PROJECT RESULTS FROM THE MNSP:

WHAT WENT RIGHT, WHAT WENT WRONG?

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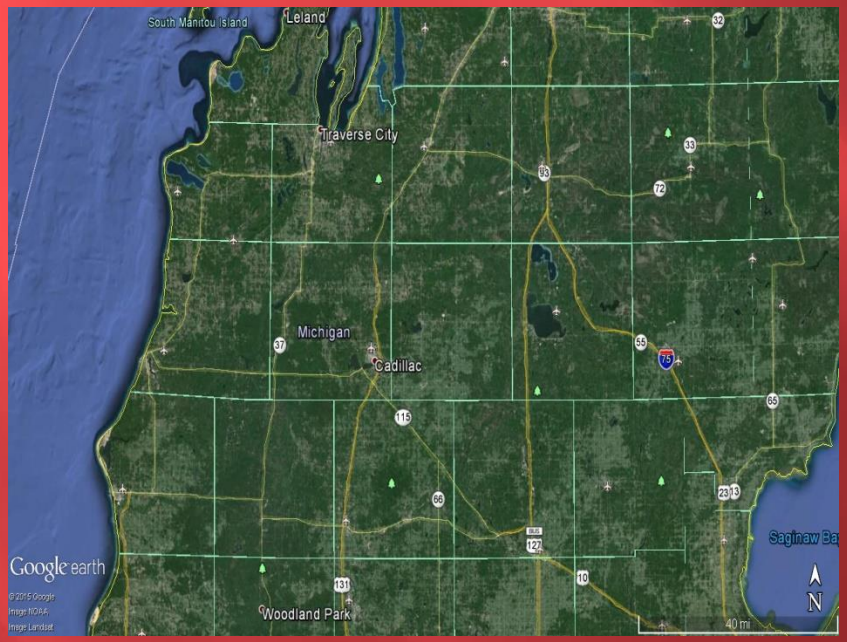
Michigan Natural Shoreline Partnership
2015 Shoreline & Shallows Conference

In this session we will:

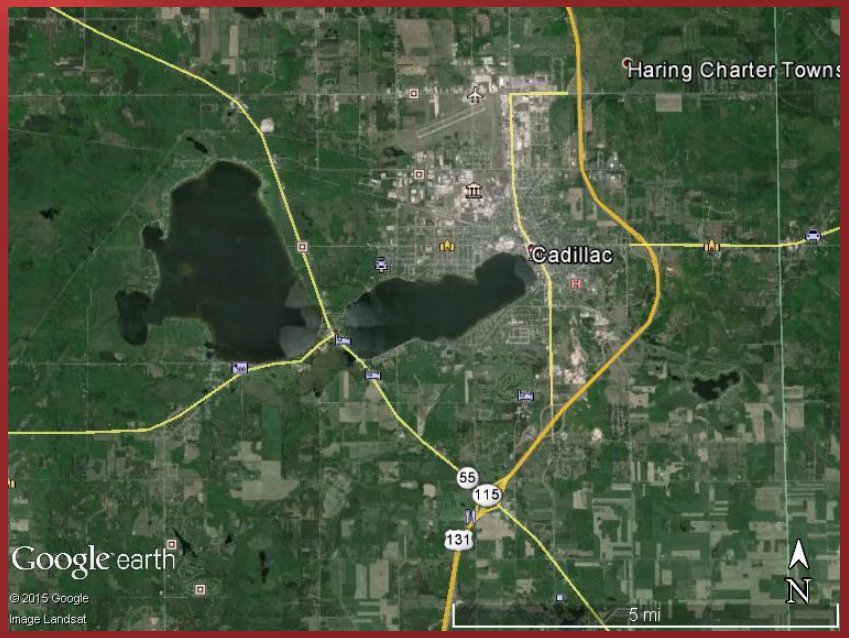
- Provide overviews of two MNSP projects
- Explore what seems to be going well and not-so-well
- Put our collective heads together to determine:
  - Possible subtle site conditions
  - Possible additional site information needs
  - Possible alternative treatments
  - Possible fixes to remedy existing problems

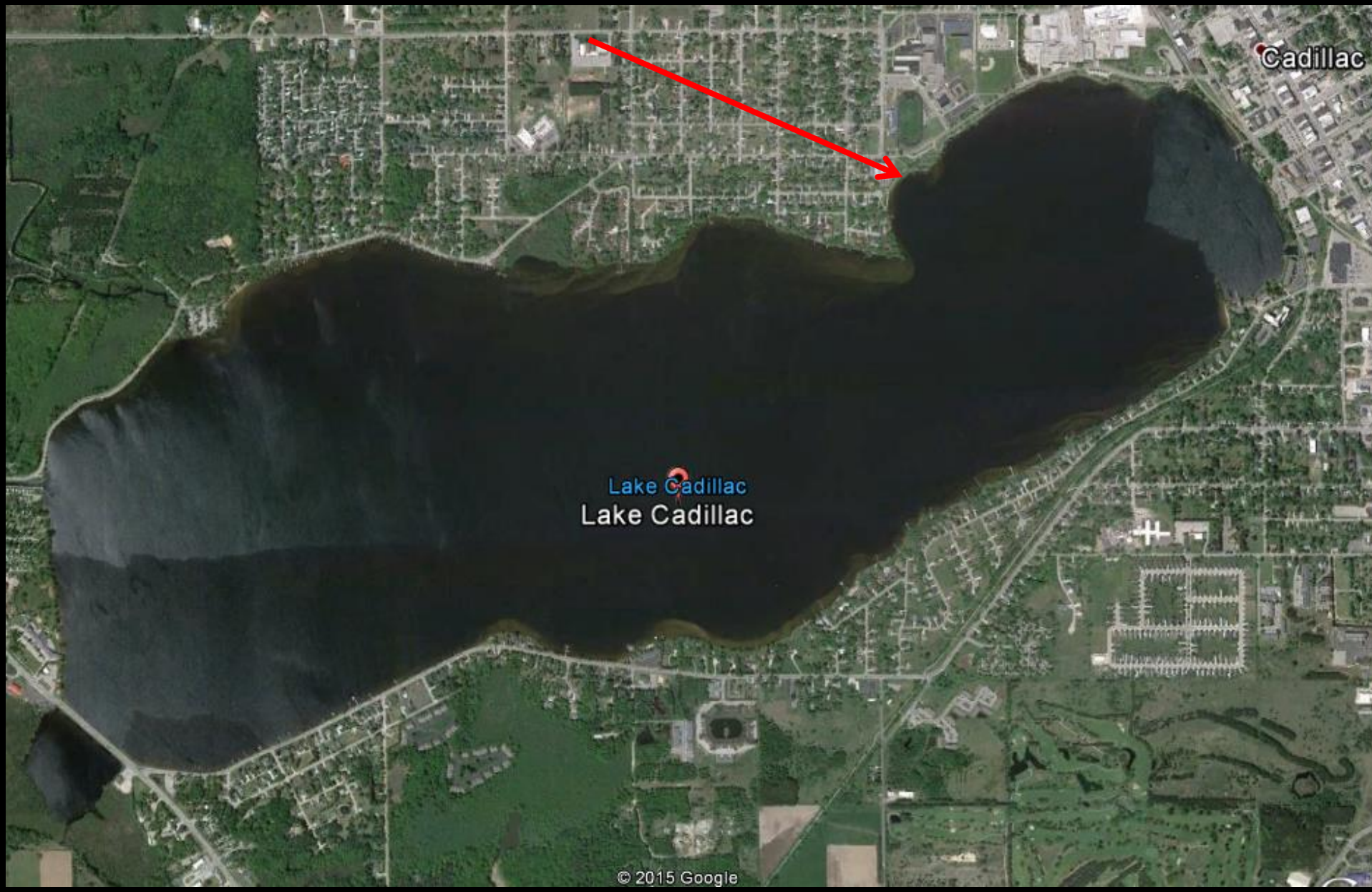
Demonstration Sites

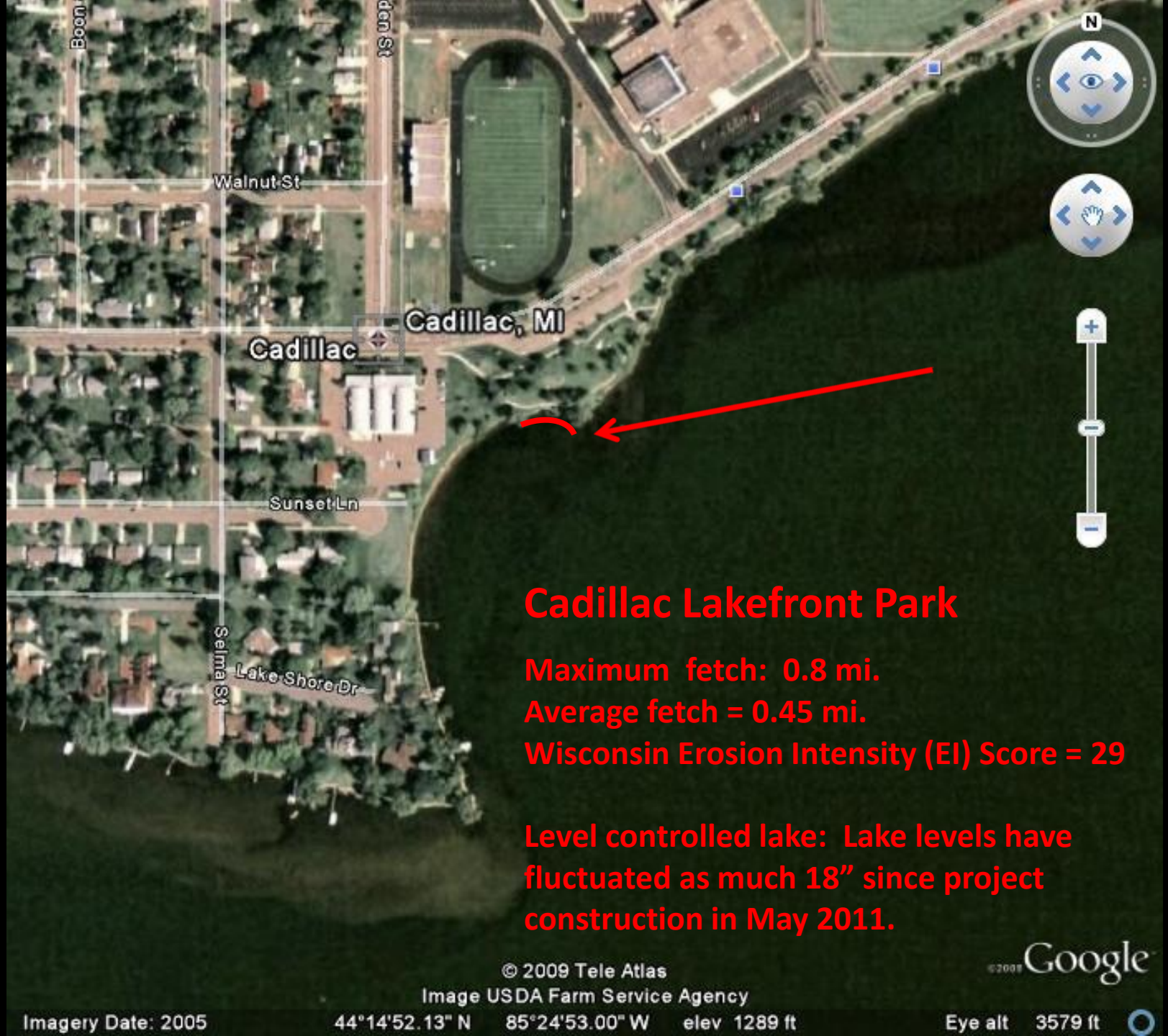
- Lake Cadillac, Cadillac, Michigan



Wexford County
44.248344 N
86.415331 W

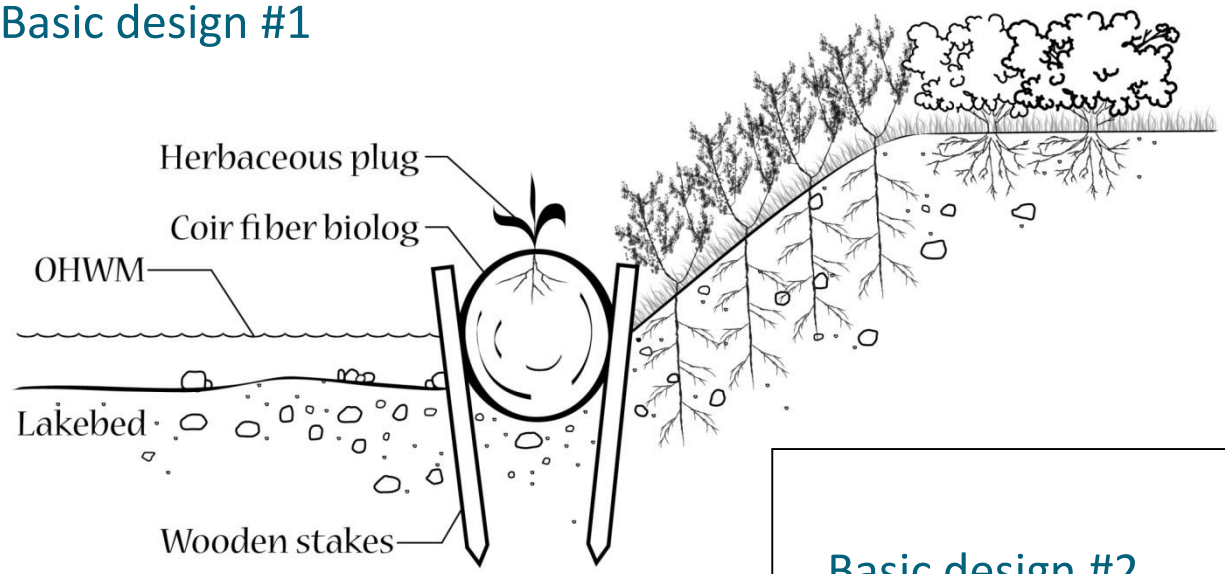



Cadillac
Lake Cadillac
Lake Cadillac
© 2015 Google


Walnut St
Cadillac, MI
Cadillac
Sunset Ln
Selma St
Lake Shore Dr
Cadillac Lakefront Park
Maximum fetch: 0.8 mi.
Average fetch = 0.45 mi.
Wisconsin Erosion Intensity (EI) Score = 29
Level controlled lake: Lake levels have fluctuated as much 18" since project construction in May 2011.
© 2009 Tele Atlas
Image USDA Farm Service Agency
Google
Imagery Date: 2005
44°14'52.13" N 85°24'53.00" W elev 1289 ft
Eye alt 3579 ft

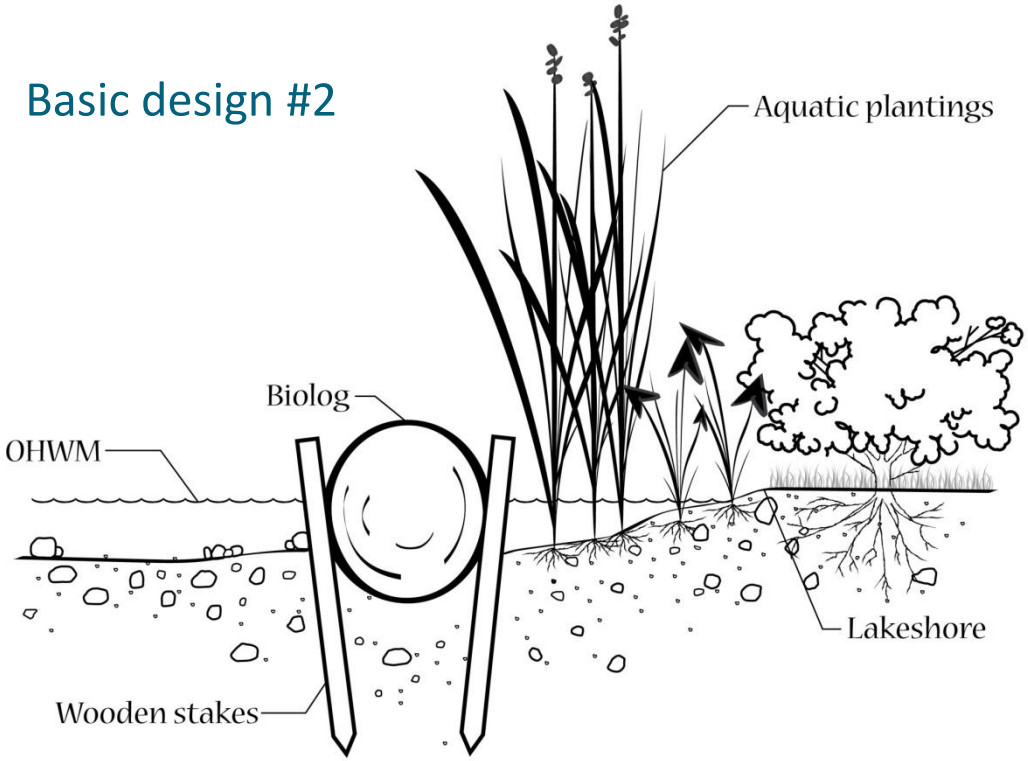

Before
Lake Cadillac, Cadillac Lakefront Park
Site assessment/EI June 2010

Basic design #1



Biolog Placement at Bank Toe

Basic design #2



Biolog Placement as Wavebreak

May 24, 2011

2011 (Year 1)

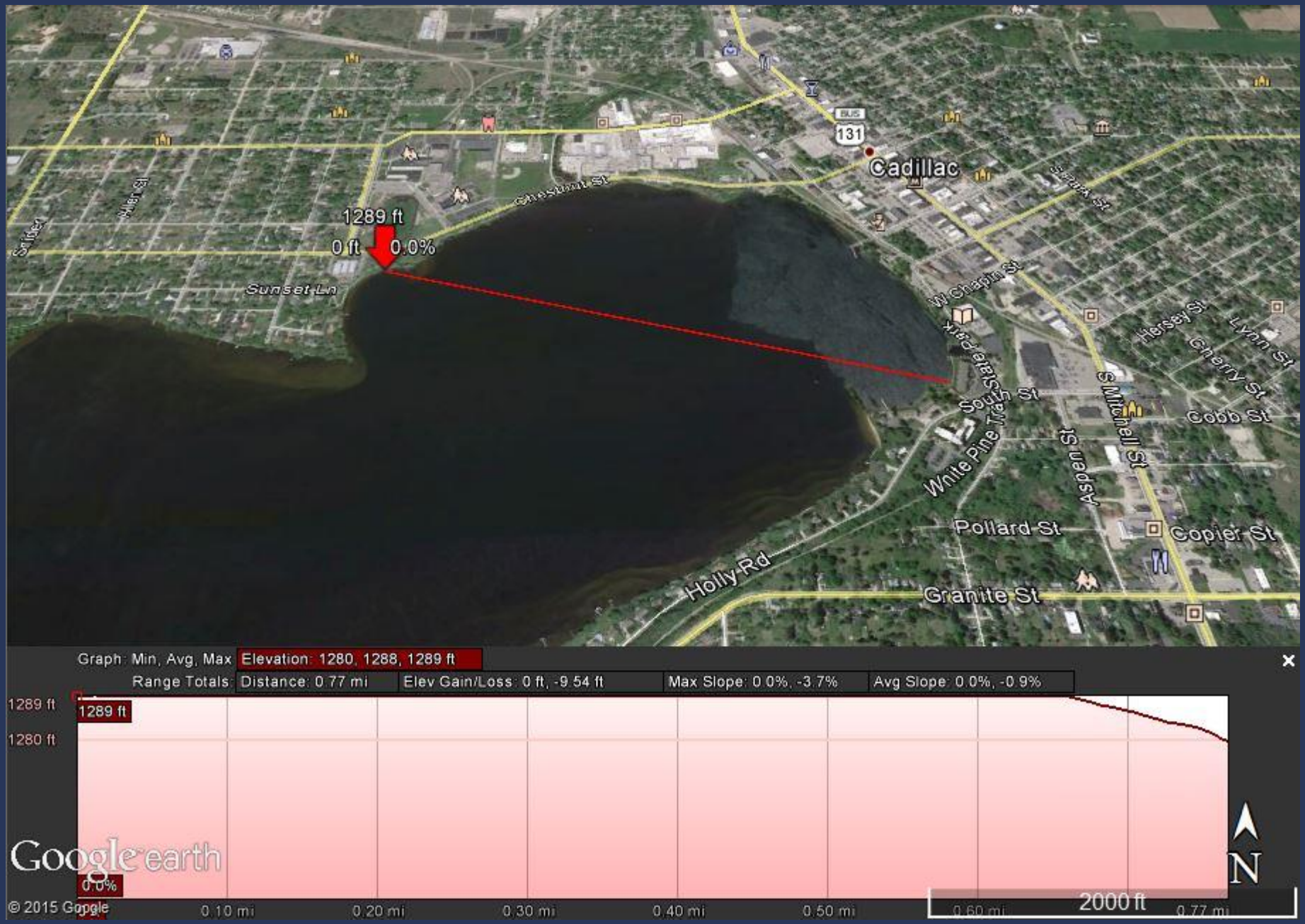
2013 (Year 3)

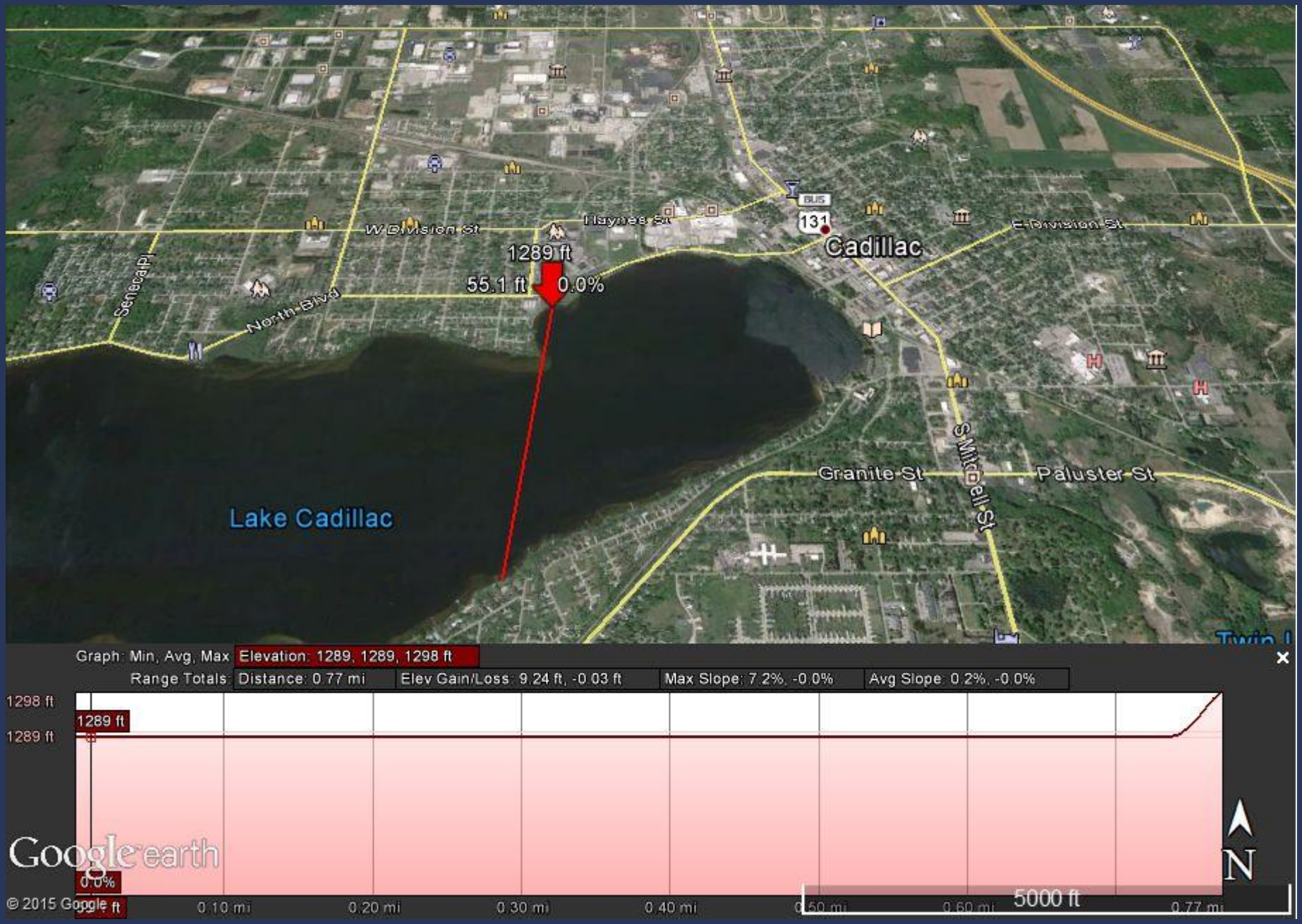
2013 (Year 3)

2014 (Year 4)

Lake Cadillac Observation #1

- Shoreline susceptibility to erosion appears to be sensitive to changes in shoreline orientation
- Subtle changes to shoreline orientation, geometry, bathymetry, and slope may be more important to successful shoreline restoration than we realized


1289 ft
0 ft
0.0%
Cadillac
131
Chestnut St
Sunset Ln
W Chapin St
South St
White Pine Trail State Park
Aspen St
S Mitchell St
Hersey St
Cherry St
Lynn St
Cobb St
Pollard St
Copier St
Holly Rd
Granite St
Graph: Min, Avg, Max
Elevation: 1280, 1288, 1289 ft
Range Totals:
Distance: 0.77 mi
Elev Gain/Loss: 0 ft, -9.54 ft
Max Slope: 0.0%, -3.7%
Avg Slope: 0.0%, -0.9%
1289 ft
1280 ft
0.0%
0.10 mi
0.20 mi
0.30 mi
0.40 mi
0.50 mi
0.60 mi
0.77 mi
2000 ft
N
Google earth
© 2015 Google


W Division St
Haynes St
BUS
131
Cadillac
E Division St
1289 ft
55.1 ft
0.0%
Seneca Pl
North Blvd
Lake Cadillac
Granite St
Paluster St
S Mitchell St
Graph: Min, Avg, Max
Elevation: 1289, 1289, 1298 ft
Range Totals
Distance: 0.77 mi
Elev Gain/Loss: 9.24 ft, -0.03 ft
Max Slope: 7.2%, -0.0%
Avg Slope: 0.2%, -0.0%
1298 ft
1289 ft
1289 ft
0.0%
0.10 mi
0.20 mi
0.30 mi
0.40 mi
0.60 mi
0.77 mi
5000 ft
N
Google earth
© 2015 Google

Lake Cadillac Observation #2

- Local historic wind data (direction) may be more accurate than Regional wind data; may potentially alter the restoration practice.

Obtaining Winds for Cadillac, MI

Regional-Average Annual Wind Directions

Eichenlaub, V.L. et.al. (1990). The Climatic Atlas of Michigan. U. of Notre Dame Press, Notre Dame, IN.

Local Winds (historic: daily, weekly, monthly)

Weather Warehouse Historical Weather Data (1955-2015)

Wexford County Airport w/I 6.4 miles

WeatherForYou.com – Windfinder, Winds Archives (1999-2015) Fee

Weather Underground – Historic Weather (1948-2015)

Flight Aware (Fee)

National Data Buoy Center NOAA

Lake Cadillac Observation #3

- Wake (boat-generated waves) may be more impactful than Wind-generated waves
- Boat traffic proximity & orientation may impact shoreline stability to a greater extent than we realized

Boat Wake v. Wind Waves

Wake waves direct greater energy onto shorelines with gentle lakebed slopes; and less energy onto shorelines with steep lakebed slopes, where much of the energy is reflected away from the shoreline.

Wind Waves direct greater energy onto shorelines with steep lakebed slopes; and less energy onto shorelines with gentle lakebed slopes.

Where **Wake Waves** are more pronounced than **Wind waves**, Wake Wave energy should be the decisive factor in implementing shoreline restoration practices

Asplund, T. (2000). The effects of motorized watercraft on aquatic ecosystems. Wisconsin Department of Natural Resources, Bureau of integrated Science and University of Wisconsin-Madison, Water Chemistry Program

Glamore, W. (none). A decision support tool for assessing the impact of boat wake waves on inland waterways. Water Research Laboratory, School of Civil and Environmental Engineering, University of New South Wales, Australia

Gourlay, T. (2011). Notes on shoreline erosion due to boat wakes and wind waves. Centre for Marine Science and Technology, Curtin University CMST research report 2-11-16

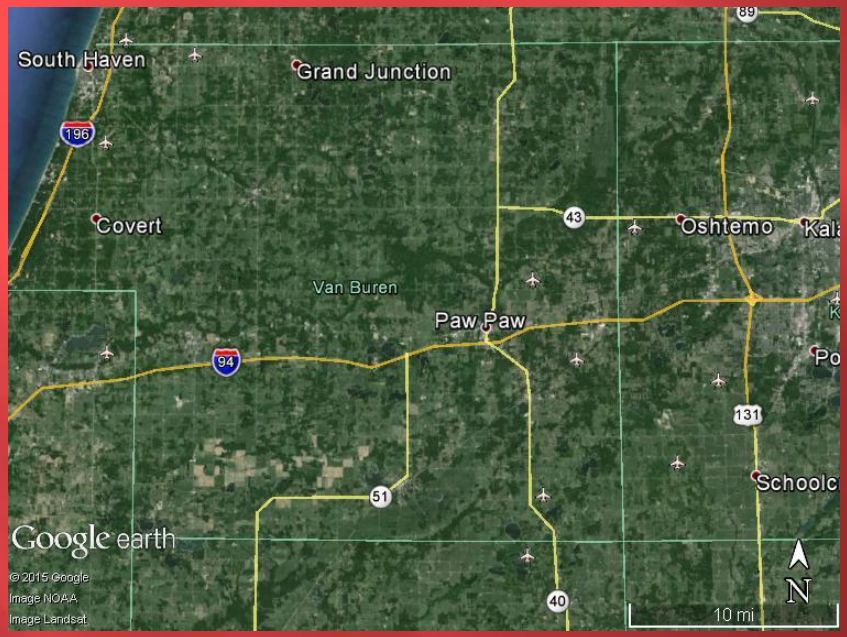
Lake Cadillac Observation #4

- Possible Shoreline Starvation/ Accretion

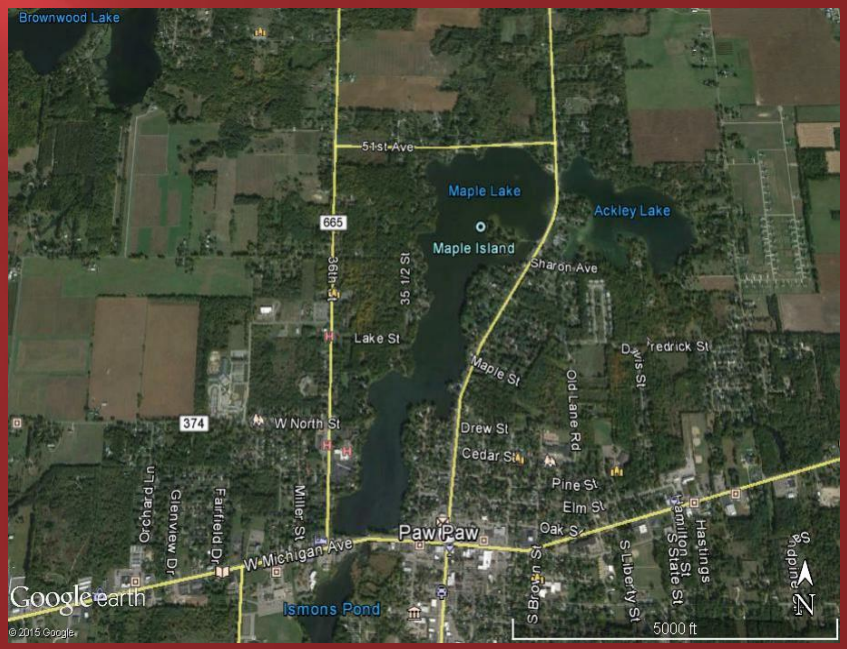
Inadvertent sand starvation and loss of protective beach down-lake of stormwater discharge pipe?

Demonstration Site

- Maple Lake, Paw Paw, Michigan



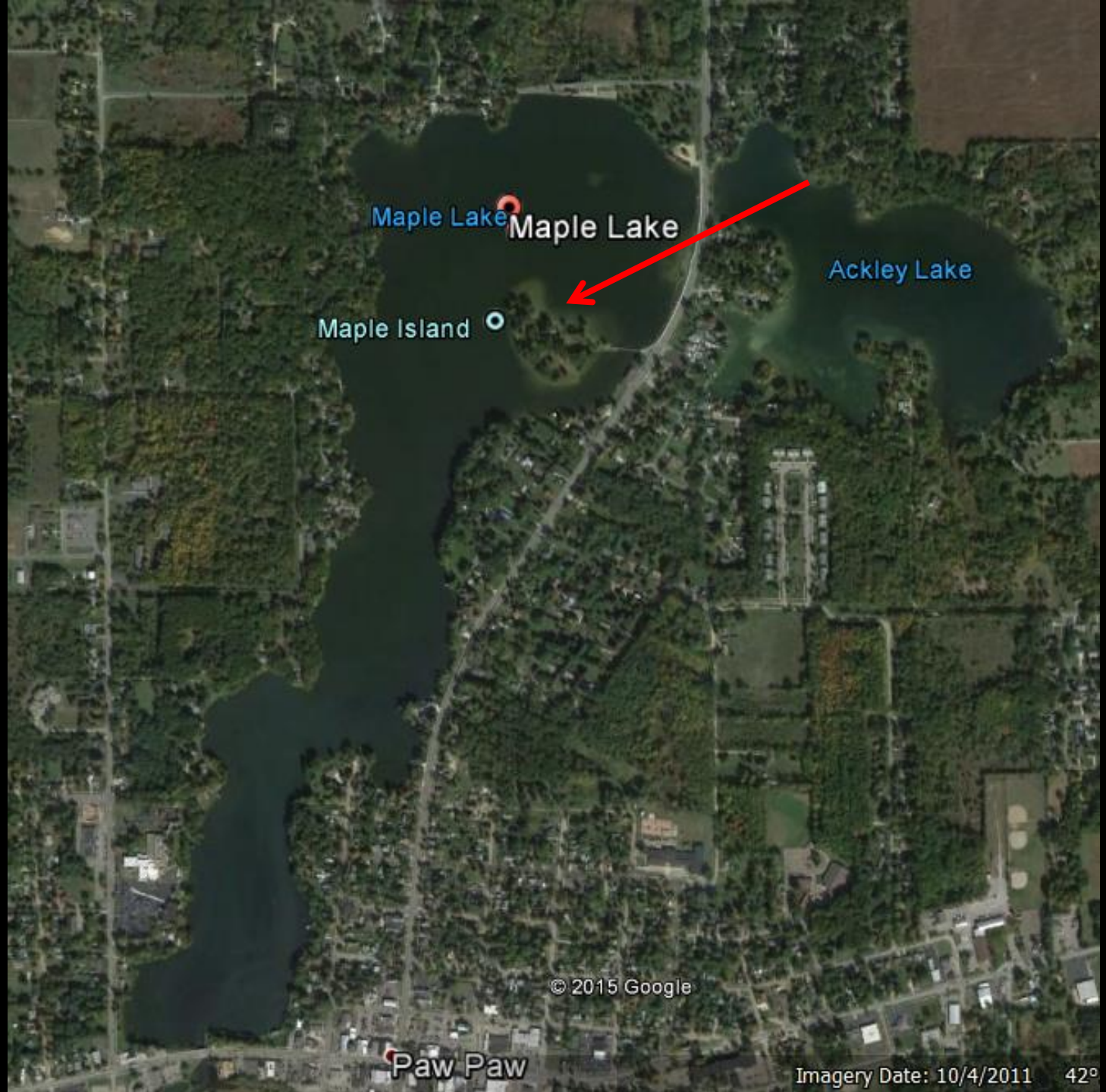
Van Buren County
42.231181 N
85.887364 W

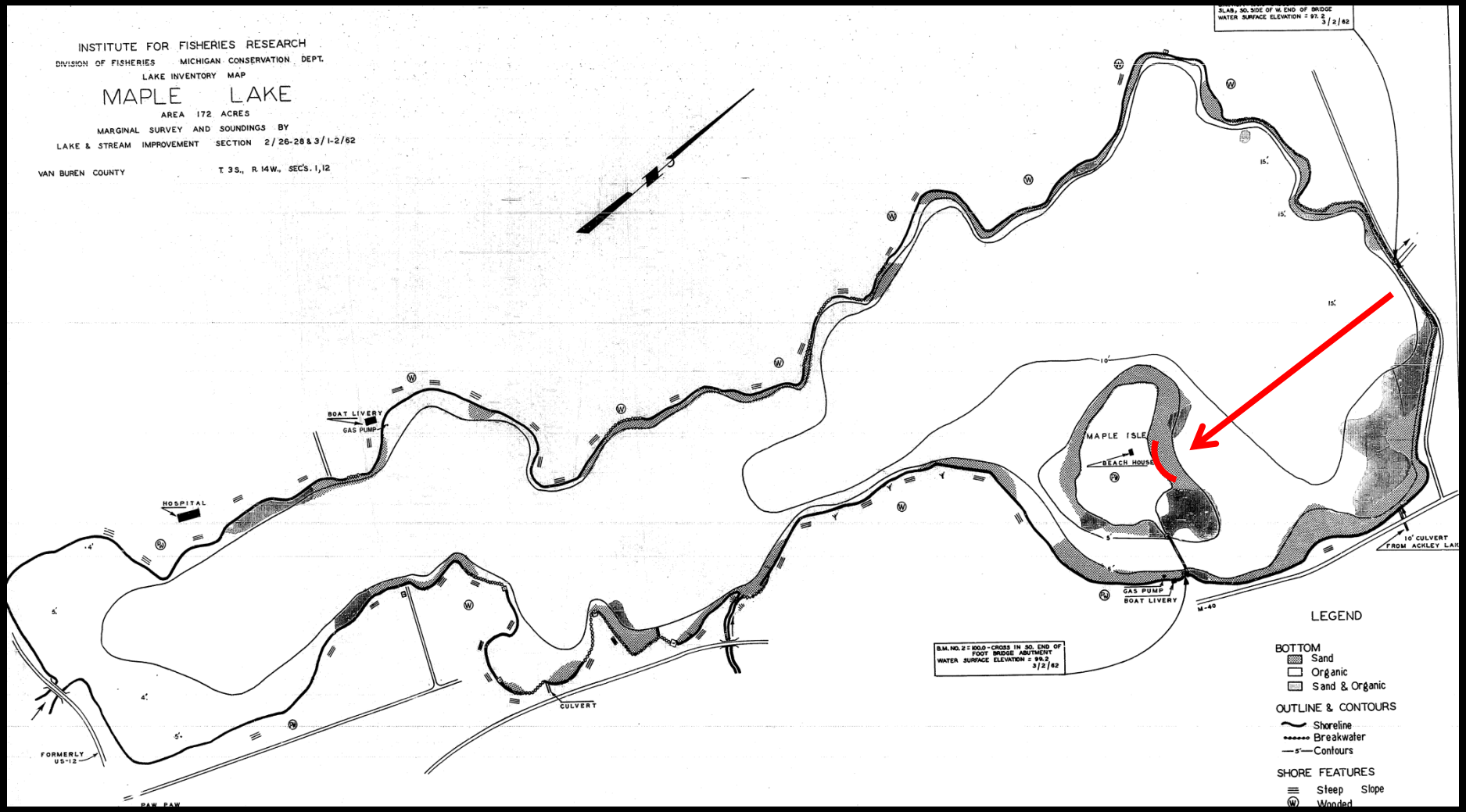


Before

Maple Lake
Maple Isle Park
Village of Paw Paw
Van Buren Co.

Photos: Jane Herbert

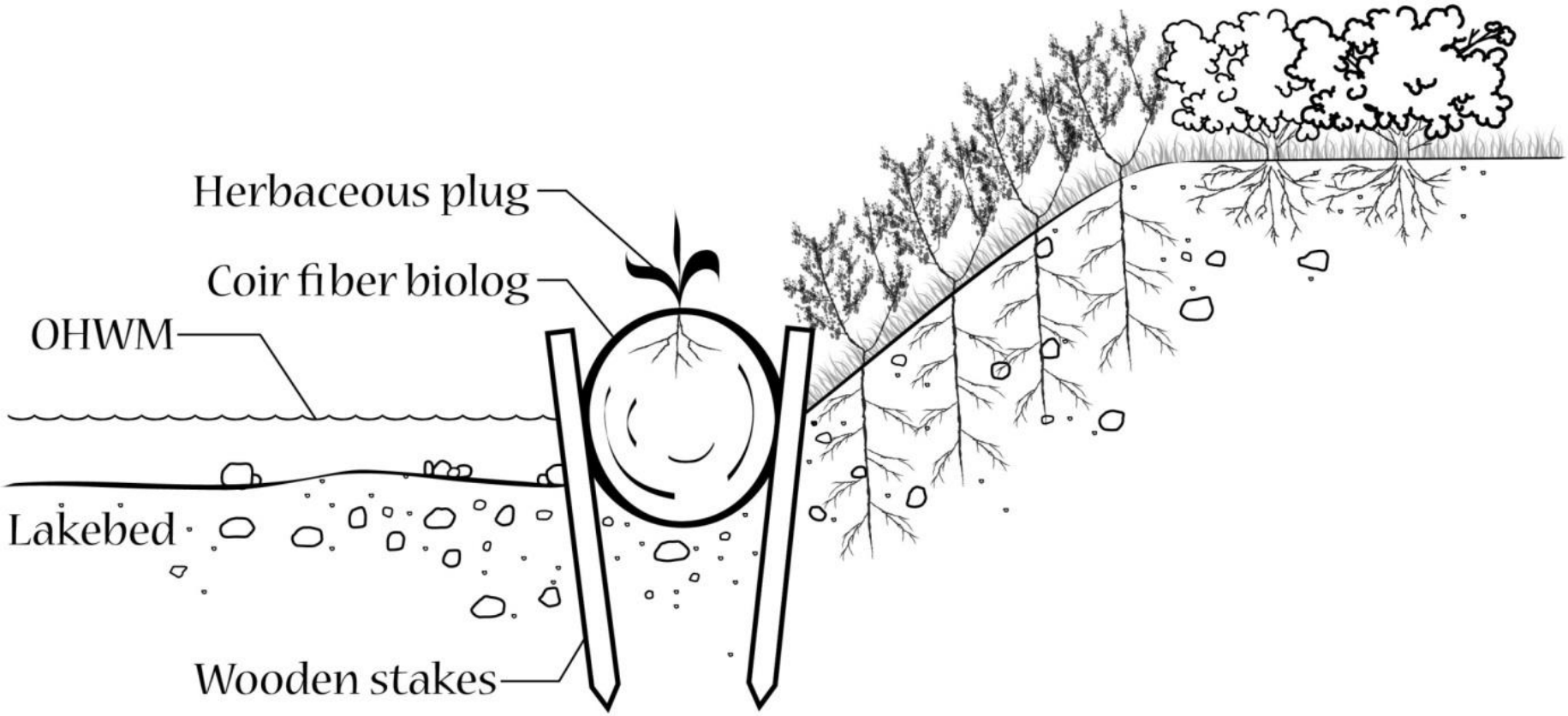

Maple Lake
Maple Lake
Ackley Lake
Maple Island
© 2015 Google
Paw Paw
Imagery Date: 10/4/2011
42°



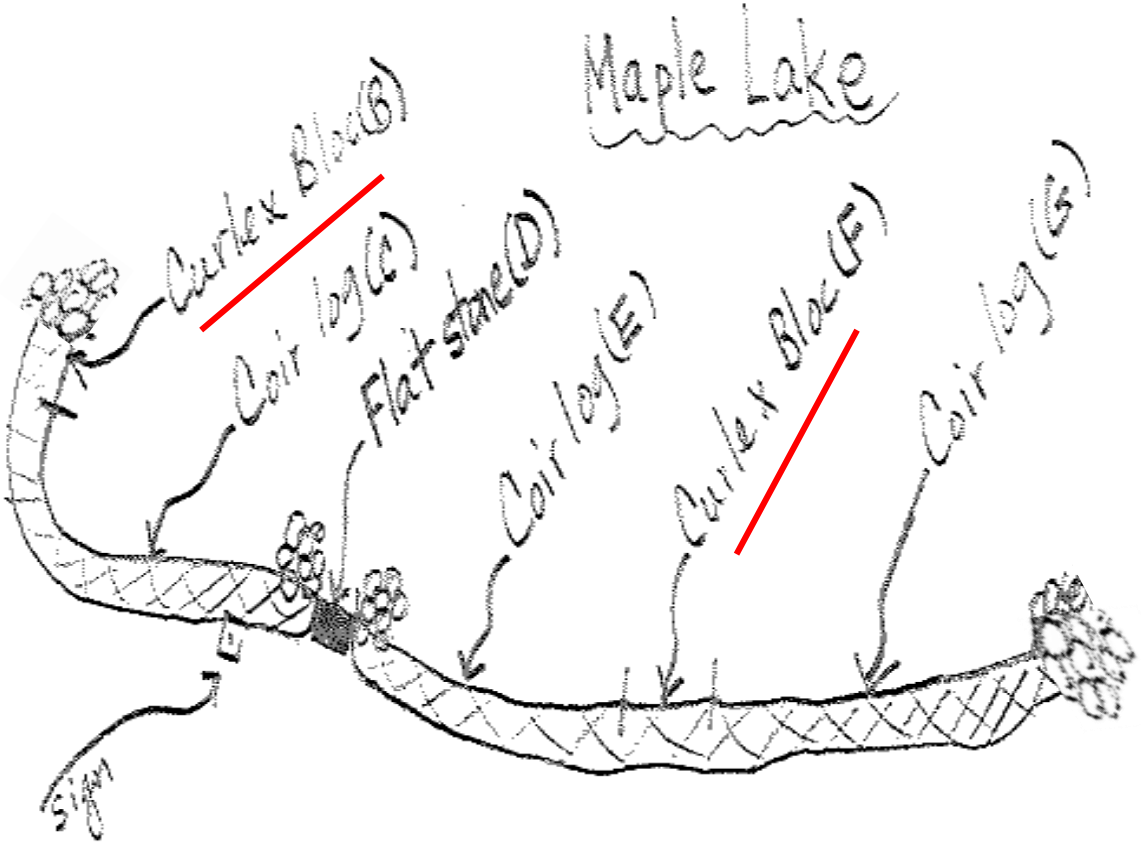
Maximum fetch: 0.25 mi.
Average fetch = 0.18 mi.
Wisconsin Erosion Intensity (EI) Score = 37

Reservoir: Water levels are tightly controlled (within a 4-inch range) for power generation.

Basic design #1



BIOLOG PLACEMENT AT BANK TOE



Plan view (200’ total)

Maple Lake

Maple Isle Park

June 5 & 6, 2013
(200’ total)

Three weeks

Six weeks

Twelve weeks

Year 2

Curlex Bloc F

Year 2

Curlex Bloc B -- at different orientation ?? to lake

Maple Lake Observation #1

- Shoreline susceptibility to erosion appears to be sensitive to changes in shoreline orientation
- Shoreline orientation, geometry, bathymetry, and slope may be more important to successful shoreline restoration than we realized

Maple Lake Observation #2

- Local historic wind data (direction) may be more accurate than Regional wind data; may potentially alter the restoration practice.

Maple Lake Observation #3

- Water level fluctuation is maintained by a dam for power generation. The consistent range of fluctuation (~ 4”):
  - Makes project design easier
  - Does not allow for exposed lakebed
  - May impact the way the shoreline functions biologically (plant establishment on lake bed)

Maple Lake Observation #4

- Wave Run-Up directs the force of the waves
  - **Wake waves** direct greater energy onto shorelines with gentle lakebed slopes; and less energy onto shorelines with steep lakebed slopes, where much of the energy is reflected away from the shoreline.
  - **Wind Waves** direct greater energy onto shorelines with steep lakebed slopes; and less energy onto shorelines with gentle lakebed slopes.

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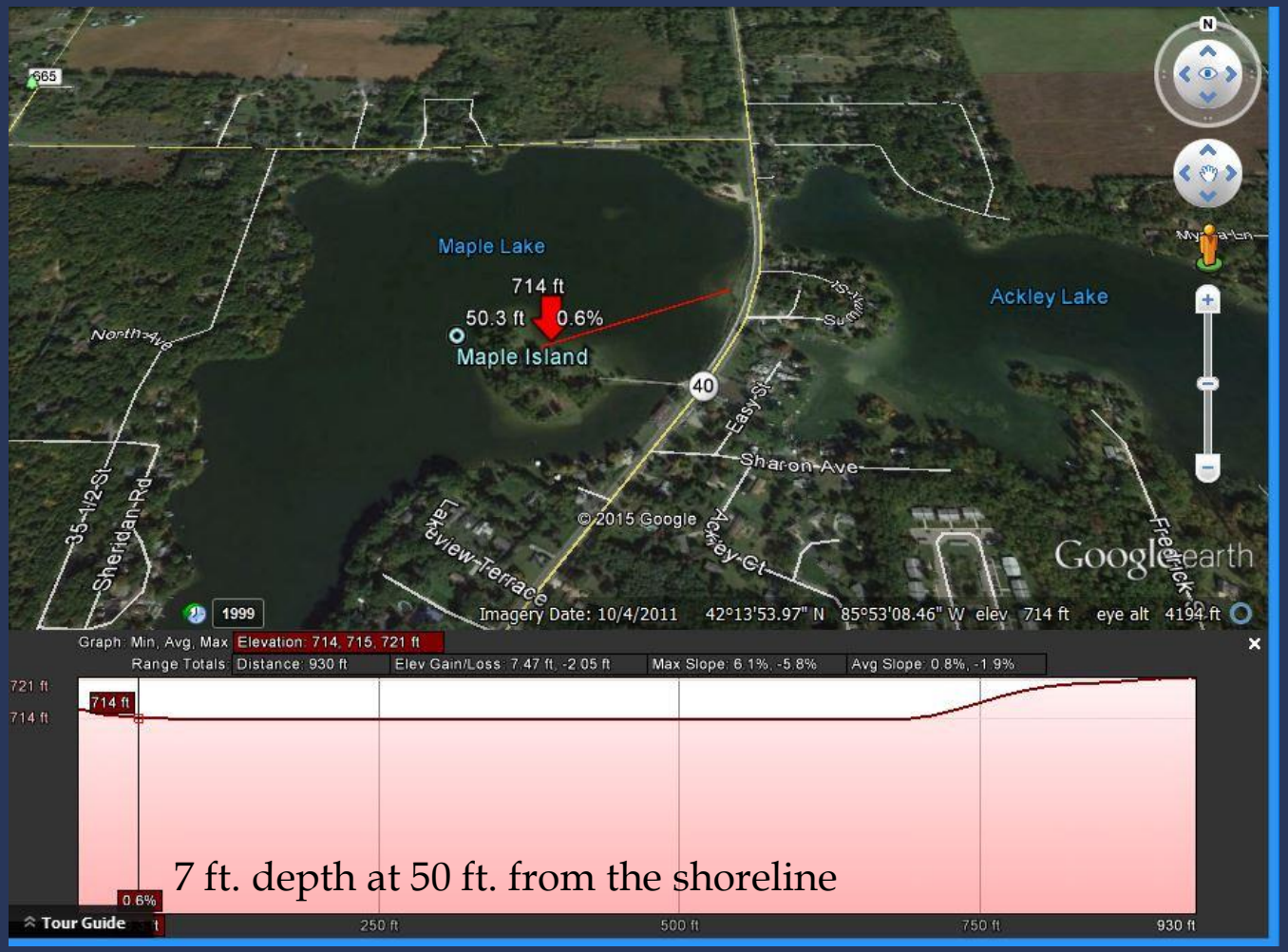
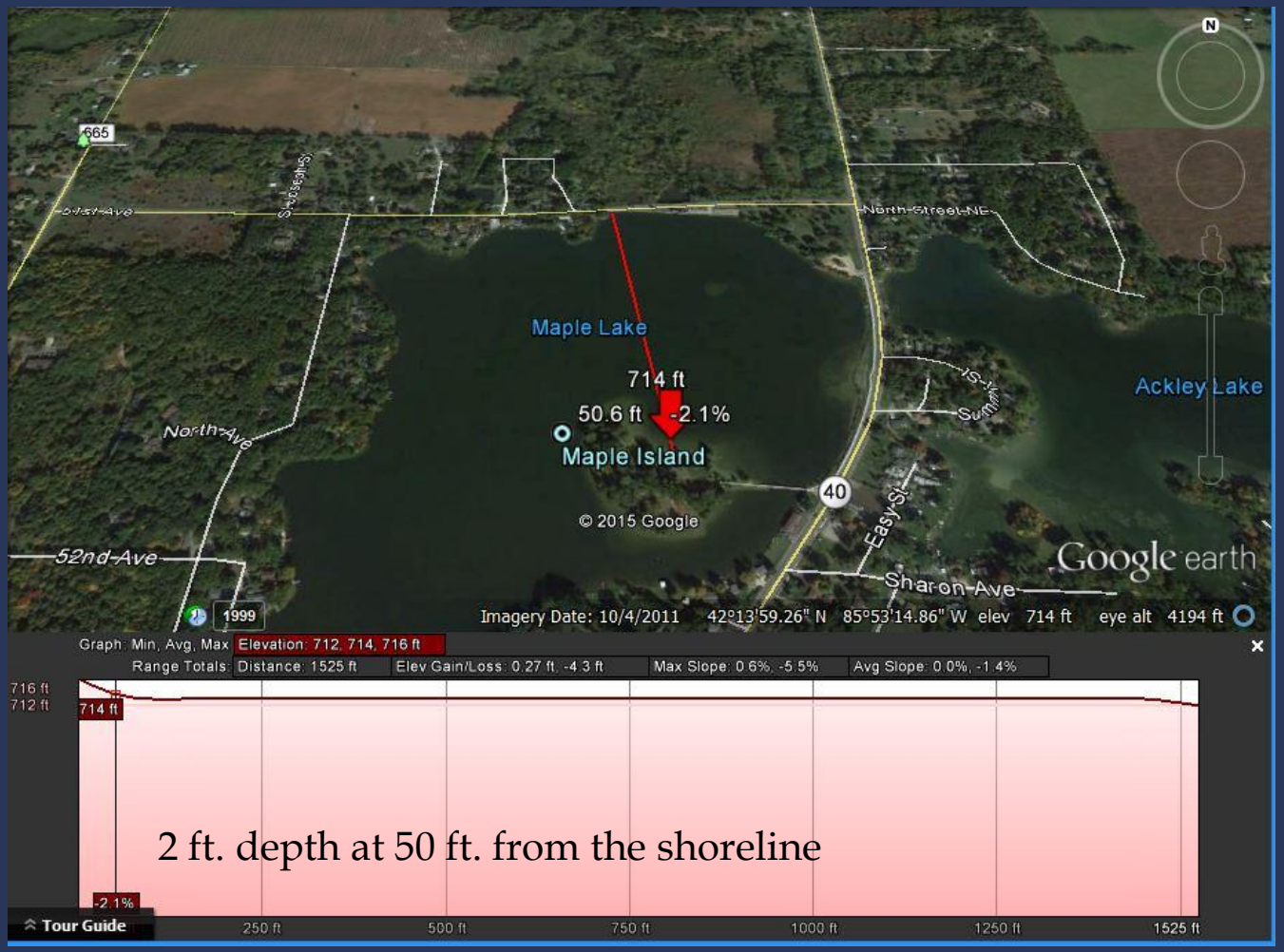
- Where Wake Waves are more pronounced than Wind waves, Wake Wave energy should be the deciding factor in deciding on shoreline restoration practices

Distance & Bathymetry over a Northeasterly Run Based on Changes in Shoreline Orientation



7 ft. depth at 50 ft. from the shoreline

Distance & Bathymetry over a Northwesterly Run Based on Changes in Shoreline Orientation



Summary/Considerations

- For subtle changes in shoreline orientation
  - Conduct additional assessments where changes in orientation to prevailing winds occur along a shoreline
  - Use local historic wind direction data when available

- If significant boat wake energy is suspected
  - Wake waves may be more impactful than Wind Waves
  - Determine bathymetry at 50 ft. out from water's edge

- Tightly controlled water levels (eg. Maple Lake)
  - May slow movement of plants onto lake bed

- Relatively small structures (eg. Lake Cadillac storm drain)
  - May impede beach building – plan accordingly

What "fixes" might we consider for these existing projects?

- Lake Cadillac – addition of 12" coir log in front of problem area?
  - Encourage plants to move out into deeper water (more root systems to protect shoreline)

What "fixes" might we consider for these existing projects?

- Maple Lake

Too early to tell?

Questions? Comments?