Voluntary Wetland Restoration Case Studies

Brian Majka. Restoration Ecologist, GEI Consultants

September 13, 2023

Wetland Restoration Project Intent

- Why are you planning a wetland restoration, enhancement, or creation?
  - Wetland mitigation
  - Stormwater control
  - Shoreline stabilization
  - Wastewater treatment
  - Water quality
  - Wildlife habitat
  - Recreation
- The choices you make may differ depending on the reasons for your project

Wetland Restoration Project Intent

- Why are you planning a wetland restoration, enhancement, or creation?
  - ~~Wetland mitigation~~
  - Stormwater control
  - Shoreline stabilization
  - Wastewater treatment
  - Water quality
  - Wildlife habitat
  - Recreation
- The choices you make may differ depending on the reasons for your project

"Renewing and restoring degraded, damaged, or destroyed ecosystems and habitats…."

- By definition, the process begins by understanding an ecosystem or habitat and WHY it is degraded
- So, it starts with knowing what you have….and knowing where you want to go. Then figuring out how to get there
- Must be mindful of both ecosystem structure and function

What do you want to have, and what's keeping you from getting there?

Common Sources of Degradation in Wetlands

- Wildlife
- Pollution
- Human use
- Invasive species
  - Plants
  - Animals
- Erosion
- Soil nutrients/structure
- Altered hydrologic regimes
- Climate
- Stochastic events

Grand Trunk Wetland Restoration

- Fill removal for wetland creation
- Site influenced by Muskegon Lake and Lake Michigan
- Excavation, seeding, erosion controls


Low Water

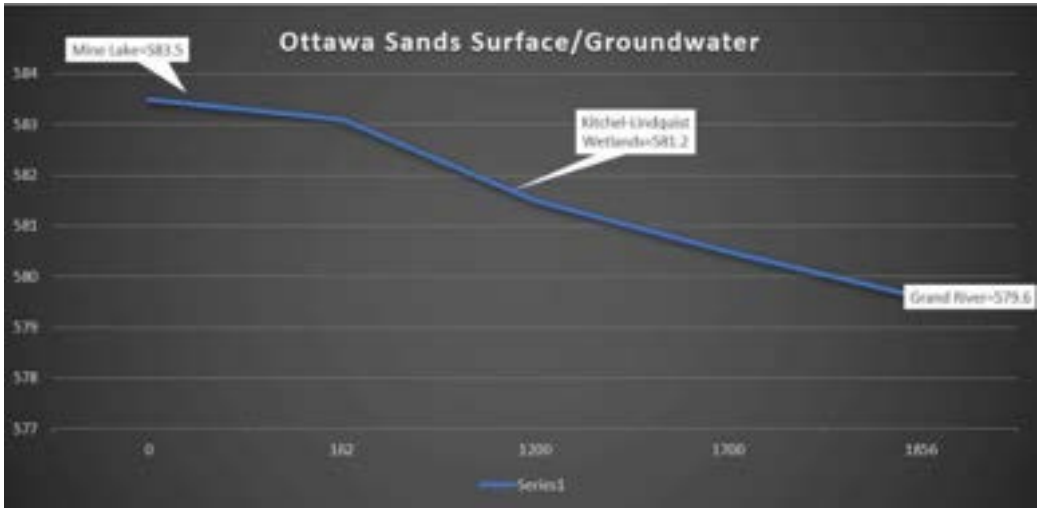

High Water

Ottawa Sands County Park

- Ottawa County park near mouth of Grand River at Lake Michigan
- Gravel mine lake in critical dune area
- Restoration of ~1 mile of shoreline and creation of 6 acres of interdunal wetlands
- Habitat creation for fish, birds, herpetofauna
- Construction in Sept 2023

Ottawa Sands County Park

- Groundwater gradient from mine lake to Grand River, with surface water expressions in depressions
- Water level changes as Lake Michigan fluctuates
- Shoreline and interdunal wetlands modeled off of adjacent reference communities
- Plans include grading, placement of habitat structures, creation of a new dune

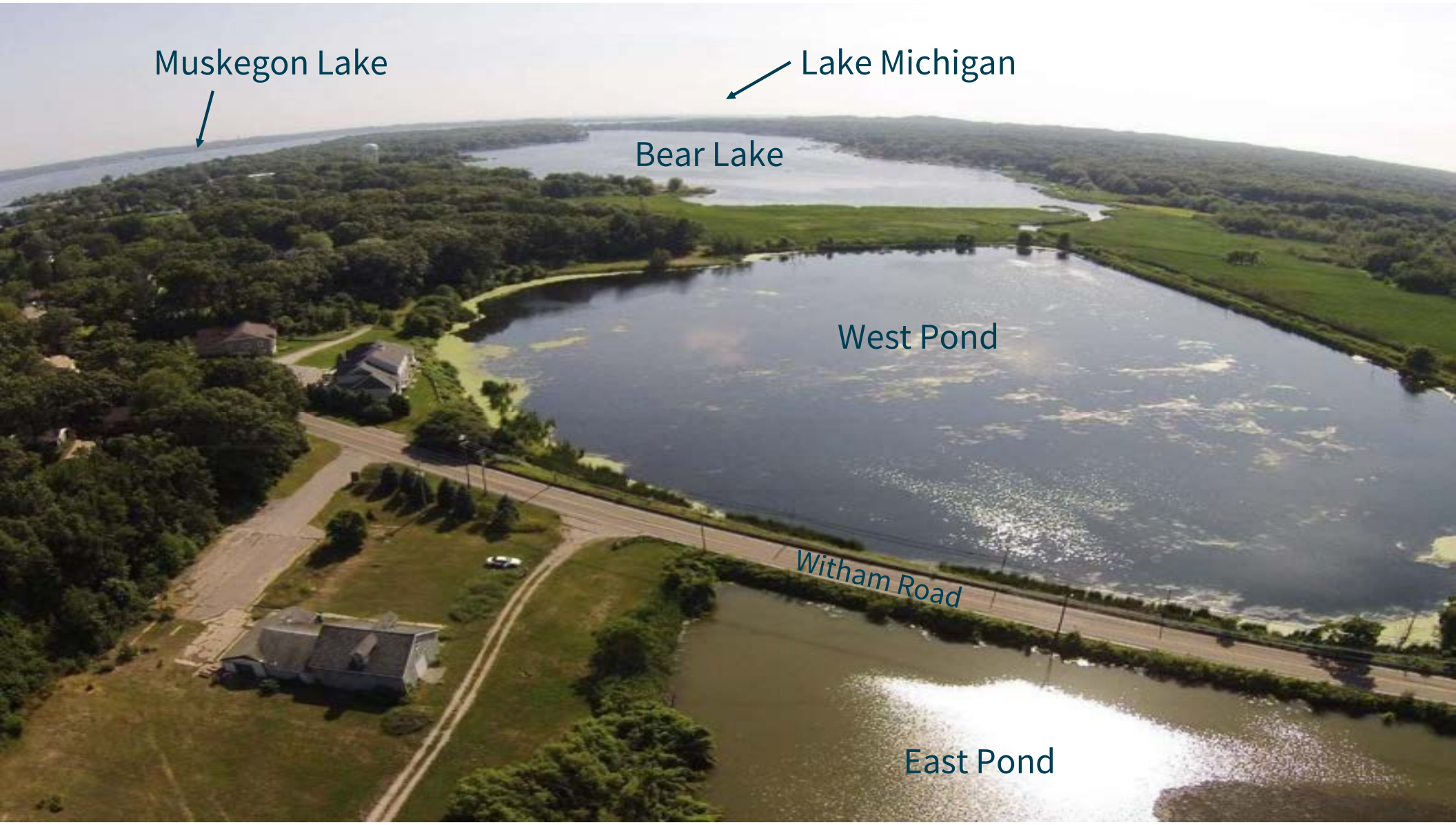


Existing

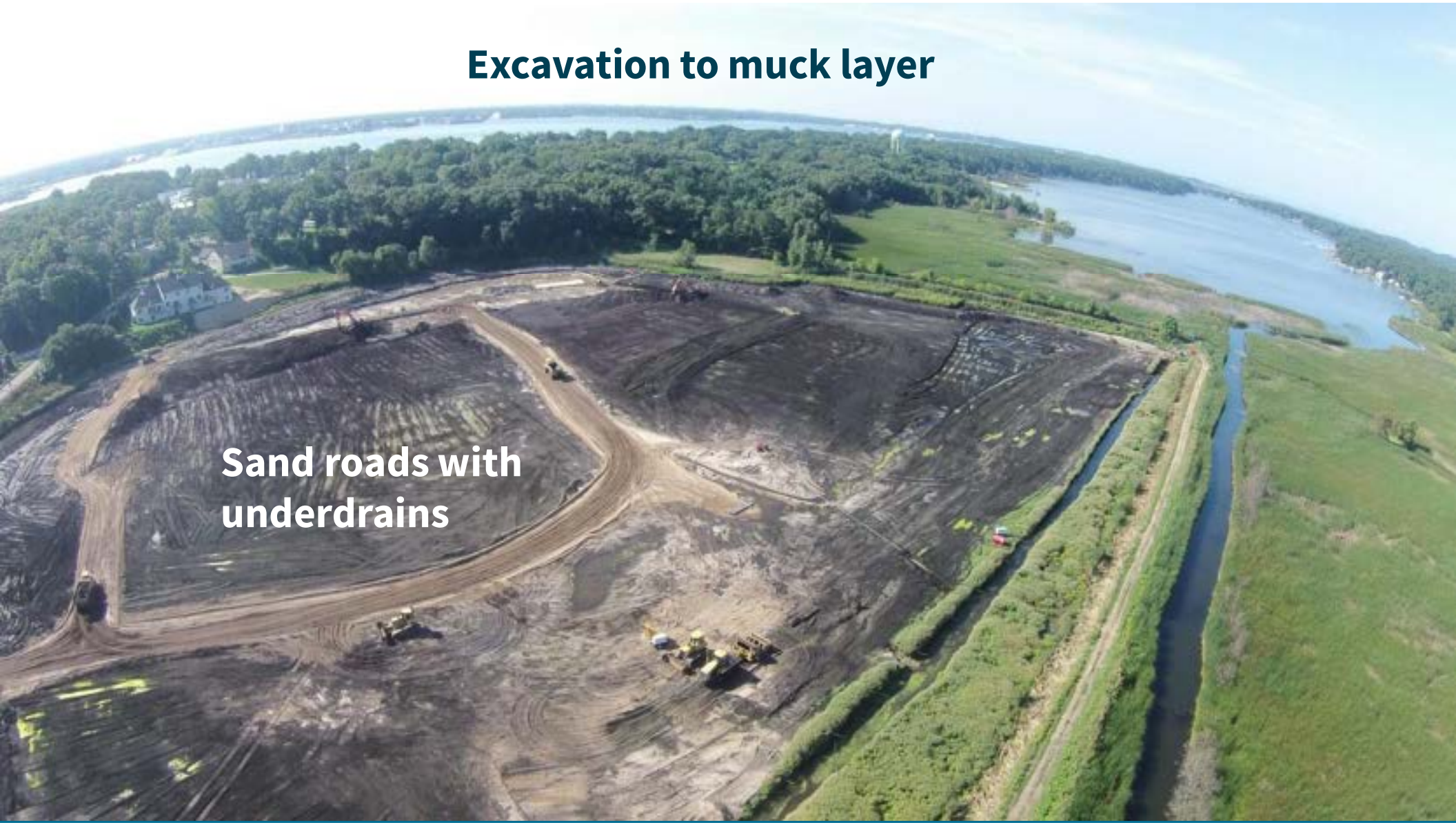
Proposed

Bear Lake Hydrologic Reconnection

- Wetland restoration through reconnection of 36 acres of former celery farm to Bear Creek, Bear Lake, and Lake Michigan
- Property owned by Muskegon County
- Wetland restoration/water quality goals

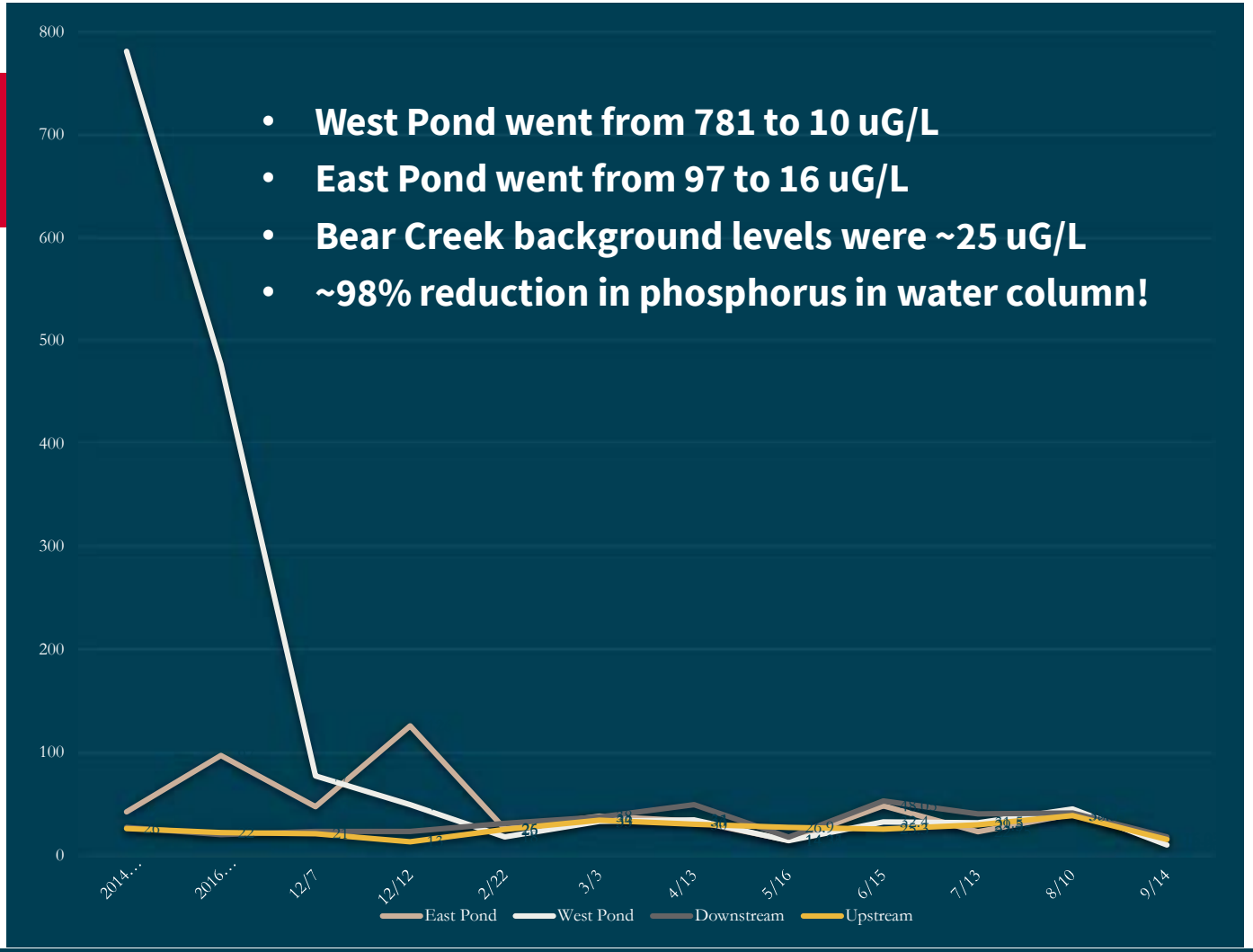

Muskegon Lake
Lake Michigan
Bear Lake
West Pond
Witham Road
East Pond

Excavation to muck layer



Excavation to native sand

Total Phosphorus



- West Pond went from 781 to 10 uG/L
- East Pond went from 97 to 16 uG/L
- Bear Creek background levels were ~25 uG/L
- ~98% reduction in phosphorus in water column!

3/28/2017

3/28/2017

Lower Muskegon River

- Muskegon Lake Area of Concern
  - Loss of Fish and Wildlife Habitat Beneficial Use Impairment
- Parcel acquired by Muskegon County with the intent to restore
- Historic ~60 acre celery farm, farmed for hay until 2015
- Hydrologically disconnected from the Muskegon River through dike construction
- Broad partnership to improve water quality and enhance habitat

Project Background

- Muskegon Lake Area of Concern
  - Loss of Fish and Wildlife Habitat Beneficial Use Impairment
- Parcel acquired by Muskegon County with the intent to restore
- Historic ~60 acre celery farm, farmed for hay until 2015
- Hydrologically disconnected from the Muskegon River through dike construction
- Broad partnership to improve water quality and enhance habitat


2011
Muskegon River

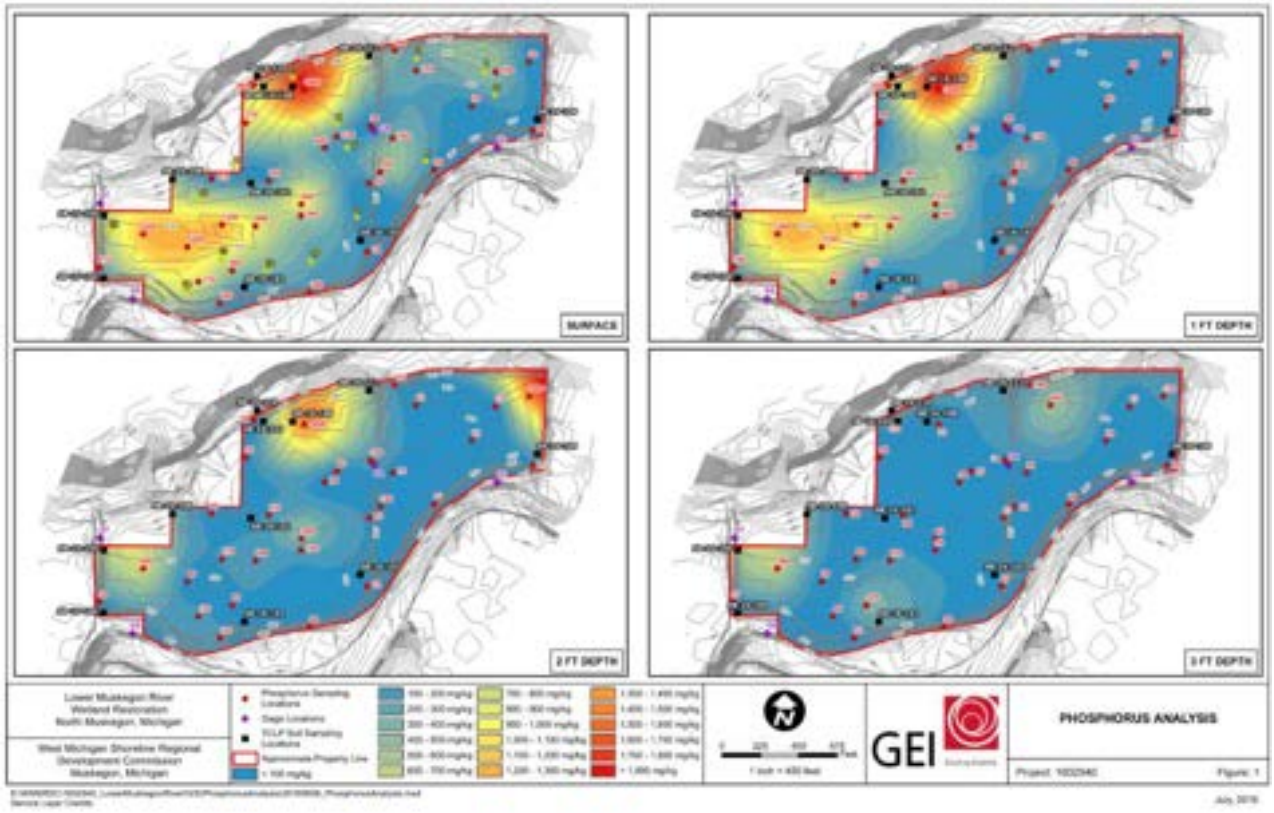

2018 (pre-restoration)
Muskegon River

Project Goals

- Hydrologically reconnect the ~60 acre parcel to the Muskegon River by selectively removing the dike
- Minimize water quality impacts to the Muskegon River, Muskegon Lake, and Lake Michigan
- Create habitat diversity
- Create a system that is resilient to fluctuating water levels in the Muskegon River and Lake Michigan

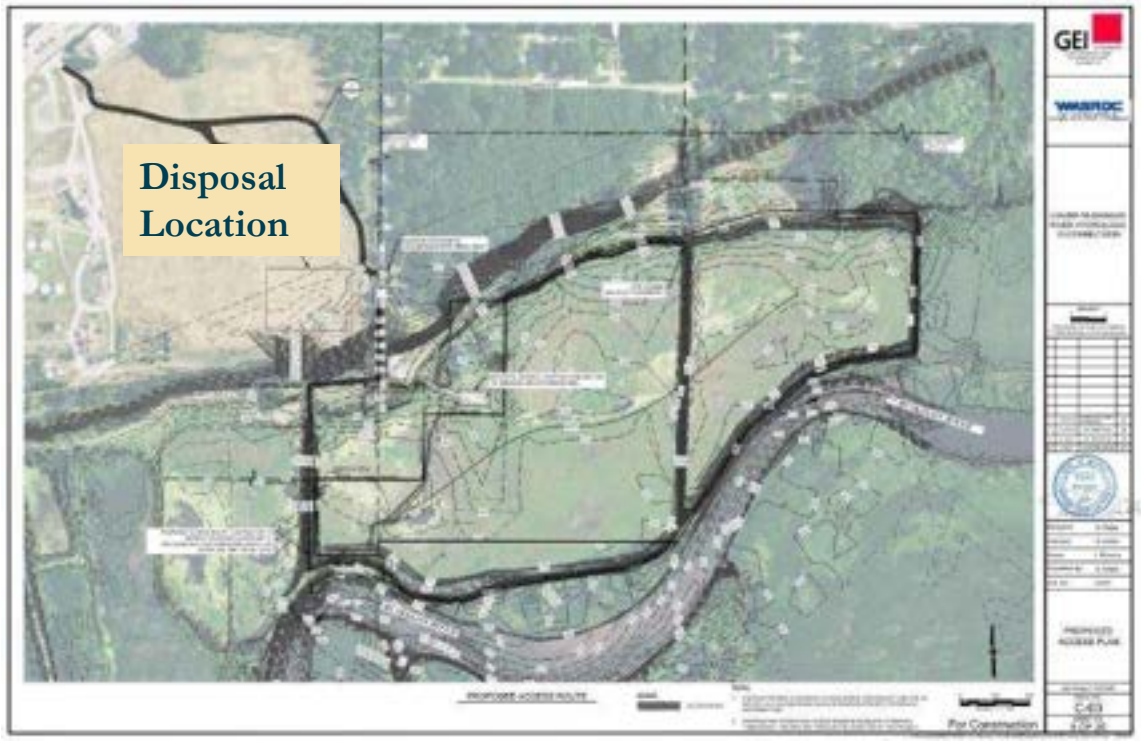
Nutrients

- GVSU-AWRI determined that phosphorus levels above 600 mg/kg were harmful to water quality
- High P soils primarily found in upper 1-2’ of soil column
- Grading plans developed to remove high P soils out of the 100yr floodplain



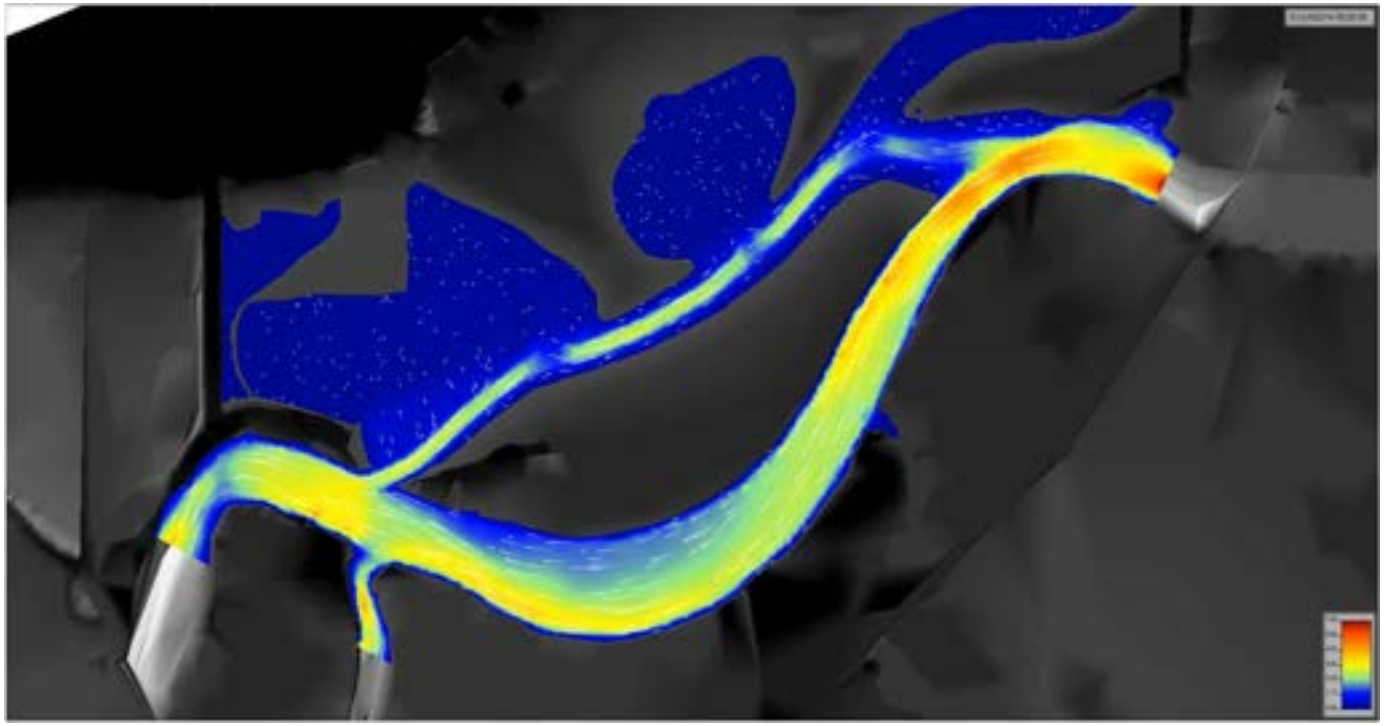
Soil Disposal

- Total excavation and placement of 101,850 CY of soil
- Some disposed on site—but not all
- EGLE requirements typically say an appropriate disposal site or landfill disposal is needed
- Adjacent site is Part 201 facility contaminated with lead, and phosphorus binds lead. Win-win for disposal



Hydrology

- Water levels at site are determined by both Lake Michigan and the Muskegon River
- Need site to function at both high and low Lake Michigan levels
- Flows through the site need to carry sediment to prevent deposition from disconnecting the site from the river
- 2-dimensional hydrological models developed for both low and high water scenarios



Habitat

- Habitats in Great Lakes coastal wetland shift as lake levels rise and fall
- Grading plans developed with long, gentle slopes to allow vegetation to follow changing water levels
- Floodplain Forest, Scrub Shrub, Wet Meadow, Emergent Marsh, Submergent Marsh, and open water habitat all designed
- Supplemental habitat structures such as wood and reptile hibernacula added to the site

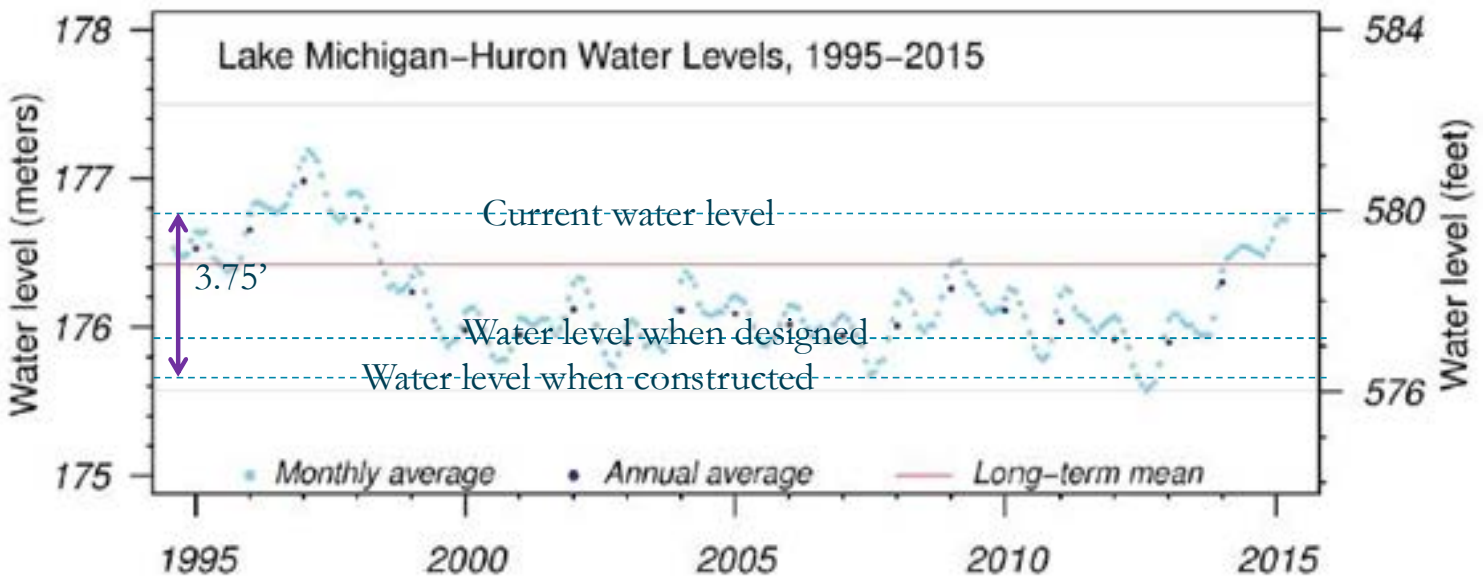

VOLVO
VOLVO


HITACHI

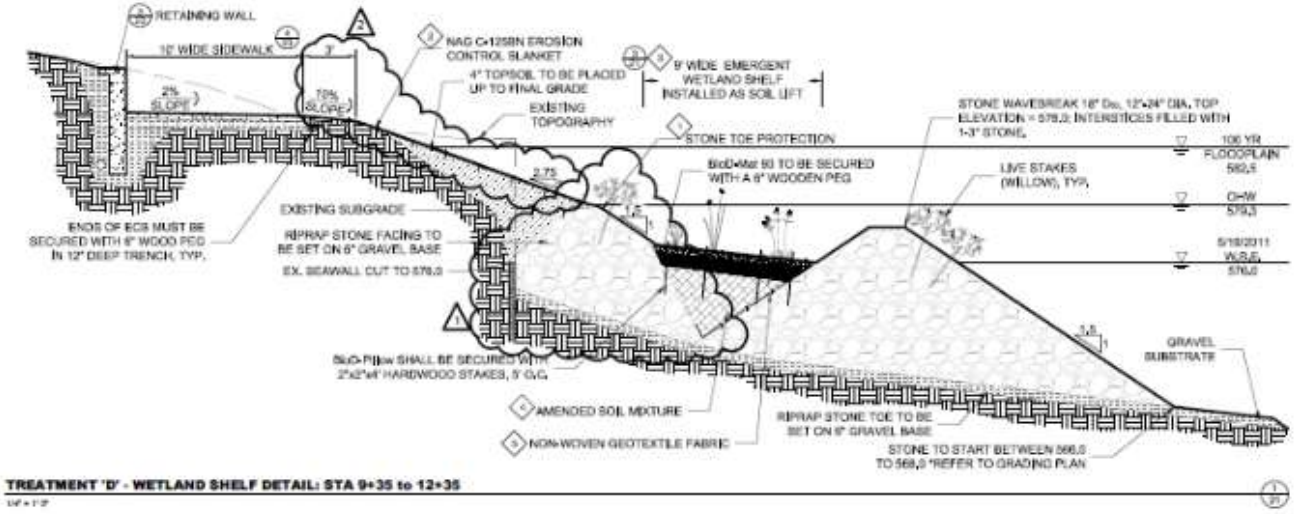
Marysville Shoreline Restoration

- St. Clair River
- Dual-purpose shoreline restoration/public use project
- Ice push from multiple directions
- Constructed in 2012
- 2000’ of shoreline restoration including 1900’ of seawall removal
- $1.6 million construction cost ($800/l.f.)

Water level fluctuations

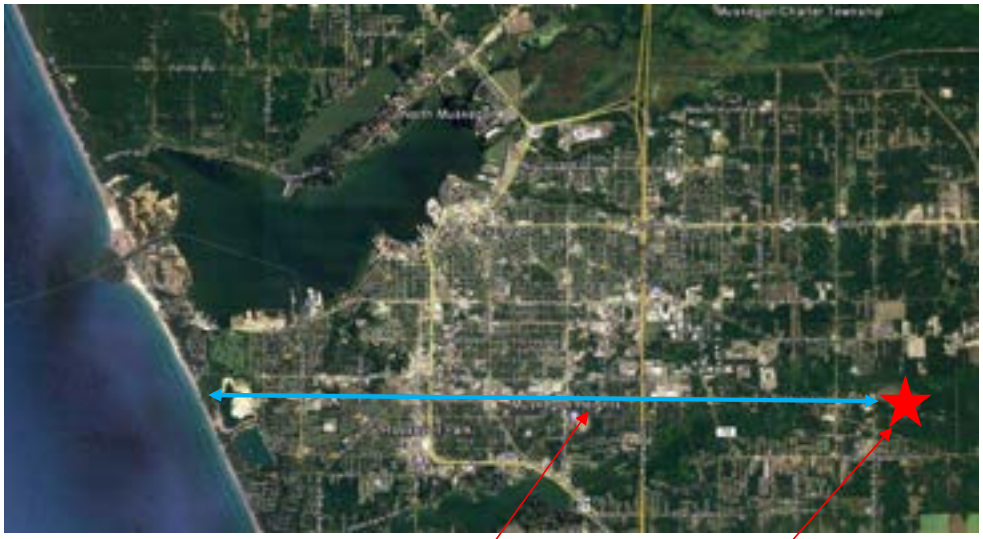


Design Solution



SCA Independent Landfill

- Waste Management Landfill
- 100-acre site adjacent to Black Creek in Muskegon County
- Began operations in 1968
- Closed in 1987
- Superfund site with long term monitoring

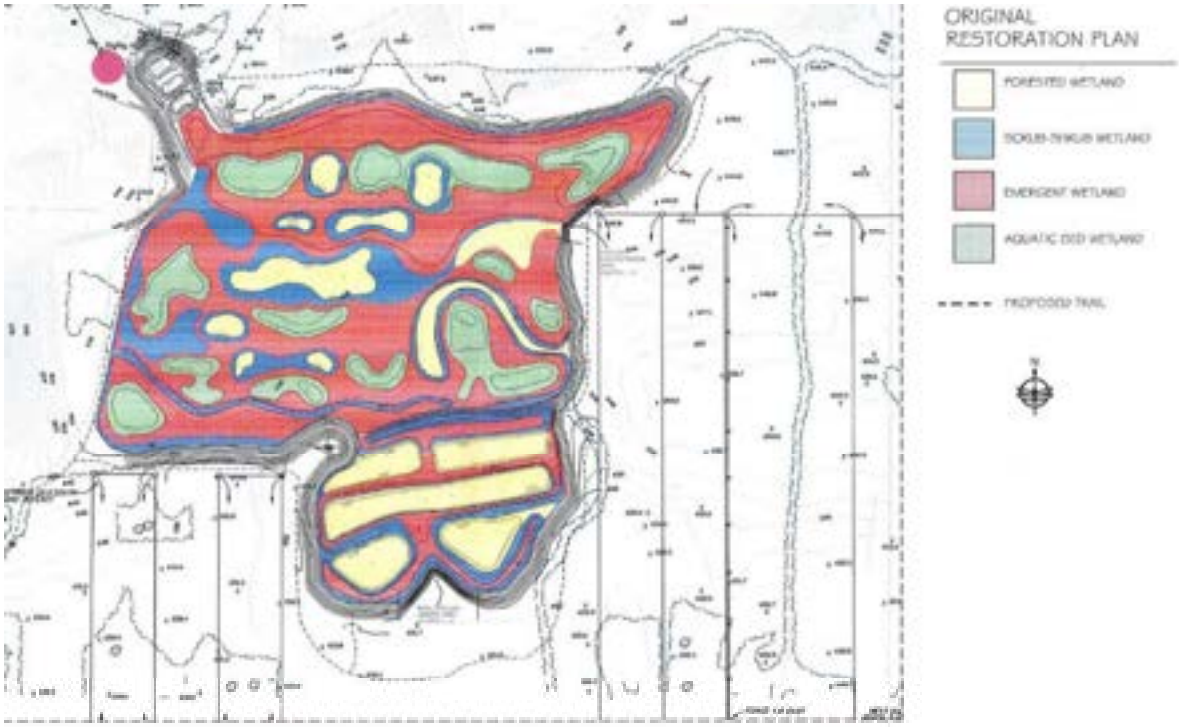



1969


2006
Brooks Rd

Wetland Restoration

- Intent to create 25-acre wetland mitigation bank in early 2000s
- Convert borrow area into wetland
- Extensive hydrologic studies, grading, planting plans completed
- Mitigation bank abandoned; site voluntarily constructed in 2006



Surrounding Beech-Sugar Maple forest

2007 Site Visit

- Sandy site with high groundwater
- Volunteer species all over (remember, ~20' had been excavated
- BUT…these weren't just opportunistic weeds
- 110 native species, 38.4 Native FQI
- Species composition strongly resembles *Interdunal Wetland*
- Many disjunct Atlantic coastal species
- Rare species all over the site:
  - *Carex woodii* (C=8)
  - *Eleocharis ovata* (C=8)
  - *Epilobium palustre* (C=10)
  - *Euthamia remota* (C=10)
  - *Lobelia kalmii* (C=10)
  - *Panicum longifolium* (C=10, State Threatened, not previously found in Muskegon County)
  - *Rotala ramosior* (C=8)

Unexpected Plant Communities

Year	Total# Species	Total # Native Species	Native FQI
2007	139	99	35.2
2008	158	110	38.4
2009	194	141	47.3

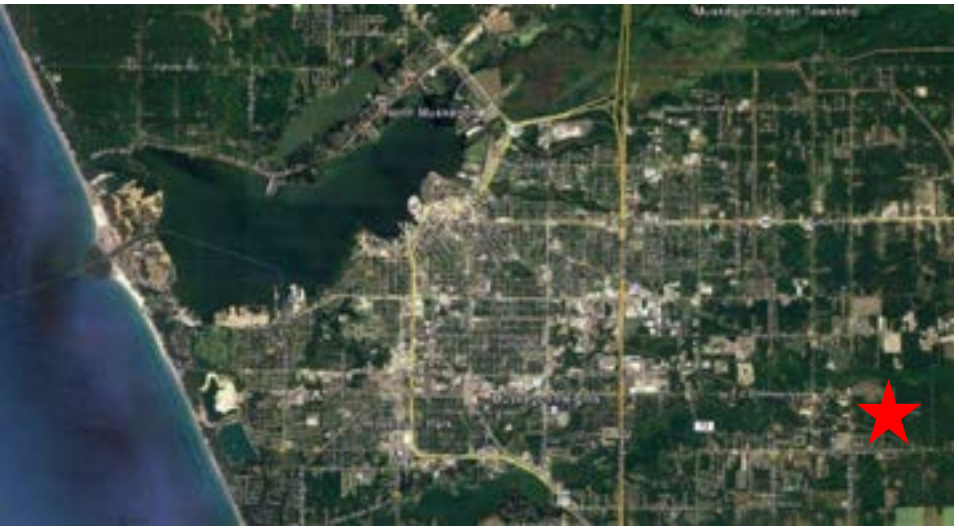
- For first 3 years, total species and FQI increased
- New species included:
  - *Carex cumulata* (C=10)
  - *Cladium mariscoides* (C=10)
  - *Juncus acuminatus* (C=8)
  - *Juncus brevicaudatus* (C=8)
  - *Juncus greenei* (C=10)
  - *Viola pedata* (C=10)

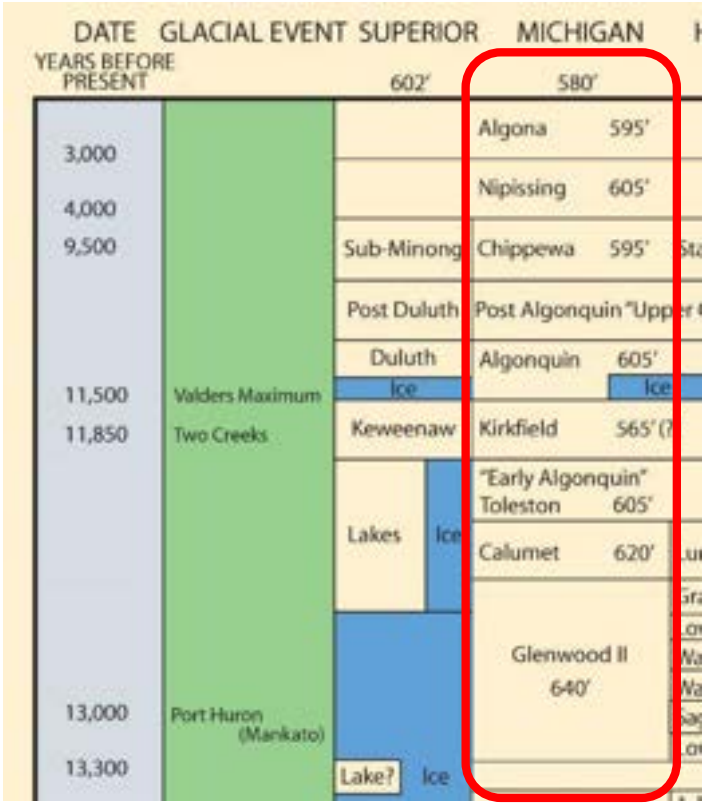
So how did an interdunal wetland get here?

Site Elevations

*Lake Michigan is currently at ~580

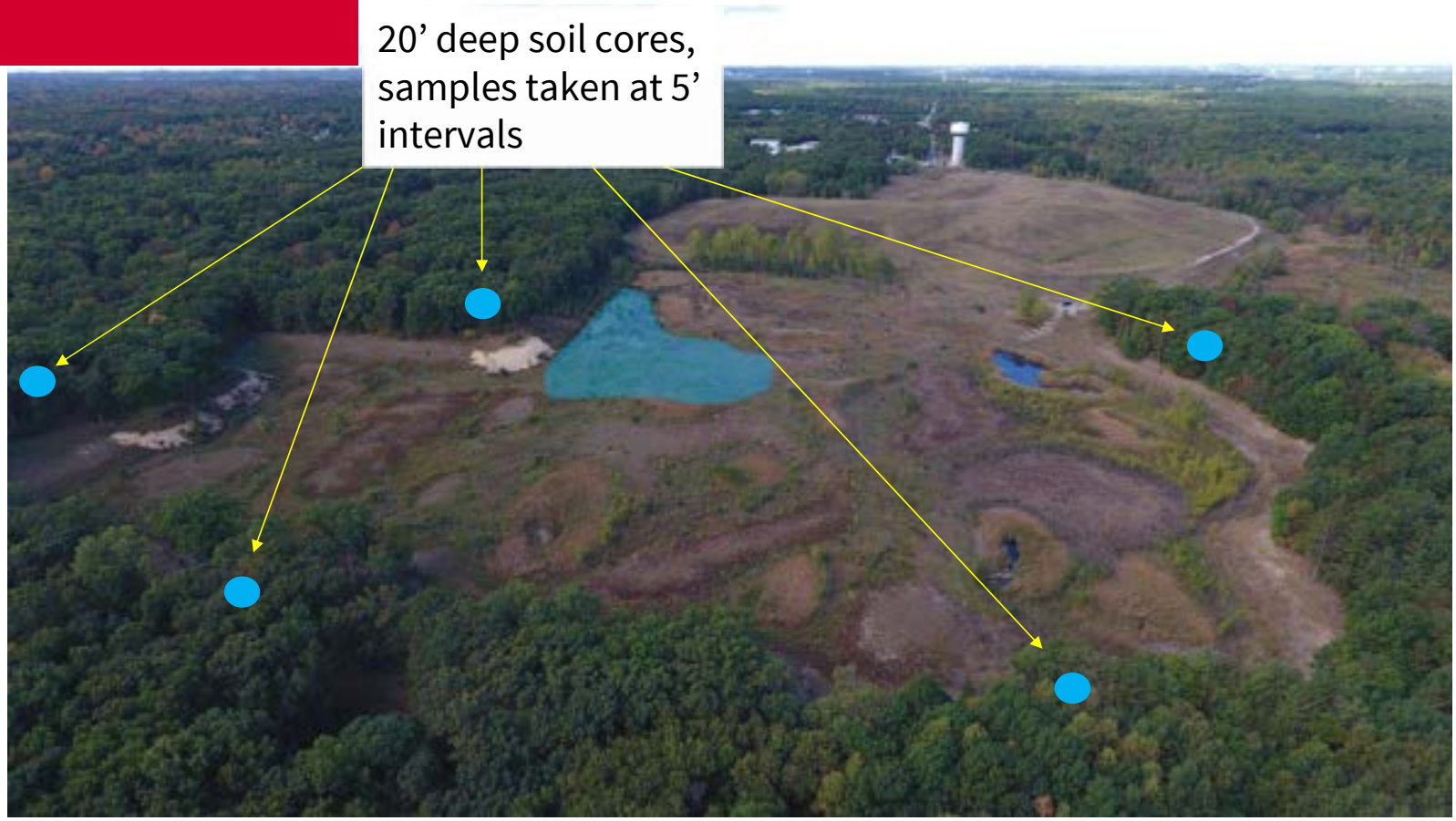
When was the last time the elevation 630 may have been exposed?



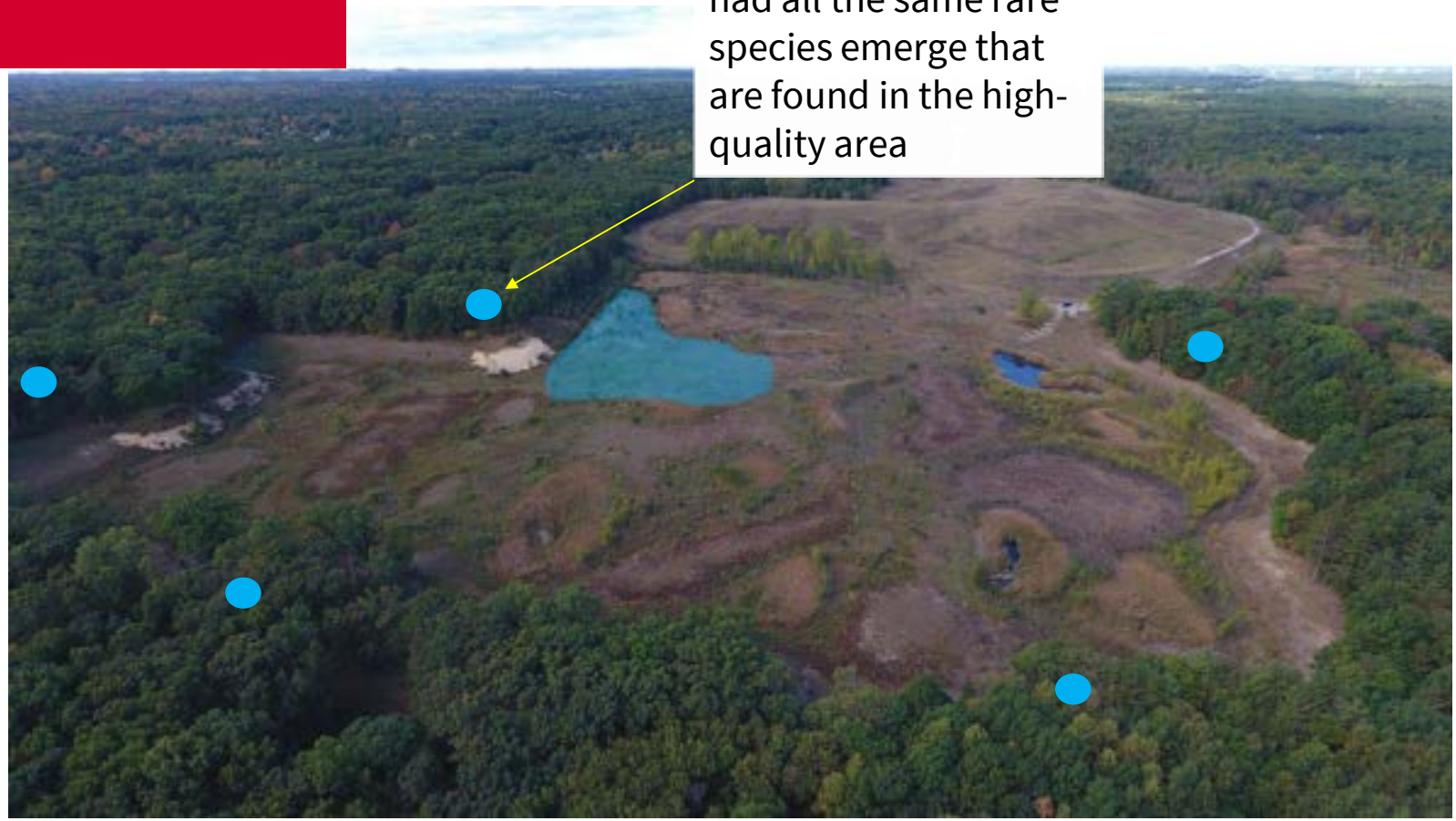


Source: Gillespie et al, Geology of Michigan and the Great Lakes

Seed Bank/Common Green House Study



Seed Bank/Common Green House Study



Questions?

Brian Majka
GEI Consultants, Inc
bmajka@geiconsultants.com