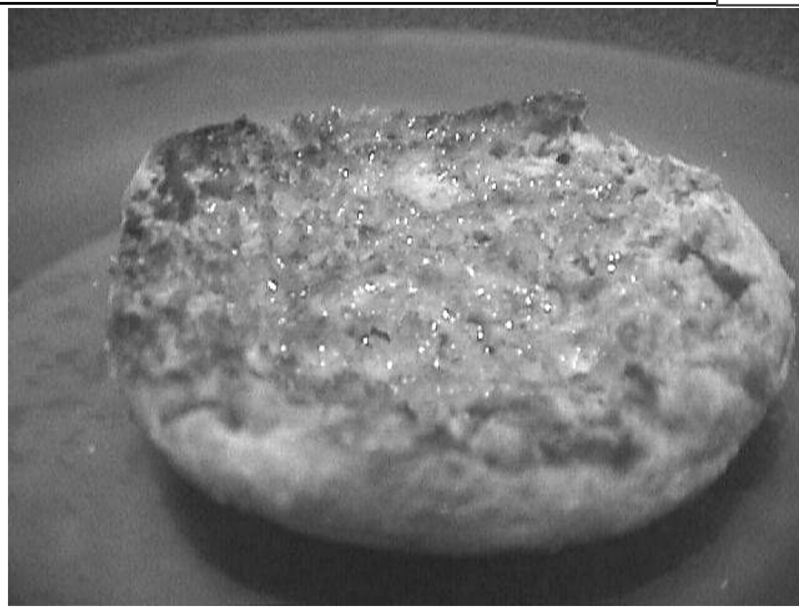
Excessive grading to achieve a uniform elevation is not necessary and will be counterproductive.

An great example of micro-topography. See also deer fence enclosure.

No associated notes.

84

Micro-topography



No associated notes.

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Plants and Plant Installation

- Grading
- Staging
- Plant orientation and spacing

The final action before installation of plants should be some activity, such as discing, to ensure that the soil is not compacted so as to interfere with the intended movement of water through the soil profile. In addition to preventing soil compaction, the use of discing, cultivators, bedding harrows or other farm implements can be used to develop microtopographic aspects to the mitigation area.

Plants and Plant Installation

Photo: Planting Grid (photo from Charles Harman, AMEC Earth and Environmental, Inc 2004).

The design specifications will identify the vegetative species to be planted. The selection of the particular species will be based on the type of wetland, the biogeographic distribution of a species, climate, and desired wildlife habitat or ecological system.

Grids are commonly used for planting spacing, though individual species should be randomly offset from each grid node to create some spatial heterogeneity. See Section 4.0 for a discussion on plant distribution with regards to grid plantings. Broadcast seeding can be used to enhance the herbaceous community and supplement the plantings. Photo: Plant staging (photo from Charles Harman, AMEC Earth and Environmental, Inc 2004).

All plants should be delivered and staged onsite prior to planting. Upon deliver, plants should be inspected to ensure that they are in good health, are not root bound, and are the correct species and form. The holes that are dug for potted species should be sufficiently larger in circumference than the pot so that loose soil can be filled in around the plant. For most species, the depth of the hole should equal the depth of the plant container. Depending upon the hydraulics of the site during planting activities, the plants may need to be watered following their installation. Plants should not be removed from containers until immediately before planting to minimize exposure of the root system to dry air. Roots should be examined to determine if they are pot bound. Roots that are pot bound should be gently separated prior to planting. Plants may be mulched with wood chips, straw, hay, or other mulching materials, or may be left unmulched to allow a wetland seed mix to produce a living mulch. After planting, protect the plants from drought, damage from grazers, and human intrusion. If necessary, periodic waterings can help establish the new plants.

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Costs Associated with Various Types of Mitigation Wetlands

	Emergent Freshwater	Forested Freshwater	Emergent Estuarine/coastal
General	$15k - 35k/ acre	$25k - 70k/ acre	$15k - 35k/ acre
Restoration Enhancement	$15k - 25k/ acre	$25k - 40k/ acre	$15k - 25k/ acre
Creation	$20k - 35k/ acre	$40k - 70k/ acre	$25k - 35k/ acre
Land costs	$ 5k - 100k/ acre	$ 5k - 100k/ acre	$ 5k -100k/ acre

Please see section 4.2.4 Mitigation Cost in the Document
"ITRC Technical and Regulatory Guidance for Characterization, Design, Construction and Monitoring of Mitigation Wetlands"
Wetlands -2 www.itrcweb.org

Please see section 4.2.4 Mitigation Cost in the Document, "ITRC Technical and Regulatory Guidance for Characterization, Design, Construction and Monitoring of Mitigation Wetlands" (Wetlands -2) www.itrcweb.org

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Costs Other than Mitigation Implementation Dennison and Berry (1993)

Activity	Cost range/acre
Wetland delineation	$500 - 750
Functional assessment and evaluation of existing wetlands	$5,000 - $20,000/site
Preparation of permit applications (or permit equivalents)	$3,000 - 10,000
Development of mitigation plans • Conceptual plan • Wetland creation plan • Restoration/enhancement designs • Engineering plans and specifications	$5,000 - 15,000
Post-construction monitoring (annual costs)	$1,000 - $4,000/site

1. Variation in cost is the result of the complexity of the wetland system; small, isolated emergent wetlands with obvious boundaries requiring a routine level delineation will cost less than a larger, more complex site requiring an intermediate level delineation.
2. Cost is a function of both the size and complexity of the wetland site; in particular, the more potential functions that the wetland has, regardless of size, the more complex and detailed the functional evaluation will be; a small, single function wetland will cost less to evaluate than a large, multi-function wetlands.
3. Costs do not include the replacement of plants to ensure an 85% survival rate; most monitoring programs can last from 5 to 10 years.

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Mitigation Monitoring

Project: ________ Date of Assessment: _______________________
Location: ____
Wetland Creation: ____ Wetland Restoration: ____ and/or Wetland Enhancement ___________
Person(s) Conducting the Assessment: ____
Initial Evaluation: ____ Semiannual: ____ Annual: ___

Hydrology

Has adequate wetland hydrology been achieved? Yes _____ No _____ Partial __________
If partial, what percentage of the assessment area has adequate wetland hydrology? _____ %
What percentage of the assessment area will be inundated or have open water for three weeks or more during the growing season? _______%.
Range of depths of inundation: ______________ to ______________.
Remarks:____

Vegetation

Have all disturbed nonaquatic/wetland areas been revegetated? Yes _ No ____________.
Approximate aerial cover. ________%.
Is the assessment area adequately protected from significant erosion? Yes ____ No ____.
Is the area sustaining significant herbivory? Yes ____ No _____.
Will additional plantings/seedings or actions be necessary to achieve adequate erosion control? Yes _____ No _____.
Have hydrophytic plant species volunteered into the assessment area? Yes ____ No ____.

The monitoring program is a critical portion of the wetlands mitigation project and will usually be designed in accordance with state and/or federal guidelines specific to the location of the mitigation project. While the performance standards may change from state to state, or between USACOE districts, in general the focus of the monitoring is over an agreed upon length of time. Schneider and Sprecher (2000) suggest that items to assess the development of wetland conditions on the mitigation site which are measured through an evaluation of wetland hydrology, vegetation, and soils be monitored over time include:

Surface water and groundwater elevations;
Elevation of wetland floor at critical points;
Physical integrity of inlet/outlet structures (if used);
Vegetative community composition and coverage;
Plant health and vegetative success;
Presence of nuisance species;
Wildlife species present;
Water quality (pH, turbidity, dissolved oxygen, or salinity, as appropriate);
Erosion of buffer zones; and
Evidence of human disturbance

The monitoring plan should include a detailed description of how each of these activities will be accomplished. As with the Mitigation Plan in general, the Monitoring Plan must begin with a description of the goals and objectives of the monitoring activity, which should be based on the performance standards that have been agreed upon with the appropriate regulatory agencies. The monitoring program should also outline the periodicity of the monitoring frequency. Again, this will be a function that may fluctuate, depending upon the regulatory body for the site. The monitoring program should last a sufficient time to ensure the long-term success of the mitigation site. This timeframe typically runs from 5 to 10 years. Monitor the mitigation site twice per year. Some regulatory agencies will allow a shift in monitoring frequency to once a year in the later years of the monitoring program. Consideration should also be given to a preliminary monitoring visit approximately 6 weeks after completion of the mitigation to gauge initial planting success and adaptation to the mitigation area.

The results of the monitoring will be summarized and submitted to the appropriate agencies at a minimum on an annual basis, and occasionally with interim reports for each monitoring visit to support the annual report. The annual report should include, at a minimum:

List of parties responsible for the monitoring and preparation of the annual report;
Results of monitoring activities and quantitative analyses of the data;
Monitoring photographs;
Establishment of reference points;
Maps showing location where monitoring photographs were taken;
Maps showing monitoring areas;
Results of any remedial actions; and
Copies of field data sheets

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Mitigation Monitoring (See Table 6-1)

SAMPLE MITIGATION WETLAND ASSESSMENT FORM, PAGE TWO

Vegetation (Continued)
Indicate the results of survival evaluation compared to plantings. Include remarks on volunteer species in assessment area: ________________________________
What percent of dominants that are FAC, FACW, or OBL species. __________%
Is the plant community a wetland? Yes ____ No ____.
Will additional plantings/seedlings be necessary to create a hydrophytic dominated community? Yes ____ No ____.

Functions and Values
Indicate the wetland functions currently observable in the mitigation wetland and their relative value in the wetland system.________________________________
Dominant species
Percent cover
Wetlands indicator status
Recommendations/Comments ____

The monitoring program is a critical portion of the wetlands mitigation project and will usually be designed in accordance with state and/or federal guidelines specific to the location of the mitigation project. While the performance standards may change from state to state, or between USACOE districts, in general the focus of the monitoring is over an agreed upon length of time. Schneider and Sprecher (2000) suggest that items to assess the development of wetland conditions on the mitigation site which are measured through an evaluation of wetland hydrology, vegetation, and soils be monitored over time include:

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Elevation of wetland floor at critical points;
Physical integrity of inlet/outlet structures (if used);
Vegetative community composition and coverage;
Plant health and vegetative success;
Presence of nuisance species;
Wildlife species present;
Water quality (pH, turbidity, dissolved oxygen, or salinity, as appropriate);
Erosion of buffer zones; and
Evidence of human disturbance

The monitoring plan should include a detailed description of how each of these activities will be accomplished. As with the Mitigation Plan in general, the Monitoring Plan must begin with a description of the goals and objectives of the monitoring activity, which should be based on the performance standards that have been agreed upon with the appropriate regulatory agencies. The monitoring program should also outline the periodicity of the monitoring frequency. Again, this will be a function that may fluctuate, depending upon the regulatory body for the site. The monitoring program should last a sufficient time to ensure the long-term success of the mitigation site. This timeframe typically runs from 5 to 10 years. Monitor the mitigation site twice per year. Some regulatory agencies will allow a shift in monitoring frequency to once a year in the later years of the monitoring program. Consideration should also be given to a preliminary monitoring visit approximately 6 weeks after completion of the mitigation to gauge initial planting success and adaptation to the mitigation area.

The results of the monitoring will be summarized and submitted to the appropriate agencies at a minimum on an annual basis, and occasionally with interim reports for each monitoring visit to support the annual report. The annual report should include, at a minimum:

List of parties responsible for the monitoring and preparation of the annual report;
Results of monitoring activities and quantitative analyses of the data;
Monitoring photographs;
Establishment of reference points;
Maps showing location where monitoring photographs were taken;
Maps showing monitoring areas;
Results of any remedial actions; and
Copies of field data sheets

ISSUES!

No associated notes.

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Issues

- Regulatory
  - Lack of federal or state oversight and follow-up
  - Multiple permitting authorities
- Ecological value compared to impacted wetland
- Sustainability
  - Maintenance
  - Monitoring
  - Protection
- Replacement ratios and functional equivalency
- In-kind vs. out-of-kind
- On-site vs. off-site

No associated notes.

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Issues (continued)

- Mitigation banking
  - Advantages
    - Economic incentives
    - Higher credit value
    - Closer oversight and monitoring
  - Disadvantages
    - Out-of-kind
- Constructed treatment wetlands

Mitigation is not without is critics. There are a number of issues that consistently are discussed. The ecological value of the created wetland in comparison to the wetland that was filled which probably has occupied the landscape for centuries. The sustainability of the created wetland is another issue. Also how much acreage is needed to replace the wetland that is lost and how do you measure functional equivalency. The last two issues which the federal government has grappled with is in-kind replacement of wetland functions versus out of kind and whether it is better to have the mitigation on-site versus off-site.

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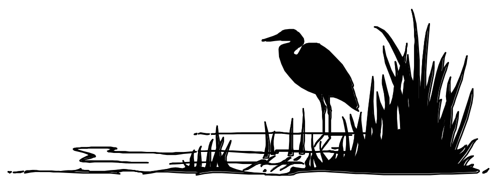
Additional Stakeholder Issues

- Wetland creation follows wetland destruction
  - Temporary loss of wetland acreage and function
  - Wetland creation should be underway before wetlands are destroyed
    - Provides buffer against ecological losses
- Increase the time period for monitoring
  - Monitor for a minimum of 5-10 years
  - 20 years for forested wetlands systems
  - implement mid-course corrections as necessary



The goal of the various wetland conservation laws was to insure that there was no net loss of wetland functions. To replace these natural functions with a mitigation wetland can take on the order of years to decades. Therefore in order to replace a specific function may require a larger area of mitigation wetland than the size of the original impacted site. Ratios vary from 1:1 to 100:1 depending on the type of the mitigation

In Minnesota, the replacement ratio is a function of the amount of wetlands remaining in a given area. The state has been divided into a number of regions based on the percentage of original wetlands remaining. In general, the larger the amount of original wetlands the smaller the replacement ratio. Minimum replacement ratio ranges from 1:1 if > 80% original wetlands present to 2:1 if < 80% are present. The minimum ratio increases if mitigation is out of kind.

In other cases, states require only a 1:1 ratio fairly universally.

Recommendation: Regardless of the variability of mitigation ratios, which are based on an acre basis, the team believes that a functional equivalency should continue to be pursued as a parameter used to calculate a mitigation ratio. This will further approach a no net loss in wetlands functions.

Stakeholder Issues (continued)

- Use buffer zones
  - Increase mitigation success
- Protect all wetlands
  - No size exclusions
- Deed restrictions and conservation easements
  - Preserve mitigation sites
- Improve stakeholder involvement

Monitor for 5-10 years (20 years for forested wetlands systems) and implement mid-course corrections as necessary. Also establish a long term maintenance fund (e.g. escrow account) or other financial assurances for long-term management/repairs/noxious weed control. This allows compensation wetlands site to be protected in perpetuity which is what the law requires.

Wetland mitigation success has been jeopardized for a variety of reasons, including ineffective site selection without necessary nutrient levels; incomplete knowledge of a mitigation site's hydrology; exotic plant invasion, catastrophic flooding and drought; human impacts during construction, poor use of construction equipment; and lack of maintenance. There is growing concern that restoration and creation projects do not consistently replace lost wetland structure and function. (See Society of Wetland Scientists. http://www.sws.org/wetlandconcerns/Performance.html).

The fact that restoration projects are not replacing lost wetland function consistently underscores the importance of developing appropriate performance standards. Stakeholders are concerned that there is no clear guidance regarding performance parameters or the duration of performance-standard monitoring. We do not suggest a cookie-cutter approach to this issue, for performance standards may differ by geographical region and/or wetland function. We suggest that standards and the duration of monitoring be developed during the permitting process. Performance standards should take account of the following factors: survival of planted stock; plant density; plant diversity; hydrology; nutrient inputs; staging of different performance standards over time as the project matures; use of natural wetlands as a benchmark to measure function; limiting the occurrence of exotic or nuisance plant species; and monitoring for a minimum of 5 years or until the standards have been met for at least 3 consecutive years, and until survival of the wetland is assured.

A wetland is a wetland whether large or one tenth of an acre. In certain states small wetlands have little or no regulatory protection. Small wetlands help protect the diversity of species (Semlitsch, 2000). The destruction of small wetlands can result in the collapse of wetland species, particularly amphibians. In the coastal Carolina bays small wetlands are crucial to maintaining the regional biodiversity of the area. The value of a wetland is intimately tied to its position in the landscape. Small wetlands are not expendable.

Deed restrictions are not a reliable mechanism in all states for protecting the mitigation wetland in perpetuity because new owners can sometimes remove the restriction from their deed without notifying the original owner who placed the deed restriction. Conservation easements provide a more permanent solution to restriction of the use of a mitigated site to preserve the permanence of the wetland.

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Conclusion

- Solid foundation (site selection, data, plans)

Prior

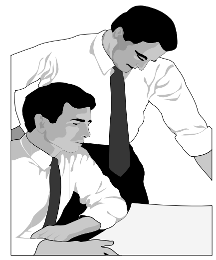
Proper Planning

Prevents Poor Performance

The plans should be based on a detailed analysis of the site.

Communication is critical for the success of the site. I tell people we have a common goal which is to make the project a success which will mean government will leave their life sooner as opposed to later. Use all the assets on the site. If you can transplant some species which may be lost during construction do so even if the plan doesn't show it. Get to the operator, they are your best friend. Every grading, planting and construction meeting has been time well spent. We always encounter changes that need to be made, perhaps not as drastic as the examples I have shown today but all were necessary. Thank you

Conclusions (continued)



- Consistent reviews/standards (checklists)
  - http://www.epa.gov/owow/wetlands/guidance
- Communicate
  - State, federal, stakeholders
  - Pre-construction meeting
  - Periodic meetings to increase success
  - Emphasize we all have a common goal

No associated notes.

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Questions and Answers

No associated notes.

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Thank You for Participating

Links to additional resources

For more information on ITRC training opportunities and to provide feedback visit:
www.itrcweb.org

Links to additional resources:
http://www.clu-in.org/conf/itrc/mitwet/resource.cfm
Your feedback is important – please fill out the form at:
http://www.clu-in.org/conf/itrc/mitwet/

The benefits that ITRC offers to state regulators and technology developers, vendors, and consultants include:

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Helping regulators save time and money when evaluating environmental technologies

Guiding technology developers in the collection of performance data to satisfy the requirements of multiple states

Helping technology vendors avoid the time and expense of conducting duplicative and costly demonstrations

Providing a reliable network among members of the environmental community to focus on innovative environmental technologies

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