DRUID LAKE SENSITIVE AREA MAP AND PROTECTION STRATEGY

INTRODUCTION

Druid Lake is located in the Town of Erin, Washington County. Druid Lake is on the upper end of the Ashippun River with the river flowing into and out of the lake on the east-end. The lake is located within a one-half hour drive of Milwaukee. Because of its location, fishery and scenic beauty of the Kettle Moraine area, Druid Lake has been experiencing increased pressures on lake and shoreland use.

As part of the development of a total Lake Management Plan for Druid Lake, a sensitive area map and protection strategy has been accomplished. This report covers that aspect of the management plan.

The Druid Lake Inland Protection and Rehabilitation District Board indicated a concern for the protection of the aquatic ecosystem of the lake. The delicate ecosystem of the lake can be easily damaged by the actions of man. Activities such as boating and shoreline development can progressively change the character of a lake.

The quality of an aquatic ecosystem is directly related to the quality of the habitat in the lake. To protect the aquatic community, it is important to understand the types and locations of the important aquatic habitats. Aquatic macrophyte beds provide spawning areas for fish, nursery areas for small fry and a substrate for macroinvertebrates. Once identified, critical habitats can be protected through the designation of these habitats as "sensitive areas" under Wisconsin Administrative Code NR 107. A sensitive area map can act similarly to a zoning map for upland areas, identifying where activities and development should and should not occur.

The Sensitive Area Map as prepared for Druid Lake was constructed according to the following process:

1. A base map was prepared for the lake using the existing hydrographic map of the lake prepared by the Wisconsin Department of Natural Resources and aerial photographs from the Southeastern Wisconsin Regional Planning Commission (Figure 1).

2. An aquatic macrophyte survey of the lake was conducted, identifying species types, locations and plant abundance. The modified Jensen-Loud method developed by the Wisconsin Department of Natural Resources was used for the survey. Figure 2 illustrated the location of the sampling transits. A map showing the aerial extent of the aquatic plant beds was produced (Figure 3).

Figure 1 – Lake Map

3. A survey of the bottom substrate of the lake was conducted to identify habitat types. A map of the lake showing bottom substrate types was produced (Figure 4). Bottom substrates were mapped based on their percent of gravel, sand, marl and organic muck. Substrates were mapped out to a depth of 20 feet.

4. Based on the information in 1-3, and a review of WDNR fish management files, critical habitats for fish spawning, fish nursery areas and aquatic invertebrates were identified.

5. Once the environmentally sensitive areas on the lake were identified, potential threats to these habitats were researched. Potential threats include such things as high speed boating, significant riparian land use changes, increased surface water runoff, installation of seawalls and docking facilities, etc.

The quality of an aquatic ecosystem is directly related to the quality of the habitat in the lake. To protect the aquatic community, it is important to understand the types and locations of the important aquatic habitats. Included in this report are summary maps showing the aquatic macrophyte beds, bottom substrate, fish spawning areas, fish nursery areas, important macroinvertebrate habitat, spring areas and recommendations for protection. There is also a map showing the Druid Lake Bottom Substrate Survey essential for the locations of aquatic plant habitat. This report and maps will be incorporated into the Lake Management Plan and can be used for submittal to the Wisconsin Department of Natural Resources for adoption under State Administrative Code NR 107.

Druid Lake is a 120-acre lake with a maximum depth of 53 feet and mean depth of 25 feet. Due to a relatively deep mean depth, Druid Lake has a correspondingly small littoral zone (shallow area) in which aquatic life feeds and spawns. The fishery of Druid Lake is made up of predominantly panfish, with small numbers of Northern Pike, Walleye and Largemouth Bass. Protection of the limited littoral habitat is important to the protection of Druid Lake's fishery. The first step in protection of the important habitat area is preparation of a "Sensitive Area Map" of the lake so that natural areas can be identified.

Natural areas for lakes in Wisconsin are identified along public shorelines and are intended to preserve important habitat. Areas of the shoreline where aquatic vegetation is comprised of predominately native species and "identified as offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the area" may be included as a natural area under Wisconsin Admin. Code NR 107.

PLANT COMMUNITIES OF DRUID LAKE

Aquatic plant growth in this lake is confined to small areas around the shoreline of the lake and in two mucky bays. Around the shoreline the aquatic plants do not extend out past a depth of 20 feet. The total area of the lake occupied by aquatic plants is estimated to be 1.7 acres (or 1.3% of the entire lake area). This excludes the bays that are primarily water lillies and watermilfoil. All of these species are of ecological importance because they provide critical fish habitat, spawning, nursery, food and cover as well as wildlife habitat (nesting, food and migration). These areas protect water quality and help prevent shoreline erosion. Because these areas are so small on Druid Lake, it is advisable for each one to be designated a "natural area".

Aquatic plants in Druid Lake were surveyed using a transect method. From sites located on the shoreline. A transect was created by rowing a boat into the lake perpendicular to the shoreline. Along the transect, sampling began at 0.5 m deep and continued at depth intervals of 0.5 m until no aquatic vegetation was detected. The last depth where plants grew is considered the maximum rooting depth. Nine transects were sampled in Druid Lake (Figure 2). The results of the survey are summarized in Table 1.

In Druid Lake, the following macrophyte species were found: Bullrush, Curlyleaf pondweed, Large leaf pondweed, Sago pondweed, White water lily and Yellow water lily. The location of the various aquatic plant communities are illustrated on Figure 3. Following are brief descriptions taken from "A Guide to Aquatic Plants" published by the Minnesota Department of Natural Resources. These paragraphs describe the benefits or detriments of each species present.

Large Leaf Pondweed (Broad-leafed Pondweeds) (*Potamogeton spp*.) -- Broad-leaf pondweeds provide excellent habitat for panfish, largemouth bass, muskellunge, and northern pike. Bluegills nest near these plants and eat insects and other macroinvertebrates found on the leaves; walleyes use these pondweeds for cover.

Although Curlyleaf Pondweed (*Potamogeton crispus*) is an exotic species it does provide cover for fish, seed and winter buds for waterfowl. It is also found to be associated with the desirable native species of wild celery (*Vallisneria americana*) and Sago Pondweed (*Potamogeton pectinatus*). Although wild celery is not currently found in the lake it would appear that the habitat is suitable for its survival.

Bullrushes (*Scirpus spp.*) are excellent fish habitat, providing spawning areas for northern pike and, in early spring, providing nesting cover for largemouth bass and bluegills. Bulrushes attract marsh birds and songbirds and provide food for ducks, geese and swans.

Table 1. Aquatic Macrophyte Survey Summary.

Transit number	Depth (m)	Depth (ft)	Macrophyte species A=abundant (>40%), P=present (10-40%), R=rare (<10%): Bull-rush	Curly leaf pondweed	Large leaf pond weed	Sago pond weed	White water lily	Yellow water lily	None	Substrate type M=muck S=sand G=gravel
1	0.0	0.0							x	G
	0.5	1.6							x	S
	1.0	3.3							x	S
	2.0	6.6							x	S
	3.0	9.8							x	S
	4.0	13.1							x	S
2	0.0	0.0							x	G
	0.5	1.6							x	S
	1.0	3.3							x	S
	2.0	6.6							x	S
	3.0	9.8							x	S
	4.0	13.1							x	S
3	0.0	0.0	A							S
	0.5	1.6							x	S
	1.0	3.3							x	S
	2.0	6.6							x	S
	3.0	9.8							x	S
	4.0	13.1							x	S
4	0.0	0.0							x	S
	0.5	1.6		R						S
	1.0	3.3					A			S
	2.0	6.6							x	S
	3.0	9.8							x	S
5	0.0	0.0				R				S
	0.5	1.6			P		A			S
	1.0	3.3							x	S
	2.0	6.6							x	S
6	0.0	0.0			P		R			S
	0.5	1.6							x	S
	1.0	3.3							x	S
	2.0	6.6							x	S
	3.0	9.8							x	S
7	0.0	0.0				R				G
	0.5	1.6							x	S
	1.0	3.3							x	S
8	0.0	0.0		R			R	P		G(lily)/S
	0.5	1.6							x	S
	1.0	3.3							x	S
	2.0	6.6							x	S
	3.0	9.8							x	S
9	0.0	0.0							x	S
	0.5	1.6							x	S
	1.0	3.3			P					S
	2.0	6.6							x	S
	3.0	9.8							x	S
	4.0	13.1							x	S

Figure 2 – Sampling Transits

Figure 3- Aquatic Plant Beds

Cattail (*Typha latifolia, Typha angustifolia*) helps stabilize marshy borders of lakes and ponds. Cattail also helps protect shorelines from wave erosion. Northern Pike may spawn along shore behind the cattail fringe. It provides cover and nesting sites for waterfowl and marsh birds such as the red-winged blackbird. Stalks and roots are eaten by muskrats and beavers.

White Water Lily (*Nymphaea spp*.) provides excellent habitat for largemouth bass and sunfish; seeds are eaten by waterfowl.

Yellow Water Lily (*Nuphar spp*.) fruits are eaten by waterfowl and muskrats. The underwater roots contain starch and are also edible.

Sago Pondweed (*Potamogeton pectinatus*) provides some cover for bluegills, perch, northern pike and muskellunge and good cover for walleye. It provides food for waterfowl; supporting aquatic insects and many other small animals that fish and ducklings eat. Swans, geese and diving ducks such s canvasbacks favor the tubers and seeds of sago.

Watermilfoil – There are two species of watermilfoil typically found, although there are others – Northern Watermilfoil (Myriophyllum exalbescens) which is a native species provides cover for fish and invertebrates. Waterfowl occasionally eat the fruit and foliage. Eurasian Watermilfoil (Myriophyllum spicatum) is an undesirable exotic that forms dense surfacemats, which can shade native plants.

Purple Loosestrife (*Lythum salicaria*) is an undesirable exotic hardy perennial not native to North America. It is an aggressive plant that crowds out native vegetation and provides less-valuable food or habitat for muskrats, waterfowl, and many popular marsh birds. It also can destroy northern pike spawning areas and clog drainage ditches.

Substrate Characteristics

Bottom sediments act as a nutrient source and anchoring point for aquatic plants. Some bottom types (e.g., rocks or cobble) are so hard that plant roots cannot penetrate them. Others are so soft, flocculent, and unstable that they will not anchor plants. Extremely coarse-textured sediment (sand) can be so nutritionally poor for macrophyte growth that low level accumulation of organic matter from plant growth or erosion stimulates growth. Bottom substrates in Druid Lake are illustrated on Figure 4.

Turbidity, nutrient concentration, sediment texture, sediment organic matter, siltation rates, wind and wave action are parameters identified as important factors determining aquatic plant distribution and abundance. These parameters are interrelated and interact with basin depth, bottom slope, surface area and shape to determine littoral zone size.

Figure 4 - Substrate

Water depth is one of the most critical environmental factors determining the lakeward extent of the littoral zone and the type of plants that grow in a water body. Where a lake's substrate exceeds 2-3 times the Secchi depth, submersed aquatic plants will be light limited and generally not able to grow. With some exceptions, a depth range between 30 and 45 feet is the limit for most aquatic plants.

NUISANCE SPECIES LOCATION AND CONTROL

The plant species purple loosestrife exists in various locations on the shoreline of Druid Lake as shown in Figure 3. Purple Loosestrife is an exotic plant from Eurasia that has no natural enemy in the United States (Furniss, 1995 and 1996). Purple loosestrife typically exists where there are moist conditions, such as; marshes, wetlands, ditches, streambanks, stormwater retention ponds, and canals (Water Hauler's Bulletin, 1992). The plant can tolerate a wide range of environmental conditions and appears only to be sensitive to light conditions (Furniss, 1995 and 1996). Seed dispersal occurs by movement from: wind, water, wildlife, and humans (Furniss, 1995). Purple loosestrife is an aggressive plant that has been known to convert diverse wetland areas to monospecific loosestrife communities (Furniss, 1995). This loss of plant diversity is a loss of food diversity for many species of fish and wildlife (Furniss, 1995). The dense, impenetrable stands that purple loosestrife develops into are unsuitable as cover, food or nesting sites for various wetland animals, such as; ducks, geese, rails, bitterns, muskrats, frogs, toads, and turtles (McIntyre, 1996). Control during early stages of infestation is important; once the investation becomes large, control is difficult. Manual control of a small cluster of plants is possible. Pull or dig out the plant before early August, when it flowers and produces seeds. Dry and then burn the plants if possible; otherwise

An internet inquiry was done on methods of controlling purple loosestrife. Unsuccessful control measures found consist of water level manipulation, mowing, and fire. There are three groups of successful control measures; hand pulling, chemical control, and biological control.

The Missouri Department of Conservation states that up to 100 plants are best eliminated by hand pulling, and this should be done early in the flowering season (prior to August, WDNR, 1995) to avoid scattering seeds in the removal process. However, this may not be a permanent solution since plants can resprout even from a small part of a root or stem (Maia, 1996). The Wisconsin Department of Natural Resources (WDNR) recommends pulling small plants in loose soil, however states that it is difficult to properly remove older (larger) plants by pulling. The Virginia Natural Heritage Program recommends bagging the plants at the site, so that fragments are not dropped along the exit route, and then burning the plants. WDNR recommends drying the plants and then dispose of properly.

Chemical treatment would consist of treating purple loosestrife with Rodeo, whose active ingredient is glyphosate. The WDNR has published a fact sheet on this chemical and requires a permit to use it in the state. This chemical is approved for use over water in the state of Wisconsin. A short summary of the fact sheet follows.

Rodeo will kill a broad spectrum of plants including grasses, sedges, broadleaved plants, and woody species. The chemical prevents the plant from making the necessary proteins for growth. Any contractor hired to perform the treatment must be certified by the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP). An effective method of treatment is cutting the plants and painting the cut stems with a 50% concentrated solution of Rodeo. This method is more labor intensive, but will preserve other native plant species in the area.

The recommended treatment method for Druid Lake is cutting, bagging, and burning the plants, followed by painting of the stems with Rodeo. Inform the pesticide applicators of the value of the rest of the macrophytes in the lake. Be certain that they understand that the use of herbicide (if it is chosen) must be limited only to the purple loosestrife area.

In addition, biological control of purple loosestrife is currently being researched by many agencies in the United States and Canada. Researchers are studying several insects, both leaf eaters and root miners. Various insects researched are the natural enemy of purple loosestrife and were imported from Europe. Research by the WDNR began in 1994, and reports that these insects are dependent on purple loosestrife and are not a threat to other plants. Currently the insects are only approved for research in Wisconsin, and the WDNR is not distributing the insects for public use. The WDNR also reports that effective biological control may take as long as decades to be observed. However, this is more of a long term solution to the purple loosestrife problem, whereas hand-pulling and chemical control are short term solutions that may have to be repeated on a regular basis to maintain control of the plant.

FISHERY OF DRUID LAKE

Based on fisher surveys conducted by the Wisconsin Department of Natural Resources, the fishery of Druid Lake is made up of predominately panfish, walleye, northern pike, and large mouth bass. The fishery in the lake has not been sampled in recent years. The results of the latest electroshocking survey in 1978 are summarized in Table 2.

Table 2
Results of 1978 Electroshocking Survey Conducted by WDNR

Species	Number	Average Length (inches)	Estimated Size Range (inches)	Percent Composition
Walleye	12	10.8	7.9 –19.2	44.4
Norther Pike	10	16.1	10.1 – 20.5	37.1
Largemouth Bass	1	10.6	10.6	3.7
White Bass	4	13.3	12.3 – 14.6	14.8

Source: WDNR, 1980

The most abundant fish species in the lake are panfish and walleye. White sucker and carp are also common in the lake.

Druid Lake is stocked with walleye. Past stocking of walleye by the WDNR is summarized in Table 3.

Table 3
Summary of Historic Walleye Stocking Druid Lake

Date	Number	Pounds	Size/age
05/08/77	1,000,000	UNK	FRY
05/19/78	1,000,000	UNK	FRY
10/17/79	1,810	121	5 mo. FGL
08/28/81	13,000	160	4 mo. FGL
07/16/82	920	2.1	3 mo. FGL
07/16/82	5,250	12	3 mo. FGL
07/12/84	800	2	2 mo. FGL
07/12/84	5,508	12	2 mo. FGL
08/07/85	6,000	33	3 mo. FGL
07/24/86	6,000	48	3 mo. FGL
07/08/87	6,976	16	2 mo. FGL
07/18/89	11,030	52	3 mo. FGL
09/12/95	10,000	51	3 mo. FGL

Source: WDNR (FGL means fingerling)

Spawning habitat for panfish, and largemouth bass is abundant in Druid Lake. Panfish, and largemouth bass are both fish that spawn in sand or gravel nest that they form along shorelines. As illustrated in Figure 4, the lake has abundant spawning habitat for bottom nesting species.

Walleye habitat in Druid Lake is limited. Walleye nest in gravel beds or shoals characterized with void spaces between the rocks. Walleye lay their eggs in the void spaces and the young use the rack bed as a nursery are during early life stages. As the walleye start to mature they move out into aquatic plants beds where they spend their lives as fingerlings. Druid Lake has no significant gravel beds and limited aquatic plant beds for spawning and nursery habitat. Walleyes are maintained in the lake by stocking.

Northern Pike spawn on vegetation by leaving sacks of eggs suspended in the water column. For northern pike aquatic vegetation is important for all life stages, including spawning, nursery, and adult stages.

PROTECTION OF NORTHERN PIKE

Northern Pike (*Esox lucius*) exist in Druid Lake. However, it appears that the spawning habitat is limited in the lake by the size of the macrophyte beds and the lack of sufficient cover may threaten the existence of this fish species in Druid Lake. Northern pikes are most abundantly found in shallow drainage lakes with extensive weed beds. They are

also very tolerant of low dissolved oxygen concentrations. The northern pike are sight feeders and other fish are their dominant food item, therefore, they require fairly clear water to survive.

The following description of the northern pike's physical characteristics, preferred habitat, and spawning habitat was taken from Threinen et. al., 1978. Physical characteristics of a northern pike are; canine teeth, duck-like mouth, undershot lower jaw, rounded fins, dorsal and anal fins located near the tail, forked tail, light colored bean shaped horizontal markings on body, full scaled cheek, half scaled operculum, and brain weight is 1/1305 of the body weight.

Spawning migrations usually take place during the night in the early spring just after the ice is out. The preferred habitat for spawning is warm water (40°F) with flooded short emergent vegetation. The eggs are then elevated off the bottom which will avoid fungus growth and improve egg survival. The highest survival rate occurs when these physical conditions are constant and ample food supply exists until a fingerling size of 2 inches is attained.

Spawning areas for northern pike in Druid Lake can be seen on Figure 3, synonymous with the various macrophyte species found in Druid Lake in August 1996. The fish may spawn in the bullrush ,cattail and curlyleaf pondweed areas. The areas for spawning are very limited and should be protected if it is desired to keep this species of fish in Druid Lake.

PROTECTION OF EXISTING FISHERIES AND ENVIRONMENTALLY SENSITIVE AREAS ON DRUID LAKE

Because the macrophyte beds are synonymous with the fishery it is important to designate them as sensitive areas and afford these areas as much protection as possible. Recommendations for protection of environmentally sensitive areas are as follows:

1. **Establish "No-Wake Zones" around the existing macrophyte beds**. Wave action can harm plant beds as well as propellers cutting the plants themselves. The "Environmentally Sensitive Areas" illustrated in Figure 5 should be established as no-wake zones in the Town of Erin Boating Ordinance.

2. **Allow no "weed harvesting" or "chemical herbicide control" of submerged aquatic plants to occur in the lake.** The aquatic plant beds in Druid Lake are limited in size. The loss of even a small amount of limited habitat could have significant impacts on the fishery and ecological balance of the lake. The WDNR should adopt the "Environmentally Sensitive Areas" illustrated in Figure 5 under Wisconsin Administrative Code NR 107, which regulates the use of herbicides in waters of the state.

Figure 5 – Environmentally Sensitive Areas.

3. **The Town of Erin should adopt an erosion control ordinance.** Shoreline development can seriously alter the lake ecosystem, causing the lake to become muddy and shade out the aquatic plant life. If development is occurring in the watershed, care must be taken to assure that adequate erosion control measures are used so that little or no sedimentation reaches the lake.

4. **Ban the installation of sea-walls around the lake**. Sea-walls destroy shallow water habitat taking away valuable littoral zone area. Waves bouncing off sea-walls rebound with as much force as the original wave. Excessive wave energy in near shore areas can disturb spawning by panfish and largemouth bass.

5. **Conduct an annual program of purple loosestrife control.** Purple loosestrife is established along the east shore of the lake, was not observed along the west undeveloped shoreline. The current beds are still small enough to control by hand pulling and herbicide use. An eradication program should be undertaken before the beds expand behold the lake districts control. A team of volunteers should be recruited to under take the annual eradication program. If volunteers can not be found the Lake District should consider contracting with a commercial firm to eradicate this nuisance plant.

6. **Educate the general public about the value of the aquatic plant beds and their relationship to the health of the lake ecosystem and the fishery.** The public may not realize that without aquatic plants there would be no fish. Without a balanced fishery a balanced ecosystem can not be maintained. The University of Wisconsin Extension and WDNR offers several educational brochures on the value of aquatic plants. Titles include:

   Attributes of Wisconsin Lake Plants, Wisconsin Geological and Natural History Survey, Informational Circular 73, 1991. Available from University of Wisconsin Extension at 3817 Mineral Point Road, Madison, WI 53705.

   Aquatic Community: Interactions of Submerged Macrophytes, Wisconsin Department of Natural Resources, Technical Bulletin No. 156, 1985. Available from WDNR at P.O. Box 7921, Madison, WI 53707.

7. **The aquatic plant management program should be reassessed on a regular basis**. The program should be reviewed to ascertain (1) whether it is fulfilling its objectives, (2) whether the problems associated with plant growth are being alleviated, and (3) what is its long-term effect on vegetation in the lake. The severity or mildness of purple loosestrife growth each season may require different levels of control. Changes in plant community composition and location may also require some fine-tuning of the management objectives.

8. **Conduct follow-up biological monitoring.** Biological monitoring provides feedback about the relative success of both control programs and identification of native species that are meant to be protected. The plant community should be evaluated routinely to provide scientific information for management decisions. Biological monitoring should include species' lists and maps depicting the distribution and density of vegetation. (ref. Aquatic Plants in Lake Waubesa: Their Status and Implications for Management, Wisconsin Department of Natural Resources)

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