RICE LAKE MANAGEMENT PLAN
RICE LAKE
BARRON COUNTY, WISCONSIN

November 1993

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AYRES ASSOCIATES

TABLE OF CONTENTS

RICE LAKE MANAGEMENT PLAN

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FACT SHEET

November 1993

PURPOSE OF THE PLAN

The purpose of this Management Plan is to provide the Rice Lake Protection and Rehabilitation District the basis for future planning and action with respect to water quality improvement and recreational use. The District's goals in this plan are to improve water quality, improve depth, decrease weeds, and improve the overall recreation of the lake. The plan was prepared by Ayres Associates, Eau Claire, Wisconsin with funding from the Wisconsin Lake Management Planning Grant Program.

SCOPE OF PLAN DEVELOPMENT

The scope of this study was to review past data and investigate potential solutions to the water quality problems of Rice Lake. The tasks performed included reviewing previous reports and water quality data. Investigation of watershed practices by the Barron County Land Conservation District included a watershed inventory in an attempt to identify sources of sediment and nutrients to the lake. The study also included investigation of possible solutions to the sediment and weed problems the lake has experienced. Dredging alternatives were evaluated, depth soundings and sediment samples were obtained and analyzed. Weed control alternatives investigated included mechanical harvesting and chemical treatment. Costs for dredging and weed control were also developed.

PAST STUDIES

A feasibility study was performed by the Wisconsin Department of Natural Resources in 1983. This study included a year long water quality data collection program.

WATERSHED DATA

- Drainage Area - 370 sq. miles
- Rice Lake Surface Area - 939 acres
- Rice Lake Volume - 7,950 acre feet
- Rice Lake Maximum Depth - 22 feet

ALTERNATIVE LAKE IMPROVEMENTS STUDIES

1. Dredging. A range of limited dredging alternatives were studied to include dredging a 50 foot channel upstream into the Red Cedar River and a navigation channel connecting the north and the south ends of Rice Lake. Cost for dredging range from 1.12 million to 1.52 million dollars. In addition, it would be wise to construct a sediment trap in the Red Cedar River to capture sediment before it reaches the lake; this would cost an additional $410,000. Sediment samples were collected in the lake and analyzed for metals, pesticides, herbicides, PCB's, and nutrients. Results of the testing indicated that there are no contaminates in the sediments that would present major obstacles to a dredging project.

2. Weed control through harvesting and chemical means were investigated. Past harvesting methods in Rice Lake have been successful. Chemical treatment for weed control is not considered to be a desirable long-term solution.

3. Watershed practices. The Barron County Land Conservation District performed a watershed inventory which included portions of the Red Cedar River, Brill River, Bear Creek, and Little Bear Creek. The stream bank survey indicated that the banks are in generally good condition however there are a few areas pastured resulting in trampling of the stream banks. Erosion due to machinery crossings also contributes sediment to the river. The survey identified 55 feed lots and barnyards which are potential sources of water pollution. The study estimated that 300 tons of sediment and 1800 pounds of phosphorus enter Rice Lake each year.

RECOMMENDATIONS

1. Implement a water quality sampling and testing program.

2. Obtain additional sediment samples and analysis.

3. Continued investigations to identify nutrient and sediment sources.

4. Work with the Barron County Land Conservation District in implementing best management practices in the watershed.

5. Continue weed harvesting efforts. Increase efforts to reach satisfactory aesthetic conditions.

6. In conjunction with weed harvesting, develop a systematic plan for weed harvesting.

RICE LAKE MANAGEMENT PLAN
RICE LAKE
BARRON COUNTY, WISCONSIN

INTRODUCTION

Rice Lake is located in Barron County in northwestern Wisconsin, at the City of Rice Lake. The lake is created by a 12-foot-high dam owned by Barron County. The lake has a total surface area of 939 acres and a total volume of approximately 7,950 acre-feet. Rice Lake has been experiencing eutrophication and sedimentation, resulting in aesthetic problems as well as problems for recreational users. Weeds, algae and sediment have created problems for boaters, swimmers, and fishermen.

A feasibility study was performed by the Wisconsin Department of Natural Resources in 1983. The study included a year-long water quality data collection program. Appendix A contains the water quality data collected for the 1983 study.

The purpose of this management plan is to provide the Rice Lake Protection and Rehabilitation District a basis for future planning and action with respect to water quality and recreational use. The District's goals are to improve water quality, improve depth, decrease weeds, and improve the overall recreation of the lake. This report summarizes the investigations and data review and provides recommendations for water quality improvements, including sediment control, weed control, and watershed practices.

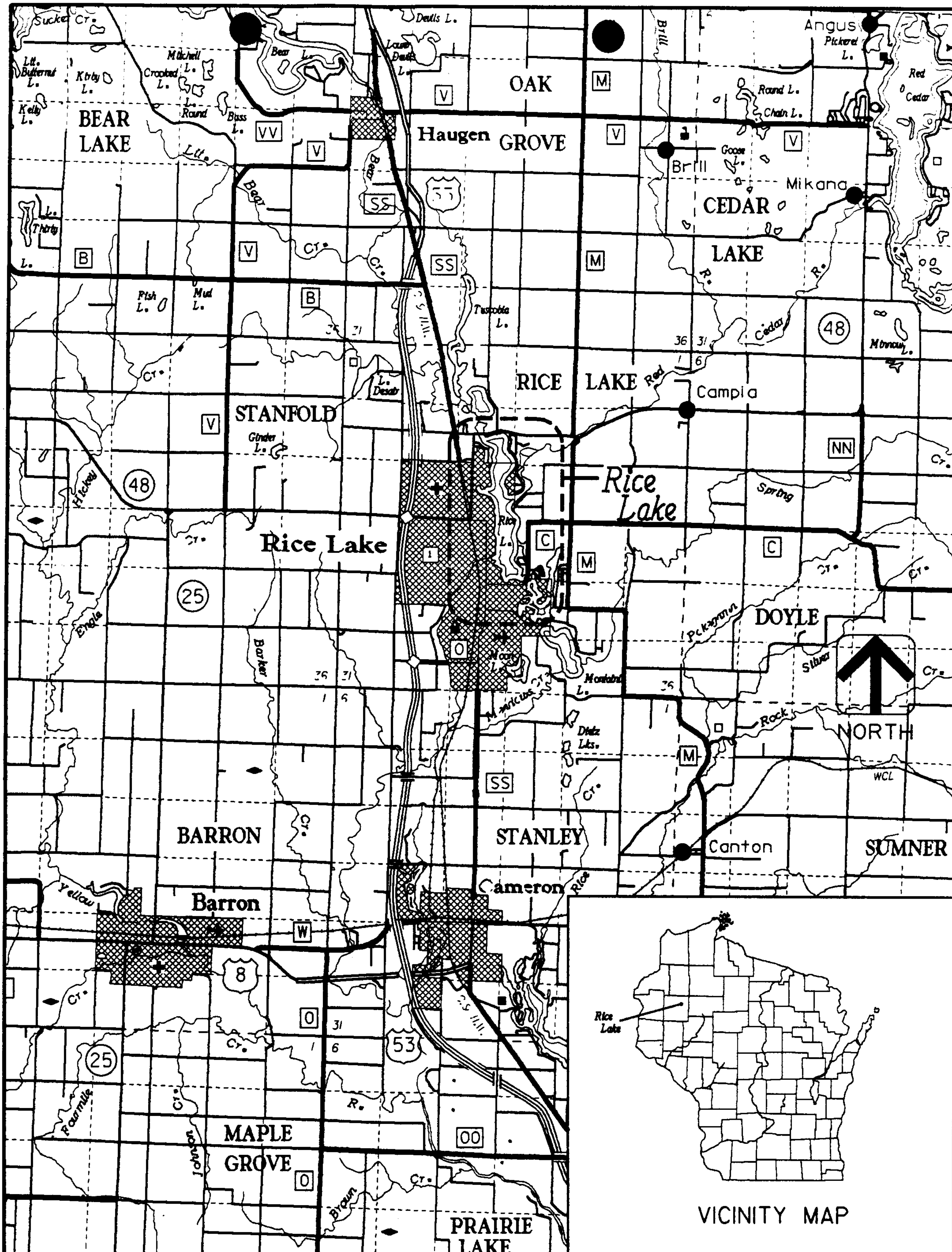
SCOPE OF STUDY

The scope of this study is to review past data and investigate potential solutions to the water quality problems of Rice Lake. The first task includes reviewing previous reports and available water quality data. An investigation of watershed practices includes a watershed inventory to identify sources of sediment and nutrients to the lake.

This study also includes investigation of possible solutions to the sediment and weed problems the lake has experienced. Dredging alternatives are evaluated. Depth soundings and sediment samples were obtained to determine the feasibility of dredging. Weed control alternatives investigated include mechanical harvesting and chemical treatment. Costs for each of the dredging and weed control alternatives are developed for comparison.

WATERSHED DESCRIPTION

The Rice Lake watershed has a total area of approximately 370 square miles. A map of the watershed is shown in Figure 2. Two major stream systems enter the lake: the Red Cedar River and Bear Creek. The Red Cedar River enters the lake at the east side of Rice Lake and has a contributing drainage area of approximately 290 square miles. Bear Creek enters the lake from the north and has a drainage area of 80 square miles. The Red Cedar River outlet from the lake is at the Rice Lake Dam. The focus of the watershed study is the Red Cedar River and its tributaries between Rice Lake and Red Cedar Lake approximately seven miles upstream. The area of this portion of the watershed is approximately 220 square miles.



RICE LAKE MANAGEMENT PLAN
RICE LAKE PROTECTION &
REHABILITATION DISTRICT
BARRON COUNTY, WISCONSIN

DRN. BY: R.FANDEL
CHK. BY: D.STEINES
DATE: AUGUST 1993

AYRES ASSOCIATES

VICINITY & LOCATION MAP

FIGURE 1

The upper portions of the watershed consists mainly of forest. The lower portions of the watershed contain agricultural land. Agricultural crops grown in the watershed include hay, oats, corn, soybeans, and potatoes. The City of Rice Lake is adjacent to the lake with the majority of development on the west side of the lake within the City limits. There is lakeshore development on all sides of the lake.

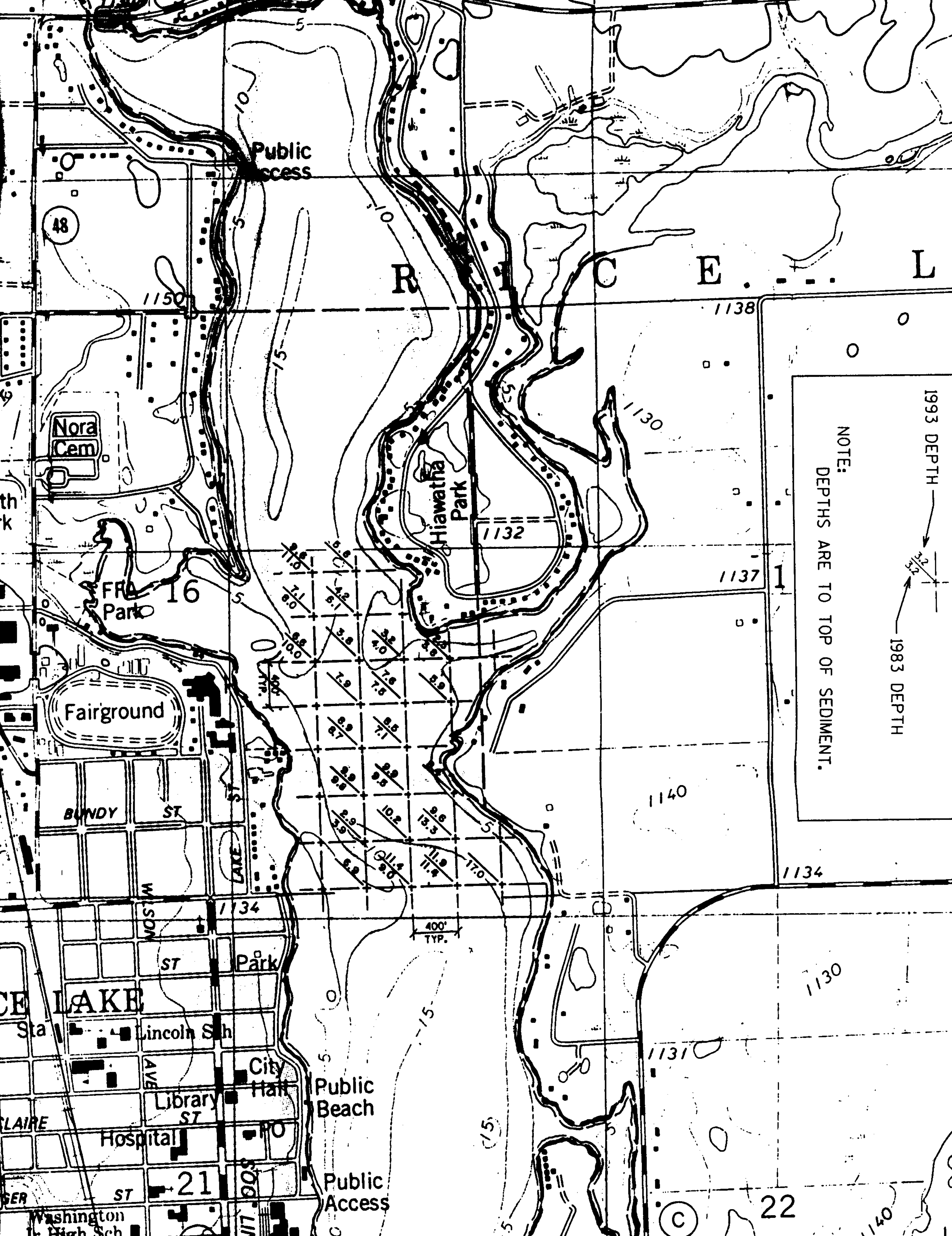
PROBLEM DESCRIPTION

Macrophyte growth and sediment accumulation have been identified as the most serious problems. Algae is also a concern. Weeds and shallow water have made navigation difficult in some areas of the lake, especially near the mouth of the Red Cedar River. As flow from the Red Cedar River slows and enters Rice Lake, sediment and nutrients are deposited in the lake. Shallow areas created by sediment deposition coupled with dense weed growth restrict navigation. The dense weed growth also tends to slow the river current resulting in additional sediment deposition and accumulation. Figure 3 shows a map of Rice Lake with depth contours and soundings taken in 1983 and 1993.

The shallow water and presence of loose sediment encourage growth of macrophytes. Excessive weeds contribute further to navigation difficulty. Recreation such as fishing and swimming are also negatively impacted by excessive weeds. The weeds also create aesthetic problems. Weed growth is as deep as eleven feet in some areas. Pondweed grows quickly in spring and becomes very dense by early summer. Coontail also becomes abundant in the summer along with other species such as waterweed and wild celery.

Algae growth has also been a nuisance. According to measurements taken for the 1983 Feasibility Study, concentrations of chlorophyll a were as high as 36 ug/l. Lakes having chlorophyll a concentrations of 10 ug/l or higher are considered eutrophic. The abundance of algae indicates a high availability of nutrients, possibly from urban runoff, agriculture and barnyards upstream, septic systems adjacent to the lake, or internal recycling.

Water chemistry in the lake was analyzed in the 1983 study. Conductivities of 178 and 186 micromhos/cm indicated moderate levels of dissolved chemicals. Chloride levels of 2 mg/l suggest little impact from cultural activities. pH levels of 7.3 to 7.5 and alkalinities of 65-69 mg/l confirm that the system is relatively well buffered. There is minimal danger of acidification due to acid rain. Total phosphorus is relatively low (.02 mg/l) and the nitrogen to phosphorus ratio exceeds 20 in both the north and south basins. Therefore, algal growth appears to be limited by the availability of phosphorus.



Public Access
48
R I C E L
1150
1138
Nora Cem
Hiawatha Park
1132
16
FFA Park
1137
1130
NOTE: DEPTHS ARE TO TOP OF SEDIMENT.
1993 DEPTH
1983 DEPTH
Fairground
400' TYP.
1140
BUNDY ST
LAKE ST
WILSON
1134
Park
CE LAKE
Sta
Lincoln Sch
City Hall
Public Beach
Library
AVE
Hospital
PO
21
Washington Jr. High Sch
Public Access
1131
22

SEDIMENT REMOVAL

Sediment removal by hydraulic dredging would be most economically accomplished using a cutter-head section dredge. A typical cutter-head dredge is shown in Figure 4. The cutter consists of conical blades that rotate to loosen bottom sediment. Spuds are located at the stern of the dredge on both sides and are used to walk the dredge. The sediment slurry is pumped from the bottom and to the disposal site through a floating line. The disposal site containment area would consist of earth dikes around the perimeter of the site. Residence time of the carriage water required to provide adequate settling time dictates the spoil site volume and spillway configuration. This type of dredge is capable of operating continuously and dredge large volumes of sediment in short periods.

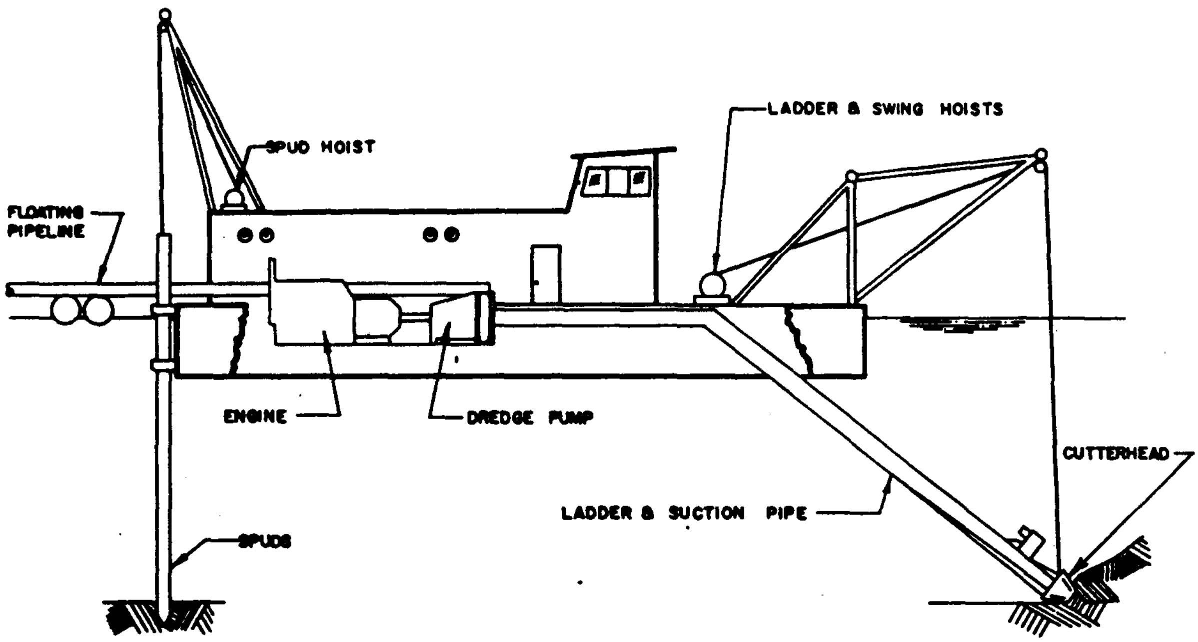


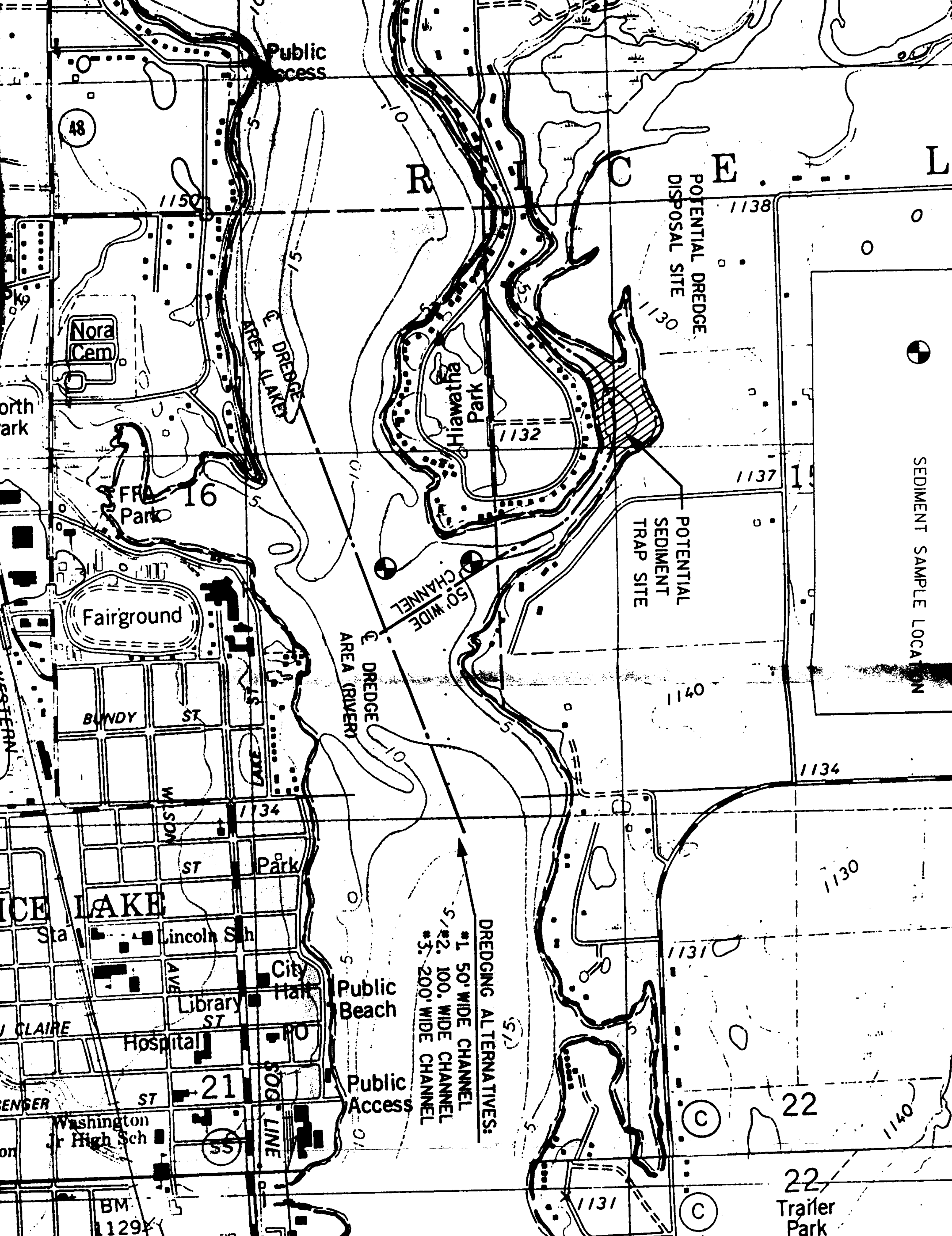
Figure 4
Hydraulic Cutterhead Dredge

Three dredging scenarios were considered with cost estimates developed for each. The dredging would include a channel 15 feet deep connecting the north and south ends of the lake and a channel extending up the Red Cedar River approximately 4,000 feet. The 15-foot depth would minimize the light penetration to the lake bottom resulting in little weed growth. All three scenarios include a channel 50 feet wide in the river. Varying channel widths were used for the channel in the lake including 50, 100, and 200 feet. A sediment trap was also considered just upstream of the mouth of the Red Cedar River to collect and remove incoming sediment. Figure 5 shows the three dredging scenarios along with sediment sample sites and potential sites for dredge disposal and a sediment trap.

A potential dredge disposal site is located in the northwest quarter of Section 15, northeast of and across the river from Hiawatha Park. The site is currently vacant and in close proximity to the dredging area. Prior to establishing this site as a disposal area, the site would have to be evaluated in terms of environmental concerns and impacts as well as suitability for construction of a containment area. Land ownership and/or easements would need to be addressed. A route for dredge pressure piping and carriage water return would have to be determined also.

Sediment samples were obtained and screened for contaminants. The samples were taken near the mouth of the Red Cedar River as shown in Figure 5. Core samples were obtained using a stainless steel hand auger for PCB, pesticide and herbicide testing and plastic pipe for sediments tested for metals. Samples were screened for metals and pesticides, herbicides, and PCB's. Additional analyses included grain size analysis using a hydrometer and content of nitrogen and phosphorus.

The results of the sediment sample analyses indicate that concentrations of metals and organics are below ceiling concentrations for land disposal. However, if the lake is dredged, additional samples would be required in accordance with Department of Natural Resources regulations (Chapter NR 347). A summary of the sample screening analyses results is given in Table 1. Appendix B contains the complete results of the sediment sample analyses.



Public Access
R I C E L
POTENTIAL DREDGE DISPOSAL SITE
1138
1150
1130
Nora Cem
Hiawatha Park
1132
1137
DREDGE AREA (LAKE)
North Park
FFA Park
16
POTENTIAL SEDIMENT TRAP SITE
SEDIMENT SAMPLE LOCATION
50' WIDE CHANNEL
Fairground
DREDGE AREA (RIVER)
1140
BUNDY ST
1134
WILSON
LAKE
Park
ST
RICE LAKE
Sta
Lincoln Sch
City Hall
Library
Public Beach
EAU CLAIRE
ST
Hospital
PO
21
MESSENGER ST
Public Access
Washington Jr High Sch
SOO LINE
DREDGING ALTERNATIVES:
#1. 50' WIDE CHANNEL
#2. 100' WIDE CHANNEL
#3. 200' WIDE CHANNEL
1131
22
Trailer Park
BM 1129
48
53

Table 1
Sediment Screening Summary

Component	Measured Concentration	Ceiling Concentration
Arsenic	1.0 mg/kg	75 mg/kg
Lead	<5.0 mg/kg	840 mg/kg
Mercury	0.08 mg/kg	57 mg/kg
Zinc	24 mg/kg	7500 mg/kg

Note: Ceiling concentrations from 40 CFR Part 503

Costs for dredging were developed based on a unit cost per cubic yard of sediment removed. Annual costs were determined assuming a 30-year period and 8% interest. The unit cost is based on the assumption that hydraulic dredging is used to remove the sediment and that operation is continuous or nearly continuous. Mobilization costs would be the same for each of the scenarios, approximately $125,000. Dredging would cost approximately $2.50 per cubic yard.

Additional costs would result from preparation of a disposal site, which would vary depending on the quantity of dredged material. Preparation of the disposal site includes the construction of a settling basin with dikes and weirs to contain water and control discharges. The quantities and costs for each of the scenarios is summarized in Table 2.

Table 2
Dredging Cost Estimates

Channel Width (feet)	Dredge Volume	Total Cost (cubic yards)	Annual Cost
50	265,000	$1,115,000	$100,000
100	310,000	$1,255,000	$112,000
200	390,000	$1,515,000	$135,000

A sediment trap could potentially be located due east of Hiawatha Park, where the river channel widens. Approximately 165,000 cubic yards of material would have to be dredged to create the trap. The total cost for this would be approximately $410,000 ($36,000 annual) in addition to the costs shown in Table 1. Additional maintenance costs would be incurred to clean the trap periodically.

Dredging would provide a good solution to the sediment and macrophyte problems, especially if the sediment trap is installed. Deepening the lake would reduce weed growth and would provide improved navigation. The sediment removed from the lake could be suitable for agricultural purposes. However, dredging is costly and does not address the source of the problem. Therefore, dredging may again be necessary within a number of years.

WEED CONTROL

Weed Harvesting

Weeds are commonly controlled by dredging, harvesting, or chemical treatment. Harvesting of weeds is accomplished using a weed harvesting machine that cuts the weeds and then collects them for disposal. Weed harvesters are employed during most of the summer to reduce the weeds in Rice Lake. Annual weed harvesting costs have typically been approximately $50,000 to $60,000.

Currently, the Rice Lake Protection and Rehabilitation District operates two weed cutters, both manufactured by AquaMarine. Both have eight foot wide cutter bars. In 1992 the Lake District cut and dumped 316 tons of weeks (drained weight). Cutting begins in May, peaks in June and tapers off in July. In 1993, 516 tons of weeks were cut and disposed of.

Harvesting provides a very good temporary means of controlling weeds. The area to be cleared can be easily controlled by the machine operator. The weeds are removed and prevented from contributing further release of nutrients. Costs of harvesting are comparable to chemical control and much lower than the cost of dredging. Harvesting generally does not interfere with continued recreational use of the lake.

One disadvantage of harvesting is that the weeds must be collected, removed, and disposed of. Harvesting can also fragment plants and cause them to spread further. Selective harvesting of species is difficult, and harvesting can inadvertently kill nontarget species of plants and fish. Harvesting does not provide long-term control of weeds.

Chemical Control

Weeds can also be controlled using chemical herbicides. For pondweed, coontail, and waterweed, a combination of diquat, aquathol, and cutrane may be effective. The cost of chemical treatment would be approximately $200 per acre and would likely be required twice annually. To treat an area equivalent to the large-scale dredging scenario (23 acres) would cost approximately $9,200 annually.

Chemical control of weeds is effective for selective control of target species. However, chemicals are not as effective in controlling the area to be to be treated as harvesting due to wind and currents. Chemicals can have undesirable or unknown effects. Water use restrictions are usually required to limit use of the water for a period after chemicals are applied. The application of chemicals is regulated by the DNR. Chemical treatment is not a good long-term solution to weed control.

WATERSHED PRACTICES

A watershed study was performed to help identify sources of sediment and nutrients contributing to the degradation of water quality in Rice Lake. The study covered approximately 61,000 acres of the watershed. It included the Red Cedar River upstream of Rice Lake to the Long Lake Dam, the Brill River, Bear Creek between Tuscobia Lake and Bear Lake, and Little Bear Creek. A complete report on the study is included as Appendix C.

Streambank Survey

The streambanks of the Red Cedar River and Brill River are generally in good condition. There are some areas of pasturing by sheep and cattle, as well as erosion, a machinery crossing, and a personal road crossing that contribute sediment to the river. Bear Creek and Little Bear Creek have considerably more pasturing along the banks and have cattle crossings. Cattle have access to the lakeshore of Tuscobia Lake at two locations. A ditch discharges to Stump Lake at an area with no vegetation.

Specific areas identified in the streambank survey as potential sediment contribution sites include the following:

1. Section 32, Cedar Lake Township. Nearly 4,000 feet along the Red Cedar River are pastured by cattle and sheep.

2. Section 6 (NW 1/4), Doyle Township. A large gully has eroded adjacent to the Red Cedar River.

3. Section 24, Oak Grove Township. Over 4,000 feet along the Brill River is heavily pastured.

4. Section 25 (SW 1/4), Long Lake Township, Washburn County. Machinery crosses the Brill River on a regular basis.

5. Section 25 (NW 1/4), Long Lake Township, Washburn County. A personal road and bridge cross the Brill River. Sand used to build up the road is entering the river.

6. Oak Grove Township. Cattle cross Bear Creek regularly.

7. Tuscobia Lake, Section 5 of Rice Lake Township and Section 33 of Oak Grove Township. Cattle have access to the lake shore.

8. Stump Lake, southeast corner. A ditch from Highway 48 discharges to and erodes an area void of vegetation.

Erosion from the areas listed above can be reduced using best management practices. Fencing would limit cattle access to streambanks and lakeshores. Cattle and machinery crossings should be protected with rock. Areas eroded by stormwater should be filled and compacted, with protection provided by vegetation or rock riprap.

Sediment Loadings

A computer model utilizing the universal soil loss equation was used to estimate the volume of sediment entering Rice Lake annually. The computer model, WINHOSLE, was developed by the Wisconsin Department of Natural Resources. An area 4,000 acres in size representative of the entire watershed was chosen for the model. The area includes the portion of the watershed above Highway V near Lower Devils Lake to the Red Cedar River west of the intersection of Highways 48 and M. An inventory of 46% of the study area was performed.

The results of the model indicate that 34 tons of sediment enter the river each year from this 4,000 acre area. In addition, 205 pounds of phosphorus also is contributed. Assuming the remainder of the 61,000-acre study area yields 70% of the 4,000-acre model area and the sediment entering Tuscobia Lake and Stump Lake settle before entering Rice Lake, 300 tons of sediment and 1,800 pounds of phosphorus enter Rice Lake each year.

Barnyard Survey

Fifty-five feed lots and barnyards were identified within the study area. A ranking system was used to assign potential water pollution impacts for each barnyard: 1 (high), 2 (medium), and 3 (low). Of the 55 barnyards identified, 26 received a ranking of 3, 22 received a ranking of 2, and 7 received a ranking of 1. Often the potential for pollution from a barnyard can be reduced by moving the barnyard a short distance and providing a butter strip. Federal funding may be available to farmers where more expensive means are necessary to reduce pollution potential.

RECOMMENDATIONS

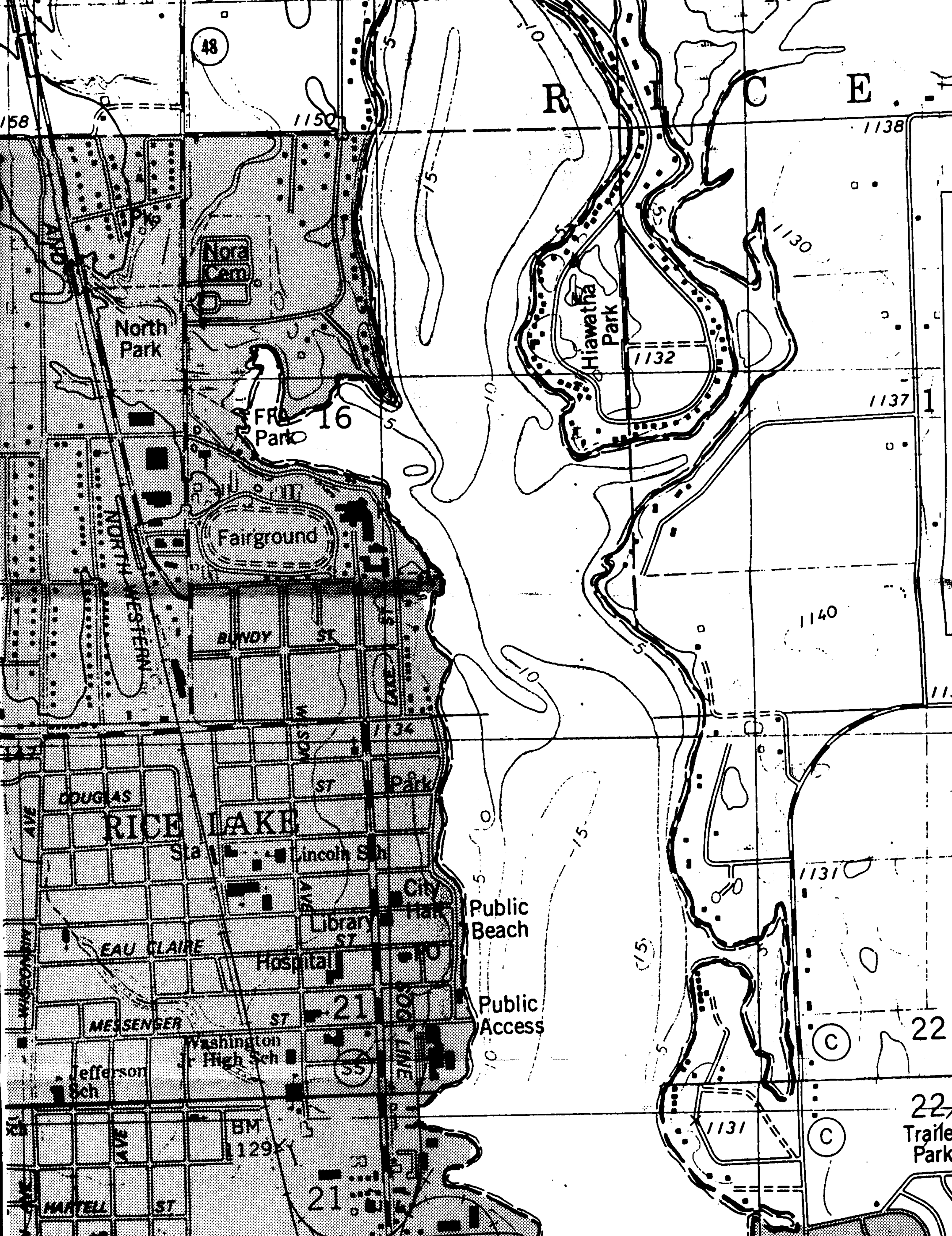
Recommended actions to aid the Rice Lake Protection and Rehabilitation District in improving water quality for Rice Lake include the following:

1. Implement a water quality sampling and testing program.
2. Obtain additional sediment samples and analyses.
3. Continued investigations to identify nutrient and sediment sources
4. Work with the Barron County Land Conservation District in implementing best management practices in the watershed.
5. Continue weed harvesting efforts. Increase efforts to reach satisfactory aesthetic conditions.
6. In conjunction with weed harvesting, develop a systematic plan for weed harvesting.

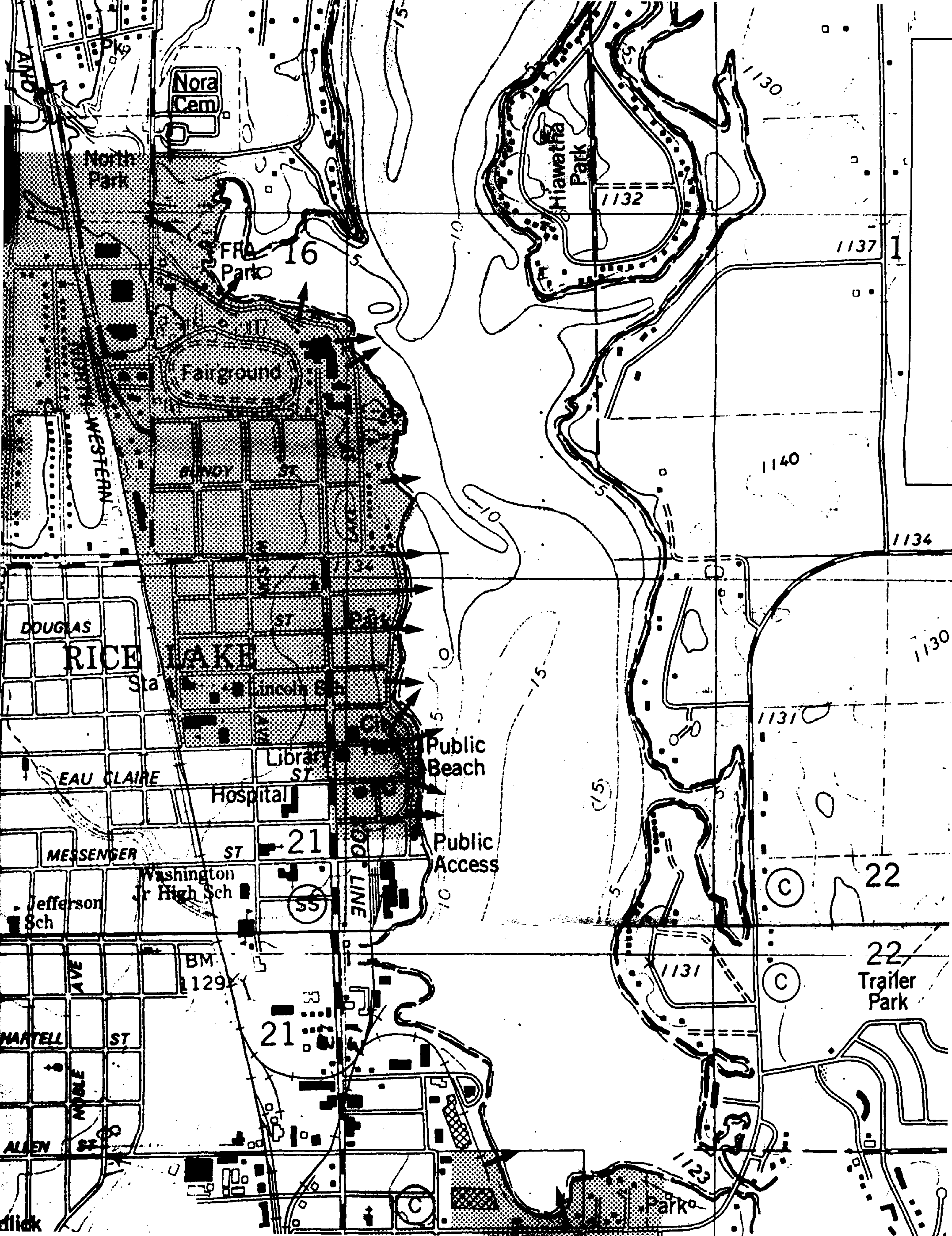
A long term water quality sampling program would be useful in detecting nutrient levels in the lake and monitoring changes in water quality. This program would include obtaining water samples for laboratory tests for chlorophyll a, phosphorus, nitrogen, and dissolved oxygen on a regular basis. Water clarity measurements should also be obtained with a secchi disk. This could be accomplished by Lake District volunteers.

Costs for dredging are presented in this report and need to be evaluated by the District in terms of their capacity to take on such a project. Should the District decide to pursue dredging, they should begin to position themselves in the event grant money becomes available. Additional sediment samples will be required if dredging is considered further. Several samples will be necessary in the area to be dredged. Requirements for sampling and analyses are provided in the DNR regulations, Chapter NR 347. Coordination with the DNR is recommended.

The watershed practices inventory in Appendix C provides a basis for implementing better land management practices to reduce sediment delivery to Rice Lake. A more comprehensive study of sediment and nutrient loadings may be helpful in further identifying sources and implementing practices to reduce the sediment and nutrients carried to the lake. The Lake District should work closely with the County Conservationist to help implement best management practices upstream of the lake. Some best management practices include:



RICE
RICE LAKE
North Park
Nora Cem
Fairground
Park
16
Hiawatha Park
1132
1137
1130
1138
1140
1150
1158
1134
1131
BUNDY ST
NORTH WESTERN
DOUGLAS
Sta
Lincoln Sch
City Hall
Library
ST
Public Beach
EAU CLAIRE
Hospital
21
Public Access
MESSENGER
Washington Jr High Sch
Jefferson Sch
SOO LINE
BM 1129
HARTELL ST
AVE
22
Trailer Park
48


Pk
Nora
Cem
North
Park
FFA
Park
16
Fairground
Hiawatha
Park
1132
1130
1137
1
NORTH WESTERN
BUNDY
ST
LAKE
1140
1134
DOUGLAS
ST
Park
RICE LAKE
Sta
Lincoln Sch
Library
Public
Beach
EAU CLAIRE
ST
Hospital
21
MESSENGER
ST
Public
Access
Washington
Jr High Sch
Jefferson
Sch
LINE
1131
22
Trailer
Park
BM
1129
HARTELL
ST
NOBLE
AVE
ALLEN
ST
1123
Park

1. Animal waste management.
2. Conservation tillage.
3. Contour farming.
4. Strip cropping.
5. Streamside management zones (buffer strips).
6. Natural waterway maintenance.
7. Stream bank stabilization.

The current weed harvesting efforts appear to be successful in improving the usability of the lake. The District should as a minimum continue its present efforts in this area and may want to increase its harvest capacity through improvement of loading/unloading pads and upgrading to cutters with larger capacity machines in the future. The District should invite feedback from lakeshore owners and other lake users to get a "feel" for the effectiveness of weed cutting efforts.

A weed harvesting plan should be developed. This plan should be coordinated with the DNR and should outline a systematic approach to the harvest of weeds. Areas to be cut should be prioritized; other areas should be set aside to be left uncut. This gives the District a plan to execute consistent weed harvesting activities, attack the worst problem areas first and effectively utilize weed harvesting equipment time.

CONCLUSION

Rice Lake has been experiencing water quality aesthetic problems that have had a negative impact on recreational use. Weeds and sediment have interfered with navigation, swimming, fishing, and other recreational activities. Nutrients in the water have also created nuisance algae.

This management plan provides a tool for the Rice Lake Protection and Rehabilitation District to take steps to improve the quality of Rice Lake. Actions such as dredging and on-going weed harvesting provide short-range solutions to some of the problems. However, long-term solutions aimed at the source of the problem such as implementing best management practices in the watershed are effective in reducing the rate of water quality degradation.

Continued effective weed harvesting efforts will be necessary to maintain lake usability, even if limited dredging is accomplished.

REFERENCES

Wisconsin Department of Natural Resources, Wisconsin Administrative Code, "Chapter NR 347 - Sediment Sampling and Analyses, Monitoring, Protocol and Disposal Criteria for Dredging Projects", November 1992.

U.S. Environmental Protection Agency, "The Lake and Reservoir Restoration Guidance Manual", Second Edition, 1990.

U.S. Environmental Protection Agency, "Sediment Removal as a Lake Restoration Technique", February 1981.

Wisconsin Department of Natural Resources, "Rice Lake Barron County Feasibility Study Results; Management Alternatives", 1983.

APPENDIX B

SEDIMENT ANALYSES

SWANSON ENVIRONMENTAL INC.

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Brookfield, Wisconsin 53045
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FAX (414) 783-5752

WDNR Certification #268181760

ANALYTICAL REPORT

REPORT NUMBER: B3109

Ayres Associates
1300 West Clairemont Avenue
P.O. Box 1590
Eau Claire, WI 54702-1590
Attn: Mr. Dean Steines
Project #5076.00

DATE: July 9, 1993
PURCHASE ORDER:
SEI NO: WL5985
DATE COLLECTED: 06/15/93
DATE RECEIVED: 06/17/93

Matrix: Soil
Source: Rice Lake Protection & Rehab District

Units: mg/kg (ppm) (Dry Weight Basis)

HERBICIDE EXTRACTABLES	SEI ID Sample ID	5985-1 Red Cedar
2,4-D		<0.6
Dalapon		<260
2,4-DB		<40
Dicamba		<12
Dichloroprop		<29
Dinoseb		<3.3
MCPA		<11000
MCPP		<8600
2,4,5-T		<0.2
2,4,5-TP		<0.2

Elevated detection level due to matrix interference during sample prep.

Gary E. Barry
Gary E. Barry
Projects Coordinator

ORIGINAL

SWANSON ENVIRONMENTAL
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FAX (414) 783-5752

ANALYTICAL REPORT

WDNR Certification #268181760

REPORT NUMBER: 33109

Ayres Associates
1300 West Clairemont Avenue
P.O. Box 1590
Eau Claire, WI 54702-1590
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Matrix: Soil
Source: Rice Lake Protection & Rehab District

Units: mg/kg (ppm) (Dry Weight Basis)

PESTICIDE EXTRACTABLES	SEI ID Sample ID	5985-1 Red Cedar
Aldrin		<1.6
a-BHC		<1.6
b-BHC		<1.6
d-BHC		<1.6
g-BHC		<1.6
Chlordane		<5.0
4,4'-DDD		<1.6
4,4'-DDE		<1.6
4,4'-DDT		<22
Dieldrin		<1.6
Endosulfan I		<1.6
Endosulfan II		<1.6
Endosulfan sulfate		<5.0
Endrin		<5.0
Endrin aldehyde		<5.0
Heptachlor		<1.6
Heptachlor epoxide		<1.6
Methoxychlor		<5.0
Toxaphene		<220
PCB 1016		<8.3
PCB 1221		<8.3
PCB 1232		<8.3
PCB 1242		<8.3
PCB 1248		<8.3
PCB 1254		<8.3
PCB 1260		<8.3

ORIGINAL

SWANSON ENVIRONMENTAL

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Brookfield, Wisconsin 53045
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RECEI

JUL 12 93

AYRES ASSOCIATES

WDNR Certification #268181760

ANALYTICAL REPORT

REPORT NUMBER: B310

Ayres Associates 1300 West Clairemont Avenue P.O. Box 1590 Eau Claire, WI 54702-1590 Attn: Mr. Dean Steines Project #5075.00	DATE: July 9, 1993 PURCHASE ORDER: SEI NO: WL5985 DATE COLLECTED: 06/15/93 DATE RECEIVED: 06/17/93

Matrix: Soil
Source: Rice Lake Protection & Rehab District

Units: mg/kg (ppm)

Analyte	SEI ID Sample ID	5985-1 Red Cedar
Nitrogen, Ammonia		800
Nitrogen, Kjeldahl		5,510
Nitrogen, Nitrate		80
Nitrogen, Nitrite		<10
Phosphorous, Total		1,800

ORIGINAL

SWANSON ENVIRONMENTAL

3150 North Brookfield Road
Brookfield, Wisconsin 53045
telephone (414) 783-6111
FAX (414) 783-5752

WDNR Certification #268181760

ANALYTICAL REPORT

REPORT NUMBER: 93109

Ayres Associates
1300 West Clairemont Avenue
P.O. Box 1590
Eau Claire, WI 54702-1590
Attn: Mr. Dean Steines
Project #5076.00

DATE: July 9, 1993
PURCHASE ORDER:
SEI NO: WL5985
DATE COLLECTED: 06/15/93
DATE RECEIVED: 06/17/93

Matrix: Soil
Source: Rice Lake Protection & Rehab District

Units: mg/kg (ppm)

	SEI ID	5985-2
Analyte	Sample ID	Storm Sewer Outlet
Arsenic		0.6
Cadmium		<3
Chromium		10
Lead		22
Mercury		<0.03
Zinc		67

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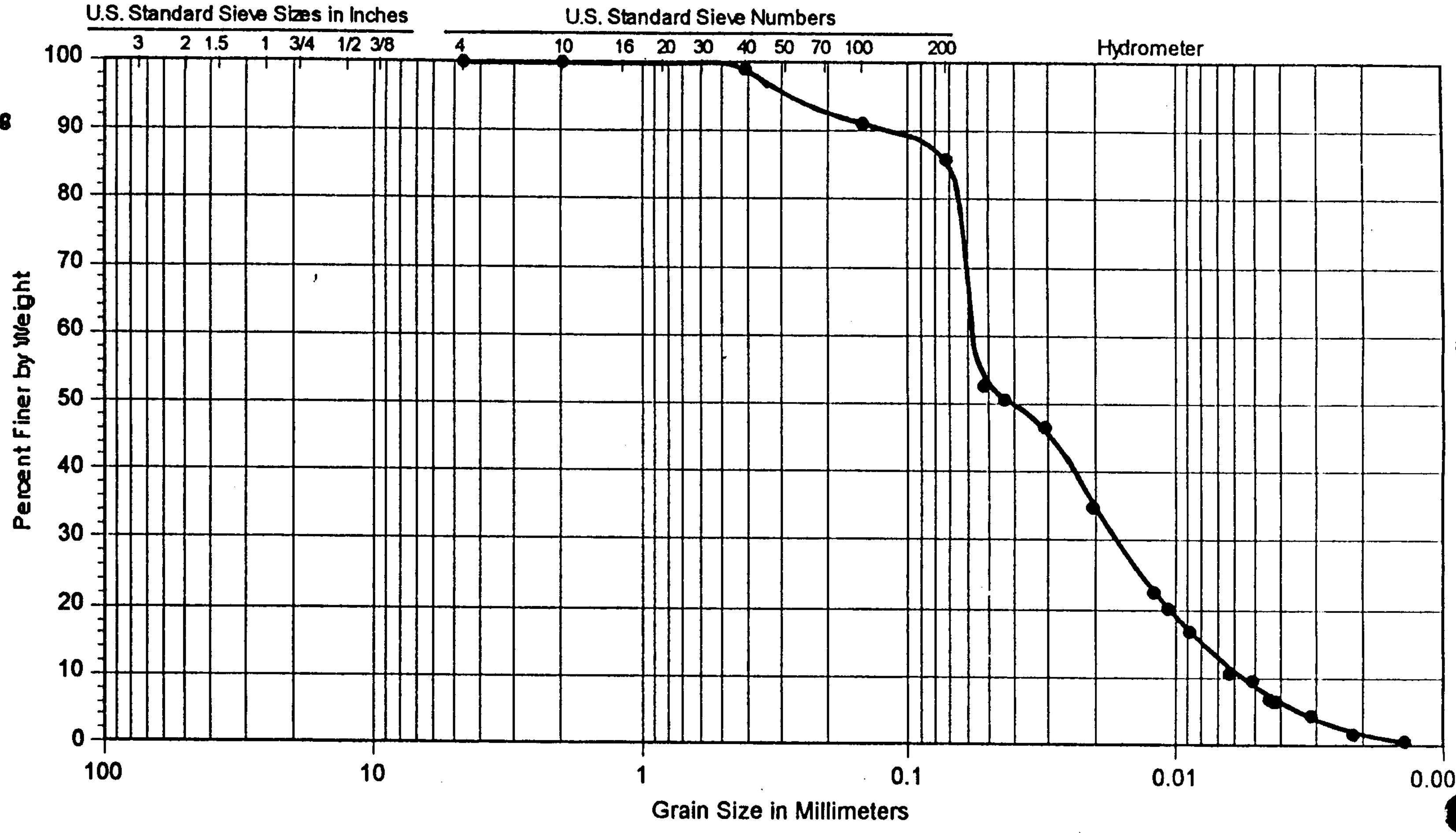
GRAIN SIZE ANALYSIS

Wisconsin Testing Laboratories

Sieve Size	Percent Passing
No.4	100.0
No. 10	99.9
No. 40	99.1
No. 100	91.2
No. 200	86.0



UNIFIED	GRAVEL	SAND	SILT AND CLAY
AASHTO	GRAVEL	SAND	SILT AND CLAY

NUMBER	DEPTH	w	w_L	w_P		CLASSIFICATION
5985-1						Silt (ML) or Elastic Silt (MH) or Silty Clay (CL-ML) or Lean Clay (CL) or Fat Clay (CH)

Client Project No.: 5985-1
WTL Job No.: L-9368
Client: Swanson Environmental, Inc.
Date: July 27, 1993

SWANSON ENVIRONMENTAL INC.
3150 North Brookfield Road
Brookfield, Wisconsin 53045
telephone (414) 783-6111
FAX (414) 783-5752

RECEIVED
APR 12 1993
AYRES ASSOCIATES

WDNR Certification #268121710

ANALYTICAL REPORT

REPORT NUMBER: B2105

Ayres Associates
1300 West Clairemont Avenue
P.O. Box 1590
Eau Claire, WI 54702-1590
Attn: Mr. Dean Steines

DATE: April 7, 1993
PURCHASE ORDER:
SEI NO: WL4739
DATE COLLECTED: 03/93
DATE RECEIVED: 03/23/93

Matrix: Sediment
Source: Rice Lake

Units: mg/kg (ppm)

Analyte	SEI ID Sample ID	4739-2 PVC Composite
Arsenic		1.0
Lead		<5.0
Mercury		0.08
Zinc		24

Gary E. Barry
Gary E. Barry
Projects Coordinator

ORIGINAL

APPENDIX C

WATERSHED PRACTICES REPORT

NON-POINT SOURCE POLLUTION
STUDY OF THE WATERSHED OF
RICE LAKE

COMPLETED FOR THE RICE LAKE

LAKE DISTRICT

BY THE

BARRON COUNTY LAND CONSERVATION DEPARTMENT

Watershed study completed by:

Nathan Olson
Wastewater Management and
Soils student, U.W. Stevens
Point

Dale Hanson
County Conservationist
Barron County Land
Conservation Department

Assisted by:

Jim Riemer, Project Manager
Yellow River Watershed

Carol Evenson, Data Manager
Yellow River Watershed

Ken Baun
Computer Analyst
Wisconsin DNR

In cooperation with the Rice Lake Lake District, the Barron County Land Conservation Department has conducted a study of the watershed area of the Rice Lake Flowage.

The Rice Lake Lake District has acquired a lake planning grant from the State of Wisconsin for the purpose of conducting a comprehensive lake study. The watershed study was done as a part of the entire lake study.

The entire geographic watershed of Rice Lake is approximately 350,000 acres. The watershed study area was 61,000 acres. The watershed study area extended from the confluence of the Red Cedar River and Rice Lake upstream to the Mikana dam; from the confluence of the Brill River and the Red Cedar River upstream to the Long Lake Dam, which is 2 miles north of the Barron/Washburn County line. The study area also extended from the confluence of Bear Creek and Tuscobia Lake upstream to the Bear Lake dam in Haugen, and the entire area of Little Bear Creek. The watershed study area also included all the land areas between the above mentioned rivers.

The first step in the watershed study was the streambank survey.

Red Cedar River

The streambank survey of the Red Cedar was done by canoe. The streambanks of the Red Cedar river are generally in very good condition. In section 32 of Cedar Lake Township nearly 4000 feet of the river is pastured by cattle and sheep. Although the streambank trampling and erosion is not serious at this time, this area of the river should be fenced. In the NW 1/4 of section 6 of Doyle Township is a quite large gully that erodes sediment into the river. A gully control measure should be installed here to stop the sedimentation. In addition to these 2 problems, a couple of sites were found where garbage consisting of building demolition have been dumped along the river. Although unsightly, these garbage dumps do not pose a threat to the river or lake.

Brill River

As with the Red Cedar River, the streambanks of the Brill River are generally in very good condition. One area along the Brill was found to be pastured. Over 4000 feet of the river is quite heavily pastured in section 24 of Oak Grove. In the SW 1/4 of section 25 of Long Lake Township in Washburn County there is a site where the river is being crossed with machinery on a regular basis. This causes streambank and river bed erosion. A rock stream crossing should be installed. In the NW 1/4 of section 25 of Long Lake Township a personal road and bridge have been developed. A large amount of sand has recently been deposited to build up the road. The sand is washing into the river.

Bear Creek and Little Bear Creek

The Bear and Little Bear Creeks have considerably more pasturing along the streambanks than the Red Cedar and Brill. 11 sites were found where cattle are pasturing the streambanks quite heavily. The exact location of the sites is on record at the Land Conservation Department. In the SE 1/4 of Oak Grove Township there is a site on the Bear Creek where the river is being crossed on a regular basis. A rock stream crossing should be installed.

Tuscobia and Stump Lakes Shoreline

Two sites were found on Tuscobia Lake where cattle have access to the lakeshore. One site is on the west side of the lake in section 5 of Rice Lake Township, and the other site is along the east side in section 33 of Oak Grove Township. At the very southeast corner of Stump Lake there is a 40 foot long unvegetated area that is the outlet of the north ditch of highway 48. This area is currently eroding into the lake and should be shaped, seeded, and mulched.

The second step of the watershed study was to measure the sediment entering the rivers and streams from crop fields.

In the past there was no accurate method to measure how much sediment was entering a stream from an agriculture area, other than the "swag" (scientific wild-ass guess) method. However recently the Department of Natural Resources has developed a computer model for estimating sediment delivery. The first model, called WIN (Wisconsin Non-Point) was first used for watershed planning in 1987. This version was only in part endorsed by the USDA-Soil Conservation Service. This second edition of the computer model, which came out in 1992, is called WINHUSLE (Wisconsin Non-Point Hydrologic Unit Sediment Load Estimation Program). WINHUSLE has been endorsed by the USDA-Soil Conservation Service.

The Universal Soil Loss Equation (USLE) has been in use to measure soil erosion for nearly 50 years. The USLE measures soil erosion in a crop field, but does not measure how much sediment is leaving the field. WINHUSLE takes the amount of soil erosion, and then based on the length of the slope in the field, the distance to the nearest intermittent stream, the morphology and cover found in the intermittent stream, and the distance to the perennial stream or river, predicts the amount of soil sediment that actually reaches the water.

Time did not allow for an inventory of the entire 61,000 acre study area for WINHUSLE, so a 4000 acre sub-watershed that is extensively cropped was chosen. The sub-watershed starts above Highway V near Lower Devils Lake, and enters the Red Cedar River just west of the Highway 48 and M intersection. The State has indicated in the WINHUSLE instructions that only 20% of a sub-watershed or hydrologic unit needs to be inventoried to get accurate results from the model. In an effort to ensure accuracy, 46% of the subwatershed was inventoried. The inventory of each crop field included the slope of the land, the length of slope, soil type, the crop rotation, and conservation practices that exist.

The results indicate that each year 34 tons of sediment enter the river from this sub-watershed. The model also estimated that 205 pounds of phosphorous enters the river along with the sediment. If the remainder of the study area yields 70% that of the 4000 acre sub-watershed does, and if the sediment coming into the Tuscobia and Stump system settles out and stays in those lakes, 300 tons or more of sediment, along with 1800 pounds of phosphorous enters Rice Lake each year from agriculture crop fields each year.

There are agriculture areas around Wisconsin that spill much more sediment into our rivers and streams than this 61,000 acre study area. However, it is the recommendation of the Barron County Land Conservation Department that the Lake District encourage farmers in the drainage area to adopt reduced tillage and to install 50 foot wide grass buffer strips where tillage is currently being done very close to the streams and rivers.

The third step in the watershed study was a barnyard survey.

Contained within the study area are 55 feedlots and barnyards that could be contributing animal manure nutrients to Rice Lake. When the barnyard survey was done, the barnyards were ranked according to potential water quality impact. The highest potential for water pollution were given a 1, a medium a 2, and a low ranking barnyard was given a 3. Of the 55 barnyards surveyed, 26 received a rank of 3, 22 received a rank of 2, and 7 received a rank of 1. A serious barnyard runoff problem can have a significant impact on water quality, and can also be very costly to correct. The Lake District should encourage farmers to correct runoff problems. Often moving the feedlot a short distance and installing a buffer area can reduce the amount of runoff. If expensive measures are necessary, the farmer can be encouraged to apply for Federal funding to assist with the cost

Construction Site Erosion Control Ordinance

One source of sediment that is often over looked is sediment from construction sites. It is estimated that acre for acre, a construction site will have up to 5 times as much erosion as the worst crop field. If a construction site is near a stream or lake, or within a city where the storm sewer system will convey the sediment to the stream or lake, large amounts of sediment can be deposited in the water.

In most cases controlling construction site erosion is neither a difficult or expensive task. Builders and contractors should be encouraged to adopt construction site erosion control measures, and municipalities should be encouraged to adopt construction site erosion control ordinances.

The Department of Natural Resources has published a book entitled Wisconsin Construction Site Best Management Practice Handbook. This handbook describes the best methods for controlling construction site erosion. This handbook is available through the Barron County Land Conservation Department.

Conclusions and Recommendations

To put it in simple terms, the agriculture watershed of Rice Lake is having a serious negative impact on the water quality of Rice Lake.

If we look at the amount of sediment and nutrients that enter the lake annually, especially compared to watershed areas that have much steeper slopes for cropland, one might conclude that the runoff problem is not serious. However the accumulation of the sediment and nutrients over the years, both past and future, poses a very serious threat to the water quality of Rice Lake.

Below are the major problems that have been identified, and the solutions for each problem.

Streambank and Lakeshore grazing	Fence livestock away from the shore, and install watering access for the livestock.
Soil erosion and resulting sedimentation of the lake	Encourage farmers to use conservation tillage (no-till or reduced till) when growing row crops, and install buffer strips of vegetation along the streams, river or lake.
Nutrients from animal manure entering the lake	Encourage eligible farmers to install barn-yard runoff and manure storage facilities.

Many of the above conservation practices can be costly. There are federal programs available to farmers that provide funding for installation of conservation projects. However these funds are limited, there is often waiting lists, and as with most government programs, there are "strings attached" that discourage some farmers from participating. The Lake District may want to consider making some funds available to farmers who agree to install a conservation practice that will help the lake protection effort. The Land Conservation Department would be happy to help set up a "cost sharing" program if the Lake District were interested in pursuing a funding program.