The Association of State Wetland Managers Presents:

Improving Wetland Restoration Success
2014 — 2015 Webinar Series

How to Prepare a Good Wetland Restoration Plan

Presenters: John Teal, Richard Weber, Tom Harcarik, Mick Micacchion and Lisa Cowan

Moderators: Jeanne Christie & Marla Stelk

If you have any technical difficulties during the webinar you can send us a question in the webinar question box or call Laura at (207) 892-3399 during the webinar.

HAVING TROUBLE WITH THE SOFTWARE?

Don’t Panic -
we’ve got it covered!

Check your email from this morning:

1. You were sent a link to instructions for how to use the Go To Webinar software.
2. You were also sent a PDF of today’s presentation. This means you can watch the PDF on your own while you listen to the audio portion of the presentation by dialing in on the phone number provided to you in your email.

AGENDA

- **Welcome and Introductions** (5 minutes)
- **Restoration Webinar Schedule & Future Recordings** (5 minutes)
- **How to Prepare a Good Wetland Restoration Plan** (60 minutes)
- **Question & Answer** (15)
- **Wrap up** (5 minutes)

WEBINAR MODERATORS

Jeanne Christie,
Executive Director

Marla Stelk,
Policy Analyst

WETLAND RESTORATION PROJECTS

- Convened interdisciplinary workgroup of 25 experts
- Developing monthly webinar series to run through September 2015
- Will develop a white paper based on webinars and participant feedback
- To be continued through 2016 in an effort to pursue strategies that:
  - Maximize outcomes for watershed management
    - Ecosystem benefits
    - Climate change
  - Improve permit applications and review
  - Develop a national strategy for improving wetland restoration success

WEBINAR SCHEDULE & RECORDINGS

WEBINAR SCHEDULE & RECORDINGS

FUTURE SCHEDULE - 2014

- **Tuesday, December 9, 3:00pm eastern:**
  - Atlantic/Gulf Coast Coastal Marshes and Mangrove Restoration

    Presented by:

    Robin Lewis, Lewis Environmental Services, Inc. & Coastal Resource Group, Inc.; John Teal, Woods Hole Oceanographic Institution (Scientist Emeritus); Joseph Shisler, ARCADIS; Jim Turek, NOAA Fisheries Restoration
- **Tuesday, January 20, 3:00pm eastern:**
  - Temperate and Tropical/Subtropical Seagrass Restoration

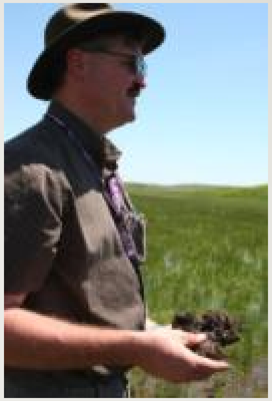
    Presented by:

    Robin Lewis, Lewis Environmental Services, Inc. & Coastal Resource Group, Inc.; Mark Fonseca, CSA Ocean Services

PRESENTERS

John Teal
Ecologist
Woods Hole Oceanographic Institution (Scientist Emeritus)

Tom Harcarik
Environmental Planner,
Ohio EPA



Richard Weber
Wetland Hydraulic Engineer,
NRCS Wetland Team,
CNTSC

Mick Micacchion
Wetland Ecologist,
Midwest Biodiversity Institute

Lisa Cowan
Professional Landscape Architect,
Studioverde

A "COOKBOOK" APPROACH TO WETLAND RESTORATION WON'T WORK

There are too many variables.

- ***Ingredients are always different***
- ***Reason for 'cooking' varies***
- ***Recipe isn't always correct***
- ***Inexperienced cooks***
- ***Cooking time varies***
- ***Poor inspection when "cooking"***
- ***Additional ingredients may be needed***
- ***Is it really done?***

WE NEED TO UNDERSTAND THE PLANNING PROCESS AND VARIABLES FROM SITE TO SITE THAT MUST BE STUDIED, UNDERSTOOD AND ADDRESSED

How to Prepare a Good Wetland Restoration Plan

IT WILL TAKE US A FEW MOMENTS TO MAKE THE SWITCH…

Wetland Restoration Planning in Coastal Systems

Dr. John Teal

Woods Hole Oceanographic Institution

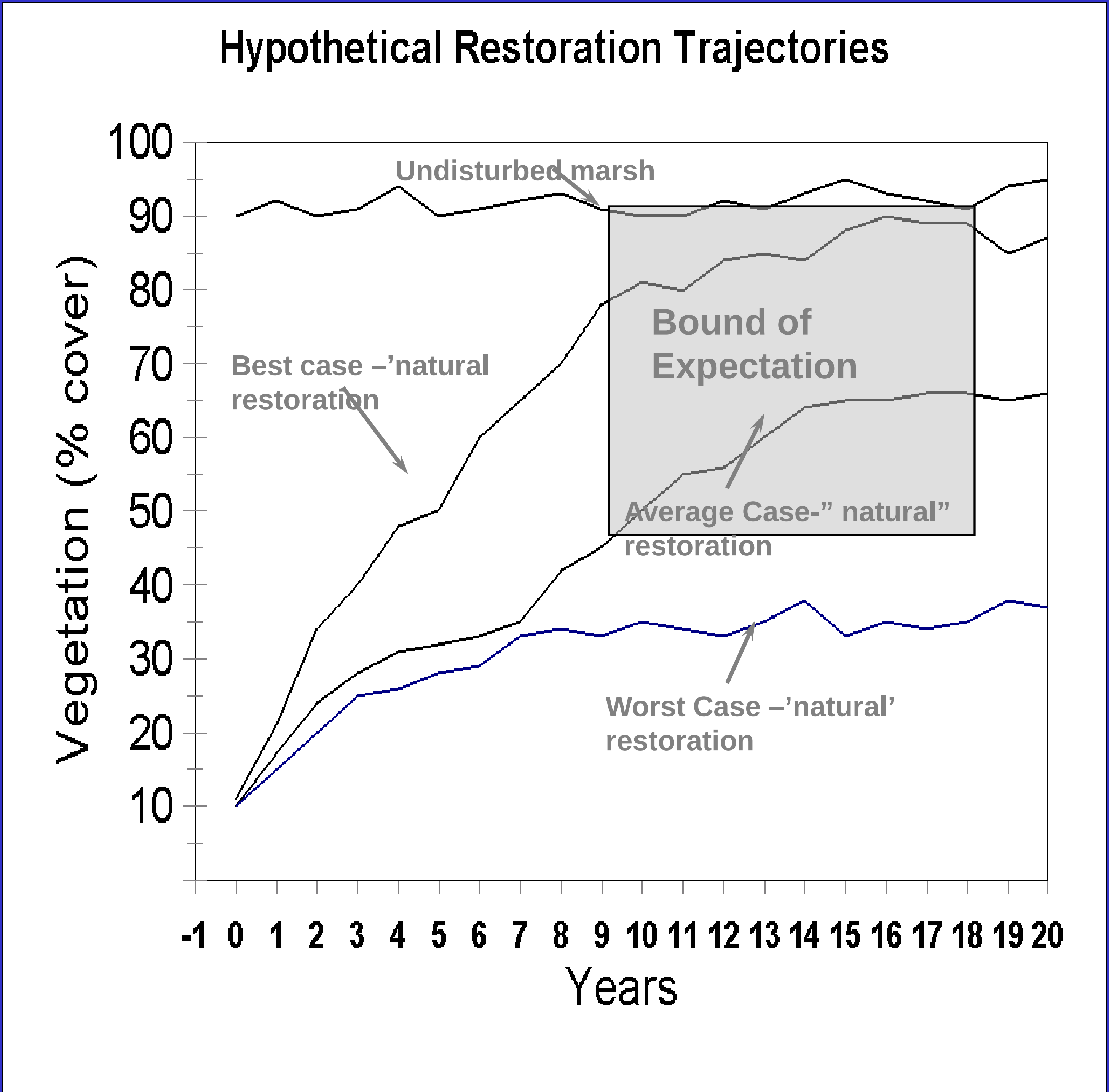
(Scientist Emeritus)

Wetland Restoration Principles

1. State goals clearly, as agreed by the stakeholders; make the goals site specific and realistic.

2. Get experts in ecology and hydrology experienced in coastal systems.

Public meeting to discuss plans and get feedback



Hypothetical Restoration Trajectories
Vegetation (% cover)
100
90
80
70
60
50
40
30
20
10
-1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years
Undisturbed marsh
Bound of Expectation
Best case –'natural restoration
Average Case-" natural" restoration
Worst Case –'natural' restoration

Wetland Restoration Principles

3. Include environmental variability when stating goals

Mud flat with worms early in restoration

Gulls and Horseshoe Crabs using marsh edge

Snow goose eatout

Marsh grass die back

Sand moved onto marsh surface by winter storm

Ice moved marsh peat up onto marsh surface

Class on boardwalk built to observe marsh restoration


Boardwalk After Sandy
destroyed last third

Wetland Restoration Principles

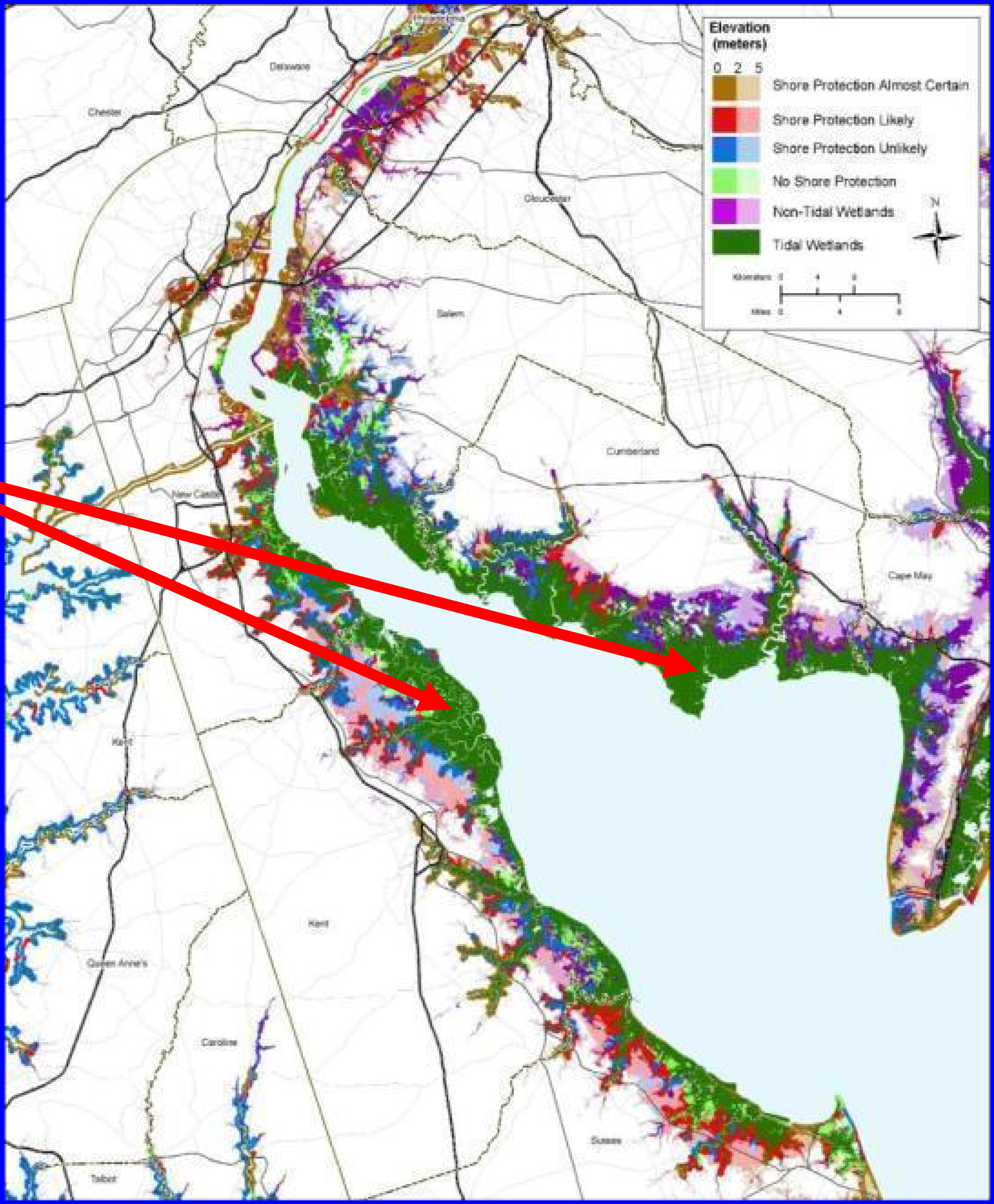
4. Consider people and property adjacent to restoration site.

Channel Dredging

Wetland Restoration Principles

5. Select (consider) sites in a landscape ecology framework.

Tidal wetlands



Wetland Restoration Principles

6. Use ecological engineering (self design).

Sheet Drain Area

Old Sheet Drain Area + 1 yr

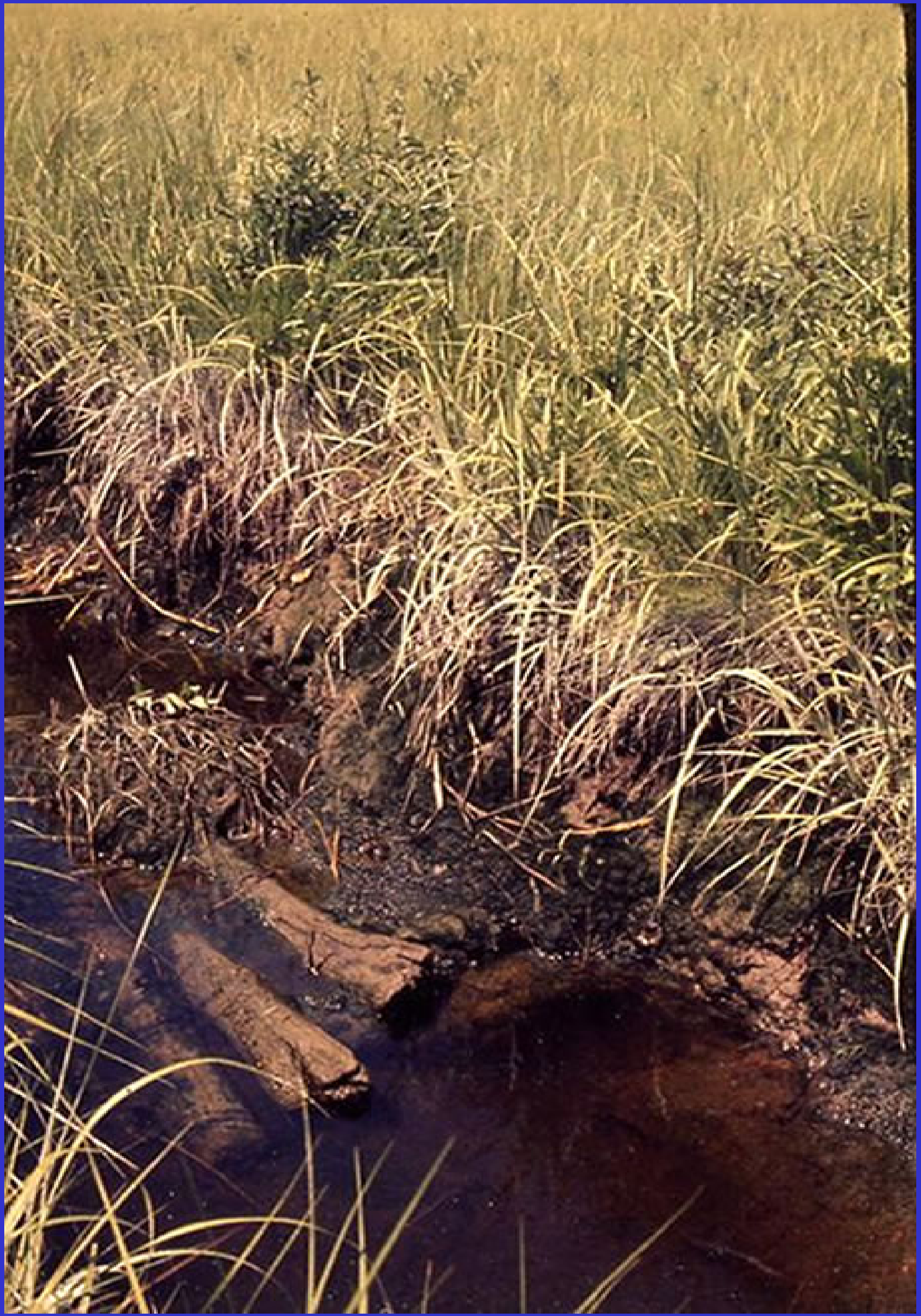
Wetland Restoration Principles

6. Use ecological engineering.
7. Design restored sites to be self-sustaining and guided by adaptive management.

Great Sippewissett Marsh 1973

Same spot 11 yrs later

Bridge laid on marsh surface by early colonists now buried by new marsh as sea level rose

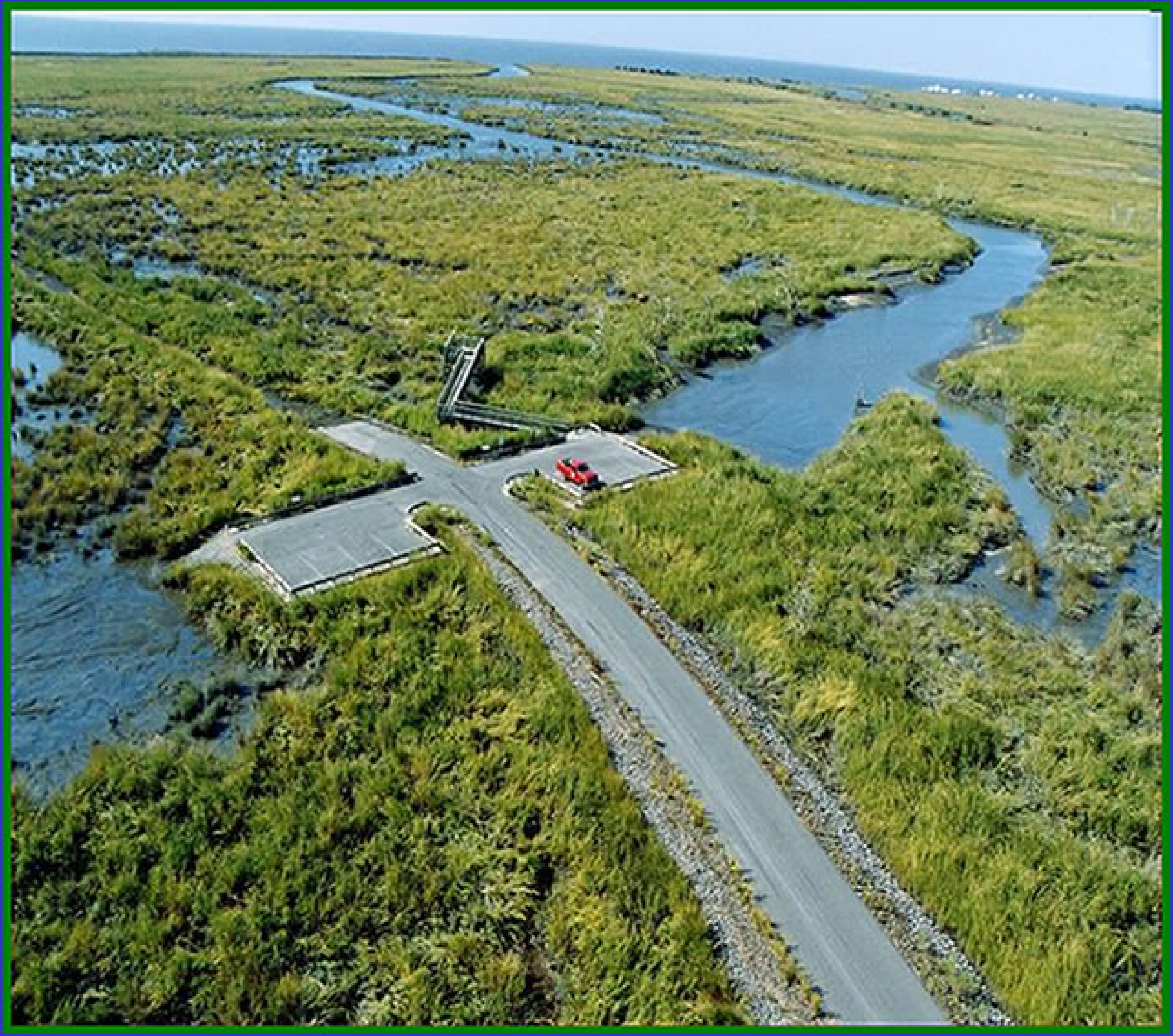


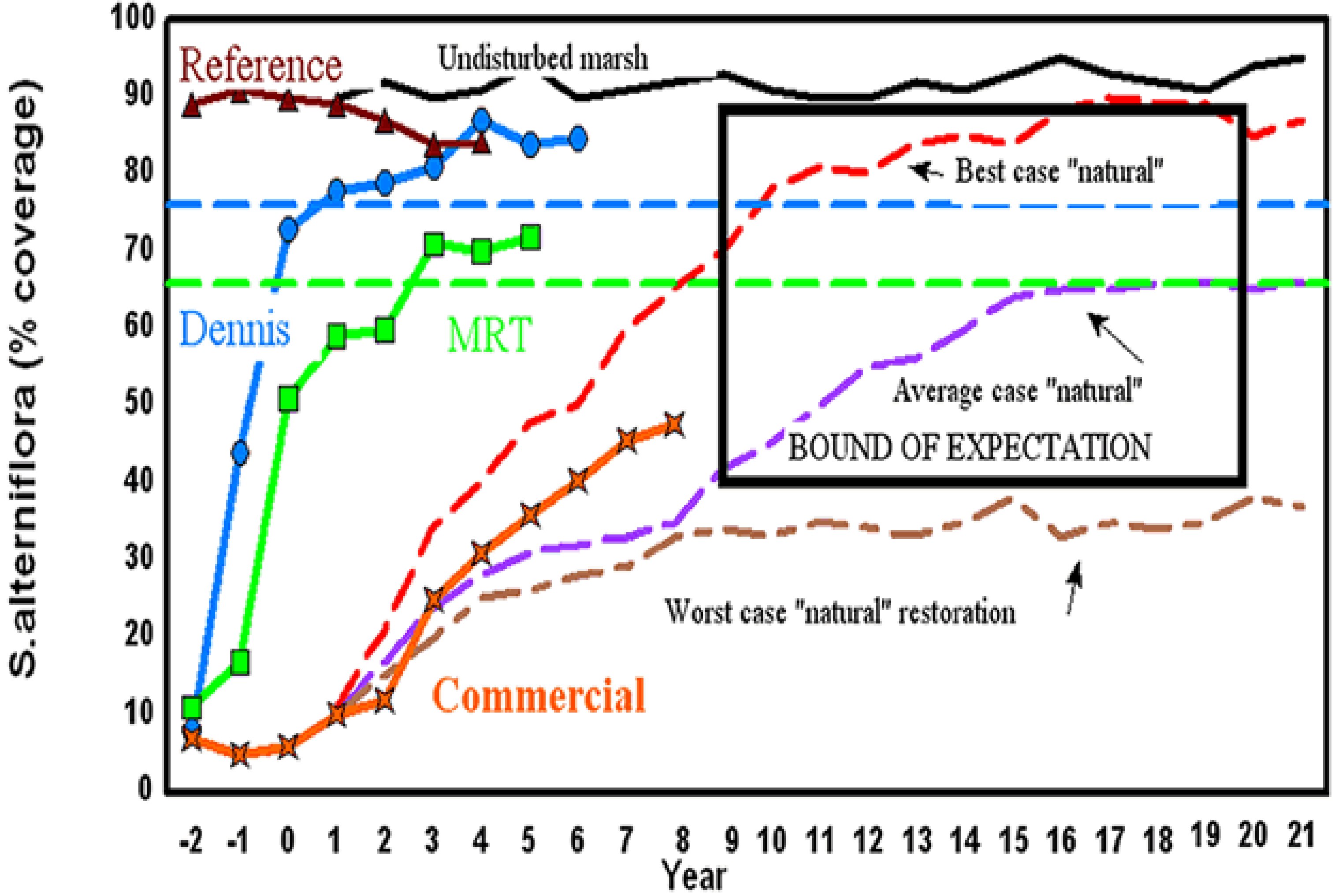
Wetland Restoration Principles

8. Plan, implement and continue site monitoring until goal is reached

Old salt hay farm after new channels and dike opened

Salt hay farm 5 years later after natural restoration





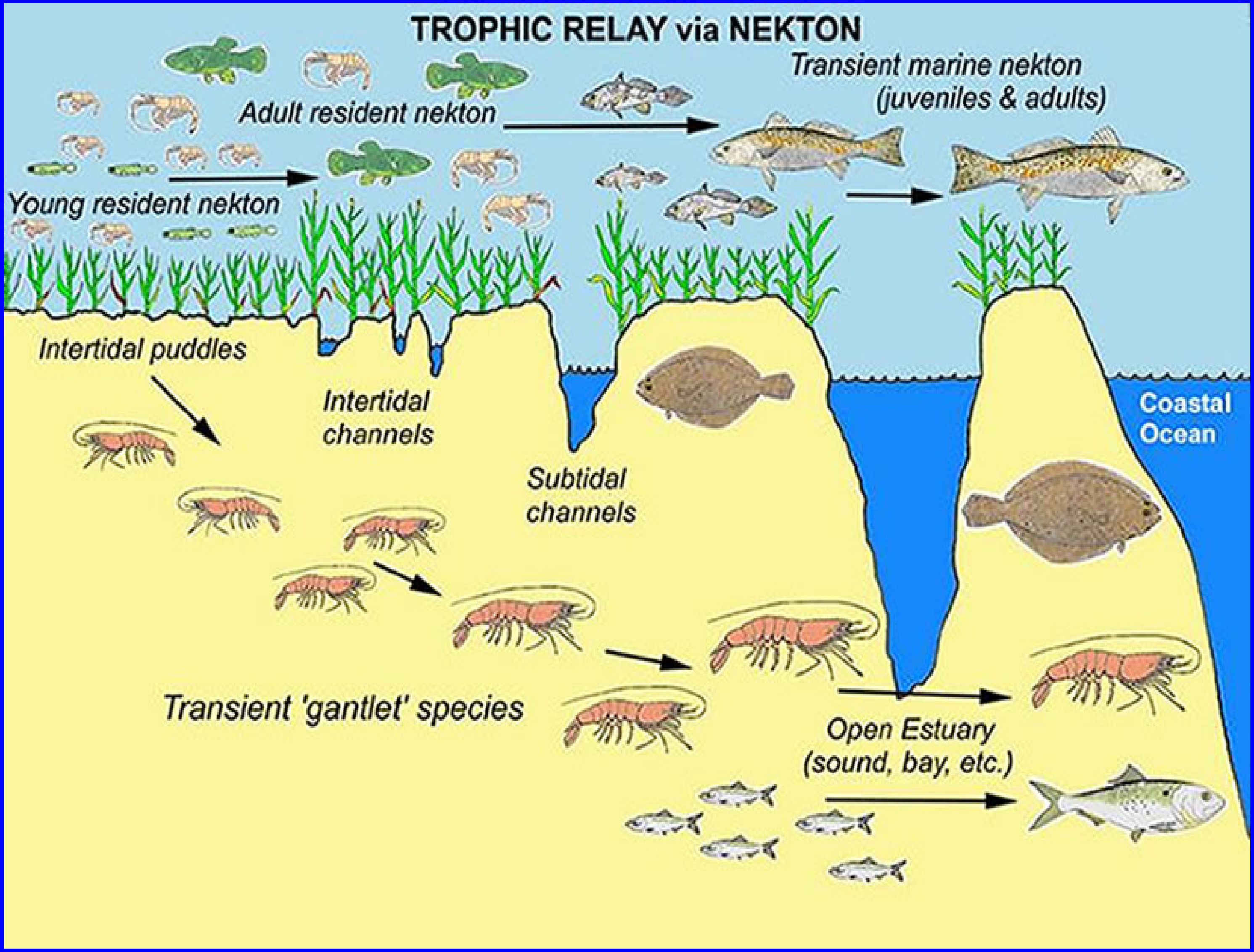
S.alterniflora (% coverage)
100
90
80
70
60
50
40
30
20
10
0
Reference
Undisturbed marsh
Dennis
MRT
Best case "natural"
Average case "natural"
BOUND OF EXPECTATION
Worst case "natural" restoration
Commercial
-2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Year

Wetland Restoration Principles

9. Include functional as well as structural components in performance criteria.

Fundulus heteroclitus

Life styles of the rich and mobile

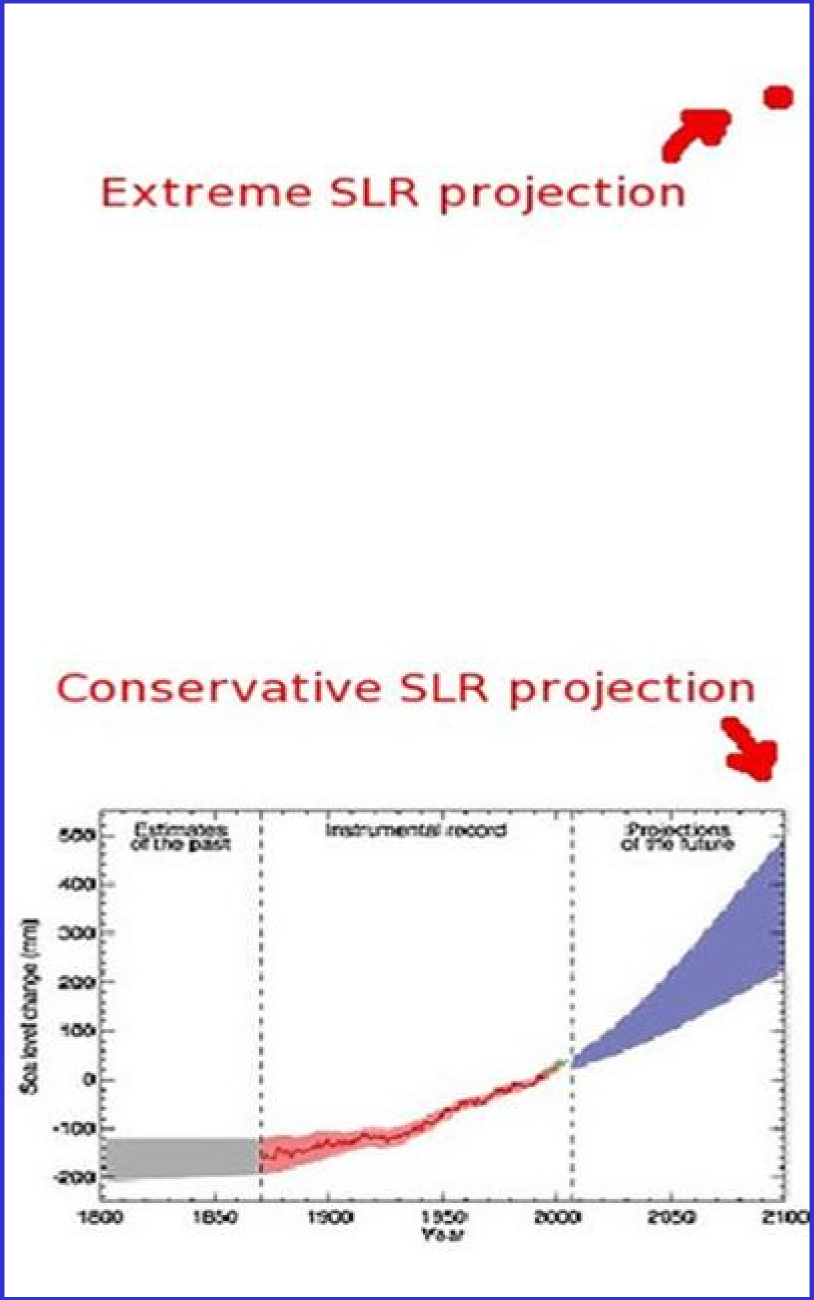


Real benefit of marsh restoration to this man

Wetland Restoration Principles

10. Consider sea level rise

Past and projected global average sea level. The gray shaded area shows the estimates of sea level change from 1800 to 1870 when measurements are not available. The red line is a reconstruction of sea level change measured by tide gauges with the surrounding shaded area depicting the uncertainty. The green line shows sea level change as measured by satellite. The purple shaded area represents the range of model projections for a medium growth emissions scenario (IPCC SRES A1B). For reference 100mm is about 4 inches. Source: IPCC (2007)

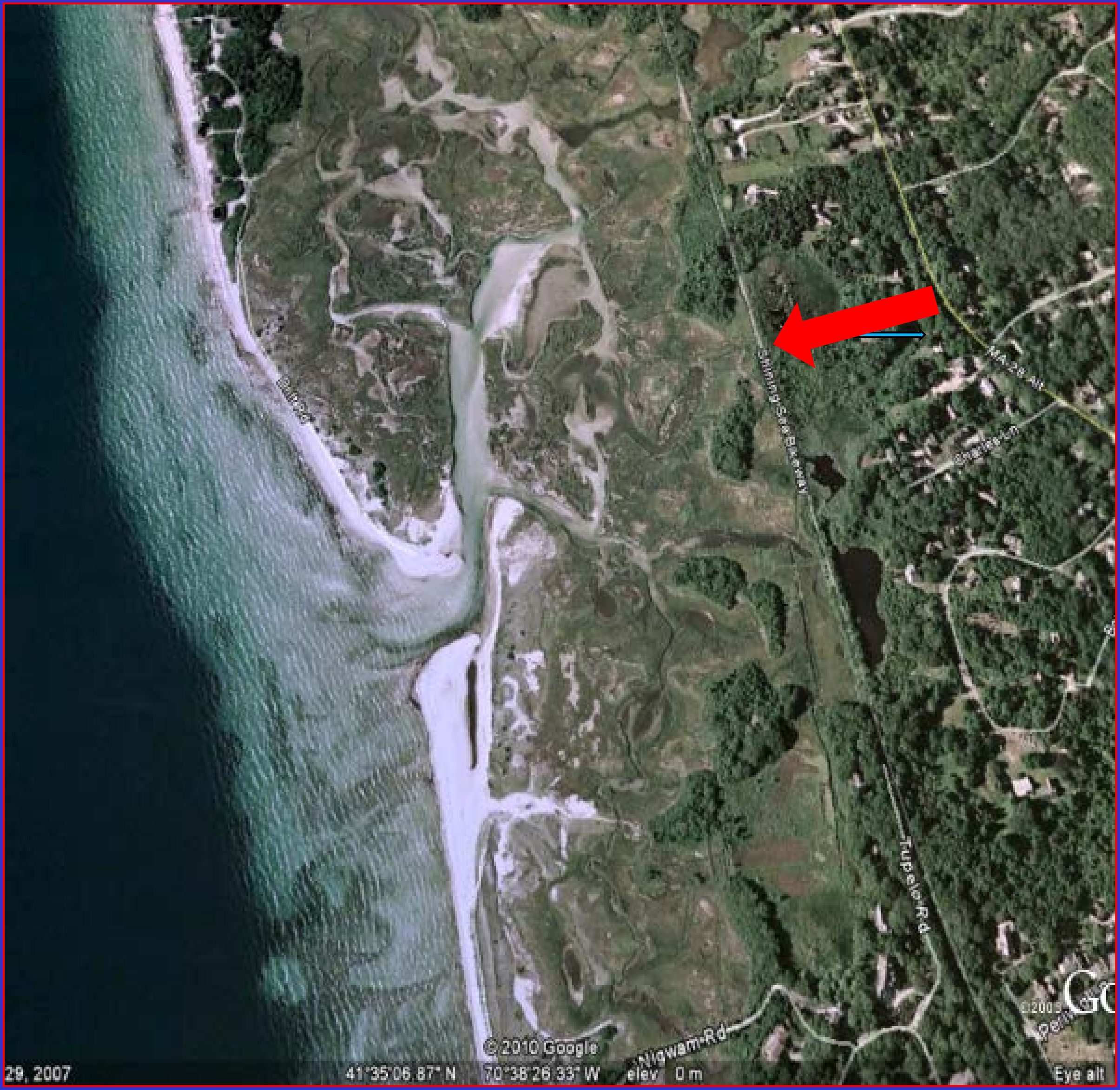


Hewes Point, Chandeleurs

Delaware Bay drowned forest

Drowned forest with Spartina now growing there

Railroad in back of Great Sippewis-sett Marsh



References

Weinstein, M.P., J.M.Teal, J.H.Balletto, and K.A.Strait. 2001. Restoration principles emerging from one of the world's largest tidal marsh restoration projects. Wetlands Ecology and Management 9.5:387-407.

Kneib, R.T. 2000. Salt marsh ecoscapes and production transfers by estuarine nekton in the southeastern United States. In Concepts and Controversies in Tidal Marsh Ecology. Weinstein, M.P. and D. A. Kreeger, eds. Pp.267-292

Wetland Restoration Planning For Natural Function

Richard Weber

Wetland Hydraulic Engineer

Wetland Team, CNTSC

Fort Worth, TX

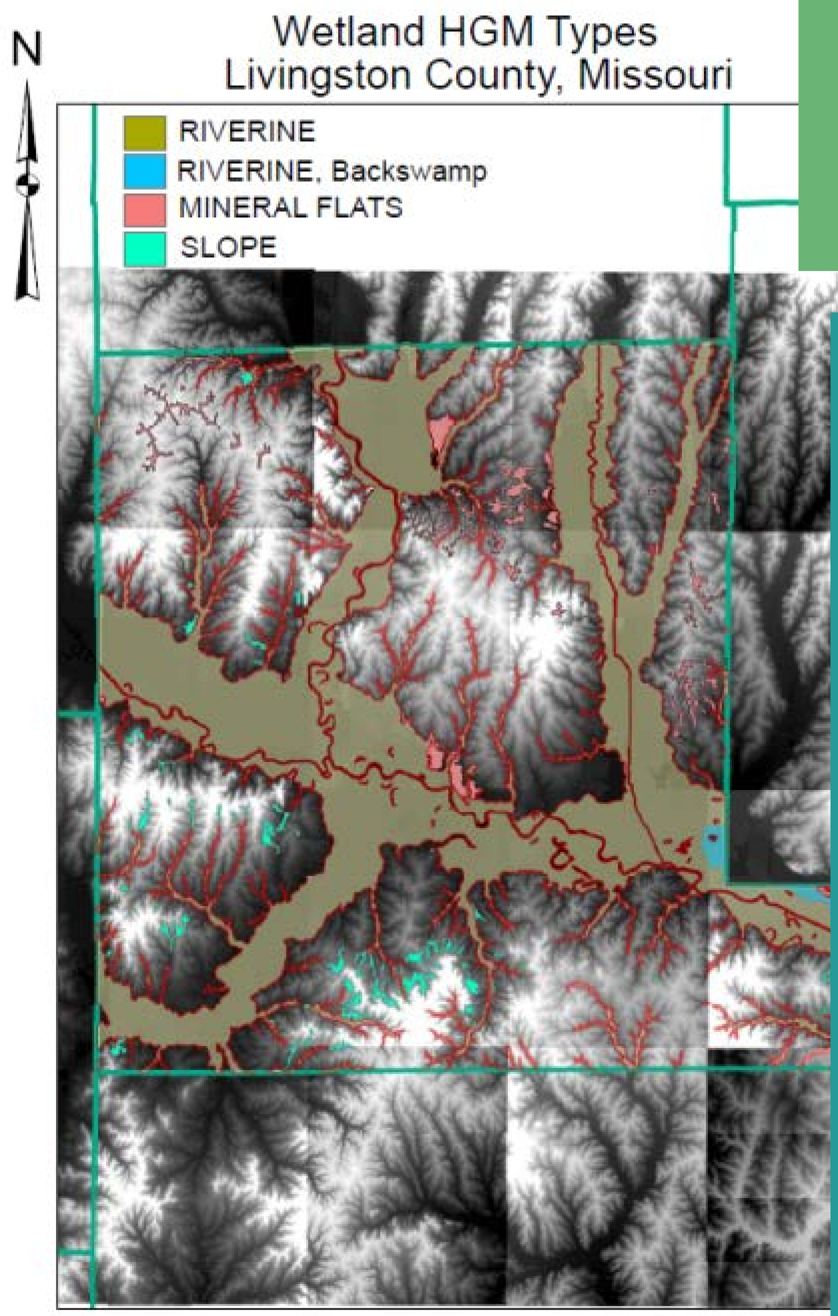
Determine Objectives

- Restoration
  - Restore reference hydrology
  - Restore reference wetland vegetation
  - Restore reference wetland habitat
- Enhancement
  - Usually means hydrology
    - More Depth
    - More Area
    - Longer hydroperiod
- Creation
  - Usually for specific function
    - Water Treatment
    - Recreational and Educational

Planning in “Rural” Areas

- Assumptions
  - Site is an Element Within a Watershed
  - Objectives based on Watershed Function
  - Site Reference Conditions Establish Planning Objectives
  - Project is a RESTORATION, or a conscious departure from reference conditions - ENHANCEMENT

Watershed Elements



- Landscape Positions
  - Uplands, Interfluves, Large Stream Terraces
    - Flatwoods, Wet Prairies…
  - Headwater Reaches
    - Fens, Sloughs
  - Floodplains
    - Backswamps, Natural Levees, Oxbows, Terraces
  - Watershed Outlets
    - Estuaries, Lake Fringes

Water Budgets

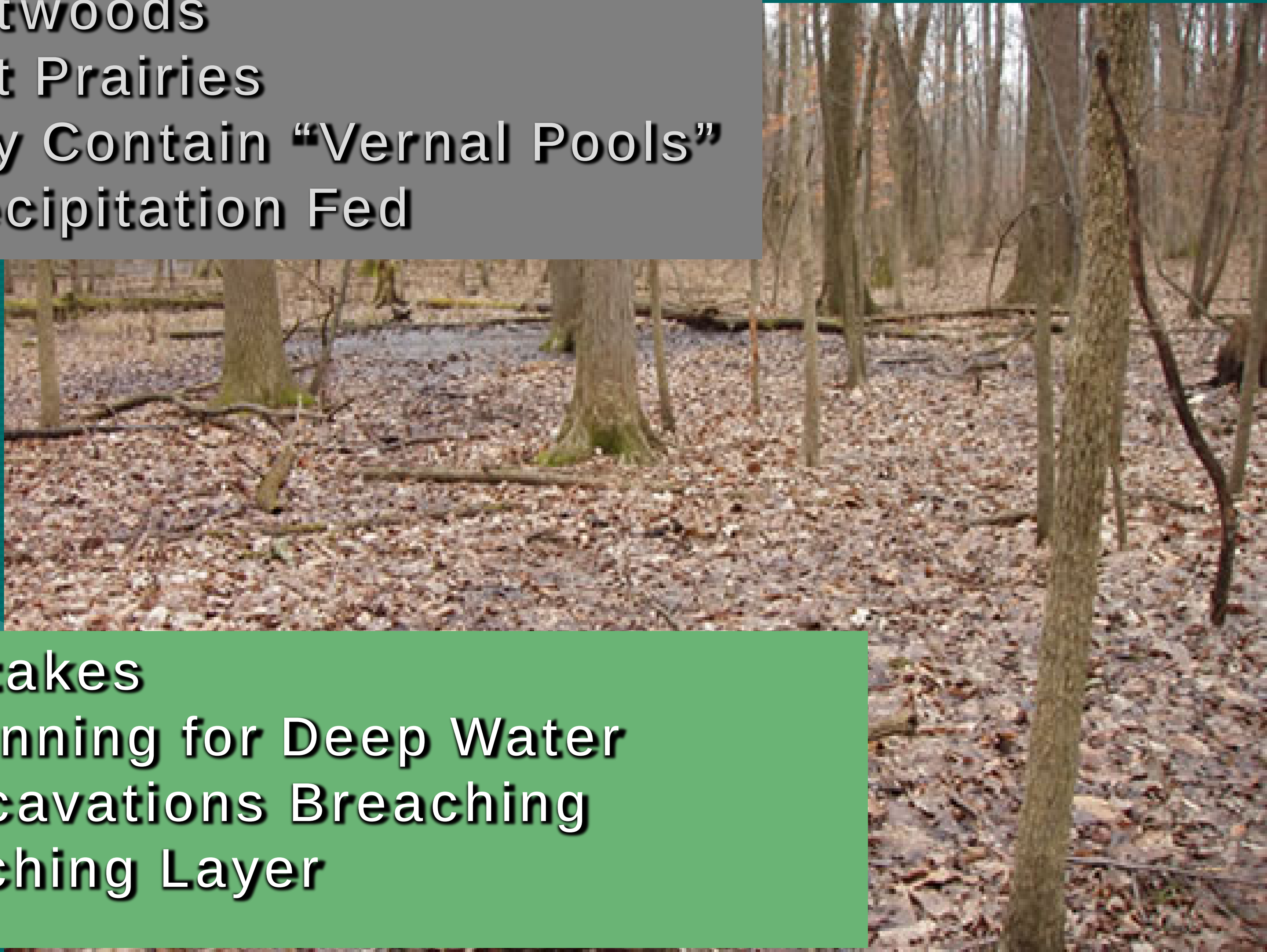
- Uplands, Interfluves
  - Rainfed, Groundwater *Recharge*, Deliver Runoff
- Headwater Reaches
  - Groundwater *Discharge*
  - Runoff Concentration
- Floodplains
  - Stream Hydrograph
- Outlets
  - Ocean Tides, Lake Fluctuations

Inventory Resources

- Watershed Element – Landscape Position
- Soil Hydrologic Properties
  - Recharge/Discharge
  - Perching Layers
  - Bio-geochemical Properties
- Reference Plant Community
- Potential Wildlife Habitat

Interfluves

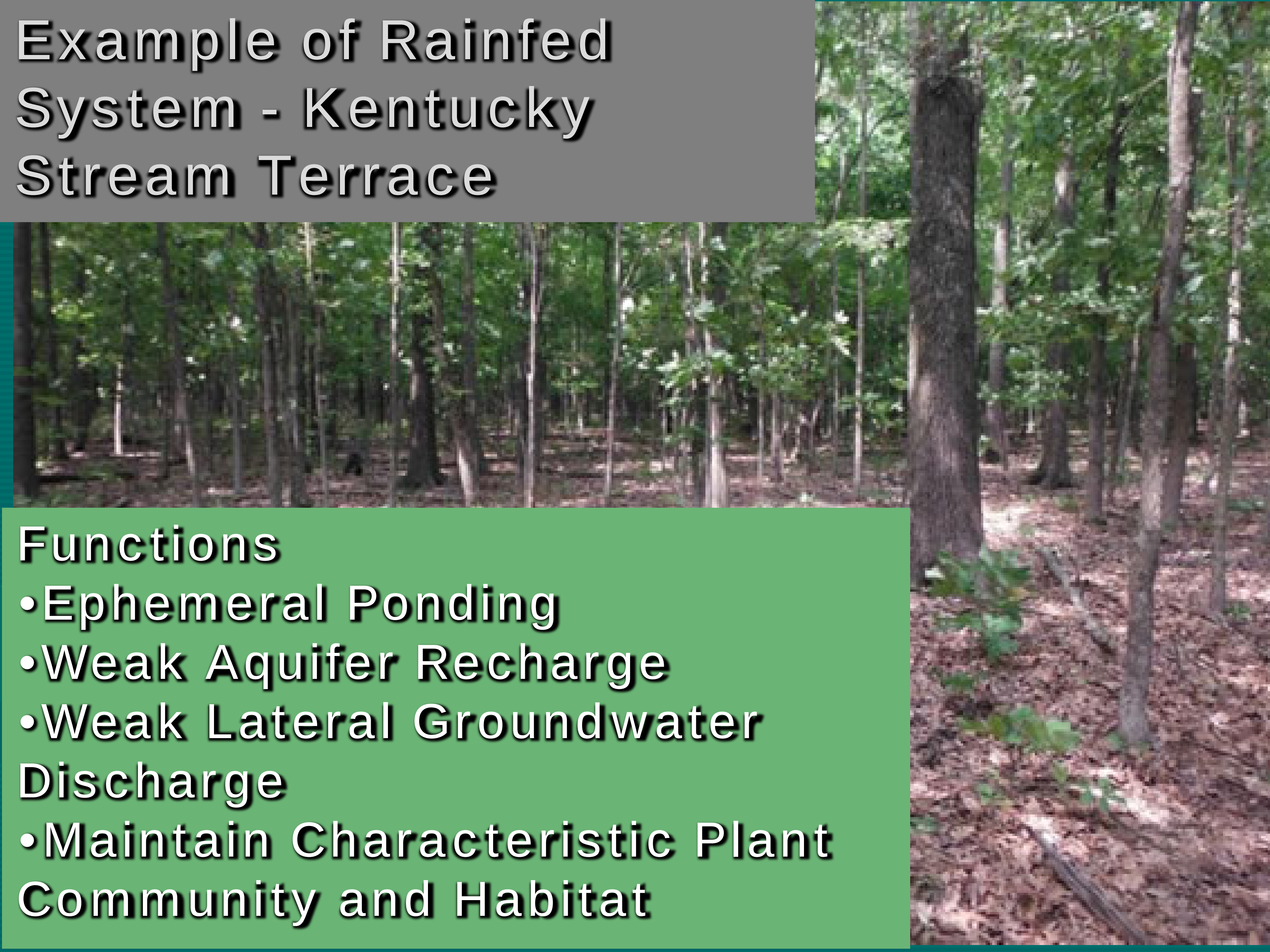
- Flatwoods
- Wet Prairies
- May Contain “Vernal Pools”
- Precipitation Fed



Mistakes

- Planning for Deep Water
- Excavations Breaching Perching Layer

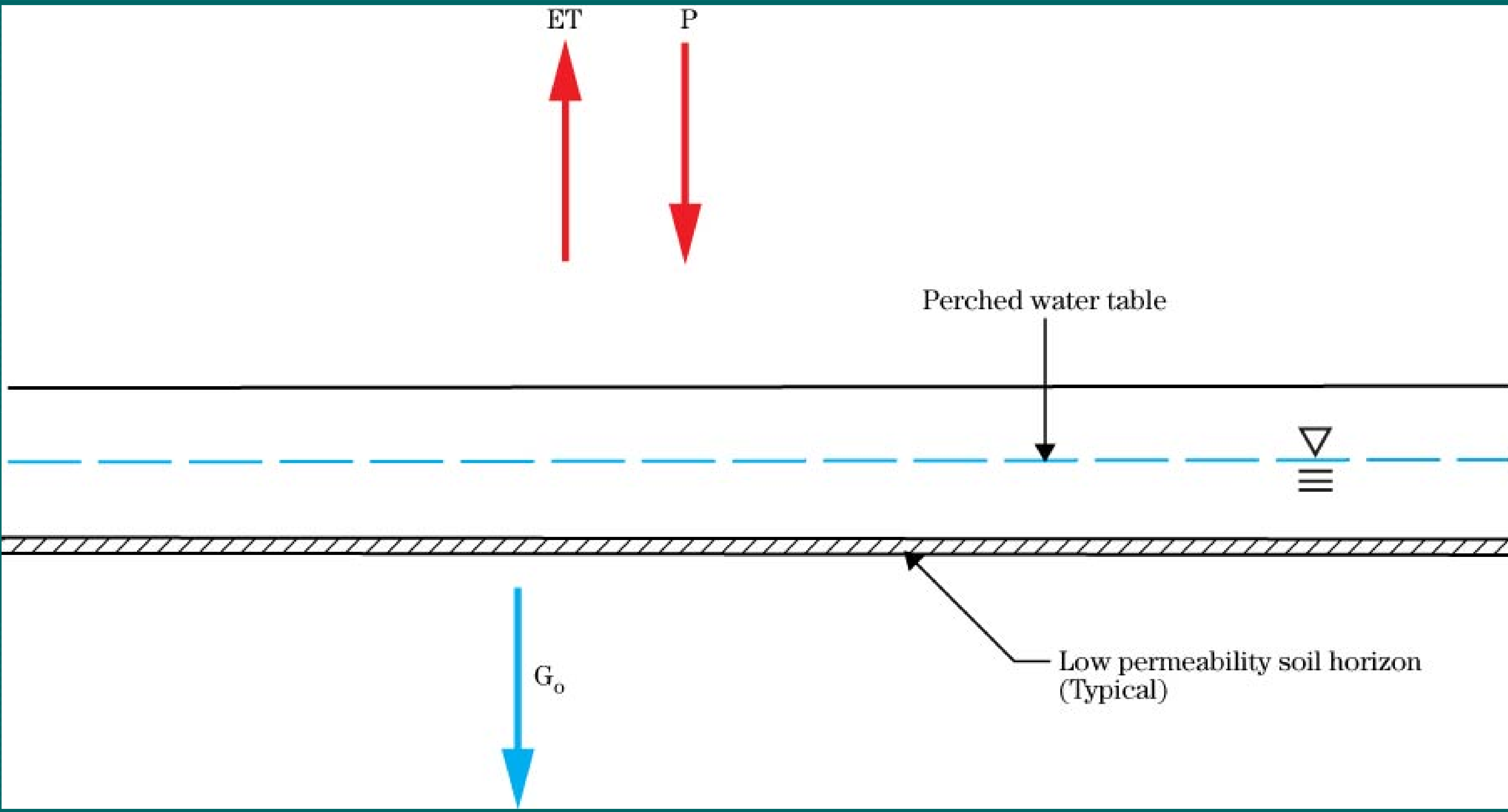
Example of Rainfed System - Kentucky Stream Terrace



Functions

- Ephemeral Ponding
- Weak Aquifer Recharge
- Weak Lateral Groundwater Discharge
- Maintain Characteristic Plant Community and Habitat

Water Budget and Soil Hydrodynamics – Rainfed Site



Headwaters Groundwater Fed

Upstream - Intact

Downstream – Dewatered by Gully

Impoundments on Headwater Reaches

- Replace Saturation with Ponding
- Can Block Downstream Baseflow Maintenance
- Interrupe Sediment Transport

SLOPE Wetland Before "Restoration"

SLOPE Wetland After "Restoration"

Application of Riverine Function on Headwater Site

Restore Headwater Hydrology

- Raise Stream WSP
- Raise Water Table
- Restore Lateral Connectivity

Riverine Restoration

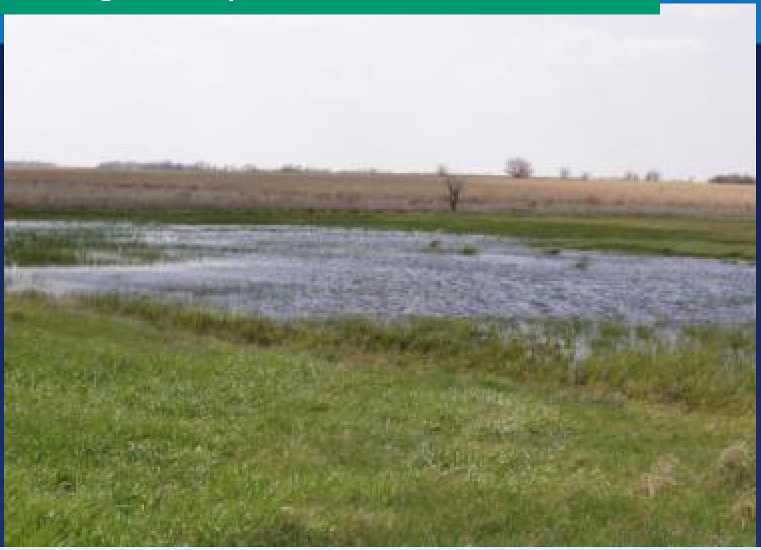
- Off Channel Oxbow
- Groundwater Supported by WSP
- Lateral Connectivity Maintained by Stream Hydrograph

Restored Channel

Did Project Restore

- **Lateral Connectivity?**
- **Floodplain Groundwater Table?**
- **Flood Frequency and Duration?**

DEPRESSIONS



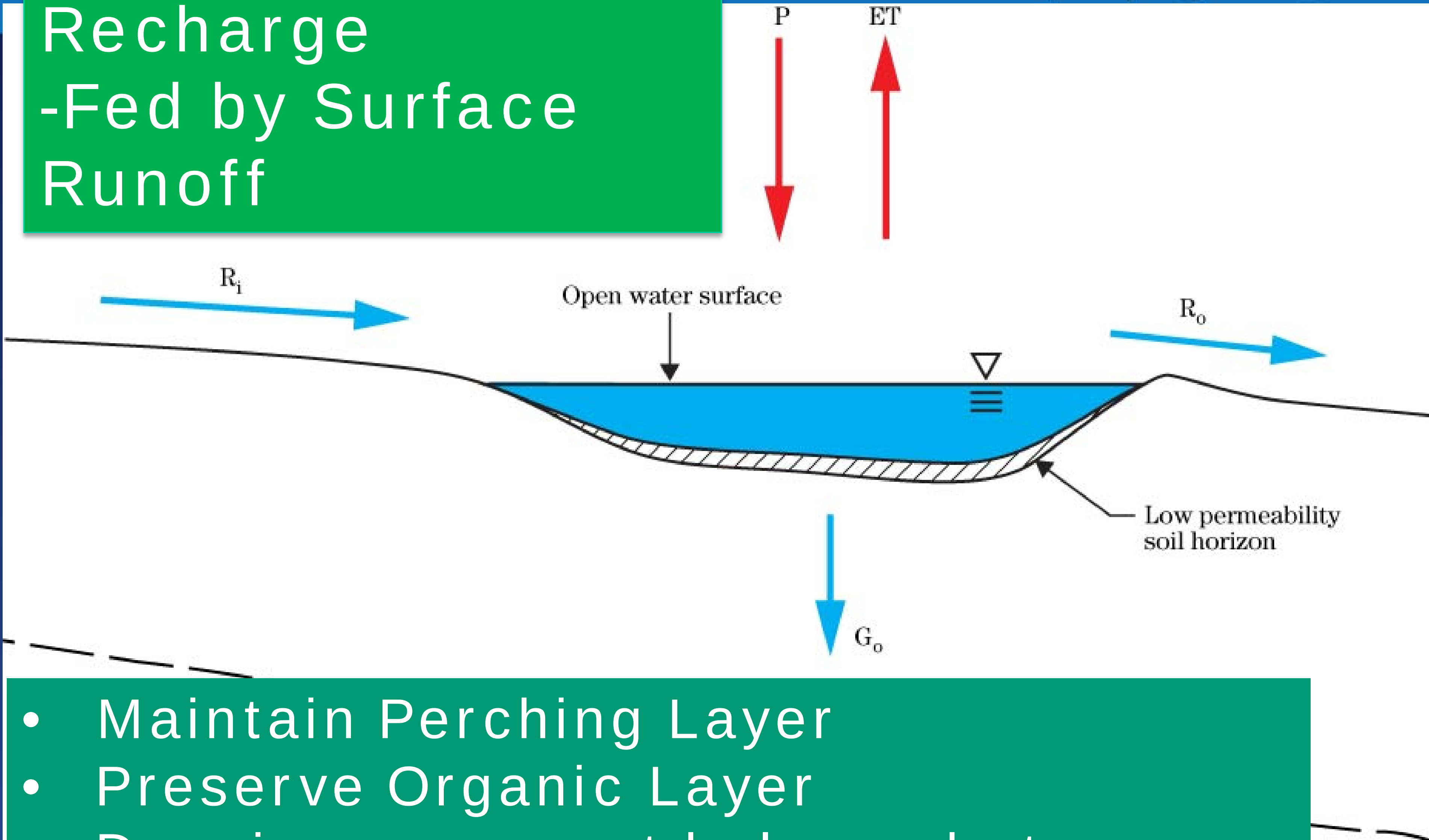
Nebraska Rainwater Basin – Recharge Depression

Wyoming – Recharge Depression, Gillette

South Dakota Prairie Pothole

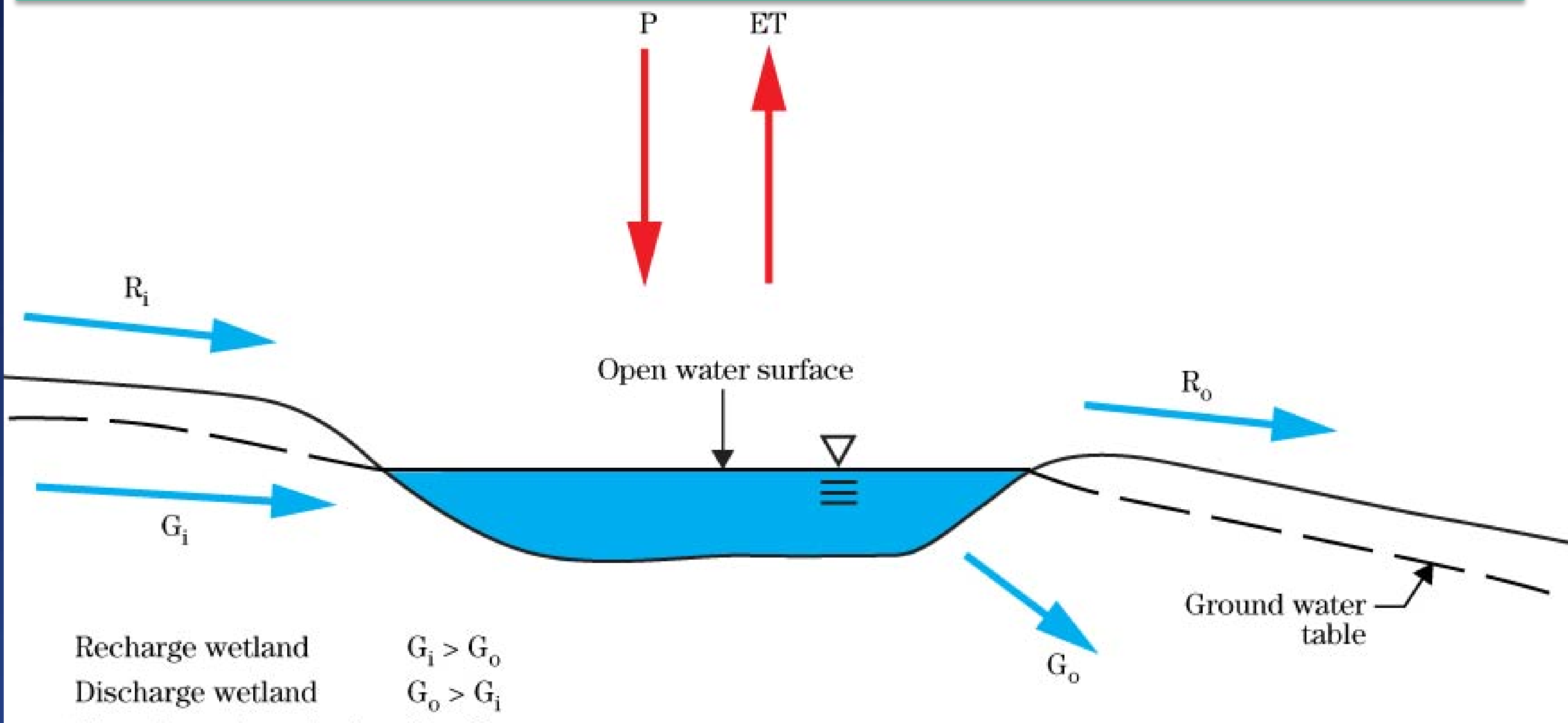
South Carolina – Carolina Bay

Depressions – Recharge
-Fed by Surface Runoff



- Maintain Perching Layer
- Preserve Organic Layer
- Deeping can upset balance between storage and watershed yield

Depressions – Discharge, Fed by Groundwater



- Difficult to Water Budget
- Drained by interception of groundwater discharge

Web Soil Survey – Physical Soil Properties

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors Kw	Kf	T	Wind erodi-bility group	Wind erodi-bility index
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
Bu:														
Butler	0-11	---	---	18-27	1.20-1.40	4.23-14.11	0.22-0.24	3.0-5.9	2.0-4.0	.37	.37	3	6	48
	11-31	---	---	45-55	1.10-1.20	0.07-0.42	0.11-0.13	6.0-8.9	1.0-2.0	.37	.37			
	31-38	---	---	32-40	1.10-1.30	0.42-1.41	0.14-0.20	6.0-8.9	0.5-1.0	.37	.37			
	38-60	---	---	20-35	1.20-1.40	4.23-14.11	0.18-0.22	3.0-5.9	0.0-0.5	.37	.37			
Ce:														
Crete	0-10	---	---	20-27	1.20-1.40	4.23-14.11	0.22-0.24	3.0-5.9	2.0-4.0	.37	.37	5	6	48
	10-13	---	---	27-40	1.25-1.45	1.41-4.23	0.18-0.20	6.0-8.9	1.0-3.0	.37	.37			
	13-28	---	---	42-55	1.20-1.30	0.07-0.42	0.11-0.16	6.0-8.9	0.5-2.0	.37	.37			
	28-32	---	---	27-40	1.25-1.45	0.42-1.41	0.18-0.20	6.0-8.9	0.5-1.0	.37	.37			
	32-80	---	---	20-27	1.30-1.45	4.23-14.11	0.18-0.22	6.0-8.9	0.5-1.0	.43	.43			
CeB:														
Crete	0-5	---	---	20-27	1.20-1.40	4.23-14.11	0.20-0.23	3.0-5.9	2.0-4.0	.37	.37	5	6	48
	5-8	---	---	27-40	1.25-1.45	0.42-1.41	0.16-0.18	6.0-8.9	1.0-3.0	.37	.37			
	8-32	---	---	42-55	1.20-1.30	0.07-0.42	0.11-0.16	6.0-8.9	0.5-2.0	.37	.37			
	32-80	---	---	25-40	1.30-1.45	4.23-14.11	0.18-0.20	3.0-5.9	0.5-1.0	.43	.43			
Fm:														
Fillmore	0-13	---	---	18-27	1.30-1.40	4.23-14.11	0.21-0.24	0.0-2.9	2.0-4.0	.37	.37	3	6	48
	13-32	---	---	45-55	1.10-1.30	0.07-0.42	0.11-0.18	6.0-8.9	1.0-2.0	.37	.37			
	32-44	---	---	27-40	1.20-1.40	0.42-1.41	0.18-0.20	6.0-8.9	0.5-1.0	.37	.37			
	44-80	---	---	18-45	1.30-1.50	0.42-14.11	0.10-0.20	3.0-5.9	0.0-0.5	.43	.43			

Web Soil Survey – Water Features

Water Features—Linn County, Kansas

Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table		Ponding			Flooding	
				Upper limit	Lower limit	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*	*Ft*				
8201—Osage silty clay loam, 0 to 1 percent slopes, occasionally flooded										
Osage	D	—	January	0.5-1.5	>6.0	—	—	None	Very brief (4 to 48 hours)	Occasional
			February	0.5-1.5	>6.0	—	—	None	Very brief (4 to 48 hours)	Occasional
			March	0.5-1.5	>6.0	—	—	None	Very brief (4 to 48 hours)	Occasional
			April	0.5-1.5	>6.0	—	—	None	Very brief (4 to 48 hours)	Occasional
			May	0.5-1.5	>6.0	—	—	None	Very brief (4 to 48 hours)	Occasional
				—	—	—	—	None	Very brief (4 to 48 hours)	Occasional
				—	—	—	—	None	Very brief (4 to 48 hours)	Occasional
				—	—	—	—	None	Very brief (4 to 48 hours)	Occasional
				—	—	—	—	None	Very brief (4 to 48 hours)	Occasional
				—	—	—	—	None	Very brief (4 to 48 hours)	Occasional

Restored Hydrology is:

- Restored Flooding
- Restored Ponding
- Restored Groundwater

Common Issues Associated with Wetland Restoration in Ohio

Association of State Wetland Managers
Wetland Restoration Series
November 4, 2014

Tom Harcarik
Ohio Environmental Protection Agency
Div. of Environmental and Financial Assistance

Overview

* Goals/Objectives
* Planning/Design Phase
* Construction
* Post-Construction Monitoring

First - a few terms used in Ohio

* Ohio Rapid Assessment Method (ORAM) is a semi-quantitative method used to determine the regulatory category of a wetland
* Category 1 = low, Category 2 = medium; Category 3 = high

* VIBI: Vegetative Index of Biotic Integrity measures wetland quality based on plants

* AmphIBI: Amphibian Index of Biotic Integrity measures wetland quality based on amphibians

* WRRSP – Water Resource Restoration Sponsor Program (WRRSP) has provided $162 M to restoration and protection projects in Ohio through its SRF program

Goals/Objectives

* Section 401 – Performance criteria dictated by conditions in the WQC and/or 404 permit:
  * Acreage (ratios dictated by Ohio Admin. Code)
  * Vegetation classes (forested /emergent/scrub-shrub)
  * Quality (Ohio requires at least Category 2 or 3 wetlands) as measured by Vegetative Index of Biotic Integrity (VIBI) or Amphibian Index of Biotic Integrity (AmphIBI) Level 3 tools

  * (Voluntary programs (WRRSP, 319) enjoy more flexibility to select goals/objectives not tied to mitigating specific impacts)

Planning/Design Phase

- Collection of Baseline data is essential but often underperformed
- Inadequate hydrology modeling/characterization
- Missed tiles
- Failure to recognize importance of soil health:
  - Need to do more than look at hydric soils map
  - Cannot assume farmed wetlands simply need restored hydrology

Planning/Design Phase

* Failure to understand/characterize the hydrogeomorphic classification of the restoration site

* Failure to characterize surrounding watershed to understand current/future effect of urban/suburban influences (often study is limited to boundaries of the mitigation site property)

* Inadequate buffers to ensure long term protection of wetland integrity and biological communities (e.g. some salamanders may require 200 m upland forested buffers to complete life cycle)

Planning /Design Phase

* Inadequate site characterization (some projects proposed as "restoration" were actually "enhancements" and some were simply "preservation")
* Select site based on landowners willingness to sell rather than on selecting best site

Construction Phase

* Not attending pre-bid or pre-con meetings to stress importance of restoration
* Contractor not experienced with nuances of wetland restoration

Construction Phase

* All too common for site to not be built according to the plans (have seen elevations off by several feet)

* Plant material selection:
  * Wrong plants for ecoregion or wetland type;
  * Nursery stock from out of state with wrong genome

* Site disturbances:
  * Heavy equipment can = soil compaction
  * Subcontractor + chain saw + bad day = excessive tree clearing

Construction Phase

* Approved planting plan is not followed
* Improper stockpiling /replacing of hydric soils resulting in planting on substandard soils
* Conversely, have observed attempts to force plant species density by overplanting

Post-construction Monitoring

* Resistance to collecting necessary data:
  * Hydrology data, soils, chemistry
* Requests to shorten monitoring period:
  * Standard 5 yrs. for non-forested, 10 yrs. for forested
* Inadequate response to invasive species early in post-construction period
* Success rate for woody vegetation lower than herbaceous plant species coverage

Ongoing Challenges

* General resistance to spend the money on all phases of wetland restoration and implement adaptive management

* Seeing requests to use Level 2 rapid assessment methods to assess restoration sites in lieu of more intensive methods

* Economy of scale – ongoing tension between smaller permittee–responsible sites that keep function in the watershed and larger banks sites located outside of the watershed

Lessons Learned

* Perform Restoration or Enhancement (Ohio does not support wetland creation due to high failure rates)

* Early mitigation efforts resulted in many "bathtub wetlands" with steep slopes and no depth heterogeneity that functioned like ponds (now look for 15:1 slopes)

Lessons Learned

* Pressure to issue timely permits reduces time available to prepare/review restoration plans
* Ohio EPA /401 has two staff dedicated to conducting post-construction monitoring of stream and wetland mitigation sites

Contact Information

Ohio EPA
Div. of Environmental and Financial Assistance

Tom Harcarik
614-644-3639
tom.harcarik@epa.ohio.gov

Natural and Mitigation Wetland Condition vs. Landscape Disturbance Levels

Mick Micacchion
Wetland Ecologist, PWS
Midwest Biodiversity Institute

MBI Midwest Biodiversity Institute

Ecological Condition Performance Standard

Success Criteria–Mitigation wetlands of "GOOD" or better ecological condition

- Wetlands of sufficient ecological integrity to adequately compensate for losses
- Wetlands that demonstrate high environmental resilience
- Meets Ohio's Wetland Water Quality Rules standard

Results – Ohio Lake Erie Watershed Bank and PRM Wetlands -Ecological Condition - VIBI Scores

- MBs – OVERALL 30% MET GOALS (30 sites)
  - 27% - POOR (8 sites)
  - 43% - FAIR (13 sites)
  - 17% - GOOD (5 sites)
  - 13% - EXCELLENT (4 sites)
- PRMs – OVERALL 13% MET GOALS (30 sites)
  - 30%- POOR (9 sites)
  - 57%- FAIR (17 sites)
  - 13% - GOOD (4 sites)

Mitigation Bank Results

- Overall increase in MB success rate
  9.7% in the 2003-2004 Ohio study
  30% for 2011 Ohio Lake Erie MBs

- May be a result of quantifiable ecological performance standards linked to credit releases – started in 2003

  Responsibility on the banker for non-performance

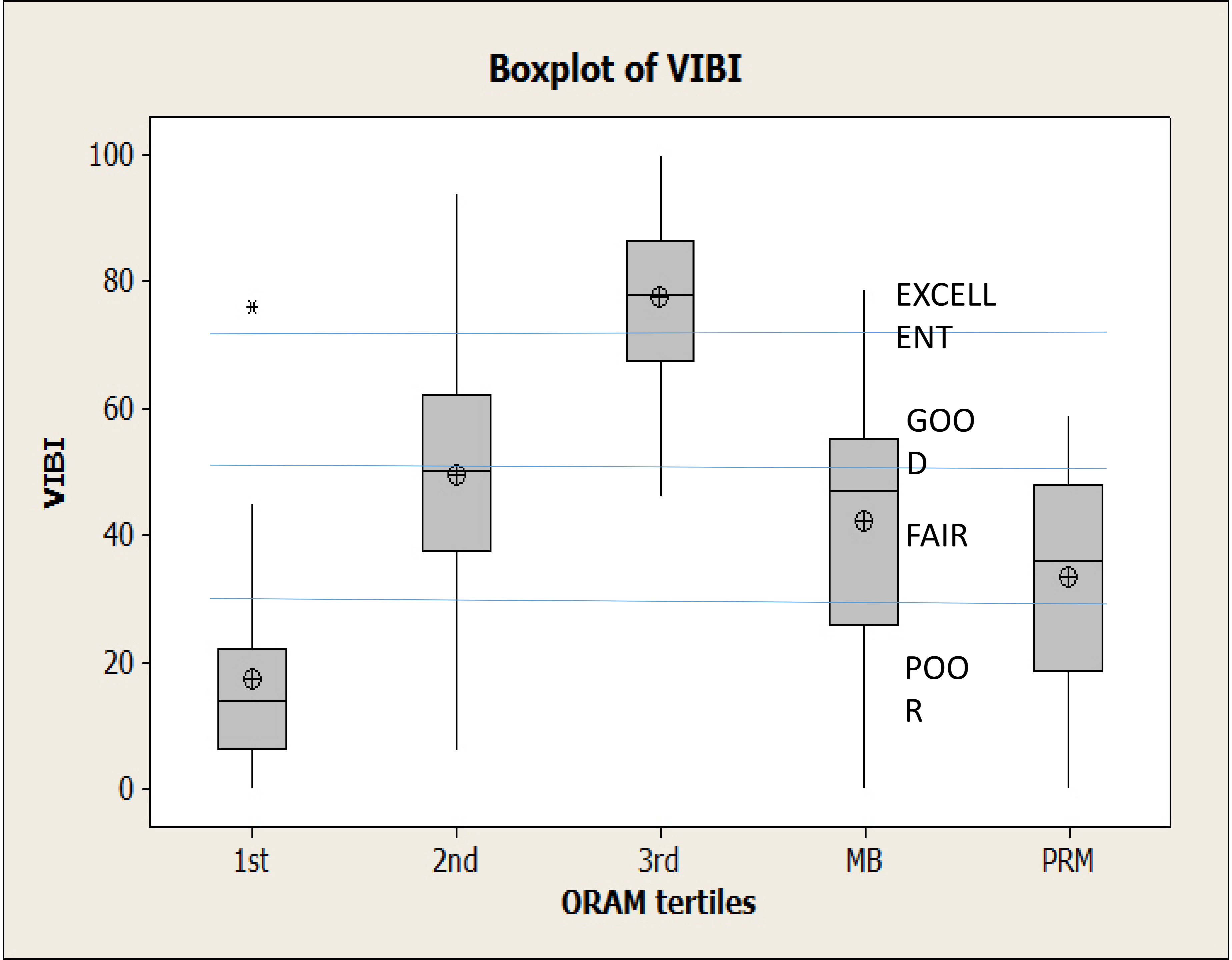
  Importance of site selection, restoration design, implementation and adaptive management

Permittee-Responsible Mitigation Results

- A slight decrease in success rate from earlier study:
  19.2% in 2007 Ohio study
  13% in GLBECS PRMs

- 87% failure rate

- Need to implement and enforce the provisions for financial assurances in the 2008 Federal Mitigation Rule



Boxplot of VIBI
100
80
60
40
20
0
VIBI
EXCELL
ENT
GOO
D
FAIR
POO
R
1st
2nd
3rd
MB
PRM
ORAM tertiles

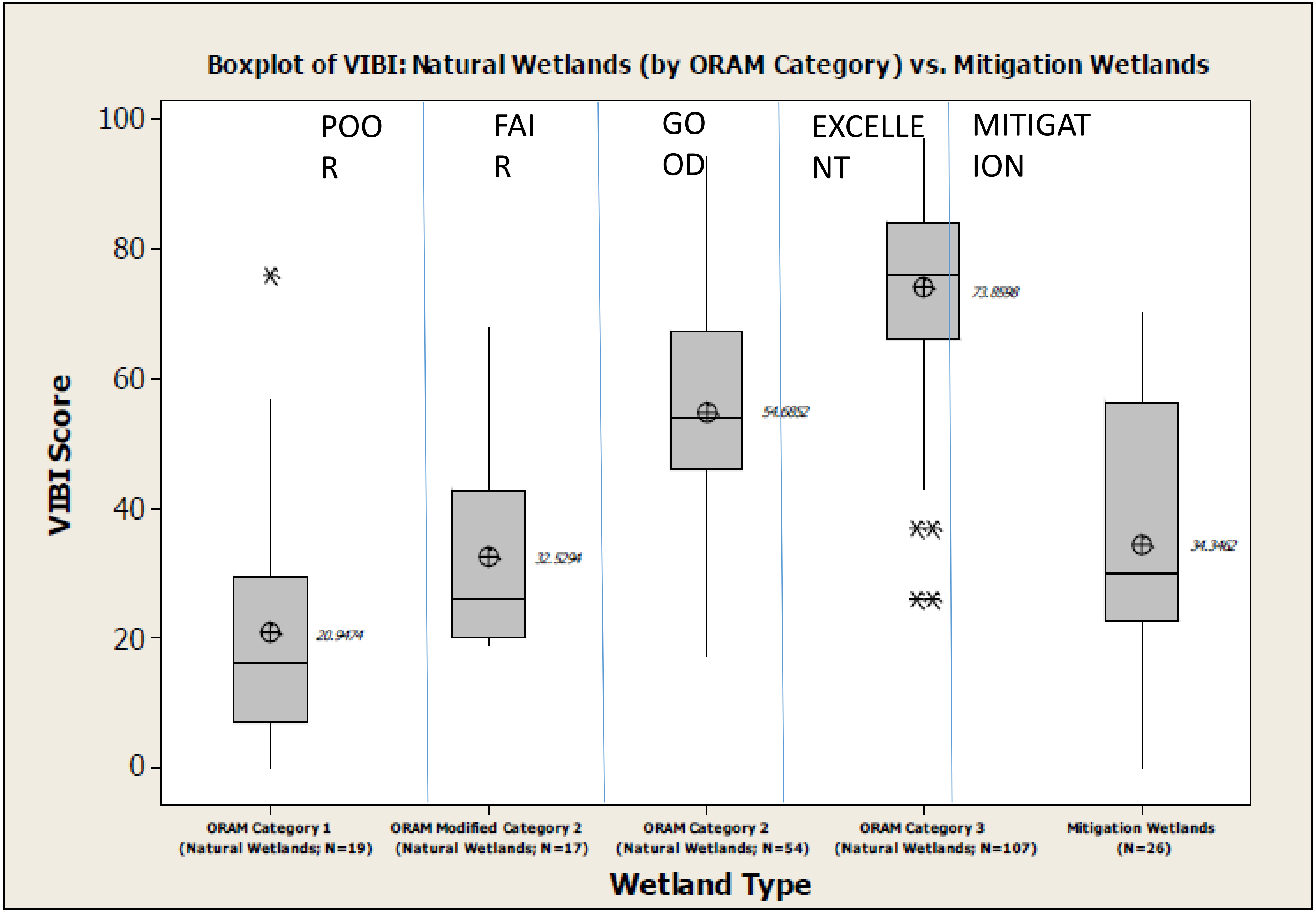


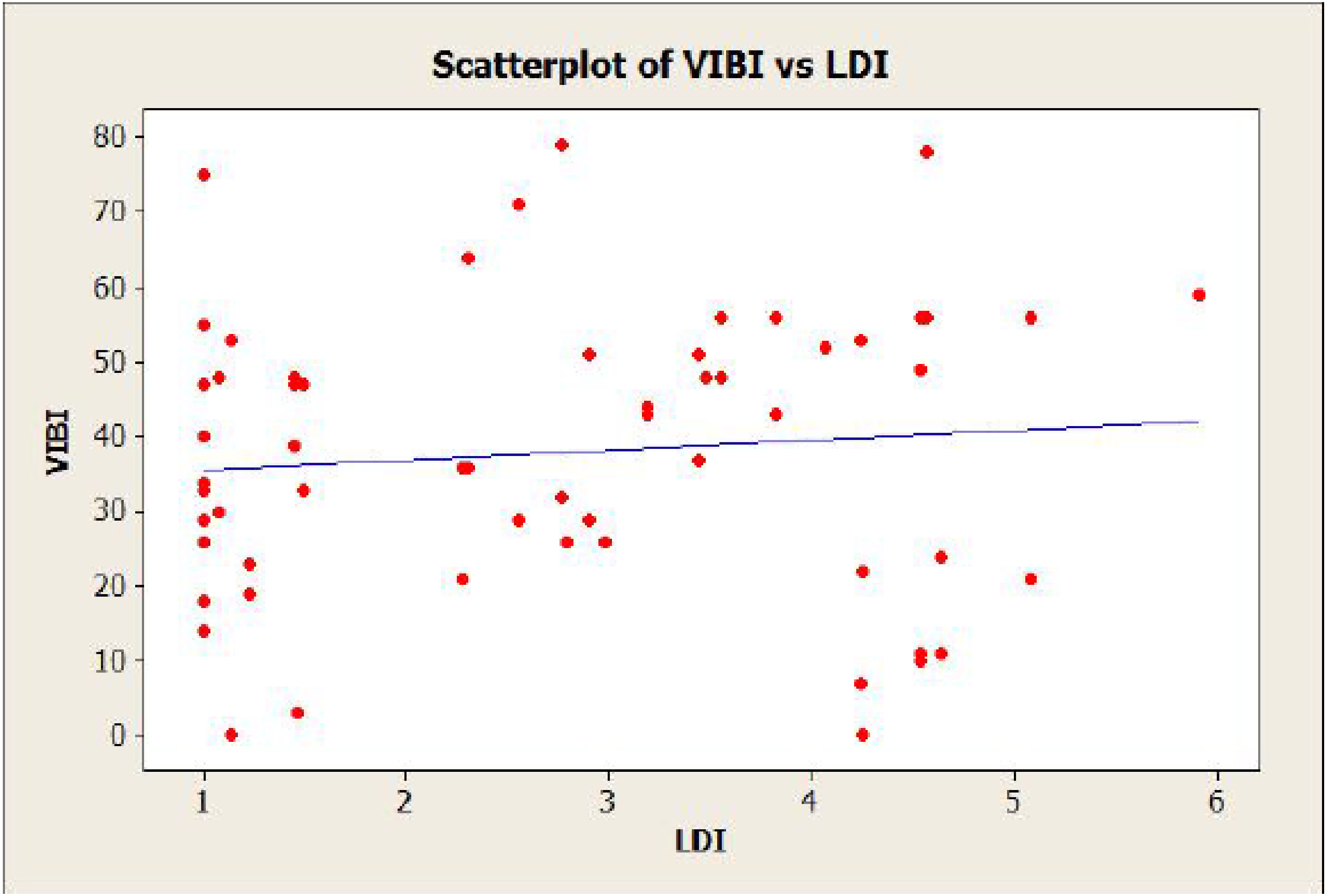
Figure 5. Box and whiskers plot comparing mean VIBI score for natural wetlands (by ORAM antidegradation category) with VIBI scores for mitigation wetlands (df = 222, F = 71.43, p < 0.001).

Table 2. 2001 National Land Cover Dataset (NLCD) Land Use Categories and corresponding Landscape Development Intensity (LDI) Coefficients (*derived from* Brown and Vivas, 2005).

Land Use Category	LDI Coefficient
11 (Open Water)	1.00
21 (Developed, Open Space)	6.92
22 (Developed, Low Intensity)	7.47
23 (Developed, Medium Intensity)	7.55
24 (Developed, High Intensity)	9.42
31 (Barren Land)	8.32
41 (Deciduous Forest)	1.00
42 (Evergreen Forest)	1.00
43 (Mixed Forest)	1.00
52 (Shrub/Scrub)	2.02
71 (Grassland/Herbaceous)	3.41
81 (Pasture/Hay)	3.74
82 (Cultivated Crops)	4.54
90 (Woody Wetlands)	1.00
95 (Emergent Herbaceous Wetlands)	1.00

Figure 6. Standard Assessment Area (AA) and buffer plot of a representative GLBECS sample site (2011). a. AA/buffer with aerial background; b. same AA/buffer with land use layer overlay. Each colored pixel in the buffer area of b. represents a different land use type (Table 2), which is calculated into the LDI score.

Figure 4. Scatterplot and regression line for VIBI scores vs. LDI scores from GLBECS study (2011).



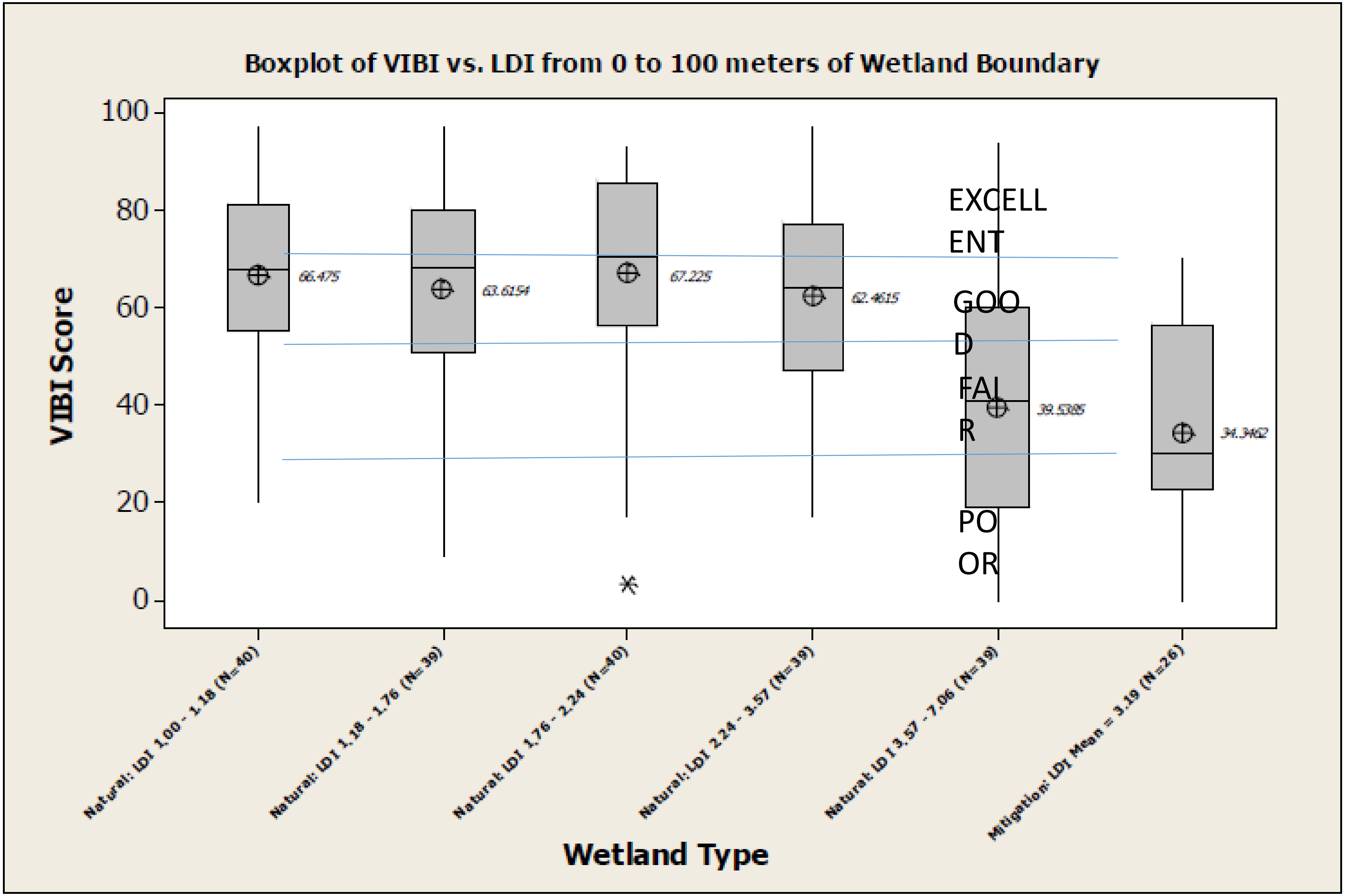


Figure 8. Box and whiskers plot comparing mean VIBI score for natural wetlands (divided into 5 equal LDI groups for area within 0 to 100 meters of wetland boundary) with VIBI scores for mitigation wetlands (df = 222, F = 15.08, $p < 0.001$).

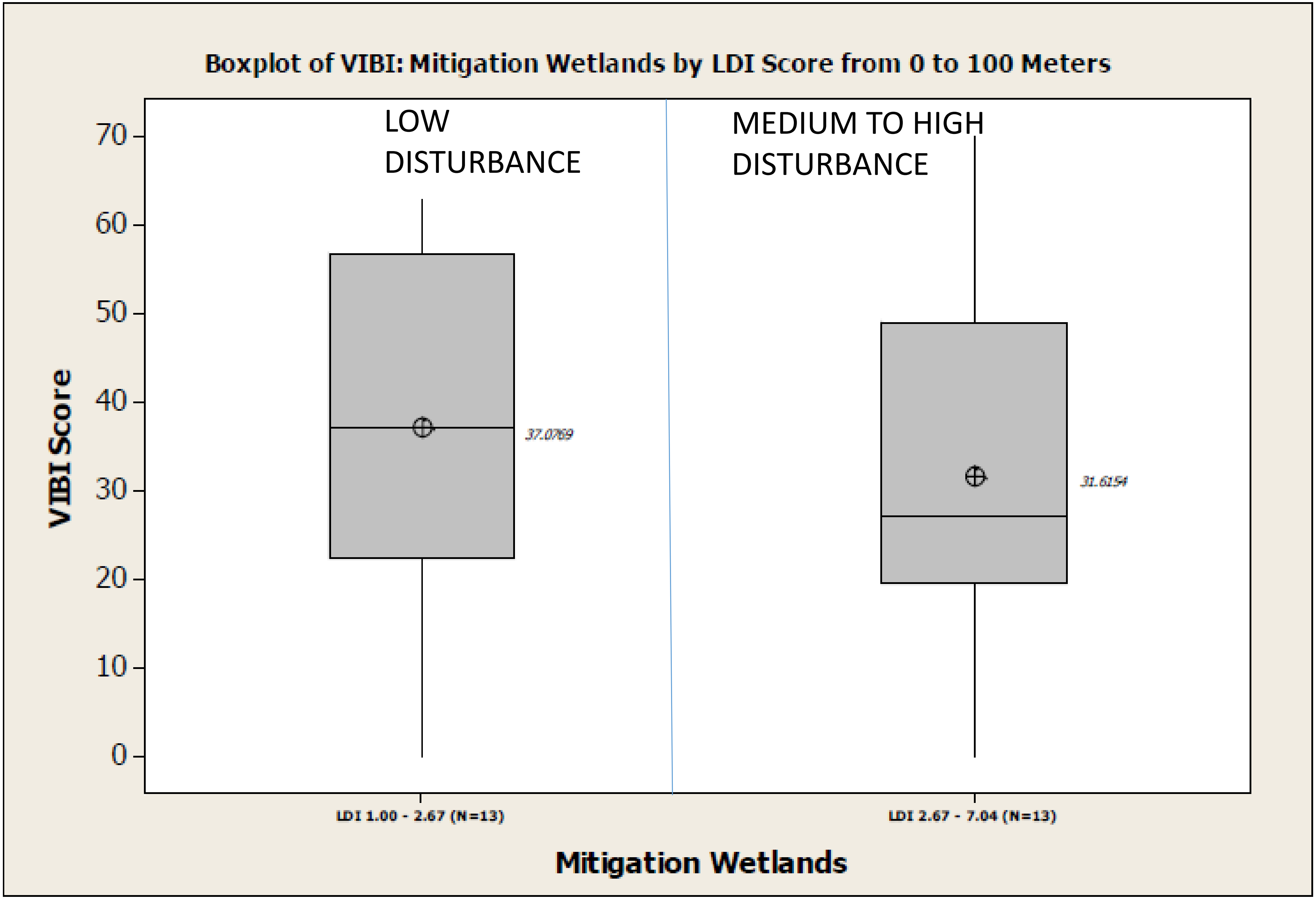


Figure 10. Box and whiskers plot comparing mean VIBI score for mitigation wetlands divided into Low LDI and High LDI groups for area within 0 to 100 meters of wetland boundary (df = 25, F = 0.49, p = 0.489).

Summary

- Goals –Develop wetlands of "GOOD" or better ecological condition

- Provide financial incentives to meet mitigation performance goals

- Mitigation wetlands in the studies are performing at lower levels than most unimpaired natural wetlands

- Landscape level stresses affect the condition of natural wetlands but mitigation wetlands are performing at uniformly low conditions regardless of their landscape setting

How to Prepare a Good Wetland Restoration Plan

(FROM A LANDSCAPE ARCHITECTURAL PRACTITIONER'S PERSPECTIVE):

Example: restored stream and wetlands, T24 Township, Maine.

studioverde
landscape architecture + design

TOPICS

- Integrated planning and design team vs. silos
- The power of graphic and visual communication tools
- Wetland restoration/creation in transitional + urbanized areas
    - ✓ Trends: The Triple Bottom Line (TBL) view of wetland performance

Integrated planning and design team vs. silos

Example: Wetland restoration site, Aurora Township, Maine

studioverde
landscape architecture + design

Integrated planning and design team vs. silos

- Leadership + Collaboration leads to Innovation to address goals + challenges:
  - Core team: Wetland scientist, landscape architect, hydrologist and/or civil engineer,
  - Specialties: The list is long! Soil scientist, botanist, horticulturist, forester, hydrologist, geofluvial morphologist, etc.
- Expand to involve or consult with:
  - Contractors, suppliers, operations + maintenance personnel.
  - Members of the community or stakeholders.

studioverde
landscape architecture + design

Integrated planning and design team vs. silos

- Leadership roles can and should change to reflect project phases:

o Leadership roles:
  - understand the comprehensive process but recognizes individual team members contributions.
  - Encourages dialog and problem solving.

- **Planning/Permitting**

Integrated planning and design team vs. silos

- Leadership roles can and should change to reflect project phases:
  - **Planning/Permitting**
  - **Design/Construction Documents**

- Leadership roles:
  - understand the comprehensive process but recognizes individual team members contributions.
  - Encourages dialog and problem solving.

studioverde
landscape architecture + design

Integrated planning and design team vs. silos

- Leadership roles can and should change to reflect project phases:
  - **Planning/Permitting**
  - **Design/Construction Documents**

o Leadership roles:
- understand the comprehensive process but recognizes individual team members contributions.
- Encourages dialog and problem solving.

- **Construction monitoring:**
  - **Grading**

studioverde
landscape architecture + design

Integrated planning and design team vs. silos

- Leadership roles:
  - understand the comprehensive process but recognizes individual team members contributions.
  - Encourages dialog and problem solving.

- Leadership roles can and should change to reflect project phases:
  - **Planning/Permitting**
  - **Design/Construction Documents**

- **Construction monitoring:**
  - **Grading**
  - **Infrastructure**

studioverde
landscape architecture + design

Integrated planning and design team vs. silos

- Leadership roles:
  - understand the comprehensive process but recognizes individual team members contributions.
  - Encourages dialog and problem solving.

- Leadership roles can and should change to reflect project phases:
  - **Planning/Permitting**
  - **Design/Construction Documents**

- **Construction monitoring:**
  - **Grading**
  - **Infrastructure**
  - **Planting**

studioverde
landscape architecture + design

Integrated planning and design team vs. silos

- Leadership roles:
  - understand the comprehensive process but recognizes individual team members contributions.
  - Encourages dialog and problem solving.

- Leadership roles can and should change to reflect project phases:
  - **Planning/Permitting**
  - **Design/Construction Documents**

- **Construction monitoring:**
  - **Grading**
  - **Infrastructure**
  - **Planting**
- **Post-Construction Monitoring**

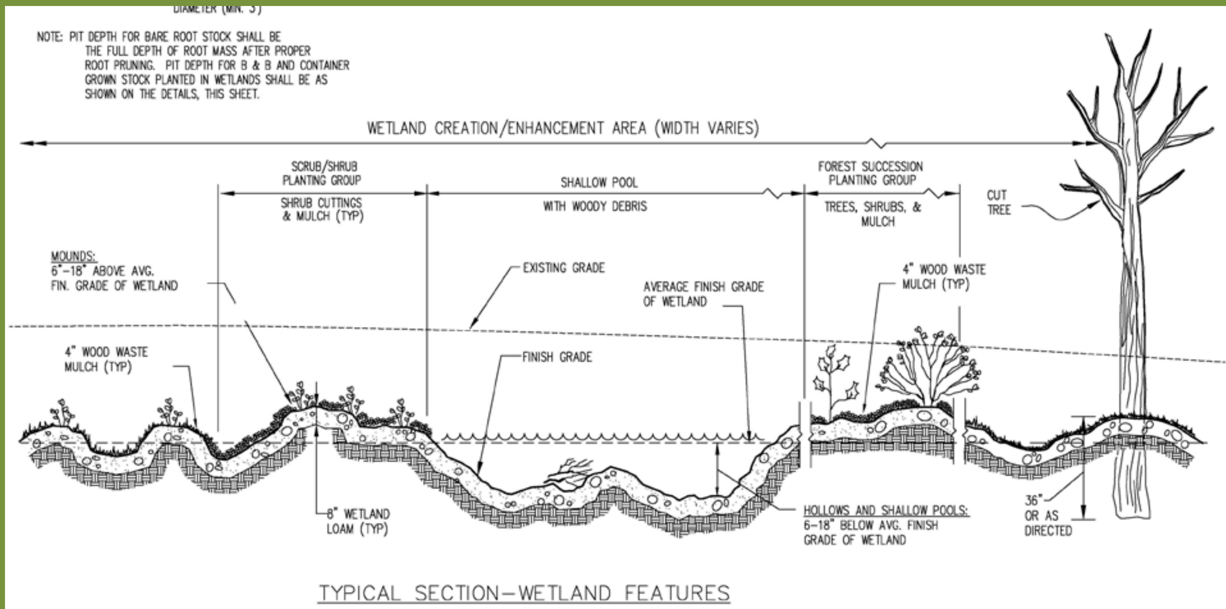
studioverde
landscape architecture + design

The power of visual communication tools

Example: Wetland restoration grading plan detail: Westbrook/Rand Road Mitigation site

studioverde
landscape architecture + design

The power of visual communication tools

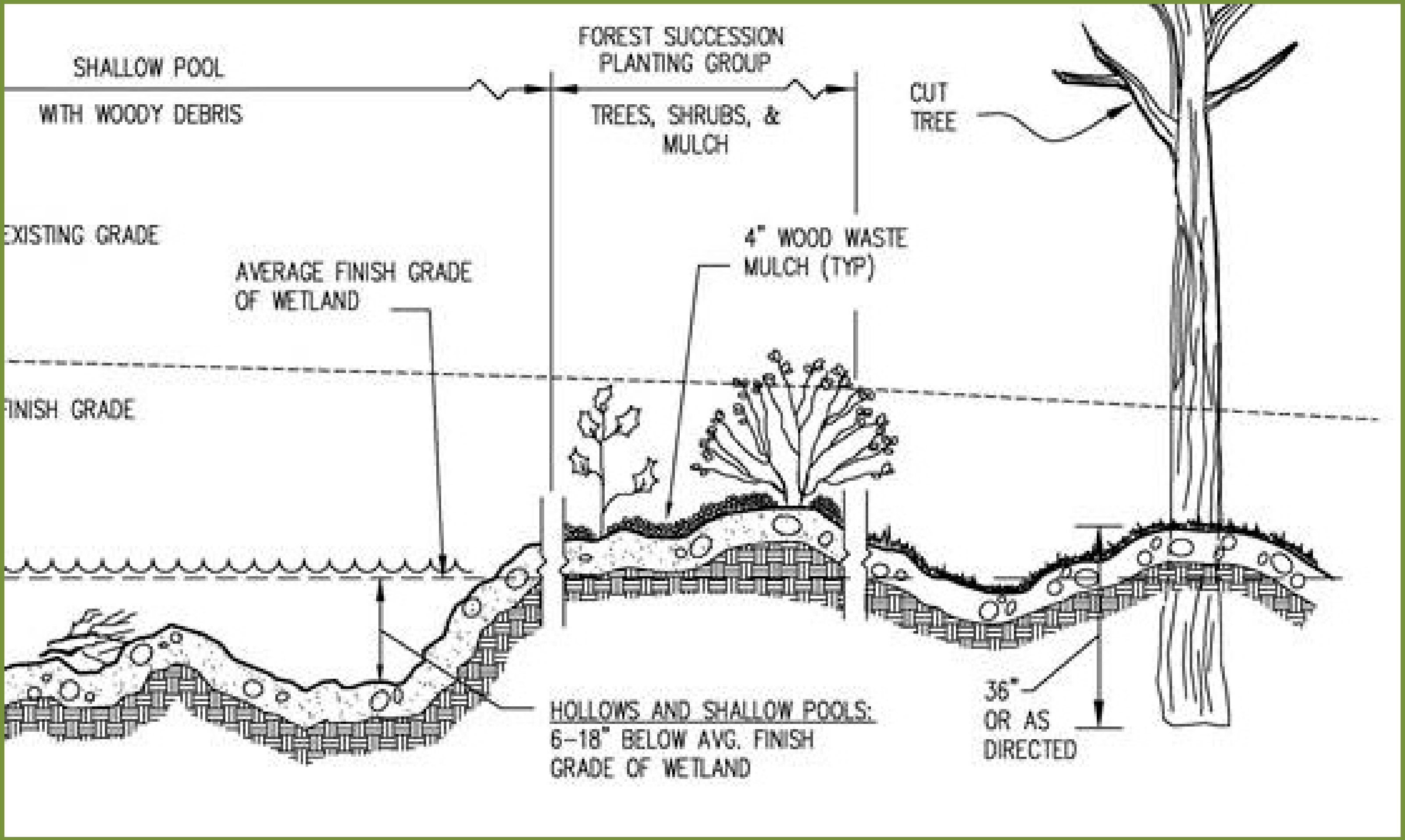


Example: Wetland restoration grading plan detail: Westbrook/Rand Road mitigation site

- Planning and permitting phase: Use visuals and graphic tools to design and communicate the complex details in a style that reflects the creation of a **natural ecosystem.**

studioverde
landscape architecture + design

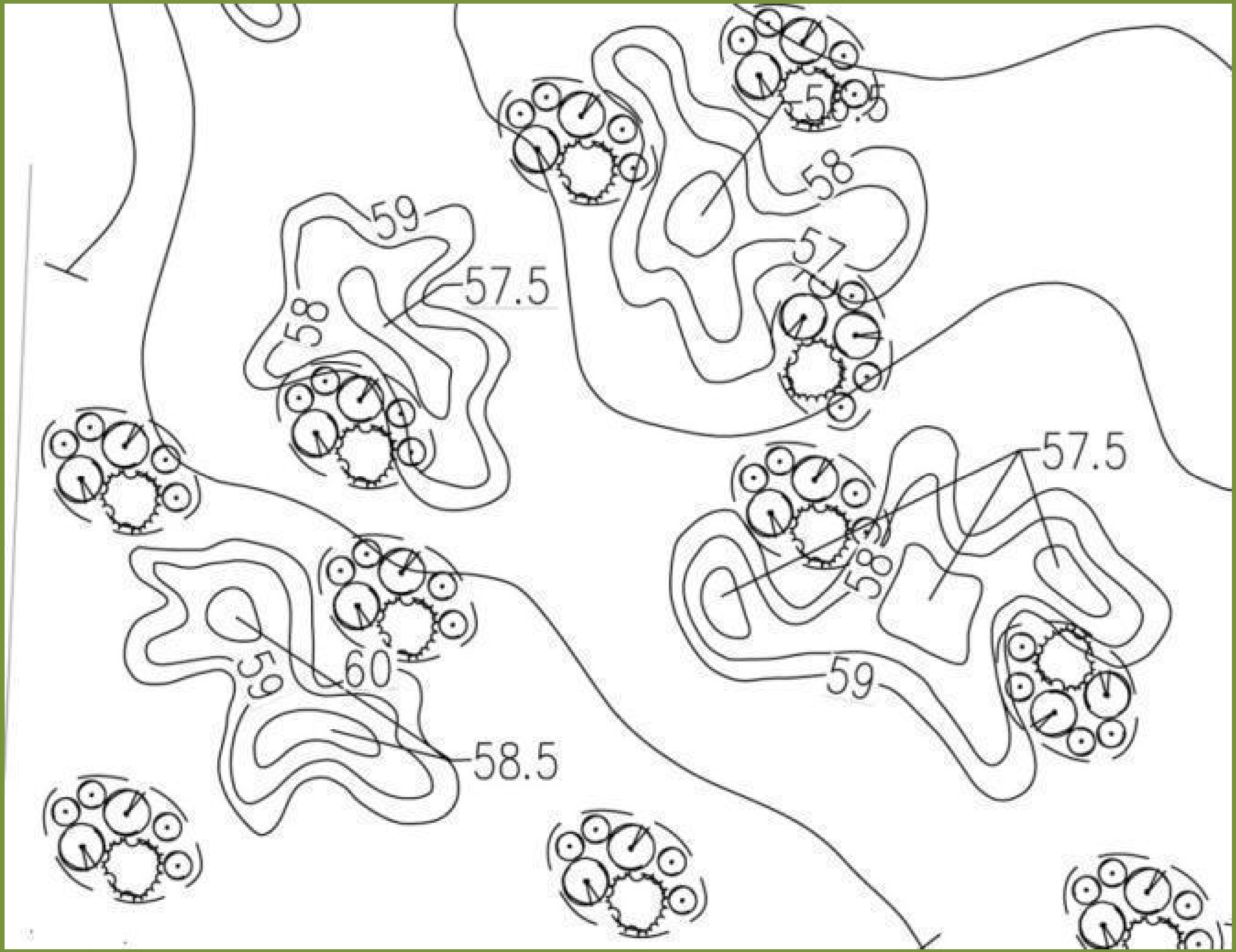
The power of visual communication tools



Construction documents – detail critical components, with the construction contractor and wetland design team monitoring construction, as the audience.

studioverde landscape architecture + design

The power of visual communication tools



Wetland restoration/creation in transitional and urbanized areas

Example: Wetland buffer, Prospect Park, New York

studioverde
landscape architecture + design

Wetland restoration/creation in transitional and urbanized areas

Examples: Bioswale or raingarden for parking lot stormwater runoff

studioverde
landscape architecture + design

Wetland restoration/creation in transitional and urbanized areas

- Community engagement and social equity.

- Design, design, design:
  - Design principles will more likely take lead role over replication of natural ecological plant/soil communities:
    - Above ground: Visual order, repetition through massing. + multi-seasonal physiological and visual performance.

studioverde
landscape architecture + design

Wetland restoration/creation in transitional and urbanized areas

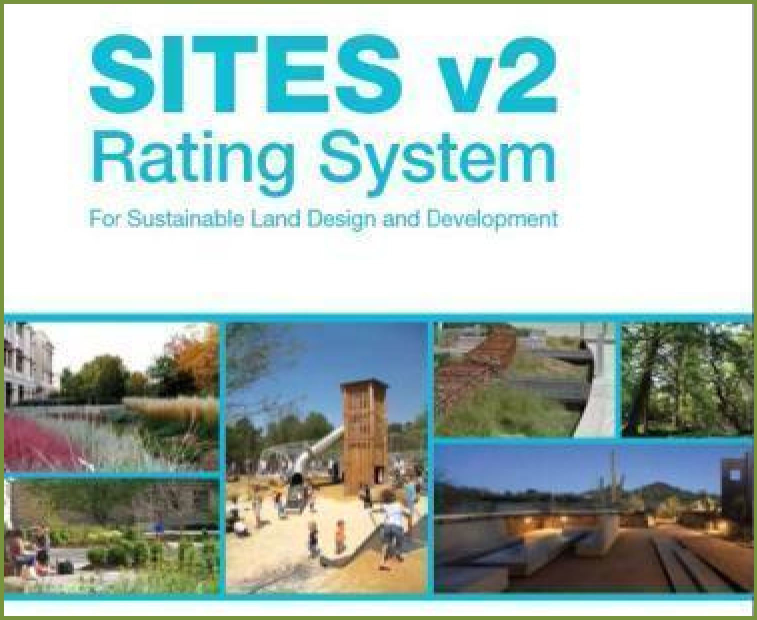
- **High performance soils and plants:**
  - Below ground - Soil mixes for :
    - stormwater functions
    - quick plant establishment + performance
  - Above ground - Plants:
    - Native <u>and</u> adaptive species suited for context and multi-seasonal benefits
    - Layout and massing to head off questions like "Is that a weed?" (by maintenance staff) or , " A bunch of weeds? " (by the public).

studioverde
landscape architecture + design

Trends: The Triple Bottom Line (TBL) view of wetland performance

studioverde
landscape architecture + design

Trends: The Triple Bottom Line (TBL) view of wetland performance



- The Sustainable Sites Initiative or SITES rating system: A recently released set of guidelines and recommendations for the sustainable development of outdoor landscapes that can be used as a model or tool for good wetland restoration process and practices.

http://www.sustainablesites.org/
For the free version of the rating system guidelines (Bundle #1):
http://www.sustainablesites.org/rating-system

studioverde
landscape architecture + design

Lisa N. Cowan, PLA, lcowan@studioverdelandscape.com
Check out our blog on: www.studioverdelandscape.com
Studioverde on Facebook

studioverde
landscape architecture + design

A "COOKBOOK" APPROACH TO WETLAND RESTORATION WON'T WORK

There are too many variables.

- ***Ingredients are always different*** *(wetland type, landscape position, surrounding land uses, soil, water, plants, etc.)*
- ***Reason for 'cooking' varies*** *(project goals are always different)*
- ***Recipe isn't always correct*** *(ingredients aren't understood and/or wrong ingredients are selected)*
- ***Inexperienced cooks*** *(contractors don't understand wetland restoration or don't have a good, detailed plan to follow, or don't follow the plan. Sometimes new things are discovered during construction (drainage tiles, gravel layer below clay) that require a change in plans that doesn't get addressed)*
- ***Cooking time varies*** *(different wetlands take different time periods to develop, weather patterns differ annually)*
- ***Poor monitoring when wetland is "cooking"*** *(monitoring information isn't collected, or is the wrong information to troubleshoot problems, problems aren't identified)*
- ***Additional ingredients may be needed*** *(action may need to be taken if restoration is unsuccessful – invasive species, hydrology different than expected, plant die off, etc.)*
- ***Do we really know how to tell when it is done?*** *(Looking back to our first webinar in this series on evaluating 'success').*

John Teal Recommendations

Follow all the principles listed:

1. State goals clearly
2. Use experts in ecology and hydrology
3. Include environmental variability in planning
4. Include function with structure when setting goals
5. Consider adjacent people, property and landscape
6. Use self design (environmental engineering)
7. Use monitoring and adaptive management till goal is reached
8. Plan for sea level rise

Rich Weber Recommendations

Cause of Failure	Recommendation	Selected Measures
Restoration Objectives not in line with Site Potential	Match objectives with Landscape position in the local watershed	Identify Hydrogeomorphic wetland class appropriate to project
Soil substrate breached, causing reduction of hydroperiod in recharge wetland	Maintain perching layer	Research NRCS Web Soil Survey water features, and/or on site investigation
Riverine restoration technique applied to Groundwater Discharge site	Identify appropriate wetland type by watershed stream order	Use soil properties to identify flooded/ponded soils vs. groundwater discharge soils
Depressional restoration fails to maintain planned depth/duration	Analyze water budget	Use water budgeting technique

Tom Harcarik Recommendations

Cause of Failure	Recommendation	Selected Measures
Inadequate screening and selection of restoration site	Develop better tools to assess the proposed site for its restoration potential and effectiveness of action.	Require specific data collection for proposed restoration site that extends beyond the project boundary and accounts for watershed scale influences. Require more detailed analysis of soils and hydrology
Lack of adequate buffers	Ensure adequate buffers are present to meet project specific goals	Require average and minimum buffer widths that account for site specific project goals such a protecting the site from adjacent land uses or the needs of targeted biological communities
Contractor not familiar with wetland restoration or importance of key restoration design features	Ensure contractors are familiar with wetland restoration construction techniques, and understanding of soils, hydrology, vegetation.	Develop better screening methods, list of qualifications. Have design consultants and regulators attend pre-bid and pre-con meeting. Consider developing list of pre-qualified contractors based on demonstrated knowledge and success
Inadequate post-construction follow-up. Resistance to devoting time and resources to monitoring and correcting problems	Require better post construction monitoring follow up	Ensure implementers (and regulators) are collecting the appropriate data to measure the restoration site performance
Failure to incorporate lessons learned	Analysis data collected at restoration sites to determine what worked and what didn't and why	Develop feedback loop to allow new data and observations to be incorporated into future restoration efforts

Mick Micacchion recommendations:

Cause of Failure	Recommendation	Selected Measures
Goals cannot be quantified preventing accurate assessments and limited incentive to achieve high quality.	Use quantifiable ecological performance standards as goals for mitigation and other restorations.	Use IBIs or other quantifiable ecological performance standards as goals. Set goals of "GOOD" or better ecological condition to assure restored wetlands compensate for losses, have high environmental resilience, and require minimal management.
No financial obligation for permittee or banker to meet performance standards.	Require monetary guarantees that are not released unless goals are met.	Make sure site and plans will lead to meeting quantifiable goals. Do not release non-performing bank credits or release bonds or other guarantees for under achieving permittee-responsible mitigation wetlands.
Natural wetlands have lower ecological condition when their surrounding land uses have high levels of human disturbance while a large percentage of mitigation wetlands perform at low levels in any landscape.	Give mitigation and restored wetlands the highest chance of success by placing them in landscapes with low levels of human disturbance.	Select appropriate sites and develop plans that will maximize the opportunity for meeting quantifiable ecological performance standards. Knowing that wetland condition is highly influenced by surrounding land uses place wetland restoration projects in areas where wide buffers are present or can be restored and the intensity of other surrounding land uses is low.

Lisa Cowan, PLA, Studioverde recommendations

Cause of Failure	Recommendation	Selected Measures
Collaboration between agencies, wetland team, stakeholders is minimal	Use integrated planning process and visual tools for education, outreach, engagement, support.	Project leadership should encourage and support collaboration internally, break down territory staking and barriers. Develop relationships with NGO's, contractors and suppliers and foster 2-way communication.
Contractor bids over budget. Change orders are often used during construction to address unanticipated challenges.	Include qualified land design professionals, such as a landscape architect on team to work with scientists to develop strategies that meet budget and area feasible to build.	Planning through design – collaborate to problem solve and vision strategies. Investigate local and innovative materials and construction methodologies to achieve outcome goals. Construction documents should be developed to provide specific guidelines and constraints on contractor, but not tell them exactly "how to do it".
Wetland features look contrived and manmade.	Use clear strategic graphics to communicate complexity of wetland features.	Anticipate the look and vision of natural wetland features within this context. Collaborate with wetland team members on details. Minimize CAD drafting of details until end to reduce need for time consuming revisions.
Poor wetland plant community establishment and performance	Soil mixes and construction methodologies for installation are critical and measures taken for each project to ensure requirements are enforced.	Specify feasible soil mix and installation measures. Communicate these as priorities on construction documents, during pre-bid and pre-construction meetings. Ensure that qualified construction monitoring personnel are on-site to adequately monitor and enforce soils supply and installation requirements.
Lack of community support for LID or green infrastructure projects that include wetlands.	More outreach and education throughout process. Plan for efficient maintenance and long term project sustainability upfront.	Use visual tools and other community engagement methodologies to engage stakeholders. Strategize on ways to include local businesses, labor forces, community groups for construction and stewardship. Create designs that have visual order. Use materials that are local, resilient and durable. High performance plants.

Questions?

John Teal	teal.john@comcast.net	508-763-2390
Richard Weber	richard.weber@ftw.usda.gov	817-509-3576
Tom Harcarik	tom.harcarik@epa.ohio.gov	614-644-3639
Mick Micacchion	MMicacchion@mwbinst.com	614-403-2085
Lisa Cowan	lcowan@studioverdelandscape.com	207-829-3600
Jeanne Christie	jeanne.christie@aswm.org	207-892-3399
Marla Stelk	marla@aswm.org	207-892-3399


Thank you for your participation!
ASSOCIATION OF STATE WETLAND MANAGERS
www.aswm.org