






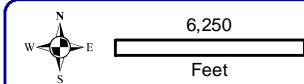
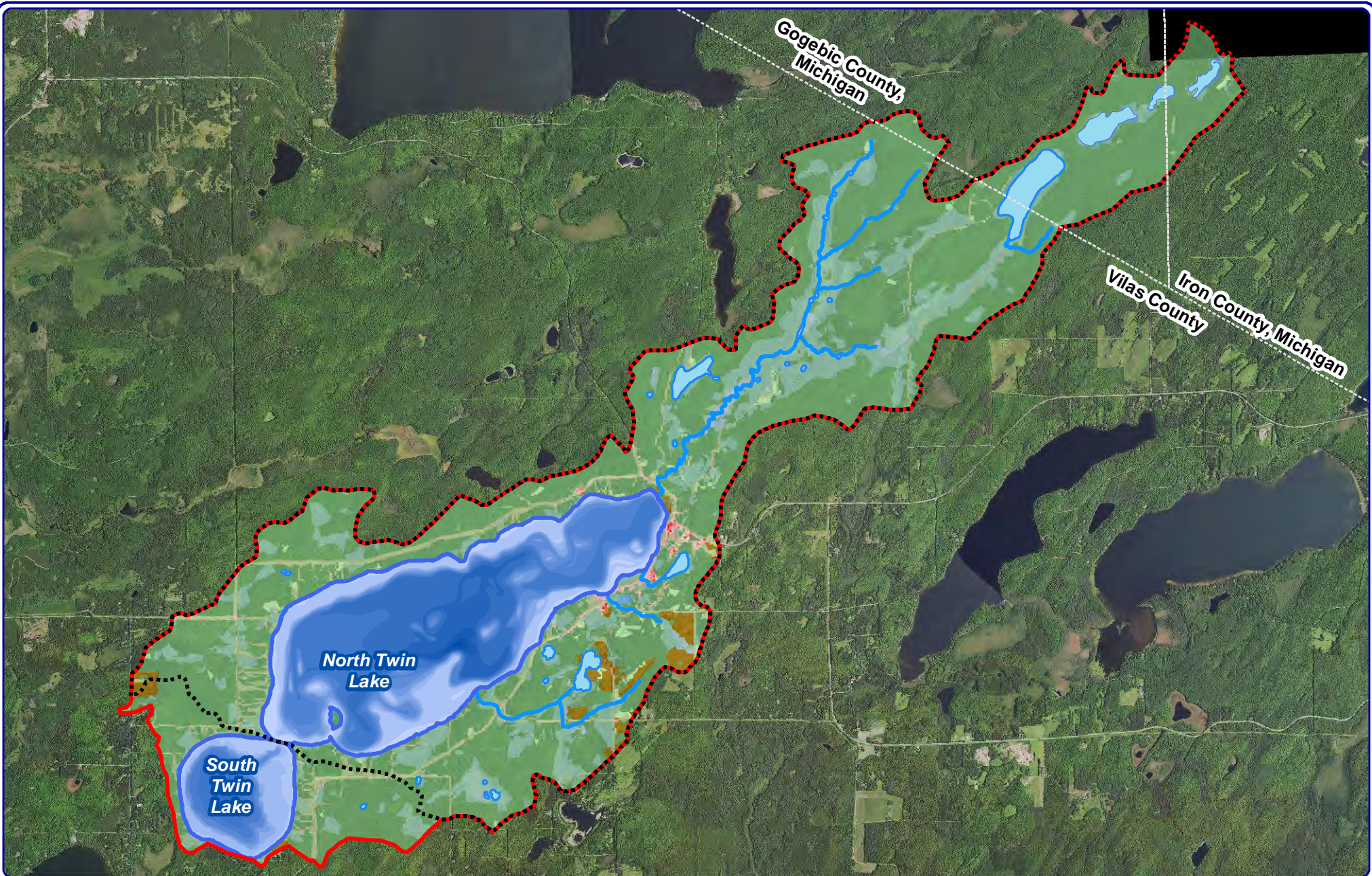
Onterra LLC
 Lake Management Planning
 815 Prosper Road
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

Sources:
 Roads and Hydro: WDNR
 Bathymetry: WDNR, Onterra digitized
 Map Date: May 30, 2017
 Filename: Map1_NSTwin_Location.mxd

Legend

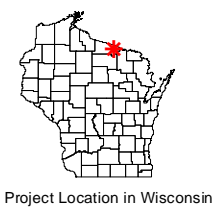
-  North and South Twin Lake ~ 3,516 acres
Onterra Definition
-  Point-Intercept Survey Location
 - North Twin: 100 meter spacing, 1,164 total points
 - South Twin: 63 meter spacing, 622 total points
-  Public Access
-  Public Park
-  Public Beach
-  Water Quality Sampling Locations

Map 1
 North and South Twin Lake
 Vilas County, Wisconsin
**Project Location
 & Lake Boundaries**



Onterra LLC
 Lake Management Planning
 815 Prosper Road
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

Sources:
 Hydro: WDNR
 Bathymetry: WDNR, Onterra digitized
 Orthophotography: NAIP 2015
 Land Cover: NLCD 2011
 Watershed Boundaries: Onterra 2016
 Map Date: April 4, 2017
 Filename: NSTwin_Watershed.mxd



Legend

Land Cover Types	
	Forest
	Forested Wetlands
	Wetlands
	Open Water
	Rural Open Space
	Pasture/Grass
	Row Crops
	Rural Residential
	Medium Density Urban
	High Density Urban

	South Twin Lake Watershed Boundary
	North Twin Lake Watershed Boundary
	River/Stream

Map 2
 North & South
 Twin Lake
 Vilas County, Wisconsin
**Watershed &
 Land Cover Types**



Onterra LLC
 Lake Management Planning
 815 Prosper Road
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

Sources:
 Hydro: WDNR
 Orthophotography: NAIP, 2015
 Shoreline Assessment: Onterra, 2016
 Map Date: December 7, 2016
 Filename: NTwin_ShorelandCondition_2016.mxd



Project Location in Wisconsin

Legend

- Natural/Undeveloped
- Developed-Natural
- Developed-Semi-Natural
- Developed-Unnatural
- Urbanized

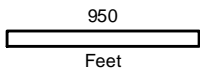
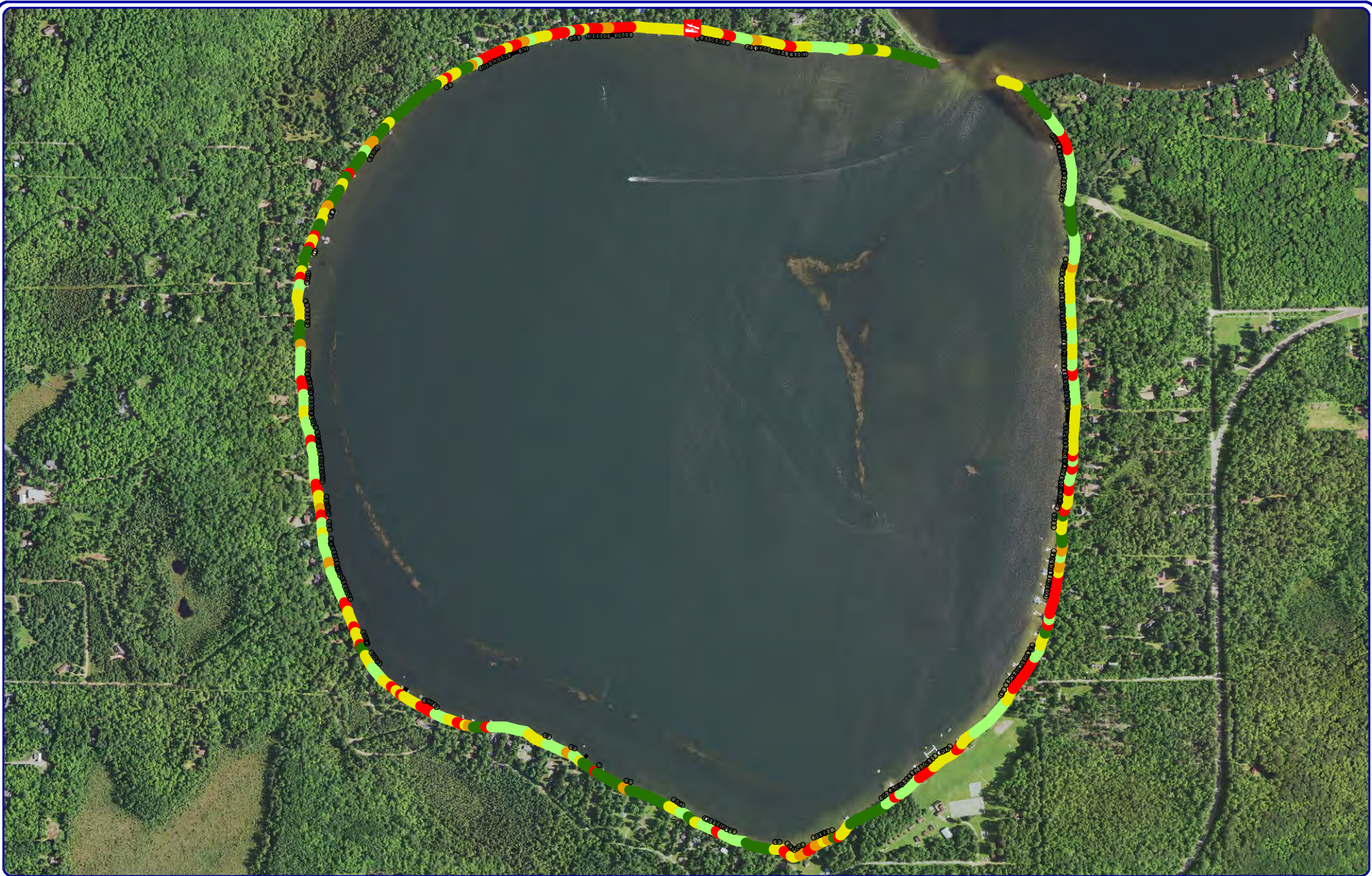
Seawall

- Rip-Rap
- Wood/Masonry/Metal

Map 3

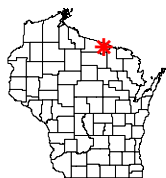
North Twin Lake
 Vilas County, Wisconsin

2016 Shoreland Condition



Onterra LLC
 Lake Management Planning
 815 Prosper Road
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

Sources:
 Hydro: WDNR
 Orthophotography: NAIP, 2015
 Shoreline Assessment: Onterra, 2016
 Map Date: December 2, 2016
 Filename: STwin_ShorelandCondition_2016.mxd



Project Location in Wisconsin

Legend

- Natural/Undeveloped
- Developed-Natural
- Developed-Semi-Natural
- Developed-Unnatural
- Urbanized

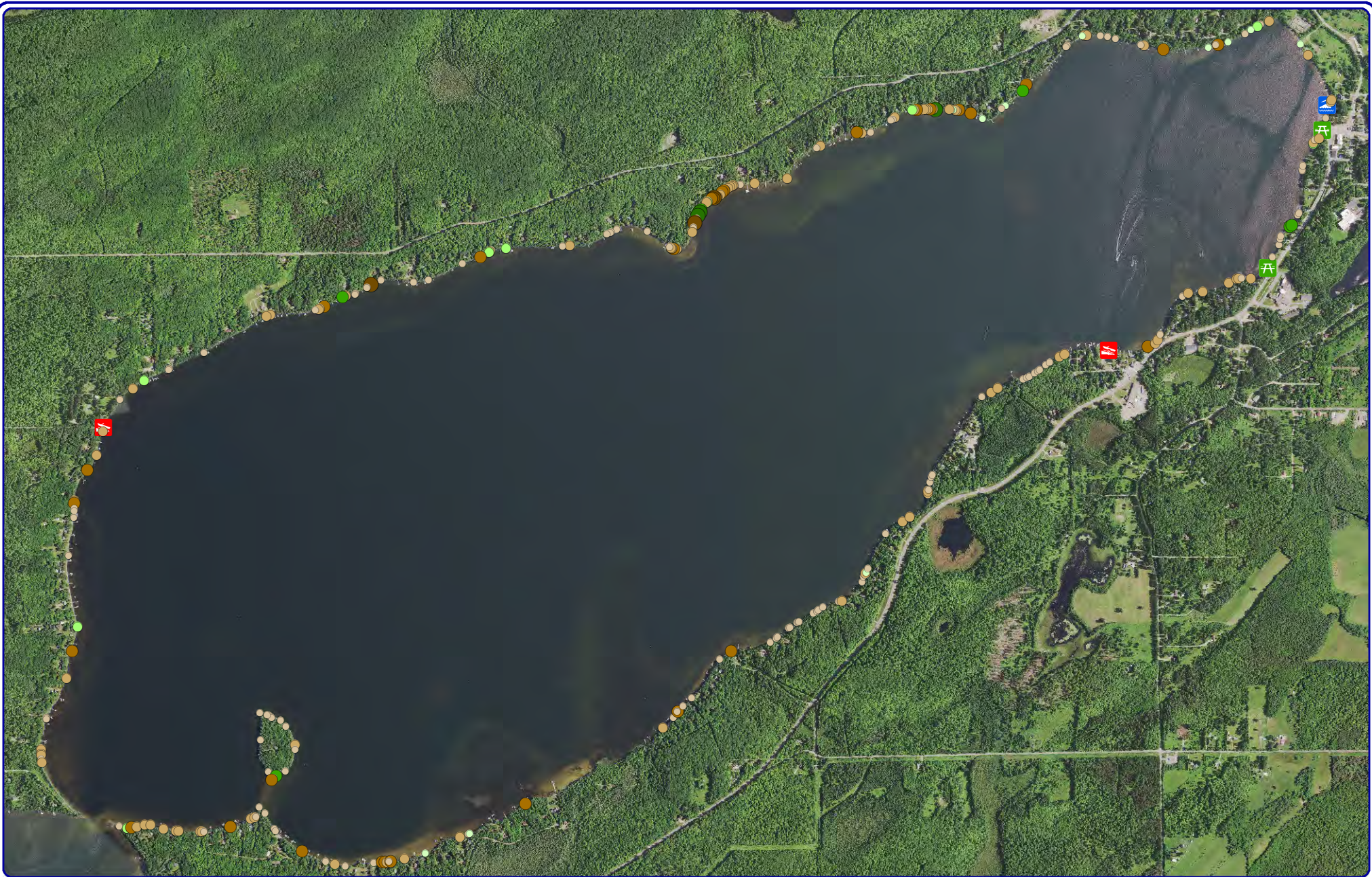
Seawall

- Rip-Rap
- Wood/Masonry/Metal

Map 4

South Twin Lake
 Vilas County, Wisconsin

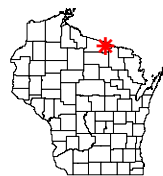
**2016 Shoreland
 Condition**



1,200
Feet

Onterra, LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Hydro: WDNR
Orthophotography: NAIP, 2015
Shoreline Assessment: Onterra, 2016
Map Date: December 7, 2016
Filename: NTwin_CWH_2016.mxd



Project Location in Wisconsin

2-8 Inch Pieces

- No Branches
- Minimal Branches
- Moderate Branches
- Full Canopy

8+ Inch Pieces

- No Branches
- Minimal Branches
- Moderate Branches
- Full Canopy

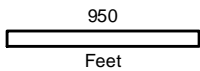
Cluster of Pieces

- No Branches (none)
- Minimal Branches (none)
- Moderate Branches (none)
- Full Canopy (none)

Map 6

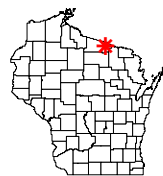
North Twin Lake
Vilas County, Wisconsin

**Coarse Woody
Habitat**



Onterra, LLC
 Lake Management Planning
 815 Prosper Road
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

Sources:
 Hydro: WDNR
 Orthophotography: NAIP, 2015
 Shoreline Assessment: Onterra, 2016
 Map Date: December 7, 2016
 Filename: STwin_CWH_2016.mxd



Project Location in Wisconsin

2-8 Inch Pieces

- No Branches
- Minimal Branches
- Moderate Branches
- Full Canopy (none)

Legend

8+ Inch Pieces

- No Branches
- Minimal Branches
- Moderate Branches (none)
- Full Canopy

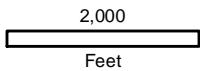
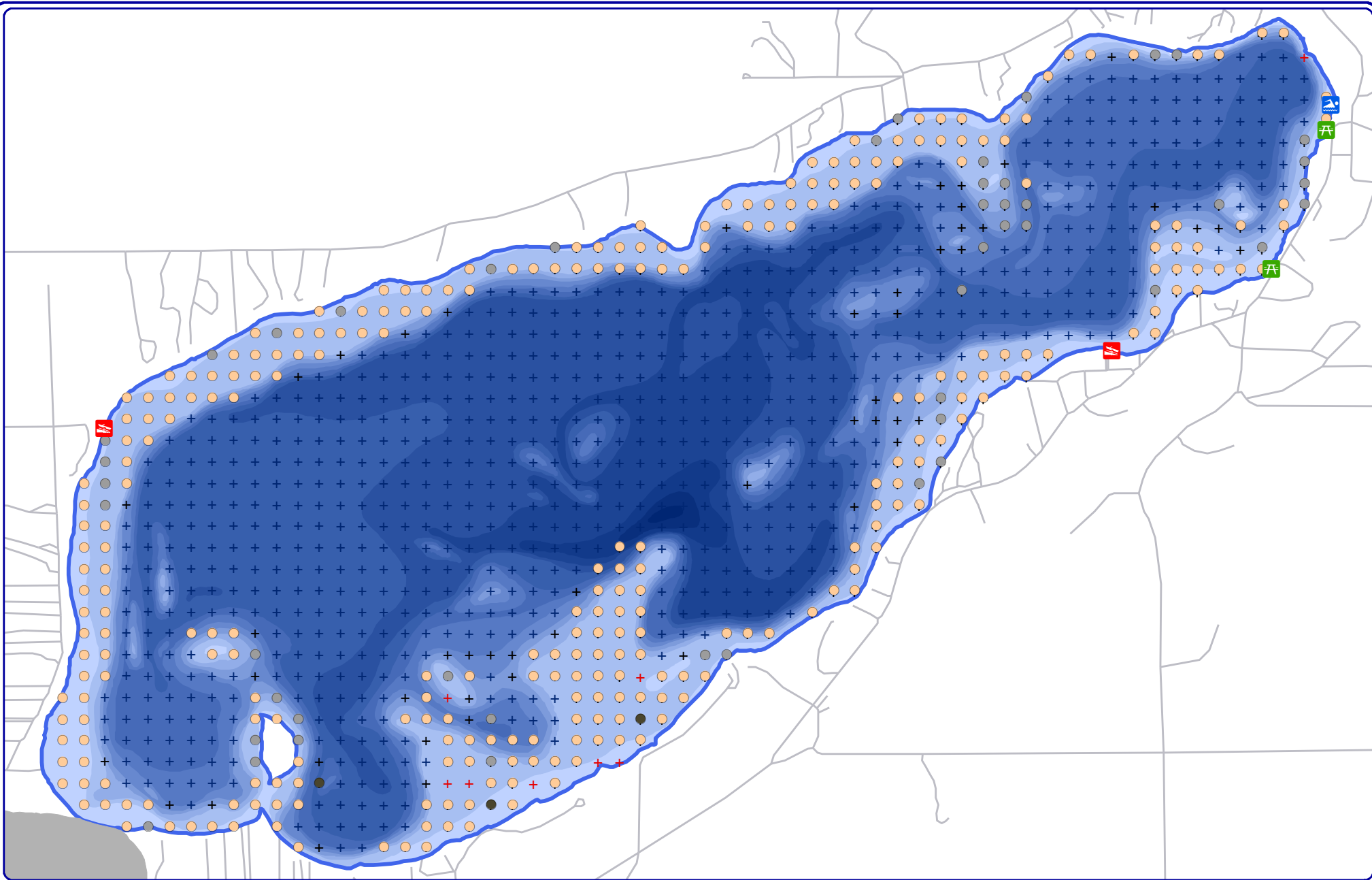
Cluster of Pieces

- No Branches (none)
- Minimal Branches (none)
- Moderate Branches (none)
- Full Canopy (none)

Map 6

South Twin Lake
 Vilas County, Wisconsin

**Coarse Woody
 Habitat**



Project Location in Wisconsin

Legend

- Soft/Organic Sediments
- Rock
- Sand
- + Too Deep
- + Non-Navigable

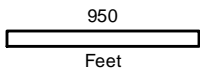
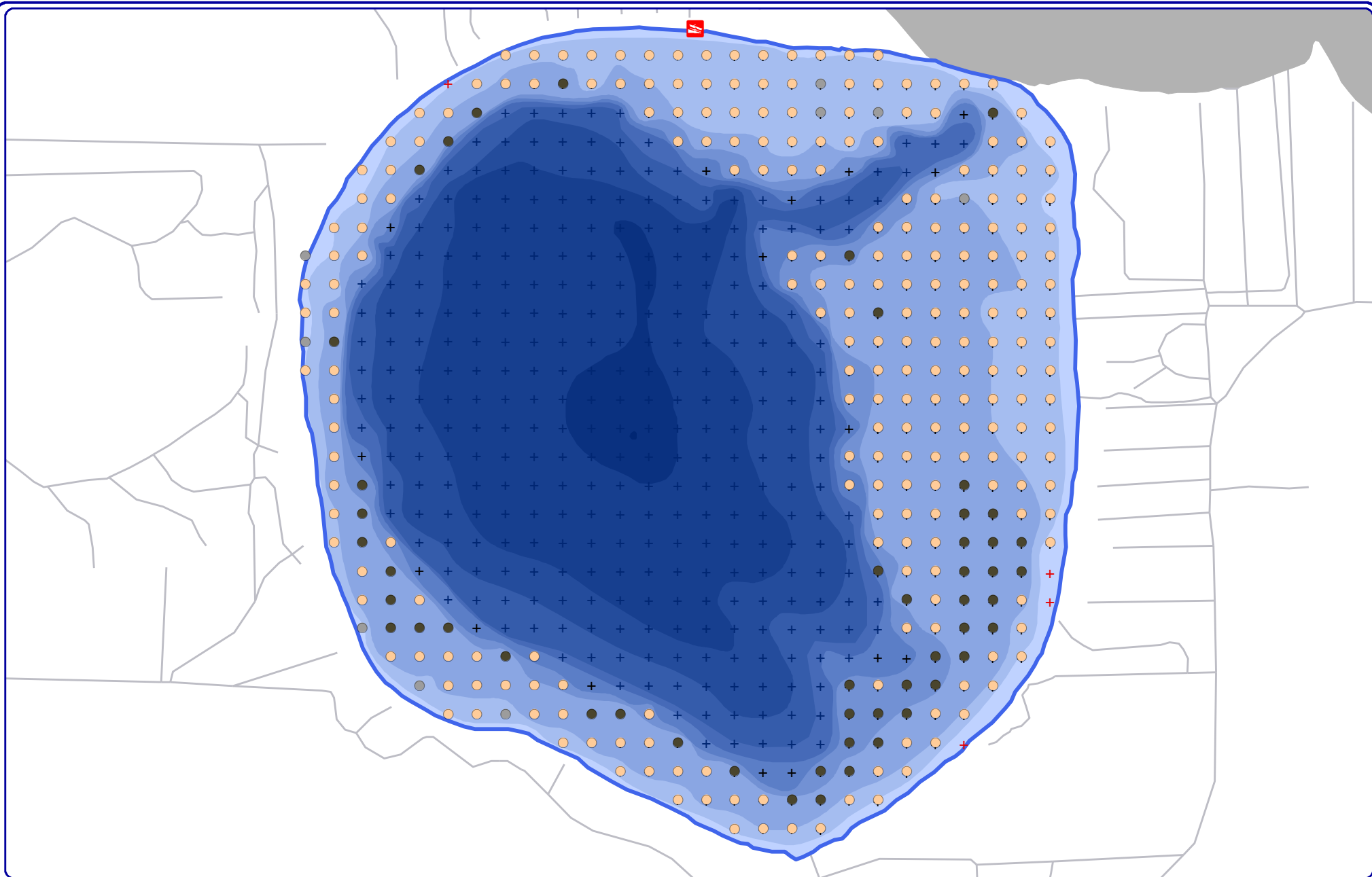
Map 7 North Twin Lake

Vilas County, Wisconsin

2016 PI Survey: Substrate Types

Onterra LLC
Lake Management Planning
815 Prosper Rd
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Plant Survey: Onterra, 2016
Map Date: May 31, 2017
Filename: Map7_NTwin_TRFPL_2016.mxd



Project Location in Wisconsin

Legend

- Soft/Organic Sediments
- Rock
- Sand
- + Too Deep
- + Non-Navigable

Map 8

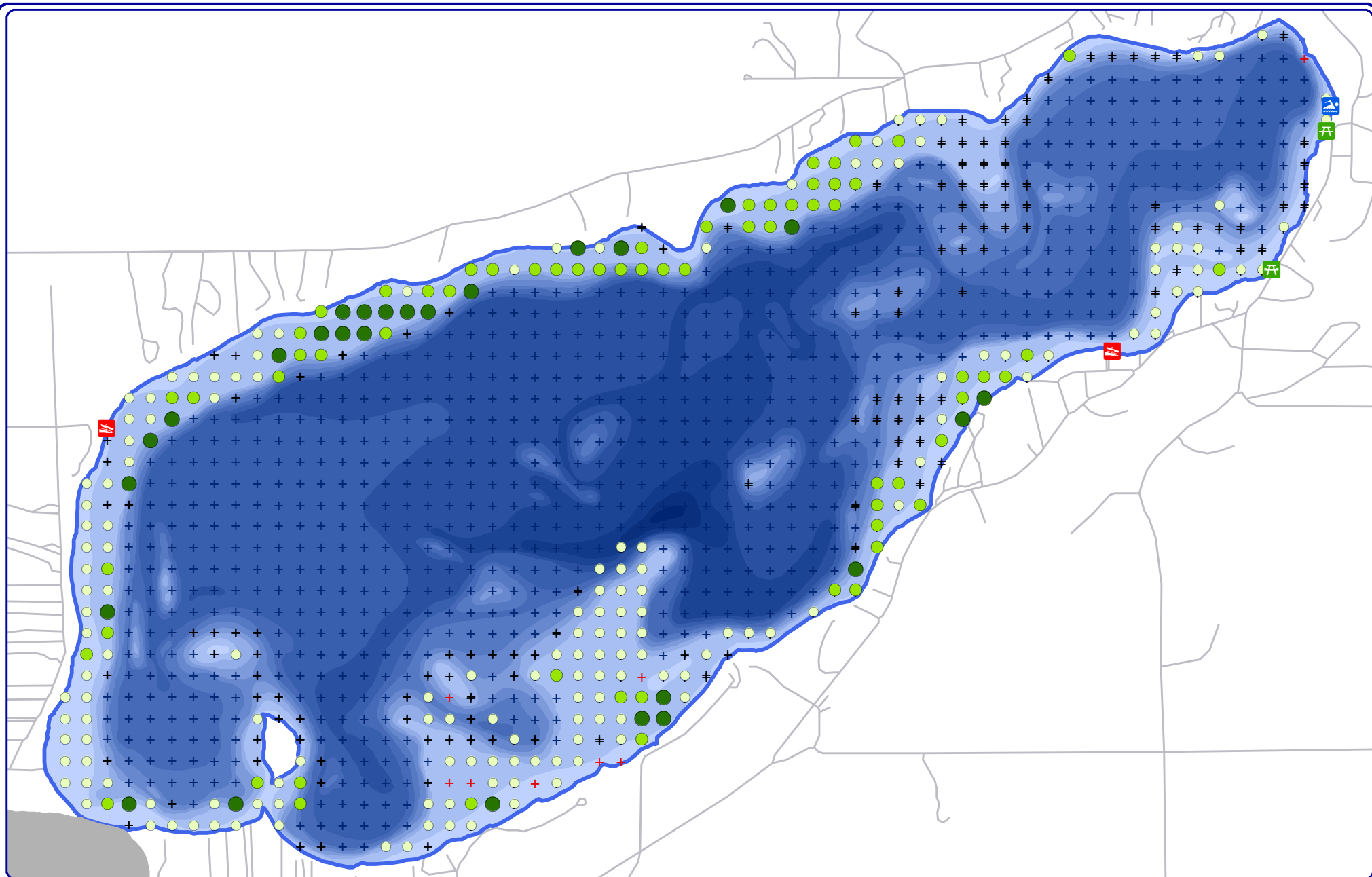
South Twin Lake

Vilas County, Wisconsin

2016 PI Survey: Substrate Types

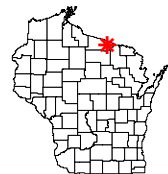
Onterra LLC
Lake Management Planning
815 Prosper Rd
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Plant Survey: Onterra, 2016
Map Date: May 31, 2017
Filename: Map8_STwin_SedPI_2016.mxd



2,000

Feet



Project Location in Wisconsin

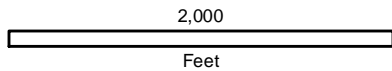
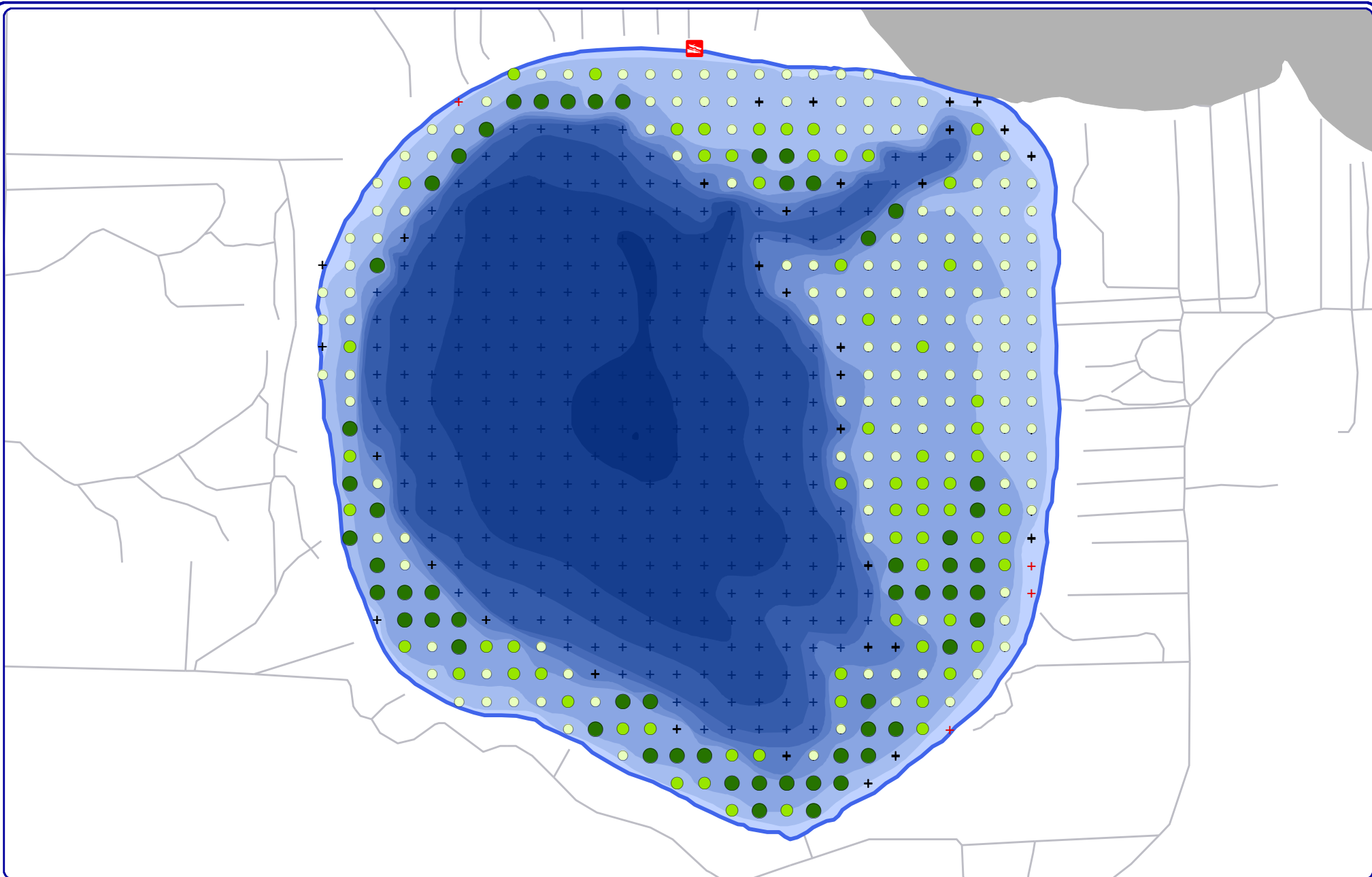
Onterra LLC
 Lake Management Planning
 815 Prosper Rd
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

Sources:
 Roads and Hydro: WDNR
 Plant Survey: Onterra, 2016
 Map Date: November 30, 2016
 Filename: MapX_NTwin_TRFPI_2016.mxd

Legend

- Total Rake Fullness = 1
- Total Rake Fullness = 2
- Total Rake Fullness = 3
- + No Vegetation
- + Non-Navigable

Map 9
 North Twin Lake
 Vilas County, Wisconsin
2016 PI Survey:
Aquatic Vegetation
Distribution



Project Location in Wisconsin

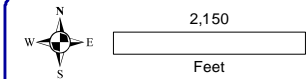
Legend

- Total Rake Fullness = 1
- Total Rake Fullness = 2
- Total Rake Fullness = 3
- + No Vegetation
- + Non-Navigable

Onterra LLC
 Lake Management Planning
 815 Prosper Rd
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

Sources:
 Roads and Hydro: WDNR
 Plant Survey: Onterra, 2016
 Map Date: November 30, 2016
 Filename: MapX_STwin_TRFPL_2016.mxd

Map 10
 South Twin Lake
 Vilas County, Wisconsin
2016 PI Survey:
Aquatic Vegetation
Distribution



Onterra LLC
 Lake Management Planning
 815 Prosper Road
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

Sources:
 Aquatic Plants: Onterra, 2016
 Orthophotography: NAIP, 2015
 Map Date: October 28, 2016
 Filename: NTwin_Comm_2016.mxd



Project location in Wisconsin

Small Plant Communities

- Emergent
- Floating-leaf
- Mixed Floating-leaf & Emergent

Legend

Large Plant Communities

- Emergent
- Floating-leaf
- Mixed Floating-leaf & Emergent

Map 11
 North Twin Lake
 Vilas County, Wisconsin
**Aquatic Plant
 Communities**



Onterra LLC
 Lake Management Planning
 815 Prosper Road
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

Sources:
 Aquatic Plants: Onterra, 2016
 Orthophotography: NAIP, 2015
 Map Date: October 28, 2016
 Filename: STwin_Comm_2016.mxd



Project location in Wisconsin

Small Plant Communities

- Emergent
- Floating-leaf
- Mixed Floating-leaf & Emergent

Legend

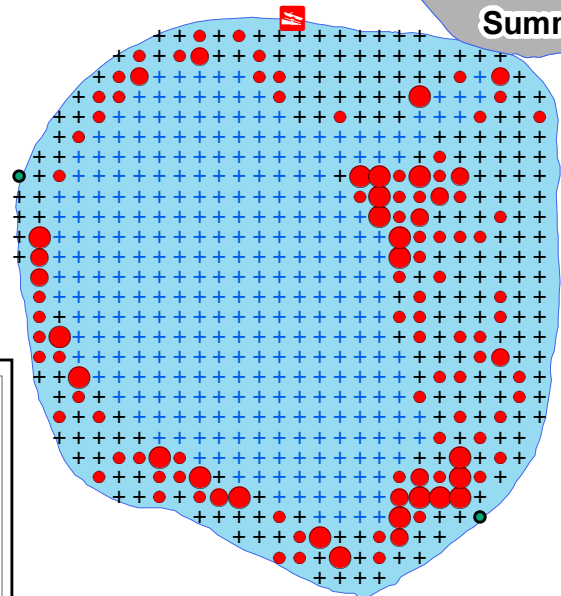
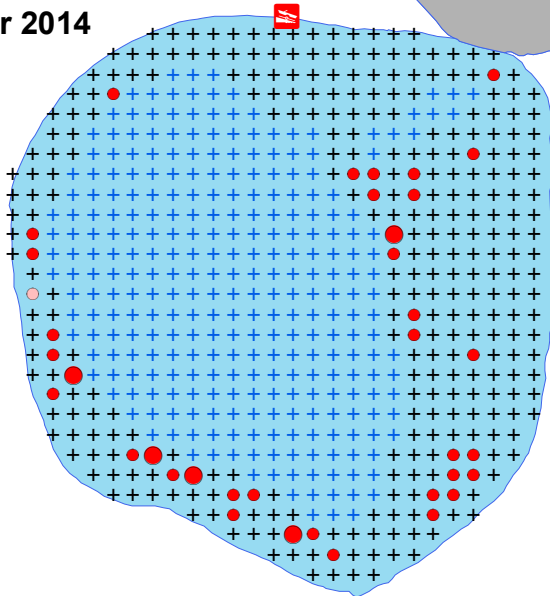
Large Plant Communities

- Emergent
- Floating-leaf
- Mixed Floating-leaf & Emergent

Map 12
 South Twin Lake
 Vilas County, Wisconsin
**Aquatic Plant
 Communities**

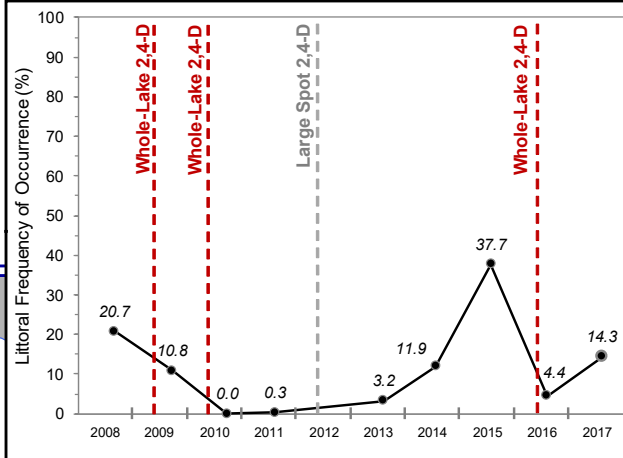
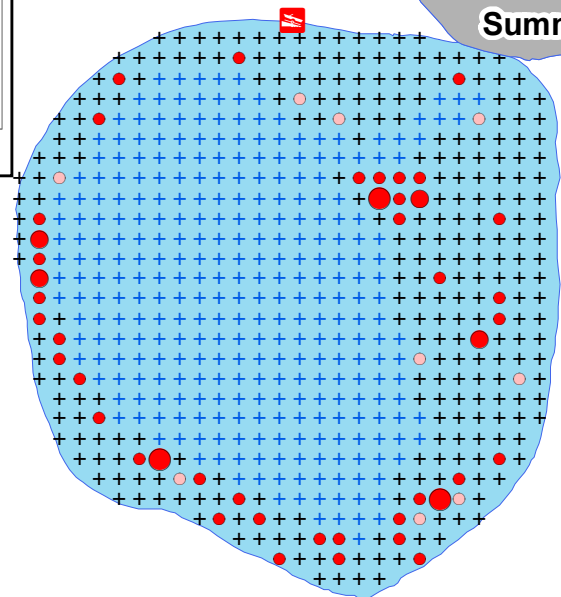
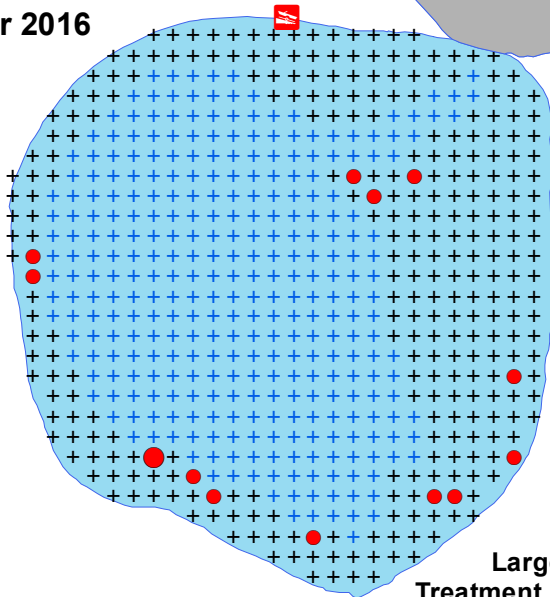
Summer 2014

Summer 2015

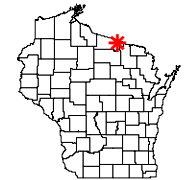
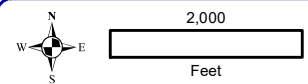


Summer 2016

Summer 2017



Large-Scale Herbicide Treatment Occured in Spring 2016



Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Aquatic Plants: Onterra, 2014-2017
Map Date: October 5, 2017
Filename: STwin_EWM_PI_2011-2017.mxd

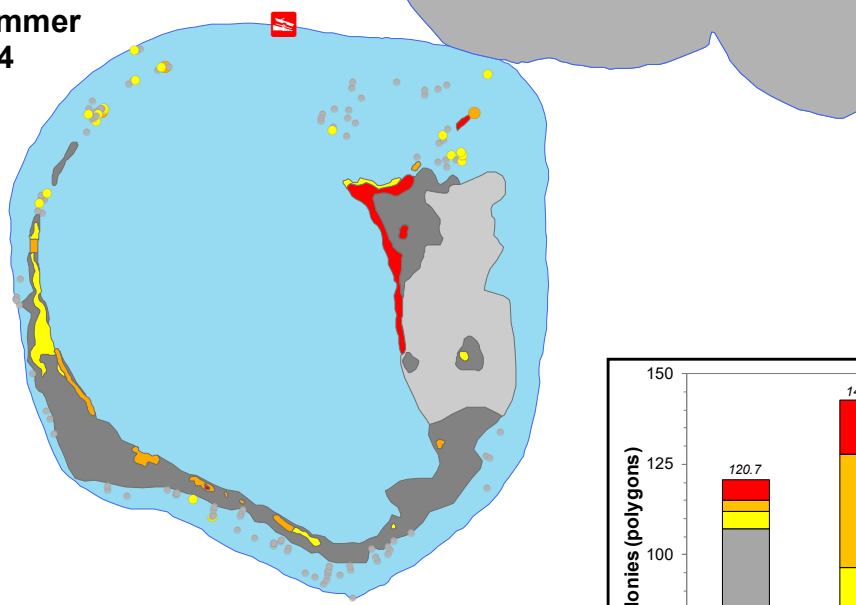
Project Location in Wisconsin

Legend

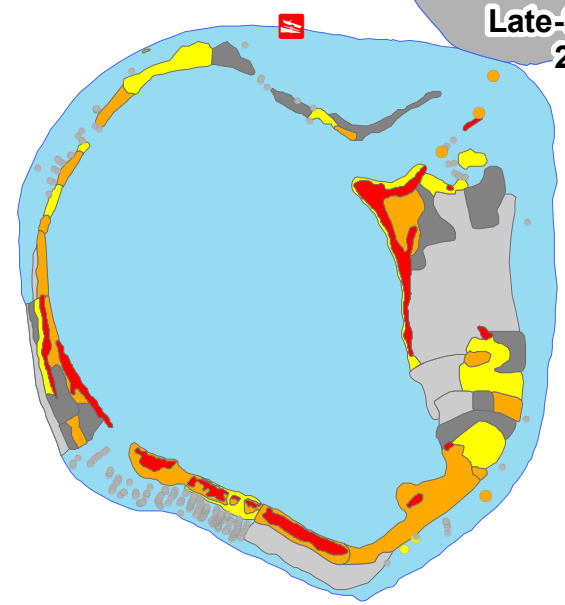
- EWM Total Rake Fullness = 3
- EWM Total Rake Fullness = 2
- EWM Total Rake Fullness = 1
- EWM Visible
- + No EWM on Rake
- + Too Deep

Map 13
South Twin Lake
Vilas County, Wisconsin
**2014 - 2017 EWM
Point-Intercept
Survey Results**

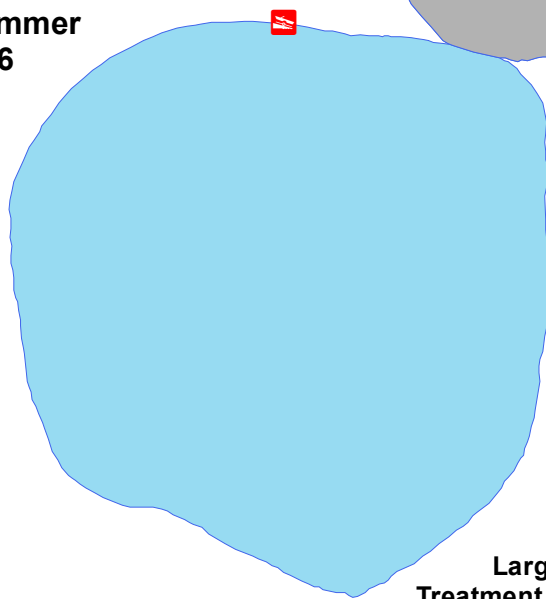
Late-Summer
2014



Late-Summer
2015

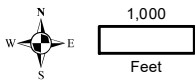
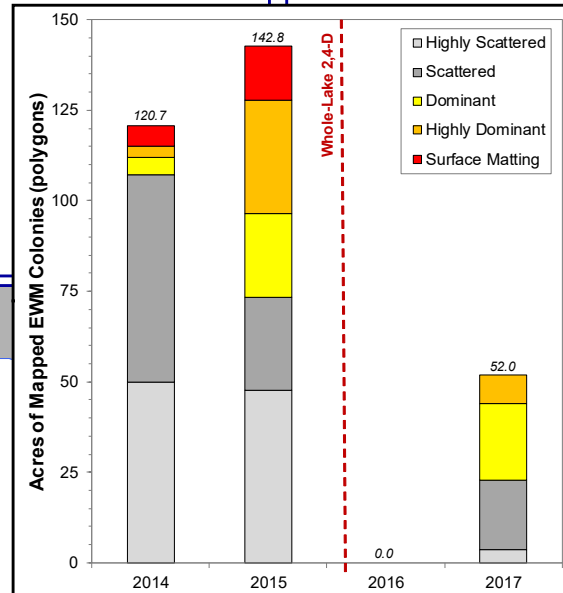
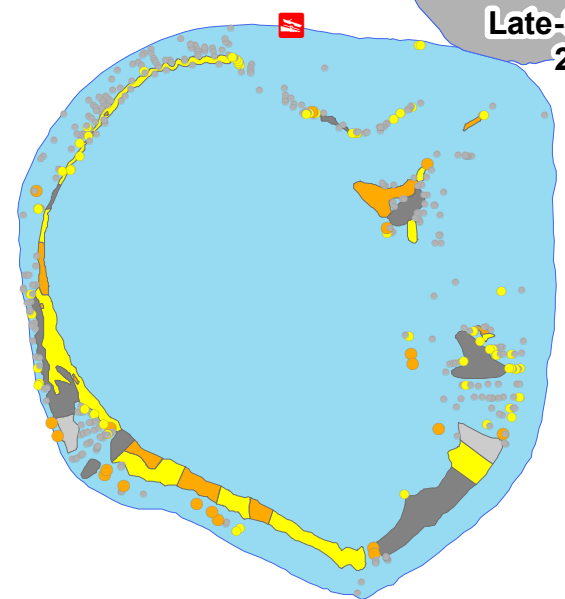


Late-Summer
2016



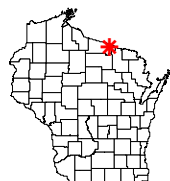
Large-Scale Herbicide
Treatment Occured in Spring 2016

Late-Summer
2017



Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Aquatic Plants: Onterra, 2014-2017
Map Date: October 3, 2017
Filename: STwin_EWMPB_2014-2017.mxd



Project Location in Wisconsin

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting

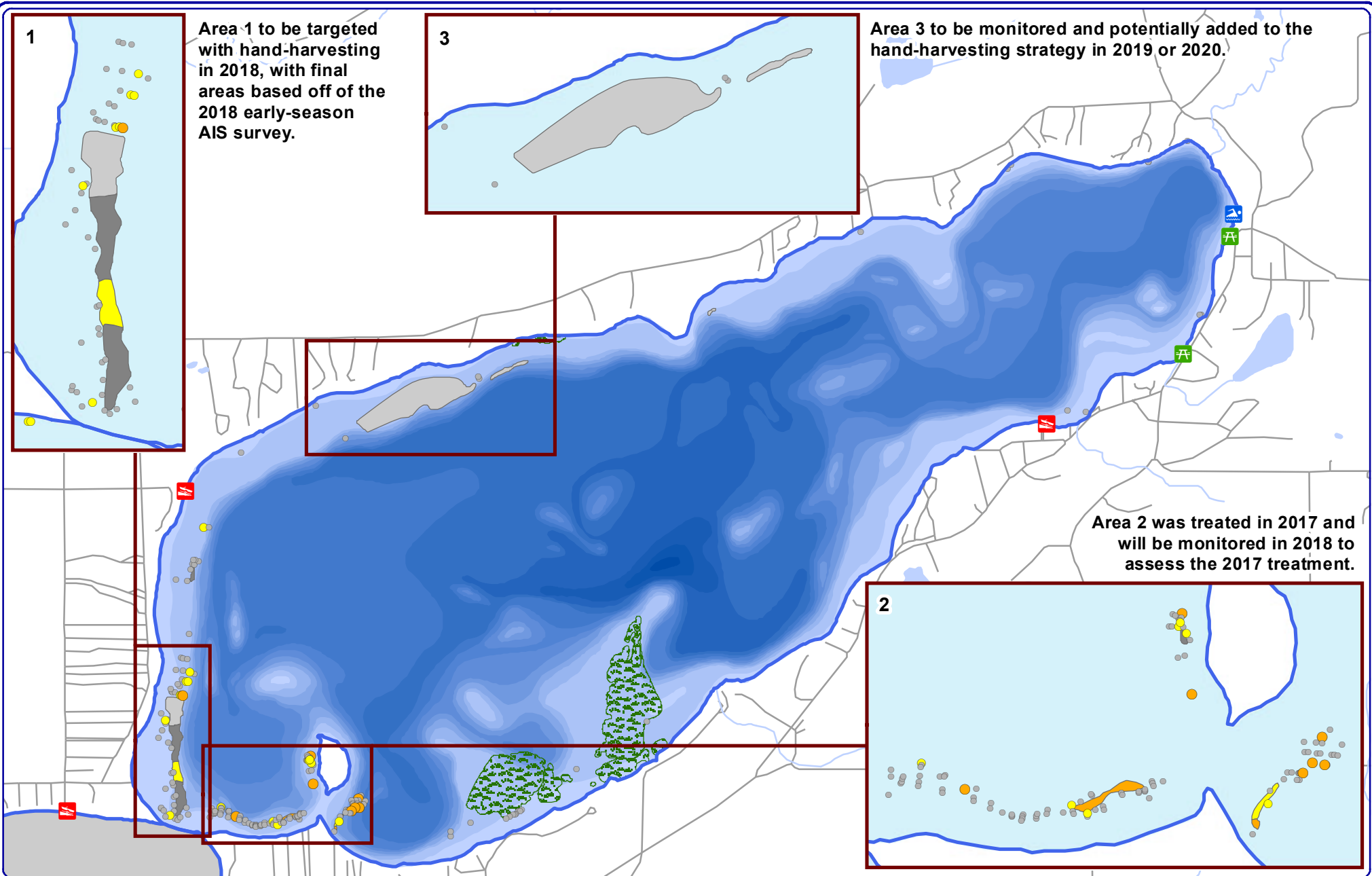
Legend

- Single or Few Plants
- Clump of Plants
- Small Plant Colony

Map 14

South Twin Lake
Vilas County, Wisconsin

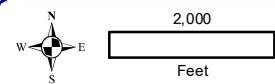
**2014 - 2017 EWM
Survey Results**



Area 1 to be targeted with hand-harvesting in 2018, with final areas based off of the 2018 early-season AIS survey.

Area 3 to be monitored and potentially added to the hand-harvesting strategy in 2019 or 2020.

Area 2 was treated in 2017 and will be monitored in 2018 to assess the 2017 treatment.



Onterra LLC
 Lake Management Planning
 815 Prosper Road
 De Pere, WI 54115
 920.338.8860
 www.onterra-eco.com

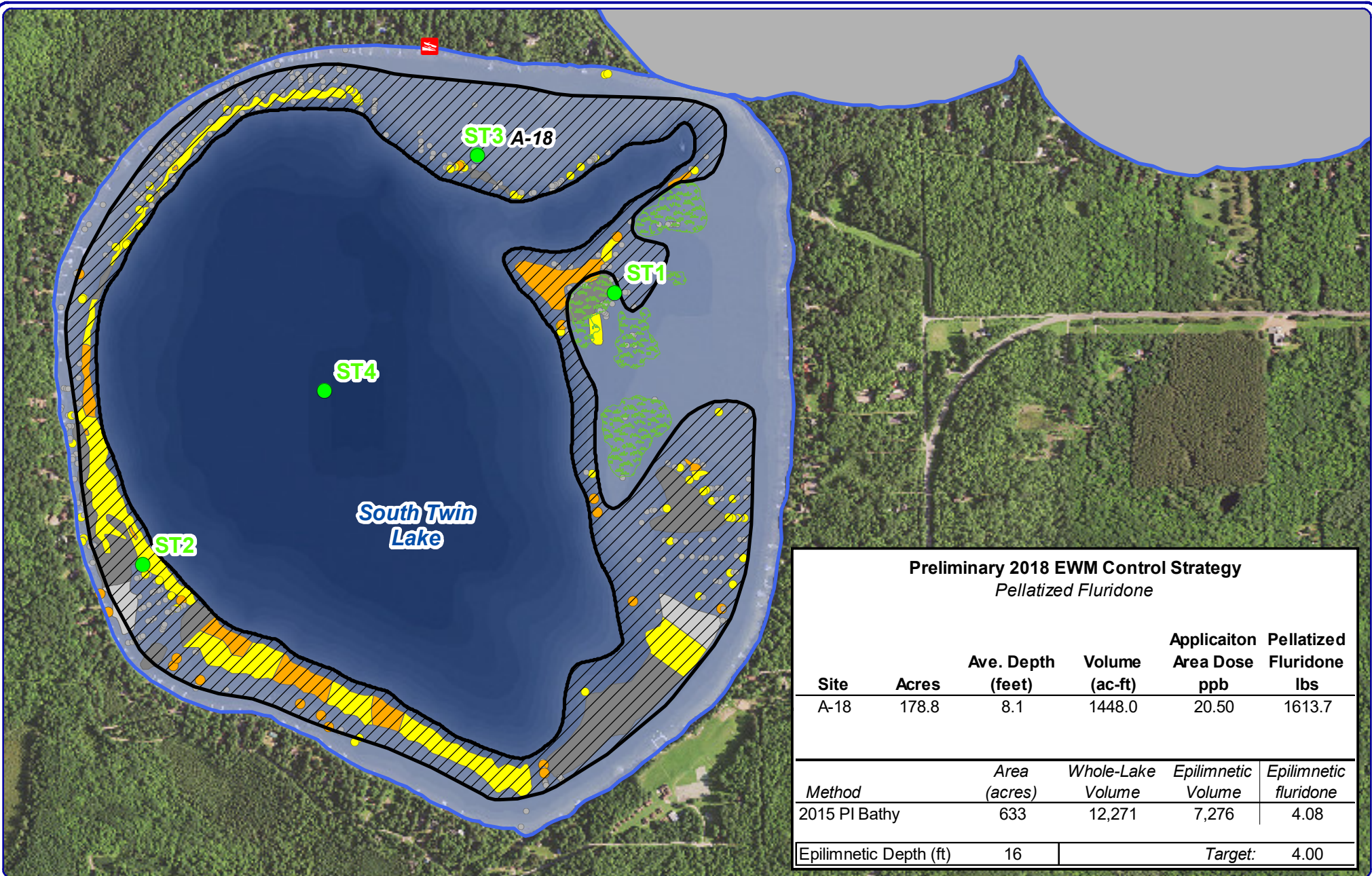
Sources:
 Roads and Hydro: WDNR
 Bathymetry: WDNR, digitized by Onterra
 Orthophotograph: NAIP, 2015
 Aquatic Plants: Onterra, 2017
 Map Date: January 31, 2017
 Filename: NTwin_EWMPB_Sep17.mxd



Legend

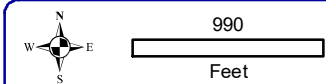
- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting (None)
- Single or Few Plants
- Clump of Plants
- Small Plant Colony
- Bullrush Community (Summer 2016)

Map 15
 North Twin Lake
 Vilas County, Wisconsin
September 2017 EWM
Survey Results



Preliminary 2018 EWM Control Strategy
Pellatized Fluridone

Site	Acres	Ave. Depth (feet)	Volume (ac-ft)	Applicaiton Area Dose ppb	Pellatized Fluridone lbs
A-18	178.8	8.1	1448.0	20.50	1613.7
Method	Area (acres)	Whole-Lake Volume	Epilimnetic Volume	Epilimnetic fluridone	
2015 PI Bathy	633	12,271	7,276	4.08	
Epilimnetic Depth (ft)	16		<i>Target:</i>	4.00	



Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads & Hydro: WDNR
Bathymetry: Onterra, 2015
Orthophotograph: NAIP, 2017
EWM Survey: Onterra, 2017
Map date: January 19, 2018
File Name: SouthTwin_T2018_Prelim1.mxd



- Legend**
- Proposed 2018 Herbicide Application Area
 - Bulrush Community
 - Herbicide Concentration Monitoring Location

Map 16
South Twin Lake
Vilas County, Wisconsin
2018 Preliminary EWM Treatment Strategy