LAKE CLASSIFICATION SHORT REPORT ON BIG ROCHE A CRI LAKE, ADAMS COUNTY, WI

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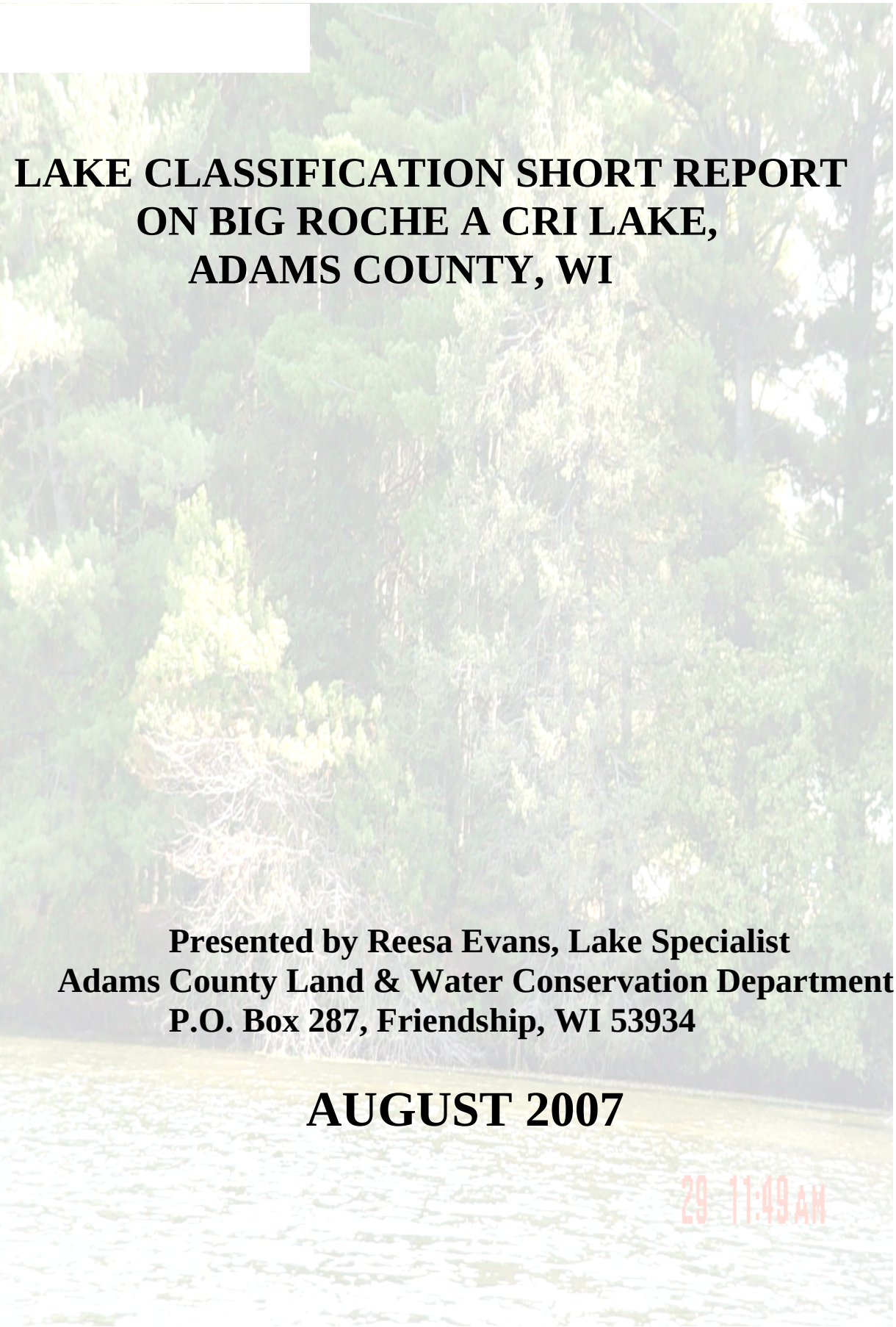
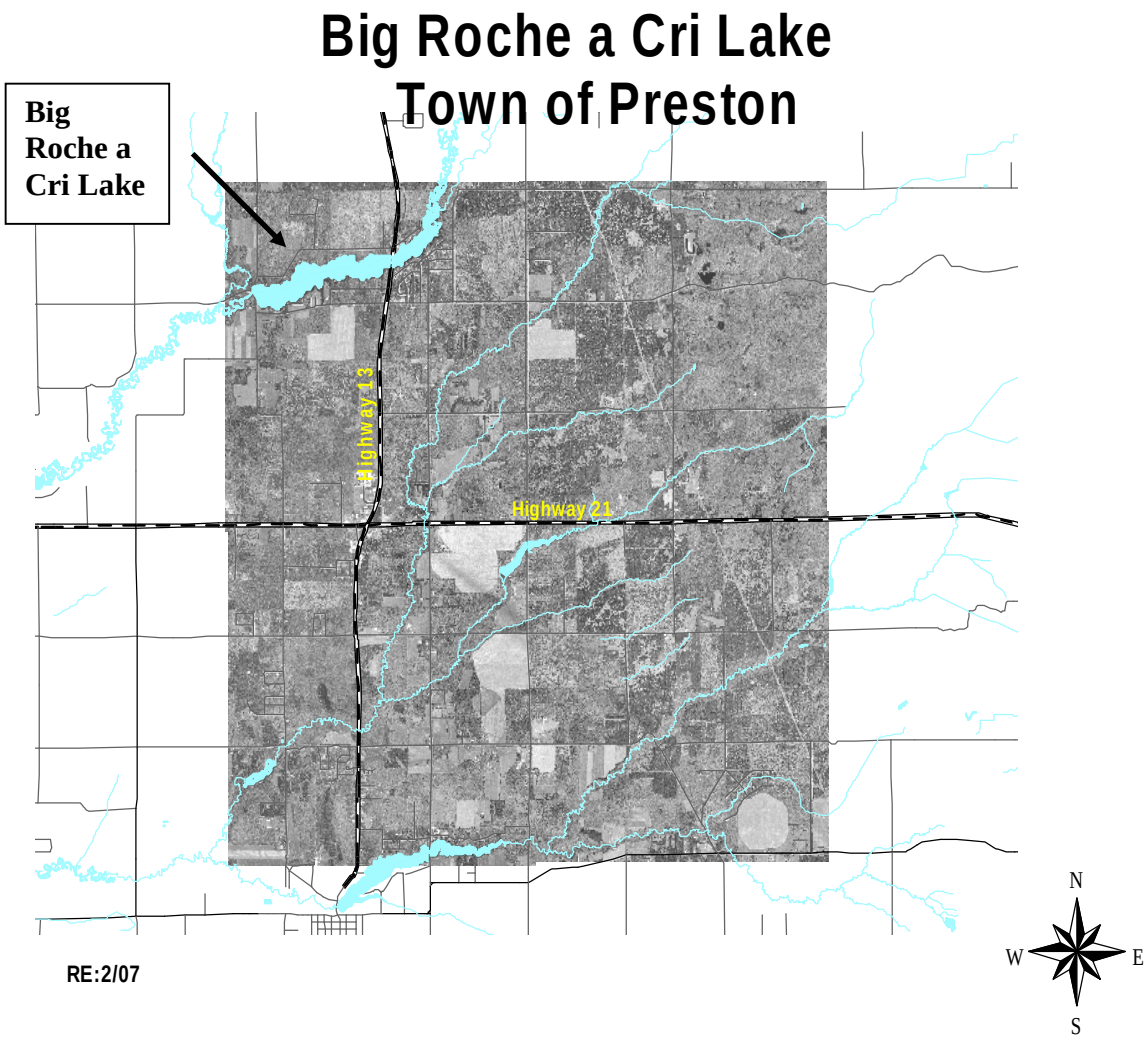
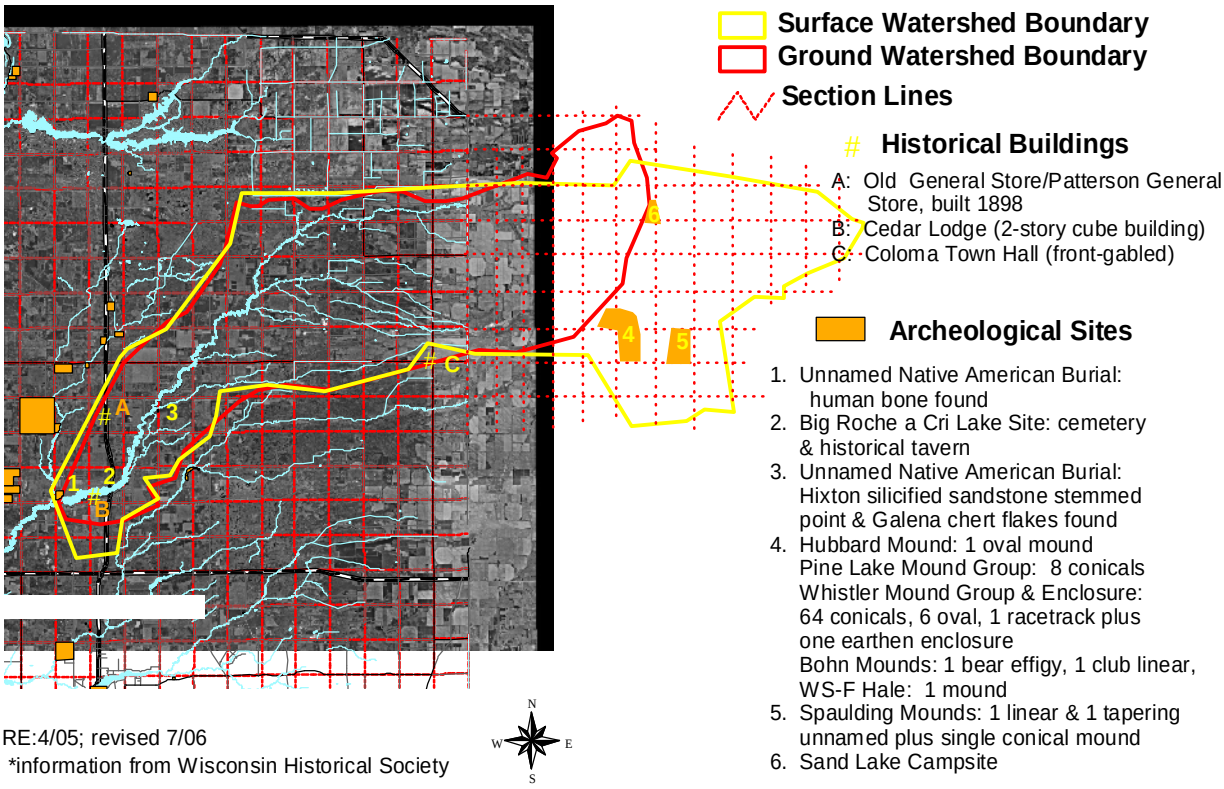


Introduction

Information about Big Roche a Cri Lake: Big Roche Cri Lake is located in north central Adams County in the Town of Preston. The impoundment has a surface area of 205 acres, a maximum depth of 25 feet and a mean depth of 9 feet. The lake has a large tributary area from Big Roche a Cri Creek that extends east into the next county (Waushara). Development occurs on most lots around the lake. The Cottonville Dam impounds water to form the Big Roche Cri Lake. The dam is owned by Adams County, but is leased to a private individual. The dam has been operated to produce hydroelectricity.



Archeological/Historical Sites in Big Roche a Cri Lake Watersheds*



RE:4/05; revised 7/06
*information from Wisconsin Historical Society

Conical mound

There are many Native American archeological sites in Adams County, with several being located in the Big Roche a Cri Lake watersheds. Several of the sites are burial mounds in conical, linear or effigy (animal) shape. In order to preserve Native American heritage, state and federal acts on Native American burials prohibit further disturbance of these sites without permission of the federal government and input from the local tribes.

There are also some historical building sites, noted on the map above.

Land Use

Both the surface and ground watersheds of Big Roche a Cri Lake are very large, over 20,000 acres. Studies have shown that lakes are products of their watersheds, i.e., that the watersheds have 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. Runoff from native landscapes tend to be low.

Land use by acres and percent of total are shown below:

	Surface		Ground		Total	
Big Roche a Cri	**Acres**	**% Total**	**Acres**	**% Total**	**Acres**	**% Total**
Agriculture--Non Irrigated	4569.84	9.75%	1673.99	8.27%	6243.83	9.30%
Agriculture--Irrigated	18,088.50	38.59%	6729.19	33.26%	24817.69	36.98%
Government	285.43	0.61%	103.18	0.51%	388.61	0.58%
Grassland/Pasture	808.86	1.73%	505.77	2.50%	1314.63	1.96%
Residential	3113.97	6.64%	2495.54	12.34%	5609.51	8.36%
Water	1820.21	3.88%	821.37	4.06%	2641.58	3.94%
Woodland	18,185.17	38.80%	7901.84	39.06%	26087.01	38.88%
total	46,871.98	100.00%	20,230.88	100.00%	67102.86	100.00%

The largest land use in both the surface and ground watersheds of Big Roche a Cri Lake is agricultural (both irrigated and non-irrigated). Agriculture may contribute significantly to the amount of nutrients in water.

Woodland is the second largest land use category in both the surface and ground watersheds. Since forest floors are often full of leaves, needles and other duff, runoff from wooded lands is may be more filtered than that from agricultural or residential lands.

Residential land use, especially around the lake itself, is the third largest land use. This land use category may also contribute nutrients to the water from stormwater runoff, mowed lawns, and impervious surfaces.

At the east end of the lake, there are a number of wetlands. 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 the wetlands for the continued health of Big Roche a Cri Lake waters.

Wetlands at East End of Lake

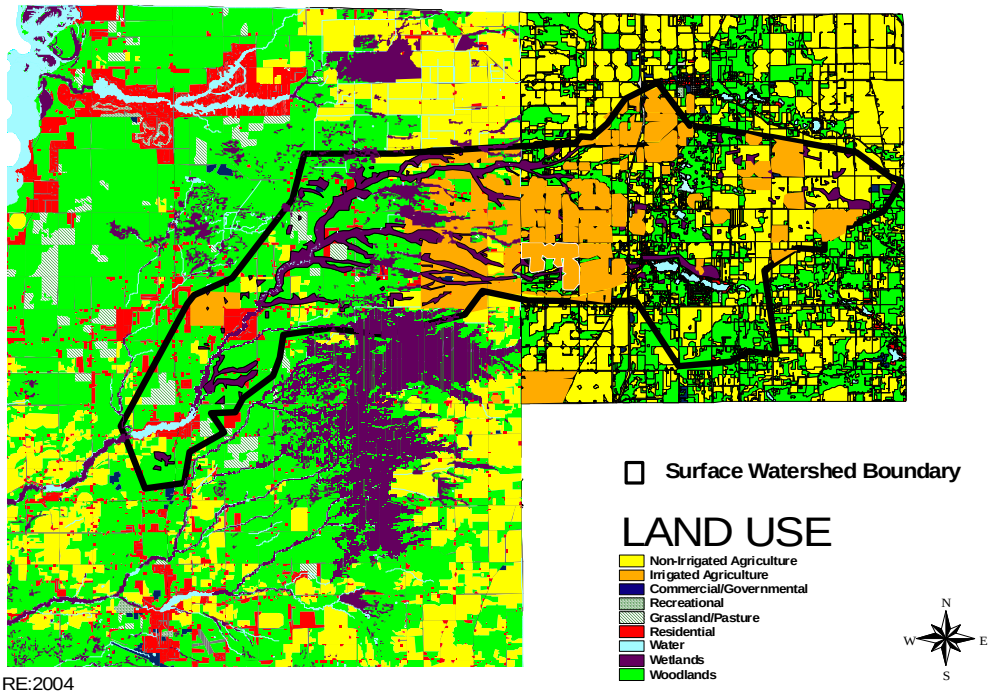
Like many lakes in Wisconsin, Big Roche a Cri Lake is a phosphorus-limited lake. This means that of the pollutants that end up in the lake, the one in the shortest supply and that most affects the overall quality of the lake water is phosphorus. Land use types play a major role in determining the amount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

MOST LIKELY PHOSPHORUS LOADING		
BY LAND USE	Current	%
Agriculture--Non Irrigated	1628.00	13.8%
Agriculture--Irrigated	8052.00	68.2%
Government	13.20	0.1%
Grassland/Pasture	107.80	0.9%
Residential	336.60	2.9%
Other Water	215.60	1.8%
Woodland	497.20	4.2%
Groundshed	899.80	7.6%
Lake Surface	26.40	0.2%
Septic	29.04	0.2%
total in pounds/year	11805.64	100.0%

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 and septic use of the land can be increased or decreased by human activities. Decreasing the phosphorus load of agricultural, residential and septic use by just 10% per year would result in 1094.44 fewer pounds of phosphorus per in the lake. Since one pound of phosphorus can produce up to 500 pounds of algae, the 10% reduction could translate into 547,220 **fewer** pounds of algae per year of the lake!

	Current	-10%	-25%	-50%
Agriculture--Non Irrigated	1628.00	1465.20	1221.00	814.00
Agriculture--Irrigated	8052.00	7246.80	6039.00	4026.00
Government	13.20	13.20	13.20	13.20
Grassland/Pasture	107.80	107.80	107.80	107.80
Residential	336.60	302.94	252.45	168.30
Other Water	215.60	215.60	215.60	215.60
Woodland	497.20	497.20	497.20	497.20
Groundshed	899.80	809.82	674.85	449.90
Lake Surface	26.40	26.50	26.50	26.50
Septic	29.04	26.136	21.78	14.52
total in pounds/year	11805.64	10711.20	9069.38	6333.02

Land Use--Big Roche a Cri Lake Surface Watershed



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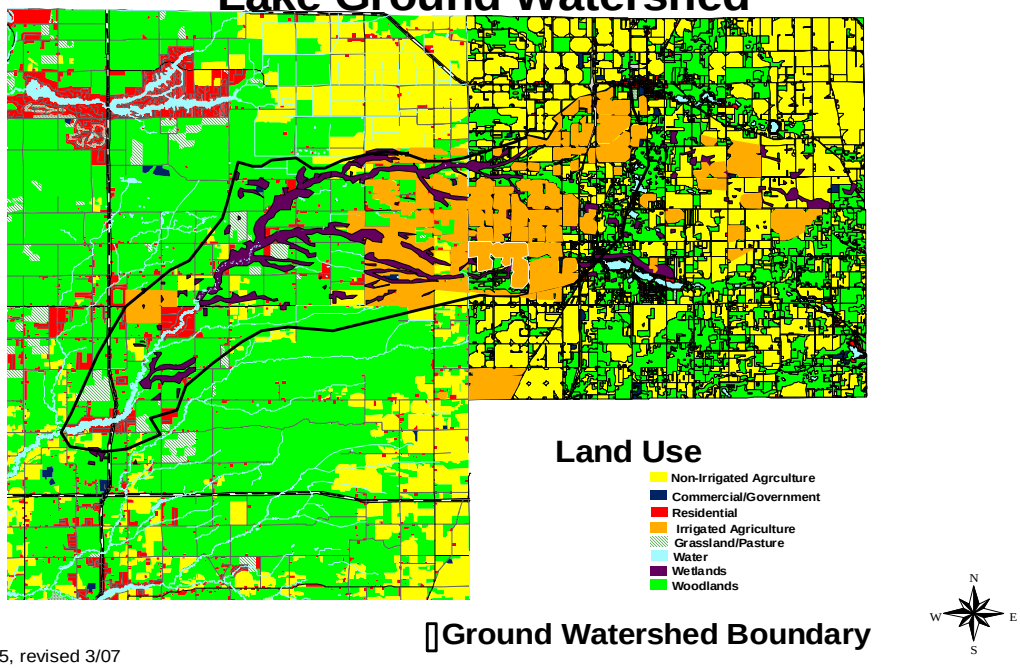
Land Use in Big Roche a Cri Lake Ground Watershed



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Shorelands

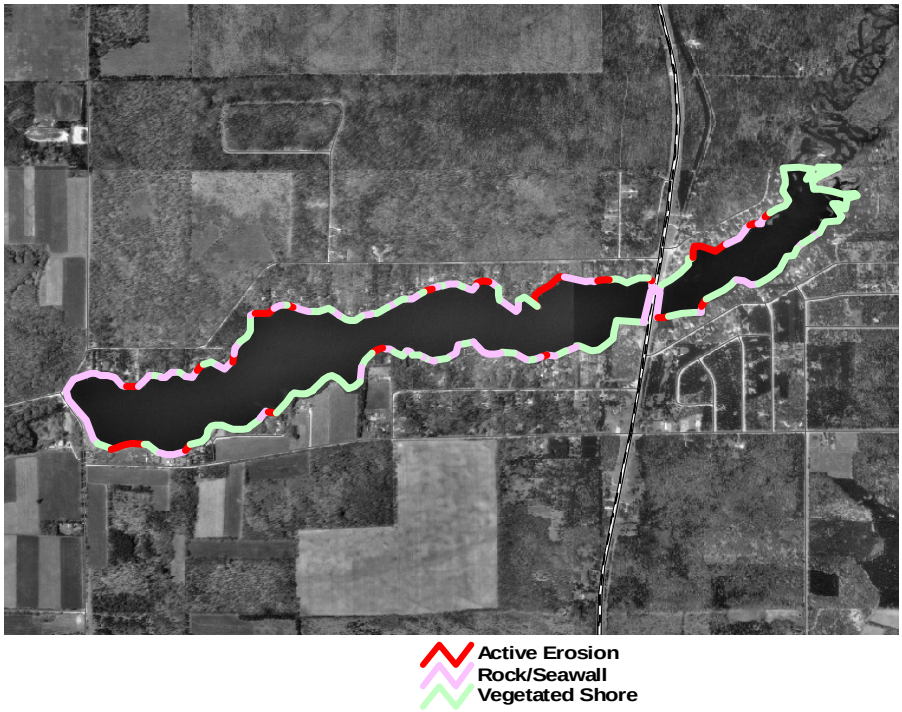
Big Roche a Cri Lake has a total shoreline 6.1 miles (32,208 feet). Most of the eastern third of the lake is less than 5' deep and is less developed than the western 2/3 of the lake. The eastern-most end of the lake has been largely left unaltered.

Most of the areas near the shore are steeply sloped, with soft steep, sometimes nearly vertical hills. Buildings are generally located 70 or more feet back from the shore, except at the far northwest part of the lake, where the shore flattens out.

64% of Big Roche a Cri Lake's shoreline is vegetated. However; a 2004 shore survey showed that only 33.6% of the shore had an "adequate buffer." An "adequate buffer" is a native vegetation strip at least 35 feet landward from the shore. The "inadequate" buffer areas included those with traditional mowed lawns, with rock riprap or seawall, or with insufficient native vegetation at the shoreline to cover 35 feet landward from the water line.

Since the survey in 2004, several properties on Big Roche a Cri Lake have had shoreland improvement practices, including planting of buffers, protecting shorelines and stormwater management.

Shoreline--Big Roche a Cri Lake



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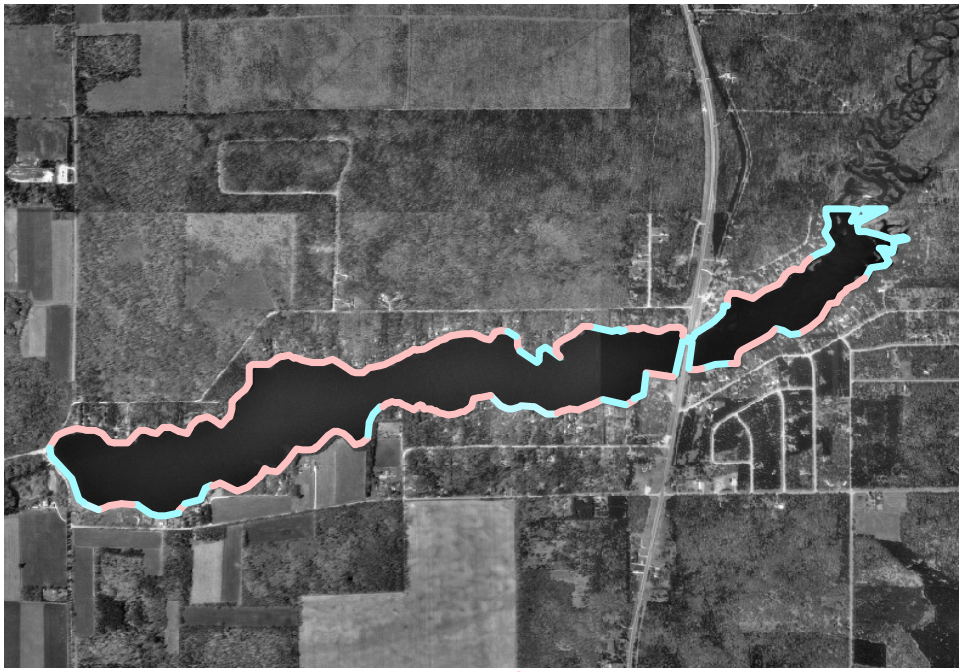
Shoreland buffers are an important part of lake protection and restoration. These buffers are simply a wide border of native plants, grasses, shrubs and trees that filter and trap soil & similar sediments, fertilizer, grass clippings, stormwater runoff and other potential pollutants, keeping them out 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 sandy, as are many of the Big Roche a Cri Lake shores.

Buffers--Big Roche a Cri Lake



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Adequate Buffer

Inadequate Buffer

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.

BRC Lake's overall TSI is 55

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 Big Roche a Cri Lake in 2004-2006 was 7.19 feet**. This depth puts Big Roche a Cri Lake's water clarity in the "good" category and is similar to the historic Secchi disk levels in the 1990s. 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 Big Roche a Cri Lake was 33.91 micrograms/liter.** This is in the "fair" category, but the total phosphorus level has increased since 1995, suggesting further accumulation of nutrients, probably from non-point pollution sources such as increased stormwater runoff (from increased development), aging septic systems, higher agricultural runoff, pet wastes or lawn fertilization. The phosphorus levels should be monitored and may need a plan for management to prevent further accumulations and reduce the current levels.

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 Big Roche a Cri Lake was 14.1 micrograms/liter.** This level gives Big Roche a Cri Lake a "fair" ranking for chlorophyll-a. However, this is substantially higher than the average 3 micrograms per liter registered in the 1990s. Increased levels could be from the hot dry weather, but also from greater accumulations of nutrients in the water.

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 Big Roche a Cri Lake aquatic plant community is characterized by below average quality, but good species diversity. The quality of the community has been negatively impacted by high levels of disturbance. *Ceratophyllum demersum* (coontail), *Elodea canadensis* (waterweed), *Myriophyllum spicatum* (Eurasian watermilfoil, an invasive) and *Vallisneria americana* (water celery) were the most common aquatic species.

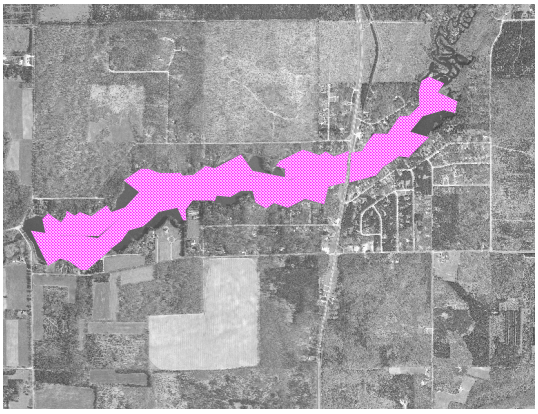
Important to improving quality and diversity of the aquatic plant community is an integrated aquatic plant management plant that controls the invasive plants in the lake. The most prevalent invasive exotic in Big Roche a Cri Lake is currently *Myriophyllum spicatum* (Eurasian watermilfoil), which occurred in all four depth zones, with the higher occurrence in the 5'-10' depth zone and a substantially occurrence even in the 10'-20' depth zone. Other invasive plants found were *Potamogeton crispus* (Curly-Leaf Pondweed) and *Phalaris arundinacea* (Reed Canary Grass). The latter two are less common at Big Roche a Cri Lake.

Curly-Leaf Pondweed

Purple Loosestrife

Eurasian Watermilfoil

Submergent Plants in Big Roche a Cri Lake



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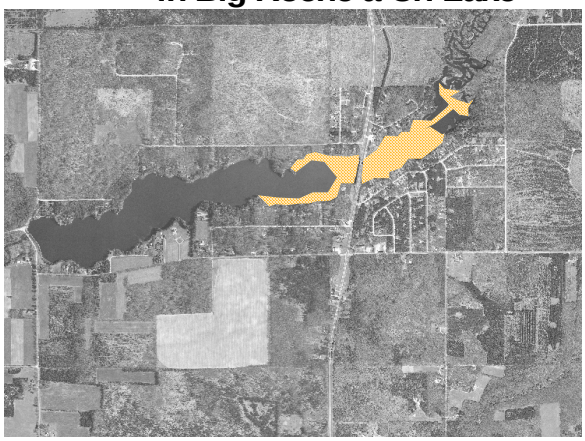
Submergent Plants Found

Free-Floating & Floating-Leaf Plants in Big Roche a Cri Lake



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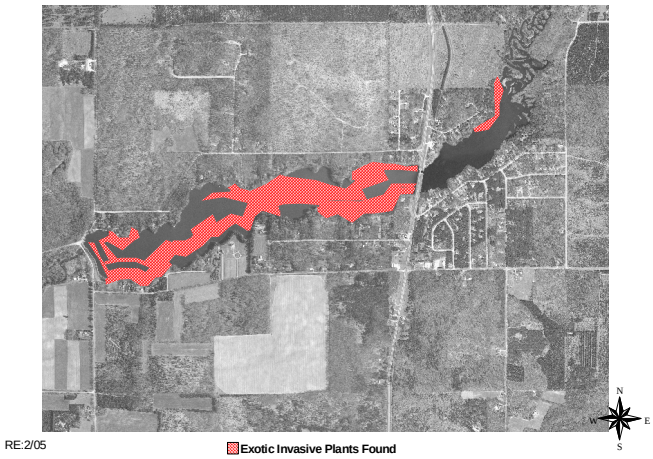
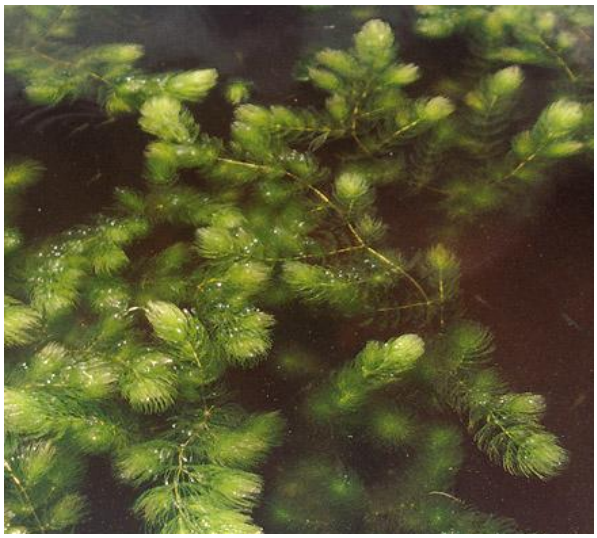
Free-Floating & Floating-Leaf Plants Found

Emergent Plants in Big Roche a Cri Lake

Emergent Plants Found

Exotic Invasives in Big Roche a Cri Lake





***Ceratophyllum demersum* Coontail**
The most common plant in BRC Lake

More detailed information can be found in the aquatic plant report of the 2004 survey, available on request from the WDNR or Adams County Land & Water Conservation Department.

Critical Habitat

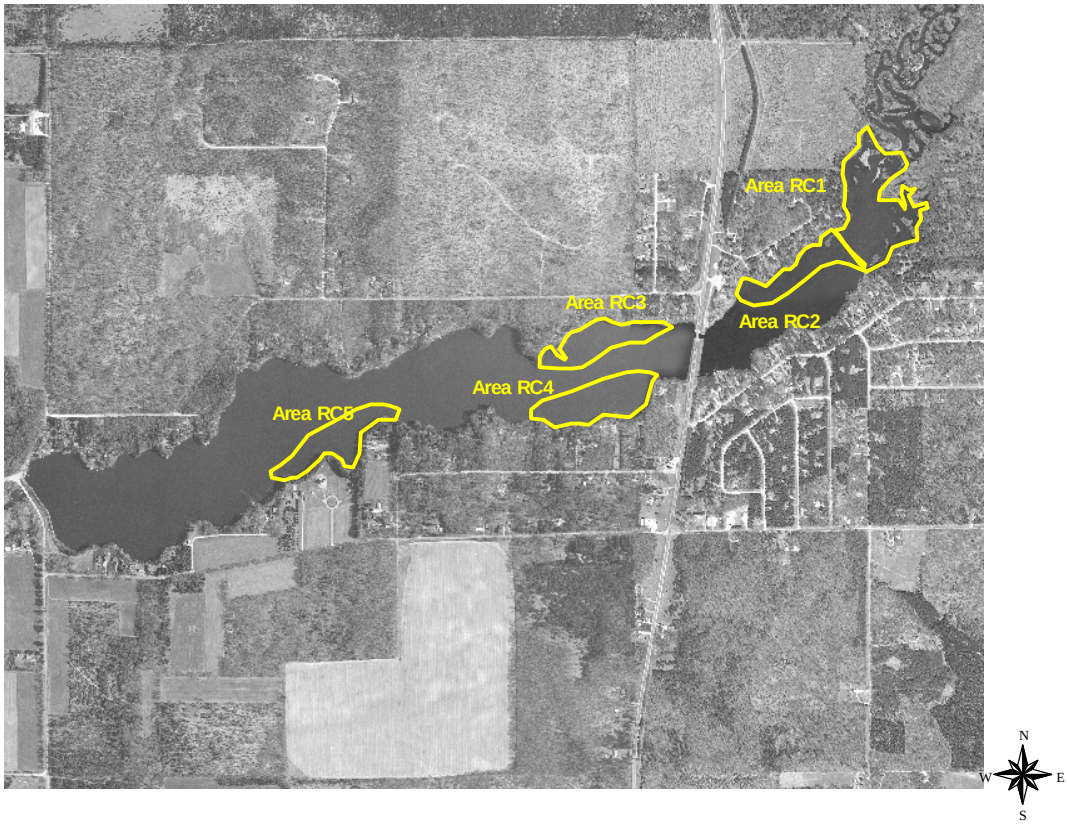
Wisconsin Rule 107.05(3)(i)(I) defines a “critical habitat areas” as: “areas of aquatic vegetation identified by the department as offering critical or unique fish & wildlife habitat or offering water quality or erosion control benefits to the body of water. Thus, these sites are essential to support 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.

Five areas on Big Roche a Cri Lake were determined to be appropriate for critical habitat designation. RC1 is 13 acres of the shallow river inlet, which is largel6 undisturbed, and contains shallow marsh wetlands and shrub-carr. RC2 extends along approximately 1500 feet of the northern shoreline of the east basin of the lake. It includes deep marsh and shrub-carr areas. About 1500 feet of shoreline along the north shore, just west of Highway 13, comprises RC3. RC4 is about 1100 feet of the south shore, just west of Highway 13. Finally, RC5 is about 1900 feet of shore on the south shore of the lake, in the narrows areas.

Part of RC5

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

Critical Habitat Areas--Big Roche a Cri Lake



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Part of RC2

Part of RC3

Fishery/Wildlife/Endangered Resources

Greater Prairie Chicken

Karner Blue Butterfly

1-Flowered Broomrape

WDNR fish stocking records for Big Roche a Cri Lake go back to 1932, when 196 black bass were stocked. Stocking continued through the 1970s. Fish types stocked in those years also included perch, smallmouth bass, bullheads, largemouth bass, and northern pike. The first recorded fish inventory by the WDNR was in 1957, when bluegills and white sucker were abundant; black crappie were common; and northern pike, largemouth bass, yellow perch, and bullheads were scarce. In the most recent fish inventories in 1998 and 2002, largemouth bass and bluegill were abundant; other fish, including northern pike, yellow perch, black crappie and bullheads, were scarce.

Muskrat and mink are also known to use Big Roche a Cri 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.

The Big Roche a Cri watersheds were inventoried in the 1990s by the WDNR Natural Heritage Inventory personnel. Endangered natural communities in the watersheds include: alder thicket; floodplain forest; northern sedge meadow; and stream (hard, fast, cold). Plants of concern were 1-Flowered Broomrape, Slim-Stem Small Reedgrass and Whip Nutrush. The pygmy shrew and greater prairie chicken are also known to inhabit these watersheds. Endangered invertebrates in the area include the Karner Blue butterfly, Persius Dusky Wing butterfly, Sand snaketail dragonfly and a tiger beetle.

Recommendations

Lake Management Plan

- The Lake District should make sure when it annually reviews its Management Plan, the plan always includes the following: aquatic species management; control/management of invasive species; wildlife and fishery management; nutrient budgeting; shoreland & 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 Big Roche a Cri 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, Big Roche a Cri Lake District should encourage landowners and Adams County Land & Water Conservation Department to develop and implement steps for dealing with identified 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 now includes water quality monitoring, invasive species monitoring and the Clean Boats, Clean Waters agenda.
- Lake residents should protect and restore natural shoreline around Big Roche a Cri Lake. Studies show lower frequency and density of the most sensitive plant species in disturbed shoreline areas, suggesting that shore disturbance can negatively impact the aquatic plant community of a lake.

Aquatic Plant Recommendations

- Lake Residents & the lake district should be sure that they review & implement an integrated aquatic plant management plan that uses various 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 Big Roche a Cri Lake District should continue monitoring and control of Eurasian Watermilfoil to maintain the most effective methods and modify if necessary. The District should investigate ways to increase treatment effectiveness in the deeper water. Residents may need to hand-pull scattered plants. Winter drawdowns to help control EWM should occur no more than once every 3 to 5 years and need to be timed to reduce impacts on reptiles and amphibians. No chemicals are recommended at this time.
- A milfoil weevil survey should be conducted on Big Roche a Cri Lake in order to evaluate milfoil weevil availability for assistance in controlling EWM.
- 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. Noting the presence and density of invasives 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. Restore natural shorelines where possible to help protect habitat and water quality.
- Leave fallen trees along shoreline & in water.
- Seasonal protection of spawning habitat.
- Maintain the wildlife corridor.
- No use of chemicals on lawns above these sites.
- Protection emergent vegetation.
- Seasonal control of exotics. Use controls as specific as possible. No broad spectrum control of exotics is recommended.
- No bank grading or grading of adjacent land. Shoreline erosion control should favor bioengineering, rather than rock riprap or retaining walls.
- Maintain aquatic vegetation in undisturbed condition for wildlife habitat, fish use and water quality protection.
- Pier placement by permit only and only constructed of light-penetrating pier material.
- No dredging or lake bed removal in these areas.
- Make such areas “no-wake” to reduce disturbances.