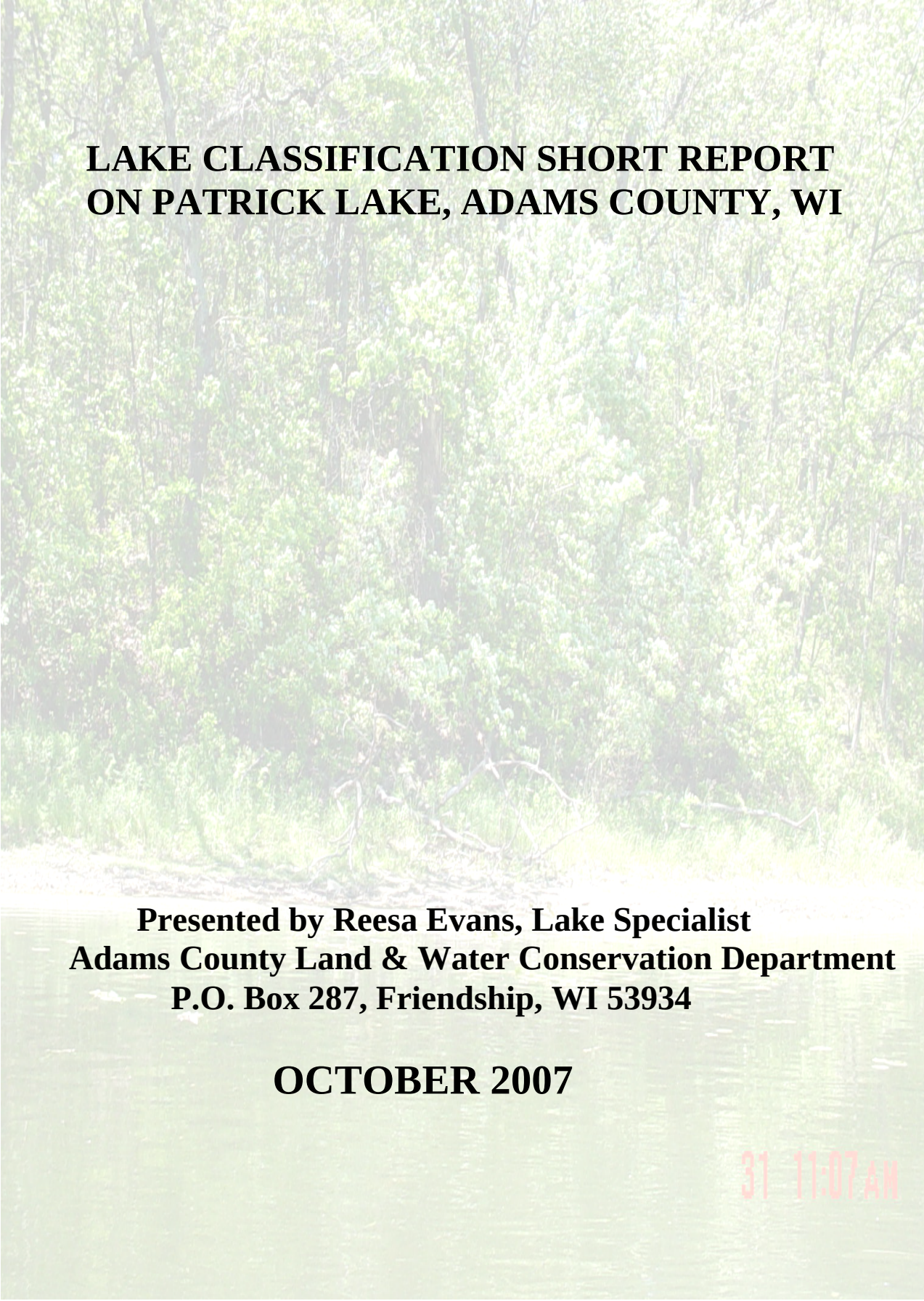

LAKE CLASSIFICATION SHORT REPORT ON PATRICK LAKE, ADAMS COUNTY, WI

Presented by Reesa Evans, Lake Specialist
Adams County Land & Water Conservation Department
P.O. Box 287, Friendship, WI 53934

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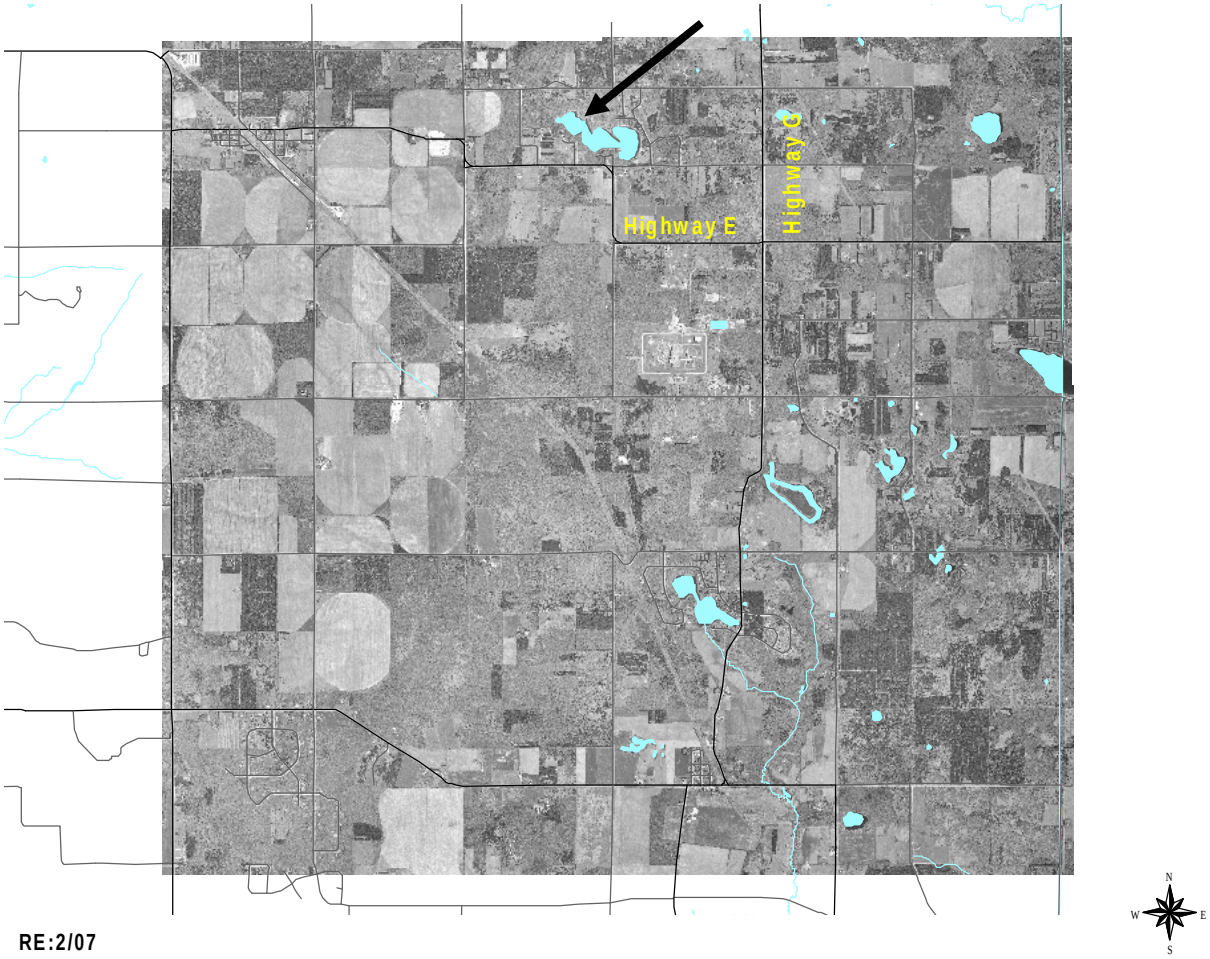
Introduction

Information about Patrick Lake: Patrick Lake is located in the Town of New Chester, Adams County, WI, in the south central part of Wisconsin. It is reached off of County E as it turns south. Patrick Lake is a mesotrophic seepage lake with good to very good water quality and clarity. It has 50 surface acres, with a maximum depth of 21 feet and a mean depth of 10 feet. In the past few years, the water level in Patrick Lake has been declining substantially. As in the case in all seepage lakes, the water level on Patrick Lake fluctuates naturally with the underground water table, but studies are underway to determine if some other factors may be contributing to the lowering water levels. There is a county park and boat launch at the southeast "corner" of the lake.

PATRICK LAKE



Land Use

While the surface watershed of Patrick Lake is fairly small, the ground watershed goes east and north of the lake about three miles. The ground watershed has mostly irrigated cropland, with some scattered residential sites and some forested land and more concentrated residential sites closer to the lake. Studies have shown that lakes are products of their watersheds, with land use having a great impact on the water quality of that lake, especially in the amount and content of stormwater runoff from the surface. Stormwater runoff volume is affected by the amount of impervious surface, the soil type and the slope of the area. Stormwater runoff from natural landscapes tends to be low.

Land use in acres and percent of total are shown on the chart below:

	Surface		**Ground**		**Total**	
Patrick Lake	**Acres**	**% Total**	**Acres**	**% Total**	**Acres**	**% Total**
Agriculture--Non Irrigated	87.8	8.51%	63.71	12.09%	151.51	9.72%
Agriculture--Irrigated	0	0.00%	239.22	45.41%	239.22	15.34%
Residential	437.16	42.35%	23.18	4.40%	460.34	29.53%
Water	50.1	4.85%	5.26	1.00%	55.36	3.55%
Woodland	457.2	44.29%	195.43	37.10%	652.63	41.86%
total	1032.26	100.00%	526.8	100.00%	1559.06	100.00%

Woodlands are the largest land use category in both Patrick Lake watersheds. Since forest floors are often full of leaves, needles and other duff, runoff from forested lands is may be more filtered than that from agricultural or residential lands.

Residential land use is the second most common land use category in both the Patrick Lake watersheds, especially around the lake itself, where residential land use is most concentrated. This land use category may contribute a significant amount of nutrients to the water from stormwater runoff, mowed lawns, and impervious surfaces. Septic systems may also add to nutrient loading from residential land use.

Agricultural land use may contribute significantly to the amount of nutrient loading in a watershed. While only a small part of the surface watershed of Patrick Lake is in agricultural use, the groundwatershed has a much larger portion of its land use in agriculture.

There are some wetlands near Patrick Lake's shore. Wetlands play an important role in water quality by trapping many pollutants in runoff waters and by serving as buffers to catch and control what would otherwise be uncontrolled water and pollutants. Wetlands also play an essential role in the aquatic food chain, thus affecting fishery, and also serve as spaces for wildlife habitat, wildlife reproduction & nesting, and wildlife food. It is essential to preserve these wetlands for the continued health of Patrick Lake waters.

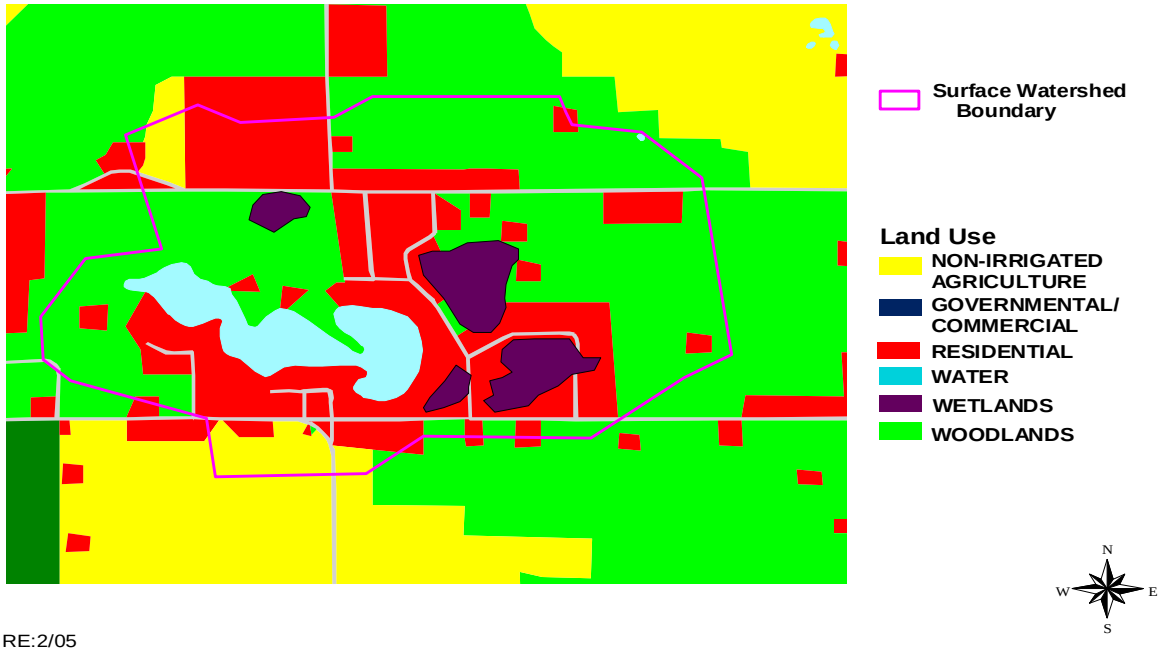
Like many lakes in Wisconsin, Patrick Lake is a phosphorus-limited lake. This means that of the pollutants that end up in the lake, the one in the shortest supply and most affects the overall quality of the lake water is phosphorus. Land use types play a major role in determining the amount of phosphorus being loaded into the lake.

Some aspects of phosphorus loading can't be modified by human behavior—they are simply part of the natural landscape. However, phosphorus loading from agriculture, residential, recreational and septic use of the land can be decreased or increased by human activities. A decrease of phosphorus loading of just 10% in these areas would result in 8.51 **fewer** pounds of phosphorus per year. While this may not sound like much, when it is considered that one pound of phosphorus can produce up to 500 pounds of algae, the 8.51 pounds becomes up to 4255 **fewer** pounds of algae per year!

MOST LIKELY PHOSPHORUS LOADING		
BY LAND USE	**% Loading**	**current**
Non-Irrigated Agriculture	28.0%	30.80
Residential	17.5%	19.80
Woodlands	18.3%	19.80
Ground Watershed	21.1%	24.20
Lake Surface	6.0%	6.60
Septics	9.1%	10.38
total in pounds/acre	100.0%	111.58

	current	-10%	-25%	-50%
Non-Irrigated Agriculture	30.80	27.72	23.10	15.40
Residential	19.80	17.82	14.85	9.90
Woodlands	19.80	19.80	19.80	19.80
Ground Watershed	24.20	21.78	18.15	12.10
Lake Surface	6.60	6.60	6.60	6.60
Septics	10.38	9.35	7.79	5.19
total in pounds/acre	111.58	103.07	90.29	68.99

Patrick Lake--Surface Watershed Land Use



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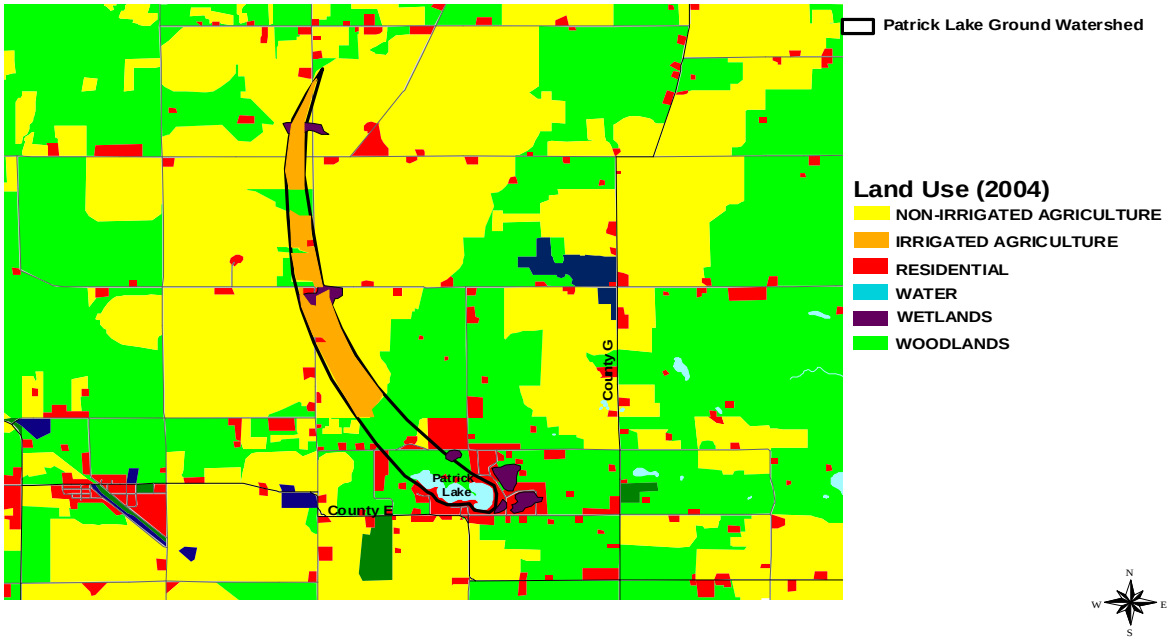
Patrick Lake Ground Watershed Land Use



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Shorelands

Patrick Lake has a total shoreline of 1.68 miles (8870.4 feet). Much of the shore in the northwest lobe and in the west part of the center lobe of the lake has been left mostly undisturbed. Buildings in these areas tend to be uphill and more than 70' from the shore.

The eastern lobe of the lake is in residential use and park use. Most of the areas in this lobe are flatter than the northwest end. Buildings in this lobe are generally located closer to the shoreline than those on the west part of the lake. 80% of Patrick Lake's shoreline is vegetated.

Patrick Lake Shoreline

RE:9/05

Sand/Beach
Vegetated Shore

A 2004 shore survey showed that most of the shore had an “adequate buffer.” An “adequate buffer” is a native vegetation strip at least 35 feet landward from the shore.

However, there were still areas of “inadequate” buffers, mostly those with mowed lawns and insufficient native vegetation at the shoreline to cover 35 feet landward from the water line. There are also several areas of sand bars and some active erosion.

Patrick Lake--Buffers

Adequate Buffer Inadequate Buffer

RE:9/05

Shoreland buffers are an important part of lake protection and restoration. These buffers are simply a wide border of native plants, grasses, shrubs and trees that filter and trap soil & similar sediments, fertilizer, grass clippings, stormwater runoff and other potential pollutants, keeping them out of the lake. A 1990 study by the Wisconsin Department of Natural Resources of Wisconsin shorelines revealed that a buffer of native vegetation traps 5 to 18 times more volume of potential pollutants than does a developed, traditional lawn or hard-armored shore. The filtering process and bank stabilization that buffers provide help improve a lake's water quality, including water clarity.

Example of Adequate Buffer

Example of Inadequate Buffer

Vegetated shoreland buffers help stabilize shoreline banks, thus reducing bank erosion. The plant roots give structure to the bank and also increase water infiltration and decrease runoff. A vegetated shore is especially important when shores are steep and soft, as are many of the Patrick Lake shores.

Water Quality Information

One of the measures Wisconsin uses to give a general estimate of a lake's water quality is the **trophic state index.** This index looks at a lake's water clarity, its amount of total phosphorus (the element most related to aquatic plant and algal growth), and its chlorophyll-a level (chlorophyll-a is a pigment used by algae for photosynthesis).

Depending on the trophic index score, lakes are then classified as **Oligotrophic** (good)**, Mesotrophic** (fair), or **Eutrophic** (poor)**:**

- **Good:** Oligotrophic lakes have clear, deep water with few algal blooms. Larger game fish are often found in such lakes.
- **Fair:** Mesotrophic lakes have more aquatic plant and algae production, with occasional algal blooms and a good fishery. The water is usually not as clear as that of oligotrophic lakes.
- **Poor:** Eutrophic lakes are very productive, with lots of aquatic plants and algae. Algal blooms are often frequent in these lakes. They may have a diverse fishery, but rough fish (such as carp) are also common. Water is often cloudy or murky. Small shallow lakes are more likely to be eutrophic.

Patrick Lake's overall TSI is 42

Score	TSI Level Description
30-40	**Oligotrophic:** clear, deep water; possible oxygen depletion in lower depths; few aquatic plants or algal blooms; low in nutrients; large game fish usual fishery
40-50	**Mesotrophic:** moderately clear water; mixed fishery, esp. panfish; moderate aquatic plant growth and occasional algal blooms; may have low oxygen levels near bottom in summer
50-60	**Mildly Eutrophic:** decreased water clarity; anoxic near bottom; may have heavy algal bloom and plant growth; high in nutrients; shallow eutrophic lakes may have winterkill of fish; rough fish common
60-70	**Eutrophic:** dominated by blue-green algae; algae scums common; prolific aquatic plant growth; high nutrient levels; rough fish common; susceptible to oxygen depletion and winter fishkill
70-80	**Hypereutrophic:** heavy algal blooms through most of summer; dense aquatic plant growth; poor water clarity; high nutrient levels

Water clarity readings are usually taken by using a Secchi disk (shown at right). Average summer Secchi disk clarity in Patrick Lake in 2004-2006 was 10.2 feet. Average water clarity for 1986-2006 of 10.05 feet shows that the water clarity in Patrick Lake has consistently remained in the "very good" clarity category. Water clarity can be reduced by turbidity (suspended materials such as algae and silt) and dissolved organic chemicals that color or cloud the water.

Increased phosphorus levels in a lake will feed algal blooms and also may cause excess plant growth. The 2004-2006 summer average phosphorus concentration in Patrick Lake was 17.3 micrograms/liter. This puts Patrick Lake in the "good" category for phosphorus levels and is below the 25 micrograms/liter average for natural lakes in Wisconsin. It is also slightly below the average for the 1990s of 19.8 micrograms/liter. However, phosphorus levels should be monitored because of phosphorus contribution to high plant growth and algal blooms.

The third measure used in trophic state classification is the amount of chlorophyll-a contained in the lake. The amount of chlorophyll-a found in a lake is an indication about the amount of algae in the lake. The 2004-2006 summer average chlorophyll-a concentration in Patrick Lake was 2.8 micrograms/liter. This low level of chlorophyll-a gives Patrick Lake a "very good" ranking for chlorophyll-a. Although this level is an improvement over the chlorophyll-a average of 5.9 micrograms/liter from the 1990s, both levels are low.

In-Lake Habitat

Aquatic Plants

A diverse aquatic plant community plays a vital role in improving water quality, providing valuable habitat resources for fish and wildlife, resisting invasions of non-native species and checking excessive growth of the most tolerant species.

An updated aquatic plant survey was performed in 2005. The 0-1.5ft depth zone supported the most abundant aquatic plant growth, although the 1.5'-5' and 5'-10' depth zones were only slightly lower. The Patrick Lake aquatic plant community is characterized by average quality and good species diversity. The most commonly-occurring aquatic species were *Chara* spp (muskgrass), and *Najas guadalupensis* (Southern naiad).

Important to maintaining a quality, diverse aquatic plant community is an integrated aquatic plant management plant that controls the invasive plants in the lake. The most prevalent invasive exotic in Patrick Lake is historically *Myriophyllum spicatum* (Eurasian watermilfoil), although it wasn't found in 2005 (the lake had been chemically treated within the two months prior to the aquatic plant survey). No other invasive plants were found during the 2005 survey.

More detailed information can be found in the aquatic plant report of the 2005 survey, available on request from the WDNR or Adams County Land & Water Conservation Department.

***Chara* spp**

Najas guadelupensis

Eurasian Watermilfoil

Emergent Plants in Patrick Lake

RE:2/07

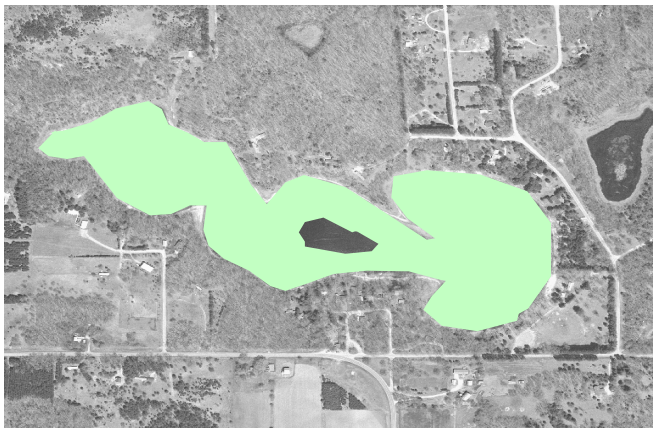
Emergent Plants Found

Floating-Leaf Plants in Patrick Lake

RE:2/07

Floating-Leaf Plants Found

Submergent Vegetation in Patrick Lake



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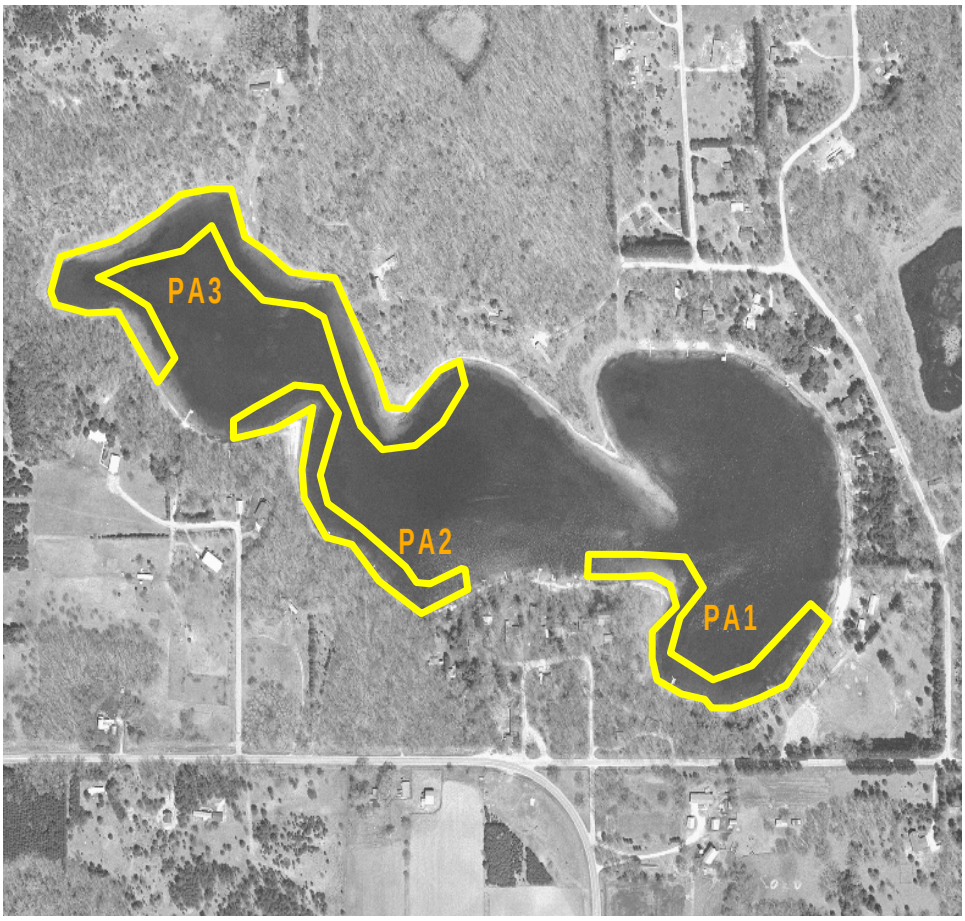
Aquatic Vegetation Found 2005

Critical Habitat

Wisconsin Rule 107.05(3)(i)(I) defines a "critical habitat areas" as: "areas of aquatic vegetation identified by the department as offering critical or unique fish & wildlife habitat or offering water quality or erosion control benefits to the body of water. Thus, these sites are essential to support the wildlife and fish communities. They also provide mechanisms for protecting water quality within the lake, often containing high-quality plant beds. Finally, critical habitat areas often can provide the peace, serenity and beauty that draw many people to lakes in the first place.



RE:6/06

Patrick Lake--Critical Habitat Areas

Three areas on Patrick Lake were determined to be appropriate for critical habitat designation. PA1 extends along approximately 800 feet of the southeastern shoreline of Patrick Lake, up to the ordinary high water mark. PA2 extends along approximately 1000 feet in the middle of the southern shoreline. PA3 covers 1650 feet of the western end of the lake.

Part of Area PA2

Part of Area PA3

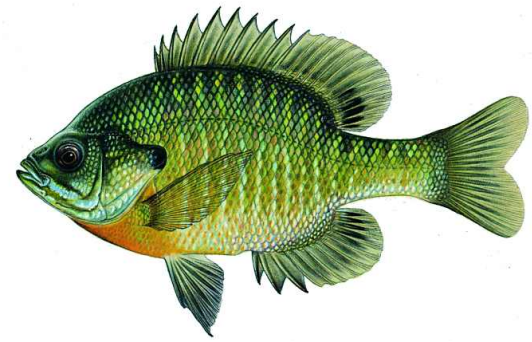
The Critical Habitat Report for Patrick Lake has more specific information on these sites. Copies are available from the Adams County Land & Water Conservation Department.

Fishery/Wildlife/Endangered Resources

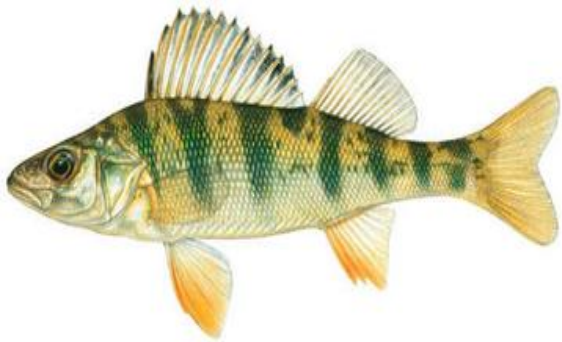
WDNR records show that Patrick Lake had a long history of fish winterkills, back to 1936, until an aeration system was installed in 1974. A chemical eradication of fish in the lake in 1962 revealed only yellow perch, black bullheads and bluegills. For reason unknown, largemouth bass & northern pike that had been stocked previously had apparently not survived. After the 1962 kill, stocking started again in 1963, and later inventories show that the lake included northern pike, largemouth bass, crappie and bluegills. Whatever the previously problem was for non-survival, apparently it didn't continue after the 1962 chemical eradication. Since 1963, fish inventories have found that largemouth bass continued to survive in the lake, as well as pumpkinseed, black bullhead, perch and bluegills. Pike continue to survive, but are scarce.

Muskrat are also known to use Patrick Lake shores for cover, reproduction and feeding. Seen during the field survey were various types of waterfowl and songbirds. Frogs and salamanders are known, using the lake shores for shelter/cover, nesting and feeding. Turtles and snakes also use this area for cover or shelter in this area, as well as nested and fed in this area. Upland wildlife feed and nest here as well.

No endangered resources are reported in the Patrick Lake watersheds.



BLUEGILL



YELLOW PERCH

Recommendations

Lake Management Plan

- The Lake District should, when it reviews the lake management plant, be sure that the plan includes at least the following aspects concerning the management of the lake: aquatic species management; control/management of invasive species; wildlife and fishery management; nutrient budgeting; shoreland protection; critical habitat protection; water quality protection.

Watershed Recommendations

- Since computer modeling results suggest that input of nutrients, especially phosphorus, are a factor that needs to be explored for Patrick Lake, it is recommended that both the surface and ground watersheds be inventoried, documenting any of the following: runoff from any livestock operations that may be entering the surface water; soil erosion sites; agricultural producers not complying with nutrient management plans and/or irrigation water management plans.
- If such sites are documented, the Patrick Lake District should encourage land owners and the Adams County Land & Water Conservation Department to design and implement practices that will address site issues.

Water Quality Recommendations

- All lake residents should practice best management on their lake properties, including keeping septic systems maintained in proper condition and pumped every three years, eliminating the use of lawn fertilizers, cleaning up pet wastes and not composting near the water.
- Reducing the amount of impervious surface around the lake and management of stormwater runoff will also help maintain water quality.
- Residents should become involved in the Citizen Lake Water Monitoring Program. This program includes water quality monitoring, invasive species monitoring, and Clean Boats, Clean Waters.
- Lake residents should cooperate with the study on low lake levels being conducted by George Kraft of UW-Stevens Point and the WDNR. Lake residents often have historical information not available to the researchers and, hopefully, will share their knowledge, so that the diminishing water level problems can be resolved.

- Natural shores should be protected and maintained, with as little disturbance as possible.

Aquatic Plant Recommendations

- All lake users should protect the aquatic plant community in Patrick Lake by assisting in implementing an integrated aquatic plant management plan that uses multiple methods of control.
- The Lake District should maintain exotic species signs at the boat landings and contact DNR if the signs are missing or damaged.
- The Patrick Lake District should continue monitoring and control of Eurasian Watermilfoil maintain the most effective methods and modify if necessary. The Lake Association should investigate ways to increase treatment effectiveness in the deeper water. Residents may need to hand-pull scattered plants.
- A milfoil weevil survey should be conducted on Patrick Lake in order to evaluate milfoil weevil availability for assistance in controlling the Eurasian Watermilfoil.
- Shores with inadequate buffers may need to restore the buffers to an adequate condition to provide winter habitat for these weevils, as well to assist in maintaining water quality.
- Lake residents should get involved in the county-sponsored Citizen Aquatic Invasive Species Monitoring Program. This will allow not only noting changes in the Eurasian Watermilfoil pattern, but also those for Curly-Leaf Pondweed and other exotics. Noting the presence and density of these plants early is the best way to take preventive action to keep them from becoming a bigger problem.

Critical Habitat Recommendations

- Maintain current habitat for fish and wildlife with as little disturbance as possible.
- Leave fallen trees along shoreline & in water.
- Seasonal protection of spawning habitat. No disturbance of littoral zone except for authorized viewing/access corridor or WDNR-approved projects.
- Maintain the wildlife corridor.
- Protection emergent vegetation.
- Seasonal and specific control of exotics.
- No bank grading or grading of adjacent land. If shore erosion present, use bioeingeering rather than rock or similar hard structure.
- Maintain aquatic vegetation in undisturbed condition for wildlife habitat, fish use and water quality protection.
- Any new piers installed should be of material that allows light penetration to the lake bottom.