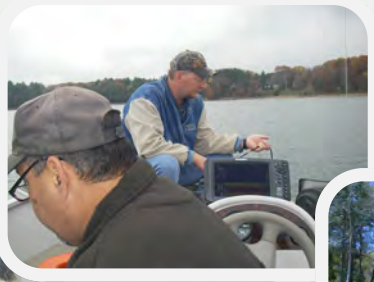
WAUSHARA COUNTY SHORELINE INVENTORY

Report and Atlas - July 2011

Funded by

Wisconsin DNR Lake Planning Grant Program

Waushara County Land Information Council



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Center for Land Use Education

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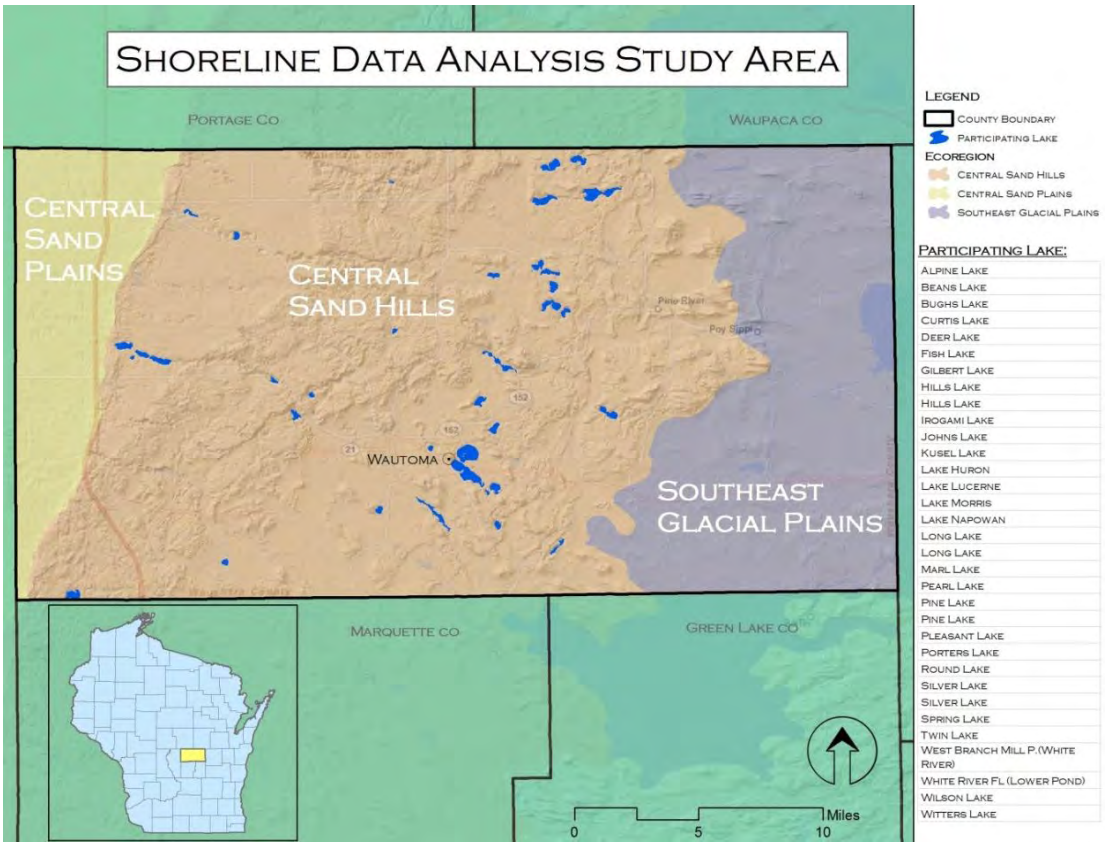
Description of the Resource

Waushara County is a small rural county with a full time population of about 25,000. Between 1980 and 2000, Waushara County grew by more than 20% with most of the population increase being located upon the lakes and streams. There has been more non-resident growth in the county rather than resident growth, particularly on our lakes, and this non-resident population offers a whole additional set of challenges, such as difficulty in communicating with absentee owners, unfamiliarity with local regulations because they do not live here, higher rates of property transfers, etc.

This population increase has resulted in a greater need for the facilitation, technical assistance and education, including information on the lakes and streams. Waushara County has three distinct eco-regions that lie within the county borders. The Southeast Glacial Plains eco-region landscape is made up of glacial materials deposited during the Wisconsin Ice Age. The Central Sand Hills eco-region contains what was once Glacial Lake Wisconsin. The area is characterized by a mixture of farmland, woodlots, wetlands, small kettle lakes, and cold water streams, all on sandy soils. The Central Sand Plains eco-region is found in the western area of the county and occurs on a flat, sandy lake plain, and supports agriculture, forestry, recreation, and wildlife management. The ecological landscape formed in and around what was once Glacial Lake Wisconsin, which contained glacial melt water extending over 1.1 million acres at its highest stage.



Overview of the Project

The Waushara County Shoreline Inventory provides an objective record of the environmental and physical characteristics of 32 Waushara County inland lakes. This data provides critical information about the potential threats and opportunities for lake planning, thus providing a backbone for a variety of applications and uses, from resource monitoring, planning, protection, and policy formation. Many of the lakes' private shorelines are developed. However, if managed caringly, these lands could provide a healthy buffer surrounding the lakes to maintain water quality and form a linear environmental corridor for animal movement. Portions of Waushara County's lakes are undeveloped and in a natural state. Opportunities for protection and thoughtful management could preserve the natural scenic beauty of these segments.

The spatial inventories and subsequent analyses are important for lake management planning. They provide a baseline inventory of current conditions and offer useful information for locating and managing properties that are vital for improving water quality, and fish and wildlife habitats. Information about vegetation, erosion, topography, and impervious surfaces are documented and mapped in this atlas, providing decision-makers and local residents with information in an all-inclusive format. The purpose of this atlas is for making well-informed lake, shoreline, and riparian management decisions.

Executive Summary

The area where land and water meets provides critical habitat for aquatic and terrestrial biota and can either be a source of water quality problems and can improve the water quality of runoff from the nearby landscape. The identification of shoreline vegetation, natural features, and water quality buffers were conducted in the summer of 2010 by County Land Conservation staff. Near shore attributes that affect runoff to the lakes were evaluated using survey forms, hand-held GPS, and orthophotos. The inventory consisted of 32 inland lakes. The inventory documented the current conditions of the shoreland for these lakes and identified areas that may warrant intervention using GPS technology. Intervention may be in the form of education and/or technical assistance to landowners of the affected areas. The inventory consisted of a modified version of the EPA's shoreland assessment tool that was used in the National Lakes Assessment. LCD staff described the depth and composition of the vegetative buffer, slope, seawalls, rip rap, boat landings, boat houses, docks, erosion, direct drainage, and buildings within 75 feet of the shoreline. Inventoried shorelines are associated with a tally sheet indicating the need for mitigation or BMP's based on a scoring system as determined by the LCD staff (Appendix A).

To aid in the shoreline inventory, a GPS enabled digital camera was used during the early summer of 2011.

Digital photos were taken from a boat approximately fifty feet from shore. The "geotagged" photos help to document the current status of buildings, foliage, docks, beaches, and development within close proximity to the shoreline. Such images provide citizen groups with a historic, geospatial record for the implementation, tracking, and improvements to their lake management plans. The images also assist the county in the enforcement of shoreland regulations and in future investigations of environmental and/or property disputes.

General Lake Statistics

- 32 lakes with shoreline assessments encompassing 74 miles of shore and 3,275 acres of water (Long Lake – Plainfield and Lake Poygan only have photo inventories).
- 89 miles of shoreline photographed with GPS referenced photos
- 70 miles (95%) of the inventoried shoreline is vegetated
- 55 miles (74%) of the inventoried shoreline has some kind of human influence (dock, structure, beach, seawall, rip-rap).

Vegetation Findings (for all 32 lakes)

Vegetation within 15 feet of shore	Miles	%
Canopy > 15 feet	66	89
Understory 1-15 feet	45	61
Woody shrubs and saplings	46	62
Native herbs, grasses, forbs	46	62
Organic - leaf pack and detritus	25	34
Wetland	7	9
Woody structure at water interface	25	34

Human Influence Findings (for all 32 lakes)

Human influence within 15 feet of shore	Miles	%
Artificial beach	24	32
Barren, bare dirt	1	1
Boat landing	1	1
Dock/pier at water	53	72
Gully erosion	1	1
Undercut banks erosion	1	1
Mowed lawn	25	34
Rip-rap	27	36
Seawall	20	27

Overview of Methods

Shoreline maping of natural and physical shoreline characteristics were conducted by boat during the summer of 2010 by LCD staff. High resolution digital orthophotos of the county were used as a reference while conducting field observations. The shoreline inventory indicates the location of natural features, critical habitat, ecological corridors, water quality buffers, and the development status. A hand-held GPS was utilized to mark the precise location of features in the form of waypoints. Staff then recorded their observations of shoreline characteristics on a hard-copy data entry sheet (Appendix A). Features were also assessed by their proximity to the water's edge.

Shoreline observations and GPS waypoints were mapped and digitized into a GIS database by UWSP Center for Land Use Education using ArcGIS 10. Shoreline observations include:

Vegetation

- Canopy taller than 15 feet
- Understory canopy 1-15 feet tall
- Woody shrubs and saplings
- Native herbs, grasses, and forbs
- Organic – leaf pack and detritus
- Wetland
- Woody structure at OHWM

Erosion

- Undercut banks
- Gullies
- Steep, moderate, or flat slopes
- Length of erosion

Human Influence

- Artificial beach
- Barren, bare dirt
- Boat landing
- Dock/pier at water
- Gully erosion
- Undercut banks
- Mowed lawn
- Rip-rap
- Seawall

Buildings

- Principle structure
- Detached deck/patio/gazebo/ boathouse
- Other impervious surface

LCD staff collecting shoreline data

Shoreline Scoring

The LCD staff developed a scoring system from the collected data to target potential problem areas and where management and conservation may be warranted. The scoring system is based on the presence/absence and abundance of shoreline features as well as their proximity to the water's edge. Values were tallied for each shoreline category and then summed to produce an overall score. Larger scores denote a healthier shoreline with good land management. These are areas where protection and/or conservation should be targeted. On the other hand, lower scores signify an ecologically unhealthy shoreline. These are areas where management and/or mitigation practices may be desirable for improving water quality.

Finally, weighted averages of shoreline scores were calculated for each category, lake, and as a whole. This allows for comparison of the status of lake shorelines across the county for each category.

Waushara County Shoreline Inventory Results

The following section provides the results of the shoreline inventory scoring system for each lake. Lists are sorted by lakes with healthier shorelines to those with lower overall scores. Photos of shorelines with high scores, medium scores, and low scores are provided for reference.

Vegetation Scores by Lake

Higher vegetation scores indicate lakes with more natural shoreline vegetation within 35 feet of the water. Vegetation indices include: canopy cover, understory, shrubs, tall grasses, leaf pack, woody structure, and wetlands.

Lake *	Vegetation Score
Lake Lucerne	15
White River Flowage	14
Beans Lake	14
Curtis Lake	12.4
Twin Lake	12.1
Spring Lake	11.9
Deer Lake	11.6
Pine Lake Hancock	11
Lake Napowan	10.9
Mill Pond	10.9
Little Hills Lake	10.1
Porters Lake	9.9
Kusel Lake	9.6
Gilbert Lake	9.5
Fish Lake	9.4
Round Lake	9.3
Pearl Lake	9.1
Big Hills Lake	8.6
Lake Huron	8.1
Pine Lake Springwater	8
Wilson Lake	7.3
Lake Morris	7.2
Marl Lake	7.1
Johns Lake	7.1
Irogami Lake	6.7
Long Lake Saxville	6.7
Lake Alpine	6.5
Witters Lake	6.2
Pleasant Lake	6.2
Bughs Lake	5.2
Little Silver Lake	4.6
Big Silver Lake	4

High vegetation score

Medium vegetation score

Low vegetation score

Human Influence Scores by Lake

Human influences represent the development status of the shoreline such as the presence/absence of beaches, docks, seawall, and rip-rap. Lakes with a larger absolute value are considered to have more degraded shorelines.

Lake *	Human Influence Scores
Lake Lucerne	-0.4
Beans Lake	-0.7
Deer Lake	-0.9
White River Flowage	-1
Pine Lake Hancock	-1
Twin Lake	-1
Porters Lake	-1.8
Spring Lake	-2
Kusel Lake	-2
Marl Lake	-2
Lake Napowan	-2.1
Mill Pond	-2.2
Little Hills Lake	-2.2
Curtis Lake	-2.2
Johns Lake	-2.7
Fish Lake	-2.7
Gilbert Lake	-2.8
Round Lake	-3.3
Lake Huron	-3.3
Irogami Lake	-3.3
Lake Morris	-3.4
Lake Alpine	-3.7
Long Lake Saxville	-3.9
Pine Lake Springwater	-3.9
Big Hills Lake	-4.1
Little Silver Lake	-4.1
Witters Lake	-4.4
Wilson Lake	-4.4
Pearl Lake	-4.5
Bughs Lake	-4.8
Pleasant Lake	-4.8
Big Silver Lake	-5.1

High human influence score

Medium human influence score

Low human influence score

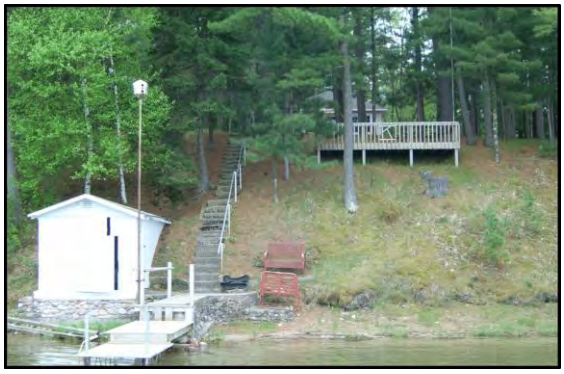
Erosion Scores by Lake

These scores indicate the presence/absence of erosion at the water's edge. Larger scores represent lakes with erosion problems. Examples include lakes with exposed ground with steep slopes, undercut banks, and gully erosion. These lakes may experience increased runoff because water cannot enter the ground and will be washed quickly to the lake.

Lake *	Erosion Scores
Bughs Lake	8
Curtis Lake	8
Wilson Lake	8
White River Flowage	8
Lake Alpine	8
Spring Lake	7.9
Johns Lake	7.6
Irogami Lake	7.5
Porters Lake	7.4
Lake Huron	7.4
Pine Lake Hancock	7.3
Mill Pond	7.2
Kusel Lake	7.2
Lake Morris	7.1
Little Silver Lake	7.1
Witters Lake	7
Pine Lake Springwater	6.4
Lake Napowan	6.4
Little Hills Lake	6.3
Beans Lake	6.2
Pleasant Lake	6.1
Marl Lake	6.1
Big Silver Lake	6
Big Hills Lake	6
Deer Lake	6
Twin Lake	5.9
Fish Lake	5.7
Long Lake Saxville	5.7
Gilbert Lake	5.3
Pearl Lake	4.9
Round Lake	4.2
Lake Lucerne	4.2

High erosion score

Medium erosion score



Low erosion score

Structure Scores by Lake

This table is sorted by each lake's structure score. Lakes with a larger absolute value (near the bottom) have more developed shorelines. Examples include main structures, boathouses, docks, and patios within close proximity to the water's edge.

Lake *	Structure Score
Lake Lucerne	-0.1
Beans Lake	-0.4
Deer Lake	-0.4
Twin Lake	-0.4
White River Flowage	-0.6
Lake Alpine	-0.6
Porters Lake	-0.8
Curtis Lake	-0.8
Pine Lake Hancock	-1
Kusel Lake	-1.1
Marl Lake	-1.1
Little Hills Lake	-1.4
Lake Napowan	-1.6
Spring Lake	-1.6
Gilbert Lake	-1.8
Mill Pond	-1.8
Fish Lake	-2
Lake Huron	-2.3
Irogami Lake	-2.3
Wilson Lake	-2.3
Lake Morris	-2.5
Johns Lake	-2.6
Little Silver Lake	-2.7
Round Lake	-2.7
Pearl Lake	-2.9
Bughs Lake	-2.9
Long Lake Saxville	-2.9
Big Hills Lake	-3.1
Pleasant Lake	-3.2
Pine Lake Springwater	-3.5
Witters Lake	-3.9
Big Silver Lake	-4.3

High structure score

Medium structure score

Low structure score

Total Score by Lake

This category represents the cumulative scores for vegetation, human influence, erosion, and structures scores for each lake. Lakes with lower scores represent shorelines that are more degraded. Examples include limited natural vegetation, developed shorelines, and exposed ground that increases surface water runoff to the lake. Lakes with healthy overall shorelines have higher total scores.

Lake *	Total Score
White River Flowage	20.4
Beans Lake	19
Lake Lucerne	18.7
Curtis Lake	17.4
Twin Lake	16.5
Pine Lake Hancock	16.3
Deer Lake	16.3
Spring Lake	16.2
Porters Lake	14.8
Mill Pond	14.1
Kusel Lake	13.6
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Round Lake	7.5
Big Hills Lake	7.4
Pine Lake Springwater	7
Pearl Lake	6.7
Bughs Lake	5.5
Long Lake Saxville	5.5
Witters Lake	5
Little Silver Lake	4.9
Pleasant Lake	4.4
Big Silver Lake	0.6

High total score

Medium total score

Low total score

Waushara County
Shoreline Assessment

Map Date -- July, 2011
Aerial Date -- April, 2010

B E A N S L A K E

Summary

Shorelines are color-coded to show their overall health based on natural and physical characteristics. For example, shorelines shown in red indicate locations where management or mitigation may be warrented. Blue shorelines mark healthy riparian areas with natural vegetation and few human influences.

Calculating Shoreline Scores

Scores are based on the presence/absence of:

+ Natural vegetation
+ Human influences (docks, boathouses, etc)
+ Erosion
+ Structures

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BIG HILLS LAKE

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BIG SILVER LAKE

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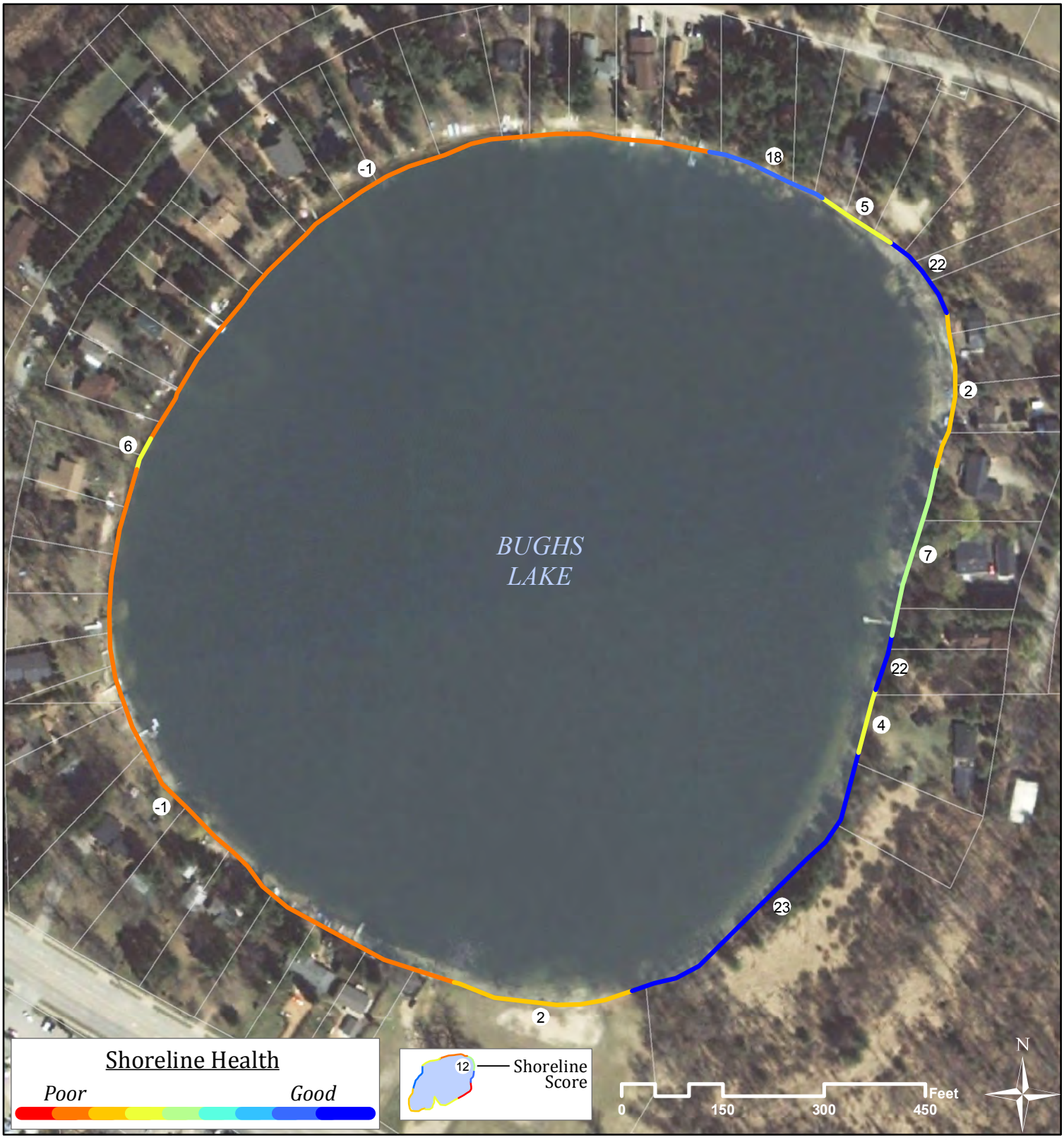
B U G H S L A K E



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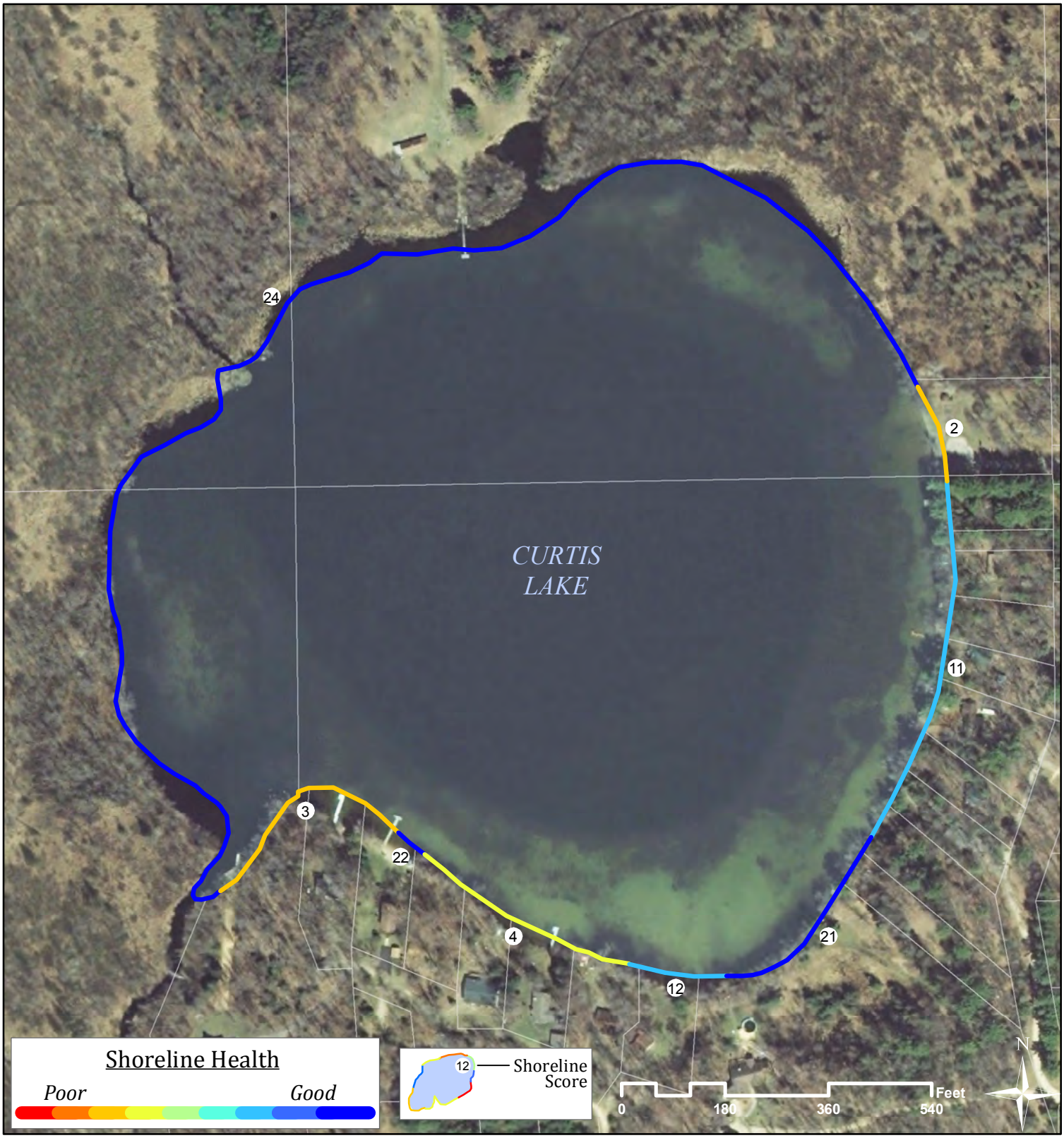
CURTIS LAKE



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DEER LAKE

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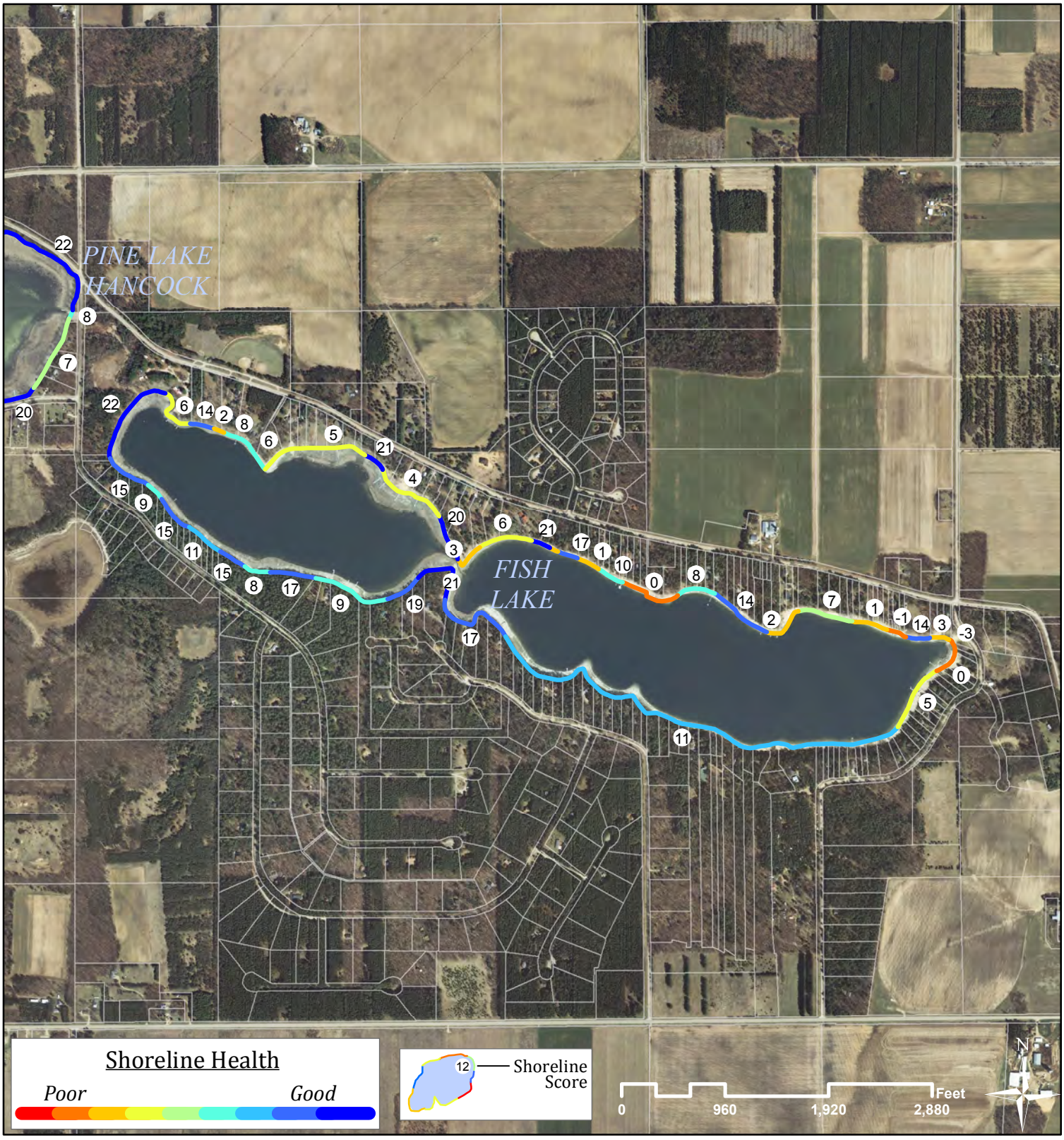

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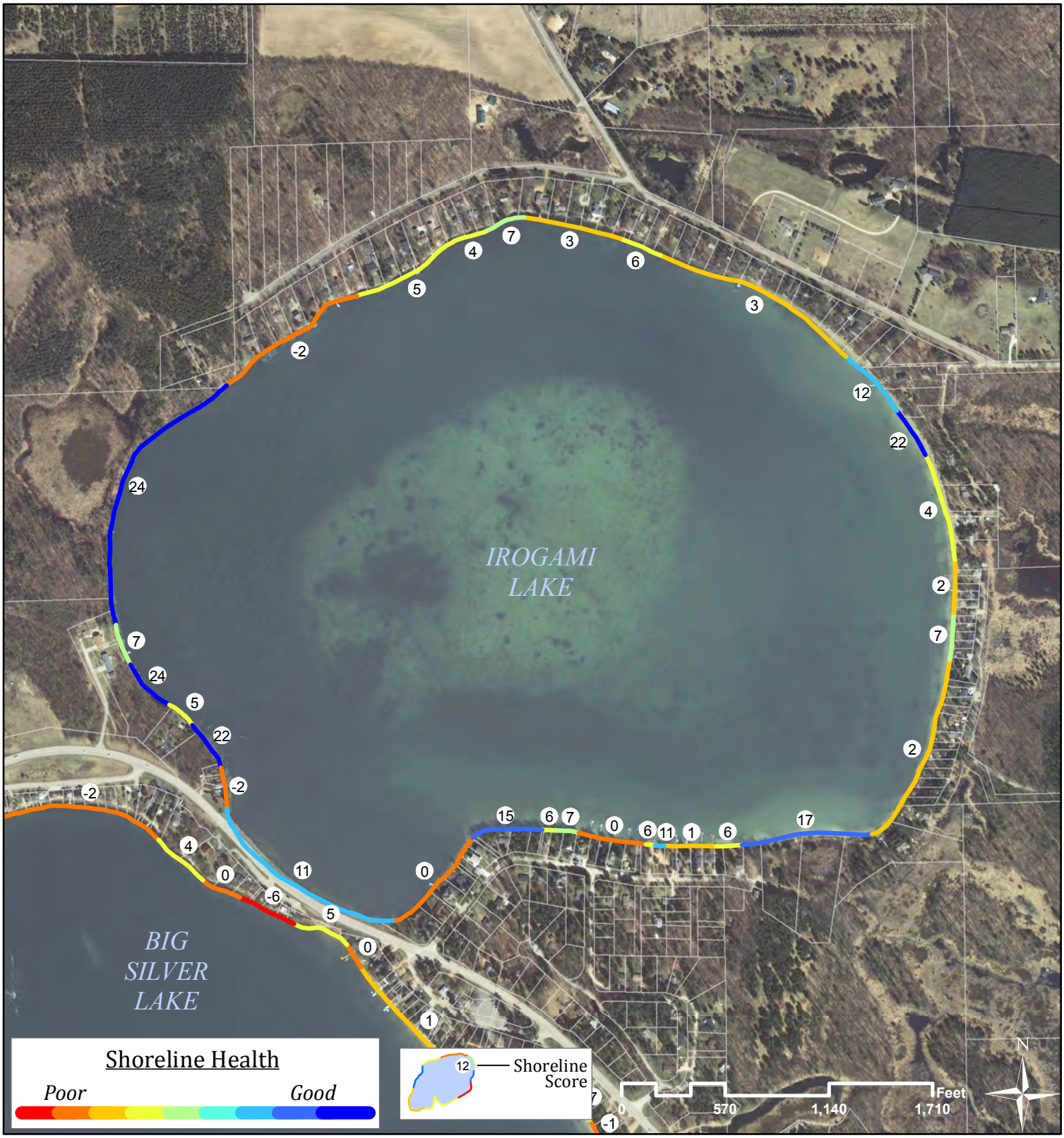
I R O G A M I L A K E



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JOHNS LAKE

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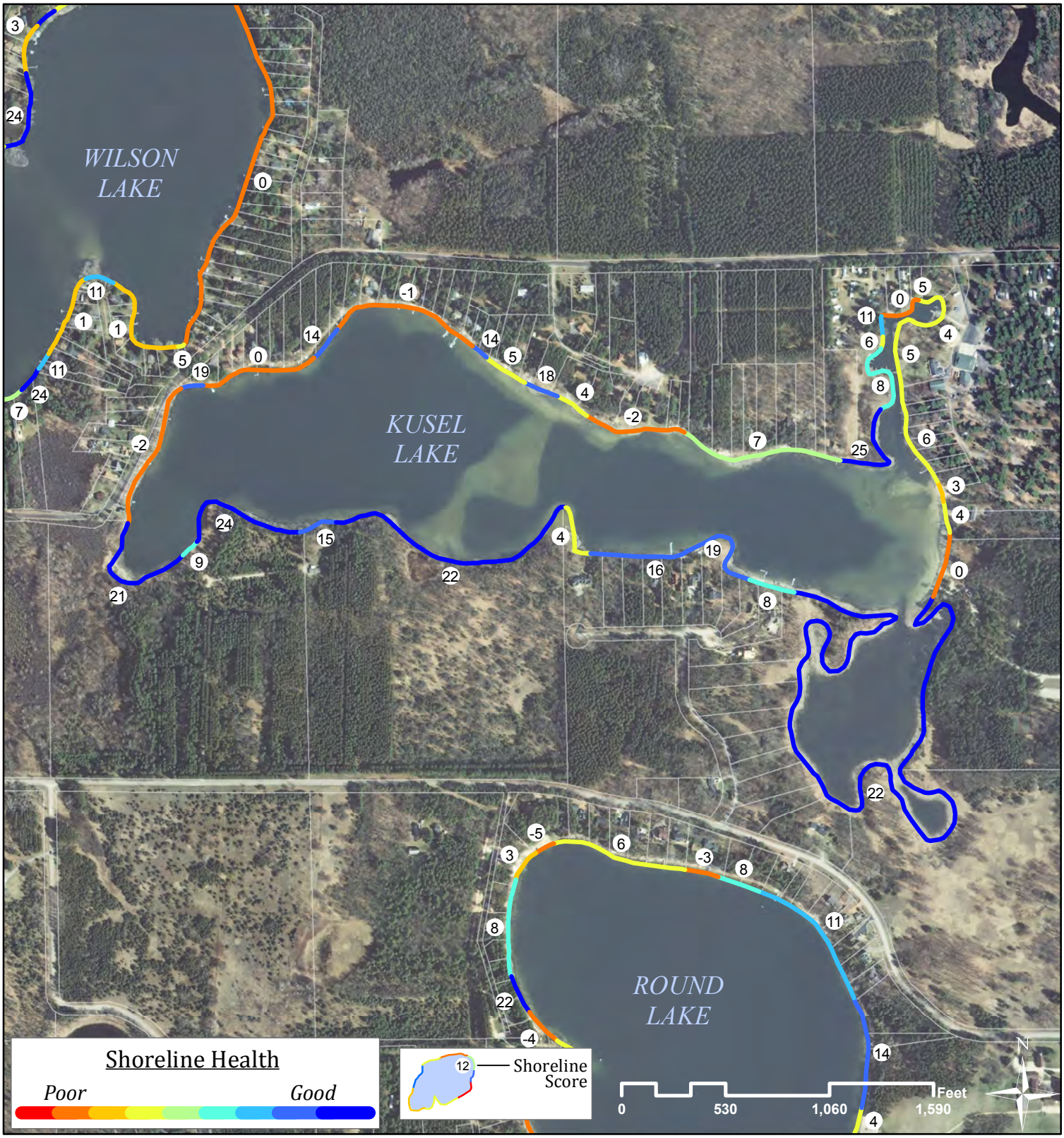
KUSEL LAKE



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LAKE ALPINE

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LAKE HURON

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LAKE LUCERNE

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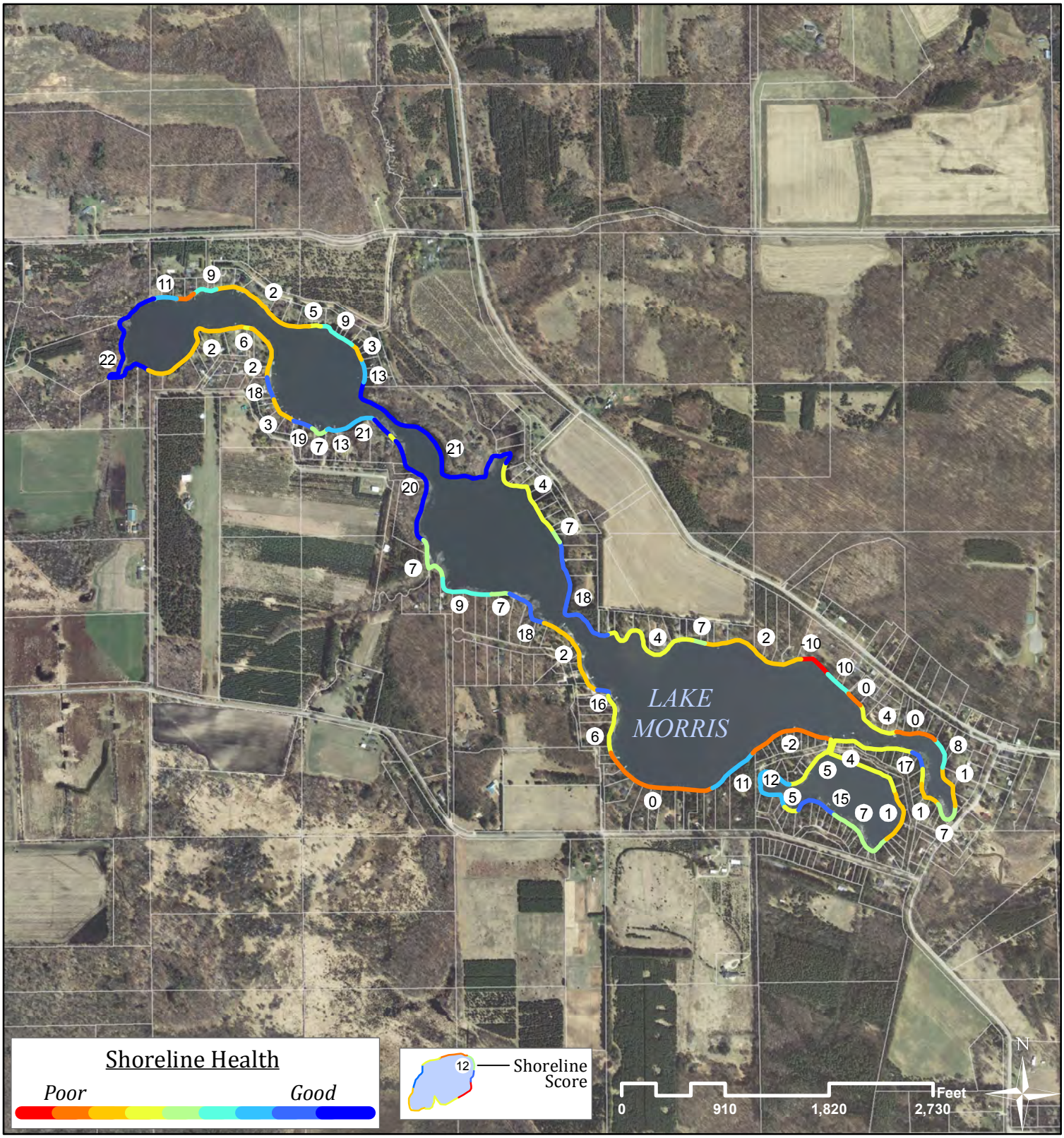
LAKE MORRIS



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LAKE NAPOWAN

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LITTLE SILVER LAKE

Summary

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Calculating Shoreline Scores

Scores are based on the presence/absence of:

+ Natural vegetation
+ Human influences (docks, boathouses, etc)
+ Erosion
+ Structures

Center for Land Use Education

Map created by Dan McFarlane
Center for Land Use Education

Waushara County Shoreline Assessment

Map Date -- July, 2011
Aerial Date -- April, 2010

LONG LAKE

Summary

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Center for Land Use Education

Map created by Dan McFarlane
Center for Land Use Education

Waushara County
Shoreline Assessment

MARL LAKE

Map Date -- July, 2011
Aerial Date -- April, 2010

Summary

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Center for Land Use Education

Map created by Dan McFarlane
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Waushara County
Shoreline Assessment *MILL POND*

Map Date -- July, 2011
Aerial Date -- April, 2010

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Waushara County Shoreline Assessment

Map Date -- July, 2011
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PEARL LAKE

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Waushara County Shoreline Assessment

Map Date -- July, 2011
Aerial Date -- April, 2010

PINE LAKE

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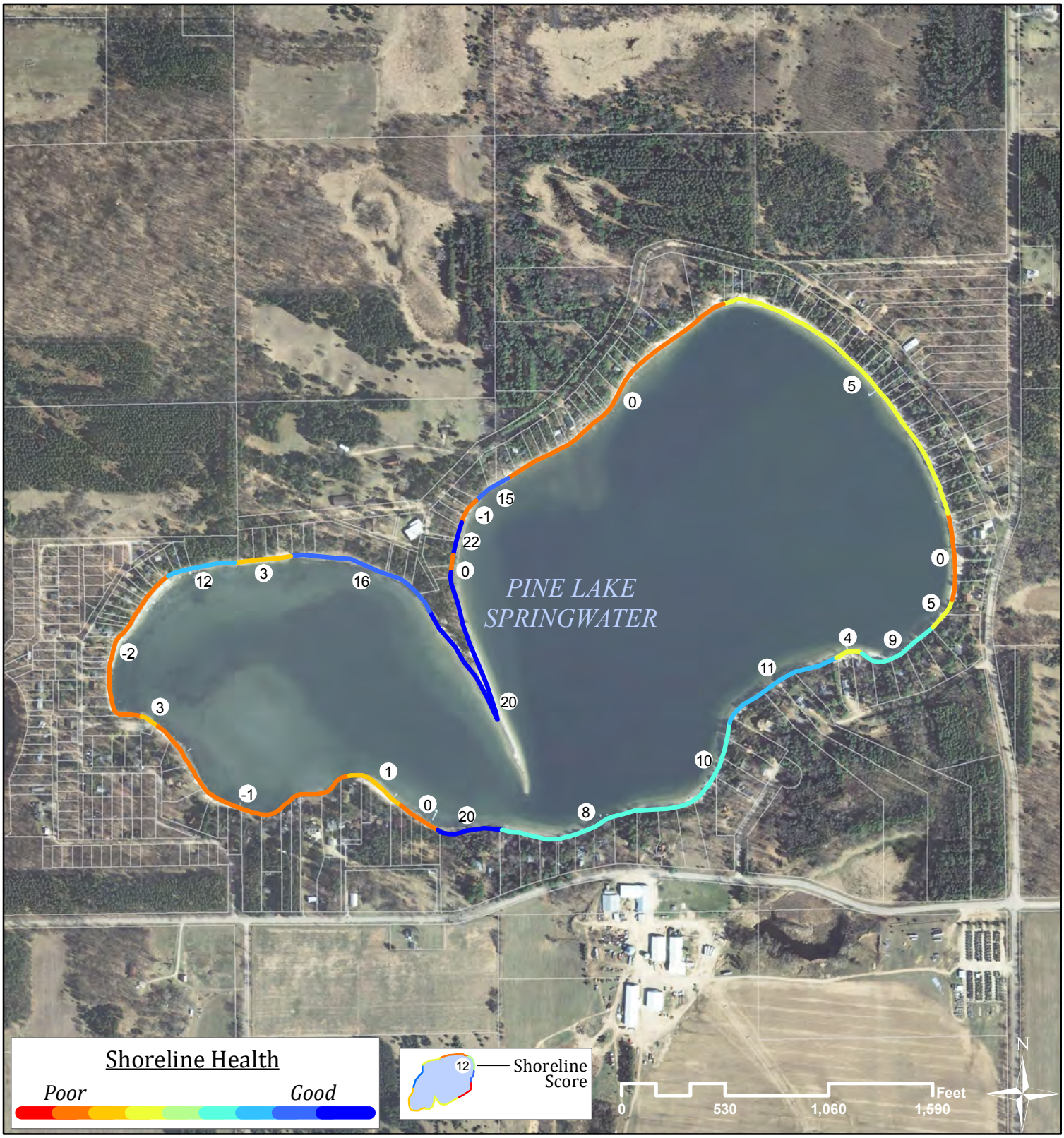
Waushara County
Shoreline Assessment

Map Date -- July, 2011
Aerial Date -- April, 2010

P I N E L A K E



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Waushara County
Shoreline Assessment

Map Date -- July, 2011
Aerial Date -- April, 2010

P L E A S A N T L A K E

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Center for Land Use Education

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Waushara County Shoreline Assessment

Map Date -- July, 2011
Aerial Date -- April, 2010

PORTERS LAKE

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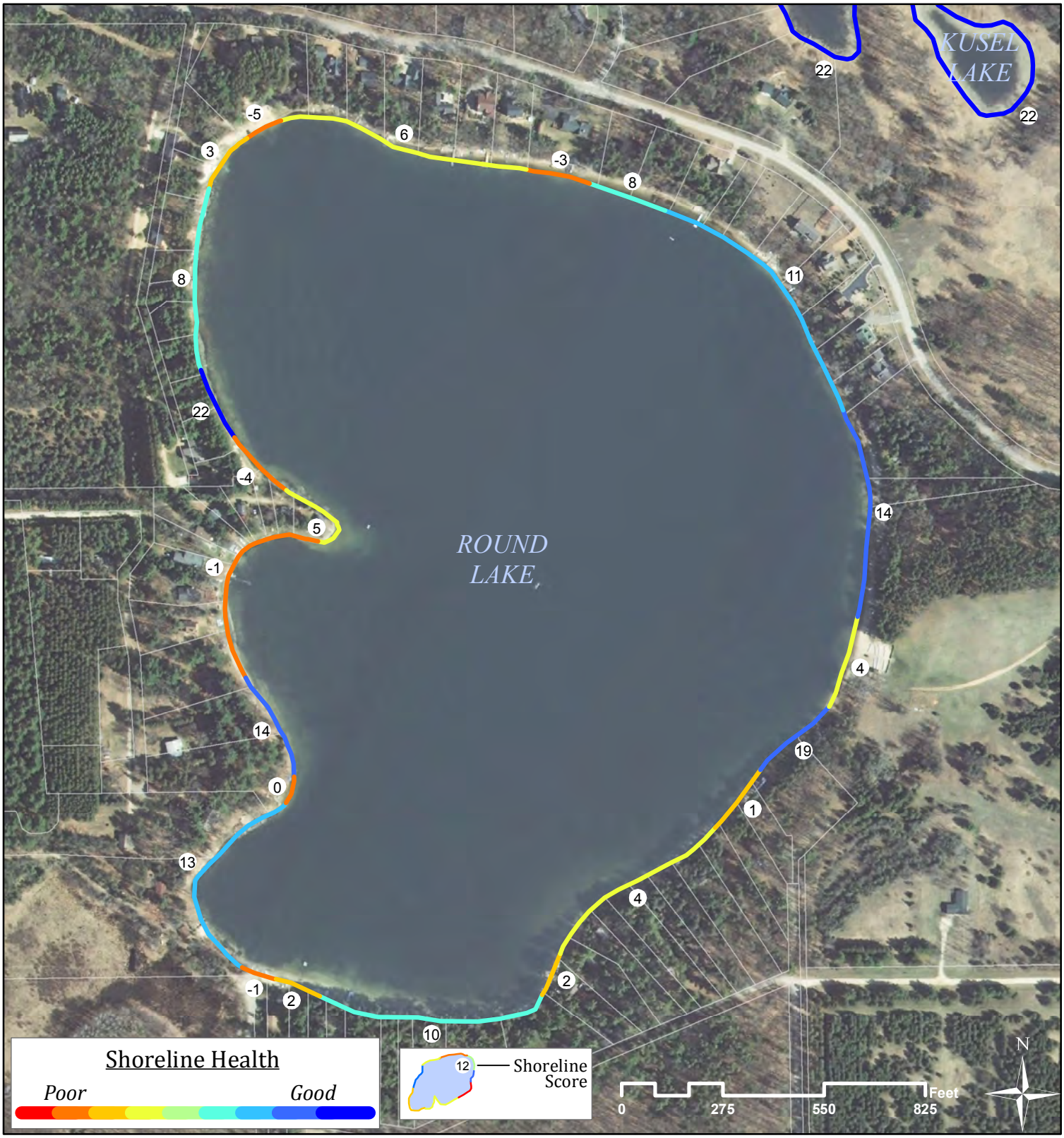
Center for Land Use Education

Map created by Dan McFarlane
Center for Land Use Education

Waushara County
Shoreline Assessment

Map Date -- July, 2011
Aerial Date -- April, 2010

ROUND LAKE



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Center for Land Use Education

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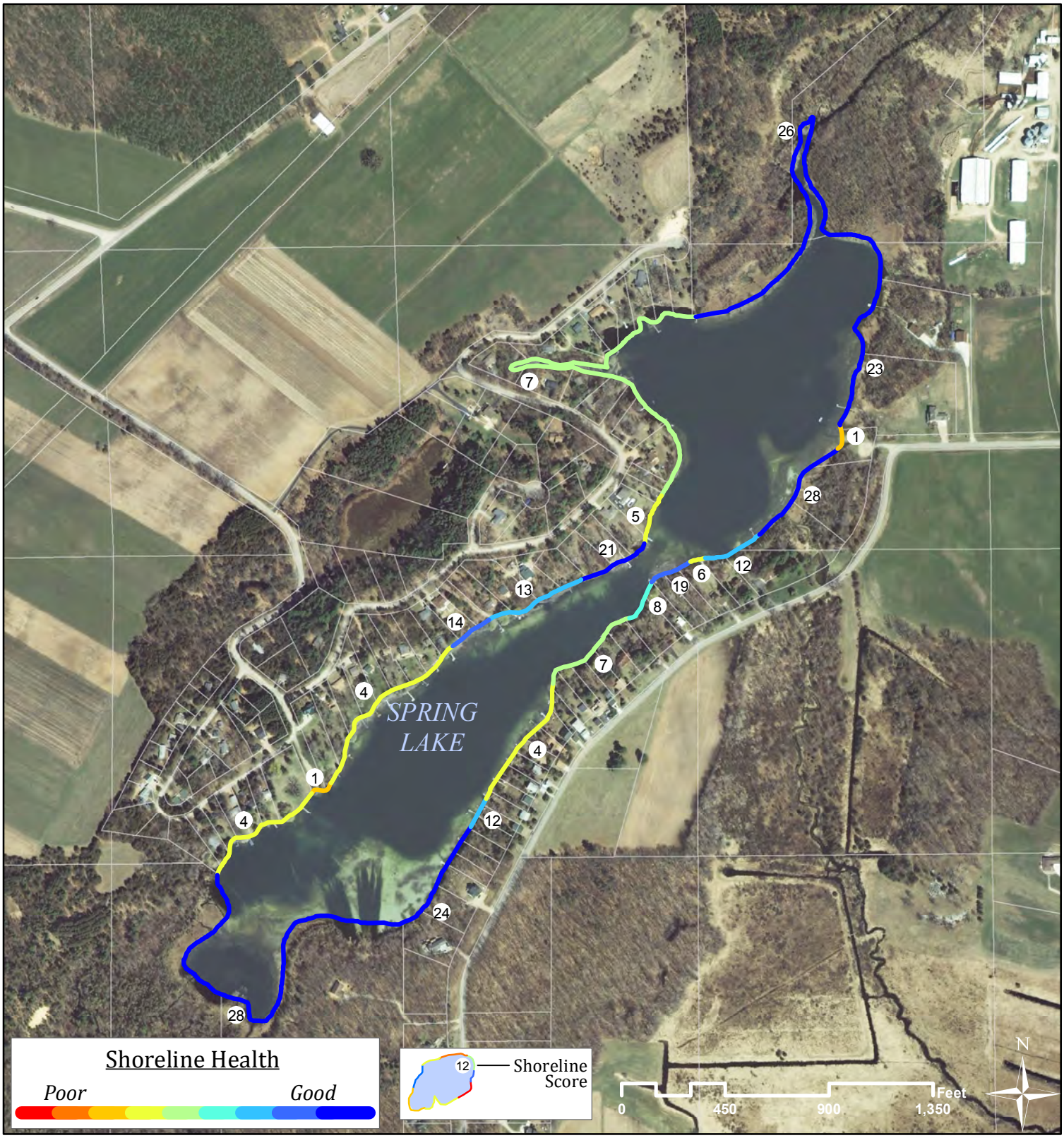
Waushara County
Shoreline Assessment

Map Date -- July, 2011
Aerial Date -- April, 2010

SPRING LAKE



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Center for Land Use Education

Waushara County Shoreline Assessment

T W I N L A K E

Map Date -- July, 2011
Aerial Date -- April, 2010

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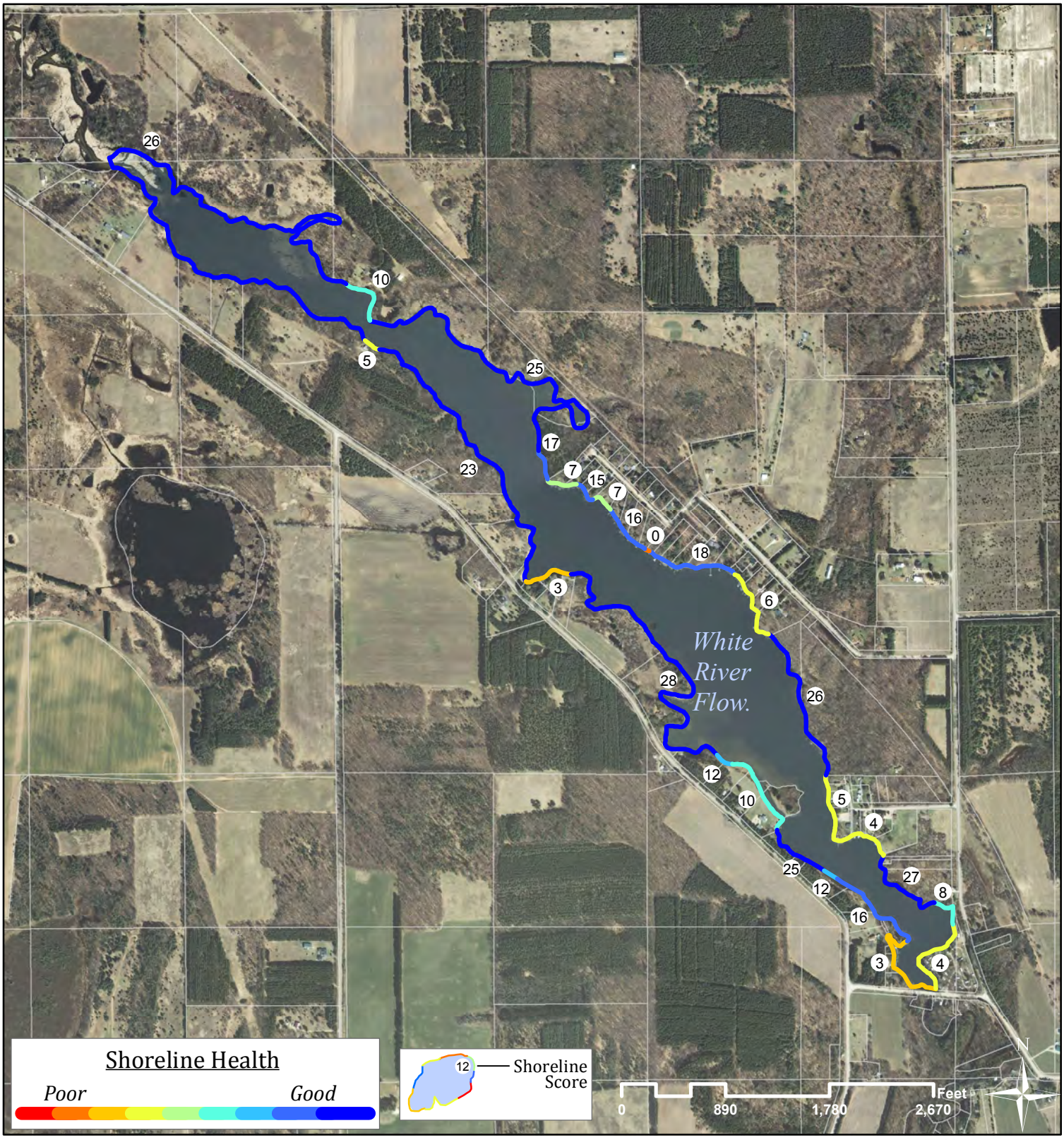
Waushara County Shoreline Assessment

Map Date -- July, 2011
Aerial Date -- April, 2010

WHITE RIVER FLOW.



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Center for Land Use Education

Map created by Dan McFarlane
Center for Land Use Education

Waushara County Shoreline Assessment

Map Date -- July, 2011
Aerial Date -- April, 2010

WILSON LAKE

Summary

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Center for Land Use Education

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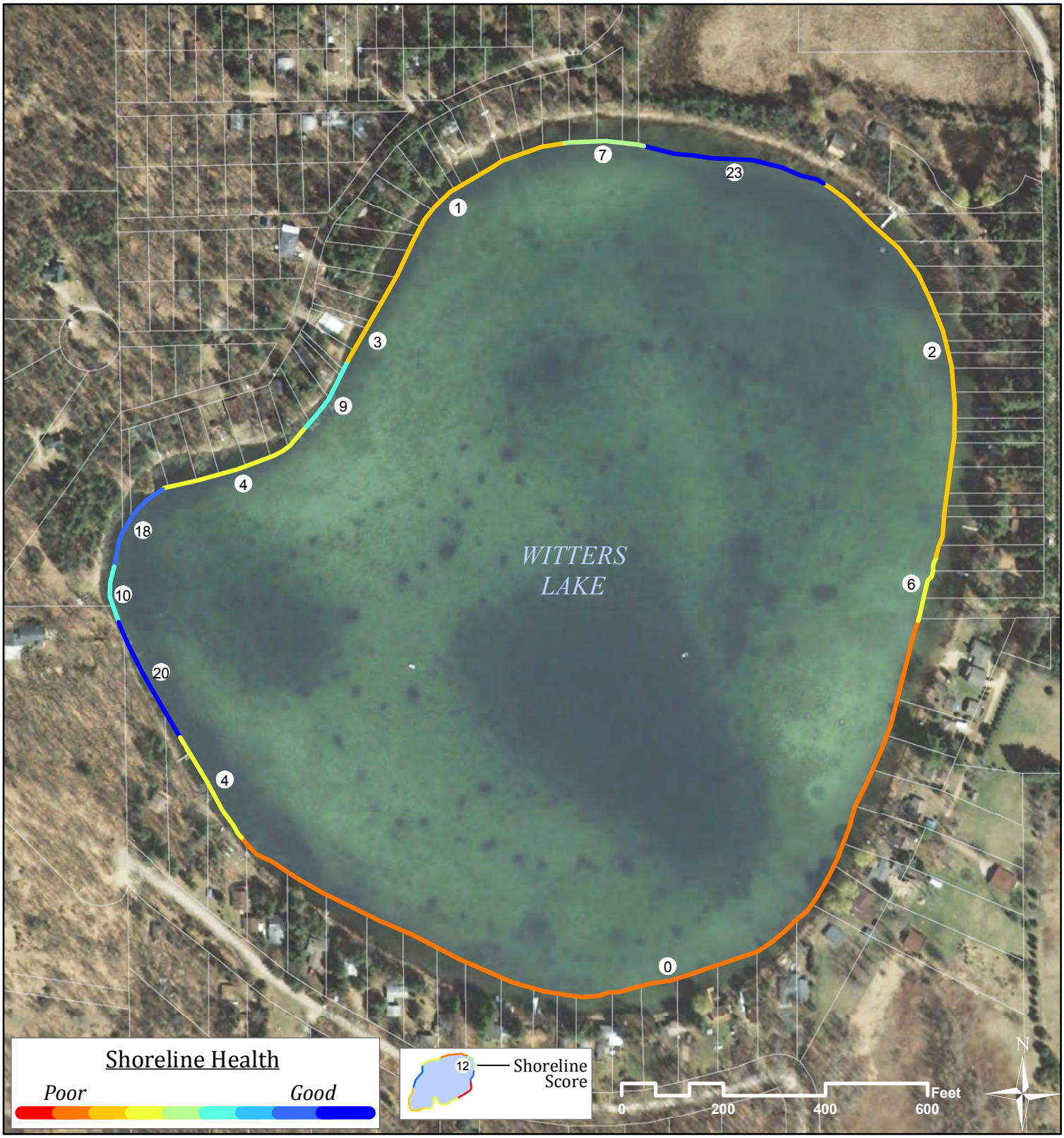
Center for Land Use Education

Waushara County Shoreline Assessment

Map Date -- July, 2011
Aerial Date -- April, 2010

WITTERS LAKE



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Appendix A – Shoreline Data Sheet

Waushara County Shoreland Survey					
Lake Name:					
Waypoint number (or range):					
Within 35 feet of Ordinary High Water					
Vegetation	**0-15**	**15-35**	**70-100%**	**30-70%**	**0-30%**
Canopy (>15 ft high)	1	1	2	1	0
Understory (1-15 ft high)	1	1	2	1	0
Woody shrubs and saplings	1	1	2	1	0
Native herbs, grasses, forbs	1	1	2	1	0
Wetlands	1	1			
Organic (leaf pack, detritus)	1	1			
Woody structure at water interface	2		Total pts		
Human Influence					
Artificial beach	-1	-1			
Seawall	-2	-2			
Rip-rap	-1	-1			
Dock / pier at water	-1				
Boat landing	-1	-1			
Mowed lawn	-1	-1			
Barren, bare dirt	-2	-2	Total pts		
Type **Erosion**					
None	1	1			
Undercut banks/slumping	-3	-3			
Furrow/gullies	-5	-5			
Erosion Length					
<21 Feet	-1	-1			
21-60 Feet	-2	-2			
>60 Feet	-3	-3			
Slope					
Flat (<10%)	3	3			
Moderate (10-25%)	2	2			
Steep (>25%)	1	1	Total pts		
Within 75 feet of Ordinary High Water					
Buildings	**0-35**	**35-75**			
Principal Structure	-3	-2			
Detached Deck/Patio/Gazebo/Boathous	-2	-1			
Other Accessory Building/Impervious	-1	0	Total pts		
Land use					
Residential	Yes	No			
Cropland	Yes	No			
Fallow	Yes	No			
Forest	Yes	No			
Mark on Map	Approx location of waypoint				
Erosion				**Grand Total**	
Preferred flow channels/Culverts					

Data sheet and scoring system used for the shoreline inventory. Values were totaled for each category between GPS waypoints to establish the Total Score for each shoreline segment.