FINAL REPORT

Wisconsin Lake Management Planning Project Grant

BLACK OTTER LAKE
Outagamie County, Wisconsin

May 1992

Sponsored
by

Black Otter Lake Protection and Rehabilitation District

and

State of Wisconsin
Department of Natural Resources

Prepared
by

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SUMMARY

In 1989 Black Otter Lake was drained and 120.000 cubic yards of sediment removed from the lake. This removed about 56% of the sediment in the lake and accomplished the primary objective of the Black Otter Lake Rehabilitation Plan of 1982 which identitied sediment removal as the primary restoration and maintenance strategy to achieve maximum lake renewal benefit for the lake.

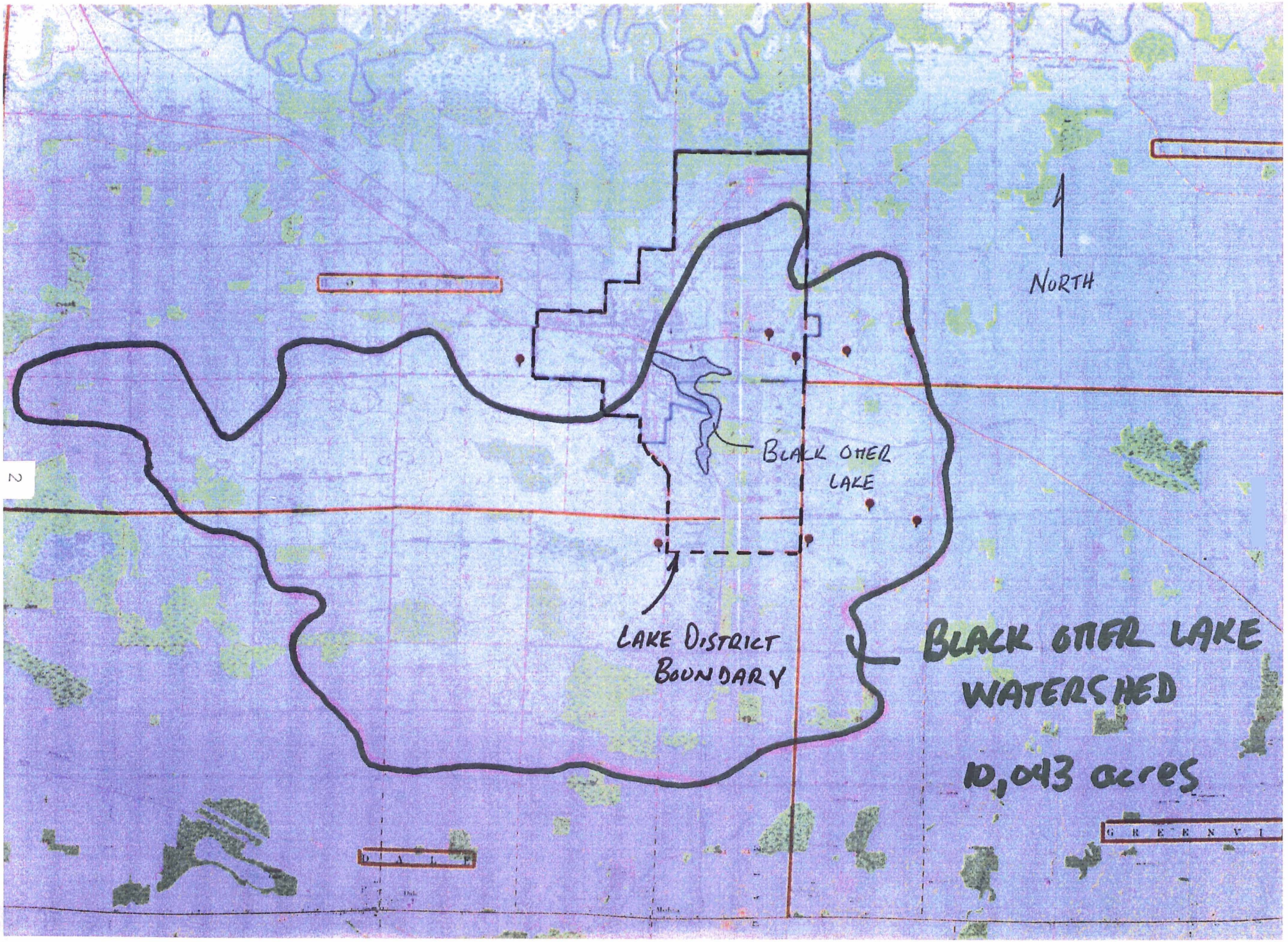
Sediment removal was not expected to be the sole solution to restore and maintain the lake. The Plan further identified the following strategies for implementation.

1. Aerate the lake. - doing
2. Implement "Best Management Practices" in the watershed.
3. Install storm water retention basins, and
4. Provide recreational opportunity.

Since 1982 work has been underway to implement these strategies.

The specific purpose of the Wisconsin Lake Management Planning Project Grant is to assess the progress made so far and clearly identify what further activities need to be done to achieve maximum lake renewal. In order of priority, the following action items by the Black Otter Lake District are considered necessary.

1. **Immediately work to curtail several possibly serious nutrient pollutant discharges to the lake.**
2. **Begin in 1992 a yearly weed harvesting program.** doing
3. **Immediately seek to establish a new water level agreement allowing maximum water levels in the summer and minimum water levels in the winter.** done
4. **Aggressively seek enforcement of existing rules and regulations for natural resources use and management for the townships, village and county of the watershed. Emphasize particularly those sites that have been identified in the report as highly erodable.**
5. **Aggressively lobby for county wide new construction site erosion control BMPs and enforcement.**
6. **Discover and create opportunities for people in the watershed to become active participants in managing the lake. Focus particularly on the children.**
7. **Inform the County Board on a minimum quarterly basis the activities and direction of the Lake District. Aggressively lobby to restore county interest and financial support for Black Otter Lake.**
8. **Encourage new and continued DNR assistance in fisheries and wildlife management, aquatic plant manipulation, and wetland reclamation.**
9. **Investigate alternative lake aeration systems.**


NORTH
BLACK OTTER LAKE
LAKE DISTRICT BOUNDARY
BLACK OTTER LAKE WATERSHED
10,043 acres

INTRODUCTION

Black Otter Lake is a 75 acre impoundment on Black Otter Creek in Outagamie County, Wisconsin. The lake was constructed around 1847 to run a sawmill. The upland watershed is 10,043 acres and is primarily agricultural.

Since the early 1950's there have been various attempts to improve the condition of the lake. In 1976 the Black Otter Lake Protection and Rehabilitation District was created to provide a focused and unified effort to restore and maintain the lake.

A Black Otter Lake Rehabilitation Plan was formalized in 1982 and the lake district has been striving to implement the strategies of the Plan since then. Aerators have been in service during the winter months since 1982 successfully maintaining dissolved oxygen levels sufficient to prevent serious winter kills of fish.

In 1989 the lake was drained and 120,000 cubic yards of sediment were removed from a 55 acre portion of the lake which is between the railroad bridge and the dam. This was just over half of the sediment estimated in the entire lake. The lake was refilled in 1990.

During the time the lake was drained and dredged, three upland and one inlake sediment basins were constructed. Black Otter Creek was also rerouted back through a wetland before entering the lake as it had before the 1950's. In December 1991 an additional sediment basin was constructed along a 735 acre drainage basin on the east side of the lake. All these efforts are to reduce future sediment deposition in the lake.

PRESENT LAKE CONDITION

Sediment removal and consolidation of dried sediment has increased the mean depth of the 55 acre portion of the lake an estimated 2 feet. The mean depth of the lake is now about 6 feet below the spillway crest. In 1990 and 1991 the village was holding the water level 1.2 feet above the crest. There are now four areas of the lake where the water is 8 to 11 feet deep. (Figure 1)

Water quality monitoring during 1990 and 1991 indicates that the lake is still eutrophic. (Appendix A) The Outagamie County sanitarian also observed coliform levels too high to allow a swimming area in the lake at the present time. (Appendix B)

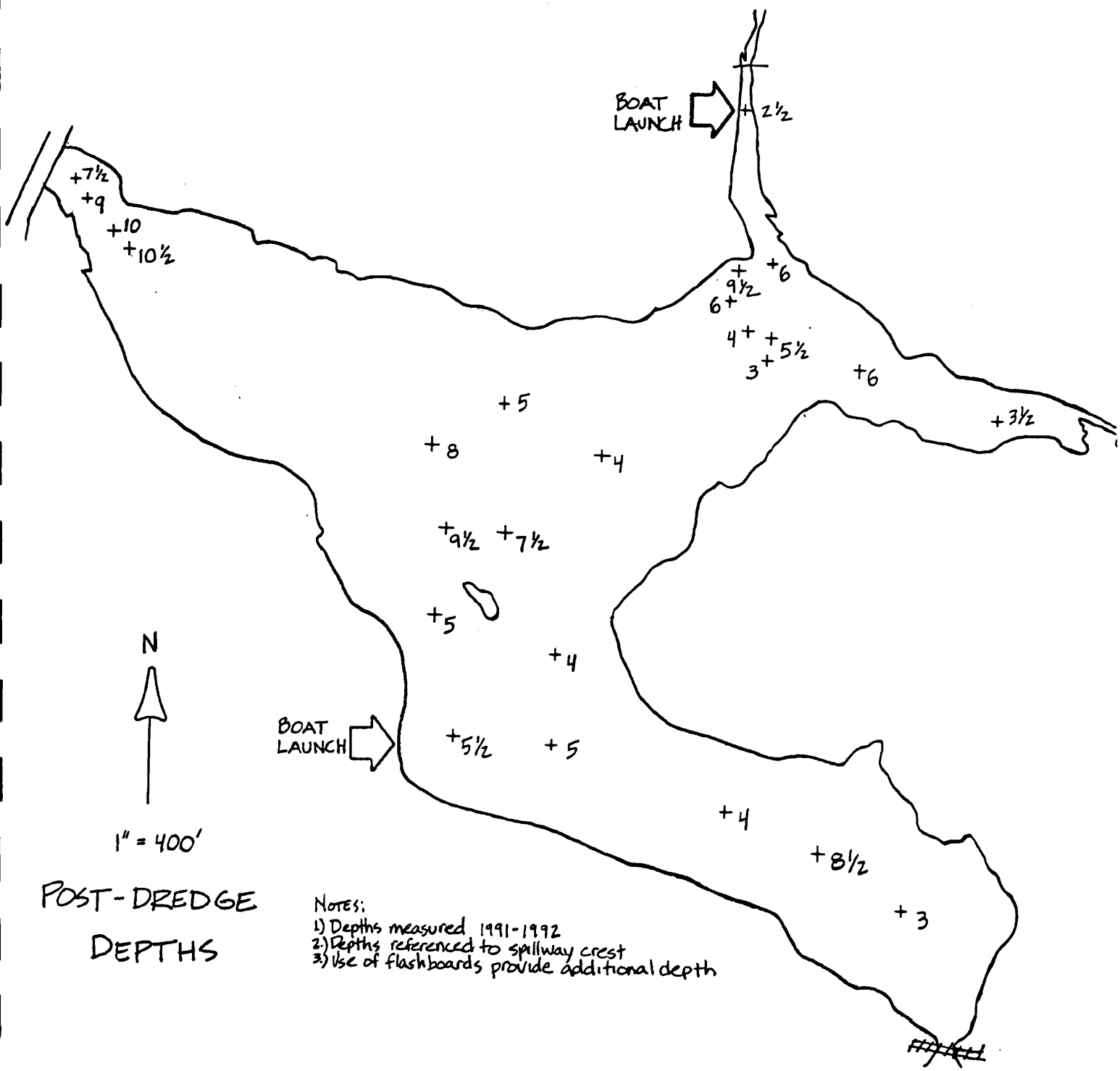

BOAT LAUNCH
+2½
+7½
+9
+10
+10½
+9½
+6
6+
4+
+5½
3+
+6
+5
+8
+4
+3½
+9½
+7½
+5
+4
N
BOAT LAUNCH
+5½
+5
+4
+8½
+3
1" = 400'
POST-DREDGE DEPTHS
NOTES:
1) Depths measured 1991-1992
2) Depths referenced to spillway crest
3) Use of flashboards provide additional depth

Figure 1

Aquatics plants were thriving in 1990 and 1991. In July 1991 about 30% of the surface area of the lake was covered with dense mats of plants. Submerged plants were found in up to eight feet of water. A formal survey of species and densities was not performed, but coontail, milfoil, flatstem pondweed, common pondweed, elodea, duckweed and chara were observed during lake inspections in 1991. Visually it appeared the plant species composition was similar to what was observed during the detailed macrophyte survey in 1978. Based on the report of that survey, it appeared the major differences were in the extent and density of plant growth. Growth even to this extent however has been a major disappointment to people wanting to enjoy the lake. (Appendix C)

LAKE DISTRICT MEETINGS AND QUESTIONNAIRE

To encourage more public input into the affairs of the lake district, and particularly the project grant, a special open forum was held in April 1991 to hear citizens input and answer questions about the future of Black Otter Lake. A questionnaire was also mailed in October 1991 to over 1400 people living or owning property within the watershed. The lake district further had its monthly meetings which typically had a small attendance. There was also the annual meeting in August 1991.

Minutes of the April forum and the questionnaire and reply tabulation are in Appendix D. The results narrative is on the next page.

BLACK OTTER LAKE QUESTIONNAIRE RESULTS

The following is a general description of the results from the Black Otter Lake Questionnaire. Of the approximately 1,400 questionnaires that were sent out, 271 replies were received. Of those received, 102 replies were from residents within the village and 169 replies were from outside the village. For the following results, the number in the () corresponds to the number of the question as it appeared on the questionnaire.

Respondents

(1) All from outside the village who responded were located further than 3 miles from the lake, and the majority of respondents from within the village were located 1 mile or closer to the lake.

Current Lake Use/Quality

(2) The majority (67%) of respondents indicated that they do not enjoy or use the lake now. (3) Those who do enjoy or use the lake like it for viewing, fishing, and ice skating. (4) Those who do not enjoy or use the lake cited other interests, too dirty, not enough fish, and that previous projects destroyed the lake.

(5) Most (73%) respondents believe the lake is an asset to the community. (6) However, the condition of the lake is believed to be in poor to O.K. quality and (7) this condition does keep most from enjoying or using the lake.

(8) Weeds were cited as the biggest problem of the lake. Watershed pollution, poor fishing, and no flow were the other most indicated problems.

(9) According to most (60%) of the respondents, something more should be done. When asked "What?" the response favored weed control and stocking the lake with fish.

Aquatic Plants (Weeds)

(10) Most (87%) support a plan by the district to rent a weed harvester this summer to cut the weeds. (11) The majority (77%) do not support the use of chemicals to kill the weeds. (12) The weeds would not be used by most (73%) as mulch or compost.

Land Use Practices in the Watershed

(13) The majority (71%) of respondents believe that unless we change land use practices that fill the lake with soil and pollution, everything we do in the lake will not solve the problem/s.

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(14) Manure runoff from barnyards and feedlots is the land use practice most believe affect Black Otter Lake. Runoff from streets, use of lawn fertilizers, and poor cropping practices were the other most indicated land use practices affecting Black Otter Lake.

Lake District

(15) Feelings about the lake district having done an adequate job so far to protect and rehabilitate Black Otter Lake were slightly in favor of the lake district.

(16) Most (65%) think the lake district should be more aggressive in trying to change the land use practices that are harming the lake, (17) and the majority (63%) support the approach suggested in the questionnaire:

1. talk to the land owner/s believed having a harmful impact and encourage that person/s to change practices
2. seek support from governmental agencies
3. purchase, lease or contract easements of the properties so the district can manage the land/s better
4. seek legal action -- go to court if necessary

(18) Those that do not support this approach suggest leaving the lake alone...that it is just a millpond, and educating the landowners.

(19) The majority (63%) of the respondents do not think that the lake district should increase the size of the district to include more of the watershed.

Prospective Lake Uses

(20) Of the choices given, most were in favor of the district promoting better fishing and creating of special waterfowl areas. Most were opposed to allowing motorized boats in the water and more public property along the shore.

(21) If offered a choice between waterfowl or swimming uses for the lake, most (74%) respondents would choose waterfowl.

Public information/meetings/volunteerism

(22) Most (59%) do not believe the public is adequately informed about issues of the lake and what is being done. (23) Those that feel this way think there should be more newsletters, meetings, and education for the public. (24) The overwhelming majority (85%) of the respondents feel more should be done to teach the children how to care for the lake.

RESULTS - Page 3

(25) Most (76%) respondents never attend the lake district monthly or annual meetings. (26) Those who seldom or never attend are not aware of the meetings, not interested, or have no time.

(27) For the majority (67%) of respondents there is not anything the lake district could do differently that would get them to offer their time and talents more readily. (28) For those who it could motivate to offer their time and talents, letting the lake front owners shoulder responsibility and allowing the lake to go back to nature would be their impetus.

ACTION ITEMS FOR THE LAKE DISTRICT

(In Order of Priority)

1. Immediately work to curtail several possibly serious nutrient pollutant discharges to the lake.

Part of the project grant involved an investigation of the current land use practices within the watershed. The investigation included both ground and air reconnaissance.

During the investigation which occurred during the summer and fall of 1991, three specific sites were identified as potentially serious nutrient pollutant discharges from lifestock to the lake. The three sites are:

#1 Two livestock feed lots along the main stem of Black Otter Creek along C.T.H. "M" just south of the village limits. Cattle have direct access to the creek from one of the feed lots.

#2 A feed lot just off the barn of a farm on Greenville Road just south of Hillview Road. Cattle have direct access to the drainage corridor.

#3 A pasture area just south of S.T.H. "45" on Lake Street in the village limits. It does not appear that animals are pastured here continuously but when they are they have direct access to the drainage corridor.

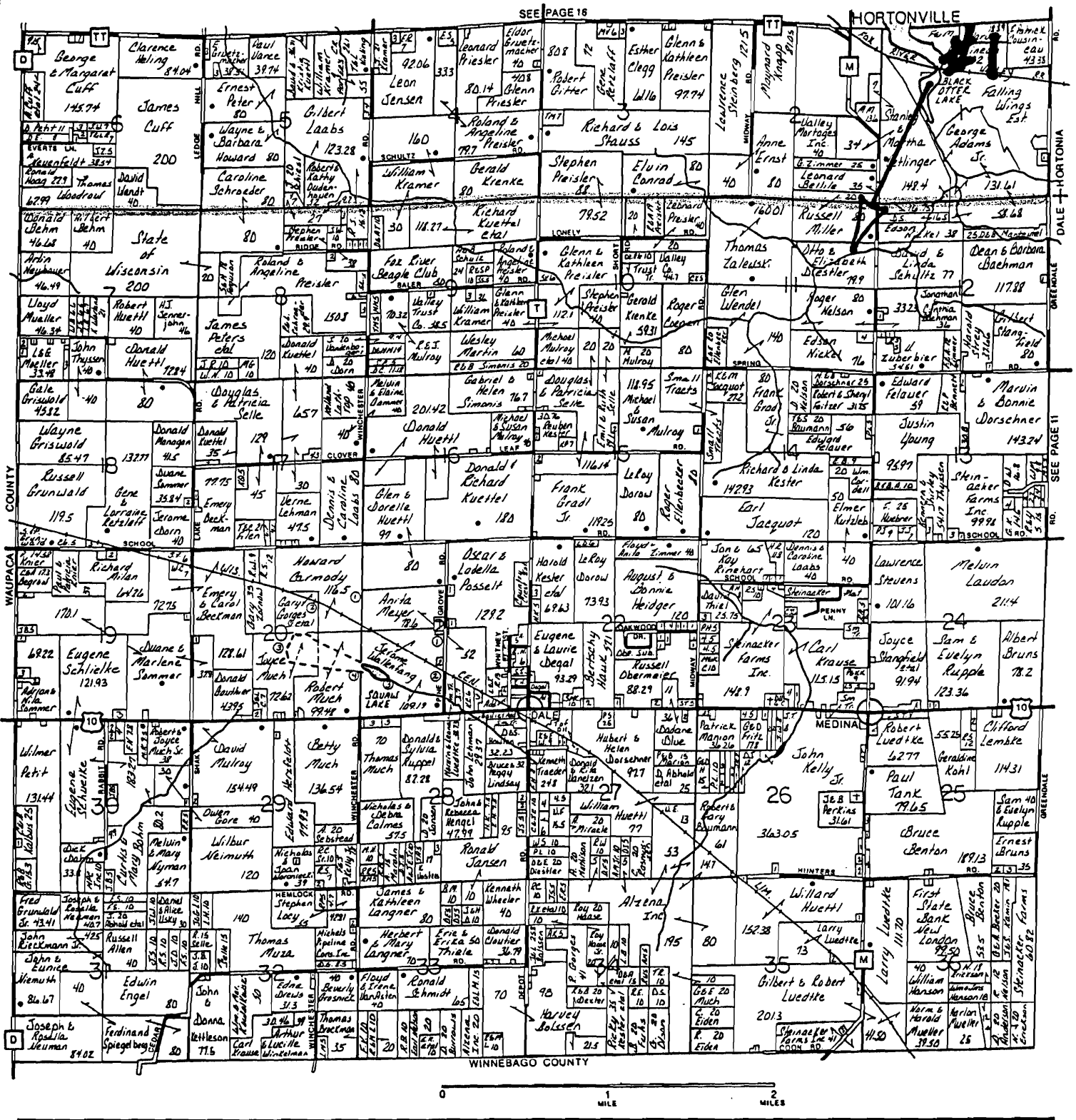
Another disappointing aspect of this situation is that the trees and brush in the drainage corridor were cut the past year increasing the likelihood of higher water temperatures and increased erosion of the corridor.

To magnify the problem, a storage building has been erected immediately on the north side of the corridor with little regard for construction site and parking lot erosion into the corridor. This will be discussed more in Action Items 4 & 5.

One additional note true for all three sites is the fact they are all located fairly close to the lake. Runoff and pollutant loadings from these sites are quickly and effectively transported to the lake.

The following location maps and photographs further describe the three sites.

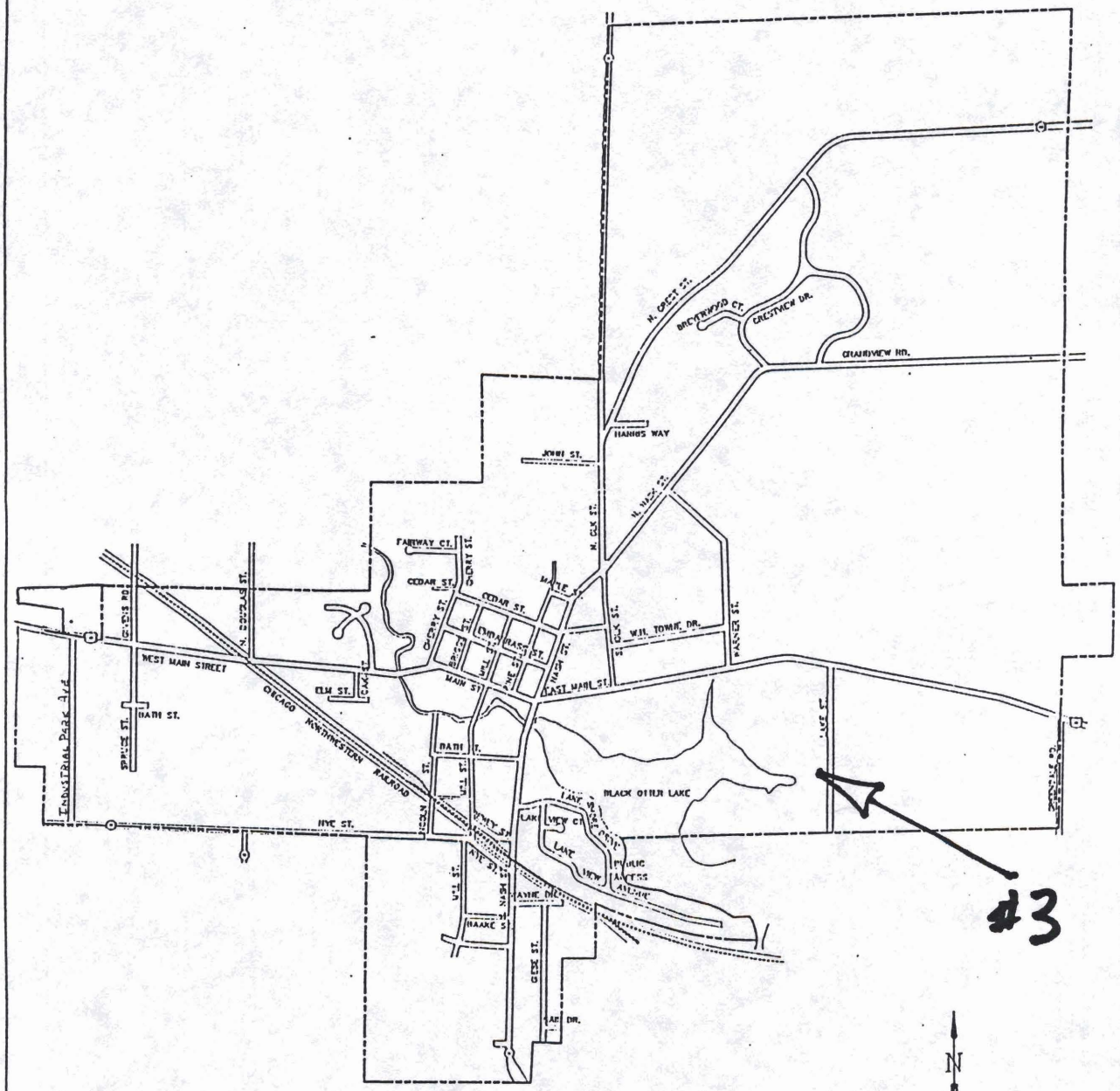
DALE SOUTH PART HORTONIA T.21N. - R.15E.



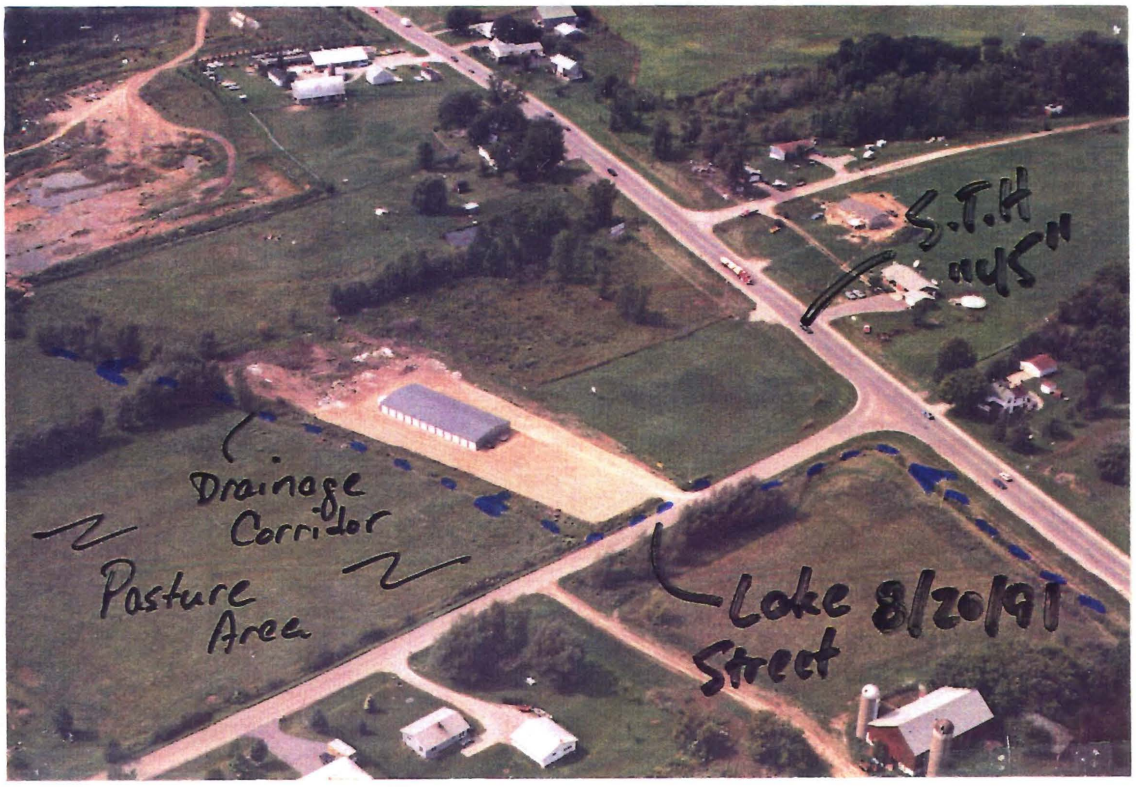
VILLAGE OF HORTONVILLE

OUTAGAMIE COUNTY

WISCONSIN



Reduced Scale



Site #3
Black Otter Lake Watershed

1997 Harvesting 2x/yr

2. Begin in 1992 a yearly weed harvesting program.

Records indicate that as early as 1957 work was done to control aquatic weed growth. In that year Rotonone was used. In 1979 a commercial weed harvestor was contracted to remove 120 tons of vegetation. The same was done in 1981 and the lake was further treated the same year with Diquat , Cutrine Plus and copper sulfate for vegetation and algae. Since 1981 no further weed harvesting has been done although the 1989 drawdown and dredging project was a major effort to help remedy the aquatic plant problem.

As mentioned earlier in this report, the trophic status of the lake in 1990 and 1991 remained eutrophic and aquatic weeds continued to thrive after the 1989 dredging project. It appears the vegetation problem is not as serious as it was before 1989 since more areas of the lake are deeper now and below the photic zone. However in August 1991 the aquatic plant growth still covered about 30% of the lake surface north of the railroad bridge. Unfortunately for anyone along the shoreline trying to visually enjoy the lake or even trying to launch a small boat it appeared far worse since the shoreline was most affected. This was a major disappointment for the people and public support locally and on the county level was seriously hurt. The extent of the aquatic plant growth as seen in August 1991 is shown in the photgraphs in Appendix C.

It became clear during the course of the lake management planning project grant that the weeds were the key public indicator whether any efforts to date to improve the condition of the lake were successful or not. And if there would ever be any hope of increasing, or even maintaining public support for continued rehabilitation efforts, something more tangible needed to be done with the weeds.

Two options for aquatic plant control were investigated; mechanical harvesting and chemical treatment. Since mechanical harvesting in shallow areas near the shoreline can be difficult, a combination of the two methods was also explored.

Representatives from firms performing each method examined the lake and prepared treatment strategies and costs. The City of Marion employee who does the mechanical weed harvesting on the Marion Millpond also attended a lake district meeting and answered questions. Allowing for recent dredging, the need for fishery habitat, and inaccessible shallow areas, about 19 acres of the lake could be harvested. A cutting in mid-June with a second in early August were proposed. A harvesting machine with a six foot wide cutting bar and 300 cubic foot weed capacity would take about 40 hours for both cuttings at a cost between $4000 to $6000 ($210 to $315/acre).

Chemical treatment is most effective in shallow areas and is also

more regulated. If the area along the shore and out 100 feet were treated it would be about 15 acres. Both a herbicide and algaecide were recommended with an initial application in June and touch-up later in the growing season. Total cost was estimated at $4200 ($280/acre) and included permit application, notice and processing. If treatment would only extend 50 feet offshore the area would be reduced to 8 acres and the total cost was estimated at $2670 ($335/acre).

If a combination of both methods were used the weed harvestor would work as close to the shore as possible with chemical treatment in the areas the harvestor could not do. The combined total cost estimate was estimated at $5000 to $7000 ($263 to $368/acre).

The above information was presented at the lake district meetings and the question of treatment preference was also asked in the questionnaire. As the questionnaire results indicate, the majority (77%) of people replying to this issue prefered mechanical harvesting only. A comment was made at one of the meetings that owners of property along the shore can physically pull the weeds out by hand or rake if a weed-free shore is that important to them.

A question that followed then was whether it was more practical to purchase a weed harvestor for the lake district or contract the work out. Table 1 details that investigation. Even with potential 50% Wisconsin Waterways Grant matching dollars, the economics were not overly pursuasive at this time to purchase. The overwhelming consensus of comments at the meetings and questionnaire (87%) were to rent (i.e. contract) weed harvesting for one or two years and evaluate the success of harvesting before making a substantial financial committment to purchase.

There surface extent of mechanical weed harvesting for 1992 is shown on Figure 2.

ECONOMIC ANALYSIS

AQUATIC WEED HARVESTOR

Contract vs. Purchase

Question: Is it more economical to purchase a new weed harvestor contract with outside firm?

Given: 1.	Cost of new harvestor - 5 ft. cutter bar - 200 cu. ft. weed storage bed - 30 ft. trailer/conveyor transfer	$53,000
2.	Life expectancy	15 years
3.	Manpower cost to operate	2,000/year
4.	Fuel, maintenance & insurance	2,000/year
5.	Initial down payment (10%)	5,300
6.	Resale value after 15 years (50%)	26,500
7.	Interest rate for loan	8 %
8.	Cost to contract (assume constant)	6,000/year

Total Cost to Contract

$6,000/year x 15 years	90,000

Total Cost to Purchase

Option 1 - 100% by lake district (no outside funding)

Down payment of $5,300 + principal of $47,700	53,000	
Interest on $47,700 for 15 years @ 8%	34,352	
Manpower @ $2,000/year x 15 years	30,000	
Fuel, etc. @ $2,000 x 15 years	30,000	
Resale	-26,500	
	$120,852	= 8,057/yr

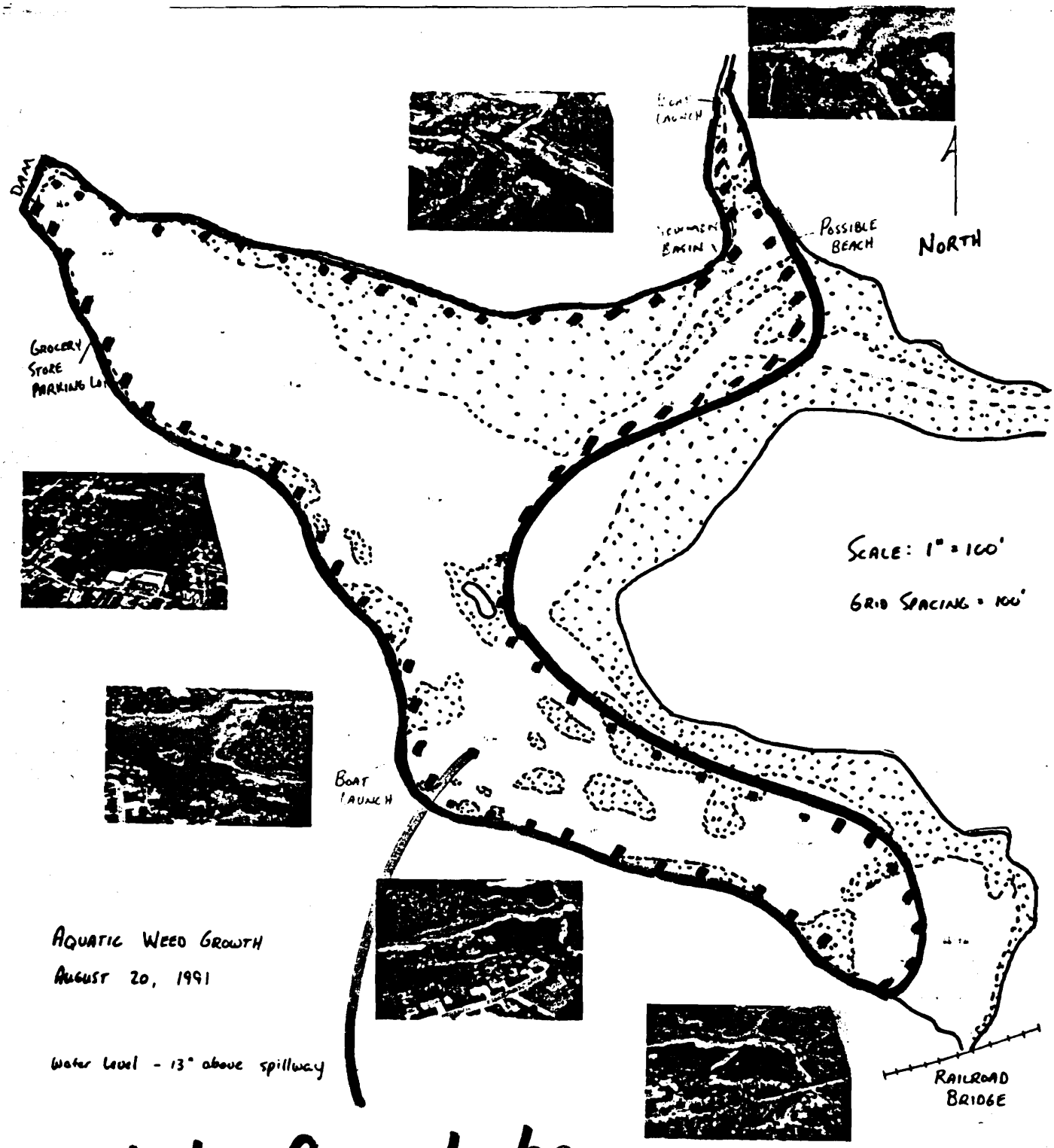
Option 2 - 50% by lake district (50% outside funding)

Down payment of $5,300 + principal of $21,200	26,500	
Interest on $21,200 for 15 years @ 8%	15,268	
Manpower @ $2,000/year x 15 years	30,000	
Fuel, etc. @ $2,000 x 15 years	30,000	
Resale (assume 100% to district)	-26,500	
	$ 75,268	= 5,018/yr

Conclusions:

1. Contract is $2,057 less than 100% purchase
2. Contract is $ 982 more than 50% purchase

TABLE 1



Lake Area to be Mechanically Harvested in 1992

FIGURE 2

village maintains water levels. (1997)

3. Immediately seek to establish a new water level agreement allowing maximum water levels in the summer and minimum water levels in the winter.

Since 1926 the water level for Black Otter Lake has been legally set by agreement. The agreement, which is legally still in effect, requires that the lake level is held approximately 10 inches lower from May 1st to September 15th (growing season) than the rest of the year. According to lake district files, the purpose in 1926 was to keep cropland and timberland adjacent to the lake and creek from being flooded or water-logged. Checking with village personnel, the lake level has been held fairly constant throughout the year for at least the past 30 years which up until the drawdown in 1989 appeared to be about 1.8 inches above the spillway sill. Since the lake was refilled in 1990 the level has been held about 1.2 inches above the sill to permit easier repair of the dam wing walls and flume. This work was just recently completed.

Based on generally accepted best management practices for water level control on impoundments such as Black Otter Lake it is desirable to keep the lake level as high as possible during the growing season and as low as possible during the winter. Light penetration, retention time, fish habitat, decaying plant availability are some of the major reasons for such practice. Legally and for a period of time after 1926, the lake level has been managed just the opposite. For the past 30 years however, the lake level has apparently not been managed at all. The reason seems to be one of convenience.

Based on a site survey in 1989 and the reasons mentioned above, Coastal Planning presented the lake district in February 1992 recommendations for seasonal water level settings. (Appendix E) The commission concurred with the consultant recommendations except for the winter level and chose a winter water level setting of + 0.5 rather than 0.0. This was to better insure no frost penetration in the spillway structure during the winter and provide additional marsh area for northern pike potentially spawning in late winter/early spring before the spring runoff.

In subsequent conversation with Wisconsin DNR water regulations staff, the + 2.0 summer limit is subject to a DNR field survey establishing the OHW (ordinary high water) mark of the lake. Once the OHW mark is determined by the DNR, this will be the legal upper limit for any future water level control. If the lake district and Village of Hortonville (as owner of the spillway) want a higher level, easements will have to be obtained from all property owners along the lake allowing flooding of private property. In all likelihood, securing all easements would be a difficult task and most likely not attempted. The summer water level would therefore be the OHW level as established by the DNR.

As of late March 1992, further progress of this action item is with the Village of Hortonville. If the village is interested in pursuing the recommendation of the lake district, it can either request the DNR to determine the OHW and then incorporate that level in its recommendation, or submit a recommendation to the DNR acknowledging the upper water level will be as determined by the DNR. Once the DNR determines the OHW mark, it will public notice the request, provide a public hearing if necessary, and approve or deny the request.

4. Aggressively seek enforcement of existing rules and regulations for natural resources use and management for the townships, village and county of the watershed. Emphasize particularly those sites that have been identified in the report as highly erodible.

"Let's get laws to do something about pollution." This is a valid comment and a necessity when volunteer and present legal means are inadequate to deal with a pollution problem. The truth of the matter however is that there <u>are</u> laws on the books that deal with many of the pollution problems observed within the Black Otter Lake watershed. The dilema is more one of understanding what laws do exist and how they are or should be enforced. In this section of the report we will examine what pollution laws do exist and how they apply to specific sites in the watershed.

To understand exactly what laws exist, inquiries were made to the Village of Hortonville, Outagamie County Land Conservation Department, Outagamie County Zoning Department, Wisconsin Department of Natural Resources and U.S. Soil Conservation Service. During this investigation, the author also made contact with Mr. Donald Last, Soil and Water Conservation Specialist, Cooperative Extension Service, University of Wisconsin, Stevens Point, Wisconsin. Mr. Last prepares an occasional report entitled, <u>Law of the Land Review</u>. The report is intended for local government officials regarding rules and regulations for natural resources use or management. In the author's opinion, the report is an excellent inventory and brief discussion of current natural resource laws in Wisconsin. Four recent issues are included in Appendix *E*.

What about the Black Otter Lake watershed? What are the problems, and for this discussion, what laws apply? Let us first be clear what needs to be identified. Our concern here is "law of the land" issues as opposed to "law of the lake". Law of the land issues are land use issues that affect the lake which is our concern, but they also affect things such as land productivity, groundwater recharge, wildlife habitat and so on. Law of the lake issues are issues such as dredging and lake level regulation which were discussed earlier. Weed harvesting is an issue that falls somewhere in between, a consequence of both land use practices and lake characteristics. The presentation for the balance of this action item is about law of the land issues.

How do such laws apply to the Black Otter Lake watershed? Earlier we discussed immediate action to curtail several possibly serious nutrient pollutant discharges. Three specific cases were discussed in Action Item #1. How could these be corrected with existing laws?

Nutrient Pollution

NR 243, "Animal Waste Management," is state authority to correct animal waste impacting water quality. The DNR must be contacted and a site inspection made. If corrective action is warranted, a "notice of discharge" is issued and the responsible party has two years to correct the problem. A "notice of discharge" citation also enables the responsible party to seek up to 70% cost share support with generally no dollar limit except for manure storage which has a $10,000 limit. This is a state program and state dollars. There are also other programs that can provide technical and financial support. On the federal level, there are the Annual Cost Share (ACP) and Long Term Agreement (LTA) programs for fencing, moving barnyards, etc. All three of these programs should be considered for the three specific cases in Action Item #1.

In Outagamie County the best way to initiate an investigation and corrective action if warranted is to contact the Outagamie County Conservation Services. This is a combined office of the Land Conservation Department and the Soil Conservation Service and is a very convenient way to access local, state and federal resources with one call. It is also a good procedure to the extent that a responsible property owner can be approached on a local level in an attempt to seek volunteer cooperation before seeking the recourse of law. If the property owner is unwilling to cooperate, the local Land Conservation Department can contact the state and federal authorities to require corrective action. For the lake district, the key task should be to develop an attentive eye for such problems within the watershed and when suspected contact the Land Conservation Department. Problems like this do not occur overnight, and it is more a situation of noticing what is happening in the watershed and seeking timely help.

Soil Pollution

Land use issues -- is there more than animal waste to contend with? Yes there is. Another major area of concern is soil erosion from land in the watershed. Beside being a major problem by itself causing the lake to fill in, it is also the major carrier mechanism for nutrients and other pollutants. One of the problems with soil erosion is it occurs practically everywhere and because of this it is often difficult to focus in on the problem and do something about it.

For this reason the following approach for this project grant was used. The entire 10,043 acre watershed was first investigated by air and road side survey. Most of the watershed visually appears in excellent condition, particularly the areas to the south and west. There are extensive wetlands, no till areas, and buffer strips along the drainage corridors in those areas. (Photo 4) The east and northeast portions of the watershed however have steeper slopes, are closer to the lake, and are an area of greater potential urban growth being close to HWY 45 which connects with the Fox Cities area. Within this subwatershed

Well Vegetated Buffer Strip
in Drainage Corridor
Crossing Winchester Road
near Schultz Road

Summer 1991

Photograph Sheet #4

area, five sites were identified as having potentially significant soil erosion problems.

Visual/Local Identification

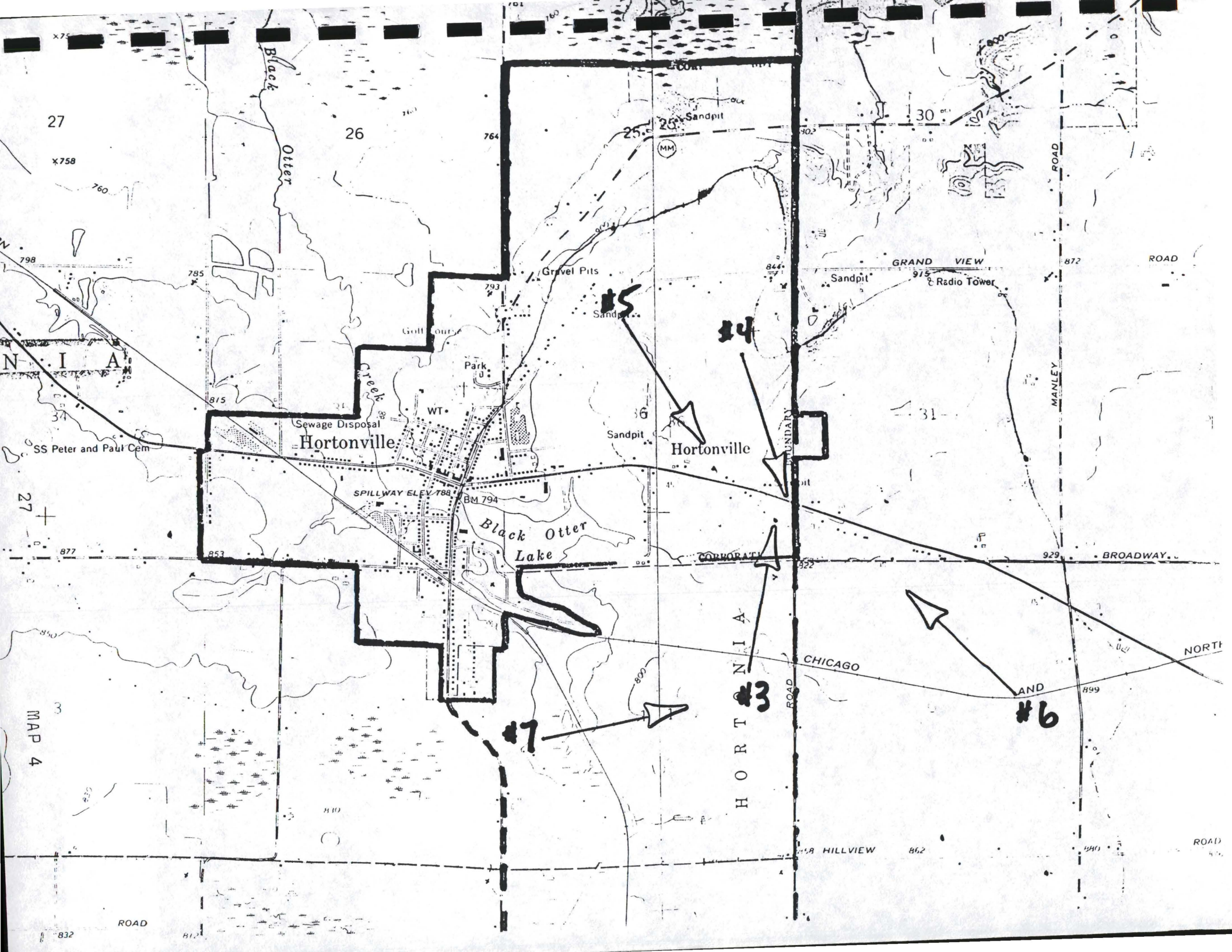
Two sites were identified as areas of potential problems based on visual observation and local input. The first site, labeled Site #3, is immediately adjacent to the same area discussed earlier as Site #3 and is therefore identified as the same site. The existing drainage corridor at this location is bounded by a pasture on the south and a new storage building on the north. Even though the building site is immediately adjacent to the drainage corridor, no silt fencing other than a "dry furrow" has been used to keep the fill material being dumped at the site from eroding into the corridor.

The second site identified as Site #4 is a ditch area along STH 45 which according to a resident of the area carries a large amount of sediment laden runoff from the nearby steep sloped land. The resident, who was once a member of the lake district commission, suggested that the ditch be planted with a denser vegetation and not be cut in the summer, or at least less frequently, to slow the fast moving water that drains through that area. (Photo 5)

Computer Model Identification -- The AGNPS Model

In cooperation with the University of Wisconsin - Green Bay, soil erosion within a 1100 acre subwatershed on the east side of Black Otter Lake was investigated using a computer model called the Agricultural Non-point Pollution Source (AGNPS) model. For this project, the model evaluated 10 acre parcels within the 1100 acre subwatershed and calculated soil erosion from each of the 112 cells for pristine conditions and existing conditions during 1990 and 1991. The AGNPS model relies on the Universal Soil Loss Equation (USLE) and soil, terrain and vegetation data specific for each cell. Such data is gathered from USGS 1:24,000 quad maps, the Outagamie County Soil Survey, air photos, plat books, SCS and ASCS records and site inspections. Table 2 lists the soil values used in AGNPS. Table 3 lists the spring surface cover, crop management and hydrologic factors used in AGNPS for N.E. Wisconsin.

Based on the input data and a ten year frequency 24 hr type II storm event soil erosion in tons/acre for each of the 112 cells was calculated for pristine and existing land uses. Generally one would expect pristine conditions to yield lower soil erosion and the model bears this out. The maximum cell erosion for pristine conditions calculated by the model was less than 3 tons/acre. Figure 3. Eighty-two or 73% of the 112 cells had cell erosion less than 1/4 tons/acre. In contrast, the model calculated as much as 150 tons/acre cell erosion for one cell in 1990. Four cells were over 50 tons/acre. Twenty-eight were over 13 tons/acre. Figure 4.


Black Otter Creek
Sandpit
Gravel Pits
Golf Course
Park
WT
Sewage Disposal
Hortonville
SS Peter and Paul Cem
SPILLWAY ELEV 788
BM 794
Black Otter Lake
Sandpit
Hortonville
GRAND VIEW
Sandpit
Radio Tower
ROAD
MANLEY ROAD
BOUNDARY
CORPORATE
BROADWAY
CHICAGO AND NORTH
HORTONIA
ROAD
HILLVIEW
ROAD
MAP 4
#5
#4
#3
#6
#7

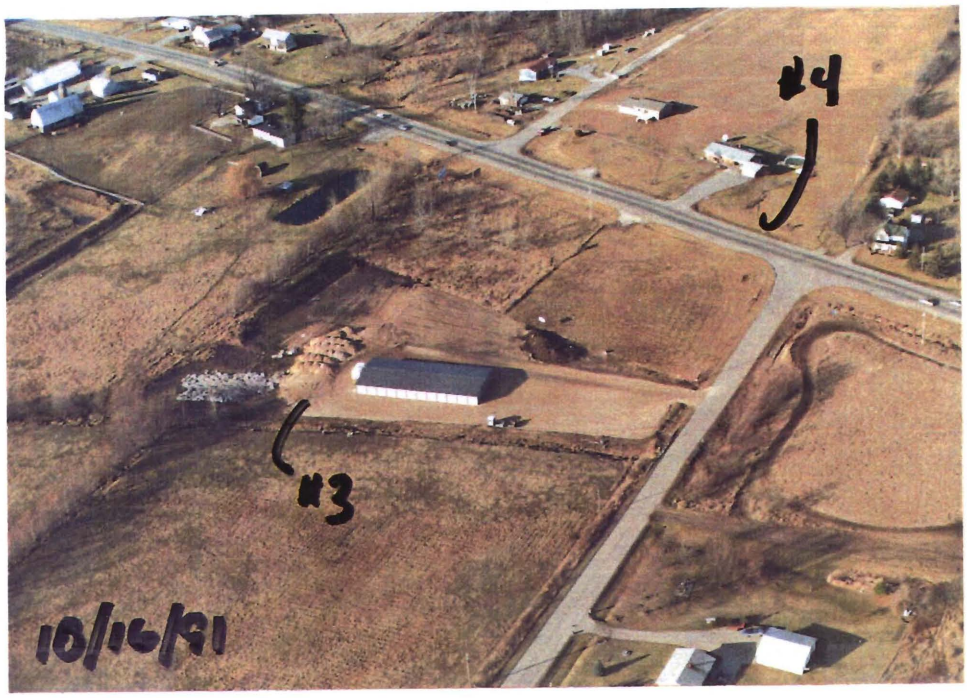


PHOTO 5

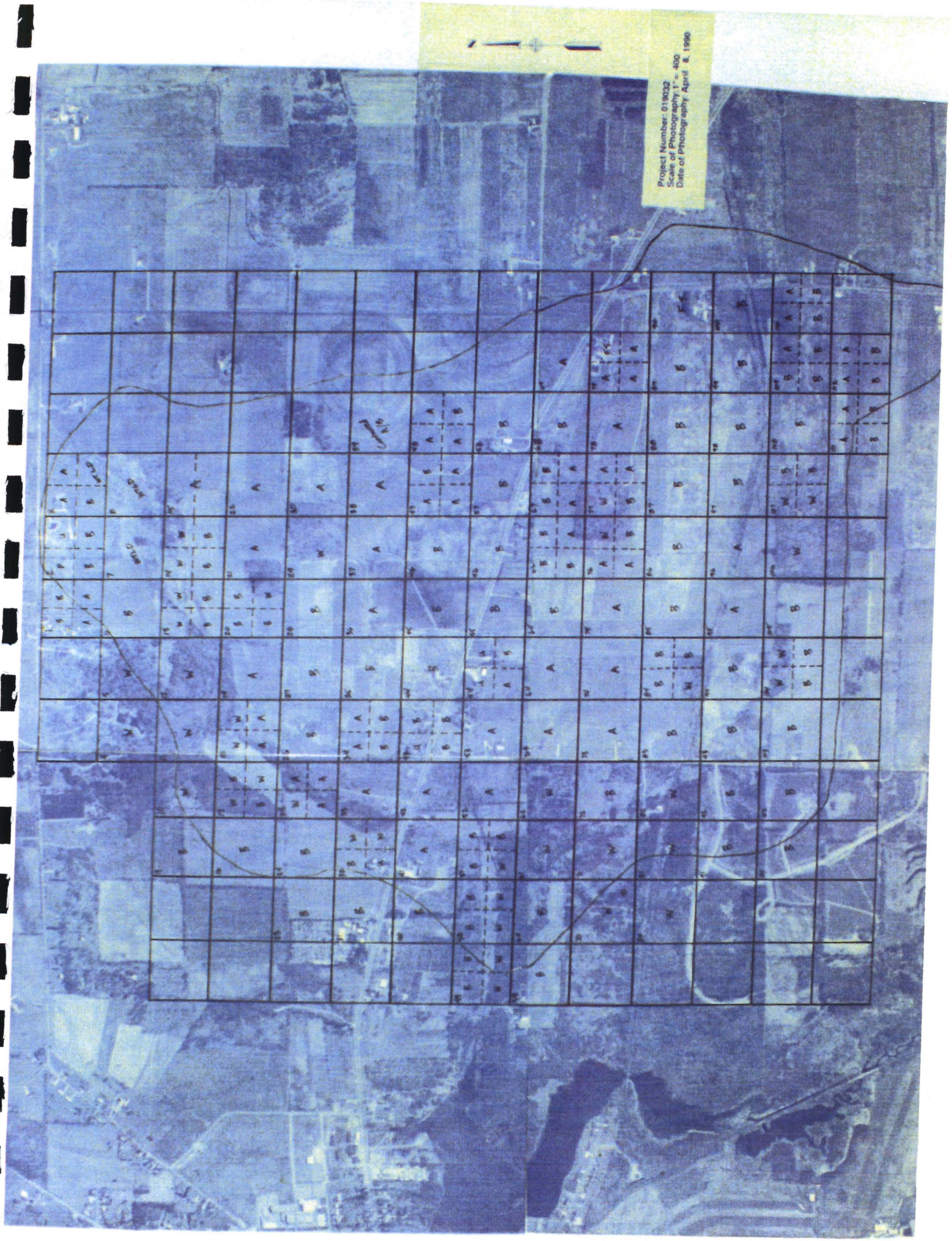

Project Number: 019032
Scale of Photography: 1" = 400'
Date of Photography: April 4, 1990

Table 1. Soil values used with AGNPS for modeling watersheds in Outagamie Co. WI.

Soil Series	Mapping Units	Phases				AGNPS parameters				
		Texture	Slope	Eros.	Slope %	Shape	Length ft.	K-fact	Texture Code	Hydro. Group
Cathro	Cm	Org	A	1	0	1	200	0.30	4	A/D
Deford	De	LFSa	A	1	0	1	200	0.17	1	A/D
Fluvaquents	Fu		A	1	1	1	200	0.32	2	C
Fluvaquent, wet	Fw?		A	1	1	1	200	0.32	2	D
Hortonville	Hn	FSaL	B	1	4	2	150	0.37	1	B
			C	2	9	2	125	0.37	1	B
Hortonville	Hr	SiL	B	1	4	2	150	0.37	2	B
			C,D,E	2,2,1	9,16,25	2	125	0.37	2	B
Manistee	Me	LFSa	B	1	4	2	150	0.17	1	A
			C	2	9	2	125	0.17	1	A
Manistee	Mf	FSaL	B	1	4	2	150	0.17	1	A
Menommnee	Ms	LFSa	B	1	4	2	150	0.17	1	A
			C	2	9	2	125	0.17	1	A
Pella	Pe	SiL	A	1	0.5	1	200	0.28	2	B/D
Rousseau	Ro	LFSa	B	1	4	2	150	0.15	1	A
Shawano	Se	FSa	C	1	9	2	125	0.17	1	A
			D	1	16	2	125	0.17	1	A
Wainola	Wa	LFSa	A	1	1	1	200	0.15	1	A

Notes: Shapes: 1=Uniform; 2=Convex; 3=Concave

Recommendations collated by Rukamp & McIntosh from tables in Outagamie County Soil Survey, SCS listings of Hydrologic and K factors, AGNPS documentation, and suggestions by A. Otter, SCS, Appleton.

Draft Dec. 91

Table 2a. Spring - surface cover, crop management and hydrologic factors used in AGNPS models for N. E. Wisc.

Surface Cover	Crop Management C factors				Pract.	SCS Curve Number for Hydrologic Group				Manning's	Condition Constant	COD
	Conv. Till.		Cons. Till.									
	Fall	Spring	30% Reduced Tillage	Cover Fall Chisel Spring Disk	P	A	B	C	D	n		
	-	C	-		P					n		
Orig. Forest			0.01		1.0	25	55	70	77	0.3 no channel 0.06 w/channel	0.59	65
Mgnt. Woodland inc. Shrubland	-		0.01	-	1.0	40	58	73	80	0.3	0.59	65
Pasture with Good Grass or	-		0.03	-	1.0	49	69	81	85	0.3	0.59	60
Grass Waterway	-		0.10	-	1.0	49	69	81	85	0.3	1.0	60
Alfalfa Hay Planting Year with Oats	0.13	0.10	0.07	0.08	1.0	77	86	91	94	0.06	0.05	20
Alfalfa Hay	-	0.03			1.0	58	72	81	85	0.15	0.29	20
Corn Conv. Plow	0.22	0.14			1.0	77	86	91	94	0.06	0.05	170
Corn Red. Till			0.18	0.15	1.0	77	86	91	94	0.08	0.15	170
Small Grain		0.6	-	-	1.0	77	86	91	94	0.06	0.05	80
Bare - Just plowed, disked & planted	-	0.6	-	-	1.0	77	86	91	94	0.06	0.05	115
Animal Lot												
Unpaved	-	-	-	-	1.0	90	90	91	94	0.06	0.01	
Concrete	-	-	-	-	1.0	95	95	95	95	0.012	0.01	
Dry lot w/Veg					1.0	68	79	86	89	0.15	0.01	
Roof Area	1.0	1.0	1.0	1.0	1.0	100	100	100	100	0.012	-	
Farmstead	-	0.01	-	-	1.0	59	74	82	86	0.15	0.01	80
Urban - General		0.01			1.0	72	79	85	88	0.04	0.01	80
Parks, Golf C. Lawn		0.03			1.0	39	61	74	80	0.30	0.59	60
Residential (1/2 acre)		0.03	-	-	1.0	54	70	79	83	0.08		60
Residential (30% Imper)		0.10			1.0	57	72	81	86	0.20	0.10	60
Grass with road		0.1	-	-	1.0	57	72	81	86	0.20	0.10	60
Res. -High Density		-	-	-	1.0	70	78	84	86	0.12	0.01	60
Commercial (85% Imperv.)		-	-	-	1.0	89	92	94	95	0.012	-	80
Industrial (72% imperv.)					1.0	81	88	91	93	0.012	-	80
Paved lot, roads		-	-	-	1.0	98	98	98	98	0.012	-	80
Gravel roads/lots		-	-	-	1.0	76	85	89	91	0.02	-	
Wetland	1.0	1.0	1.0	1.0	1.0	90	90	90	90	0.30	-	25
Water	-	0.0	-	-	0	100	100	100	100	0.01	0.0	0

Notes: Selected summary by McIntosh from grouping of cover values from SCS tables, AGNPS documentation, suggestions by Hunt, Otter, Wilson and Saunders, SCS.

TABLE 3

GRADUATION OF CELL EROSION FOR PRISTINE CONDITIONS IN BLACK OTTER LAKE SUBWATERSHED

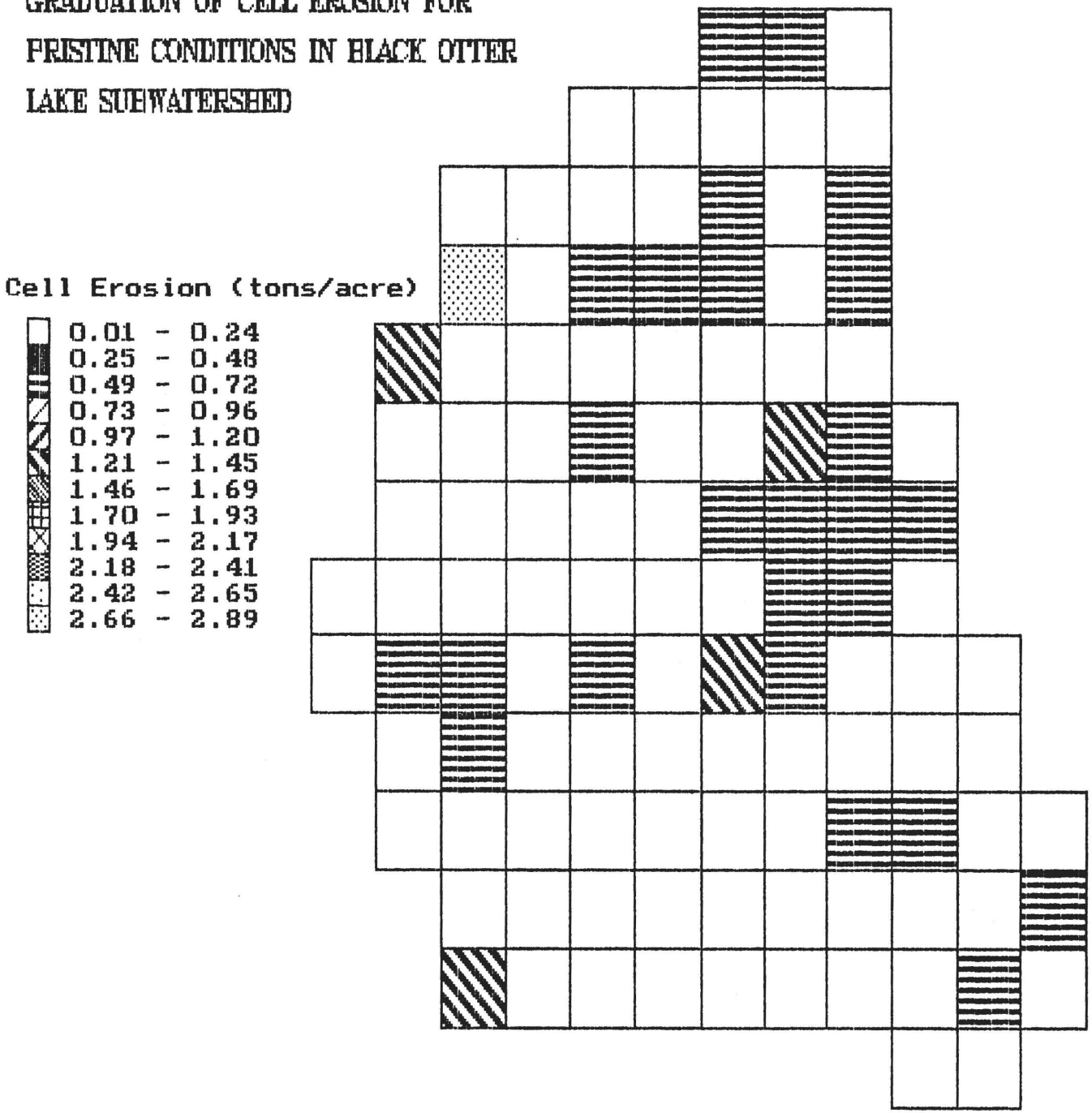
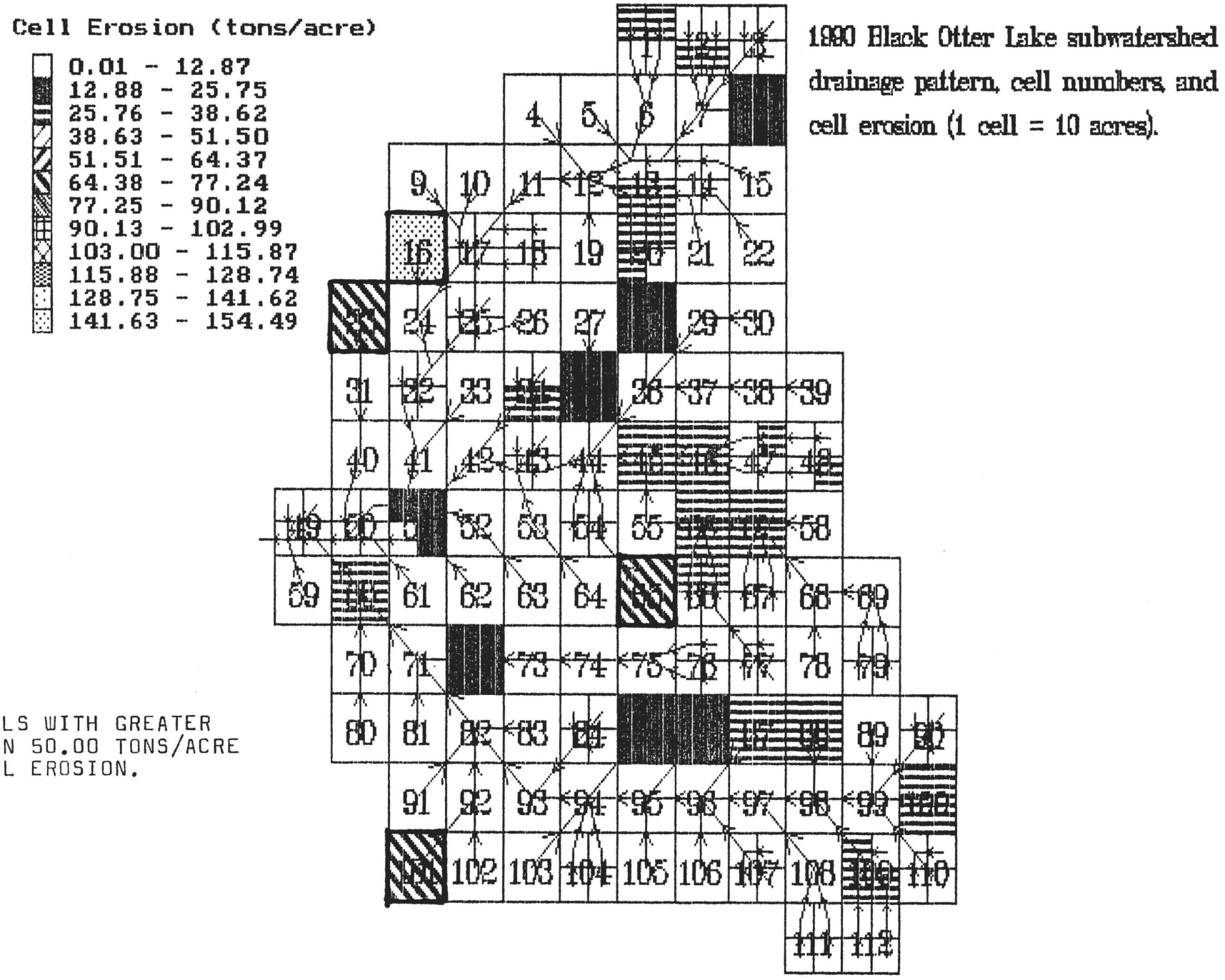


FIGURE 3



1990 Black Otter Lake subwatershed drainage pattern, cell numbers, and cell erosion (1 cell = 10 acres).

FIGURE 4

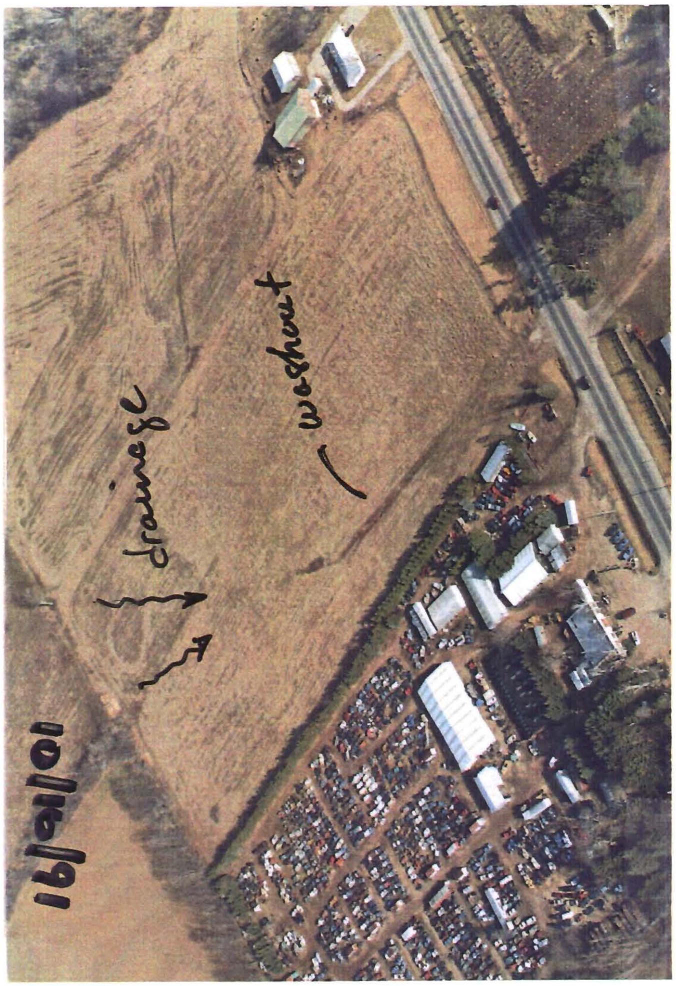
It was arbitrarily decided to focus on cells with calculated erosion greater than 50 tons/acre. As Figure 4 shows, cells 16, 23, 65 and 101 were above 50. A follow-up field inspection was made of the 4 cells to first visually see if erosion was evident, and if so, what if any corrective actions could be implemented.

Cells 16 and 23 were the first two inspected. The photos on page 35 show the area in 1991. Sheet and gully erosion were evident. The Land Conservation Department was contacted and reported that the field portions of 16, 23 and 31 are in the Federal Conservation Reserve Program (CRP). The corn stubble field in 16 was planted in pine seedlings in 1991. It appears the corn stubble field in 23 and 31 has not been cultivated for the past one to two year and has a weed cover. It is possible that the area in pine seedlings may also be in the Wisconsin Managed Forest Law program. In any event, the good news is that this area which was identified by the model as being highly erodable has been taken out of intensive crop production and should become less erodable as the trees and vegetation mature. In the meantime however, the sheet and gully erosion that is still occuring can be further addressed through the programs just mentioned as well as through additional Land Conservation Department support. It may also be that the area in the vicinity of the gully erosion which should have been seeded with a legum and grass mix when put in the program was not. In which case it should be to establish a better vegetation cover.

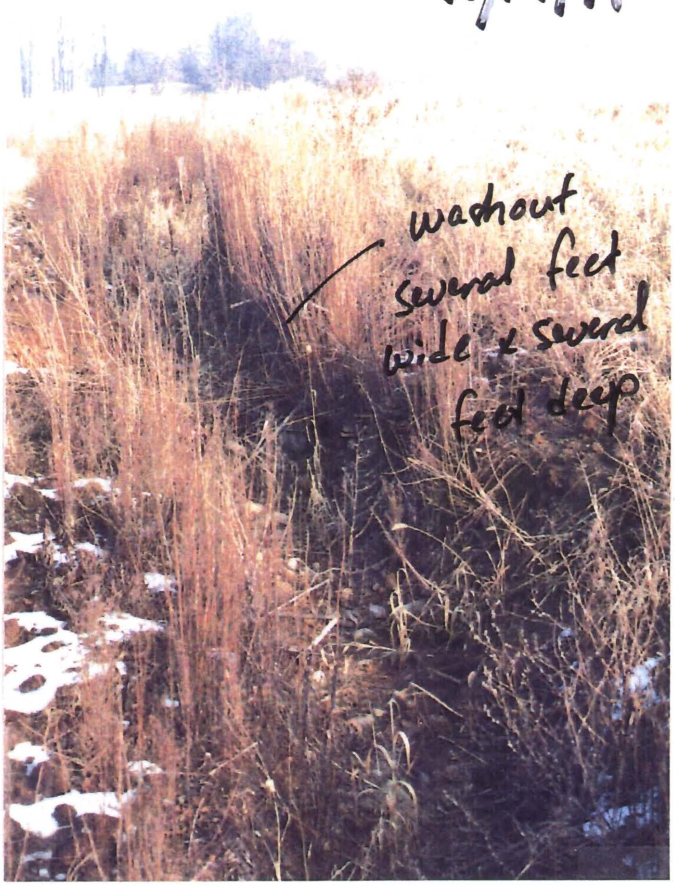
Cell 65 is not accessible by public road so was not inspected directly. Photo 7. The aerial photos however show that it presently being cropped with hay and there is a drainage swale in the center of the cell running northerly. It appears the land is well managed. Checking with the Land Conservation Department this property is in a federal program called the Food Security Act. As part of the program a 6 year crop rotation is required to insure continued productivity. Since the AGNPS model does indicate this land as having more erosion potential, it is advisable that the Land Conservation Department inspect the land possibly every one to two years to insure best management practices are used.

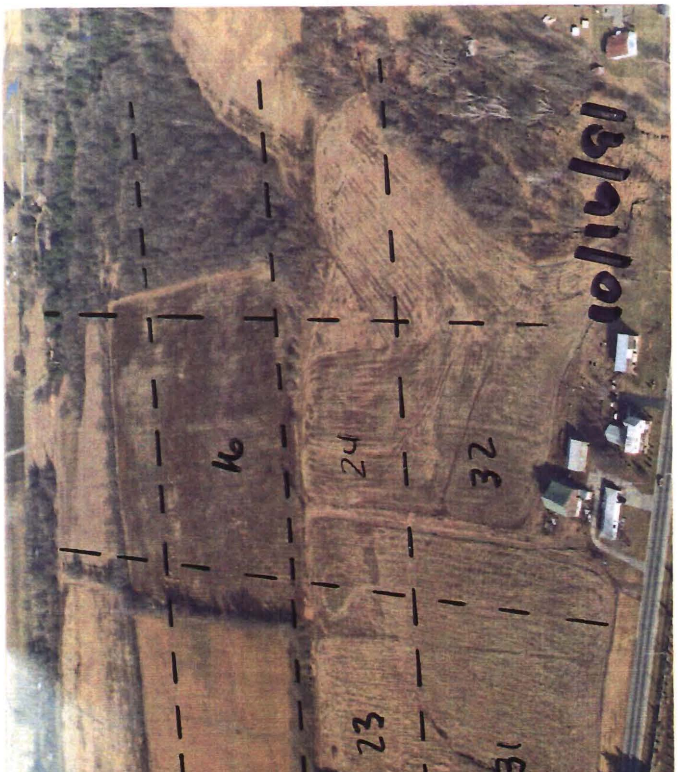
Cell 101 is in an area that within the past three years has been subdivided and is being developed with residential homes. Photo 8. At the time the subdivision was platted, a construction site erosion plan was required of the developer and is included as a covenant when a parcel of property is purchased. As you can see from the photographs however site clearing for a new home can be extensive and it is very important that compliance with the construction site erosion plan is enforced as additional construction occurs. In addition to being highly erodable land, the location is also very close to Black Otter Lake making best management practices that much more important.

As a final note to the AGNPS model, areas that are calculated as

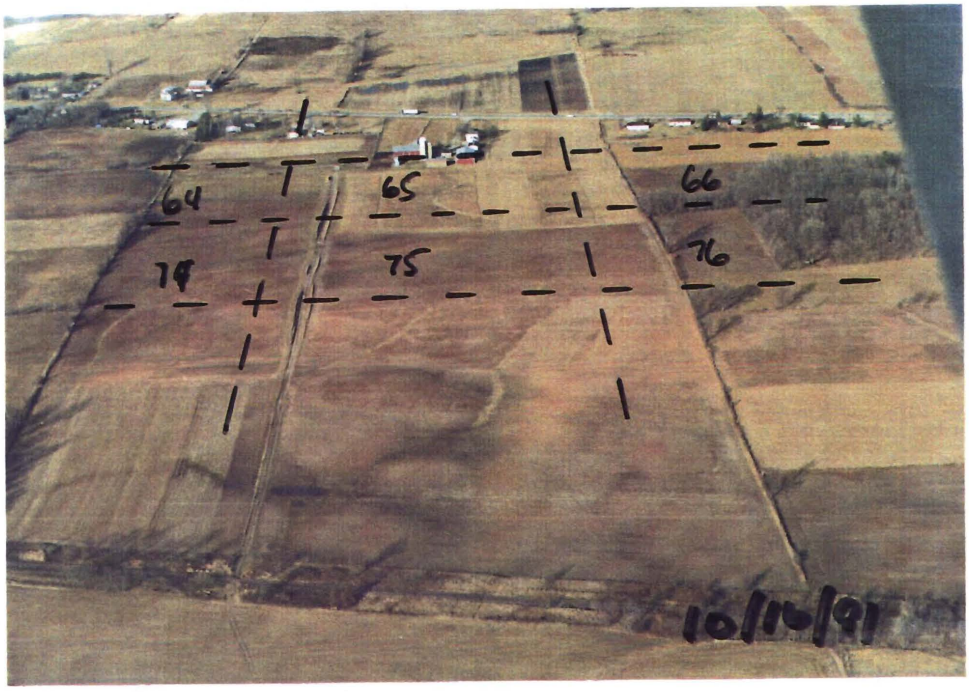

drainage
washout

11/14/91


washout
several feet
wide & several
feet deep


16
24
32
23
31


10/31/91
Pine seedling



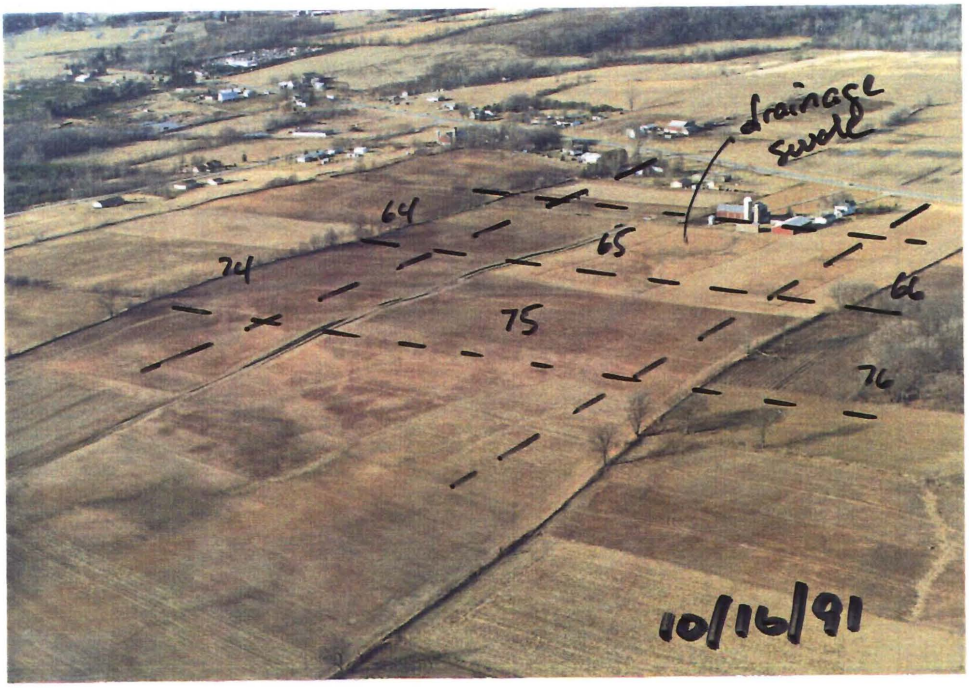
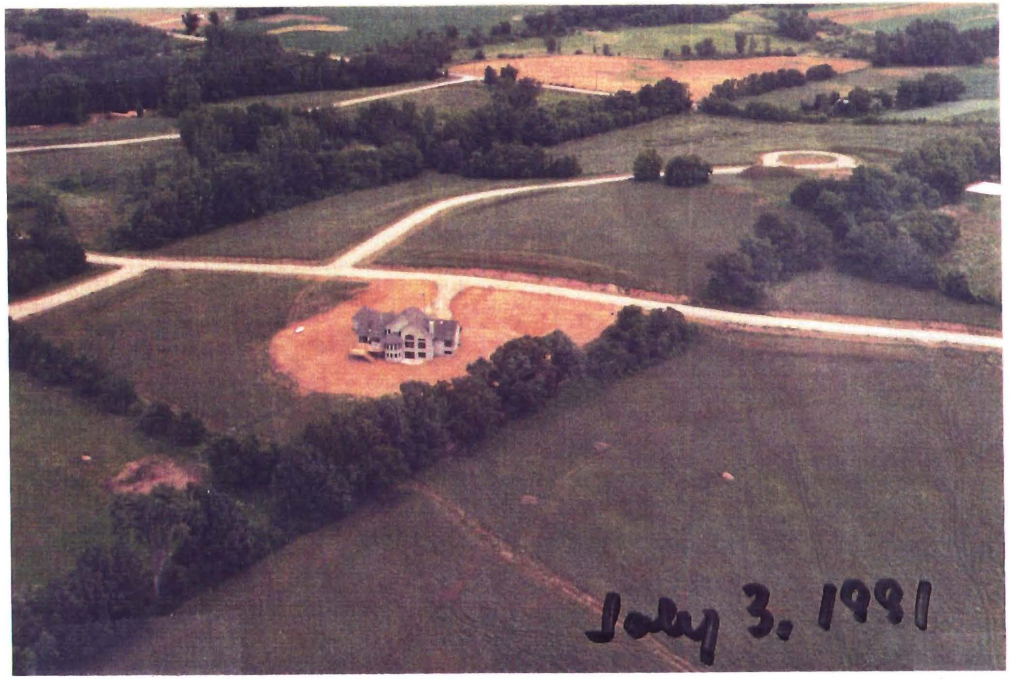
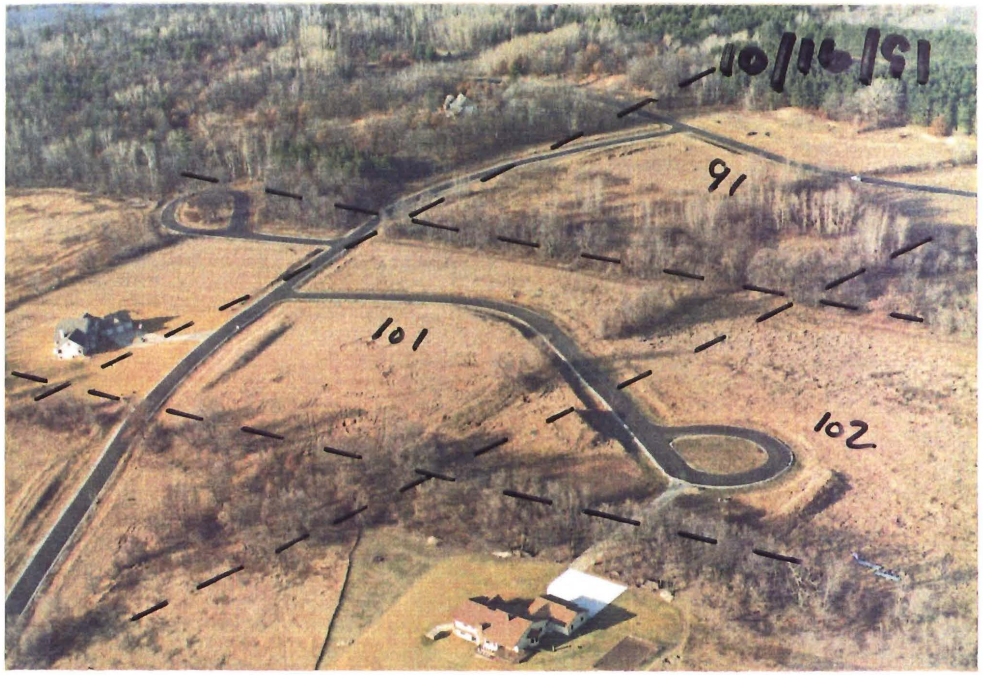


PHOTO 7





37

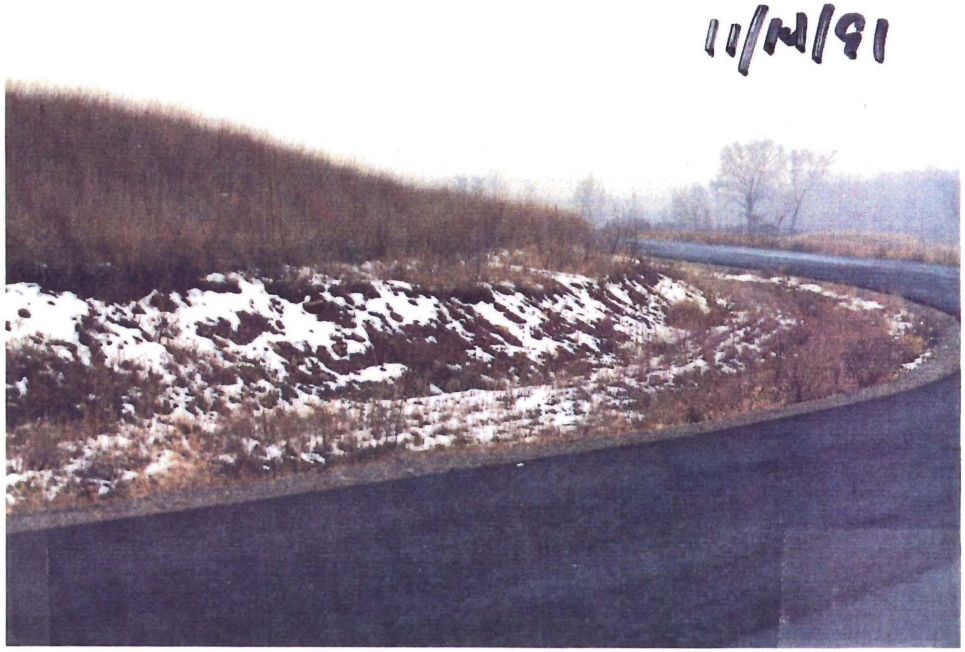


PHOTO 8

having high cell erosion under existing land use conditions also had "high" erosion under pristine conditions in a relative sense. Although the magnitudes are drastically higher today, the key concern should be focused on those areas (cells) which have the soils and slopes that have the "potential" for severe erosion if not managed properly. The AGNPS model provides that focus. The task then is to ensure proper management. In most cases existing rules and regualtions are in place. Enforcement is the issue.

5. Aggresively lobby for county wide new construction site erosion control BMPs and enforcement.

In general most of the land use problems currently affecting Black Otter Lake can be properly dealt with through existing rules and regulations as mentioned in the previous discussion. There is however the potential for a significant erosion problem along the urbanizing corridor of STH 45 unless urbanization is properly managed. This is an area expecting rapid growth as the urban community of the Fox Cities continues to move outward. Presently there is little if any control of urban development in such areas. The village has no jurisdiction since the area is outside the village limits and the township and county do not require construction site erosion BMPs.

Photo 9 shows two examples of concern. Both parcels are along Hillview Road between Greendale Road and Manley Road. The first example is being sold as approximately 30 acres of development land for sale. The "for sale" sign reads as follows:

* perkable
* low tax rate
* rapidly growing area
* terms available
* divide as desired

The sign itself is in a drainage corridor that appears to never have been cropped, and it appears the land for sale extends from the road to the area being cropped. Whether or not this area should be classified as wetland is one matter. Even if it is not wetland, what is required of the developer to insure at least a drainage corridor will be adequately protected? To the author's knowledge, there are no requirements. If the drainage corridor is not protected, the impacts will eventually transfer to the lake.

The second example shows a house being located along the same drainage corridor but on the other side of the road. The drainage corridor crosses the road via a culvert near where the photo was taken. Although the house is not directly in the corridor and everything is well vegetated when the photograph was taken in August, it would still be desirable to have silt fencing on the corridor side of the construction site.

What should be done to protect the drainage corridors, and consequently Black Otter Lake, from this "rural urbanization"? Elsewhere in the State of Wisconsin it appears implementation and enforcement of new construction site erosion control BMPs on a county wide basis is the choice. A county appears to be able to "distance" itself better from the immediate parcel being developed and appreciate the larger consequence of many of these "localized" developments on a natural resource. In the Fox Valley area, Brown and Winnebago Counties which border Outagamie


August 23, 1991


August 23, 1991

County on two sides have implemented such controls. The League of Wisconsin Municipalities and the Wisconsin Department of Natural Resources have developed a "construction site erosion control model ordinance" as a guideline for such controls. A copy is presented in Appendix 6.

In the interest of protecting Black Otter Lake, the lake district should aggressively lobby for county wide new construction site erosion control BMPs and enforcement. Enforcement is crucial, and it will carry a price. But development should no longer be allowed to occur in the manner it has to this day at the expense of other resources.

6. Discover and create opportunities for people in the watershed to become active participants in managing the lake. Focus particularly on the children.

One of the things which has been very evident during the course of the planning grant, and was particularly brought out in the questionnaire, is the lack of public participation in managing the lake. Why is this? And what can be done about it?

It is not an easy question to answer but there seem to be several reasons. First, there seems to be a sense of resignation. The lake district has already been in this process since 1976 and ever since at least the early 1950's there have been various attempts to improve the condition of the lake. It has been a long, drawn out process. And in a "fast fix" society a "slow fix" lake repair can seriously suffer a loss in momentum and credibility.

Secondly, the lake district meetings suffer from routine. As with any organization, particularly one in existence for some time, the agenda becomes the same agenda each month and the excitement is lost.

Thirdly, the lake suffers from the Rodney Dangerfield stigma of no respect. Where is it evident? Look along the lakeshore, by the dam and at the parks. Bottles, cans, and debris. Sensitive shoreline embankments battered by ATV traffic. A house with serious yard erosion right on the shore of the lake. It is hard to be a brother's keeper but the message that is conveyed to someone who looks at the lake is that this lake doesn't matter.

What can be done?

First, the message needs to be clear that lake rehabilitation takes time and the process is continuing. This lake management plan has attempted to set clear and attainable priority action steps for continued rehabilitation of Black Otter Lake. These objectives should be openly discussed and aggressively pursued.

Secondly, there is a need for variety, fresh air, comparisons. The Black Otter Lake District is not in this alone. Meetings should include special guest speakers, documentaries, testimonials, awards and recognitions. Field trips through the watershed, and to other watersheds, should occur at least several times a year. The lake district should work closely with the school in developing a comprehensive environmental curriculum specific for Black Otter Lake for children in all grades.

Finally, care for the lake should be fun. There should be at least one, and possibly even three (spring, summer fall) "lake appreciation days" focused on cleaning the shoreline of the lake. Such interest has grown in recent years on the Fox River in the Green Bay area largely because a child was fed up with the

neglect she saw and sought help. Combined with a potluck meal, some appropriate entertainment, maybe a fishing contest, this could be a fun, inspiring and educational outing.

7. Inform the County Board on a minimum quarterly basis the activities and direction of the Lake District. Agressively lobby to restore county interest and financial support for Black Otter Lake.

The structure of the lake district commission includes a county representative. This is for two reasons. First, it is intended to assure communication between the lake district and the county which both have a vested interest in Black Otter Lake. Second, it taps the knowledge and resources of the county Land Conservation Department in land management concerns of the lake district.

For the past two years these interests have not been adequately accomplished. For 1992 the lake district no longer has financial support from Outagamie County. It appears the county is disappointed with the present condition of the lake and chose to eliminate its funds. For the lake district the disappointment is mutual. It just completed a massive lake dredging effort with county support, incumbered substantial costs because of that effort which are presently on the tax rolls of lake district citizens, and was planning weed harvesting and other maintenance projects for 1992. These activities are now being reduced.

The most serious disappointment for the lake district however was that it was never asked to present its position to the county when 1992 funding was being discussed. It is critical that the lake district take the initiative for 1993 and beyond by presenting in a regular manner to the county the activities and direction of the lake district. This should be done at least quarterly by the county representative on the commission. During county budget deliberations, this should also include at a minimum the lake district chairperson.

For the lake management plan to succeed, county support is critical. Renewed financial support is welcome, but the far more important element is the in-kind support of the Land Conservation Department in correcting the nutrient pollution and soil erosion problems discussed earlier, and implementing and enforcing a county wide new construction site erosion control BMP ordinance.

8. Encourage new and continued DNR assistance in fisheries and wildlife managment, aquatic plant manipulation, and wetland reclamation.

The Wisconsin Department of Natural Resources (DNR) has been very supportive of the activities of the Black Otter Lake District. On numerous fronts, the DNR has provided support.

For instance:

a) Fisheries

The DNR has been actively stocking the lake with game fish since 1973. Since 1990 when the lake dredging project was completed, the DNR and lake district have stocked largemouth bass, bluegill, perch and northern pike in the lake. Based on the latest electrofishing survey in the fall of 1991, "the bluegill population appears to be in good condition, both in numbers of young fish and in their condition and rate of growth." (excerpt from DNR Lake Survey and Management Report dated January 10, 1992) Full text in Appendix H.

b) Wildlife Management

DNR help would be welcome here. The lake has attracted a large number of geese. As noted in the county sanitarian's report in Appendix H, the geese are contributing to high bacterial contamination of the lake. It is desirable to control the size of the goose population if possible.

c) Aquatic Plant Manipulation

The DNR has provided the lake district with signs alerting boaters of eurasian milfoil and how it is transported. It has also provided the lake district with information on aquatic plant screens, harvesting methods and harvested plant uses. Lastly, it has provided names of people to contact to establish desirable aquatic plants in Black Otter Lake. These people were contacted as part of the lake management planning project. The concept is still being tested elsewhere in the state however and is not planned for Black Otter Lake at this time. Appendix H includes all the materials provided by the DNR.

d) Wetland Reclamation

The Black Otter Lake watershed has several former wetland areas that were tiled and drained to support agriculture in the past. As part of a mitigative measure with the Wisconsin DOT for a road project elsewhere in the state, the DNR suggested to the DOT the former wetlands in the Black Otter Lake watershed be recreated. The DOT ultimately secured other lands so the effort was never attempted. The possibility still exists however for such work in

the future.

e) Stewardship Fund Support

The DNR Oshkosh Area Office has secured funds to purchase easements to fence cattle out of Black Otter Creek. The DNR will be attempting in 1992 to negotiate such easements with property owners. Action Item #1 in the report indicates where such action is most urgently needed.

ACTION ITEMS FOR THE LAKE DISTRICT
(In Order of Priority)

9. Investigate alternative lake aeration systems.

Since 1982 the lake district has used surface aerators during the winter with good success. Winter fish kills are no longer a problem.

Interest was expressed at several of the lake district meetings to investigate another method of aeration involving PVC piping on the bottom of the lake with small orifices as air diffusers. Air would be supplied from a shore air compressor. The report is that this method has been very successful for Mountain Lake in Waupaca County. Aquatic plant growth is in better balance and dissolved oxygen levels are good. This and any other methods should be investigated and compared with the present system.

APPENDIX A

Data summary report for **Black Otter Lake** in **Outagamie County** - 1990

The first year of the Expanded Self-Help Monitoring Pilot Program was 1990, with a total of 33 lakes participating (see map). With only a few exceptions, each lake was sampled once a month in July, August, September, and October. **Black Otter Lake was sampled on July 21, August 30, and October 13, 1990; this report is based on those data. The parameters you sampled were Secchi disc depth, precipitation, dissolved oxygen, temperature, pH and phosphorus. Your lake was one of the 14 that was sampled for chlorophyll. In 1991, all of the lakes in the program will be sampled for chlorophyll.**

Secchi Depth Data

As you know, the *Secchi disc depth* is used to measure the water clarity of a lake; water clarity is one indication of water quality. The data you collected last summer will be added to the data you have collected in the past, which is indicated on the graph that is attached. Once again, the objective is to look for water quality trends over time in order to determine if it is getting better, getting worse, or staying about the same.

You are probably already familiar with the water quality index that is based on Secchi disc depth. The index was developed by DNR limnologists (lake scientists) based on thousands of Secchi depth values over a period of years. The index is as follows:

Water Quality Index Based on Secchi Depth

Description	Secchi Depth
Excellent	>20 Feet
Very Good	10 - 20 Feet
Good	6.5 - 10 Feet
Fair	5 - 6.5 Feet
Poor	3.25 - 5 Feet
Very Poor	<3.25 Feet

The first sampling date on your lake was July 21. The Secchi depth of 2.5 feet indicates that the water clarity was very poor. This may be a reflection of the fact that the lake had just been dredged and was still filling up, and the sediment was not settled. On August 30, it was 5.25 feet, or fair. On October 13, the Secchi depth was 4.25, or poor.

Precipitation

You measured precipitation with a rain gauge near your lake. Rainfall may be significant if it results in runoff carried to the lake. Runoff may carry loads of sediment and/or nutrients to a lake, resulting in decreased water clarity. Organic material that runs off into a lake may also require a significant amount of oxygen once it dies and decays.

pH

You used the pH pocket probe to measure the pH of your lake to get a very general indication of its sensitivity to acid rain. Only one of the lakes in the expanded program, Crystal Lake in Vilas County, may be sensitive to acid rain. Remember, however, that sensitivity to acid rain is more carefully assessed based on the *alkalinity* of the lake, rather than pH, and alkalinity was not one of the parameters included in this program.

pH is an indicator of biological productivity (such as algae blooms) of the lake. The more biologically productive the lake is, the higher the pH is. Most of the lakes had fairly uniform pH measurements throughout the lake profile. On most lakes, the pH decreased as the dissolved oxygen decreased. All the lakes showed pH readings between 5.2 and 9.5.

Dissolved Oxygen

The amount of dissolved oxygen available in a lake, particularly in the deeper parts of the lake, is critical to its overall health. The amount of dissolved oxygen in the water is determined by water temperature (cold water holds more oxygen than warm water), atmospheric pressure (which increases with depth), and biological productivity. Plants produce oxygen, but decomposing plants (or animals) consume oxygen. In general, cold-water fish, such as trout, need at least 5 parts per million of oxygen to survive, as well as cold temperatures. In contrast, warm-water fish, which are more common to the majority of lakes in Wisconsin, need at least 3 parts per million of oxygen.

The dissolved oxygen and temperature data from Black Otter Lake are more or less typical of a shallow lake. On July 21 the dissolved oxygen concentrations were sufficient to support a warm-water fishery, except at depths below 5 feet, which on that date was about the bottom of the lake. On August 30 the dissolved oxygen concentrations were sufficient to support a warm-water fishery except below 7.5 feet, again the bottom of the lake. On October 13 the dissolved oxygen concentration were sufficient to support a warm-water fishery.

Temperature

Temperature is another critical factor in understanding a lake. Just as trout need lots of oxygen to survive, they also need cold water temperatures. If the cold water is not available to them, a fishkill may result. On the other hand, most fish can tolerate warmer temperatures; bluegills, for example, can survive in water as warm as 80° F.

You took the water temperature from the top to the bottom (the profile) in order to see how much it changed. The data obtained will show whether or not the lake *mixes* or *stratifies*. Shallow lakes typically mix almost constantly through normal wind and wave action, allowing water that had been at the bottom to move to the top and vice versa. Because of this mixing, the temperature and the dissolved oxygen remain about the same from the surface to the bottom.

In contrast, deep lakes usually *stratify* or divide into distinct temperature layers during the summer months. The warm water stays at the top and the cold water stays at the bottom. Maybe you've felt this if you have ever dived into a lake! The temperature will be more or less the same down to a certain depth, and then will sharply decline. The zone at which the temperature changes most abruptly is called the *thermocline*. Water below the thermocline is usually much colder and it doesn't mix with the water at the top of the lake because cold water is much denser and heavier than the warm water. The reason you must take the temperature of the water at regular intervals is so you don't miss the thermocline, the point at which the lake divides into layers.

Deep lakes normally stratify during the summer months and mix in the spring and fall. As the air temperature starts declining at the end of summer and early fall, the surface of the water cools. The cooler, denser water begins to sink, destroying the stratification and initiating complete circulation of the water column. The lake will have a uniform temperature during the winter, when its frozen surface prevents further circulation of the water column. Once the ice melts in the spring, the water is once again exposed to wind action, and begins circulating again. The spring overturn will continue until the lake "sets up" or stratifies on a calm, warm day in the summer.

The dissolved oxygen and the temperature are usually related. If you see that there is a thermocline, you know that the lake stratifies. Once you determine where the thermocline is, you can usually predict that the dissolved oxygen concentration will decline at the same point. This is typical for deep lakes. If the dissolved oxygen concentration declines to the point where there is none, chemical reactions can take place that would otherwise not occur in an oxygen-rich environment. Specifically, in an anoxic (zero oxygen) environment, phosphorus that had been chemically bound to the bottom sediments can now be released into the water column. This may result in algae blooms or excessive plant growth in the lake.

In shallow lakes, there is usually no thermocline, and usually not much change occurs in the dissolved oxygen concentration of the lake. However, shallow lakes that are constantly mixing may be more sensitive to loadings of nutrients from the watershed. These loadings can come from nonpoint sources of pollution, such as agricultural runoff from farm fields or barnyards, or from urban runoff from streets or construction sites. When nutrients are added to a shallow lake, they may be constantly available to feed weeds or algae. In a deep lake, they may become isolated in the deep, cold water part of the lake (the hypolimnion), where they are unavailable to be taken up by plants or algae until overturn.

The temperature data on Black Otter Lake are also typical of a shallow lake. On July 21, there were signs of weak stratification, despite its shallow depth. The lake did not stratify on the other two sampling dates.

Phosphorus

You also took phosphorus samples on your lake at the top of the water column and one or two feet off the bottom. Phosphorus is a nutrient that plants and algae need to grow. The samples that you collected were analyzed at the State Laboratory of Hygiene in Madison. The results of the test will enable you to answer the question, "Is my lake *potentially* susceptible to algae blooms?" Your samples were measured for total phosphorus. Phosphorus may appear in water in various forms and may not always be in a form available for biological productivity. Therefore, total phosphorus shows the potential productivity of the lake. Lakes that have more than 20 micrograms per liter (ug/L or parts per billion), and impoundments that have more than 30 micrograms per liter of total phosphorus may experience noticeable algae blooms.

The phosphorus sample from the bottom is potentially very important for several reasons, particularly on deep lakes. If there is no oxygen in the bottom waters (anaerobic conditions), phosphorus contained in bottom sediments is released. When the lake turns over in the spring and fall, that same phosphorus may be circulated into the water column and be available to feed weeds or algae.

DNR limnologists, or lake scientists, have developed a Water Quality Index based on total phosphorus concentrations of thousands of lakes throughout the state over a period of years. The following index is based on surface phosphorus data only, not deep samples:

Water Quality Index Based on Total Phosphorus

Description	Total P (ug/L)
Excellent	<1
Very Good	1 - 10
Good	10 - 30
Fair	30 - 50
Poor	50 - 150
Very Poor	>150

It should be noted that 4 ug/L is the lowest concentration that our laboratory can measure. Therefore, the highest rating a lake could obtain is "very good." Several lakes obtained results of "<4ug/L," or less than 4 ug/L, meaning the actual concentration may have been better than very good. It helps to imagine how small one microgram per liter (or one part per billion) is to realize that the lab is already capable of analyzing very minute quantities. One part per billion is equivalent to one second in 35 years!

One problem we did encounter in the beginning of the summer was not having the lab analyze the samples for low levels of phosphorus. Some of the samples came back marked "<20ug/L," or less than 20 micrograms per liter. In other words, the sample may have contained less than 20 micrograms per liter, but since we did not ask the lab to analyze the samples as precisely as possible (down to 4 micrograms per liter), we obtained only crude results. For example, a lake may have contained 10 ug/L of total phosphorus, but we were informed only that it contained less than 20 ug/L. (The reason this occurred is that the State Lab of Hygiene is used to analyzing phosphorus samples obtained from sewage treatment plants, where you would not expect to see less than 20 ug/L in the effluent water. Lakes, in contrast, may contain far less phosphorus than you would find in a sewage treatment plant.) We corrected that problem by having you add the stickers to the lab slips before they were mailed to the lab.

A second problem we encountered was not receiving the phosphorus results back from the Lab. Phosphorus samples must be processed by the Lab within 28 days of the day the water was collected and preserved. Since the lab is extremely busy in the summer months, some of our samples exceeded the allotted 28 day holding time before they were processed. While results were still reported, they are not based on the quality procedures that are required by the U.S. Environmental Protection Agency. Both of the phosphorus problems that we encountered have been resolved and should not be an issue in the 1991 summer sampling season.

On July 21, the total phosphorus concentration of Black Otter Lake at the surface was 80 ug/L, with a much higher concentration at the bottom (210 ug/L); this is translated to poor, based on the water quality index. On the next date, August 30, the data is not

reported because it exceeded the allowed holding time at the lab (see above). Finally, on October 13, the total P concentration was 23 ug/L, or good.

Chlorophyll

Chlorophyll is a pigment that makes plants green. When you filtered the water during each sampling episode last summer, you were extracting the algae from the water. We then picked up your samples and analyzed them at our lap to actually quantify how much algae was in the water. Unfortunatley, we had bad luck with the chlorophyll samples from last summer. The filter paper proved to be incorrect, the filtering apparatus was somewhat inadequate, particularly for those lakes that had to filter larger volumes of water, and most importantly, the method of freezing the samples for such a long time period proved disappointing. We will not report your chlorophyll data to you here because of the skepticism we hold toward the methodology used.

In 1991, all of the lakes in the Expanded Monitoring Program will be included in the chlorophyll analysis. The new equipment you received to replace what you used last summer includes the correct type of filter paper, and a new method for preserving the samples so that they will last longer in your freezer without being degraded. This method is based on that used in Florida's citizen monitoring program, where they have had volunteers collecting, filtering and freezing their chlorophyll samples for many years with good results.

Trophic State Index

The phosphorus results, along with the Secchi depth and chlorophyll data, if available, allow us to determine the *trophic status* of the lake. Lakes can be divided into three levels of nutrient enrichment categories. The first is *oligotrophic*, or nutrient-poor. These lakes are characterized by very high Secchi depths (very clear water), plenty of oxygen even in deep water, and they may have cold-water fish species living in them.

The oxygen concentrations may be low if the lake is closer to the next category, called *mesotrophic*. Mesotrophic lakes fall in the middle of the continuum from nutrient-poor to nutrient-rich. They have moderately clear water, and may experience low to no oxygen concentrations in bottom waters.

Lakes that are nutrient-rich are called *eutrophic*. They have decreased Secchi disc readings and experience low to no oxygen in the bottom waters during the summer. These lakes would only be habitable to warm-water fish. They may also experience blue-green algae blooms. Lakes that are super-enriched are called hyper-eutrophic. They experience heavy algae blooms throughout the summer, and may even experience fish kills. Rough fish dominate in hyper-eutrophic lake systems.

We are able to calculate the trophic state index for Black Otter Lake based on the data you collected last summer. Black Otter Lake falls into the eutrophic range.

Quality Assurance

In October, you were asked to perform a variety of tests to help us evaluate the quality of the data collected. The first test involved saturating a cup of water by passing it back and forth between two cups, and then measuring the dissolved oxygen in three subsamples from that cup. The three values that you reported for the dissolved oxygen saturation test averaged 97% of the expected value, indicating excellent technique with the test kit.

The second test involved your measuring an "unknown" pH buffer solution that was provided to you from our office. The pH of 9.9 that you reported for the "unknown" buffer that we send you was in excellent agreement of the actual value of 10.0. Good job!

Conclusion

Before an overall analysis of the water quality at Black Otter Lake is drawn, we should allow the dredging/refilling project to be completed and let the lake return to equilibrium. The data you collect in 1991 will add significantly to our data base and our overall analysis of the water quality of your lake. Al, you and your son Tony, did an excellent job in collecting data last summer, and the DNR appreciates all the time and effort you devoted to the Self-Help Lake Monitoring Program. We are glad you have continued into the second year of the program.

Black Otter Lake – Outagamie County

Data collected by: Al and Tony Habeck

21–Jul–90

Time: 3:00

Secchi Depth	Depth	Dissolved Oxygen (ppm)	Temperature Degrees F	pH	Phosphorus ug/L	Comments
2.5 Feet	1	–	–	–	80	
	3	11.9	78.6	9.2		
	5	0.6	71.6	7.9	210	

Lake is drawn down

Summary: 21–Jul–90

The Secchi depth is considered to be very poor.
The dissolved oxygen concentrations appear to be sufficient to support a warm–water fishery except at depths below 5 feet, shown in the gray shaded area.
Based on the surface phosphorus concentration, the apparent water quality index is poor.

Black Otter Lake – Outagamie County

Data collected by: Al and Tony Habeck

30–Aug–90

Time: 12:30

Secchi Depth	Depth	Dissolved Oxygen (ppm)	Temperature Degrees F	pH	Phosphorus ug/L	Comments
5.25 Feet	1	–	–	–		
	3	7.2	75.4	8.2		
	6	8.2	69.0	7.9		
Rainfall from	7.5	2.8	66.8	7.8		
8–1 to 8–30–90						
5 Inches		Lake is 3 ft. below normal				

Summary: 30–Aug–90

The Secchi depth is considered to be fair.
The dissolved oxygen concentrations appear to be sufficient to support a warm–water fishery except at depths below 7.5 feet, shown in the gray shaded area.

Black Otter Lake – Outagamie County

Data collected by: Al and Tony Habeck

13-Oct-90

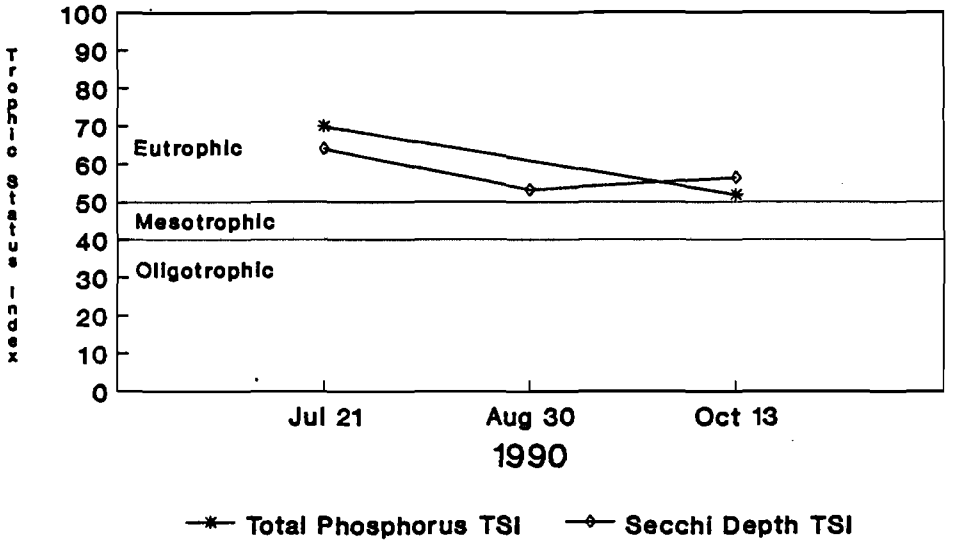
Time: 10:09

Secchi Depth	Depth	Dissolved Oxygen (ppm)	Temperature Degrees F	pH	Phosphorus ug/L	Comments
4.25 Feet	1	–	–	–	23	
	3	11.5	46.3	8.4		
	6	12.2	46.3	8.4		
	7.5	11.8	46.3	8.4	20	

Summary: 13-Oct-90

The Secchi depth is considered to be poor.
The dissolved oxygen concentrations appear to be sufficient to support a warm-water fishery.
Based on the surface phosphorus concentration, the apparent water quality index is good.

1990 - Trophic State Index
Black Otter Lake

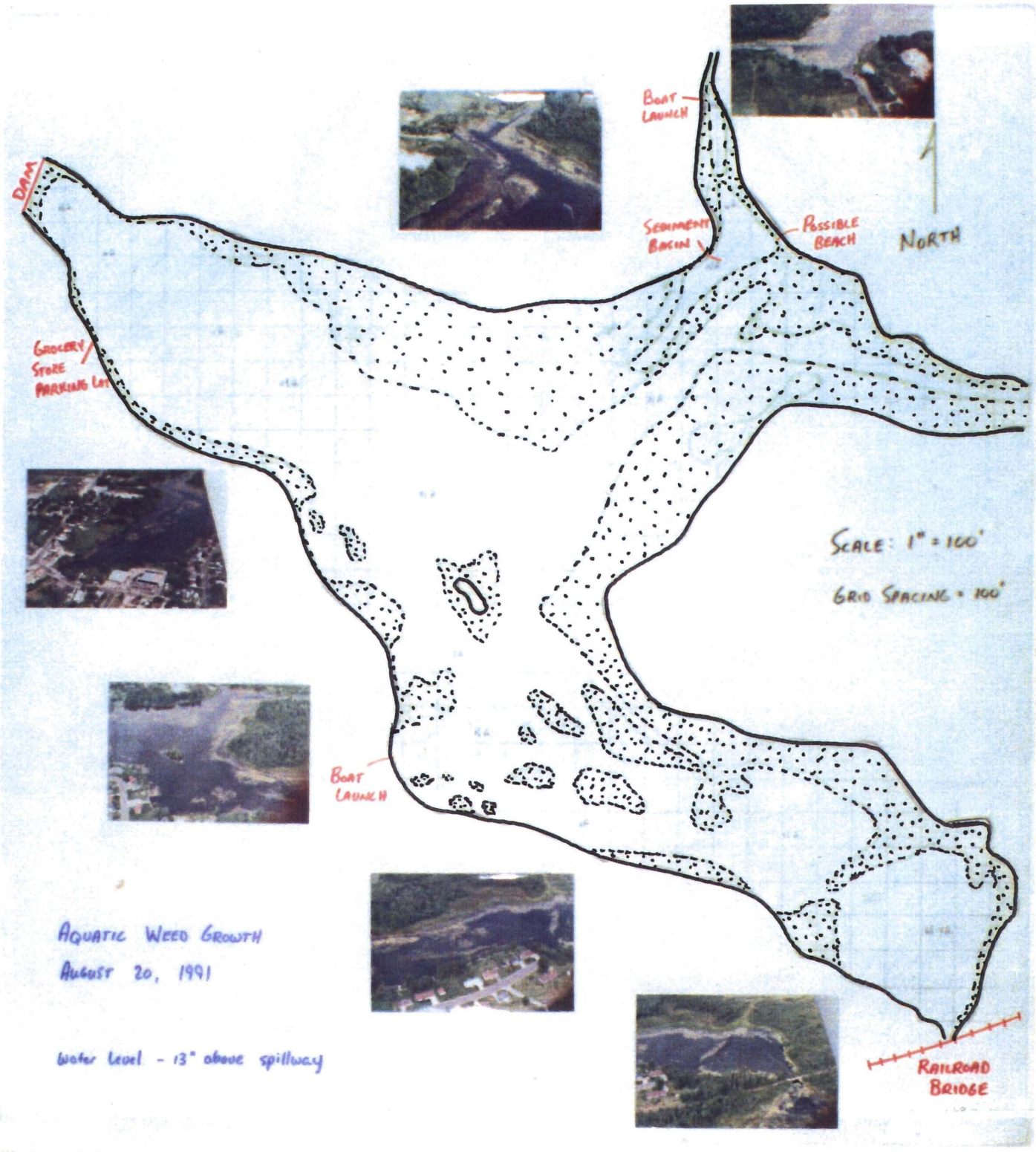


Trophic Category Descriptions

Category	TSI	Lake Characteristics
Oligotrophic	1-40	Clear water; oxygen rich at all depths, except if close to mesotrophic border; then may have low or no oxygen; cold-water fish likely in deeper lakes.
Mesotrophic	41-50	Moderately clear; increasing probability of low to no oxygen in bottom waters.
Eutrophic	51-70	Decreased water clarity; probably no oxygen in bottom waters during summer warm-water fisheries only; blue-green algae likely in summer in upper range; plants also excessive
Hyper-eutrophic	70-100	Heavy algal blooms throughout the summer; if >80, fish kills likely in summer & rough fish dominate.

Adapted from Carlson, 1977

APPENDIX C



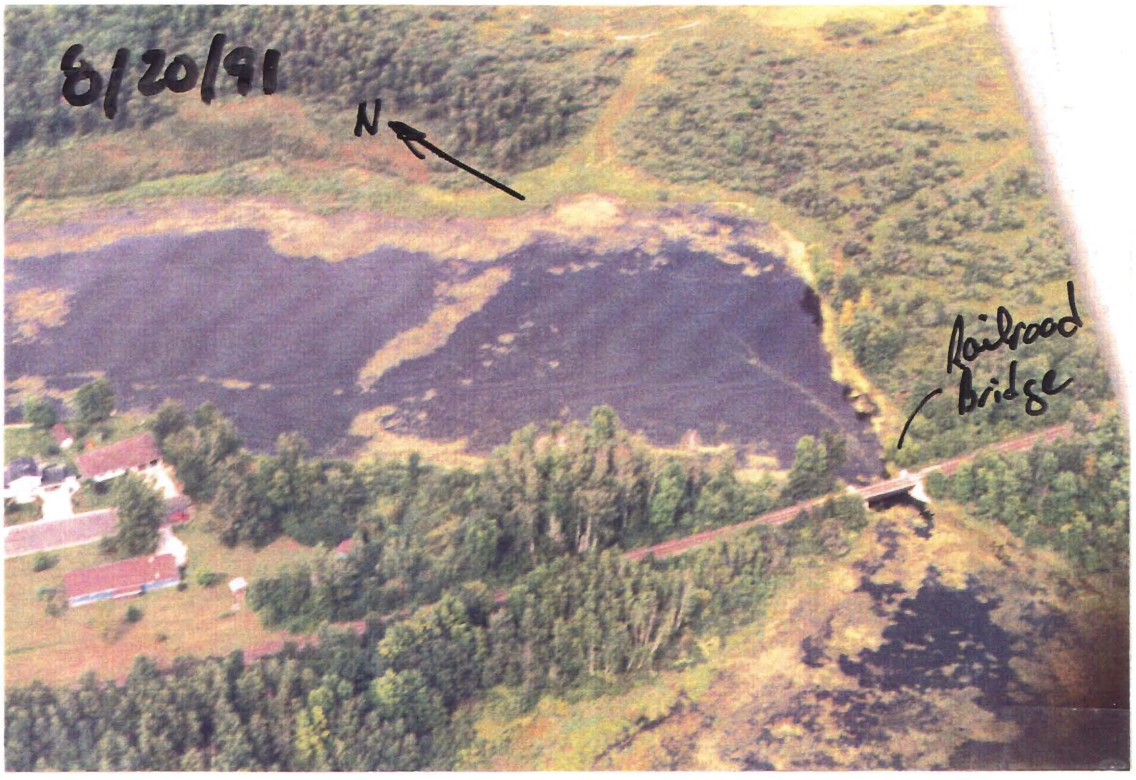
AQUATIC WEED GROWTH
AUGUST 20, 1991

Water Level - 13" above spillway


East Boat launch
8/20/91
North Shore
Dam


8/20/91
North
West Boat Launch


8/20/91
West Shore


8/20/91
N
Railroad Bridge


August 23, 1991


August 23, 1991

APPENDIX D

REPLY TABULATION

BLACK OTTER LAKE QUESTIONNAIRE
October 1991

Key: 1st Number - number of respondents replying that live within village limits
2nd Number - number of respondents replying that live outside of village limits but within watershed
3rd Number - total number of respondents

For word answers: ( ) - number of respondents
not underlined - within village
underlined - outside village

1. Approximately how far from the lake is your property?

11, 0,11 along the shore	7,21,28 within 2 miles
49, 6,55 within 1/4 mile	1,27,28 within 3 miles
31,18,49 within 1 mile	0,87,87 beyond

2. Do you or your family enjoy or use the lake now?

46,31,77 Yes 52,106,158 No

3. If yes, how do you enjoy or use the lake?

41,25,66 viewing	13,5,18 hiking along the shore
12, 5,17 boating/canoeing	16,5,21 ice skating
23,11,34 fishing	11,5,16 other

4. If no, is there a reason? (10) Not interested
(17) Other interests, (12) too dirty, not enough fish
(11) previous projects destroyed lake

5. Do you believe the lake is an asset to the community?

62,115,177 Yes 31,35,66 No

6. What do you think about the condition of the lake now?

47,55,102 poor	11,17,28 good
31,51, 82 OK	11,23,34 other

7. Does the condition of the lake keep you from enjoying or using it?

36,49,85 Yes 58,101,159 No

REPLY TABULATION
BLACK OTTER LAKE QUESTIONNAIRE
Page 2

8. What do you believe the problems are with the lake?

6,20, 26	poor boat access	21,35,56	people don't care
34,46, 80	no flow	30,43,73	too shallow
50,48, 98	watershed pollution	14,16,30	litter
58,84,142	weeds	21,43,64	low oxygen in winter
29,56, 85	poor fishing	6, 5,11	too many waterfowl
19,30, 49	not enough public shoreline for trails, etc.		
11,30, 41	other Main one: do not know		

Check all that apply. Rank them if you wish 1, 2, 3 and so on with #1 being the most significant.

9. Do you believe something more should be done?

54,78,132 Yes 39,52,91 No

What? (15) Weed Control/Spray
(10) Keep weeds down, (8) Stock Lake, (6) Money spent before with no results

Let's discuss aquatic plants for a moment. Maybe you call them weeds.

10. The district is planning to rent a weed harvestor next summer to cut the weeds. Do you support this plan?

45,87,132 Yes 45,61,106 No

11. Herbicides (chemicals to kill the weeds) could also be used. Would you support the use of chemicals?

25,28,53 Yes 63,114,177 No

12. Harvested weeds can be used for mulch or compost. If the district would pile the cut weeds somewhere (maybe at the county park), would you be interested in using the weeds for mulch or compost? 17,48,65 Yes 78,98,176 No

Let's talk about land use practices in the watershed for a moment.

13. Some folks say everything we do in the lake will not solve the problem/s until we change land use practices that fill the lake with soil and pollution. Do you agree?

66,90,156 Yes 21,44,65 No

REPLY TABULATION
BLACK OTTER LAKE QUESTIONNAIRE
Page 3

14. Here is a typical list of land use practices that may affect a lake. Do you believe any of these practices affect Black Otter Lake?

    30,45, 75 streambank erosion
    31,47, 78 construction site erosion
    65,79,144 manure runoff from barnyards and feedlots
    39,54, 93 poor cropping practices (planting too close to waterways, cropping on steep slopes)
    36,71,107 use of lawn fertilizers
    36,45, 81 wetland drainage
    42,78,120 runoff from streets
     0,11, 11 Dont Know (write in)

    Check all that apply. Rank them if you wish 1, 2, 3 and so on with #1 being the most significant.

Let's talk about the lake district for a moment.

The district has the power under State Statute 33, **Public Inland Waters** to sue and be sued, make contracts, accept gifts, purchase, lease, devise or otherwise aquire, hold, maintain or dispose of property, disburse money, contract debt and do any other acts necessary to carry out a program of lake protection and rehabilitation.

15. Do you believe the lake district has done an adequate job so far to protect and rehabilitate Black Otter Lake?

    43,68,111 Yes 48,59,107 No

16. If present land use practices are harming the lake, should the district be more aggressive in trying to change the practices? 59,92,151 Yes 28,52,80 No

17. One possible approach might be taken in this order:
    1. talk to the land owner/s believed having a harmful impact and encourage that person/s to change practices
    2. seek support from governmental agencies
    3. purchase, lease or contract easements of the properties so the district can manage the land/s better
    4. seek legal action -- go to court if necessary

    Do you support this approach? 47,94,141 Yes 35,48,83 No

18. If not, what would you suggest? (4) leave as is, (5) Educate landowners, <u>(7) leave as is, its just a millpond</u>

19. The boundaries of the district and watershed are shown on the attached map. Should the lake district increase the size of the district to include more of the watershed?

    39,38,77 Yes 47,83,130 No

Let's talk for a moment about the kinds of uses you would like to see for the lake.

20. Do you feel the district should better promote the following:

Yes	No	
61,101,162	20,24, 44	better fishing
26, 52, 78	42,60,102	more public property along the shore
42, 72,114	24,36, 60	special waterfowl areas
39, 63,102	40,53, 93	public swimming beach
20, 22, 42	51,83,134	motorized boats
___	___	other
___	___	other

21. Waterfowl in the numbers we have seen on the lake the past few years and a public swimming beach may not be compatable uses because of animal waste in the water. If it were a choice between the two, which would you prefer?

    65,97,162 waterfowl 22,35,57 swimming

Now for some final questions.....

22. Do you believe the public is adequately informed about issues of the lake and what is being done? 38,56,94 Yes 50,86,136 No

23. If not, what more should be done? (19) Newsletters, (10) Educate, (17) More info, newsletters, meetings

24. What about our children. Should more be done to teach them how to care for the lake? 67,114,181 Yes 16,17,33 No

25. The lake district meets monthly and has an annual meeting in August. Do you attend the meetings?

    5,3,8 Often 29,20,49 Seldom 58,121,179 Never

26. If seldom or never, why? (22) Don't know of meetings, (14) No time; (45) Don't know of meetings, (23) not interested

REPLY TABULATION
BLACK OTTER LAKE DISTRICT
Page 5

27. The district has a very difficult time getting folks to give their time and talents to help the lake through the lake district. Is there anything the district can do differently that would get you to offer your time and talents more readily? 28,36,64 Yes 46,84,130 No

28. If yes, what? (10) Let it go back to nature,
(11) Lake front owners should be responsible

END OF TABULATION