McDill Pond Lake Management Plan

Prepared for:
McDill Pond Inland Lake Protection and Rehabilitation District
City of Stevens Point

February 2001

Prepared by:
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February 2001

Funding provided by:
Wisconsin Department of Natural Resources Lake Planning Grant Program
City of Stevens Point
McDill Pond Inland Lake Protection and Rehabilitation District

(cover photo by JF Brennan)

This report is a compilation of the natural and human history of McDill Pond. It summarizes all of the known reports and scientific studies that have been completed to date on McDill Pond and provides specific management recommendations for the lake. The management recommendations were developed based on historical information and the results of the studies. The recommendations are designed to help the Lake District Board of Commissioners and Lake District members make wise decisions about the future of McDill Pond.

Since there have been quite a number of reports and studies on McDill Pond over time, this lake management plan summarizes the results and displays actual information from the reports in the appendix. This lake management plan should, therefore, also serve as a useful reference document.

Special thanks to the current Lake District Board of Commissioners, the City of Stevens Point, and the UW-Stevens Point Environmental Task Force Lab. Additional thanks to Tim Evenson, former Lake District president, Dave Schleihs, former Stevens Point Mayor's assistant, Gary Oudenhoven, McDill newsletter chairman, and the many others who have contributed to this project.

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HISTORY OF MCDILL POND[1]

The creation of McDill Pond dates back to 1853 when Amos Courtwright and Luther Hanchett first dammed the Plover River near the site of the current dam for logging purposes. In 1864, ownership of the dam was transferred to Dr. Alexander S. McDill and his brother Thomas H. McDill who operated a sawmill there as well as a grist mill. As pioneer lumbermen and merchants, they made the Plover River integral in the local lumber industry. At that time the area took on the last name of the brothers, and was locally known as "McDillville".

Early settlers in the area harnessed the Plover River for energy and water transportation. During the lumbering days, the Plover River became one of the most extensively used streams in central Wisconsin. In addition to the McDill dam, the Plover River had several other dams. The earliest of these was the Jordan Dam (Highway 66), built about 1843. Other dams included the Van Order/Curtis dam, just north of the Jordan dam, in 1857, followed by another little known dam another 4 miles north. A dam and sawmill operation was also constructed at current-day Iverson Park around 1865. It was located where Highway 10 crosses the Plover River, but discontinued in 1878.

In the 1870's, lumber rafting on the Plover River began to decline due to the development of the railroad. Logs began to be hauled by rail instead of by water. The last log drives on the Plover River probably occurred in the early 1890's. In 1895, a fire destroyed the McDill sawmill.

The McDill Pond grist mill was erected in 1885 at the same site as the sawmill. The site originally contained two dams. The grist mill was used to grind grain from area farmers. Later, the site served as a graphite mill for graphite mined in the Junction City area. Near the turn of the century, the site was purchased by a paper company and a Kraft pulp mill was operated. Locally termed the "stink mill", it operated on and off until after World War II.

In 1954, the Village of Whiting bought the land and mill buildings for $7000. At that time the size of the pond created by the dam was much smaller than it is today. After the Village of Whiting purchased the land, they raised the water level to approximately where it is today.

By the late 1950's, the McDill dam was in poor condition. In 1959, the Village of Whiting drained the pond to build a new dam. During the three year drawdown, previously submerged tree stumps were collected and burned, muck was removed from some channels, and several areas of the pond were deepened, including a trout pond that was dug by a local sports club. A few property owners also draglined and

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[1] Information in this section was compiled from the following sources:
Lemmens et al. 1978. McDill Pond Background and Lake District Considerations.
"McDillville's Colorful Past", Stevens Point Journal newspaper article. October 10, 1991, page 4.

bulldozed channels. In some areas, bottom material was used to create and expand some of the islands in the pond.

In 1962, the Village of Whiting completed the construction of the new concrete dam for $31,000, which contained three adjustable gates for water flow. Upon completion of the dam, it took approximately one week for the pond to return back to its previously set water level. Until 1999, the Village of Whiting manually adjusted the water level in the pond to account for fluctuations in water flow. This required frequent (often daily) monitoring of water levels and manual adjustments of the dam gates.

In 1999, a new dam was constructed by the Department of Transportation and Portage County as part of the Highway HH reconstruction. The Village of Whiting retains ownership and maintenance of the dam.

PHYSICAL CHARACTERISTICS

McDill Pond is a 261 acre impoundment of the Plover River. The average water depth is approximately 4 feet, due to shallowing of the pond over time from sediment deposited by the Plover River.

Physical Characteristics	
Size:	261 acres
Average Depth:	4 feet
Lake Volume:	1044 acre-ft
Flushing rate:	100 times/year

(It takes about 3.65 days for the total water volume to be replaced in McDill Pond.)[2]

The Plover River watershed is 112,297 acres or about 195 square miles. The watershed lies in Portage, Marathon, Langlade and Shawano counties as shown in Figure 1. The river begins in the southwestern corner of Langlade County and flows in a south-southwesterly direction for about 60 miles into the Wisconsin River south of Stevens Point. The watershed is long and narrow and its outer areas are ridges or moraine deposits left by the glaciers. The average elevation drop (gradient) of the river is about five feet per mile.[3]

Soil erosion contributes to the sediment problem in McDill at several points on the river. Three impoundments above Highway 66 act as sediment and nutrient traps, preventing some upstream pollutants from reaching the pond. Riverbank erosion and the scouring of the river channel itself by the Plover River (downstream of Jordan Pond) probably account for most of the sediment that reaches McDill.

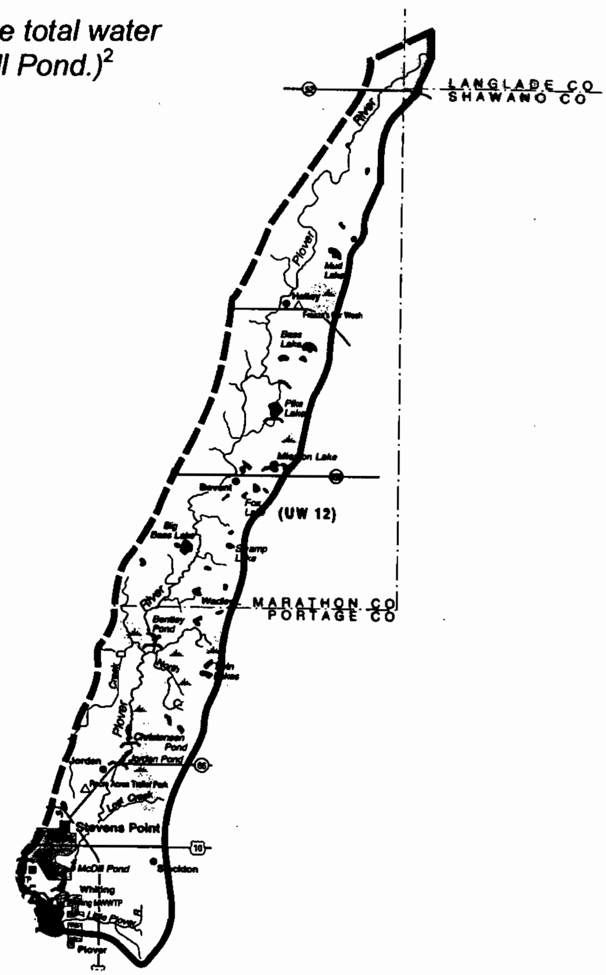

Figure 1. Plover River Watershed

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[2] Short, Elliot, and Hendrickson Inc., 1994. McDill Pond Water Quality Studies Project, Phase One 1993 Report. SEH File A-STEPT3037.00

[3] Lemmens, J., D. Ankley, B. Shaw, J. Woller, and J. Zimmerman. 1978. McDill Pond Background and Lake District Considerations.

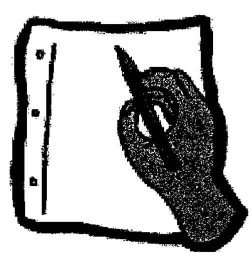
HISTORY OF LAKE ORGANIZATION

Around the mid-1960's, a group of property owners formed the Riverwoods Association. The association's activities mainly included a nuisance weed control program, along with an annual cleanup and debris removal.

In 1991, the Riverwoods Association changed its name to the McDill Pond Association to reflect a broadened scope of interest. Although steps were taken as early as 1977 to form a lake district, it wasn't until 1994 that the McDill Pond Inland Lake Protection and Rehabilitation District was officially created. Early attempts to form a lake district in the late 1970's looked at including all of the City of Stevens Point, the Villages of Whiting and Park Ridge, and parts of neighboring towns within the Plover River watershed to be within the lake district.

When the McDill Inland Lake Protection and Rehabilitation District was officially created in 1994, it included all properties with water frontage and also non-water properties within Dan's Drive loop. In 1997, 14 non-water property owners successfully petitioned the lake district board for removal from the lake district during a time when dredging proposals were being considered for the lake. There are currently 171 properties in the lake district.

PROPERTY OWNER SURVEY



A survey of riparian residents of McDill Pond was conducted in 1992[4]. The purpose of the survey was to obtain information on local perceptions of McDill Pond's use and water quality. The survey was conducted as a preface to applying for state funds for grant projects and was sponsored by UW-Extension, the City of Stevens Point, and the McDill Pond Association.

Fifty-two percent of McDill Pond residents responded to the survey. About half of the survey respondents felt that McDill Pond was "polluted", with weeds and silt being the primary causes. Ninety percent reported a worsening of the pond's condition in the last 15 years, yet survey results showed it was still well-used for recreation. Recreational uses, however, had tended to shift from contact recreation to more passive, non-contact activities.

In terms of homeowner practices, 72% of respondents regularly fertilized their lawns, (20% with a lawn care company) and 21% regularly used herbicides and pesticides on their lawns. Many homeowners reported using "environmentally-friendly" landscape

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[4] Lies S. and Thornton J. 1992. Public Opinion of Water Use and Water Quality in McDill Pond (Portage County). UW-Stevens Point.

practices, such as vegetative buffer strips, along their lake frontages. Respondents also expressed their willingness, in concert with their local authorities and state, to protect and rehabilitate McDill Pond.

GRANTS

Three grant projects have been undertaken on McDill Pond. All three received state grant funding through the Wisconsin Department of Natural Resources' (DNR) Lake Planning Grant Program and are summarized below:

1st grant project - completed in 1994, sponsored by the McDill Pond Association and the City of Stevens Point. The grant project was to conduct a hydrologic and water quality analysis of McDill Pond and the immediate watershed. A consulting firm, Short, Elliot, and Hendrickson Inc., was hired to conduct the project. Results are contained in the final report, McDill Pond Water Quality Studies, Phase One 1993 Report[5], and are summarized later in this document.

2nd grant project - completed in 1996, sponsored by the McDill Pond Association and the City of Stevens Point. This project investigated riverbank erosion, evaluated sediment characteristics, and conducted a dredging feasibility study to evaluate dredging options. Short, Elliot, and Hendrickson Inc. and the UW-Stevens Point Environmental Task Force Lab were hired to complete the studies. Results are contained in the reports: 1995 Plover River Erosion Evaluation - Jordan Park to Iverson Park[6], Evaluation of Plover River/McDill Pond Sediment Sample Physical and Chemical Characteristics[7], and McDill Pond Sediment Dredging Feasibility Study[8], and are summarized later in this document.

3rd grant project - completed in 2001, sponsored by the McDill Lake District and the City of Stevens Point. Two grants were received from DNR for this project. This project studied stormwater impacts, evaluated sediment accumulation, investigated aquatic plant/sediment/groundwater relationships, and developed a lake management plan for McDill Pond. Results are contained in the reports: McDill Pond Stormwater

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[5] Short, Elliot, and Hendrickson Inc., 1994. McDill Pond Water Quality Studies Project, Phase One 1993 Report. SEH File A-STEPT3037.00

[6] UW-Stevens Point Environmental Task Force Lab, 1995. Plover River Erosion Evaluation: Jordan Park to Iverson Park. UW-Stevens Point.

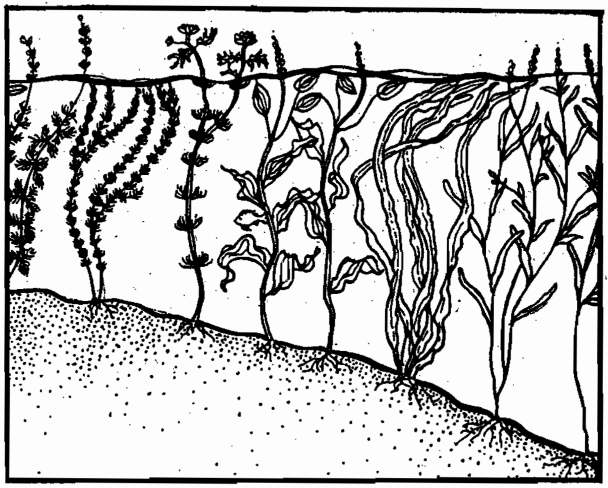
[7] UW-Stevens Point Environmental Task Force Lab, 1996. Evaluation of Plover River/McDill Pond Sediment Sample Physical and Chemical Characteristics. UW-Stevens Point.

[8] Short, Elliot and Hendrickson Inc., 1996. McDill Pond Sediment Dredging Feasibility Study. SEH File No. STEPT9702.00

Investigation and Management[9], McDill Pond Sediment Accumulation[10], and Relationships of Aquatic Macrophytes to Sediment and Groundwater Characteristics – Implications for Lake Management[11]. All of these reports are summarized within this lake management plan.

AQUATIC PLANTS

The physical characteristics of McDill Pond provide ample growing conditions for rooted aquatic plants. The clear water and shallow nature of the pond allow sunlight to reach the bottom of most of the pond, aiding plant growth. The amount of nutrients in the lake water, particularly phosphorus, are also sufficient to support an excessive growth of aquatic plants in McDill Pond.



Carol Watkins, Through the Looking Glass

While phosphorus levels are high enough to cause nuisance algae blooms in McDill, algae is not generally a large concern on McDill. This is probably because the aquatic plants utilize much of the phosphorus and because water is flushed through McDill Pond very quickly (about once every four days)[12], so algae have little time to grow and multiply.

Since the original dam was built, large amounts of sand and organic matter have accumulated in the lake. This nutrient-rich sediment provides ideal conditions for plant growth. The organic nature and nutrient quality of these sediments is similarly increased with each annual cycle of aquatic plants. As the plants die, they decompose and their nutrient content is incorporated into the sediment to supply the requirements for future plants.

Aquatic Plant Density

Prior to about 1930, there seem to have been very few aquatic plants in McDill Pond. Very gradually, the amount of aquatic plants in the pond seem to have increased. By 1959, there were reports of excessive aquatic plants in McDill Pond.

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9 Lyden T., 2000. McDill Pond Stormwater Investigation and Management. UW-Stevens Point.

10 Lyden, T., 2001. McDill Pond Sediment Accumulation. UW-Stevens Point.

11 Lyden, T., 2000. Sediment and Groundwater Characteristics in McDill Pond – Implications for Lake Management. UW-Stevens Point MS Thesis.

12 Short, Elliot, and Hendrickson, Inc., 1994. McDill Pond - Water Quality Studies Project. Phase One 1993 Report.

In 1959, McDill Pond was drawn down for three years to build a new dam. When the water came back up again in 1962 there were no reports of aquatic plants for about two years, most likely because there had been winter freeze-outs of the plants. Significant plant growth started to occur again in about 1966.[13]

In 1983, and again in 1992, field inventories were done to determine the extent of aquatic plant growth in McDill[14]. The 1983 inventory found about 15 percent of McDill Pond surface area (about 35 acres) with moderate to heavy plant growth. The 1992 inventory found that the areal coverage of plants had significantly increased to 32 percent of the surface area (about 73 acres).

In general, lakes that contain a variety of plant communities are often able to support a more varied and healthy fishery than lakes with few aquatic plants or with limited plant species. Plant cover densities ranging between 30-50 percent are probably optimal to maintain a healthy variety of fish.[15]

In 1991, McDill Pond was drawn down for about three months to allow for private dredging and the creation of a silt trap near Patch Street. Reports claimed there were fewer aquatic plants that following summer. In 1999, the pond was drawn down again for three months for construction of a new dam.

Aquatic Plant Species

The only complete survey of the types of aquatic plants in McDill Pond was conducted in 1983[16]. Nineteen floating and submergent aquatic plants were found. Table 1 shows the common and scientific names of those plants found, along with each species' abundance (both in McDill and throughout Wisconsin) and their value to fish. A generalized map of aquatic plant distribution from the 1983 report is in Appendix A.

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[13] Lemmens, J., D. Ankley, B. Shaw, J. Woller, and J. Zimmerman. 1978. McDill Pond Background and Lake District Considerations.

[14] Shaw and Mealy, 1983. Water, Sediment, Aquatic Weed Study of McDill Pond for City of Stevens Point. UW-Stevens Point, unpubl. rprt

Short, Elliot, and Hendrickson, Inc., 1994. McDill Pond - Water Quality Studies Project. Phase One 1993 Report.

[15] WDNR Environmental Assessment Aquatic Plant Management (NR 107) Program, 3rd edition, 1990.

[16] Shaw and Mealy, 1983. Water, Sediment, Aquatic Weed Study of McDill Pond for City of Stevens Point. UW-Stevens Point, unpubl. rprt.

Table 1: Aquatic Plants Found in McDill Pond in 1983 study

Common Name	Scientific Name	Relative Abundance in McDill[1]	Relative Abundance in WI[2]	Fish Value[2]		
				Food	Cover	Spawning
Submergent Species						
Curly Leaf Pondweed	Potamogeton crispus	Abundant	Common	x	x	
Northern Water Milfoil	Myriophyllum exalbescens	Abundant	Common	--	--	--
Elodea/waterweed	Elodea canadensis	Abundant	Abundant	--	--	--
Coontail	Ceratophyllum demersum	Abundant	Abundant	x		x
Wild celery/eel grass	Valisneria americana	Abundant	Abundant	x	x	
Sago Pondweed	Potamogeton pectinatus	Abundant	Abundant	x	x	
Large leaf pondweed/	Potamogeton amplifolius	not determined	Abundant	x		
White stem pondweed	Potamogeton praelongus	not determined	Common	x	x	
Clasping Leaf Pondweed	Potamogeton richardsonii	not determined	Common	x	x	
Floating Leaf Pondweed	Potamogeton natans	not determined	Abundant	--	--	--
Bull-head pond lily	Nuphar variegatum	not determined	Abundant	x	x	
Water crowfoot	Ranunculus trichophyllum	Isolated stands	Infrequent	x		
Arrowhead	Sagittaria spp.	not determined	--	--	--	--
Muskgrass	Chara spp.	Abundant	Abundant	--	--	--
Floating Species						
Duck weed	Lemna minor	Abundant	Infrequent	x		
Common water-meal	Wolffia columbiana	not determined	Infrequent	--	--	--
Great duckweed	Spirodela polyrhiza	not determined	Infrequent	x		
Forked duckweed	Lemna trilusca	not determined	Infrequent	--	--	--

[1] Based on Shaw and Mealy (1983) and DNR file information (1991)
[2] Source: Nichols and Vennie, 1991
[3] Provides direct food or supports fish food fauna
-- information unknown or unreported

In 1992, the non-native Eurasian Water Milfoil plant was documented for the first time in McDill Pond. Both Curly Leaf Pondweed and Eurasian Water Milfoil are non-native plants present in McDill that can proliferate and replace more beneficial, native plants. Results from a recent aquatic plant study[17] showed that Curly Leaf Pondweed was very abundant in McDill Pond, while Eurasian Water Milfoil was still only present at limited levels.

During the 1999 drawdown, reed canary grass proliferated in the northern 1/3 of the pond. Reed canary grass is an extremely aggressive emergent wetland plant that often grows in disturbed areas. After a drawdown, some plant species will tend to increase in abundance, while others plant species may decrease. Wild Celery, a submergent species, appears to have increased since the drawdown and Curly Leaf Pondweed and Coontail, also submergent species, were growing again in 2000[18]. No other specific information is available on changes that have occurred to the rest of the aquatic plants in McDill Pond since the recent drawdown.

Aquatic Plant Control (Herbicides and Weed Harvesting)

In the 1950's, a small aquatic plant harvester was operated on McDill Pond by the Stevens Point Sportsman Club. No further information could be found about the specifics of this harvesting effort.

In 1967, the Riverwoods Homeowners Association worked with the DNR to begin chemical treatment of aquatic plants in the channels and other selected areas. Chemical treatments were gradually expanded to larger portions of the lake until 1982 when aquatic plant harvesting began. The homeowners association administered the chemical treatment program with some limited financial help from Portage County, the DNR, and the City of Stevens Point. Chemical treatments by year and location are included in Appendix B.

In 1982, aquatic plant harvesting on McDill Pond was initially contracted out to a group called Wisconsin Lake Harvesters. Costs were borne by the City of Stevens Point, Portage County, and the Riverwoods Homeowners Association. In 1992, an aquatic plant harvester was purchased through a 50% cost-share grant from the Wisconsin Waterways Commission. The City of Stevens Point and the Wisconsin Waterways Commission each contributed $39,000. A second harvester was acquired at the end of

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17 Lyden, T., 2000. Sediment and Groundwater Characteristics in McDill Pond – Implications for Lake Management. UW-Stevens Point MS Thesis.

18 Communication with Jim Laszewski, Weed Harvester Chairman and Operator. 2001.

year 2000 through room tax monies from the City of Stevens Point. Two harvesters will begin operating at the same time in the 2001 season.

Table 2 summarizes the approximate number of aquatic plant loads that were harvested out of McDill Pond each year, days spent harvesting, and approximate annual costs. (Information from some years was not available.) Since 1992, variations from year to year were mostly due to equipment repair and down days from mechanical breakdowns.

Table 2
Harvesting Records for McDill Pond: 1983-2000

Year	# Loads	# Harvest Days	Cost[1]
1983	60		[2]
1984	57		$2,780 [2]
1985	45		$4,273 [2]
1986	44		$5,153 [2]
1987	88	(104 hours)	$4,950 [2]
1988	63	(110 hours)	
1989			
1990	62	(84 hours)	$4750
1991		(200 hours)	$20,000
1992	58	10	$600
1993	167	36	$3,460
1994		44	$6,636
1995	244	55	$4,917
1996	215	61	$5,133
1997	399	68	
1998	198	49	$5,083
1999[4]	--	--	--
2000	289	65	$7,886

[1] does not include insurance costs
[2] City and County paid a portion of costs
[3] City paid a portion of costs
[4] No harvesting took place due to the lake being drawn down

The harvester that was purchased in 1992 is leased to the Lake District by the City of Stevens Point from May 15 to September 15 annually under an agreement until 2004. The lake district rents the harvester, conveyor, and a city truck for $1 per year. Maintenance, personnel, and operational costs are borne by the lake district. Routine maintenance of the harvester and related equipment is performed by the City of Stevens Point. Winter storage of the harvesting equipment is at the City garage. Liability insurance for operation of the harvester is borne by the lake district. An aquatic plant harvesting plan for McDill Pond is on file with the DNR[19].

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[19] City of Stevens Point and McDill Pond Association, 1992. McDill Pond Aquatic Plant Management Plan.

Because harvesting physically removes plants from the pond, phosphorus tied up in the plants is also removed from the pond. The amount of phosphorus that is removed from harvesting, however, is minimal compared to the amount of phosphorus that annually accumulates in the pond. Estimates show that each load of harvested plants removes between 0.44 and 0.89 lbs of phosphorus[20,21]. In order to equal the annual retention rate in McDill Pond of 2,300 lbs of phosphorus[22], between 2,500 and 5,000 harvesting loads would need to be removed from the pond each year, much more than is currently harvested. Harvesting in McDill Pond, therefore, should not be considered as a method of removing a substantial amount of phosphorus from the lake, but rather as way to provide recreational relief and improve aesthetics.

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[20] Shaw, B. and R. Mealy. 1983. Water, Sediment, Aquatic Weed Study of McDill Pond for City of Stevens Point. UW-Stevens Point.

[21] calculated from plant phosphorus data collected by: Lyden, T., 2000. Sediment and Groundwater Characteristics in McDill Pond – Implications for Lake Management. UW-Stevens Point MS Thesis.

[22] Short, Elliot, and Hendrickson Inc., 1994. McDill Pond Water Quality Studies Project, Phase One 1993 Report. SEH File A-STEPT3037.00

FISHERIES

For the last number of decades, McDill Pond has been considered a very good bass and bluegill lake. The lake has also supported a population of yellow perch along with some northern pike and crappie. Carp have also been present, though their numbers have never increased enough to become a problem, as sometimes happens in other lakes.[23]

Historical stocking records[24] show that 1943 was the first time McDill Pond was stocked with fish. Stocking took place annually through the 1940's and then periodically up until 1963 when it was stocked after the 3 year drawdown. A variety of fish species have been stocked in the lake over the years, including white suckers, bullheads, rainbow trout, walleye, as well as bass, northern pike, perch and bluegill.

According to a few personal historical observations[25], the quality, quantity and size of fish in McDill Pond seemed to dramatically improve after the lake was refilled in 1962. Prior to that time, personal reports said the lake had consisted mostly of small pan fish, suckers, and carp.

After 1963, the lake was not stocked again until 1999 because the lake's fishery was considered to be in good condition, and did not need any supplemental stocking. In 1999, when the lake was drawn down again for construction of the dam, lake district residents worked with the DNR and Portage County to manage and monitor the lake's fishery. Before the drawdown, a number of bass were removed and temporarily transferred to Springville Pond. In 1999, after the water level returned, fish were re-captured and returned to McDill and many additional bass were stocked. A year later perch and bluegills were stocked with funds from the Portage County Highway committee as follow-up to the dam reconstruction.

A fair amount of sampling was done by the DNR in 2000 to monitor the status of the fishery after the drawdown. Results from the samplings show that the fishery has begun to recover fairly well, with results showing good reproduction of northern pike,

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[23] communication with Dale Kufalk, DNR Wisconsin Rapids Office. 2001.

[24] DNR file information - Wisconsin Rapids.

[25] Lemmens, J., D. Ankley, B. Shaw, J. Woller, and J. Zimmerman. 1978. McDill Pond Background and Lake District Considerations.

largemouth bass, crappies, and bluegills[26]. According to the sampling results, yellow perch have not yet recovered quite as well. DNR fisheries staff, however, anticipate that the yellow perch population will come back on its own, and expect the overall panfish fishery to be back to normal within 2-3 years[27]. According to DNR fisheries staff, with a reduced number of fish, growth rates will typically increase.

RECREATION

Since it was first created by darnming up of the Plover River, McDill Pond has always been a long, narrow and shallow lake. These characteristics have always made it a less desirable prospect than other lakes for extensive waterskiing, sailing and powerboating activities. A 1978 report stated that the most common recreational uses at that time were swimming, fishing, canoeing and picnicking. The report went on to state that in 1978 the average depth of the pond was only about 5 feet, resulting in heavy weed growth that hampered travel by sailboats and larger powerboats, and confined skiing to a narrow channel in the center of the pond and those areas in the weed control program.[28]

The operation of an aquatic plant harvester in recent years has provided some recreational relief from weed growth for boaters. Continued sedimentation of the lake over time, however, especially near Patch Street, has resulted in extensive shallowing of the northern portion of the pond, rendering it practically un-navigable for even non-motorized boats.

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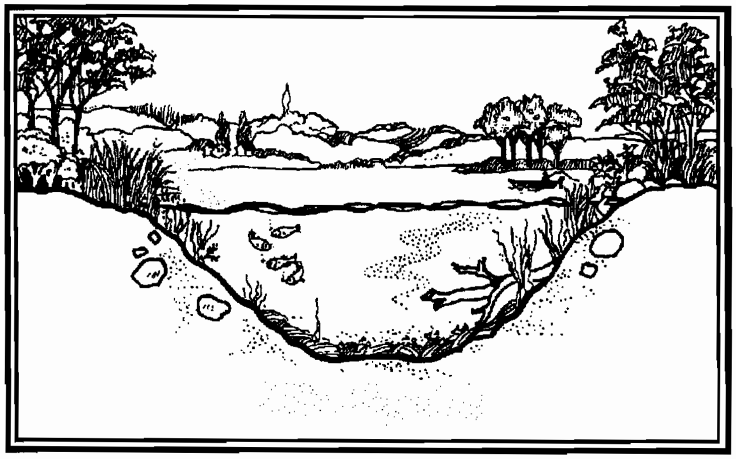
[26] communication with Al Hauber, Portage County DNR Fish Manager, Wausau Office. 2001

[27] communication with Al Hauber, Portage County DNR Fish Manager, Wausau Office. 2001

[28] Lemmens, J., D. Ankley, B. Shaw, J. Woller, and J. Zimmerman. 1978. McDill Pond Background and Lake District Considerations.

WATER QUALITY

A fair amount of water quality data have been collected on McDill Pond over the years. Overall, the results do not show McDill Pond to be highly polluted, but do show that there are sufficient nutrient and sediment inputs to cause aquatic plant and shallowing problems.



Early data collected by UW-Stevens Point in 1972-1978[29] showed the average amount of nutrients entering McDill Pond from the Plover River as:

Ortho Phosphorus:	0.01 mg/l	Nitrate Nitrogen:	0.7 mg/l
Total Phosphorus:	0.03 mg/l	Ammonium Nitrogen:	0.1 mg/l

This and other information collected showed that:

- **Phosphorus levels are high enough to support an excessive growth of aquatic plants, but are below levels found in many problem lakes.** While the actual nitrogen levels are quite high, they are less of a concern because **phosphorus is the limiting factor controlling aquatic plant growth in McDill Pond.**

- **In the 1970's, the major sources of nutrients to the Plover River and McDill Pond were considered to be: runoff from barnyards, runoff from farm fields with winter spreading of manure, and high nitrates in groundwater. Sediment sources were soil erosion at several points on the river and stream bank erosion on the stream itself.**

- **The three impoundments upstream of McDill Pond act as sediment and nutrient traps, which help prevent most upstream pollutants from reaching McDill. Nutrient and sediment contributions downstream of Jordan Pond have a much greater impact on McDill Pond.**

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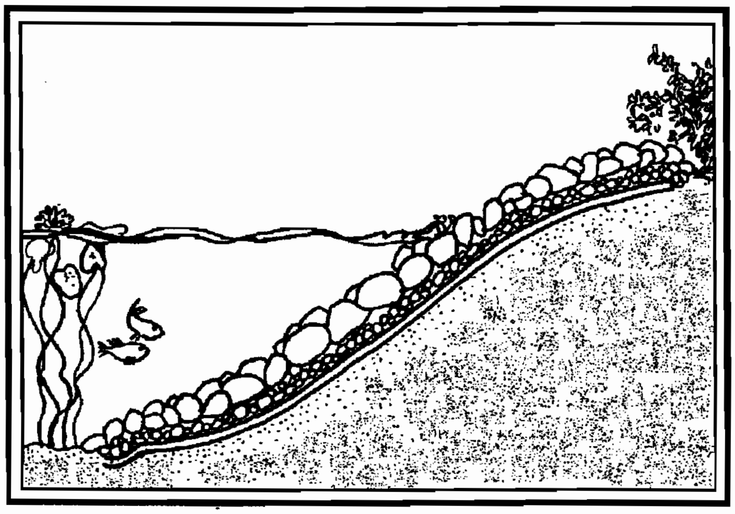
[29] Lemmens, J., D. Ankley, B. Shaw, J. Woller, and J. Zimmerman. 1978. McDill Pond Background and Lake District Considerations.

In 1975, information was collected by a UW-Stevens Point student[30] that compared water quality at different sites in the Plover River from Jordan Pond to McDill Pond. The results showed **no increase in phosphorus levels from Jordan Pond downstream to McDill Pond**. Actual data are included in Appendix C.

In 1975-1977, additional water quality information was collected along the Plover River between Hwy 10 and the McDill Pond dam by UW-Stevens Point. The information was collected as part of an evaluation of water quality impacts from construction of the proposed Patch Street bridge[31]. A map of the sampling sites and actual data are included in Appendix D.



Six years of water quality information were collected at the inlet and outlet of McDill Pond, and at the outlet of Jordan Pond, by the UW-Stevens Point Environmental Task Force Lab from 1977-1981. The data show an average annual total phosphorus value of 0.032 mg/l at the inflow of McDill Pond, and 0.026 mg/l at the outlet, indicating that **McDill Pond acts as a nutrient trap.** Although the actual values were considered low because they did not include peak runoff events, it was estimated that approximately 700 lbs of phosphorus are retained in the pond annually.[32] Actual data are included in Appendix E.

In 1992-1993, additional water quality information was collected by Short, Elliot, and Hendrickson, Inc.[33] as part of the first grant project. Actual data are included in Appendix E, along with 1977-1981 data. From the information that was collected,

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[30] Dembiec, Jeffrey, 1975. The Plover River: Jordan Park to McDill Pond. Report for UW-Stevens Point Water 480 course.

[31] Shaw, Byron, 1977. An Evaluation of Possible Water Quality Impacts of the Patch Street Bridge Project.

[32] Shaw, B. and R. Mealy. 1983. Water, Sediment, Aquatic Weed Study of McDill Pond for City of Stevens Point. UW-Stevens Point.

[33] Short, Elliot, and Hendrickson Inc., 1994. McDill Pond Water Quality Studies Project, Phase One 1993 Report. SEH File A-STEPT3037.00

- **McDill Pond has a very short average water residence period of about 3-4 days. This means that water that enters McDill Pond from the Plover River, leaves through the dam 3-4 days later.**

- **McDill Pond does not thermally stratify or experience oxygen depletion. The primary reasons are both its shallow nature and its rapid water flushing rate.**

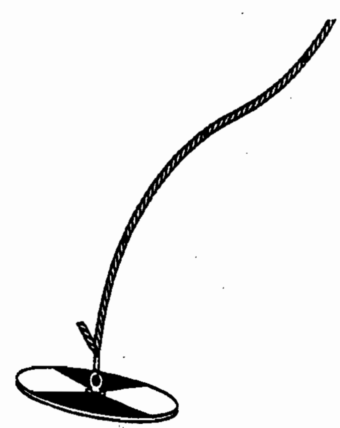
- **There is very little difference in water quality between Jordan Pond and McDill Pond.** Monitoring of the Jordan Pond and McDill Pond outlets, which involved the collection and analysis of 93 samples in 1977-1981 and 1992-1993, indicated little difference in water quality between the two impoundments.

- Based on water quality monitoring data, **the Plover River (above Hwy 10) contributes most of the annual total phosphorus loading (86.7% or 13,519 lbs.) to McDill Pond. The remainder of the phosphorus comes from lands that drain to the Plover River between Highway 10 and Patch Street, lands that drain directly into McDill Pond, and stormwater runoff.**

- Data suggest that **McDill Pond retains about 15% of all of the incoming total phosphorus, or about 2,300 lbs. per year.**

- **The period of highest incoming phosphorus to McDill Pond occurs during the spring runoff period in March and April.** Other high periods occur in summer, but less so because plants growing within the watershed intercept and use up some of the phosphorus before it can reach McDill. The period of highest level of incoming Nitrate-Nitrite Nitrogen is in mid-winter, indicating that **groundwater inflow is the primary source of nitrogen to McDill Pond.**

From 1994 to 2000, water clarity readings have been taken regularly on McDill by lake district volunteers through the DNR Self-help Volunteer Lake Monitoring Program. Volunteers lower a secchi disk into the water every few weeks to visually measure the clarity of the water. How clear the water is will depend on how much sediment and algae are present in the water. Frequent readings provide an indication of water quality conditions and can provide a good measure of any long-term changes. John Vollrath has been monitoring McDill's water clarity since 1997. Before 1997, Bernard Landerman and Victor Nelezen monitored the lake. Actual readings and graphs showing McDill Pond's water clarity since 1996 are included in Appendix F.



Results of the volunteer monitoring show that **McDill is considered a eutrophic lake. Eutrophic lakes are high in nutrients, tend to have more organic sediments, and support a lot of weed and algae growth. Because they are productive lakes, they often support large fish populations. Rough fish are more common in eutrophic lakes.** Very limited readings from three different sites in 1996 show an average summer water clarity for McDill Pond of 2.6 ft., while 1997, 1998, and 2000 readings for one site show much clearer readings of 4.75, 4.8, and 5.3 feet respectively. Using these limited readings, **water clarity in McDill Pond may actually be improving slightly, or at the very least, not getting any worse.** Continued readings will be needed to know if McDill's water clarity is actually remaining the same or possibly improving over time.

STORMWATER IMPACTS

In the late 1960's, a storm sewer system was put in along Highway 10 (Clark Street) that drained into the Plover River. Prior to construction, concerns were raised about the pollution effects on the downstream swimming beach at Iverson Park, sediment contribution to McDill Pond, and impact to city wells.

In 1983, the City of Stevens Point contracted with the UW-Stevens Point Environmental Task Force Lab to study the impact of stormwater on the Plover River at the Hwy 10 storm sewer discharge[34]. Data are included in Appendix G. The results indicated a significant amount of nutrients and suspended solids entering the Plover River. Without a detention basin or some sort of sedimentation barrier at the discharge site, sediments and nutrients were unable to settle out of the stormwater and were directly entering the Plover River with stormwater.

When the Patch Street bridge and accompanying storm sewer system was constructed in the late 1970's, stormwater detention basins were put in to lessen the impact of stormwater pollution to McDill Pond.

In 1996, a study of stormwater impacts to McDill Pond was conducted[35] as part of the third grant project. The study looked at the impact of stormwater from the three main discharges to the Plover River and McDill Pond (Highway 10 near Iverson Park, Highway 51, and Patch Street.). Data and a map of the drainage areas are included in Appendix I. Results show that the stormwater discharges are contributing high levels of nutrients and somewhat high levels of sediment, lead, and zinc to the Plover River and McDill Pond. Of the three, the Highway 10 stormwater discharge is contributing the highest concentrations of nutrients and pollutants, most likely because there is no detention basin at that location to settle out particulates before discharging to the river. The results also show an increase in nutrient concentrations at the Highway 10 stormwater discharge since the 1983 study.

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[34] Mealy, R. and B. Shaw, 1983. Stormwater Runoff Quality in the Highway 10 Storm Sewer Discharge and its Impact on the Plover River: A Report to the City of Stevens Point. UW-Stevens Point.

[35] Lyden, T., 2000. McDill Pond Stormwater Investigation and Management. UW-Stevens Point.

SEDIMENT

Since at least the early 1960's, sediment has been a source of concern on McDill Pond. Because McDill Pond is an artificial lake created by damming the Plover River, the faster-moving Plover River water slows down when it reaches the inlet of McDill Pond. Slower-moving water cannot hold as much sediment, so the sediment is dropped out of the water when it reaches McDill Pond. The shallow nature of McDill Pond is compounded by the additional sediment deposited by the Plover River.

In terms of aquatic plants, sediment aids McDill Pond's plant growth in two ways:

1) Nutrients needed for plant growth are transported by sediments into the lake
2) The shallower the pond becomes, the more sunlight that is able to reach the bottom and aid plant growth

Sources of Sediment

Since there is another impoundment upstream of McDill Pond, most of the sediment that enters McDill Pond from the Plover River probably comes from the stretch of river in between the two impoundments.

In 1978, some erosion and sedimentation problems were reported to have developed[36]. Large gullies were reportedly contributing significant quantities of sediment to the Plover River.

In 1995, the UW-Stevens Point Environmental Task Force Lab conducted a streambank erosion study[37] as part of the second grant project. The study identified erosional sites upstream of McDill Pond contributing to sedimentation and developed some initial recommendations to address the issue. Twenty sites identified along the Plover River between Highway 66 and Iverson Park were estimated to be contributing 307.6 tons of sediment to the river annually. Six of the sites had erosion equal to or exceeding 10 tons of sediment per year, with estimates for these sites ranging from 10 to 100 tons of sediment/year. The six sites were responsible for 93% (286.8 tons/year) of the sediment input to this stretch of the Plover River. A map of the sites and erosional information is included in Appendix I. In addition to the stream bank erosion of sandy material, the study observed a significant amount of organic material such as leaves and other decomposed material being transported by the river. This is because the river flows through a forested area. The report concluded that control measures such as rock riprap or bio-engineering methods were needed to prevent stream bank erosion and additional sedimentation of McDill Pond.

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[36] Lemmens, J., D. Ankley, B. Shaw, J. Woller, and J. Zimmerman. 1978. McDill Pond Background and Lake District Considerations.

[37] UW-Stevens Point Environmental Task Force Lab, 1995. 1995 Plover River Erosion Evaluation - Jordan Park to Iverson Park.

Sedimentation Rate

The first known estimate of McDill Pond's sedimentation rate was done in 1983 when the UW-Stevens Point Environmental Task Force Lab was contracted to conduct a study for the City of Stevens Point[38]. The project measured water depths and soft sediment depths and compared results to a 1964 lake depth map prepared by the US Geological Survey. Maps showing 1983 water depths, soft sediment depths, and data are included in Appendix J.

The study determined that from 1964 to 1983, McDill Pond's average depth had decreased from 5'2" to 4'7". The biggest decreases were found in areas of the lake having depths less than 3 feet, which generally were the upper reaches of the lake. Overall, the report calculated a net decrease in lake volume of 145.8 acre-ft which, spread over the entire pond, corresponded to an overall reduction in average depth of 6.5" in 20 years.

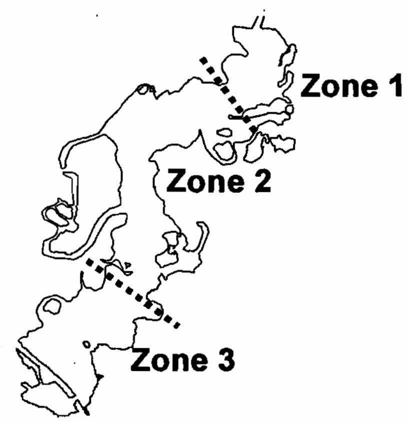
In terms of soft sediment, the 1983 study found that the heaviest accumulations of soft sediment were in the bays of secluded inlets opposite the river channel. The average depth of soft sediment in the pond in 1983 was 10.2 inches of soft sediments. Only slightly more than 25% of the pond had an accumulation of 2 feet or more. The total volume of soft sediment in the pond at the time was 359,000 cubic yards.

Ten years later, water and soft sediment depths were measured in 1993 as part of the first grant project, to approximate sediment inflow to McDill[39]. Depths were measured at various points along seven transects in McDill Pond and data were compared to the 1983 map of McDill Pond.

The report showed that from 1983 to 1992 the water depth in the pond had decreased and the depth of soft sediment had *significantly* increased,
as shown below:

Avg. Water Depth	1983	1992	Percent Change
upper portion (zone 1)	3.0 ft	1.4 ft	-54%
middle portion (zone 2)	4.3 ft	3.5 ft	-19%
lower portion (zone 3)	–	–	--

Avg. Soft Sediment Depth	1983	1992	Percent Change
upper portion (zone 1)	1.1 ft	3.7 ft	+236%
middle portion (zone 2)	1.0 ft	3.1 ft	+210%
lower portion (zone 3)	2.0 ft	3.9 ft	+95%



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[38] Shaw, B. and R. Mealy. 1983. Water, Sediment, Aquatic Weed Study of McDill Pond for City of Stevens Point. UW-Stevens Point.

[39] Short, Elliot, and Hendrickson Inc., 1994. McDill Pond Water Quality Studies Project, Phase One 1993 Report. SEH File A-STEPT3037.00

Historically, the area upstream of Patch Street had probably previously acted as a sediment trap for McDill Pond. By the 1980's, the area was reportedly filled, resulting in whatever sediment was being transported by the river instead entering McDill Pond.

In 1997, the City of Stevens Point undertook a detailed survey of the water depths and soft sediment depths in the pond for dredging information purposes. A computer-generated map showing 1997 water depths and soft sediment depths is on file with the City of Stevens Point Engineering Department. As part of the third grant project, results of that survey were compared to the 1983 information to more accurately determine sedimentation rates over time.

Results showed that the average water depth in McDill Pond had decreased 7" in 14 years, from an average depth of 4'7" in 1983 to 4'0" in 1997. This corresponds to a decrease in lake volume of about 157 acre-ft (about 253,000 cubic yards) from 1983 to 1997. **Based on this, about 18,000 cubic yards of sediment are probably deposited in McDill Pond each year. Overall, McDill Pond loses roughly 1/2" of depth every year due to sedimentation.**

Sediment Quality/Sediment Characteristics

In 1977, sediment sampling was done by UW-Stevens Point as part of an evaluation of possible water quality impacts from construction of the Patch Street bridge[40]. The study evaluated sediment samples above and below the proposed bridge for texture, pH, and nitrogen levels. A map of sampling sites and the results are included in Appendix K.

In 1983, sediment samples were collected by UW-Stevens Point as part of a water, sediment and aquatic weed study for the City of Stevens Point[41]. Fifteen sites in McDill Pond were sampled to determine the nitrogen and phosphorus content of the sediment. **Phosphorus and nitrogen levels were low in the upper reaches of the lake, typical of sandy sediments. Higher nitrogen and phosphorus values were found in calm bays where aquatic plant decomposition results in the accumulation of organic matter.** A map of the sampling locations and the data are included in Appendix L.

In 1988, the Stevens Point Parks and Recreation Department contracted with the UW-Stevens Point Environmental Task Force Lab to analyze three sediment core samples, two near Koziczkowski Park, and one near the Patch Street bridge. A map of the actual sampling locations and the data are included in Appendix M.

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[40] Shaw, Byron, 1977. An Evaluation of Possible Water Quality Impacts of the Patch Street Bridge Project.

[41] Shaw, B. and R. Mealy. 1983. Water, Sediment, Aquatic Weed Study of McDill Pond for City of Stevens Point. UW-Stevens Point.

The removal of nutrient-rich organic sediments by dredging should reduce some of the plant growth in McDill Pond. However, many of the sandy sediments still contain sufficient nutrients for excessive aquatic plant growth. In order to most effectively limit plant growth by dredging, some areas may need to be deepened to about 12' to prevent sunlight from reaching the bottom. Realistically, this is not possible throughout the pond, but could be used in specific areas.

There are two main types of dredging methods - mechanical and hydraulic. Mechanical dredging uses bulldozers and trucks to remove sediment, requiring the lake to be drawn down, and time for sediments to dry out. Hydraulic dredging is done with the water at a normal level and uses a barge to hydraulically pump wet sediments to a containment area for dewatering. The separated water is then returned to the lake.

In general, the primary concern over mechanical dredging is usually the effect of a drawdown on lake organisms. With hydraulic dredging, the main concerns are usually the stirring up of sediments and potential algae blooms as nutrients are released from the sediments into the water column.

Past dredging activities

The first known dredging on McDill Pond occurred during 1959-1962 when the pond was drawn down by the Village of Whiting to constuct a new dam. Muck was reportedly removed from some channels, and several areas of the pond were deepened, including a trout pond dug by a local sports club. A few property owners also reportedly draglined and bulldozed channels, and bottom material was used to create and expand some of the islands in the pond.[44]

In 1991, a second dredging operation occurred. The lake was drawn down from early September until November 1, 1991 to allow for private dredging by individual property owners and the dredging of a silt trap by the City of Stevens Point. The silt trap was formed by deepening a section of the Plover River just downstream of Patch Street. The purpose of the silt trap was to allow sediment to drop out of suspension into the deepened area and 'catch' the sediment before it entered the rest of the lake. When filled, the sediment trap could then be dredged out as needed.

In the early weeks of the three-month long drawdown, a lot of the sediments remained too wet to allow access by heavy dredging machinery. Due to this, most of the private dredging took place toward the end of the drawdown period. The most extensive dredging effort took place in the north channel where 17 property owners each contributed an average of $1000 toward dredging. Approximately 3,000 total cubic

[44] Lemmens, J., D. Ankley, B. Shaw, J. Woller, and J. Zimmerman. 1978. McDill Pond Background and Lake District Considerations.

yards of sediment were removed through private dredging efforts[45].

The dredging of the silt trap near Patch Street was done by the City of Stevens Point during the same time period. The trap measured about 120 ft x 80 ft x 8 ft deep and was expected to hold approximately 3,000 cubic yards of sediment. Several lake district members reported that the silt trap filled up with sediment quite quickly, probably within several months to a year after it had been created.

Sediments from all of the 1991 dredging efforts were placed in the city industrial park. The City of Stevens Point coordinated the permitting process for both the silt trap and the private dredging that took place. The permitting process reportedly took about 2 years and cost about $7000.

Up until the early 1970's, dredging also reportedly took place annually at the Iverson Park swimming beach. For those years, the deep swimming hole that was maintatined there probably acted as a small silt trap for the Plover River and ultimately for McDill Pond.

Dredging Feasibility Study

In the mid 1990's more comprehensive dredging efforts were being considered by the Lake District. As part of the second grant project, a dredging feasibility study was conducted for McDill Pond by the Short, Elliot, and Hendrickson, Inc. consulting firm.[46] The feasibility study evaluated options and costs for different dredging alternatives, located potential disposal sites, and reviewed environmental considerations.

The dredging feasibility study proposed creating boating channels 5-6' deep in the upper portions of McDill Pond. Two main dredging areas were evaluated, one north of the Wisconsin Central Railroad bridge running 3,200 feet upstream to Iverson Park, and one starting downstream of the Patch Street bridge and running 3,500 feet south. Varying dredge cut widths between 50 and 400 feet were used to develop different alternatives. The study looked at the options of both mechanical and hydraulic dredging for each of the alternatives. Cost estimates showed that mechanical dredging would cost less than hydraulic dredging for smaller projects. For larger projects the study concluded that the costs for the two methods would probably be similar.

The environmental considerations for mechanical dredging identified in the feasibility study centered mostly around the drawdown which could affect the fishery, reduce the water supply of wells near McDill Pond during the drawdown, and temporarily reduce

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[45] "Pond residents race to finish cleanup", Stevens Point Journal newspaper article, Oct 31, 1991, page 1.

[46] Short Elliot Hendrickson, Inc., 1996. McDill Pond Sediment Dredging Feasibility Study. SEH No. STEPT9702.00

muskrat and other fur-bearing animal populations. The main environmental considerations identified for hydraulic dredging were that a rise in the water table at a disposal site could cause flooding of nearby basements or septic systems, and that potential pollutants such as nitrate or organic nitrogen could be discharged to groundwater in the process.

Recent Dredging Attempts

In 1998 attempts were made to hydraulically dredge 400,000 cubic yards of sediment from McDill Pond. The project would have transported dredged material via pipeline to the Portage County business park and would have cost approximately $2,073,000. Portage County had agreed to pay $800,000 to the lake district to purchase 200,000 cubic yards of the dredged material for construction of the Brilowski Road overpass. At a 1998 special lake district meeting, lake district residents approved an annual maximum assessment of $1,055 per property owner for 10 years to pay for the remainder of the dredging costs. The project contractor was JF Brennan from LaCrosse, WI. In 1999, the project encountered difficulties with dredging permits and obtaining approval to install monitoring wells for groundwater at the site of the business park. These difficulties ultimately put a halt to the dredging plans.

Another dredging plan is currently underway. In 2000, the Stevens Point Common Council approved $250,000 towards a dredging project. This funding will be matched by a prior $250,000 state grant provided through the efforts of State Senator Shibilski. The project plans are to hydraulically remove sediment primarily from the northern portion of the pond. The land located immediately west of the pond and south of Patch Street is proposed to be used as a containment site and temporary storage of the material before it can be sold to recover some of the costs.

SUMMARY & LAKE MANAGEMENT RECOMMENDATIONS

Aquatic Plants

The physical characteristics of McDill Pond provide ample growing conditions for rooted aquatic plants. The clear water and shallow nature of the pond allow sunlight to reach the bottom of most of the pond, aiding plant growth. Nutrient levels in the water, particularly phosphorus, are high enough in McDill Pond to support an excessive growth of aquatic plants. Many of the lake's nutrient-rich sediments provide ideal growing conditions.

The physical removal of aquatic plants by harvesting does reduce some of the phosphorus, but the amount is minimal compared to the total phosphorus that annually accumulates in McDill Pond. Harvesting, therefore, should primarily be considered as a way to provide recreational relief and improve aesthetics.

Management Recommendations:

1. Reduce phosphorus inputs to McDill Pond wherever possible. This can be done through stormwater controls, reducing fertilizer use in the area surrounding McDill Pond, and reducing sediment input from streambank erosion upstream of McDill Pond. Specific recommendations are included in the water quality, and sediment recommendation sections.
2. Continue aquatic plant harvesting efforts, including adding a second harvester as planned in 2001 to increase efficiency and overall plant harvest.
3. Continue to avoid known fish spawning areas with the harvester during May and early June. Update harvesting plan as needed.

Fisheries

McDill Pond has been considered a very good bass and bluegill lake, and has also supported a good yellow perch population. Historical information indicated that previous drawdowns on McDill Pond, including a three year drawdown in 1959, did not negatively impact the fishery.

Fish sampling results done after the three month drawdown in 1999 show good reproduction of northern pike, largemouth bass, crappies, and bluegills, but lower numbers of yellow perch. DNR fisheries staff anticipate that the yellow perch population will come back on its own and that McDill's overall panfish fishery will be back to normal in 2-3 years.

Management Recommendations

1. Continue to work with the DNR to determine how the fishery is progressing and if

additional management activities will be needed.
2. Identify and protect spawning areas
3. Promote natural shorelines for spawning/habitat purposes

Water Quality

Data collected over the years show McDill Pond's water quality to be in fair condition. Phosphorus levels in the lake are high enough to cause excessive aquatic plant growth, but are still below the levels found in many problem lakes. Phosphorus is the key nutrient that affects plant and algae growth in McDill Pond. It originates from a variety of sources including soil erosion, detergents, leaves, grass clippings, and also lawn fertilizers. The 1992 property owner survey showed that 72% of respondents in the lake district regularly fertilize their lawns and 21% regularly use herbicides and pesticides on their lawns. While the use of these chemicals may not be considered overly excessive, they can still contribute to the "fertilization and pollution" of McDill Pond. Rainfall and snowmelt events can easily carry phosphorus and sediment from nearby lands into the McDill Pond and the Plover River.

Jordan Pond acts as a sediment and nutrient trap for McDill, preventing most upstream pollutants from reaching McDill Pond. For this reason, land uses and activities that occur below Jordan Pond have a much greater impact on McDill Pond's water quality.

Management Recommendations:

1. Continue to regularly monitor the water clarity of McDill Pond through the DNR Self-Help Lake Monitoring Program.
2. Reduce fertilizer use in the immediate drainage area of McDill Pond. Fertilizers applied before a rain event, excessive fertilizer, or fertilizer spilled on sidewalks and driveways can all be washed into McDill Pond, thereby adding phosphorus and other nutrients and pollutants to the lake.
3. Encourage natural shorelines. Natural shorelines help filter nutrients and pollutants out of runoff before reaching the lake.
4. Reduce nutrient and pollutant inputs from storm sewers (see stormwater recommendation section).

Stormwater

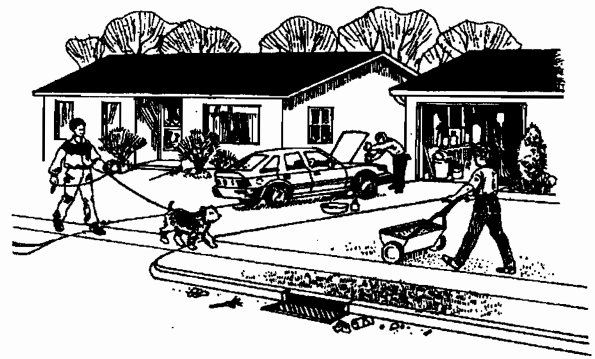
All stormwater outlets that drain to McDill Pond or the Plover River contribute some amount of nutrients, pollutants, or sediment to the lake. Of the three main stormwater discharges to McDill Pond and the Plover River, the Highway 10 stormwater discharge is contributing the highest concentration of nutrients and pollutants. This is likely because there is no detention basin at that location to settle out particulates before discharging to the river.

Management Recommendations:

1. Support the use of city street sweeping equipment to clean debris and pollutants

from streets. Encourage private street sweeping for parking lots. This will remove pollutants from streets before they are washed into the stormsewers by large rain events that will carry them into the waterway.

2. Reduce the use of lawn fertilizers in the stormwater drainage areas. Fertilizers applied before a rain event, the application of excessive fertilizer, or fertilizer spilled on sidewalks and driveways can all be washed into storm sewers and eventually into the Plover River and McDill Pond.



3. Support local and state construction site erosion controls. The use of erosion controls during construction can significantly reduce the amount of sediment that enters into storm sewers and eventually into waterbodies. Sediment particles can also easily transport phosphorus into waterways.
4. Support the use of detention basins for any future storm sewer constructions.
5. Encourage/support any potential modification of the Highway 10 storm sewer to include a detention basin.

Sediment

McDill Pond is an artificial lake created by damming up a section of the Plover River. For this reason, some amount of sediment will always be brought into McDill Pond from the river. This happens because the fast-moving Plover River water has to slow down when it enters McDill Pond. Slower-moving water cannot hold as much sediment, and the sediment gets dropped out of suspension and deposited in McDill. This additional sediment load from the river compounds the already shallow nature of McDill Pond.

The amount of sediment accumulating in McDill Pond over time is probably more noticeable than in some impoundments. This is because McDill Pond's volume is very small compared to the large volume of water flowing down the Plover River. Consequently, McDill Pond receives a relatively high amount of incoming flow and therefore more potential to accumulate sediment.

Historically, the area upstream of Patch Street has acted as a sediment trap for McDill Pond. Aerial photos show that this area currently contains a great deal of sediment. The area is probably unable to hold a lot of additional sediment, and therefore, most incoming sediment is probably now getting deposited downstream of Patch Street in McDill Pond.

Incoming sediment aids aquatic plant growth by transporting nutrients into McDill Pond, and by causing the lake to become more shallow, thereby allowing more sunlight to reach the bottom and promote plant growth.

Streambank Erosion

Most of the sediment that enters McDill Pond from the Plover River probably comes from streambank erosion and river channel scouring in the stretch of river between Jordan Pond and McDill Pond. While some amount of sediment will always be picked up and transported by the Plover River, it may be possible to reduce that quantity by limiting the amount of erosion that is occurring along the river. Twenty streambank erosion sites between Jordan Pond and McDill Pond have been identified. Six of these sites were estimated to be contributing over 90% of the streambank erosion to the Plover River.

Management Recommendations

1. Investigate the use of control measures such as rock riprap or bio-engineering methods to reduce streambank erosion at one or more of the six major erosion sites identified on the Plover River.

Dredging

Based on an estimated quantity of 18,000 yds^3 of sediment annually deposited in McDill Pond, periodic dredging will need to occur to maintain adequate boating depths. Without any dredging, the pond will eventually revert to a stream and wetland.

Based on past experience, small-scale efforts (such as dredging a small silt trap) are probably less cost effective options in the long run than large-scale dredging efforts. Large-scale dredging efforts essentially create a much larger silt trap that needs to be dredged out less often, so dredging efforts can be repeated over much longer intervals. Based on the annual estimated sediment deposition rate of 18,000 yds^3, a 200,000 yds^3 dredging project would not need to be repeated again for over 10 years.

The removal of nutrient-rich organic sediments by dredging should reduce some of the plant growth in McDill Pond. However, many of the sandy sediments still contain sufficient nutrients for excessive aquatic plant growth. In order to most effectively limit plant growth by dredging, some areas may need to be deepened to about 12' to prevent sunlight from reaching the bottom. Realistically, this is not possible throughout the pond, but could be used in specific areas.

Overall dredging goals should not be to create a uniform depth in the lake, or a 'bathtub' type of lake. Dredging goals should include creating lake bottom contours that provide a variety of depths to improve fish habitat and aquatic plant diversity.

Management Recommendations

1. Continue to pursue current dredging plans
2. Monitor sediment accumulation over time in McDill Pond over time, either through aerial photos or actual depth measurements
3. Pursue additional dredging as needed

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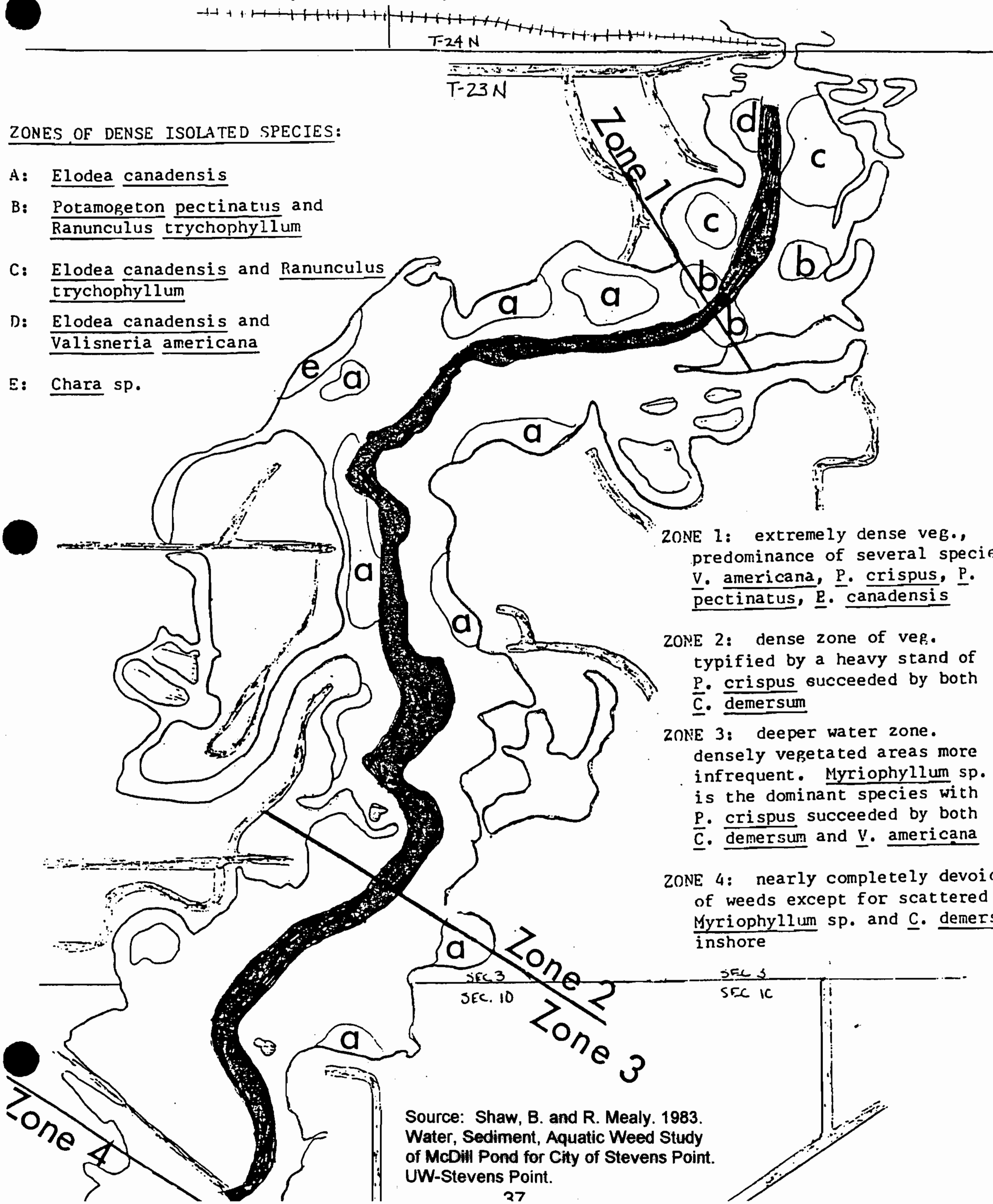
Appendix A

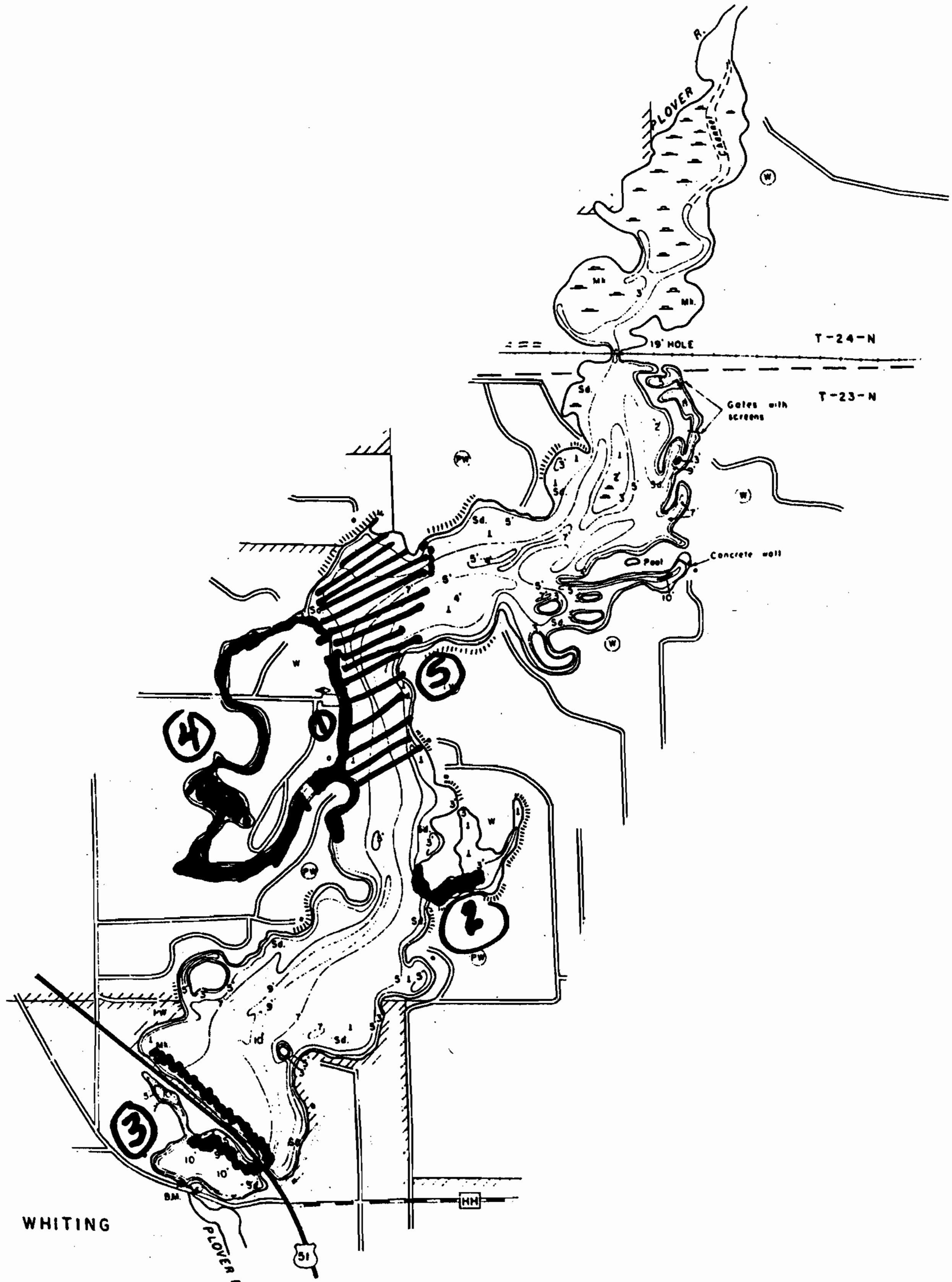
Map of 1983 Aquatic Plant Distribution



Source: Shaw, B. and R. Mealy. 1983. Water, Sediment, Aquatic Weed Study of McDill Pond for City of Stevens Point. UW-Stevens Point.

Appendix B

Map of 1967-1982 McDill Pond Aquatic Herbicide Use



Appendix B (cont'd)

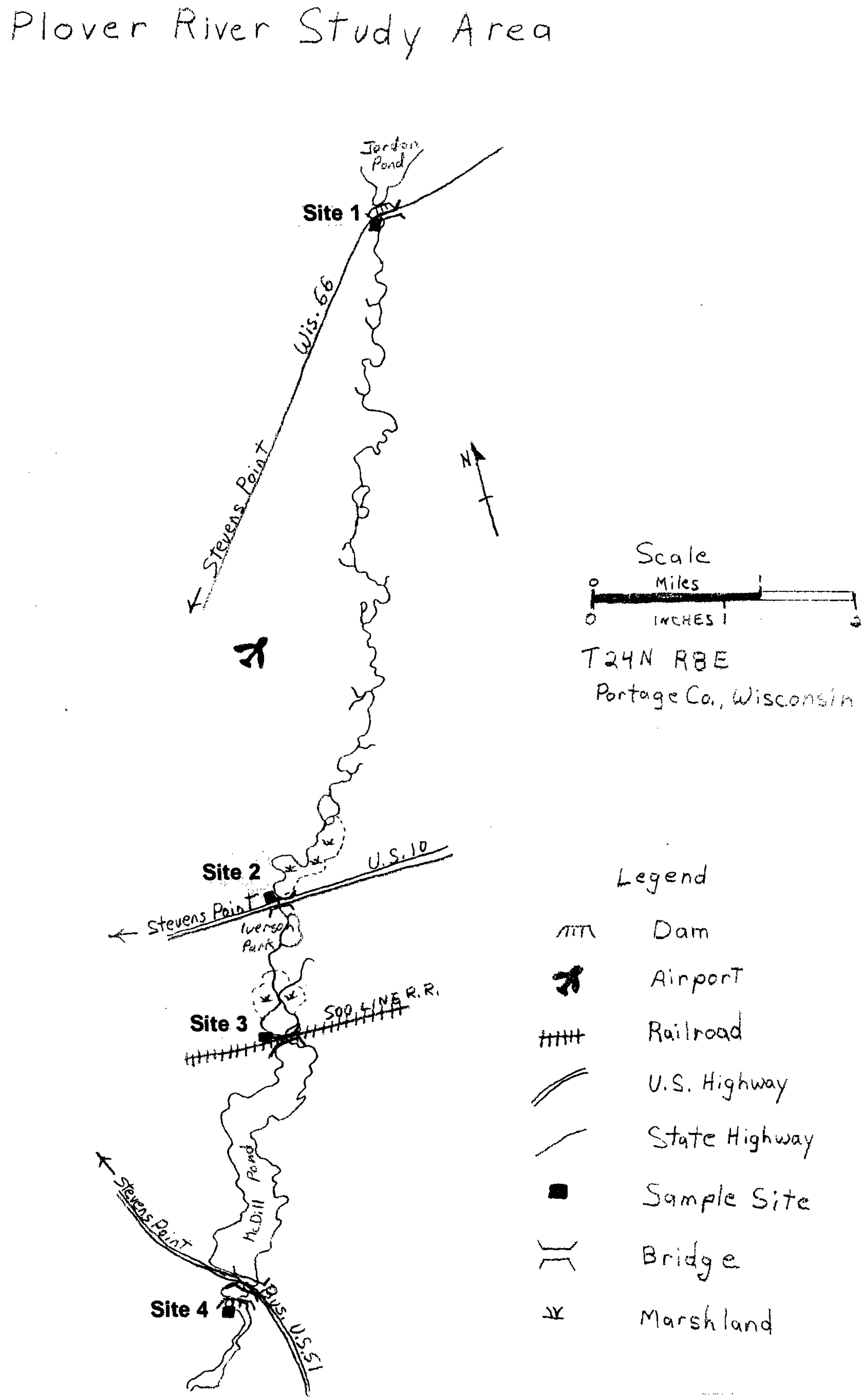
1967-1982 McDill Pond Aquatic Herbicide Use

Chemical	Date	Acres Treated	Chemical Amount		Active Ingredient	Fraction AI		Amount AI (lbs)	Location (see map)
Sodium	7/17/67	7.0	90.0	gal.	Arsenic	6.0	lbs/gal	540.0	3
Diquat	6/7/68	6.0	12.0	gal.	Diquat	2.0	lbs/gal	24.0	1,2,3
Diquat	7/3/68	1.1	3.0	gal.	Diquat	2.0	lbs/gal	6.0	3
Diquat	8/7/68	2.0	3.0	gal.	Diquat	2.0	lbs/gal	6.0	1,2,3
Aquathol	8/7/68	2.0	50.0	lbs.	Endothall	7.2	%	3.6	1,2,3
Diquat	6/24/69	10.0	20.0	gal.	Diquat	2.0	lbs/gal	40.0	1,2,3
Diquat	7/29/69	2.0	5.0	gal.	Diquat	2.0	lbs/gal	10.0	1,2,3
Aquathol K	7/6/70	2.0	22.5	gal.	Endothall	3.0	lbs/gal	66.0	1,2,3
Aquathol	7/6/70	0.5	150.0	lbs.	Endothall	7.2	%	10.8	1,2,3
Diquat	7/6/70	5.0	10.5	gal.	Diquat	2.0	lbs/gal	21.0	1,2,3
Diquat	8/4/70	2.0	2.0	gal.	Diquat	2.0	lbs/gal	4.0	2
Aquathol K	6/21/71	17.0	16.0	gal.	Endothall	3.0	lbs/gal	48.0	*
Copper Sulfate	7/4/71	11.1	60.0	lbs.	Copper	25.0	%	15.0	*
Aquathol Plus	6/24/72	10.5	35.0	gal.	Endothall	1.7	lbs/gal	59.5	1,4
Aquathol Plus	6/24/72	10.5	35.0	gal.	Silvex	2.4	lbs/gal	84.0	1,4
Aquathol Plus	7/13/73	4.7	35.0	gal.	Endothall	1.7	lbs/gal	59.5	1,4
Aquathol Plus	7/13/73	4.7	35.0	gal.	Silvex	2.4	lbs/gal	84.0	1,4
Aquathol Plus	7/13/73	5.5	200.0	lbs.	Endothall	3.6	%	7.2	1,4
Aquathol Plus	7/13/73	5.5	200.0	lbs.	Silvex	5.0	%	10.0	1,4
Aquathol Plus	6/28/74	18.0	50.0	gal.	Endothall	1.7	lbs/gal	85.0	1,4,5
Aquathol Plus	6/28/74	18.0	50.0	gal.	Silvex	2.4	lbs/gal	120.0	1,4,5
Aquathol K	6/13/75	18.0	30.0	gal.	Endothall	3.0	lbs/gal	90.0	1,4,5
Diquat	6/13/75	18.0	8.0	gal.	Diquat	2.0	lbs/gal	16.0	1,4,5
Diquat	6/18/76	20.0	19.0	gal.	Diquat	2.0	lbs/gal	38.0	1,4,5
Aquathol K	6/18/76	20.0	30.0	gal.	Endothall	3.0	lbs/gal	90.0	1,4,5
Copper Sulfate	6/18/76	15.0	100.0	lbs.	Copper	25.0	%	25.0	1,4,5
Diquat	6/18/77	20.0	35.0	gal.	Diquat	2.0	lbs/gal	70.0	1,4,5
Diquat	6/17/78	25.0	46.0	gal.	Diquat	2.0	lbs/gal	92.0	1,4,5
Diquat	6/23/79	25.0	40.0	gal.	Diquat	2.0	lbs/gal	80.0	1,4,5
Cutrine Plus	6/23/79	25.0	40.0	gal.	Copper	0.9	lbs/gal	36.0	1,4,5
Cutrine Plus	6/14/80	25.0	30.0	gal.	Copper	0.9	lbs/gal	27.0	1,4,5
Diquat	6/14/80	25.0	30.0	gal.	Diquat	2.0	lbs/gal	60.0	1,4,5
Diquat	6/6/81	25.0	29.0	gal.	Diquat	2.0	lbs/gal	58.0	1,4,5
Aquathol K	6/6/81	25.0	30.0	gal.	Endothall	3.0	lbs/gal	90.0	1,4,5
Cutrine Plus	6/6/81	25.0	40.0	gal.	Copper	0.9	lbs/gal	36.0	1,4,5
Cutrine Plus	6/19/82	27.0	25.0	gal.	Copper	0.9	lbs/gal	22.5	1,4,5
Aquathol K	6/19/82	27.0	25.0	gal.	Endothall	3.0	lbs/gal	75.0	1,4,5
Diquat	6/19/82	27.0	23.0	gal.	Diquat	8.0	lbs/gal	46.0	1,4,5

* unknown herbicides were used throughout the south ½ of the pond
compiled by Bill Jaeger, DNR

Appendix C

1975 Water Quality Data - Jordan Park to McDill Pond



Appendix C (cont'd)

1975 Water Quality Data - Jordan Park to McDill Pond

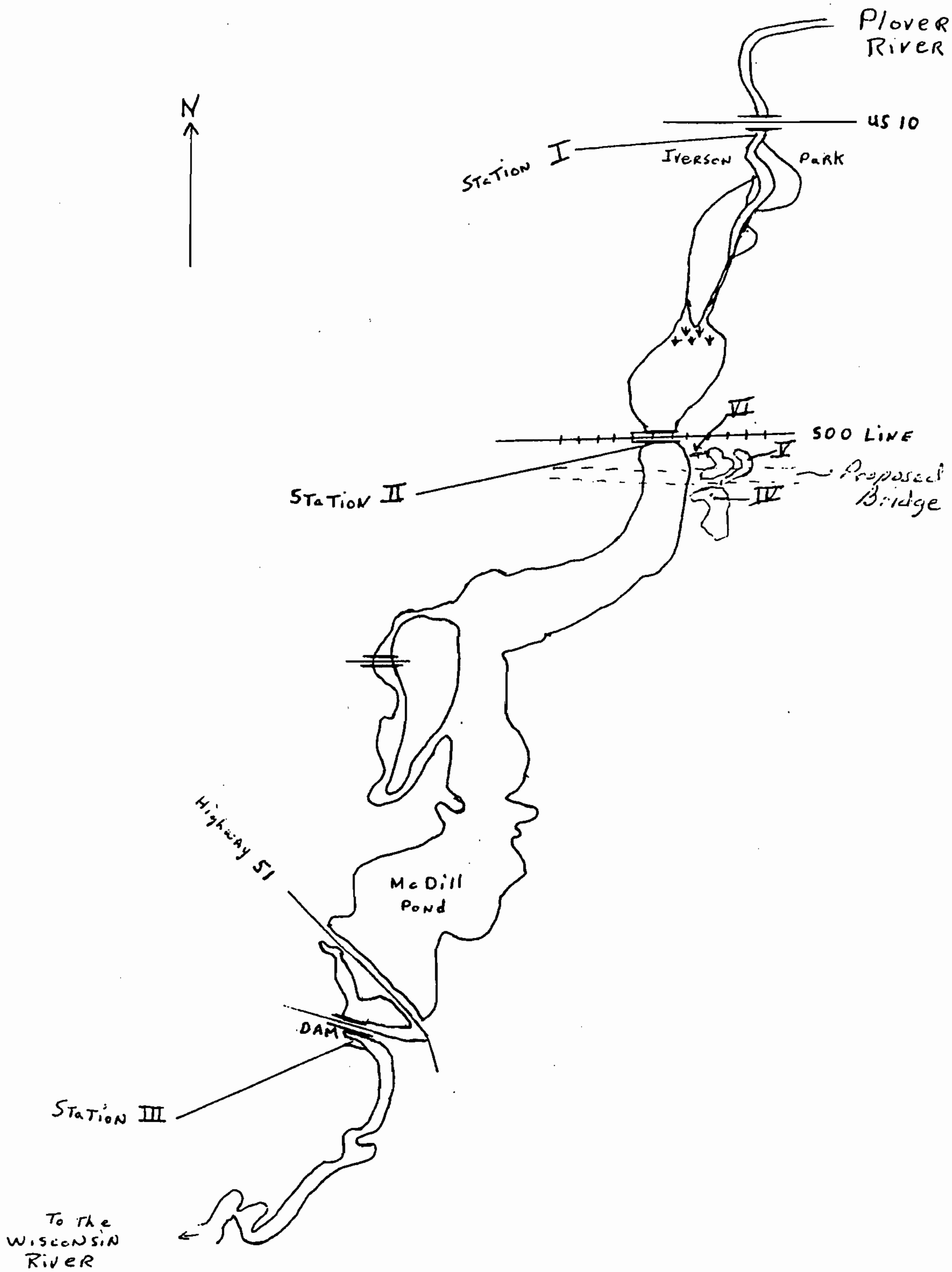
Table 1. Water Quality Data - Plover River Jordan Pond to McDill Pond in ppm except pH

Sample	°C Temp.	pH	Oxygen	B.O.D.	C.O.D.	NH_4^+	$NO_3^- - NO_2^-$	Org. N	Alkalinity	Calcium Hardness	Total Hardness	Ortho Phosphate	Total Phosphorous	Conductance / T.D.S.	Total Iron	Chloride	Mg ++ Hardness	Sulfate	Silica
10/14 1	14.5	8.1	9.3	1.3	5.6	.250	.175	.980	178.0	180.0	212.0	.004	.021	340 / 221.0	.058	7.74	97.9	—	—
10/14 2	14.5	8.2	9.4	0.9	4.0	.105	.168	.880	178.0	160.0	194.0	.004	.035	330 / 214.5	.340	7.74	93.8	—	—
10/14 3	14.5	8.2	10.0	1.4	1.6	.063	.192	.910	174.0	116.0	189.0	.002	.014	330 / 214.5	.030	6.88	68.8	—	—
10/14 4	14.5	8.2	9.9	1.2	4.0	.262	.213	.880	174.0	110.0	186.0	.004	.014	320 / 208.0	.065	7.96	67.5	—	—
11/8 1	10.0	7.7	10.8	2.5	—	.280	.490	—	183.0	142.0	234.0	.006	0	355 / 230.75	.100	9.14	—	9.5	.50
11/8 2	10.0	7.8	9.8	2.4	—	.245	.385	.350	174.0	146.0	248.0	.0013	.0025	331 / 215.15	.210	12.9	—	10.8	.45
11/8 3	9.5	7.9	8.8	2.5	—	.455	.560	.210	179.0	140.0	248.0	.0025	.0025	311 / 202.15	.062	10.75	—	10.0	.43
11/8 4	10.0	7.9	10.8	2.8	—	.210	.595	.140	165.0	142.0	228.0	.002	.0023	321 / 208.65	.370	12.69	—	10.8	.45

Note: — indicates value not obtained

Appendix D

1975-1977 Water Quality Data



Appendix D (cont'd)

1975-1977 Water Quality Data

DATA SHEET

PATCH STREET BRIDGE - TABLE II

NO.	SITE	DEPTH	TEMP C°	pH	COND µMHOS	ALK	TOTAL HARD	Ca^{++} HARD	D.O.	C.O.D.	BOD_5	ORTHO P	TOTAL P	NH_4 N	NO_3-NO_2 N	Kjeldahl N
	Below Dam 8-17-77	1 ft.		8.78	300	145	156	82	9.1	10.9	2.35	.023	.030	0.01	0.11	0.35
	Below Dam 9-12-77	1 ft.	18.1	8.45	322	150	166	114	9.2	12.17	1.10	.010	.029	.02	0.25	0.52
	Below Dam 9-28-77	1 ft.	14.8	8.35	294	148	166	90	9.1	33.8	1.35	.006	.031	0.25	0.64	0.47
	Below Dam 10-10-77	1 ft.	9.5	8.31	310	148	168	146	10.3	13.50	.80	.010	.020	.02	.75	0.84
IV	Spring Pond 3-10-75	1 ft.	7.0	7.82	380	131	182	176	9.2	0	1.65	0.034	0.057	0.00	4.24	1.09
	Spring Pond 5-27-75	1 ft.	20	8.5	259	111	142	72	16.2	.73	1.31	.006	.012	0.00	3.22	0.38
	Spring Pond 10-6-75	1 ft.	13.0	8.39	291	136	164	86	9.1	23.5	1.15	.004	.038	0.30	4.30	0.68
	Spring Pond 9-28-77	1 ft.	14.0	8.20	291	136	164	86	9.1	23.5	1.15	.004	.038	0.30	4.30	0.68
V	Culvert 3-10-75	1 ft.	3.0	7.87	319	125	168	162	8.3	0	0.95	0.025	0.086	0.00	4.17	0.56
	Culvert 5-27-75	1 ft.	20	8.65	261	116	147	74	17.5	2.91	1.50	.001	.018	0.00	3.22	0.38
	Culvert 10-6-75	1 ft.	12.0	8.46	315	134	218	132	13.4	6.98	2.95	.002	.012	0.00	3.12	0.42
	Culvert 9-28-77	1 ft.	13.7	8.38	307	146	168	92	11.1	1.4	1.25	.004	.126	0.35	3.90	0.52
VI	Pond Outlet 3-10-75	1 ft.	6.5	8.22	312	123	178	170	12.0	0	0.05	0.015	0.030	0.00	4.38	0.18
	Pond Outlet 5-27-75	1 ft.	22	8.65	304	148	172	104	15.6	9.45	3.60	.006	.006	0.00	1.12	0.56

ALL VALUES IN PPM UNLESS NOTED

1975-1977 Water Quality Data

DATA SHEET

PATCH STREET BRIDGE - TABLE III

NO.	SITE	DEPTH	TEMP C°	pH	COND µMHOS	ALK	TOTAL HARD	Ca^{++} HARD	D.O.	C.O.D.	BOD_5	ORTHO P	TOTAL P	NH_4 N	NO_3-NO_2 N	Kjeldahl N
	Pond Outlet 10-6-75	1 ft.	13.0	8.12	319	132	216	132	10.4	5.08	3.50	.004	.011	0.00	3.40	0.35
	Pond Outlet 9-28-77	1 ft.	12.9	8.22	291	134	160	90	8.6	17.6	1.20	.004	.021	0.25	4.35	0.47

ALL VALUES IN PPM UNLESS NOTED

Appendix E (cont'd)

1977-1981 and 1992-1993 Water Quality Data

INFLOW SAMPLING SITE McD-In2

Parameter / Date	1977 Jul-18	1977 Aug-16	1977 Sep-12	1977 Oct-10	1977 Nov-08	1977 Dec-12	1978 Jan-18	1978 Feb-13	1978 Mar-13	1978 Apr-24	1978 May-22	1978 Jun-20	1978 Jul-17	1978 Aug-14	1978 Sep-18	1978 Oct-30	1978 Dec-11	1979 Jan-18
Temperature (C)	26.3		18.1	9.5	9.8	0.6	0.5	0	1	8	20.8	22.2	24.3	25.6	15.8	7.1	0	0
Dissolved Oxygen (mg/L)	7.7	9.1	9.2	10.3	10	11.2	11.2	11.65	13.78	11.4	8.31	8.24	7.18	8.21	7.9	10.8	11.2	10.5
Chloride (mg/L)															7.6	7.9	9.5	6.9
Alkalinity (mg/L)	156	145	150	148	134	156	166	170	158	118	132	148	146	162	136	158	170	174
pH	8.61	8.78	8.45	8.31	7.98	7.69	7.70	7.68	8.04	8.13	8.56	8.46	8.10	8.42	8.00	8.00	7.80	7.54
Total P (mg/L)	0.052	0.030	0.029	0.020	0.028	0.009	0.014	0.015	0.018	0.015	0.037	0.034	0.026	0.039	0.080	0.014	0.018	0.014
Dissolved P (mg/L)	0.008	0.023	0.010	0.010	0.006	0.006	0.011	0.011	0.009	0.004	0.021	0.034	0.015	0.004	0.032	0.004	0.006	0.014
Ammonia-Nitrogen (mg/L)	0.060	0.010	0.020	0.020	0.050	0.080	0.100	0.020	0.210	0.040	0.010	0.050	0.030	0.030	0.030	0.005	0.005	0.050
NO3+NO2-Nitrogen (mg/L)	0.010	0.110	0.250	0.750	0.620	1.400	1.800	1.560	1.540	0.730	0.650	0.540	0.900	0.880	0.720	1.120	1.720	1.640
Inorganic N (mg/L)	0.070	0.120	0.270	0.770	0.670	1.480	1.900	1.580	1.750	0.770	0.660	0.590	0.930	0.910	0.750	1.125	1.725	1.690

Parameter / Date	1979 Feb-12	1979 Mar-12	1979 Apr-24	1979 May-29	1979 Jun-25	1979 Jul-23	1979 Aug-20	1979 Sep-17	1979 Oct-15	1980 Nov-26	1980 Jan-08	1980 Feb-18	1980 Mar-24	1980 Apr-21	1980 May-19	1980 Jun-09	1980 Jul-21	1980 Aug-25
Temperature (C)		0.2	15	20.3	19.8	25	18.8		7.5	2.3		0	3	18	18	17.3	26	20.8
Dissolved Oxygen (mg/L)	11.1	12.12	8.3	8.1	7.2	7.5	8.3	9	11.21	11.9	12.6	12.2	12	9.4	9.8	5.46	7.9	7.1
Chloride (mg/L)	6.9	10.7	4.8	6.6	7	11.1	6.7	5.5	6.9	3.9	8.8	5.58	19.04	4.5	6.02	2.32	7.8	5.6
Alkalinity (mg/L)	170	164	92	154	134	174	176	174	178	130	194	180	126	128	145	64	166	134
pH	7.44	7.84	7.65	8.25	7.99	8.34	8.22	8.39	8.36	7.99	7.9	7.81	7.8	8.2	8.45	7.33	8.36	8.05
Total P (mg/L)	0.024	0.093	0.060	0.035	0.070	0.045	0.040	0.030	0.030	0.025	0.020	0.040	0.160	0.045	0.035	0.040	0.029	0.040
Dissolved P (mg/L)	0.023	0.026	0.008	0.030	0.050	0.006	0.014	0.005	0.002	0.002	0.005	0.010	0.070	0.001	0.002	0.015	0.002	0.005
Ammonia-Nitrogen (mg/L)	0.030	0.010	0.110	0.010	0.080	0.040	0.030	0.020	0.020	0.040	0.110	0.080	0.520	0.010	0.200	0.070	0.010	0.010
NO3+NO2-Nitrogen (mg/L)	1.540	1.280	0.250	0.550	0.820	0.700	1.040	0.960	1.120	1.120	1.850	1.860	1.280	0.860	0.520	0.130	0.610	0.700
Inorganic N (mg/L)	1.570	1.290	0.360	0.560	0.900	0.740	1.070	0.980	1.140	1.160	1.960	1.940	1.600	0.870	0.540	0.200	0.620	0.760

Parameter / Date	1980 Sep-22	1980 Oct-27	1981 Dec-15	1992 Jul-28	1992 Aug-24	1992 Sep-30	MIN.	MAX.	AVE.	STDEV.
Temperature (C)	14.7		0				0.00	26.30	12.24	9.53
Dissolved Oxygen (mg/L)	7.1	11.8	12.5				5.46	13.78	9.76	2.01
Chloride (mg/L)	6.1	6.8	6.4	10	10	9	2.32	19.04	7.50	3.06
Alkalinity (mg/L)	106	138	188	178	184	147	64.00	194.00	151.21	26.28
pH	7.66	7.91	7.92	8.31	8.39	8.11	7.33	8.78	8.07	0.34
Total P (mg/L)	0.027	0.010	0.012	0.028	0.023	0.025	0.009	0.160	0.036	0.028
Dissolved P (mg/L)	0.005	0.001	0.001				0.001	0.070	0.013	0.014
Ammonia-Nitrogen (mg/L)	0.040	0.040	0.070	0.023	0.018	0.018	0.005	0.520	0.058	0.086
NO3+NO2-Nitrogen (mg/L)	0.590	1.080	1.900	1.330	1.130	1.230	0.010	1.900	0.985	0.509
Inorganic N (mg/L)	0.630	1.120		1.353	1.148	1.253	0.070	1.960	1.013	0.511

Appendix E (cont'd)

1977-1981 and 1992-1993 Water Quality Data

INFLOW SAMPLING SITE McD-In1							
	1992	1992	1992	MIN.	MAX.	AVE.	STDEV.
Parameter Date	Jul-28	Aug-24	Sep-30				
Temperature (C)							
Dissolved Oxygen (mg/L)							
Chloride (mg/L)	10.00	9.00	9.00	9.00	10.00	9.33	0.58
Alkalinity (mg/L)	180	186	146	146	186	171	22
pH	8.26	8.37	8.17				
Total P (mg/L)	0.029	0.024	0.032	0.024	0.032	0.028	0.004
Dissolved P (mg/L)							
Ammonia-Nitrogen (mg/L)	0.040	0.022	0.020	0.020	0.040	0.027	0.011
NO3+NO2-Nitrogen (mg/L)	1.340	1.110	1.300	1.110	1.340	1.250	0.123
Inorganic N (mg/L)	1.380	1.132	1.320	1.132	1.380	1.277	0.129

INFLOW SAMPLING SITE McD-In2							
	1992	1992	1992	MIN.	MAX.	AVE.	STDEV.
Parameter Date	Jul-28	Aug-24	Sep-30				
Temperature (C)							
Dissolved Oxygen (mg/L)							
Chloride (mg/L)	10	10	9	9.00	10.00	9.67	0.58
Alkalinity (mg/L)	178	184	147	147	184	170	20
pH	8.31	8.39	8.11				
Total P (mg/L)	0.028	0.023	0.025	0.023	0.028	0.025	0.003
Dissolved P (mg/L)							
Ammonia-Nitrogen (mg/L)	0.023	0.018	0.018	0.018	0.023	0.020	0.003
NO3+NO2-Nitrogen (mg/L)	1.330	1.130	1.230	1.130	1.330	1.230	0.100
Inorganic N (mg/L)	1.353	1.148	1.253	1.148	1.353	1.251	0.103

Appendix E (cont'd)

1977-1981 and 1992-1993 Water Quality Data

OUTFLOW SAMPLING SITE McD-OUT

	1977	1977	1977	1977	1977	1977	1977	1977	1978	1978	1978	1978	1978	1978	1978	1978	1978	1978
Parameter Date	May-24	Jun-20	Jul-18	Aug-16	Sep-12	Oct-10	Nov-08	Dec-12	Jan-18	Feb-13	Mar-13	Apr-24	May-22	Jun-20	Jul-17	Aug-14	Sep-18	Oct-30
Temperature (C)	22.50	22.50	26.3	18.1	9.5	9.8	0.5	0.5	0.6	1	8	18.5	21.6	23.8	24.1	16.5	7.2	0
Dissolved Oxygen (mg/L)	7.00	8.40	7.7	9.1	9.2	10.3	10	11.4	11.2	11.75	13.55	10.5	7.8	8.34	7.28	7.59	8.2	11.3
Chloride (mg/L)																	8.3	12.2
Alkalinity (mg/L)	128	138	156	145	150	148	134	164	166	158	116	122	150	140	152	134	158	172
pH	8.22	8.80	8.61	8.78	8.45	8.31	7.98	7.80	7.70	7.53	7.89	8.20	8.37	8.45	8.10	8.46	8.00	8.60
Total P (mg/L)	0.040	0.019	0.052	0.030	0.029	0.020	0.028	0.010	0.014	0.015	0.013	0.026	0.032	0.037	0.028	0.035	0.088	0.016
Dissolved P (mg/L)	0.018	0.006	0.008	0.023	0.010	0.010	0.006	0.006	0.011	0.014	0.004	0.008	0.019	0.030	0.016	0.006	0.024	0.011
Ammonia-Nitrogen (mg/L)	0.460	0.070	0.060	0.010	0.020	0.020	0.050	0.130	0.100	0.040	0.020	0.010	0.020	0.050	0.060	0.050	0.050	0.030
NO3+NO2-Nitrogen (mg/L)	0.670	0.110	0.010	0.110	0.250	0.750	0.620	1.500	1.800	1.780	1.820	0.800	0.440	0.600	0.700	0.720	0.660	1.140
Inorganic N (mg/L)	1.130	0.180	0.070	0.120	0.270	0.770	0.670	1.630	1.900	1.820	1.840	0.810	0.460	0.650	0.760	0.770	0.710	1.170

	1978	1979	1979	1979	1979	1979	1979	1979	1979	1979	1979	1980	1980	1980	1980	1980	1980	1980
Parameter Date	Dec-11	Jan-18	Feb-12	Mar-12	Apr-23	May-29	Jun-25	Jul-23	Aug-20	Sep-17	Oct-15	Nov-26	Jan-08	Feb-18	Mar-24	Apr-21	May-19	Jun-09
Temperature (C)	0	0	0	0.6	14.5	18	18.9	24.5	19.3	16.2	7	2.3	0	0	0.5	15	14.5	17.2
Dissolved Oxygen (mg/L)	12.6	11.1	12.1	12.42	9.86	8.2	8.1	7.6	8.8	10	12.32	12.3	2.3	12.9	12.2	10.2	9.6	6.78
Chloride (mg/L)	13.4	7.7	7	9.7	5.32	6.9	7.63	11.1	7.8	8.9	7.2	6.8	10.54	6.53	6.22	5.4	7.42	2.68
Alkalinity (mg/L)	174	168	160	89	146	128	166	166	172	168	126	178	178	112	120	147	84	158
pH	7.70	7.56	7.70	7.78	7.79	8.23	7.92	8.36	8.30	8.48	8.41	8.06	7.92	7.80	7.50	8.49	8.42	7.60
Total P (mg/L)	0.020	0.012	0.012	0.025	0.020	0.035	0.065	0.045	0.030	0.045	0.025	0.030	0.020	0.025	0.205	0.030	0.020	0.045
Dissolved P (mg/L)	0.001	0.012	0.012	0.018	0.018	0.030	0.065	0.008	0.013	0.010	0.005	0.005	0.005	0.010	0.055	0.001	0.002	0.010
Ammonia-Nitrogen (mg/L)	0.005	0.050	0.140	0.010	0.020	0.005	0.100	0.120	0.010	0.060	0.020	0.040	0.060	0.120	0.760	0.010	0.020	0.090
NO3+NO2-Nitrogen (mg/L)	1.880	1.840	1.940	1.500	0.350	0.600	0.760	0.500	0.840	1.000	1.160	1.100	2.150	2.000	1.220	1.160	0.600	0.200
Inorganic N (mg/L)	1.885	1.890	2.080	1.510	0.370	0.605	0.860	0.620	0.850	1.060	1.180	1.140	2.210	2.120	1.980	1.170	0.620	0.290

	1980	1980	1980	1980	1992	1992	1992	MIN.	MAX.	AVE.	STDEV.
Parameter Date	Jul-21	Aug-25	Sep-22	Oct-27	Jul-28	Aug-24	Sep-30				
Temperature (C)	20.5	21.7	15	3.2				0.00	26.30	11.50	9.22
Dissolved Oxygen (mg/L)	7.1	7.2	7.9	11.9				2.30	13.55	9.60	2.31
Chloride (mg/L)	7.2	6.6	8.5	7.4	11	12	10	2.68	13.40	8.20	2.40
Alkalinity (mg/L)	158	140	129	142	173	177	152	84	178	147	23
pH	8.39	8.25	7.92	7.96	8.36	8.56	8.22	7.50	8.80	8.15	0.35
Total P (mg/L)	0.030	0.025	0.022	0.010	0.023	0.017	0.030	0.010	0.205	0.033	0.031
Dissolved P (mg/L)	0.002	0.005	0.005	0.002				0.001	0.065	0.013	0.013
Ammonia-Nitrogen (mg/L)	0.030	0.040	0.040	0.010	0.024	0.021	0.036	0.005	0.760	0.072	0.130
NO3+NO2-Nitrogen (mg/L)	0.400	0.440	0.940	1.300	1.150	0.927	1.500	0.010	2.150	0.975	0.582
Inorganic N (mg/L)	0.430	0.480	0.980	1.310	1.174	0.948	1.536	0.070	2.210	1.047	0.605

Appendix E (cont'd)

1977-1981 and 1992-1993 Water Quality Data

OUTFLOW SAMPLING SITE JP-Out

Parameter / Date	1977 May-24	1977 Jun-20	1977 Jul-18	1977 Aug-16	1977 Sep-12	1977 Oct-10	1977 Nov-08	1977 Dec-13	1978 Jan-18	1978 Feb-13	1978 Mar-13	1978 Apr-24	1978 May-22	1978 Jun-20	1978 Jul-17	1978 Aug-14	1978 Sep-18	1978 Oct-30
Temperature (C)	20.80	20.50	24.58	19.00	17.10	7.70	9.20	0.00	0.00	0.00	0.30	6.00	18.10	20.40	24.20	25.00	15.50	8.10
Dissolved Oxygen (mg/L)	7.40	8.20	6.90	8.60	9.10	10.40	10.00	12.00	11.30	11.75	10.75	10.70	8.71	8.65	7.49	7.68	8.30	11.40
Chloride (mg/L)																	7.10	6.60
Alkalinity (mg/L)	142.00	158.00	168.00	172.00	166.00	134.00	124.00	170.00	176.00	180.00	168.00	114.00	134.00	154.00	152.00	172.00	136.00	168.00
pH	8.25	8.60	8.49	8.43	8.45	8.14	7.89	7.80	7.65	7.62	7.90	8.11	8.61	8.58	8.11	8.35	7.90	8.50
Total P (mg/L)	0.042	0.032	0.034	0.036	0.030	0.026	0.010	0.010	0.013	0.015	0.016	0.033	0.036	0.045	0.038	0.051	0.080	0.018
Dissolved P (mg/L)	0.009	0.016	0.033	0.007	0.011	0.006	0.009	0.006	0.006	0.010	0.011	0.026	0.020	0.028	0.028	0.018	0.015	0.004
Ammonia-Nitrogen (mg/L)	0.630	0.140	0.060	0.030		0.020	0.030	0.090	0.110	0.030	0.030	0.010	0.010	0.080	0.070	0.060	0.130	0.010
NO3+NO2-Nitrogen (mg/L)	0.350		0.060	0.040	0.220	0.420	0.400	1.050	1.520	1.380	1.340	0.500	0.240	0.230	0.520	0.460	0.520	0.840
Inorganic N (mg/L)	0.980	0.140	0.120	0.070	0.220	0.440	0.430	1.140	1.630	1.410	1.370	0.510	0.250	0.310	0.590	0.520	0.650	0.850

Parameter / Date	1978 Dec-12	1979 Jan-16	1979 Feb-12	1979 Mar-12	1979 Apr-24	1979 May-29	1979 Jun-25	1979 Jul-23	1979 Aug-20	1979 Sep-17	1979 Oct-15	1980 Nov-26	1980 Jan-08	1980 Feb-18	1980 Mar-24	1980 Apr-21	1980 May-19	1980 Jun-09
Temperature (C)	0.00	0.00	0.00	0.00	15.80	17.60		25.00	18.80	17.20	7.00	2.00	0.00	0.00	0.00	14.80	13.90	11.00
Dissolved Oxygen (mg/L)	12.40	10.90	11.60	12.05	8.30	8.20	7.80	7.20	8.40	9.30	11.97	11.60	12.30	12.20	12.80	9.60	9.20	7.70
Chloride (mg/L)	7.80	5.70	6.00	8.90	4.10	5.80	5.91	11.00	6.10	5.60	7.00	5.60	8.32	4.87	5.20	3.30	5.70	2.10
Alkalinity (mg/L)	180.00	184.00	176.00	174.00	96.00	148.00	138.00	182.00	178.00	182.00	184.00	134.00	206.00	192.00	122.00	128.00	142.00	58.00
pH	7.70	7.57	7.38	7.66	7.73	8.36	7.97	8.27	8.20	8.62	8.34	7.66	7.77	7.69	7.70	8.10	8.34	7.50
Total P (mg/L)	0.018	0.044	0.030	0.040	0.062	0.045	0.070	0.050	0.030	0.010	0.035	0.035	0.055	0.175	0.045	0.030	0.055	0.041
Dissolved P (mg/L)	0.001	0.008	0.032	0.018	0.011	0.040	0.019	0.012	0.023	0.001	0.002	0.007	0.002	0.001	0.090	0.002	0.002	0.002
Ammonia-Nitrogen (mg/L)	0.005	0.040	0.070	0.020	0.080	0.100	0.070	0.040	0.140	0.040	0.120	0.040	0.070	0.080	0.540	0.140	0.040	0.040
NO3+NO2-Nitrogen (mg/L)	1.420	1.560	1.240	1.200	0.200	0.500	0.540	0.340	0.720	0.720	0.880	0.780	1.500	1.580	0.980	0.660	0.400	0.360
Inorganic N (mg/L)	1.425	1.600	1.310	1.220	0.280	0.600	0.610	0.380	0.860	0.760	1.000	0.820	1.570	1.660	1.520	0.800	0.440	0.080

Parameter / Date	1980 Jul-21	1980 Aug-25	1980 Sep-22	1980 Oct-27	1981 Dec-15	1981 Jan-26	1981 Mar-02	1981 Apr-13	1981 May-18	1981 Jun-15	1981 Jul-27	1992 Jul-28	1992 Aug-24	1992 Sep-30	MIN.	MAX.	AVE.	STDEV.
Temperature (C)	24.00	21.50	15.50	3.00	0.00	0.00	0.00	9.00	13.00	23.80	19.70				0.00	25.00	11.07	9.22
Dissolved Oxygen (mg/L)	7.50	7.20	7.40	11.50	13.40	12.40	12.50	10.40	10.50	7.70	7.60				6.90	13.40	9.81	1.95
Chloride (mg/L)	6.90	4.10	5.30	6.20	5.70	3.20	5.80	4.10	5.50	6.20	6.80	10.00	10.00	9.00	2.10	11.00	6.22	1.98
Alkalinity (mg/L)	174.00	154.00	96.00	142.00	200.00	178.00	136.00	115.00	166.00	180.00	185.00	180.00	186.00	146.00	58.00	206.00	156.60	29.62
pH	8.15	8.01	7.66	8.14	7.98	7.80	7.83	7.93	8.83	8.42	8.12	8.26	8.37	8.17	7.38	8.83	8.07	0.35
Total P (mg/L)	0.041	0.040	0.035	0.010	0.010	0.015	0.035	0.032	0.027	0.024	0.027	0.029	0.024	0.032	0.010	0.175	0.036	0.025
Dissolved P (mg/L)	0.002	0.002	0.005	0.001	0.002	0.002	0.007	0.001	0.001	0.002	0.002				0.001	0.090	0.012	0.015
Ammonia-Nitrogen (mg/L)	0.030	0.040	0.040	0.010	0.060	0.080	0.080	0.005	0.040	0.005	0.130	0.040	0.022	0.021	0.005	0.630	0.078	0.113
NO3+NO2-Nitrogen (mg/L)	0.360	0.340	0.400	0.800	1.700	1.760	1.020	0.540	0.400	0.400	0.400	1.340	1.110	1.300	0.040	1.760	0.766	0.484
Inorganic N (mg/L)	0.390	0.380	0.440	0.810	1.760	1.840	1.100	0.545	0.440	0.405	0.530	1.380	1.132	1.321	0.070	1.840	0.821	0.506

Appendix E (cont'd)

1977-1981 and 1992-1993 Water Quality Data

LAKE SAMPLING SITE McD-01

	Temperature (C)			Dissolved Oxygen (mg/L)			pH			Specific Conductivity			REDOX		
	1992	1992	1993	1992	1992	1993	1992	1992	1993	1992	1992	1993	1992	1992	1993
Depth (m)	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May
0	23.63	21.72	12.46	9.79	10.11	8.11	8.03	8.33	7.37	349	361	229	273	272	467
1	23.47	20.22	11.95	9.66	10.15	8.20	8.03	8.33	7.38	350	361	230	273	271	463
2	21.83	19.90	11.85	7.20	9.65	8.07	7.74	8.26	7.34	352	361	227	283	273	461
2.2	21.18	19.90		3.41	9.65		7.44	8.26		356	273		290	273	

	1992	1992	1993			
Parameter	28-Jul	19-Aug	5-May	Max.	Min.	Avg.
Secchi (meters)	2.13	1.61	1.31	2.13	1.31	1.68
Chlorophyll a (ug/L)	8.51	8.45	4.02	8.51	4.02	6.99
Color (Pt-Co)	20	15	100	100	15	45
Chloride (mg/L)	11	11	8	11	8	10
Alkalinity (mg/L)	174	178	96	178	96	149
Total P (mg/L)	0.022	0.023	0.029	0.029	0.022	0.025
Dissolved P (mg/L)	0.004	0.004	0.008	0.008	0.004	0.005
Total N (mg/L)	1.940	1.560	1.582	1.940	1.560	1.694
Inorganic N (mg/L)	1.320	1.170	1.014	1.320	1.014	1.168

NOTE: Analytical data for Aug. 19 is the average of two samples.

Appendix E (cont'd)

1977-1981 and 1992-1993 Water Quality Data

LAKE SAMPLING SITE McD-02

	Temperature (C)			Dissolved Oxygen (mg/L)			pH			Specific Conductivity			REDOX		
	1992	1992	1993	1992	1992	1993	1992	1992	1993	1992	1992	1993	1992	1992	1993
Depth (m)	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May
0	23.54	21.28	12.36	8.86	10.11	7.68	7.98	8.38	7.27	363	363	217	268	268	498
1	22.08	19.94	11.85	6.95	10.15	7.70	7.80	8.19	7.24	370	370	215	275	275	494
2	21.60	19.01	11.80	6.27	9.65	7.71	7.70	8.04	7.25	371	371	215	279	279	490

	1992	1992	1993			
Parameter	28-Jul	19-Aug	5-May	Max.	Min.	Avg.
Secchi (meters)	1.37	1.52	1.22	1.52	1.22	1.37
Chlorophyll a (ug/L)	7.86	5.74	3.66	7.86	3.66	5.75
Color (Pt-Co)	20	15	110	110	15	48
Chloride (mg/L)	10	11	7	11	7	9
Alkalinity (mg/L)	177	180	93	180	93	150
Total P (mg/L)	0.025	0.024	0.028	0.028	0.024	0.026
Dissolved P (mg/L)	0.006	0.005	0.004	0.006	0.004	0.005
Total N (mg/L)	1.720	1.595	1.499	1.720	1.499	1.605
Inorganic N (mg/L)	1.287	1.225	0.928	1.287	0.928	1.147

NOTE: Analytical data for Aug. 19 is the average of two samples.

Appendix E (cont'd)

1977-1981 and 1992-1993 Water Quality Data

LAKE SAMPLING SITE McD-03

Depth (m)	Temperature (C) 1992 28-Jul	Temperature (C) 1992 19-Aug	Temperature (C) 1993 5-May	Dissolved Oxygen (mg/L) 1992 28-Jul	Dissolved Oxygen (mg/L) 1992 19-Aug	Dissolved Oxygen (mg/L) 1993 5-May	pH 1992 28-Jul	pH 1992 19-Aug	pH 1993 5-May	Specific Conductivity 1992 28-Jul	Specific Conductivity 1992 19-Aug	Specific Conductivity 1993 5-May	REDOX 1992 28-Jul	REDOX 1992 19-Aug	REDOX 1993 5-May
0	22.91	20.22	12.54	9.10	10.74	8.57	7.93	8.25	7.33	360	370	211	293	321	486
1	22.75	19.40	12.26	8.48	9.40	8.62	7.89	8.14	7.30	363	369	211	296	319	479
1.5	22.39	19.15	12.23	8.09	8.24	8.61	7.84	8.10	7.29	360	374	212	300	318	475

Parameter	1992 28-Jul	1992 19-Aug	1993 5-May	Max.	Min.	Avg.
Secchi (meters)	1.37	1.52	1.46	1.52	1.37	1.45
Chlorophyll a (ug/L)	8.82	4.88	3.54	8.82	3.54	5.75
Color (Pt-Co)	20	15	100	100	15	45
Chloride (mg/L)	10	10	8	10	8	9
Alkalinity (mg/L)	177	183	91	183	91	150
Total P (mg/L)	0.029	0.023	0.021	0.029	0.021	0.024
Dissolved P (mg/L)	0.007	0.005	0.011	0.011	0.005	0.008
Total N (mg/L)	1.870	1.420	1.571	1.870	1.420	1.620
Inorganic N (mg/L)	1.417	1.143	0.888	1.417	0.888	1.149

NOTE: Analytical data for Aug. 19 is the average of two samples.

Appendix E (cont'd)

1977-1981 and 1992-1993 Water Quality Data

LAKE SAMPLING SITE McD-04

	Temperature (C)			Dissolved Oxygen (mg/L)			pH			Specific Conductivity			REDOX		
	1992	1992	1993	1992	1992	1993	1992	1992	1993	1992	1992	1993	1992	1992	1993
Depth (m)	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May
0	23.30	22.25	12.54	11.07	9.92	8.57	7.9	8.08	7.33	364	378	211	300	284	486
0.5	20.20	18.15	12.26	16.18	11.60	8.62	7.46	6.81	7.30	374	395	211	310	279	479

	1992	1992	1993			
Parameter	28-Jul	19-Aug	5-May	Max.	Min.	Avg.
Secchi (meters)	Bottom	Bottom	Bottom	0.00	0.00	#DIV/0!
Chlorophyll a (ug/L)	N.A.	N.A.	N.A.	0.00	0.00	#DIV/0!
Color (Pt-Co)	N.A.	N.A.	N.A.	0	0	#DIV/0!
Chloride (mg/L)	N.A.	N.A.	N.A.	0	0	#DIV/0!
Alkalinity (mg/L)	N.A.	N.A.	N.A.	0	0	#DIV/0!
Total P (mg/L)	0.017	0.014	0.018	0.018	0.014	0.016
Dissolved P (mg/L)	N.A.	N.A.	N.A.	0.000	0.000	#DIV/0!
Total N (mg/L)	1.870	N.A.	N.A.	1.870	1.870	1.870
Inorganic N (mg/L)	1.422	1.240	1.190	1.422	1.190	1.284

NOTE: Analytical data for Aug. 19 is the average of two samples.

Appendix E (cont'd)

1977-1981 and 1992-1993 Water Quality Data

LAKE SAMPLING SITE McD-05

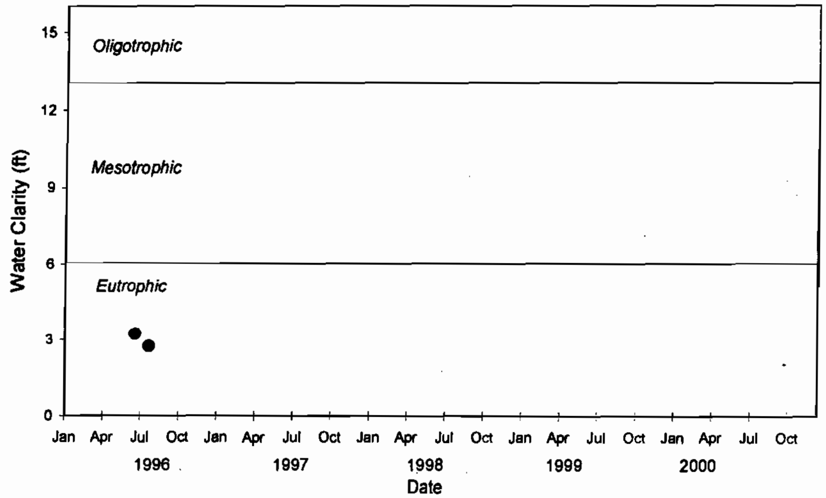
	Temperature (C)			Dissolved Oxygen (mg/L)			pH			Specific Conductivity			REDOX		
	1992	1992	1993	1992	1992	1993	1992	1992	1993	1992	1992	1993	1992	1992	1993
Depth (m)	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May	28-Jul	19-Aug	5-May
0	24.32	21.14	14.00	12.27	11.78	8.22	7.81	7.67	6.93	378	407	303	304	285	482
1	20.15	18.80	12.16	14.44	13.61	7.71	7.43	7.95	6.59	390	400	383	320	287	485
1.7	17.54	17.78	10.56	13.41	12.45	1.48	6.65	7.27	6.15	449	420	596	345	307	495

	1992	1992	1993			
Parameter	28-Jul	19-Aug	5-May	Max.	Min.	Avg.
Secchi (meters)	Bottom	Bottom	Bottom	0.00	0.00	#DIV/0!
Chlorophyll a (ug/L)	N.A.	N.A.	N.A.	0.00	0.00	#DIV/0!
Color (Pt-Co)	N.A.	N.A.	N.A.	0	0	#DIV/0!
Chloride (mg/L)	N.A.	N.A.	N.A.	0	0	#DIV/0!
Alkalinity (mg/L)	N.A.	N.A.	N.A.	0	0	#DIV/0!
Total P (mg/L)	0.028	0.005	Lost	0.028	0.005	0.017
Dissolved P (mg/L)	N.A.	N.A.	N.A.	0.000	0.000	#DIV/0!
Total N (mg/L)	2.280	N.A.	N.A.	2.280	2.280	2.280
Inorganic N (mg/L)	1.719	1.640	Lost	1.719	1.640	1.680

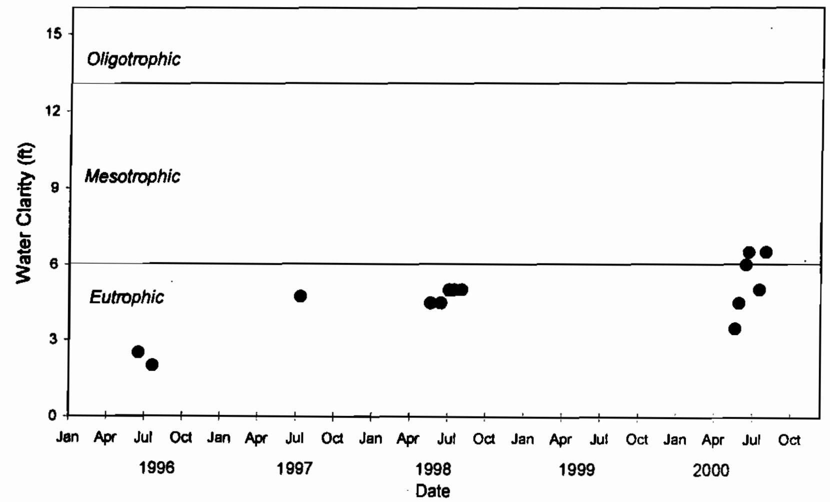
NOTE: Analytical data for Aug. 19 is the average of two samples.

Appendix F
1996-2000 Water Clarity Results from Volunteer Monitoring

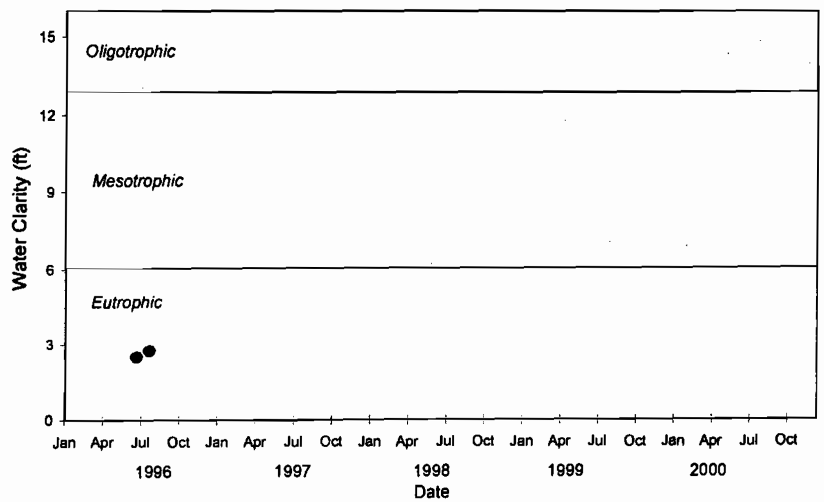
Summer Water Clarity
McDill Pond Site #1



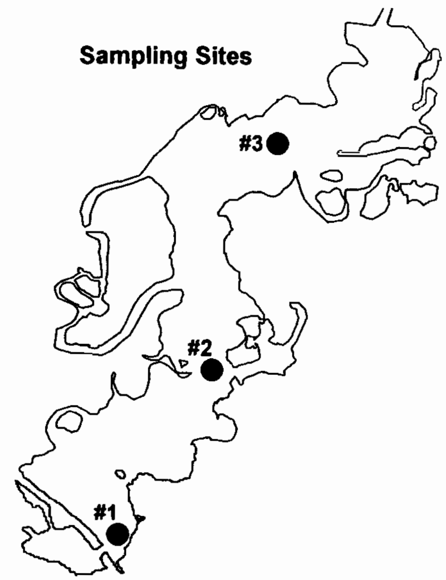
Summer Water Clarity
McDill Pond - Site #2



Summer Water Clarity
McDill Pond Site #3



Sampling Sites



Lakes can be grouped into different categories that tell the relative age of a lake. Lakes can be classified as oligotrophic - nutrient poor/young; eutrophic - nutrient rich/old; or mesotrophic, which lies between the two.

Sites 1 and 3 were discontinued in 1997. Actual data included on back side.
(Data collected by McDill Lake District volunteers thro[illegible] DNR Self-Help Lake Monitoring Program)