

Big Lake Land Use and Flow Accumulation Mapping

Prepared by:

Polk County Land and Water Resources Department
100 Polk County Plaza, Suite 120, Balsam Lake, WI 54810

Colton Sorensen

Katelin Anderson

The area of land that drains to a lake or river is called a watershed. Watersheds can be separated into different sizes depending on the receiving waters of interest. The watershed for Round and Church Pine Lakes total 1,973 acres and flows into Big Lake. The Big Lake Watershed is 2,409 acres. The Big, Round, Church Pine Lakes watershed totals 4,382 acres. All are part of the larger Horse Creek watershed. The Big Lake Watershed was delineated using ArcMap spatial analyst hydrologic tools and 2015 LIDAR data. Land use for the watershed was determined using Polk County's spring 2015 high resolution aerial photo. The most common land use in the Big Lake watershed is row crops (29%), followed by forest (27%). The tables below show the land use in both watersheds.

Big Lake Watershed Land Use

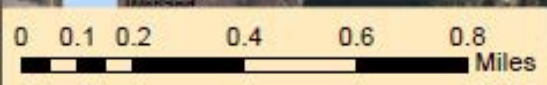
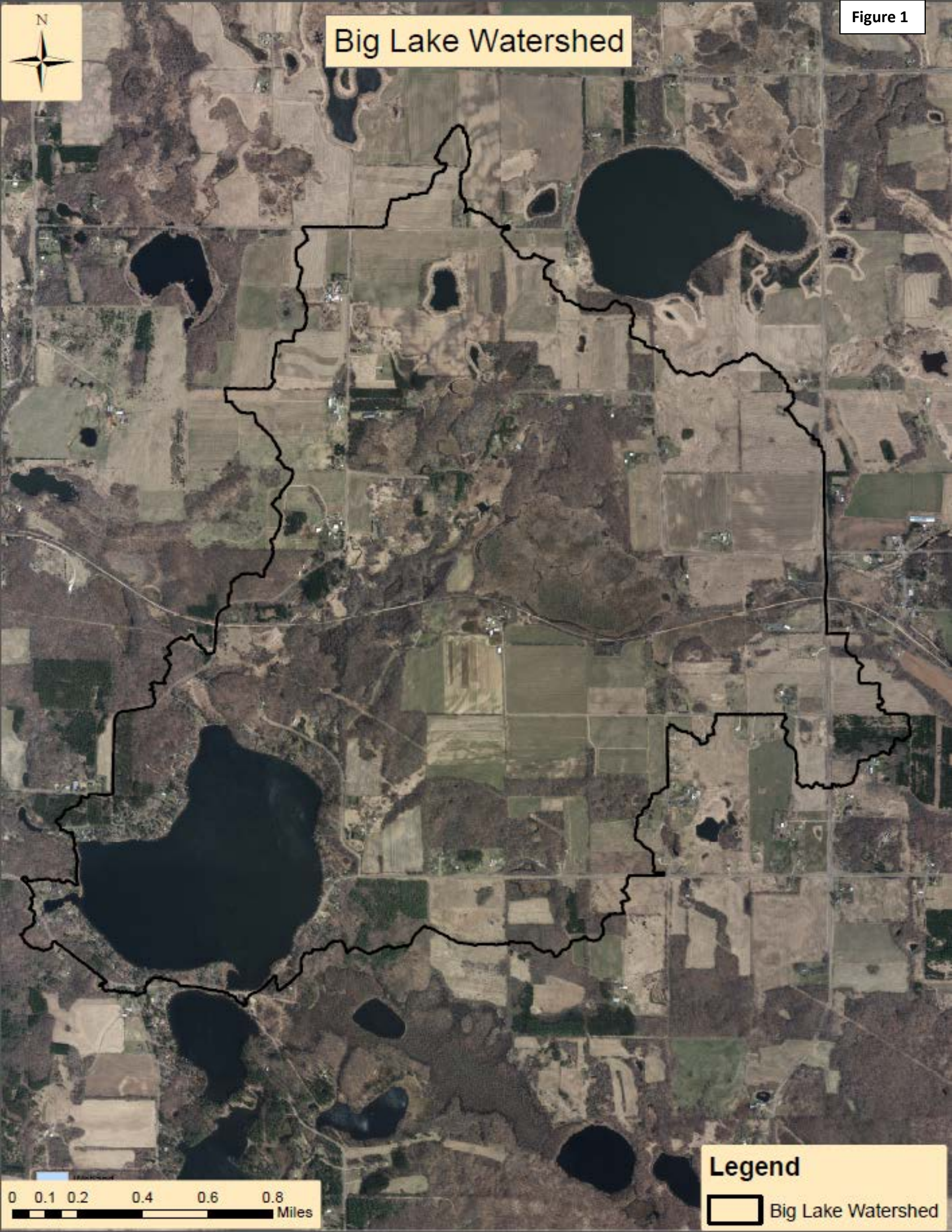
Land Use	Acres	Acres
Row Crop	693	29%
Forest	656	27%
Wetland	283	12%
Big Lake	253	11%
Mixed Agriculture	208	9%
Rural Residential	123	5%
Medium Residential	104	4%
Road	45	2%
Pasture	19	1%
Livestock	16	1%
Open Water	9	0%

Round and Church Pine Lakes Watershed Land Use

Land Use	Acres	Acres
Forest	917	46%
Mixed Agriculture	212	11%
Wetland	196	10%
Row Crop	184	9%
Rural Residential	139	7%
Round, Church Pine Lakes	134	7%
Medium Residential	82	4%
Open water	65	3%
Road	34	2%
Pasture	8	0%
Livestock	2	0%

Figure 1

Big Lake Watershed




Legend

 Big Lake Watershed

Big, Round, Church Pine Lake Watershed



Legend

 Big, Round, Church Pine Lake Watershed

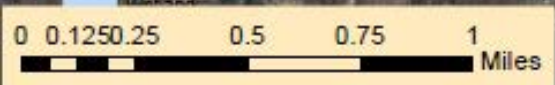
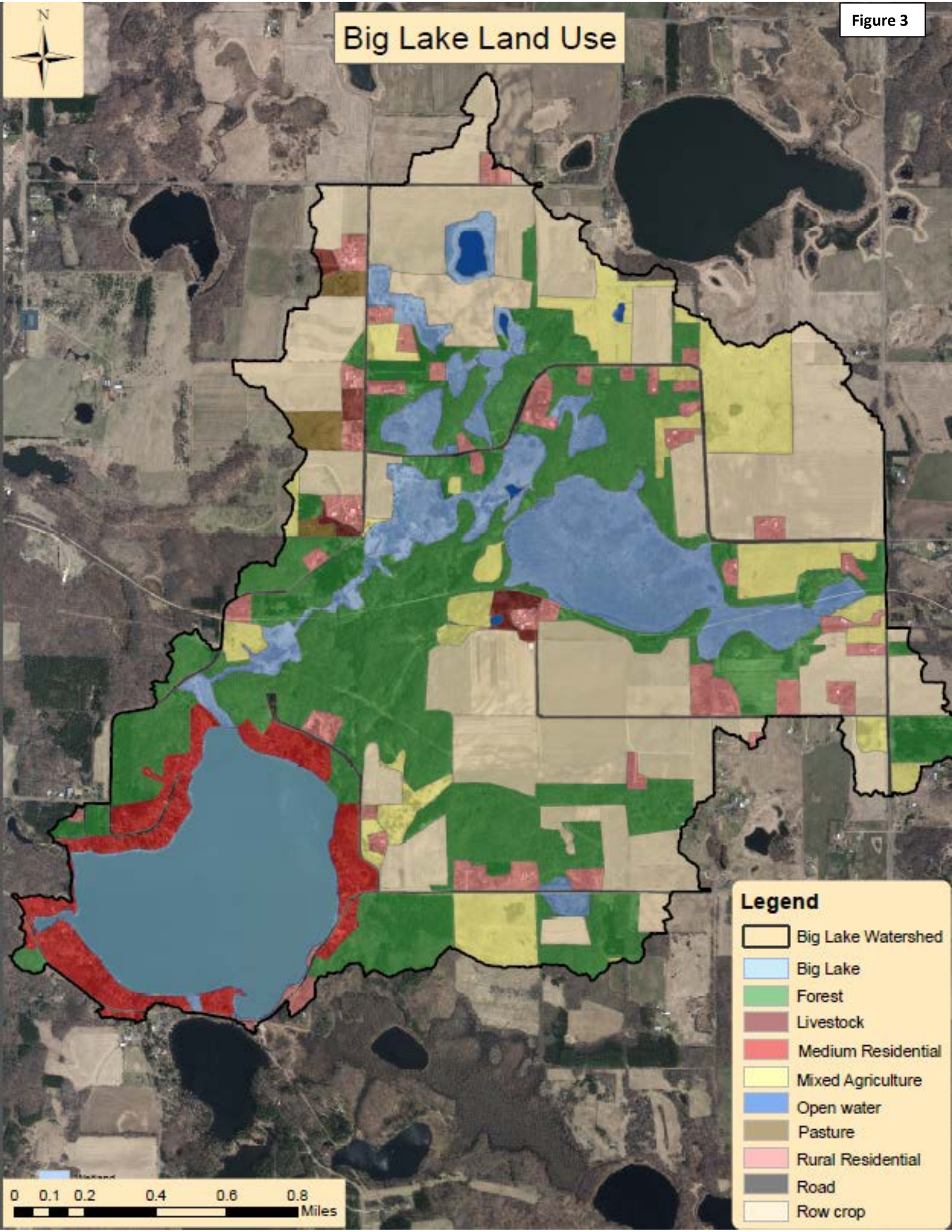


Figure 3

Big Lake Land Use



Legend

- Big Lake Watershed
- Big Lake
- Forest
- Livestock
- Medium Residential
- Mixed Agriculture
- Open water
- Pasture
- Rural Residential
- Road
- Row crop

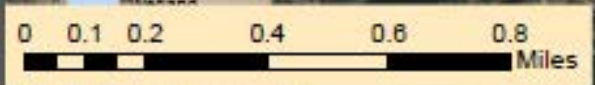
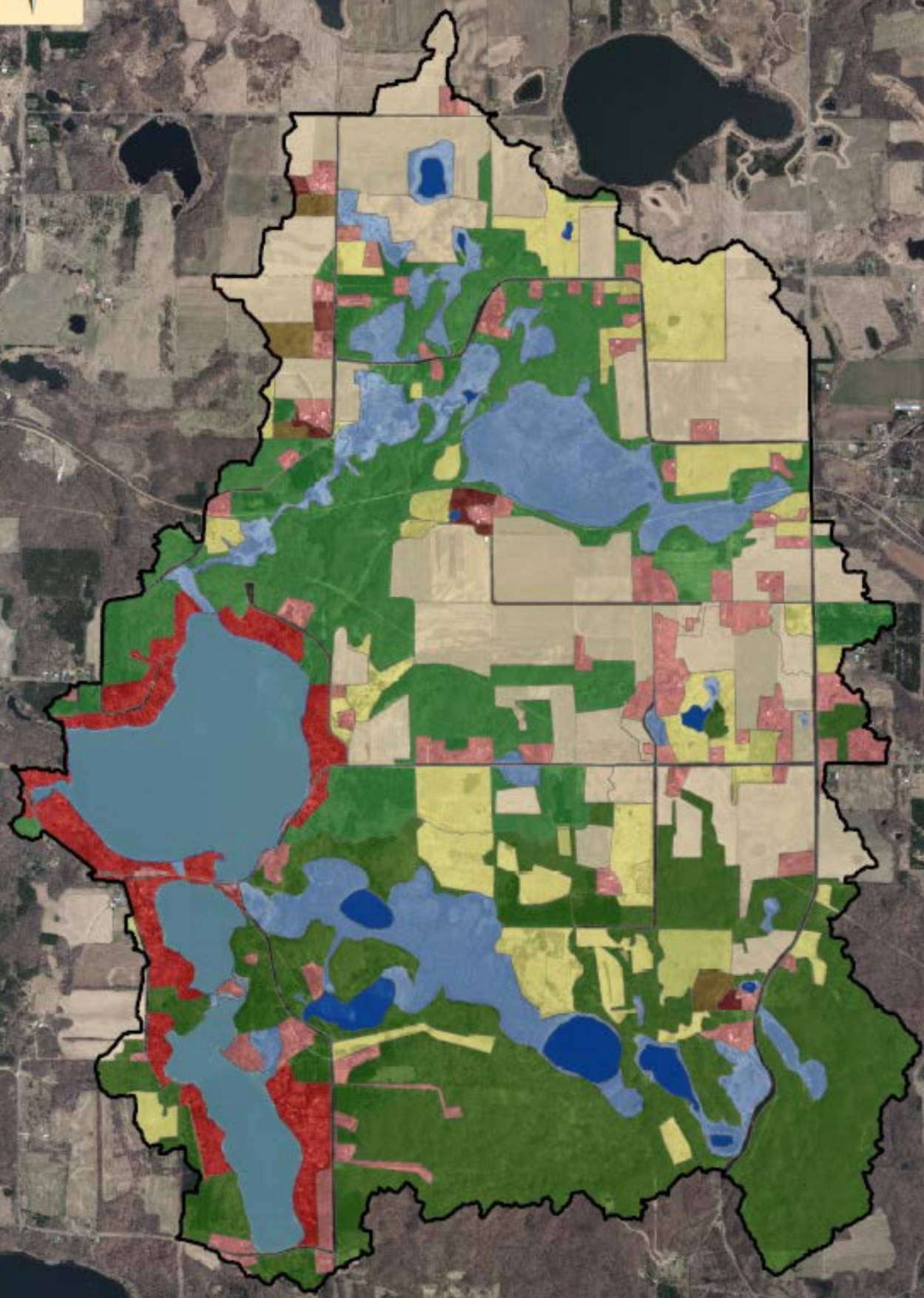


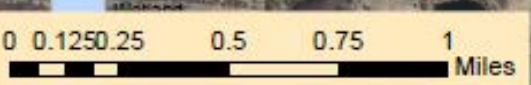
Figure 4

Big, Round, Church Pine Lake Land Use



Legend

- Big, Round, Church Pine Land Use
- Big Lake
- Forest
- Livestock
- Medium Residential
- Mixed Agriculture
- Open water
- Pasture
- Rural Residential
- Road
- Row crop

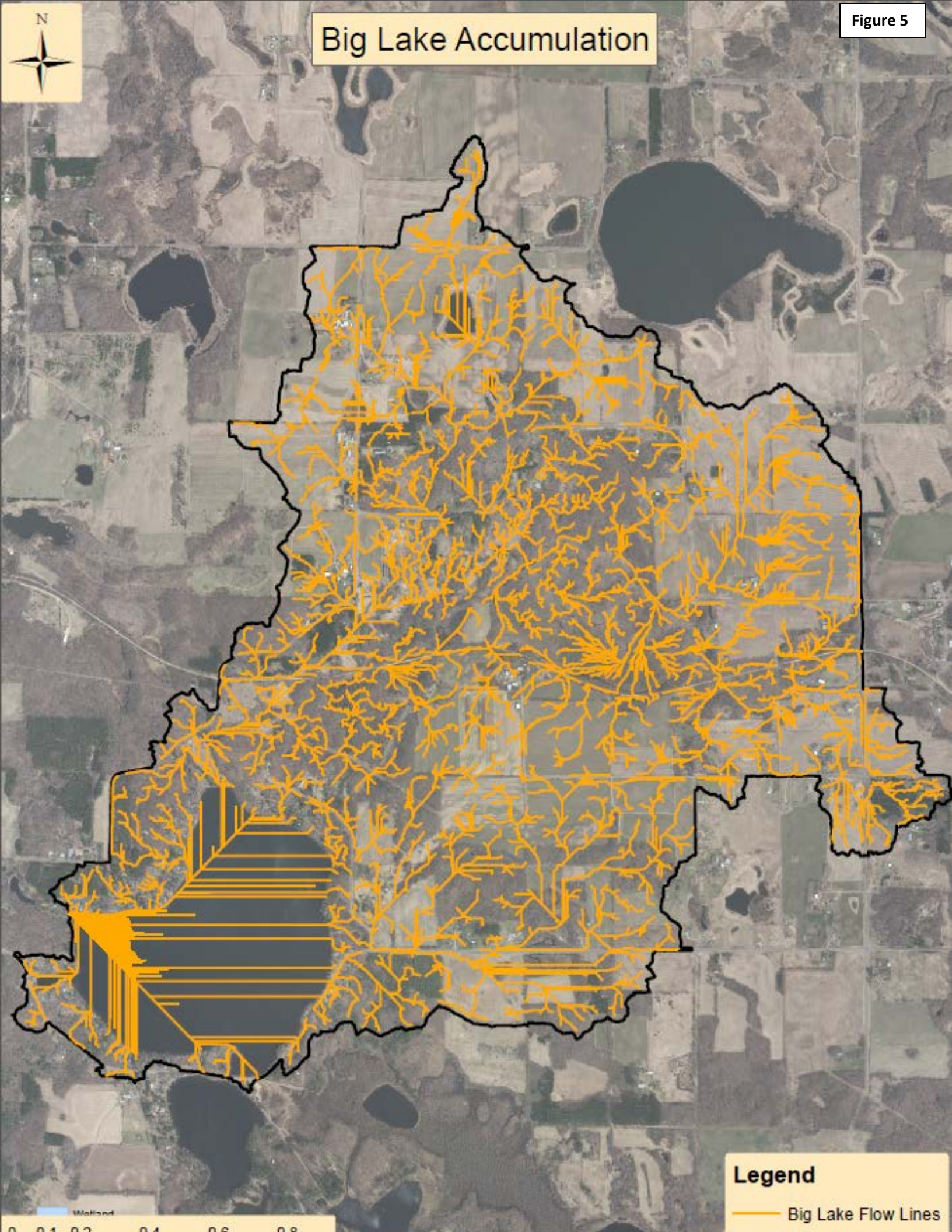


Flow Accumulation

Flow accumulation is important in watershed mapping and planning. Flow accumulation maps show where water runs on the surface of the earth and eventually creates a channel. These channels are where the water will flow during a rain fall or run off event. The flow lines that appear in figures 5 to 8 do not indicate substantial erosion is present, but rather where water will accumulate and flow in an event. In example 1, there are four separate flow lines that meet and leave the circle as one flow line. This trend of flow lines meeting continues throughout the entire watershed until the flow line eventually enters the lake. In figure 8, two red dots represent where the large majority of the flow paths enter the lake, one being the inlet stream on the north end of the lake that drains a large portion of the watershed. Figure 5 shows the flow accumulation map for the entire Big Lake watershed and figures 6-8 show a zoomed in area of the watershed.



Big Lake Accumulation



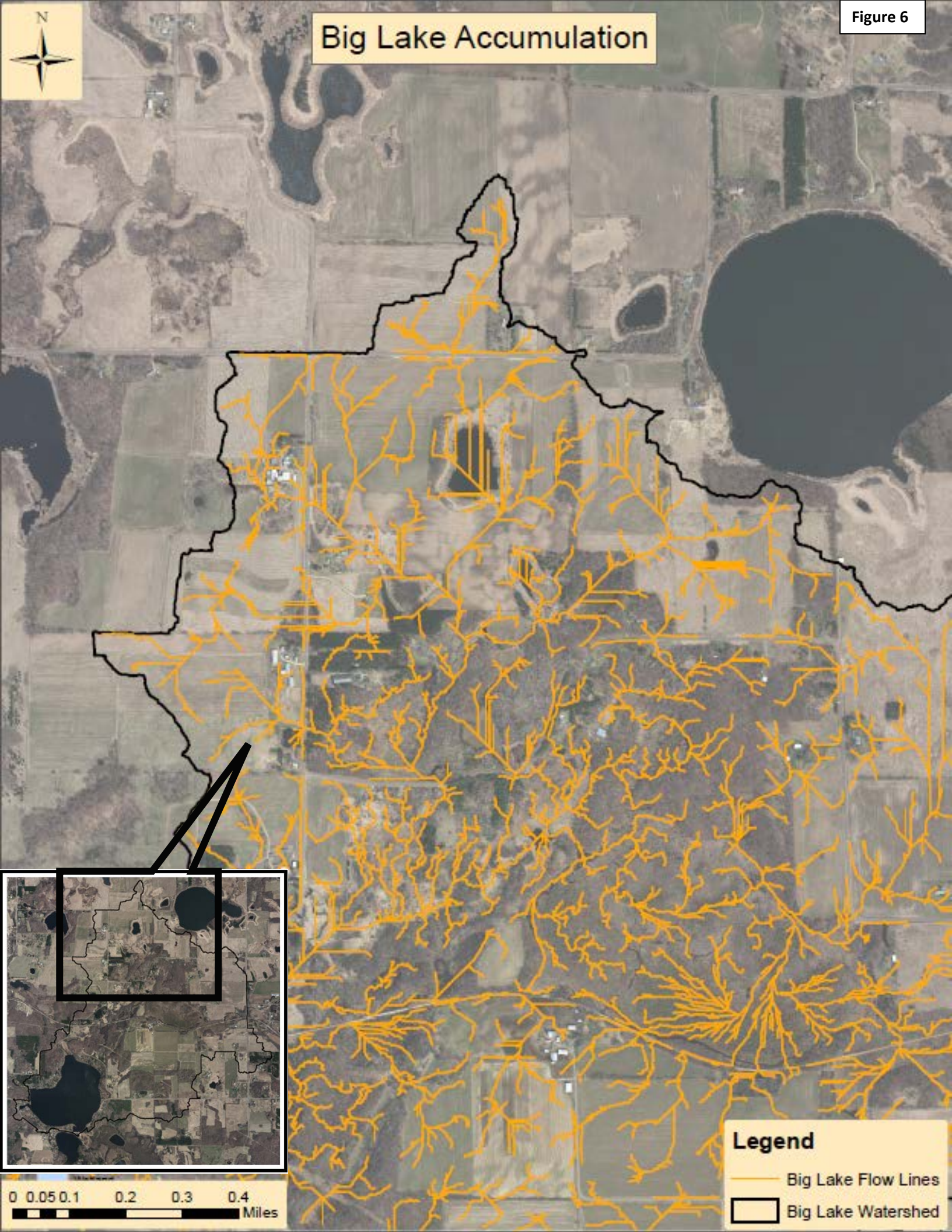
Legend

— Big Lake Flow Lines



Figure 6

Big Lake Accumulation



Legend

- Big Lake Flow Lines
- Big Lake Watershed

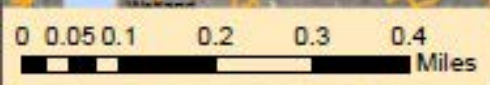
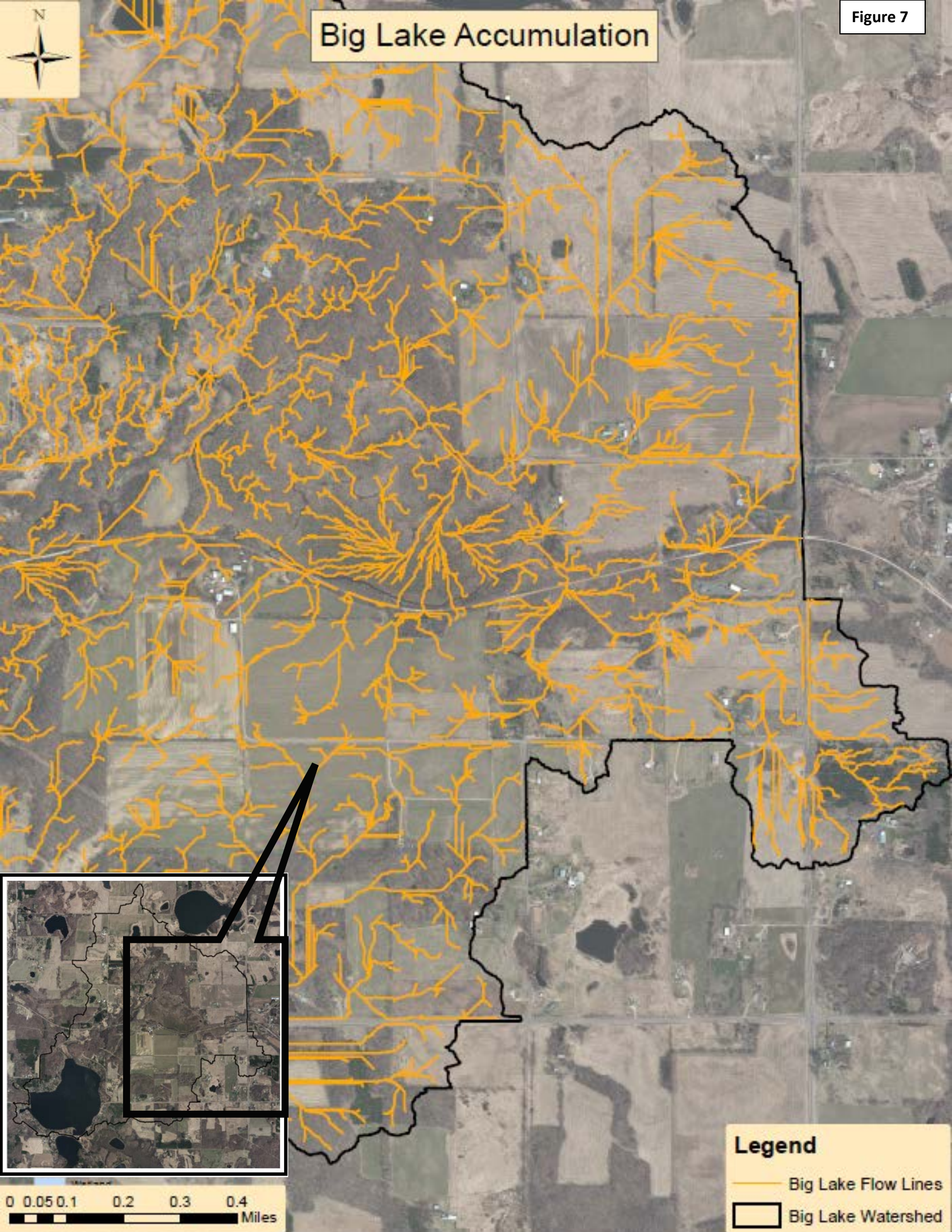


Figure 7

Big Lake Accumulation

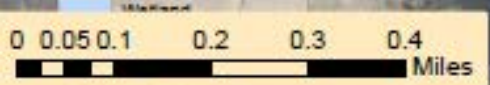
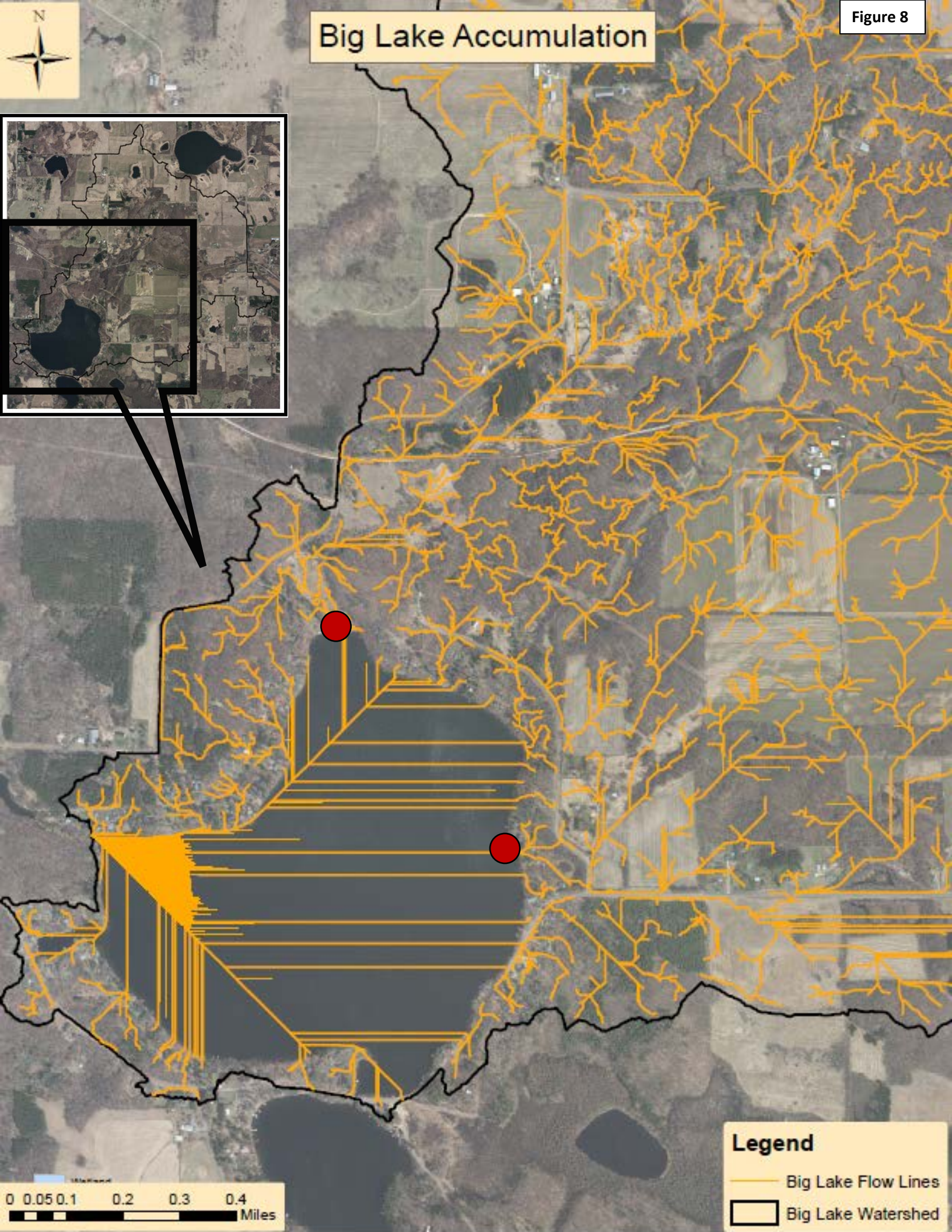


0 0.05 0.1 0.2 0.3 0.4 Miles

Legend

- Big Lake Flow Lines
- Big Lake Watershed

Big Lake Accumulation

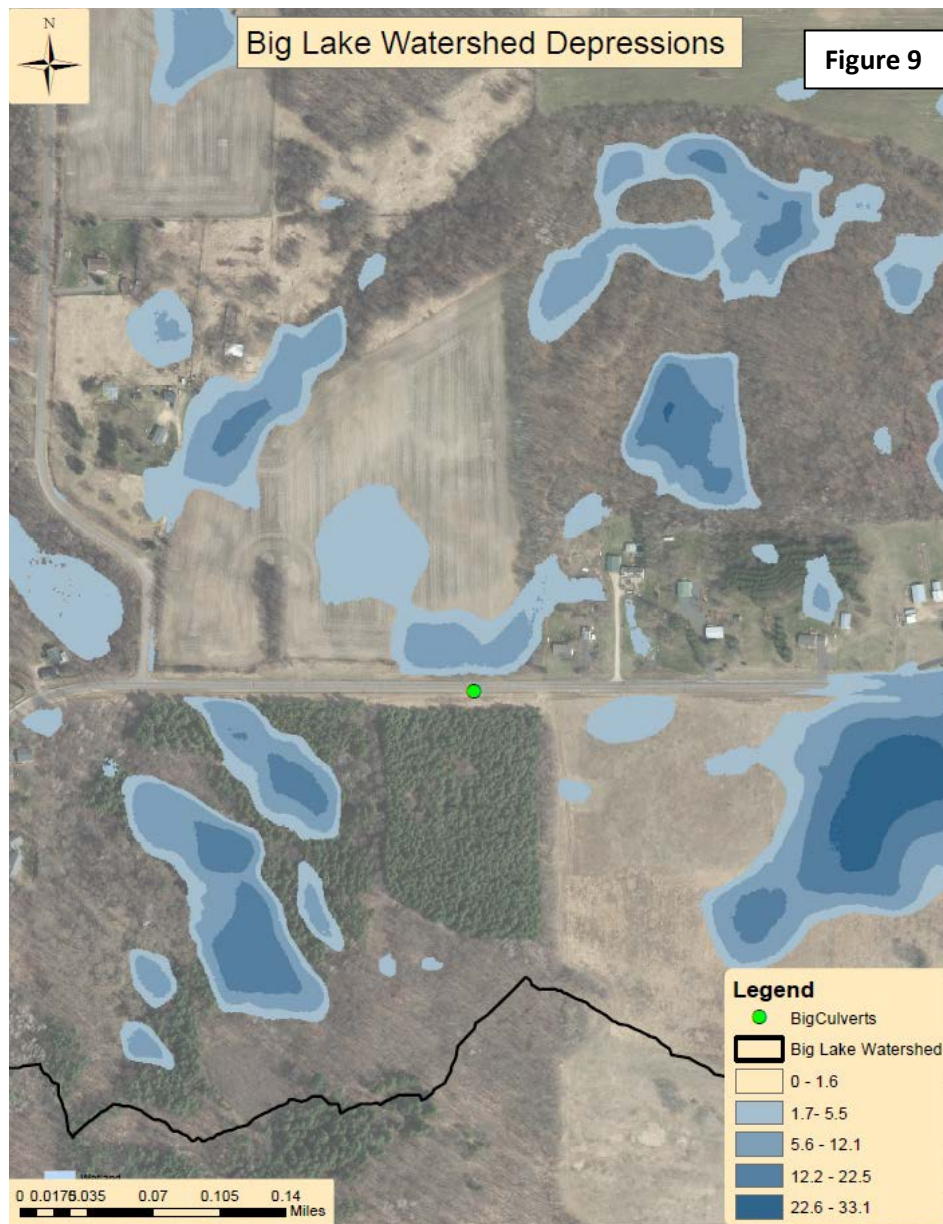


Legend

- Big Lake Flow Lines
- Big Lake Watershed

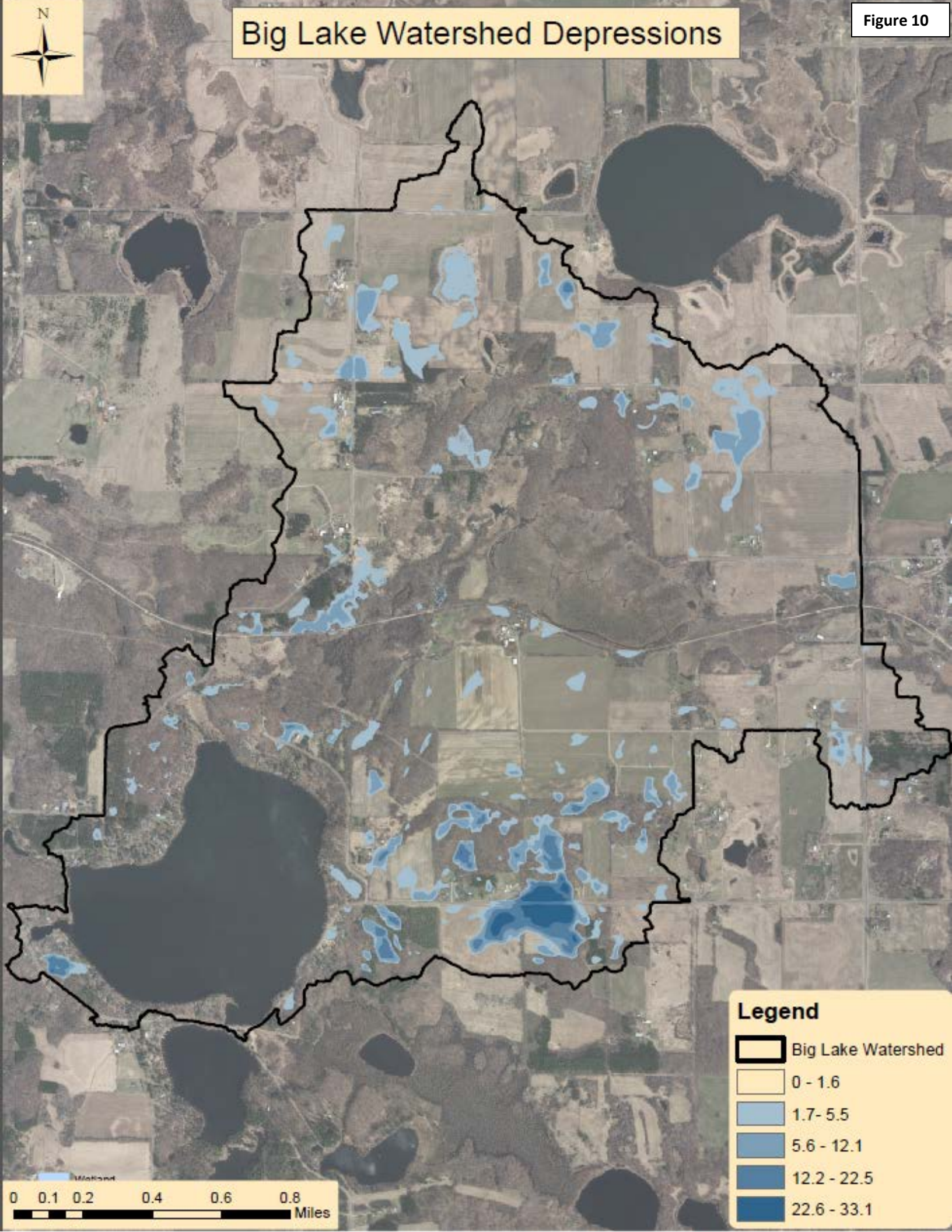
Culvert Connection

The connection of culverts underneath roads is a very important aspect of watershed mapping. When mapping a watershed, the computer software perceives roads as dams which block the flow of water. Knowing the locations of culverts allows for a continuous flow path to be created in ArcMap which accurately depicts how water moves across the landscape. The Big Lake Watershed depressions map (figure 9) shows how a depression area alongside the road could be indicating the presence of a culvert under the road. After identifying these areas on the map, field verification occurred to identify if a culvert existed at that location. The green dot on the Big Lake Watershed depressions map (figure 9) represents a field verified culvert. Once the culvert data was added to ArcMap, the watershed could be adjusted to be more accurate.









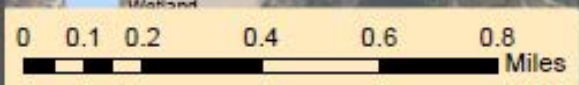
Big Lake Watershed Depressions

Figure 10

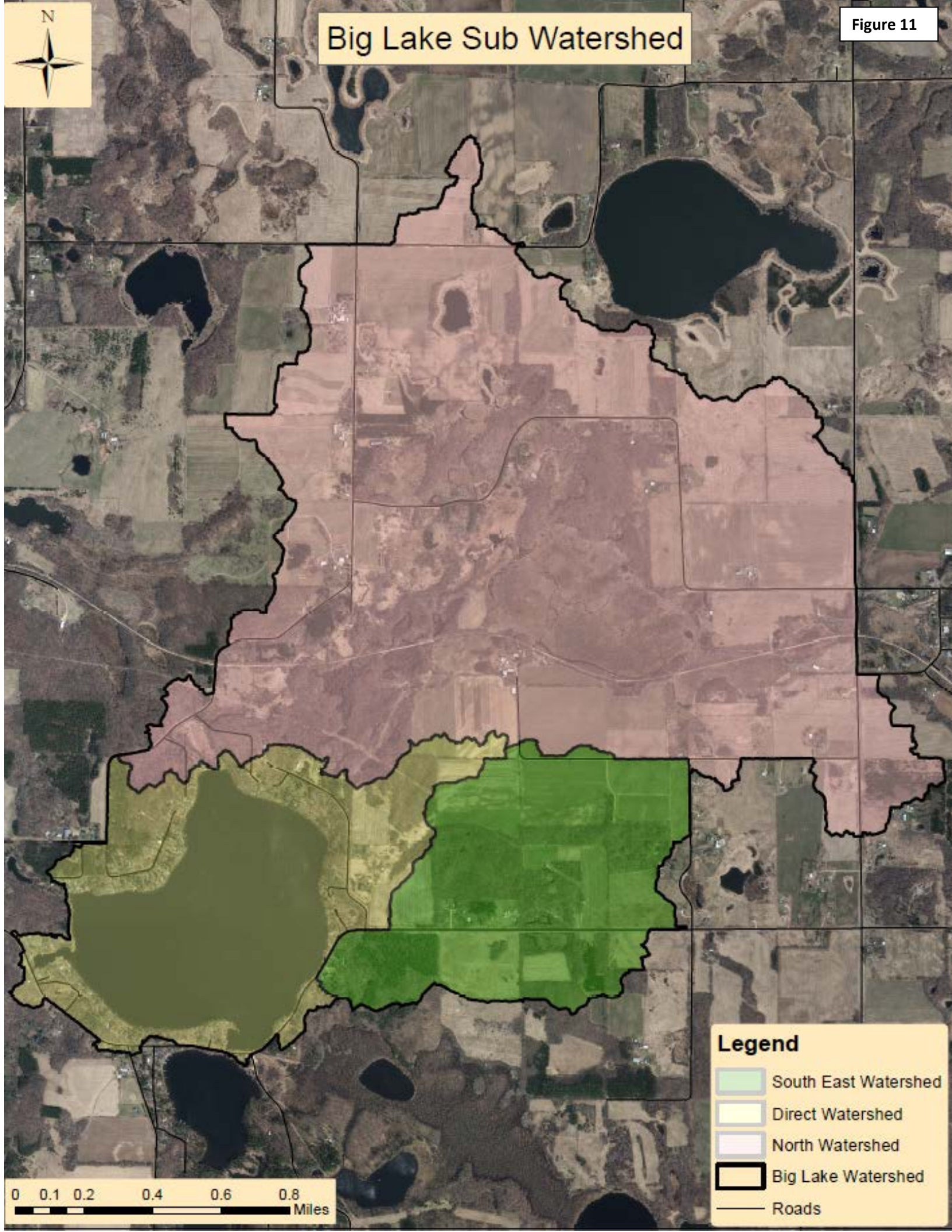


Legend

-  Big Lake Watershed
-  0 - 1.6
-  1.7 - 5.5
-  5.6 - 12.1
-  12.2 - 22.5
-  22.6 - 33.1

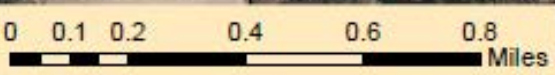


Big Lake Sub Watershed

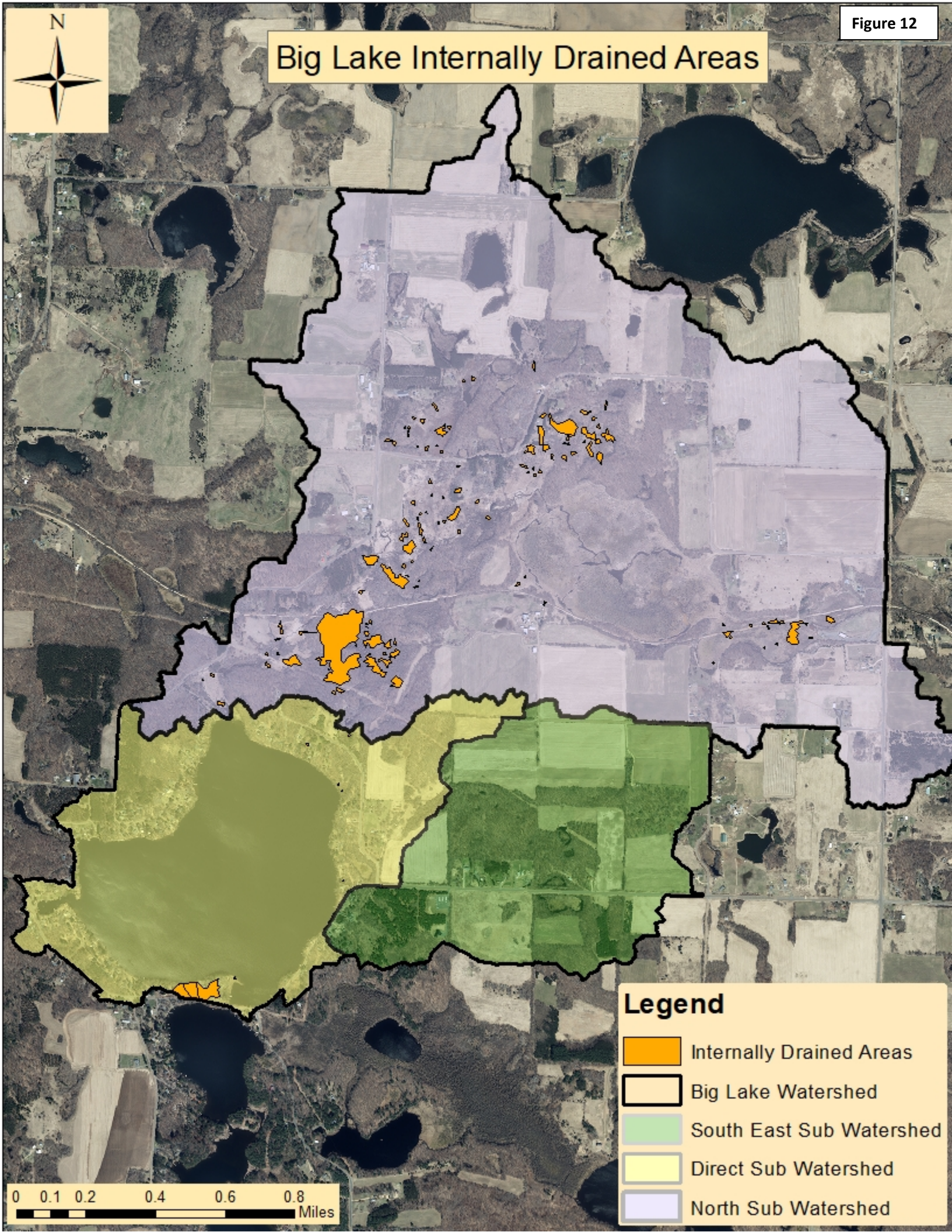


Legend



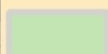
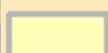
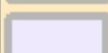
- South East Watershed
- Direct Watershed
- North Watershed
- Big Lake Watershed
- Roads

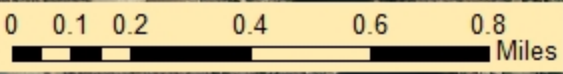


Big Lake Internally Drained Areas



Legend

-  Internally Drained Areas
-  Big Lake Watershed
-  South East Sub Watershed
-  Direct Sub Watershed
-  North Sub Watershed



The full Big Lake Watershed is 2,409 acres, which can then be broken down into sub watersheds. The North Sub Watershed is 1,554 acres, South East Sub watershed is 363 acres, and the Direct Sub Watershed is 492 acres. Within the watershed there is areas that are internally drained, meaning this water would not reach Big Lake by overland flow. To determine the internally drained areas the Wisconsin DNR's Erosion Vulnerability Assessment for Agricultural Lands (EVAAL) toolbox was used. Which uses a curve number-based estimation of runoff for a given frequency and duration of precipitation. The frequency and duration of the storm will allow for variation in the surface water runoff which could increase or decrease internally drained areas.

A 10 year storm with a duration of 24 hours was used in the modeling for the Big Lake watershed. This is the equivalent of 4.2 inches of rain over a 24 hour period. With this criteria the EVAAL tool identified 26.46 acres of internally drained area in North Sub Watershed, 3.38 in the Direct Sub Watershed and 0 acres of internally drained area in the Southeast Watershed. Figure 12 displays the areas that are internally drained.

Internally Drained Areas	Acres
North Sub Watershed	26.46
Direct Sub Watershed	3.38
Southeast Watershed	0