



North Carolina
Coastal Federation
Working Together for a Healthy Coast



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Lake Mattamuskeet Watershed Restoration Plan

October 16, 2018 Public Meeting

Agenda Overview

7:00 p.m. Welcome

7:05 p.m. Update on Plan Development: Erin Fleckenstein

7:10 p.m. Priority Actions as agreed upon by CST: Michael Flynn

7:20 p.m. Technical Presentations and Research Updates

- Carp removal study: April Lamb
- Conditions of outlet canals: Dr. Randall Etheridge
- Hydrologic modeling of Lake Mattamuskeet: Dr. Randall Etheridge
- Facilitating active water management: Daniel Brinn

8:10 p.m. Next Steps: Michael Flynn

8:15 p.m. Question and Comment Period: Panel

8:30 p.m. Adjourn



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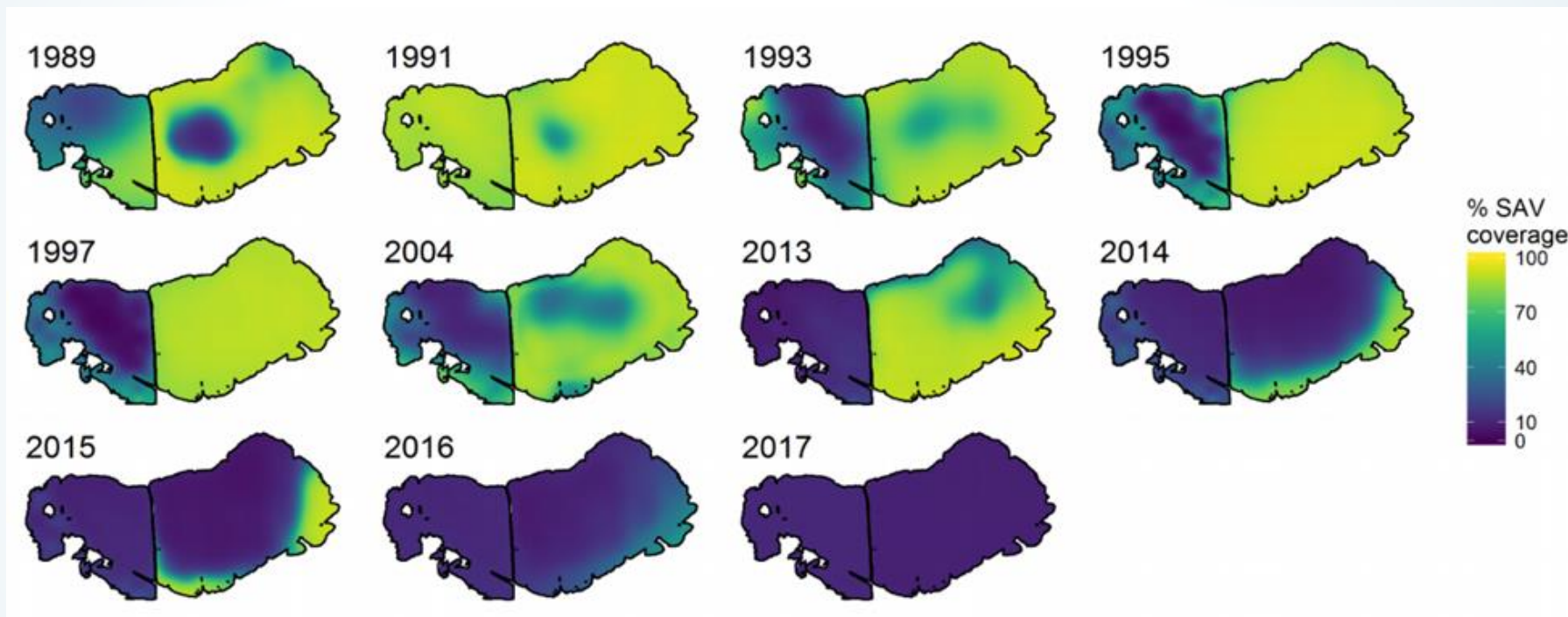
Developing a Watershed Restoration Plan

Concerns about Lake Mattamuskeet



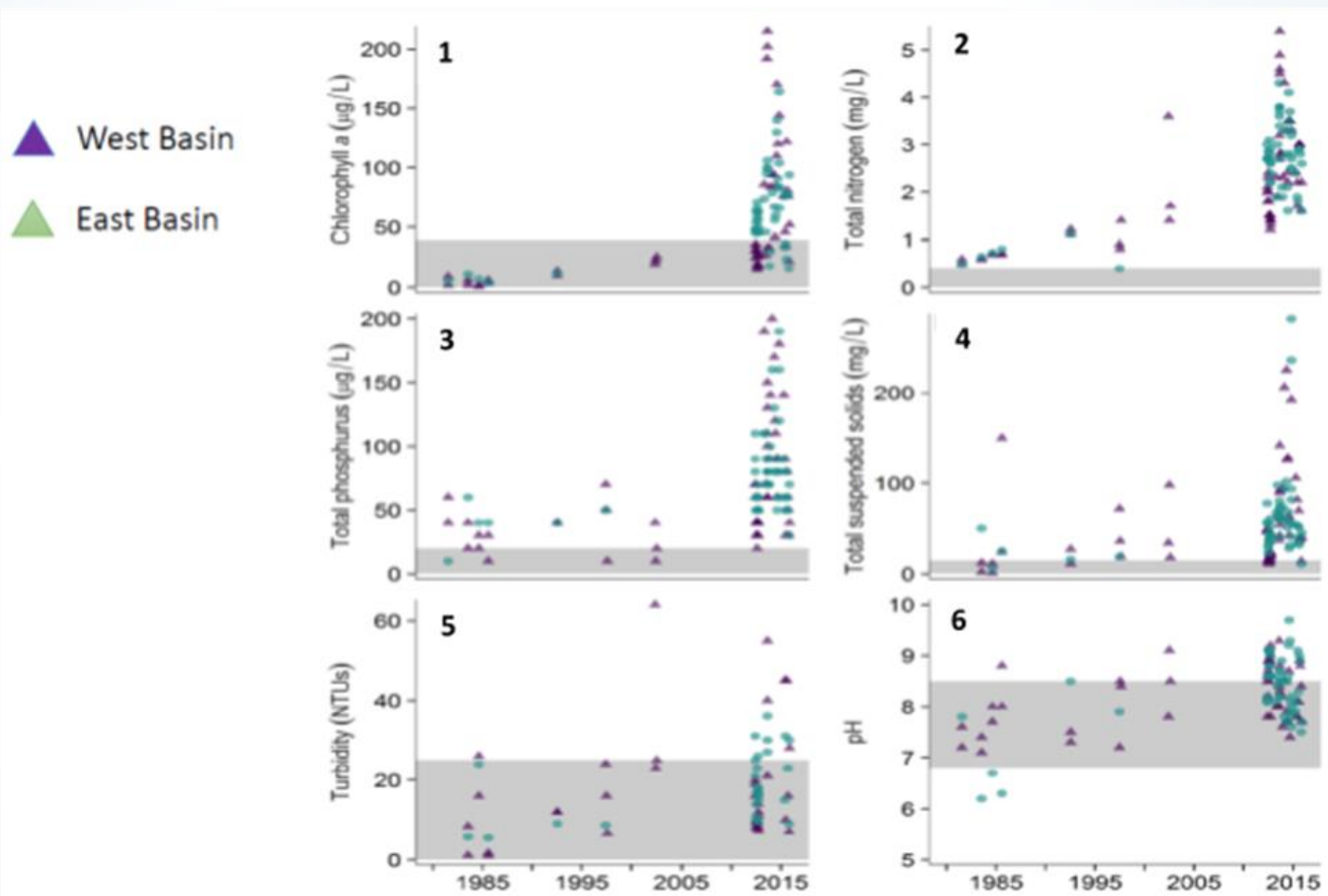
Flooding of Residential and Agricultural Lands

Concerns about Lake Mattamuskeet



Loss of SAV from the Lake by 2017

Concerns about Lake Mattamuskeet



**Lake was listed on NC303(d) list of impaired waters
in 2016 for elevated levels of pH and chlorophyll-*a***

What is a watershed restoration plan?

- A voluntary plan for a specific waterbody
- Identifies pollutants and causes of impairment
- Provides the framework and guidance to restore an impaired waterbody and outlines future action
- Recommends management strategies devised by all stakeholders
- Adaptive plan that can be updated over time
- Once approved, it can be used to secure grant funds for implementation

Key Steps in Developing a Watershed Restoration Plan

Assemble Planning Team

Engage stakeholders and the public in the plan development

Determine Water Quality and Quantity Conditions and Impairments

- Summarize research on the current status and trends of the lake water quality
- Capture oral and written history of changes to or improvements in hydrology around the lake

Complete Watershed Characterization

Establish Plan Goals, Objectives and Action Items

Identify Stormwater Reduction or Water Management Techniques

Analyze impact of solutions

Develop Management Plan including priorities and next steps

Major Progress to Date

Assemble Planning Team

Engage stakeholders and the public in the plan development

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Complete Watershed Characterization

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Develop Management Plan including priorities and next steps

Stakeholder Team

Daniel Brinn- Hyde Drainage

Pete Campbell- U.S. Fish and Wildlife Service

Michael “Slim” Cahoon- Farming Community

Doug Howell- N.C. Wildlife Resources Commission

Art Keeney- Residential Community

Bill Rich- Hyde County Manager

Ben Simmons- Farming Community/Fairfield Drainage

Pat Simmons- Hospitality Industry

J.W. Spencer- Hyde County Soil and Water Board

James “Booboo” Topping- Residential Community

Joey Ben Williams- Impoundments

Working with Stakeholders and the Public

5 Public Meetings

13 Stakeholder Meetings

Webpage for updates and comments:

nccoast.org/lakemattamuskeet

Press Releases

E-mail update after Public Meetings



Watershed Restoration Plan



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Plan Goals

Protect the way of life in Hyde County:

Maintain existing land uses and industries in the watershed (residential, farming, fishing and tourism) and enhance and maintain the health of the lake's natural resources (waterfowl and wildlife).

Plan Goals

Actively manage the lake water level:

Minimize flooding of residential, business, and farm properties. Allow for annual drawdowns to establish and maintain submerged aquatic vegetation within the lake, and to establish and maintain a zone of emergent vegetation around the lake periphery.

Plan Goals

Restore water quality and clarity:

Reduce nutrients, sediments, and phytoplankton blooms, promote the growth of submerged aquatic vegetation and remove the lake from the NC 303(d) list of impaired waters.

Review the Draft Plan

Restoring the Lake Mattamuskeet Watershed

The next Public Meeting for the Lake Mattamuskeet Watershed Restoration Plan is Oct. 16 [EVENT DETAILS](#)

Lake Mattamuskeet is a vital part of the Hyde County's amazing natural and cultural heritage. County residents and visitors treasure this natural resource.

However, the lake faces declining water quality and changing lake levels. In order to address these concerns, Hyde County, the N.C. Wildlife Resources Commission and the U.S. Fish and Wildlife Service have come together to support the development of a watershed restoration plan. In developing this plan, the county and its partners will seek public input to identify issues facing the lake and begin identifying possible management solutions.

When completed, the watershed management plan will explain how the lake should and does function, its current status and health, and identify various practical management options for the lake that help address water quality and flooding issues. These goals, and the actions necessary to achieve them, will be informed by past and ongoing scientific studies as well as local knowledge and experiences.

To work toward identifying management solutions the North Carolina Coastal Federation will help the county and its partners develop the plan. The federation previously worked with Hyde County landowners to develop a watershed restoration plan for about 43,000 acres of farmland and wetlands situated north of Engelhard. That plan has worked well in helping to address both drainage and environmental needs for the property owners.

As part of plan development, there will be six quarterly public meetings that will allow the public to discuss long-term solutions. The public meetings will be held in the multipurpose room at the Hyde County Government Complex in Swan Quarter at 7 p.m.

The next public meeting will be held on Oct. 16. [Click here to read the agenda.](#)

Upcoming Events

TUE 16	Public Meeting for Lake Mattamuskeet Watershed Restoration Plan October 16 @ 7:00 pm - 8:30 pm
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[View More...](#)

Resources

- 1 Draft watershed restoration plan
- 2 Want to get more involved in the planning process? [Click here.](#)
- 3 Draft goals for the watershed restoration plan, updated December 2017
- 4 Information about the stakeholder group for the watershed restoration plan
- 5 Timeline of changes to the lake



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nccoast.org/lakemattamuskeet

Submit Comments Online

Submit Comments and Subscribe to Lake Mattamuskeet updates

Email *

First Name

Last Name

County

Please leave a comment for the watershed restoration planning team here. Please understand that the comments will be provided to the stakeholder team for their consideration. Comments received will not necessarily receive a personal response, but all will be taken into consideration in the development of watershed management strategies for the Lake watershed.

Notes

Submit

In The News

- ["Restoring Lake Mattamuskeet In North Carolina"](#) — June 29, 2017. U.S. Fish and Wildlife Service.
- ["Secrets of Lake Mattamuskeet"](#) — NC Science Now | UNC-TV
- ["Where Has the Grass Gone?"](#) — Wildlife in North Carolina, November/December 2016. Printed by N.C. Wildlife Resources Commission.

Additional Resources

- [Study Shows New Flap Gates at Lake Mattamuskeet Bring Minimal Water Flow Change](#) — N.C. Wildlife Resources Commission
- [Mattamuskeet National Wildlife Refuge Website](#) — U.S. Fish and Wildlife Service
- [Updates on current and historic status of the lake's ecosystem and wildlife](#) — U.S. Fish and Wildlife Service
- [Continuous Water-Quality Monitoring at Lake Mattamuskeet, North Carolina](#) — U.S. Geological Survey
- [Mattamuskeet Foundation](#)



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Lake Mattamuskeet Watershed Restoration Plan

Priority Actions

Current State of the Lake and Watershed

1. No active management of lake level other than tide gates
 - Flooding of residential property, septic system failures, & inadequate drainage of croplands
2. Turbid and hypereutrophic water (excessive nutrient levels)
 - Frequent phytoplankton & cyanobacteria blooms
3. SAV coverage is absent along lakebed
4. Minimal emergent vegetation
5. Abundance of common carp
6. Listed on NC 303(d) list of impaired waters
 - Chl-*a* (40 µg/l, AL, NC)
 - pH (8.5, AL, SW)

Desired State of the Lake and Watershed

1. Active management of lake level in addition to tide gates
 - Less frequent flooding of residential property
 - Fewer septic system failures & adequate drainage of croplands
2. Clear and mesotrophic water (moderate nutrient levels)
 - Fewer phytoplankton & cyanobacteria blooms
3. Increased SAV abundance along lakebed
4. Increased emergent vegetation
5. Reduced common carp populations
6. Increased game fish and blue crab populations
7. Removal from the NC 303(d) list of impaired waters
 - Chl-*a* and pH within federal and state guidelines

Priority Actions

- Create a governing body that provides managing authority and a process for active water management.
- Perform hydrologic study of the watershed.
- Engineer for active water management of the lake watershed.
 - Infrastructure Improvements
 - Additional Outlet Evaluation
 - Potential Sheet Flow Sites

Priority Actions

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**Lake Mattamuskeet Watershed:
Potential Sheet Flow Application Sites**

Legend:

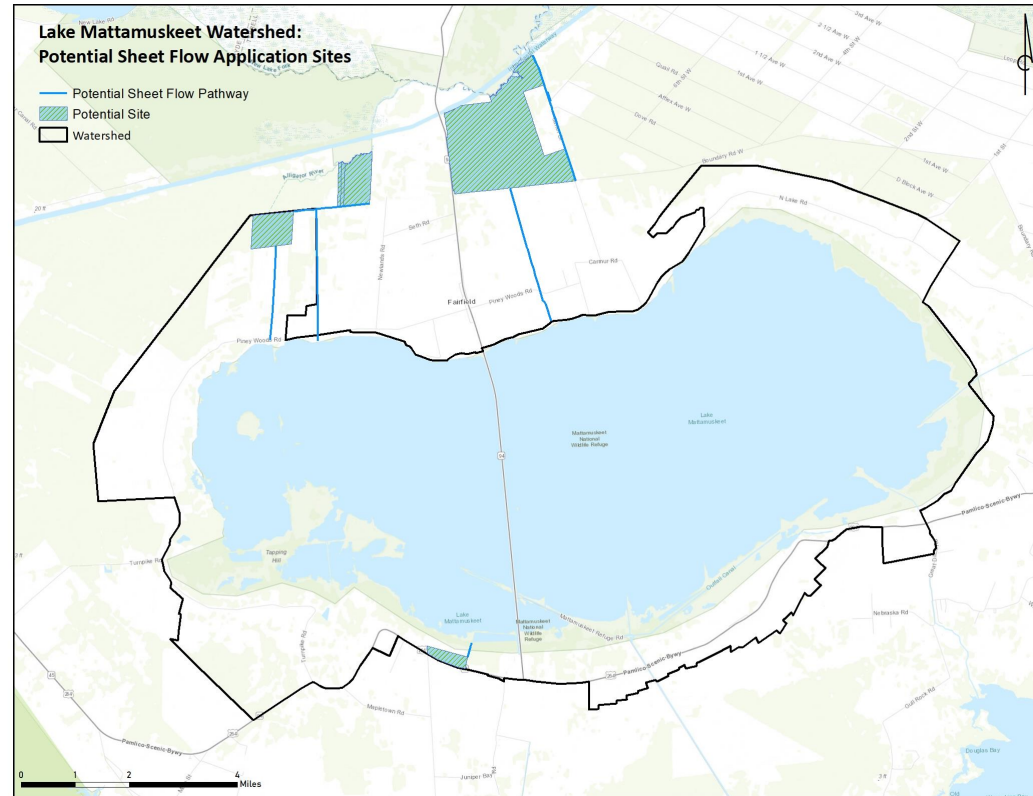
- Potential Sheet Flow Pathway (Blue line)
- Potential Site (Green hatched area)
- Watershed (Black outline)

The map displays the Lake Mattamuskeet Watershed, a large body of water surrounded by land. The watershed boundary is marked by a thick black line. Several roads are shown, including US Highway 1, NC Highway 12, and various local roads like Gravel Rd, 1st Ave W, 2nd Ave W, 3rd Ave W, 4th Ave W, 5th Ave W, 6th Ave W, 7th Ave W, 8th Ave W, 9th Ave W, 10th Ave W, 11th Ave W, 12th Ave W, 13th Ave W, 14th Ave W, 15th Ave W, 16th Ave W, 17th Ave W, 18th Ave W, 19th Ave W, 20th Ave W, 21st Ave W, 22nd Ave W, 23rd Ave W, 24th Ave W, 25th Ave W, 26th Ave W, 27th Ave W, 28th Ave W, 29th Ave W, 30th Ave W, 31st Ave W, 32nd Ave W, 33rd Ave W, 34th Ave W, 35th Ave W, 36th Ave W, 37th Ave W, 38th Ave W, 39th Ave W, 40th Ave W, 41st Ave W, 42nd Ave W, 43rd Ave W, 44th Ave W, 45th Ave W, 46th Ave W, 47th Ave W, 48th Ave W, 49th Ave W, 50th Ave W, 51st Ave W, 52nd Ave W, 53rd Ave W, 54th Ave W, 55th Ave W, 56th Ave W, 57th Ave W, 58th Ave W, 59th Ave W, 60th Ave W, 61st Ave W, 62nd Ave W, 63rd Ave W, 64th Ave W, 65th Ave W, 66th Ave W, 67th Ave W, 68th Ave W, 69th Ave W, 70th Ave W, 71st Ave W, 72nd Ave W, 73rd Ave W, 74th Ave W, 75th Ave W, 76th Ave W, 77th Ave W, 78th Ave W, 79th Ave W, 80th Ave W, 81st Ave W, 82nd Ave W, 83rd Ave W, 84th Ave W, 85th Ave W, 86th Ave W, 87th Ave W, 88th Ave W, 89th Ave W, 90th Ave W, 91st Ave W, 92nd Ave W, 93rd Ave W, 94th Ave W, 95th Ave W, 96th Ave W, 97th Ave W, 98th Ave W, 99th Ave W, 100th Ave W. The map also shows several potential sheet flow pathways (blue lines) and potential sites (green hatched areas) for sheet flow application. A scale bar at the bottom left indicates distances up to 4 miles. A north arrow is located in the top right corner.

2,477 acres outside watershed

Currently seeking additional sites for evaluation.

Potential Sheet Flow Sites

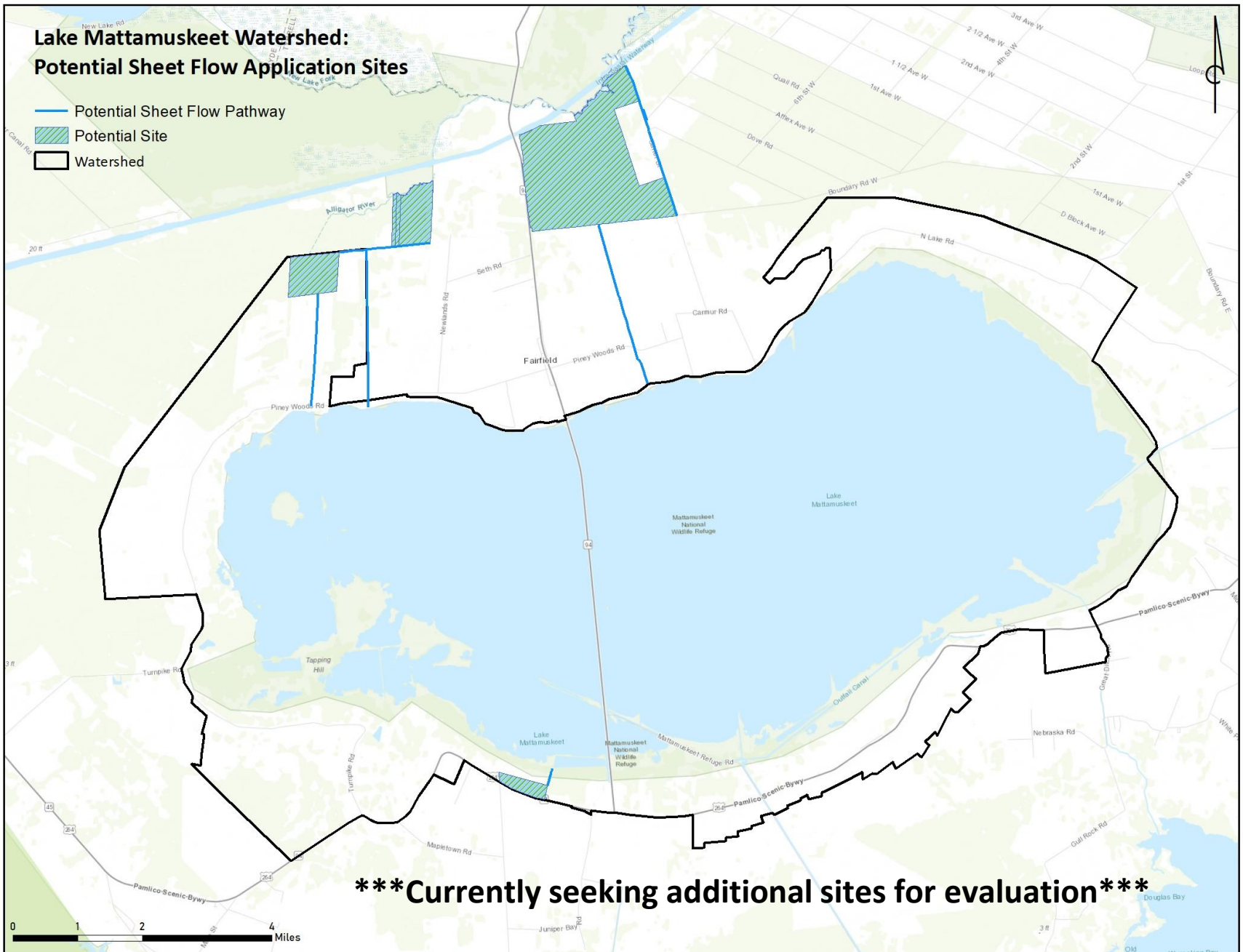


Benefits include:

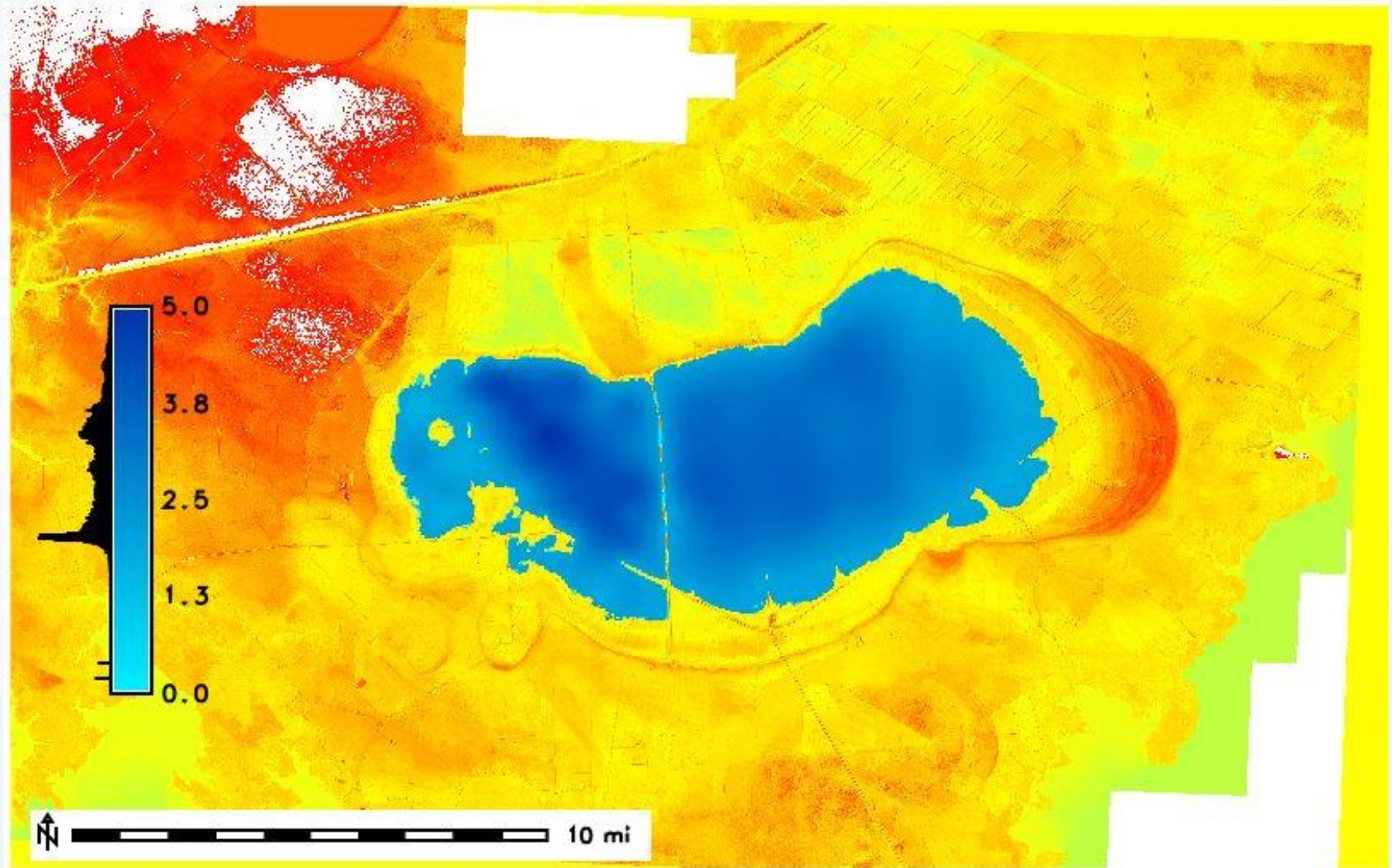
- Water quality treatment
- Restoring the natural hydrology
- Reduction of water volume draining to the lake

Lake Mattamuskeet Watershed: Potential Sheet Flow Application Sites

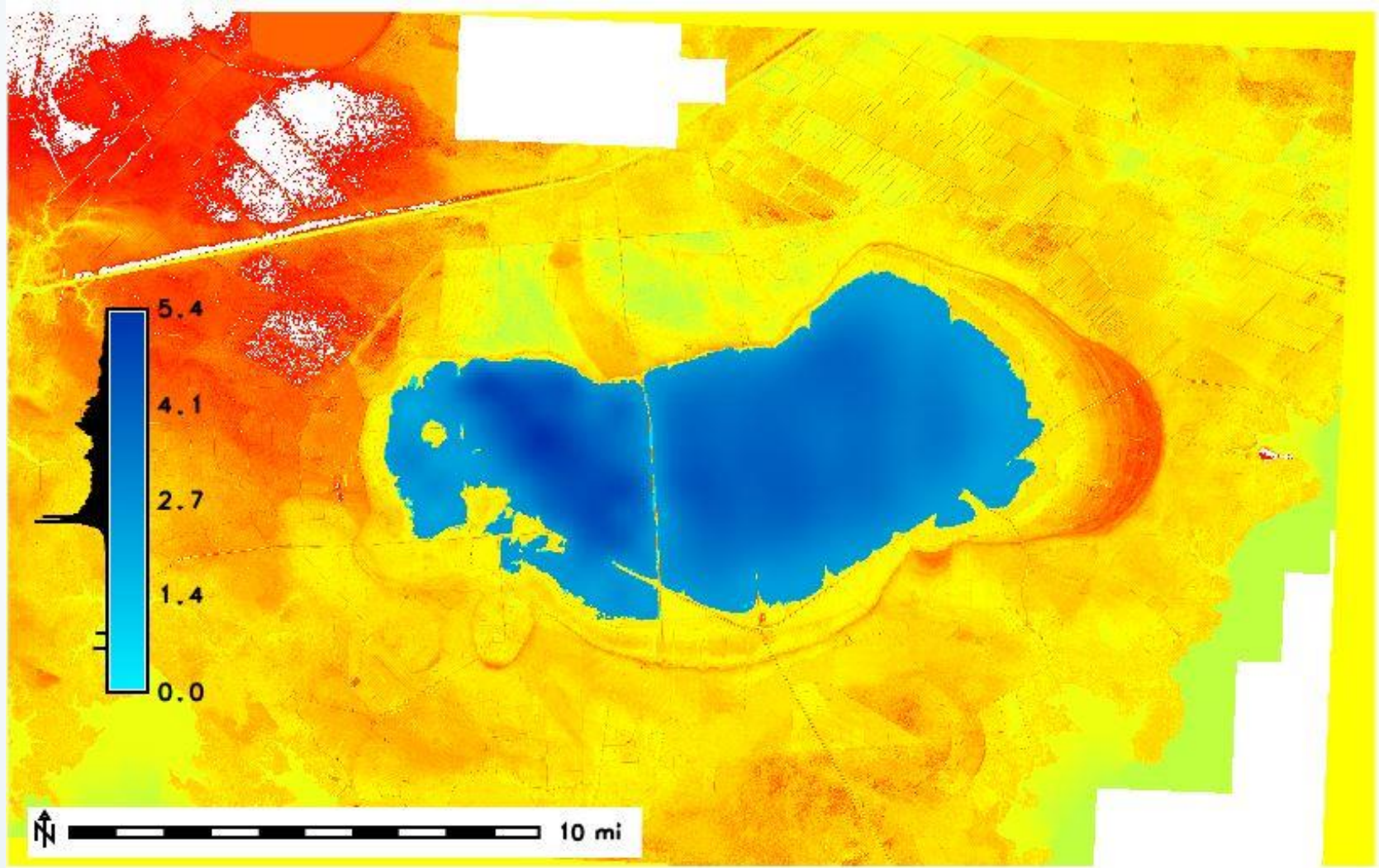
- Potential Sheet Flow Pathway
- Potential Site
- Watershed



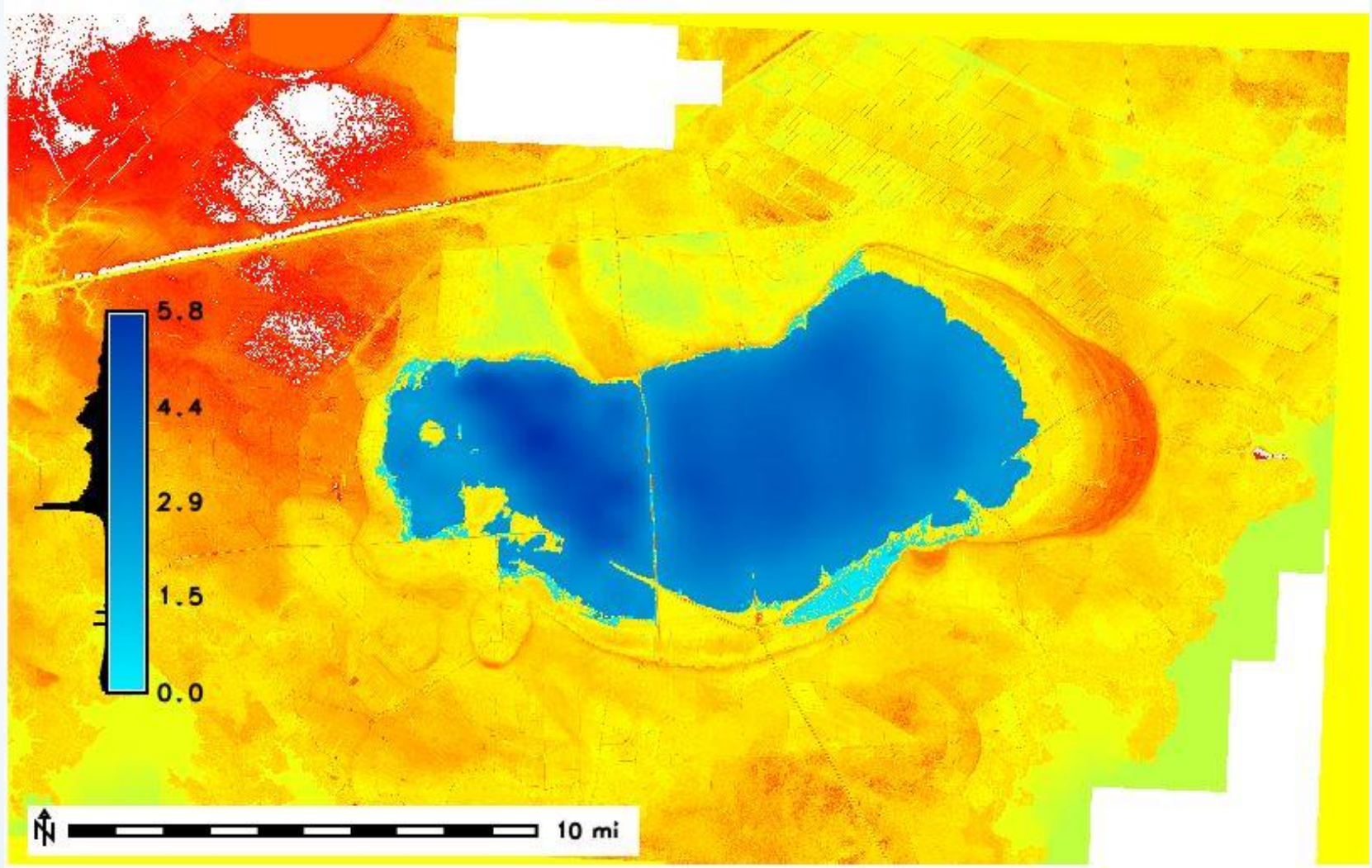
Water Level = -0.3 ft (MSL)



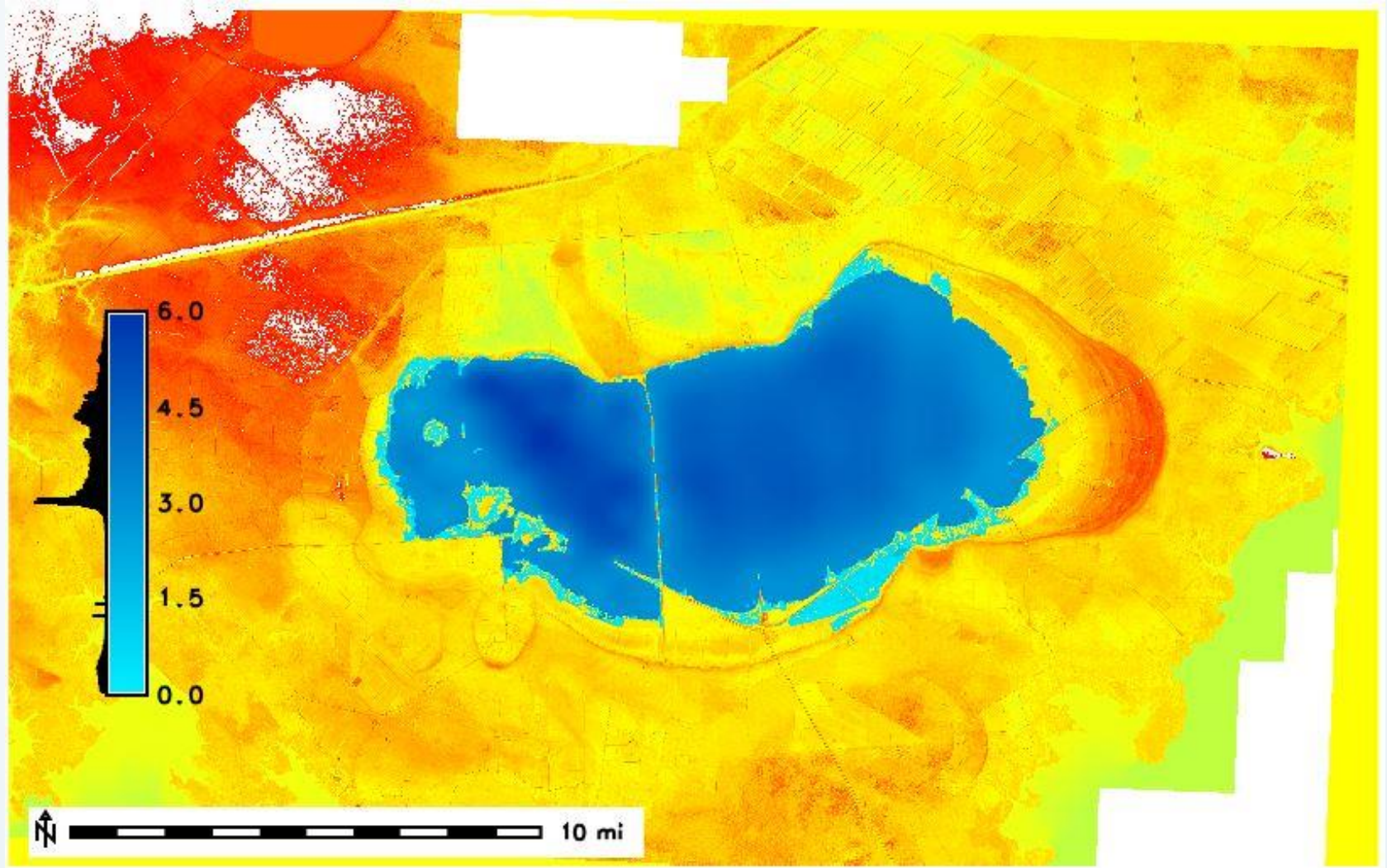
Water Level = 0.1 ft (MSL)



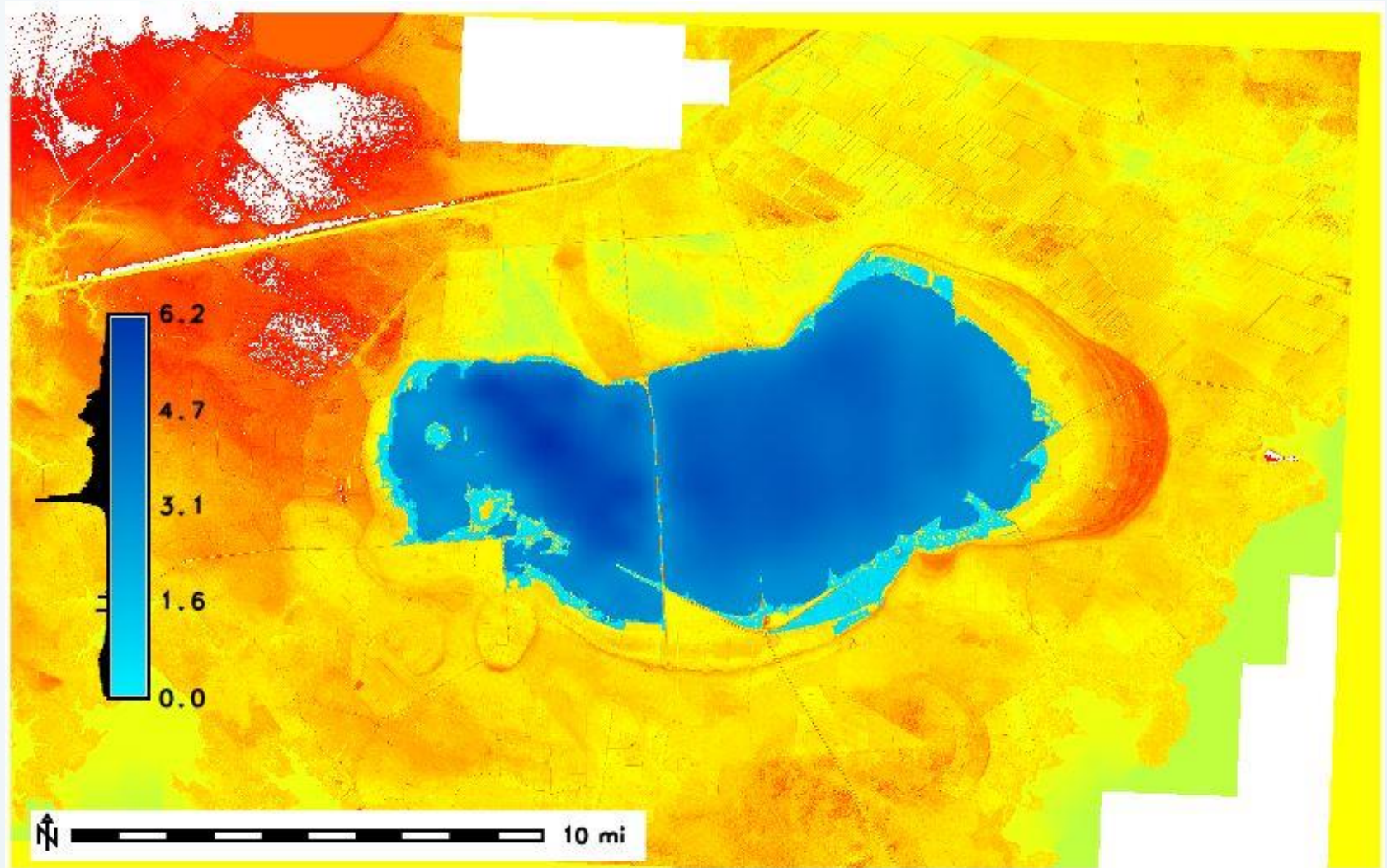
Water Level = 0.5 ft (MSL)



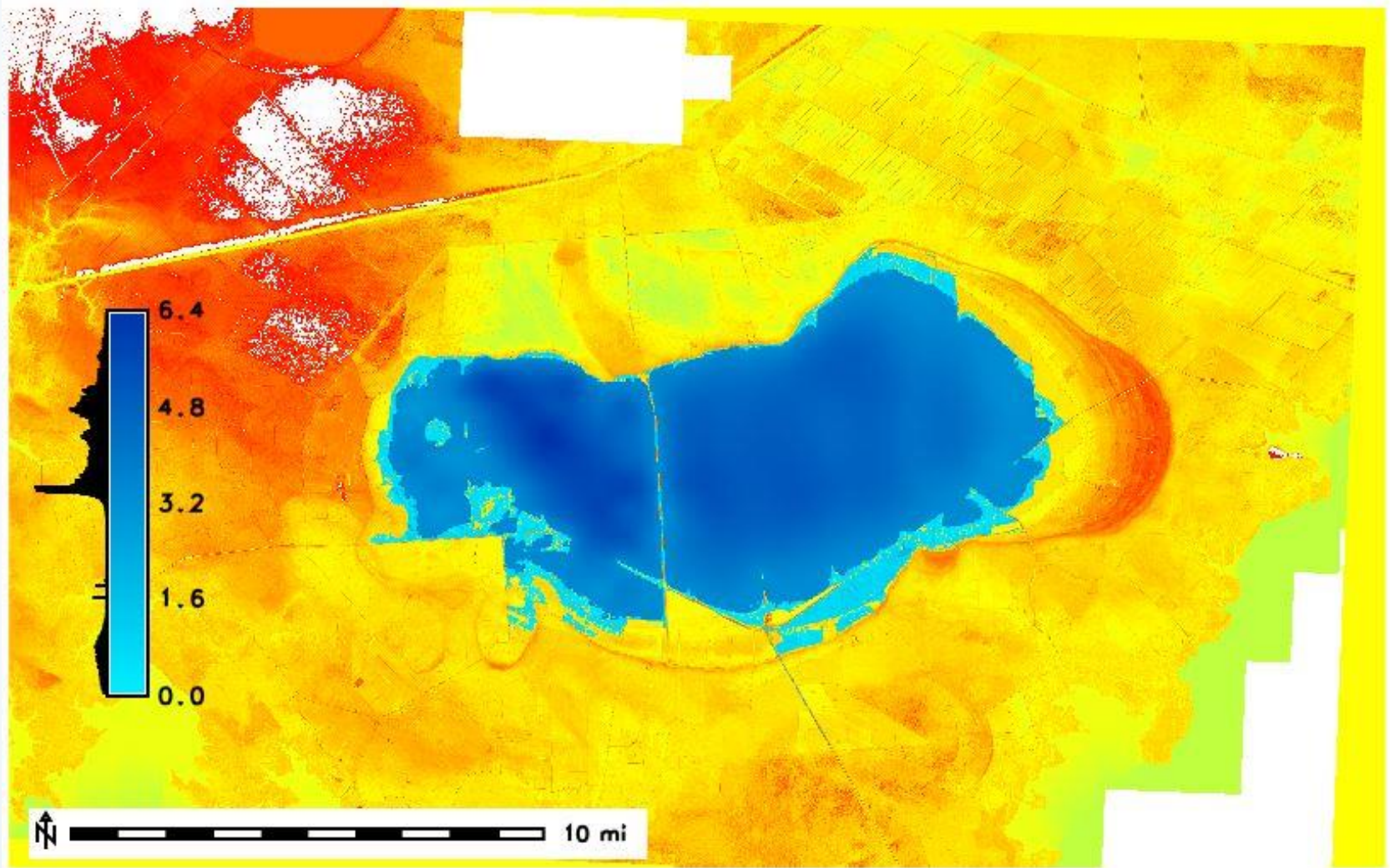
Water Level = 0.7 ft (MSL)



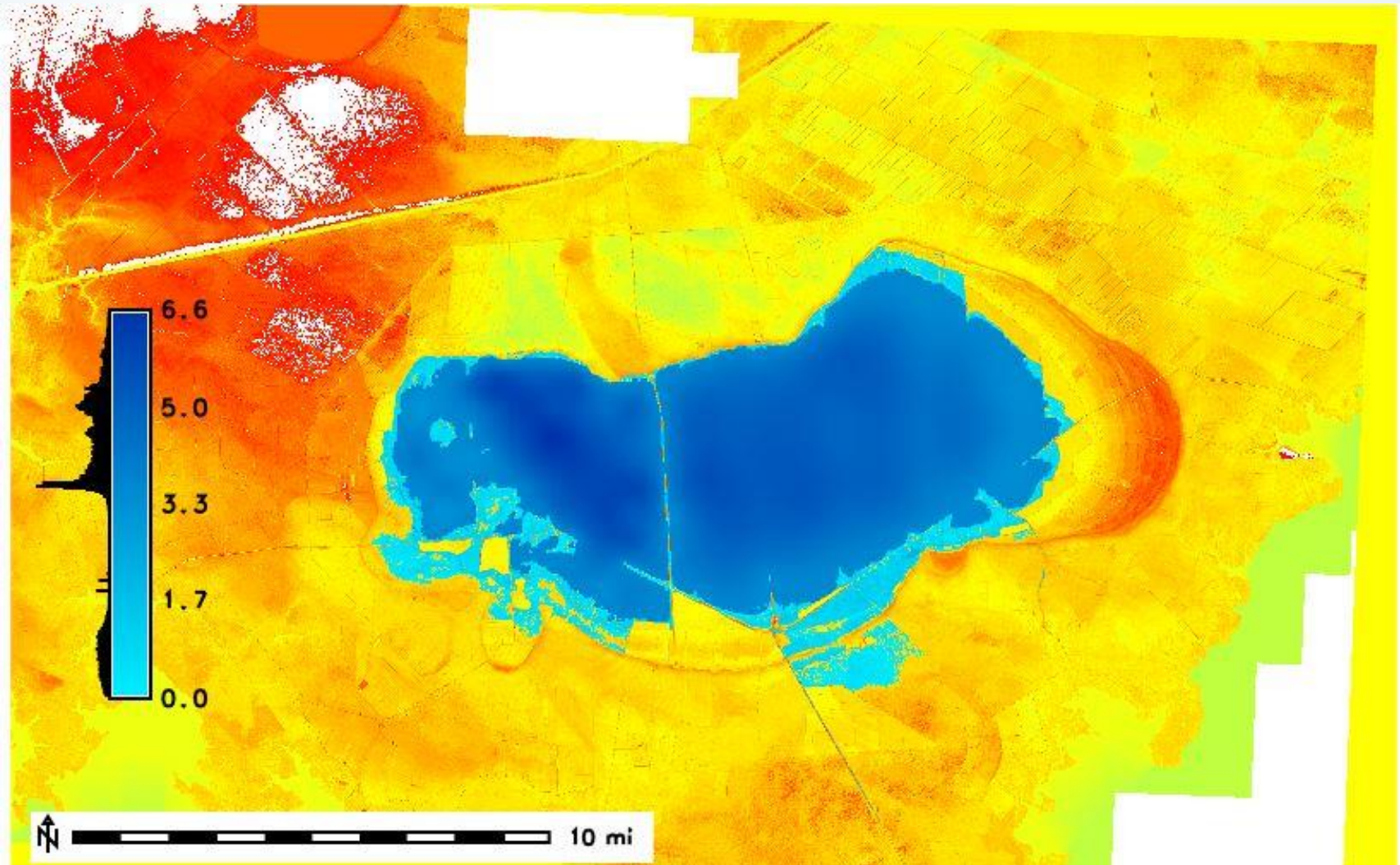
Water Level = 0.9 ft (MSL)



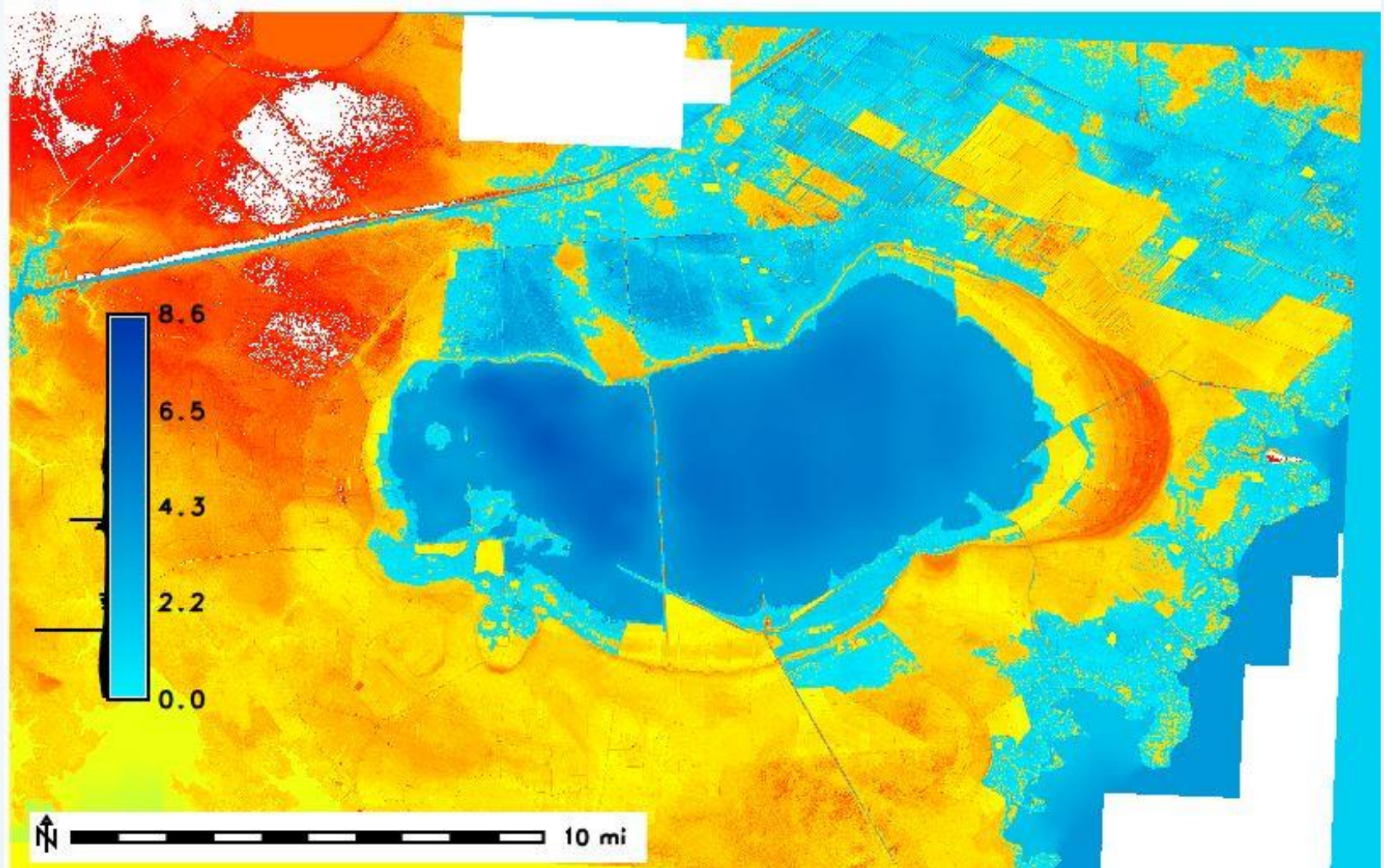
Water Level = 1.1 ft (MSL)



Water Level = 1.3 ft (MSL)



Water Level = 1.5 ft (MSL)





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Lake Mattamuskeet Watershed Restoration Plan

Technical Presentations and Research Updates

Evaluating the Feasibility of Common Carp Exclusion and Targeted Vegetation Restoration in Lake Mattamuskeet

April D. Lamb and Jesse R. Fischer

North Carolina State University, Department of Applied Ecology





**NC STATE
UNIVERSITY**



April D. Lamb

M.S. student in Applied Ecology
NSF Graduate Research Fellow

Dr. Jesse R. Fischer

Assistant Professor in Applied Ecology

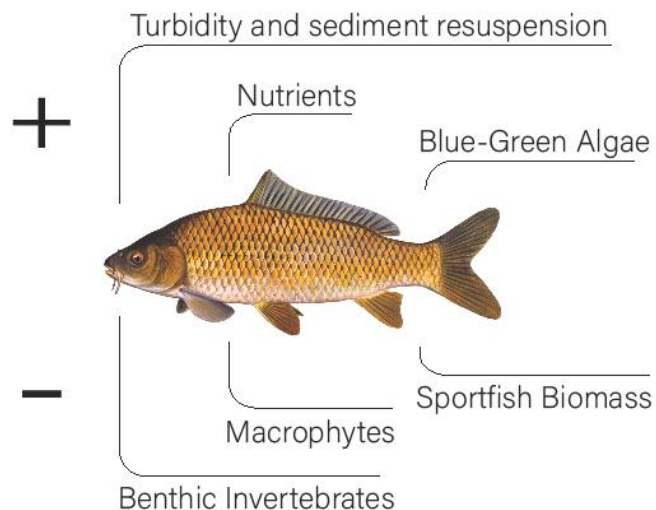
- **Not** to be confused with **Grass Carp**, which eat living aquatic vegetation
- Or **Crucian Carp**, which are essentially goldfish that have been introduced into systems
- Or **Silver Carp**, **Bighead Carp**, or other Asian “carp” which are invasive in the US



None of these fish are in Lake Mattamuskeet

How do Common Carp impact shallow lakes?

- Affect both “top-down” (predator abundance) and bottom-up (phytoplankton levels) biological processes



The history of Common Carp in Lake Mattamuskeet



COMMERCIAL CARP REMOVAL AT LAKE MATTAMUSKEET, NORTH CAROLINA

Willie G. Cahoon¹

U. S. Fish and Wildlife Service, New Holland, North Carolina

Lake Mattamuskeet is famous as a National Wildlife Refuge for a wintering concentration of swans, Canada geese and ducks. The 50,000-acre lake is located in Hyde County, North Carolina, seven miles north of Pamlico Sound. Prior to 1915 the lake was an open body of water with no obstructions to mar the surface. The marsh was limited to a narrow band of low flats on the south shore. There was only one small outlet canal draining this vast area.

In 1915 the lake was purchased by a stock company and the largest pumping plant in the world, at that time, was installed. The lake was drained and approximately 20,000 acres were reclaimed for farm lands. Except for short periods, these lands were cultivated until the fall of 1932, when the lake refilled after financial failure of the drainage project.

On October 30, 1934 the Federal Government purchased the lake as a wintering ground for migratory waterfowl. After the refuge was established improvements were begun to manage the area for the purpose desired. More canals were constructed to secure drainage by gravity, not only for the purpose of influencing plant life in the marsh, but also to assist crop production on

adjacent private farm lands. An earthen causeway, with five bridges, constructed in 1941-42, more or less divides the lake in halves.

At present, levels are controlled by gates on six canals draining into Pamlico Sound. The lake receives no creek or river drainage, being fed by runoff and agricultural drainage from the surrounding watershed. The open water consists of approximately 30,000 acres, bordered by 20,000 acres of marsh and upland. It is the practice to lower the lake water level during the growing season to expose shorelines as early in the spring as possible for proper growth of native emergent waterfowl food-plants. The number of waterfowl utilizing the area has increased substantially as a result of this drawdown.


Until 1949 the lake water was so turbid that submerged aquatic plants could not exist. Secchi disc visibility in the lake proper was approximately six inches in waters that averaged three feet deep. The salt content of the open lake for the past five years averaged 875 p.p.m. chlorides, or 2.5% sea strength. After the first agricultural drainage the fish population naturally was reduced to a minimum; but, subsequent to the 1932 water rise, there developed a tremendous population of largemouth bass, crappie and white perch, which provided excellent sport-fishing. Since 1937 the lake fishery

¹ Appreciation is expressed to W. P. Baldwin, U. S. Fish and Wildlife Service, for assistance in the preparation of this article.

Is removal an option?

- Common Carp removal has been shown to increase water clarity and facilitate the re-emergence of aquatic vegetation
- But is this a “one and done” fix?
 - If not enough carp are removed, they may bounce back even stronger, because Common Carp are excellent at surviving and producing offspring
- A carp management plan is critical to ensuring that population numbers remain at a manageable level





This project aims to investigate the role of Common Carp in the regime shift observed at Lake Mattamuskeet and assess the feasibility of Common Carp removal as a restoration strategy for submerged aquatic vegetation.

Large-scale Common Carp Removal Experiment

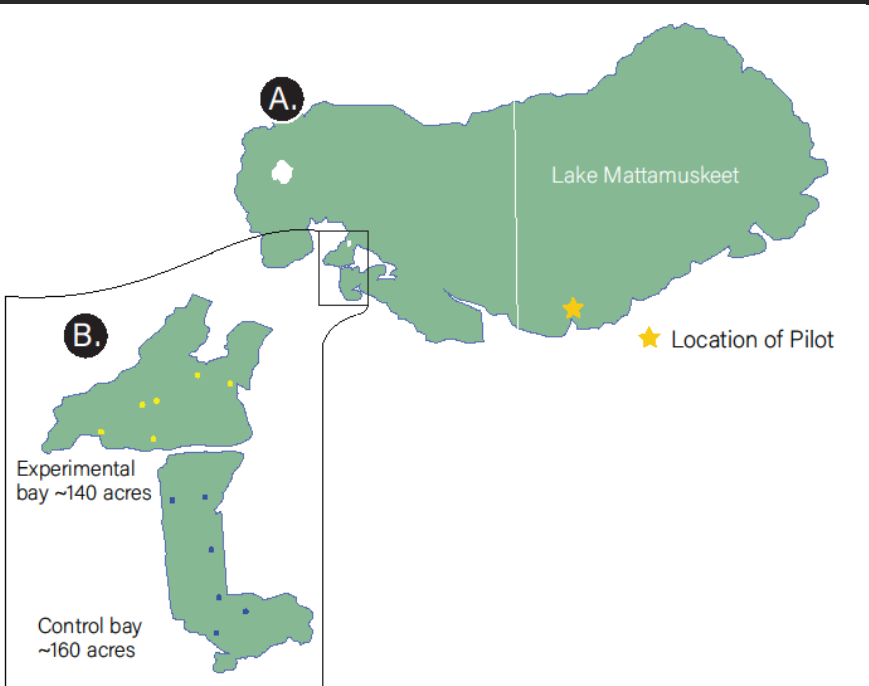


Prototype carp fence (Oct 2017 – March 2018)



- Constructed using galvanized steel cattle panels
- Panels attached using wire connectors and overlaid with chicken wire using zip-ties
- Left standing overwinter to test structural integrity of materials

Site selection



Rose Bay Canal →



Construction the full-scale carp fence



Public notices



- Signs are posted at the Rose Bay Boat Ramp and the Osprey Nest Campground Boat Ramp
- Restricted area signs are placed at each fenced off entrance to the control bay

Carp fence post Hurricane Florence



How many carp are in the bay?

- Simple mark-recapture to estimate population density
- 200 fish captured from outside experimental bay
- Fish were marked via a caudal, or tail, fin clip
- Fish were held for 24 hours before being released in NE, NW, SE, SW corners of the bay
- Then given a 48 hour adjustment period before recapture attempt



Density Estimate

- Three days
- Five electrofishing boats
- Seven WRC biologist from five districts
- 15+ volunteers from NC State, Mattamuskeet NWR, and Pocosin Lakes NWR
- 33 Total hours of “pedal-down” time



Density Estimate - Results

Day	Effort (hours)	Captures	Average Weight (kg)	Average Length (mm)	Recaptures
1	10.01	78	2.07	538.2	8
2	11.25	68	2.09	545.0	1
3	12.22	61	2.13	545.0	3
Total	33.48	207	2.09	542.4	12

$$\hat{N} = \frac{MC}{R}$$

N = true population size M = marked
C = total capture R = total recaptures

- Length, weight, and DNA sample taken for all individuals
- Using the Lincoln-Peterson Index (left) we estimate there to be **3,200** individuals, or 10/ha, present in the embayment.

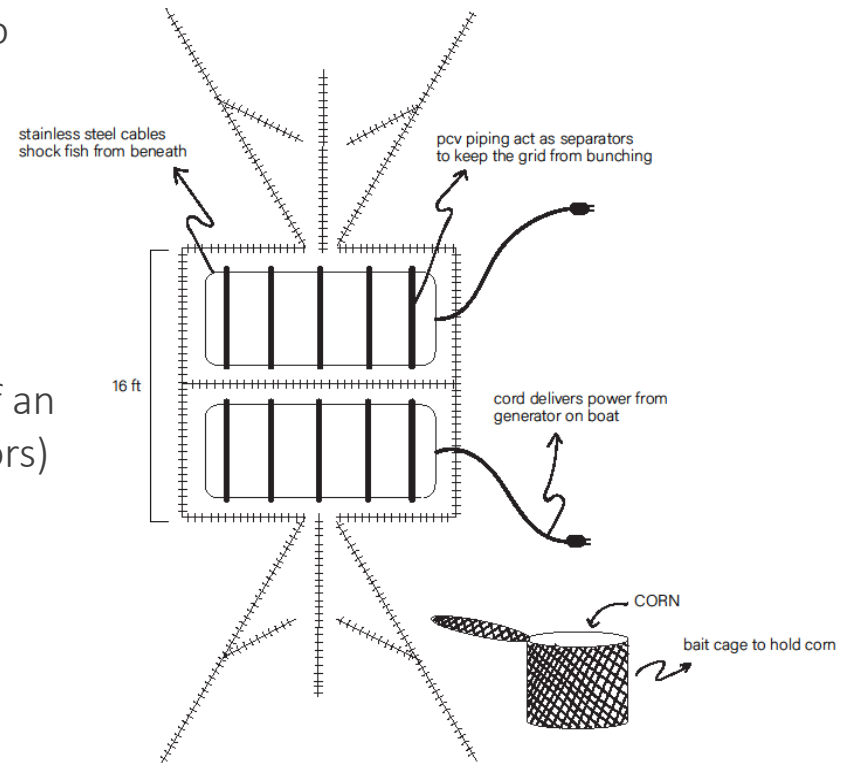
Complications

- 3,200 is a lot of Common Carp
- Electrofishing shown to be **inadequate** for large-scale removal
- Potential complications during sampling
 - Weather conditions (> 90 degree F)
 - Carp are sensitive to sound
 - Difficult to reach all areas of the embayment due to phragmites coverage

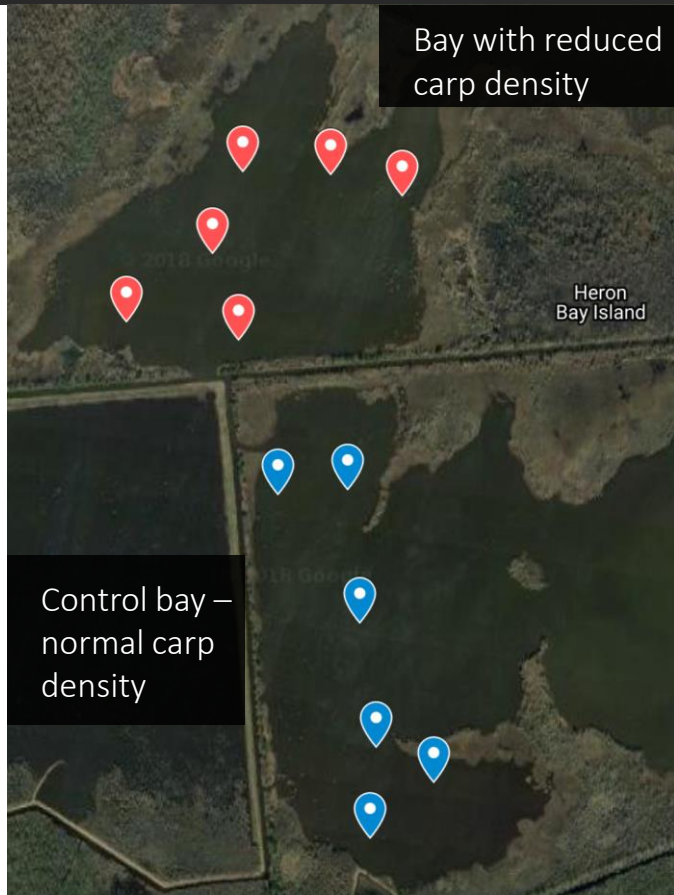


Removal Alternatives

- Currently, we're baiting "carp traps" with deer corn to specifically target Common Carp
 - Two traps to date, but more will be built
 - Only Common Carp and catfish will eat corn
 - Will be modifying to limit corn loss and chance of an encounter from unwanted predators (e.g. alligators)
 - Alternative bait options: dog food, soybean cake



Water Quality Monitoring



- Sampling sites chosen randomly in ArcGIS under given constraints
 - 50 m from documented osprey nests
 - 10 m from shore
- Water samples will be taken monthly and will be analyzed for the following parameters

Physical and Chemical Water Quality Parameters

Chlorophyll <i>a</i>	Temperature
Total Phosphorous	Dissolved Oxygen
Orthophosphorous	pH
Nitrate	Salinity
Nitrite	Conductivity
Ammonia	
Turbidity	
Suspended Solids	

Temperature and light attenuation will be measured continuously using Hobo™ data loggers

Vegetation Revegetation Experiment

- Species chosen based on
 - **ecosystem value**
 - *Vallisneria americana* – Wild celery
 - **biological characteristics** – increased survival in turbid system
 - *Nymphaea odorata* – White waterlily
- Plots will be fully caged to help vegetation establish easier
 1. Prevents Common Carp from uprooting
 2. Prevents turtles and birds from snacking
- Plant health and growth will be measured monthly using a combination of destructive and non-destructive sampling techniques

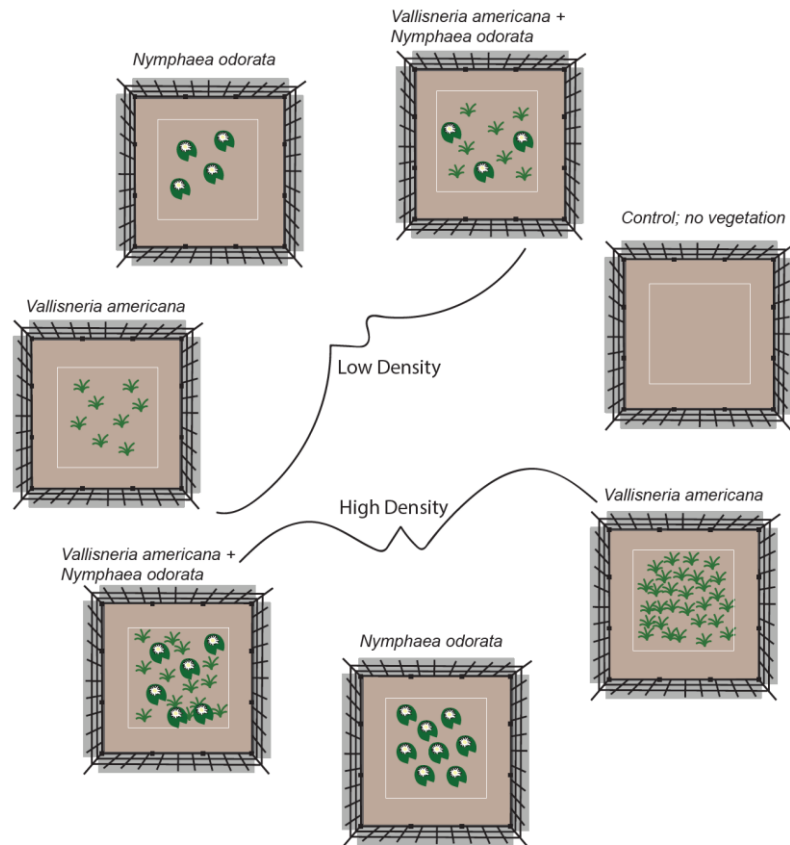


*Vallisneria
americana*



Nymphaea odorata

Vegetation Restoration Experiment



- 12 total revegetation “clusters”
 - 6 in bay with reduced carp biomass (fence)
 - 6 in control bay (no fence)
- 72 total cages planned with vegetation
- Cages are being built this fall
- Planting will be in early Spring 2019
 - If you’re interested in volunteering to help us transplant and plant vegetation please see me after the meeting.

Vegetation Restoration Experiment



Public Notices



- Additional signage (shown here) will be placed at each vegetation cluster in the control bay
- We kindly ask that people do not interfere or tamper with these plots in any way.

Special thanks to our supporters
and collaborators from:



**NC STATE
UNIVERSITY**



-Funding for this project has been provided by:

NSF Graduate Research Fellowship Program
Mattamuskeet National Wildlife Refuge
USFWS Inventory and Monitoring Fund
USFWS Migratory Bird Fund



**THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL**



Flow Reduction of Lake Mattamuskeet Outlet Canals

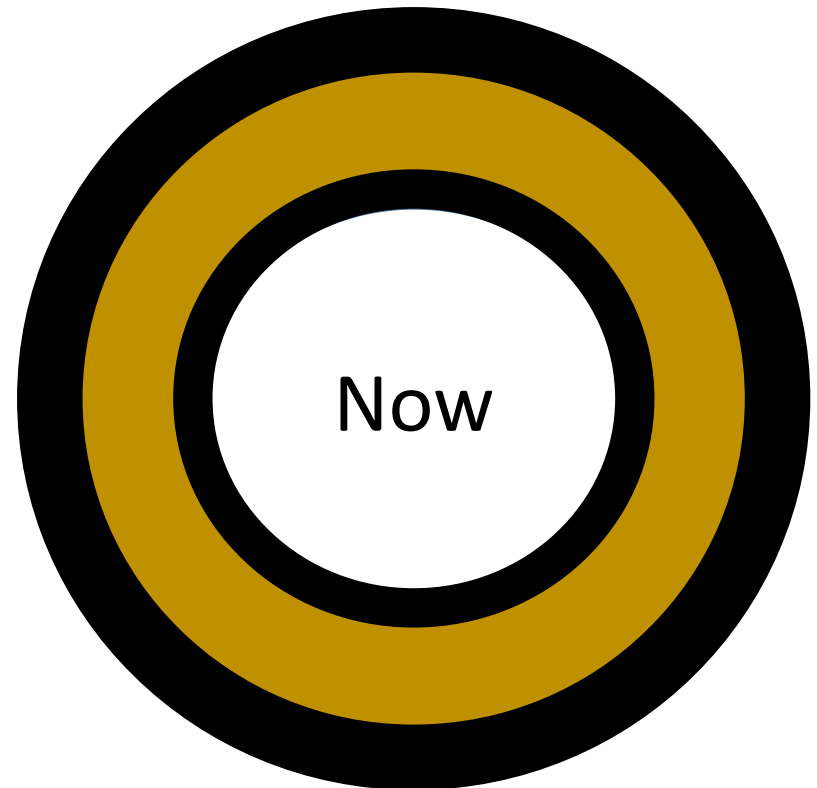
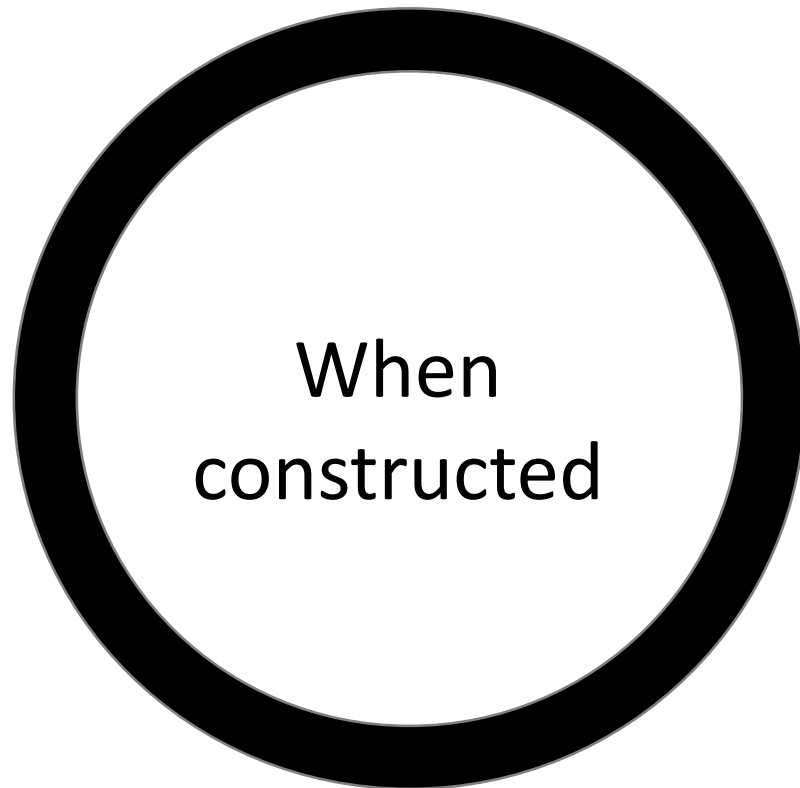
October 16, 2018

Randall Etheridge
East Carolina University
Department of Engineering, Center for Sustainable Energy and
Environmental Engineering

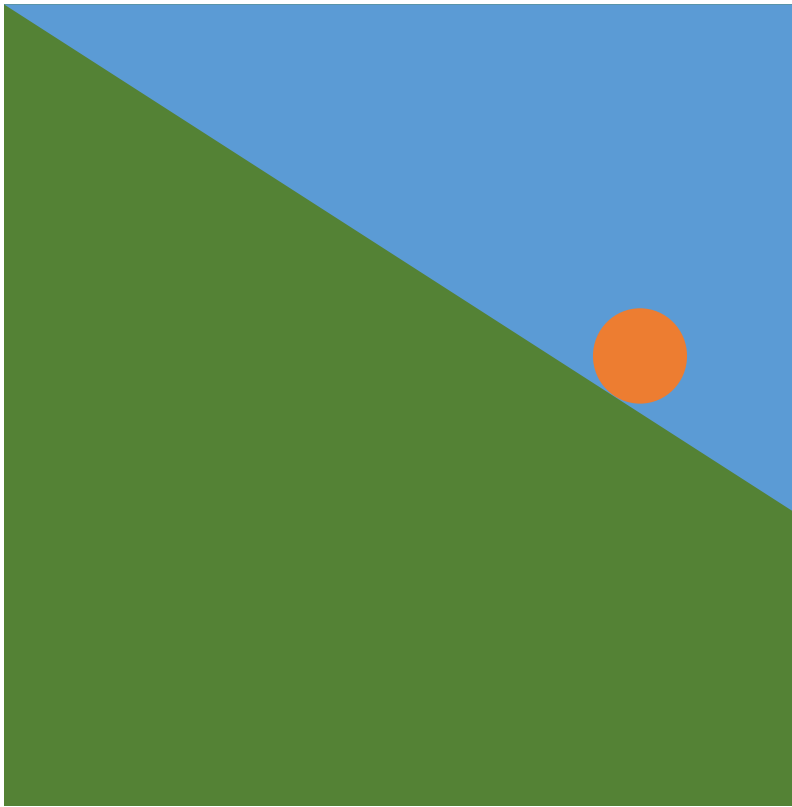
In partnership with:
Hyde County Soil & Water Conservation District



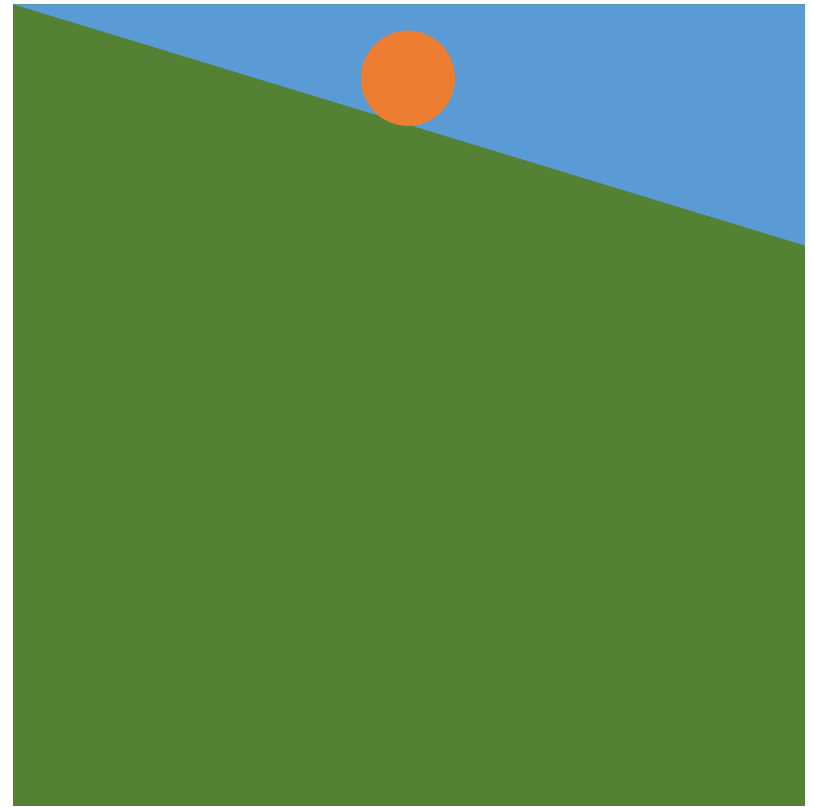
Sedimentation



Sea Level Rise



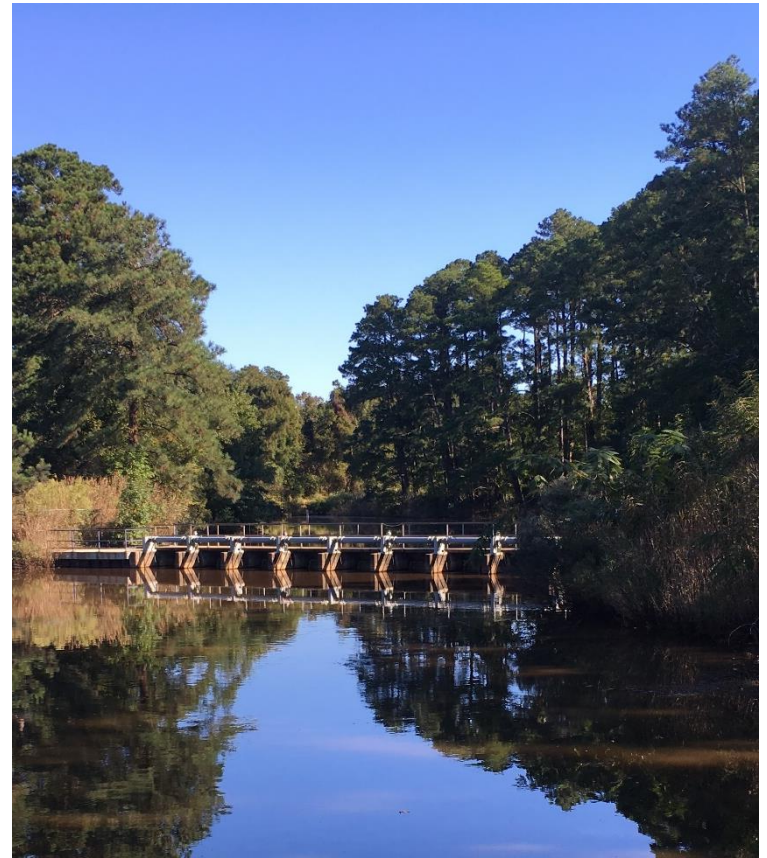
When constructed



Now

Tide Gates

- Flow occurs only when water level in the lake is above water level in the sound
- Dredging will have minimal impact on when tide gates are open



Goals for study

- Use a model to determine how much sedimentation has reduced the flow in the four outlet canals
- Use a model to determine how much sea level rise has and will continue to reduce flow in the outlet canals
- Simulate the impact of dredging the canals on lake water levels during Hurricane Joaquin (2015) and Hurricane Matthew (2016)

Methods

- Current canal dimensions
 - surveying
- Original canal dimensions
 - Drainage Record Book 1 for Outfall and soil probe for others
- Only takes into account portion of canal between tide gate and sound



Methods

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- Original canal dimensions
 - Drainage Record Book 1 for Outfall and soil probe for others
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Methods



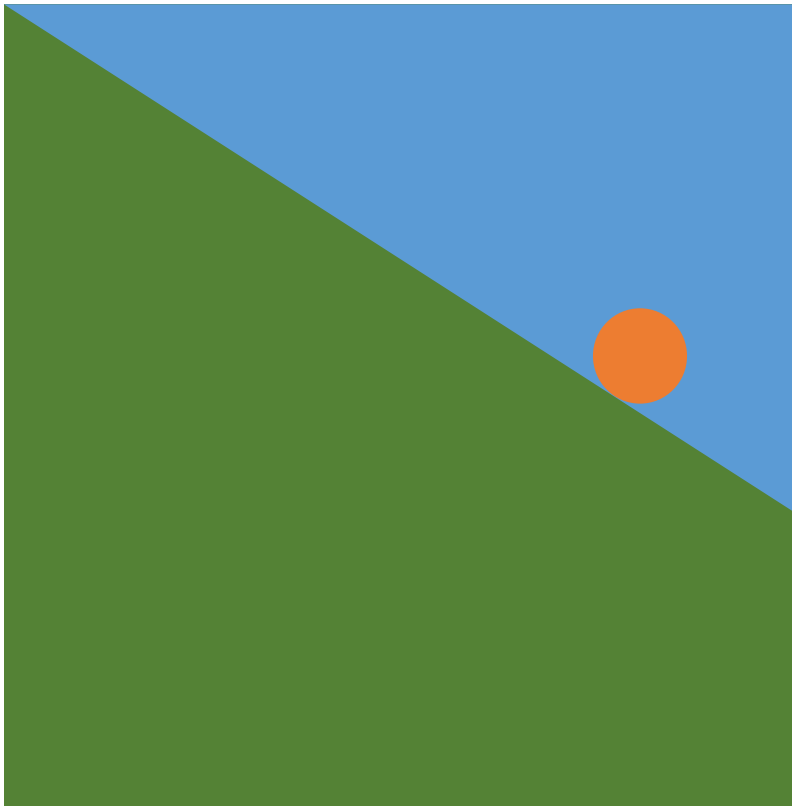
- Current flow rates – acoustic Doppler profiler
- Model: HEC-RAS from U.S. Army Corps of Engineers
- Hurricane simulation: Water balance

Results - Outfall

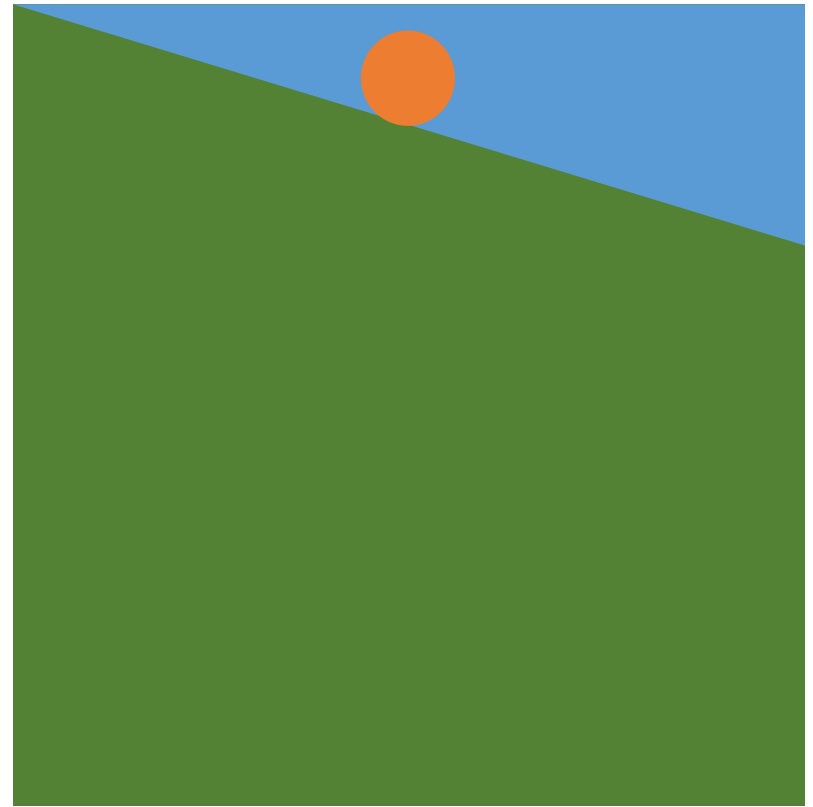
Maximum flow rate to maintain the water level below 1.5 ft at the tide gate.

Downstream Water Level (ft)	Original Canal Dimensions Flow (cfs)	Current Canal Dimensions Flow (cfs)	Sedimentation Reduction
-1	2230	332	85%
0	1830	309	83%
1	1120	217	81%

Sea Level Rise



When constructed



Now

Results - Outfall

49% Reduction in flow due to 2 ft rise in sea level even if canals are dredged

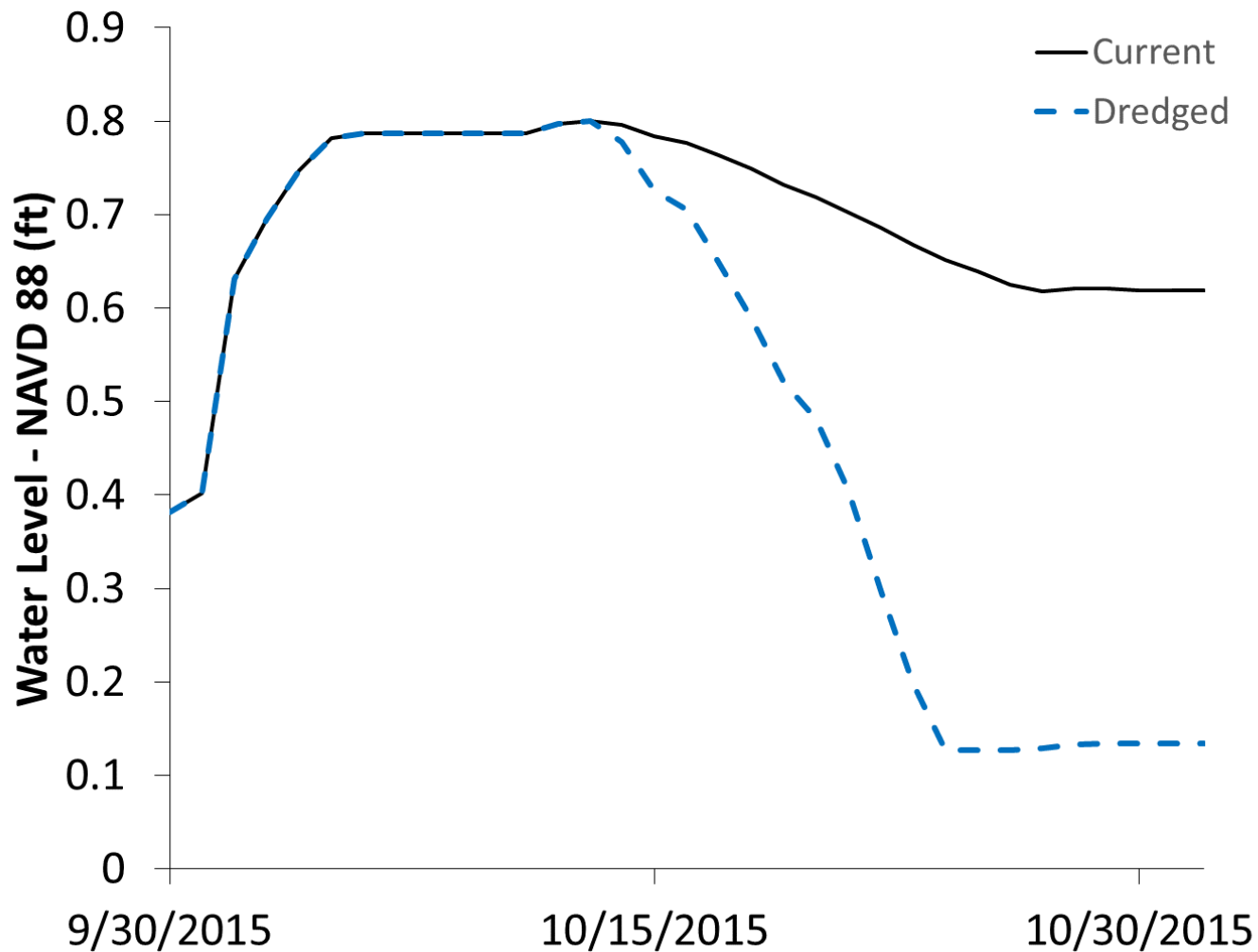
Downstream Water Level (ft)	Original Canal Dimensions Flow (cfs)	Current Canal Dimensions Flow (cfs)	Sedimentation Reduction
-1	2230	332	85%
0	1830	309	83%
1	1120	217	81%

Results – All Canals

- Percent reduction in flow for sedimentation and sea level rise are independent of each other and not additive
- Dredging the canals will not result in full restoration of flow due to sea level rise

Canal	Original Canal Flow (cfs)	Sedimentation Reduction	2 ft Sea Level Rise Reduction
Outfall	2230	85%	49%
Lake Landing	1260	80%	45%
Rose Bay	864	66%	48%
Waupoppin	631	76%	44%

Results – Hurricane Joaquin



Results - Hurricanes

- Hurricane Joaquin – number of days before water level drops below 0.7 ft
 - Current canals: 22 days
 - Simulated dredged canals: 17 days
- Hurricane Matthew – number of days before water level drops below 0.9 ft
 - Current canals: 47 days
 - Simulated dredged canals: 21 days

Summary

- Flow in the canals does not occur when the water level in the sound is higher than the water level in the lake
- Dredging the canals will increase the flow in the four outlet canals
- Dredging the canals could reduce the duration of flooding
- Sea level rise will continue to reduce the flow in the canals whether they are dredged or not

Questions?

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The Hydrological Modeling of Lake Mattamuskeet

Raymond Smith¹

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East Carolina University

¹Department of Engineering

²Center for Sustainable Energy and Environmental
Engineering



Why Model Lake Mattamuskeet?

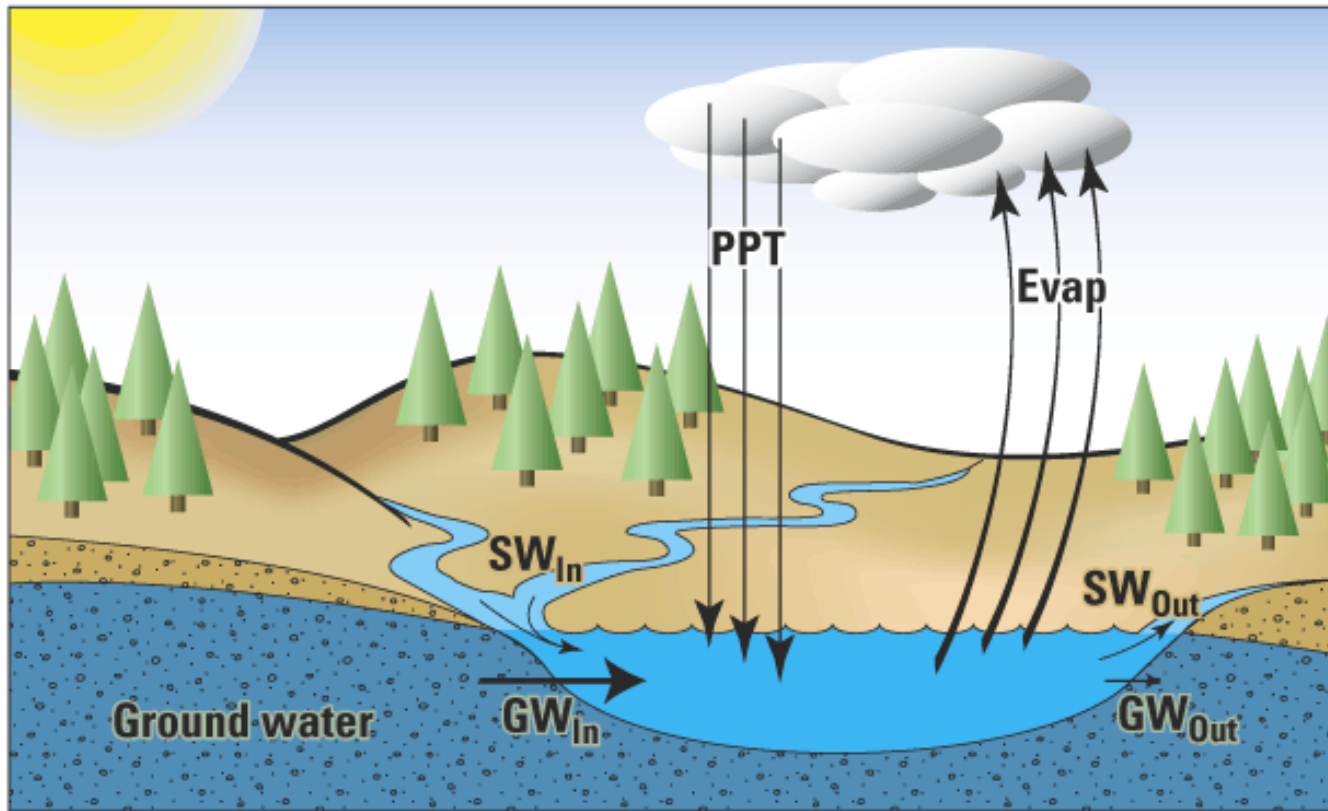
- Develop an understanding of lake stage level in response to variations in input.
- Provide a resource to support decision-makers and stakeholders in pursuit of watershed restoration goals.
- Provide a resource to explore identified scenarios, management policies, and *what-if's* leading to improved water management.



What is a Hydrologic Model?

- A simplification of a real-world system that aids in the understanding, predicting, and managing water resources.
- Hydrologic analyses are performed to quantify the flow rate of water draining from the watershed over time.

Hydrologic Balance of a Lake



NOT TO SCALE

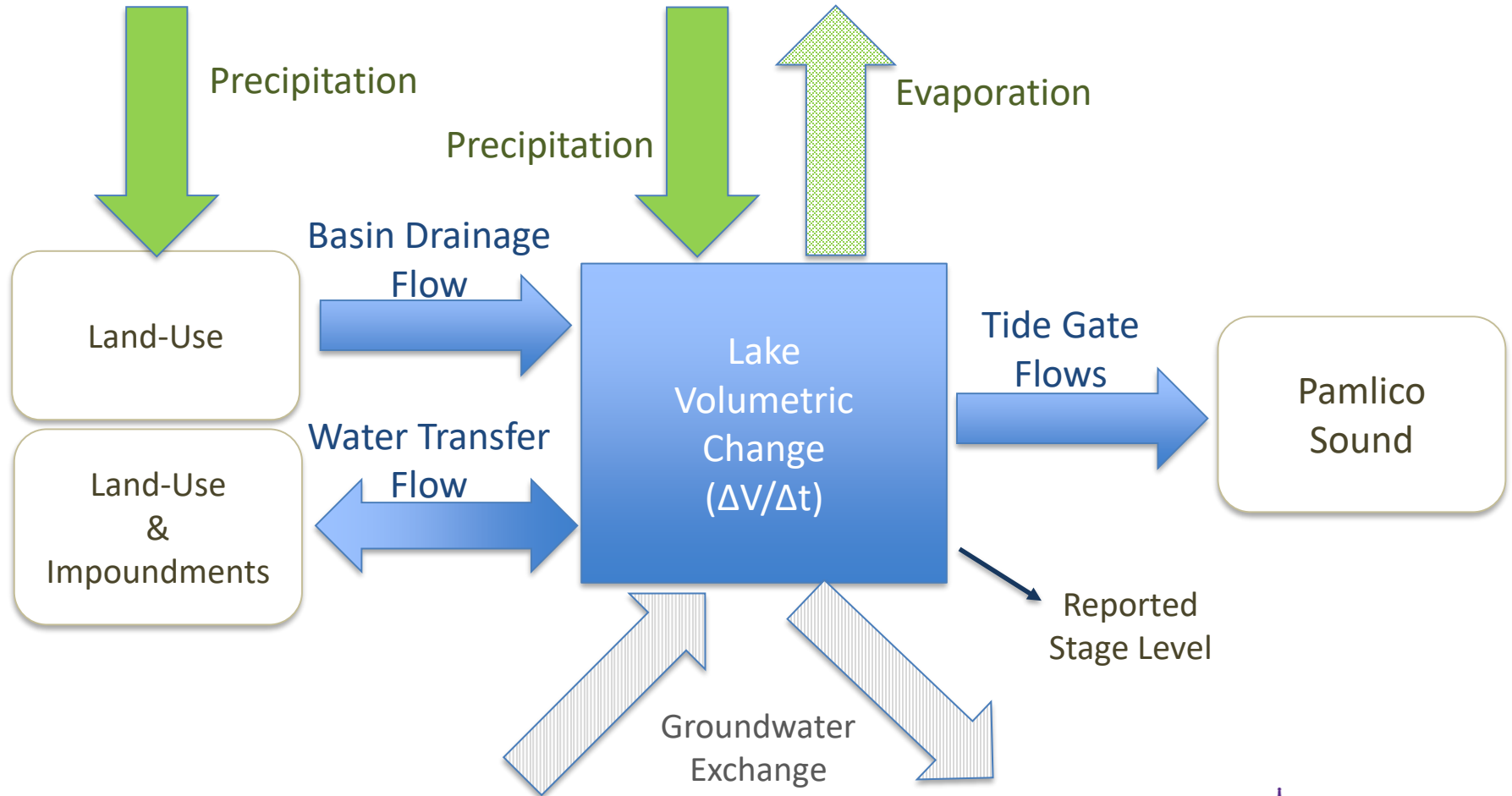
EXPLANATION

Evap	Evaporation
GW _{In}	Ground-water inflow
GW _{Out}	Ground-water outflow
PPT	Precipitation
SW _{In}	Surface-water inflow
SW _{Out}	Surface-water outflow

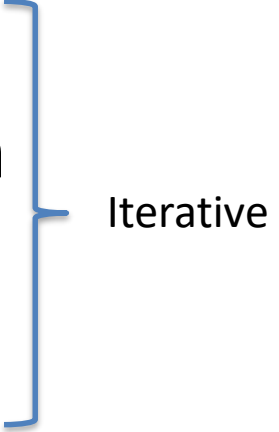
Reference: https://serc.carleton.edu/integrate/teaching_materials/earth_modeling/student_materials/index.html

Hydrologic Balance of Lake Mattamuskeet

“A Water Budget”



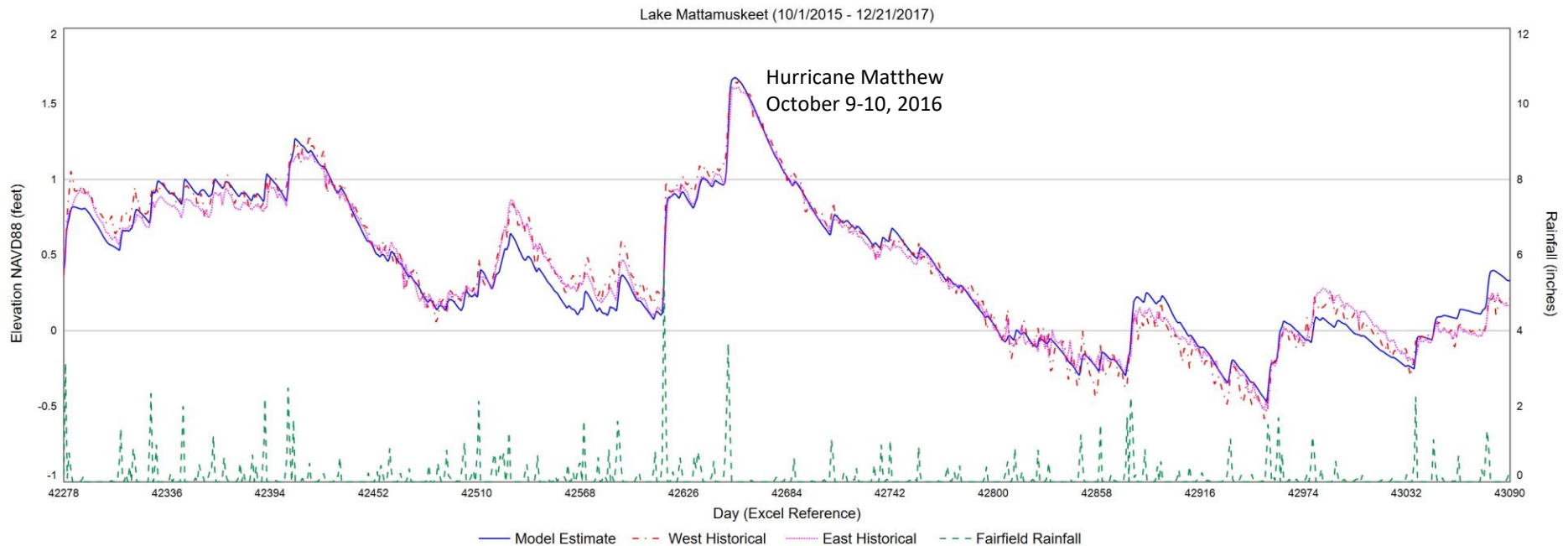
Steps of the Modeling Process

1. Articulate the goals
 2. Perform appropriate data collection
 3. Build and calibrate the model
 4. Validate the built model
 5. Policy design and evaluation
 6. Conduct simulation experiments
 7. Analyze results and report findings
- 
- Iterative

Preliminary Model Dynamics

(unvalidated model 8/1/2018)

Lake Mattamuskeet - Stage Level (feet)



Next Steps

1. Secure research funding resources
2. Enhancement of the model:
 - a) Incorporate surrounding land-use types and interactions
 - b) Incorporate water transfers *into* and *out of* impoundments
 - c) Evaluate impact of wind
 - d) Obtain additional observational data
3. Perform model calibration
4. Conduct a rigorous model validation

Then ...

5. Study identified scenarios, management policies, and *what-if* questions through experimentation and report findings.

Questions

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Facilitating Active Water Management

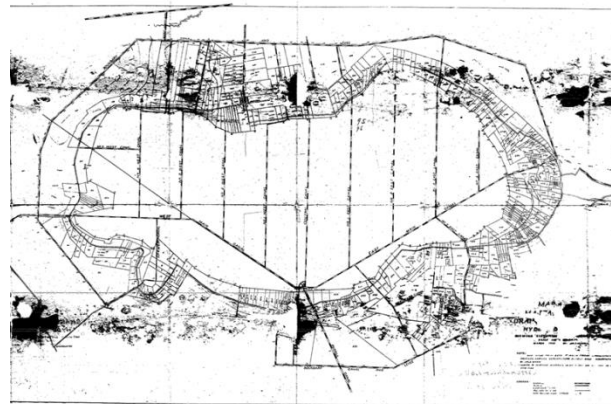
Lake Mattamuskeet Watershed

Daniel Brinn

Historic Water Management Activities



- Lake Landing Canal
 - Earliest efforts in 1773, Constructed in 1837
- Hyde County Drainage District #1
 - Public Law 509
 - The creation of the Mattamuskeet Drainage District set in motion a plan that eventually drained Lake Mattamuskeet three times—in 1916, 1920 and in 1926.
- Rose Bay Canal





The Need for Active Management

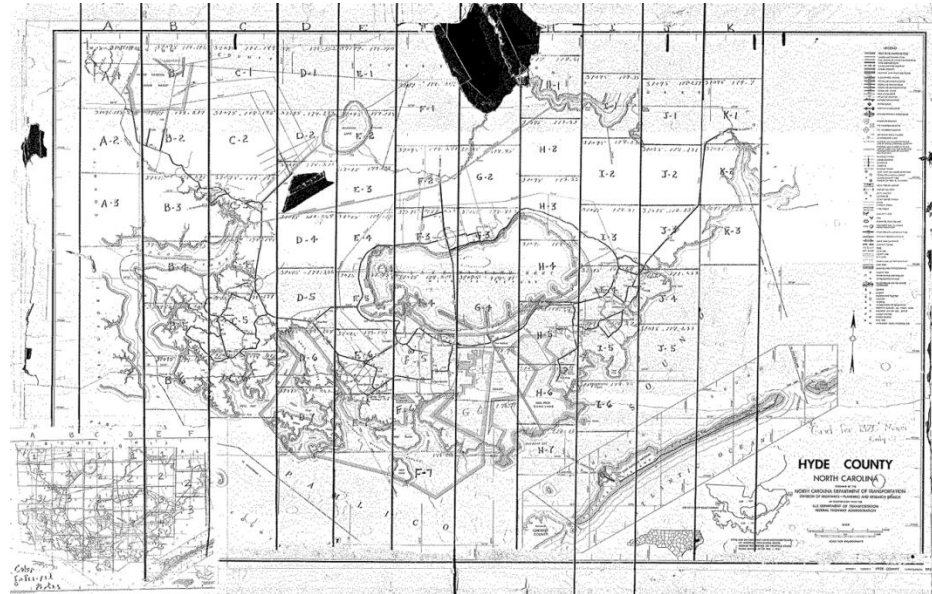
- Preserving the way of life within the watershed
- Water Quantity issues
- Water Quality concerns





Making it Happen

- Plan
- Engineering
- Infrastructure
- Funding
- Continued Operation



Establishing a Service District for the Lake Mattamuskeet Watershed



- NCGS 153
- Process
- Boundaries
- Responsibilities
- Governance
- Funding





North Carolina
Coastal Federation

Working Together for a Healthy Coast



learnnc.org

Lake Mattamuskeet Watershed Restoration Plan

Next Steps

Next Steps

- Review the Draft Plan at nccoast.org/lakemattamuskeet
- Please submit comments by Friday, November 2
- Incorporate feedback
- Finalize the plan by the end of November
- Public Symposium on December 3, 2018 at Martelle's Feed House in Engelhard
- Initiate implementation of management actions and BMPs

Questions and Comments