Aquatic Plant Management Plan

Big Dummy and Little Dummy Lakes

Dummy Lakes Management District

April 2015

Final Revision April 2016

AQUATIC PLANT MANAGEMENT PLAN
BIG DUMMY AND LITTLE DUMMY LAKES

April 2015
Final Revision 2016

Prepared for:

Dummy Lakes Management District
PO Box 156
Cumberland, WI 54829

Prepared by:

Flambeau Engineering, LLC
PO Box 273
Park Falls, WI 54552

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Tiffiney Kleczewski, PE

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1.0 Executive Summary

The Dummy Lakes Management District (DLMD) was formed in 1983 to address resource management concerns on Big Dummy and Little Dummy Lakes (The Lakes). The Management District has been active in a number of lake management activities on The Lakes including aquatic plant management, invasive species monitoring and control, habitat improvements, boat landing monitoring and community education activities. DLMD contracted Flambeau Engineering, LLC to develop an aquatic plant management (APM) Plan update for Dummy Lakes. The Dummy Lakes APM Plan includes a review of available lake information, an aquatic plant survey, water quality evaluation and an evaluation of feasible physical, mechanical, biological and chemical aquatic plant management alternatives if deemed appropriate. The APM Plan also recommends specific management activities for nuisance native vegetation in the lake system which are discussed below.

An aquatic plant survey on Dummy Lakes was completed in 2013 by Ecological Integrity, which identified 30 aquatic plant species in Big Dummy and 20 in Little Dummy. The most abundant aquatic plants identified during the survey were large purple bladderwort, watershield and white water lily on both lakes. These abundant plants are the species that are growing at nuisance levels and impeding navigation in certain areas of the lakes. The Floristic Quality Index (FQI) is an index that uses the aquatic plant community as an indicator of lake health. Big Dummy exhibited an FQI of 40.82, and Little Dummy 34.18; both higher than the state northern ecoregion average (20.9).

Recommended Aquatic Plant Management Plan

There were not any AIS found in the lakes during the 2013 survey. The issues on the lakes are caused by abundant native species; in particular large purple bladderwort, watershield and white water lily. These plants grow so thickly in certain areas of the lake that navigation is impossible. Limited management of these stands is recommended to improve navigation and recreational use of the Lakes.

The following Active Goals form the structure of the Dummy Lakes Aquatic Plant Management Plan:

Active Goal: Improve navigation through the western half and south bay of Big Dummy Lake and the southern bay of Little Dummy Lake.

Active Goal: Preserve native vegetation and protect and improve fish and wildlife habitat.

Active Goal: Maintain an aquatic invasive species monitoring program that will survey for invasive species, and if found, monitor their locations and extent of population spread.

Active Goal: Continue and expand the Dummy Lakes comprehensive water quality monitoring program through the WDNR Citizen Lake Monitoring Network. The program would include Water Clarity Monitoring and Water Chemistry Monitoring.

Active Goal: Prevent the introduction of AIS by educating lake users.

Active Goal: Promote shoreland protection and restoration to improve water quality and habitat.

Active Goal: Assess watershed and work with local land owners and Barron County Soil and Water Conservation Department to protect water quality.

Active Goal: Evaluate management/treatment effectiveness and adjust plan accordingly.

2.0 Introduction

The DLMLD was formed to manage, protect, preserve and enhance the natural conditions of the Dummy Lakes, and has completed several projects to improve conditions on the Lakes. A major concern is the state of the aquatic plant community and the need of an APM Plan update to actively manage problems associated with them and other pertinent issues. Pursuant to this concern, the DLMD has several goals including completing an APM plan, water quality evaluation, watershed assessment, measure bog expansion, fisheries management, measure sediment accumulation, create bathymetric map of lake bottom and public education. Preliminary project goals and objectives have been discussed and include:

- Improve navigation
- Determine plant community diversity in lake
- Maintain and improve recreational opportunities
- Preserve native aquatic plants
- Protect, designate and improve fish and wildlife habitat
- Evaluate water quality and address concerns/solutions
- Educate lake users on AIS
- Assess watershed and land use
- Document boundary of bog
- Document sediment accumulation in littoral zone
- Update aquatic plant management plan

Big Dummy and Little Dummy Lakes are natural seepage lakes located in northwest Barron County, north of the City of Cumberland, WI. The lakes form a 157 acres system with Little Dummy (43 acres) lying to the north connected to Big Dummy (114 acres) with a narrow, shallow, man-made channel. The channel is approximately 300 feet long (depending on water levels) and can be used to navigate between lakes. During low lake levels the channel was only passable by small water craft; a dredging project was completed in 2014 to deepen the channel to improve navigation. Aquatic vegetation generally grows to a depth of 10 to 14 feet in the lakes.

Each lake has a public boat landing with ramps of gravel and a depth of 1 to 3 feet. Big Dummy landing has enough space for up to five vehicles with trailers. Annual improvements have been made by WDNR since 2011 to enlarge parking area, gravel road, improve boat launch. The lake District chemically treats nuisance aquatic plants each year. Public access is also available through the Dummy Lakes Fishery Area located on the southwest corner of Little Dummy and along the connecting channel. This public land is accessible from 8th Street and allows walking access to the lakes. There is also a small parcel at the end of 25 ½ Ave that is shown on the Barron County GIS website and appears to allow public access to both lakes. See Figure 1 in Figures Section for access locations.

There are no businesses located on the lakes but several private residences are operated as vacation rentals. Stores located in Rice Lake and Cumberland provide lake users with bait and other shopping opportunities. Area restaurants and bars are frequented by lake users. The lake is populated with approximately 60 homes and cabins of which 17 are year round residences. Historically, nuisance native vegetation has been actively managed on the lakes. Prior to 1997, a small harvester and conveyor were purchases by the DLMD. Protection and enhancement of these water resources is essential to providing continued quality recreation. Dummy Lakes offers the following recreational opportunities and extended benefits for visitors and local community:

- Recreational boating
- Fishing
- Wildlife viewing
- Pontoon boating
- Non-motorized watercraft use
- Aesthetic beauty
- Important habitat for fish and wildlife
- Waterfowl Hunting
- Swimming
- Snowmobiling
- Cross country skiing/snowshoeing
- Revenue for local and surrounding communities including real estate taxes and tourism dollars

The lakes contain a diverse aquatic plant community with several "species of special concern". Big Dummy contains a total of 30 species with the following species of special concern: Farwell's water milfoil, Vasey's pondweed, snail-seed pondweed, purple bladderwort and spiny hornwort. Little Dummy contains 20 species. Slow No Wake signage will be installed on both lakes notifying lake users that Little Dummy is a no wake lake and Big Dummy is no wake within 100 feet of shore; signs will be purchased with monies from the state grant program. Historically, nuisance native vegetation has been actively managed on the lakes. Navigation lanes have been chemically treated since 1997 on the lake. Bladderwort, watershield, spatterdock and white water lily have created navigational issues on the lakes for years. Some form of management is required to allow navigation in these areas of the lake. Alternate forms of management will be investigated during this project.

The existing APM Plan is outdated and needs to be revised with current vegetation data. An APM Plan was written in 2009 for Dummy Lakes, the DLMD has set in action steps to update the outdated document to protect Dummy Lakes and other water bodies from the threat of AIS and to educate the lake users on AIS. The DLMD would like to investigate alternative methods of aquatic plant control beyond the historic chemical treatments that have been taking place. DLMD sought matching funds from the Wisconsin Department of Natural Resources (WDNR) Grant program to update the APM Plan.

Two public meetings were held to discuss the APM Plan. The first was held in June 2013 to kickoff the project and explain to the attendees the purpose of the project. A component of the presentation was AIS education. Attendees were introduced to both plant and animal AIS identification and impacts to lake resources. A second meeting was held in June 2014 to present the APM Plan and gather public input.

3.0 Baseline Information

Following is baseline information on the Lakes and surrounding watershed. This information provides background on the Lakes.

3.1 Lake History and Morphology

Big Dummy and Little Dummy Lakes are natural seepage lakes that form a 157 acre system with Little Dummy lying to the north connected to Big Dummy with a narrow, shallow channel. The channel is approximately 300 feet long (depending on water levels) and can be used to navigate between lakes. During low lake levels the channel was only passable by small water craft; a dredging project completed in 2014 deepened the channel to improve navigation. Aquatic vegetation generally grows to a depth of 10 to 14 feet in the lakes.

Big Dummy is in the shape of a horseshoe with the west side consisting of a shallow lobe with muck bottom. The arc at the top (north) contains a state owned island. The east lobe is a deep basin with the deepest part of the lake located near the north end. Little Dummy is an oblong basin with the deepest part of the lake in the northern half. Little Dummy is classified as a Priority Navigable Waterway (PNW) by WDNR which imposes greater restrictions are waterway permits. It is also less than 50 ac in size which prohibits travel above the speed of "slow/no wake" by state law. The following summarizes the lake's physical attributes:

Table 1 Physical Attributes

	Big Dummy	**Little Dummy**
County:	Barron	Barron
Lake Type:	Seepage	Seepage
Surface Area - acres	114	43
Maximum Depth – ft	54	44
Mean Depth – ft	12	13
Waterbody ID (WBIC)	1835100	1861400
Access	Public landing, state owned island	Public landing, state owned fishery area

Source: Wisconsin Lakes, WDNR 2005 and WDNR Lake Survey map, 1969

Figure 2 and 3 (included in Figures Section) illustrates the lakes bathymetry.

3.2 Watershed Overview

The watershed was delineated using USGS topographic map to determine the land area that is contributing surface water to the lakes. Aerial photos were used to determine land use; the land use was then field checked by DLMD to ensure accuracy. The total watershed encompasses approximately 727 acres; it is a mix of agricultural, residential, wetland and forest. The following tables list the land use for both Big and Little Dummy Lakes. The Figure below outlines the Lakes watershed and lists agricultural landuse as shown on the Barron County GIS site. A larger map is included in the Figures Section.

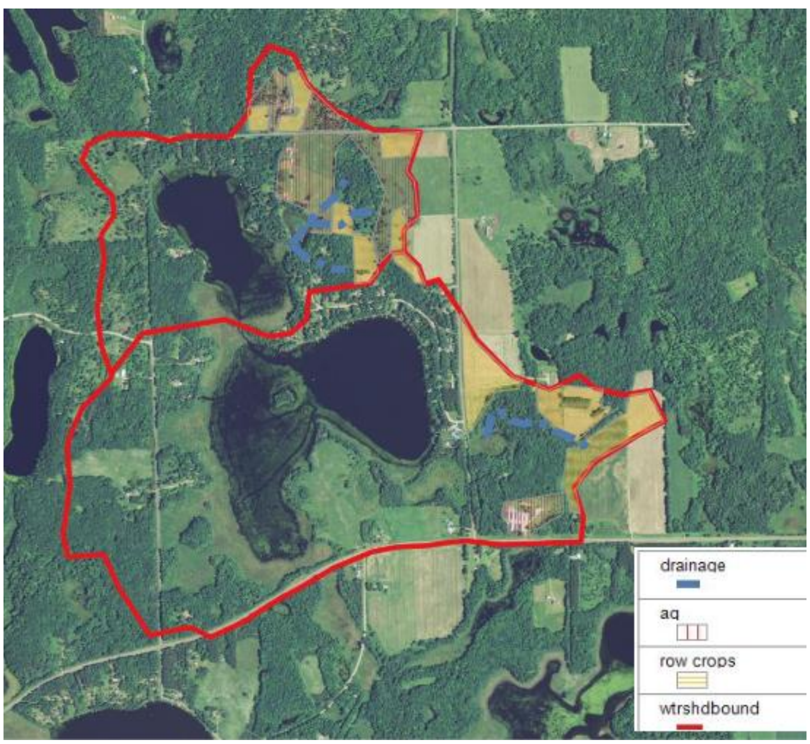
Table 2 Big Dummy Watershed Landuse Area in Acres

Land Use	Area - ac
Row Crop	40
Mixed Use Ag	12
MD Residential	41
Rural Residential	34
Wetland	100
Forest	151
Big Dummy	114
Total	**491**

Table 3 Little Dummy Watershed Landuse Area in Acres

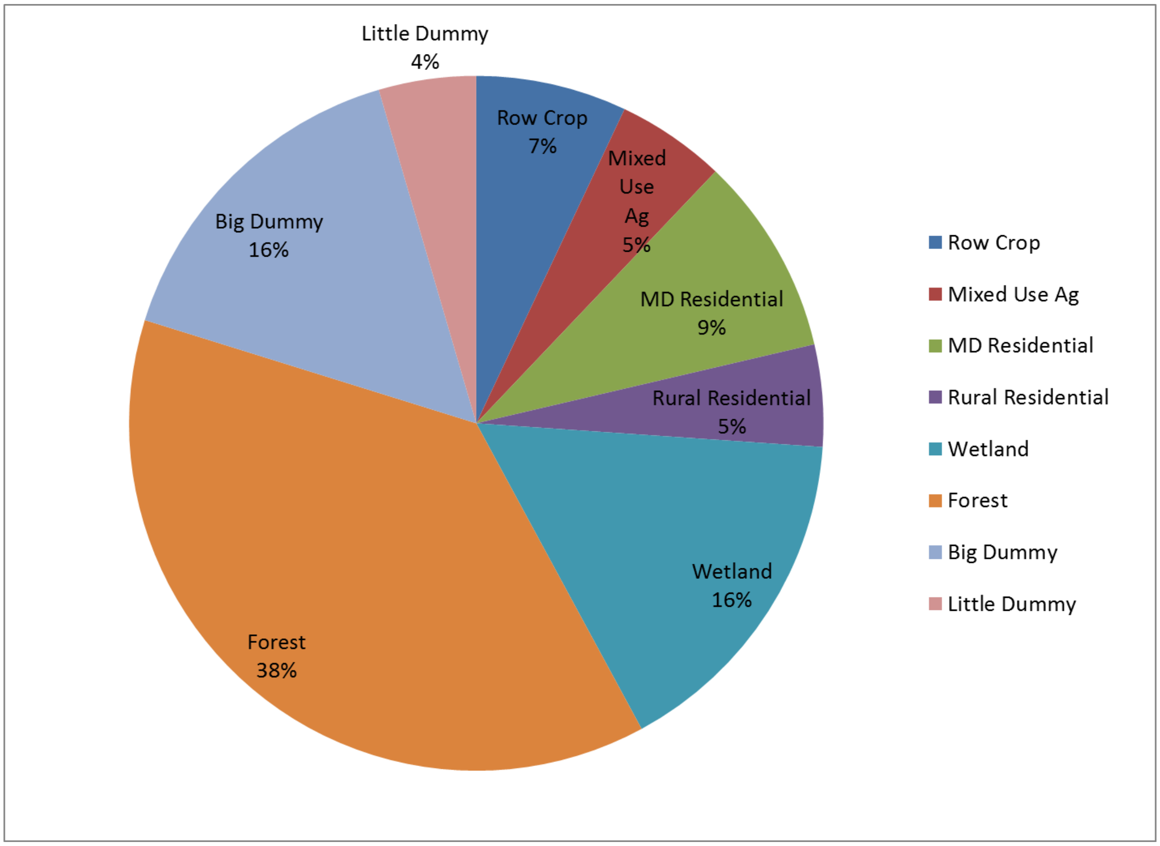
Land Use	Area - ac
Row Crop	12
Mixed Use Ag	25
MD Residential	26
Wetland	17
Forest	124
Little Dummy	33
Total	**236**

Figure 4 - Watershed Boundary and Agricultural Landuse



The following figure depicts the land use as a percent of the watershed area.

Figure 5 - Total Watershed Landuse Percent of Area



3.3 Water Quality

WDNR Lake Water Quality Database indicates that the following water quality information is available.

Table 4 Water Quality Parameters Available

	Big Dummy	Little Dummy
Secchi	1989-1995, 1998-2014	1989-2000, 2002-2014
Chlorophyl a	1989-1990, 2004-2014	1989-1990, 2004-2014
Total Phosporous	1989-1990, 2004-2014	1989-1990, 2004-2014
Dissolved Oxygen/Temperature	2004-2007, 2009-2014	2004-2014

The parameters listed above are commonly used to assess water quality of lakes. Secchi depth is used to measure water clarity and light penetration. Total phosphorus is a measure of nutrients available for plant growth. Chlorophyll a is green pigment present in all plant life and necessary for photosynthesis. These three parameters are used to evaluate the trophic status of a lake. The trophic state index (TSI) ranges along a scale from 0-100 and is based upon relationships between secchi depth and surface water concentrations of chlorophyll a and total phosphorus; the higher the TSI the lower the water quality of the lake. The TSI of both Big Dummy and Little Dummy is currently 48 indicating mesotrophic conditions. All of the water quality parameters mentioned above are further discussed in subsequent sections of this report.

3.4 Summary of Lake Fishery

The Dummy Lakes are considered a bass/panfish/northern pike fishery and are similar in nature to area lakes. Aaron Cole, WNDR fisheries biologist, was contacted to discuss the fishery in the lakes. According to Mr. Cole the lakes are in pretty good shape overall and are typical of lakes for their size and shape.

In 2006 a spring shocking survey was completed on Big Dummy. The following species were observed:

Table 5 - Fishery Data Big Dummy Lake

WDNR Fisheries Fall Shocking Survey							
Big Dummy Lake							
September 12, 2006							
Species	**Total Catch**	**Miles Shoreline**	**Catch per mile**	**Min. Length**	**Max. Length**	**Ave. Length**	**Number Measured**
				in	**in**	**in**	
Black Crappie	3	0.5	6	4.5	9	7.3	3
Bluegill	226	0.5	452	3	6.5	4.5	167
Largemouth Bass	46	2	23	6.5	16	11.5	46
Northern Pike	3	2	1.5	16.5	29.5	22.4	3
Pumpkinseed	5	0.5	10	5	7.5	6.5	5
Yellow Perch	8	0.5	16	3	8	6	8

Big Dummy has historically been stocked beginning in 1974 and continuing until 2012. Largemouth bass were stocked once in 1974, walleye were stocked from 1978 to 2006 and northern pike from 2008-2012. Following is the stocking data:

Table 6 - Big Dummy Lake Stocking Record

Year	Species	Age Class	Number	Average Length - in
1974	Largemouth Bass	Fingerling	5,000	3.0
1978	Walleye	Fingerling	363	3.0
1983	Walleye	Fry	228,000	1.0
1984	Walleye	Fingerling	7,265	3.7
1986	Walleye	Fingerling	2,840	3.0
1986	Walleye	Fry	111,000	1.0
1989	Walleye	Fingerling	2,807	4.0
1992	Walleye	Fingerling	5,550	2.0
1994	Walleye	Fingerling	5,550	1.9
1996	Walleye	Fingerling	5,550	2.4
1997	Walleye	Large Fingerling	1,110	3.8
1998	Walleye	Small Fingerling	190	2.3
2000	Walleye	Small Fingerling	5,550	2.2
2002	Walleye	Small Fingerling	5,547	1.6
2004	Walleye	Small Fingerling	5,592	1.4
2006	Walleye	Small Fingerling	3,927	1.7
2008	Northern Pike	Large Fingerling	293	7.2
2010	Northern Pike	Large Fingerling	333	8.6
2012	Northern Pike	Large Fingerling	250	7.7

Stocking of walleye was discontinued due to poor survival and was replaced by stocking northern pike. A size and bag limit (26-in minimum and 2 fish limit) on northern pike was implemented to thin the bluegill population and increase their size structure. The northern pike stocking has been put on hold in hopes that natural reproduction should occur following the stocking. Big Dummy was tentatively scheduled for a fisheries survey in 2015 but may be delayed due to budget cuts. When the survey is completed the data will be reviewed and future management will be decided. There is no record of stocking on Little Dummy and future stocking is not scheduled.

There is no record of habitat enhancement on the lakes such as fish cribs. Mr. Cole mentioned that Fish Sticks may be a good habitat improvement to investigate. Fish Sticks are large trees that are brought into the lake and secured to the bank so they lie in the littoral zone of the lake providing natural habitat for fish and aquatic life. If this is to be pursued a suitable site along the shoreline must be secured, a source for the trees found and a method of transportation and installation must be found. A permit is also required from WDNR for a project such as this.

3.5 Aquatic Plants and Lake Management History

There has been a history of lake management on Dummy Lakes. Chemical treatment of navigation lanes was first recorded in 1990. Treatment has occurred on a regular basis to keep these lanes open. Following is the treatment information as provided by DLMD.

Table 7 - Dummy Lakes Chemical Treatment

		Big Dummy	**Little Dummy**			
Date	**Chemical**	**Area-ac**	**Area - ac**	**Total Acres**	**Cost**	**Cost/Acre**
9/6/2012	Rodeo	5.04	1.78	6.82	$4,000	$587
7/13/2011	DMA-4. 2,4-D	3.5	1.55	5.05	$2,967	$588
7/11/2006	Navigate	3.5	1.55	5.05	$4,538	$898
6/27/2005	AquaKleen	3.5	1.55	5.05	$4,963	$982
6/29/2004	AquaKleen	3.53	1.55	5.08	$4,331	$852
9/11/2003	AquaKleen	3.49	3.2	6.69	?	?
8/19/2002	AquaKleen	3.49	1.55	5.04	$4,000	$794
2001		6.99	3.1	10.09	**Permit Denied**	
2000					$4,000	
7/23/1999		2.24	1.15	3.39	$4,000	$1,180
8/4/1998		2.24	1.15	3.39	$3,000	$885

Date	Chemical	Big Dummy Area-ac	Little Dummy Area - ac	Total Acres	Cost	Cost/Acre
7/21/1997		2.3	1.09	3.39	$5,000	$1,475
1996		2.28	0.64	2.92	$3,000	$1,027
7/18/1995	2,4-D, Ortho-77	3.54	1.44	4.98	$6,000	$1,204
7/14/1994	Rodeo, Ortho-77	3.54	0.58	4.12	$2,200	$533
1993	-		-		$5,000	
8/21/1992		0.826	0.09	0.916	$3,000	$3,275
1991	Hydrothol 191	0.06	0.46	0.52	$3,000	$5,769
7/3/1990	Salts of Endothol	0.06	0.23	0.29	$4,400	
Totals		50.126	22.66	72.786	$67,399	

Brand	Active Ingredient	Form
Rodeo	glysophate	liquid
DMA-4	2,4-D	liquid
AquaKleen	2,4-D	granular
Navigate	2,4-D	granular
Ortho-77	spreader	
Hydrothol 191	endothal	granular
Salts of Endothal	endothal	granular

The chemical that has been used most frequently is 2,4-D; control with this method has varied. In recent years glysophate has been used to control the floating-leaf, nuisance vegetation with good success along shorelines with dense vegetation. Mid lake treatment has been marginal with channels much too narrow. Steps will be taken in 2015 to widen the narrow channels. Other treatment options will be investigated in this APM Plan.

3.6 Goals and Objectives

DLMD identified the following goals for aquatic plant management on Dummy Lakes.

- Improve navigation
- Determine plant community diversity in lake
- Maintain and improve recreational opportunities
- Preserve native aquatic plants
- Protect, designate and improve fish and wildlife habitat
- Evaluate water quality and address concerns/solutions
- Educate lake users on AIS
- Assess watershed and land use
- Document boundary of bog
- Document sediment accumulation in littoral zone
- Update aquatic plant management plan

4.0 Project Methods

To accomplish the project goals, the DLMD needs to make informed decisions regarding APM on the lakes. To make informed decisions, DLMD proposed to:

- Collect, analyze, and interpret basic aquatic plant community data
- Recommend practical, scientifically-sound aquatic plant management strategies

Offsite and onsite research methods were used during this study. Offsite methods included a thorough review of available background information on the lake, its watershed, and water quality. An aquatic plant community survey was completed onsite to provide the data needed to evaluate aquatic plant management alternatives.

4.1 Existing Data Review

A variety of information resources were reviewed to develop a thorough understanding of the ecology of the lakes. Information sources included:

- Local and regional geologic, limnologic, hydrologic, and hydrogeologic research
- Discussions with DLMD members. Barron County SWCD, WDNR fisheries biologist, herbicide applicators and aquatic plant surveyor.
- Available topographic maps and aerial photographs
- Data from WDNR files

The following specific reports were reviewed:

- Aquatic Plant Survey, Little Dummy Lake, Barron County, Wisconsin, WDNR 2006
- Aquatic Plant Management Plan, Big and Little Dummy Lake, Barron County, Wisconsin, Harmony Environmental, August 2009,
- Aquatic Macrophyte Survey for Little and Big Dummy Lakes, Barron County, Wisconsin, Endangered Resources Services, LLC, Summer 2008
- Aquatic Macrophyte Survey, Big Dummy Lake and Little Dummy Lake, Barron County, Wisconsin, Ecological Integrity Service, August 2013

These sources were essential to understanding the historic, present, and potential future conditions of the lakes, as well as to ensure that previously completed studies were not unintentionally duplicated. Specific references are listed in Section 8.0 of this report.

4.2 Watershed Assessment

A general evaluation of pollutant sources (usually non-point source nutrient pollutants for waters in the Dummy Lakes area) within the lakes' watershed was completed. The Wisconsin Lake Modeling Suite (WiLMS), a screening level water quality evaluation tool, was used to model the lake's nutrient inputs (C1). Using WiLMS, estimates of nutrient and sediment runoff from the various land uses was determined.

The DLMD gathered information from shoreland property regarding potential pollution sources. This information aided in identifying potential threats to water quality from land uses within the watershed. The following sources were noted (See Figure 1a in Figures Section):

- Deforestation of stream and headwaters of Little Dummy Lake (privately owned)
- Hobby farm runoff in southern lobe for over 50 years
- Grazing of livestock in waterway
- Road dust from high use gravel road (25 ½ Ave) during summer months
- Shoreline erosion due to flooding and high water years
- Excavation of shorelines

Barron County and Natural Resources Conservation Service (NRCS) were contacted to discuss current management of agricultural land in the watershed and what programs are available for this purpose. The Barron County website was used to research the ordinances that pertain to land use and zoning in the watershed.

4.3 Shoreline Characterization

The point intercept method described above may not accurately identify emergent and floating-leaf aquatic plants in near shore areas. Therefore, a boat tour was completed traveling the entire perimeter of the lake's shoreline. During the boat tour, visual observations of the emergent and floating-leaf plant communities were located and recorded. The boat tour also included a shoreline characterization, which provides an evaluation of shoreline development on the lake. The following scale was used to rate the level of shoreline development.

1: **Natural undeveloped** - Forested or wetland
2: **Developed low impact** - Structures including homes on the lots; may have docks, swimming rafts, boat lifts; some clearing of vegetation with good tree cover.
3: **Developed high impact** – All items listed in Moderate but more clearing of shoreland with maintained lawns to waters edge, major clearing of trees, shrubs and native grasses. This category also contained lots that had structures that did not meet the setback; within 75 feet to 100 feet of the ordinary high water mark.

Barron County has classified all of its lakes into four categories based on how fragile the lake is. Big Dummy is Class II, or moderately restrictive; Little Dummy is Class III or More Restrictive. The following chart indicates the requirements for new development on lots on these lakes. These charts are taken from the publication *Guidelines for Buyers and Builders in Barron County.*

Figure 6 - Shoreland Requirements from Guidelines for Buyers and Builders in Barron County

SHORELAND SETBACKS AND REQUIREMENTS

Lakes Classification	Lot Size	Lot Width	Shoreline Setback	Sideyard Setback	Vegetation ProtectioArea
Class 1	43,560s.f.	150 ft.	75 ft.	20 ft	50 ft. (OHWM)
Class 2	62,500s.f.	200 ft.	100 ft.	35 ft	75 ft. (OHWM)
Class 3*	80,000s.f	200 ft.	100 ft.	35 ft.	75 ft. (OHWM)
Class 4	160,000s.f	400 ft.	125 ft.	40 ft.	100ft.(OHWM)

*All rivers & streams are classified as Class 3 waters and require the same setbacks and requirements.

The following explains the Vegetation Protection Area listed above.

Figure 7 - Vegetation Protection Area from Guidelines for Buyers and Builders in Barron County

VEGETATION PROTECTION AREA

1. No clear cutting allowed in the vegetation protection area.
2. View/access corridor max. 30' in width allowed.
3. Up to 50% of the existing trees can be removed in the view/access corridor.
4. Pruning allowed throughout the area.
5. Pedestrian access (walkways, pathways, stairways) located within view/access corridor.
6. Pier, wharf and lift placement confined to waters immediately adjacent to view/access corridor unless not feasible due to slope, Soils, etc.
7. Removal of dead, diseased or hazardous trees allowed.
8. Control of noxious and exotic species allowed.

Note: Member(s) of DLMD believe that the vegetation protection area is currently not being enforced by Barron County zoning office.

4.4 Water Quality Methods

The existing information that was available on water quality for the lakes was gathered and assessed. The WDNR Citizen Monitoring Network was accessed online to collect the water quality data available for both Big and Little Dummy Lakes. Graphs were completed depicting the secchi depth, total phosphorus, chlorophyll a and dissolved oxygen for each lake.

4.5 Aquatic Plant Survey and Analysis

The aquatic plant community of the lakes was surveyed in June and again in early August 2013. The June survey was conducted as an early season search for curly-leaf pondweed; none was found. A full lake survey was conducted in August to assess the aquatic plant community. The sample grid was spaced at 120 ft between points. Appendix A includes the Aquatic Macrophyte Survey, Big Dummy Lake and Little Dummy Lake, Barron County, Wisconsin, Ecological Integrity Service, August 2013 (2013 Survey). The following text in *italics* is directly from the 2013 Survey.

A point intercept method was employed for the aquatic macrophyte sampling. The Wisconsin Department of Natural Resources (Wisconsin DNR) generated the sampling point grid of 332 sample points for Big Dummy Lake and 122 sample points for Little Dummy Lake. All points were initially sampled for depth only. Once the maximum depth of plants could be established, only sample points at that depth or less were sampled for plants. If no plants were sampled, one sample point beyond that was sampled for plants. In areas such as bays that appear to be under-sampled, a boat survey *was conducted to record plants that may have otherwise been missed. This involved going to the area and surveying that area for plants, recording the species viewed and/or sampled. The type of habitat is also recorded. These data are not used in the statistical analysis nor is the density recorded. Only plants sampled at predetermined sampled points were used in the statistical analysis. In addition, any plant within six feet of the boat was recorded as "viewed." A handheld Global Positioning System (GPS) located the sampling points in the field. The Wisconsin DNR guidelines for point location accuracy were followed with an 80 ft resolution window and the location arrow touching the point.*

At each sample location, a double-sided fourteen-tine rake was used to rake a 1m tow off the bow of the boat. All plants contained on the rake and those that fell off of rake were identified and rated as to rake fullness. The rake fullness value was used based on the criteria contained in the diagram and table below. Those plants that were within six feet were recorded as "viewed," but no rake fullness rating was given. Any under surveyed areas such as bays and/or areas with unique habitats were monitored. These areas are referred to as a "boat survey."

The depth and predominant bottom type was also recorded for each sample point. Caution must be used in using the sediment type in deeper water as it is difficult to discern between muck and sand with a rope rake. All plants needing verification were bagged and cooled for later examination. Each species was mounted and pressed for a voucher collection and submitted to the Wisconsin DNR for review. On rare occasions a single plant may be needed for verification, not allowing it to be used as a voucher specimen and may be missing from the collection.

The point intercept method was used to evaluate the existing emergent, submersed, floating-leaf, and free-floating aquatic plants. If a species was not collected at a specific point, the space on the datasheet was left blank. For the survey, the data for each sample point was entered into the WDNR "Worksheets" (i.e., a data-processing spreadsheet) to calculate the following statistics:

- **Taxonomic richness** - the total number of taxa detected
- **Maximum depth of plant growth**
- **Community frequency of occurrence** - number of intercept points where aquatic plants were detected divided by the number of intercept points shallower than the maximum depth of plant growth
- **Mean intercept point taxonomic richness** - the average number of taxa per intercept point
- **Mean intercept point native taxonomic richness** - the average number of native taxa per intercept point
- **Taxonomic frequency of occurrence within vegetated areas** - the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points where vegetation was present
- **Taxonomic frequency of occurrence at sites within the photic zone** - the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points which are equal to or shallower than the maximum depth of plant growth
- **Relative taxonomic frequency of occurrence** - the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the sum of all species' occurrences

- **Mean density** - the sum of the density values for a particular species divided by the number of sampling sites
- **Simpson Diversity Index (SDI)** - is an indicator of aquatic plant community diversity. SDI is calculated by taking one minus the sum of the relative frequencies squared for each species present. $SDI = 1-(\Sigma(\text{Relative Frequency}^2))$ Based upon the index of community diversity, the closer the SDI is to one, the greater the diversity within the population.
- **Floristic Quality Index (FQI)** - this method uses a predetermined Coefficient of Conservatism (C), that has been assigned to each native plant species in Wisconsin, based on that species' tolerance for disturbance. Non-native plants are not assigned conservatism coefficients. The aggregate conservatism of all the plants inhabiting a site determines its floristic quality. The mean C value for a given lake is the arithmetic mean of the coefficients of all native vascular plant species occurring on the entire site, without regard to dominance or frequency.

- The FQI value is the mean C times the square root of the total number of native species.
  FQI = mean C * sqrt N
  C= coefficient of conservatism
  N= number of native species

  This formula combines the conservatism of the species present with a measure of the species richness of the site.

4.6 Lake Bottom Assessment and Bog Assessment

The lake bottom sediment depth was estimated based on probing at 332 points across Big Dummy Lake. The points that were sampled for the plant survey were used for the sediment survey (grid spacing 120 ft). The data was collected by a consultant and is included in this report.

Both Lakes contain bog around the edges; this is the floating "land" that is attached to the shoreline. Bogs typically consist of a blanket of sphagnum moss, sedges, grasses, bushes, with a few black spruce and tamarack trees. The edge of the bog around each lake was recorded using GPS. These points were then overlaid on an aerial photo to determine if the bog has expanded.

The west bay of Big Dummy Lake has a mat of mud and vegetation that periodically floats to the surface; this is not considered bog by WDNR. The bog and this mat are further discussed in the following section.

4.7 Bathymetric Mapping

A bathymetric map of both lakes was prepared to serve as a baseline for measuring sediment accumulation on the lake bed. The data was collected using Lowrance HDS5 sonar. Transects spaced at approximately 50 ft were run across the entire lake surface. A transect following the shoreline of each lake was also completed. The data was then used to map the bottom of the lake and depth of water set at the ordinary high water mark.

5.0 Discussion of Project Results

Following is a discussion of the results of the project. It includes data that was collected during the project and the significance of the data.

5.1 Watershed Assessment

The watershed assessment included determining land use for WiLMS modeling, a review of agricultural management programs, and the possible effects of drought on the lake.

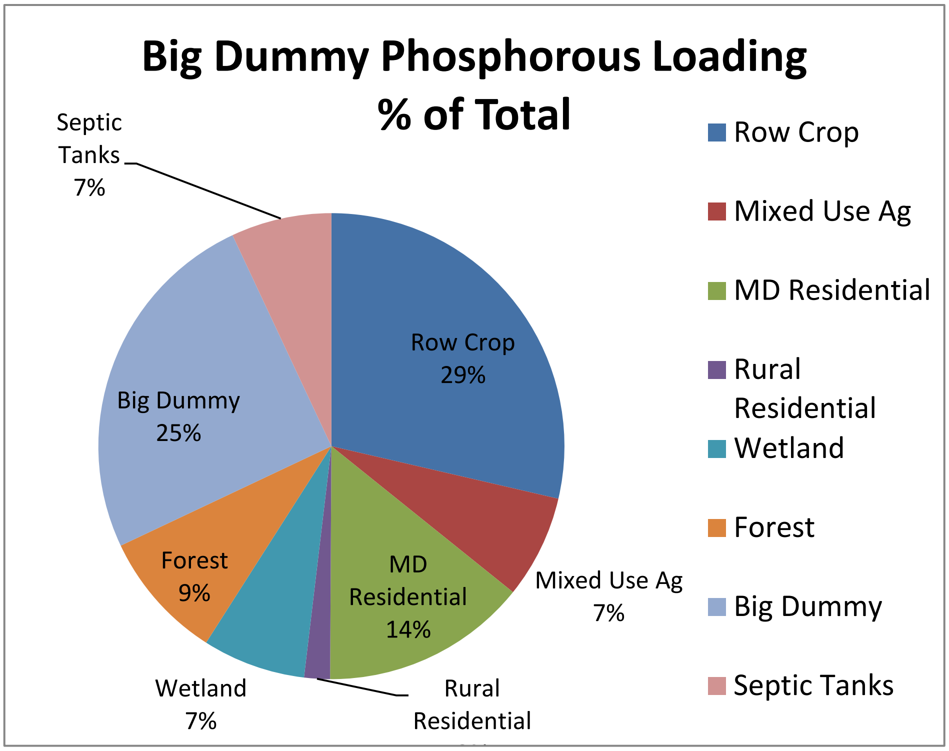
5.1.1 Land Use

The watershed assessment was completed using WiLMS and the data gathered from the Citizen Lake Monitoring. The average total phosphorous, chlorophyll a and secchi depths were used as input along with morphometric features of the lakes. The following phosphorous loading values were predicted from the model.

Table 8 - Big Dummy Land Use and Phosphorous Loading

Big Dummy		
Land Use	**Area - ac**	**Likely Loading (kg/yr)**
Row Crop	40	16.0
Mixed Use Ag	12	4.0
MD Residential	41	8.0
Rural Residential	34	1.0
Wetland	100	4.0
Forest	151	5.0
Big Dummy	114	14.0
Septic Tanks		3.9
Total		**56**

Figure 8 - Big Dummy Phosphorous Loading

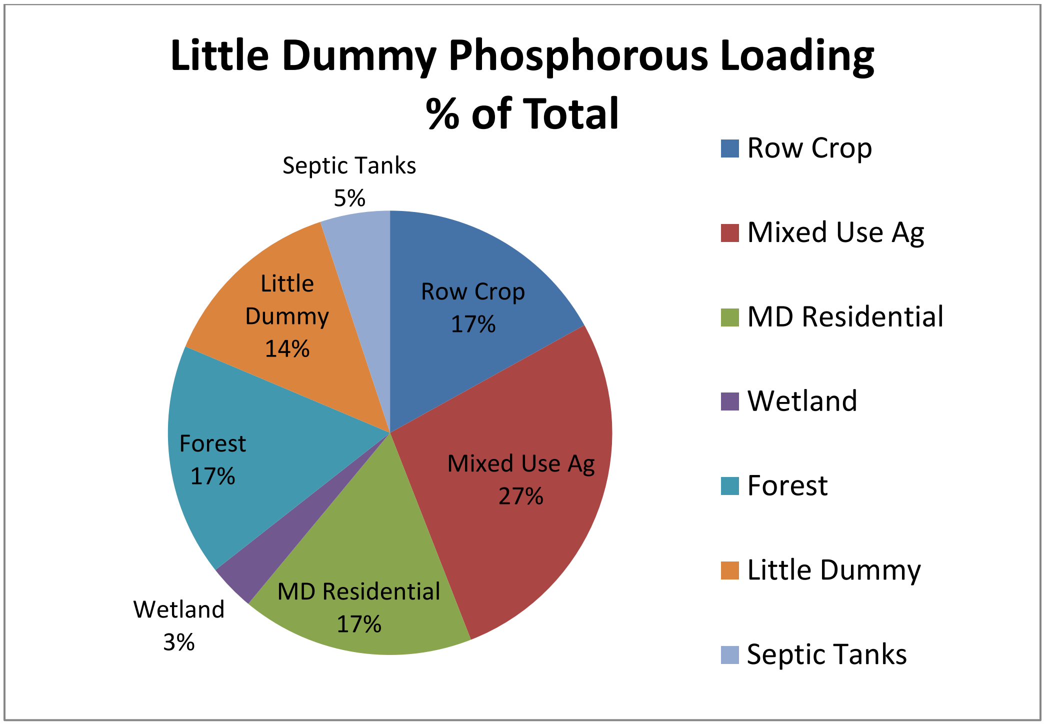


The largest contributor to phosphorus loading is from row crops in the watershed followed closely by atmospheric loading to the lakes surface.

Table 9 - Little Dummy Land Use and Phosphorous Loading

Little Dummy **Land Use**	**Area - ac**	**Likely Loading (kg/yr)**
Row Crop	12	5.0
Mixed Use Ag	25	8.0
MD Residential	26	5.0
Wetland	17	1.0
Forest	124	5.0
Little Dummy	33	4.0
Septic Tanks		1.5
Total		**30**

Figure 9 - Little Dummy Phosphorous Loading



The largest contributor of phosphorous loading to Little Dummy is mixed use ag followed closely by residential land use, row crops and forestry. Options for decreasing this loading are reviewed in the following section.

5.1.2 Agricultural Management Programs

The Natural Resources Conservation Service (NRCS) has a number of programs that offer assistance to agricultural land operators to protect soil and water quality. The following programs are listed on the Barron County Soil and Water Conservation Department website.

Environmental Quality Incentives Program (EQIP)
EQIP provides technical and financial help to landowners for conservation practices that protect soil and water quality. Grassed waterways, stream fencing, critical area planting, terraces, manure management systems including storage structures and barnyard runoff protection, and many other conservation practices are eligible for EQIP.

Conservation Stewardship Program (CSP)
The CSP will help owners and operators of agricultural lands maintain conservation stewardship and implement and maintain additional needed conservation practices. The conservation benefits gained will keep farms and ranches more sustainable and profitable and increase the benefits provided to all Americans through improved natural resources. Participants take additional steps to improve resource condition including soil quality, water quality, water quantity, air quality, and habitat quality, as well as energy. Projects may include buffer creation/enhancement, grazing management, nutrient management, rotation/cover crops, etc.

5.1.3 Barron County Programs and Ordinances

A review of Barron County Soil and Water Conservation Department and Barron County ordinances was completed to find items that pertain to water quality protection. The following items were found.

Soil and Water Conservation (SWCD) Programs

Barron County SWCD administers a number of programs to aid agricultural land management, protect water and soil quality. Agriculture Performance Standards have been created by the state to act as guidelines in land management. The Agriculture Performance Standards as defined in state law are as follows:

- All crop fields must be farmed to tolerable soil loss levels or below.
- Farmers shall not apply nutrients in the form of manure, fertilizer or other nutrient sources above the need of the growing crop, accomplished by developing and following a nutrient management plan.
- Farmers with manure storage facilities must not allow them to overflow.
- No stacking of manure on shorelines or in floodplains.
- No direct runoff from a feedlot into streams, rivers, wetlands and lakes.
- No pasturing of livestock along a shoreline or streambank to the point that the vegetation is destroyed.

Following is a brief description of some of the other programs available through SWCD. All the following documents can be found on the Barron County Soil and Water Conservation Department website, http://www.barroncountywi.gov/index.asp?Type=B_BASIC&SEC={89D075CD-5873-4056-8599-65155CFB943F}.

Wisconsin Farmland Preservation/Working Lands Initiative
The Wisconsin Working Lands Initiative is a state run, county administered program that provides landowners with an opportunity to claim farmland preservation tax credits through participation in the program. These tax credits are income tax credits that are applied against tax liability and are available for the 2010 tax year (paid in 2011) and beyond.

- New Tax Credit
- Eligibility Requirements

Manure Storage Ordinance
Barron County was one of the first counties in the state to adopt an ordinance that requires that all new manure storage facilities be liquid tight and meet NRCS standards. The ordinance applies whenever anyone plans to construct a new animal waste facility or alter an existing structure. The ordinance covers all animal waste storage structures regardless of size. All new facilities or upgrades must meet specific design standards and be approved by an engineer before obtaining a Waste Storage Permit from the Barron County SWCD. This permit costs $250. The Department provides planning and technical assistance to farmers throughout the county. The ordinance also requires and assists in the abandonment of idle manure storage facilities, which also requires a permit ($100).

- Animal Waste Storage Ordinance
- Ordinance Approval

Conservation Walkover
Barron County Soil & Water Conservation Department offers a Conservation Walkover program to provide voluntary assistance to landowners to address issues such as water quality, erosion control, grazing management and wildlife habitat improvement on their property.

Soil Erosion Transect Survey
This is an annual survey of cropland in the county to determine the soil erosion rate. It was begun in 1998 and will be used to show the trend of soil erosion in the county.

Land and Water Resource Management Plan
This plan was revised in the summer of 2006 based on input from a citizen advisory committee. It will set the direction for the department to follow in the years to come. Anyone who would like to read the Land & Water Resource Management Plan can get a copy at the SWCD.

Erosion Control Mulching
The department owns two mulchers and operates them at cost for landowners, local units of government and contractors throughout the county to protect agricultural, urban and road construction sites. They also provide an excellent sod-forming grass/legume seed mixture for waterways, construction sites, eroding slopes and other critical sites. This seed, which is sold at cost, comes in one acre bags.

Technical Assistance
Many farmers voluntarily install conservation practices on their farms to help prevent soil erosion and to improve water quality. Cost share dollars will still find priority with landowners looking to voluntarily implement BMPs to correct prohibition violations on their lands. Barron County will continue to offer voluntary cost sharing to others as program funds are available. The agricultural performance standards and prohibitions found in NR 151 require 70% cost sharing be offered to change an existing cropland practice or livestock facility to bring them into compliance with the new standards. The opportunity exists for an increase to 90% cost sharing if economic hardship is proven. Barron County will work with landowners to develop designs for the conservation practices needed to correct any concerns.

Barron County Land Use Ordinances

An inventory and review of institutional programs was completed. Barron County has ordinances related to shoreland zoning, lake classification, non-metallic mining and sanitary maintenance programs that protect water quality. All of the following documents can be found on the Barron County website in the Zoning Department, All Forms and Documents http://www.barroncountywi.gov/index.asp?Type=B_BASIC&SEC={852D4FEE-F1F4-4C13-B598-FD8FA81807FD}&DE={CC8750AD-F146-4769-9367-E77D17B9230A} Following is a brief description of each.

The Shoreland-Wetland Overlay District
Barron County Land Use Ordinance Section 17.43 – Shoreland-Wetland Overlay District was created to maintain safe and healthful conditions, prevent water pollution, protect fish spawning grounds and wildlife habitat, preserve shore cover and natural beauty, reduce flood hazards to life and property and control building and development in a manner that minimizes adverse impacts upon the wetlands. Figure 10 depicts the area incorporated in the shoreland zoning area in the lakes watershed.

Figure 10 - Shoreline setbacks

Shoreline Setbacks	Lakes Class	Lot Size	Lot Width	Shoreline Setback	Sideyard Setback	Vegetation Protection Area
	1	43,560 sq. ft.	150 feet	75 feet	20 feet	50 feet from OHWM
	2	62,500 sq. ft.	200 feet	100 feet	35 feet	75 feet from OHWM
	3	80,000 sq. ft.	250 feet	100 feet	35 feet	75 feet from OHWM
	4	160,000 sq. ft.	400 feet	125 feet	40 feet	100 feet from OHWM

Lake Classification
Barron County Water Classification System Lake Classifications (I, II, III, IV-Wilderness) of Named Lakes
The lakes are classified as follows:

Big Dummy – Class II moderately restrictive
Little Dummy – Class III more restrictive

See Section 4.3 for further information.

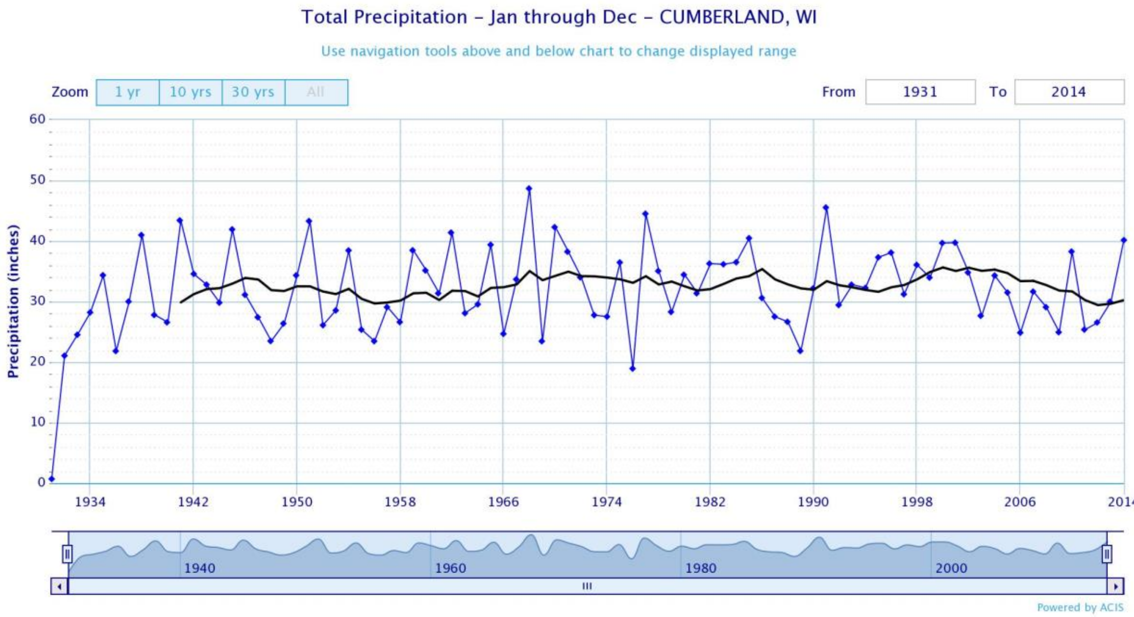
Chapter 18 Non-metallic mining
CHAPTER 18 READOPTION OF THE BARRON COUNTY NON-METALLIC MINING RECLAMATION ORDINANCE APPROVED BY BARRON COUNTY BOARD ON MAY 21, 2007
This county ordinance establishes a local program to ensure the effective reclamation of nonmetallic mining sites on which nonmetallic mining takes place in Barron County. The ordinance addresses areas disturbed and contemporaneous reclamation, public health, safety and welfare, habitat restoration and compliance with environmental regulations. There are chapters that also specifically address surface water and wetland protection, groundwater protection and topsoil management.

Sanitary Maintenance Program
Barron County Land Use Ordinance Section 17.64 – Private Sewage Systems requires that owners of private sewage systems participate in a Private Sewage System Maintenance and Management Program. All new or replacement sewage systems shall have the septic tank pumped by a licensed pumper within 36 months of the date of installation and at least once every 36 months thereafter, or when the sludge level reaches one-third of the liquid capacity of the tank. This program requires that your septic tank (and filter if applicable) be inspected and pumped as necessary. This requirement is designed to protect and improve public health, safety and groundwater quality as well as possibly prolong the life of the private sewage disposal system.

5.1.4 Drought

Water levels on the lakes have been a concern in the last several years. Following is a graph depicting the total precipitation over the last 10 years (2003-2014) for Cumberland.

Figure 11 Annual Precipitation Cumberland WI



The solid line indicates the 10 year moving average for annual precipitation according to US Drought Portal. The graph indicates that the average has been trending down for the last decade and is near the average lows that were experienced in the early 1940s and mid 1950s. The precipitation in 2014 increased dramatically over 2013 with an increase of approximately 10 inches. The reduced precipitation in 2011 to 2013 is likely a factor in the lower water levels experienced in recent years. The watershed feeding the lakes is relatively small when compared to the surface area of the lakes. The low surface water input from the watershed during dry periods and evaporation that takes place on the surface of the lake have resulted in low water levels. Groundwater may be playing a role also. The extended period of lower rainfall may have depleted the groundwater aquifer that could feed the lakes. Lakes may either feed the aquifer or receive water from the aquifer; it is not known how the lakes interact with the aquifer in this case. A search was conducted for high capacity wells in the area; there are none listed in the section in which the lakes are located. There are some located to the south used for the City of Cumberland. It does not appear that high capacity wells are affecting the water levels on the lakes.

5.2 Shoreline Characterization

Overall the condition of the shoreline on both lakes is good. Both lakes have large areas of shoreline that are undeveloped and in a healthy, natural state. Most of the properties that are developed have maintained some of the natural cover; mostly consisting of shorter grass with mature trees. What is lacking on most lots, as is the case on many lakes, is the shrub layer and the longer,native grasses.

The shoreline of Big Dummy is fully developed along the north and east shoreline. Many of these lots would benefit from shoreland restoration to restore shrub and native grass cover. There are several lots that have structures that are within the setback; these were classified as high impact. The shoreland on the west and south is bog and/or agricultural land that is not developed. The following figure shows the shoreland characterization. The yellow green indicates forested/shrub scrub, palustrine wetlands. The blue green indicates aquatic beds in open water. These wetlands are as shown on the Barron County GIS and classified according to Wisconsin Wetland Inventory mapping.

Figure 12 - Big Dummy Shoreline Characterization

Little Dummy has scattered development around the entire lake with a few lots rated at high impact. The land on the south end is boggy and not suitable for development.

Figure 13 - Little Dummy Shoreline Characterization

Shoreline Protection and Restoration

Protection of the native aquatic plant community is needed to slow the spread of EWM from lake to lake and within a lake once established. Therefore, riparian landowners should refrain from removing native vegetation. Additionally, EWM can thrive in nutrient (phosphorus and nitrogen) enriched waters or where nutrient rich sediments occur. Two simple actions can prevent excessive nutrients and sediments from reaching the lake.

The first activity is the restoration of natural shorelines, which act as a buffer for runoff containing nutrients and sediments. Establishing natural shoreline vegetation can sometimes be as easy as not mowing to the water's edge. Native plants can also be purchased from nurseries for restoration efforts. Shoreline restoration has the added benefits of providing wildlife habitat and erosion prevention. A vegetated buffer area can also prevent surface water runoff from roads, parking areas and lawns from carrying nutrients and sediments to the lake. Runoff is reduced by limiting impervious areas (hard surfaces) that do not allow the water to infiltrate into the ground. Ways to reduce runoff in the near shore area include limiting paved areas for parking, reducing road widths, reduce roof top areas, plant rain gardens to capture and infiltrate water, maintain vegetated ditches that slow water and allow infiltration, reduce maintained lawn and allow natural vegetation to grow. These methods are recommended for the areas listed in Section 4.2 and as shown in Figure 1a.

The second easy nutrient prevention effort is to use lawn fertilizers only when a soil test shows a lack of nutrients. A relatively new Wisconsin law prohibits the application of turf fertilizer containing phosphorus except in certain circumstances. Phosphorous containing fertilizer may be used when planting a new lawn or when a soil test indicates the soil is low in phosphorous. Fertilizer may not be applied to impervious surfaces or frozen ground under the new law. More information can be found in Wisconsin Statute 94.643.

Another possible source of nutrients to a lake is the septic systems surrounding the lake. Septic systems should be properly installed and maintained in order to prevent improperly treated wastewater, which carries abundant nutrients, from reaching the lake. Property owners who are not sure if their septic system is adding nutrients to the lake should contact a professional inspector and have their system assessed.

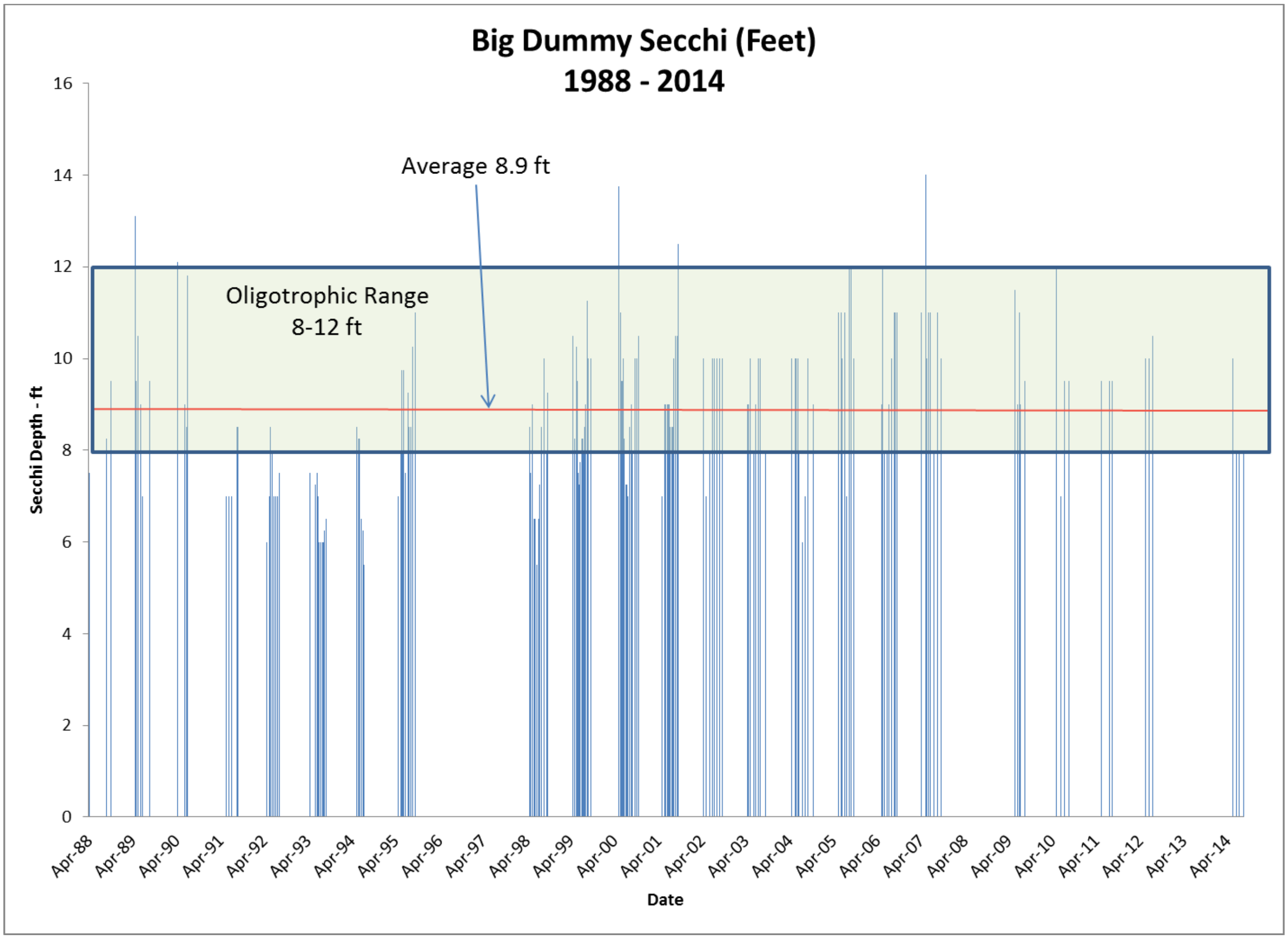
5.3 Water Quality

The water quality of the lake indicates mesotrophic conditions with moderate nutrient levels, water clarity and productivity of aquatic plants and fish. It appears to have remained steady over the years based on the data that has been collected on total phosphorus, chlorophyll a and secchi depth.
Big Dummy has been listed as an impaired water under the EPA 303(d) Clean Waters Act. This means that the waterbody does not meet water quality standards. The pollutant of concern for the Dummy lakes is phosphorous; the limit for a stratified, seepage lake is 20 ug/l. Little Dummy will be listed as an impaired water for phosphorus in 2016. The following sections discuss the water quality results in detail.

5.3.1 Water Clarity

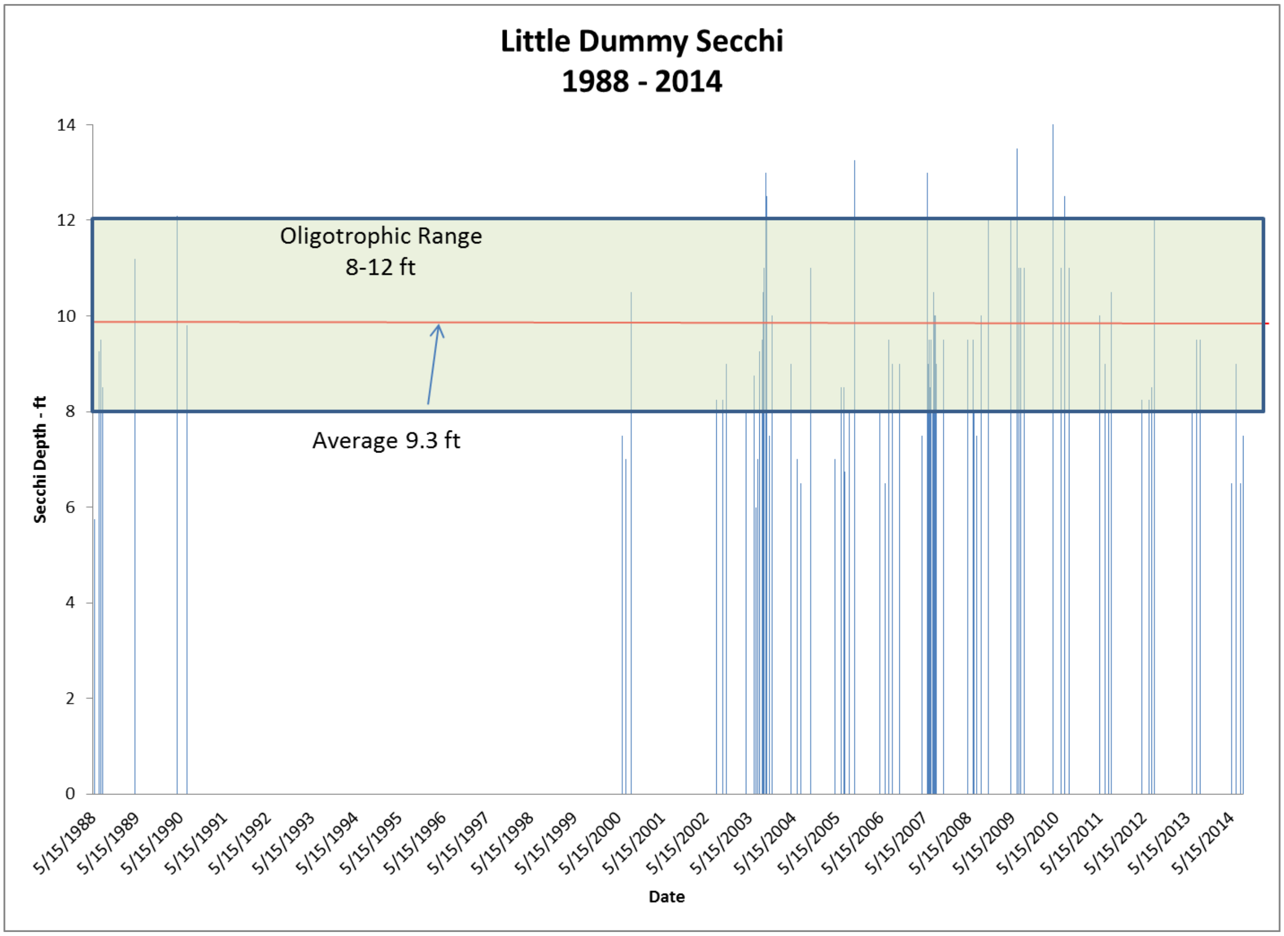
The historical water clarity average based on secchi disk readings for Big Dummy is 8.9 feet and ranges from 5.5 to 14 feet indicating good water clarity. The Wisconsin average secchi disk reading in 2005 was 10 feet (Larry Bresina, The Secchi Disk and Our Eyes - Working Together to Measure Clarity of Our Lakes; internet document). The following graph illustrates the historical water clarity measurements on Big Dummy Lake.

Figure 14 - Big Dummy Secchi Depth (Date v feet)



Little Dummy Lake has an average secchi depth of 9.4 ft with a range of 5.5 ft to 14 ft indicating good water quality. The following figure depicts the secchi readings from 1988 to 2014.

Figure 15 - Little Dummy Secchi Depth (Date v feet)



The data on water clarity for both lakes indicates the clarity decreased in the last several years. This could be due to a number of factors including drought, increased plant growth, algae blooms, more stained water, or increased sediment runoff. The clarity is still good and continued sampling through CLM is recommended to track water clarity.

5.3.2 Total Phosphorus and Chlorophyll *a*

Following is a discussion of the total phosphorous and chlorophyll a concentrations in the lakes over the years of data.

Table 10 - TP and Chl A

	Big Dummy	Little Dummy
Average TP ug/l	20.5	21.8
Max	32	48
Min	11	11
Average Chl a ug/l	6.8	6
Max	17	13.5
Min	2.5	2.2

The lakes have similar water quality and nutrient levels that indicate good water quality.

The following graphs illustrate the historical phosphorus and chlorophyll *a* measurements on the lakes.

Figure 16 – Big Dummy Total Phosphorous

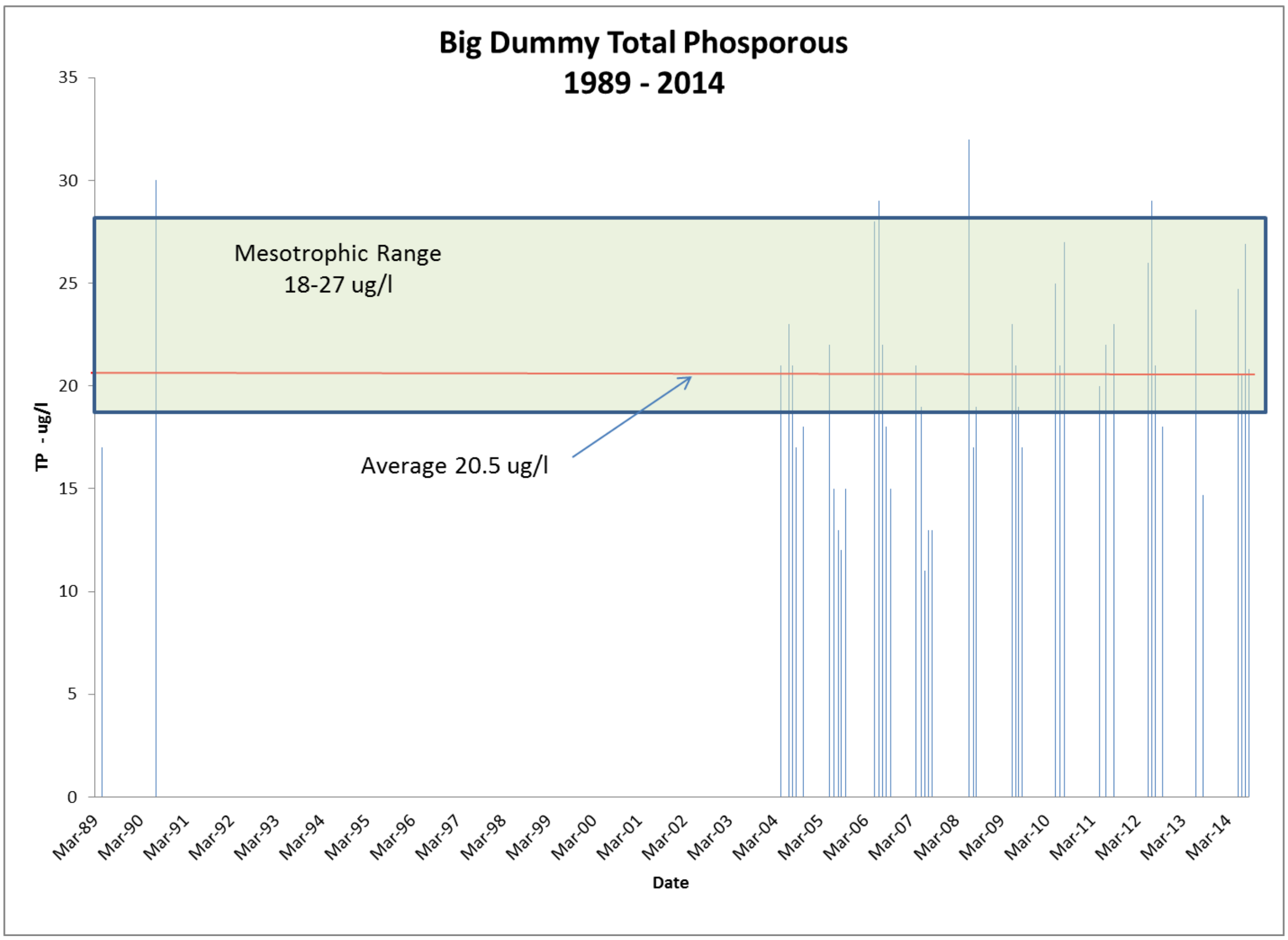
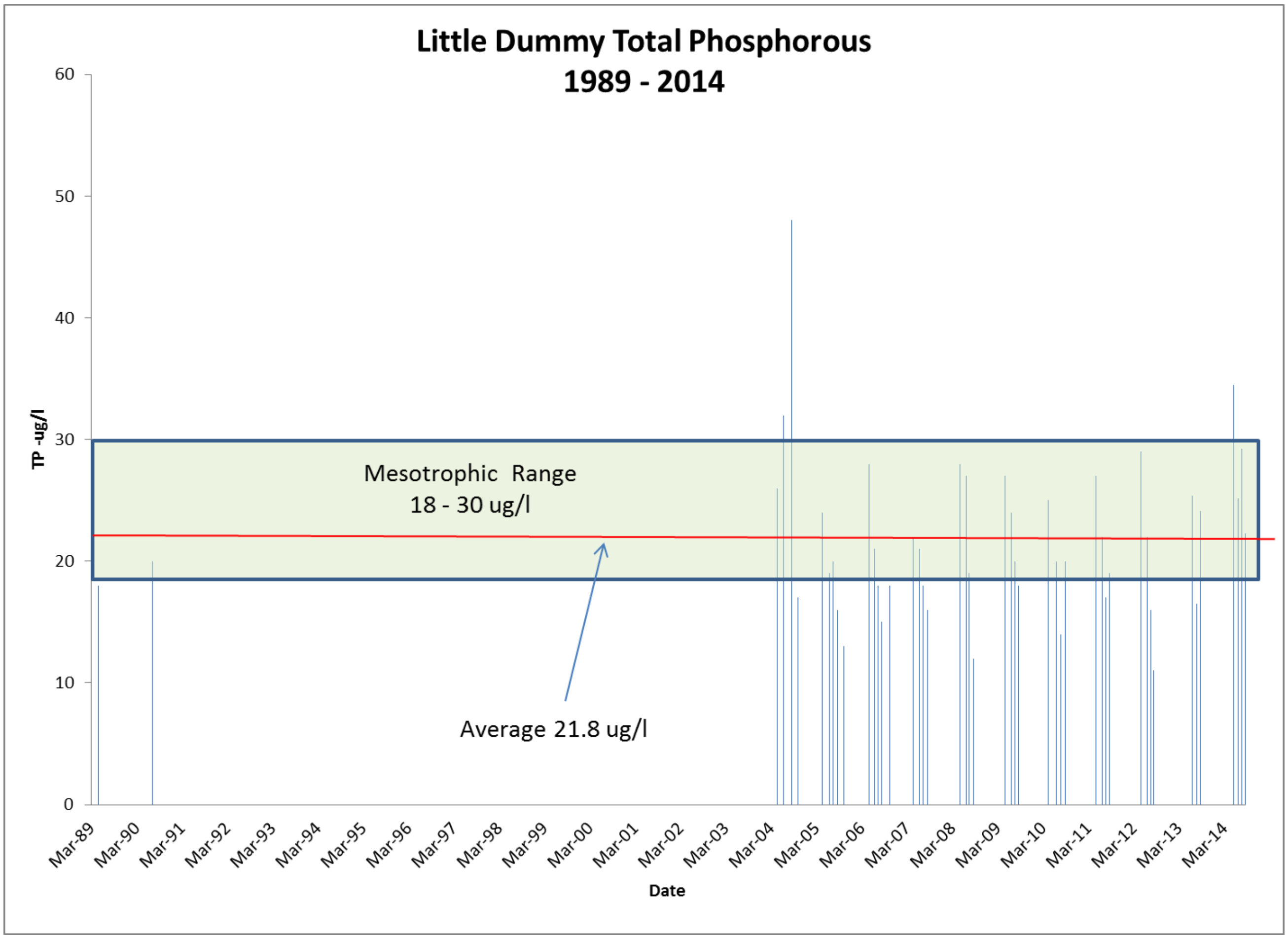


Figure 17 – Little Dummy Total Phosphorus



The measurements have remained relatively consistent over the years with varied levels throughout the year. According to the graph TP may be slightly increasing on both lakes. The threshold for 303(d) impaired water listing for phosphorus is 20ug/l, both lakes averages slightly exceeded this limit.

Figure 18 – Big Dummy Chlorophyll a

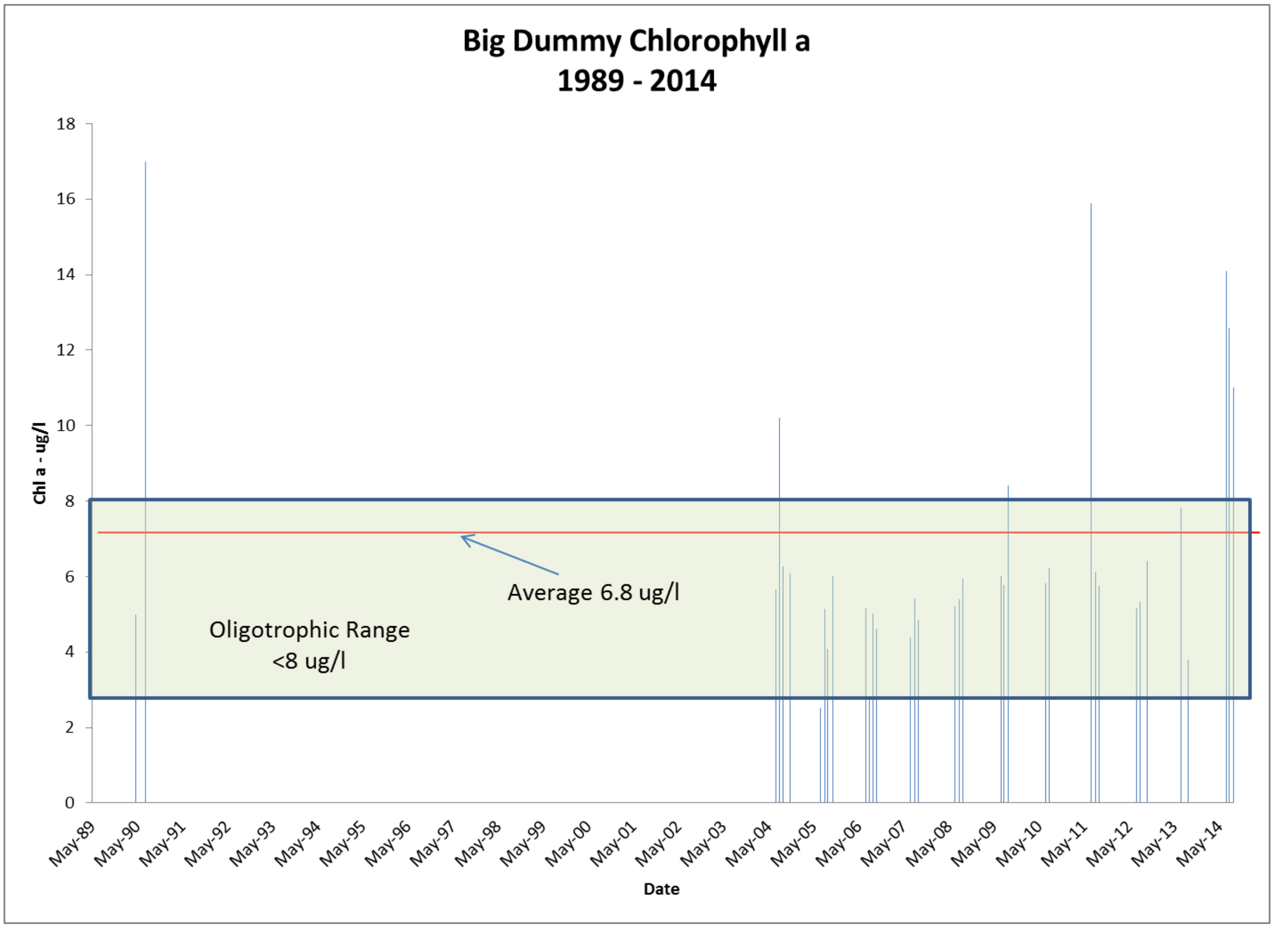
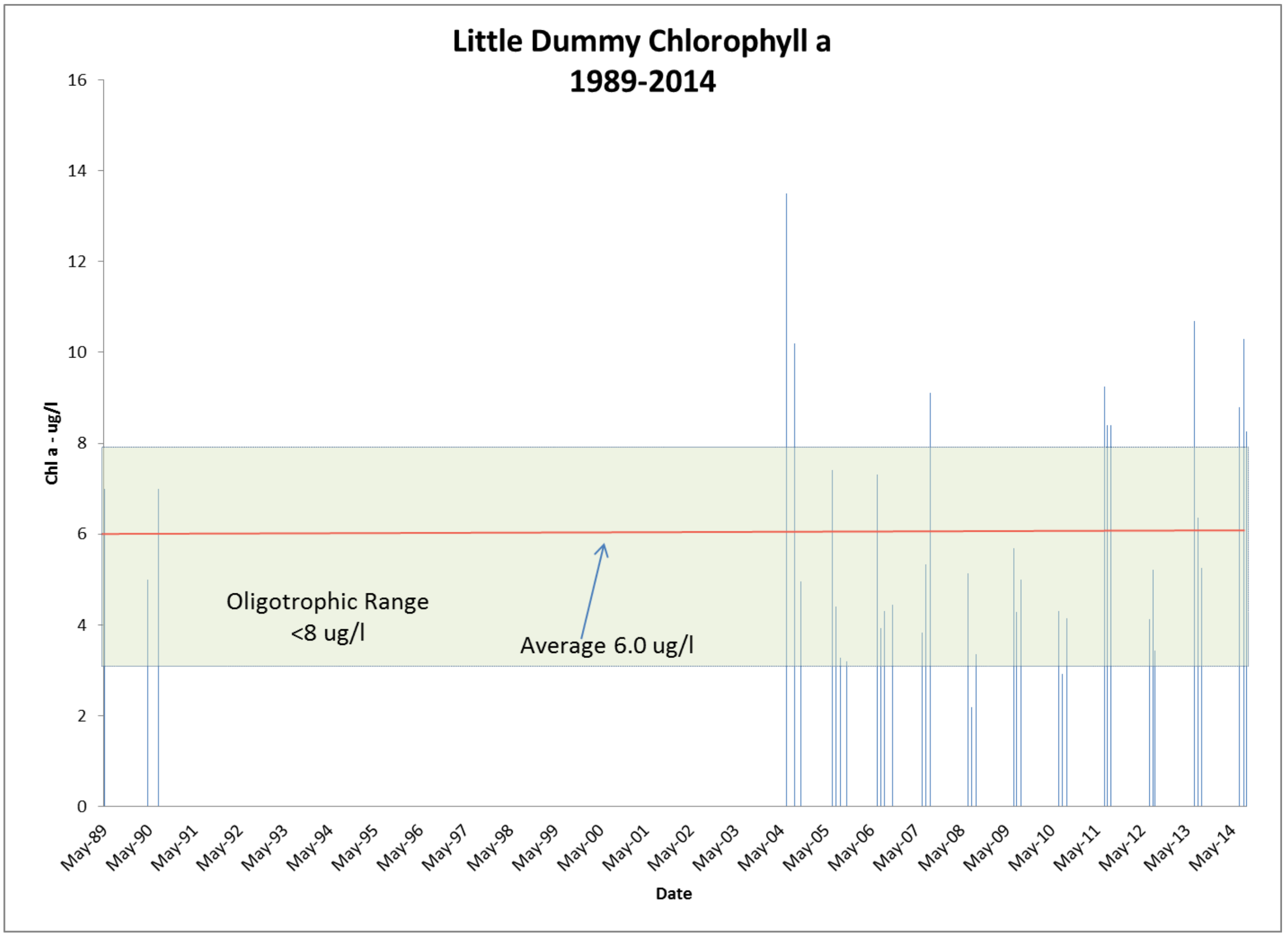


Figure 19 – Little Dummy Chlorophyll a



The measurements have remained relatively consistent over the years with varied levels throughout the year. According to the graph Chl a may be slightly increasing on both lakes. Both lakes are in the mesotrophic range for both TP and Chl a levels. Following is information on the above listed nutrients.

<u>Total Phosphorus (TP)</u> - measure of nutrients available for plant growth and high concentrations can promote excessive plant growth. In more than 80% of Wisconsin lakes phosphorous is the key nutrient affecting the amount of algae and plant growth. Phosphorous comes from a variety of sources, many of which are human related and include animal and human waste, soil erosion, detergents, septic systems and runoff from agricultural land and lawns. On lakes with high development in the near shore area fertilization of lawns and failing septic systems can contribute high amounts of phosphorous to the water.

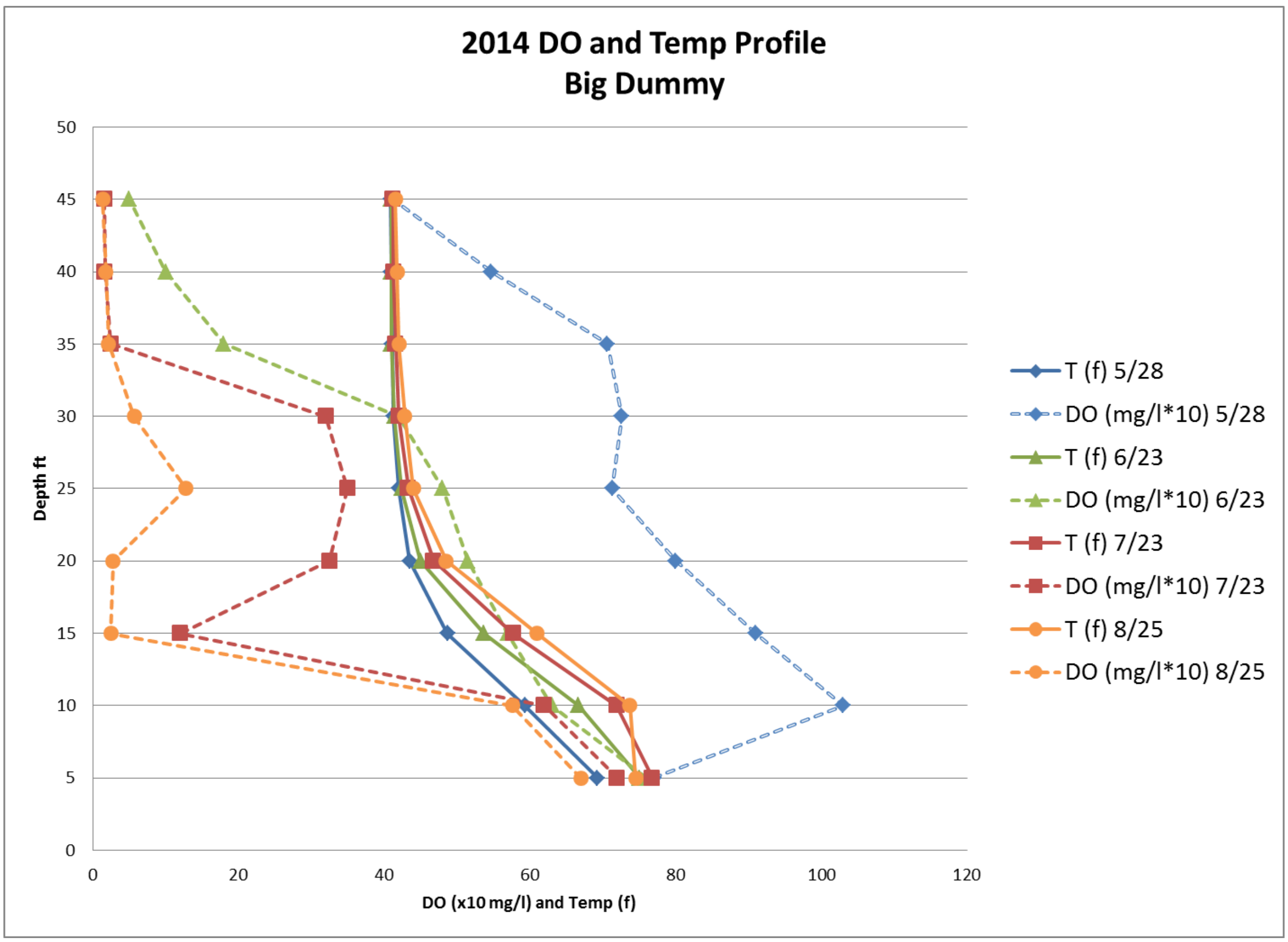
<u>Chlorophyll a -</u> green pigment present in all plant life and necessary for photosynthesis. The amount present in lake water depends on the amount of algae suspended in the water column of a lake. Chlorophyll a is used as a common indicator of water quality (Shaw et al, 2004). Higher chlorophyll a values indicate lower water quality.

According to the water chemistry data above (secchi, total phosphorous and chlorphyll a) the water quality of the lakes has been decreasing over the last several years. This could be a nature fluctuation in the system or it could be sign that water quality is being affected by land use and pollution coming from the watershed. Consistent monitoring throughout the season and from year to year is encouraged to track the water quality. If a consistent downward trend in these parameters is noticed the decreased water quality is likely due to outside influences from the watershed. Implementing the suggested shoreland restorations and addressing the other concerns in the watershed from the agricultural landuse is recommended to reduce these possible influences.

Dissolved Oxygen and Temperature

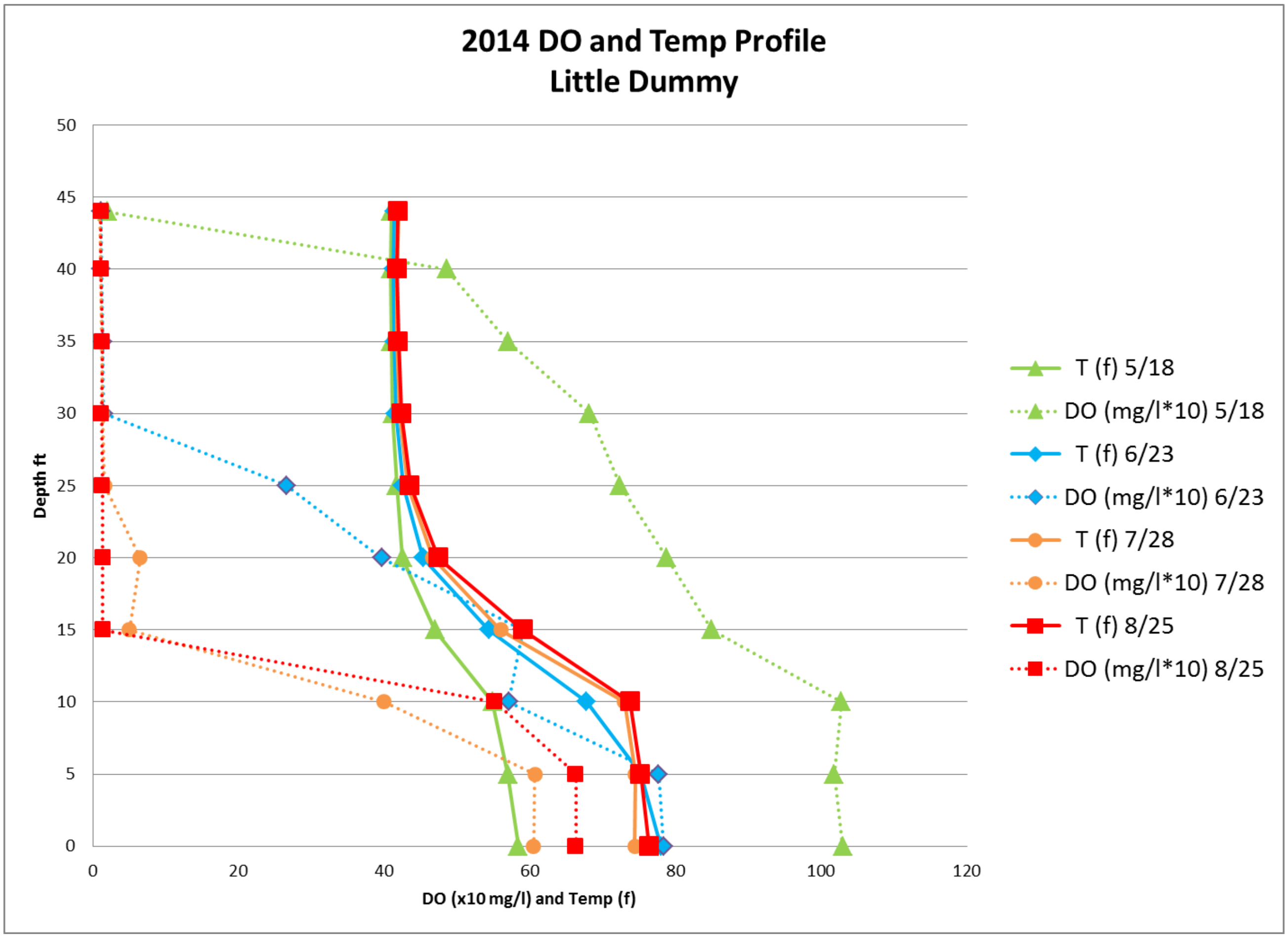
Dissolved oxygen in a lake is used by all organisms. Dissolved oxygen (DO) is dependent on temperature; colder water can hold more dissolved oxygen. DO enters the water through the surface from the atmosphere and varies in concentration diurnally (day and night) and seasonally. Photosynthesis is the primary process affecting the dissolved-oxygen/temperature relation; water clarity and strength and duration of sunlight, in turn, affect the rate of photosynthesis. A graph of the DO and temperature using the latest data is shown below. The DO are the lines to the left and temp are the lines to the right side. DO is expressed as 10x the actual readings for graphing purposes.

Figure 20 - Big Dummy Dissolved Oxygen Profile



The data indicates the thermocline of the lake is at approximately 15 feet; this is where a significant drop in the DO can be seen. When stratified in the summer the lake generally will not mix below this depth.

Figure 21 - Little Dummy Dissolved Oxygen Profile



The thermocline in Little Dummy appears to be at approximately 12 feet.

The dissolved oxygen levels in the lakes are adequate to support aquatic life.

5.3.3 Trophic State Index

Trophic State Index (TSI) values are assigned to a lake based on total phosphorus, chlorophyll *a*, and water clarity values. The TSI is a measure of a lake's biological productivity. The TSI used for Wisconsin lakes is described below.

Figure 22 - TSI Description

Category	TSI	Lake Characteristics	Total P *(ug/l)*	Chlorophyll a *(ug/l)*	Water Clarity *(feet)*
Oligotrophic	1-40	Clear water; oxygen rich at all depths, except if close to mesotrophic border; then may have low or no oxygen; cold-water fish likely in deeper lakes.	< 12	<2.6	>13
Mesotrophic	41-50	Moderately clear; increasing probability of low to no oxygen in bottom waters.	12 to 24	2.6 to 7.3	13 to 6.5
Eutrophic	51-70	Decreased water clarity; probably no oxygen in bottom waters during summer; warm-water fisheries only; blue-green algae likely in summer in upper range; plants also excessive.	> 24	>7	<6.5
Big Dummy	**49**	**Mesotrophic**	**52**	**49**	**46**
Little Dummy	**48**	**Mesotrophic**	**52**	**48**	**45**

Adopted from Carlson 1977, Lillie and Mason, 1983, and Shaw 1994 et. al.

The historical water clarity, total phosphorus, and chlorophyll a data indicate that Dummy Lakes are mesotrophic lakes. The lakes are borderline eutrophic based on the combined average of the TSI and individual TSI measurements. The TSI has remained relatively stable over the years but a slight increase has been tracked over the last several years. This is not unusual in lakes and may be a natural fluctuation based on natural occurrences. It could also indicate increased pollutant loading from the watershed. Continued water quality monitoring is important to further track these changes to determine the cause. Implementing watershed best management practices is encouraged to reduce pollutant loading from the watershed.

5.4 Aquatic Plant Ecology

Aquatic plants are vital to the health of a water body. Unfortunately, people all too often refer to rooted aquatic plants as "weeds" and ultimately wish to eradicate them. This type of attitude, and the misconceptions it breeds, must be overcome in order to properly manage a lake ecosystem. Rooted aquatic plants (macrophytes) are extremely important for the well-being of a lake community and possess many positive attributes. Despite their importance, aquatic macrophytes sometimes grow to nuisance levels that hamper recreational activities. This is especially prevalent in degraded ecosystems. The introduction of certain aquatic invasive species can often exacerbate nuisance conditions, particularly when they compete successfully with native vegetation and occupy large portions of a lake.

When "managing" aquatic plants, it is important to maintain a well-balanced, stable, and diverse aquatic plant community that contains a high percentage of desirable native species. To be effective, aquatic plant management in most lakes must maintain a plant community that is robust, species rich, and diverse. Appendix C includes a discussion about aquatic plant ecology, habitat types and relationships with water quality.

5.5 Aquatic Invasive Species

Aquatic Invasive Species (AIS) are aquatic plants and animals that have been introduced by human action to a location, area, or region where they did not previously exist. AIS often lack natural control mechanisms they may have had in their native ecosystem and may interfere with the native plant and animal interactions in their new "home". Some AIS have aggressive reproductive potential and contribute to a decline of a lake's ecology and interfere with recreational use of a lake. Common Wisconsin AIS include:

- Eurasian Watermilfoil
- Curly-leaf Pondweed
- Zebra Mussels
- Rusty Crayfish
- Spiny Water Flea
- Purple Loosestrife

Appendix C2 provides additional information on these AIS.

5.6 2013 Aquatic Plant Survey

The following text in *italics* and graphics are directly from "Aquatic Macrophyte Survey, Big Dummy Lake and Little Dummy Lake, Barron County, Wisconsin, Ecological Integrity Service, August 2013."

Results

Big Dummy Lake

In June, an early season survey searching for Potamogeton crispus-curly leaf pondweed, was conducted. All sample points (332) were visited to get a depth at each sample point. Any points less than 20 feet in depth were sampled. In addition, many other areas were monitored with a high *definition underwater camera. Other AIS were being monitored as well.* ***No AIS were located at any point in Big Dummy Lake***

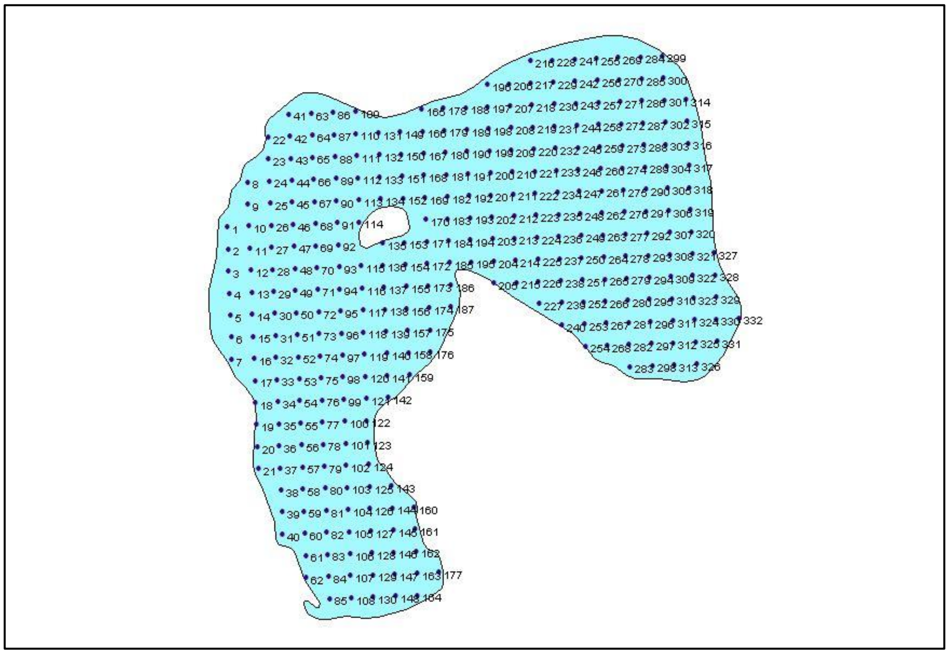


Figure 1: Big Dummy Lake sample points

In early August, the late seasons full lake survey was conducted. All points less than 20 feet were sample. Figure 2 shows where plants were sampled. In the southern portion of the west basin, 17 sample points had floating bog/bottom, so they could not be sampled. They are shown as no plants even though it is likely there were plants there. The maximum depth plants were sampled was 13.7 feet, with a mean depth at 3.22 feet (see figure 3).

Big Dummy Lake has extensive plants coverage at depths plants are capable of growing. At depths less than 13.7 feet, the coverage is 89.7% with plants. In this west basin, where the depth is less than 10 feet in all areas, the coverage is 100% with plants. Many of these areas are extremely dense with plants and can severely impede navigation. Figure 4 shows the rake density rating at each sample point with plants.

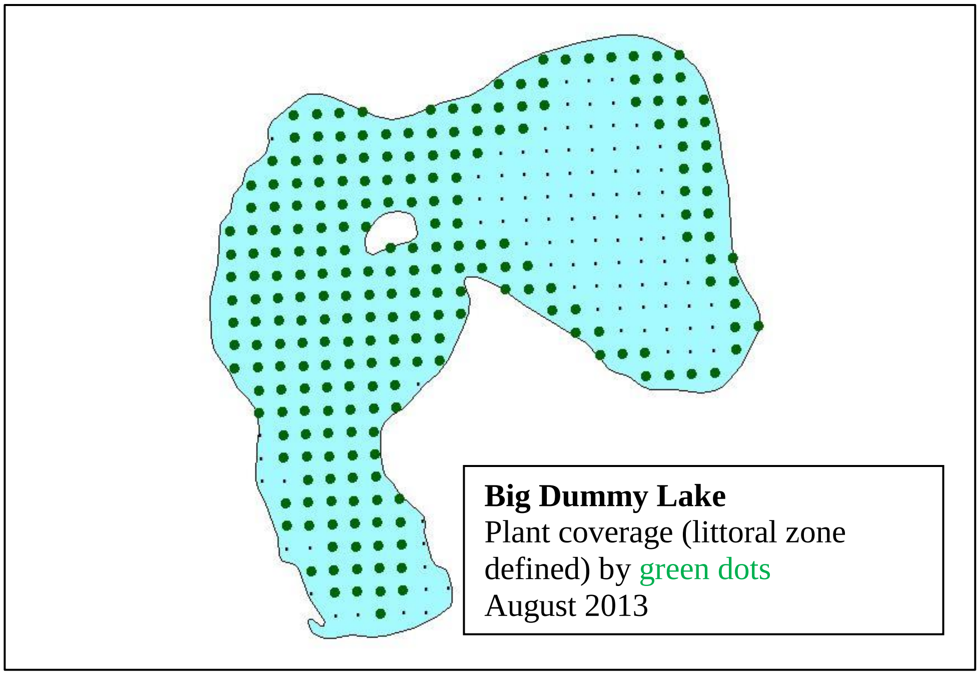


Figure 2: Littoral zone of Big Dummy Lake-points with plants sampled, 2013

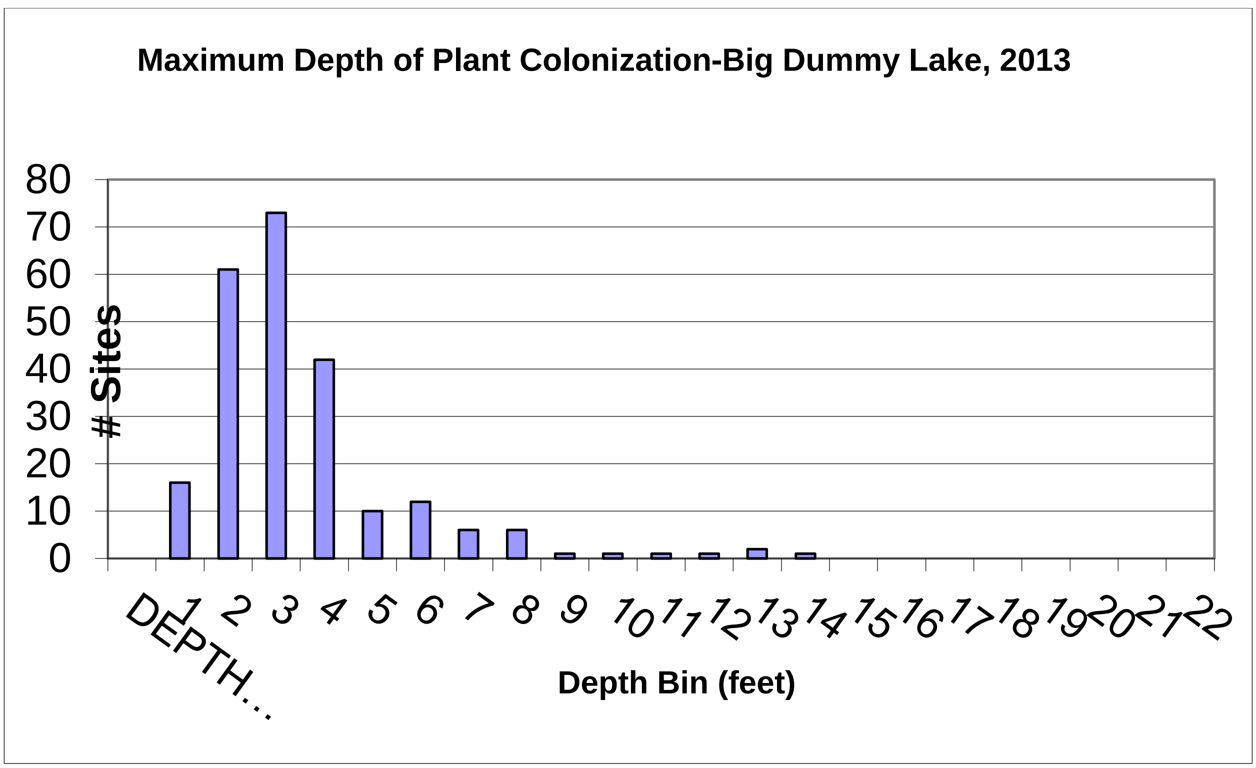


Figure 3: Graph of depth analysis in Big Dummy Lake, 2013.

Total number of sample sites	*332*
Total number of sites with vegetation	*233**
Total number of sites shallower than maximum depth of plants	*252*
Frequency of occurrence at sites shallower than maximum depth of plants	*92.46*
Simpson Diversity Index	*0.85*
Maximum depth of plants (ft)	*13.70*
Mean depth plant sampled (ft)	*3.22*
Average number of all species per site (shallower than max depth)	*2.82*
Average number of all species per site (veg. sites only)	*2.83*
Average number of native species per site (shallower than max depth)	*2.82*
Average number of native species per site (veg. sites only)	*2.83*
Species Richness	*30*
Species Richness (including visuals)	*34*

Table 1: Summary of survey statistics, Big Dummy Lake, 2013.

Big Dummy lake has a moderately diverse plant community. The Simpson's diversity is 0.85 and the species richness is 30 (see table 2 for species list). All plants sampled and viewed are native species to Wisconsin Lakes. Both species richness and Simpson's index values show good diversity. The dominating plants are large purple bladderwort, a submergent aquatic plant, and two floating leaf plants, watershield and white lily. Both large purple bladderwort and watershield have relative frequencies over 20%. This shows that these plants were sampled in many locations. Large purple bladderwort is nearly everywhere plants can grow, with a frequency of occurrence of 97.4%.

The following density ratings are based on WDNR protocol as described below. Green is lowest and red is highest density.

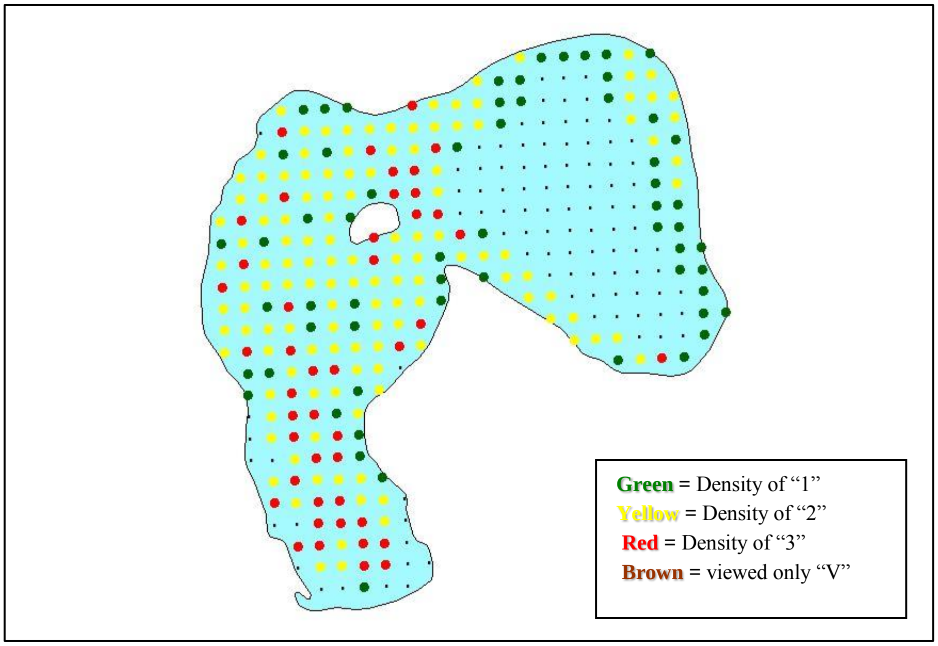


Figure 4: Map of density rating at each sample point-Big Dummy Lake, 2013.

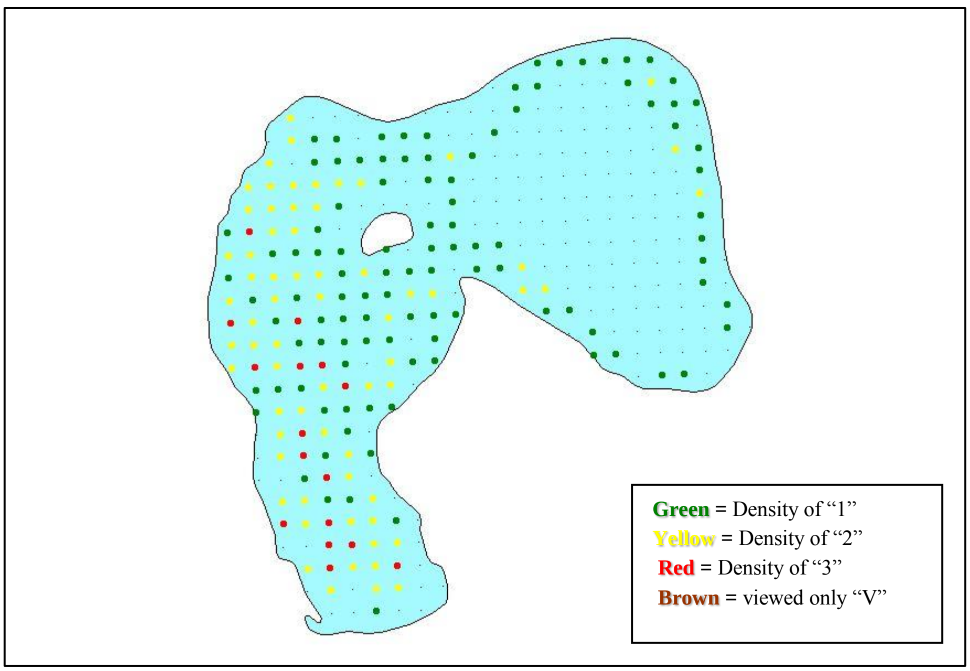


Figure 5: Distribution map of large purple bladderwort-highest relative frequency.

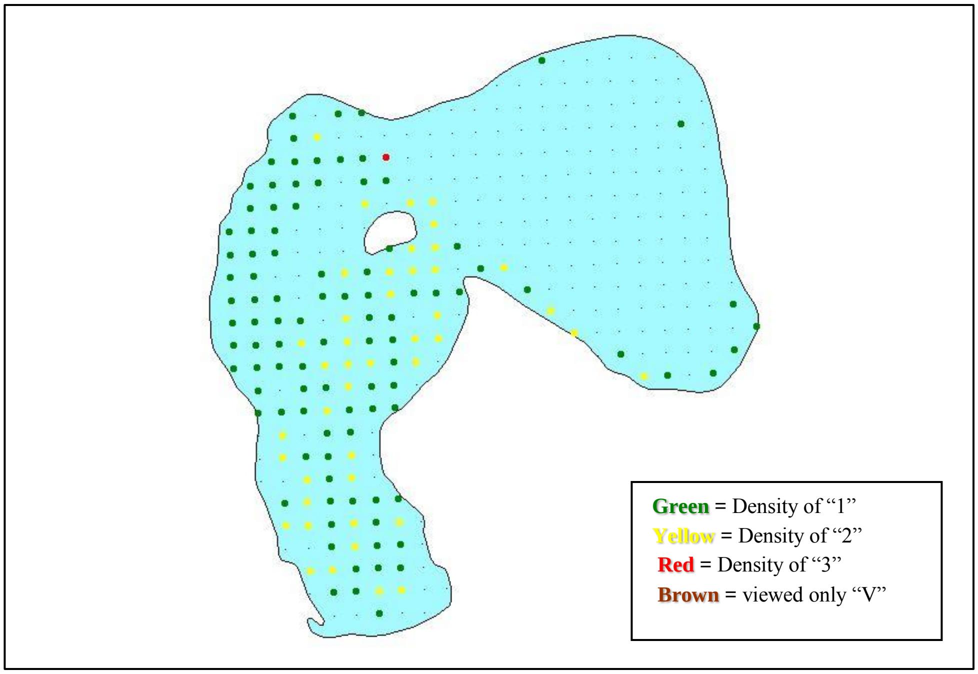


Figure 6: Distribution map of watershield-second highest relative frequency.

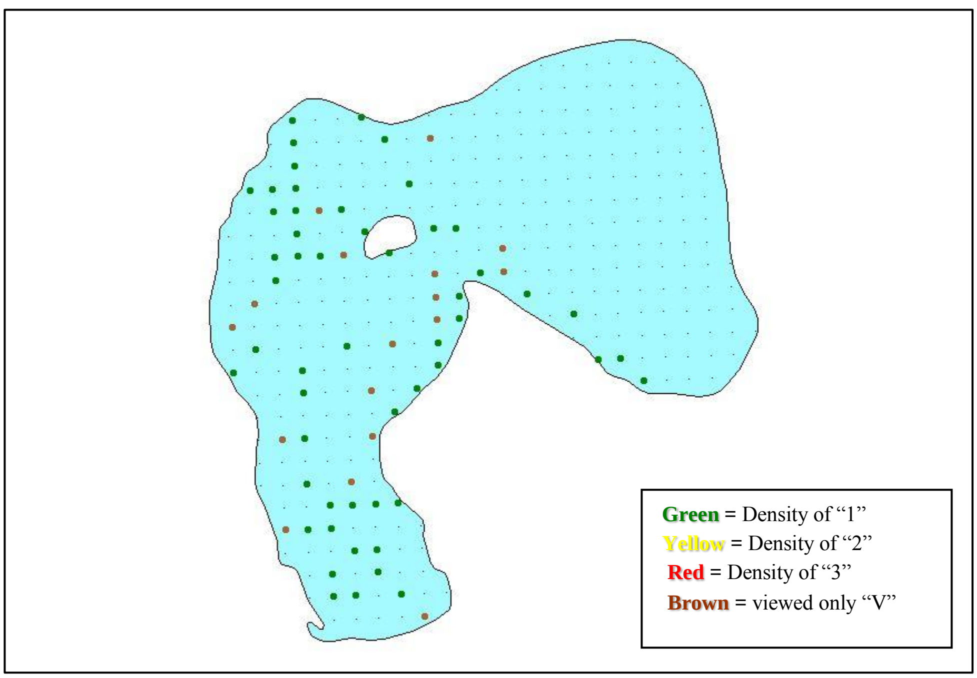


Figure 7: Distribution map of white lily-third highest relative frequency.

The above density ratings are based on the Recommended Baseline Monitoring of Aquatic Plants in Wisconsin: Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis, and Applications that outlines WDNR procedures for aquatic plant surveys. Following is an example of the density ratings:

Fullness Rating	Coverage	Description
1		Only few plants. There are not enough plants to entirely cover the length of the rake head in a single layer.
2		There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover the tines.
3		The rake is completely covered and tines are not visible.

Figure 8 is a map showing how many species were found at each sample location. Most of the high diversity sample points were in the west basin. This is also an area dominated by two species at nearly every sample point. However, the diversity is quite high in this basin. A few points in the east basin had high diversity.

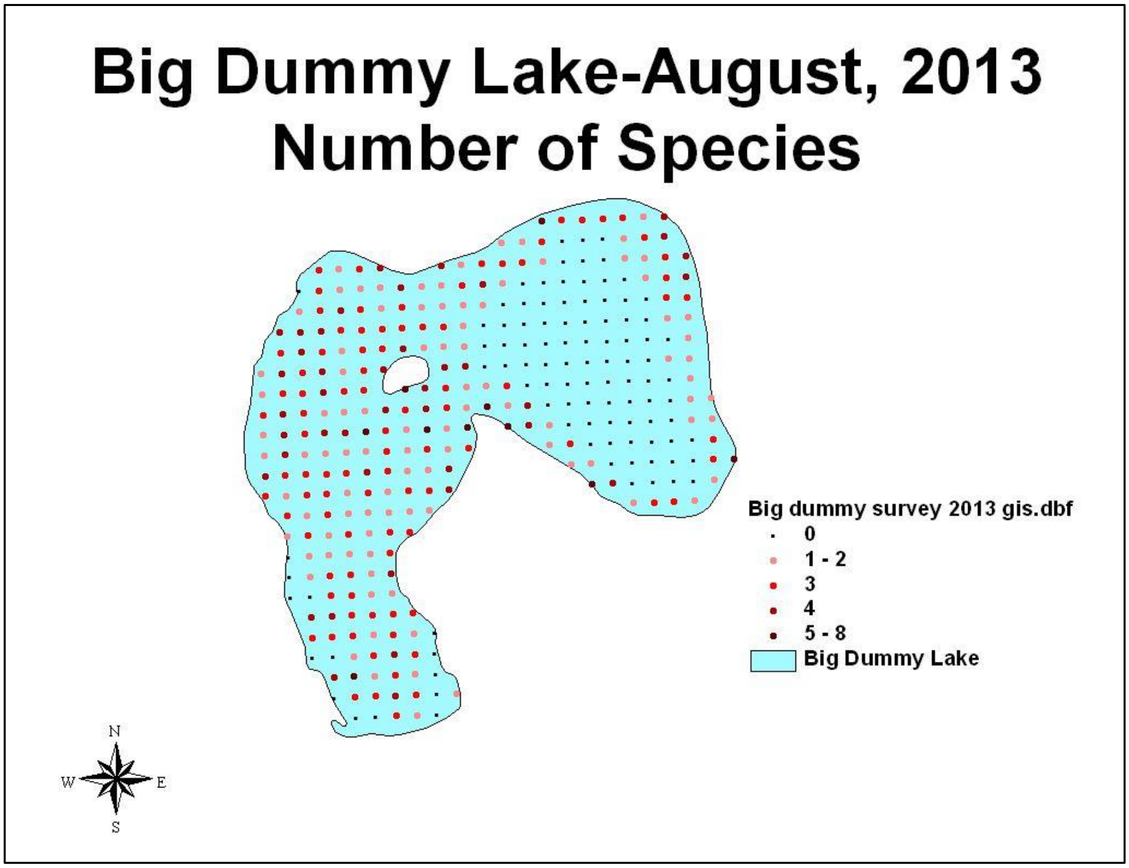


Figure 8: Map showing the number of species per sample point on Big Dummy Lake-2013.

The most profound indicator from the survey data is the number of sensitive plants sampled. There were numerous plants that are adversely affected by habitat changes and some that are quite rare. The State of Wisconsin lists some of these plants as "species of special concern." Although they are not endangered or threatened, their distribution is so limited that the potential from them to reach this status is present. The following "species of special concern" were sampled: Farwell's water milfoil, Vasey's pondweed, snail-seed pondweed, and spiny hornwort.

It is not unusual to find one of these species, but to see this many in a single, small lake is rather unusual and indicates a unique plant community.

Species	Freq. Veg.	Freq Littoral	Relative Freq	# sampled	Mean den	# viewed
Utricularia purpurea, Large purple bladderwort	97.40	80.26	28.38	187	1.52	3
Brasenia schreberi, Watershield	73.96	60.94	21.55	142	1.32	3
Nymphaea odorata, White water lily	27.60	22.75	8.04	53	1.00	17
Potamogeton robbinsii, Fern pondweed	24.48	20.17	7.13	47	1.26	0
Utricularia intermedia, Flat-leaf bladderwort	23.44	19.31	6.83	45	1.00	2
Nuphar variegata, Spatterdock	16.15	13.30	4.70	31	1.00	15
Schoenoplectus subterminalis, Water bulrush	15.10	12.45	4.40	29	1.38	5
Nitella sp., Nitella	10.42	8.58	3.03	20	1.10	1
Sagittaria sp., Arrowhead	7.81	6.44	2.28	15	1.00	2
Potamogeton amplifolius, Large-leaf pondweed	6.77	5.58	1.97	13	1.00	1
Potamogeton vaseyi, Vasey's pondweed	6.25	5.15	1.82	12	1.17	0
Myriophyllum farwellii, Farwell's water-milfoil	4.17	3.43	1.21	8	1.00	6
Pontederia cordata, Pickerelweed	4.17	3.43	1.21	8	1.00	1
Utricularia vulgaris, Common bladderwort	4.17	3.43	1.21	8	1.00	2
Eleocharis acicularis, Needle spikerush	2.60	2.15	0.76	5	1.20	1
Elodea nuttallii, Slender waterweed	2.60	2.15	0.76	5	1.00	0
Potamogeton bicupulatus, Snail-seed pondweed	2.60	2.15	0.76	5	1.20	1
Ceratophyllum echinatum, Spiny hornwort	2.08	1.72	0.61	4	1.25	0
Eleocharis robbinsii, Robbins' spikerush	2.08	1.72	0.61	4	1.25	3
Utricularia gibba, Creeping bladderwort	2.08	1.72	0.61	4	1.00	1
Myriophyllum tenellum, Dwarf water-milfoil	1.56	1.29	0.46	3	1.33	1
Elatine minima, Waterwort	1.04	0.86	0.30	2	1.00	1
Najas gracillima, Northern naiad	1.04	0.86	0.30	2	1.00	0
Dulichium arundinaceum, Three-way sedge	0.52	0.43	0.15	1	1.00	2
Eleocharis palustris, Creeping spikerush	0.52	0.43	0.15	1	1.00	1
Eriocaulon aquaticum, Pipewort	0.52	0.43	0.15	1	1.00	0
Isoetes echinospora, Spiny spored-quillwort	0.52	0.43	0.15	1	1.00	0
Potamogeton pusillus, Small pondweed	0.52	0.43	0.15	1	2.00	0
Schoenoplectus pungens, Three-square bulrush	0.52	0.43	0.15	1	1.00	0
Vallisneria americana, Wild celery	0.52	0.43	0.15	1	1.00	0
Aquatic moss	14.06	11.59	n/a	27	1.07	0
Filamentous algae	3.65	3.00	n/a	7	1.00	0
Carex comosa, Bottle brush sedge	Viewed	only				1
Juncus pelocarpus f. submersus, Brown-fruited rush	Viewed	only				1

Potamogeton epihydrus, Ribbon-leaf pondweed	*Viewed*	*only*				*1*
Sagittaria latifolia, Common arrowhead	*Viewed*	*only*				*1*

Table 2: Species richness list with frequency and sampling data, Big Dummy Lake-2013.

A boat survey was conducted to determine if any plants species may be present in under-sampled areas (due to the sample point generation results. Table 3 lists the species not sampled or viewed but observed from the boat survey. These can vary from survey to survey as there is no basis for effort. As a result, they are not included in the species richness count.

Species observed in boat survey only
Phalaris arundinacea-reed canary grass
Typha latifolia-broad-leaved cattail
Carex sp.-sedge
Potamogeton oakesianus-Oakes' pondweed
Juncus brevicaudatus-narrow panicle rush

Table 3: List of species observed from boat survey conducted on Big Dummy Lake, 2013.

The FBI in Big Dummy Lake is very high. This is due to the sensitive nature of the plants. There is a fairly large number of plants used in the Big Dummy Lake FBI. However, the mean conservatism for the plants used is very high at 7.7. The Big Dummy Lake FBI is twice the FBI median for other studied lakes in the eco-region.

Little Dummy Lake Results

In June, an early season survey searching for Potamogeton crispus-curly leaf pondweed, was conducted. All sample points (122) were visited to get a depth at each sample point. Any points less than 20 feet in depth were sampled. In addition, many other areas were monitored with a high definition underwater camera. Other AIS were being monitored as well. ***No AIS were located at any point in Little Dummy Lake***

In early August, the late seasons full lake survey was conducted. All points less than 20 feet were sample. Figure 10 shows where plants were sampled. In the southern portion of the west basin, sample points had floating bog/bottom, so they could not be sampled. They are shown as no plants even though it is likely there were plants there. The maximum depth plants were sampled was 10.0 feet, with a mean depth of plants at 3.35 feet (see figure 11). The plants are most common in the 2-5 foot depths.

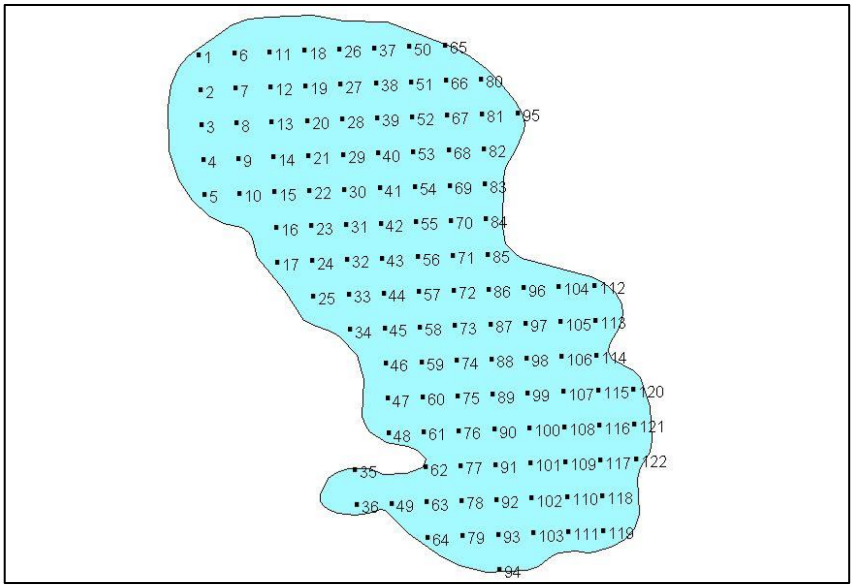
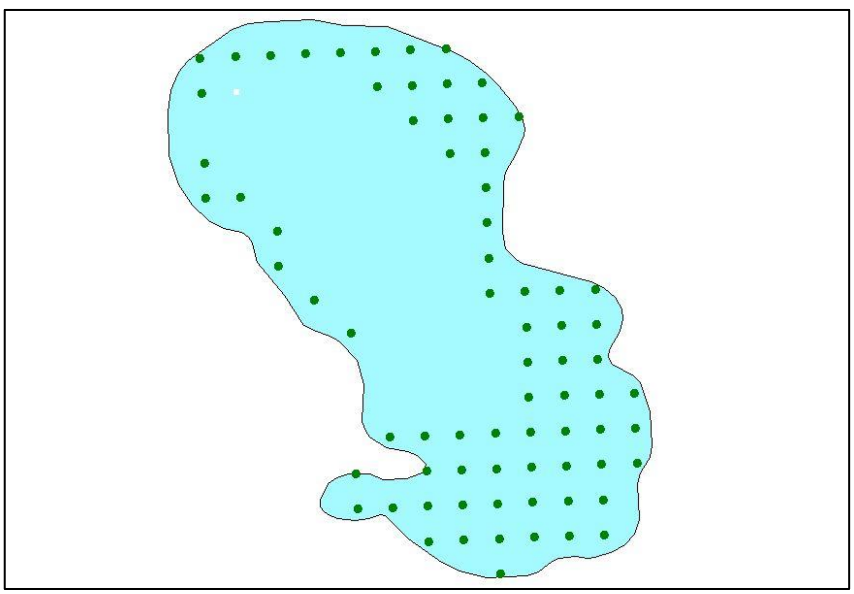


Figure 9: Sample point grid on Little Dummy Lake.



Big Dummy Lake
Plant coverage (littoral zone defined) by green dots
August 2013

Figure 10: Sample points with plants, defining the littoral zone, Little Dummy Lake- 2013.

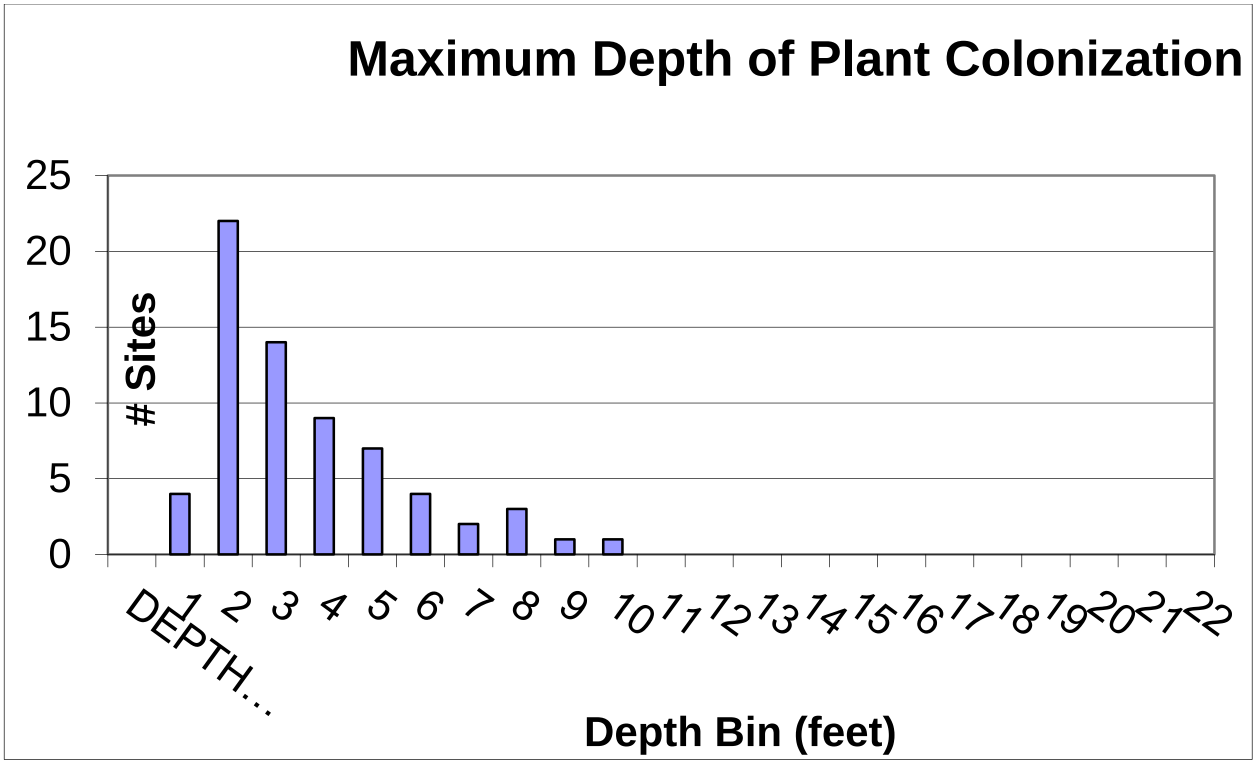


Figure 11: Depth analysis graph for Little Dummy Lake, 2013. This shows the depths with the number of sites sampled.

Total number of sample sites	*122*
Total number of sites with vegetation	*68*
Total number of sites shallower than maximum depth of plants	*71*
Frequency of occurrence at sites shallower than maximum depth of plants	*95.77*
Simpson Diversity Index	*0.83*
Maximum depth of plants (ft)	*10.00*
Mean depth plants sampled (ft)	*3.35*
Average number of all species per site (shallower than max depth)	*2.46*
Average number of all species per site (veg. sites only)	*2.61*
Average number of native species per site (shallower than max depth)	*2.46*
Average number of native species per site (veg. sites only)	*2.61*
Species Richness	*20*
Species Richness (including visuals)	*21*

Table 6: Summary of survey statistics, Little Dummy Lake-2013.

The coverage of aquatic plants in Little Dummy Lake at depths below 10 ft. (maximum depth plants were sampled) is high. Of the sample points 10 feet and less, 95.77% had plants present. The *density of plant growth was high in some areas, mostly south basin and east. Numerous sample points had a rake density of 3. There were areas that could impeded navigation.*

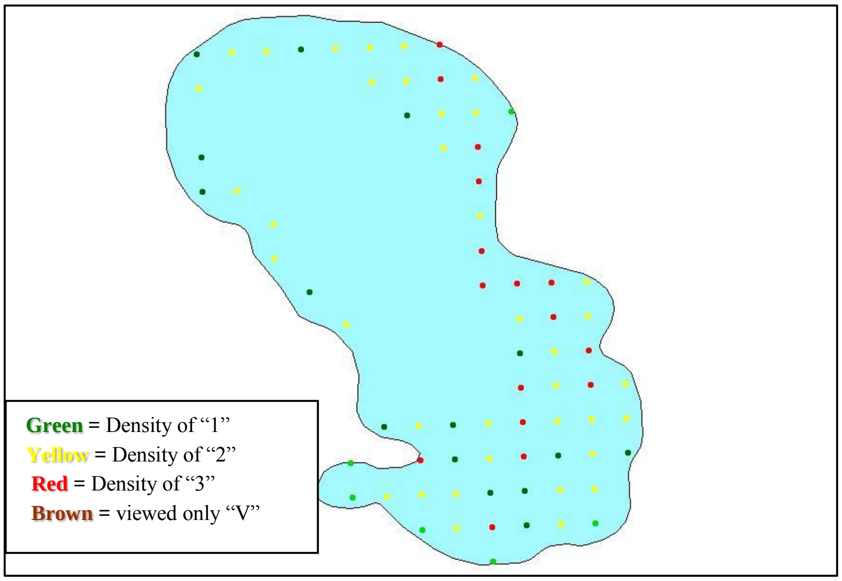


Figure 12: Density rating at each sample point, Little Dummy Lake, 2013.

Species	Freq. veg	Freq. littoral	Rel. Freq	# sampled	Mean density	# viewed
Utricularia purpurea, Large purple bladderwort	83.82	80.28	32.77	58	1.47	0
Brasenia schreberi, Watershield	55.88	53.52	21.47	38	1.37	1
Nymphaea odorata, White water lily	23.53	22.54	9.04	16	1.00	3
Schoenoplectus subterminalis, Water bulrush	16.18	15.49	6.21	11	1.18	0
Eleocharis robbinsii, Robbins' spikerush	14.71	14.08	5.65	10	1.20	3
Nuphar variegata, Spatterdock	8.82	8.45	3.39	6	1.00	3
Utricularia intermedia, Flat-leaf bladderwort	8.82	8.45	3.39	6	1.00	0
Myriophyllum farwellii, Farwell's water-milfoil	5.88	5.63	2.82	5	1.20	4
Pontederia cordata, Pickerelweed	5.88	5.63	2.26	4	1.00	3
Potamogeton robbinsii, Fern pondweed	5.88	5.63	2.26	4	1.00	0
Utricularia gibba, Creeping bladderwort	5.88	5.63	2.26	4	1.00	0
Utricularia vulgaris, Common bladderwort	5.88	5.63	2.26	4	1.00	0
Ceratophyllum echinatum, Spiny hornwort	2.94	2.82	1.13	2	1.00	0
Eriocaulon aquaticum, Pipewort	2.94	2.82	1.13	2	1.00	0
Potamogeton oakesianus, Oakes' pondweed	2.94	2.82	1.13	2	1.00	0
Nitella sp., Nitella	1.47	1.41	0.56	1	1.00	0
Potamogeton amplifolius, Large-leaf pondweed	1.47	1.41	0.56	1	1.00	2
Potamogeton bicupulatus, Snail-seed pondweed	1.47	1.41	0.56	1	1.00	0
Potamogeton epihydrus, Ribbon-leaf pondweed	1.47	1.41	0.56	1	1.00	0
Sagittaria sp., Arrowhead	1.47	1.41	0.56	1	1.00	1
Aquatic moss	2.94	2.82	n/a	2	1.00	0
Filamentous algae	1.47	1.41	n/a	1	1.00	0
Typha latifolia, Broad-leaved cattail	viewed	only				1

Table 7: Species richness list with frequency and sampling data, Little Dummy Lake-2013.

A boat survey was conducted to determine if any plants species may be present in under-sampled areas (due to the sample point generation results. Table 8 lists the species not sampled or viewed but observed from the boat survey. These can vary from survey to survey as there is no basis for effort. As a result, they are not included in the species richness count.

Species observed in boat survey only
Sparganium eurycarpum-common bur-reed
Eleocharis erythropoda-bald spikerush
Juncus brevicaudatus-narrow panicle rush
Sagittaria gramineus-grass-leaved arrowhead
Sagittaria latifolia-common arrowhead
Schoenoplectus acutus-hardstem bulrush
Isoetes echinospora-spiny spored quillwort
Phalaris arundinacea-reed canary grass

Table 8: Species list of plants observed from boat survey, Little Dummy Lake-2013.

Little Dummy Lake has less diversity in terms of species richness than Big Dummy Lake, with 20 species. All of the plants sampled and viewed are native aquatic plants in Wisconsin lakes. The area where plants have habitat to grow is less and can account for this. The Simpson's diversity index is somewhat lower at 0.83, which again is moderately high. The most dominant species were large purple bladderwort, watershield, and white lily respectively. The relative frequency of large purple bladderwort was 32.77% which is very high and indicates the lake is dominated by this plant.

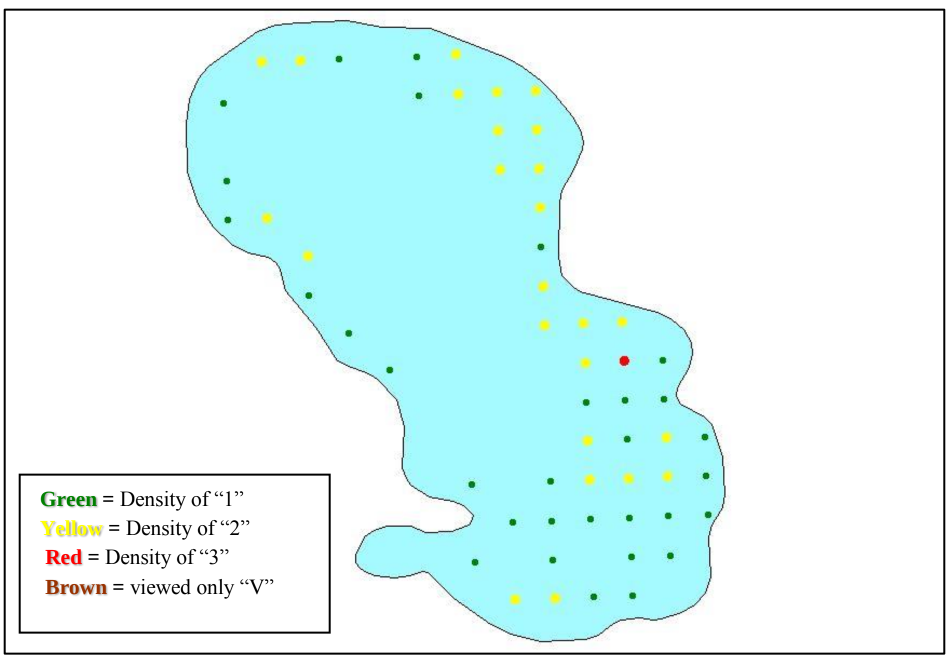


Figure 13: Distribution map of large purple bladderwort, most frequent aquatic plant sampled, Little Dummy Lake-August, 2013.

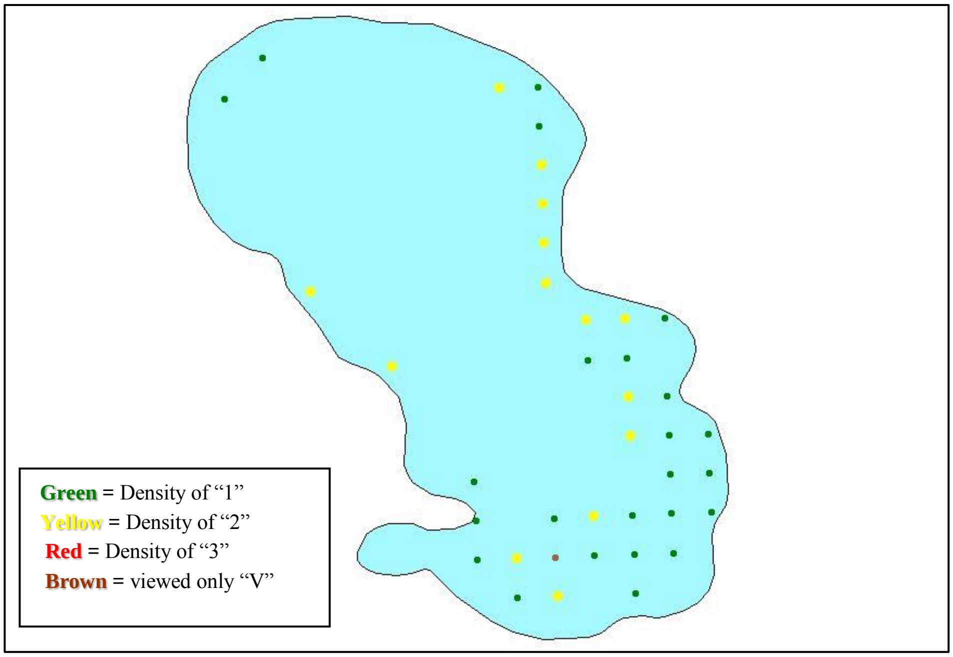


Figure 14: Distribution map of watershield, second most frequent plant, Little Dummy Lake-August 2013.

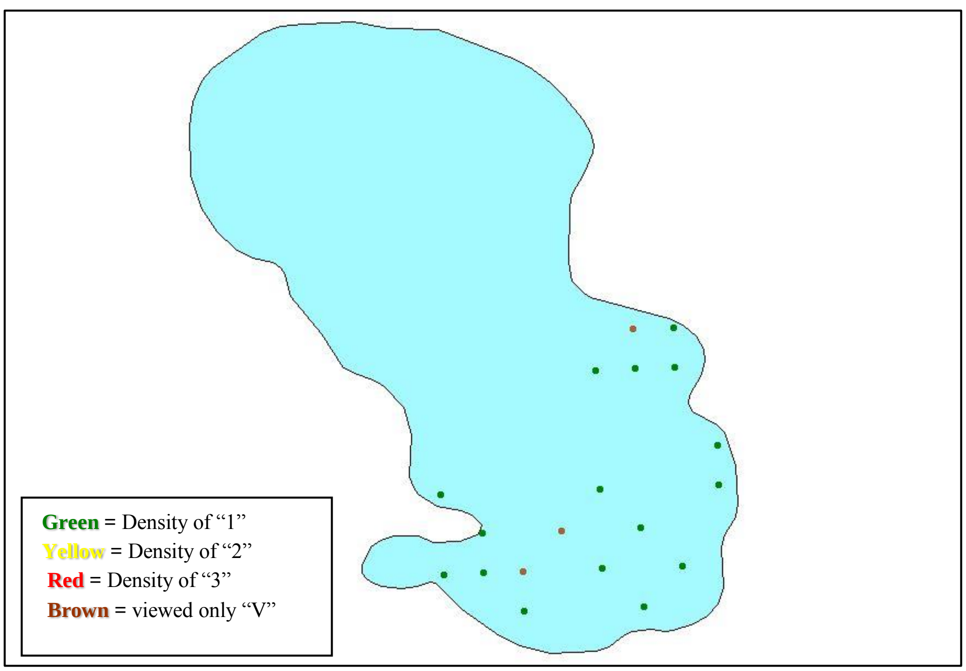


Figure 15: Distribution map of white lily, third most frequent plant sampled, Little Dummy Lake-August 2013.

The south basin of Little Dummy Lake contains the most diversity. Figure 16 shows the number of species per sample point.

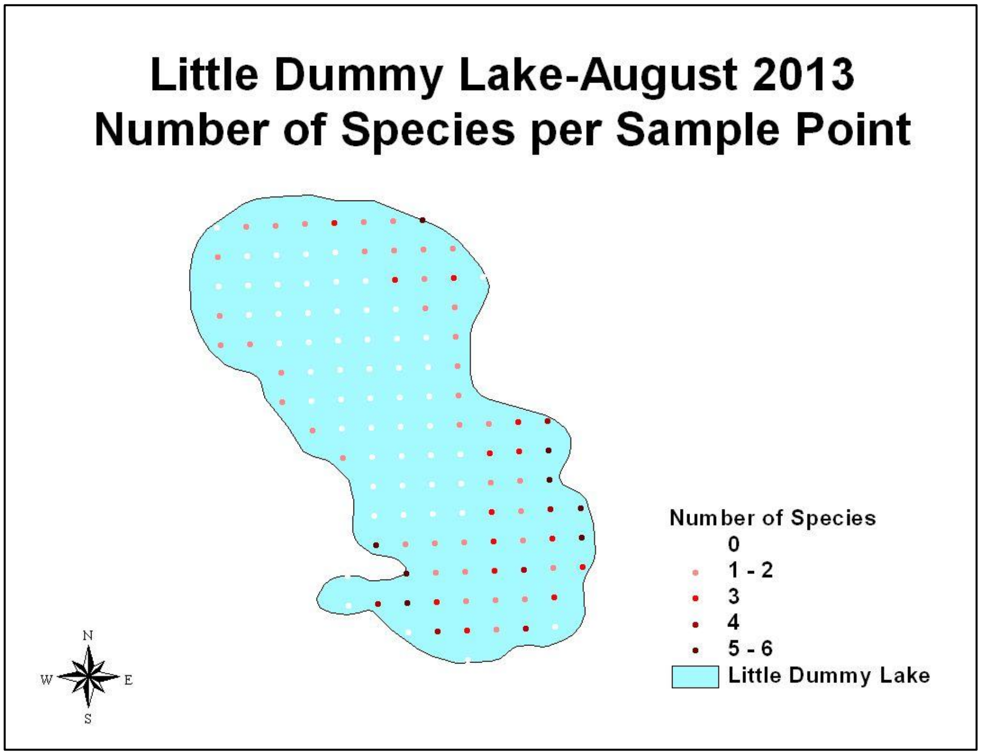


Figure 16: Number of species sampled at each sample point, Little Dummy Lake-2013.

5.6.1 Floating-Leaf Plants

The following three floating-leaf aquatic plant species were identified during the 2013 aquatic plant survey.

Big Dummy Lake

- *Nuphar variegata* (spatterdock)
- *Nymphaea odorata* (white water lily)
- *Brasenia schreberi* (watershield)

Little Dummy Lake

- *Nuphar variegata* (spatterdock)
- *Nymphaea odorata* (white water lily)
- *Brasenia schreberi* (watershield)

5.6.2 Submersed Plants

The following submersed aquatic plant species were identified during the 2013 aquatic plant survey.

Big Dummy Lake

- Aquatic moss
- Ceratophyllum echinatum, Spiny hornwort
- Elatine minima, Waterwort
- Elodea nuttallii, Slender waterweed
- Eriocaulon aquaticum, Pipewort
- Filamentous algae
- Isoetes echinospora, Spiny spored-quillwort
- Juncus pelocarpus f. submersus, Brown-fruited rush
- Myriophyllum farwellii, Farwell's water-milfoil
- Myriophyllum tenellum, Dwarf water-milfoil
- Najas gracillima, Northern naiad
- Nitella sp., Nitella
- Potamogeton amplifolius, Large-leaf pondweed
- Potamogeton bicupulatus, Snail-seed pondweed
- Potamogeton epihydrus, Ribbon-leaf pondweed
- Potamogeton pusillus, Small pondweed
- Potamogeton robbinsii, Fern pondweed
- Potamogeton vaseyi, Vasey's pondweed
- Utricularia gibba, Creeping bladderwort
- Utricularia intermedia, Flat-leaf bladderwort
- Utricularia purpurea, Large purple bladderwort
- Utricularia vulgaris, Common bladderwort
- Vallisneria americana, Wild celery

Little Dummy

- Aquatic moss
- Ceratophyllum echinatum, Spiny hornwort
- Eriocaulon aquaticum, Pipewort
- Filamentous algae
- Myriophyllum farwellii, Farwell's water-milfoil
- Nitella sp., Nitella
- Potamogeton amplifolius, Large-leaf pondweed
- Potamogeton bicupulatus, Snail-seed pondweed
- Potamogeton epihydrus, Ribbon-leaf pondweed
- Potamogeton oakesianus, Oakes' pondweed
- Potamogeton robbinsii, Fern pondweed
- Utricularia gibba, Creeping bladderwort
- Utricularia intermedia, Flat-leaf bladderwort
- Utricularia purpurea, Large purple bladderwort
- Utricularia vulgaris, Common bladderwort

5.6.3 Emergent Plants

The following emergent aquatic plant species were identified during the 2013 aquatic plant survey.

Big Dummy Lake

- Carex comosa, Bottle brush sedge Dulichium arundinaceum, Three-way sedge Eleocharis acicularis, Needle spikerush
- Eleocharis palustris, Creeping spikerush
- Eleocharis robbinsii, Robbins' spikerush
- Pontederia cordata, Pickerelweed Sagittaria latifolia, Common arrowhead
- Sagittaria sp., Arrowhead
- Schoenoplectus pungens, Three-square bulrush
- Schoenoplectus subterminalis, Water bulrush

Little Dummy Lakes

- Eleocharis robbinsii, Robbins' spikerush
- Pontederia cordata, Pickerelweed
- Sagittaria sp., Arrowhead
- Schoenoplectus subterminalis, Water bulrush
- Typha latifolia, Broad-leaved cattail

5.6.4 Comparison of 2013 Survey to Historic Surveys

A full lake point intercept macrophyte survey was conducted on Big Dummy Lake in 2006. In comparing those data to the survey data of 2013, there are some minor differences. One is that it appears a slightly higher percentage of littoral zone with plants in 2006 compared to 2013. This could be due to lesser water clarity, eliminating plants in deeper water. The 2006 survey showed plants growing at a maximum of 15.5 feet, which is greater than the 13.7 feet observed in 2013. However, the annual secchi disk data does not support this speculation. The difference could be simply sampling variation.

The species richness is slightly higher in 2013, but does not indicate a major change in the diversity of the plants community. A few differences in species sampled and/or viewed are present. Coontail was not sampled in 2013, but was present in only one point in 2006. This is of no concern as coontail is a very adaptable and hardy plant. There was no Farwell's water-milfoil sampled or viewed in 2006 but there was in 2013. The milfoil identified in 2006 was listed as whorled water-milfoil. Farwell's and whorled water milfoils are very difficult to tell apart when no fruiting bodies are present. The whorled water milfoil may have actually been Farwell's. The Farwell identification was verified[1].

The Simpson's diversity index was actually lower in 2013, indicating less diversity per sample point. It appears that the dominance of large purple bladderwort and watershield has increased from 2006. The west basin has both of these plants sampled at nearly every point.

[1] Dr. Susan Knight. UW Trout Lake Station. Boulder Junction, WI

Big Dummy Lake	*2006*	*2013*
% of littoral zone with plants	*93.8*	*92.46*
Simpson's diversity index	*0.89*	*0.85*
Number of species sampled	*26*	*30*
Maximum depth of plants	*15.5*	*13.7*
Three most dominant species (rel. freq.)	*Large purple bladderwort (19.7)* *Watershield (17.7)* *Common bladderwort (10.9)*	*Large purple bladderwort (28.38)* *Watershield (21.55)* *White lily (8.04)*
FBI	*35.52*	*40.82*

Table 11: Comparison of stats between 2006 and 2013 surveys.

Species	2006*	2013*	p	Significant change	Change
Utricularia purpurea, Large purple bladderwort	127	187	0.00000	***	+
Brasenia schreberi, Watershield	114	142	0.0025	**	+
Nymphaea odorata, White water lily	35	53	0.02	*	+
Potamogeton robbinsii, Fern pondweed	47	47	0.84	n.s.	+
Utricularia intermedia, Flat-leaf bladderwort	19	45	0.0002	***	+
Nuphar variegata, Spatterdock	22	31	0.14	n.s.	+
Schoenoplectus subterminalis, Water bulrush	67	29	0.00004	***	-
Nitella sp., Nitella	4	20	0.0006	***	+
Sagittaria sp., Arrowhead	2	15	0.001	***	+
Potamogeton amplifolius, Large-leaf pondweed	23	13	0.11	n.s.	-
Potamogeton vaseyi, Vasey's pondweed	11	12	0.76	n.s.	+
Myriophyllum farwellii, Farwell's water-milfoil	0	8	0.004	**	+
Pontederia cordata, Pickerelweed	1	8	0.015	*	+
Utricularia vulgaris, Common bladderwort	70	8	0.00000	***	-
Eleocharis acicularis, Needle spikerush	2	5	0.23	n.s.	+
Elodea nuttallii, Slender waterweed	0	5	0.022	*	+
Potamogeton bicupulatus, Snail-seed pondweed	0	5	0.022	*	+
Ceratophyllum echinatum, Spiny hornwort	5	4	0.78	n.s.	-
Eleocharis robbinsii, Robbins' spikerush	0	4	0.041	*	+
Utricularia gibba, Creeping bladderwort	31	4	0.00000	***	-
Myriophyllum tenellum, Dwarf water-milfoil	4	3	0.74	n.s.	-
Elatine minima, Waterwort	0	2	0.15	n.s.	+
Najas gracillima, Northern naiad	0	2	0.15	n.s.	+
Dulichium arundinaceum, Three-way sedge	1	1	0.98	n.s.	+
Eleocharis palustris, Creeping spikerush	0	1	0.31	n.s.	+
Eriocaulon aquaticum, Pipewort	0	1	0.31	n.s.	+
Isoetes echinospora, Spiny spored-quillwort	0	1	0.31	n.s.	+
Potamogeton pusillus, Small pondweed	1	1	0.98	n.s.	+
Schoenoplectus pungens, Three-square bulrush	0	1	0.31	n.s.	+
Vallisneria americana, Wild celery	1	1	0.98	n.s.	+
Myriophyllum verticillatum , whorled water milfoil	2	0	0.16	n.s.	-
Ceratophyllum demersum, coontail	1	0	0.32	n.s.	-
Najas flexilis, bushy pondweed	1	0	0.32	n.s.	-
Heteranthera dubia, water stargrass	2	0	0.16	n.s.	-

Note: Does not include viewed only or boat survey species.

Table 12: Chi-square analysis data comparing 2006 and 2013 survey frequencies, Big Dummy Lake.

A chi-square analysis was conducted to compare the frequency of the various native plants sampled in 2006 to those sampled in 2013. If the p value is less than 0.05, the change is considered significant and more than just random chance. If the change is significant, the cause of the change is not known, just that a change has occurred. The causes could include water depth change, water temperature differences at various times of the growing *season, water clarity, nutrient availability, or sediment/substrate composition. Sampling differences could also cause a change in frequency. For those plants with low frequency of occurrence, just a small change in location of sample could determine if a plant were sampled or not.*

Big Dummy Lake shows a statistically significant reduction in the frequency of three species. These species include: water bulrush (Schoenoplectus subterminalis), common bladderwort (Utricularia vulgaris), and creeping bladderwort (Utricularia gibba). There was statistically significant increase in 11 species. This shows that the plant community has maybe changed since the 2006, showing the dynamic nature of lakes. Since there was more increase in frequency of species than decreases, it is unlikely the changes are due to human activities.

In 2008, a full lake point intercept macrophyte survey was completed on Little Dummy Lake. Comparing this survey to the 2013 survey reveals some differences. The major difference is the percentage of the littoral zone with plants growing. It was nearly 10% less in 2008. However, this is largely due to the fact that the maximum depth of plants is twice the depth as in 2013 (20 ft in 2008 vs 10 ft in 2013). Since the littoral zone is defined in 2008 at any point less than 20 ft, many points are added to this calculation. The lower percentage with plants indicates that most of these added points did not have plants present.

The reason for a greater depth of plants typically would be higher water clarity. However the annual secchi disk data does not support this increase, especially enough of an increase to cause this change. A possible reason is that in 2008 a dislodged plant was picked up upon rake retrieval in a 20 foot depth. This would also explain why most depth 10-20 feet did not have plants. It is also possible that a small sample of plants was living at that depth and got sampled.

All other data are only slightly different and show no big changes in the plant community between 2008 and 2013. There were no plants sampled in 2008 that were not observed in 2013. In 2013, there were three plants viewed that were not viewed in 2008, but were observed in the boat survey. These differences are negligible.

Little Dummy Lake	*2008*	*2013*
% of littoral zone with plants	*85.1*	*95.77*
Simpson's diversity index	*0.84*	*0.83*
Number of species sampled	*17*	*20*
Maximum depth of plants	*20.0*	*10.0*
Three most dominant species (rel. freq.)	*Large purple bladderwort (32.64)* *Watershield (16.58)* *White lily (10.36)*	*Large purple bladderwort (32.77)* *Watershield (21.47)* *White lily (9.04)*
FBI	*29.18*	*34.18*

Table 13: Comparison of survey stats from 2008 and 2013 surveys, Little Dummy Lake.

Species	***2008****	***2013****	***P value***	***Significant change***	***(proportional to # sampling points)***
Utricularia purpurea, Large purple bladderwort	*63*	*58*	*0.17080*	**n.s.**	**+**
Brasenia schreberi, Watershield	*32*	*38*	*0.03512*	***	**+**
Nymphaea odorata, White water lily	*20*	*16*	*0.94613*	**n.s.**	**-**
Schoenoplectus subterminalis, Water bulrush	*15*	*11*	*0.76811*	**n.s.**	**-**
Eleocharis robbinsii, Robbins' spikerush	*11*	*10*	*0.79072*	**n.s.**	**+**
Nuphar variegata, Spatterdock	*12*	*6*	*0.29309*	**n.s.**	**-**
Utricularia intermedia, Flat-leaf bladderwort	*2*	*6*	*0.07936*	**n.s.**	**+**
Myriophyllum farwellii, Farwell's water-milfoil	*2*	*5*	*0.14949*	**n.s.**	**+**
Pontederia cordata, Pickerelweed	*6*	*4*	*0.74574*	**n.s.**	**-**
Potamogeton robbinsii, Fern pondweed	*5*	*4*	*0.97561*	**n.s.**	**-**
Utricularia gibba, Creeping bladderwort	*4*	*4*	*0.76763*	**n.s.**	**+**
Utricularia vulgaris, Common bladderwort	*6*	*4*	*0.74574*	**n.s.**	**-**
Ceratophyllum echinatum, Spiny hornwort	*0*	*2*	*0.11515*	**n.s.**	**+**
Eriocaulon aquaticum, Pipewort	*0*	*2*	*0.11515*	**n.s.**	**+**
Potamogeton oakesianus, Oakes' pondweed	*0*	*2*	*0.11515*	**n.s.**	**+**
Nitella sp., Nitella	*0*	*1*	*0.26679*	**n.s.**	**+**
Potamogeton amplifolius, Large-leaf pondweed	*6*	*1*	*0.09539*	**n.s.**	**-**
Potamogeton bicupulatus, Snail-seed pondweed	*1*	*1*	*0.88481*	**n.s.**	**+**
Potamogeton epihydrus, Ribbon-leaf pondweed	*0*	*1*	*0.26679*	**n.s.**	**+**
Sagittaria sp., Arrowhead rosette	*0*	*1*	*0.26679*	**n.s.**	**+**
Sagittaria latifolia, common arrowhead	*1*	*0*	*0.36480*	**n.s.**	**-**
Dulichium arundinaceum ,three-way sedge	*1*	*0*	*0.36480*	**n.s.**	**-**

***Does not include viewed only or boat survey species.**

Table 14: Chi-square analysis data comparing 2008 and 2013 frequencies, Little Dummy Lake.

The chi-square analysis showed only statistically significant in frequency between 2008 and 2013. The change was an increase in watershield (Brasenia shreberi). There are no other changes to address in Little Dummy Lake.

5.7 Floristic Quality Index (FQI)

Higher FQI numbers indicate higher floristic quality and biological integrity and a lower level of disturbance impacts. FQI varies around the state of Wisconsin and ranges from 3.0 to 44.6 with the average FQI of 22.2 (WDNR, 2005). The coefficient of conservatism is a value that is assigned to each species based on the tolerance of that species to disturbance. The following lists the range of Coefficient of Conservatism and the conditions under which the plant is generally found.

0-3: Species found in wide variety of plant communities and very tolerant of disturbance.
4-6: Species found in specific plant community but tolerant of moderate disturbance.
7-8: Species found in narrow range of plant communities in advanced stages of succession but can tolerate minor disturbance.
9-10: Species restricted to narrow range of conditions with low tolerance of disturbance.

Table 11 - Big Dummy FQI

Big Dummy FQI Info	Big Dummy Lake 2013	Median for Ecoregion[2]
Number of species in FQI	28	14
Mean conservatism	7.71	5.6
FQI value	40.82	20.9

[2] Nichols, Stanley. 1999. *Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications*. Journal of Lake and Reservoir Management, 15(2):133-141.

Table 12 - Big Dummy Floristic Quality Index and Coefficient of Conservatism

Species	Common Name	C
Brasenia schreberi	Watershield	6
Ceratophyllum echinatum	Spiny hornwort	10
Dulichium arundinaceum	Three-way sedge	9
Elatine minima	Waterwort	9
Eleocharis acicularis	Needle spikerush	5
Eleocharis palustris	Creeping spikerush	6
Elodea nuttallii	Slender waterweed	7
Eriocaulon aquaticum	Pipewort	9
Isoetes echinospora	Spiny-spored quillwort	8
Myriophyllum farwellii	Farwell's water-milfoil	8
Myriophyllum tenellum	Dwarf water-milfoil	10
Najas gracillima	Northern naiad	7
Nitella sp.	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Pontederia cordata	Pickerelweed	8
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton bicupulatus	Snail-seed pondwwed	9
Potamogeton pusillus	Small pondweed	7
Potamogeton robbinsii	Fern pondweed	8
Potamogeton vaseyi	Vasey's pondweed	10
Schoenoplectus pungens	Three-square bulrush	5
Schoenoplectus subterminalis	Water bulrush	9
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia purpurea	Large purple bladderwort	9
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6

Table 13 - Little Dummy FQI

	Little Dummy Lake 2013	Ecoregion
Number of species	18	14
mean Conservatism	8.06	5.6
FQI value	34.18	20.9

Table 14 - Little Dummy Floristic Quality Index and Coefficient of Conservatism

Species	Common Name	C
Brasenia schreberi	Watershield	6
Ceratophyllum echinatum	Spiny hornwort	10
Eriocaulon aquaticum	Pipewort	9
Myriophyllum farwellii	Farwell's water-milfoil	8
Nitella	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Pontederia cordata	Pickerelweed	8
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton bicupulatus	Snail-seed pondwwed	9
Potamogeton epihydrus	Ribbon-leaf pondweed	8
Potamogeton oakesianus	Oakes' pondweed	10
Potamogeton robbinsii	Fern pondweed	8
Schoenoplectus subterminalis	Water bulrush	9
Utricularia gibba	Creeping bladderwort	9
Utricularia intermedia	Flat-leaf bladderwort	9
Utricularia purpurea	Large purple bladderwort	9
Utricularia vulgaris	Common bladderwort	7

The FQI of Dummy Lakes is higher than Wisconsin's northern region mean of 24.3 and suggests that Dummy Lakes exhibits good water quality when using aquatic plants as an indicator.

5.8 Lake Bottom Assessment and Bog Assessment

The lake bottom assessment indicates that the deepest sediment is located in the west bay of Big Dummy Lake. This is expected since this area is shallow and heavily vegetated; the muck is created from the decayed vegetation. The muck depth ranged from 2.8 to 9.9 feet deep in this area; the majority of points were 4.8 to 9.9 feet. The following figure shows the location and muck depth.

Figure 23 – Big Dummy Sediment Depth

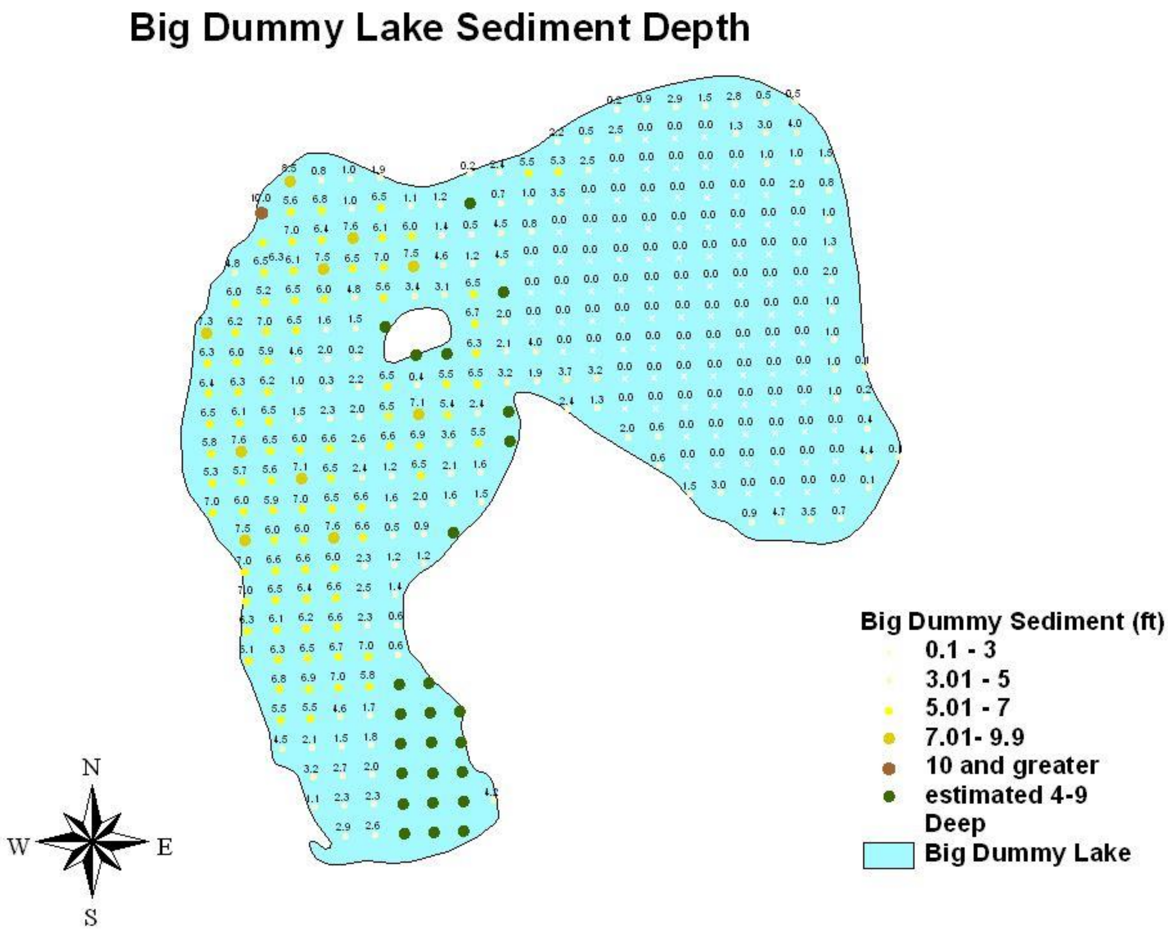
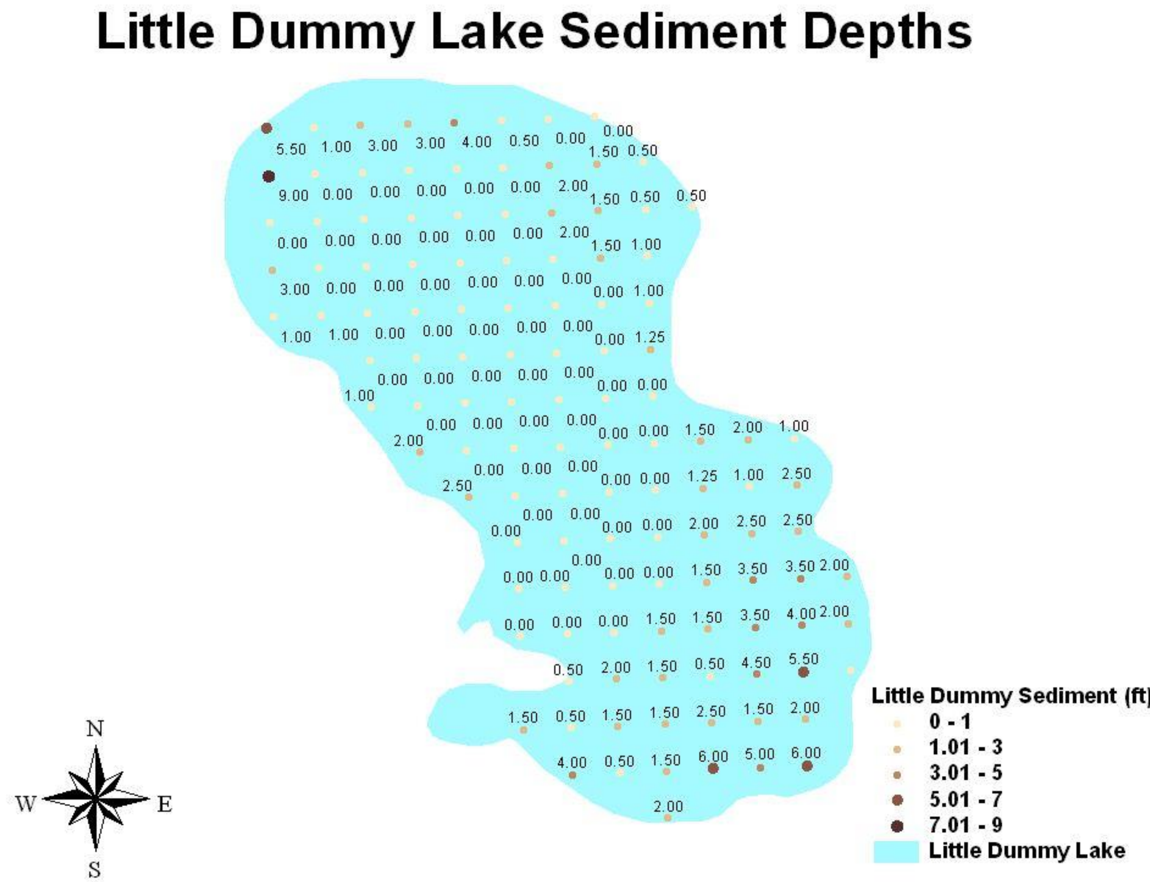
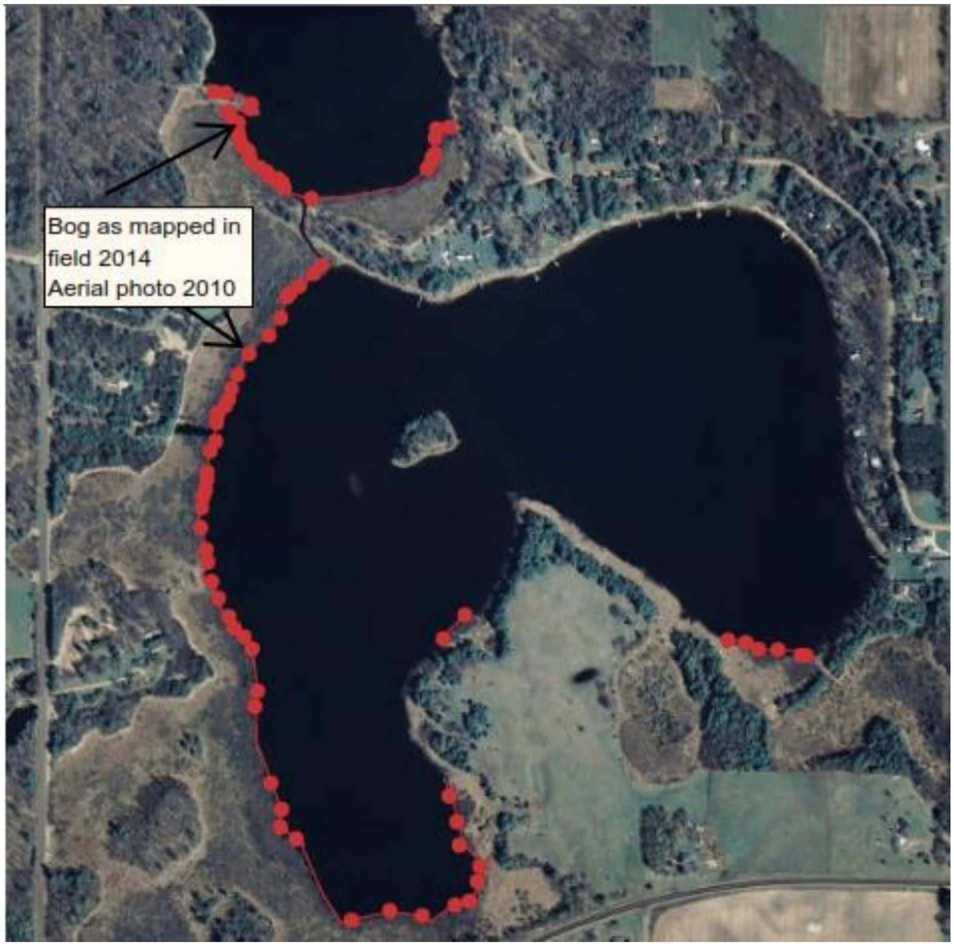


Figure 24 – Little Dummy Sediment Depth



The edge of the bog on both lakes was recorded with GPS and overlaid on an aerial photo from 2010.

Figure 25 - Bog as Mapped in Field



The bog mapped above is floating bog consisting of grasses, sedges and shrubs. It is currently attached to the shoreline and stationary. Sections of bog may break free and float about the lake causing navigation issues; this has happened in the past on the lake. If this happens in the future the bog may be dealt with in a number of ways including:

- Moving to a convenient location and anchoring to shore
- Removal and disposal in an upland location

There is also an issue with the lake bottom in the western portion of Big Dummy Lake. In this area the lake bottom consisting of decomposed mats of vegetation rises and shifts creating navigation issues. In some cases the mats are so extensive that they prevent navigation in large sections of this area. A number of options have been researched to deal with this problem including:

- Removal by dredging
- Removal by harvesting equipment
- Staking to bottom to prevent rising

Any type of dredging is very expensive and therefore unfeasible at this time. Removal by harvesting equipment would require a specially fabricated machine and removal of the bog may still prove to be impossible with this method. Staking the bog to the bottom would be risky; determining where to place the stakes and the number needed to keep the bog on the bottom would be difficult to calculate. If the stakes did not stay in place they would cause a navigational hazard on the lake.

This is not an uncommon problem in lakes and it is generally caused by the decomposition of vegetative material that forms gases which causes the mats to rise. It typically happens when the water is warm and decomposition of the vegetation is active. There is some concern that the continued use of herbicides, in particular 2,4-D, is causing or exacerbating the problem of the rising lake bottom. It would be difficult to determine the cause but further investigation could collect useful data. The following tasks could be completed by the District to collect data.

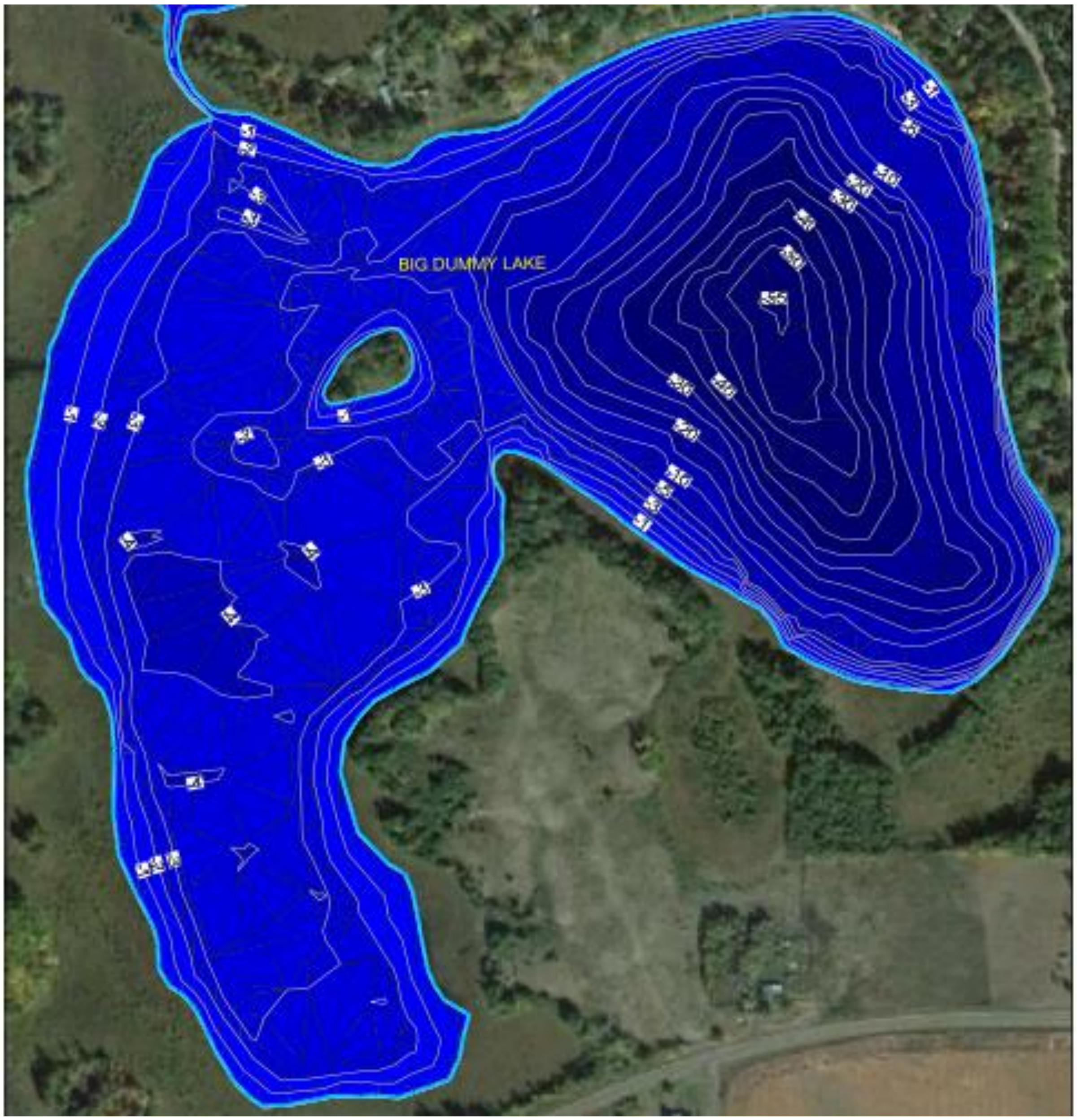
- Water depth in areas where mats are located
- GPS location of mats
- Average thickness, length and width of mats
- Type of plant roots identifiable in mats
- Position of plant roots – growing above, through or underneath mat
- If the mat is floating, submersed or partially floating
- Track movement of mats if mobile
- Date of rise and fall of mats
- Water temperature and level when mats rise and fall
- Significant weather events such as high winds, thunderstorms, drought

Collecting this data may lead to a better a understanding of what may be causing the rise and fall of the mats.

5.9 Bathymetric Mapping

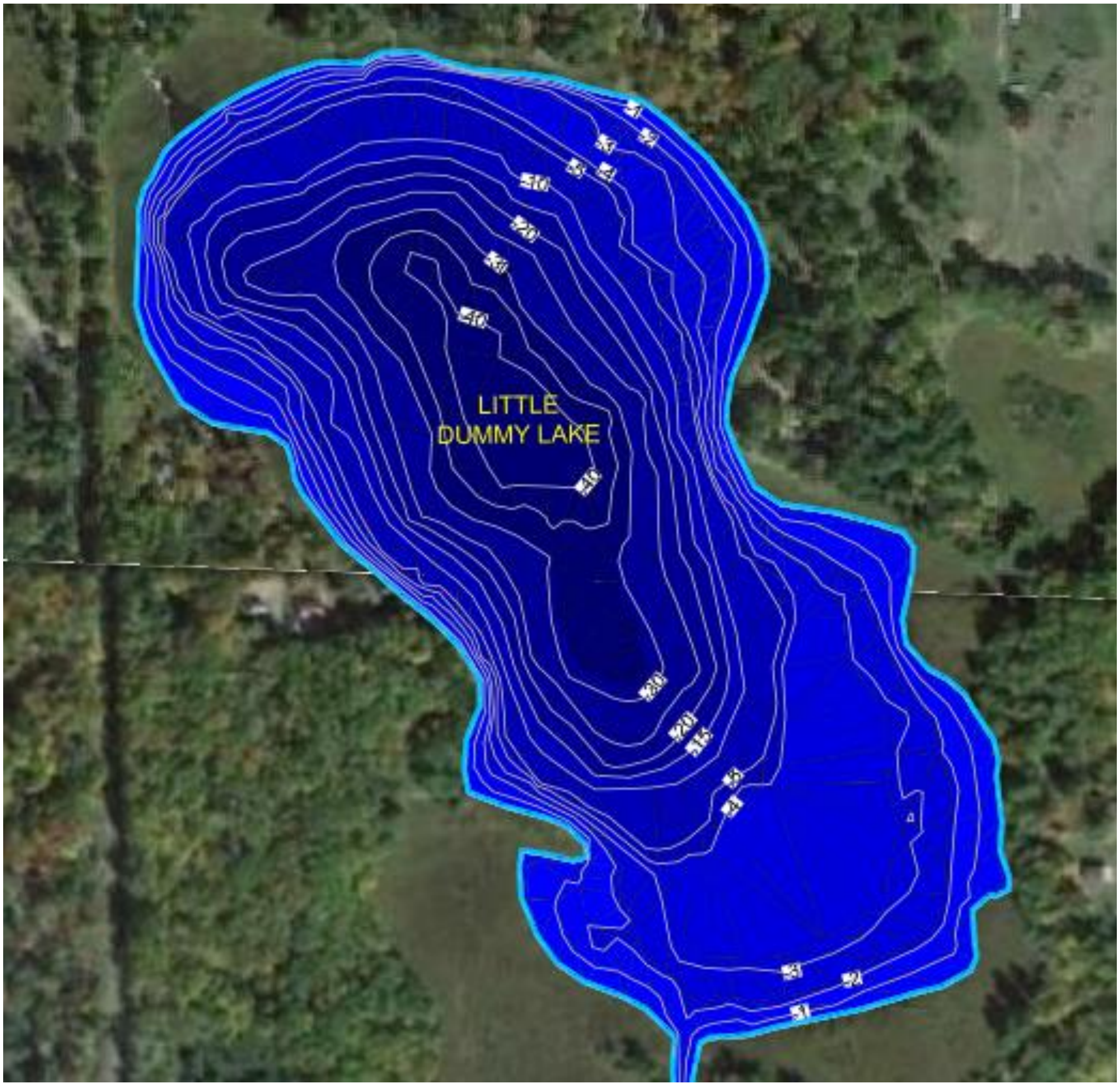
Following are the bathymetric maps that were created using the sonar data. The contour interval is 1 foot in the west half of Big Dummy and 5 feet in the remaining areas. The complete maps are included in the Figures Section as **Figure 2 – Big Dummy** and **Figure 3 – Little Dummy**.

Big Dummy Bathymetric Map – Figure 2



The maximum depth of Big Dummy was found to be 55 feet in the east basin. The maximum depth found in the west basin was 4 feet.

Little Dummy Bathymetric Map – Figure 3



The maximum depth of Little Dummy was found to be 40 feet.

6.0 Management Alternatives and Recommendations

Based on the goals of the stakeholders as mentioned in section 3.6, several management alternatives are available for this APM P lan. Some general alternatives are discussed below. More information on management alternatives is included in Appendix E. Currently, the Northern Region of the WDNR is working under an aquatic plant management strategy that is officially titled Aquatic Plant Management Strategy, Northern Region WDNR, Summer, 2007 (working draft), or commonly referred to as the NOR Region APM Strategy (Appendix H). This strategy lays out an approach for acceptable aquatic plant management in Northern Region lakes. The strategy protects native aquatic plant communities in northern Wisconsin and does not allow permits to control native plants unless documented circumstances of nuisance levels exist. The following management alternatives are based on the approaches described in the NOR Region APM Strategy, and incorporate recommendations of Flambeau Engineering.

6.1 Aquatic Plant Maintenance Alternatives

The maintenance alternative may be used at a lake in which a healthy aquatic plant community exists and invasive and non-native plant species are generally not present. The maintenance alternative is a protection-oriented management alternative because no significant plant problems exist or no active manipulation is required. This alternative can include an educational plan to inform lake shore owners of the value of a natural shoreline and encourage the protection of the lake water quality and the native aquatic plant community. The maintenance alternative is recommended for Dummy Lakes in general with limited manupilation techniques in the western half of Big Dummy lake and southern bay of Little Dummy lake. In these specific areas native vegetation grows at nuisance levels that inhibit navigation.

6.1.1 Aquatic Invasive Species Monitoring

In order to monitor spread of new AIS in the future a strong Citizen Lake Monitoring program that surveys for AIS is highly recommended. In some lake systems, native aquatic plants "hold their own" and AIS never grow to nuisance levels; in others however, vigilant and active management is required. This can be based on several things including water quality.

If an AIS is found the procedures for Early Detection and Rapid Response should be followed immediately upon detection. This DNR document is included in Appendix C2. This document outlines the steps to follow if new AIS are discovered that will help to control pioneer populations before they become established.

The University of Wisconsin-Extension Lake's Program provides training and coordinates the Citizen Lake Monitoring Program. More information about the program is available by contacting Laura Herman, Citizen Lake Monitoring Network Education Specialist, (715) 346-3989, email: lherman@uwsp.edu, website: http://www.uwsp.edu/cnr/uwexlakes/clmn/.

Completing pre and post aquatic plant monitoring in any areas that are actively managed to evaluate management effectiveness is recommended. The protocol for these surveys was created by WDNR and must be followed if the management activities are grant funded. The protocol should be followed even if grant funds are not involved to assess management effectiveness. In general lake-wide aquatic plant surveys are recommended every 5 years (essentially repeating the 2013 point intercept aquatic plant survey) to monitor changes in the overall aquatic plant community and the effects of the APM activities. Aquatic plant communities may change with varying water levels, water clarity, nutrient levels and aquatic plant management actions.

6.1.2 Aquatic Plant Protection and Shoreline Management

Protection of the native aquatic plant community is needed to slow the spread of EWM, CLP and other AIS from lake to lake and within a lake once established. Therefore, riparian landowners should refrain from removing native vegetation unless they need access via a 30 ft. corridor. Additionally, EWM and CLP can thrive in nutrient (phosphorus and nitrogen) enriched waters or where nutrient rich sediments occur. Two simple actions can prevent excessive nutrients and sediments from reaching the lake.

The first activity is the restoration of natural shorelines, which act as a buffer for runoff containing nutrients and sediments. Properties with seawalls, manicured lawn to water's edge and active erosion would be good candidates for shoreland restorations; lots like this are shown in Figures 12 and 13 in red. Many of the developed lots on the lakes could use limited restoration of grasses and shrubs. The many benefits of natural shorelands cannot be stressed enough. Establishing natural shoreline vegetation can sometimes be as easy as not mowing to the water's edge. Native plants can also be purchased from nurseries for restoration efforts. Shoreline restoration has the added benefits of providing wildlife habitat, preventing erosion and it may deter geese from entering the lawn area. A vegetated buffer area can also prevent surface water runoff from roads, parking areas and lawns from carrying nutrients to the lake. The Barron County Land Conservation Department and DLMD may be able to offer assistance to restore native vegetation to shoreland property. Shoreland restoration can also be funded through a Lake Protection Grant.

The second easy nutrient prevention effort is to use lawn fertilizers only when a soil test shows a lack of nutrients. A relatively new Wisconsin law prohibits the application of turf fertilizer containing phosphorus except in certain circumstances. Phosphorous containing fertilizer may be used when planting a new lawn or when a soil test indicates the soil is low in phosphorous. Fertilizer may not be applied to impervious surfaces or frozen ground under the new law. More information can be found in Wisconsin Statute 94.643. The fertilizers that were commonly used for lawns and gardens have three major plant macronutrients: nitrogen (N), phosphorus (P), and potassium (K). These are summarized on the fertilizer package by three numbers. The middle number represents the amount of phosphorus. Since most Wisconsin lakes are "phosphorus limited", meaning additions of phosphorus can cause increased aquatic plant or algae growth, preventing phosphorus from reaching the lake is a good practice. Local retailers and lawn care companies can provide soil test kits to determine a lawn's nutrient needs. Of course, properties with an intact natural buffer require very little maintenance and no fertilizers.

Another possible source of nutrients to a lake is the septic systems surrounding the lake. Septic systems should be properly installed and maintained in order to prevent improperly treated wastewater, which carries substantial nutrients, from reaching the lake. Property owners who are not sure if their septic system is adding nutrients to the lake should contact a professional inspector and have their system assessed.

6.1.3 Public Education and Involvement

The DLMD should continue to keep abreast of current AIS issues throughout the County. The County Soil and Water Conservation Department, the WDNR Lakes Coordinator, and the UW Extension are good sources of information. Many important materials can be ordered at the following website:

http://www.uwsp.edu/cnr/uwexlakes/publications/

Appendix G includes resources for further information about public education opportunities.

6.2 Aquatic Plant Manipulation Alternatives

This management alternative may be used when aquatic plants present some sort of problem that must be dealt with or manipulated by human action. This technique is recommended for limited management of nuisance native vegetation in the western half of Big Dummy and the southern bay of Little Dummy. The following alternatives may be used to manage the native vegetation in isolated problem areas.

6.2.1 Manual Removal

Manual removal consists of physically removing plants using bodily force and hand tools. Manual removal efforts include hand raking, cutting and hand pulling unwanted plants. This method is most effective when plants are pulled or cut as near the sediment as possible and all plant material is removed from the lake. Manual removal of aquatic plants can be quite labor intensive and time consuming. This technique is well suited for small areas in shallow water where property owners can weed the aquatic garden. Hiring laborers to remove aquatic vegetation is an option, but also increases cost. Scuba divers can be contracted to remove unwanted vegetation in deeper areas. Benefits of manual removal by property owners include lower cost compared to chemical control methods, quick containment of pioneering (new) populations of invasive aquatic plants, and the ability for a property owner to slowly and consistently work on active management. The drawback of this alternative is that pulling aquatic plants include the challenge of working in the water, especially deep water, the threat of letting fragments escape and colonize a new area, and the fact that control of any significantly sized population is quite labor intensive. Again, hiring laborers to remove aquatic vegetation is an option, but also increases cost.

Native Vegetation

Native plants may be found at nuisance levels that inhibit navigation and recreational use in certain areas in the lake. Manual removal of these plants is allowed at individual properties (except wild rice in the northern region) under Wisconsin law to a maximum width of 30 feet (recreation zone). The intent is to provide pier, boatlift or swimming raft access in the recreation zone. A permit is not required for hand pulling or raking if the site is **not located in a Sensitive Area** and maximum width cleared does not exceed the 30-foot recreation zone (manual removal of any native aquatic vegetation beyond the 30-foot area would require a permit from the WDNR that satisfies the requirements of Chapter NR 109, Wisconsin Administrative Code, see Appendix F). Manual removal is **cautioned** because it could open a niche for non-native invasive aquatic plants to occupy.

Limited manual removal of native vegetation is recommended for individual property owners where nuisance conditions occur. The area of removal should be kept to a minimum; the maximum allowed per WDNR regulations is 30 ft wide around docks and for a navigation lane. A navigation lane just wide enough for watercraft used is recommended. If lanes for fishing from the dock are required an area a few feet wide could be cleared to provide casting opportunities. If the navigation lane is used on a regular basis (with a motor boat) it should stay clear throughout the season. If limited **chemical treatment** is needed a permit from WDNR is required. **Individual navigation lanes must be permitted with the lake navigation lanes; discuss permitting with District members to be sure all proposed treatments are included.**

6.2.2 Native Vegetation Management - Chemical Herbicide Treatment

Native vegetation is generally not managed in Wisconsin waters. In the case of Dummy Lakes native vegetation has become so thick in isolated areas that it has reached nuisance levels by severely limiting navigation and recreation. Limited management in isolated areas is considered to allow navigation. Since 1990 navigation lanes have been treated in both lakes. The treatments have been effective but are expensive and are needed each year to keep the navigation lanes open. Continued limited treatment of these areas may be continued to provide a navigation lane that allows access for landowners in these areas. Both areas contain beneficial vegetation and Big Dummy contains several species of special concern. These areas provide critical habitat for fish and wildlife that is limited in the main body of the lake. Removal of native vegetation also creates the perfect environment for AIS invasion and establishment in these areas. Limited management on an as needed basis is recommended to balance navigation needs and habitat protection.

Manage navigation lanes in Big and Little Dummy

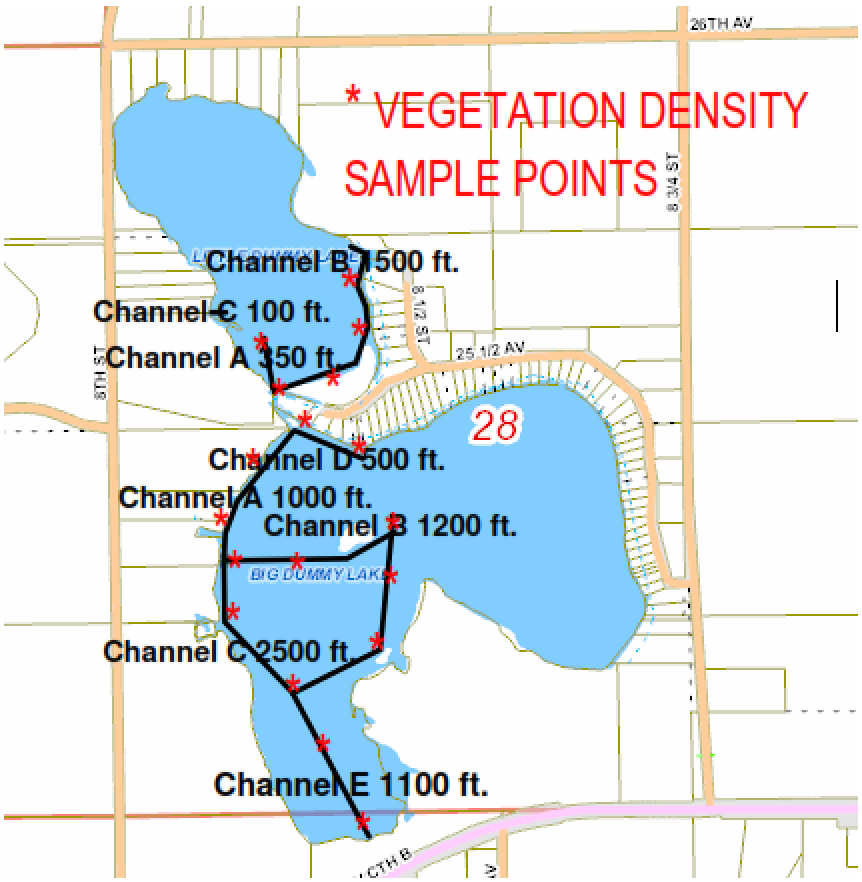
Under this option small areas of native plants would be managed. A navigation lane up to 50 feet wide located approximately 150 feet from docks would be maintained to provide access. The vegetation that poses a problem in these areas is both submersed and floating-leaf plants such as watershield, white water lily, large purple bladderwort. Limited chemical treatment may be required to maintain a common navigation lane for access to these areas. Annual evaluation of plant density is recommended to determine when chemical treatment is warranted. The navigation lane should be surveyed for plant density for both submersed and floating-leaf. Plant density should be determined by rake samples at predetermined points (at least two per channel) for submersed vegetation and visual observation for floating-leaf vegetation. Observations should be made at peak plant density late in the growing season in July or August to determine if chemical treatment will be needed the following year to maintain navigation. The following criteria may be followed to assess the need for chemical treatment. If chemical treatment will be pursued a pre-treatment survey will be conducted according to WDNR protocol which is included in Appendix H.

The following criteria may be used to **assess plant density in late summer (August) the year *prior* to herbicide application**:

> **Submersed vegetation** – sample vegetation with a rake at predetermined points. If at least **75%** of the sample points have a **rake density of 3** chemical treatment may be considered the following year.
>
> **Floating-leaf vegetation** – make visual observations of surface coverage at predetermined sample points. If at least **75%** of the **water surface is matted** with vegetation chemical treatment may be considered the following year.

If the treatment criteria have been reached, plans for treatment the following year may be made. **WDNR APM staff will not issue a permit until a site visit has been conducted in early summer (June/early July) in the year the treatment is proposed.** The above listed assessment may be used for planning purposes and obtaining bids from contractors for treatment with the understanding that treatment will not take place until reviewed and approved by WDNR. The following figure shows the proposed navigation lanes vegetation density sample locations.

Figure 26 – Proposed Navigation Channels



There are several herbicides that target the plants that are causing navigation issues. Following is a brief description of the herbicides:

2,4-D

- Target – lily, spatterdock, watershield, bladderwort
- Form – granular applied early season before leaves reach surface at dose recommended on current label. Amine form (Sculpin G) has been found to be less toxic to environment and does not require swimming restriction; however a 21 day waiting period does apply for certain uses of irrigation water. Applying at maximum rate may not be effective on lily, spatterdock

or watershield in this setting due to high dispersion and must be applied before gelatinous coating appears on the underside and stem of watershield. The configuration of the treatment area being a long, narrow navigation channel allows for greater dispersion of the herbicide and less concentration and contact time is achieved. Application may be more effective in stagnant areas such as the south bay on Big Dummy with limited water movement. For 2,4-D in this form to be effective the plant must take the herbicide in through its leaves, stems and/or roots; a reduced concentration and contact time limit the amount of uptake by the plant. A reduced concentration (under 2 ppm) and contact time under 24 hrs limits the amount of uptake by the plant. A higher concentration is allowed for plants such as waterlily, and watershield as these plants are less susceptible to 2,4-D. DLMD has found the cost of this treatment to be exceptionally high.

- Form – liquid (DMA-4) with surfactant applied as a foliar application following emergence of leaves. Apply at rate specified on current label. This may be the most effective use of 2,4-D for the lily, spatterdock and watershield since it will be applied directly to the leaves at the surface increasing contact and concentration. Care must be taken during application not to wash the herbicide off of the leaves from wind/wave action.

Glysophate

- Target – lily, watershield, spatterdock

- Form – liquid with surfactant applied as foliar application following emergence of leaves. Apply at rate specified by label. Apply to actively growing plants at water's surface; glysophate is not effective when applied below the surface. Applying to leaves at surface allows for contact above the water's surface and intake of the herbicide through the plants leaves. Care must be taken during application not to wash the herbicide off of the leaves from wind/wave action.

Imazapyr/Diquat

- Target – lily, spatterdock, watershield (Imazapyr); bladderwort, watershield (Diquat)

- Form – liquid with surfactant applied as foliar application following emergence of leaves. Apply at rate specified on label. Diquat is less effective in turbid, silty water; care must be taken not to disturb bottom sediments during application.

The above herbicides should be applied at the rate specified on the current product label and as recommended by applicator and WDNR staff issuing permits. The amount/density of plant growth will also dictate the amount of herbicide needed and should be considered when determining application rates. Care should be taken to estimate spring water depths as herbicide application contracts are awarded prior to spring thaw. Conditions affecting the application and effectiveness such as wind, waves, turbidity, rain, should be discussed with the applicator.

The most cost effective option to maintain navigation lanes is likely the use of glysophate based on the following:

- Foliar application with surfactant is effective on lily and watershield
- Less costly than 2,4-D foliar application
- Granular 2,4-D is not effective in long, narrow treatment areas due to high dispersion and low contact and concentration
- Imazapyr/diquat treatment has not been widely used and little data on effectiveness was found
- Glysophate will not affect bladderwort; since this is not a rooted plant and it readily moves about, any treatment of bladderwort is not very effective. If the plants in the lane are killed during application others will likely drift in and cause navigation problems. Manual removal through raking may be the best way to keep bladderwort out of the navigation lanes.
- Once a channel is treated and the vegetation is cleared to allow for navigation, continued use of the channel will keep vegetation from growing back. If a navigation channel is not used after treatment the vegetation will likely grow back later in the season spreading from adjacent plants. Navigation in the channel is an effective management tool to be used after the initial treatment with herbicide and future navigational channel treatment should be evaluated based on usage.

No matter which option is initially chosen close monitoring to track the effectiveness is critical to a successful plan. Conditions on the lake change seasonally and annually and treatment may be altered to account for these changes. If the chosen treatment proves ineffective the reasons for that should be investigated. Other options include alternating treatments on an annual basis such as 2,4-D granular early season treatment followed by glysophate foliar the next year. The following data may be collected by the District to determine effectiveness of the treatments:

- Weed Rake Fullness Sample Pts (2 per channel)
- Water Depth
- Water and Air Temperature
- Wind Speed and Water Movement
- Recent Storms and Precipitation
- Clarity
- Color
- Turbidity
- Stage of Plant Growth
- Pre-treatment Photos
- Usage
- Post Treatment Plant Growth Photos (2-3 weeks after treatment)

6.2.3 Native Vegetation Management – Harvesting

DLMD has been investigating harvesting as an alternative to chemical treatment on the lakes. They are concerned with the biological effects of continuous chemical treatment as well as the cost. The harvesting would take place in the lanes that have been established through chemical treatment. There are a number of logistical concerns when using harvesting as a management option. DLMD has already addressed a number of these as follows:

- One person will be designated as the harvester operator and will be responsible for harvesting as needed.

- Storage – the harvester will be stored on site during the harvesting season and in local storage unit during the winter months.
- The cut vegetation will be transported to the corresponding landing for off-loading from the lake and delivered to local farmers for composting.
- The harvester will be maintained by the DLMD and the cost will be covered by taxes and donations. A capital equipment loan will be sought through the Board of Commissioners of Public Lands.
- If water levels are too low for harvesting chemical treatment may be used as a management option.

Harvesting is basically "mowing" the vegetation in the lake. The harvester removes vegetation from 2-5 ft deep then the vegetation is collected and removed from the lake. There are pros and cons to harvesting as follows.

Pros

- Immediate results
- Minimal impact to lake
- Harvest lanes through thick vegetation can increase growth and survival of some fish
- Removes some nutrients from the lake
- Cost effective way to keep purple bladderwort out of navigation channels

Cons

- Not selective in species removal
- Can remove small fish and reptiles
- Initial cost of harvester is high

Purchasing a harvester and operating throughout the season has been found be more cost effective than annual herbicide treatments. Table 15 in the Tables Section is a cost comparison of harvesting vs. herbicide treatment prepared by DLMD (based on 7.5 acres of herbicide treatment). Since harvesting is like mowing a lawn it must be done on a recurring basis; several times per growing season. The timing and scheduling will have to be determined based on individual site conditions and may change throughout the season and from year to year. If water levels are low the harvester may not be able to access certain areas where the floating-leaf vegetation is growing. Access may be limited in the western half of Big Dummy due to the floating lake bottom. Vegetation growth may increase after harvesting just as many plants do after they are trimmed or cut. White water lily and watershield reproduce through seeds and rhizomes and white water lily has been known to increase seed germination after leaves of the plant have been removed. Harvesting will not spread white water lily, spatterdock or watershield through fragmentation; however, uprooting and severing the tubers may. Any future infestations of milfoil would be treated chemically in localized applications.

Harvesting into the south lobe in Big Dummy may open up larger areas for fishing while increasing localized populations of certain species. Harvesting larger areas rather than limited chemical treatment will create better recreational opportunities for boaters. Removal of the vegetation through harvesting will reduce muck production in the future.

The following figure shows the proposed harvest areas.

Figure 27 – Proposed Harvest Areas

6.2.4 Native Vegetation Management – Dredging

Dredging navigation lanes may be an option that will provide relativity long term relief from the nuisance vegetation. Dredging of a navigation lane up to 50 ft wide may be funded through the Recreational Boating Facilities grant. Dredging navigation lanes would remove the existing vegetation and deepen the channels to provide navigation even during lower water levels. Deepening the channels may also reduce future growth of the floating-leaf vegetation.

Pros

- Plants are removed along with sediment
- Increases water depth
- Removes nutrient rich sediments
- Most effective when soft sediments overlay harder substrate
- For extremely impacted systems
- Removes soft bottom sediments that may have high oxygen demand

Cons

- Expensive
- Increases turbidity and releases nutrients
- Exposed sediments may be recolonized by invasive species
- Extensive planning required
- Sediment testing is expensive and may be necessary
- Removes benthic organisms
- Dredged materials must be disposed of
- Severe impact on lake ecosystem

Dredging navigation lanes in the western half of Big Dummy may not provide long term channels. The lake bottom that rises to form floating mats may fill in the dredged channels. Observations made on the lake indicate that these mats float about and when they sink in the fall may land in the dredged channels and fill them in as discussed below.

6.2.5 Big Dummy Lake Western Half

There are issues with the western half of Dummy Lake that may impact the effectiveness of the above listed management options. According to several sources the bed of the lake appears to be silt that lies atop a bog-like mat. This mat rises in summer and sinks in the fall; navigation is impossible in some areas. The mat is not continuous but is in pieces that shift and float about. When the mats settle the navigation lanes that were treated the previous year are not continuous but appear to have been broken up by the shifting mats. If this is the case and the bottom does rise and shift dredging a navigation channel will not be an effective option. The dredged channel will likely be filled in areas if the bog rises, shifts and settles in the channel. Harvesting in this area would not be possible while the bog mat is floating either. Management options for this area were discussed in section 5.8.

7.0 Conclusion and Recommended Action Plan

Native vegetation has risen to nuisance levels in several areas of the lakes and has been actively managed for nearly 20 years. Management is necessary to provide navigation in certain areas of the lakes. Due to these issues, the following Recommended Action Plan focuses on native nuisance management and public education.

7.1 Recommended Active Goals

The recommended action plan includes actions for Dummy Lakes based on the Maintenance Alternatives listed above in Section 6. The DLMD board has approved the following active goals. It will be up to residents of Dummy Lakes and the DLMD to determine the actions, find the funding, and gather the individuals needed to implement the active goals.

Active Goal: Improve navigation through the western half of Big Dummy Lake and the southern bay of Little Dummy Lake.

Action: Use a combination of manual removal and herbicide treatment to manage native vegetation and improve navigation. Herbicide treatments are recommended to create a common navigation lane in these problem areas. Annual assessment will indicate if herbicide treatment will be needed the following year. Pre and post surveying to track effectiveness and impacts is highly recommended. Manual removal is recommended for small areas and for individual land owners to gain access to the navigation lane. If manual removal is proposed in a Sensitive Area obtain permits. ***If herbicide is necessary for individual access areas they must be permitted with the lake treatment permit.***

Further investigate purchase of a harvester as it may be more economical than continued herbicide treatment. If a harvester is purchased, harvesting may take the place of herbicide treatment. Harvesting is not permitted in water less than 3 ft deep.

Timing: Complete pre-treatment survey in August of the year prior to treatment for planning purposes. Bids from contractors may be obtained; however, treatment may not take place until reviewed and approved by WDNR in early summer the year of treatment. Apply herbicide following WDNR approval in early summer.

Manual removal can begin anytime and continue throughout summer. Removal is limited to a 30 ft wide navigation lane and around docks.

Funding: Herbicide treatment of native vegetation is not eligible for grant funding. It will be the Districts responsibility to fund herbicide treatments. The purchase of a harvester may be eligible for Recreational Boating Facilities Grant. It is recommended DLMD pursue this grant if they are planning on purchasing a harvester.

Responsible Party: Chris Mrdutt

Active Goal: To implement and maintain an aquatic invasive species monitoring program that will survey for invasive species, and if found, monitor their locations and extent of population spread.

Action: Participate in Citizen Lake Monitoring training for aquatic invasives and monitor the lake on an annual basis according to CLM protocol.

Timing: Complete training in 2015 and begin monitoring immediately.

Responsible Party: Chris Mrdutt

Active Goal: To continue and expand the Dummy Lakes comprehensive water quality monitoring program through the WDNR Citizen Lake Monitoring Network.
Action: Participate in CLM training for water quality monitoring. Collect samples monthly throughout the growing season for chlorophyll a and total phosphorus along with Secchi measurements. Sampling should begin at spring turnover (April/May) and end at fall turnover (October/November).
Timing: Complete training in 2015. Begin monitoring immediately.
Responsible Party: Lee Peterson and Dave King

Active Goal: Prevent the introduction of AIS by educating lake users.
Action: Install/maintain signs at boat landing explaining prevention techniques. Include information on all AIS to prevent spread into lake.
Funding: Small education projects may be eligible for Small Scale Lake Planning Grant. Large scale AIS projects may be eligible for AIS Grant, Education, Planning and Prevention Grant.
Responsible Party: Jerry Holt

Active Goal: Preserve native vegetation and protect and improve fish and wildlife habitat
Action: Place maps at landings indicating critical habitat areas and remind lake users to reduce impacts to these areas. Increase awareness of No-Wake Zones. Limit management in areas where vegetation is present; in particular areas where species of special concern are documented.
Funding: Small education projects may be eligible for Small Scale Lake Planning Grant
Responsible Party: Holly Joseph

Active Goal: Promote shoreland restoration.
Action: Complete detailed assessment of shorelines rated 3 in Shoreland Assessment map. Contact property owners that could benefit from shoreland restoration to encourage them to take action. Contact Barron County Soil and Water Conservation Department (SWCD) for assistance with restoration plans.
Funding: Apply for Lake Protection Grant for funding for restorations.
Responsible Party: Holly Joseph

Active Goal: Assess watershed and work with local land owners and Barron County Soil and Water Department to protect water quality.

Action: Contact Barron County SWCD for assistance with programs. Discuss sites at District meetings that may benefit from SWCD programs and contact landowners.
Funding: Apply for Lake Protection Grant for funding for watershed projects.
Responsible Party: Holly Joseph

Active Goal: Evaluate management/treatment effectiveness and adjust plan accordingly.

Action: The APM Plan is a living document that is used to guide management of the lake. As conditions on the lake change and as new management options become available they should be evaluated and investigated to see if they may be a viable option. **Conducting a whole lake point intercept survey on each lake is**

recommended every 5 years. This will provide data to evaluate effectiveness of treatments and to monitor the rare plants that have been documented.

Responsible Party: Dummy Lakes Board

7.2 Pursue Grant Funding to Implement Actions

There are a number of grants available through WDNR to implement actions outlined in this plan and to complete further research and projects on Dummy Lakes. Following is a brief description of the grants available through WDNR.

Small Scale Lake Management Planning

Funding Amount: $3,000
Local Match: 33%
Purpose: Funding to collect and analyze information needed to protect and restore lakes and watersheds
Application Deadline: December 10
Eligible Projects:

- Lake monitoring such as water quality and aquatic plants
- Lake education such as activities that will collect/disseminate information about lakes to educate public on lake use, lake ecosystem and lake management techniques
- Organization development such as assist management units in formation of goals/objectives for management of lake
- Studies/assessments to implement management goals and expanding monitoring

Large Scale Lake Management Planning

Funding Amount: $25,000
Local Match: 33%
Purpose: Funding to collect and analyze information needed to protect and restore lakes and watersheds
Application Deadline: December 10
Eligible Projects:

- Gathering and analysis of physical, chemical and biological information
- Describing present and potential land uses in watershed and on shoreline
- Reviewing jurisdictional boundaries and evaluating ordinances that relate to zoning, sanitation or pollution control or surface use
- Assessment of fish, aquatic life, wildlife and their habitats
- Gathering and analyzing information from lake property owners/users
- Developing, evaluating, publishing, distributing alternative courses of action and recommendations in a lake management plan

Lake Protection Grant

Funding Amount: $200,000
Local Match: 25%
Purpose: Funding for large, complex, technical projects for lake protection
Application Deadline: February 1
Eligible Projects:

- Purchase of land or conservation easements
- Restoration of wetlands and shorelands to protect water quality

- Development of local regulations to protect lakes and education activities necessary to implement them
- Lake management plan implementation project recommend in **WDNR approved plan**
    - Watershed management projects
    - Lake restoration
    - Diagnostic feasibility studies

Aquatic Invasive Species Education, Planning and Prevention Grant

Funding Amount: $150,000
Local Match: 25%
Purpose: Educate lake users on AIS
Application Deadline: December 10
Eligible Projects:

- Educational programs including workshops, training or coordinating volunteer monitors.
- Develop prevention and control plans for AIS
- Monitor, map and assess waterbodies for AIS or studies that will aid in prevention AIS
- Watercraft inspection and education projects (CBCW). Inspectors must be trained and staff boat launch facilities a minimum of 200 hours between May 1 and October 30. Limited to $4,000 per boat launch facility.

Aquatic Invasive Species Established Population Control Project

Funding Amount: $200,000
Local Match: 25%
Purpose: Provide for eradication/substantial reduction and long term control of AIS with goal of restoring native species.
Application Deadline: February 1
Eligible Projects:

- Department approved control activities recommended in control plan
- Experimental or demonstration project in WDNR approved plan
- Purple loosestrife bio-control project

Aquatic Invasive Species Early Detection and Response

Funding Amount: $20,000
Local Match: 25%
Application Deadline: As approved
Eligible Projects: Identification and removal by approved methods of small, pioneer population of AIS. Localized beds must be present less than 5 years and less than 5 acres in size or less than 5% of lake area. Control of recolonization following completion of an established population control project is eligible.

Aquatic Invasive Species Research and Demonstration

Funding Amount: $500,000
Local Match: 25%
Purpose: Funding for cooperative research or demonstration activity between sponsor and WDNR
Application Deadline: February 1

Aquatic Invasive Species Maintenance and Containment

Funding Amount:	Full cost of aquatic plant management permit
Local Match:	25%
Purpose:	Funding for department approved management at desired level of AIS where eradication is not possible. Monitoring and reporting are required.
Application Deadline:	Continuous

7.3 Closing

This APM Plan was prepared in cooperation with the Dummy Lakes Management District. It includes the major components outlined in the WDNR Aquatic Plant Management guidance. The "Recommended Action Plan" section of this report can be used as a stand alone document to facilitate management activities for the lakes. This section outlines important monitoring and management activities. The greater APM Plan document and appendices provides a central source of information for the lake's aquatic plant community information, the overall lake ecology, and sources of additional information. If there are any questions about how to use this APM Plan or its contents, please contact Flambeau Engineering.

This APM Plan should be updated periodically to reflect current aquatic plant problems, and the most recent acceptable APM methods. Repeating the aquatic plant survey and updating the APM Plan is recommended every five years. Information regarding aquatic plant management and protection is available from the WDNR website: http://dnr.wi.gov/org/water/fhp/lakes/aquaplan.htm or from Flambeau Engineering upon request.

8.0 References

While not all references are specifically cited, the following resources were used in preparation of this report.

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Figures

Figure 1 Dummy Lakes Public Access

Legend

Wetland Class Points
- Dammed pond
- Excavated pond
- Filled excavated pond
- Filled/drained wetland
- Wetland too small to delineate

Filled Points

Wetland Class Areas
- Wetland
- Upland

Filled Areas

Intermittent Streams

Township

Section

Rivers and Streams

Open Water

State Natural Areas (SNAs)

DNR Managed Lands
- Other
- FM
- NA
- PR

Other Federal Lands
- Bureau of Land Management (BLM
- Department of Defense (DOD)
- U.S. Fish & Wildlife Service (FWS)

Notes

0.5 0 0.25 0.5 Miles

NAD_1983_HARN_Wisconsin_TM

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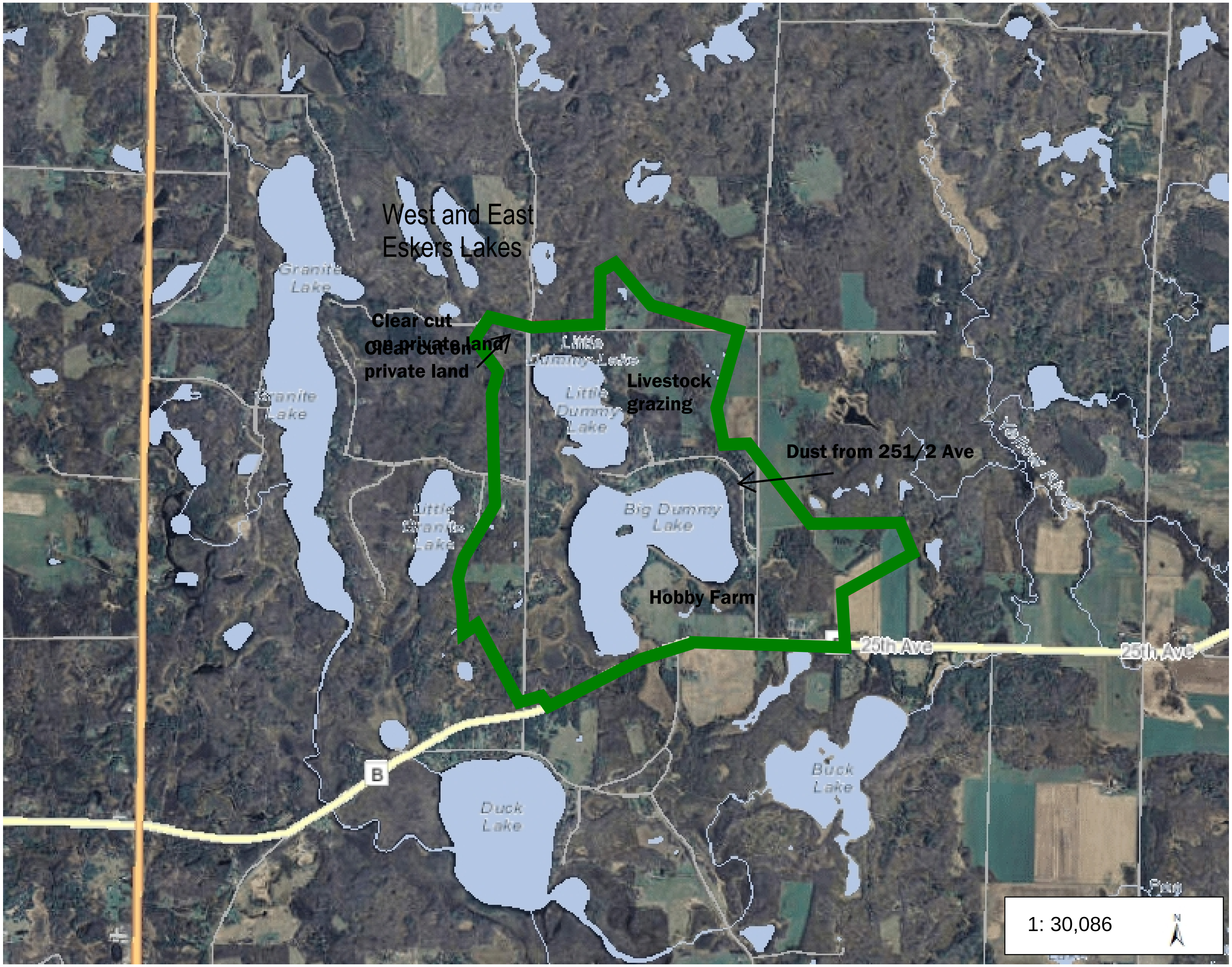
Figure 1a Dummy Lakes Watershed



Legend

Rivers and Streams

Open Water

2010 Air Photos (WROC)

Notes

0.9 0 0.47 0.9 Miles

NAD_1983_HARN_Wisconsin_TM

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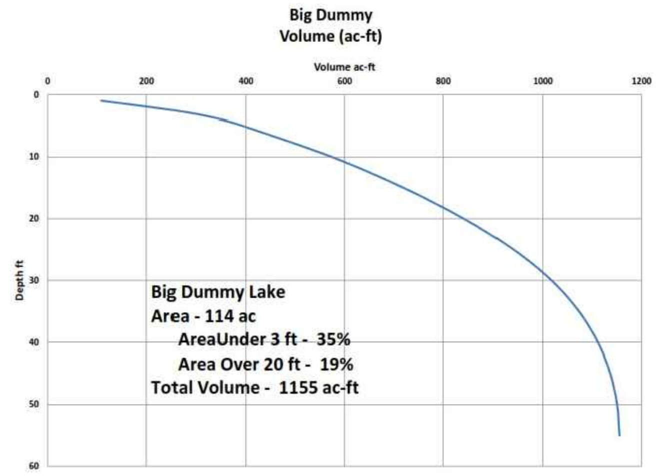
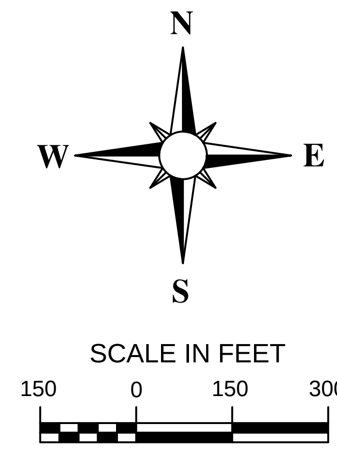
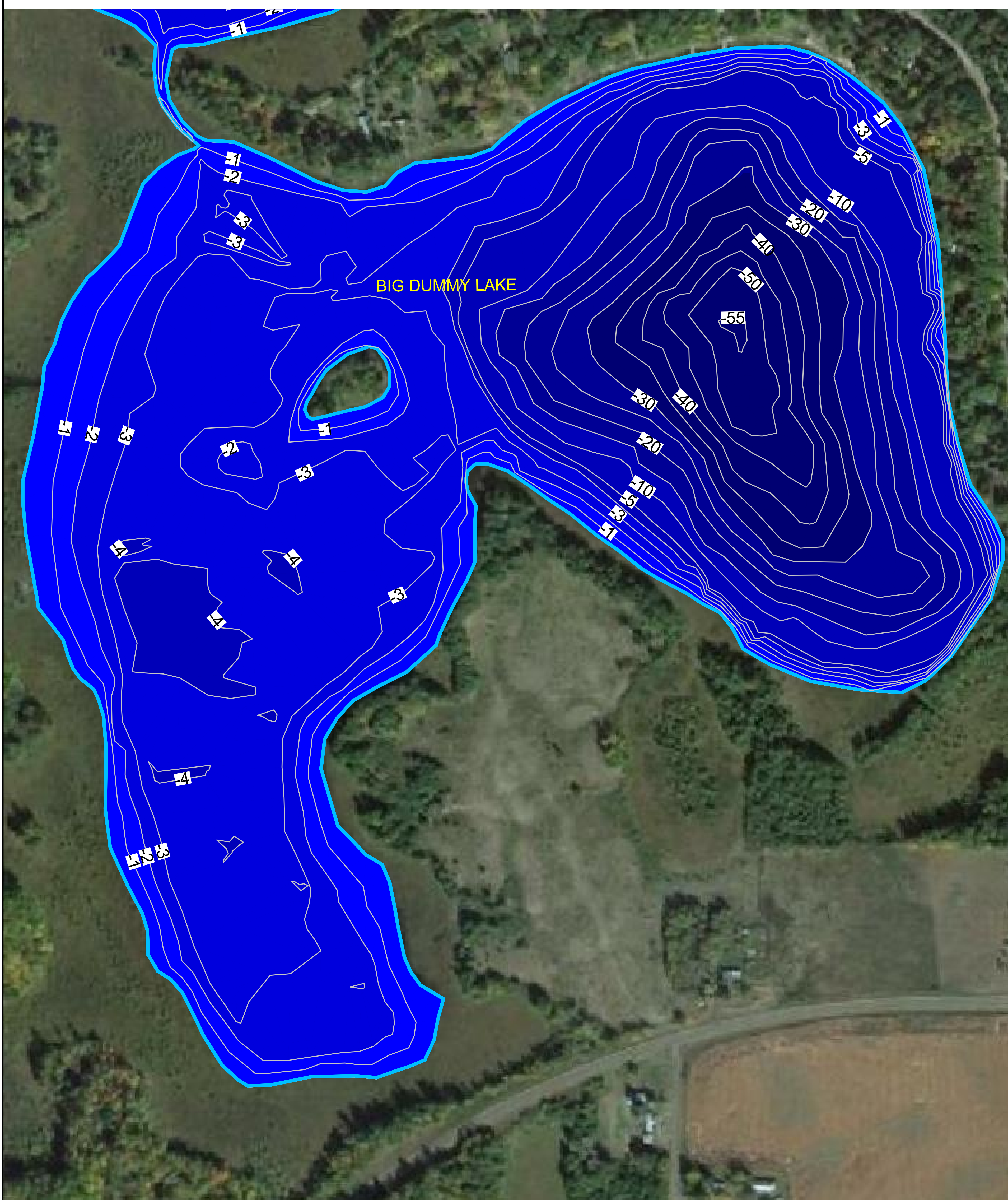
Figure 2 - Big Dummy Bathymetric Map



Species of Fish	Common	Present
Panfish	X	
Bass	X	
Northern Pike	X	
Walleye		X





REV.	DESCRIPTION	DATE

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APPROVED BY: TAK
DRAWN BY: NLB
DATE: 6-23-14
SCALE: 1"=400'

BATHYMETRIC MAP

BIG DUMMY DUMMY LAKE
SEC. 28, T36N, R13W
TOWN OF LAKELAND, BARRON COUNTY, WISCONSIN

PROJECT NUMBER: 105
FIGURE NO.
C100

Figure 3 - Little Dummy Bathymetric Map

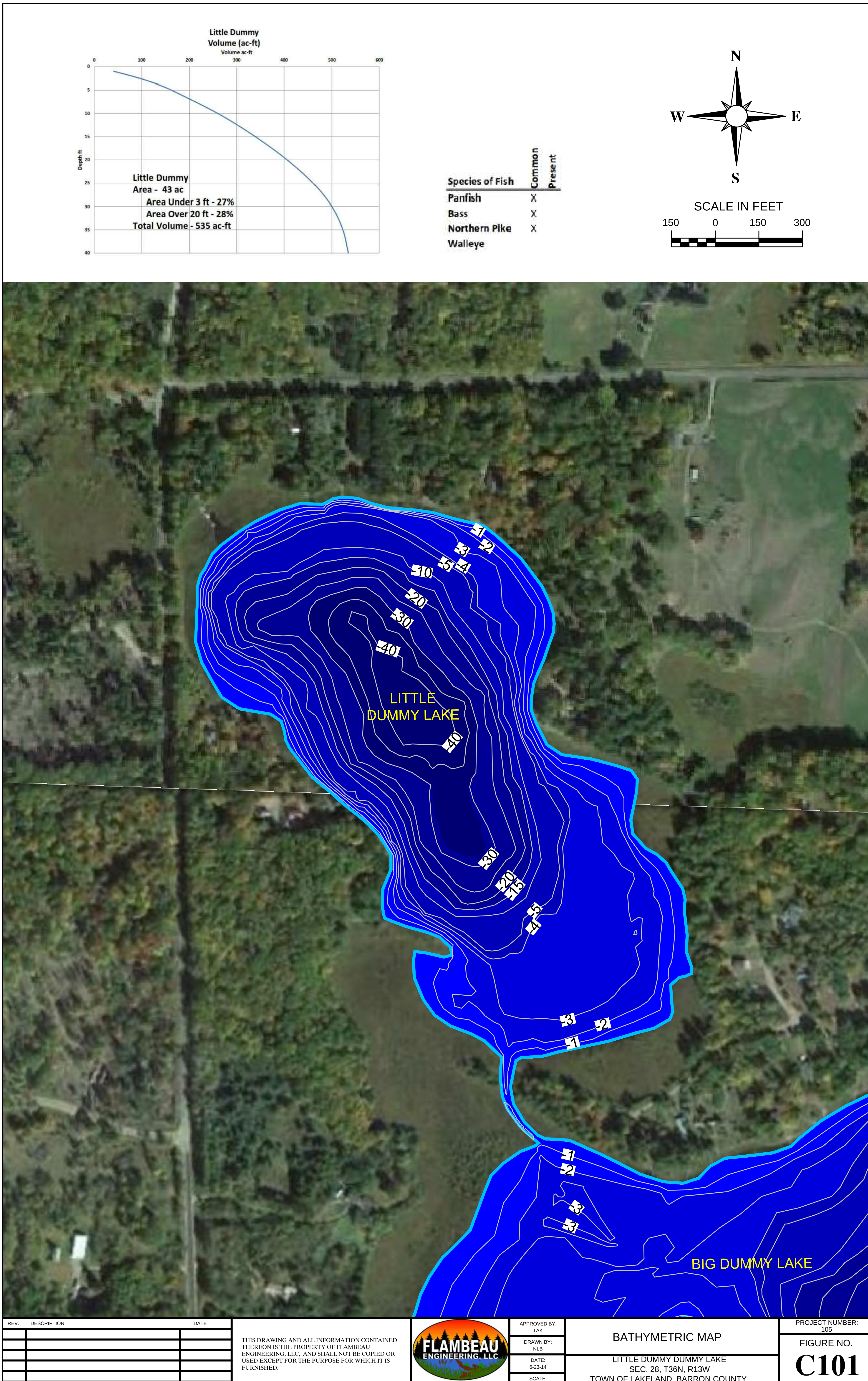
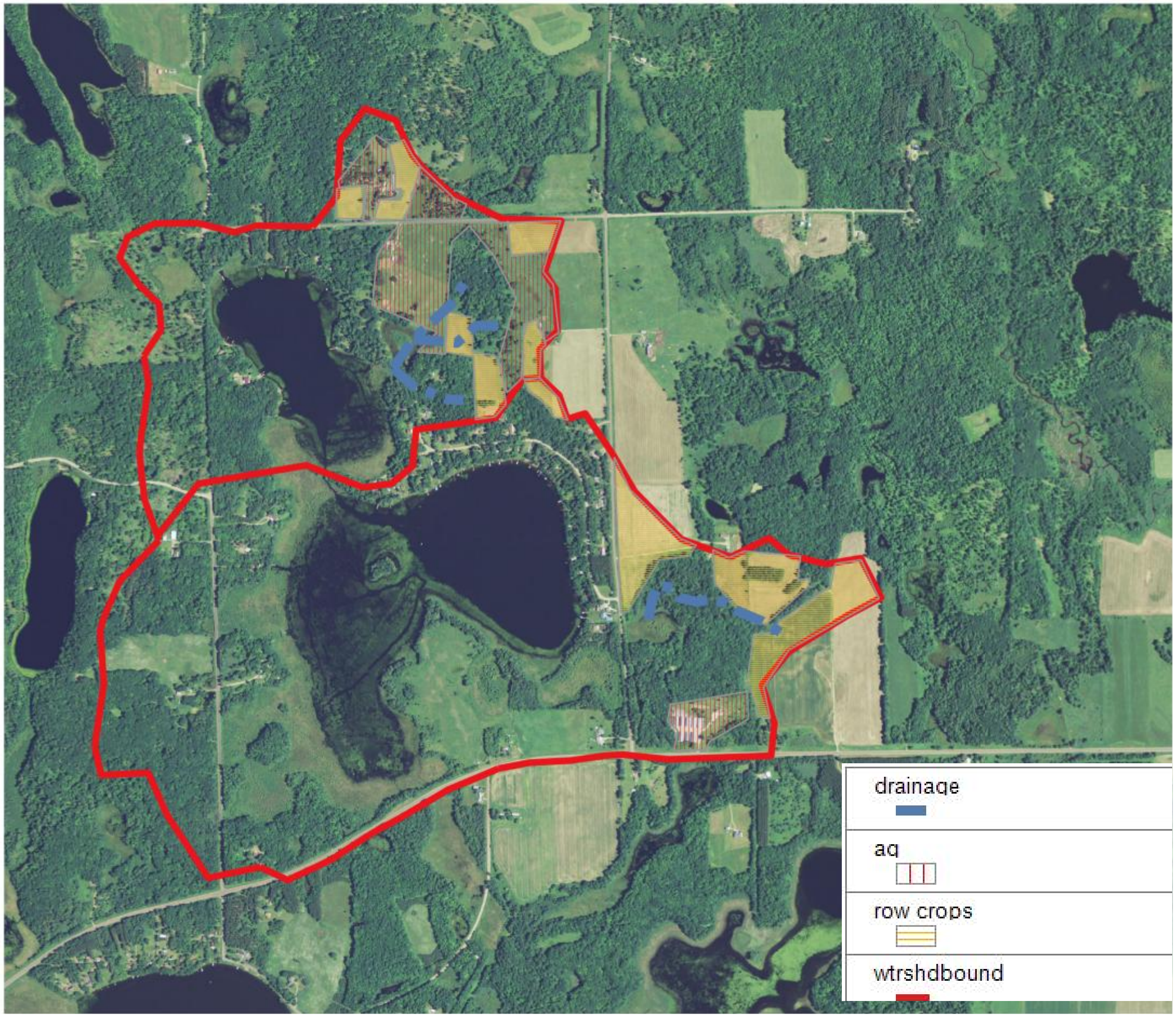


Figure 4 - Dummy Lakes Watershed with Ag Land Use and Drainage Ways



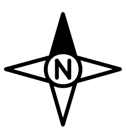
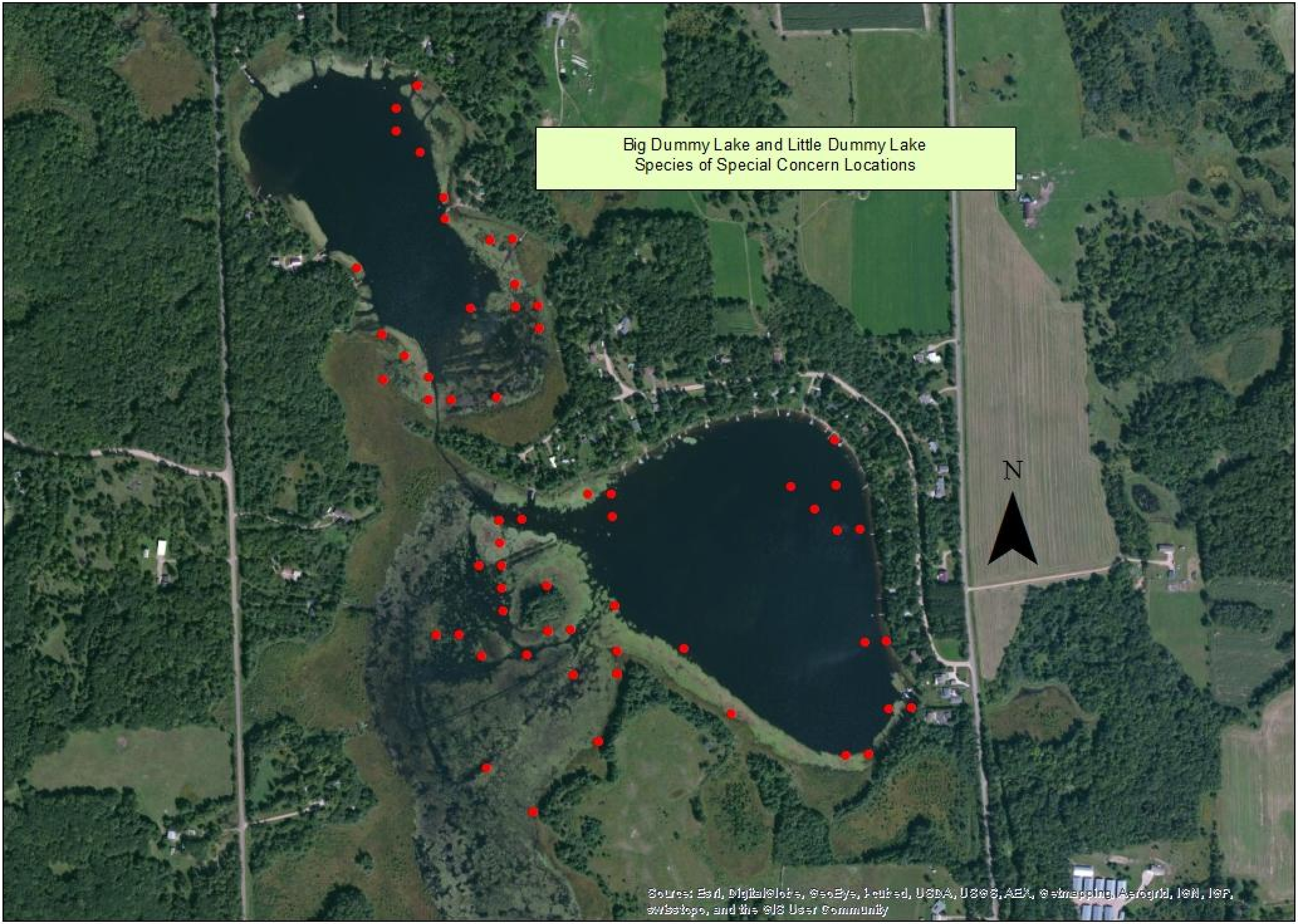


Figure 28 Species of Special Concern



Tables

Table 15

Chemical Treatment vs. Harvester 2/01/12

			0.0375	0.0375	180	180
	0.03	0.05	35000	70000	10	12
	Chemical	**Treatment**	**Harvester**	**Comparison**	0.03	0.03

Year	**3% Inflation**	**5% Inflation**	**10 yr Annual Payment**	**20 Yr Annual Payment**	**Operating Costs**	**Labor Costs**	**Operating + Labor Costs**	**10 Yr Annual Payment + Operating + Labor Costs**	**10 Yr Annual Payment + Operating Costs**	**20 Yr Annual Payment + Operating + Labor Costs**	**20 Yr Annual Payment + Operating Costs**
1	7150.00	7150.00	4202.52	4980.20	1800.00	2160.00	3960.00	8162.52	6002.52	8940.20	6780.20
2	7364.50	7507.50	4202.52	4980.20	1854.00	2224.80	4078.80	8281.32	6056.52	9059.00	6834.20
3	7585.44	7882.88	4202.52	4980.20	1909.62	2291.54	4201.16	8403.68	6112.14	9181.36	6889.82
4	7813.00	8277.02	4056.00	4980.20	1966.91	2360.29	4327.20	8383.20	6022.91	9307.40	6947.11
5	8047.39	8690.87	4202.52	4980.20	2025.92	2431.10	4457.01	8659.53	6228.44	9437.21	7006.12
6	8288.81	9125.41	4202.52	4980.20	2086.69	2504.03	4590.73	8793.25	6289.21	9570.93	7066.89
7	8537.47	9581.68	4202.52	4980.20	2149.29	2579.15	4728.45	8930.97	6351.81	9708.65	7129.49
8	8793.60	10060.77	4202.52	4980.20	2213.77	2656.53	4870.30	9072.82	6416.29	9850.50	7193.97
9	9057.41	10563.81	4056.00	4980.20	2280.19	2736.22	5016.41	9072.41	6336.19	9996.61	7260.39
10	9329.13	11092.00	4202.52	4980.20	2348.59	2818.31	5166.90	9369.42	6551.11	10147.10	7328.79
11	9609.00	11646.60		4980.20	2419.05	2902.86	5321.91	5321.91	2419.05	10302.11	7399.25
12	9897.27	12228.93		4980.20	2491.62	2989.95	5481.57	5481.57	2491.62	10461.77	7471.82
13	10194.19	12840.37		4980.20	2566.37	3079.64	5646.01	5646.01	2566.37	10626.21	7546.57
14	10500.02	13482.39		4980.20	2643.36	3172.03	5815.39	5815.39	2643.36	10795.59	7623.56
15	10815.02	14156.51		4980.20	2722.66	3267.19	5989.86	5989.86	2722.66	10970.06	7702.86
16	11139.47	14864.34		4980.20	2804.34	3365.21	6169.55	6169.55	2804.34	11149.75	7784.54
17	11473.65	15607.55		4980.20	2888.47	3466.17	6354.64	6354.64	2888.47	11334.84	7868.67
18	11817.86	16387.93		4980.20	2975.13	3570.15	6545.28	6545.28	2975.13	11525.48	7955.33
19	12172.40	17207.33		4980.20	3064.38	3677.26	6741.63	6741.63	3064.38	11721.83	8044.58
20	12537.57	18067.69		4980.20	3156.31	3787.57	6943.88	6943.88	3156.31	11924.08	8136.51
TOTAL	$ 192,123.18	$ 236,421.57	$ 41,732.16	$ 99,604.00	$ 48,366.67	$ 58,040.01	$ 106,406.68	$ 148,138.84	$ 90,098.83	$ 206,010.68	$ 147,970.67
Interest			$ 6,732.16	$ 29,604.00							
Savings @ 3%								**$ 43,984.33**	**$ 102,024.34**	**$ (13,887.51)**	**$ 44,152.50**
Savings @ 5%								**$ 88,282.73**	**$ 146,322.74**	**$ 30,410.89**	**$ 88,450.90**

Cost per Acre In 20 Years		**Increase**
2012	$800	
3%	$1,400	75%
5%	$2,021	152%