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

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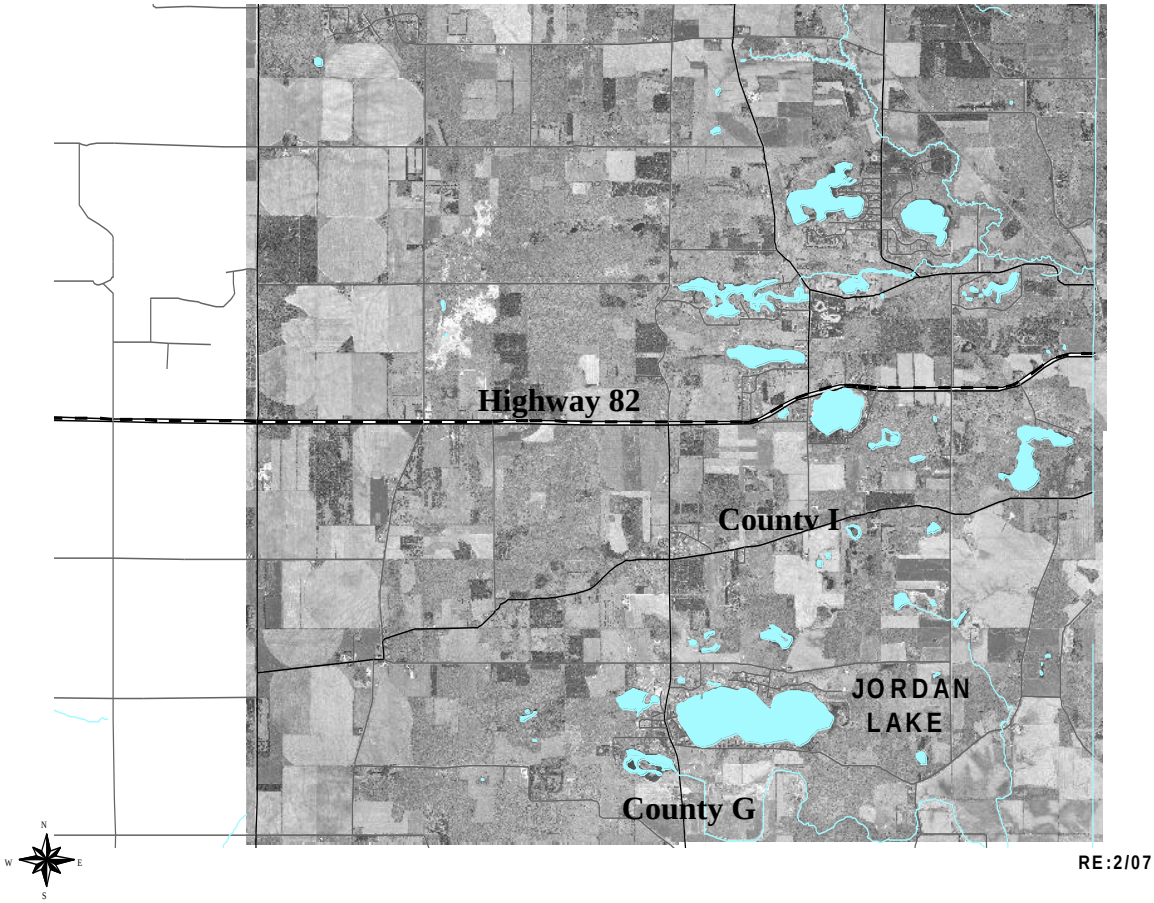
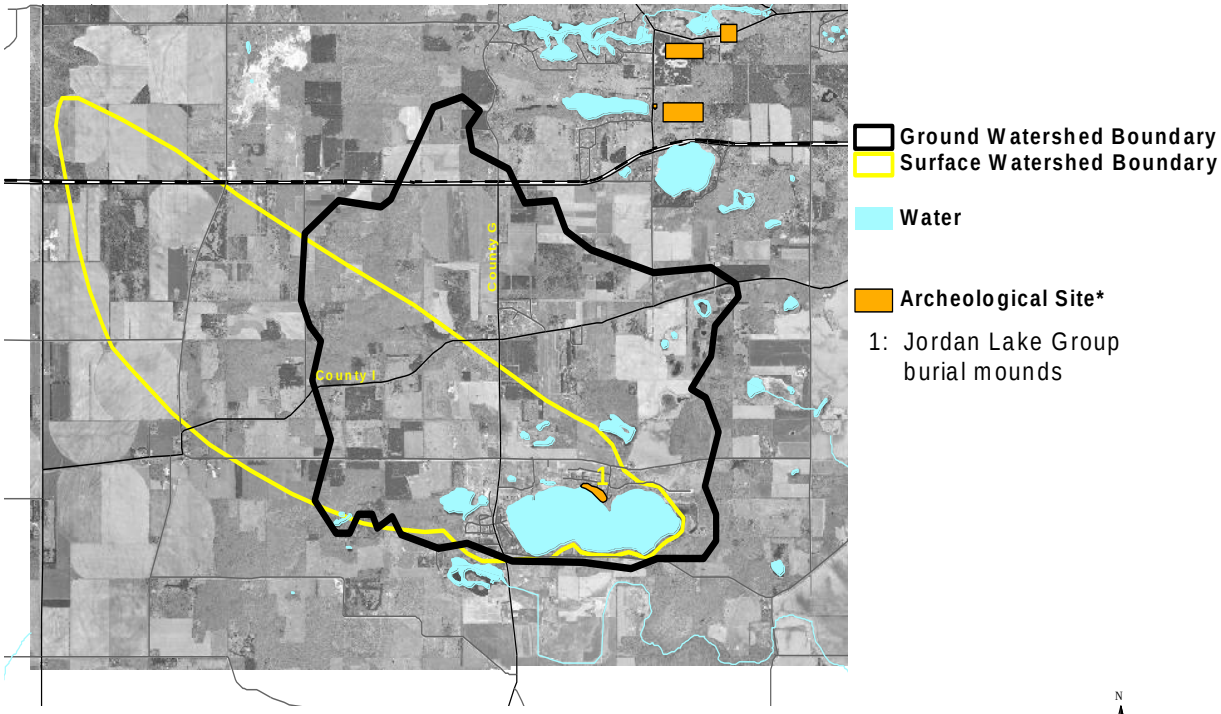
Introduction

Information about Jordan Lake: Jordan Lake is located in the Town of Jackson, Adams County, WI, in the south central part of Wisconsin. Jordan Lake is a mesotrophic /oliogotrophic seepage lake with good to very good water quality and very good water clarity. It has 213 surface acres, with a maximum depth of 80 feet. Except for one section, Jordan Lake is heavily-developed. As is the case for all seepage lakes, the water level on Jordan Lake fluctuates naturally with the underground water table. Jordan Lake is a "seepage" lake, a natural lake fed by precipitation, surface runoff, and groundwater. With no stream outlet, water leaves the lake through groundwater seepage or by evaporation from the lake's surface. The water table in most areas around the lake is fairly near the surface. There is a public boat ramp owned by the Adams County Parks Department on the west side of the lake.



Jordan Lake Archeological Site



RE:4/05; revised 7/06

*information from Wisconsin Historical Society

Conical mound

There are many Native American archeological sites in Adams County, with one located on the northern shore, mid-Jordan Lake. To protect Native American heritage, federal and state laws prohibit further disturbance of these sites without permission of the federal government and input from the local tribes.

Land Use

The surface watershed and ground watershed of Jordan Lake are about the same size. The ground watershed for extends north and west of the lake. Studies have shown that land use around a lake is the product of its watersheds, especially in the amount and content of stormwater runoff from the surface. Land use in both watersheds is concentrated. Stormwater runoff volume is affected by the amount of impervious surface, the soil type and the slope of the area. Natural landscape tends to have low stormwater runoff.

Land use by acreage and % of total are shown on the chart below:

	Surface		Ground		Total	
Jordan Lake	**Acres**	**% of Total**	**Acres**	**% of Total**	**Acres**	**% of Total**
Agriculture--Non Irrigated	1068.03	23.84%	641.9	24.65%	1709.93	24.14%
Agriculture--Irrigated	417.54	9.32%	539.71	20.73%	957.25	13.51%
Grassland/Pasture	110.66	2.47%	60.67	2.33%	171.33	2.42%
Residential	638.4	14.25%	432.27	16.60%	1070.67	15.11%
Water	384.38	8.58%	44.52	1.71%	428.90	6.05%
Woodland	1861.44	41.54%	884.98	33.98%	2746.42	38.77%
total	4480.45	100.00%	2604.05	100.00%	7084.50	100.00%

Woodlands are the largest individual land use in the Jordan Lake surface watershed and are also a large component in the ground watershed. Since forest floors are often full of leaves, needles and other duff, runoff from forested lands is often more filtered than that from agricultural or residential lands.

Agriculture (both irrigated and non-irrigated) is the second largest land use in the surface watershed and the largest land use in the ground watershed. Agriculture may contribute significantly to the nutrient loading of a water body.

Residential land use is the third most common use in Jordan Lake watersheds, especially around the lake itself, where residential land use is quite concentrated. This land use category, in some instances, may also contribute a significant amount of nutrients to the water from stormwater runoff, mowed lawns, and impervious surfaces. Nutrients from septic systems may also contribute to the loading into the water body.

There are several wetland areas in the watersheds, especially on the west end of the lake. 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 Jordan Lake waters.

The photo below shows one of the wetlands along Jordan Lake's shore. There are several wetlands at or near its shore.

One of wetlands along Jordan Lake shore

Like many lakes in Wisconsin, Jordan Lake is a phosphorus-limited lake. This means that of the pollutants that end up in the lake, the one in the shortest supply that 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 as the result of human activities.

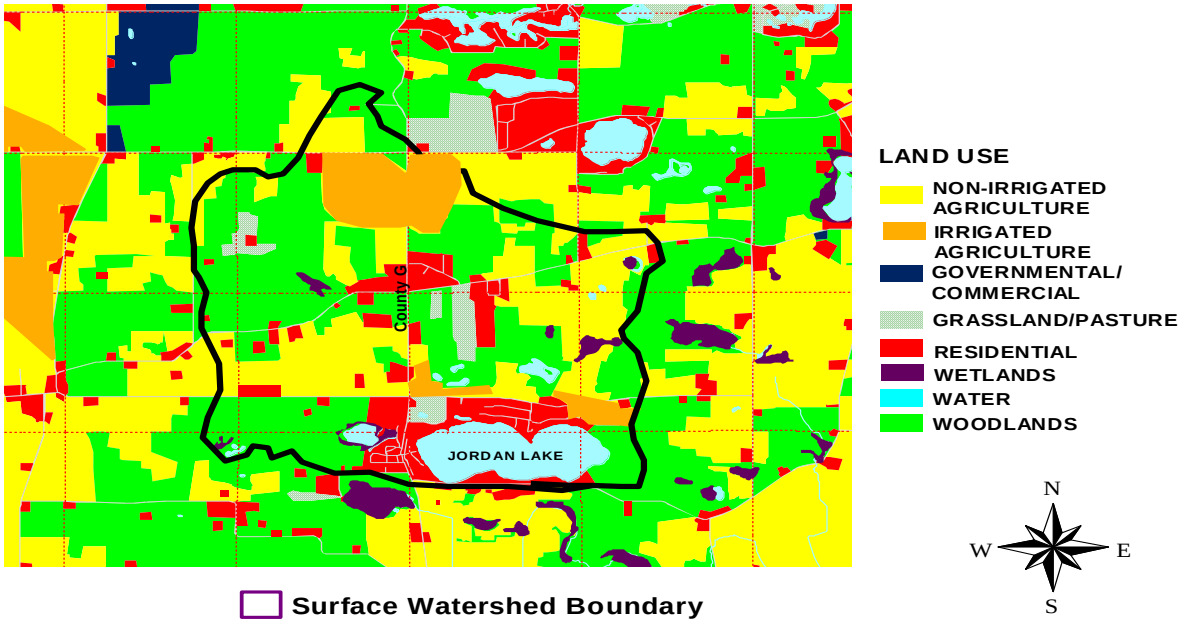
An additional phosphorus issue in a deep lake like Jordan Lake that stratifies is that twice a year, there is turnover, where what is on the bottom comes to the top and vice versa. Testing from 2004-2006 showed that phosphorus levels in the lower depths of Jordan Lake are substantially higher than those near the surface. Steps need to be taken to reduce the phosphorus entering the lake to reduce that accumulation at the bottom.

MOST LIKELY PHOSPHORUS LOADING		
BY LAND USE		lbs
	%	current
Agriculture--Non Irrigated	33.1%	365.20
Agriculture--Irrigated	24.1%	266.20
Grassland/Pasture	2.6%	28.60
Residential	15.3%	169.40
Other Water	2.1%	22.00
Woodland	4.4%	48.40
Groundshed	10.5%	116.60
Lake Surface	2.6%	28.60
Septic	5.3%	58.08
total in pounds/year	100.0%	1103.08

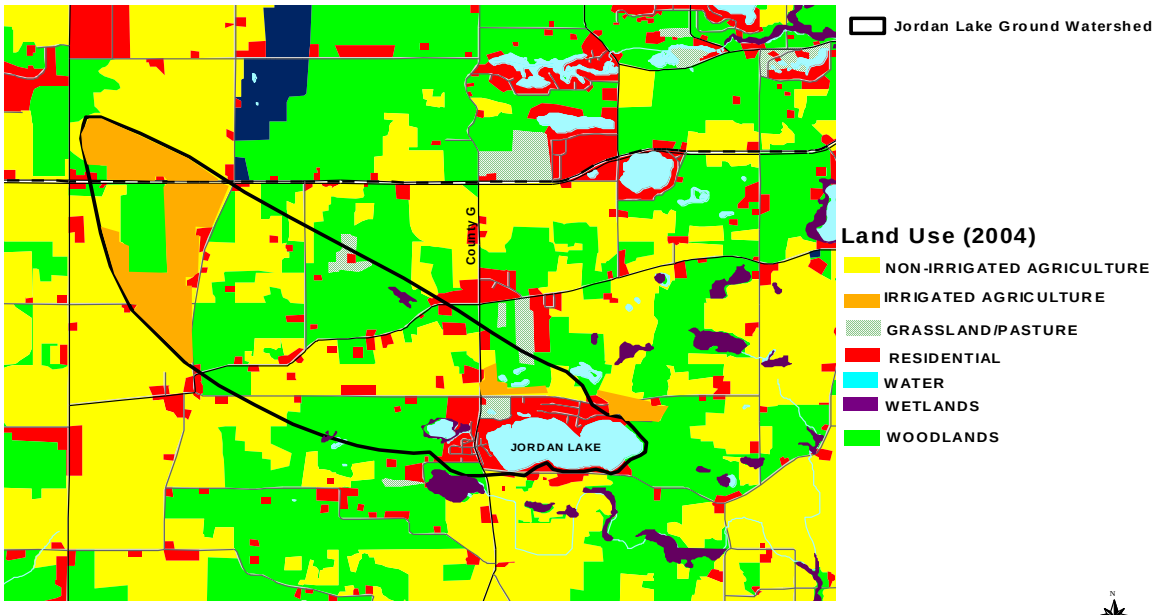
A 10% decrease in phosphorus loading just these areas—agriculture, residential & septic—would result in 97.55 **fewer** pounds of phosphorus per year. This may not initially sound like much. However, when it is considered that one pound of phosphorus can produce as much as 500 pounds of algae, the 42.97 pounds less of phosphorus could result in 48,775 pounds **fewer** of algae per year!

LAND USE	current	-10%	-25%	-50%
Agriculture--Non Irrigated	365.20	328.68	273.90	182.60
Agriculture--Irrigated	266.20	239.58	199.65	133.10
Grassland/Pasture	28.60	28.60	28.60	28.60
Residential	169.40	152.46	127.05	84.70
Other Water	22.00	22.00	22.00	22.00
Woodland	48.40	48.40	48.40	48.40
Groundshed	116.60	104.94	87.45	58.30
Lake Surface	28.60	28.60	28.60	28.60
Septic	58.08	52.27	43.56	29.04
total in pounds/year	1103.08	1005.53	859.21	615.34

Land Use--Jordan Lake Surface Watershed



JORDAN LAKE GROUND WATERSHED LAND USE



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Shorelands

Jordan Lake has a total shoreline 2.8 miles (14,784 feet). Most of the shoreline is in residential or commercial housing. Several buildings are located less than 70 feet from the high water mark. Some of the banks are steep and sandy; some are flatter. Marsh areas are located along some of the shore. There is an undeveloped section of shore on the east end of the lake.

Only about 28% of Jordan Lake's shoreline is vegetated with native plants (grasses, forbs, shrubs, trees). Over 42% of the shore was covered with traditional mowed lawn.

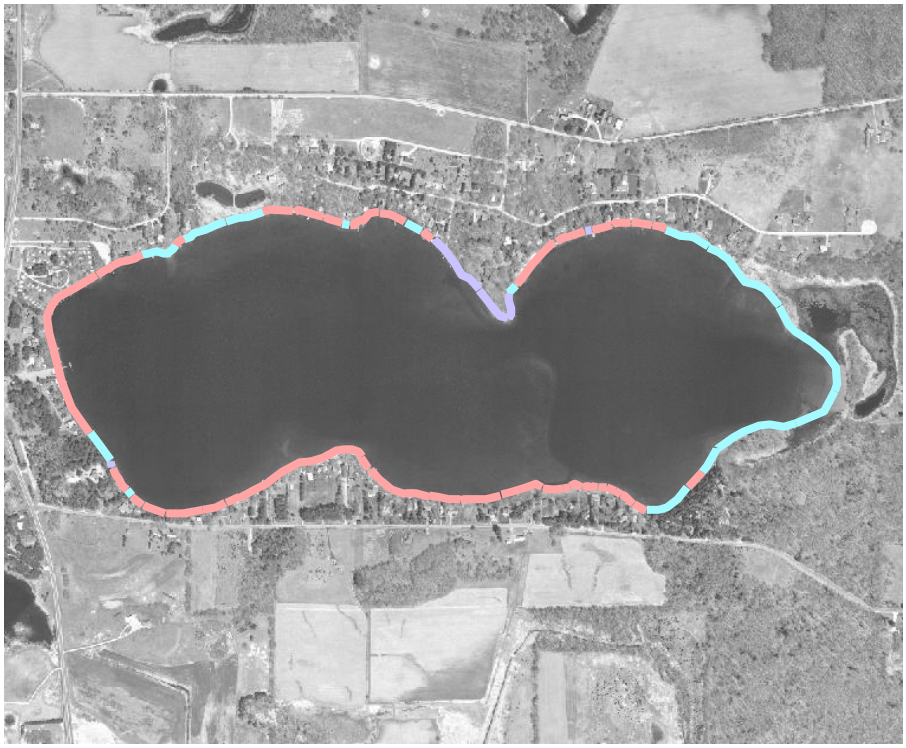
Shoreline on Jordan Lake

RE:2/05 Active Erosion Hard Structure Sand/Beach Vegetated Shore

Some of the undeveloped Jordan Lake shore

A 2004 shore survey showed that only about 1/4 of the shore had an "adequate buffer." An "adequate buffer" is a native vegetation strip at least 35 feet landward from the shore. Most of the "inadequate" buffer areas were those with hard structure, mowed lawns and/or insufficient native vegetation at the shoreline to cover 35 feet landward from the water line.

Jordan Lake Buffers



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Inadequate Buffers **Adequate Buffers**

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 Jordan 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.

Jordan Lake's overall TSI is 41 →

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 Jordan Lake in 2004-2006 was 11.19 feet. Since 1986, records show that the water clarity in Jordan 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 Jordan Lake was 15.0 micrograms/liter**.** This is below the 25 micrograms/liter average for natural lakes in Wisconsin. This places Jordan Lake in the "good" category for phosphorus. However, phosphorus levels have increased since 1986, so this needs to be reduced. Higher levels could be caused by many factors, including increased shore development, more impervious surface, weather changes, changes in nutrient input, etc.

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 Jordan Lake was 2.23 micrograms/liter. This level of chlorophyll-a gives Jordan Lake a "very good" ranking for chlorophyll-a (i.e., it's very low). Since 1986, Jordan Lake's chlorophyll-a levels have remained very 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. The Jordan Lake aquatic plant community is characterized by good quality and good species diversity. *Chara* spp (muskgrass), *Myriophyllum spicatum* (Eurasian watermilfoil, an invasive), and *Potamogeton pectinatus* (Sago pondweed) were the most common aquatic species.

Important to maintaining such 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 Jordan Lake is currently *Myriophyllum spicatum* (Eurasian watermilfoil), which currently has a patchy pattern of occurrence around the lake. Other invasive plants found were *Potamogeton crispus* (Curly-Leaf Pondweed) and *Phalaris arundinacea* (Reed Canary Grass). The latter two are less common at Jordan Lake.

Ten plant species—almost all native species--occurred at more than average density where they were present, although only *Chara* spp was found at higher than average densities over all the lake.

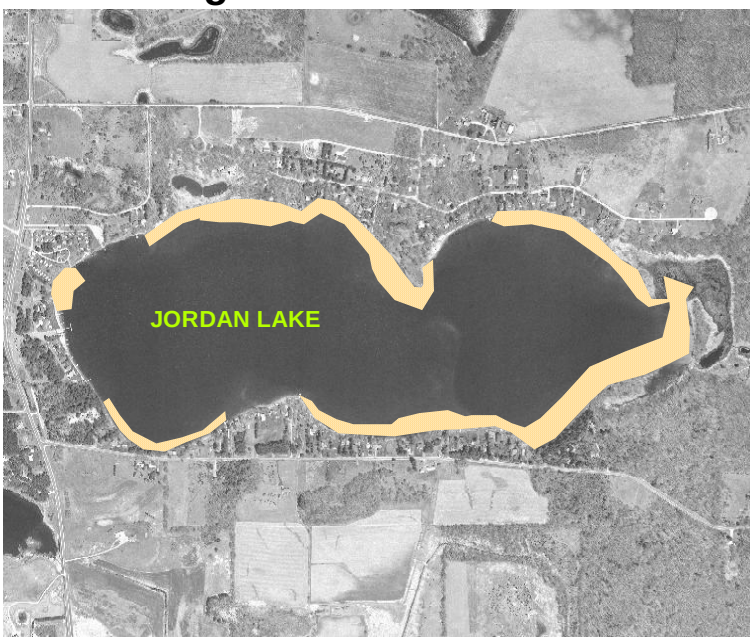
More detailed information can be found in the aquatic plant report of the 2006 survey, available on request from the WDNR or Adams County Land & Water Conservation Department.

Curly-Leaf Pondweed

Reed Canary Grass & Purple Loosestrife

Eurasian Watermilfoil

Emergent Plants Found 2006



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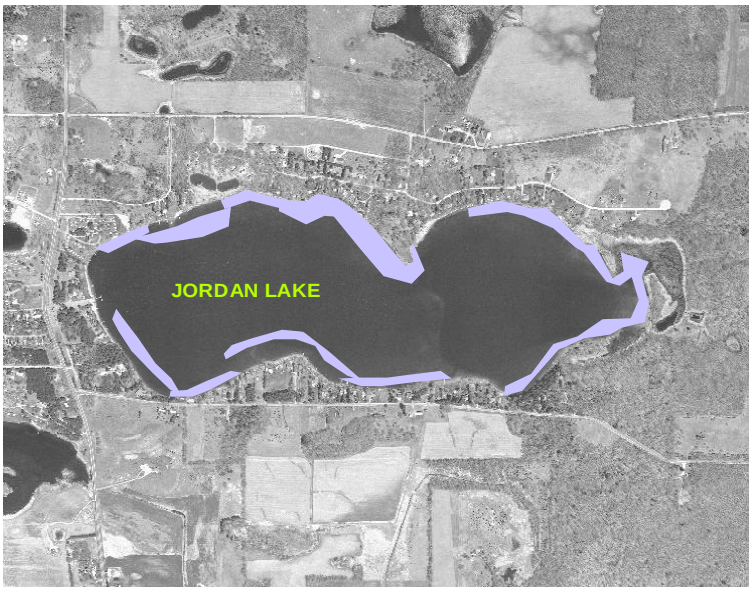
Emergent Plants Found 2006

Floating Plants in Jordan Lake 2006



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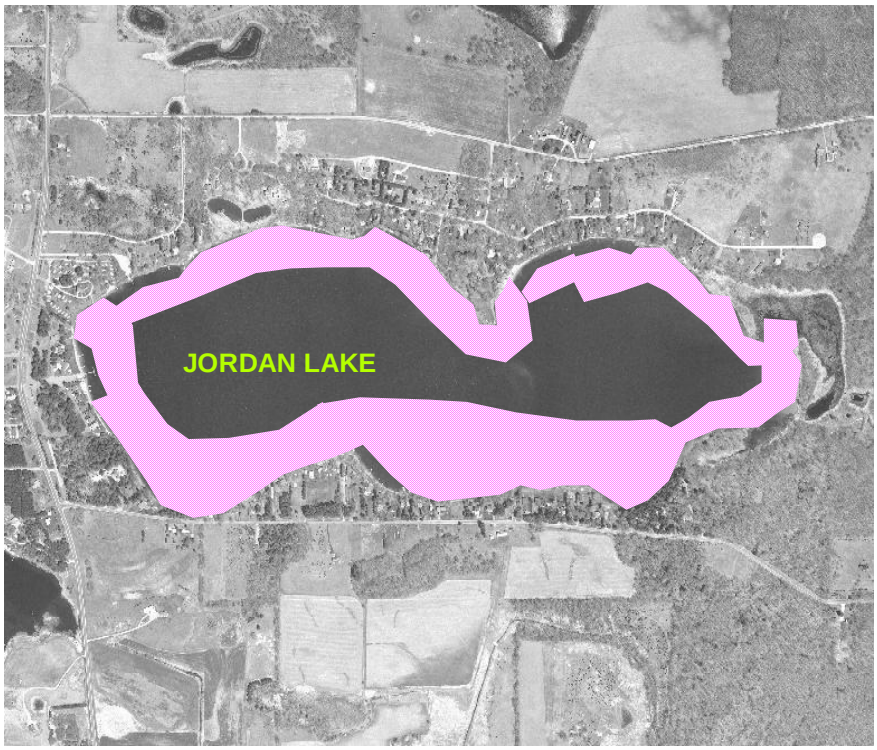
Floating-Leaf or Free-Floating Plants Found 2006

Submergent Plants in Jordan Lake 2006



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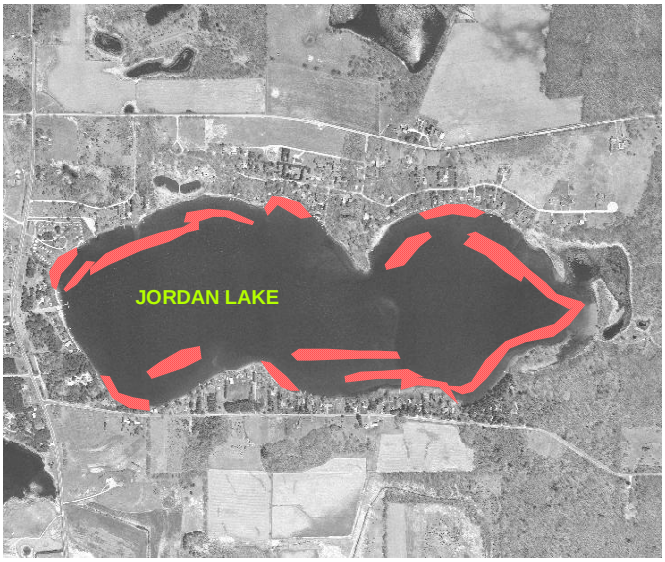
Submergent Plants Found

Exotic Aquatic Vegetation Found In Jordan Lake 2006



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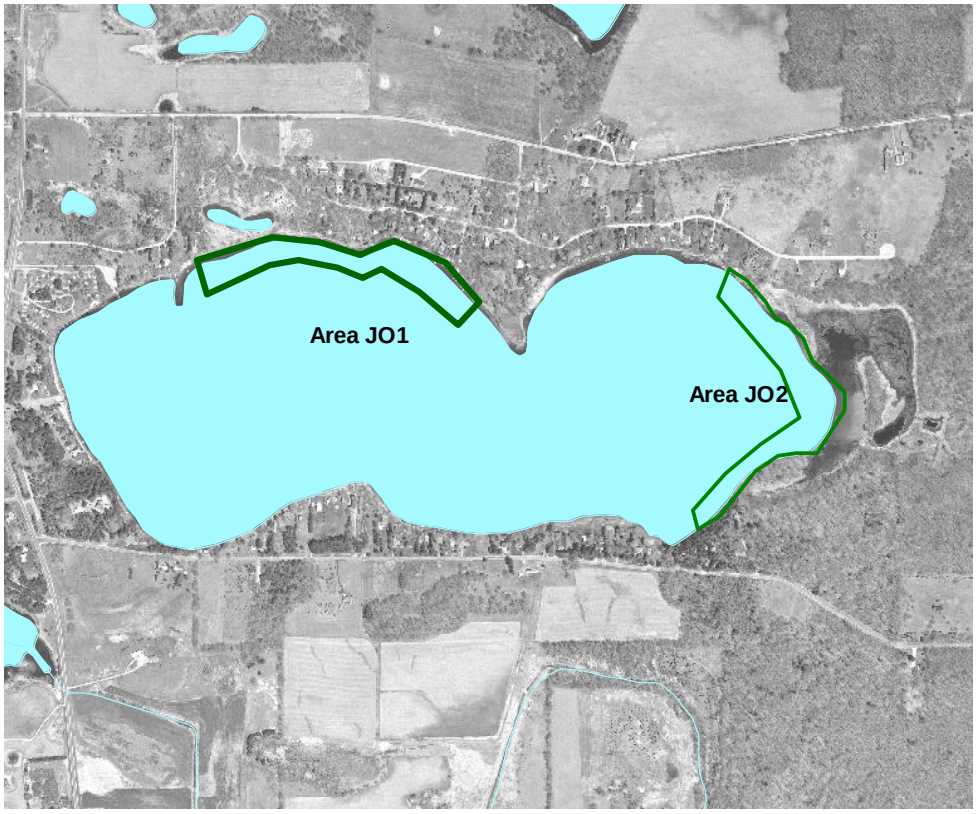
Exotic Aquatic Vegetation Found 2006

Critical Habitat

Critical Habitat Areas--Jordan



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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.

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

Two areas on Jordan Lake were determined to be appropriate for critical habitat designation. JO1 extends along approximately 2600 feet of the north shoreline of the Lake, up to the ordinary high water mark. JO2 extends along approximately 1800 feet of the far east shore and is, at the point, unaltered and undeveloped.

Photo of part of Area JO1

Photo of Part of JO2

Fishery/Wildlife/Endangered Resources

WDNR fish stocking records for Jordan Lake extend back to 1933, when 308 black bass were stocked. Fish were stocked by that agency most years since then, through 2002. Other fish that were stocked included walleye, perch, smallmouth bass, largemouth bass, northern pike and brown & rainbow trout. The most recent shocking inventory, in October 2006, found bluegills were abundant. Prior inventories have shown the presence of bullheads, ciscos, pumpkinseeds, crappie, suckers and shiners, in addition to the fish type stocked. An endangered species, Banded Killifish, was found in the lake previously. No other endangered resources in the Jordan Lake watersheds have been identified.

BLUEGILL

CRAPPIE

LARGE-MOUTHED BASS

Muskrat and mink are also known to use Jordan Lake shores for cover, reproduction and feeding. Seen during the field survey were various types of waterfowl, songbirds, and turkey. 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.

Fundulus Diaphanous
Banded Killifish

Recommendations

Lake Management Plan

- Once the lake management plan is approved by the WDNR, reviews need to make sure that the plant always 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 Jordan 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 Jordan Lake District should encourage the landowners & the Adams County Land & Water Conservation Department to design and implement practices to address the 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, which includes water quality monitoring, invasive species monitoring and Clean Boats, Clean Waters.
- Lake residents should protect and restore natural shoreline around Jordan Lake. Studies have found that there is lower frequency and density of the most sensitive plant species in disturbed shoreline areas.
- The sites that currently have inadequate buffers should have adequate buffers installed. Buffers are the least expensive way the filter pollutants and prevent or decrease their addition to the lake.

Aquatic Plant Recommendations

- All lake users should protect the aquatic plant community in Jordan Lake by assisting in developing and implementing an integrated aquatic plant management plan that uses multiple methods of control.
- The Jordan Lake District should maintain exotic species signs at the boat landings and contact DNR if the signs are missing or damaged.
- The Jordan Lake District should continue monitoring and control of Eurasian Watermilfoil maintain the most effective methods and modify if necessary. The Lake District 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 Jordan Lake in order to evaluate milfoil weevil availability for assistance in controlling the Eurasian Watermilfoil.
- Shores with inadequate buffers 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 Reed Canarygrass. Noting the presence and density of these plants—or other invasive species-- 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.
- Leave fallen trees along shoreline & in water.
- Seasonal protection of spawning habitat.
- Maintain the wildlife corridor.
- Protection emergent vegetation.
- No removal of aquatic vegetation in the littoral zone, except for the view/access corridor (30’ of 100’, or 30% of shores less than 100’) or for WDNR-approved projects.
- Seasonal control of exotics. Hand removal of exotics in these areas, if possible.
- No bank grading or grading of adjacent land. Shore restoration should be bioengineering, if possible.
- Maintain aquatic vegetation in undisturbed condition for wildlife habitat, fish use and water quality protection.
- Make these areas no-wake areas to encourage low disturbance.