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2021 Waukesha County Stormwater Workshop
April 21, 2021

Ecological Restoration of Stormwater Infrastructure in the UW-Madison Arboretum (2000-2020)

Jon H. Lindert, P.E., LEED AP, **Strand Associates, Inc.®**
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(608) 251-4843

Outline

- Project Location
- Project Timeline
- Studies
- Project Highlights
- Curtis Pond Rehabilitation (2020)
- Project Costs and Performance
- CSWEA Stormwater Bike Tour (2019)
- Questions

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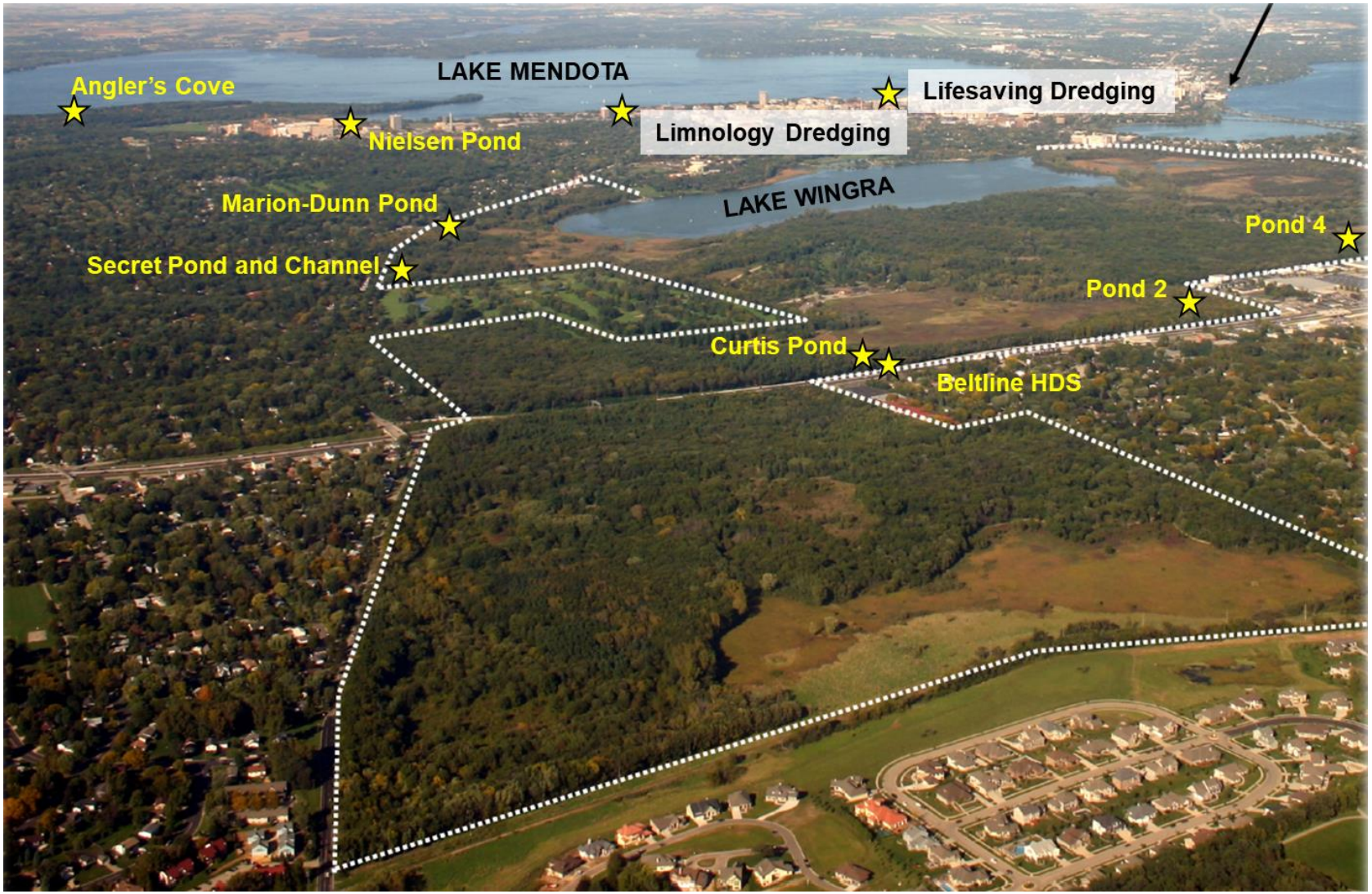
Location



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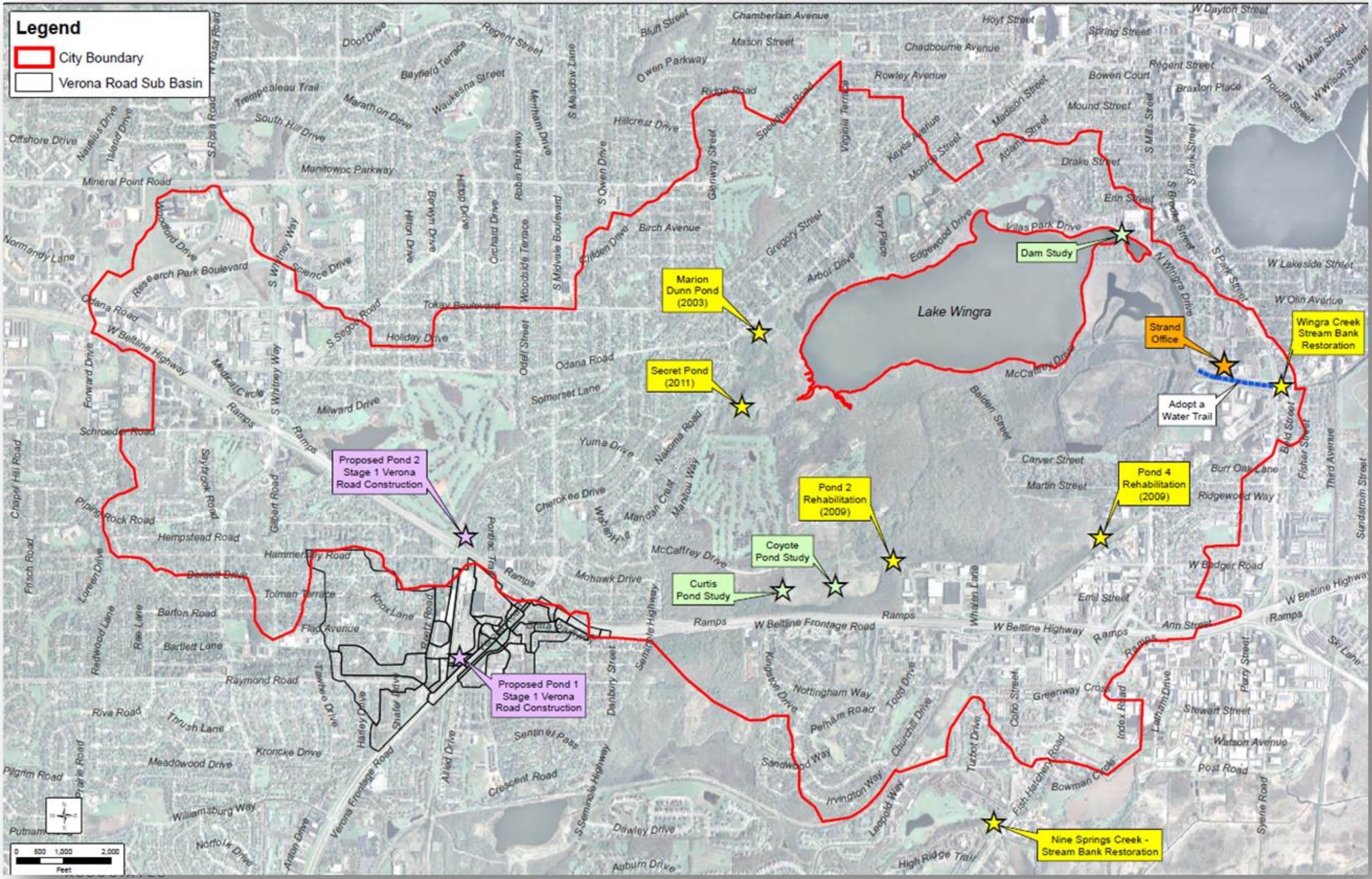
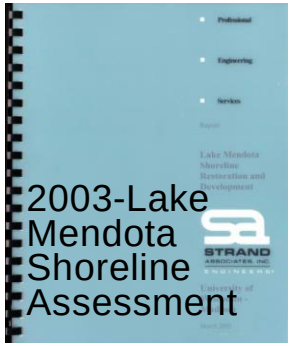
Location

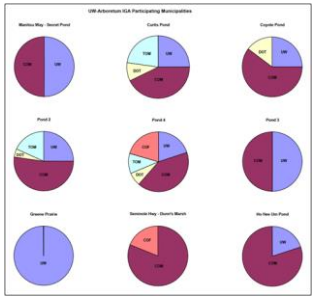

Legend
City Boundary
Verona Road Sub Basin
Lake Wingra
Dam Study
Marion Dunn Pond (2003)
Secret Pond (2011)
Strand Office
Wingra Creek Stream Bank Restoration
Adopt a Water Trail
Proposed Pond 2 Stage 1 Verona Road Construction
Pond 2 Rehabilitation (2009)
Pond 4 Rehabilitation (2009)
Coyote Pond Study
Curtis Pond Study
Proposed Pond 1 Stage 1 Verona Road Construction
Nine Springs Creek - Stream Bank Restoration
0 500 1,000 2,000
Feet

Timeline



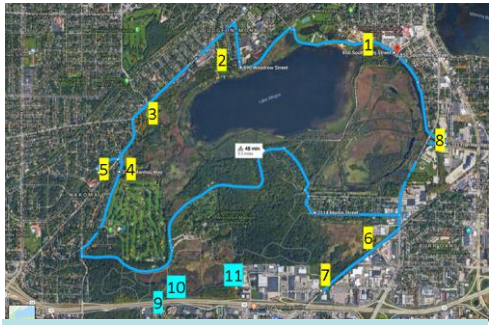
2004-ANGLER'S COVE REHAB

2004-NIELSEN POND REHAB



2008-IGA

2013-LAKE MENDOTA DREDGING



MAY 2019-CSWEA BIKE TOUR

2000

2005

2007-S. ARB SW PLAN

2008-SW QUALITY PLAN

2010

2010-SECRET POND GI

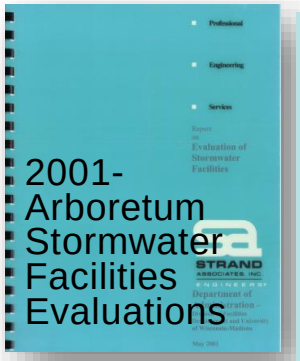
2012-CURTIS POND PLAN

2015

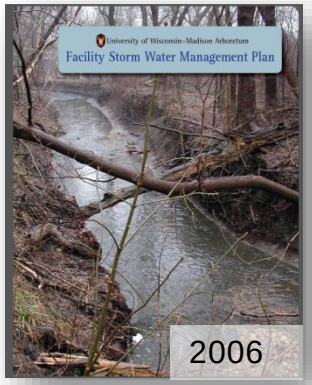
2015-LAKE WINGRA PLAN

2018-CURTIS POND PLAN 2

2020



2003-MARION-DUNN POND REHAB



2008-POND 2 & WETLAND REHAB

2009- POND 4 REHAB

2011-SECRET POND REHAB

2012-2014: 3-Year Native Vegetation Maintenance

2014-BELTLINE HDS

2020-CURTIS POND REHAB

2021-2023: 3-Year Native Vegetation Maintenance

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2001-Arboretum Stormwater Facilities Evaluation

- Required by Phase 1 WPDES/MS4 Permit
- Evaluation Criteria
- Recommendations and Costs for Dredging and Rehab

Project	Avg. Sediment Depth (ft)	Avg. Water Depth (ft)	Avg. Pond Depth	Control Structure	Berm Condition	Outlet Condition	Inlet Condition
Marion Dunn Pond Rehab	2.5	2.5	4.5	Failed	OK	Eroded	No Forebay
Nielsen Pond Rehab				Pipe OK	Eroded	OK	No Forebays
Pond 2 & Wetland Basin Rehab	1.8	2.7	4.5	Failed	OK	Eroded	No Forebay
Pond 4 Rehab				Failed	Failed	Scoured	No Forebay
Secret Pond Channel & Rehab	3.3	0.7	4	None	Failed	Eroded	Highly Eroded
Curtis Pond Rehab	2	3.9	5.9	OK	OK	OK	Highly Eroded

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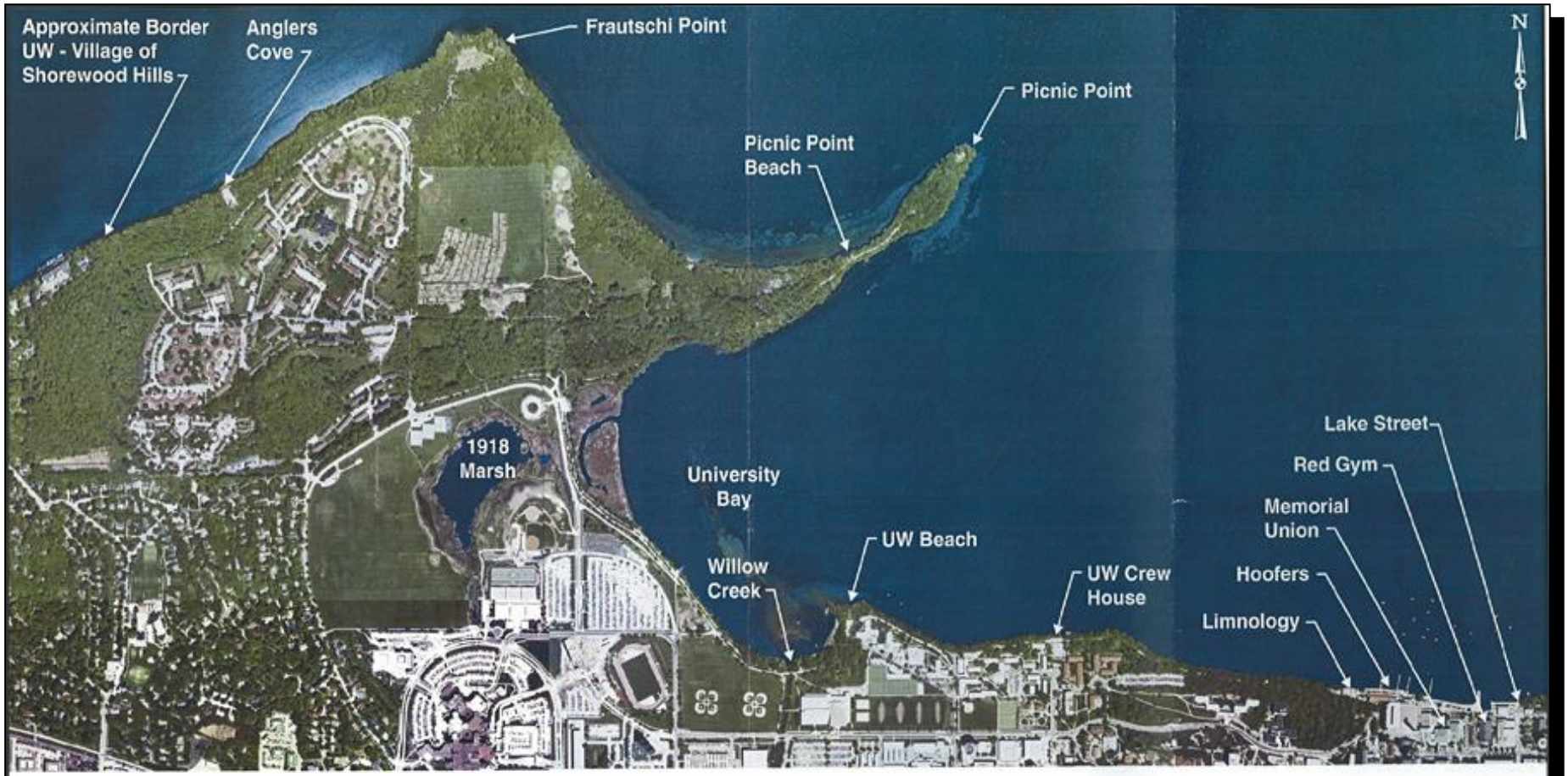
2003-Lake Mendota Shoreline Assessment



Summary of Project Analysis Sections

- Lake Street to Hoofers
- Hoofers
- Limnology
- Limnology to Babcock Drive (UW Crew House)
- Babcock Drive to Willow Creek
- University Bay Drive
- Picnic Point
- Picnic Point to Anglers Cove
- Anglers Cove
- Anglers Cove to Shorewood Hills

Wisconsin Department of Administration
UW Madison Shoreline Restoration

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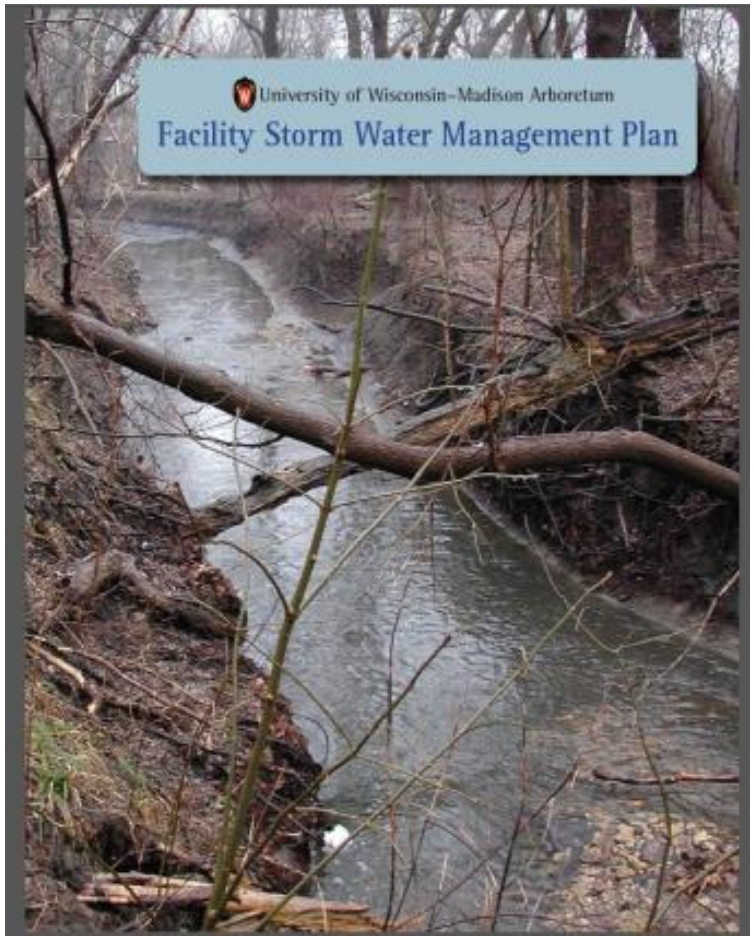
Figure No. 1.02-1

Shoreline Study Area

1-104-751

2006-Arboretum Facility Stormwater Management Plan



- **UW-Madison Arboretum Stormwater Values and Guiding Principles**
  - Serve and enhance Arboretum restoration, teaching, research, and outreach activities
  - Minimize impact on Arboretum ecosystems
  - Be consistent with ecological restoration tenets
  - Encourage wise stormwater management in the surrounding community

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Project Components – Matrix of Ecological Restoration Components

Project	Construction Year	Native Prairie Restoration	Native Vegetation Restoration	Invasive Species Management	Wetland Creation	Microtopography	3-Year Native Vegetation Maintenance	Pond Dredging	Natural Channel Design	Optimized Outlet Structure	Forebay	Trenchless Pipe Rehab	Spill Control	Black Locust Stair Structure/Fence	Energy Dissipater	Level Spreader to Wetland	Hydrodynamic Separator-Coanda Screen	Soil Bioengineering	Underwater Planting Shelves	Ecological Assessment/Vegetation Survey
Angler's Cove Prairie & Bluff Restoration	2003	x												x	x			x		
Marion Dunn Pond Rehab	2003		x					x		x	x				x					
Nielsen Pond Rehab	2004		x					x		x	x									
Pond 2 & Wetland Basin Rehab	2008		x		x	x		x		x	x		x				x			x
Pond 4 Rehab	2009		x			x		x		x	x		x			x			x	
Secret Pond Channel & Rehab	2011		x		x		x	x	x	x	x							x		x
Curtis Pond Rehab	2020		x	x			x	x		x	x	x					x			x

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Angler's Cove Prairie and Bluff Restoration (2003)

Before

After

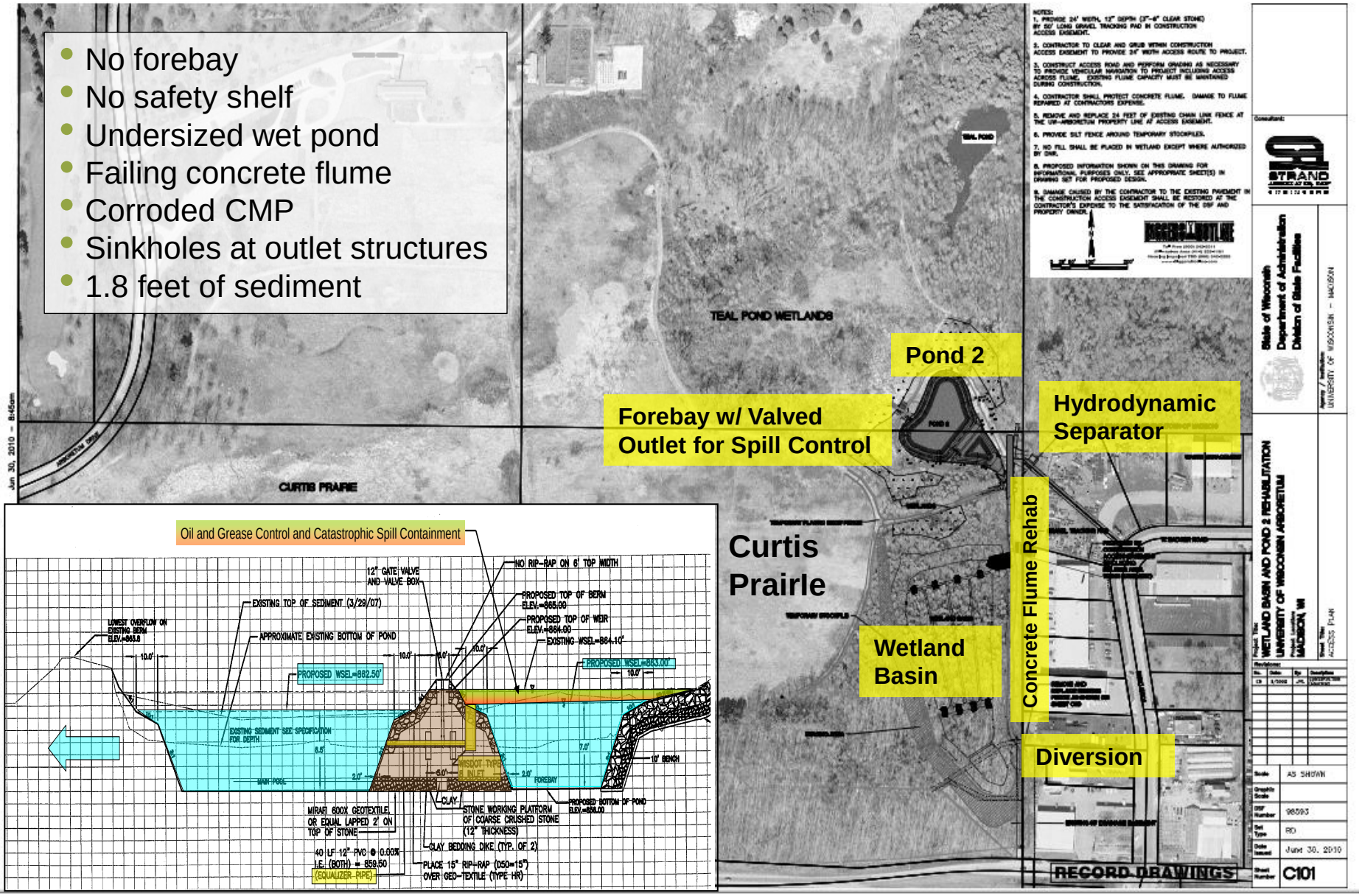
Marion-Dunn Pond Dredging and Rehabilitation (2003)

Before

After

Pond 2 Rehab and Wetland Basin (2008)-Design

- No forebay
- No safety shelf
- Undersized wet pond
- Failing concrete flume
- Corroded CMP
- Sinkholes at outlet structures
- 1.8 feet of sediment



Pond 2 Rehab and Wetland Basin (2008)-After

Pond 4 Dredging and Rehabilitation (2009)-Before

Before

- No forebay
- No safety shelf
- Undersized
- Topsoil Berms
- Corroded CMP
- 2.3 feet of sediment

After

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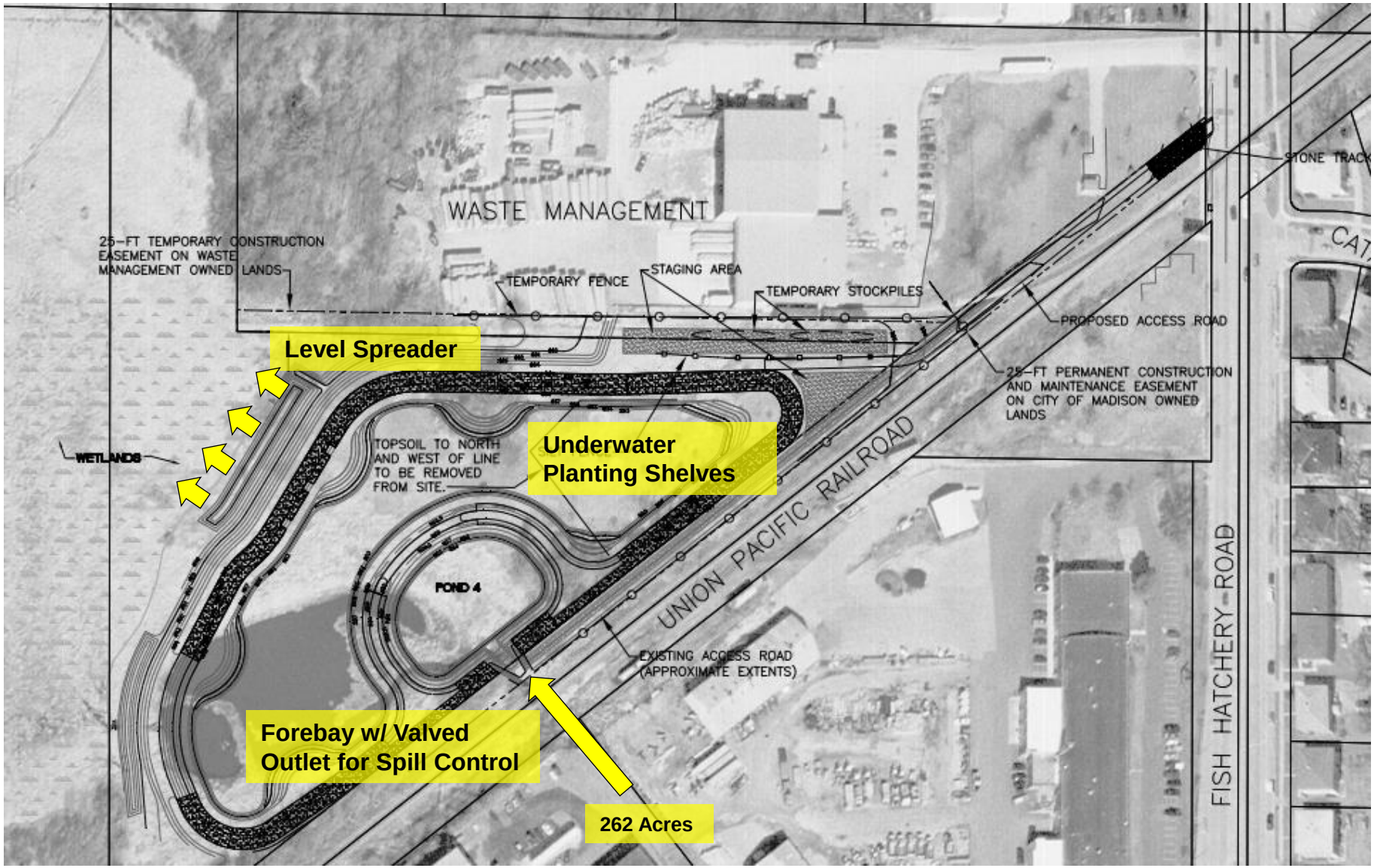
Pond 4 Dredging and Rehabilitation (2009)-Design



Pond 4 Dredging and Rehabilitation (2009)-After

Microtopography


Level Spreader

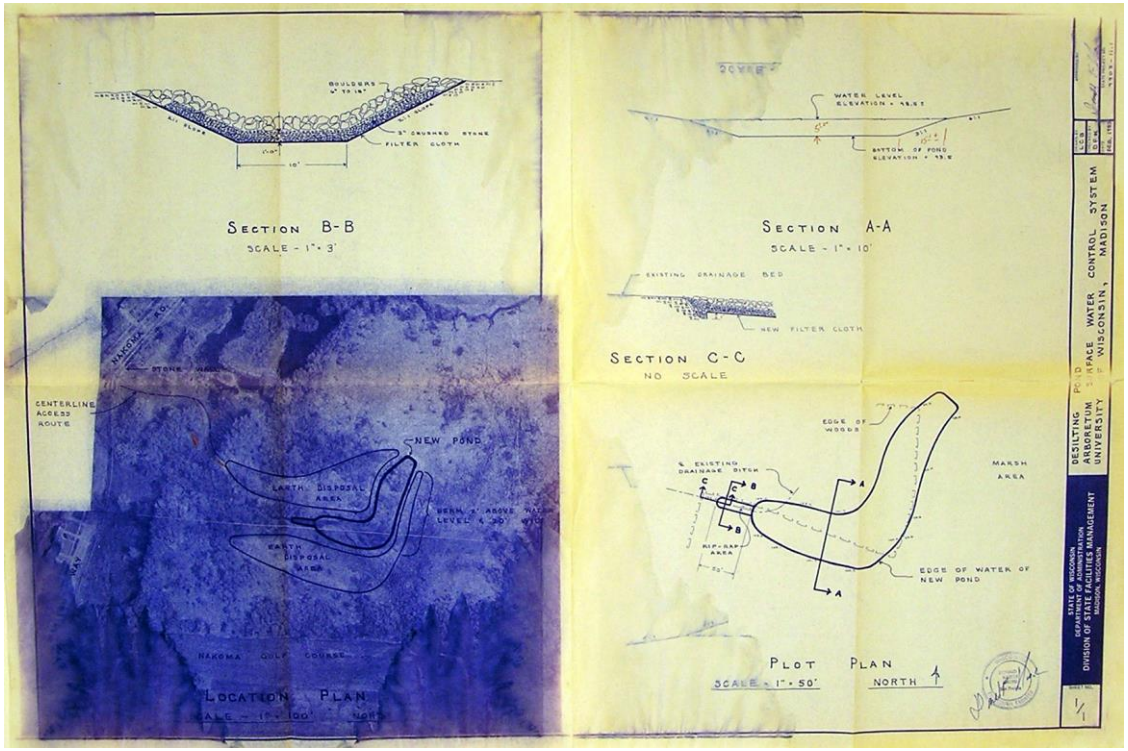
Underwater Planting Shelves

Level Spreader

Secret Pond and Channel Rehab (2011)-2003 Dissipater

- 2.5 Sq. Mile Watershed
- Q100=434 cfs
- Q50 367 cfs
- Q25=308 cfs
- Q25=4.5 fps

Secret Pond and Channel Rehab (2011)-Before



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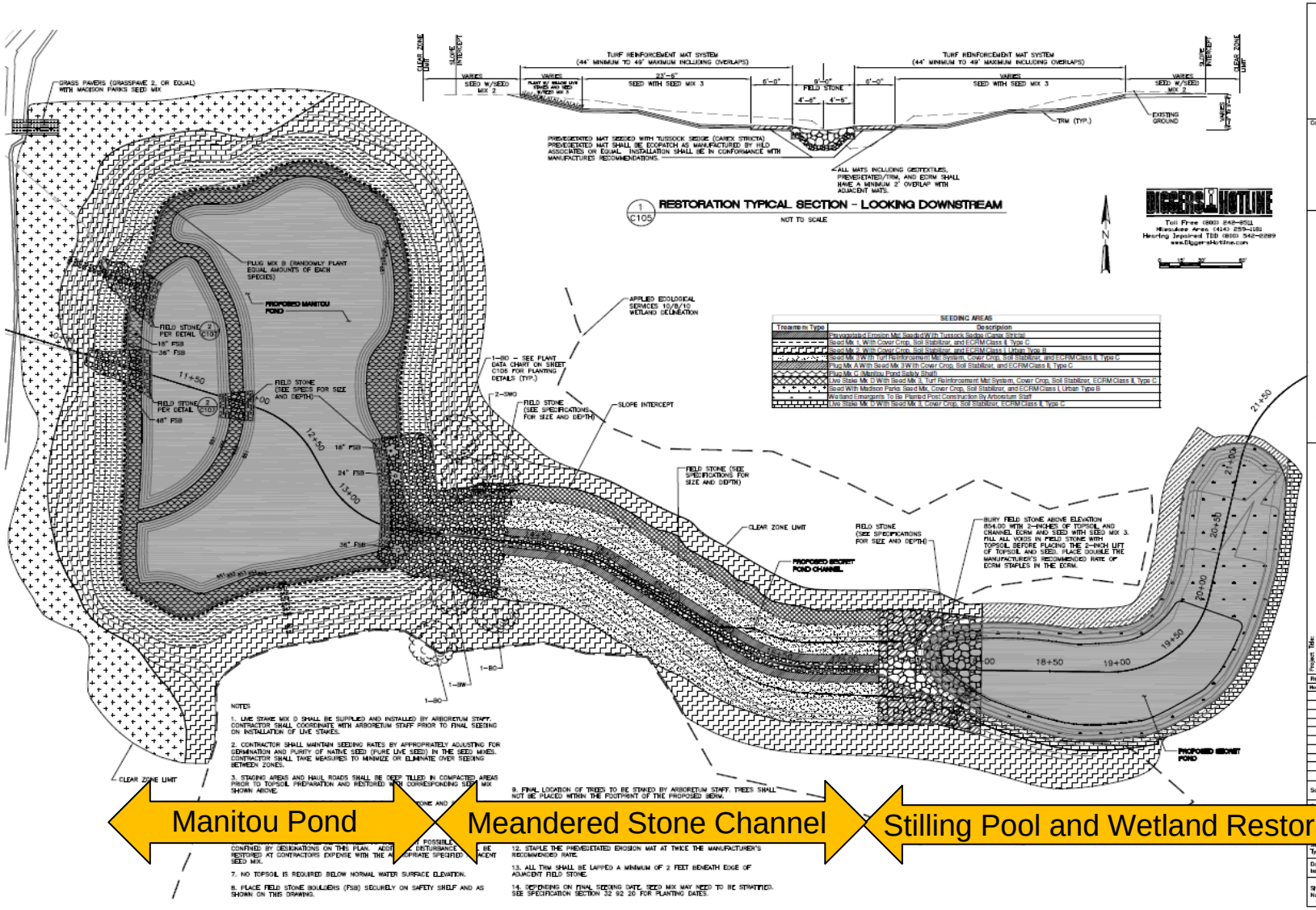
Secret Pond and Channel Rehab (2011)-Design



Secret Pond and Channel Rehab (2011)-After

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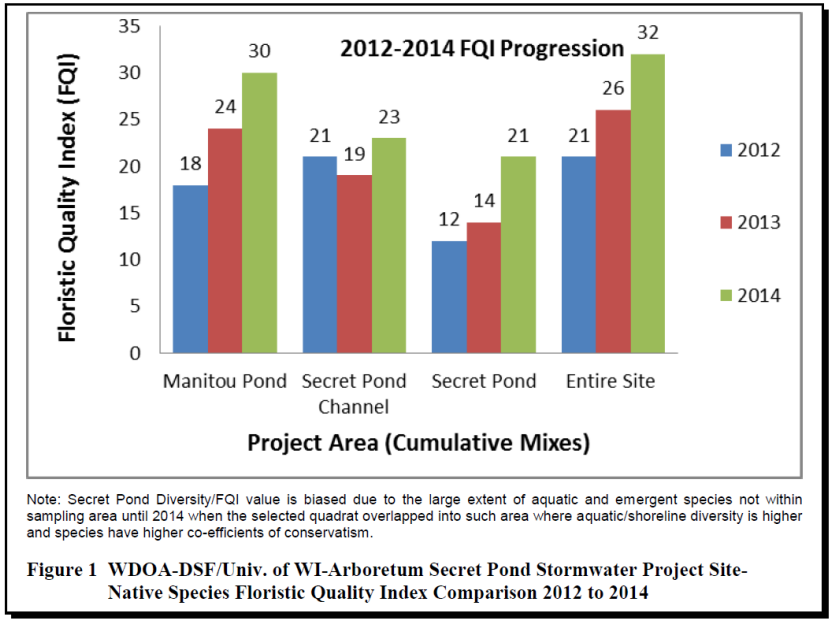
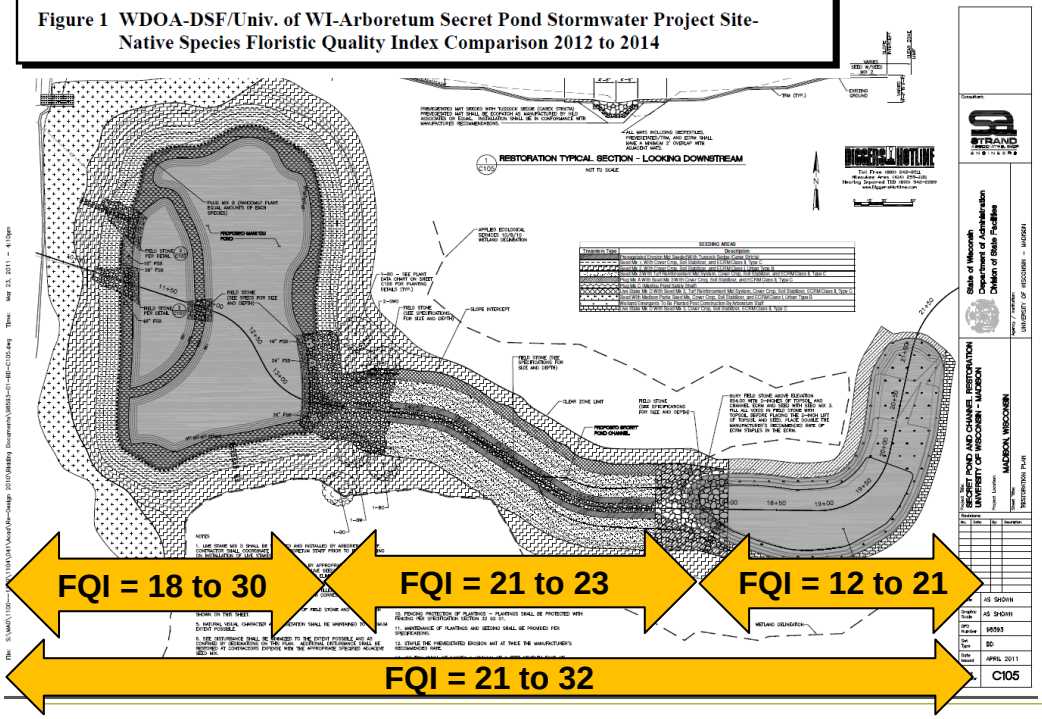
Secret Pond and Channel Rehab (2011)-3-Year Monitoring



Note: Secret Pond Diversity/FQI value is biased due to the large extent of aquatic and emergent species not within sampling area until 2014 when the selected quadrat overlapped into such area where aquatic/shoreline diversity is higher and species have higher co-efficients of conservatism.

Figure 1 WDOA-DSF/Univ. of WI-Arboretum Secret Pond Stormwater Project Site-Native Species Floristic Quality Index Comparison 2012 to 2014

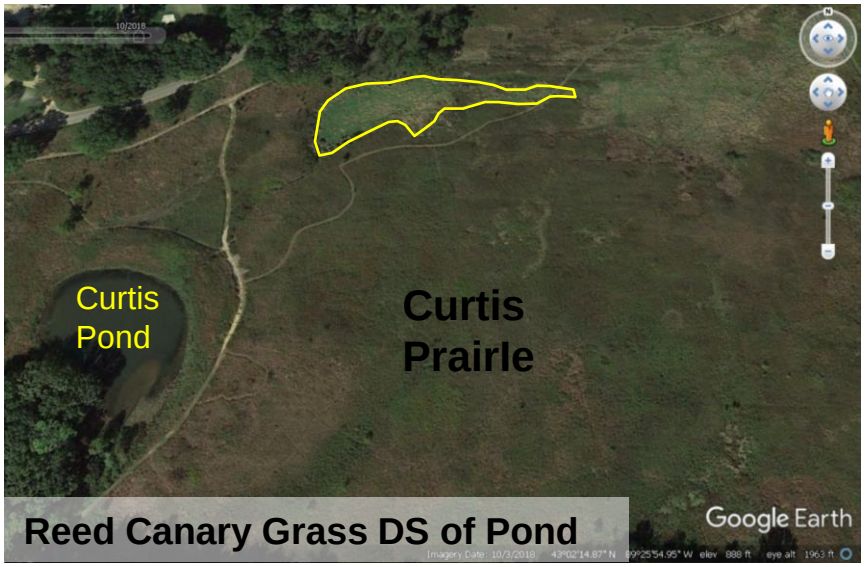


Example Assessment Quadrat

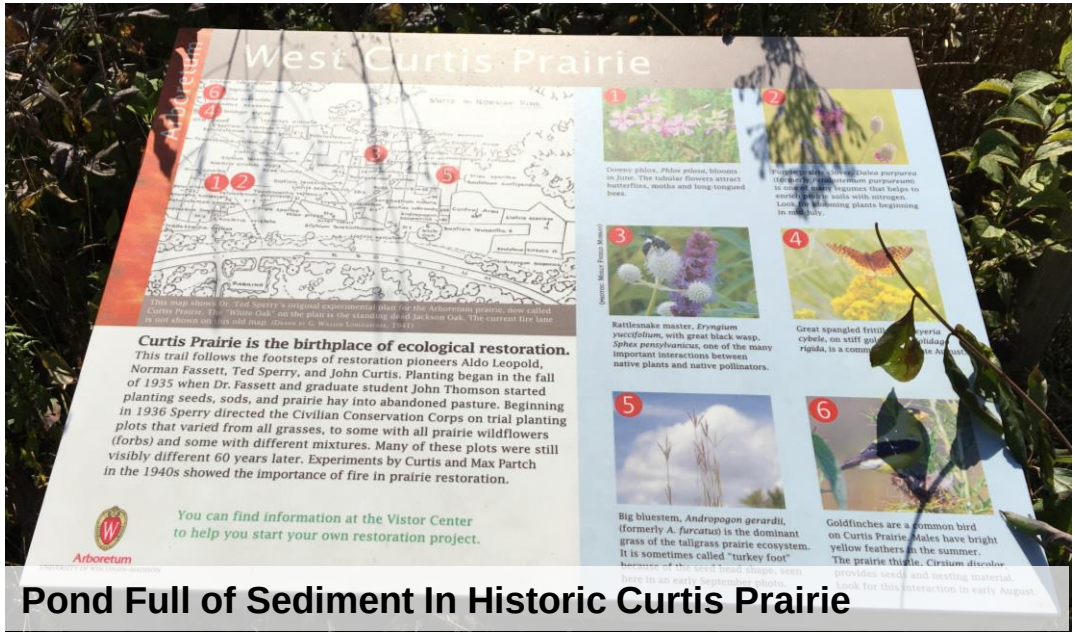
- **Floristic Quality Assessment (FQA)**
  - Floristic Quality Index (FQI)
  - FQI>20 = Relatively Good Ecological Diversity
  - FQI>30 = Strong Natural or Restored Asset Based on Species Diversity

Curtis Pond Dredging and Rehab (2020) – Problems

Failed Concrete Flume



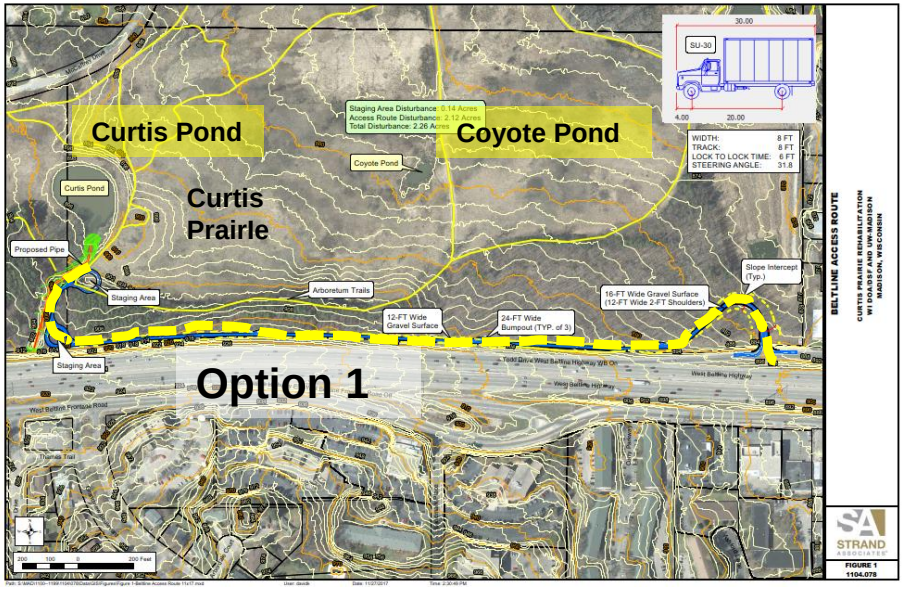
Reed Canary Grass DS of Pond

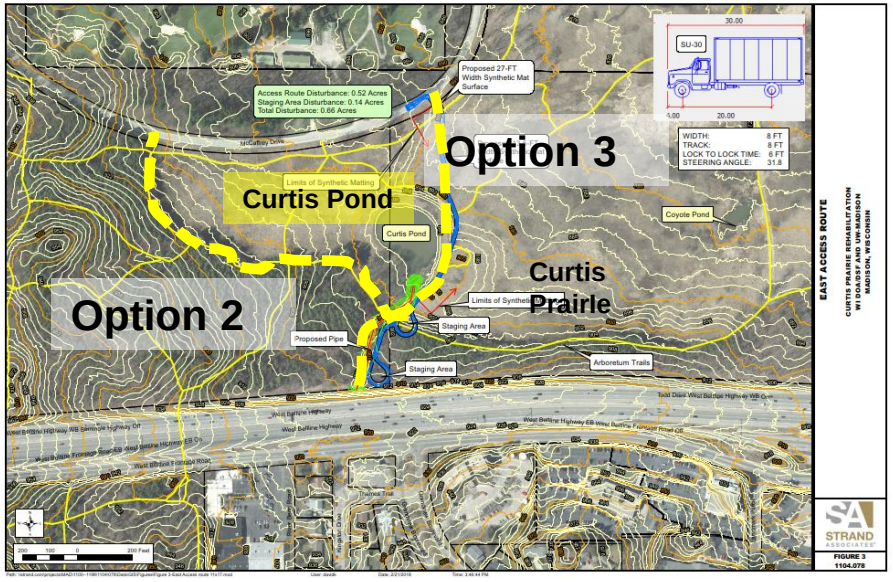


Pond Full of Sediment In Historic Curtis Prairie

Failed CMP

Curtis Pond Dredging and Rehab-PLANNING





Sediment Sampling and Material Disposal Options for Dredging Projects

NR 347 for Navigable Waterways

NO

Stormwater Management Facility

YES

NR 528-Management of Accumulated Sediment from Stormwater Management Structures

Coordinate with DNR

- Submit sediment sampling plan to DNR and obtain approval
- Analytical parameters in NR 347 for Inland Waters and Great Lakes
- Lengthy list of parameters, negotiable with DNR (DNR may have existing data for nearby dredging project)
- Same options for disposal or reuse
- Cases by case determination that is dependent on contaminants in the sediment
- DNR coordination and approval is needed (not a self-implementing process like NR 528)

DISPOSAL OPTIONS

Beneficial Reuse

- Consult NR 720 Direct Contact Soil Standards
  - Non-Industrial Site
  - Industrial Site
  - Protection of Groundwater
- NR 500.08(3) Dredged Material Exemptions for solid waste facilities or mines (daily cover or reclamation)
- Establish a dedicated sediment management site
- General fill, confined geotechnical fill, capped fill site
- Agricultural Land Spreading

Landfill Disposal

- Early coordination/waste profile
- Paint filter test
- Support own weight, support weight placed, and maintain stable slopes
- Construction contractor confirmation testing

Accumulated Sediment End Use Certification (Form 4400-248)

Site Meets Part A-Land Use and Suspected Contamination Criteria?

Yes

Category 1
- No sediment sampling by environmental professional
- Comply with setbacks and performance standards
- Document reuse location and retain records

No

Sediment Sampling by Environmental Professional

< Ceiling Levels

Category 2
- If contaminants detected above background levels, additional analysis may be warranted
- Evaluate end use options per NR 528.07
- Document reuse location and retain records

> Ceiling Levels

Category 3
- Dispose of sediment in a licensed landfill
- NR 528 Sediment End Use Certification is not applicable

Design Considerations

- Adequate On-Site Sediment Drying Area
- Adequate Weather For Drying/Turning Sediment
- Accumulated Sediment End Use Certification
- Mechanical vs Hydraulic Dredging

Note: Stormwater ponds may have elevated PAHs.

Sampling Considerations

- Number and location of samples
- Grab or Composite Sampling
- Vertical profile
- Typical analytes: physical properties, nutrients, pH, metals, PAHs, PCBs

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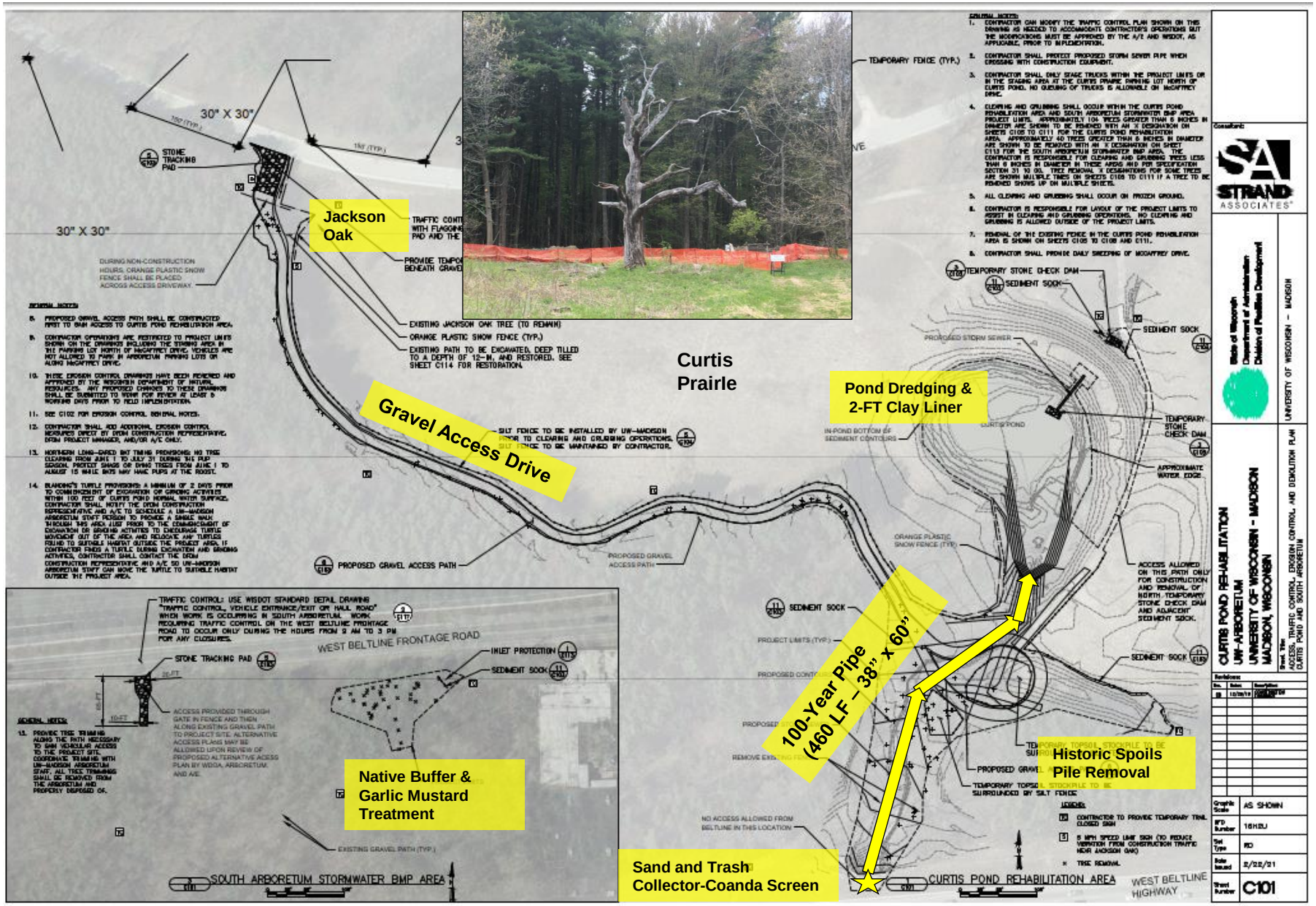
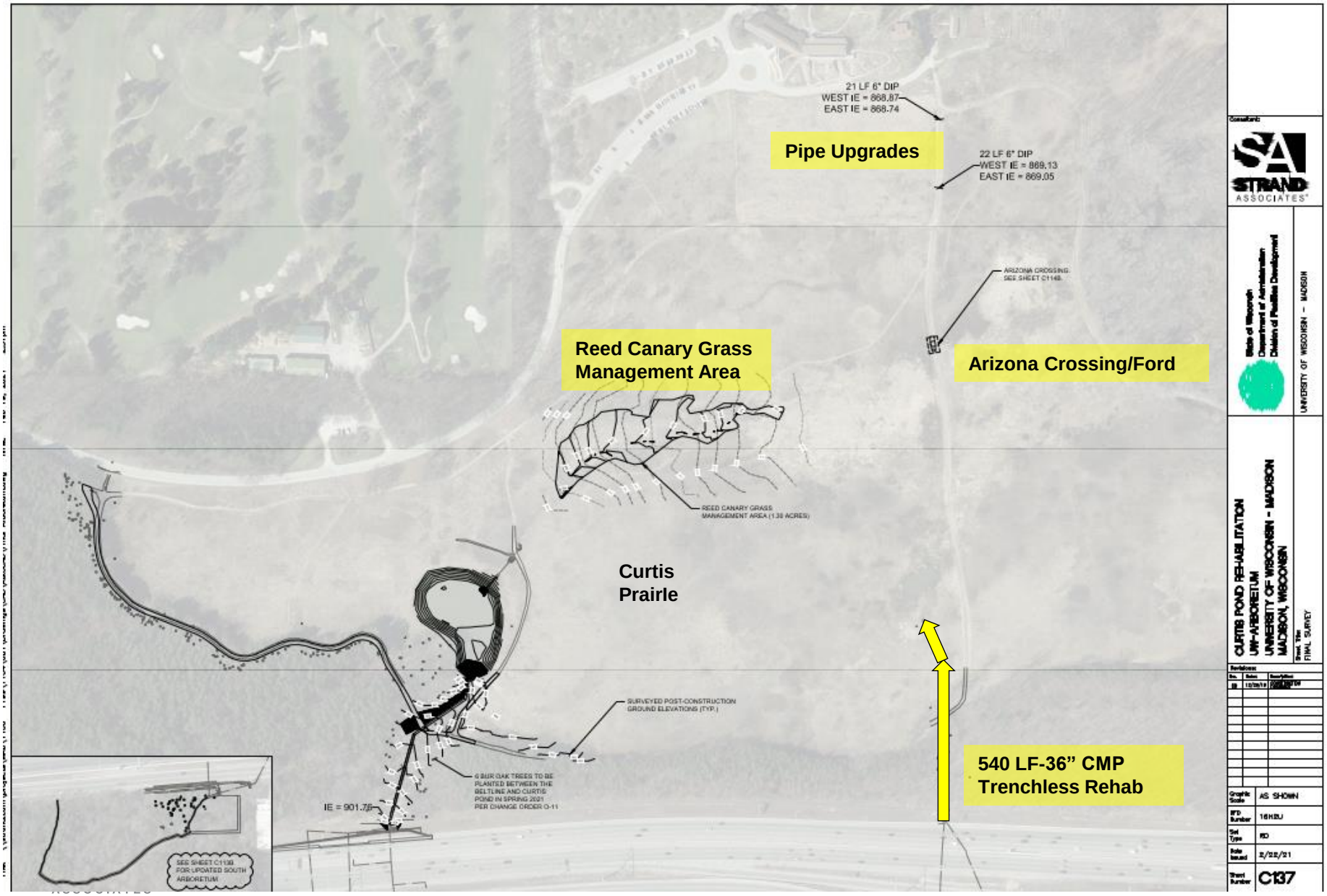
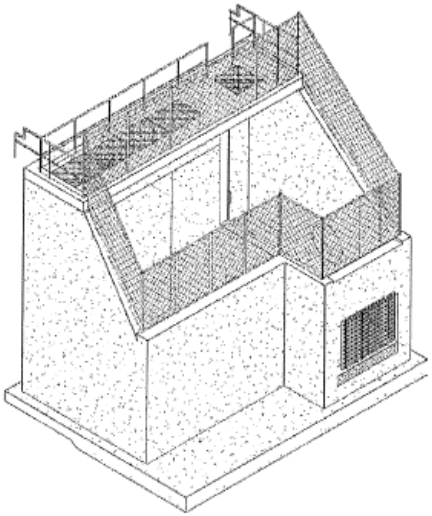
Curtis Pond Dredging and Rehab (2020)-Design



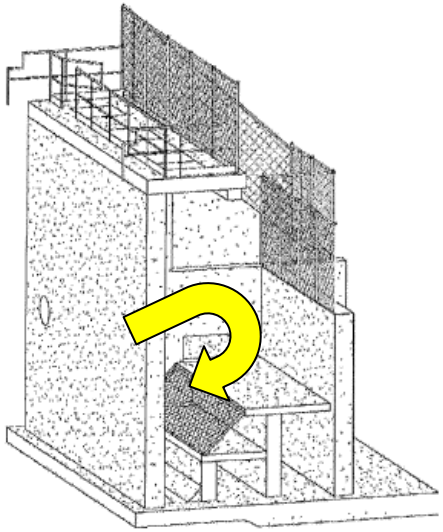
Curtis Pond Dredging and Rehab (2020)-Design



Curtis Pond Dredging and Rehab-Coanda Screen (2013)



3D PERSPECTIVE (LOOKING SOUTHWEST)
NOT TO SCALE



3D PERSPECTIVE (LOOKING NORTHWEST)
NOT TO SCALE

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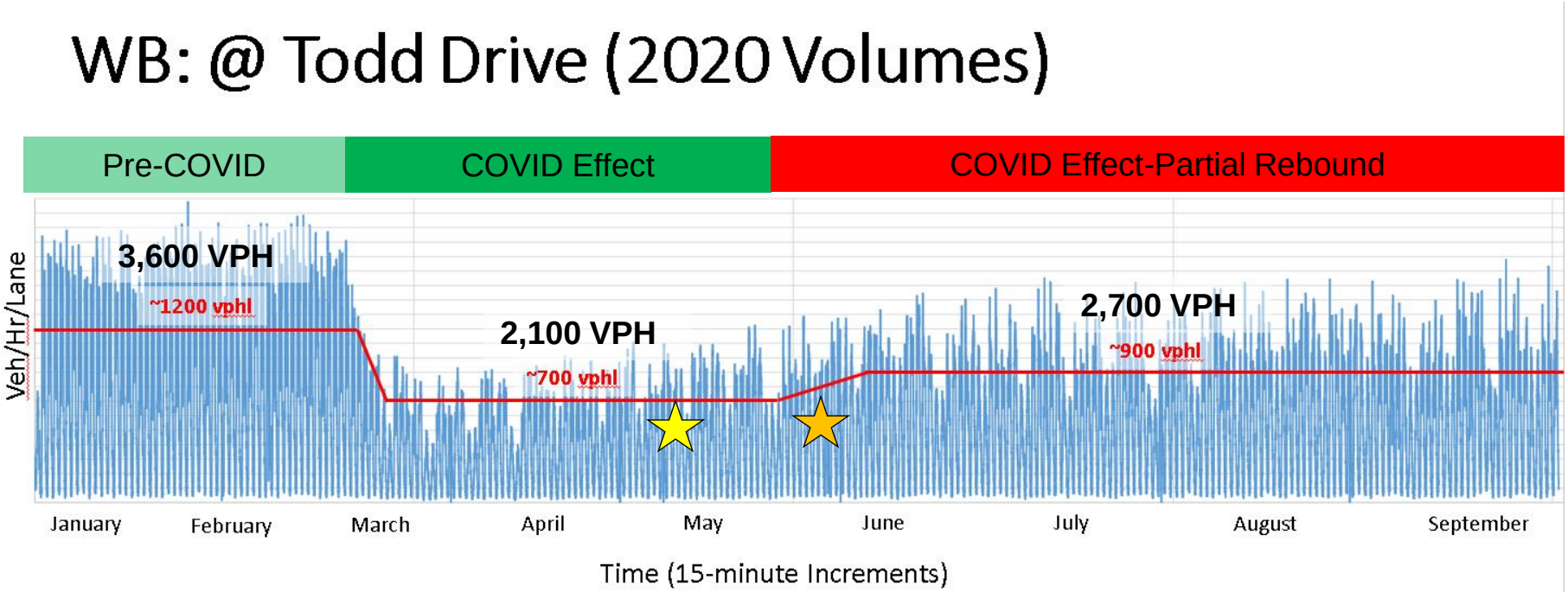
Curtis Pond Dredging and Rehab (2020) – Pond Dredging

Curtis Pond Dredging and Rehab (2020) – Trenchless Rehab

Curtis Pond Dredging and Rehab (2020) – Trenchless Rehab



Contractor Original Schedule for Trenchless Rehab from Beltline – Weekday Work

Contractor Final Schedule for Trenchless Rehab from Beltline – **Weekend Work**

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Curtis Pond Dredging and Rehab (2020) – RCGMA

Low Ground Bearing Pressure Equipment-4 psf

Herbicide Twice, Then 6” to 10” Depth Scrape

Temporary Access Mats Through Prairie

Native Seed, Plugs (1 per 2 sf), and Emat

Curtis Pond Dredging and Rehab (2020) – Native Buffer

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Curtis Pond Dredging and Rehab (2020) – Overlook

Curtis Pond Dredging and Rehab (2020)-After

Access Path: 11/09/20

Curtis Pond: 11/09/20

Sand and Trash Collector: 11/09/20

RCGMA: 11/09/20

Project Details

- **Permitting**
  - Artificial Wetland Exemption
  - WRAPP
  - No Chapter 30
  - Dewatering/Dredging Permits
  - Endangered Species
    - Incidental Take Permit (Silphium Borer Moth)
    - Blanding's Turtle
    - Northern Long-eared Bat
- **Sediment Sampling/Disposal**
  - High PAHs Required Subtitle D Landfill Disposal
- **Specification Provisions**
  - 6 Native Seed Mixes and 2 Plug Mixes
  - Fill Pond Prior to Turn Off Dewatering – **Used Upstream Fire Hydrant ($200)**
  - Jackson Oak Speed Limit Signs
- **Prius Scrape**

Silphiums: prairie dock, cup-plant, rosinweed, and compass plant

BMP Age At Start of Rehab and Quantities

Project	Original Construction Year	Rehab Construction Year	Age At Start Rehab	CY of Sediment Dredging	CY of Parent Excavation	Total Excavation
Angler's Cove Prairie & Bluff Restoration	N/A	2003	N/A	N/A	N/A	N/A
Marion Dunn Pond Rehab	1984	2003	**19**	3,900	3,900	7,800
Nielsen Pond Rehab	1978	2004	**26**	3,850	950	4,800
Pond 2 & Wetland Basin Rehab	1975	2008	**33**	3,600	20,036	23,636
Pond 4 Rehab	1981	2009	**28**	2,945	29,776	32,721
Secret Pond Channel & Rehab	1983	2011	**28**	2,197	8,299	10,496
Curtis Pond Rehab	1969	2020	**51**	4,147	2,075	6,222
			Total	**20,639**	**65,036**	**85,675**

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Costs and Performance

Project	Construction Cost In Construction Year	Construction Cost 2021 Dollars	TSS Reduction (%)	TP Reduction (%)
Angler's Cove Prairie & Bluff Restoration	$ 141,638	$ 241,129	N/A	N/A
Marion Dunn Pond Rehab	$ 526,092	$ 895,636		43.8%
Nielsen Pond Rehab	$ 345,890	$ 571,703	58.8%	43.0%
Pond 2 & Wetland Basin Rehab	$ 1,103,004	$ 1,619,799	66.5%	34.0%
Pond 4 Rehab	$ 1,182,989	$ 1,686,659	65.8%	
Secret Pond Channel & Rehab	$ 1,424,759	$ 1,914,757		57.4%
Curtis Pond Rehab	$ 1,497,400	$ 1,542,322	63.1%	43.1%
Total	**$ 6,221,772**	**$ 8,472,005**		

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Contractors and Disposal Locations

Project	Contractor	Restoration Contractor	Disposal Location
Angler's Cove Prairie & Bluff Restoration	Land Resource Company, LLC	Same	N/A
Marion Dunn Pond Rehab	RG Huston	Sub	RG Huston Pit near Cottage Grove
Nielsen Pond Rehab	S&S Underground	Sub	Middleton Area
Pond 2 & Wetland Basin Rehab	Edgerton Contractors	Land Resource Company, LLC	Mandt Pit near Oregon
Pond 4 Rehab	Edgerton Contractors	Land Resource Company, LLC	Mandt Pit near Oregon
Secret Pond Channel & Rehab	Veit	Applied Ecological Services	Mandt Pit near Oregon
Curtis Pond Rehab	Integrity Grading & Excavating, Inc.	Field and Stream Restorations, LLC	**Prairie Landfill** near Sun Prairie

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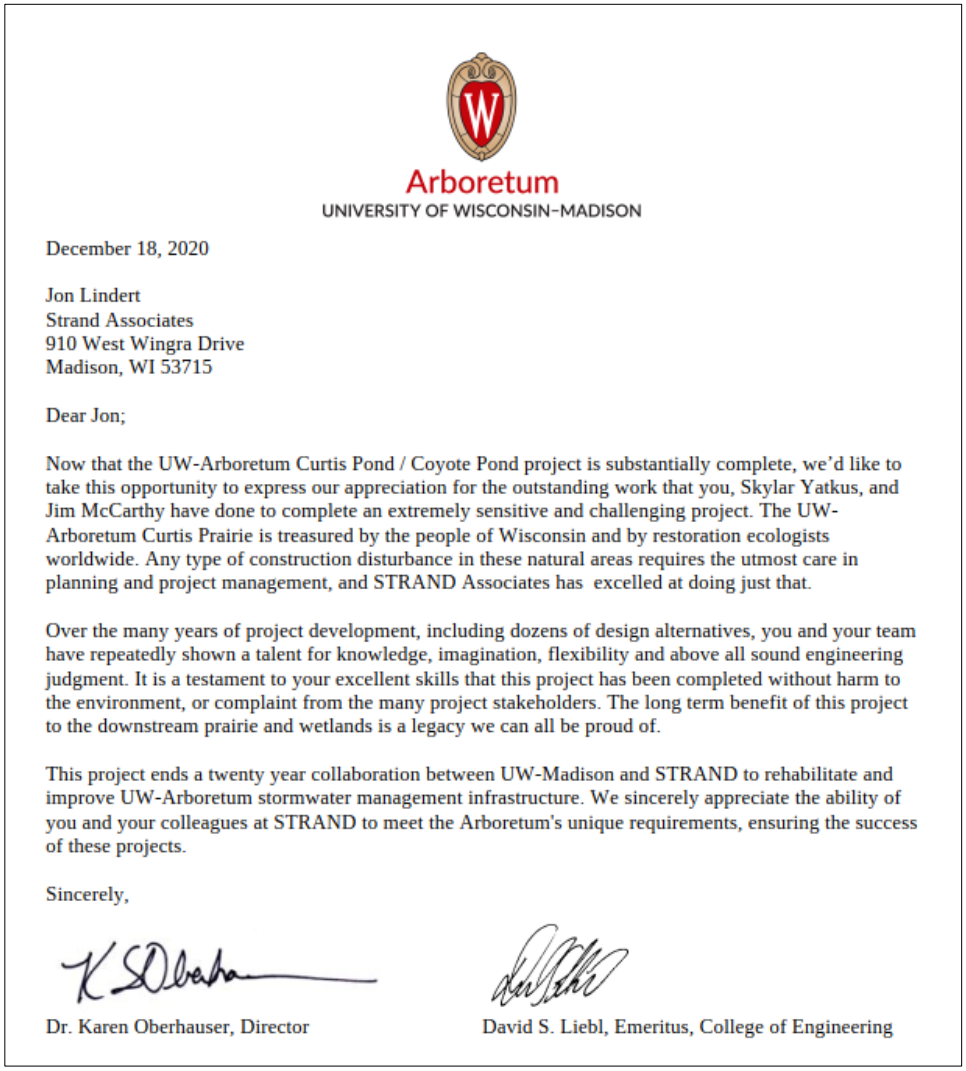
Project Partners



Arboretum
UNIVERSITY OF WISCONSIN–MADISON

December 18, 2020

Jon Lindert
Strand Associates
910 West Wingra Drive
Madison, WI 53715

Dear Jon;

Now that the UW-Arboretum Curtis Pond / Coyote Pond project is substantially complete, we'd like to take this opportunity to express our appreciation for the outstanding work that you, Skylar Yatkus, and Jim McCarthy have done to complete an extremely sensitive and challenging project. The UW-Arboretum Curtis Prairie is treasured by the people of Wisconsin and by restoration ecologists worldwide. Any type of construction disturbance in these natural areas requires the utmost care in planning and project management, and STRAND Associates has excelled at doing just that.

Over the many years of project development, including dozens of design alternatives, you and your team have repeatedly shown a talent for knowledge, imagination, flexibility and above all sound engineering judgment. It is a testament to your excellent skills that this project has been completed without harm to the environment, or complaint from the many project stakeholders. The long term benefit of this project to the downstream prairie and wetlands is a legacy we can all be proud of.

This project ends a twenty year collaboration between UW-Madison and STRAND to rehabilitate and improve UW-Arboretum stormwater management infrastructure. We sincerely appreciate the ability of you and your colleagues at STRAND to meet the Arboretum's unique requirements, ensuring the success of these projects.

Sincerely,

Dr. Karen Oberhauser, Director

David S. Liebl, Emeritus, College of Engineering

- **University of Wisconsin-Madison**
  - Steve Harman
  - Gary Brown
  - Matt Collins
  - Rhonda James
  - Jon Panuska
- **UW-Madison Arboretum**
  - Karen Oberhauser
  - Brad Herrick
  - Michael Hansen
  - Joy Zedler
  - Steve Glass
  - Kevin McSweeney
  - Stormwater Committee-David Liebl
- **City of Madison**
  - Mike Dailey
  - Greg Fries
- **City of Fitchburg**
- **Town of Madison**
- **Wisconsin Department of Transportation**
  - Curt Neuhauser
- **WDOA-DFDM**
  - Jim McMillan
  - Jim Schaefer
  - Kathy Kalscheur
- **Strand Associates, Inc.**
  - Jon Lindert, PM
  - Mike Williams
  - Tim Sina
  - Jim McCarthy, Ecologist
  - Skylar Yaktus
  - Rad Hawkos, LA
  - Luke Hellermann, PG
- **Soils and Engineering Services, Inc.**
  - Duane Reichel
  - Craig Bower

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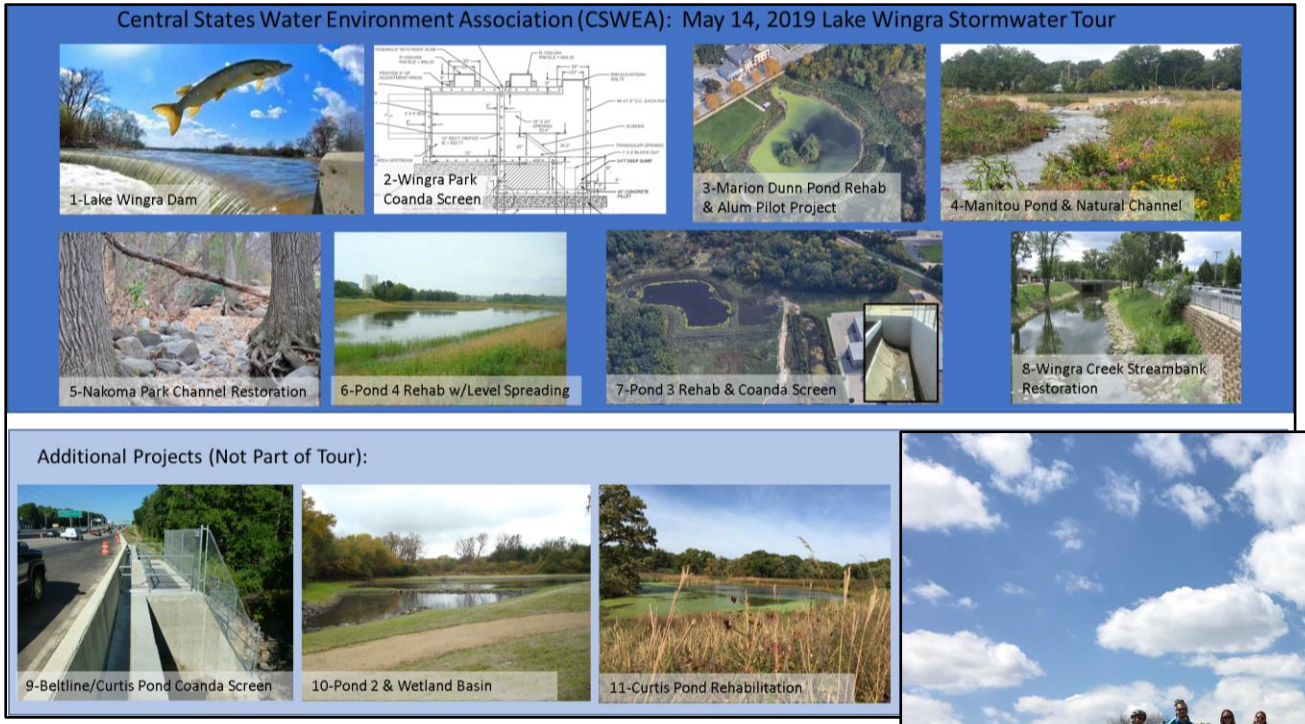
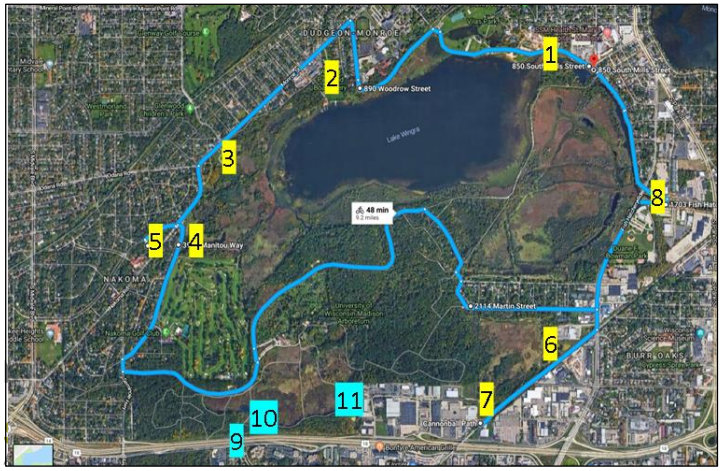
CSWEA Stormwater Bike Tour – May 2019





Key Takeaways

- Sediment disposal location-Beneficial Reuse or to Landfill
- Use low-ground bearing pressure equipment in sensitive areas
- Importance of signage and communication with public
- Rehabilitation of stormwater BMPs eases future maintenance
- Gate off temporary access mat route to RCGMA
- Post-construction survey documents final elevations
- Operation and maintenance plan for future maintenance
- Recommend Contractor Plans for
  - Dewatering
  - Material Management
    - Excavation Staging
    - Sediment Dewatering
    - Material Disposal
  - Traffic Control
- Longevity through listening, excellent service, and relationships

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Questions

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