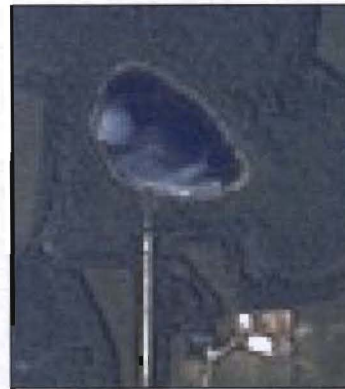


Lake Management Planning Grant Report

Carstens and Weyers Lakes
Manitowoc County, Wisconsin
WDNR Project Number LPL-441



Vision Statement

“Restore the watershed and water quality of Carstens and Weyers Lakes; eliminate the dependence on mechanical aeration; sustain healthy fisheries and swimmable waters; protect the existing natural shoreline and buffering capability”

TABLE OF CONTENTS

1.0 CARSTENS LAKE

- 1.1 Introduction
 - Background
 - History
- 1.2 Results of Lake Classification
- 1.3 Resource Inventory
- 1.4 Public Input
 - Citizen Concerns
 - Vision Statement
 - Water Quality Goals
- 1.5 Analysis of Problem
 - Fishery
 - Land Use
 - Nutrient Management
 - Water Chemistry
- 1.6 Plan of Action
- 1.7 Appendices
 - A) Carstens Lake Fish Survey Chart
 - B) Carstens Lake Watershed Map
 - C) Hydric Soils of Carstens Lake Map
 - D) Carstens Lake Landuse Map
 - E) Dissolved Oxygen Levels – 98, 99

2.0 WEYERS LAKE

- 2.1 Introduction/Background
- 2.2 Plan of Action & Recommendations
- 2.3 Appendices
 - A) Weyers Lake Shoreline Development Map
 - B) Weyers Lake Landuse Map
 - C) Dissolved Oxygen Levels – 98, 99
- 3.0 REFERENCES/ACKNOWLEDGEMENTS

CARSTENS LAKE

1.1 INTRODUCTION:

Ecological concerns dealing with the quality of Carstens Lake in southeast Manitowoc County have been of great concern over the past fifteen to twenty years. Over this period of time, tests and studies of various aspects have been conducted in an effort to improve Carstens Lake. Correcting and then maintaining the Carstens Lake ecosystem for the future, however, will need to be approached through proper land use practices in the watershed. This approach will include awareness of in-going and out-going streams, tile systems, septic systems, agricultural practices in the watershed, and any other human activities which could adversely affect Carstens Lake. A lake plan is a valuable tool which will be helpful in achieving the goal of improving Carsten's Lake. It can be used to focus on courses of action and to evaluate the effectiveness of taken action.

Background:

Carstens Lake is very characteristic of the lakes in Manitowoc County. The lake was formed by the activity of the last glacier episode in Eastern Wisconsin. The lake is twenty-two acres with a maximum depth of 28 feet and mean depth of twelve feet (Tim Rasman, WI DNR). The lake is also the headwaters of Pine Creek which makes its way to Lake Michigan. The lake's watershed encompasses 685.9 acres with 539.7 acres of the watershed entering the lake via stream (Michelle Yanda, Manitowoc Co. SWCD). The remaining 146.2 acres of watershed surrounding the lake enters via overland flow. The lake also is fed by groundwater. Carstens Lake is characterized as eutrophic, meaning that it has a high nutrient level causing excessive vegetation and producing the possibility of a winterkill due to low oxygen levels.

History:

Fishery:

A quality fishery, which appeals to today's public, was at one time present in Carstens Lake. It was noted in the Wisconsin Conservation Department's book, "Surface Waters of Manitowoc County", that a fishery of largemouth bass, crappies, and bluegills was present in 1968. Prior to 1982, the composition of the fishery shifted predominately to carp and bullheads. In 1982, the lake was treated with rotenone to remove rough fish species and a fish barrier was placed in Pine Creek to prevent re-entry from Lake Michigan. Starting in 1982, a stocking program was undertaken by the Wisconsin Department of Natural Resources. A number of species were stocked between 1982 and

1986, including northern pike, largemouth bass, golden shiner, and yellow perch. The number of each species and size of the fish are shown in the Carstens Lake Fish Stocking Chart below.

Carstens Lake Fish Stocking Chart

Year	Species	Size	Number stocked
1982	Northern pike	Fingerling	250
1983	Largemouth bass	Adult	39
1983	Golden Shiner	Adult	76
1983	Yellow Perch	Adult	606
1984	Yellow Perch	Adult	25
1984	Yellow Perch	Yearling	50
1984	Yellow Perch	Adult	50
1985	Yellow Perch	Adult	100
1985	Northern Pike	Fingerling	200
1986	Yellow Perch	Yearling/Adult	2000

The lake has also experienced problems with prolific weed growth in the summer, which has caused fish kills in the winter. To combat the problem of winter kill, an aerator was placed in the lake to keep the ice open in an area, and allow entry of oxygen into the lake.

Land Use:

The Carstens Lake watershed has for many years been predominately used for agriculture. The number of residences dotting the shores of the lake has increased over the years.

Nutrient Management:

The Seven-Mile Silver Creek Watershed project, a Wisconsin funded priority watershed, was started in 1968. This watershed area includes the Carstens Lake watershed. Since 1968, a barnyard manure storage facility and wetland restoration have been completed in the Carstens Lake Watershed. A rotational grazing setup has also been installed on the west side of the lake.

In past years, agricultural practices have led to the addition of unneeded nutrients being supplied to the lake. In the winter of 1985, a severe manure runoff occurred on the west side of the lake. During this event, manure made its way onto the ice of the lake and later settled into the lake.

1.2 Results of Lake Classification

In 1999, Manitowoc County conducted a lakes classification system to group county lakes into similar management strategies to develop effective zoning and land use protection. The classification system inventoried the degree of development as well as potential development. Lakes that have a high potential for development and a remaining portion of the lake to be developed would be in need of the most urgent protection.

Part of the scoring system measured the habitat and aesthetics impacts of the development. The more homes there are on the lake and the closer the homes are together the less aesthetically pleasing it is to live on the lake. Likewise the more homes there are on a lake and the closer the homes are together the less natural habitat there is for native wildlife due to habitat destruction. A University Study conducted in Vilas County found that increased development reduces fish production from the loss of habitat.

As a result of the classification of county lakes and using the above criteria, three classes of lakes were developed: natural lakes, semi-developed lakes and highly-developed lakes. For each category of lakes, separate Shoreland Zoning and Protection criteria was developed to protect that grouping of lakes. The Zone Change Proposal, at the time of this report, is being submitted for draft language to the County's Corporation Counsel.

Carstens Lake was classified as a semi-developed lake. The goal of protection for this category of lakes is to protect the remaining natural shoreline area and restore the developed shoreline by establishing zoning standards for moderate density of single-family residential development. This would be accomplished by providing incentives to property owners to restore native vegetation on developed lots and have stricter set backs and lot widths on areas not yet developed. New construction and remodeling would be subject to controlling runoff and erosion along with establishing and restoring natural shoreline buffers.

Summary of Classification Criteria:

Carstens Lake was found to be 35% developed, with most lots meeting current zoning standards of 100 feet wide and homes set back at least 75 feet. 46% of the lake was found to be unable to be developed due to unsuited soil or wetlands. The remaining 20% was suitable and could be developed as soon as current owners sought zoning changes or desired to develop.

The lake scored quite well for Aesthetics and Habitat due to the low density of homes .7 per 100 feet of developed shoreline and 64% of the lake being undeveloped. The current type of development will offer an opportunity for landowners, due to the larger lot sizes, to re-establish natural shorelines and wider vegetative buffers. The larger buffers will be important to intercepting sediment and nutrients from surrounding drainage areas. The percent of impervious areas on a lot (roofs and driveways) will be important to reducing runoff to the lake.

A large portion of the lake (46%) should remain in a natural condition due to the wetlands and unsuitable soils. If the zoning proposal does not pass as presented, there is a risk of access through the wetlands via boardwalks and multiple piers due to keyhole development. Keyhole development would be the selling of easements from the back lot areas to allow multiple families to

have docks and piers or access to the water. Keyhole development is not allowed in the current zoning proposal.

1.3 Resource Inventory

Fishery:

The problems with the fishery of Carstens Lake have drawn most of the concerns. As previously stated, in 1982, the lake was treated with rotenone to remove the rough fish and a fish barrier was placed on Pine Creek. Since 1982, the rough fish have been kept in check, but the survival of more preferred species such as perch, largemouth bass and northern pike has failed. As a result of, elevated phosphorus levels, accelerated weed and algae problems have produced depleted oxygen levels in the lake. A typical fishery for such a lake requires a dissolved oxygen level of about 5 ppm to live and reproduce normally. This level has not been sustained throughout the year; most commonly it falls below 5 ppm in the winter. This problem has been combated in the recent years through the use of an aerator.

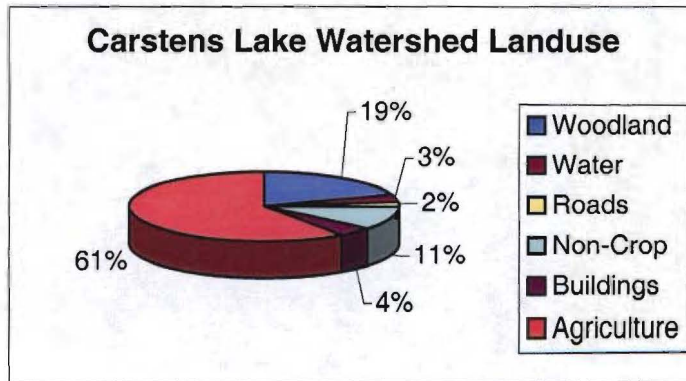
Overfishing may be another cause for the poor recruitment of certain fish. From the Carstens Lake fish stocking chart and the Carstens Lake fish survey chart (found in the Appendix) it appears that perch, large-mouth bass, and northern pike were removed by fishermen soon after stocking. Therefore the population wasn't given a chance to establish itself. In the spring of 1998, Hogler and Sorendunk from the Wisconsin DNR surveyed the fish population in Carstens Lake and found 3 northern pike, 2 bluegills, and over 50 mudminnows. This data supports that the winterkill of 1998 was quite devastating to the fish populations, however it wasn't a total kill. Oxygen levels again dropped to dangerous levels in the winter of 99-2000. Residents found dead fish in the spring of 2000, indicating a possible second winter kill.

To summarize, the problems with the Carstens Lake fishery include the overabundance of phosphorus which causes extensive vegetation growth, degraded oxygen levels caused by this extensive vegetation growth, and the overfishing of a vulnerable fishery.

Land Use

A variety of land uses occur throughout the watershed of Carstens Lake. The acreage for each of the six landuse types is shown in the Carstens Lake landuse pie graph below.

The land in the watershed is predominately being used for agricultural purposes. The non-



crop land also includes land used in agriculture through pasture and rotationally grazed land.

Nutrient Management

Two intermittent stream channels had water samples taken from them in the spring of 1998. The channels were estimated to flow 30 days out of the year.

Tim Rasman, Wisconsin Department of Resources Biologist, reported from his analysis that the channel on the north side of the lake was adding 0.498 pounds of phosphorus per year to Carstens Lake. He also found that the channel near the lake access was adding 0.492 pounds annually to the lake. Overall, the estimated total phosphorus loading for a given year from these channels falls in the range of between 0.80 pounds and 1.30 pounds. The concentrations of phosphorus from the two channels were taken at four different times during 1998; these numbers are shown in the table below. The relative amount of phosphorus coming into the lake is low compared to the loading amounts of other lakes in the area.

Phosphorus Concentrations in Runoff

	Runoff	MFFCC	Total P mg/L	Discharge CFS
Access	3/31/98	3300	0.365	3.7
	4/01/98		0.277	2.2
	4/14/98		0.064	1.5
	4/21/98		0.067	1.0
Carstens	3/31/98	330	0.257	5.5
	4/01/98		0.154	11.5
	4/14/98		0.062	3.0
	4/21/98		0.091	2.0

MFFCC = Millipore filter fecal coliform count

The inlake phosphorus levels have also been found to be high. Since 1976, the inlake phosphorus has ranged from a low of 38 ug/L to a high of 433 ug/L, with the average at 150 ug/L.

Other lakes throughout the area are also dealing with inlake phosphorus. The table below compares Carstens Lakes with others in the county.

Total Surface Phosphorus of Manitowoc Lakes

Lake	Big Long	Carstens	Hartlaub	Silver East	English
Surface Total P (ug/L)	46 to 108	101 – 104	34 – 52	148 - 357	24 - 81

It was observed that the lake level fluctuates rapidly with significant rainfalls and the discharges of intermittent stream channels. This occurs as a result of the outflow channel not being able to handle the amount of water being delivered to the lake. This causes the lake to retain water, phosphorus, and other nutrients.

High phosphorus levels cause heavy growth of algae in the summer. In the winter these algae die and decay, consuming the available oxygen used by fish to survive.

The channel flow was also sampled for fecal material. The millipores of fecal material found near the Carstens Road channel was 330 and the count near the boat landing was 3300. From this data it is suspected that the drainage to the channel near the boat landing could be contaminated by a failing septic tank.

1.4 Public Input

Three meetings were held to involve landowners and other concerned citizens in the study of and goal setting for Carstens and Weyers Lakes. These meetings helped to recognize citizen concerns, water quality goals, and develop a vision statement for Carstens and Weyers Lakes.

The first meeting, held on October 10, 1997, was a planning meeting with a discussion of the lake's health, watershed health, and project timetable. The second meeting, held on March 17, 1998, was a review of collected water quality data and discussion of future water monitoring needs and fishery management needs. The third meeting, held on July 15, 1998, helped to wrap up the planning process and a vision statement was formed. Citizen concerns with the lakes were also recorded and water quality goals were decided.

Watershed residents and interested citizens in attendance at these planning meetings included: Tom Ward, Tim Rasman, Dave Pozorski, John Karbon, Donald Hammel, Jim Schaus, Charles Bouc, Chris Zigmunt, Brian Robley, Scott Siedchalag, Mandia Siedchalag, Larry Karstens, Robert Bushman, Ed Rosenbauer, Dale Barnes, John Hardrath, Tom Hochkammer, Doug Fogle,

Alice Fogle, Henry Vogt, Michael Reilly, Kermit Schulz, Gary Visser, Joe Kinscher, Leroy Waack, Gerald Miller, Steve Sorendonk, Steve Hogler, and Herman Siedchalag.

Citizen Concerns:

The citizen concerns with Carstens and Weyers Lakes as identified at the meetings are as follows:

- Maintain a natural shoreline
- Create an infiltration basin on the west side of the lake
- Reduce littering
- Everyone take ownership; residents and nonresidents
- Distribute fish harvest throughout the year, not just at spawning time
- Improve public access (separate fishing pier from the boat launch)
- Improve the lake outlet
- Develop a filter between field drainage tiles and the lake.
- Clean up the watershed
- Develop wetland detention basins
- Purchase easement on remaining wild lands
- Improve the water quality so aerator is no longer needed
- Inform the public of the positive things being done to the lake
- Educate landowners on easements
- Buffer areas protecting the lake
- Insure that water quality is safe for swimming (free of bacteria)
- Control future building/construction to prevent erosion
- Encourage native and non-evasive species in buffers
- Development of easements or purchase of critical sites
- Improve water clarity to a range of 8 to 9 ft.

Vision Statement:

The vision statement that was developed at the last planning meeting represents what the group thought was the lake's future potential:

"RESTORE THE WATERSHED AND WATER QUALITY OF CARSTENS LAKE TO ELIMINATE THE DEPENDANCE ON MECHANICAL AERATION AND SUSTAIN HEALTHY FISHERIES AND SWIMABLE WATERS; PROTECT THE EXISTING NATURAL SHORELINE AND BUFFERING CAPABILITY"

Water Quality Goals:

The water quality goals that were identified at the planning meetings are:

-Reduce phosphorous entering the lake from the watershed area to insure long-term sustainment of in-lake treatment.

Actions:

- 1) Identify critical sites in the watershed to apply to easements, buffers, and wetland restoration sites.
- 2) Reduce runoff from roads and impervious surfaces by restoring natural shorelines.
- 3) Educate the watershed residents on practices to reduce nutrient runoff into the lake.

-Lower in-lake phosphorous levels from 100mg to 25mg per liter to eliminate the dependence on mechanical lake aeration.

Actions:

- 1) Reduce nutrient sources entering the lake from the north tributary, boat landing tributary or field tile source, and failing septic tanks.
- 2) Investigate the effectiveness of the outlet channel to improve the flushing rate or time for runoff floodwater to exit the lake.
- 3) Conduct an alum treatment of the lake to remove in-lake phosphorous.
- 4) Restore native vegetation.
- 5) Prevent entry of carp and bullheads.

-Encourage a public ownership of the lake to reduce littering and other lake conflicts.

Actions:

- 1) Post signs identifying lake problems at the boat landing.
- 2) Use Fish and Game reward to reduce violations.
- 3) Identify violator's boat registration number and report on DNR hotline.
- 4) Publish name of violators receiving tickets at the boat landing and newspaper.

-Protect the existing natural shoreline and enhance shoreline and open space with native vegetation.

Actions:

- 1) Educate lake residents on shoreline vegetation management.
- 2) Develop a showcase on the lake with a demonstration site through the County Lake Classification grant.

- 3) Educate the lake residents on wildlife benefits of natural shoreline.
- 4) Watershed residents should become involved in the town land use plan to ensure the incorporation of lake goals.

-Develop fish harvest management to encourage a sustainable fish population.

Actions:

- 1) Members of this group advise the fish manager in developing specific harvest regulations for the lake.
- 2) Inventory the fish habitat and fish species of the lake.

1.5 Analysis of the Problem

Fishery:

The 97-98 winter kill resulted in a need to restock and re-examine the fishery. The winter kills can be partially controlled with the use of an aerator. An aerator, however, is only a temporary treatment to a bigger problem. The inlake phosphorus levels will need to be reduced to manageable levels in order to prevent future kills. Monitoring of oxygen levels (Appendix G) in 1999 and 2000, continue to illustrate the need for in lake phosphorus treatment (alum). In spite of shallow snow falls the oxygen continues to plummet to low levels again causing a limited winter kill in the winter of 1999 – 2000.

To prevent over-harvesting of certain species and to gain size diversity in the fishery, special fishing regulations may need to be established on Carstens Lake. Regulations such as catch and release during re-establishment, seasonal catch and release during stocking, restricted bag limits, and size limits could be considered on Carstens Lake.

Land Use:

The area directly encompassing the lake is primarily used as residential or vacation property. Lake users need to be aware that the activities they participate in can directly affect the health of Carstens Lake.

The land outside of this residential area is mostly used agriculturally. This landuse will most likely remain for many years and alternatives to traditional ways of farming need to continue to be focused on. Some of these alternatives include conservation tillage, rotational grazing, and cover cropping. Some of these practices, such as rotational grazing, have been implemented in the area and have shown much promise in the improvement of environmental concerns in the watershed.

Nutrient Management:

Nutrient management will need to be addressed to enable Carstens Lake to return to a self-sustaining lake. Concern over nutrients entering the lake cannot only be centered on the local farmers, it needs to also be addressed by homeowners in the watershed.

Control of sediment and phosphorus will be essential if the lake receives a alum treatment to remove phosphorus. The sediment can also cover the alum blanket on the lake bottom and render it ineffective or shorten the life of the treatment. The good news is the watershed has a significant number of natural sediment basins, which are the depressional or hydric soils mapped in yellow on Appendix C. However, in the area to the north of the lake these areas have been ditched with agricultural drainage ditches and the channelization has destroyed the effectiveness of the basin in those areas. The road ditch and channel along the north side of Carstens Road will need to be buffered with a grassed buffer system or the immediate fields kept in permanent hayland.

The west drainage basin which outlets at the boat landing and west shoreline, is currently under a rotational grazing system by the current owner. This is one of the most effective methods of controlling sediment and nutrient runoff. The permanent cover of the pastures insures ideal conditions to intercept rainfall and recycle nutrients. This type of system does not require herbicides and pesticides as do row-crop systems.

Since the start of this lake project, Manitowoc County has enacted a Animal Waste Ordinance, Chapter 19. The ordinance prohibits the winter application of field-applied manure within 1000 feet of the lake unless in can be incorporated. This should prevent any future contamination events such as the runoff event of the mid-eighties.

The local homeowners need to be aware of their own septic systems and where they filter. Residents have pointed out a failing septic system that will need to be corrected prior to any lake treatment. During the first year of this study, bacteria levels at the boat landing indicated a possible source of septic contamination from a field drainage tile line. Follow-up monitoring in 1999 and 2000, by DNR did not identify any contamination sources. Maintenance concerns and over fertilizing of lawns in the watershed need to, also, be addressed. In summary, an effort toward educating the whole population of the watershed must be accomplished to bring the concerns and possible alternatives about nutrient management to the public forefront.

1.6 Plan of Action

To accomplish the Vision that the watershed residents identified to:

**“ RESTORE THE WATERSHED AND WATER QUALITY OF CARSTENS LAKE TO
ELIMINATE THE DEPENDANCE ON MECHANICAL AERATION AND SUSTAIN HEALTHY**

FISHERIES AND SWIMMABLE WATERS; PROTECT THE EXISTING NATURAL SHORELINE AND BUFFERING CAPABILITY”.

GOAL I. Reduce phosphorus entering the lake from the watershed area to insure long-term sustaining of in-lake treatment.

Action items:

1. Landowners with critical sites as mapped will be contacted by Soil & Water Conservation Department.
2. A Lake Planning Grant will be pursued by February 2001 to establish demonstrations of residential shorelines on area water conservation staff to encourage the development of easements, buffers and wetland restoration sites during 2001.
3. The County Lakes Association's Carstens/Weyers Lake Committee will be asked to educate residents on practices to reduce nutrient runoff into the lake.

GOAL II. Lower in-lake phosphorus levels from 100 mg to 25mg per liter, to eliminate the dependence on mechanical lake aeration.

Actions items:

1. The Manitowoc Soil & Water Conservation Dept. will initiate a complaint with the County Zoning Dept. to abate a failing septic system as identified by residents at a public meeting.
2. The Soil & Water Conservation Department and DNR will complete a analysis of the effectiveness of the outlet channel to improve the flushing rate or time for runoff floodwater to exit the lake.
3. The Wisconsin Conservation Corp will continue to monitor the oxygen levels of the lake.
4. A volunteer monitor will be sought from local lake residents to monitor progress of reaching water quality goals. → Doug was collecting
5. A committee of lake residents and members of the County Lakes Association will be organized in late 2000, to begin investigating the alum treatment of the lake.
6. A application for a Lakes Implementation Grant to do the alum treatment will be initiated by the same group in early 2001 to meet the next grant deadline.

GOAL III. Encourage a public ownership of the lake to reduce littering and other lake conflicts.

Action items:

1. The committee from the County Lakes Association will be asked to sponsor signs at the boat landing identifying lake problems and needs for protection or fish management.

2. Residents will be encouraged to use Fish & Game rewards to reduce violations.
3. Residents and lake users will be encouraged to identify violators by boat registration number and report on DNR hot line.
4. The Lakes Association will be requested to publish the names of violators receiving tickets of violation on the lake.
5. Encourage the watershed residents to be knowledgeable of the County Animal Waste Ordinance and notify the Soil & Water Conservation Dept. of any violations in the watershed.

GOAL IV. Protect the existing natural shoreline and enhance shoreline and open space with native vegetation.

Action items:

1. The County Lakes Association, who has been acting as an umbrella group for Carstens Lake, can encourage the establishment of a shoreline residential restoration demonstration. ← accomplished
2. The same committee will be requested to develop an education program on wildlife benefits of natural shoreline.
3. Local residents will be encouraged to contact the County Board members and Planning & Parks Commission to accept the Shoreline Proposal Protection Proposal as developed by the Citizens Committee.
4. Watershed residents should become involved in the Town of Newton's Land Use Plan to insure the incorporation of lake goals.
5. The Soil & Water Conservation Dept. will coordinate the findings of this report and lakes classification with the Town of Newton's Land Use Planning Consultant.

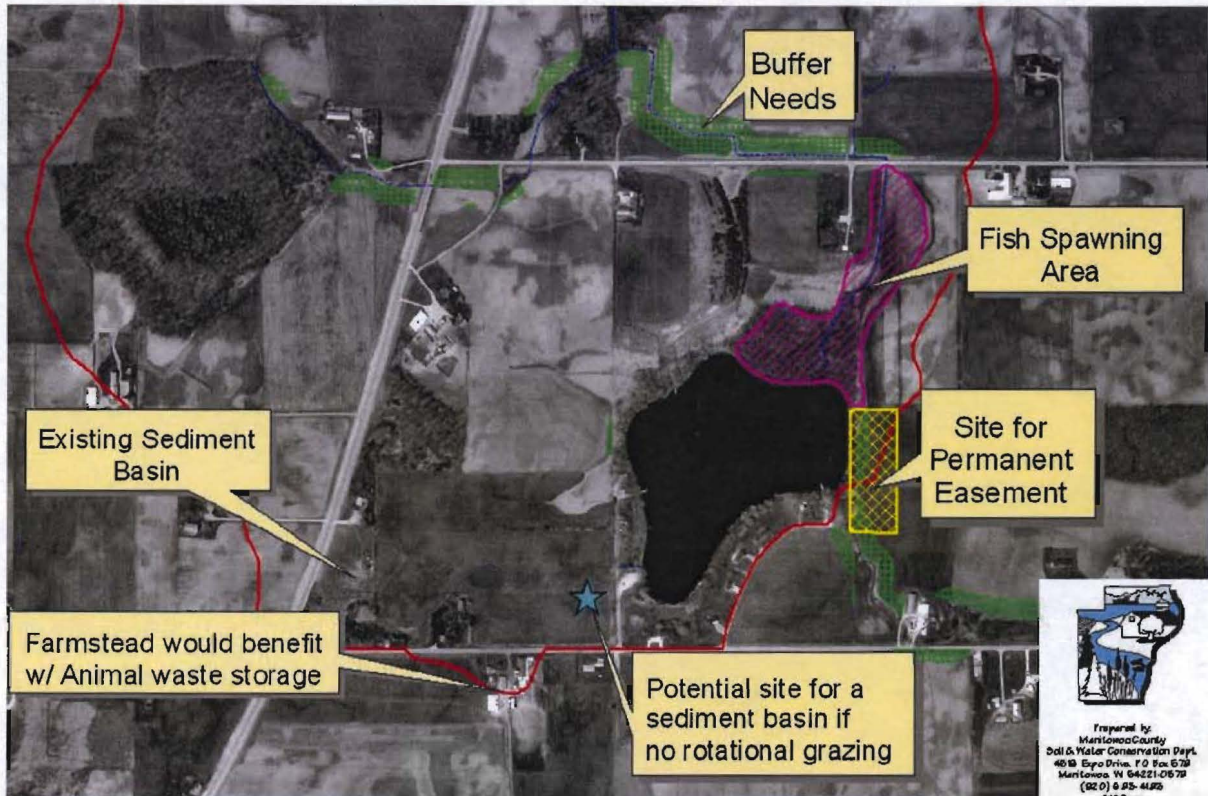
GOAL V. Develop fish harvest management to encourage a sustainable fish population.

Action items:

1. Members of the County Lake Association's Carstens/Weyers Lake Committee and lake residents advise the fish manager in developing specific harvest regulations for the lake.
2. After completion of the Alum treatment and the water quality goals have been met encourage the DNR to conduct an intensive fish survey.
3. Monitor any encroachment or lake management that may impact the northern pike spawning marshes.
4. Encourage the maintenance and management of the aerator by the County Lakes Association until such time the aerator is no longer needed.



Location of Recommended Conservation Practices for the Watershed of Carstens Lake



Talk w/ Tim about
the problems of delivery
associated w/ the Tile
drainage system

What about water
Chemistries Tim
collected

2 Separate Tile
drains

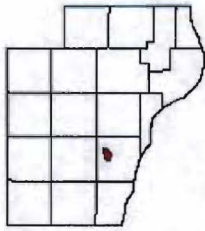
Are Culverts causing
reduced outflows
and overly fluctuating
water levels

1.7 Appendices

A) Carstens Lake Fish Survey Chart

Species	Carstens Lake Fish Survey						
	1983 Fall	1984 Fall	1985 Spring	1985 Fall	1986 Fall	1987 Fall	1988 Fall
Northern Pike		3	4	4	14	7	3
Golden Shiner	11	12	16	9	173	14	5
C. Mudminnow				1		2	
Bullhead spp.					1	3	
Bluegill							19
Largemouth Bass	104	104	65	137	770	113	379
Yellow Perch		9	2		342	1	14
Total	115	128	87	151	1300	140	420
Effort (miles)	0.78	0.78	0.78	0.78	1.56	0.78	1.56
CPUE (fish/mile shocked)	147.4 fish	164.4 fish	111.5 fish	193.6 fish	833.3 fish	179.5 fish	269.2 fish
Information provided by Hogler & Sorendunk, WI DNR							

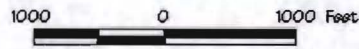
B) Carstens Lake Watershed Map



Location Diagram

Carstens Lake Watershed

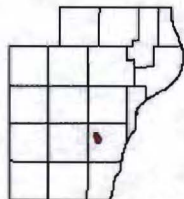
Town of Newton



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Mishkin Consulting
2616 River Drive, Suite 100
Madison, WI 53705
Phone: 608-441-0379
www.mishkin.com



C) Hydric Soils of Carstens Lake Map



Location Diagram

Carstens Lake Soils

Town of Newton



1000 0 1000 Feet

LEGEND

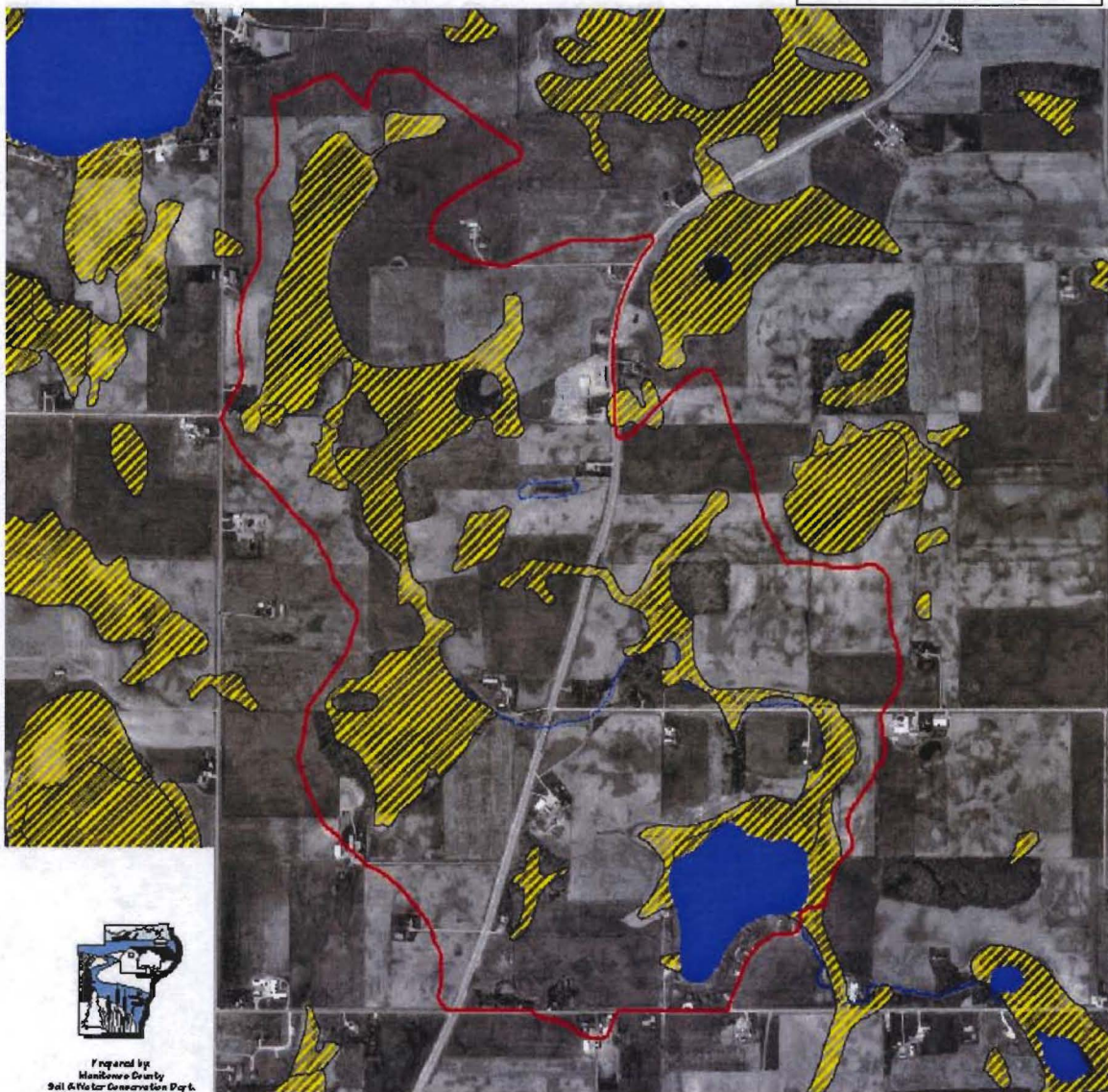
Hydric Soils



Y



Watershed Boundary



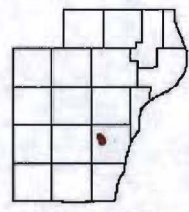
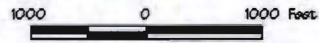
Prepared by:
Madison County
Soil & Water Conservation Dept.
4549 E. Fox Drive P.O. Box 578
Madison, WI 53421-0578
©2003-03-23
9100 mg

D) Carstens Lake Landuse Map

LEGEND	
	Agriculture - 69.7%
	Building Sites - 4.5%
	Non-Crop Land - 10.9%
	Non-Metallic Mining - 0%
	Roads - 2.4%
	Surface Water - 5.4%
	Woodland - 19.4%

Carstens Lake

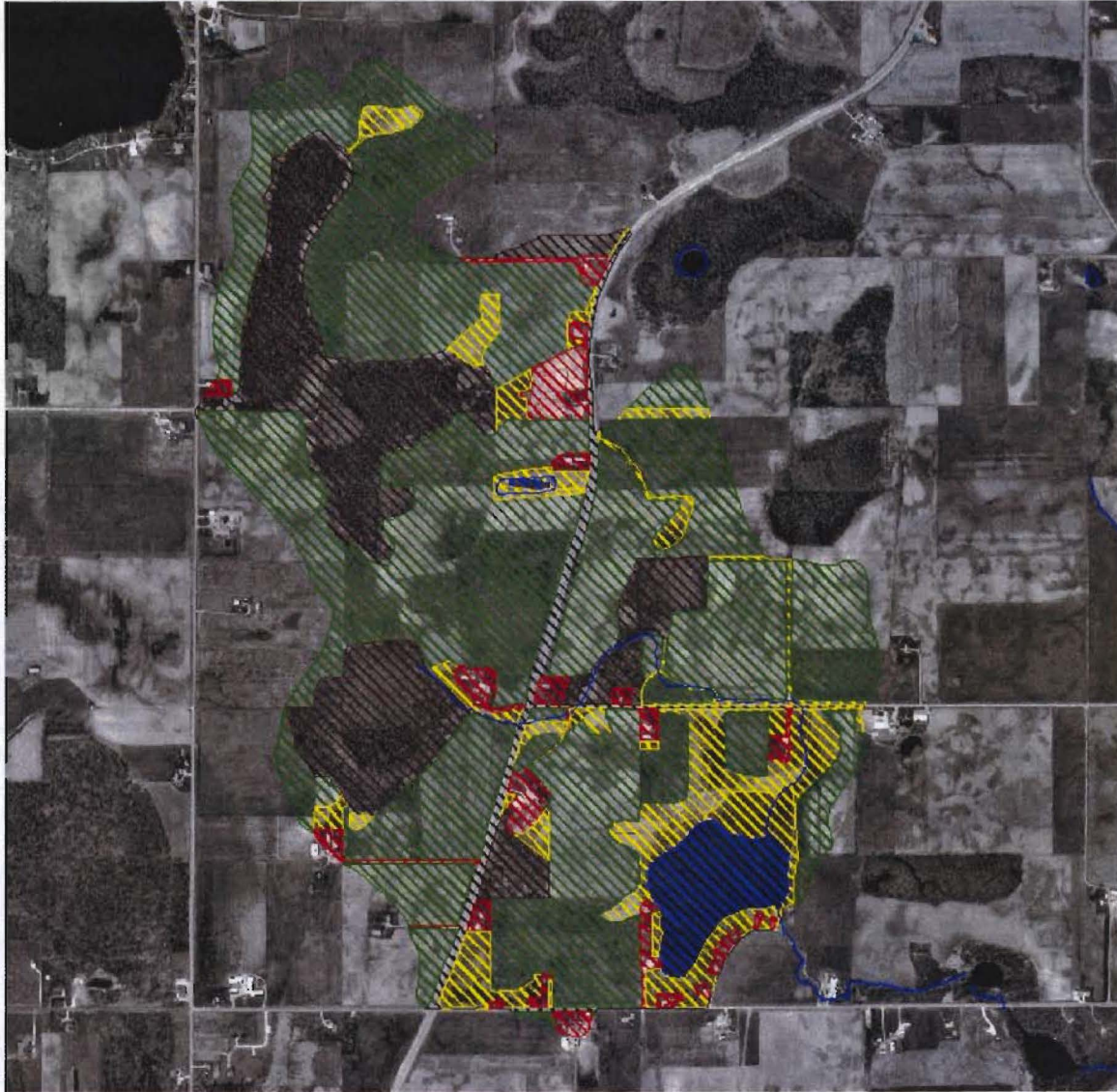
Town of Newton



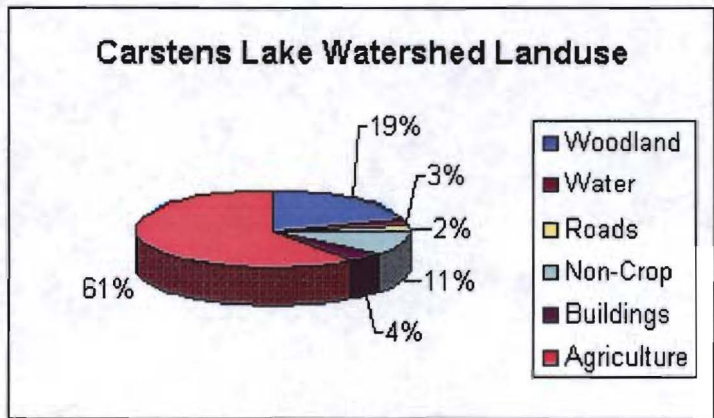
Location Diagram



Prepared by:
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 Wisconsin Department of Natural Resources
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 608-261-6000
 www.dnr.wisconsin.gov






Woodland	137.4
Water	23.8
Roads	17.1
Non-Crop	77.3
Buildings	30.4
Agriculture	422.7

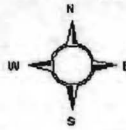


E) Carstens Lake Shoreline Development Map

Carstens Lake Shoreline Development Lake Classification

LEGEND

-  Developed Land
-  Nonbuildable Land
-  Buildable Land



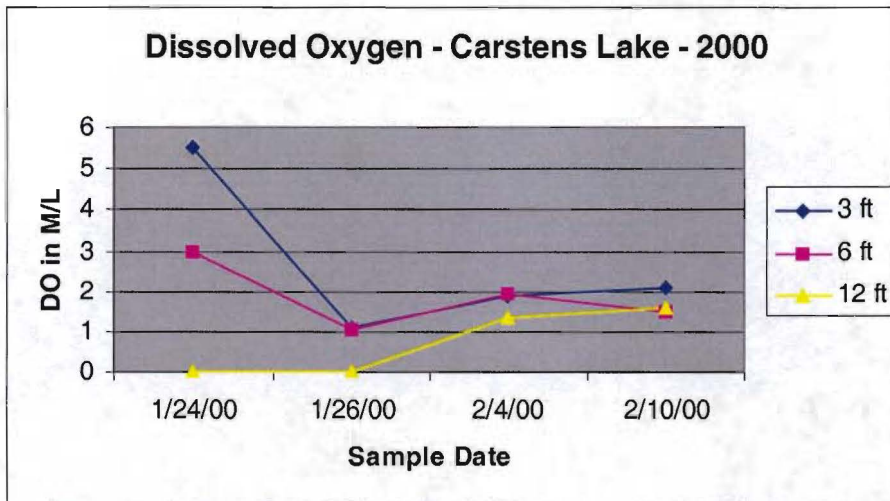
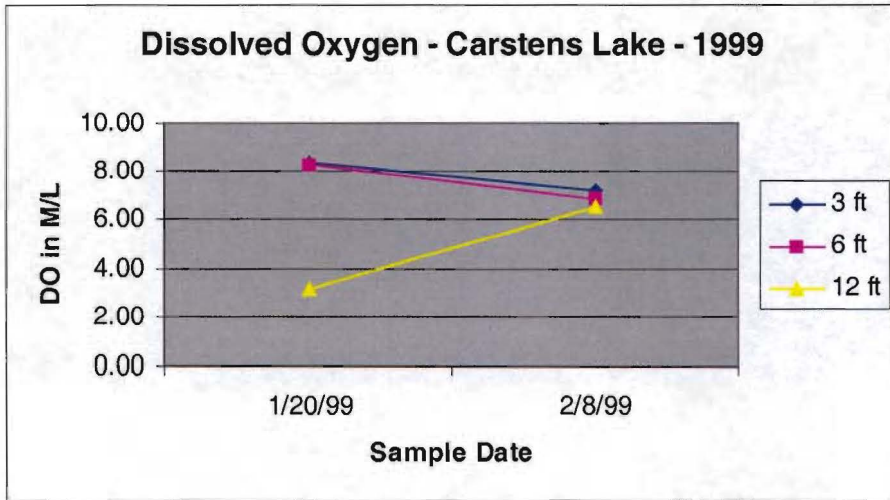
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SDD my

F) Dissolved Oxygen Levels – 1998, 99

Carstens Lake			
	<i>3 ft</i>	<i>6 ft</i>	<i>12 ft</i>
<i>1/20/99</i>	8.39	8.3	3.18
<i>2/8/99</i>	7.15	6.87	6.50

Carstens Lake			
	<i>3 ft</i>	<i>6 ft</i>	<i>12 ft</i>
<i>1/24/00</i>	5.5	3	N R
<i>1/26/00</i>	1.07	1.05	N R
<i>2/4/00</i>	1.9	1.91	1.35
<i>2/10/00</i>	2.1	1.5	1.6

(Coordinating graphs located on following page)



WEYERS LAKE

2.1 Introduction/Background:

Weyers Lake is a small (6 acre) seepage lake with a maximum depth of 32 feet and mean depth of 15 feet. Soils around the lake are a poorly drained Houghton Muck. The only development on the lake is a public access on the south shore off Clover Road. The lake has a history of winterkill due to low dissolved oxygen. The Manitowoc Fish and Game Club, who own most of the property surrounding the lake, maintain an aeration system that has reduced the effect of winterkill.

In 1997, the Manitowoc County Soil and Water Conservation Department along with the Wisconsin Department of Natural Resources began to develop a lake management plan through the department's lake planning grant program. The department collected water quality information and the county assessed the land surrounding the lake. (Tim Rasman)

2.2 Plan of Action & Recommendations:

It is protected from the influence of wind induced turnover

Weyers Lake was found to be quite well protected with the majority of the watershed woodland. The lake because of its ~~shallow depth~~ is annually subject to low winter oxygen levels and the aerator will be necessary to maintain the fisheries. There was no evidence of nutrient loading to the lake. The fisheries will be subject to over harvest because of its small size.

RECOMMENDED MANAGEMENT OPTIONS ON WEYERS LAKE

1. The Natural Lakes protection category of the Shoreland Zoning Proposal if adopted by the County Planning and Parks Commission will maintain the ~~wilderness~~ ^{Natural} setting of this lake.
2. The land around the lake is currently owned by Manitowoc Fish & Game Protective Association, however, if the organization ever dissolves it is recommended that Fish & Game place a restrictive stipulation on the deed to prevent future development.
3. The Town of Newton Land Use plan should be reviewed to see if the watershed is protected from non-compatible land uses in the watershed and restrictive parcel sizes.




4. The Manitowoc County Lakes Association will need to maintain and operate the aerator on the Lake.
5. The lake should be considered for special or restrictive fish harvest regulations to protect over fishing of this small lake
6. Current landowners are doing a good job of preserving the woodland areas of the watershed, a protective easement or purchase of development rights from willing landowners would insure long-term protection of these areas.
7. *Maintain boat landing and garbage disposal*

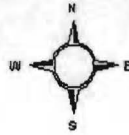
2.3 Appendices

A) Weyers Lake Shoreline Development Map

Weyers Lake Shoreline Development Lake Classification

LEGEND


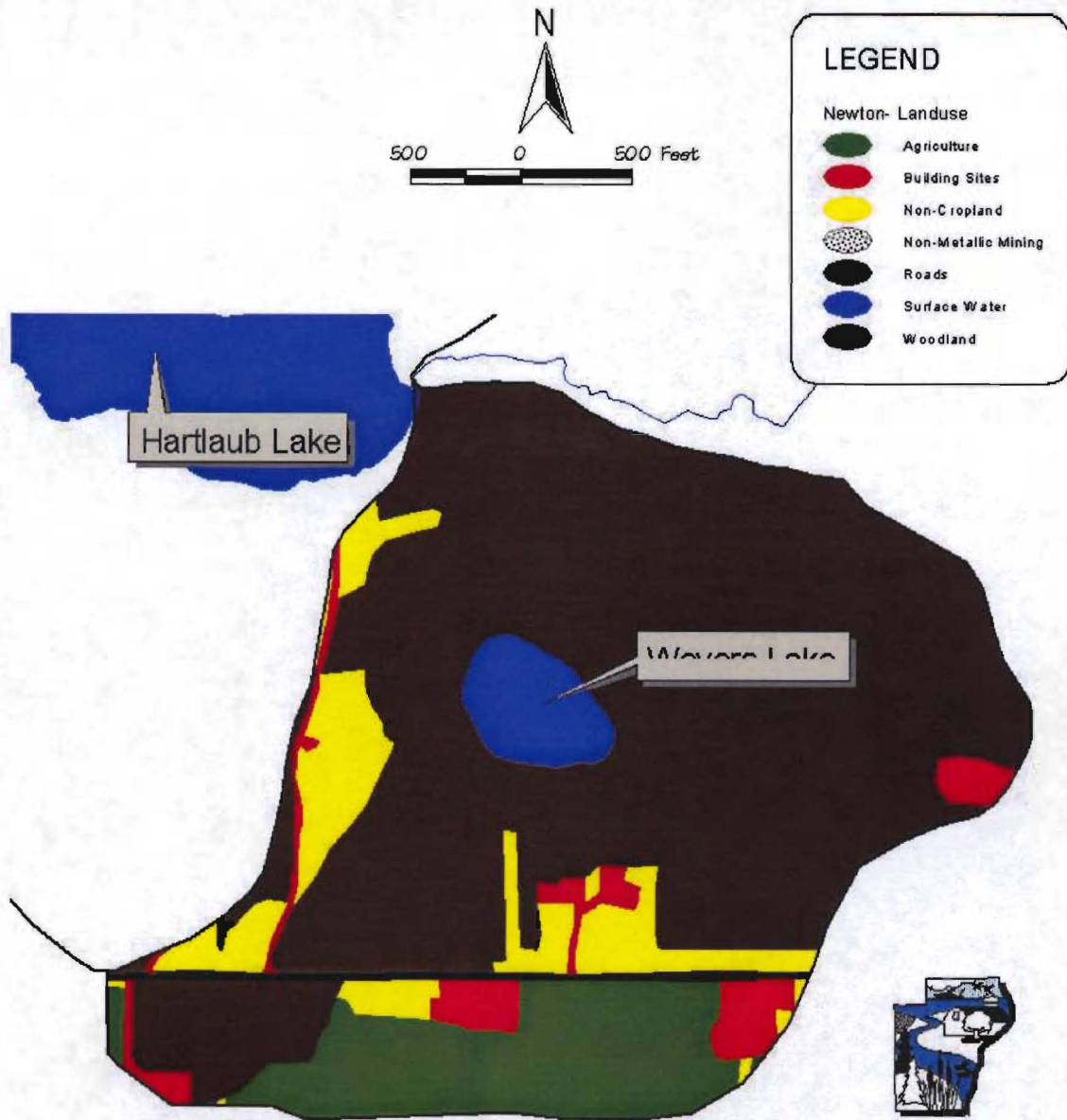
-  Developed Land
-  Nonbuildable Land
-  Buildable Land



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B) Weyers Lake Landuse Map

Weyers Lake Watershed Landuse Cover

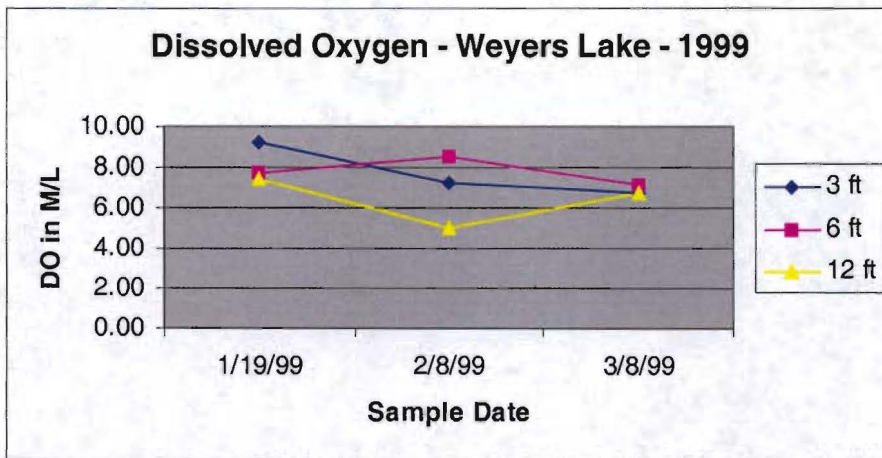


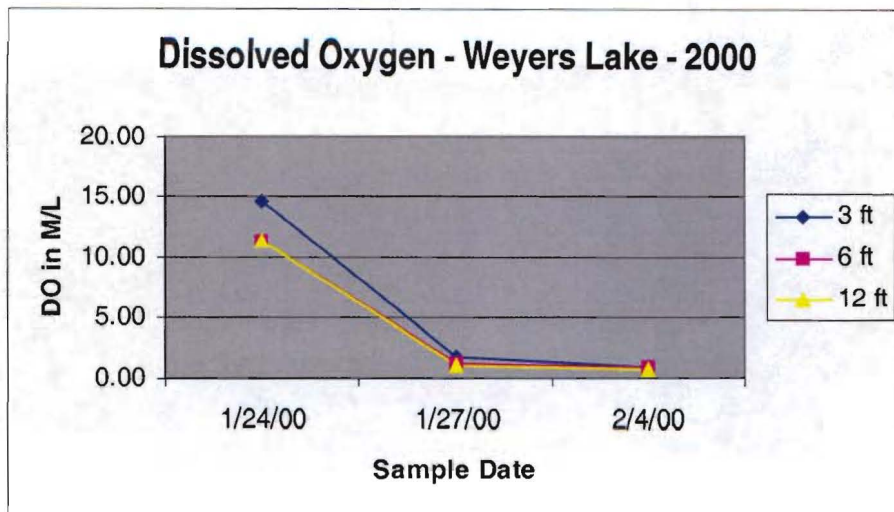
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C) Dissolved Oxygen Levels – 98,99

Weyers Lake			
	3 ft	6 ft	12 ft
1/19/99	9.21	7.70	7.37
2/8/99	7.23	8.54	5.04
3/8/99	6.67	7.10	6.70

Weyers Lake			
	3 ft	6 ft	12 ft
1/24/00	14.50	11.30	11.2
1/27/00	1.58	1.18	1.01
2/4/00	0.81	0.79	0.58





2.0 References/Acknowledgements

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Tom Ward, Manitowoc County SWCD director

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Tim Rasman, Department of Natural Resources

Also:

Steve Hogler, Wisconsin Department of Natural Resources

Residents of the Carstens and Weyers Lakes Watersheds

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Tony Smith, Manitowoc County SWCD

Steve Sorendunk, Wisconsin Department of Natural Resources

Michelle Yanda, Manitowoc County SWCD