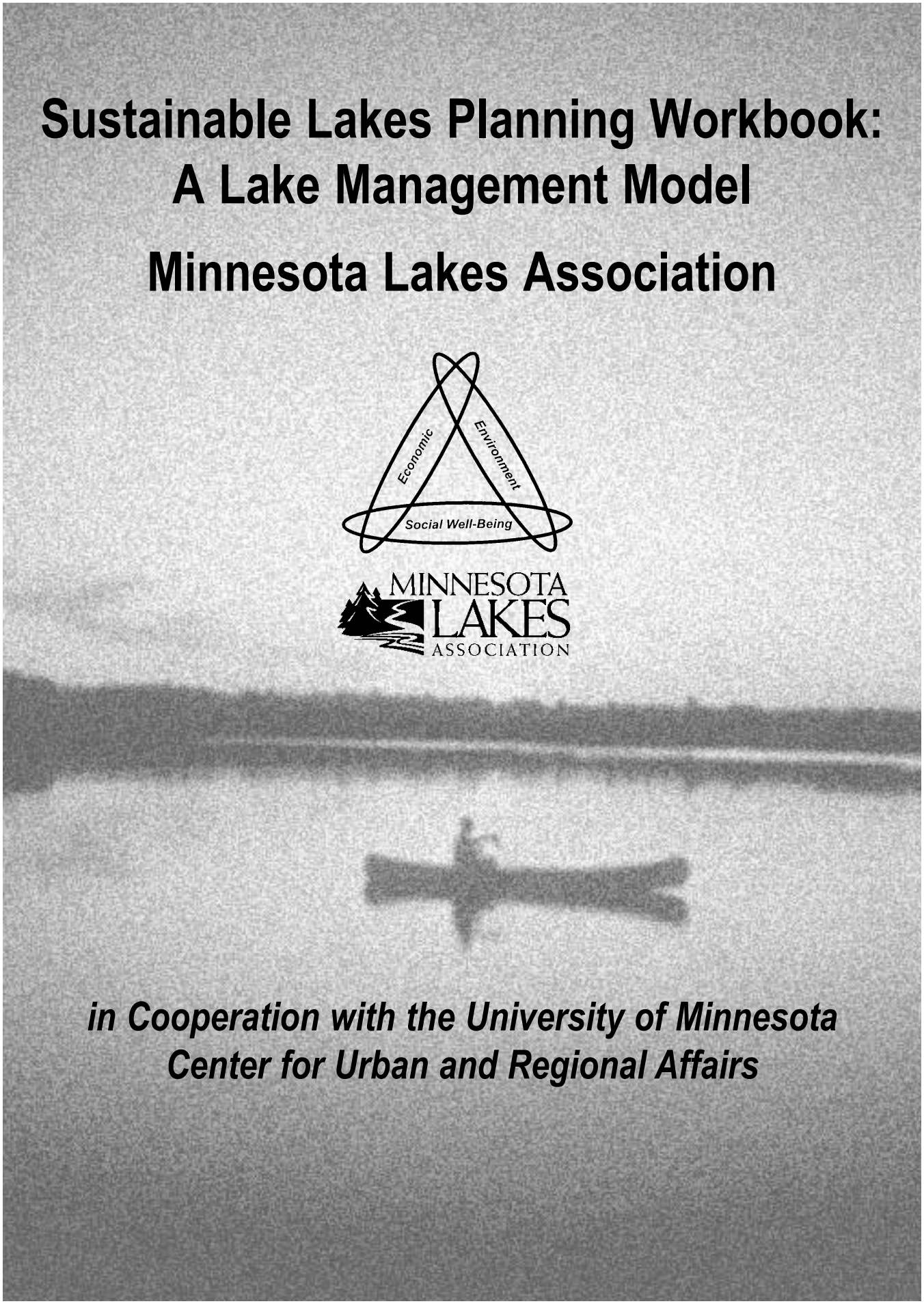
Sustainable Lakes Planning Workbook: A Lake Management Model

Minnesota Lakes Association



in Cooperation with the University of Minnesota Center for Urban and Regional Affairs

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Sustainable Lakes Planning Workbook: A Lake Management Model

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Minnesota Lakes Association in cooperation with the University of Minnesota Center for Urban and Regional Affairs

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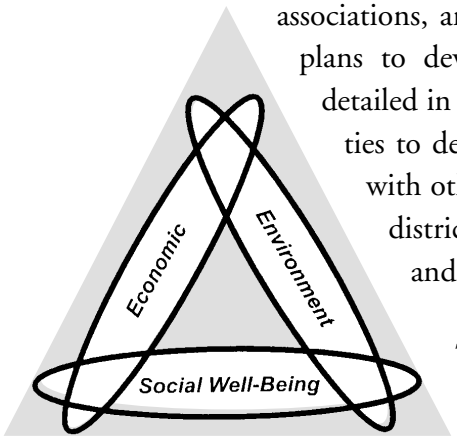
EXECUTIVE SUMMARY

A Charter for Minnesota Lakes

It Shall be Minnesota Public Policy
To Protect, Preserve, and Enhance its Lakes
As Irreplaceable Natural Assets,
Holding Them in Trust for Future Generations,
While Encouraging Responsible Current Use
For Widely Diverse Purposes.
Minnesota Lake Management Forum, 1992

I. Overview of the Sustainable Lakes Project

In 1997, the Legislative Commission on Minnesota Resources (LCMR) awarded the Minnesota Lakes Association (MLA) $270,000 for the purpose of conducting a two-year Sustainable Lakes Project. The goal of the project was to develop comprehensive lake management plans for five pilot lakes, working with their lake associations, and to use the experiences of those associations and their lake plans to develop a Sustainable Lake Management Model. The model detailed in this workbook can be used by lake associations and communities to develop and implement lake management plans in cooperation with other jurisdictions such as watershed districts, lake improvement districts, soil and water conservation districts, county water plans, and state resource agencies.



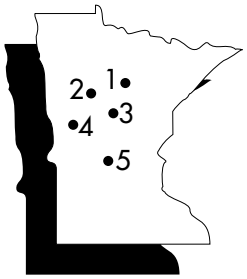
The project was administered by a policy committee of MLA and lake association leaders. The technical review committee was the Interagency Lakes Coordinating Committee (ILCC), formed in 1993 by a memorandum of agreement between the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, the Minnesota Board of Water and Soil Resources, the Minnesota Department of Agriculture, and the Metropolitan Council to improve the coordination of lake management and planning activities of these agencies. The Minnesota Lakes Association has also been an active ad hoc management participant in the ILCC. The ILCC prepared two documents that have helped in preparing lake management plans—the *Lake and Watershed Data Collection Manual* (1994) and

Developing a Lake Management Plan (1996) were written by the cooperative efforts of the agencies involved in the ILCC. This planning workbook was built from these documents and the work of the five pilot lakes.

The project was administered for the Minnesota Lakes Association by the Center for Urban and Regional Affairs (CURA) at the University of Minnesota under the direction of Mr. George Orning.

The Sustainable Lakes Management Model is developed around the general principles of sustainable development, which is a process of analyzing decisions in order to find a balance among environmental protection, economic growth, and the social needs of the people.

Pilot Lakes Chosen



Five Pilot Lakes

1 – Deer Lake
2 – Kabekona Lake
3 – Pine River Watershed (Whitefish Lake Area)
4 – Clitherall Lake
5 – Sugar Lake

From a pool of 40 interested lake associations, five lakes, representing different geographic areas of the state, were chosen to participate in the Sustainable Lakes Management Project beginning in July 1997. The five lakes (and their nearby cities) were Clitherall Lake (Fergus Falls) in Otter Tail County, West Region; Sugar Lake (Clearwater) in Wright County, Metro Fringe Region; Deer Lake (Grand Rapids) in Itasca County, Northeastern Region; Whitefish Chain of Lakes (Crosslake) in Crow Wing County, Central Lakes Region; and Kabekona Lake (Park Rapids) in Hubbard County, North Central Region.

Each pilot lake association was involved in the planning process and committed to a 12 to 15 month process to create a Sustainable Lake Management Plan. The associations helped develop the scope of information to be collected, organized focus groups, and agreed to the responsibility of implementing their plan's goals and objectives. In some cases, they implemented and analyzed a survey of association members.

The Vision for a Sustainable Lakes Management Plan

Each participating lake association developed a vision of what they wanted their lake to look like 20 years from now and what needed to be accomplished to achieve that vision. Each approached the task of developing a lake management plan in a slightly different way. Some processes described in this workbook worked better for some participating lake associations than others, but all the associations shared a common vision of ensuring that the quality of the lake would be sustained for future generations.

A great deal was learned about the process of developing a lake management plan from the experiences of the five pilot lake associations. This workbook is our best estimate of the knowledge gained during the two-year project. Looking back at the project, the vision that evolved and was followed can be expressed by the following three objectives.

- One, to improve development and individual management practices of lakeshore property owners.
- Two, to enhance resource productivity and improve the environmental qualities and aesthetics of each lake and its watershed.
- Three, to enhance the quality of life of each resident in the watershed and visitor to the lake.

II. Sustainable Lakes Management Plan

Drawing from the experiences of the five pilot lake associations, the following is a summary of the Sustainable Lakes Planning model that a lake association can use to develop a lake management plan. Once an initial vision for the planning process is determined, the work of developing a Sustainable Lake Management Plan for a lake can be divided into four phases. Phases One and Two include data collection and analysis. Phases Three and Four use these data to develop goals and an action plan for lake management.

• Phase One: Data Collection

In the first phase, data were identified that could assist lake associations in understanding the economic, social and environmental characteristics of their watershed, lake basin and shoreland management. The data collection phase of the Sustainable Lakes Project lasted roughly six months and was divided into two parts.

The first part was the collection of physical and cultural information about the lake. Using Geographic Information System (GIS) software, data collected on resource characteristics, land use, and public management within each lake's watershed was stored and mapped into a set of 21 resource maps used for modeling and analysis in the second phase of the project. Lake basin data, such as water levels, water quality data, aquatic vegetation maps, and contour maps, were collected from various state agencies, and a database of information on each lakeshore parcel was compiled using county auditor records and visual observations and ratings of shoreland management practices.

Data Collection Approach	Data Collection Tools
1. Physical and Cultural Data on Each Lake	
Watershed Data Land use, irrigation, pasture land/crops, development patterns, soils, groundwater sensitivity, slopes, land ownership, etc.	**Atlas of Watershed Maps** A set of 21 resource maps for each lake
Shoreland Data Development, erosion patterns, buffer strips, septic systems, and lawn management	**Parcel Map/Parcel Database** Database of information on each individual parcel on the lake. The database included county data, plus visual photographs of each property rated for various individual shoreland management practices.
Lake Basin	**Water Quality Data** **Lake Basin Maps** aquatic vegetation depth contours historic water levels
2. Lake Use and Property Owner Concerns on Each Lake	**Property Owner Survey**

The second part of the data collection phase used a property owner survey to obtain quantitative data on the opinions, concerns and demographic characteristics of those who owned property on the lakeshore of each of the pilot lakes.

- ## Phase Two: Analysis of Data

The specific information gathered during the data collection phase, including watershed maps, lake basin data, shoreline information organized by parcel (if available), and input from a lake owners' survey should be used to develop a set of recommended issues for the lake. It is also important to consider any pressing problems that might be affecting the lake, but are not evident from the data, for example, high water levels, feedlot runoff, presence of exotic plants, etc.

- ## Phase Three: Discussion of Findings

It is important to involve lake association leaders, lakeshore property owners, county officials, and other interested stakeholders in the discussion of data findings and recommendations. This information should be examined in the

light of the overarching question, "What do we want the lake to look like in 20 years?" These considerations should lead to action steps to achieve the answer.

Each lake group should prioritize the issues, establish specific management goals, and draft potential solutions that could be incorporated in a sustainable lake management plan. Several of the pilot lakes hired a facilitator to conduct the group process.

The objective of these discussions is to give the lake association information on the lake and surrounding watershed that can be used to create a Sustainable Lake Plan that is unique for the specific lake.

- **Phase Four: Creating the Sustainable Lakes Plan**

The leadership of each lake association took the specific goals and formulated them into a Sustainable Lake Management Plan. Each lake plan included goals, implementation steps, and indicators of success, and each was unique to the environment of the lake. See Appendix C for copies of the five lake plans. Some of the plans were organized around already established committees for the lake association, others developed new committees to address particular sections of their plans.

The pilot plans cover shoreland development, lake uses, water management, and water quality. In addition to creating a framework for managing individual lakes, the plans also create a framework within which major public developments can be planned and prioritized such as sewer districts, parks, road improvements, and public recreational facilities.

III. Unique Characteristics of the Sustainable Lakes Project

Efforts to protect lakes throughout Minnesota, and much of the United States, have been extensive, but have largely suffered from at least one of two distinct shortfalls. One shortfall is a focus on individual issues and piecemeal solutions. Second is the lack of sufficient data to understand the true extent and location of problems that affect lake quality. The Sustainable Lakes Project attempts to address each of these problems in two unique approaches.

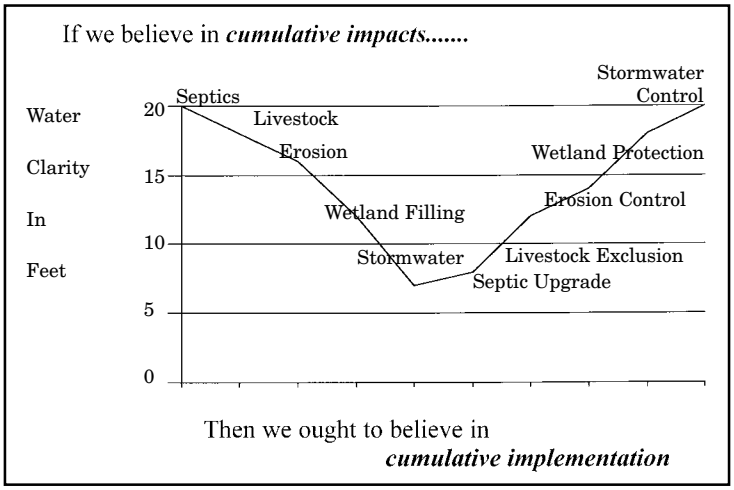
Watershed View of Lake Management

"The Sustainable Lakes Project has a strong emphasis on collecting information that is important to effective lake management, but has never been gathered together in a common database—watershed characteristics, lake basin data, shoreland parcel data and observations, and property owner perceptions."

First, a watershed view takes a holistic view of lake management by addressing the interconnections among particular issues and land uses in the watershed, rather than individual problems.

Second, the Sustainable Lakes Project has a strong emphasis on collecting information that is important to effective lake management, but has never been gathered together in a common database—watershed characteristics, lake basin data, shoreland parcel data and observations, and property owner perceptions. The process allows those involved in lake management an improved understanding of the resources and issues they face on a particular lake, and it gives them the tools for local lake management.

Particularly unique to the Sustainable Lakes Project is its focus on parcel-based lake management. This focus is in response to the cumulative nature of land use impacts on lakes—where it is usually not the actions of one person that negatively affects the lakes, but the combined actions of many individuals around the lake and in the watershed. Thus, in the information collection stage of the project, data were attached to individual parcels, making it possible for planning organizations to better understand how individual parcels in the watershed are affecting lake quality and how to efficiently focus their management efforts.



IV. Recommendations for Improved Lake Management

The Sustainable Lakes Project has shown that lake associations can engage in more informed and effective lake planning efforts than have historically been conducted. Still, there is more that can be done to improve this pilot project to enhance cooperation among state and local governments and local lake managers for improved lake management. These include:

- **Better coordination of lake management among state and local government agencies.** Responsibility for lake management is divided among so many state and local government agencies that it is extremely difficult to organize an effective and comprehensive lake management program among the agencies and citizens.

- **Improved collection of parcel-based data.** Data collected by county and city officials would better serve lake management efforts if it was collected at the parcel level. As lakeshores become more and more urbanized, it is essential that management agencies have better access to detailed information about individual parcels. State permit information, e.g. irrigation well permits, aquatic plant management permits, and others, should be incorporated with county permit and parcel data in county databases for more integrated management, and enforcement, between state and local agencies.

- **A broader scope.** Parcel data should be collected for all properties in a watershed, not just shoreline properties. While it is true that shoreline properties have the greatest impact on lakes, land use practices on other properties in the watershed can have an impact on water quality, too. These include feedlots, poor crop management, cattle grazing along streams or directly in lakes, stream-bank erosion, stormwater runoff, wetland drainage, etc. This will become increasingly important if permanent and seasonal housing development extends to a second and third tier around a lake.

- **More information for lake management.** There are other factors important to lake management to be considered other than those in the Sustainable Lakes Planning model. However, that information is insufficient or not readily available to the public. For example, directions of groundwater or surface water flow and/or impervious surfaces could be mapped to model how a new development would affect drainage patterns and the intensity of possible impact on a lake.

V. Using the Sustainable Lakes Planning Workbook

Funding for the Sustainable Lakes Project ended in June 1999, with the five lake plans nearing completion. The workbook that follows this Executive Summary is a detailed description of each component of the Sustainable Lakes Planning process to help any lake association create a Sustainable Lake Management Plan for their own lake following the project model.

"The fact that Minnesota's lake management structure is decentralized and spread throughout a number of state agencies necessitates that lake associations take on the critical role of coordinating the management of their lakes resources themselves."

It is not assumed that a lake association must use all the data collection components of the model (watershed mapping, lake basin data, property owners' survey, and parcel mapping) to develop a lake management plan. For example, smaller lakes may not need a lake survey if their association meetings are well attended and can be used as a representative forum to identify critical issues and potential solutions. With larger associations, a survey questionnaire may be the best choice for reaching large numbers of property owners to gather statistically valid data about their concerns. Using all data collection components of the model, however, will result in a more comprehensive approach to lake management. Each lake association using this model will have to assess the process, taking into consideration the unique aspects of its membership and association structure.

This workbook will help lake associations manage their lakes by:

- Assisting in the collection of:

    1. Watershed data such as land ownership, erosion susceptibility, pollution sources, development pressures and recreational facilities and opportunities.

    2. Lake basin data, such as aquatic vegetation, historical lake levels, fish populations and surface water recreation use.

    3. Shoreline data, such as beach characteristics, septic suitability, erosion patterns and development characteristics all cataloged in a parcel management database.

- Facilitating the planning process

    1. Using a property owners' survey to determine concerns, perceptions and attitudes.

2. Using stakeholder meetings to involve relevant stakeholders in identifying key issues and solutions to include in the management plan.

- Providing a framework to implement the lake management plan

1. Examples of how other lakes have used this process to develop lake management plans.

2. Parcel data identifies which properties to target information on best management practices.

3. A written plan with timelines and indicators to measure success.

Lake Associations Must Take on a Stronger Role in the Management of Lake Resources

Because the role of lake associations in managing lakes is becoming of more importance, the Sustainable Lakes Management Model is a critical tool for the statewide management of Minnesota's lakes. Increasing levels of development and use of lake resources increases the need for a long-term commitment from each lake association to the management of the lake and associated watershed, including the development of clear goals for watershed and shoreline development, water surface use management, and fishery management.

"Increasing levels of development and use of lake resources increases the need for a long-term commitment from each lake association to the management of the lake and associated watershed, including the development of clear goals for watershed and shoreline development, water surface use management, and fishery management."

The fact that Minnesota's lake management authority is spread throughout a number of state and local agencies, and special jurisdictions with no centralized control, necessitates that lake associations take on the critical role of promoting and coordinating management that will sustain the lake resource. At the same time, state agencies and local governments must be open to cooperation with private organizations, such as lake associations. A strong partnership is needed between lake associations, local government, state agencies and other interest groups if Minnesota lakes are to be managed effectively for future generations of people to enjoy the present benefits.

A living document

This workbook is intended to be a living and flexible document. Because the environmental, social and economic aspects of Minnesota's lakes are so diverse, it is

unlikely that any workbook can provide all of the information needed to address those aspects. As this workbook is put into practice by lake associations and other groups, it is likely that changes and adaptations will need to be made and additional examples added.

It is the hope of the staff of the Sustainable Lakes Project and members of the Minnesota Lakes Association that this workbook will become an invaluable tool for those interested in protecting Minnesota's lakes.

INTRODUCTION

"The public interest requires doing today those things that men of intelligence and goodwill would wish, five or ten years hence, had been done."

—Edmund Burke

Getting Started

"The purpose of this workbook is to provide a model for writing and implementing a lake management plan to maintain and improve the quality of any lake."

The decision to create a lake management plan represents a challenging, yet enormously rewarding, task for a lake association or other group interested in the management of a particular lake or watershed. Not only does it require time and energy to learn about the different issues that affect the lake, it also requires taking the information and knowledge learned and transforming it into lake management actions. While this effort is an admittedly ambitious undertaking, it is also necessary to sustain the lake quality and characteristics that make it such an attractive place to live. The purpose of this workbook is to provide a model for writing and implementing a lake management plan to maintain and improve the quality of any lake.

The Sustainable Lake Planning Model presented in this workbook grew out of the efforts of five lake associations in Minnesota through a grant to the Minnesota Lakes Association from the Legislative Commission on Minnesota Resources. The project was conducted with the cooperation of the University of Minnesota's Center for Urban and Regional Affairs, the Minnesota Department of Natural Resources, the Science Museum of Minnesota, St. Thomas University, the local governments of the five counties where the pilot lakes are located, and others.

While it is important to address each of the steps in this workbook during the planning process, the order of steps should not be constraining. The individual characteristics of a particular watershed or lake community may be better addressed by conducting the data collection in a different order, working on multiple steps at the same time through different committees, or refining the steps in some other way suitable to the structure of your organization. Resist the urge to skip a step unless it is obviously

not necessary for the unique lake situation. While following each step can often be time-consuming, the quality of the resulting management plan and its likelihood of success will increase significantly by investing the time to make the process work.

Planning Steps

The following is a recommended process for lake associations to create a unique lake management plan. The steps are general enough to cover the scope of topics that need to be addressed for a comprehensive lake management plan, but also flexible enough to be tailored to the unique needs of a specific lake and its community.

1. Initiating Support for the Planning Process

- Commit to the lake management plan
  Can the lead organization and community stakeholders commit the time and energy to develop, implement and sustain a management plan?

- Identify and involve stakeholder interests
  Who are the community stakeholders—people who will be directly and indirectly affected by your efforts to manage the lake—and what are their self-interests?

- Choose a planning method
  Will you involve the various stakeholder interests directly or indirectly? Do you want to create a steering committee to spearhead the planning process?

2. Data Collection and Information Gathering

- Develop a case history of the lake with available data and anecdotal information from those who have lived on the lake for many years.
  How has the lake changed? Perceptually and trends in the data? This can be the basis later for establishing lake management goals.

- Create watershed maps
  These maps should show the major features of your watershed.

- Create a parcel-based database
  Creating a parcel-based database will help your association to determine where management efforts are best focused and where to monitor aspects such as septic system upkeep, lawn management, erosion control.

- Collect water quality and lake basin data
  Where are areas of sensitive fish habitat? Where is aquatic vegetation? Where are the historical high and low water marks? What water quality data are available?

- Conduct a property owners' survey
  What are the major concerns of property owners on the lake and in the watershed? What do property owners see as potential solutions?

3. Planning Your Lake Management Actions

- Identify issues and concerns
  The data and information collected will indicate what issues are affecting the quality of your lake. How do various issues connect with each other? How do they conflict with each other?

- Develop a vision for the future
  What do you want the lake to look like in 20 years?

- Determine your management goals
  What needs to be accomplished to achieve your vision? Which of these goals are short-term and which are long-term?

- Create action steps you will take to meet your goals
  Be specific. What steps are you going to take this year to work toward your goals? In two years? In five years? How long will each step take and who's going to be responsible?

4. Evaluating and Updating Your Plan

- Regularly evaluate progress in meeting the lake management goals
  Are you achieving what you set out to do? How will you determine success or failure? Where do you need to focus more energy?

- Update the plan as necessary to meet new challenges
  What new issues or challenges have arisen since your plan was developed? Do your current goals address these challenges or do you need to refocus?

CHAPTER ONE: INITIATING SUPPORT FOR THE PLANNING PROCESS

Commit to the Lake Management Plan

Many efforts at long-range planning have failed due to a lack of commitment. They usually begin with a lot of energy and slowly fizzle out as people become frustrated with a perceived lack of progress, money runs out, key leaders leave, or it takes longer than expected. All of these are normal parts of a planning process that deals with challenging, long-term issues. Having the strength and commitment to work through them is essential to the success of your planning efforts. Everyone involved has to feel that they have both a self-interest and a responsibility to invest the time and energy in developing an effective plan. They need to feel that the alternative—allowing current trends to continue—is an option that will lead to decreased water quality, poor fishing, less vibrant business opportunities, and a gradual destruction of the quality of life that made you want to be on the lake in the first place.

"...planning is a process not only in developing a lake management plan, but also largely an exercise in building a commitment to protecting and enhancing the lake collaboratively."

Developing a community-wide commitment may take some time and will be an ongoing process; it's not something that can be forced upon someone or created overnight. When you begin to build this commitment, start by ensuring that you have a core of individuals and/or organizations that are willing to start the process rolling and reasonably committed to seeing it finished. Set a realistic time frame from the beginning. Depending on your individual community, this could take as short as a few months or as long as a few years. It will be this core group's responsibility to decide when a sufficient commitment has been met—when enough people feel that allowing things to continue as they have is no longer an option.

In some cases, this commitment might grow out of shared concerns among the various stakeholders or other factors at work that the lake association can benefit from or participate in. For example, Deer Lake Association participated in the development of a County Land Use Plan for Itasca County. Among other things, this plan seeks to maintain and improve the quality of lakeshore property. The Deer Lake Plan is consistent with the objectives of the County Plan, thereby ensuring that its recommended actions will be supported by County ordinances and codes.

Moving Ahead

Once your group has decided there is a sufficient commitment from the community (lake community or broader), move ahead with the process. Those who remain reluctant to join in the effort may decide to join later when they see progress is being made and feel assured that the effort will continue. If they see that there is a significant commitment from other members of the community, and realize that their viewpoints need to be heard, it is likely that you will soon have them on board. It is important to remember that planning is a process, not only in developing a lake management plan, but also largely an exercise in building a commitment to protecting and enhancing the lake collaboratively among those who own property on the lake or have an interest in the lake.

Identify and Involve Stakeholders

To start, you will first need to identify those who will be actively involved in the planning process. As the organization initiating the planning, it is your responsibility to ensure that all the key players who will be affected by the management plan are involved in its creation. Another name for these key players is "stakeholders."

A stakeholder can be defined as an individual, organization, government agency, or anyone else that would be significantly affected by what happens on the lake and in its watershed. When you open up the process to the key stakeholders in your community, you'll gain legitimacy in your effort and increase the community's ownership of the lake management plan. This can be the difference between a plan that sits on the shelf or one that is implemented and supported throughout the community.

"... the lake association's role in the process of developing a sustainable lake management plan is to act as a facilitator to actively involve the many diverse interests in the community and develop a plan together."

Developing a sustainable lake management plan—a plan that will be used and adapted over time—means that the whole community needs to have the commitment and determination to actively protect the lake and its surrounding watershed. In this sense, the lake association's role in the process of developing a sustainable lake management plan is to act as a facilitator to actively involve the many diverse interests in the community and develop a plan together. In the end, a plan written with active community involvement will be much more effective than a plan written by one organization or person.

Strategies For Recruiting Community Stakeholders

- **Contact key leaders first:** Contact those in the community who are respected and actively involved. By gaining their commitment, it will create legitimacy in your efforts and help bring more stakeholders into the planning process.
- **Create a core group of support:** Network with those who you have gained commitment from, and create a core group that will commit to getting the planning started. The core group should be willing to serve as the initiator of the process to publicize the effort, obtain funds, develop a planning method, etc.
- **Publicize your efforts:** Offer to give talks or presentations to stakeholders that you feel would be interested in what you are doing. Once data has been collected, show them what you have learned from the data to highlight issues of importance to them. Articles in the local newspaper can also help to create interest and inform the community of what you're doing.
- **Keep membership open:** Publicize widely what you are doing, and encourage other community members and organizations to commit to the planning process. Recruit those who would be affected by any management efforts on the lake or watershed—both positively and negatively. Don't forget to include those who stand to benefit or lose indirectly, or those who would not normally get involved in such a collaboration.

The following table and worksheet will help determine key players, in other words, where support lies and where opposition may come from. Knowing this will help you recruit stakeholders for involvement in the planning process. Keep in mind, no matter what you do, not all stakeholders will support you.

Possible Stakeholders in Lake Management

Government

- Local City Officials
- Township Officials
- City Council
- County Commissioners
- County Water Plan
- Planning & Zoning
- Soil & Water Conservation District
- Watershed District
- Lake Improvement District
- County Extension
- Department of Natural Resources
- Department of Health
- Pollution Control Agency
- Department of Agriculture
- Board of Water & Soil Resources

Business

- Chamber of Commerce
- Resort Owners
- Sporting Goods Stores
- Recreational Rental
- Farmers
- Tourism Businesses
- Bait shops
- Wood Products Manufacturers
- Mining Companies

Special Interest Groups

- County Coalition of Lake Associations
- Statewide and Local Recreational and Sporting Organizations (hunting, fishing, hiking, gardening, boating, birdwatching, etc.)
- Conservation Clubs
- Land Preservation Organizations (The Minnesota Land Trust, The Nature Conservancy, Pheasants Forever, etc.)
- Agricultural Associations, e.g. Farm Bureau, producer groups, irrigator groups, etc.

Stakeholder Identification Worksheet

1. Who is the stakeholder?

2. Are they directly or indirectly affected? How?

3. Why are they important to the success of the lake management plan?

4. What is their self-interest in the lake management plan?

5. What strengths does the stakeholder bring to the planning process? How can they help?

6. What weaknesses does the stakeholder have? How could they be detrimental to the planning process?

7. What is their expected level of support for the lake management plan?
   - ❑ highly supportive (without encouragement)
   - ❑ supportive (with encouragement)
   - ❑ unsupportive (could be swayed)
   - ❑ highly opposed (not likely to change)

Once the stakeholders are identified and their level of support anticipated, assemble them in the following table. Concentrate initial efforts to involve stakeholders identified in the highly supportive and supportive categories. Some stakeholders in the unsupportive category may be swayed, but probably not without much effort. It is important, however, to attempt to involve all stakeholders because even though they may not support the plan, they may not actively oppose it if they have had the opportunity for involvement.

Highly Supportive Stakeholders	Supportive Stakeholders	Unsupportive Stakeholders	Highly Opposed Stakeholders

How to keep momentum for the process going? After successfully recruiting key stakeholders, it is important to keep them committed to the planning process. If the members of the collaboration begin to feel like they are not actively involved or it starts to lose its usefulness to them, their support will not continue. Here are some strategies for avoiding this disintegration.

- **Keep members informed.** If members feel like the collaboration is acting without their knowledge, they are more likely to drop out. Newsletters, frequent discussion meetings and telephone networks can help avoid this communication gap.

- **Recognize and reward members.** Special events, such as boat cruises, picnics, or ceremonies, can help to recognize the work that the collaboration is doing. Since the planning process is long-term, it is important to ensure that members are recognized for the interim work.

- **Don't depend on one leader.** If the leadership is dominated by one or two people who leave for one reason or another, the collaborative can become vulnerable. Relatively diffuse power in your collaboration will increase its ability to withstand the loss of members and setbacks to progress in the planning process.

- **Be clear about your direction.** Serious differences can arise among members if clear direction and goals for the project have not been set.

- **Be flexible.** Since the planning process and its implementation take time, it is likely that new issues and circumstances will arise during the planning process. The ability to adapt to these, while maintaining the original commitment, is essential.

- **Monitor progress.** Keep the big picture in mind. Reinforce the purpose of the collaboration and often point out where you are in the process. This will prevent members from getting lost in the details.

Choose a Planning Method

Once you have obtained the necessary commitment from stakeholders, you will need to choose a method to effectively filter the information that you have, decide what is especially important to address and develop a plan for addressing those issues. When choosing the method, there are several considerations that should be taken into account. These include:

1. **Time:** How much time are you willing and able to commit to planning? Are all stakeholders willing to commit the same amount of time?

2. **Money/Resources:** Consider the amount of money and other support that you have when deciding how extensive your planning should be. Are there grant resources or local water planning monies to assist?

3. **Sense of community:** Does the community have a history of working collaboratively to address its problems? Or, are there deep divisions within the community which make it difficult to work collaboratively?

The answers that you come up with to these questions will help you to determine the level of stakeholder involvement that you are willing and able to take on. The more stakeholders involved, the more time, money, and patience that you will need. The benefits, however, can be tremendous. With less involvement, you will be able to develop a plan much more quickly and at a lower cost. However, with fewer people come fewer ideas and less ownership in the plan. Implementation of the plan may be slower, and it may be longer before the plan's goals are achieved.

The following list describes various planning methods. Consider the answers that you have given to the planning considerations when deciding which method is most suitable to your situation. Those methods with the highest level of stakeholder involvement are given first, with each successive method involving fewer stakeholders.

- **Direct involvement.** Key stakeholders will be directly involved in the development of the lake management plan. Typically, this means creating a committee or work group structure where each stakeholder has equal representation and decisions are made collaboratively.

- **Indirect community input.** As an alternative to direct involvement of key stakeholders because of time, money or commitment, a good alternative is to ask them for their thoughts, opinions and concerns indirectly. This could take the form of surveys, focus groups, presentations to community organizations or various other methods.

- **Stakeholder role-playing.** With this method, the organization writing the plan assigns its members to take the role of an important stakeholder so that their views and concerns will be addressed in the lake management plan. In playing the role, be objective about the concerns of the stakeholder.

- **No community input.** Finally, a last option could be for a single organization to write the plan entirely from its own perspective. While this is probably the quickest and cheapest method, implementing the plan will be much more difficult without the support and involvement of others in the community.

Set an Initial Vision

All of the lake associations in the pilot project had a broad vision of what they wanted their lake to look like in 20 years. If your lake association doesn't have such a broad vision for the future, now is the time to establish one. This vision will help your association in setting short- and long-term goals and a more defined vision further along in the planning process. This initial vision may be nothing more than to maintain water quality at its present level, or to improve the lake's fisheries or manage water surface use for fewer conflicts. Look back at the reason the association was originally formed—it usually has to do with an issue—or look at the reasons the lake association decided to embark on the planning journey.

Developing the Plan

The following chapters will detail the two primary phases of developing and implementing a Sustainable Lake Management Plan. The first phase is the collection and analysis of data, and the second phase is the transfer of that data into specific visions, goals, and a plan of action.

In the data collection and analysis phase:

1. Information is gathered about the physical, economic and social characteristics of the lake's watershed.

2. Water quality, recreational use, resource data, and historical information about the specific lake basin are assembled from previous monitoring records, state resources, and long-time residents.

3. A database of information about management practices on each parcel of land around the lake is generated from county data and visual observations.

4. The lake users are surveyed about their perceptions of the lake, critical issues, and possible solutions.

5. All data are analyzed to identify commonalties between perceptual data and real data.

In the planning phase, the data gathered and analyzed is presented to the stakeholders to:

1. Develop a vision for lake management.

2. Define the critical issues and possible solutions.

3. Set specific short-term and long-term goals that relate to the vision.

4. Establish an action plan, with implementation goals, timelines and indicators of success.

5. Implement and monitor the plan, and update it as necessary.

CHAPTER TWO: WATERSHED MAPS

The Lake-Watershed Connection [i]

In the simplest terms, a watershed is the area of land that drains into a lake or river and is essentially the boundary in which lake management practices are conducted. The water quality of a lake depends largely on the conditions and dynamics of the watershed. Every watershed is unique and several factors interact to define a lake basin's characteristics. It is important to learn about the watershed when producing a lake management plan.

One of the very first steps in lake management planning is to understand the relative size and characteristics of the watershed. *The Minnesota Lake and Watershed Data Collection Manual* * (1994, Interagency Lakes Coordinating Committee) provides information on watershed delineation. A watershed can be from 10 to 100 square miles. Watersheds can often be broken down into sub-watersheds from 1 to 10 square miles. Most local watershed planning is done at the sub-watershed and watershed level.

The hydrology of a watershed is defined as the route the precipitation takes on its way to the lake. Some precipitation will fall directly on the lake surface, some will runoff the adjacent land surface into the lake and some infiltrates into the land surface recharging the groundwater. As water flows over the surface of the land or beneath the ground, it can pick up nutrients, minerals and organic matter and deliver them to the lake where they will influence the lake's characteristics. A basic understanding of the watershed's hydrology is important to lake management because modifications in the watershed, such as farming, development, draining of wetlands and the loss of forests can increase how much and how fast water reaches the lake.

Many factors influence watershed hydrology, including precipitation, soils and the use of the land. Layers of sand, gravel and clay deposited by glaciers created the groundwater flow patterns that affect lakes. Depending on the patterns and the climate, a lake may either receive water from or discharge water into the groundwater system.

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*Available from the Minnesota Lakes Association, 800-515-5253.

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i Developing a Lake Management Plan (1996); Interagency Lake Coordinating Committee

Understanding Watershed Soils [ii]

Understanding the soil types found in the watershed is important because they influence surface water runoff, both how much gets to the lake and its quality. Soils in Minnesota fall into two broad groups: mineral and organic. Mineral soils are made up of varying ratios of sand, silt and clay particles. Soils made primarily of sand absorb precipitation quickly and are naturally low in available phosphorous and nitrogen. In contrast, soils made of primarily silt and clay generally have lower absorption rates and are generally high in available phosphorous and nitrogen. Organic soils are made up of more than 50 percent organic materials, such as peat. Generally, they are not subject to erosion by water because of their high water holding capacity.

A basic understanding of soils helps to target watershed protection programs to sites that will maximize available resources. For example, if there are two sub-watersheds of similar size, it may be wise to target soil erosion control practices to the one with a higher percentage of silt and clay, because these soils will have a higher potential to negatively impact the lake.

"The lake's watershed is the boundary in which lake management practices are conducted... the watershed maps define the neighborhood of water impact for each lake."

Why Create Watershed Maps?

Maps are an effective way to gather information about a watershed. Assuming that water quality and land use practices in a lake's watershed are directly related, data are collected on resource characteristics, land use, and public management within the lake's watershed and mapped for later analysis and comparison to other data.

In the Sustainable Lakes Project, the Minnesota Department of Natural Resources, a leader in geographic information, supplied a number of data sets to the Sustainable Lakes Project to produce 30 watershed maps useful for lake planning. Some of the maps represented one data source, while others were the result of combining data from various resources.

Watershed maps were created for each pilot lake using the newest Geographic Information Systems (GIS) technology in a joint effort of the University of Minnesota, the St. Thomas University computer laboratory, and the Department of Natural Resources. It was the first integrated and computerized watershed-wide database requiring the cooperation of state agencies, local governments, and higher education institutions.

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ii Developing a Lake Management Plan (1996); Interagency Lake Coordinating Committee

The watershed maps served as a key education tool for several pilot lake associations. The maps defined the neighborhood of water impact for each lake and helped answer questions such as: What goes on in each watershed (e.g. land use activities) that directly impacts the quality of water runoff into the lake and in turn the water quality of the lake? The various maps produced for each lake further defined present and potential water and land use problems that can affect each lake through its watershed. See the four maps at the end of this chapter as examples of some of the watershed maps used in the Sustainable Lakes Project and which can be available to your lake association to gather more information about your watershed.

How to Produce Maps of Your Watershed

An atlas of 21 state-of-the art GIS resource maps for any lake, watershed, or county in Minnesota can be produced at the map laboratory of the new Science Museum of Minnesota in St. Paul. The Minnesota Lakes Association and the Science Museum of Minnesota have collaborated efforts to provide the necessary facilities and materials to produce the maps.

At the Museum's Map Lab there is an automated watershed mapping program that is part of their new watershed mapping display. Staff will guide your group through the production of the most important watershed maps created by the Sustainable Lakes Project. The program allows you to determine which boundaries you want mapped, view the data on the computer screen, and print the maps. Staff is available to produce the maps, but it is recommended that groups visit the map laboratory to observe the process and take part in the educational opportunity. Often other observations are evident, or additional maps may be desired.

The cost for the complete set of 21 maps from the Science Museum of Minnesota is $1,000; smaller map packages are being developed. The complete atlas includes:

- An atlas of 21 resource maps in two sized sets: 17 X 22 inches and 8 1/2 by 11 inches. The specific maps are:

Government Political Boundaries	Forest Cover
Pre-Settlement Vegetation	Soils
Shaded Relief	Septic Tank Suitability
Groundwater Contamination Potential	Slope
Scenically Attractive Areas	Area Roughness
Aerial Photography	Geomorphology
USGS Topography	Public Ownership
Land Use	Water Features

Erosion (runoff) Susceptibility and Water Orientation

Scenically Attractive Private Land Within 1/4 mile of a Road
Scenically Attractive Public Land Within 1/4 Mile of a Road
Scenically Attractive Public Land Over 1/4 Mile of a Road
Possible Agriculture Irrigation Areas on Private Land with less than 8% slope

- Image files of each map (.jpeg format, total of 21) available on CD-ROM. With the files, each group can print out additional maps.

For an additional $500, the atlas of 21 maps will be analyzed by trained GIS consultants and a written set of observations developed for your lake association or organization. For further information, or to schedule a time to use the map lab facilities, contact: Daphne Karypis, 651-221-2590 or dkarypis@smm.org at the Science Museum of Minnesota.

"It is important to identify likely sources of water contamination, potential development sites, recreation opportunities, and public management responsibilities within your watershed to organize administration efforts and focus attention on critical issues within the lake plan."

How to Use the Maps

Once you have obtained your set of resource maps for your lake's watershed, it is time to investigate them to gain a sense of what exists within your planning boundary. The natural attributes, land use, and management practices that occupy the watershed affect both lake quality and the character of the lake community. It is important to identify likely sources of water contamination, potential development sites, recreation opportunities, and public management responsibilities within your watershed to organize administration efforts and focus attention on critical issues within the lake plan.

The maps can be broken down into three categories: resource characteristics, land use, and public management responsibilities.

1. Resource Characteristic Maps

A watershed is an area of land in which all rainfall eventually leaves the area at a common pour point or line (e.g. river or stream); some rainfall evaporates into the atmosphere. The physical properties of a watershed define specific land areas that are most likely to contribute to water contamination. There are particular resource characteristics vulnerable to erosion, runoff, and the pollution of water including soil type, slope, residential development and water features. The resource characteristic maps will help determine likely sources of water contamination.

Resource Characteristic Maps	Description/Use
1. Soils 2. Slope	Soil information is used to produce many of the watershed maps because they have an impact on water contamination through surface runoff and groundwater. Soils differ in size and composition making some soils more water absorbent than others. Sandy soils are relatively large with spaces between sediment particles that allow water to penetrate through at a rapid pace and enter groundwater. Clay soils resist water drainage and are susceptible to surface water runoff, especially when found on steep slopes. Use the *Soils* map to identify the location and type of soils within the watershed and the *Slope* map to recognize steep areas.
3. Erosion (Runoff) Susceptibility and Water Orientation	Residential areas with numerous impervious surfaces (e.g. buildings, concrete slabs) do not absorb water and are susceptible to runoff. This map combines the elements of poorly drained soils, steep slopes, and residential areas to define places most susceptible to erosion and highlights areas near water.
4. Groundwater Sensitive to Contamination	This map ranks areas sensitive to groundwater contamination based on soil type and the water table. Well-drained soils (sands) extending from the surface to the water table and water tables near the surface (wetland areas) are locations where contaminants can easily enter groundwater.
5. Water Features	This map distinguishes wetland areas as lakes, marsh, swamp, and bogs. Wetlands play an important role in controlling groundwater levels and water quality, acting as nutrient absorbers and digesting many nutrients that would otherwise reach lakes. Wetlands also have fish and wildlife habitat, flood control, and open space benefits.
6. Geomorphology	Natural resources are a function of the surrounding geology and geologic processes. Soils and vegetation, for example, are both dependent to varying degrees on the underlying geologic strata and how the landscape is shaped. The *Geomorphology* map provides geomorphic association descriptions of your watershed's landscape to better understand the landforms and processes that form those landforms within your watershed.
7. Area Roughness	The *Area Roughness* map is created by comparing the height of land in contrast to its surroundings and depicts rolling hills as well as steep areas. Both scenic amenities, rolling hills and steep slopes are used in the production of the *Scenically Attractive Areas* map series.
8. Shaded Relief	The *Shaded Relief* map shows accentuated shaded elevation features to help viewers actualize the rise and fall of the land and determine the flow of surface water within watersheds.

2. Land Use Maps

Natural amenities and land composition direct the location of development, recreation, and cultivation (i.e., agriculture and timber harvesting). It is important to realize preferred features for recreation and housing as well as environmental constraints related to such developments. The Land Use maps will help localize present land use activities, project future recreation and development sites, and identify issues for sustainable development.

Land Use Map	Description/Use
9. Land Use	The *Land Use* map presents a visual representation of the land covering the watershed. It is one of the most important maps in the watershed atlas and is used in the production of many other maps. The map breaks down land attributes under eight categories: urban and rural development, cultivated land, hay/pasture/grassland, brushland, forested, water, bog/marsh/fen, and mining. Study this map to increase awareness of the development activities and natural vegetation present within the watershed.
10. Scenically Attractive Areas	Recreation and housing research has identified landscape features most desirable for residential development and recreation sites. The *Scenically Attractive Areas* map combines the top three desired amenities (steep slopes, forested areas, and water bodies) to produce a ranking classification from most to least attractive land areas. The most attractive sites contain all three of the amenity variables while the least attractive sites are void of amenities.
11. Scenically Attractive Private Land Within 1/4 Mile of Any Road (e.g. likely development areas)	This map displays the scenically attractive classification scheme for private land areas within one-quarter mile of any road. This depiction concentrates on areas likely to be developed for residential use due to the proximity of roads and desired amenities.
12. Scenically Attractive Public Land Within 1/4 Mile of Any Road (e.g. potential recreational development)	This map displays the scenically attractive classification scheme for public land areas within one-quarter mile of any road. These are ideal locations for public recreational sites, such as trails and picnic areas. This map can help determine easily accessible and scenically attractive public sites desirable for recreational development.

Land Use Map	Description/Use
13. Scenically Attractive Public Land Over 1/4 Mile From Any Road	This map displays the scenically attractive classification scheme for public land areas over one-quarter mile from any road. Remote public lands require effort to reach and are prime locations for secluded recreational activities such as camping, cross country skiing, and biking. This map can help determine remote, scenically attractive public sites desirable for developing new and expanding existing public recreation locations.
14. Pre-settlement Vegetation	The *Pre-settlement Vegetation* map shows broad patterns of land cover during the 19th century, prior to European settlement based on General Land Office survey records of the time. This map offers a historical sense of the watershed's landscape.
15. Forest Cover	The forested classification from the *Land Use* map is extracted to produce the *Forest Cover* map. Forested areas maintain the scenic character and wildlife population of watersheds. Protecting these areas should be considered when applying sustainable management forest practices.
16. Possible Agricultural Irrigation Areas on Private Land with Less Than 8 Percent Slope	Agriculture activities occur throughout Minnesota and dominate some watersheds. Based on slope and soil type, this map shows private land areas where intense agriculture utilizing irrigation is most likely. Low slopes are required for the placement of irrigation rigs, which are predominantly located on sandy soils that quickly lose moisture due to rapid drainage. The excess water expedites the infiltration of herbicides and pesticides used in crop production through the soil and into groundwater, and irrigation rigs are often located near water bodies.
17. Septic Tank Suitability	This map ranks ground area appropriateness for septic tanks based on soil permeability. Large particle soils disseminate contaminated discharge from septic tanks faster than small particle soils and have the potential to hit groundwater. Septic tanks servicing lakeshore homes are often installed on large grain, sandy soils and threaten lake contamination. Use the *Septic Tank Suitability* map to determine areas prone to septic tank failure and priority areas for septic tank compliance monitoring and mound systems.

Land Use Map	Description/Use
18. USGS Topography	The *USGS Topography* map shows scanned map images of familiar looking maps often referred to as "quad sheets." Basic features such as roads, lakes, streams, urban and forested areas, and elevation contours are present as well as specific site features such as schools and gravel pits. This map helps orient oneself to a particular location.
19. Aerial Photography	The *Aerial Photography* map is a digital picture rendered from a photograph taken from approximately 5,000 feet. Original photographs are manipulated to correct displacement and eliminate terrain relief. This map offers a representative picture of the land area, allowing for a unique perspective and understanding by orienting oneself with a particular land area.

3. Public Management Responsibilities Maps

Federal, state, and local agencies regulate planning efforts that affect various aspects of our everyday lives. Government officials are responsible for many decisions that affect watersheds, regulating both private and publicly owned lands. It is important to recognize those in decision-making positions regarding watershed activities so lake associations or other lake management planning groups may approach them with the issues and concerns of the organization.

Public Management Responsibilities Map	Description/Use
20. Government Political Boundaries	Many management issues affecting the lake community will be addressed by local planning entities. *The Government Political Boundaries* map delineates townships to help you recognize government departments that need to be approached when acting toward goals of the lake management plan.
21. Public Ownership	The *Public Ownership* map displays the state or county government sector responsible for managing public land within the watershed. Public lands are valuable land areas, occupying approximately one-quarter of the state. They provide many benefits such as recreation areas, wildlife preserves, and parks. Public land should be managed, protected, and preserved in the best interest of the public, including lake users.

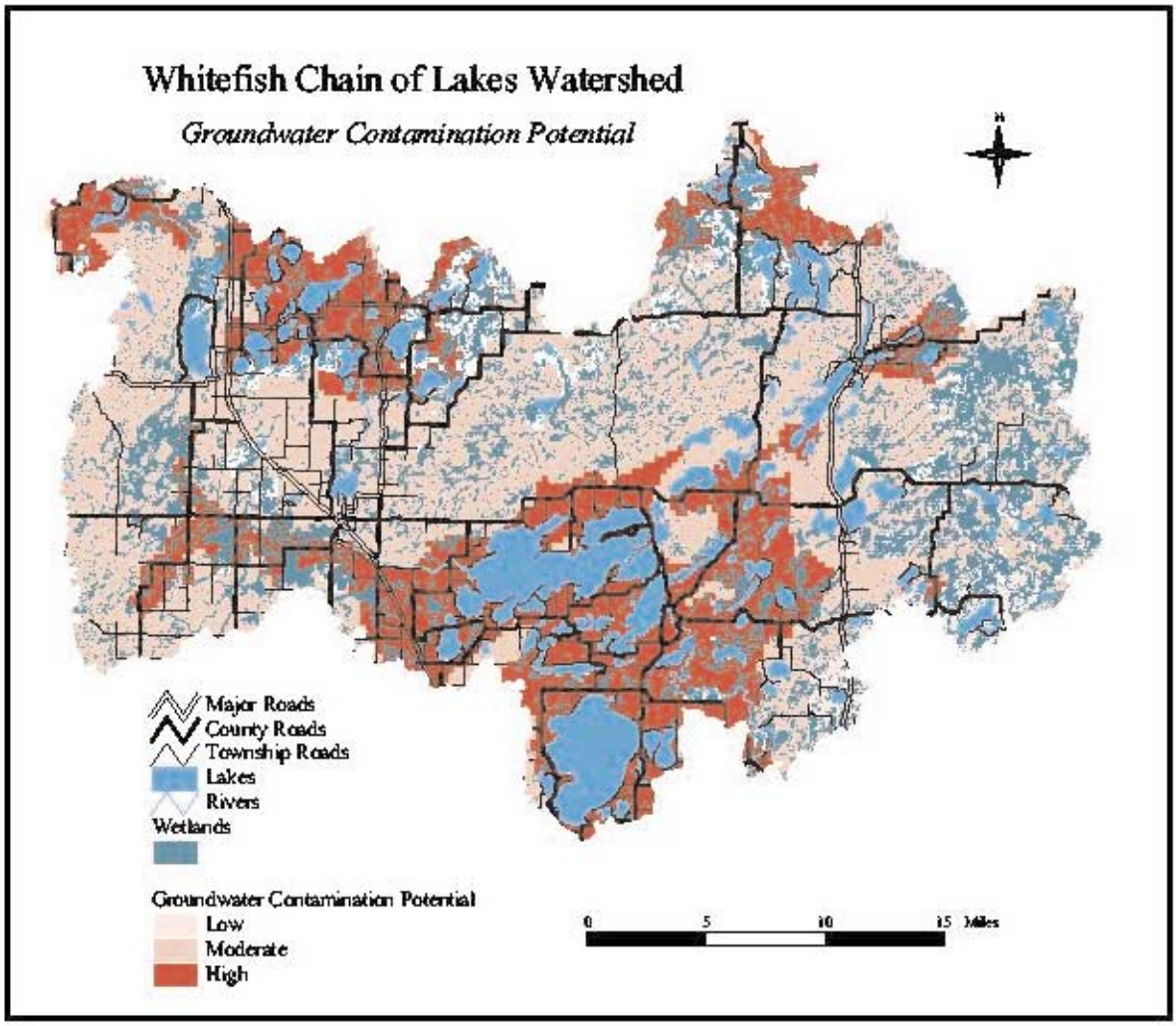
Conclusion on Watershed Maps

" ...watershed maps provide a framework to formulate issues and goals for a Sustainable Lake Management Plan."

The presentation of watershed information supplied in this chapter provides a framework to analyze maps as your organization formulates issues and goals for a Sustainable Lake Management Plan. Each map should be studied in detail to verify concerns you may have and to derive possible new issues and concerns before beginning data analysis, which can be difficult and timely.

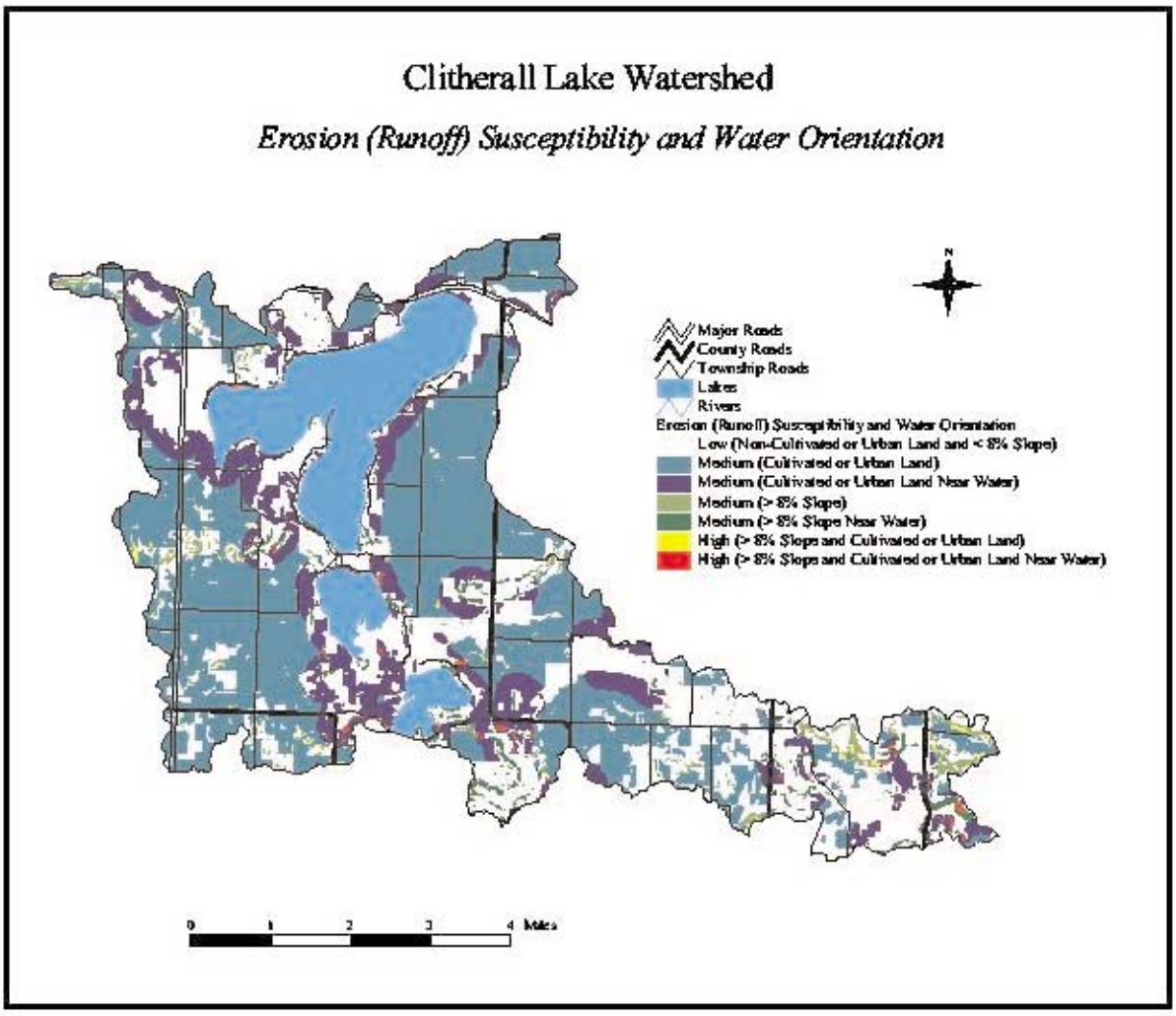
It is not necessary to follow the above framework completely. Each lake association will differ in its approach to watershed analysis because of the unique character of different lake communities. It is up to the planning group to create a comprehensive set of issues unique to your watershed for your personal lake plan. For those associations with the available financial resources, it is highly advisable to have the trained consultants at the Science Museum analyze the maps to develop an accurate assessment of the map atlas and its implications for lake management.

Groundwater Contamination Potential



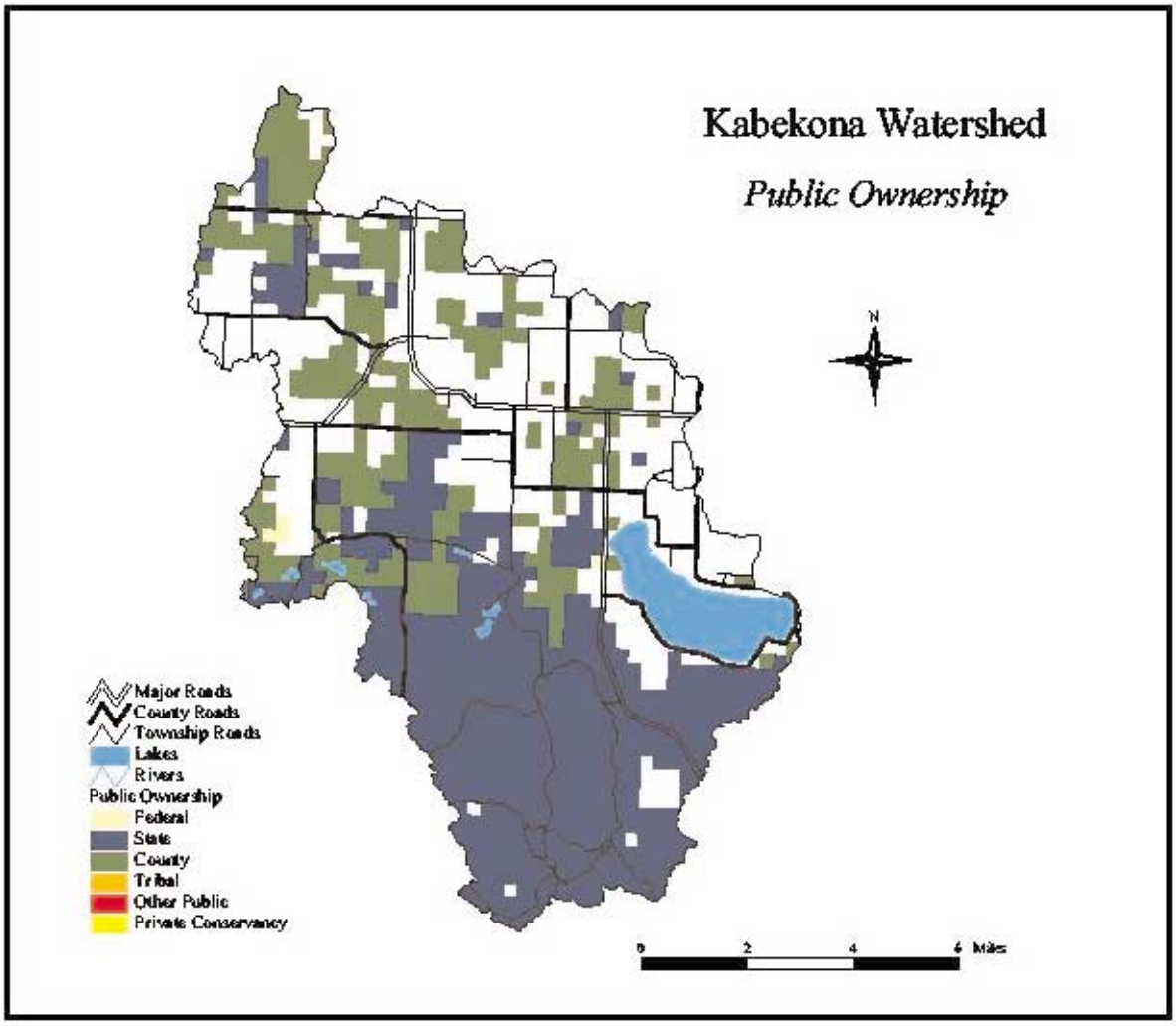
The Whitefish Chain of Lakes Watershed map shows areas susceptible to groundwater contamination. The darker areas on the map correspond to areas in the watershed that are highly susceptible to groundwater contamination. In these areas, there is abundant groundwater and very porous, sandy soils which create no protection between the surface and the water table. These areas also correspond to areas undergoing the most rapid development.

Erosion (Runoff) Susceptibility and Water Orientation



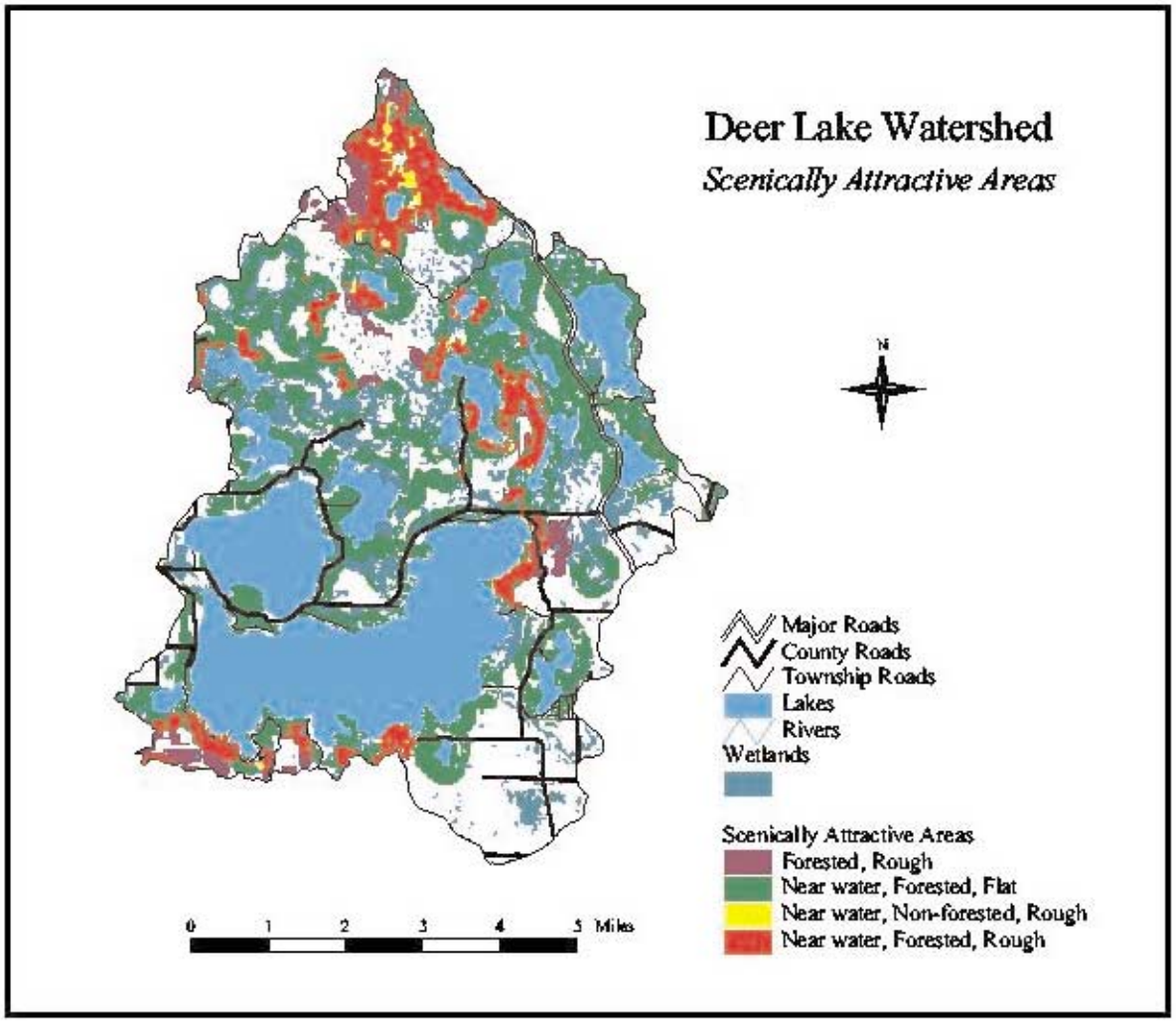
The Erosion Susceptibility and Water Orientation Map shows the areas of the watershed that need to be managed to protect water quality, such as steep slopes in urban or cultivated-use areas near water. This map can direct the association's activities to key areas where zoning or land acquisition to prevent development can be concentrated.

Public Ownership



The Public Ownership map shows areas where public lands management can emphasize water quality outputs, and areas that could be developed for recreation and scenic values to take pressure off the lake, or potential uses for municipal service such as waste disposal.

Scenically Attractive Areas



The scenic amenity map from Deer Lake of hills, trees and waters shows areas most likely to come under development pressures and those areas that have the highest value for land-based outdoor recreation. Lake surveys showed that trails are the most important recreation activity desired by lake residents.

CHAPTER THREE: PARCEL DATA MAPPING

"Gathering parcel data is based on the concept that each individual lakeshore property owner is a mini land use manager and that what happens on their parcel of land is the basic level of lake management."

Gathering information about each property parcel around the lake, and creating a database of this parcel information, is one of the most important steps in the data gathering process and your efforts to protect the lake. Gathering parcel data is based on the concept that each individual lakeshore property owner is a mini land use manager and that what happens on their parcel of land is the basic level of lake management. The collective actions of these mini lake managers can lead to major impacts on lake quality.

On four of the five lakes in the pilot project, a database of information on parcels around the lake was gathered from two sources. First, information about parcels was obtained from county departments such as Management Information Systems, the Assessor's Office, the Planning and Zoning Department, and the Department of Health, including information such as septic system and well information, length of property shoreline, market value, seasonal properties versus homesteads, and parcel identification. Second, each property was photographed from the lake and then the management practices, such as lawn management, septic system suitability, shoreland erosion, grade, etc. were rated. In the pilot project, the rating was done by a resource professional. However, the guidelines for rating are provided further in this chapter and can easily be used by the lake association.

County real estate identification codes were used to identify each property and to build a parcel database using the information gathered. Maintaining a database of information about each parcel, including its physical characteristics, helped the lake associations assess and monitor where intervention for best management practices should be targeted. For example, shoreland education and local enforcement efforts can be targeted to parcels identified with unsuitable soils for septic systems or where lawn care practices or shoreline erosion are likely to impact water quality.

Developing good parcel maps can have many benefits in lake management:

- Monitoring of state regulations and local permits (e.g. septic systems, wells, shoreline and aquatic vegetation alternations) can be improved by linking records of permits issued back to the parcel database using a parcel's real estate identification number.

- Parcel data can be used to develop common sewer maintenance programs, such as lakewide pumping contracts and subsequent tracking of pumping schedules.

- Undeveloped properties that should be preserved and areas suitable for low-density development can be identified.

- Parcel maps can assist in the development of master plans for emergency services, such as fire fighting and 911.

- Better linking of assessor records and a parcel's physical characteristics can lead to more accurate parcel assessment and more wide-spread knowledge of how land assessment values are calculated.

- Lake association programs can be targeted toward parcels which require the most attention.

"Without a database and maps containing information for every parcel, it would be hard to implement practices that would reduce land use impacts to the lake because most problems around the lake are solved one parcel at a time."

Without a database and maps containing information for every parcel, it would be hard to implement practices that would reduce land use impacts to the lake because most problems around the lake are solved one parcel at a time.

Developing the Parcel Database File

SELECTED INFORMATION IN PARCEL DATABASE

- **Parcel ID**
- **Emergency ID (Fire #)**
- **Property owner name and contact info**
- **Property value**
- **Development type (undeveloped, agriculture, seasonal home, permanent home, etc.)**
- **Slope**
- **Suitability of soil for septic systems**
- **Distance of structure from lakeshore**
- **Vegetation cover**
- **Dock type (floating, anchored, roll-in, etc.)**
- **Lawn management type (mowed, natural, etc.)**
- **Boat type(s), if present**

Standard database programs such as Microsoft Access or FileMaker Pro, or even a spreadsheet program such as Microsoft Excel, can be used to read and manage this information. Template databases for the most commonly used database programs are being further developed. For more information on availability, contact the Minnesota Lakes Association at 800-515-5253.

The first step in developing this database is to obtain parcel data and plat maps from the county tax assessor's office. You should be specific about what you want and how you plan to use it. The database components will generally come in two components: a computer file and a set of maps. An example of the computer file's probable contents is shown below.

PARCELID	LASTNAME	FIRST	S	T	R	LOT	BLOCK	ACRES	LANDVAL	BLDVAL	MKTVAL	TAX
14148004004A009	Smith	John	05	137	27	004	004	0.25	19,800	0	19,800	1500
14148004003A009	Johnson	Jack	05	137	27	003	004	1.00	40,000	0	40,000	2158
14148004005A009	Karphyis	Daphne	05	137	27	005	004	40.00	30,000	100,000	130,000	5000

The second component, the plat maps, are one of the most critical components of your database. These maps are your reference to the location of each parcel record in the county's computer file. As such, it should be mentioned that not every county has a good set of current plat maps available.

In some counties, digital versions of the plat maps are available, which could be used in conjunction with a Geographic Information System (GIS). If you are able to access GIS files, these could be useful to you, but they are by no means necessary if paper plat maps are also available.

Most plat maps that you will be provided will have a unique parcel identification number written inside the boundaries of each parcel. (This is also referred to as a "real estate code.") You will find a field in the database that should correspond with those numbers. This will allow you to tie a location on the map to a record in your database.

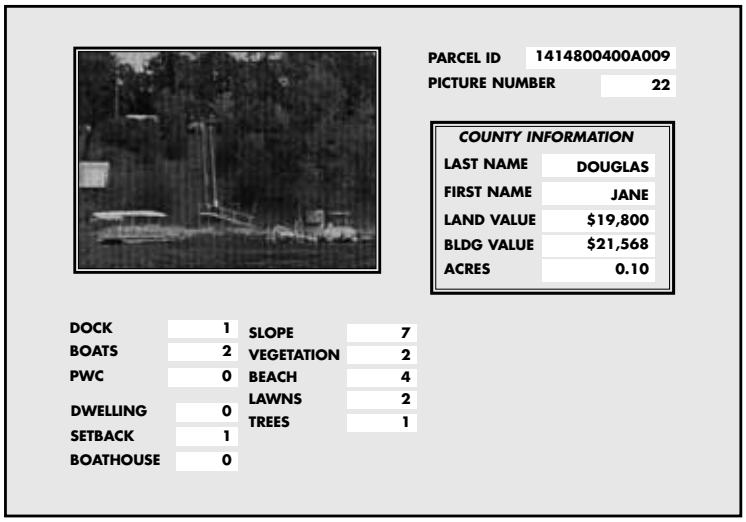
Gathering Your Own Parcel Information

While the information provided by the county can prove very useful, many items important to lake management are not present. Most notably, the county information lacks a description of the natural and man-made features that are found within the boundaries of the parcel. With a little planning and time, this additional information can be gathered by a lake association and incorporated into the information provided by the county.

The most effective means to collect information about the parcels of land surrounding your lake is by spending a day or two photographing each property from the lake. Bring a copy of your plat map along in the boat and record the location of each photograph as you take it. Then, when your film has been developed, you will be able to identify which photographs belong to which parcels in your database. Another effective way to gather this information is with a video camcorder or digital camera. These methods both save film development costs, but some image sharpness is lost.

After the pictures have been taken, you need to decide what information is contained in those pictures that might be important for your lake management practices. It may be helpful to compare information in the photos to the Minnesota Department of Natural Resources' historical permit data for shoreline alterations, such as excavation, shore protection, structures (such as docks or retaining walls), beach sanding and aquatic plant management.

Next is a listing of the standard set of parcel information categories and rating codes developed for the pilot project. You may want to tailor these codes to meet the needs of your specific lake. For example, if a species of aquatic vegetation is at particular risk in your lake, you may want to add a code to indicate the presence of that species in the waters adjacent to the parcel in question.



This is an example of how your database might look after gathering additional data from pictures and combining it with the information you have already obtained from the county tax assessor's office.

Categories for Rating Parcel Photos

Docks
0 - no dock
1 - unadorned dock
(boat lift with no cover allowable)
2 - high profile dock
(boat lift with cover, water slide, etc.)

Boats
Count of number of boats with motors or sails (don't count dinghies or paddle-boats)
Number of PWC

Boathouse
0 - no boat house
1 - shed near waterline
2 - permanent boathouse

Dwelling Setback
0 - no dwelling
1 - over 100 feet
2 - 50 to 100 feet
3 - 0 to 50 feet

Slope
0 - level
1 - gentle slope
2 - steep slope
3 - bluff

Aquatic Vegetation
0 - no aquatic plants
1 - some aquatic plants
2 - many aquatic plants (emergent and submergent)

Beach
Choose one and rate

Natural Beach
1 - wet natural
2 - wet grass/landscaping
3 - sand natural
4 - sand grass/landscaping
5 - gravel grass/landscaping
6 - gravel landscaping

or

Altered Beach
1 - riprap natural
2 - riprap grass/landscaping
3 - rock natural
4 - rock grass/landscaping
5 - wall with natural beyond
6 - wall with natural and landscaping beyond

Slope of Setback Zone
1 - gentle/flat
2 - gentle /flat moderate
3 - gentle/flat steep
4 - moderate gentle/flat
5 - moderate moderate
6 - moderate steep
7 - steep gentle/flat
8 - steep moderate
9 - steep steep

Lawns
1 - all natural
2 - some lawn/some natural
3 - lot entirely mowed

Trees
0 - many trees with underbrush
1 - many trees
2 - a few large trees
3 - no trees

Land Ownership Parcels

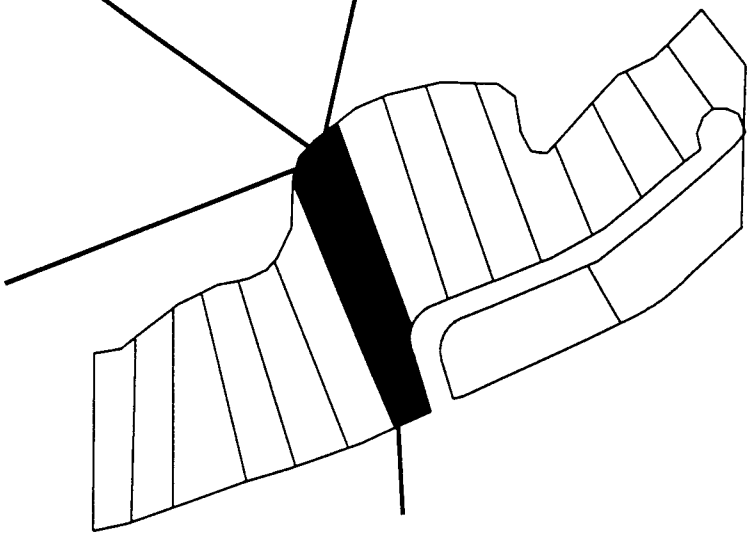
The Key to Local Resource Management

Parcel Photographs

- Beach Description
- Dock Type
- Lawn Management

State Management Information

- Shore Alteration Permits
- Aquatic Vegetation Permits



Local Management Information

- Lot Size
- Waste Disposal System
- Land Value
- Structure Information
  - Value
  - Size
  - Number of Bedrooms
- Well Location
  - Well Type
  - Water Safety
- Amount of Impervious Surface
- Tax Information
- Homestead vs. Non-Homestead

Resource Information

- Aquatic Vegetation
- Shore Drop - Off
- Soil
  - Erodability
  - Waste Disposal
- Slope
- Bluffs
- Trees
  - Size
  - Type
  - Density
- Ground Cover

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Minnesota Lakes Association

CHAPTER FOUR: LAKE BASIN DATA

Gathering specific data about the lake basin itself is the final type of physical and cultural data gathered on each lake for lake management planning. Lake basin data includes depth contour, high/low water maps, aquatic plant inventories, water quality data, and other observations. Since the Sustainable Lakes Management Model is based on land use impacts to water quality, specific water quality monitoring was not part of the modeling process. Rather, water clarity and other water quality data already available on the pilot lakes were used in the overall assessment of lake basin characteristics and land use impacts to water quality.

How is lake basin data used for lake management?

Aquatic plant inventories, when combined with depth contours and water clarity measurements, can help lake associations be better lake managers by knowing where the important aquatic resources are for fisheries and wildlife management. High/low water levels impact real estate development, recreation, aquatic plant growth, and fish habitat.

"Aquatic plan inventories, when combined with depth contours and water clarity measurements, can help lake associations be better lake managers by knowing where the important aquatic resources are for fisheries and wildlife management...

Water quality measurements are an indicator of the impacts of land-based activity on the lake."

Water quality measurements are an indicator of the impacts of land-based activity on the lake. With minimal impacts, the water clarity is typically high. If there is significant inputs of nutrients, such as phosphorus, from lakeshore properties and practices further into the watershed, water clarity is likely to be poor. Water quality monitoring data is an important baseline of data about what the lake is like at the beginning of the management process, and ultimately a tool to measure the effectiveness of the plan and changes in the land use impacts on the lake over time. Specific water quality goals may be incorporated into the plan as an indicator of success. For example, over five years, the goal might be to achieve a 30 percent increase in the summer mean secchi disk reading, e.g. from 9 feet to 12 feet.

Collecting Lake Basin Data

Lake Depth Maps

Understanding the nature of the bottom of your lake is an important first step in managing the natural species that make it home. The depths of the lake identify where fish are likely to live and where aquatic vegetation is likely to grow. These maps also identify important parts of the lake that may be appropriate to demarcate with buoys or signs, or other opportunities, such as an optimal location for a new fish reef.

How do we get a map showing our lake depth?

The Minnesota Department of Natural Resources (DNR) Lake Finder on its web page has digital images of each lake that are available for viewing online or to download. The Lake Finder is a series of pages that provides access to lake survey reports, depth maps, lake data from the Pollution Control Agency, and the Department of Health fish consumption advisory for more than 4,500 lakes and rivers throughout the state. The Lake Finder also features a timely "Lake Notes" section where DNR staff post information about boat accesses, special conditions (e.g. low lake levels), and Section of Fisheries inventory activities.

Go to http://www.dnr.state.mn.us and then click on the "Lake Finder" button. To retrieve the lake map click on "Map" and several choices will be displayed.

You will be able to choose between one or more maps of your lake in either TIFF or PDF format. Both of these formats require a separate program in order to view them and allow you to print a copy of your lake map.

To view PDF files download:
"Adobe Acrobat Viewer" from http://www.adobe.com/

To view TIFF files download:
"Imaging For Windows" at http://www.eastmansoftware.com

If you have a little extra time for this project, you might consider going to a Kinko's, Insty Prints, or a similar business and asking them to help you print some larger copies of the map. Consider making a number of copies of the map so each person in the core planning group has a set of the maps, and the maps can actually be marked up for desirable outcomes. Another way to get a lake depth map, which does not require a computer, is to order them directly from the Minnesota Bookstore at a cost of $5 per map. Call the bookstore at 1-800-657-3757 to order several copies of the map.

Map the Aquatic Vegetation in Your Lake

Aquatic vegetation is important for fish and wildlife habitat and water quality. Aquatic vegetation maps can be useful in a number of ways, such as identifying primary fish spawning and wildlife areas that should be preserved and plant harvesting permits denied, or where to place buoys so boats don't run through loon nesting areas.

Contact your area DNR office (see Appendix A for a listing of area DNR offices) and speak to the area fisheries manager. Explain that you are with a lake association and that you would like the DNR to assist you in mapping the location of critical aquatic vegetation in your lake as part of your comprehensive planning effort. If possible, request to accompany the fisheries staff while they are out on the lake mapping the vegetation. This opportunity can provide significant anecdotal information that would not necessarily be visible on the map.

If your DNR office is not able to assist in preparing this map, you can try to map the lake's vegetation on your own.

1. Take a driver and a copy of your depth map out into the boat with you. Slowly circle the shore marking down the location of emergent vegetation and submerged beds. Do your best to be accurate, but realize that these beds can shift in location over the course of a season, so your map will never capture everything.

2. If you know that underwater vegetation exists in an area but is not visible, mark those areas on the map as well.

3. If you know the differences between the aquatic plants, mark that information on the map. The DNR publishes the *Guide to Aquatic Plant Identification and Management,* which can be obtained at no charge by calling the Ecological Services Section at 651-296-2835.

4. After making the map, you should speak to your area fisheries manager, and ask which areas on your map would be most critical to fish habitat and what techniques can be used to preserve these areas.

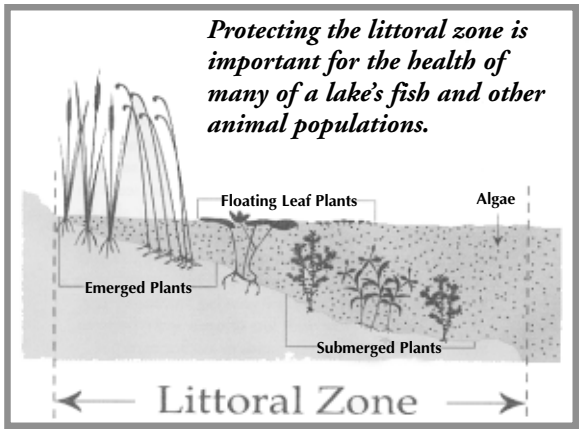
Map the Littoral Area of the Lake

What is the littoral zone?

A littoral zone map is related to the map of aquatic vegetation. The littoral area is the shallow transition zone between dry land and the open water area of the lake. It is the

part of the lake within which light can penetrate to the bottom and therefore aquatic vegetation is able to grow. It is generally defined as less than 15 feet. The clearer the lake, the larger the littoral area.

The littoral zone is a highly productive area of the lake. The shallow water, abundant light, and nutrient-rich sediment provide ideal conditions for plant growth. The aquatic plants, in turn, provide food and habitat for many animals such as fish, frogs, birds, muskrats, turtles, insects and snails. Even if parts of the littoral area are free of vegetation during one year, it might grow there the following year.



Protecting the littoral zone is important for the health of many of a lake's fish and other animal populations.

The depth of a littoral area is variable based on the clarity of the lake and the richness of the underwater soil. The width of the littoral zone often varies within a lake and among lakes. In places where the slope of the lake bottom is steep, the littoral area may be narrow, extending several feet from the shoreline. In contrast, if the lake is shallow and the bottom slopes gradually, the littoral area may extend a hundred or more feet into the lake, or it may even cover the lake entirely.

As a general rule, it is safe to assume that for most Minnesota lakes, the littoral area is the part of the lake that is less than five feet in depth. If your lake is notably murky or clear, you might adjust that definition up or down. Cloudy or stained water, which limits light penetration, many restrict plant growth. In lakes where water clarity is low all summer, aquatic plants will not grow throughout the littoral zone, but will be restricted to the shallow areas near shore. In some Minnesota lakes with high water clarity, the zone can extend as far as a depth of 15 to 20 feet.

Other physical factors influence the distribution of plants within a lake. For example, aquatic plants generally thrive in shallow, calm water protected from heavy wind, wave, or ice action. If the littoral area is exposed to the frequent pounding of waves, plants may be scarce. In a windy location, the bottom may be sand, gravel, or large boulders—none of which provide a good place for plants to take root.

Mapping the littoral zone

Take a brightly colored marker and outline the approximate littoral area on your aquatic vegetation map, using your depth contour map as a reference. Most maps will have a contour line representing five feet in depth. If that contour line isn't present, you may need to guess at its location. For example, if there is only a 10-foot contour line, you could draw a line half way between the shore and the 10-foot mark. Most of

the littoral area will be along the shore, but there may be some isolated areas in the center where the lake is shallow.

Examining the distribution and composition of the plant community in the lake are important considerations in setting lake management goals that affect the shoreline of the lake. Again, check with qualified lake specialists at the DNR area office who can help your committee decide what should or should not be done to alter the shoreline of the lake. You can also contact the Ecological Services Section at the Minnesota Department of Natural Resources by calling toll-free at 800-766-6000. See Appendix A for listing of DNR offices.

Map the Historical Water Levels

Lakes are natural systems and their levels fluctuate over time based on rainfall fluctuations. These fluctuations can change the character of the shoreline (for example, from sandy beach to marsh) and have large impacts on both fish and wildlife populations.

The water levels of most lakes are susceptible to changes in precipitation patterns. It can be valuable, particularly in assessing the viability of new development, to understand how your lake would look if a drought period were encountered, or to understand how your lake would look during flooding resulting from heavy precipitation. It also gives a snapshot of possible changes in amount and location of recreation and vegetation types. For accurate management, lake fluctuations for both high and low water should be taken into account.

High and low water maps can be obtained at the John Borchert Map Library at the University of Minnesota's Wilson Library.

The DNR keeps records of the lake levels of many lakes in Minnesota. Some lakes have records dating back over 100 years. High and low water maps can be obtained at the John Borchert Map Library at the University of Minnesota's Wilson Library. You can ask a DNR officer to review that record with you. Ask them how long the historical record for your lake is, when the lowest recorded level occurred, when the highest level occurred, and most importantly, what the level of the lake was at those times. The level will be reported as 'feet above sea level.' It is important to know the current lake level. The greatest period of drought occurred during the 1930s. If the lake record does not go back that far, the historical low water mark probably does not reflect the most dramatic effect of drought.

Mark the historical low water level on another copy of the lake map.

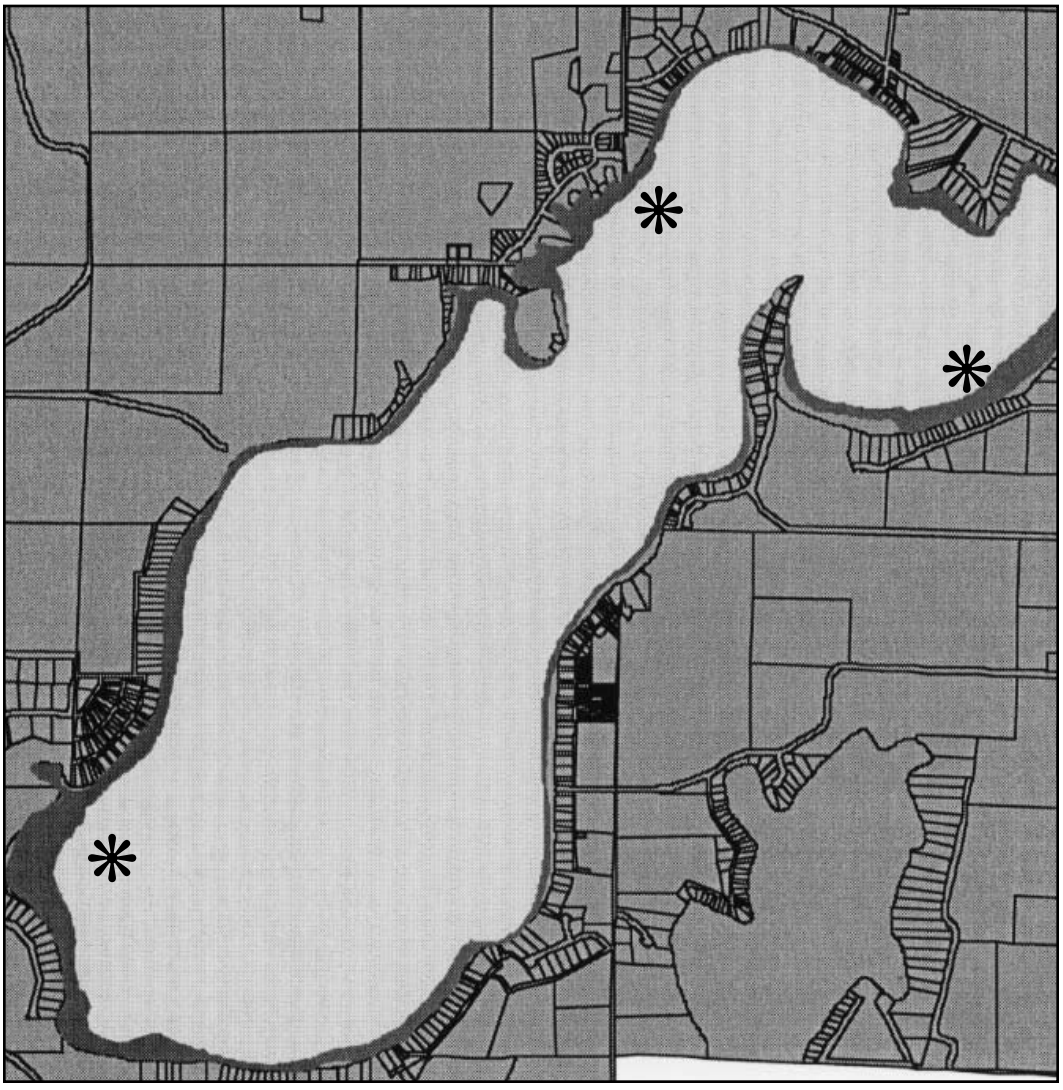
1. First, calculate how many feet into the basin your low water mark is. Subtract the historic low water level from today's water level. For example, today the lake is at

1210 feet above sea level and in 1938 it was at 1199 feet above sea level. Your line should be at 11 feet below the current level.

2. Draw this line on the lake depth map. It's likely you'll have to interpret the location of this line between the existing contours on the map. In the example above, the line would be about 1/5th of the way between the 10-foot contour and the 15-foot contour.

When this map is completed, you'll be able to see that the effects of drought would have an uneven impact on sections of the lake. Some present lakefront properties would loose access to the lake. Recently, high water has also been a problem on some lakes. A map to analyze this impact would be too difficult to prepare appropriately, but visually you can see areas that are more likely to experience erosion impacts from high water.

Sugar Lake Historical Low Water



⁕ **Areas of greatest impact from low water levels.**

Water Quality and Other Observational Data

No new water quality data were gathered on the pilot lakes in the Sustainable Lakes project. Rather, water quality data that already existed was taken into consideration along with the other physical, cultural and lake survey data in determining major issues to address in each lake's management plan.

Many lake associations have ongoing water quality monitoring programs and historical water quality data. Data can also be obtained from other sources. See Appendix D, "Gathering Existing Data" for information on collecting data that is stored by the state. In addition, the county soil and water conservation district may have data or the county may have collected lake data through implementation of the county water plan. Contact the soil and water conservation district manager and/or the county water planner about additional existing data. In the seven-county metropolitan area, the Metropolitan Council has extensive water quality data on area lakes.

For lake associations that are not already annually collecting water quality data, there are several basic water quality parameters that should be measured yearly to predict trends in water quality and quantity over time. These include:

Water Clarity Readings

From *Water Transparency In Minnesota's Fish and Game Lakes,* author Art Peterson, Spec. Pub. 92

Median secchi in fish lakes	
Northern lakes	8.5 feet
Southern lakes	5.5 feet

Average secchi by fish species	
Lake trout	16.1 feet
Walleye	7.8 feet
Panfish	7.8 feet
Algae bloom lakes	< 3.0 feet

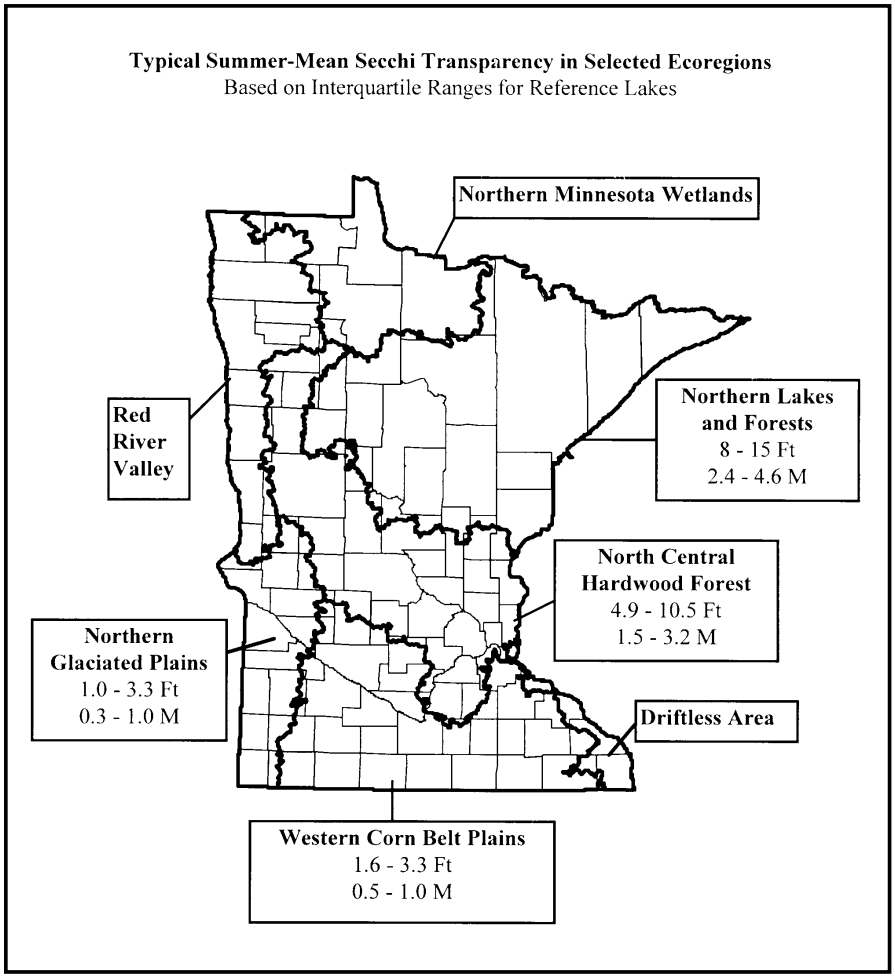
Water clarity is measured using a secchi disc, which is an eight-inch white circular metal plate attached to a rope marked in half-foot intervals. It is lowered into the water and the depth at which it is no longer visible (the disappearance depth) is recorded. It is used to measure water clarity or transparency of a lake and is the simplest and most common index of lake water quality.

Water clarity is influenced by several factors, including the amount of algae, aquatic plants and sediment present, and the natural color of the lake water—all of which interfere with light penetration. Algae blooms produce the most common variation in water clarity. Therefore, the secchi disc reading not only indirectly measures the algal populations in the lake, but is also an index of its aesthetic attractiveness and swimming appeal. The exception is bog-stained lakes that have low secchi values, but no algae problems.

Water transparency varies considerably in Minnesota lakes. In northeastern lakes, a secchi disc may frequently be seen at well over 20 feet. Many southern and western lakes have transparencies of no more than two or three feet for most of the year, while in Central Minnesota, secchi disc readings can average anywhere from four feet to

over 12 feet, depending on surrounding land use and topography. Transparencies can change in a matter of several days because of rapid changes in the algal populations. During a severe algal bloom, readings may drop by several feet, only to return to the average readings when the algae die off. Generally, the greater the summer-mean secchi disc reading for a lake, the better the lake's water quality.

Changes in water clarity can occur not only seasonally, but from year to year because the lake is an ever-changing ecological system. It is important that monitoring be conducted on each lake for a number of years so trends in water clarity can be detected. Tracking and plotting summer mean transparency (secchi) readings of a lake over time is one way to identify patterns or trends in water quality. See Appendix D for lake assessment procedures.

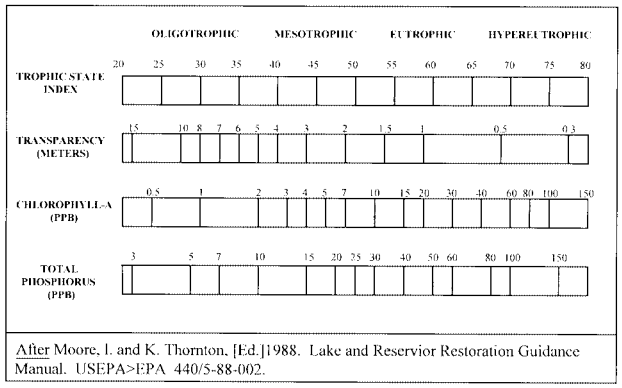


Other water quality measurements that lake associations may collect include dissolved oxygen levels, pH, chlorophyll-a, total phosphorus, nitrates, and turbidity. This additional water chemistry data, in particular, phosphorus and chlorophyll-a, are further indication of the trophic status of the lake. Compare the data for each variable to the Carlson Trophic State Index Scale to establish an interrelationship between the variables and the current trophic status of your lake. Comparing all three variables on the scale will help to confirm this assumption. See Appendix D for information on plotting water quality data and assessing trends.

OLIGOTROPHIC
- Clear water, low productivity
- Very desirable fishery of large game fish

MESOTROPHIC
- Increased production
- Accumulated organic matter
- Occasional algal bloom
- Good fishery

EUTROPHIC
- Very productive
- May experience oxygen depletion
- Rough fish common



After Moore, I. and K. Thornton, [Ed.]1988. Lake and Reservior Restoration Guidance Manual. USEPA>EPA 440/5-88-002.

Figure 2—Carlson Trophic State Index Scale

See Appendix A for water quality programs of the Minnesota Pollution Control Agency that your lake association can participate in to collect water transparency data or for assistance in determining the current water quality status of your lake.

Lake Level Minnesota (LLM)

The water levels of all lakes fluctuate, some lakes more than other lakes. In Minnesota, historic water level fluctuations in excess of 10 vertical feet have been recorded, although fluctuations of two to three feet in any year is typical. Water level fluctuation can be the result of human activities, such as construction or operation of a dam, or acts of nature, such as beaver activity. However, water level fluctuations are commonly the response to short- and long-term changes in precipitation (rain or snow). The amount your lake increases after a rainstorm is an indication not only of how much it rained, but also home much runoff from the watershed enters the lake. Keeping a record of level fluctuations provides data helpful in understanding watershed impacts to lake quality and lake biology.

Knowing the history of the lake level can be of assistance in coping with lake problems such as flooding, drought-related access, vegetation growth or lakeshore erosion.

Lakeshore development and use are often adversely affected by water level fluctuations. Knowing and understanding the history of water level fluctuations on a particular lake can help in coping with these problems.

Historic water level data are useful in developing computer simulations of lake fluctuations. The data are used to estimate flood levels, which in turn are used by local zoning officials to locate building or sewage treatment sites and to establish low floor elevations for new construction.

The data are also used for administration of DNR's public waters permit program and to help determine ordinary and historic high water elevations. Watershed managers and planners use historic lake level data to prepare local water management plans and to model lake water quality characteristics. Lakeshore owners use the data to better understand the impacts of water levels at their property.

The Minnesota Department of Natural Resources has a lake gauge network comprised of approximately 900 permanent and temporary gauge stations to measure the lake level. Twenty-five lakes, known as indicator lakes, are specifically monitored to show general lake level trends. Their levels can be found at: http://solum.soils.umn.edu/research/climatology/doc/llmin.html

If a lake level gauge is not already installed on a permanent structure on your lake, a temporary gauge can be affixed to a board driven into the lake bed or a permanent gauge can be established. Lake gauges should be read once a week, at approximately the same time each week, and within 12-24 hours of a heavy rainfall (more than two inches).

To determine the status and eligibility of your lake, contact:

Bob Potocnik
DNR Division of Waters
500 Lafayette Road
St. Paul, Mn 55155
651-296-4800
bob.potocnik@dnr.state.mn.us

Precipitation (Rainfall) Measurements

Precipitation is ultimately the only source for water in our lakes and in other parts of the hydrologic system. The frequency, intensity and time of year that rainfall or snowmelt events normally occur within a watershed will influence the lake. Precipitation has the ability to detach soil particles (sediment) and transport them to a receiving water body.

The potential for precipitation to cause soil erosion and to transport pollutants to a lake depends on the land use, and on rainfall—when, how much, and how intense it is. Precipitation is very different, depending on where you are in Minnesota. Total precipitation varies from a low of 20 inches/year in northwestern Minnesota to a high of 32 inches/year in southeastern Minnesota. Generally, the potential for raindrops to erode soil and transport the sediment and attached pollutants to a lake is greater in southern and eastern Minnesota than in northern and western Minnesota.

Measuring rainfall is important to better understand the behavior of lakes. Measure the rainfall at the same time each day using a standard rain gauge, located in an area that has a 45 degree clearance of trees and buildings so that the rain will not be intercepted.

Surface Water Temperatures

Most lakes in Minnesota are considered to be warm water lakes—those where the surface temperatures can be expected to rise to 80 F or higher in the summer. However, deep waters of lakes remain cool, about 50 F for the summer. Almost everyone is interested in lake temperatures, including researchers, the media, swimmers and those persons who like to fish.

Surface water temperatures can indicate when the summer swimming season can safely begin. Usually by mid-June, or a bit later, a good share of Minnesota's lakes finally reach a surface temperature of 70 F or more, which is the cut-off point for safe swimming. At temperatures below 70 F, most swimmers can't exercise enough to maintain a normal body temperature. Surface water temperatures can also indicate when the summer swimming season is over.

Surface water temperatures can be a valuable tool for the avid angler, who wants to know when fish are spawning and peak feeding times.

Spawning Temperatures		Peak Feeding Temperatures	
Largemouth bass	62-65 F	Lake trout	50 F
Smallmouth bass	60-63 F	Brook trout	58 F
Walleye	43-63 F	Muskellunge	63 F
(peak before 60)		Northern Pike	66 F
Northern Pike	40-52 F	Smallmouth bass	68 F
Crappie	60-65 F	Yellow perch	68 F
Bluegill	66-70 F	Walleye	69 F
		Bluegill	69 F
		Crappie	71 F
		Largemouth bass	73 F

To get good standard readings of lake temperature, measurements should be made in five feet of water or more. Try to take the surface water temperature in late afternoon, or early evening (for maximum warmth), at least once each week. To take readings, securely tie a rope to a thermometer and hold it about one foot under the surface of the water for several minutes. Read the thermometer immediately.

Other Seasonal Observations

Observations about aquatic events, wildlife sightings, seasonal events, and ecological happenings in or around the lake can provide valuable information for better recreational and resource management of lakes, as well as an understanding and appreciation for your surrounding environment. Keeping track of seasonal events is the science called phenology. It can give us a better understanding of the interdependency of all living things.

Some events to measure include:

- Spring leaf out/peak of fall color. Record the first date when a greenish tinge is noticed in the tops of hardwood trees. For peak of fall color, make observations about species of tree or shrub and record: almost fall peak, at peak, still colorful, gone by.

- Seasonal events such as when the first loon comes north or last loon leaves for the south, the first flower blooms, the hummingbirds return, first frost on the

lawn, last lawn mowing, etc.—any observation that happens on a seasonal basis, including observations of unusual happenings during the summer months.

- Ice out/ice on dates are of interest to everyone that recreationally uses and enjoys Minnesota lakes. Over a period of years, these dates can provide valuable information on changes in climate patterns and are useful for recreational and resource management. Record the date on which at least 90 percent of the lake is free of ice for ice out. Check to see if anyone in the lake association has been keeping historical data on these dates.

- Wildlife observations such as sightings of non-game birds such as swans, eagles, osprey, pelicans, cormorants, etc. and their location.

- Periodic aquatic events, including the dates and location (if applicable) of algae blooms, fish kills, fish spawning areas, and any other unusual sightings. Note any unusual color, odor, or other physical appearance to the lake.

CHAPTER FIVE: CONDUCTING A PROPERTY OWNERS' SURVEY

"Conducting a property owners' survey is an easy and inexpensive research method that can generate needed information from people who really know the lake."

Another important part of the data gathering phase is obtaining background information about problems facing the lake and how the quality of the lake is perceived by those who own property on it. Conducting a property owners' survey is an easy and inexpensive research method that can generate needed information from people who really know the lake. To develop this section, we worked with the University of Minnesota's Cooperative Park Studies Unit.

Why Should Our Lake Association Conduct a Property Owners' Survey?

The three general objectives of a property owners' survey are to describe, explain, and explore information. A property owners' survey can generate this type of information based on property owners' perceptions of problems, demographic data about the property owners, how they use the lake, and the amount of lake use. The survey can also be used to inquire about potential ways property owners think problems should be addressed. The responses to this type of survey can be used to assess which management actions are supported or opposed by the property owners.

Using Sugar Lake in Wright County, one of the pilot lakes in the Sustainable Lakes Project, as an example, here are some key findings that came out of their property owners' survey. These findings were considered by the Sugar Lake Association when they set goals and defined actions for lake management. See highlights of the other pilot lake property owners' surveys in Appendix B.4.

- The survey of property owners on Sugar Lake in Wright County determined that approximately one-third of the shoreline properties were used year-round with approximately 20 percent of those having been converted to year-round use.

  Interpretive Note: This information shows a trend in conversion from seasonal to year-round properties, which means that the septic systems on those properties will be subjected to more intense use pressure.

- On average, septic systems were last upgraded in 1987.

  Interpretive Note: Knowing this might indicate the need to encourage property owners to voluntarily get their systems inspected and their certificate of compliance brought up to date. Using their parcel database, the association can target which properties most likely need to update systems.

- The opportunity to view scenery and obtain solitude was valued very high by property owners.

- Proximity to the Twin Cities was a high factor in the decision to buy property on Sugar Lake. Thirty-two percent of the respondents felt the quality of the lake and lake living was getting worse over the past five years due to motorized recreation, a decline in water quality, the introduction of muskies, and problems associated with shoreland development.

  Interpretative Note: Knowing these are strong concerns of property owners helps the association to set goals in their management plan directed at education, monitoring and enforcement efforts that would eliminate or improve those concerns. Doing another survey in five years and comparing the results of priority issues then versus the current survey is an objective way of measuring the impact of projects and efforts taken to improve concerns.

- Respondents felt that increasing aquatic plant growth and declining water quality due to agricultural runoff were the two most important problems concerning Sugar Lake.

- The three main activities that respondents participated in during the summer were pleasure boating, swimming and fishing.

- Three out of the top-five-supported management actions related to the fishing resource. Respondents support the stocking of game fish and panfish and better control of rough fish. Likewise, the most strongly opposed management action was stocking Sugar Lake with muskies.

  Interpretive Note: This information will be valuable to the association in working with the area DNR fisheries staff to develop a unique fisheries management plan for Sugar Lake.

Conducting a Property Owners' Survey

A property survey should ask specific questions about:

- how the property is used
- identification of management problems and their level of severity
- types of activities that lake users participate in
- perception of the resource condition
- public and private management needs
- user impact

Constructing the Questionnaire

1. *Deciding which questions to ask is the first step in preparing a property owners' survey.*

   To help simplify this process, a survey questionnaire used by Clitherall Lake in Otter Tail County during the Sustainable Lakes Project is included in Appendix B.1; along with an executive summary (Appendix B.2), and a tabulation of results (Appendix B.3). This questionnaire includes questions that generated the essential background information Clitherall Lake Association needed for creating their lake management plan. This example is a good starting point for creating your individual property owners' survey.

   The questionnaire was designed by survey experts at the University of Minnesota's Cooperative Park Studies Unit, and it was successfully used by the five pilot lake associations. Each lake had a different biophysical setting and various uses and users that made each survey unique. Some of the survey questions in the Clitherall survey example may not pertain to your individual lake. For example, your lake's watershed may not contain any agricultural land with intensive agricultural practices. Therefore, your lake association can choose to omit any survey questions related to agricultural practices from the sample survey.

2. *You can modify the survey by adding questions unique to your lake situation.*

   After reviewing the sample questionnaire and deciding which questions do or do not pertain to your lake's unique situation, your lake association can further modify the survey by adding other questions your lake association considers important. For example, Deer Lake Association added questions about the effectiveness of the association. As another example, rather than impacts from agricultural practices, your lake may be located near the urban fringe of a growing city or an area where large feedlots are proposed. Therefore, your lake association may

decide to add questions about commercial development and stormwater runoff or questions related to feedlot concerns in Section 2, Question 7 of the sample questionnaire.

3. *Careful attention must be given to the wording of the questions.*

A considerable amount of research addressing the content of questions has been conducted. Table 1 is a compiled checklist of "do's and don'ts" to consult before adding a question to your individualized property owners' survey.

Table 1: Wording Questions

DO	DON'T
Use simple words	Be vague
Keep it short	Use abbreviations or unconventional words
Be specific, but not too specific	Talk down to respondents
Avoid bias and objectional questions	Assume too much knowledge
Avoid hypothetical questions	Ask leading or threatening questions
Include all possible responses expected	
Keep answer categories mutually exclusive (respondents should not be compelled to select more than one answer)	
Make questions technically accurate	

Sources: *Babbie, E. R. 1973. Survey Research Methods. Wadsworth Publishing Co. Inc.: Belmont,California.*
Bailey, K. D. 1982. Methods of Social Research. Macmillan Publishing Co. Inc: New York.
Dillman, D. A. 1978. Mail and Telephone Surveys: The Total Design Method. John Wiley & Sons, Inc: New York

4. *Decide the format of the questionnaire.*

Once your lake association has decided which questions are appropriate to include in the survey, your organization must decide where to place the questions in the survey and the appearance of the survey booklet.

The ordering of questions should be given much consideration. The easiest types of questions to arrange are ones that easily fall into the question groupings found in the large boxes located in the sample survey (i.e. Appendix B.1 survey questions 7, 13, 14, 16, 17, etc.). For example, you want to assess if property owners feel stormwater runoff or feedlot waste containment is a problem on your lake. Adding this type of question is as easy as adding it to the list of issues in question 7.

Another example is the ease of inquiring about the amount of time residents participated in certain recreational activities. Again, the additional activities can easily be added to the list of winter or summer activities (sample questions 13 and 17).

More time must be taken when adding questions that cannot be easily integrated into the pre-existing questions in the sample survey. The ordering of questions is very important. Researchers have several suggestions regarding the ordering of the individual questions in a survey (Table 2). In addition to the ordering of questions, attention must be given to providing clear directions for responding to any additional questions. Respondents should have clear and concise directions that help them understand how to respond to each type of question.

Table 2: Suggestions for Ordering Questions

1. Ask easy questions first
2. Questions should logically flow
3. Place sensitive and open-ended questions in the survey
4. Group questions by content
5. Order the questions the respondent is most likely to view as useful and important first
6. Vary questions by length and type

Sources: Bailey, K. D. 1982. Methods of Social Research. Macmillan Publishing Co. Inc: New York.
Dillman, D. A. 1978. Mail and Telephone Surveys: The Total Design Method. John Wiley & Sons, Inc: New York

Once the questions are formed and properly ordered in the survey, the format of the questionnaire must be determined. The respondent's initial exposure to the appearance of the survey particularly affects their decision to fill out the questionnaire or to toss it aside.

The survey should:

- Be in a booklet format and printed on quality colored paper (colored paper tends to grab one's attention).
- Not contain any survey questions on the front cover.
- Grab the respondents' attention and make them feel that answering the survey is important.
- Include a title on the cover that communicates the topic of the study and makes the questionnaire sound interesting. A simple graphic illustration is another way to add interest to the cover.
- Contain any necessary instructions and the name and address of your lake association on the cover and any other organizations that are sponsoring the survey.

Preparing the Mailing Materials

Now that the format of the survey is determined, your lake association can prepare the remaining mailing materials. What will be in the mailing?

- A survey booklet
- Cover letter
- Stamped return envelope to the lake association

Cover Letter

The cover letter may be the first portion of the mailing the property owners will inspect. The cover letter introduces the lake planning effort, conveys its benefit and assures confidentiality. It must encourage the respondent to instantly take the questionnaire, fill it out, place it in the return envelope, and mail it back to your lake association. In addition, the cover letter is the only reference document respondents have for answering any questions or reservations they have about filling out the survey. Finally, it should have the name, phone number and other contact information for an association member who can be reached to answer further questions.

To pull the mailing materials together, your association needs to obtain the names and addresses of all the property owners around the lake. If you don't have a current list of property owners, contact your county auditor's office. Often a current list can be purchased from county property records.

To aid in survey tracking and follow up, an identification number needs to be placed on the cover of each property owner's survey booklet. At the same time, your association will need to make a master list of each property owner and their corresponding survey identification number. This number enables your association to track which property owners completed the survey and which ones need to be reminded to complete the survey. Your association must be careful and certain that the name and address label on the mailing envelope correctly corresponds to the identification number located on the survey booklet inside the mailing envelope. Due to the needed confidentiality disclaimer in the cover letter, this number should never be used to tie responses to specific property owners.

Appearance of Mailing

In preparing the outer mailing envelope and the enclosed stamped return envelope, your association needs to decide how much money it wants to invest in the appearance of the mailing.

Example 1. Cover Letter

Your lake association's letterhead should be used to add interest to the letter through color and/or graphics

Name of your association

7/18/98

Clitherall Lake Association, Inc.
P.O. Box 101
Clitherall, MN 56524

Dear Clitherall Lake Property Owner:

Introduce the study and the sponsoring organizations

The Clitherall Lake Association (CLA) is participating in a Sustainable Lakes Planning Project to develop a Lake Management Plan for Clitherall Lake and its surrounding watershed. The plan will consider development, recreational uses, agricultural uses, water quality, and management issues.

Convey that the survey is part of a useful study

As part of the planning process, CLA, in cooperation with the Minnesota Lakes Association and the University of Minnesota, is conducting a Property Owners' Survey to learn how you use Clitherall Lake, concerns you have about the lake, and your opinions concerning potential ways to solve problems.

Let the respondent know that they are important to the success of this study

The questionnaire takes less than 15 minutes to complete. This is your chance to influence decisions about how Clitherall Lake is managed in the future. Information from the survey will also be used to inform public officials about your interests and concerns. You will be informed of the survey results in the *Clitherall Lake Reporter.*

Assure the confidentiality of their response

You are assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only. This is so we can check your name off the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire.

Reference a person to contact for questions

Please return the questionnaire in the enclosed self-addressed, postage paid envelope as soon as possible. I would be happy to answer any questions you may have regarding the questionnaire or the Sustainable Lakes Planning Project. I can be reached at (612) 813-0258.

Make sure that the signature is in a blue colored ink pen

Include the signature from other sponsoring organizations, if wanted and applicable.

Sincerely,

Kit Thiele Searight
President, CLA Board

Sincerely,

George Orning
Director, Sustainable Lakes Project

The outer mailing envelope should include:

- the association's return address and logo (if the association has one),
- the name and address of the property owner, and
- a first-class postage stamp.

  First class postage should be used for handling priority by the U.S. Postal Service and forwarding if the property owner has recently moved. The stamp adds personality and sincerity to the mailing.

The enclosed return envelope should be addressed to the lake association or to a specific association member. Your association can choose to either use a first-class postage stamp or have them printed with a business reply permit.

In addition to mailing out the survey, another option for distribution is to have members of your association hand deliver all or some of the questionnaires. This option saves money, adds to the sincerity of the survey by showing members face-to-face what their lake association is doing for them, and it can be a method to market your lake association to non-members. The drawback is the time it involves and the level of commitment required from association members to deliver the surveys.

Follow-up Mailings

Following-up on the initial mailing is usually necessary and recommended. The response rate your association wishes to achieve and the amount of funding available will determine the number of follow-up mailings. The response rate of your survey can be affected by several factors. The sponsorship, attractiveness, ease, and length of the questionnaire can all factor into the response rate. The nature of the cover letter and the follow-up mailings are additional factors in a good response. It is key to remember that no matter what you do, individual personalities may be a factor in some individual's unwillingness to participate.

One week after the initial mailing is sent, a postcard reminder should be sent to every property owner (Example 2). The purpose of this postcard is to both thank early respondents and to give a friendly reminder for those property owners who have not responded. The reminder should be tied to the initial mailing. Remind the property owners why their response is important, and it should include an offer to send a replacement questionnaire. Instead of following-up in the mail, members of your association can choose to phone property owners in order to convey the follow-up reminder.

Example 2. Postcard Reminder

	Dear Clitherall Lake Property Owner,
Tie to previous mailing	On July 18th, I mailed you a questionnaire about your use of Clitherall Lake, concerns you have about the lake and your opinions concerning ways to solve potential lake problems.
Thank early respondents	If you have already completed and returned this survey to us, we thank you for your time and cooperation.
Why their response is important	It is extremely important that all Clitherall Lake Property Owners return this survey. Clitherall Lake is one out of five lakes in the entire state of Minnesota whose property owners have the opportunity to express their opinions and concerns through the University of Minnesota's Sustainable Lakes Project.
Note how property owners can receive a replacement questionnaire	If by some chance you did not receive the questionnaire, or if it was misplaced, please call me immediately at 218-864-5837 to obtain a Property Owner's Survey.
	Thanks!
	Kit Thiele Searight CLA Board of Directors

A second follow-up should be mailed or hand-delivered three to four weeks after the initial mailing. This mailing should only be sent to non-respondents. The non-respondents can be determined from your master list of names and identification numbers. The person or people in charge of tracking the return surveys should be crossing off property owners' names from the master list as they return their surveys. This second follow-up mailing will contain a cover letter, a replacement questionnaire, and a stamped return envelope. The cover letter should incorporate the same information from the postcard reminder along with a stronger message of how important completing the questionnaire is.

"Strive for obtaining at least a 50 percent response rate for an accurate representation of your property owners' concerns and responses."

A third follow-up can be mailed, or hand-delivered, seven to eight weeks after the initial mailing. The cover letter for this follow-up should be similar to the second follow-up. The follow-up package should contain the cover letter, a replacement questionnaire, and a return envelope. Strive for obtaining at least a 50 percent response rate for an accurate representation of your property owners' concerns and responses. Mailing when seasonal occupancy is high will yield higher returns and a more accurate survey.

Calculating the Survey Response Rate

The response rate is defined as the percentage of property owners who returned their surveys. *Response rate = number of responses/total number of successfully delivered surveys*

For example, the initial mailing was sent to your lake association's most current name and address list of 562 property owners. During the weeks following your initial mailing, 25 undeliverable surveys were returned due to incorrect and outdated addresses. Fortunately, your association located the correct addresses for 5 of these 25 undeliverable surveys. After locating these property owners the total number of successfully delivered surveys is 542 (562 originals – 25 undeliverable + 5 address corrections = 542). Over time, 420 property owners surveys were returned. Therefore, your associations survey response rate would be 77.5% (420/542 = .7749).

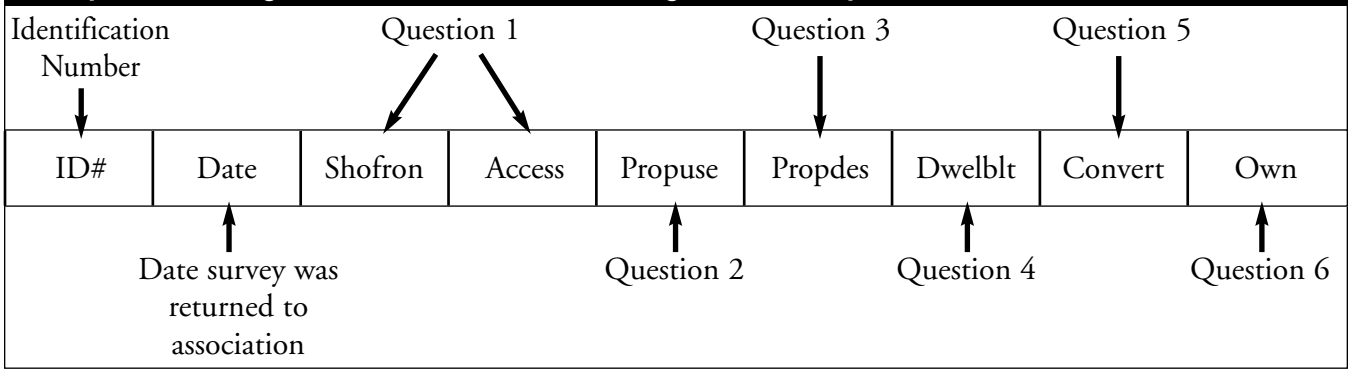
Entering Survey Responses into a Spreadsheet or Database

The next step is to synthesize the data by entering it into a spreadsheet or database. This can be done using common spreadsheet software such as Microsoft Excel, Microsoft Access, or Corel Quattro Pro. Another option is to enter the data directly into a statistics program such as SPSS or Statistix.

Close-ended Questions

Define a column that corresponds to each close-ended question response in the survey. This does not pertain to the open-ended questions. The open-ended questions will need to be analyzed differently than the close-ended questions. The sample survey has over 140 variables and the number of variables will depend on how many questions your association includes in the survey. For ease of the statistical analysis that will occur later on, the descriptive names of each variable should be no longer than eight characters, nor should any two variables have the same name (Example 3).

Example 3. Defining the Variables for the First Page of the Sample Questionnaire



Note that question one has two response variables (shofron and access) that require different columns. Many of the questions in the sample survey and your survey will need multiple columns. (In the Appendix B.1 sample survey, question 7 requires seventeen different columns for the seventeen different variables.)

After your database has all of its variables defined you can begin entering data for the close-ended questions. The majority of the sample questions require the respondent to circle a number (Example 4). These numbers make entering this type of response data quite easy.

Example 4. Sample Survey Question Seven Contains

7. To what extent do you feel each of the following to be a problem on Clitherall Lake? (Circle the number that best describes how serious you find EACH to be.)

Issue	Not a problem	A slight problem	A moderate problem	A serious problem	A very serious problem	Don't know
Overall water quality of Clitherall Lake	1	2	→3	4	5	6
Well contamination	1	→2	3	4	5	6
Lake water pollution due to faulty/substandard septic systems	1	2	3	4	5	6
Lake water pollution due to agricultural runoff	→1	2	3	4	5	6
Lake water pollution due to other factors	1	2	3	4	5	→6
Inadequate public safety (i.e. fire, health, emergency, police/sheriff)	1	→2	3	4	5	6
Inadequate public service (i.e. roads)	→1	2	3	4	5	6
Zoning ordinances are not followed	1	2	→3	4	5	6
Algae growth in Kabekona Lake	→1	2	3	4	5	6
Weed growth in Kabekona Lake	1	2	3	→4	5	6
Improper burning of leaves and brush	→1	2	3	4	5	6

No response

The data from Example 4 is simply entered into the database as a 1, 2, 3, 4, 5, 6, or the cell is left blank if there was not a response. An arrow (→) in example 4 indicates the corresponding response to each variable (Example 5).

Example 5. Data Entry of Responses in Example 4

Overall	Well	Lkss	Lkag	Lkoth	Inadpsaf	Inadpser	Zoning	Algae	Weed	Impropb
3	2		1	6	2	1	3	1	4	1

Respondents may not answer every question so there will be blank cells

Questions that do not require the respondent to circle one number that corresponds to their response take time to prepare before entering into the database. Questions such as the first four on the sample survey (see Example 6) need arbitrary numbers assigned to them. Someone needs to go through the entire survey and assign arbitrary numbers to all of the close-ended questions before they can be entered into the database.

Example 6. Assigning Arbitrary Number to Close-ended Responses

(arrow indicates response)

1. Does this property have shoreline frontage on Clitherall Lake? (check only one response)
   - → ☐ 1. Yes
   - ☐ 2. No

   If no, does the property have access rights to Clitherall Lake?
   - ☐ 1. Yes
   - ☐ 2. No

2. Which statement best describes how your household used this property during the last 12 months? (check one)
   - ☐ 1. Not used at all.
   - → ☐ 2. Year-round use.
   - ☐ 3. Summer use (most or all of the time).
   - ☐ 4. Summer use (mostly on weekends, holidays, vacations).
   - ☐ 5. Spring, summer, fall use (mostly on weekends, holidays, vacations).
   - ☐ 6. Spring, summer, fall, winter use (mostly on weekends, holidays, vacations).
   - ☐ 7. Other. Explain: _____

   Arbitrary Numbers

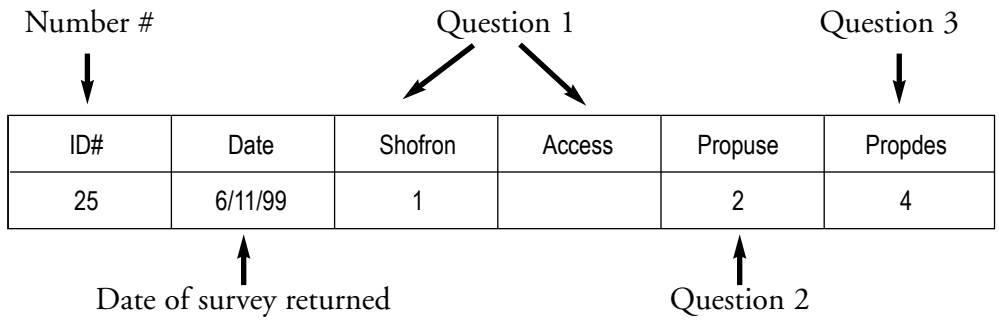
3. Which statement best describes this property? (check one)
   - ☐ 1. There is no permanent dwelling on the property. (Go to Question 7)
   - ☐ 2. The dwelling is suitable for warm weather use only.
   - ☐ 3. The dwelling is suitable for year-round use and was converted from a seasonal dwelling.
   - → ☐ 4. The dwelling was built originally as a year-round structure.
   - ☐ 5. Other. Explain:_____

4. What year was the dwelling originally built? 19____ (Simply enter the year i.e. "1974")

Instead of entering the complete language of the response into the database (i.e. Example 6, Question 2: "year-round use") the data entry person just needs to simply enter "2" into the database (Example 7). Make sure to assign arbitrary numbers to all

close-ended questions without numbers pre-assigned to them on the survey document. In order to be consistent, it is of utmost importance to keep a master copy of all the arbitrary numbers on hand for the various different people who may be entering the data.

Example 7. Data Entry of Responses to Questions in Example 6



Open-ended Questions

Sample Analysis of Deer Lake Survey Question

During the past five years, what is bad or gotten worse?

(214 total survey responses)

Jet skis	**94 responses**
Poorer fishing	**45 responses**
Shoreline alterations	**43 responses**
Boat traffic and size	**32 responses**
Property taxes	**28 responses**

Etc. listed in order of most to least responses.

Open-ended questions require a different type of data entry and analysis. The responses are not entered into a database like the close-ended questions. They require what is termed word-content analysis. This process requires someone to read and categorize the responses to each individual question. A member of the association needs to read the responses and tally the number of times an item is mentioned by the respondents. The number of times an item is mentioned per question is an indication of the strength of the feeling about an item. For example (see Appendix B.1, question 11), 44 people may mention that aquatic plant growth had gotten particularly worse and five people may have mentioned that algae growth had gotten particularly worse. One would conclude from the word content analysis that aquatic plant growth was a more pressing problem than algae growth. Word content analysis needs to be done separately for each open-ended question. Although completing the word content analysis takes a considerable amount of time and energy, an enormous amount of detailed information can be derived from the responses.

Compiling the Data

Once the responses are entered into a database, the next step is to synthesize all of the responses into a format that can be easily understood. The two major statistical cal-

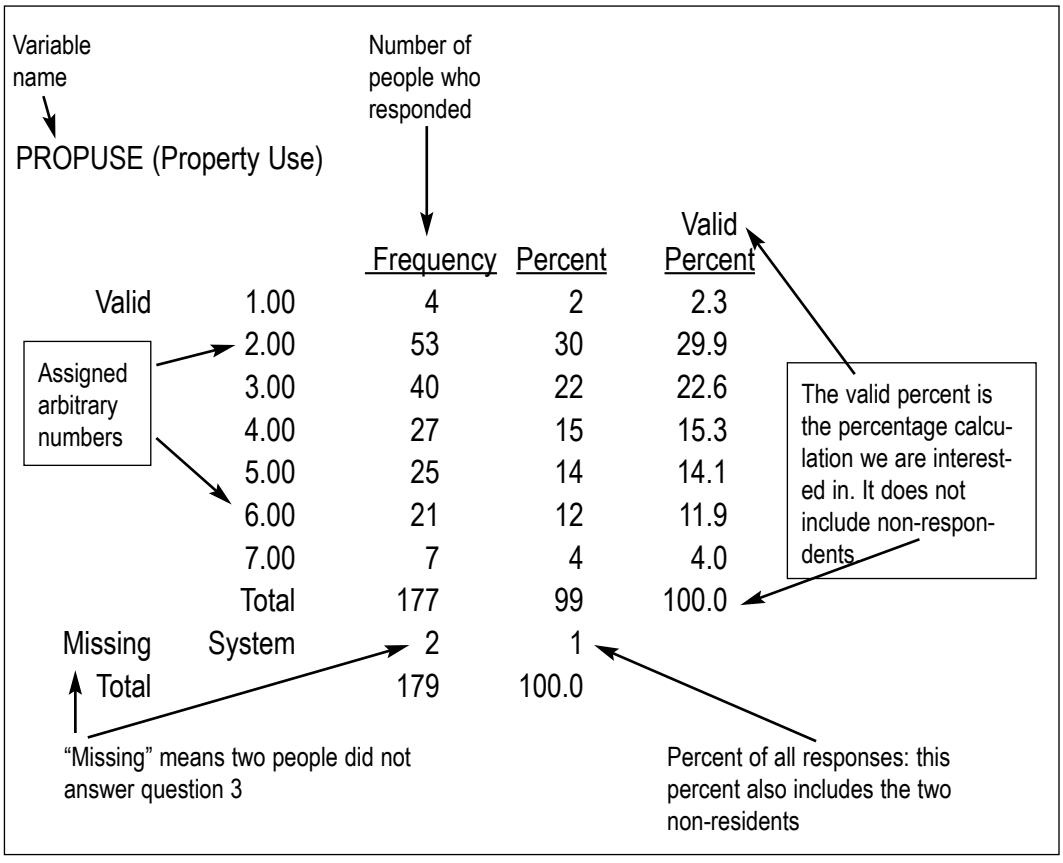
culations needed to accomplish this are the frequency distribution and the mean of each response variable.

Statistical software can accurately and quickly compute the frequency distribution of each variable. The frequency distribution describes the number of people who chose a specific response. The output from a frequency distribution calculation will contain the percent of respondents that chose each possible response for a variable (Example 8).

From Example 8 we can conclude that:

- 177 people responded to question three
- Two people did not respond to question three
- 2.3% of the people do not have a permanent dwelling (arbitrary number one)
- The highest percentage of people (29.6) have properties that are suitable for warm weather (arbitrary number two)

Example 8. Frequency Distribution Output for Question 3 in Example 6



All of the close-ended questions that are not located in the large question boxes (i.e. 7, 13, 14, etc.) simply require the calculation of frequency distributions to easily understand the responses. The questions in the large boxes that contain several vari-

ables require the calculation of the mean in order to understand the responses. These comprehensive questions contain several variables. Each of these variable's frequency distributions will be calculated in the same manner as PROPUSE (see Example 8). The frequency distribution helps analyze each individual variable, but we need to know how the variables in each question box relate to one another. Therefore, calculate the mean or average for each response.

Each of the possible response categories (not a problem, a slight problem) in the large box questions contain numbers that correspond to how much of a problem the respondent feels each variable is (Example 9). Notice how the numbers increase as the problem is viewed as being more serious. By calculating the mean or average of all the responses, one can easily see what the property owner's average feeling towards a problem is. If the variable "well contamination" had a mean of 3.5, then this would indicate that on average the property owners felt that it was a moderate to serious problem. After calculating the means for all of the variables in one question, one can easily see which problems, on average, are considered more problematic than others. If the issue well contamination had a mean of 3.5 and the issue aquatic plant growth had a mean of 2.8, one can easily conclude that on average the property owners consider well contamination to be more problematic than aquatic plant growth.

Example 9. Mean Calculation

Response Categories

A mean of 3.5 indicates the variable is considered a moderate to serious problem

Variables

Issue	Not a problem	A slight problem	A moderate problem	A serious problem	A very serious problem	Don't know
Overall water quality of Kabekona Lake	1	2	3	4	5	6
Well contamination	1	2	3	4	5	6
Lake water pollution due to faulty/substandard septic systems	1	2	3	4	5	6
Lake water pollution due to agricultural runoff	1	2	3	4	5	6
Lake water pollution due to other factors	1	2	3	4	5	6
Inadequate public safety (i.e. fire, health, emergency, police/sheriff)	1	2	3	4	5	6
Inadequate public service (i.e. roads)	1	2	3	4	5	6

IMPORTANT NOTE: Before the statistical software computes the means for the variables, each "Don't Know" response must be changed from a "6" to a blank cell. Selecting the "find" and "replace" function in your database software can easily do this. This is of utmost importance because assigning "6" to the "Don't Know" response

makes the frequency distribution calculation simple, but a value of "6" will increase the number value of the mean. If the "Don't Know" value is not changed, it would represent the same thing as a response category meaning "A very very serious problem."

Presenting the Findings

The presentation of your findings will differ based on who will be using and reading them. A report in a lake association's newsletter would most likely contain just the major highlights of your findings. On the other hand, the members involved in creating the lake management plan will need the most detailed and comprehensive information derived from the survey results.

The easiest method used to summarize the massive amount of information is to organize the frequency distribution percents and means, if applicable, into tables. The tables should be descriptive, clear, and concise (Example 10). Each question should have its own summary table.

Example 10. Analysis Table

Estimate how many days members of a household used Sugar Lake for the following activities this past SUMMER.

Include the complete names of the variables

Include number of responses for each variable (N)

List the variables according to their means. The highest use activity is listed first (Mean 3.47)

Response	N*	0 days	1 to 5 days	6 to 10 days	11 or more days	Mean
Pleasure boating (in motorized boat)	144	6.3	12.5	8.3	72.9	3.5
Swimming	144	5.6	13.2	10.4	70.8	3.5
Fishing from a boat	141	17.0	18.4	17.0	47.5	3.0
Fishing from shore	142	19.0	21.1	20.4	39.4	2.8
Water skiing	135	31.9	18.5	11.1	38.5	2.6
Paddleboating	139	56.8	11.5	7.9	23.7	2.0
Canoeing	138	70.3	16.7	4.3	8.7	1.5
Personal watercraft (Jet skiing)	139	81.3	3.6	2.9	12.2	1.5
Sailboating	137	75.9	15.3	2.2	6.6	1.4
Snorkeling	138	73.9	16.7	5.8	3.6	1.4
Fishing tournaments	137	86.9	13.1	0	0	1.1
Boardsailing	137	91.2	5.8	2.2	0.7	1.1
Waterfowl hunting	137	92.0	4.4	2.9	0.7	1.1
Scuba diving	137	93.4	4.4	1.5	0.7	1.0
Kayaking	137	96.4	2.2	0.7	0.7	1.1

Numbers correspond to the valid derived from the frequency distribution

In addition to using summary tables, findings can be condensed in an executive summary that includes sections such as an introduction, data collection methods, analysis methods, and finally a summary of the overall results (Appendix B.3).

Once the initial analysis is completed, your lake association may chose to compute cross tabulations of the responses to questions. Cross tabulations are tables that contain counts of the number of times various combinations of values of two variables occur. For example, your association may want to count how many seasonal residents support stocking game fish verses how many permanent residents support stocking game fish. Likewise, your association may want to count how many long-term residents (25+ years) felt they were catching too few fish compared to the number of shorter-term residents (1-10 years) who felt the same. Cross tabulations provide for a more detailed analysis of your survey data that is of specific interest to your association. All standard statistics programs should include instructions on computing cross tabulations.

Definitions

Frequency – A count of the number of similar responses.

Frequency Table – A table that tells you how many people (respondents) selected each of the responses to a question. It contains the number and percentage of the people who gave each response, as well as the number of people who did not respond to the question.

Mean – A measure of the center of the data set. Commonly known as the average, the sum of the observations in the set divided by the number of observations.

Number (N) – The number of respondents. Total Ns may vary from table to table because some respondents did not answer every question.

Respondents – Households of property owners on your lake.

Valid Percent - The frequency percent calculation that does not include non-respondents. This is the percent calculation that should be reported in the analysis and findings.

Key Collective Findings of Lakeshore Property Owners' Surveys

Appendix B.2 contains an executive summary of the survey results for Clitherall Lake and Appendix B.3 contains the corresponding analysis tables. Appendix B.4 contains highlights of the property surveys for Whitefish Chain of Lakes in Crow Wing County, Kabekona Lake in Hubbard County, Sugar Lake in Wright County, and Deer Lake in Itasca County.

In the Sustainable Lakes Project, collectively over 5,000 lakeshore property owners on the five pilot lakes were surveyed about their lake use patterns and concerns about their lakes. The collective results of the five surveys indicated the following general findings about property owners' perceptions of lakes in Minnesota.

- The increased amount of motorized recreation on Minnesota's lakes is threatening the peace and solitude valued by many lakeshore property owners.
- Specific problems generated by the use of motorized recreation are noise pollution, unsafe operation of motorized watercraft, and the sheer number of motorized watercraft on the lake on weekends and holidays during the summer.
- Throughout the state, residents strongly support more aggressive enforcement of safety rules and regulations.
- Property owners were concerned about catching too few fish in both the summer and winter. Likewise, residents strongly supported an increase in fisheries management activities such as stocking game fish and controlling rough fish.
- Respondents were concerned about people frequently making improper alternation to their shorelines and not following zoning ordinances.
- Lake pollution was a serious concern on heavily developed lakes. The perceived pollution sources included agricultural runoff, lawn runoff, and substandard or faulty septic systems.
- All of the lakes surveyed have experienced increased aquatic plant growth over the past five years.
- Numerous property owners participated in both land and water-based recreation activities. An increase in the desire for land-based recreation opportunities adjacent to the lake were noted.
- Year-round and seasonal residents had quite similar perceptions of problems and supported the same lake management actions.

CHAPTER SIX: PLANNING YOUR LAKE MANAGEMENT ACTIONS

Once the data collection phase is completed, planning for Sustainable Lake Management includes:

1. Analyzing the data for commonalties between perceptual and real data;

2. Defining critical issues and recommendations for possible solutions;

3. Setting a vision and specific goals that relate to the vision;

4. Establishing an action plan with implementation goals, specific tasks, timelines, and indicators of success; and

5. Monitoring implementation of the plan and regular evaluations to monitor progress towards meeting the established goals.

Analyzing Data

By combining the information from the watershed maps, shoreline information organized by parcel, and public input from the lake user survey, a set of recommended management issues can be developed that each lake association should address.

"...combining the information from the watershed maps, shoreline information organized by parcel, and public input from the lake user survey, a set of recommended management issues can be developed that each lake association should address."

In the pilot Sustainable Lakes Project, the data analysis on each of the five lakes was done by either the project staff or by the leadership of each lake association. On your own, your association can pull together the data and see what observations may be evident. What concerns are expressed by the majority of the property owners responding to the survey? How many lake parcels have conforming septic systems? In the parcel data, are there many parcels that have lawns mowed to the water's edge? etc.

With the watershed maps, compare the resource characteristic maps with the land use maps to see where potential development and recreational use conflicts may occur. For example, the groundwater sensitivity, erosion susceptibility, and soils/slope resource maps may indicate areas not suitable for development or recreational use as compared to those same areas that might be identified as potentially desirable for development on the land use maps for scenically attractive private and public lands. Hence, a conflict would exist.

For the most valuable analysis of the watershed maps, it is recommended that both the maps and the analysis, including a set of written observations, be purchased from the Science Museum of Minnesota. Without the assistance of trained personnel, many valuable and critical observations of trends and issues within the watershed may be missed.

In addition, professional resource managers can look over the data and help your association formulate observations and recommendations. Take the parcel mapping and water quality monitoring data along with aquatic survey data and property owner survey results to various local resource departments and regional government agencies for help with interpretation. Local resources might include the county water planner, county planning and zoning, or soil and water conservation district offices. State agencies would include staff at the Department of Natural Resources, Board of Soil and Water Resources, or Pollution Control Agency. Talk with any resource professionals that your association has worked with in the past and whom you know has a strong interest in local lake management. Unfortunately, since the state is not organized under one agency for lake management, your association will have to feel their way around these organizations to find the assistance that is needed to analyze the accumulated data. The Minnesota Lakes Association can also recommend trained personnel to help with data analysis.

Defining Critical Issues and Recommended Solutions

To develop a plan for protecting and enhancing your lake and its watershed, your group will have to identify those issues that are of particular importance. What are the issues affecting the quality of your lake? How do various issues connect with each other? How do they conflict with each other?

Involving the stakeholders

At this point, you will want to involve the stakeholders you identified earlier in the planning process by presenting the data collected directly to them—here's what we found out. These stakeholders may primarily be lake association members or may also include others in the community or county that have an interest in the protection of your lake. The stakeholders will help define the critical issues and possible solutions

and develop short-term and long-term visions for lake management. Once the issues and recommended solutions have been identified, a smaller group of lake leaders can take these issues and formulate an action plan for lake management. They may also be responsible for monitoring the plan once it is implemented.

The lakes in the pilot project identified issues specific to their lakes in several ways. With three of the five pilot lakes, the findings of the data collection and analysis phase were presented at the association's annual meeting. The Whitefish Chain of Lakes hired a professional facilitator to oversee the presentation of data to the lake association members and other stakeholders at a special meeting. Deer Lake Association held a special meeting to communicate the findings to its members and published the results in its association newsletter.

Think of it as a brainstorming session where the goal is to develop a large list of issues that might be addressed in a lake management plan.

Whatever issues are being raised and whatever the reasons, it is important to remember that everyone has something that is important to them. Your purpose in this stage is not to make judgements on the issues that people raise, but simply to identify every interest that people have in your lake and its watershed. Think of it as a brainstorming session where the goal is to develop a large list of issues that might be addressed in a lake management plan. Relative importance of issues, political or economic feasibility, and support for a particular issue are not important right now. What you want is for those involved in the process to gain a general feel for the resources you have in the lake watershed, the nature of current development, and the general concerns that are held by stakeholders.

Identifying issues

There will be two primary types of issues that will be identified, each of which are equally valid. These are:

1. Issues based on facts—watershed maps, information databases, surveys and other results from studies on the lake provide you with factual information. An analysis of this information will help you to identify some fact-based issues for your plan. For instance, it might tell you where development currently is, the types of natural resources in the watershed, the number of people who support fishing limits or the number of boats using the lake on an average summer day.

2. Issues based on self-interest—The different stakeholders involved in the planning process will have many different issues that they feel are particularly important to them or their organization, whether or not these issues are substantiated by the data collected. These will be based on such factors as personal experience and values, age, income, gender or hobbies.

Questions to Help Identify Issues Facing Your Lake[i]

- ❑ What major challenges are facing the lake and its watershed? How might those challenges impact stakeholders?
- ❑ What resources (strengths) and liabilities (weaknesses) does the lake have?
- ❑ What are the needs of stakeholders in the watershed?
- ❑ What role do various stakeholders currently serve? What gaps now exist and need to be filled by these or other stakeholders?
- ❑ What do stakeholders perceive as working well for the lake and its watershed? How could these improve and change?

A Sample Issue Identification Process[ii]

1. With the stakeholder group assembled, present a summary of the data already collected and analyzed. Ideally, the participants will have received this information in advance so they are already familiar with the data analysis and observations.

2. Have each person in the room individually draft 2-5 issues they feel are important to include in the lake management plan. (Use more or less issues per person depending on the size of the group so you have enough issues to review.)

3. Post each issue up on the wall for everyone to see them.

4. Group the issues posted on the wall into some general categories. This will help to organize the issues in a meaningful way and let the participants see in a more general way what types of issues are being raised. Ask if any categories are missing and add them if they are.

5. Have participants highlight key words or phrases in the issues that they think are important to address in the management plan; this can be done by underlining words and phrases or writing them below the issue. If a word or phrase is chosen by more than one person, it can be highlighted again to indicate its relative importance or a tally of votes indicated next to it as a "voting" process.

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i Adapted from: Strategic Plan, California Energy Commission, Appendix B, Publication Number P102-97-001, May 1997. http://www.energy.ca.gov/reports/strategicplan/

ii Adapted from: Nancy R. Tague (c1995) The Quality Toolbox Milwaukee, WI: ASQC Quality Press

6. Discuss those words and phrases that have been highlighted—particularly those with the most "votes." Develop them into a specific issue by asking these questions:

   - What is the issue? An issue can be phrased as a statement or question addressing something important to the lake watershed and/or a stakeholders' self-interest (i.e. "How can we prevent septic systems from polluting the lake?" or "There are too many boats on the lake").
   - Why is this an important issue?
   - What are the consequences of not addressing this issue?
   - What goal is implied by an identification of this issue?
   - What actions could be taken to address this issue?

7. Reach a consensus on the issues that should be included in the management plan.

   Issues don't always have to be determined through a group meeting. That format does work well for larger associations to get widespread input, but it may not be as effective for a smaller association. As an alternative to the large group process, a management or visioning committee for the association can compare the results of the survey versus what is seen in the other data to come up with a specific set of issues and recommendations. These can then be presented to the lake association as a whole once the final plan is determined. It is important to use a process that works for the specific dynamics of your group.

Setting a Community Vision and Specific Lake Management Goals

What do you want the lake and its surroundings to look like in two generations? This is the key question that essentially defines the purpose of the entire planning process. Identifying a vision of what you want the lake to become will help focus what your association is trying to achieve throughout the planning process. This vision should represent a collaborative effort among the stakeholders to fuse multiple interests into a general vision that can be agreed to by everyone. It should provide a general framework from which to work, but leave enough room for multiple interpretations. This may sound like an impossible task, but if the stakeholders are truly committed to developing a vision and a management plan that will be supported widely, this visioning is essential.

Guidelines for visioning

Because of its tangible and immediate quality, a vision gives shape and direction to an association's or organization's future, and it helps people set goals to achieve that vision.

- Focus on the end result of what you truly want for the organization, not the intermediate steps of getting there.

- Separate what you want from what you think is possible; a vision is about what you want.

- Focus on what you want, not on avoiding what you don't want.

- Avoid making choices for other people, groups, and organizations.

- Express the vision in the present rather than future tense (e.g., "we are" rather than "we will be"), in order to begin "living into" your vision of what you truly want the organization to be.

Vision Statement Worksheet[ii]

Developing a vision statement consensus can be accomplished in the group process in a similar manner as was used to identify key issues.

1. Again with the stakeholders assembled, have each person in the room individually draft a vision statement on a large piece of paper.

2. Post each vision statement up on the wall so that everyone can see them.

3. Have participants highlight key words or phrases in the vision statements that they think are important to address in the management plan; this can be done by underlining words and phrases or writing them below the issue. If a word or phrase is chosen by more than one person, it can be highlighted again to indicate its relative importance or a tally of votes indicated next to it as a "voting" process.

4. Discuss those words and phrases that have been highlighted—particularly those with the most "votes." Reach a consensus on the key components of a final vision statement. If a vision statement cannot be agreed upon immediately by the entire group, have a few volunteers draft a vision statement to be reviewed later. The volunteers should take into account the key words or phrases that were identified by the group and the discussion of those words or phrases.

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ii Adapted from: Nancy R. Tague (c1995) The Quality Toolbox Milwaukee, WI: ASQC Quality Press

Determining your management goals

Once you have developed an agreed upon vision, begin identifying specific goals that will help you to achieve that vision. These goals are based on the issues that you have identified and should be challenging enough to encourage innovative thinking, but also realistic to achieve given the level of commitment from your group and the availability of resources in the community.

Once the issues were defined, each of the pilot lakes established specific goals by a different process. Lake Kabekona Association integrated the issues and recommendations into their standing committees and let the committees define the goals that pertained to their committee's mission. Sugar Lake developed a broader format that matched the issues and recommendations with a local comprehensive plan. Whitefish Property Owners Association and the Clitherall Lake Association developed special committees to address the issues and develop the goals. The Deer Lake Association changed its by-laws to add a standing committee, a Lake Management Committee headed by the association vice president, to carry out and review the lake management plan.

Goal Identification Process

1. Using the general categories and the specific list of issues that your group identified, develop a set of goal statements that reflect how you want to address these issues to achieve your vision for the lake.

   It is important to keep certain characteristics in mind as goals are developed. As each goal is developed, put it to the test. Does it include the following characteristics?

   - Believable—a goal should describe situations or conditions that the coalition of stakeholders believes can be achieved. Avoid the "pie-in-the-sky" goals that members do not believe nor find possible to do.
   - Defines a timetable—a completion date should be included in the goal statement.
   - Attainable—it should be possible to accomplish the goal in the designated time.
   - Measurable—there should be specific actions that can serve as a measure of meeting the goal?
   - Tangible—the goal should be capable of being understood or realized.
   - Win-Win—the goal must allow all members of the coalition to be successful.

2. Check to see that every issue you have identified relates to one of your goals. You can cross check this by listing each issue under the goal statement that addresses it.

3. Check again to see that your goal statements reflect the issues that have been raised throughout the collaboration and that nothing is missing. Agree on a final list of goals. These goals will help to define your action plan in the next stage.

4. After the goals have been established, allow stakeholders to review them before they are written in a final form. Input and acceptance is a vital ingredient to successfully accomplishing the group's goals.

Kabekona Lake Association Goals Assigned by Work Groups

- Maintain or improve lake water quality.
- Monitor the water quality and preserve the environmental characteristics of the lake and its tributaries.
- Maintain the lake's fishery at or above present levels.
- Encourage only sustainable land development and maintain an active presence with governmental organizations whose programs affect lakes, streams and wetlands within the watershed.
- Commit the association to a continuing education program for informing the membership about issues and problems they face and the responsibilities they have for preserving the lake and the land area around it.
- Involve more residents in the ongoing lake management process.

Developing an Action Plan for Sustainable Lake Management

Up until this point, you have been laying the groundwork and organizing your information so that you have a good idea of what you want to address in your lake management plan. Now is the time to bring it all together and develop an action plan for implementing everything you've talked about—the issues, the vision, the goals for sustainable lake management, assigning responsibility for specific tasks, timelines for completion of these tasks, measurement criteria, and prioritizing these actions will all be completed during this stage.

What's in an action plan?

An action plan has three purposes.

1. It provides a framework for developing strategies and programs to tackle the issues the group has identified.

2. Action plans record your strategies, programs and activities along with specific action steps for implementation. These include:

    - All tasks necessary for implementing the strategy, activity or program;
    - Specific individuals or groups responsible for each task;
    - Clear time frames for task completion; and
    - Measurement criteria (e.g. success indicators).

    Nothing loses steam and involvement faster for a group than a lot of talking with no action. Coming up with broad ideas is one thing, but actually developing concrete strategies and getting them implemented is quite another. When an action plan is in place, both association members and the broader community of stakeholders have a mechanism to hold each other accountable to commitments that have been made and to monitor the process of program implementation and determine whether the specific goals are being achieved.

3. Most important, action plans provide a framework for accomplishing goals and allow for group planners to examine the real nuts and bolts of implementation, ensuring greater success for its programs.

Creating an action plan

To create an effective action plan that will help you achieve your goals, there are several key questions that must be answered first:

1. **What problems do you face?** The goals that you have identified will often imply specific problems. Rewrite your goals in a few words to illustrate what the problem is.

2. **What are the causes?** What are the various causes for each of these problems? Be sure to get at the root of the issue rather than simply stating symptoms.

3. **Who can address the causes?** Are their specific people or organizations that can play a role in addressing the causes of the problems you have identified? What is their role in addressing the cause?

4. **What are the barriers to solving problems?** What problems do you foresee in trying to solve specific problems? Think ahead about the barriers you'll face during the implementation of your action plan so that you will have an idea of how to break through them when they present themselves.

5. **What resources are available to you?** What human and material resources are available to address specific problems? Do you need to find more resources before you can act on a particular problem?

Prioritizing your action steps

In identifying the goals of your lake management plan, you were able to get a sense of what issues are important to stakeholders and to see how these issues connect to each other. However, to begin moving towards practical actions, you will need some way to decide which actions are most important and the order in which you want to address them. The purpose of prioritizing your action steps is not to eliminate specific actions, but simply to show those that should be attended to first. The following worksheet will help you prioritize actions.

Action Step	**How Important in Meeting Goals?** High = 5 Medium = 3 Low = 1	**Cost?** Low = 3 Moderate = 2 Expensive = 1	**Time Required?** Weeks = 3 Months = 2 Years = 1	**Probability of Success?** High = 5 Medium = 3 Low = 1	**Total Score** Add Across the Columns	**High Priority for Action is a Score of 11 or Greater** (Check Box)

Getting specific with action plans

Once you have prioritized your actions, you will need to get more specific about who will be responsible for taking these actions, the resources that will be necessary to implement them, and the time frame in which they should be accomplished.

It is particularly important in this stage that roles and responsibilities in carrying out the overall action plan are clearly established and agreed upon by every member of your group. If these roles and responsibilities are unclear, you will likely discover that some tasks are not being addressed while others are addressed by several individuals or groups. Avoid simply dividing up tasks equally so that everyone has something to do. Look at what strengths are present in your group and what each of them is best suited to address. Recognize what people are interested in doing and make an effort to match them up with that task. Be clear about what is not their role or responsibility.

Try to assign action steps—the tasks—within the context of how your association is organized. If you have standing committees, use those. Again, Kabekona Lake Association approached implementation of their management plan for a committee structure (see Kabekona Management Plan in Appendix C). Each committee can formulate additional goals and action steps within the structure of their committee. Build off what you already have.

Another option is to think about forming committees around major issues, e.g. a committee that just does the parcel mapping. In the Sustainable Lakes Project, the Whitefish Area Property Owners Association and Clitherall Lake Association set up specific work groups to address specific tasks. (See Appendix C) For example, Whitefish Area Property Owners inventoried all on-site sewer systems.

This worksheet will help organize how your association will address specific action steps/tasks in your lake management plan.

Action Planning Table[ii]

Action Step for Task/Activity	Responsible Person/Group	Resources Needed	Begin/End Date

ii Adapted from: Nancy R. Tague (c1995) The Quality Toolbox Milwaukee, WI: ASQC Quality Press

Success indicators for action steps

In order to monitor your plan to determine how well your group is doing in accomplishing its goals, you will need to have some indicators established to judge the success of a particular action item and what methods and tools you will use to achieve this success. For instance, if one of your goals is to increase the amount of natural shoreline around your lake, how will you know if your efforts are actually accomplishing this goal? What is your definition of natural shoreline? How will you measure increases or decreases in the natural shoreline? What resources, skills, or tools will you need to effectively measure your progress?

In asking questions such as these, you will probably find that there are many different ways they can be answered—many of which can be sufficiently justified. It is not important that you come up with the one "correct" answer (it doesn't exist anyway), but that you agree as a group as to how you will define success and the methods you will use to measure your progress. If you find at a later time that your methods are not as effective as they could be, reconsider them at that point. Use the following table to define success indicators; an example is given to illustrate how you might begin filling out the table.

Goal	**Definition of Key Aspect(s) of Goal**	**How Will it Be Measured?**	**Tools/Resources Needed to Measure Progress**
Increase natural shoreline surrounding the lake	Natural shoreline: at least 50 ft. of shoreline containing vegetation not maintained as lawn (lake access paths excluded)	Number of lots around the lake with natural shoreline conditions	• People who will identify natural shoreline conditions • Tape measure • Database to keep track over time

Monitoring and Evaluating Your Plan

After you have decided how to measure success in accomplishing your goals and action steps, begin to evaluate what the results of these efforts are. Some key points to remember in evaluating results are:

1. What is the desired result of your goal?

2. What actions did you take in an attempt to accomplish this goal?

3. What important accomplishments were made?

4. How has the lake changed as a result?

5. Were there any unintended side effects as a result of your actions—good and/or bad?

"Your lake management plan should be considered a living document that is most effective if it is regularly evaluated to determine whether it is helping your group or association achieve your future vision of the lake."

Your lake management plan should be considered a living document that is most effective if it is regularly evaluated to determine whether it is helping your group or association achieve your future vision of the lake. This also enables you to address new issues and challenges as they arise and to readjust your plan to insure that it continues to reflect the goals and vision of those who enjoy the lake.

Sample Lake Management Goals and Actions from Pilot Lakes

The Sustainable Lake Management Plans for each of the five pilot lakes in the Sustainable Lakes Project had goals and objectives plus specific actions, timelines and areas of responsibility assigned. See Appendix C for copies of each pilot lake's management plan. Each lake association made a commitment to review the plan at regular intervals to assess progress and realign goals, if necessary.

The pilot lake plans also fostered integrated planning efforts with local government officials, often through the local water plans, to continuously evaluate and update the plans. For Sugar Lake, the Wright County Environmental Services Department has agreed to update the initial data collected, plus the county will use the Sugar Lake plan as a model for the management of other county lakes.

It is important to gain the support of local government, which may be a source of funding support for the implementation of your plan. Local government can work cooperatively with your lake association to support grant applications for project implementation or incorporate lake management goals in the county walter plan. Counties may also be influenced by your lake plan to make changes in county shoreland zoning and other protective ordinances.

As a result of its Sustainable Lake Plan, the Whitefish Property Owners Association is now involved in a cooperative effort with Crow Wing County and the City of Crosslake, with funding from the Legislative Commission on Minnesota Resources (LCMR) and a challenge grant from the Board of Water and Soil Resources, to assess the compliance status of over 2,000 septic systems. Along with on-site inspections, the parcel mapping from the project will aid in identifying priority properties for targeted upgrades.

Here are some additional examples of specific lake management goals and corresponding actions from the pilot lake plans.

Whitefish Chain of Lakes:

- In the Pine River Watershed, land cover, slope, and soil maps are being using to locate areas on the Whitefish Chain of Lakes where development easements can be used to control land use and protect water quality.

- The Pine River Watershed Foundation is uniting efforts with the Tri-County Leech Lake Foundation for fundraising to purchase easements to keep land out of development.

Kabekona Lake:

- On Lake Kabekona, parcel maps identified undeveloped shoreland parcels with potential development problems. The lake association has purchased some parcels and is looking at purchasing others to prevent development. The parcel database is being used by the Kabekona Association to track septic system maintenance, by parcel, and alert parcels about pumping on a three-year rotation. They have also negotiated lakewide pumping services and are exploring the purchase or lease of land for a "honey wagon" dumping site.

- The property owners' survey on Lake Kabekona identified resident concerns about the quality of the fisheries in the lake. Therefore, a fisheries management plan was a high priority in their lake management plan.

Sugar Lake:

- On Sugar Lake, parcel maps helped target parcels for better lawn management and identified the need for more education on proper shoreland lawn management. The aquatic vegetation lake maps are being used to develop an aquatic vegetation management plan for the lake. In addition, the association is attempting to form a Lake Improvement District to comprehensively handle sewer management.

Clitherall Lake:

- Irrigation concerns were a major focus of the Clitherall Lake plan. The lake association will try to influence the control of pivot irrigation near the lake, lobby for additional regulation of irrigation in Otter Tail County, and monitor enforcement of shoreland ordinances to ensure that a setback for all new irrigation machinery and feedlots is developed.

- Another goal is to develop a recreational trail system, which was identified as a need on the property owner survey.

Deer Lake:

- The greatest concern among Deer Lake property owners was the noise and damage caused by jet skis. As a first step to alleviate this problem, a letter was sent to all association members pointing out the problem with jet ski use and urging owners not to use them on the lake. This is a controversial issue, but the membership mandate was strong to do something, and the association is trying.

CHAPTER SEVEN: IMPROVING LAKE MANAGEMENT STATEWIDE

Lessons Learned from the Sustainable Lakes Project

Information gathered from the pilot lakes' watershed and lake basin maps, shoreline parcel maps, and property owners' surveys identified broad critical needs for successful lake management that should be addressed to improve lake management statewide and incorporated into any future lakes initiative by the Minnesota State Legislature.

What did the project researchers and the Minnesota Lakes Association learn from the Sustainable Lakes Project?

About Watersheds In Minnesota

Water quality and land use practices in a lake's watershed are directly related.

- The major need for lake management is not water quality data, but information and monitoring of land resources and activities within the watershed.

- In most watersheds, only a small part of the watershed has a major impact on water quality (shoreline areas with steep slopes, urbanized areas, and cultivated areas near water).

- The crucial areas for water quality include the land within 1/8 mile of a lake and the land use practices that take place there.

Public land management policy needs to be changed.

- Public lands that are in the immediate vicinity of lakes need to be managed for the direct benefit of the lakes. For example, public lands now managed for multiple use forestry may be needed also for sewage disposal and for off-lake recreation sites.

- Often public lands, especially state lands, do not have special management programs despite their location near highly valued recreational lakes. Individual program goals for public land management are usually more important than lake management goals. An example, the City of Crosslake on the Whitefish Chain of Lakes. The city attempted to acquire DNR forestry land (the only feasible site) for a sewage pond, but the DNR felt forest management was more important. Therefore, the city is building a plant discharging treated water into the Pine River.

- More land-based recreational opportunities are needed in the immediate vicinity of major recreation lakes to reduce the pressure of water-based recreation. There is a high demand for walking and hiking trails, which could be sited on public land adjacent to lakes.

Intensive agricultural development can have negative impacts on water quality.

- In the immediate lake watershed, practices such as aerial spraying of herbicides and pesticides near residential areas, irrigation in sandy soils, and uncontrolled runoff of water from fertilized crop land or animal contaminant areas can impact surface and groundwater quality, including well contamination.

- State shoreland zoning regulations do not contain special provisions for water quality or public health protection from intensive agricultural practices in shoreline areas. For example, intensive irrigation in the shoreland zone is not prohibited by state shoreland ordinances.

There are gaps of critical information needed for protective lake management.

- There are no systematic programs to update the information that was collected in the pilot project and is needed for ongoing lake management (most important is the land use/cover data).

- Soils maps are almost too detailed for watershed-wide analysis, but not detailed enough for use with individual parcels and structure.

- Aquatic plant community data is typically gathered through sampling methods. Inventory-based data collection would be more effective for lake management because it would identify where important aquatic resources are on each lake.

About Lakeshore Parcels

Parcel-based lake management is an important building block for long-term lake management.

- The most important decisions affecting lake quality are made at the parcel level by the property owners.

- Collecting and using parcel data is difficult, but it is an important building block for long-term lake management. A structure for parcel mapping needs to be an important component of any state lake initiative and implemented at the local county level.

- Better linking of assessor records to the parcel's physical characteristics can help ensure that revenue streams from lakeshore property continue to exceed the costs of providing government services.

About Recreation

The quality of the fishing resource and experience is declining.

- The time spent per fish caught is increasing, fish sizes are decreasing, and fewer fishermen are catching greater percentages of the total harvest. Knowledge and quality of equipment used is increasing.

- Any lake that has an above average population of larger game fish will have an immediate increase in fishing pressure that will change the population back to the average or below average levels.

- Angling bag limits need to relate better to the ability of lakes to sustain desired fish populations (e.g. a sustainable fish population goal could be to have the fish population look like it did in 1920).

- To improve fishing for users will require limiting fishing hours, restricting the use of certain fishing equipment, reducing bag limits, encouraging catch-and-release practices, and possibly support for the statewide use of "barbless" hooks, similar to restrictions adopted in Manitoba.

The amount, speed, and maneuverability of boats are continually increasing while the water resource is essentially static.

- Currently, the state does not have an effective policy or program to manage surface water use, e.g. boating practices, especially as it relates to jet skis, weekend and holiday use, and the separation of different types of water users.

- Surface water use management should be transferred from the service division (Information and Education) of the Department of Natural Resources to an operating division, such as Waters or Trails/Waterways.

George Orning directed the Sustainable Lakes Project of the Minnesota Lakes Association through the Center for Urban and Regional Affairs at the University of Minnesota, with assistance from the four graduate students pictured. Mr.Orning has a long history of lake management research in Minnesota. His work over 20 years ago led directly to the creation of the Minnesota Shoreland Management Program and the classification of all state lakes for zoning purposes. He has taught land use planning at the University of Minnesota , and has been active with the Minnesota Lakes Association for a number of years, including serving on the board of directors. Pictured from left to right in the photo are: Chris Matthews, Ciara Schlichting, George Orning, Daphne Karypis, and Ben Oleson.

APPENDIX A: RESOURCE AGENCIES/CONTACTS

Minnesota Pollution Control Agency (MPCA)

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194
(651) 296-6300, (800) 657-3864
www.pca.state.mn.us

Citizen Lake Monitoring Program
The Minnesota Pollution Control Agency's (MPCA) Citizens Lake Monitoring Program can help your association get started in a secchi disk monitoring program. Volunteers monitor the water clarity of their lake weekly from June 15 through September 15. Results are tabulated and reported statewide by the MPCA. Secchi disks can be purchased for $10. For more information, contact:

Jennifer Klang
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155
(651) 282-2618
jennifer.klang@pca.state.mn.us
http://www.pca.state.mn.us/water/clmp.html

Lake Assessment Program (LAP)
The LAP is a higher-level water quality monitoring program coordinated by the MPCA. To be eligible, a lake must already be participating in the Citizens Lake Monitoring Program. Several lake associations around the state are chosen for water quality investigation each year.

The program assesses the water quality and hypothesizes nutrient input sites, and it provides the lake association with a set of water quality monitoring and management recommendations.

For more information on the LAP, contact your MPCA regional office or:

Steve Heiskary
Division of Water Quality
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155
(651) 296-7217
steve.heiskary@pca.state.mn.us
http://www.pca.state.mn.us/water/lakequality.html

Clean Water Partnership Program
The CWP Program was established in 1987 to provide local units of government with resources to protect and improve lakes, steams and groundwater degraded by non-point source pollution. CWP projects begin with a desire by a local government to improve a water resource that has been polluted by land-use-related activities. Local leadership and expertise, combined with technical and financial resources from the state, create an effective program for controlling pollution and restoring water quality.

This is a two-phase program. The first phase is generally a sophisticated water quality analysis. The second phase is an implementation and best management plan based on the analysis of the affected lake. The Minnesota Legislature funds the program. For more information, contact your MPCA regional office or:

Gaylen Reetz
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 551555
(651) 296-8856
gaylen.reetz@pca.state.mn.us
http://www.pca.state.mn.us/water/cwpartner.html

Basic Planning
http://www.pca.state.mn.us/water/basins/index.html
Over the next several years, the MPCA will work with partners in communities throughout the state to develop water quality plans for each of Minnesota's 10 river basins.

For more information about MPCA's Basin Planning and Management Approach, contact:
Glenn Skuta, 800-657-3864 or
glenn.skuta@pca.state.mn.us

Also contact basin planners:

Lake Superior
Brian Fredrickson, (218) 723
brian.fredrickson@pca.state.mn.us

Red River
Molly McGregor, (218) 846-0494
molly.macgregor@pca.state.mn.us

Minnesota River
Larry Gunderson, (651) 297-3825
larry.gunderson@pca.state.mn.us

Mississippi River
Jim Hodgson, (218) 828-6065
james.hodgson@pca.state.mn.us

Rainy River
Nolan Baratono, (218) 283-2240
nolan.baratono@pca.state.mn.us

Lower Mississippi/Cedar Rivers Basins
Norm Senjem, (507) 280-3592
norman.senjem@pca.state.mn.us

Missouri and Des Moines River Basins
Mark Hanson, (507) 537-6000
mark.t.hanson@pca.state.mn.us

St. Croix River
Gene Soderbeck, (651) 296-8280
gene.soderbeck@pca.state.mn.us

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North District

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1800 College Road South
Baxter, MN 56425
(218) 828-2492

District Manager: Reed Larson
reed.larson@pca.state.mn.us

Waters Unit: Laurel Mezner
laurel.mezner@pca.state.mn.us

MPCA Detroit Lakes Office
714 Lake Avenue, Lake Avenue Plaza, Suite 220
Detroit Lakes, MN 56501
(218) 847-1519

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jim.ziegler@pca.state.mn.us

Lakes Specialist: Bruce Paakh
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525 Lake Avenue South, Suite 400,
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patrick.carey@pca.state.mn.us

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heidi.bauman@pca.state.mn.us

Basin Planning: Brian Fredrickson (218) 723-4663
brian.fredrickson@pca.state.mn.us

Surface Water Quality Monitoring:
Jesse Anderson (218) 529-6218
jesse.anderson@pca.state.mn.us

Metro District

MPCA Metro District (District Office)
520 Lafayette Road
St. Paul, MN 55155-4194
(651) 296-6300, (800) 657-3864

District Manager:Jim Warner
jim.warner@pca.state.mn.us

Waters Unit: Gene Soderbeck
gene.soderbeck@pca.state.mn

Waste Management: John Hensel
john.hensel@pca.state.mn

South District

MPCA Rochester Office (District Office)
18 Wood Lake Drive SE
Rochester, MN 55904
Phone: (507) 285-7343
MPCA Toll Free: (800) 657-3864
Feedlot Hotline: (877) 333-3508

District Manager: Larry Landher (507) 285-7345
larry.landher@pca.state.mn.us

Waters Unit: Katherine Logan (507) 280-5586
katherine.logan@pca.state.mn.us

Lakes and Watershed Specialist:
Bill Thompson (507) 281-7764
bill.thompson@pca.state.mn.us

MPCA Southwest Region

Willmar Office
201 28th Avenue S.W.
Willmar, MN 56201
Phone: (320) 214-3786

Subdistrict Manager: Myrna Halbach
(320) 214-3794, myrna.hallbach@pca.state.mn.us

MPCA Marshall (SW Office)
1420 E. College Drive, Suite 900
Marshall, MN 56258
Phone: (507) 537-7146

Waters Unit: Mark Jacobs (507) 537-7132
mark.jacobs@pca.state.mn.us

Minnesota Department of Natural Resources (DNR)

Minnesota Department of Natural Resources
500 Lafayette Road
St. Paul, MN 55455
General Information: (651) 296-6157 or (888) 646-6367
www.dnr.state.mn.us

Lake Management Program
The program makes Minnesota's lake management more understandable and responsive to citizens by coordinating DNR Waters program efforts with other DNR disciplines,agencies, boards, committees, associations, and public groups involved in comprehensive lake management/watershed efforts. Also coordinates and supervises a local-state program for the establishment of Lake Improvement Districts by counties.

Contact: Russ Schultz, (218) 828-6172
Lake Management Hydrologist, Brainerd
russ.schultz@dnr.state.mn.us

Lake Level Minnesota
http://www.dnr.state.mn.us/waters/climate/hiwater/lake_level/llm.html

For Status and eligibility for lake level data:
(651) 296-4800 bob.potocnik@dnr.state.mn.us

Lake Finder:
http://www.dnr.state.mn.us/lakefind/index.html

Lake Survey Program:
http://www.dnr.state.mn.us/lakefind/lrinfo.html

Lake Depth Maps:
http://www.dnr.state.mn.us/lakefind/lakemaps/

Lake and River Shoreland Classification:
http://www.dnr.state.mn.us/waters/shoreland_management/lake_classification.html

Lake Watershed Mapping Project
Three-dimensional models (GIS format) of watershed boundaries for lakes in Minnesota greater than 100 acres in size.

Contact: Russ Schultz, (218) 828-6171
DNR Lake Management Specialist
russ.schultz@dnr.state.mn.us

Lake Hydrology:
http://www.dnr.state.mn.us/waters/programs/surwat_section/lake_hydro/index.html

Lake Recreation:
http://www.dnr.state.mn.us/water.html

Permits and Regulations:
http://www.dnr.state.mn.us/waters/programs/plu_section/pwpermits/permit_requirements.html

Protected Waters Inventory Maps
http://www.dnr.state.mn.us/waters/wetlands/pwi/index.html

Shoreland Management
Oversees the administration of the state shoreland management program to promote wise development of the quality of surface waters, preserve the economic values of shorelands, and ensure the wise use of water and related resources.

Contact: Russ Schultz, (218) 828-6172
Shoreland Management Hydrologist
russ.schultz@dnr.state.mn.us

ENFORCEMENT DIVISION

Bill Bernhjelm, Director
(651) 297-2368; fax (651) 297-3727

DIVISION OF FISH AND WILDLIFE

Lee Pfunnmuller, Acting Director
(651) 297-1308; fax (651) 297-7272

The division manages all programs concerning fish, wildlife, and native plants

Ecological Services Section
Lee Pfannmuller, Chief
lee.pfannmuller@dnr.state.mn.us
(651) 296-2835

Primary program emphasis is directed at maintaining and enhancing the health and productivity of fish, wildlife, and native plant populations and their habitats. The section provides two major categories of service to accomplish this goal: specialized technical expertise; and coordination of comprehensive fish, wildlife, and native plant initiatives that support an ecosystem approach to resource management.

Environmental Management Unit
Steve Colvin, Surveys and Review Manager
(651) 296-0786
steve.colvin@dnr.state.mn.us

Technical services include fish and wildlife disease prevention and containment, lake mapping, and aeration inspection and permitting. The section also administers and coordinates the statewide aquatic nuisance control program so that lakeshore property owners can control weeds, algae, and other nuisance conditions through permits without harming lake ecosystems. It enforces federal and state laws pertaining to aquatic pesticides through monitoring, surveillance, and inspections of applications in public waters. It also investigates hazardous material spills that damage natural resources.

For aquatic plant control permits, contact your regional DNR Fisheries office.

Minnesota Wetlands Conservation Planning Project
Doug Norris, Wetlands Program Administrator
Ecological Services Section, (651) 296-0779
doug.norris@dnr.state.mn.us

The Minnesota Wetlands Conservation Planning Project was a largely voluntary initiative sponsored by the Minnesota Departments of Natural Resources, Transportation, and Agriculture; the Minnesota Pollution Control Agency; and the Minnesota Board of Water and Soil Resources. The plan was created by a diverse group of local government staff, farmers and other business interests, environmental advocates, and agency staff. The plan was funded by a planning grant from the U.S. Environmental Protection Agency under its State Wetland Protection Planning Development Grant Program (Clean Water Act Section 104), and matching funds contributed by the sponsoring state agencies. The products from the Wetlands Planning Project include the Minnesota Wetlands Conservation Plan, the Minnesota Wetland Mitigation Banking Study, and a Memorandum of Agreement for Implementation of the Minnesota Wetlands Conservation Plan.

Fisheries Section
Ron Payer, Chief
ron.payer@dnr.state.mn.us
(651) 297-4098; fax (651) 297-4916

The section manages the state's 3.8 million acres of fishing waters used by 2.3 million anglers. Its field force operates from six regional and 28 area offices.

Fisheries and Lake Survey Programs
(651) 296-3325; fax (651) 297-4916

Fisheries Related Permits
Section of Fisheries Information
(651) 296-3325; fax (651) 297-4916

Permits needed to remove rough fish, control aquatic nuisances, to transport and stock fish, to operate lake aeration systems.

DNR Region I:
Northwest-Fisheries Regional Headquarters
2115 Birchmont Beach Road NE
Bemidji, MN 56601
(218) 755-3959

Fisheries Area Offices

Baudette - 204 Main Street East, 56623
(218) 634-2522

Bemidji - 2114 Bemidji Avenue, 56601
(218) 755-2974

Detroit Lakes - P.O. Box 823, 56502
(218) 847-1579

Fergus Falls - 1221 Fir Avenue East, 56537
(218) 739-7576

Glenwood - 23070 N. Lakeshore Drive, 56334
(320) 634-4573

Park Rapids - 301 So. Grove Avenue, 56470
(218) 732-4153

Walker - 07316 State 371 NW, 56484
(218) 547-1683

DNR Region II:
Northeast-Fisheries Regional Headquarters
1201 East Highway 2
Grand Rapids, MN 55744
(218) 327-4415; fax (218) 327-4263

Fisheries Area Offices

Duluth/Lake Superior - 5351 North Shore Drive, 55804, (218) 723-4785

Ely - 1429 Grant McMahan Boulevard, 55731
(218) 365-7280

Finland - P.O. Box 546, 55603, (218) 353-7591

Grand Rapids - 1201 East Highway 2, 55744
(218) 327-4430

Grand Marais - P.O. Box 146, 55604
(218) 387-3056

International Falls - 392 Highway 11 East, 56649
(218) 286-5220

French River Hatchery - 5357 North Shore Drive, 55804, (218)723-4881

DNR Region III:
Central-Fisheries Regional Headquarters
1601 Minnesota Drive
Brainerd, MN 56401
(218) 828-2624; fax (218) 855-5072

Fisheries Area Offices

Aitkin - 1200 Minnesota Ave South, 56431
(218) 927-4814

Brainerd - 1601 Minnesota Drive, 56401
(218) 828-2550

Hinckley - P.O. Box 398, 306 Power Avenue North, 55037, (320) 384-7721

Little Falls - 16543 Haven Road, 56345
(320) 616-2462

Montrose - 7372 State Highway 25 SW, 55363
(612) 675-3301

DNR Region IV:
Southwest-Fisheries Regional Headquarters
261 Highway 15 South
New Ulm, MN 56073-8915
(507) 359-6000; fax (507) 359-6018

Fisheries Area Offices

Hutchinson - 20596 Highway 7, 55350
(320) 234-2550

Ortonville - RR2, Box 26H, 56278
(320) 839-2656

Spicer - P.O. Box 457, 56288, (320) 796-2161

Waterville - P.O. Box 86, 56096, (507) 362-4223

Windom - Route 2, Box 245, 56101,
(507) 831-2919

DNR Region V:
Southeast-Fisheries Regional Headquarters
2300 Silver Creek Road NE, Rochester, MN 55906
(507) 285-7427; fax (507) 285-7144

Fisheries Area Offices

Lake City - 1801 South Oak Street, 55041
(651) 345-3365

Lanesboro - Route 2, Box 85, 55949
(507) 467-2442

DNR Region VI:
Metro-Fisheries Regional Headquarters
1200 Warner Road, St. Paul, 55106
(651) 772-7950; fax (651) 772-7974

Fisheries Area Offices

Metro East - 1200 Warner Road, St. Paul, 55106
(651) 772-7950

Metro West - 9925 Valley View Road, Eden Prairie, 55344-3526, (612) 826-6771

Wildlife Section
Tim Bremicker, Chief
tim.bremicker@dnr.state.mn.us
(651) 296-3344; fax (651) 297-4961

The section carries out research and management programs affecting all state wildlife species. The formulated programs are carried out by the regional and area personnel. The section acquires, develops, and manages wildlife management areas, most of which are open to public hunting during established seasons. The section recommends hunting and other wildlife related regulations, census, survey and research programs, and promotes wildlife habitat protection and development on public and private lands.

Non-Game Wildlife Program
Carrol Henderson, Supervisor
carrol.henderson@dnr.state.mn.us
(651) 296-0700; fax (651) 297-4961

The Nongame Wildlife program has more than 80 conservation projects underway in Minnesota to help wildlife. Some of these species are in jeopardy because of habitat loss, illegal killing or other environmental threats. Examples are protection and management of peregrine falcons, trumpeter swans, bald eagles and loons, improving & protecting nesting sites for endangered & rare wildlife species; providing wildlife ecology lesson plans to schools through Project WILD; and providing the public with information on how to help wildlife from plans to build nest boxes to birdhouses, to landscaping and lakescaping for wildlife, to tips on birdwatching and bird feeding.

Wildlife Regional and Area Offices

DNR Region I:
Northwest Regional Wildlife Headquarters
2115 Birchmont Beach Road NE
Bemidji, MN 56601
(218) 755-3955; fax (218) 755-4024

Wildlife Area Offices

Baudette - 204 Main Street East, 56623
(218) 634-1705

Bemidji - 2114 Bemidji Avenue, 56601
(218) 755-2964

Crookston - 203 West Fletcher Street, 56716
(218) 281-3287

Detroit Lakes - P.O. Box 823, 56501
(218) 847-1578

Fergus Falls - 1221 Fir Avenue East, Box 122, 56537, (218) 739-7576

Glenwood - 23070 N. Lake Shore Dr., 56334
(218) 634-4573

Karlstad - P.O. Box 154, 56732, (218) 436-2427

Middle River - N. E. Star Route, Box 17, 56737
(218) 222-3747

Park Rapids - P.O. Box 166, 56470
(218) 732-8452

Roosevelt - Red Lake WMA, Box 100, 56673
(218) 783-6861

Roseau - Roseau River WMA, 27952 400th St., 56751-8057, (218) 463-1557

Thief River Falls - 123 Main Avenue North, 56701
(218) 681-0946

DNR Region II:
Northeast Regional Wildlife Headquarters
1201 East Highway 2
Grand Rapids, MN 55744
(218) 327-4413; fax (218) 327-4263

Wildlife Area Offices

Cloquet - South Highway 33, 55720

(218) 879-0883

Ely - 1429 Grant-McMahan Boulevard, 55731
(218) 365-7280

Eveleth - 2005 Highway 37, 55734,
(218) 744-7448

Grand Marais - Fish & Wildlife Building, 55604
(218) 387-2370

Grand Rapids - 1201 East Highway 2, 55744
(218) 327-4428

International Falls - Route 8, Box 8, 56649
(218) 286-5434

Two Harbors - 120 State Road, 56616
(218) 834-6619

DNR Region III:
Central Regional Wildlife Headquarters
1601 Minnesota Drive, Brainerd, MN 56401
(218) 828-2615; fax (218) 828-2439

Wildlife Area Offices

Aitkin - P.O. Box 138, 56431, (218) 927-6915

Brainerd - 1601 Minnesota Drive, 56401
(218) 828-2555

Cambridge - 915 Highway 65 South, 55008
(612) 689-7108

Hinckley - P.O. Box 398, 55037, (320) 384-6148

Little Falls - 16543 Haven Road, 56345
(320) 616-2468

Onamia - Mille Lacs WMA, Route 2, Box 217,
56359, (612) 532-3537

St. Cloud - 4140 Thielman, 56301, (651) 255-4279

DNR Region IV:
Southwest Regional Wildlife Headquarters
Box 756, Highway 15 South
New Ulm, MN 56073
(507) 359-6030; fax (507) 359-6018

Wildlife Area Offices

Appleton - Appleton Civic Center, 323 Schlieman
Avenue West, 56208, (612) 289-2493

Dundee - Talcot Lake WMA, 56126
(507) 468-2248

Madison - National Guard Armory, 56256
(612) 598-7641

Mankato - Nichols Office Center, #180, 56001
(507) 389-6713

Marshall - 1400 Lyon East, 56258, (507) 537-6250

Nicollet - 501 Ninth Street, 56074, (507) 225-3572

Redwood Falls - 1241 East Bridge Street, 56283
(507) 637-2320

Slayton - 2431 26th Street, 56172, (507) 836-6919

Watson - Lac qui Parle WMA, 56295
(612) 734-4451

Willmar - 4566 Highway 71 N., Suite #1, 56201
(320) 231-5163

Windom - Route 2, Box 245, 56101
(507) 831-2917

DNR Region V:
Rochester Regional Wildlife Headquarters
2300 Silver Creek Road NE, Rochester, MN 55903
(507) 285-7435; fax (507) 285-7144

Wildlife Area Offices

Altura - Whitewater WMA, 55910 (507) 932-4133

Owatonna - Route 3, Box 45, 55060
(507) 455-5841

Winona - 411 Exchange Building, 55987
(507) 453-2950

DNR Region VI:
Metro Regional Wildlife Headquarters

1200 Warner Road, St. Paul, MN 55106
(651) 772-7942; fax (651) 772-7977

Wildlife Area Offices

Forest Lake - Carlos Avery WMA, 18310 Zodiak, 55025, (651) 296-5290

Carlos Avery Game Farm - Forest Lake, 55025
(651) 296-5200

Shakopee - 118 South Fuller Street, 55379
(612) 496-4151

DIVISION OF FORESTRY

Gerald A. Rose, Director
(651) 296-4484; fax (651)296-5954

The Division of Forestry works with public and private entities to promote the conservation, protection, and enjoyment of Minnesota's forest resources through sustainable management, wildfire and pest protection, and technical forestry assistance

Metro Region Forestry Headquarters
1200 Warner Road
St. Paul, MN 55106
(651) 772-7925; fax (651) 772-7599

TRAILS AND WATERWAYS DIVISION

Dennis Asmussen, Director
dennis.asmussen@dnr.state.mn.us
(651) 297-1151; fax (651) 297-5475

The Trails and Waterways unit is responsible for the operation of more than 3,000 miles of state park and forest trails and state trails, more than 1,400 water access sites, and 20 designated canoe and boating routes, which offer over 2,800 miles of river for recreation.

WATERS DIVISION

Kent Lokkesmoe, Director
kent.lokkesmoe@dnr.state.mn.us
DNR Waters Central Office
500 Lafayette Road
St. Paul, MN 55155-4032
Information (651) 296-4800

DNR Waters manages water resources through a variety of programs including water management, shoreland management, environmental review, public water inventory program, public water work permits, wetlands conservation program, floodplain management, lake hydrology, groundwater mapping, well sealing, and climatology.

Region I DNR Waters, Bemidji

Regional DNR Waters Office - Bemidji
2115 Birchmont Beach Road NE
Bemidji, MN 56601
(218) 755-3973

Waters Area Offices

Bemidji, 2115 Birchmont Beach Road NE, Bemidji, 56601, (218) 755-3973

Thief River Falls, 123 Main Avenue North, 56701
(218) 681-0947

Detroit Lakes, PO Box 823, 56502
(218) 847-1580

Fergus Falls, 1221 Fir Avenue East, 56537
(218) 739-7576

Region II: DNR Waters, Grand Rapids

Regional DNR Waters Office - Grand Rapids
1201 East Highway 2
Grand Rapids, MN 55744
(218) 327-4416

Waters Area Offices

Grand Rapids, 1201 East Highway 2, 55744
(218) 327-4416

Eveleth, 2005 Highway 37, 55734, (218) 744-7450

Two Harbors, 1568 Highway 2, 55616
(218) 834-6621

Region III: DNR Waters, Brainerd

1601 Minnesota Drive
Brainerd, MN 56401
(218) 828-2605

Waters Area Offices

Brainerd, 1601 Minnesota Drive, 56401, Brainerd, 56401 (218) 828-2605

Little Falls, 16543 Haven Road, 56345
(320) 616-2470

Cambridge, 800 Oak Savanna Lane SW, 55008
(612) 689-7105

Sauk Rapids, 940 Industrial Drive S. #103, 56379
(320) 255-2976

Region IV: DNR Waters, New Ulm

261 Highway 15 South
New Ulm, MN 56073-8915
(507) 359-6053

Waters Area Offices

New Ulm, 261 Highway 15 South, 56073
(507) 359-6053

Spicer, PO Box 457, 105090 Cty Rd 8 NW, 56288
(320) 796-6272

Hutchinson, 20596 Highway 7, 55370
(320) 234-2560

Marshall, PO 111, 1400 East Lyon, 56258
(507) 537-7258

Windom, 235 9th Street, 56101, (507) 831-6162

Mankato, 1230 South Victory Drive, 56001
(507) 389-2151

Region V: DNR Waters-Rochester

2300 Silver Creek Road NE
Rochester, MN 55906
(507) 285-7421

Area DNR Waters Office

2300 Silver Creek Road NE, Rochester, 55906
(507) 285-7421

Region VI: DNR Waters- Metro

1200 Warner Road
St. Paul, MN 55106
(651) 772-7910

Waters Area Office

1200 Warner Road, St. Paul, 55106
(651) 772-7910

Common Permit Requirements/Questions:

Aquatic Vegetation: Any control of emergent vegetation, such as cattails and bulrushes, and the use of pesticides in public waters requires a permit issued through Regional Fisheries Offices.

Beaver Dams: Can be removed on public private without permit. DNR public waters permit work permit required to remove a beaver dam when the bed of a lake or stream is excavated in conjunction with the dams removal. Contact Regional or Area Waters office.

Beach Sand: A DNR public waters work permit is not required if the following conditions are satisfied:

- Clean, inorganic sand or gravel free of pollutants and nutrients is installed.
- The beach sand blanket is no more than 6 inches thick, 50 feet wide along the shore, or one-half the lot width (whichever is less), and 10 feet waterward of the ordinary high water mark (OHW)
- Local watershed district and zoning office are given at least seven days prior notice.
- The site is not a posted fish spawning area.
- Installation of sand or gravel may only be repeated once at same location, not exceeding same amount and dimensions of the original sand blanket.

Boat House: Contact your city or county planning/zoning authority if you propose to construct a boat house or other accessory structures along your lake or river shoreline.

Fill: A DNR public waters work permit is required to place fill in a lake or public waters wetland. State rules specifically prohibit placement of fill into a water body by an individual or organization to create upland areas. To determine whether a local permit is required or allowed, contact your city or county planning/zoning authority if you propose to haul fill onto the existing upland portion of your property. Contact Regional Waters Office.

Fish Stocking: Stocking of fish in Minnesota's lakes, rivers and streams is regulated by Section of Fisheries. Contact Regional or Area Fisheries office.

Ice Ridge Removal: A DNR Public Waters Permit is required to remove an ice ridge. Contact Regional or Area Waters Office.

Lawn Landscaping: Landscaping work proposed on the upland part of your lakeshore or river property may require a permit from the local unit of government. Contact your city or county local planning/zoning authority.

Ordinary High Water Mark (OHW): Contact DNR Area hydrologist to find out what the OHW mark is for a specific water body.

Retaining Walls: A DNR Public Waters Work permit is required to build a retaining wall along your shoreline if the structure is proposed below the ordinary high water level (OHW). The DNR discourages the construction of retaining walls, particularly when a water basin or watercourse is relatively undeveloped. The use of hard armoring (rock riprap) or soft armoring (biovegetation) is encouraged. Many local governmental units address projects such as retaining walls with a grading and filling permit system, so you should also contact your local zoning office for any specific requirements.

Riprap: A DNR public waters work permit is not required if the following conditions are satisfied:

- Natural rock only, at least 12 inches in diameter or larger, is installed.
- Riprap is installed no more than 5 feet waterward of the ordinary high water level.
- Riprap conforms to natural alignment of shore and does not obstruct flow of water.
- The minimum finished slope is no steeper that 3:1 (horizontal to vertical).
- The site is not a posted fish spawning area, designated trout stream, nor along the shores of Lake Superior.

Well Construction: Well construction is regulated under the Minnesota Department of Health

Minnesota Board of Water and Soil Resources (BWSR)

One West Water Street, Suite 200
St. Paul, MN 55107-2039
(651) 296-3767
www.bwsr.state.mn.us

The Minnesota Board of Water and Soil Resources administers a number of state programs designed to protect Minnesota's soil and water. The Board administers a number of grant and technical assistance programs to SWCDs, watershed districts, watershed management districts, and counties. Among the programs that BWSR administers are the Comprehensive Local Water Planning Program, Wetlands Conservation Ace, Reinvest in Minnesota (RIM) Reserve Program and the Cost-Share Program.

Water Planning: 612-297-5617

Wetlands: 612-297-3432

St. Paul Central Office:
One West Water Street, Suite 200
St. Paul, MN 55107-2039
Tel: (651) 296-3767
Fax: (651) 297-5615

St. Paul Metro Region:
One West Water Street, Suite 200
St. Paul, MN 55107-2039
Tel: (651) 282-9969
Fax: (651) 284-0000

Bemidji
3217 Bemidji Avenue N.
Bemidji, MN 56601
Tel: (218) 755-4235
Fax: (218) 755-4201

Brainerd
217 S. 7th Street, Suite 202
Brainerd, MN 56401-3660
Tel: (218) 828-2383
Fax: (218) 828-6036

Duluth
394 S. Lake Avenue, Room 403
Duluth, MN 55802
Tel: (218) 723-4752
Fax: (218) 723-4794

Marshall
Box 267, 1400 E. Lyon Street
Marshall, MN 56258
Tel: (507) 537-6060
Fax: (507) 537-6368

New Ulm
261 Highway 15 S.
New Ulm, MN 56073-8915
Tel: (507) 359-6074
Fax: (507) 359-6018

Rochester
40 16th Street SE, Suite A
Rochester, MN 55904
Tel: (507) 285-7458
Fax: (507) 280-2875

BWSR Areas of Responsibility

Local Water Planning:
http://www.bwsr.state.mn.us/programs/major/localwp.html

Lakeshore Easement:
http://www.bwsr.state.mn.us/programs/minor/lakes.html

Non-Point Engineering Assistance (NPEA) Program:
http://www.bwsr.state.mn.us/programs/minor/npea.html

Wetland Conservation Act:
http://www.bwsr.state.mn.us/programs/major/wca.html

Reinvest in Minnesota:
http://www.bwsr.state.mn.us/programs/major/rim.html

Federal Grant Programs:
http://www.bwsr.state.mn.us/programs/other/webfed.html

Minnesota Soil and Water Conservation Districts (SWCD):
http://www.mn.nrcs.usda.gov/partners/maswcd/maswcd.html

SWCDs work primarily on a one-on-one basis with landowners, aiming to connect landowners with the financial and technical resources they need to put conservation practices on the land.

Other Minnesota Resources

Minnesota Association of Soil and Water Conservation

790 Cleveland Avenue South, Suite 216
St. Paul, MN 55116
Phone: (651) 690-9028
Fax: (651) 690-9065

Minnesota Department of Agriculture

90 West Plato Boulevard
St. Paul, MN 55107
Phone: (651) 297-2015
www.mda.state.mn.us

The MDA is organized into three program areas: Market & Promotion, Protection Services and Administrative Services.

Minnesota Department of Health

121 East Seventh Place, PO Box 64975
St. Paul, Minnesota 55101
(612) 623-5000
http://www.health.state.mn.us/

Fish Consumption Advisories:
http://www.dnr.state.mn.us/lakefind/fca/

Wellhead Protection in Minnesota:
http://www.health.state.mn.us/divs/eh/dwp/swp/whp_mn2.html

Nitrates in Well Water:
http://www.health.state.mn.us/divs/eh/wellmgmt/nitrate.html

Natural Resources Conservation Service

375 Jackson Street, Suite 600
St. Paul MN 55101
Phone: (651) 602-7900
Fax: (651) 602-7914
Minnesota web site: www.mn.nrcs.usda.gov
National web site: www.nrcs.usda.gov

Resources Conservation Service often has field offices co-located with SWCDs. NRCS will often provide technical or engineering assistance for local conservation projects. In addition, NRCS depends upon local SWCDs to carry out a number of federal resource management programs. NRCS focuses on working directly with landowners—although staff members do also work with rural and urban communities—providing technical assistance to help them develop conservation systems. Programs administered by the NRCS include: Conservation Technical Assistance, Environmental Quality Incentives Program, Soil Survey Programs, Wetlands Reserve Program, Wildlife Habitat Incentives Program, and others.

Environmental Quality Board, Minnesota Planning

http://www.mnplan.state.mn.us/eqb/index.html

The Environmental Quality Board at Minnesota Planning draws together five citizens and theheads of 10 state agencies that play a vital role in Minnesota's environment and development.The board develops policy, creates long-range plans and reviews proposed projects thatwould significantly influence Minnesota's

environment. Responsible for the state water plan, environmental review, animal agriculture GWIS, and sustainable development.

Contact: Marilyn Lundberg, (651) 297-1257
marilyn.lundberg@mnplan.state.mn.us

Land Management Information Center, Minnesota Planning

The Land Management Information Center at Minnesota Planning offers services to improve the effective use of geographic information in Minnesota.

Land Management Information Center
658 Cedar St., St. Paul, MN 55155
(651) 296-1211
http://www.lmic.state.mn.us/index.html
lmic@mnplan.state.mn.us

University of Minnesota Extension Service

240 Coffey Hall, 1420 Eckles Avenue
St. Paul, MN 55108
(612) 625-1915
http://www.extension.umn.edu/

Environmental and Natural Resources Program:
http://www.extension.umn.edu/environment/

Water Resources Center (WRC)
WRC helps to coordinate outreach and research within the University, enabling more effective delivery of research to decision makers andcitizens, and opening new avenues for multi-disciplinary and interdisciplinary partnerships.

Pat Brezonik, Director
173 McNeal Hall
1985 Buford Avenue
St. Paul, Minnesota 55108
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Center For Agricultural Impacts on Water Quality
A cooperative center formed within the Minnesota Agricultural Experiment Station, Minnesota Extension Service, and theUniversity of Minnesota to focus on research concerning water quality relating to agricultural management practices.

http://wrc.coafes.umn.edu/CAIWQ/CAIWQhome.htm

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APPENDIX B:
SAMPLE PROPERTY OWNERS' SURVEY

B.1: Sample Property Owners' Survey

1998 Clitherall Lake Property Owners' Survey

This survey is voluntary. However, please fill it out
and join your neighbors in evaluating Clitherall Lake! Thank You!

Section 1 - This section asks about your property on Clitherall Lake. If you own more than one property, answer the questions about the property with a dwelling (house or cabin). If the properties have no dwellings, answer the questions for any one of them.

1. Does this property have shoreline frontage on Clitherall Lake? (check only one response)

   ____ Yes ____ No If no, does the property have access rights to Clitherall Lake? ____ Yes ____ No

2. Which statement best describes how your household used this property during the last 12 months? (check one)
   - ____ Not used at all.
   - ____ Year-round use.
   - ____ Summer use (most or all of the time).
   - ____ Summer use (mostly on weekends, holidays, vacations).
   - ____ Spring, summer, fall use (mostly on weekends, holidays, vacations).
   - ____ Spring, summer, fall, winter use (mostly on weekends, holidays, vacations).
   - ____ Other. Explain:_____

3. Which statement best describes this property? (check one)
   - ____ There is no permanent dwelling on the property. (Go to Question 7)
   - ____ The dwelling is suitable for warm weather use only.
   - ____ he dwelling is suitable for year-round use and was converted from a seasonal dwelling.
   - ____ The dwelling was built originally as a year-round structure.
   - ____ Other. Explain: _____

4. What year was the dwelling originally built? 19____

5. If the dwelling was converted from a seasonal dwelling, estimate what year the major changes were completed.
   19____

6. In approximately what year did this property first come into ownership by you (or your family)? _____year

Section 2 - This section asks about your general impressions of Clitherall Lake.

7. To what extent do you feel each of the following to be a problem on Clitherall Lake? (circle the number that best describes how serious you find EACH to be.)

Issue	Not a problem	A slight problem	A moderate problem	A serious problem	A serious problem	Don't know
Overall water quality of Clitherall Lake	1	2	3	4	5	0
Well contamination	1	2	3	4	5	0
Lake water pollution due to faulty/substandard septic systems	1	2	3	4	5	0
Lake water pollution due to agricultural runoff	1	2	3	4	5	0
Lake water pollution due to agricultural chemical spraying	1	2	3	4	5	0
Property (i.e. animals, cars, plants) damage due to agricultural chemical spraying	1	2	3	4	5	0
Well water contamination due to agricultural chemical spraying	1	2	3	4	5	0
Family health concerns caused by agricultural chemical spraying	1	2	3	4	5	0
Pivot irrigation	1	2	3	4	5	0
Inadequate response of public officials to your concerns	1	2	3	4	5	0
Inadequate public safety (i.e. fire, health, emergency, police/sheriff)	1	2	3	4	5	0
Inadequate public service (i.e. roads)	1	2	3	4	5	0
Zoning ordinances are not followed	1	2	3	4	5	0
Algae growth in Clitherall Lake	1	2	3	4	5	0
Aquatic plan growth in Clitherall Lake	1	2	3	4	5	0
Improper burning of leaves and brush	1	2	3	4	5	0
Trees lost to disease	1	2	3	4	5	0
Improper alteration to shoreline made by property owners	1	2	3	4	5	0
Lakeshore erosion	1	2	3	4	5	0
Neighbors causing disturbances (i.e. noise)	1	2	3	4	5	0
Water level fluctuations on Clitherall Lake	1	2	3	4	5	0
Other (describe): _____	1	2	3	4	5	0

8. For the problems in Question 7 that you thought were moderate, serious, or very serious, give us more details below about what the problem(s) were:

Problem: _____

Problem: _____

Problem: _____

9. Over the past *five years,* would you say the overall quality of Clitherall Lake is: (check one)
   - ____ Getting better
   - ____ About the same
   - ____ Getting worse

10. Over the past *five years,* what if anything has gotten particularly better?

_____
_____
_____
_____
_____
_____

11. Over the past *five years*, what if anything, has gotten particularly worse?

_____
_____
_____
_____
_____
_____

12. Write several words or phrases that express why you *value* living on or near Clitherall Lake.

_____
_____
_____

Section 3 – This section asks about your household's use and impressions of Clitherall Lake this past WINTER, November *1997 through February 1998.*

13. From November 1997 through February 1998, estimate how many days members of your household used Clitherall Lake for the following activities? (Please circle one answer for EACH activity.)

    NOTE: If you or members of your household did not spend time at your property on Clitherall Lake this past winter, go to Question 17.

	Days			
Activity	**0**	**1 to 5**	**6 to 10**	**11 or more**
Ice fishing (in a fish house)	0	1-5	6-10	11+
Ice fishing (without a fish house)	0	1-5	6-10	11+
Snowmobiling	0	1-5	6-10	11+
ATV riding	0	1-5	6-10	11+
Hockey	0	1-5	6-10	11+
Ice skating (other than hockey)	0	1-5	6-10	11+
Ice boating	0	1-5	6-10	11+
Snowshoeing	0	1-5	6-10	11+
Hiking/walking	0	1-5	6-10	11+
Pleasure driving	0	1-5	6-10	11+
Other (describe) _____	0	1-5	6-10	11+

14. To what extent do you feel each of the following was a problem on Clitherall Lake during this past WINTER, November 1997 through February 1998? (Circle the number that best describes how serious you found EACH to be.)

Issue	Not a problem	A slight problem	A moderate problem	A serious problem	A serious problem	Don't know
Litter on the lake	1	2	3	4	5	0
Litter at the public landings or on the access roads	1	2	3	4	5	0
Lake users operating vehicles in an unsafe manner	1	2	3	4	5	0
Trespassing on your property by lake users	1	2	3	4	5	0
Vandalism of your property by lake users	1	2	3	4	5	0
Vandalism of your fish house by lake users	1	2	3	4	5	0
Lake users drinking alcoholic beverages	1	2	3	4	5	0
Lake users being inconsiderate	1	2	3	4	5	0
Too many fish houses on the lake	1	2	3	4	5	0
Unattractive fish houses on the lake	1	2	3	4	5	0
Unskilled snowmobilers on the lake	1	2	3	4	5	0
Noise from snowmobiles on the lake	1	2	3	4	5	0
People on the ice during unsafe ice conditions	1	2	3	4	5	0
Not enough law enforcement on the lake	1	2	3	4	5	0
Too much law enforcement on the lake	1	2	3	4	5	0
Catching too few fish	1	2	3	4	5	0
Too many people on the lake on weekdays	1	2	3	4	5	0
Too many people on the lake on weekends	1	2	3	4	5	0
Too many snowmobiles on the lake on weekdays	1	2	3	4	5	0
Too many snowmobiles on the lake on weekends or holidays	1	2	3	4	5	0
Other (describe): _____	1	2	3	4	5	0

15. For the problems in Question 14 that you thought were moderate, serious, or very serious, give us more details below about what the problem(s) were:

Problem: _____

Problem: _____

Problem: _____

Problem: _____

(If more space is needed, use the last page of this questionnaire or a separate page.)

16. Given the conditions on Clitherall Lake this past WINTER, November 1997 through February 1998, how do you feel about each of the following actions? (Circle the number that shows how much you support or oppose EACH action.)

Action	Strongly support	Support	Neither support nor oppose	Oppose	Strongly oppose
Provide more trash containers at the public landings	1	2	3	4	5
Be more aggressive to service the trash containers at the public landings	1	2	3	4	5
Prohibit use of snowmobiles on Clitherall Lake	1	2	3	4	5
Reduce current 50 mph speed limit for snowmobiles on Clitherall Lake	1	2	3	4	5
Prohibit use of snowmobiles during certain times (e.g. 10pm-6am)	1	2	3	4	5
Post signs warning and advising of hazards and/or thin ice	1	2	3	4	5
Provide more information for visitors at the public landing	1	2	3	4	5
Be more aggressive in the enforcement of safety rules and regulations	1	2	3	4	5
Restrict the number of fish houses on Clitherall Lake	1	2	3	4	5
Close the public landings during certain times (e.g. 10pm-6am)	1	2	3	4	5
Other (describe):_____	1	2	3	4	5

Section 4 - This section asks about your household's use and impressions of Clitherall Lake this past SUMMER, March 1997 through October 1997.

17. From March 1997 through October 1997, estimate how many days members of household used Clitherall Lake for the following activities? (Please circle one answer for EACH activity.)

    NOTE: If you or members of your household did not spend time at your property this past summer, go to Question 21.

	Days			
Activity	**0**	**1 to 5**	**6 to 10**	**11 or more**
Ice fishing (in a fish house)	0	1-5	6-10	11+
Pleasure boating (in motorized boat)	0	1-5	6-10	11+
Water skiing	0	1-5	6-10	11+
Fishing from a boat	0	1-5	6-10	11+
Fishing from shore	0	1-5	6-10	11+
Walking/hiking	0	1-5	6-10	11+
Jet skiing (personal watercraft)	0	1-5	6-10	11+
Swimming	0	1-5	6-10	11+
Paddleboating	0	1-5	6-10	11+
Boardsailing	0	1-5	6-10	11+
Sailboating	0	1-5	6-10	11+
Canoeing	0	1-5	6-10	11+
Photography	0	1-5	6-10	11+
Kayaking	0	1-5	6-10	11+
Scuba diving	0	1-5	6-10	11+
Snorkeling	0	1-5	6-10	11+
Birding	0	1-5	6-10	11+
Gardening	0	1-5	6-10	11+
Waterfowl hunting	0	1-5	6-10	11+
Other (describe):_____	0	1-5	6-10	11+

18. To what extent do you feel each of the following was a problem on Clitherall Lake during this past SUMMER, March 1997 through October 1997? (Circle the number that best describes how serious you found EACH to be.)

Issue	Not a problem	A slight problem	A moderate problem	A serious problem	A serious problem	Don't know
Litter in the lake	1	2	3	4	5	0
Litter at the public landings or on the access roads	1	2	3	4	5	0
Trespassing on your property by lake users	1	2	3	4	5	0
Vandalism of your property by lake users	1	2	3	4	5	0
People drinking alcoholic beverage	1	2	3	4	5	0
People being inconsiderate	1	2	3	4	5	0
Fishing "disturbed" due to overcrowding on the lake	1	2	3	4	5	0
More larger boats using the lake	1	2	3	4	5	0
More boats speeding on the lake	1	2	3	4	5	0
Unskilled boaters	1	2	3	4	5	0
Unskilled jet skiers (personal watercraft)	1	2	3	4	5	0
Noise from jet skiers (personal watercraft)	1	2	3	4	5	0
Unsafe boating conditions due to overcrowding on the lake	1	2	3	4	5	0
Not enough law enforcement on the lake	1	2	3	4	5	0
Too much law enforcement on the lake	1	2	3	4	5	0
Catching too few fish	1	2	3	4	5	0
Too many boats on the lake on weekdays	1	2	3	4	5	0
Too many boats on the lake on weekends or holidays	1	2	3	4	5	0
Too many people fishing on weekdays	1	2	3	4	5	0
Too many people fishing on weekends or holidays	1	2	3	4	5	0
Fishing Tournaments	1	2	3	4	5	0
Too many jet skis on the lake on weekdays	1	2	3	4	5	0
Too many jet skis on the lake on weekends or holidays	1	2	3	4	5	0
Other (describe): _____	1	2	3	4	5	0

19. For the problems in Question 18 that you thought were *moderate, serious*, or *very serious,* give us more details below about what the problems(s) were:

Problem: _____

Problem: _____

(If more space is needed, use the last page of this questionnaire or a separate page.)

20. Given the conditions on Clitherall Lake this past SUMMER, *March 1997 through October 1997,* how do you feel about each of the following actions? (Circle the number that shows how much you support or oppose EACH action.)

Action	Strongly support	Support	Neither support nor oppose	Oppose	Strongly oppose
Provide more trash containers at the public landings	1	2	3	4	5
Provide more trash containers at public landings	1	2	3	4	5
Be more aggressive to service the trash containers at public landing	1	2	3	4	5
Establish speed limits for motorboats on Clitherall Lake	1	2	3	4	5
Limit the size of motors on the lake	1	2	3	4	5
Limit the number of watercraft using Clitherall Lake during high use periods	1	2	3	4	5
Prohibit jet skis (personal watercraft) on the lake	1	2	3	4	5
Provide more information for visitors at public landing(s)	1	2	3	4	5
Be more aggressive in the enforcement of safety rules and regulations	1	2	3	4	5
Establish speed limits for motorized watercraft during high use periods	1	2	3	4	5
Increase penalties for violating boating rules and regulations	1	2	3	4	5
Close the public landing at certain times (e.g. 11pm-5am)	1	2	3	4	5
Provide more stocking of game fish	1	2	3	4	5
Provide better control of rough fish	1	2	3	4	5
Be more aggressive in aquatic plan control in the lake	1	2	3	4	5
Raise the water level of Clitherall Lake	1	2	3	4	5
Lower the water level of Clitherall Lake	1	2	3	4	5
Other (describe):_____	1	2	3	4	5

Section 5 - This section asks questions about your household.

21. How many adults (18 years age or older) residing in your household spent time at Clitherall Lake during the past 12 months? ____Adults

22. How many children (under 18 years of age) residing in your household spent time at Clitherall Lake during the past 12 months? ____Children

23. How many licensed watercrafts does your household own that were used on Clitherall Lake during the past 12 months? (Place a number in each category.)
    - ____ Pontoon boats
    - ____ Speed boats
    - ____ Bass boats
    - ____ Fishing boats
    - ____ Rowboats
    - ____ Seaplanes
    - ____ Canoes
    - ____ Sailboards
    - ____ Sailboats
    - ____ Paddleboats
    - ____ Personal Watercrafts (Jet Skis)
    - ____ Kayaks
    - ____ Other (describe):_____

Section 6 – This section asks about you and the Clitherall Lake Association.

24. Prior to receiving this questionnaire, were you aware there was a Clitherall Lake Association?

____ No If no, would you consider becoming a member of the Association?
____ No
____ Yes Please write to: Clitherall Lake Association
P.O. Box 101
Clitherall, MN 56524

____ Yes If yes, are you currently a member?
___ Yes For how many years? ____ years
___ No Were you ever a member? ____ Yes ____ No

Would you consider becoming a member of the Association?
____ No
____ Yes Please write to: Clitherall Lake Association
P.O. Box 101
Clitherall, MN 56524

25. What are *three important things* the Clitherall Lake Association can do to better serve you, your household, and Clitherall Lake? Please tell us about them!

26. Any other comments you would like to make about Clitherall Lake and the Clitherall Lake Association are welcomed.

Thank you for your time
and your cooperation.

Please return this survey in the enclosed postage-paid envelope.

B.2: Sample Executive Summary—Clitherall Lake

Introduction

This final report provides an analysis of the Clitherall Lake Property Owners' Survey. The purpose of this report is to communicate the findings of the comprehensive survey to Clitherall Lake property owners in order to facilitate discussions regarding sustainable lake planning. The survey assessed characteristics of the property, property owners' use of Clitherall Lake, concerns about Clitherall Lake, and opinions concerning potential ways to solve these concerns.

Data Collection

A comprehensive property owners' survey was mailed to each property owner within the Clitherall Lake watershed on July 18, 1998. Additionally, a post card reminder was sent to all non-respondents in August. Overall, the twelve-page questionnaire was returned by sixty-six percent of the property owners.

Methods

The survey responses were coded into a Microsoft Excel spreadsheet and then run through SPSS, a statistics program. Separate analyzes were completed for all respondents, year-round residents and seasonal residents. Frequencies, means, and percentages for each portion of each question were obtained by using SPSS. Each number in the tables corresponds to the percent of all property owners responding similarly to the individual question. Therefore, the summation of each row in each table will equal one hundred percent.

Beginning with table five, the responses in each table are listed by their means (tables 1-4 are organized by frequency or percentage). For example, respondents ranked lake water pollution due to agricultural spraying as the highest overall problem because this type of lake water pollution had the highest mean of 3.67 (see Table 9). The mean was determined by giving a number to each response option when coding them into the Microsoft Excel spreadsheet. Not a problem was entered as one, slight as a two, moderate as a three, serious as a four, and very serious as a five. A mean of "3" shows that it is a "moderate" problem. Each response's mean value was tabulated by a similar method. All the tables are organized by either the severity of the problem, the highest number of days property owners participated in a recreational activity, or by the strength of support for a specific management action.

Overall Results

Characteristics of the property, the overall impression of Clitherall Lake, the use of Clitherall Lake, concerns property owners have, and opinions about solving potential problems were determined by using the mean or the frequency of the responses to organize the data. The following is a summary of the overall results (Tables are found in Appendix B.2).

- Sixty-six percent of all property owners returned the survey. One hundred percent of the respondents were aware of the Clitherall Lake Association while approximately eighty percent were members.

- Approximately twenty percent of property owners used their properties on weekends, holidays, and vacations during the spring, summer, and fall. Another twenty percent used their properties year round and twenty percent were full time summer residents (Table 3).

- Fifty-two percent of the dwellings surrounding Clitherall Lake are suitable for year round use. Forty percent were originally built as year round structures and twelve percent of the dwellings were converted from seasonal dwellings to year-round structures (Table 4).

- Residents valued living on Clitherall Lake for several reasons. The opportunities too view scenery and obtain solitude were valued very highly by Clitherall Lake property owners. The high water quality of the lake also drew respondents to the lake. Additionally, Clitherall Lake residents had high social values. Family, friends, neighbors, and CLA keep people coming to Clitherall Lake (Table 5).

- The majority of property owners felt that the overall quality of Clitherall Lake had not changed drastically in the past five years. Interestingly, about thirty percent thought it was getting worse while only six percent thought it was getting better (Table 6).

- Specifically, respondents felt the overall quality of Clitherall Lake was getting better due to the awareness and concern of property owners and the activities of CLA (Table 7).

- On the other hand, respondents felt the overall quality of Clitherall Lake was declining due to motorized recreation and water pollution derived from agricultural activities (Table 8)

- The top five important problems facing Clitherall Lake are all related to agricultural activities. Both year-round and seasonal residents identified agricultural spraying to be the number one problem facing Clitherall Lake. Other agricultural problems were associated with agricultural runoff and pivot irrigation (Table 9, 10, 25, and 37).

- The top four summer activities respondents participated in were swimming, walking/hiking, pleasure boating, and fishing. Swimming was the number one activity for seasonal residents while walking/hiking was the activity year-round residents participated in the most (Table 26 and 38).

- Hiking/walking, pleasure driving, ice fishing, and snowmobiling are the recreational activities property owners do most frequently in the winter. Moreover, both seasonal and year round respondents participated in walking and hiking most frequently (Table 27 and 39).

- The most serious problems during the summer are associated with jet skis and fishing. Jet ski associated problems (noise, numbers, and their operation) were the top three identified problems during the summer. Following jet skis, the next significant problem was due to people catching too few fish (Table14).

- The most important winter problems differed between year-round and seasonal residents. Although both groups found fishing to be the most problematic, seasonal residents were more concerned with litter while the year-round residents were more concerned with unsafe ice conditions and unsafe operation of vehicles on the ice (Table 29 and 41).

- Respondents support the stocking of game fish and implementing better control of rough fish to help remedy the fishing problem. Also, respondents supported more aggressively controlling aquatic plants and better enforcement of safety rules and regulations during the summer (Table 18).

- To curb winter problems, respondents supported posting signs that warned people of unsafe ice conditions. Additionally, they supported putting more trash containers at the public landing as well as servicing those trash containers more frequently in order to deal with the littering issue (Table 19).

- Respondents listed several important things CLA could do to better serve their households and Clitherall Lake, such as continue to provide information and education to the property owners via the Clitherall Lake Reporter, increase their amount of political activity, and develop better intergovernmental relationships. Residents urge CLA to preserve and keep monitoring water quality. Furthermore, respondents want CLA to increase the amount of game and panfish (Table 20).

B.3: Sample Analysis Tables for Each Sample Question—Clitherall Lake

All Respondents

Characteristics of the Property

Table 1: Does this property have shoreline frontage on Clitherall Lake?

Response	Frequency*	Percent
Yes	193	98.5
No	3	1.5

Source: Question 1

*Respondents = 196; non-respondents = 4

Table 2: If no, does this property have access rights to the lake?

Response	Frequency*	Percent
No	3	60.0
Yes	2	40.0

Source: Question 1

*Respondents = 5

Table 3: Which statement best describes how your household used this property during the last 12 months?

Response	Frequency*	Percent
Spring, summer, fall use (mostly on weekends, holidays, vacations)	45	22.7
Year-round use	41	20.7
Summer use (most or all of the time)	38	19.2
Summer use (mostly on weekends, holidays, vacations)	32	16.2
Spring, summer, fall, winter use (mostly on weekends, holidays, vacations)	21	10.6
Not used at all	11	5.6
Other	10	5.1

Source: Question 2

*Respondents = 198; non-respondents = 2

Table 4 Which statement best describes this property?

Response	Frequency*	Percent
The dwelling was built originally as a year-round structure	78	39.6
The dwelling is suitable for warm weather use only	65	33.0
The dwelling is suitable for year-round use and was converted from a seasonal dwelling	25	12.7
There is no permanent dwelling on the property	21	10.7
Other	8	4.1

Source: Question 3

*Respondents = 197; non-respondents = 3

- On the average, Clitherall Lake properties came into ownership of the current owners or their families in 1973
- On the average, the dwellings around Clitherall Lake were built in 1968
- On the average, seasonal dwellings were converted to year round structures in 1983

General Impressions of Clitherall Lake – All Respondents

Table 5: Write several words or phrases that express why you value living on or near Clitherall Lake.

Response		Frequency
Scenery and Solitude	• Solitude, peace, quiet, leave work, relax, self-reflection (89) • Beauty, natural aesthetics, natural shoreline, scenic vistas (77) • Flora and fauna (28)	194
Water Resources	• Water quality: clean and clear	77
Social Values	• Family tradition, history, memories (30) • Neighbors: friendly, variety of people, environmentally aware (26) • Clitherall Lake Association: strong, active, good organization (6)	62
Recreational Opportunities	• Fishing (22) • Other: sailing, birding, swimming, snorkeling (19)	41
Development	• Low density shoreland development	20
Water surface use	• Little congestion, low use, not busy on the lake	14

Source: Question 12

Table 6: Over the past five years, would you say the overall quality of Clitherall Lake was:

Response	Frequency*	Percent
About the same	116	62.4
Getting worse	58	31.2
Getting better	12	6.5

Source: Question 9

*Respondents = 186; non-respondents = 14

Table 7: Over the past five years what has gotten particularly better?

Response		Frequency
Social Values	• Environmental awareness and concern of property owners, citizen involvement (27) • Clitherall Lake Association: active, good board, information, communication (20)	47
Fishing	• More habitat, increase in bass and blue gill, increased public concern	13
Water Resources	• Increased water quality, more attention to water quality	6
Pollution Prevention	• More upgraded septic systems	6

Source: Question 10

Table 8: Over the past five years what has gotten particularly worse?

Response		Frequency
Motorized Recreation	• Jet skis: operation/speed (25), noise (20) • Increase in motorized recreation, numbers of boats on weekends (14) • Noise pollution (4)	63
Water Pollution	• Agricultural chemical spraying (29) • Agricultural runoff (8) • Increase in corporate farm activity (5) • Well contamination (5)	47
Water Resources	• Decrease in overall water quality (15) • Aquatic plant growth (13) • Water level fluctuations (8) • Pivot Irrigation (6) • Algae growth (5)	47
Fish and Wildlife	• Declining walleye and pike populations, too many bass (21) • Decrease in wildlife: loons, birds (4) • Decrease in aquatic species: clams, leeches (3)	28
Inadequate Public Services and Safety	• Roads: speeding, increased traffic flows, litter (6) • Taxes: too high for services (6)	12
Shoreline Erosion	• E. side, North by Clitherall Lake Road, wakes, wind	10

Source: Question 11

Table 9: To what extent do you feel each of the following to be a problem on Clitherall Lake?

Response	N*	Not a problem	Slight	Moderate	Serious	Very serious	Don't know	Mean
Lake water pollution due to agricultural chemical spraying	188	9.0	8.0	15.4	19.1	31.4	17.0	3.67
Pivot irrigation	183	14.8	7.1	12.6	19.7	27.3	18.6	3.46
Lake water pollution due to agricultural runoff	192	9.9	9.4	18.8	24.0	22.4	15.6	3.46
Property (i.e. animals, cars, plants) damage due to agricultural chemical spraying	187	18.7	12.3	17.1	15.5	11.2	24.6	3.12
Family health concerns caused by agricultural chemical spraying	187	18.7	12.8	15.0	16.6	20.3	16.6	3.08
Well water contamination due to agricultural chemical spraying	188	18.6	10.1	15.4	12.2	16.5	27.1	2.97
Inadequate response of public officials to your concerns	182	21.4	11.5	18.1	17.0	13.7	18.1	2.87
Lakeshore erosion	190	15.3	33.2	20.5	14.7	10.0	6.3	2.69
Inadequate public service (i.e. roads)	188	44.1	16.5	19.1	7.9	7.4	4.8	2.36
Aquatic plant growth in Clitherall Lake	187	25.7	31.6	26.7	4.8	2.1	9.1	2.18
Well contamination	186	37.6	16.7	17.2	6.5	7.0	15.1	2.15
Trees lost to disease	187	34.2	30.5	12.8	3.7	0.5	18.2	2.11
Algae growth in Clitherall Lake	187	30.5	29.9	23.0	4.3	2.1	10.2	2.08
Lake water pollution due to faulty/substandard septic systems	186	31.2	25.3	14.5	5.4	2.7	21.0	2.02
Overall water quality of Clitherall lake	193	38.9	31.1	17.1	4.7	4.7	3.6	2.01
Zoning ordinances are not followed	182	41.8	15.9	12.1	4.9	2.7	22.5	1.85
Water level fluctuations on Clitherall Lake	188	43.6	27.1	17.6	2.7	2.1	6.9	1.84
Inadequate public safety (i.e. fire, health, emergency, police/sheriff)	184	44.0	21.7	15.8	3.8	1.1	13.6	1.79
Improper alteration to shoreline made by property owners	182	43.4	25.8	11.0	2.7	2.2	14.8	1.76
Neighbors causing disturbances (i.e. noise)	189	58.2	19.0	11.6	3.2	3.7	4.2	1.69
Improper burning of leaves and brush	187	52.9	23.0	7.5	3.2	0	13.4	1.54

Source: Question 7

*N's may vary due to some respondents not answering every question

Table 10: Give us more details about overall problems that were moderate, serious or very serious.

Response		Frequency
Water Pollution	• Agricultural spraying: noise, congestion, allergic reactions, decrease in song birds (69) • Agricultural runoff: pollution, erosion (33) • Well water contamination (29) • Misc. Agricultural: row cropping practices, need stricter regulations, draining of land (14) • Substandard/faulty septic systems (5)	150
Water Resources	• Pivot irrigation: drains aquifer, causes water level changes (32) • Water quality: brown, declining clarity (15) • Water level fluctuations (13) • Aquatic plant growth (10) • Algae growth (7)	77
Inadequate Public Safety and Services	• Lack of public officials responding to residents, lack of coordination between county, state, and federal (15) • Roads: need more maintenance, pave them, too much dust (23) • Fire, police, medical services too far away/slow response times (4)	42
Motorized Recreation	• Jet skis: noise (12), operation/speed (9) • Motorboats: speed, too close to wildlife (5)	26
Shoreline Erosion	• High water levels, ice, wind, individuals altering shore	20

Source: Question 8

Use of Clitherall Lake – All Respondents

Table 11: How many licensed watercraft does your household own that were used on Clitherall Lake during the past 12 months?

Licensed Watercraft	Total number owned by respondents
Fishing Boats	158
Speedboats	76
Canoes	70
Paddleboats	45
Pontoons	32
Sailboats	32
Rowboats	24
Jet skis	12
Sailboards	9
Bass Boats	8
Kayaks	5
Seaplanes	0

Source Question 23

Table 12: Estimate how many days members of household used Clitherall Lake for the following activities this past SUMMER.

Response	N*	0 days	1 to 5 days	6 to 10 days	11 or more days	Mean
Swimming	187	5.3	10.7	22.5	61.5	3.40
Pleasure boating (in motorized boat)	181	8.8	21.5	13.8	55.8	3.16
Fishing from a boat	187	11.8	20.9	16.6	50.8	3.06
Walking/hiking	181	17.1	18.2	17.1	47.5	2.95
Gardening	180	38.9	12.2	9.4	39.4	2.49
Fishing from shore	176	31.8	25.6	18.2	24.4	2.35
Photography	183	30.1	36.1	14.2	19.7	2.23
Water skiing	176	37.5	30.1	9.1	23.3	2.18
Birding	181	49.2	18.2	9.4	23.2	2.06
Paddleboating	179	62.6	13.4	7.8	16.2	1.77
Canoeing	178	60.1	22.5	9.6	7.9	1.65
Snorkeling	178	73.0	17.4	4.5	5.1	1.41
Sailboating	178	80.9	7.9	6.2	5.1	1.35
Personal watercraft (Jet skiing)	176	86.4	9.1	2.3	2.3	1.20
Waterfowl hunting	179	87.7	9.5	1.1	1.7	1.16
Boardsailing	176	92.6	3.4	2.3	1.7	1.13
Kayaking	176	96.0	3.4	0	0.6	1.05
Scuba diving	177	94.9	4.5	0.6	0	1.05

Source: Question 17

*N's may vary due to some respondents not answering every question

Table 13: Estimate how many days members of household used Clitherall Lake for the following activities this past WINTER.

Response	N*	0 days	1 to 5 days	6 to 10 days	11 or more days	Mean
Hiking/walking	146	56.2	20.5	8.9	14.4	1.81
Ice fishing (in a fish house)	147	74.8	8.8	6.1	10.2	1.51
Snowmobiling	143	76.2	13.3	3.5	7.0	1.41
Pleasure driving	129	76.7	14.0	3.9	5.4	1.37
Ice fishing (without a fish house)	138	81.9	11.6	2.2	4.3	1.28
ATV riding	136	92.6	3.7	1.5	2.2	1.13
Snowshoeing	134	89.6	9.0	0.7	0.7	1.12
Ice skating (other than hockey)	138	92.8	5.8	1.4	0	1.08
Hockey	137	96.4	2.2	1.5	0	1.05
Ice boating	136	100.0	0	0	0	1.00

Source: Question 13

Perceptions of Specific Problems on Clitherall Lake – All Respondents

Table 14: To what extent do you feel each of the following was a problem on Clitherall Lake during this past SUMMER.

Response	N*	Not a problem	Slight	Moderate	Serious	Very serious	Don't know	Mean
Noise from jet skiers (personal watercraft)	180	12.2	15.6	23.3	15.6	32.8	0.6	3.41
Too many jet skis (personal watercrafts) on the lake on weekends or holidays	182	23.1	23.1	17.0	11.5	23.6	1.6	2.89
Unskilled jet skiers (personal watercraft)	178	19.1	19.7	22.5	10.1	17.4	11.2	2.85
Catching too few fish	177	34.5	19.8	18.1	7.3	10.2	10.2	2.32
Too many jet skis (personal watercrafts) on the lake on weekdays	176	42.6	23.3	10.8	5.1	14.2	4.0	2.21
More boats speeding on the lake	176	51.7	26.7	13.1	4.0	2.8	1.7	1.77
Litter at the public landing(s) or on the access road(s)	173	28.9	28.3	7.5	1.2	1.2	32.9	1.76
Litter in the lake	178	42.7	42.1	11.2	1.1	0.6	2.2	1.71
Unskilled boaters	172	48.3	22.7	13.4	0.6	2.3	12.8	1.69
People being inconsiderate	174	55.7	25.9	9.2	3.4	2.3	3.4	1.66
Too many boat on the lake on weekends or holidays	173	61.8	20.2	10.4	2.9	1.2	3.5	1.56
More larger boats using the lake	175	59.4	22.9	12.0	1.1	0.6	4.0	1.54
Fishing tournaments	172	66.9	5.8	4.1	4.1	2.9	16.3	1.45
Not enough law enforcement on the lake	173	65.9	13.3	4.6	3.5	1.2	11.6	1.42
Unsafe boating conditions due to overcrowding on the lake	173	67.6	17.9	6.9	1.7	0.6	5.2	1.41
Fishing "disturbed" due to overcrowding on the lake	169	64.5	17.2	4.7	0.6	1.2	11.8	1.37
Trespassing on your property by lake users	178	73.0	14.6	5.6	1.7	1.1	3.9	1.36
Too many people fishing on weekends or holidays	174	75.9	12.1	5.2	2.3	0.6	4.0	1.32
People drinking alcoholic beverage	172	70.9	12.8	5.2	0	0.6	10.5	1.28
Too many boats on the lake on weekdays	173	85.0	9.8	2.3	0	0	2.9	1.14
Vandalism of your property by lake users	176	89.2	6.3	1.7	0	0.6	2.3	1.12
Too much law enforcement on the lake	174	81.6	4.0	1.1	0	0.6	12.6	1.09
Too many people fishing on weekdays	173	90.8	2.3	2.3	0	0	4.6	1.07

Source: Question 18

*N's may vary due to some respondents not answering every question

Table 15: Give us more details about moderate, serious, or very serious SUMMER problems. Source Question 10 .

Response		Frequency
Motorized Recreation	• Operation of motorized watercraft: speed, too close to other users (63) • Jet ski noise: especially on weekends (61) • Increase in water surface use (19)	143
Fishing	• Need better management, stricter limits, decreases in walleye and panfish (23) • Fishing tournaments (50	28
Litter	• Litter in the lake, trash at public accesses, trash on people's lawns	5

Table 16: To what extent do you feel each of following was a problem on Clitherall Lake during this past WINTER?

Response	N*	Not a problem	Slight	Moderate	Serious	Very serious	Don't know	Mean
Noise from jet skiers (personal watercraft)	180	12.2	15.6	23.3	15.6	32.8	0.6	3.41
Catching too few fish	89	36.0	18.0	16.9	3.4	6.7	19.1	2.09
People on the ice during unsafe ice conditions	90	47.8	28.9	2.2	2.2	2.2	16.7	1.58
Litter on the lake	91	49.5	24.2	8.8	1.1	0	16.5	1.53
Litter at the public landing(s) or on the access road(s)	89	43.8	20.2	5.6	1.1	0	29.2	1.49
Lake users operating vehicles in an unsafe manner	91	53.8	16.5	6.6	0	2.2	20.9	1.48
Trespassing on your property by lake users	90	64.4	17.8	5.6	1.1	1.1	10.0	1.40
Noise from snowmobiles on the lake	90	66.7	14.4	7.8	0	1.1	10.0	1.38
Lake users being inconsiderate	91	65.9	16.5	4.4	2.2	0	11.0	1.35
Lake users drinking alcoholic beverages	91	69.2	8.8	2.2	1.1	1.1	17.6	1.25
Too many snowmobiles on the lake on weekends or holidays	91	75.8	7.7	2.2	3.3	0	11.0	1.24
Unskilled snowmobilers on the lake	89	64.0	10.1	3.4	0	0	22.5	1.21
Not enough law enforcement on the lake	90	66.7	10.0	2.2	0	0	21.1	1.18
Too many people on the lake on weekends	91	75.8	9.9	2.2	0	0	12.1	1.16
Too much law enforcement on the lake	88	70.5	5.7	1.1	1.1	0	21.6	1.14
Unattractive fish houses on the lake	88	80.7	10.2	0	0	0	9.1	1.11
Vandalism of your property by lake users	91	89.0	6.6	0	0	1.1	3.3	1.11
Too many snowmobiles on the lake on weekdays	91	79.1	3.3	1.1	1.1	0	15.4	1.10
Too many fish houses on the lake	90	83.3	6.7	0	0	0	10.0	1.07
Too many people on the lake on weekdays	91	81.3	3.3	0	0	0	15.4	1.03
Vandalism of your fish house by lake users	87	89.7	0	1.1	0	0	9.2	1.02

Source: Question 14

*N's may vary due to some respondents not answering every question

Table 17: Give us more details about moderate, serious or very serious WINTER problems.

Response		Frequency
Fishing	• Catching too few fish	12
Trespassing	• Snowmobiles, people	5
Motorized Recreation	• Snowmobile operation (2), noise (2)	4

Source: Question 15

Responses to Management Actions to Solve Problems – All Respondents

Table 18: Given the conditions on Clitherall Lake this past SUMMER how do you feel about each of the following actions?

Response	N*	Strongly Support	Support	Neutral	Oppose	Strongly Oppose	Mean
Provide more stocking of game fish	178	39.3	40.4	16.9	2.2	1.1	1.85
Provide better control of rough fish	172	25.6	41.3	30.2	2.3	0.6	2.11
Be more aggressive in aquatic plant control in the lake	172	22.1	45.3	27.9	3.5	1.2	2.16
Be more aggressive in the enforcement of safety rules and regulations	174	21.8	41.4	30.5	4.6	1.7	2.22
Provide more trash containers at public landing(s)	172	16.9	45.9	34.3	1.7	1.2	2.24
Be more aggressive to service the trash containers at public landing(s)	171	16.4	43.3	38.0	2.3	0	2.26
Prohibit jet skis (personal watercraft) on the lake	178	40.4	16.9	19.1	15.2	8.4	2.34
Provide more information for visitors at public landing(s)	170	17.6	34.1	44.1	3.5	0.6	2.35
Increase penalties for violating boating rules and regulations	174	19.5	28.7	34.5	12.1	5.2	2.54
Establish speed limits for motorized watercraft during high use periods	172	14.5	27.9	28.5	21.5	7.6	2.79
Establish speed limits for motorboats on Clitherall Lake	171	12.9	26.3	29.8	21.1	9.9	2.88
Close the public landing at certain times (e.g. 11pm-5am)	164	10.4	18.3	39.0	23.2	9.1	3.02
Lower the water level of Clitherall Lake	174	10.3	13.2	43.1	22.4	10.9	3.10
Limit the size of motors on the lake	175	10.3	16.6	32.0	27.4	13.7	3.17
Limit the number of watercraft using Clitherall Lake during high use periods	170	4.1	12.4	38.2	31.8	13.5	3.38
Raise the water level of Clitherall Lake	171	4.7	3.5	36.3	33.9	21.6	3.64

Source: Question 20

*N's may vary due to some respondents not answering every question

Table 19: Given the conditions on Clitherall Lake this past WINTER, how do you feel about each of the following actions.

Response	N*	Strongly Support	Support	Neutral	Oppose	Strongly Oppose	Mean
Post signs warning and advising of hazards and/or thin ice	84	29.8	34.5	27.4	7.1	1.2	2.15
Be more aggressive to service the trash containers at the public landing(s)	80	15.0	50.0	31.3	3.8	0	2.23
Provide more trash containers at the public landing(s)	80	16.3	47.5	31.3	3.8	1.3	2.26
Provide more information for visitors at the public landing	84	14.3	33.3	45.2	4.8	2.4	2.47
Be more aggressive in the enforcement of safety rules and regulations	81	14.8	23.5	50.6	8.6	2.5	2.60
Prohibit use of snowmobiles during certain times (e.g. 10pm-6am)	83	15.7	22.9	31.3	16.9	13.3	2.89
Reduce current 50 mph speed limit for snowmobiles on Clitherall Lake	83	9.6	19.3	43.4	18.1	9.6	2.98
Close the public landing(s) during certain times (e.g. 10pm-6am)	83	2.4	18.1	37.3	28.9	13.3	3.32
Restrict the number of fish houses on Clitherall Lake	84	6.0	7.1	46.4	25.0	15.5	3.36
Prohibit use of snowmobiles on Clitherall Lake	85	3.5	7.1	34.1	30.6	24.7	3.65

Source: Question 16

*N's may vary due to some respondents not answering every question

Clitherall Lake Association (CLA)

- 100% of all respondents were aware of the CLA
- 81.5% of all respondents are members of CLA

Table 20: What are three important things CLA can do to better serve you, your household and Clitherall Lake?

Response		Frequency
Clitherall Lake Association	• Information/education: reliable agricultural data, notices of meetings and lake activities, shoreline protection measures (26) • Political Activity: lobby, promote "lake friendly" legislation, be county and township government watchdog (14) • Increase governmental relations: work with DNR, EPA, & other Lake Associations, get a CLA member on county board (10) • Increase social opportunities and maintain current activities (8) • Equality of representation: represent old and new residents, represent majority (not vocal minority), represent permanent and seasonal residents (7)	65
Water Resources	• Water quality: maintain, monitor trends, decrease pollution, decrease runoff (36) • Work to decrease shoreline erosion (7) • Lower water level (4)	46
Fishing Resource	• Increase gamefish and panfish, stop small mouth bass project	40
Agricultural Impacts	• Address spraying, pivot irrigation, runoff. Fight these practices. Communicate their effects	30
Motorized Recreation	• Jet skis: limit, control, discourage (11), prohibit (9) • Enforce boating laws (2)	22
Taxes	• Work to decrease or maintain current tax rates, need to be fair, lobby for equal taxes	16
Development	• Keep development density low, keep out commercial and industrial uses (6) • Enforce and monitor developments, zoning regulations (6)	12
Inadequate Public Services	• Roads: more speed signs, pave gravel roads, need better plowing in winter	12

Source: Question 25

B.4: Highlights of Pilot Lake Property Owner Surveys

Kabekona Lake: Survey Response Analysis Report

The vast amount of information obtained from the comprehensive property owners' survey is organized by its applicability to the six work groups involved in the long-range plan for Kabekona Lake. The information presented to each of the work groups is based on such things as how pressing the problem is and which management actions were strongly approved or opposed. Each summary point is followed by a reference to the table where the comprehensive information can be located in the report. These summary points are not all inclusive. More detailed information can be derived by examining the specific data in the tables.

Work Group 1: Maintain or improve lake water quality.

- Water quality and clarity was the fourth most frequently mentioned reason why respondents valued living on Kabekona .
- The upgrading of septic systems was the most frequently mentioned reason why the overall quality of Kabekona Lake had gotten better.
- Water resources in general was the number one reason why the overall quality of Kabekona Lake had gotten better.
- Lake water pollution due to factors other than faulty septic system was the fifth most serious overall problem on Kabekona Lake.
- Sixty-three percent of all respondents found the overall water quality of Kabekona Lake to not be a problem.
- The top item respondents wanted KLA to do to better to serve the residents was to maintain water quality.
- Specifically, lakeshore erosion was the fifth most frequently mentioned problem on Kabekona Lake by year-round residents

Work Group 2: Monitor water quality and preserve the environmental characteristics of the lake and tributaries.

- Water quality and clarity was the fourth most frequently mentioned reason why respondents valued living on Kabekona Lake
- Flora and fauna were the fifth most frequently mentioned reason why respondents valued living on Kabekona Lake.
- The water resource itself was the overall number one thing that had gotten better over the last five years.
- The second most serious problem noted by all residents was aquatic plant growth. Seasonal residents noted that aquatic plant growth was the number one overall problem at Kabekona Lake and algae growth was fourth. On the other hand, year-round residents found aquatic plant growth to be less problematic and ranked it the seventh most serious overall problem.
- The third most important problem respondents further commented on was aquatic plant growth and fifth was water quality.
- The fifth most supported management action was to be more aggressive in aquatic plant control in the lake.
- Preserving the quality of life and managing shoreline vegetation were two actions frequently noted as things KLA can do to better serve the residents and Kabekona Lake.

Work Group 3: Maintain the lake's fishery at or above present levels.

- Fishing was the third most frequently mentioned aspect about Kabekona Lake that had become particularly worse in the last five years
- The residents of Kabekona have the most number of fishing boats compared to other means of water transportation.
- During the summer, fishing from a boat was the third most heavily used recreational activity on Kabekona Lake and fishing from the shore was sixth.
- Year-round respondents fishing from a boat was the second most heavily used recreational activity and fishing from the shore was fifth.
- Seasonal respondents fishing form a boat was the third most heavily used recreational activity and fishing form the shore was sixth.
- During the winter, ice fishing in a fish house was the fourth most heavily used recreational activity on Kabekona Lake and ice fishing without a fish house was fifth.
- Year-round respondents were more likely to fish in a fish house and seasonal residents were more likely to fish without a fish house.
- Overall, catching too few fish was the third most serious problem in the summer and was the number one most serious problem in the winter .
- Year-round residents found catching few too fish to be a less serious problem than seasonal residents did..
- Both year-round and seasonal residents thought catching too few fish was the number one problem in the winter .
- Fishing was the third most frequently mentioned problem that respondents elaborated on for the summer and the number one problem elaborated on for the winter.
- Although many residents enjoy fishing, the respondents did not encounter an overcrowding of fishing boats (Table 14) or fishing houses on the lake.
- Overall, providing more stocking of game fish and better controlling rough fish were the first and second most strongly supported management activities.

Work Group 4: Encourage only sustainable land development and maintain an active presence with governmental organizations whose programs affect lakes, streams and wetlands.

- Many respondents noted that the low density of development around Kabekona Lake was a reason why they valued living here.
- The number one reason residents valued living on Kabekona Lake was for the peace, quiet and solitude.
- An increase in development was the sixth aspect of Kabekona life that had gotten worse in the last five years.
- Overall, the sixth most serious problem is residents not following zoning. The year-round residents found zoning issues to be the third most serious problem.
- Generally, land use issues were the third most important category of problems that were moderate to very serious.
- During the winter, litter at the public landing and at the access road is the fifth most serious problem.
- Overall, in both the summer and the winter, respondents would like to see more trash cans and to have those trash cans more aggressively serviced at the public landings.

Work Group 5: Commit the Association to a continuing education program for informing the membership about issues and problems they face and the responsibilities they have for preserving the lake and the land area around it.

- Over the past five year, respondents noted the environmental awareness of the property owners as being the second most thing that has gotten better and that KLA and the Foundation's dedication and activities to be third
- Respondents noted the continuing educational importance of the Newsletter as one of the most important things KLA should do to better serve the property owners and the lake.

Work Group 6: Involve more residents in the ongoing lake management process

- Several respondents urged KLA to continue their advocacy in terms of lobbying and proactive management as one of the most important things for the Association to do to better serve the property owners and the lake

Highlights of the Whitefish Chain of Lakes Property Owners' Survey

- Property owners on all lake basins identified that motorized recreation has been decreasing the overall quality of the Whitefish Chain of Lakes in the past five years.

- Specifically, noise pollution and the unsafe operation of motorized watercraft were most problematic.

- Property owners on Daggett and Little Pine Lake were the only group of property owners to identify the operation of motorized watercraft to be more problematic than noise pollution.

- Likewise, property owners on Daggett and Little Pine Lake thought that the decrease in the overall quality of their lakes was first due to the water resource itself and was secondly due to motorized recreation.

- Aquatic plant growth and water pollution were the most frequently mentioned overall problems on all the lake basins.

- The sheltered bays (Bertha, Clamshell, Island, and Lower Hay), Rush, and Daggett-Little Pine Lake felt aquatic plant growth was the number one over all problem.

- Big Trout, Crosslake, and the whitefish lakes (Upper Whitefish, Lower Whitefish, and Pig Lake) felt lake water pollution was the number one overall problem.

- Generally, the top five to eight identified summer problems are related to motorized recreation. Included are noise from jet skis, unskilled jet skiers, too many jet skis on weekends or holidays, boats speeding, unskilled boaters, too many boats on weekends or holidays, and an increase in the number of larger boats.

- Rush Lake was the only lake that found the skill level of jet skiers to be more problematic than the noise pollution. All other lake basins perceived the noise from jet skis to be the number one summer problem.

- In the summer, catching too few fish was one of the top five problems on the whitefish lakes, the sheltered bays, and on Big Trout Lake.

- Litter at the public landings and access roads during the summer was one of the top five problems on all the basins except Crosslake.

- In the winter, catching too few fish and litter at the public landing or on the access roads were the top two problems on the sheltered bays, the whitefish lakes, Rush, and Big Trout.

- People being on the ice during unsafe ice conditions was the number one problem on Crosslake followed by catching too few fish.

- The number one and two supported management action on all the lake basins is to be more aggressive in controlling aquatic plants and to provide more stocking of game fish.

- Generally, the third most supported management action is to be more aggressive in enforcing safety rules and regulations. Only Daggett-Little Pine property owners showed a slight bit more support for controlling rough fish before enforcement.

Highlights of Sugar Lake Survey Results

Characteristics of the property, the overall impression of Sugar Lake, the use of Sugar Lake, concerns property owners have, and opinions about solving potential problems were determined by using the mean or the frequency of the responses to organize the data. The following is a summary of the results.

- Fifty-six percent of the shoreline property owners returned the survey. The overall response rate for the entire Sugar Lake watershed was nearly fifty percent.

- Approximately one-third of shoreline property owners used their properties year-round and one-fourth used their properties on weekends, holidays, and vacations during the summer.

- Nearly sixty percent of the dwellings surrounding Sugar Lake are suitable for year-round use. Forty percent were originally built as year-round structures and twenty percent of the dwellings were converted from seasonal dwellings to year-round structures.

- On average, respondents reported that their septic systems were last upgraded in 1987.

- Residents value living on Sugar Lake for several reasons. The opportunities to view scenery and obtain solitude were valued very high by Sugar Lake property owners. The water quality of Sugar Lake along with its nice shore/beach and size also drew respondents to the lake. Additionally, the proximity to the Twin Cities Metro Area was a factor in deciding to obtain properties on Sugar Lake.

- The majority of property owners felt that the overall quality of Sugar Lake had not changed drastically in the past five years. Interestingly, thirty-two percent of the respondents felt the overall quality was getting worse while only nine percent thought it was getting better.

- Specifically, respondents felt the overall quality of Sugar Lake was getting better due to the awareness and concern of property owners, an increase in water quality, and because more septic systems are in conformance.

- On the other hand, respondents felt the overall quality of Sugar Lake was getting worse due to problems generated from motorized recreationists, a decline in water quality, the introduction of muskies and the problems associated with shoreland development.

- Respondents felt that aquatic plant growth and lake water pollution due to agricultural runoff were the most important problems concerning Sugar Lake.

- Respondents noted that pollution from agricultural and lawn runoff, substandard septic systems, and oil and gas from motorized watercraft were the main causes of environmental degradation in Sugar Lake.

- Respondents participated in three main activities during the summer: pleasure boating, swimming, and fishing.

- Hiking/walking, snowmobiling, and ice skating are the recreational activities that property owners do most frequently in the winter .

- The most serious problems during the summer are associated with jet skis and fishing. The noise, numbers of, and operation of jet skis were very problematic. Respondents attributed the fishing problems with the presence of muskies in the lake and with catching too few panfish.

- In the winter, the top two problems are associated with catching too few fish and the amount of litter at the public landings, access roads, and on the lake.

- Three out of the top five supported management actions related to the fishing resource. Respondents support the stocking of game fish and panfish and better control of rough fish. Likewise, the most strongly opposed management action was to stock Sugar Lake with muskies.

- The top five supported management actions also included more aggressive aquatic plant control in the lake and preserving the remaining undeveloped lakeshore.

- In order to address winter littering issues, respondents supported providing more trash containers at the public landings along with servicing those trash containers more frequently. Furthermore, respondents supported posting signs that warned lake users of hazards and/or thin ice conditions.

- The respondents listed several important things the Sugar Lake Association could do to better serve their households and Sugar Lake. Among them are preserving the water quality of Sugar Lake, maintaining communications with property owners, monitoring shoreland developments, controlling milfoil and aquatic plant growth, and addressing water surface use issues.

Deer Lake Property Owners' Survey

Summary of Written Comments

A total of 214 surveys were returned for a 56 percent response rate. Several questions asked for written comments. In addition, respondents provided many comments of their own.

All surveys were read and the comments were categorized. The number of times an item was mentioned is considered an indication of the strength of feeling about that item. For example, 20 people commented favorably on the preservation efforts of Bear Island while only two were critical of the purchase. This suggests much stronger support than opposition to the project.

The written reactions are presented in three categories according to the relevant survey questions. The right column contains the number of people who wrote a specific comment.

I. Why do you value living on or near Deer Lake?

1.	Peace and quiet, serenity, solitude	88
2.	Beauty of lake, colors, interesting shorelines	79
3.	Water quality, clean and clear	64
4.	Wildlife, loons, flora and fauna	34
5.	Family tradition, "been a part of our family for years"	19
6.	Friendly neighbors	15

Some owners responded to the question with the following comments.

"It (Deer Lake) is my meditation focal point. All I have to do is think about it and stress fades away."

"God's essence is revealed by the lake. The lake teaches."

"A place of serenity and beauty in a noisy, cluttered and visually polluted world."

"I have spent almost every summer of my 68-year-old life on the magnificent, clear, clean lake."

"Summer moonlit nights are too beautiful to describe as the moon reflected on the water sparkles like diamonds."

II. During the past five years, what is good or has gotten better?

1. The formation and work of the Deer Lake Association	49
2. The preservation of Bear Island	20
3. Increased awareness of lake pollution problems	15
4. Improved roads, especially Highways 19 and 62	14
5. Fishing (however, fishing is also rated a serious problem)	10
6. Water sports, e.g., sailing, boating, etc.	8
7. Relatively low boat traffic	7

III. During the past five years, what is bad or has gotten worse?

1. Jet skis (personal water craft), mentioned as noisy, invasive, annoying	94
2. Fishing, too many rock bass and few walleye	45
3. Improper alterations of shoreline and properties (poor variance enforcement)	43
4. Large speed boats and boat traffic	32
5. Property taxes	28
6. Water quality, more algae bloom	24
7. Poor roads and road maintenance	23
8. Pollution: noise, chemical run off, gas/oil	20
9. Shoreline erosion from wave action and ice	20
10. More people and development	19
11. Misuse of islands: littering, burning, wildlife disruption	15
12. Loss of trees, birch and pine	14
13. Substandard septic tanks polluting the lake	11
14. Littering, both summer and winter	10

Other topics mentioned between four and nine times were:

Increased weed growth
Public services not readily available
Fewer loons
Fishing tournaments
Snowmobiles
Trespassing on private property
Inadequate buoys
Junk or trash on property
Water levels too low
Poor enforcement of boating rules

In addition, another 15 problems were listed but only by one or two respondents. These are not included in this summary.

Clearly, Deer Lake residents love the lake and feel strongly about it. They value the beauty, the changing colors, the relative isolation, and the opportunity to enjoy it. Nevertheless, they see problems that jeopardize the quality of the lake experience and feel equally strong about alleviating these problems. They object to activities they think mar the beauty and spoil the environment. These include personal water craft, improper alterations and the failure to monitor permits, pollution including noise pollution, increasing use of speed boats, and erosion among other things. They object to trash in people's yards, ugly or unkempt buildings, broad expanses of mowed and fertilized lawns, loss of trees, and expanding development.

An underlying concern is the impact of inconsiderate people who violate codes and ordinances, litter the shores and islands, pollute the water with agricultural chemicals, run leaky motors, and conduct activities that reduce the serenity and beauty of the lake.

The raising of the money to buy Bear Island shows the strength of this feeling among many residents. Yet just how to do this is a challenge for the Association and all lake residents. Surely, education and cooperation are needed. However, change in behavior among lake users is also needed. We hope the Sustainable Lakes Project can provide insights on how to preserve our lake for the next century and beyond.

Summary Report

The Deer Lake Association (DLA) has been involved in the Sustainable Lakes Project during the past two years. The purpose of this project is to develop plans to answer the question, "What should Deer Lake look like in two generations?"

One project activity was to construct and distribute a survey to all property owners on each of the five lakes participating in the project. The survey sought information on lake usage and owner concerns. A report of written comments was prepared last August and appeared in the April issue of the DLA Newsletter. This report summarizes lake owners' responses to the specific questions on the survey.

A total of 382 questionnaires was mailed out and 214 useable returns were received. A study was conducted to check for possible non-response bias, that is, were the people who returned representative of all owners. No evidence of non-response bias was found although we cannot be positively certain that the 56% who did return surveys accurately represent all of the owners.

Background Information

Thirty percent of the owners are permanent residents. Another 9 percent use their home all year, but mostly on weekends. Summer users represent 30% of the owners and 24% use their home during the spring, summer, and fall. Fifty-three percent of the dwellings are suitable for year-round use and 38% are summer-only homes.

The earliest dwelling was built in 1879 and 4% were built before 1910. The rate of new building has been fairly constant with about 32 new dwellings added each decade. The rate was greatest during the fifties (15%), sixties (17%) andsSeventies (18%) when approximately half the homes were built. Building has dropped slightly during the past two decades (10% and 11%, respectively) as the number of available lots has diminished. In recent years, there appears to be considerable remodeling of older dwellings although the survey did not address this directly.

What are the Current Problems on Deer Lake?

Respondents were asked to rate possible problem areas on the lake. A six-point scale was used including a "Don't Know" option. No problem areas were consistently rated as serious or very serious problem areas which attest to the current high quality of Deer Lake. However, six areas emerged as potential problem areas. These included, lakeshore erosion (32%), failure to follow zoning ordinances (29%), improper shoreline alterations (29%), trees lost to disease (24%), and pollution due to improper septic systems (22%).

There were a few questions that had large numbers responding, "Don't Know." This suggests the need for more information or better distribution of current information. More than a third, 37% responded, Don't Know, to "Lake water pollution due to faulty septic systems." Other areas with many Don't Know responses included; well contamination, zoning ordinances not followed, lake pollution due to agricultural runoff, and lake pollution due to other factors.

Although no areas were judged to be very serious, there were some concerns expressed about changes in the overall quality of the lake. Only 2% believe the quality of Deer Lake has gotten better during the past five years. Sixty-eight percent believe it is about the same, and 20% think it is getting worse. (10% didn't answer or have not been on the lake at least five years.)

Those who spend time during the winter on the lake were asked about problem areas. Only three areas were identified as problem areas by more than 10% of the people: catching too few fish (21%), operating vehicles unsafely (11%), and inconsiderate lake users (10%).

Summer lake users were asked about possible lake problems and two areas were found to generate the strongest negative feelings. These were jet skiing and poor fishing. The noise from jet skis was considered a serious problem by 56% of the responders. Forty-three percent were concerned about poor fishing and 40% thought there were too many jet skis on the lake on weekends or holidays. Increased speeding of boats was next with 21% rating it as a serious problem.

Areas where there were virtually no problems included vandalism, drinking, overcrowding, excessive law enforcement, and too many people fishing the lake.

How We Use the Lake

A menu of 15 activities was presented in the survey and respondents were asked to indicate the number of days they participated in these activities. The most popular activities were swimming and pleasure boating. Approximately 65% of us did these activities 11 times or more during the spring, summer, and fall months. Fifty-four percent of us went fishing 11 days or more and 26% canoed. (Interestingly, 95% reported they did not jet ski!)

The winter residents used the lake mostly for hiking/walking (21% did this 11 or more days) snowmobiling (10%) and cross-country skiing (6%). The lake was not used much for ice fishing in a fish house (only 17% did one or more times) or fishing without a fish house (27% one or more times.)

Nearly everyone on the lake owns some kind of water craft. The most popular are fishing boats (71%) and canoes (59%). Thirty-eight percent have a speed boat and about one-quarter own pontoon boats. Only 2% reported they own a jet ski. This means there are fewer than 10 personal water craft moored on the lake. Despite this small number, plus those launched from the public access, it still is the number one nuisance among property owners.

What Do We Recommend?

Respondents were asked whether they supported various actions on and around the lake, for example, should the size of motors be limited? There were seven possible actions that were either supported or strongly supported by more than 50% of the owners. These are listed below along with the percentage of support. The percent opposing or strongly opposing the action is also shown in the second column.

	Support	Oppose
Provide more stocking of game fish	74%	4%
More enforcement of safety rules	55	11
Prohibit jet skis on the lake	54	22
Better control of rough fish	54	5
More aggressive weed control	52	10
Better trash collection at public landing	52	5
More information at the public landing	51	7

There were several actions that residents generally opposed. These included, lowering the water level (54%), mandating the direction of water craft travel during high use periods (53%), limiting the number of water craft using the lake during holidays and weekends (47%), limiting the size of boat motors (44%), and raising the water level (43%).

Winter residents supported posting signs warning of hazards and thin ice (72%), better enforcement of safety rules and regulations (60%), and better service of the trash containers at the public landing. They opposed prohibiting the use of snowmobiles (69%) and restricting the number of ice houses on Deer Lake (53%).

Concluding Remarks

We are privileged to live on a lake of such beauty and high quality. Compared to other lakes, our problems and concerns are relatively modest. However, we know what can happen to lakes with improper shoreline development, excessive lake use, and poor water quality practices. Fortunately, we can plan accordingly should we think it important.

The information gathered in this survey and other data being assembled by the Sustainable Lakes Project could be used to help us to develop a comprehensive plan that would seek to find a balance among developmental pressures, environmental requirements, and the recreational activities of lake users. The Association members need to decide if they wish to become involved in the development and implementation of such a plan. To that end, you are encouraged to attend the Association meeting on August 14 to meet with representatives of the Sustainable Lakes Project and discuss the future of Deer Lake.

APPENDIX C:
PILOT LAKE PLANS

APPENDIX NOTE:

The five pilot lake plans found in this appendix are all very different in nature even though each followed the Sustainable Lakes Planning Model. Some lake associations adopted a more casual approach to documentation, while others were quite comprehensive. Some of the plans have been totally completed, others are still in the process of defining action steps for the goals they have established. As with any plan, each is a living, breathing document that is constantly taking shape and changing. The different approaches of the lake associations reflect the different character and structure of their associations, leadership styles and planning skills—just as individuals will approach problem solving differently but the outcome may be the same. What does not differ between these plans is their overall mission to protect the quality of the lake for the future enjoyment of those who live and use the lake and the ecosystems that depend on maintaining a quality environment.

CLITHERALL LAKE
Comprehensive Lake Management Plan
Detailed Outline—May, 1999

Mission Statement

"We have come from our homes in faraway cities and states, joining those who live on Clitherall Lake, to form the Clitherall Lake Association, Inc. We are the custodians. We pledge to all who love this special place that we will protect and we will enhance the quality of our water, its environs, its fishery; we will preserve the quality of our life here for unnumbered generations yet to come, forevermore. We are rich beyond measure with our good fortune. We pledge that those who succeed us will share in this wealth here on the beautiful shores of Clitherall Lake."

Introduction

The Clitherall Lake Comprehensive Plan has been developed using the principles of Sustainable Development. The goal of Sustainable Development is to balance the interests of environmental stewardship, community harmony and economic vitality. The recommendations provided in this document aim to preserve the natural character of Clitherall's lake community, yet allow for continued residential and recreational uses and responsible agricultural business.

Findings of Fact

Watershed

- The watershed is the area of land surrounding a body of water within which water drains into the body. The control of this land is crucial to maintaining water quality of the lake. It is also the area within which lakeshore residents socialize and recreate. Clitherall's watershed has a bit of an irregular shape, extending about 1 - 3 miles away from the lake on all sides, except to the southeast of the lake, where a narrow arm of the watershed extends almost eight miles from the lakeshore into hilly terrain.

- The watershed is made up almost entirely of sandy soil conditions. Because of the sandy soil, there is not a system of streams linking bodies of water. The system of water drainage is largely subterranean.

- The bulk of the land in the watershed is used for agricultural purposes. There is also a comparatively large quantity of open water and marshland in the watershed. Much of the agricultural use is concentrated to the east of Clitherall Lake. (See the land use map)

- Because of the porous nature of the watershed's soils, and the subterranean water transport system, intensive, irrigation-oriented agriculture presents an immediate threat to water quality.

- Prior to settlement, the predominant landscape present in the watershed would have been a vast rolling prairie with oak trees and other small forest stands. Today there are a few key areas in the watershed that retain that scenery, one prairie habitat on the eastern edge of the watershed, and several forest stands along the southern shore of the lake, on the peninsula and on the northwestern shore. (see Pre-White Settlement Vegetation Map)

- 48 percent of Clitherall survey respondents indicated that they hike or walk 11 or more days during the summer and 23 percent hiked or walked on more than 6 days during the winter. Hiking or walking was far and away the largest year round recreational activity preferred by Clitherall Lake residents. There is no existing trail network around the lake and its watershed.

- The land in the watershed is largely privately owned (99 percent private, 1percent public). However, 15 percent (3,247 acres) of the land participates in the Conservation Reserve Program, a 10 year easement to leave fields in a natural state. The U. S. Department of Agriculture administers this program.

Shoreline

- 75% – 85% percent of the shoreline is presently developed; 40 - 80 parcels are not developed.
- A large percent of the parcels are mowed down to the shoreline.

Basin Characteristics and Water Use

- Swimming, boating and fishing are the top summer activities enjoyed by lake residents.
- Intensive motorized boating use can disturb both human quality of life and fish habitats.
- The southern tip of the western arm is shallow, vegetated and recently developed. This area of water was entirely exposed during the droughts of the 1930s.

Goals and Recommendations

Shoreline

Recommendations:

1. Parcel Management:
   Build a system for upgrading information on Clitherall's land ownership parcels. This tool would be used to manage water wells, sewage systems and lawn management. It could also be powerfully applied in discussions of taxation.
2. Ensure that a 1,000-foot setback for all new irrigation machinery and feedlots is enforced.
3. Control development and appearance of the lakeshore, restoration of natural vegetation.

Watershed

Recommendations:

1. Control pivot irrigation.
   Strategically target the purchase of small parcels of land to prevent installation of new irrigation rigs. These parcels might have a secondary recreational or habitat function. Continue to push for additional regulation or irrigation.
2. Develop a trail system.
   Several factors could/should be considered in this development. Existing recreation resources in the watershed, areas which retain original vegetation, areas suitable for restoration to original vegetation, location of parcels purchased in order to prevent new irrigation.
3. Encourage better communication within the public management structure.

Lake Basin and Surface

Recommendations:

1. Fish management.
   Ensure that aquatic vegetation beds are retained, open sloughs for habitat and rookeries, implement a catch and release program, implement a walleye slot limit.
2. Manage lake water level.
3. Control Water quality and clarity.

Ethical and Legal Issues

Recommendations:

1. Education to include boating and snowmobile etiquette.
2. Retaining historical information about the lake and its watershed.

SUGAR LAKE
Comprehensive Lake Management Plan
Sugar Lake 1999

Plan Summary

The Sugar Lake comprehensive plan has been developed using the principles of Sustainable Development. Recommendations have been provided to preserve the natural character of the lake community, yet allow for residential development and agricultural practices.

The plan has developed goals and recommendations organized around major watershed, parcel, and basin activities shown on numerous maps and information extracted through questionnaires.

Physical Resources and Land Use

The Sugar Lake watershed is about 4,561 acres. Of this area, almost 40 percent (1,802 acres) is water or wetlands. There are 1,100 acres of open water. Most of this acreage is in the largest lake areas: Sugar, Sand, and Cassidy.

Almost all of Sugar Lake watershed is flat to gently rolling sand to loamy sand soil. The sand has some serious disadvantages. Fertilizer and pesticides from improper lawn management and discharge from non-conforming septic systems can easily pollute groundwater.

About one-third (1,487 acres) of Sugar Lake watershed is cultivated land. Farmsteads and rural residential development complexes constitute approximately five percent (244 acres) of the watershed area, mainly surrounding Sugar Lake's 42,767 feet (8 miles) of shoreline.

Community Goals

Sustainable Development Process

As a framework to guide development of the comprehensive plan the principles of sustainable development have been utilized. A variety of pressing environmental and economic opportunities and challenges face us today, and will also face our children in the future. The opportunities and challenges we have are of interest and should be a concern to all of us, especially in a county where much of the economy and lifestyle are dependent on a high quality environment. Sustainable development provides a means to protect our environment, provide economic growth opportunities, and enhance our society. This concept depends on the active involvement and participation of all citizens to find solutions to challenges, identify opportunities, and create the type of society that meets our needs and those of future generations.

The goals of environmental protection and economic development need not be conflicting; but can, in fact, be mutually reinforcing. Environmentally sound and sustainable economic development emphasizes the promotion of diverse economic opportunities while protecting the productivity and diversity of natural systems. There can be no sustained development without a clear commitment to preservation of the environment and the promotion of wise and efficient use of all resources. In the absence of appropriate growth and development, it may be difficult to protect the environment.

Sustainable development can be a catalyst for development of new industries. Its benefits are many: including environmental enhancement, job creation, industrial development, and may include improved waste management and increased cooperation and involvement of its citizens.

The Sugar Lake Comprehensive Plan is being developed around the goal of Sustainable Development. Sustainable Development requires a process of analyzing decisions in order to find a balance among economic activity, environmental requirements and the social needs of people. If this balance can be achieved all three concerns can be sustained.

To implement the process of Sustainable Development three objectives are called for:
1. Diversify and improve development and improve owner management practices in the lake area.
2. Sustain and enhance resource productivity and improve the environmental qualities and aesthetics of the Sugar Lake watershed.
3. Enhance the quality of life of each watershed resident and visitor.

Information Development

In order for the focus groups and the Sustainable Lakes Project members to function effectively they needed to be supplied with accurate and clear information on the present and likely future growth of the Sugar Lake watershed area. This need prompted the Sustainable Lakes Project Committee to develop a current information base. This information was obtained on three major categories: watershed, lakeshore parcel, and basin.

Watershed information such as land use, soil type, topography, and public ownership are used to identify likely sources of water contamination, attractive development sites, recreation opportunities, and public management responsibilities. Sugar lakeshore property owners' decisions most directly affect the lake. Through questionnaires, photographs, and public data management practices, physical characteristics, and personal issues and concerns are revealed. Lake basin data reveals lake characteristics and are used to monitor clarity and manage fish and aquatic vegetation. This information helps organize administrative efforts and focus attention on critical issues with Sugar Lake's plan.

Sugar Lake Watershed Comprehensive Plan Goals

The comprehensive plan has developed goals and recommendations organized around each major area of data collection: watershed, lakeshore parcel, and basin.

WATERSHED

Land Use/Watershed

1. Agriculture

Facts/Issues

- 1,487 acres (32%) of watershed is cultivated land and 620 acres (13%) is grass/cropland.
- When residential development occurs in agriculture zones disagreement may occur between residential and agriculture landowners as to what are allowable practices relating to agriculture operations. These disagreements can be costly to all concerned and may end up in court for resolution.
- Present agriculture zoning regulations do not effectively protect agriculture land from encroachment of residential development.
- When agriculture best management practices are followed the agriculture land base is enhanced, water quality is maintained, and overall rural quality of life is preserved.
- Agriculture land provides critical wildlife habitat for animals, waterfowl, song birds, and reptiles that is not duplicated in the natural environment.
- Some non-farm residents and lakeshore property owners are not familiar with accepted agriculture management practices.
- Sugar Lake watershed presently has no large feedlots or fields; however, there are areas in the watershed where agriculture irrigation is feasible.
- There is little interaction between farmers, rural residents, and lakeshore property owners.

Goals

- Preserve agriculture practices within the watershed region while improving sustainable development practices to maintain water quality.
- Ensure the Sugar Lake watershed maintains a strong agriculture base and rural landscape.
- Create equitable access to privately owned agriculture open space (fields and pasture).

Recommendations

- Discourage the expansion of intensive agriculture such as feedlots and large-scale irrigation within the Sugar Lake watershed.
- Encourage dialog between agriculture landowners, lakeshore property owners, and rural non-farm residents through the Lake Association and local institutions (e.g. churches, service clubs) and local service businesses (e.g. local bars/restaurants, and convenience stores).
- Encourage the preservation of quality agriculture land in lake areas by supporting cooperative efforts between rural agriculture landowners, Lake Associations, and non-farm residents. Develop a lake

region recreational agriculture landscape patterned after the English Lake Region National Park System.

- Acquire, through purchase or donation, development rights and easements to maintain the rural character of the watershed.
- Encourage city zoning to prohibit large-scale feedlots and irrigation in the immediate vicinity of Sugar Lake watershed.

2. Rural Development

Facts/Issues

- 244 acres (5%) of watershed is farmstead/rural residences or rural residential development complexes.
- As lakeshore property decreases, people will locate near public land that is attractive.
- Many rural non-farm developments are small and owners depend on Sugar Lake and land within its watershed for recreational activities.
- Much of the scenically attractive areas are not suitable for septic systems or intensive lawns.
- Development is dependent on private wells and on-site septic systems.
- Few private wells and septic systems are monitored for performance and most are operated without maintenance plans.
- Sugar Lake area is within the commuter zone to both St. Cloud and Minneapolis. Rural farmland development is increasing due to the decline of available shoreland.
- Development changes the rural landscape of the watershed and disrupts farming.
- Areas where rural development will most likely increase are in rough, forested locations near roads.

Goals

- Manage development so it does not spoil the rural character of the watershed.

Recommendations

- Continue and, if possible, expand programs that work with realtors and others connected with land development and the sale process to accurately and effectively explain to buyers the rules for governing their land purchase and future use of their land.
- Continue and improve education programs that promote lawn and vegetative management practices that protect surface and groundwater resources.
- Utilize state financial resources such as low interest loans and grants to assist individuals in upgrading individual sewage disposal systems.
- Manage rural development.
- Encourage cluster development to preserve the rural landscape.

3. Recreation

Facts/Issues

- The continuing increase in both permanent and seasonal populations is putting pressure on public lands for outdoor recreation purposes.
- During the summer, lakeshore residents of both seasonal and permanent homes recreate on the land near lakes almost as much as they participate in water-based recreation activities.
- Lake and shoreland recreation activities are increasing by both residents and non-residents while the resource base remains the same. As private land parcels become smaller and increase in value, public outdoor recreation activities will concentrate on public lands.
- Most recreation demand in the summer is on the weekends.
- For the Minnesota population as a whole, walking/hiking and biking constitute 30% of all outdoor recreation activities.
- Activities such as nature observation and sight seeing coincide with walking/hiking and constitute 7% of total Minnesota outdoor recreation.
- Almost one-quarter of all Minnesota outdoor recreation includes the water oriented activities of fishing, swimming, and boating.
- Water and trail related activities account for 60% of all outdoor recreation activity.
- The dominant winter recreation activities are walking/hiking, snowmobiling, and ice fishing.
- 638 acres (14%) of watershed is deciduous forest, providing a nice background for landscape and recreation.

Goals

- The public lands of Sugar Lake watershed are a prime location for outdoor recreation and preservation of scenic and animal habitats.
- Develop and maintain a system of trails for diverse types of outdoor recreation in areas that are scenically attractive, adjacent to public land, and owned by farmers.

Recommendations

- Provide land-based recreation facilities such as walking and biking trails for lakeshore residents, their guests, and resort guests.
- Look at the existing public land base and explore joint management and expansion of existing facilities on private land when deciding the locations for future recreation facilities such as trails, parks, camping, and picnicking.

Resource Characteristics/Watershed

1. Erosion/Pollution

Facts/Issues

- 1,465 acres (15%) of the watershed has high groundwater contamination potential and high groundwater resource sensitivity based on soil type.
- 258 acres (6%) of the total watershed is in an area sensitive to pollution supplied by runoff.

- Around one-quarter of the watershed has potential for agriculture irrigation and much of this potential agriculture land is adjacent to Sugar Lake.
- Irrigation allows high levels of herbicides and pesticides to enter groundwater.
- Ditches provide a route for upland waters to reach Sugar Lake.

Goals

- Protect and enhance wetland resources through management policies that maximize the functions and benefits this resource provides.
- Protect the quality and level of surface and groundwater resources in Sugar Lake's watershed.
- Protect groundwater from both agriculture and urban development.

Recommendations

- Protect and actively manage wetland resources to safeguard the groundwater quality and levels in the Sugar Lake watershed.
- Consider nutrient removal in wetlands as a water quality management tool.
- Prioritize agriculture resources needing first priority in best management practices or grants to improve management.

Public Management Responsibilities/Watershed

1. Public Land

Facts/Issues

- 848 acres (18%) of watershed is owned by the state: the DNR Division of Fish and Wildlife owns 693 acres (15%) and the MN Department of Agriculture owns 155 acres (3%). Almost one-fifth owned by the division of DNR.
- The primary goal of DNR Division of Fish and Wildlife owned land is fish and wildlife production. Trails and roads can compliment the DNR's use.
- Some public lands are located in environmentally sensitive areas and protect the water quality of the lake.
- Extensive state owned wetland areas may be valuable for nutrient management of Sugar Lake.

Goals

- The public lands of Sugar Lake watershed are a valuable asset for residents and visitors. The lands held in public ownership need to be managed, protected, and preserved in the best interest of the public and lake users and to enhance outdoor recreation.

Recommendations

- Public land base needs to be maintained and possibly expanded to enhance more recreational needs.
- Use public wetlands for nutrient management.
- Manage and preserve wetland nutrients for water quality .

2. Infrastructure

- Trails
- Roads
  - Stormwater management
  - Ditches
  - Ditches provide an efficient mechanism to move water from uplands to Sugar Lake.
- Stormwater runoff management for developments shall emphasize the ponding of runoff in natural or created wetlands to maximize groundwater recharge.

3. Government Boundaries

Recommendations

- Each township in Suger Lake's watershed needs similar tactics in land maintenance and road control.
- Culvert management should have a high emphasis on water quality.

SHORELINE

Parcels are the base level of management. Parcels that touch water, whether privately or publicly owned, produce both community and individual impacts. Prime community impacts include water quality, fish and wildlife production, and economic development. Individual impacts derive from recreational development, clean potable drinking water, and fair land value assessment.

Community Impacts/Shoreline

1. Water Quality Management

A. Yard Management

Facts/Issues

- High chemical impacts in shoreline can leech or runoff into the lake.
- Intensive lawn management has very high levels of fertilizer and chemical input equivalent to intensive agriculture.
- The knowledge of parcel owners on the impact of lawn management practices on water quality resources appears to be in need of improvement.

Goals

- Develop lawn management practices that minimize nutrient or chemical contributions to the lake.

Recommendations

- Continue and improve education programs that promote lawn and vegetative management practices that protect surface and groundwater resources.
- Promote an effective and low cost education program that emphasizes yard vegetation and lawn management practices that protect surface and groundwater quality.

B. Waste Management

Facts/Issues

- There are indications that many of the presently operating on-site sewer systems, even those installed to modern standards, are not functioning properly.
- New sewer technologies are coming on line at essentially the same cost as traditional septic systems and drain fields.
- Nobody has a septic system maintenance plan (some have started determining which work and which don't, which is a start to check what's there, but is not a maintenance plan.
- There is a high potential for storm water runoff from lots in high density development areas where impervious surfaces (e.g. structures, driveways) are dense.

Goals

- Produce tertiary waste management systems that have no harmful bugs or nutrients at the end of the sewage treatment process.
- Develop a storm water plan to be implemented for high density areas, such as subdivisions, to accommodate for the cumulative impacts of yard management.
- Develop an overall sewer feasibility plan for Sugar Lake.

Recommendations

- Start matching sewer technologies with sites and density.

C. Shoreline Management

Facts/Issues

- Shoreline area is the most sensitive area of a watershed. It is a danger zone for erosion and provides natural habitats for many wildlife species, such as fish, shore birds, and waterfowl.
- Proper vegetation management can lead to greater amounts of wildlife diversity and populations.
- Viewing wildlife is a major recreational activity of lake users.
- Proper vegetation management can lead to lower populations of nuisance insects.
- The DNR has information on lakescaping and a grant program to assist landowners in managing individual parcels.
- As the price of lakeshore property rises, ownership is divided or used more.
- Permanent residences use their property more and have more amenities like washer, dryers, and dish washers.
- Trend to convert from seasonal to year round residence.

Goals

- Develop a shoreland management plan for each parcel on Sugar Lake that enhances wildlife diversity and lowers nuisance insects and maintains high water quality using the DNR lakescaping for wildlife guide.

Recommendations

- Apply for grants to implement a management plan for key parcels on Sugar Lake.
- Start parcel management with parcels that require the least amount of alterations.

2. Development

Facts/Issues

- The lakeshore of Sugar Lake is developed to urban densities.
- There are few remaining natural shoreline areas surrounding Sugar Lake.
- The ratio of permanent and seasonal lakeshore property owners in increasing.
- In areas of existing development, redevelopment is enlarging the size of structures and amount of land being converted to impervious surfaces (driveways, decks, etc.)

Individual Impacts/Shoreline

1. Shore Recreation Development

Facts/Issues

- Each parcel develops shore for individual recreational development such as beach, docks, and boat storage.
- Characteristics of the shoreline do not necessarily relate to the user preferences. For example, non-swimmers do not necessarily buy weedy beaches and those who like to swim do not necessarily by hard, weedless beaches.

Goals

- Maximize enjoyment of each parcel owner, but minimize their impact on lake resource.

Recommendations

- Match lake user preferences with different physical sites that occur around the lake (real estate). The Lake Association could match up sites and place a flier in stores next to real estate brochures.

2. Clean Water For Individual Consumption

Facts/Issues

- With plastic piping, community water systems are feasible, dependable, and potentially cheaper than individual wells.
- Each owner develops an individual water system by drilling a well.
- Most wells do not have a management or monitoring plan in place.

Goals

- Everyone has access to a dependable, clean source of water at reasonable cost.

Recommendations

- Every well should have a management and monitoring plan to monitor the condition of the well and water (includes pump).
- A feasibility study for a community water system should be conducted.

3. Fair Land Assessment

Facts/Issues

- Lakeshore property is appreciating in value quickly
- Lakeshore property is the most valuable rural land.
- Lakeshore property, because of high demand from baby boomers, long range commuters and lake commuters, is high so prices are increasing quickly.
- Assessment is complex and needs a comprehensive lake base.
- Seasonal homes pay a higher tax rate than permanent homes.

Goals

- Combine parcel records created for this project with county assessor records.
- The Lake Association and county agree on methods of defining fair market value.

Recommendations

- Lake Association committees have a task to monitor assessment and relate it to resource base and structures on it.

4. Security

Facts/Issues

- Sixty-one percent of the total lakeshore homes surrounding Sugar Lake are seasonal.
- Seasonal residents present more security challenges
- Well-developed emergency residence systems can reduce the impacts of natural disasters and crime and increase health security.

Goals

- Planning should be done on the assumption that over the long run most houses will be utilized on a permanent basis or ownership will be divided among more than one family and the use will be much higher.
- Security systems be developed to make property crime rare and the level of safety (heart attack, 911) of residence high.

Recommendations

- Develop a security plan with an emphasis on seasonal residences.
- Coordinate parcel numbers with 911.

LAKE BASIN

Recreational Management/Lake Basin

1. Fish Management

Fish Habitat/Littoral Area: Where do various species of fish survive? Where are their spawning areas? Do they survive through the winter freeze. Littoral area = the area above thermocline where aquatic vegetation can grow and fish management is possible.

- Fishing: Where are the important fish habitat areas? What species of fish are present? Desired and undesired? What is the fish population and how is it maintained?
- Capacity, tournaments.

Facts/Issues
Goals
Recommendations

2. Water Surface Management (weekend, weekday, summer, winter)

- Boating: What types of boats are used on the lake? How do they conflict with each other? Is boating managed in any way (time of day, direction of travel, type of watercraft, etc…)?
- High/Low Water Levels - high and low water levels impact real estate development.

Facts/Issues
Goals
Recommendations

3. Exotic Species

- Are there significant populations of exotic plant or animal species? Where are they located? How are they being controlled, if at all?

Facts/Issues
Goals
Recommendations

4. Riparian Public Land

- Public Access: Where are public access points? How developed are they? Are they maintained?
- Public Beaches and Parks
- Dry Hydrants

Facts/Issues

- Dry hydrants can provide a year round access to water for pumper trucks.
- Rural fire insurance rates are high. If dry hydrants are made available, insurance taxes will decrease and safety will increase.
- A surface water management plan for all newly developed parcels needs to be integrated.

Goals

- A natural fit is to place dry hydrants at public accesses.
- Minimize impacts going into lakes (sewer ponds).

Recommendations

- Utilize public land, such as the highway right-of-way for the public water access for dry hydrant locations.

Water Quality

1. **<u>Aquatic vegetation</u> – various types of aquatic vegetation provide habitats for different fish species.**
   - Aquatic Vegetation: Where is significant vegetation present? What type of vegetation is it? Is it exotic or native? What ecological purpose does it serve? How is it managed (mechanical harvest, chemicals, etc.)?

2. **<u>Turnover Rate</u>**
   Facts/Issues
   Goals
   Recommendations

UPDATING AND MAINTAINING THE SUGAR LAKE COMPREHENSIVE PLAN

Maintain the commitment to the principles of sustainable development

The Sugar Lake Association needs to continue the process of long-range planning. Sugar Lake Association should monitor the implementation of recommendations of the comprehensive plan and review the policies and recommendations using key indicators of change. The plan should be updated every five years.

Development, maintenance, and analysis of key indicators

Develop and implement a work program to build a system of key indicators that are needed to monitor and evaluate the effectiveness and relevance of the Comprehensive Plan policies and recommendations. These indicators should allow better management of change. Many of these indicators can be generated by the ongoing record keeping systems of county and city government. All units of government in Wright County should build into each permit issued or activity inspected (building permit, sewer permit) a common geographically registered identification code. This action will allow the continued development of automated mapping.

The product of this system should be the maintenance of an up-to-date standard set of countywide resource and development maps and tables (many of which are contained in the comprehensive plan) that all county planning efforts can draw upon. This will reduce the up front development costs of both present and future planning and development efforts, reduce the dependence on outside consultants, and make the information available for easy use and reference.

Maintenance and development of this information can be enhanced by developing ties to the higher education community.

Foster periodic meetings with local government officials and staff to discuss common issues of mutual concern and to coordinate data collection and planning efforts. In addition, joint proposals to acquire capital to address agreed upon challenges and solutions can be developed with cooperation, enhancing chances of success.

DEER LAKE
Lake Management Plan
Deer Lake: Itasca County, No. 37-0719

The Lake Management Plan consists of three elements: policy statements, more specific objectives for each policy, and a set of specific actions designed to achieve these objectives. The format of the plan is similar to that of the Itasca County Land Use Plan. The content of the plan comes from a survey of property owners conducted in 1998, Deer Lake Association (DLA) focus groups held in August 1999, the Deer Lake Assessment Report completed by the Soil and Water Conservation District in 1997, the Itasca County Plan, and draft lake plans developed by the other associations involved in the Sustainable Lakes Project.

A. Water Quality—Promote the balanced and sustainable use of Deer Lake to preserve the high quality of the lake.

Objective 1. Maintain the high water quality of Deer Lake.

a. Monitor the effectiveness of present septic systems and ensure that county zoning ordinances are being met (e.g., code requirements and effective checks at installation and at transfer or sale.)
b. Continue the yearly monitoring of the lake using the Secchi disc program and the lake level gauge.
c. Every 5-7 years, conduct a thorough phosphorus, chlorophyll-a, pH, and oxygen-temperature profile of the lake.
d. Help monitor and enforce existing shore land management ordinances.
e. Promote the development of narrowly defined standards that must be met before variances or conditional use permits are granted.
f. Play an active role in the Board of Adjustment deliberations for variance requests in the Deer Lake watershed.
g. Monitor parcels where variances are granted to ensure that restrictions and conditions are being met.
h. Educate property owners to encourage private stewardship activities on their property, for example, the impact of fertilizers and run off on water quality.
i. Periodically monitor the lake and boats using the lake for the presence of exotic plants. If found, work with the appropriate agencies to alleviate the problem.

Objective 2. Preserve existing shoreline (forests and buffer zones) and encourage restoration of altered areas.

a. Work to develop tax incentives for the restoration of original landscaping along the lake shore.
b. Educate property owners on the value of proper landscaping of the shore line and provide information and assistance on effective practices.
c. Identify sensitive areas on the lake where the land could be irreparably altered, for example, wetlands, steep banks, high ground water, or soil type. Work to limit development in these areas.
d. Monitor shore landscaping practices and publicize examples of good management plans and report those who violate county and state ordinances.

B. Natural Beauty—Respect and maintain the natural beauty of the lake, its shoreline, and the surrounding watershed.

Objective 1. Maintain or increase current public ownership of shore land and forested areas.

a. Encourage participation in programs designed to place land in the Deer Lake watershed into the public domain. (For example, land trust or conservancy programs or the RIM program used in the purchase of Bear Island.)
b. Support the creation of tax incentives encouraging property owners not to develop, subdivide, or plat undeveloped lake shore.

Objective 2. Limit back lot or second-tier development around the lake.

a. Limit lakeshore development to single-family homes.
b. Oppose County investment in road development that would encourage back lot or second-tier development.

Objective 3. Identify and protect environmentally sensitive areas in the Deer Lake watershed.

a. Support the creation of tax incentives not to develop environmentally sensitive areas.

Objective 4. Find ways to respond to the strong opposition of property owners to the operation of personal water craft and high speed boats.

a. Inform manufacturers, owners, and other lake users of the strong opposition to personal water craft.
b. Seek to find ways to balance the competing interests and desires of boat owners and the majority of property owners.

C. Wildlife—The animals in and around Deer Lake are an important resource that must be monitored and maintained at reasonable numbers. Ways must be found to balance the competing needs of man and the animals.

Objective 1. Monitor desirable wildlife populations.

a. Work with the Department of Fisheries to determine desired fish populations and establish appropriate stocking programs.
b. Conduct yearly surveys of loon populations.
c. Monitor the eagle population and nesting sites.
d. Investigate the impact of fishing tournaments on the lake, for example, fish population and the presence of many high speed boats.

Objective 2. Find ways to reduce or eliminate the problems of nuisance animals and curb their growing populations.

a. Discourage the feeding of ducks and geese by property owners. Both are carriers of exotic species such as milfoil. Ducks spread swimmers' itch and the growing goose population is a nuisance on beaches and lawns.
b. Educate property owners on ways to effectively live with bears, deer, raccoons, etc.

D. Cooperation—The sustainable use of Deer Lake is best achieved through the cooperative efforts of the Association, governmental agencies, and other organizations concerned with natural resources.

Objective 1. Work with existing planning efforts and agencies (DNR, Itasca County Zoning office, Soil and Water Conservation District, Sheriff's Department.)

a. Continue the practice of inviting representatives of these groups and others to speak at the Association meetings.
b. Urge property owners to contact these agencies when they have questions regarding the lake, their property, and the use of the lake and its watershed.

Objective 2. Promote the work of organizations devoted to the preservation of Minnesota lakes.

a. Participate in the Itasca County Organization of Lake Associations (ICOLA)
b. Support the work of the Minnesota Lakes Association and other organizations working to preserve the lake to the extent their efforts are consistent with our policies.
c. Critically monitor other efforts devoted to the preservation of Minnesota lakes, for example, the Sustainable Lakes Project, and participate if there is evidence that such involvement will help sustain Deer Lake.

LAKE KABEKONA
Long Range Plan for Kabekona Lake
A Guide for Protecting and Enhancing Kabekona Lake's Environment and its Surroundings

Introduction

Kabekona's Character. Kabekona Lake is located in Hubbard County, Minnesota. Deciduous and coniferous forests surround the lake. The forest cover naturally camouflages several of the seasonal and year-round homes scattered throughout the shoreline. Natural vegetation and gentle slopes characterize the majority of Kabekona's shoreline. The majority (66%) of Kabekona Lake's surrounding watershed is covered with deciduous forest. The watershed also contains several pockets of grasslands and water features such as rivers, lakes, and wetlands. Generally, the waters of Kabekona are not heavily used for intense motorized recreation activities, such as jet and water skiing. Rather, the majority of the property owners use the lake for pleasure boating, fishing, and swimming.

Planning Background. The management of Kabekona Lake has been guided by their Long-Range Management Plan since 1994. The vast amount of information gathered from the Sustainable Lakes Project is coupled with this exiting plan to formulate the 1999 Comprehensive Management Plan. The content of the plan is organized by the Kabekona Lake Association's six work groups. The information for the facts/issues section was derived from a comprehensive property owners' survey and from an analysis of the biophysical resources of the watershed, the lake basin, and the individual parcels surrounding the lake.

Work Group 1: Maintain or improve lake water quality

Facts/Issues:

- Water quality and clarity was the fourth most frequently mentioned reason why respondents valued living on Kabekona Lake.
- The upgrading of septic systems was the most frequently mentioned reason why the overall quality of Kabekona Lake had gotten better.
- Water resources in general were the number one identified reason why the overall quality of Kabekona Lake had improved.
- Lake water pollution due to factors other than faulty septic systems was the fifth most serious overall problem on Kabekona Lake.
- Sixty-three percent of all respondents found that the overall water quality of Kabekona Lake was a problem.
- The number one thing respondents wanted KLA to do to better serve the residents was to maintain water quality.
- Specifically, lakeshore erosion was the fifth most frequently mentioned problem on Kabekona Lake by year-round residents.
- Each individual parcel owner makes management decisions that impact water quality
- Good parcel maps provide Lake Associations, local governments, and state governments with the ability to monitor compliance with state regulations and permits, develop priorities for enforcement and education, and critique standards and programs.

- Parcel data can be used to plan and develop lake-wide maintenance programs for individual sewer system maintenance through lake wide pumping contracts.
- Monitoring programs can be greatly improved. The ability to map out sewer system compliance is crucial to good lake management and to locating areas where individual on site systems cannot work because of resource limitations or excessive density. Presently, DNR does not have the ability to link permits issued for shoreline alterations or for the control of aquatic vegetation to parcel files.
- Lawn management practices of shoreline property are widely recognized as having a significant impact on water quality, especially for lakes like Kabekona that have largely undeveloped (forested) watersheds. Photos of each parcel that are linked to a database are allowing managers to quantify and map lawn management practices. Shoreline education efforts can then be targeted to areas where management changes are needed and recognition can be given to property owners with the best management practices.

Goal: Determine if any additional sewage treatment systems around the lake need to be upgraded

Actions:

1. Work with the Hubbard County's Environmental Services Office to determine which individual systems need upgrading.
2. Suggest cluster systems where circumstances prevent proper individual sewage treatment systems.
3. Establish a parcel database where compliant and non-compliant systems can be recorded and updated as necessary.

Goal: Develop a program to assess the recommended frequency of pumping sewage systems for lakeshore owners within the zoning regulations

Actions:

1. Set up an annual pumping schedule based on the assessment of individual systems.
2. Encourage homeowners to sign up to have their septic systems pumped at the recommended intervals, including holding tanks.
3. Develop a bidding procedure for local pumping companies to bid on the total number of systems to be pumped each year.
4. Distribute educational information concerning the care of septic systems to property owners.

Work Group 2: Monitor the water quality and preserve the environmental characteristics of the lake and its tributaries

Facts/Issues:

- Water quality and clarity was the fourth most frequently mentioned reason why respondents valued living on Kabekona Lake.
- Flora and fauna were the fifth most frequently mentioned reason why respondents valued living on Kabekona Lake.
- The water resource itself was the overall number one thing that had gotten better over the last five years.
- The second most serious problem noted by all residents was aquatic plant growth. Seasonal residents noted that aquatic plant growth was the number one overall problem at Kabekona Lake and algae growth was fourth. On the other hand, year-round residents found aquatic plant growth to be less problematic and ranked it the seventh most serious overall problem.

- The third most important problem respondents further commented on was aquatic plant growth and fifth was water quality.
- The fifth most supported management action was to be more aggressive in aquatic plant control in the lake.
- Preserving the quality of life and managing shoreline vegetation were two actions frequently noted as things KLA can do to better serve the residents and Kabekona Lake.
- Land use practices in the watershed directly impact the water quality of Kabekona Lake. The portions of the watershed that have the most impact on Kabekona Lake are the adjacent shoreline areas located on steep slopes.
- The public lands in Kabekona's immediate watershed do not have special lake management programs even though they are located near valued, high quality, high recreational lakes. Individual program goals of land management units are usually given a higher priority than lake management goals.
- Local and state zoning, both within and outside the shoreland zone, do not contain special provisions for water quality or public health protection. The classic example is allowing intensive irrigation and aerial application of herbicides and pesticides adjacent to urban settlements.
- One of the key variables in lake management is soils data. Unfortunately, the latest and most expensive soil surveys are almost too detailed for watershed wide analysis, but not detailed enough for use with individual parcels and structures.
- Currently, there are no systematic programs to update the information we have collected and need for Lake Management. The most obvious example is land use / cover.
- The major need for data collection for lake management purposes is not water quality information but information and monitoring of land resources and settlement patterns.
- There appears to be no clear, easily used models linking water quality data to cumulative individual management actions in a lake's watershed.

Goal: Monitor, analyze, and report water quality data

Actions:

1. Continue secchi disk monitoring on a weekly basis at sites 202, 205, and 206. Merge and compare data annually to assess it for long range trends in water quality.
2. Conduct laboratory analyzes of the lake water for total phosphorus and chlorophyll-A on a monthly basis from May-September every five years starting in 1999. This monitoring should be conducted more frequently if the weekly secchi data indicates a significant negative trend in water quality.
3. Analyze total phosphorus content of the three inlet steams on a monthly basis, April-September, every five years beginning in 1999.
4. At the end of three-year intervals, compare data with historical norms, determine trends, if any, and modify the management plan, as needed.
5. Determine what lake data is being collected or should be collected, by whom, and where it should be retained for future use i.e. studies, planning, etc.

Goal: Create a database with the flora and fauna located in Kabekona's watershed

Actions:

1. Contact the Minnesota County Biological Survey at the DNR to determine if their mapping is complete for Hubbard County. Maps include original/natural vegetation and areas that house rare and endangered species.
2. Inventory the flora and fauna typical of Kabekona's watershed.

Goal: Preserve the water features in Kabekona's watershed

Action:

1. Work with the DNR, the US Forest Service, the Hubbard County Land Department, the Hubbard County Environmental Services Dept. and the MPCA to develop a plan for protecting and preserving the water features in Kabekona's watershed.

Goal: Maintain Kabekona's aquatic and shoreland vegetation

Actions:

1. Educate property owners regarding the importance of using management practices that preserve a natural shoreline.
2. Encourage property owners to maintain natural vegetation along their shoreline.
3. Discourage property owners from using lawn chemicals that may run-off into the lake basin and alter the current levels of aquatic vegetation.

Goal: Monitor Kabekona Lake for the presence of exotic species

Actions:

1. Assign a committee to check the lake at least three times each season for the presence of exotic species.
2. Educate property owners about what exotics are, what they look like, and where they are typically found.
3. Encourage residents to watch for exotics while they are using the lake.

Work Group 3: Kabekona Lake's Fishery

Issues/Facts:

- Fishing was the third most frequently mentioned aspect about Kabekona Lake that had gotten particularly worse in the last five years.
- The residents of Kabekona have more fishing boats than other means of water transportation.
- During the summer, fishing from a boat was the third most heavily used recreational activity on Kabekona Lake and fishing from the shore was sixth.
- Year-round respondents fishing from a boat was the second most heavily used recreational activity and fishing from the shore was fifth.
- Seasonal respondents fishing from a boat was the third most heavily used recreational activity and fishing from the shore was sixth.
- During the winter, ice fishing in a fish house was the fourth most heavily used recreational activity on Kabekona Lake and ice fishing without a fish house was fifth.

- Year-round respondents were more likely to fish in a fish house and seasonal residents were more likely to fish without a fish house.
- Overall, catching too few fish was the third most serious problem in the summer and was the number one problem in the winter.
- Year-round residents found catching few too fish to be a less serious problem than seasonal residents did.
- Both year-round and seasonal residents thought catching too few fish was the number one problem in the winter.
- Although many residents enjoy fishing, the respondents did not encounter an overcrowding of fishing boats or fish houses on the lake.
- Overall, providing more stocking of game fish and better controlling rough fish were the first and second most strongly supported management activities.
- Fish populations and relative species growth is well known. The impact of harvest is also well understood. Fishing knowledge and quality of equipment used is increasing.
- The hours spent fishing per fish caught is increasing, the average size of fish caught is decreasing, and fewer fishermen are increasingly taking a larger percentage of the total harvest.
- Any lake, through good fortune or good management, that acquires an above average population of larger game fish may have an immediate increase in fishing pressure that will change the population back to the average.
- Present angling bag limits bear little relationship to the ability of lakes to withstand a sustained basis of continuous fishing pressure with modern angling methods and present bag limits.
- In order to improve fishing, fishing hours and fishing "toys" should be limited, major reductions in fishing limits should be implemented, and catch and release programs should be encouraged.

Goal: Maintain the lake's fishery at or above present levels

Actions:

1. Work with the DNR in studying, protecting, and, where necessary, creating aquatic habitat.
2. Compare and analyze all available fish census data from Kabekona Lake. Identify any problem or potential problem areas and work with the DNR in making corrections.

Work Group 4: Encourage only sustainable land development and maintain an active presence with governmental organizations whose programs affect lakes, streams, and wetlands

Issues/Facts:

- Many respondents noted that the low density of development around Kabekona Lake was a reason why they valued living there.
- The number one reason residents valued living on Kabekona Lake was for the peace, quiet and solitude.
- An increase in development was the sixth aspect of Kabekona life that had gotten worse in the last five years.
- Overall, the sixth most serious problem is residents not following zoning ordinances. The year-round residents found zoning issues to be the third most serious problem.
- Generally, land use issues were the third most important category of problems that were moderate to very serious.

- During the winter, litter at the public landing and at the access road is the fifth most serious problem.
- Overall, in both the summer and the winter, respondents would like to see more trash cans and to have those trash cans more aggressively serviced at the public landings.
- Each individual parcel owner makes management decisions that affect the lake.
- Good parcel maps provide Lake Associations, local governments, and state government with the ability to monitor compliance with state regulations and permits, develop priorities for enforcement and education, and critique standards and programs.
- Lawn management practices of shoreline property are widely recognized as having a significant impact on water quality, especially in lakes with largely undeveloped (forested) watersheds. Photos linked to parcels are allowing us to quantify and map lawn management practices. Shoreline education efforts can then be targeted to areas where management changes are needed and recognition can be given to property owners with the best management practices.
- Linkage of land management information to assessor's records via land parcel files should give both County Assessors and Lake Associations access to full information on the variables needed for proper land valuation assessment. This can make Lake Associations and individual parcel owners full partners in the land assessment process.
- Land values of lakeshore property on our study lakes closely correlate with the higher income neighborhoods of the Twin Cities Metropolitan Area. This trend has persisted since 1950.
- The high-assessed valuations of lakeshore properties generate a large revenue stream to local governments. This revenue exceeds the costs incurred in providing local government services. To protect lakeshore property revenue streams more local investment in lake related management seems justified, if only to protect the revenue stream.
- Master plans for emergency services can be developed from parcel maps. The optimal locations of dry hydrants can be developed and installed and lead to significant reductions in insurance rates. Public accesses can serve as prime locations for dry hydrants.
- Areas of undeveloped shoreline can be identified and decisions made on how much shoreline could and should be left in an undeveloped state or limited in its development. Careful documentation of the need for preserving undeveloped, low density developed shoreline is important because the public dollars to fund such a program will be in competition with established outdoor recreation programs unless new forms of funding and delivery of programs can be devised.

Goal: Determine which shoreline parcels are suitable for development

Action:

1. Classify property surrounding the lake into three categories: suitable for development, marginally suitable for development (with strict safeguards), and not suitable for development (wetlands, steep slopes, lot size, soil type).
2. Make recommendations to the KLA board as to the possible purchase of parcels based on their development suitability for preservation.
3. Make the information on suitability for development, by parcel, available to realtors, property owners, Hubbard County, the state, etc.

Goal: Keep up-to-date on current, new or amended zoning regulations and development proposals and work to influence outcomes that benefit Kabekona Lake

Actions:

1. Appoint a committee whose charge is to become thoroughly informed on county and state lakeshore zoning requirements, monitor development proposals, take positions, document those positions, and advise developers and governmental agencies of those positions.
2. Require the attendance and input of committee members, or spokesperson, at all meetings of the Hubbard County Zoning and Planning Board where proposals for development and/or variances are being considered.
3. Work with Hubbard County governmental agencies and Hubbard County COLA to determine and enact zoning ordinances required to regulate future development beyond the current shoreland regulations (beyond 1000 feet from the shoreline).
4. Work with Township Boards on zoning.

Goal: Work with governmental organizations that affect lakes, rivers, and wetlands

Action:

1. Maintain memberships in and appoint representatives to attend, participate in and report on meetings and the purposes of MLA, Hubbard COLA, Leech Lake Watershed Project, lake advocates and any other appropriate organizations that benefit KLA's purposes.

Goal: Keep the area surrounding Kabekona Lake clean

Action:

1. Develop and implement an Adopt-A-Road Program to keep the roads surrounding the lake clean and free of garbage.

Goal: Implement the Sustainable Lakes Parcel Database

Actions:

1. Recommend to the KLA Board all additional items unique to each parcel, which should be added to the database.
2. Obtain and enter data for each item assessed.
3. Maintain the database.

Work Group 5: Commit KLA to a continuing education program for informing the membership about issues and problems they face and the responsibilities they have for preserving the lake and the land areas around it

Issues/Facts

- Over the past five years, respondents noted the environmental awareness of the property owners as being the second most thing that has gotten better and that KLA and the Foundation's dedication and activities to be third.
- Respondents noted the continuing educational importance of the Newsletter as one of the most important things KLA should do to better serve the property owners and the lake.

Goal: Provide information to property owners via KLA's newsletter, special mailings, and special meetings/workshops

Actions:

1. Emphasize "best management" practices (discourage lawn fertilizers, conserving water use, maintain natural shoreline vegetation, etc.).
2. Rally support from membership when their influence is needed.
3. Circulate special advisories to the membership, as they become necessary.
4. Schedule special meetings and/or workshops as the need arises.

Work Group 6: Involve more residents in the ongoing lake management process

Issues/Facts:

- Several respondents urged KLA to continue their advocacy in terms of lobbying and proactive management as one of the most important things for the Association to do to better serve the property owners and the lake.
- The lake management plan needs to remain an "active" document in order to be useful.
- The plan needs to be revisited every 1-5 years in order to remain up to date with new technologies and problems.

Goal: Implement organizational and structural changes that will aid in plan implementation and monitoring

Actions:

1. Develop a broader committee structure for the KLA.
2. Give each committee a specific purpose, subsequent goals, actions to meet those goals, and deadlines for completing goals.
3. Develop measurable benchmarks of success that indicate if a committee or work group is reaching their specified goals (i.e. two parcels of land will be purchased for preservation by the year 2005).
4. Examine the lake management plan annually to determine what needs to be added, eliminated, and where and how it should be revised.
5. Meet with membership to announce the management plan.
   a. Send letter to membership outlining plan and urging fullest cooperation and participation.
   b. Send letter to non-members, invite them to join KLA and encourage their participation in implementing the management plan and formulating future plans.
   c. Outline purposes, goals, procedures, and estimated costs.
   d. Encourage discussion, questions, and suggestions.

Identified Stakeholders : Those who have a direct or indirect interest in the lake's welfare.

A. Property Owners, relatives and friends who visit the lake on a regular basis.
B. Resorts and Campgrounds: since owners' livelihood is related directly to lake preservation, they must be considered full partners in the management plan and clean, desirable lakes are vital to survival and prosperity of area businesses.

C. County Government, including Board of Commissioners, Environmental Services, Planning and Zoning, Board of Adjust, Sheriff's Department, County Engineer, Hubbard County Soil and Water Conservation District, Hubbard County Land Department.
D. Township Government—Kabekona Lake lies within the jurisdiction of three townships (Lakeport, Hendrickson, and Steamboat River), so informing and involving board members in problems that need attention is important to achieving management goals.
E. State Government:
    1. Minnesota Department of Natural Resources (Fish and Game, Trails and Waterways, Hydrology, Hydrographics, Exotic Species)
    2. Minnesota Pollution Control Agency: provides advisory services on water quality monitoring, testing, and data interpretation, and periodic consultation on management plan revisions.
    3. Board of Water and Soil Resources: provides advisory services on soil and water issues peculiar to Kabekona Lake's environments.
    4. State Representatives and Senators
F. Federal Government
    1. U.S. Forest Service: provides advisory contribution with respect to Forest Service lands adjacent to Kabekona Lake and the Kabekona watershed area.
    2. U.S. Army Corp of Engineers: provides inspection of perimeter wetlands and consultation on management approaches.
    3. U.S. Fish and Wildlife Service: provides assistance with wetland inventory/identification and protection.
    4. U.S. Congressmen
G. Nonprofit Environmental Groups
    1. Hubbard COLA
    2. Minnesota Lakes Association
    3. Leech Lake Watershed Project
H. Leech Lake Tribe

WHITEFISH CHAIN OF LAKES
Whitefish Area Property Owners Association

The following issues were identified through a professionally facilitated presentation of data and concerns to the Whitefish Area Property Owners Association (WAPOA) and other stakeholders.

1. Water Surface Management
2. Fishing Quality
3. Water Quality/Aquatic Plants
4. Management of Developed Shoreline
5. Public Lands
6. Management of Undeveloped Shore Areas
7. Land-Based Recreation Opportunities
8. Transportation (Scenic Roads)
9. Zoning
10. Land Easement to Control Development

With the ten issues above identified through a focus group setting, the WAPOA Board then narrowed the issues down to four issues where goals (desired outcomes) and actions steps were further defined.

I. Zoning

Desired Outcomes and Action Steps:

1. Develop and implement an environmentally based zoning tool by June 19, 1999, and create consensus for the use of this tool by the public and governmental units.
2. Action step: WAPOA now represented on:
   Crow Wing County Water Plan
   Crow Wing County Comprehensive Plan
   Crow Wing County/Cass County 371 Planning Grant Committee

II. Public Lands

Desired outcomes and action steps:

1. By June 19, 1999, a new comprehensive plan for public lands will be in place for 3-5 years. It will reflect stewardship and use of public lands for all user groups.
2. Action Plan:
   a. Identify what we currently have in terms of comprehensive plan
   b. Identify players and policies
   c. Set a timeline to accomplish

III. Management of Undeveloped Shore Areas

Desired outcomes and action steps:

1. Develop a management plan for inventoried public/private undeveloped shore areas—define sensitive areas (two years).
2. Direct "reasonable" development of private undeveloped shore areas.
3. Protect visual integrity of shoreline.
4. Educate public/private on stewardship balance e.g. conservation vs. preservation.
5. Enforcement of stewardship.
6. Action steps by June 19, 1999:
   a. Identify sensitive land criteria.
   b. Identify/increase funding opportunities (easements).
   c. Identify public ownership of lakes.
   d. Set date for meeting to discuss all easement options and increase citizen awareness about easements through education.

IV. Management of Developed Shorelines

Desired Outcomes and action steps:

1. Establish a set of environmental standards for lakeshore properties.
2. System in place to track compliance to environmental standards.
3. Install standards and procedures.
4. Complete conformance to environmental standards.
5. Action steps by June 19, 1999:
   a. Review existing environmental standards for lakeshore property.
   b. Identify problem areas in existing standards.
   c. Monitor development of a pilot compliance-tracking tool.

APPENDIX D: LAKE DATA ASSESSMENT GUIDE

UNDERSTANDING A LAKE THROUGH THE REVIEW OF EXISTING DATA

Bruce Paakh, Water Quality Specialist, Minnesota Pollution Control Agency

This guide was prepared to assist the citizen lake manager with utilizing and interpreting lake water quality data to better understand a lake. The document takes you through a step-by-step process of gathering, organizing, and "crunching" data that you and others have collected about your lake. The procedures discussed are fundamental in the process of analyzing lake data and converting the data to useful information about the lake.

Assessing the condition of a lake over time and learning more about the way a lake reacts to various environmental factors is important in understanding the lake, and it can assist you in your lake protection efforts. Sharing this information with others on the lake is an important step in transforming lake residents into informed lake stewards. The future of Minnesota lakes depends on this.

Each lake is unique due to the many characteristics and variables that influence its makeup. Factors such as size, shape, mean and maximum depths, volume, location, watershed size, watershed land use, soil types, climate, water chemistry, and a host of other factors affect the productive behavior of lakes. The collection of simple water quality data is one way to begin to quantify the physical condition (with Secchi disk readings), chemical condition (with phosphorus data) and biological (with chlorophyll-a data) condition of lakes.

The data assessment process is divided into the following steps:

1. Gather existing data
2. Organize and scrutinize data
3. Calculate summer mean water quality values
4. Calculate long-term mean water quality values
5. Plot summer mean and long-term mean Secchi data for each year
   a. Assess long-term trend
   b. Assess year-to-year variability
   c. Assess seasonal trends
6. Identify your ecoregion and compare data with ecoregion ranges
7. Compare distribution of Trophic State Index (TSI) values and lake basin morphometry measurements by ecoregion
8. Compare TSI and water quality characteristics
9. Assess relationships of phosphorus / chlorophyll-a/ Secchi
10. Assess use impairment with water quality conditions

Working through the steps outlined above should help you to better understand your lake. This assessment process can be done in a night or two, or can be conducted over a long period of time. It is recommended that the lake association form a Water Quality Committee to ensure the long-term collection of accurate data from good sites and to develop an informed group, rather than an informed individual. The advantage of having a committee can be significant when you are attempting to develop and implement stewardship programs aimed at protecting water quality and ensuring that the program continues over time.

The processes that follow involve transferring data values from one place to another. Whenever this is done, there is a possibility that a transcription error could occur and that you could end up working with some wrong numbers. To avoid this, you must go back and proof all data any time it is transferred. This includes transferring any numbers from data sheets to written tables or to computer spreadsheets. Catching errors up front can save a lot of time, and it will give you the confidence that your work is accurate and, therefore, meaningful.

1. Gather Existing Data

Collecting and organizing all existing water quality data available for your lake is the initial step.

Gather existing data from all residents on the lake that have ever been involved with Secchi disk monitoring. If there is any data that has never been submitted to the MPCA's Citizen Lake Monitoring Program (CLMP), ferret this out and get a copy of the original data (keep a copy for your records) and submit a copy to the CLMP. Finding this data is important because you want to have as complete a record of data as possible.

Request STORET data on your lake from the Minnesota Pollution Control Agency. All Secchi data that is submitted to the CLMP program should be included in this data set.

Data can be requested from:

Jennifer Klang, CLMP Coordinator, MPCA – St. Paul (651-282-2618)
Jesse Anderson, Monitoring Coordinator, MPCA – Duluth (218-529-6218)
Laurie Sovell, Monitoring Coordinator, MPCA – Mankato (507-389-1925)
Mike Vavricka, Monitoring Coordinator, MPCA – Detroit Lakes (218-846-0776).

STORET is a federal (EPA) water quality database where all Minnesota Pollution Control Agency (MPCA) data (including CLMP) is stored. The STORET printout should include all available phosphorus, chlorophyll and Secchi data, as well as recreation suitability data for your lake. When looking over the STORET printout, if you notice that you have lake data that isn't in STORET, please make a point to send a copy of the data to the MPCA and mark on it "for STORET entry." This will ensure that with any future retrievals of data for your lake, you will get the full set of data in an organized format.

When requesting phosphorus (P) data, ask for total phosphorus. If you get data back that is ortho-phosphorus, don't combine it with total phosphorus data as they are not the same (keep ortho P and total P in separate columns).

Make sure that when you request data that you ask for "in-lake" water quality data. You don't want to mix inlet stream phosphorus data with mid-lake phosphorus data. They are different and must be kept separate. The same goes with chlorophyll a, b or c. Keep the three separated, and specifically ask for chlorophyll-a (pheophyton corrected) data.

Request DNR Secchi Disk and Lake Level Data

Secchi disk measurements are normally taken when DNR Fisheries Surveys are conducted. These historical measurements can be obtained from the DNR Area Fisheries Office that serves your area. It is important that the sampling location be identified for each piece of data you obtain. The site should be given a site ID # or at least be identified on a copy of the lake map that is kept with your data file. The DNR also manages the Lake Level Minnesota Program and has historic lake level data for many lakes. The DNR Area Hydrologists are the keepers of lake level data.

2. Organize and Scrutinize Data

Organize data in chronological order. Once all the data is in hand, it is suggested that you organize it chronologically in tables (See Table 1 on page D-11). Start with the oldest data and continue to fill out the table until all the available data is included. If you have copies of old Secchi data sheets and or STORET printouts, these should be organized chronologically.

Go back over every data point and make sure you didn't make any errors while transferring it. Look over the values and note any data points that you have any reason not to fully trust. Some data can be considered weak. For example, an old Secchi site was located in 10 feet of water and your normal Secchi readings from the middle of the lake range from 8 to 17 feet. In this example, you may want to disregard and not use the data from the 10 foot site since it's unlikely to represent what is occurring in the lake.

Scrutinize any old phosphorus data (collected pre-1985). Some phosphorus analysis methods used in the 1970's, and earlier, had a level of detection that was above the phosphorus levels typically encountered in Northern Minnesota lakes.

For example: The lab method used back in 1978 for some of your data was only able to accurately detect phosphorus levels down to 50 parts per billion (ppb). If your recent data indicates phosphorus levels in the 20 to 40 ppb range, the old lab method may not have been capable of providing you accurate and useful information. If you see the old phosphorus values reported as < 50 ppb or ug/l ("< " means less than), this indicates that the procedure used had a detection limit of 50 ppb. If you notice that all the old phosphorus readings are relatively high for your lake, you can suspect that this may be the reason. In this case you

are advised to look into the methods used in the analysis of the samples to determine the detection limit and relative level of accuracy so that you can have an appropriate degree of confidence in the data.

If you find any data that you are uncomfortable with, bracket the data in the table and make a note next to it describing your concerns. If you have good reasons to believe that the data is weak, you may want to exclude it from, or flag it within, any of the following exercises. One note of caution here - don't exclude data just because it doesn't fit with the other data. If you exclude data you should have a good reason for it.

Review the data. The data from some lakes is very consistent and falls close to the mean (average) while the data from other lakes can be highly variable. When looking over data that falls outside the typical range encountered, consider the various environmental or climatic factors that may have contributed to the data point and look over the remainder of data to see if the relationship between the lakes water quality and the "factor" repeats itself. If you have any questions about using the data, discuss it with a resource professional, e.g. county water planner or environmental services office, regional office of MPCA and DNR, or the Soil and Water Conservation District.

3. Calculate Summer Mean Water Quality Values

Calculate the summer mean (average) phosphorus, chlorophyll-a and Secchi values for each year you have any data for your lake.

> To calculate a mean: add the values together for a parameter (i.e. phosphorus, chlorophyll or Secchi) from the same site for a particular year, and divide by the number of values or samples you added together.

Enter the summer means you calculate into Table 2 (on page D-12), or a similar table you develop. In an effort to standardize the "summer" period, when you calculate your summer mean Secchi values, use Secchi values from June 1st through September 30th. For phosphorus and chlorophyll, use May through September values in the summer mean calculations.

Start with the oldest data and fill in Table 2 in chronological order (oldest to newest). There will be many years where you will just have Secchi data. As you calculate the summer mean values, keep track of the number of samples (NS) used in each mean for each parameter and place that number under the NS headings in Table 2. This is important because, when assessing the data, you can weigh the relative strength of the mean based on the number of samples used to calculate it. For example: A mean derived from only two samples is relatively weak when compared with a mean derived from eight samples.

NOTE: If your lake is divided into some distinct bays or basins, and you have several years of Secchi data for these basins, it is recommended that you calculate a summer mean Secchi for each of these basins. It is important that you use only good (representative) sites when calculating summer means as the data

from poor sites can skew your results. Data that you have a low level of confidence in (identified and flagged in step 2) can be excluded when calculating the means. Sites that are in shallow water, or that appear to be influenced by localized near shore conditions that don't represent the lake basin as a whole, can also be excluded. Otherwise, good (centrally located and deep) sites in a basin can be combined.

4. Calculate the Long-Term Summer Mean Water Quality Values

For each parameter (Secchi, phosphorus, and chlorophyll-a), calculate the long-term summer mean by adding together the summer mean values (for each parameter) and dividing by the number of years of data you used. These values can be placed at the bottom of Table 2.

5. Plot Summer Mean and Long-Term Mean Secchi vs. Year

Plot the summer mean Secchi disk values and the long-term mean Secchi values on Figure 1 (page D-13).

> To do this: Fill in the bottom portion of the graph with the years that you have Secchi data available. Then plot the mean summer Secchi values for each year. Place a ruler on the graph at the Secchi disk value that represents your long-term mean and draw a line across the graph that shows this value. Note: If you have years with less than five Secchi samples (NS = 4 or less), you can either exclude it from the graph or make a note that this mean is weak and shouldn't be used to draw any strong conclusions.

Assess Long-Term Trend. Assessing the data for long-term water quality trends requires about 8 to 10 years of continuous Secchi disk monitoring. Draw a straight line on Figure 1 that best depicts the arrangement of the data. If the data gradually increases on the graph over time, the line should show this increase. If the data gradually decreases over time, the line should indicate this. In most cases, the data will bounce around the long-term mean without showing a trend. In some cases, there may be what appears to be a slight short-term trend, but these 3 or 4 year dips or rises are most likely due to changes in climatic conditions and shouldn't be confused with a long-term trend.

If you feel you may have discovered a positive or negative trend in your lakes water quality, it is recommended that you bring your data and graph to the attention of a resource professional for their opinion. Taking the time to do this can confirm your findings, notify the local resource agency, and avoid unnecessarily alarming others on the lake, if in fact, what you observed was only year-to-year variability.

Assess Year-to-Year Variability. Year-to-year variability is the amount of annual fluctuation in the data during the period of sampling. Examine Figure1and determine the amount of variability (measured in feet) from one year to the next and throughout the period of sampling. The data on this graph may be very tight, which means the values for each year stays relatively close to the long term mean (small range), or it can be spread out, indicating that there is a lot of year-to-year variability (large range). It is impor-

tant to understand this characteristic of your lake. You should have between 6 to 10 years of Secchi data to get a good feel for the year-to-year variability.

Assessing the variation from one year to the next may give you insight concerning how the lake responds to various climatic conditions. Precipitation, air and water temperature, lake level, quality and quantity of storm events, ground water level, etc. can all affect your lake's water quality. Changes in the algal community can also be an important factor. Some lakes respond very little to these factors and experience relatively small variations in water quality from year-to-year. Other lakes respond significantly to a combination of these factors and experience large variations in quality from year-to-year. If you have rainfall data for the period of Secchi disk record, you can assess your lake's data against rainfall and determine if there is a relationship between wet periods or periods of drought and your lake's water quality. Area rainfall information may be obtained at your local soil and water conservation district office. Statewide annual rainfall information (dating back to the 1890's) can be obtained from the Department of Natural Resources – State Climatologist at their web site (climate.umn.edu). This site also provides weekly updated precipitation maps for the state. If you need help accessing precipitation information you can contact the State Climatologist office at 651-296-4214.

Assess Seasonal Trends. This analysis involves the plotting of weekly Secchi readings vs. the month it was collected. Figure 2 (page D-14) can be used for this assessment. Take your primary site data and plot the most recent year's data for that site. Then plot previous year's data on top using different colored pencils for each year. Draw colored lines on the graph for each year. After you place 4 to 5 years of data on the graph, you may begin to see a seasonal pattern in the data. If you have Secchi data from other sites, you can repeat the process on another graph and then compare the separate site graphs.

In many lakes, seasonal trends involve an early period of high clarity followed by some bouncing around in June and then decreasing clarity to a summer minimum some time in late July or early August. This is usually followed by a return to good water clarity in September or October.

If a seasonal trend is obvious and somewhat consistent, you can fairly accurately predict how the summer is going to pan out. If your lake doesn't follow this pattern, chances are it has relatively good water quality and may not experience much in the way of significant algae production (i.e. mid-summer chlorophyll-a values typically less than 5 ppb). Look at the years that don't follow the pattern and try to determine the factor(s) that may have lead to the different Secchi pattern.

6. Identify Your Ecoregion and Compare Ecoregion Ranges

Identify the Minnesota Ecoregion that your lake falls into on Figure 3 (page D-15). Place a dot on the map where your lake is located. If the lake is near the border of two ecoregions, identify both ecoregions.

7. Compare Data with Ecoregion Ranges.

Look on Figure 4 (page D-16) to find the ecoregion heading for your lake. Compare your summer mean phosphorus, chlorophyll-a and Secchi data with the data provided for your ecoregion.

If your lake is located near the boundary of two ecoregions, it may have the characteristics (watershed size, land use, soil types, lake size and depth, etc.) of the adjacent ecoregion lakes and should be compared with those lakes from that ecoregion.

Example: Little Toad Lake in Becker County falls on the boundary of the Northern Lakes and Forests (NLF) ecoregion and the North Central Hardwood Forests (NCHF) ecoregion. Lakes in the NCHF ecoregion tend to have more agricultural land use in their watersheds and less forested land use than those found in the NLF ecoregion. Since Little Toad Lake fits the characteristics of NCHF lakes it is appropriate to compare it with the lakes found in the NCHF ecoregion.

The data in the table on the top half of Figure 4 are the "interquartile ranges," which means the 25th to the 75th percentile of the data for the ecoregion (the middle 50 percent of the data for the ecoregion). The data on the bottom of Figure 4 show the full range of the data for the ecoregion and the mean.

How does your lake fit the water quality pattern for your ecoregion?
What factors about your lake contribute to its water quality condition relative to the others?

Figure 5 (page D-17) shows the interquartile ranges for a much larger list of parameters. This information is provided for your use and in the event you have questions from lake residents about water quality parameters other than Secchi, phosphorus and chlorophyll. Note the range of water quality values change as you move from the NE part of Minnesota to the SW part of the state.

8. Distribution of Trophic State Index (TSI) Values and Lake Basin Morphometry Measurements by Ecoregion

Calculate the TSI value for your lake. The trophic state index (TSI) is a numerical value that describes the level of growth or productivity in a lake. TSI values range from 0 (ultra-oligotrophic or very low level of productivity) to 100 (hypereutrophic or very high level of productivity). In this index, each increase of 10 units represents a doubling of algal biomass.

The TSI is calculated using Secchi disk, phosphorus and chlorophyll data. This index can be used to assess changes in the lake productivity (both year-to-year changes as well as long term trends) and compare your lake to others in the same ecoregion. Compare the mean data for each variable to the Carlson Trophic State Index Scale, found on page 4-9 in the workbook text. This will give you an estimate of the TSI rating of your lake and the interrelationship between the variables.

The TSI values can be calculated for each of the variables, e.g. TSI-S (Secchi), TSI-P (phosphorus), and TSI-C (chlorophyll-a) using the following formulas:

Total phosphorus TSI (TSIP) = 14.42 ln (TP) + 4.15
Chlorophyll-a TSI (TSIC) = 9.81 ln (Chl a) + 30.6
Secchi disk TSI (TSIS) = 60 – 14.41 ln (SD)
TSI or TSI Mean = (TSIP + TSIC + TSIS) / 3

Note: TP and chlorophyll-a values are in ug/l and Secchi disk transparency is in meters. The ln in the formulas stands for natural log and is a function on many of the better calculators.

Compare Your Lake to Others in the Same Ecoregion Using Figure 6 (Page D-18)

Find the table for your lakes ecoregion. The top parameter listed is Area. To the left of Area (under the heading "my data") write down the area of your lake (in acres). Move across the row and find the place in the chart that best match up with the acreage of your lake. Place an X in this spot. Repeat this exercise with depth (this is maximum depth) and your long-term TSI values. To determine your long term TSI mean, add up the summer mean TSI values and divide by the number of summer mean TSI values you used. Place this value under the heading "my data." You can calculate your long term TSI-P, TSI-C, and TSI-S in the same way.

Go back and look at the acreage listed and see what percentile of the lakes in your ecoregion is smaller or larger than yours. Do the same review with the maximum depth data and find where your lake fits when compared with the depth of other lakes in your ecoregion. How do your TSI values compare with the TSI values of the other lakes in your ecoregion?

If your lake falls at either end of the area or maximum depth ranges for the ecoregion, this information might be useful in helping to explain why your water quality data is where it is relative to the other lakes in the ecoregion. Generally, the deeper and larger the lake is, the better water quality we find. This obviously isn't always the case, but when all else is relatively similar, you can generally expect the large deep lakes to have lower TSI values.

9. TSI and Water Quality Characteristics

Look over the Table of Summer Mean Water Quality Values that you completed during step 3 (Table 2, page D-12). Turn to Figure 7 (page D-19) and put a dot on the graph for each summer mean value for each of the three parameters on the graph. When this is completed, you can place a ruler or other straight edge vertically on the chart and mark the range of TSI that corresponds with your data for each parameter exhibited. You can also take a different colored pen and take the phosphorus, chlorophyll and Secchi ranges for your ecoregion from Figure 4 and mark these ranges onto Figure 7. This will graphically indicate where your lake data is in relation to the middle 50 percent of the lakes in the same ecoregion. The descriptions given at the top of Figure 7 help to describe lakes in the various TSI ranges.

10. Assess Relationships Between Phosphorus / Chlorophyll / Secchi

Each of the scatterplot graphs on Figure 8 (page D-20) show the relationships between the three parameters (phosphorus, chlorophyll and Secchi disk). You can see how your lake "behaves" by putting your data on each of the graphs. You can do this a couple of different ways. If you have many years of data, you can plot the summer mean data for each year on the graphs. Example: For the top graph you will need the summer mean phosphorus and chlorophyll values for each year you have sampled, see Table 2. Take these numbers for the first year and plot them together to make a single point. Continue with each year's summer mean data until it is all plotted. Move down to the next graph and do the same thing over. If you only have a couple years of data, you can plot each month's data on the graphs.

Look to see if your data consistently falls on one side of the line or if it falls on both sides. You can use this chart to assess, for example (using the top scatterplot graph), whether your lake produces an unusually low amount of chlorophyll for the amount of phosphorus available or if the opposite relationship exists. Look over each graph and see if you can draw conclusions about the relationships between the three water quality indicators on your lake.

11. Assessing Use Impairment with Water Quality Conditions

Find the three graphs entitled Recreation Suitability vs. Water Quality Indicators – Figure 9, page D-21). Using the raw data from you past CLMP data sheets or STORET printout, plot the middle graph—recreation suitability (RS) vs. Secchi. For each Secchi value put a dot on the graph indicating its corresponding recreation suitability value. Note: recreational suitability is the subjective aesthetic recreational value, 1-5, you assign to the lake conditions on the day of each Secchi disk reading.

Work through your data paying particular attention to the extreme Secchi values (high and low) until your graph shows the relationship between Secchi depth and perceived recreational suitability. Notice the Secchi depths where the use drops to a less desirable level. This information can be very useful when setting water quality goals for the lake.

Complete the other two graphs (RS vs. total phosphorus and RS vs. chlorophyll-A) if you have same day and same site data for these two parameters. Lakes involved in the lake monitoring programs of several COLAs (i.e. Becker, Hubbard, OtterTail, and Douglas) have this data available. Use the recreational suitability data from the primary site on the days that you collected phosphorus and chlorophyll data. Use this when discussing impacts of water quality on recreation use with your association, or with county officials, to demonstrate that recreational suitability changes as water quality changes.

On lakes that experience periods of poor water quality, this information can be combined with information from the seasonal Secchi trend analysis on Figure 2 to predict periods of the summer when recreation use is likely to be impacted. This information can assist in the scheduling of family or friends for vacation stays.

Summary

The conversion of lake water quality data to information about the lake is an important part of the process of understanding a lake. I hope you found this guide a useful tool in walking through this process. The completion of this data assessment process should assist you with understanding the fertility and the resultant productivity of your lake, and can ultimately help with the development of a management plan for your lake.

Identifying lake specific relationships between total phosphorus, chlorophyll-a, Secchi disk and recreational suitability is helpful in understanding the lakes water quality. Conducting the trend analysis can help you assess and track water quality changes over time. The knowledge gained through conducting these and the other assessments should be shared with the Lake Association and communicated to all lake property owners. Parcel owners should take responsibility for the long-term health of the lake by managing their properties with the lake in mind.

Once residents understand the water quality on their lake and how lakes become degraded, the lake association can begin to successfully implement programs promoting lake stewardship practices (i.e. routine septic maintenance, establishment of riparian vegetative buffers, restrictions on phosphorus fertilizer use, etc.). These programs can be developed at both the lake association and the county coalition of lake association level. Assistance from local and state resource management agencies is often available to assist with program development.

If you have questions as you complete the exercises in this lake assessment guide, feel free to contact resource professionals for help at your County SWCD Office, County Environmental Services Department, County Water Planner, DNR or MPCA, or call Bruce Paakh, MPCA Water Quality Specialist, MPCA, Detroit Lakes at 218-846-0747.

Table 1. Phosphorus and Chlorophyll Data

Date	Time	Site #	Total Phosphorus (ppb)	Chlorophyll a (ppb)

Table 2. Summer Mean Water Quality Values

		PHOSPHORUS		CHLOROPHYLL		SECCHI DISK	
YEAR	SITE #(s)	NS	CONC. (ppb)	NS	CONC. (ppb)	NS	DEPTH (ft)

FIGURE 1.

SUMMER MEAN SECCHI vs. YEAR
LONG TERM TREND ANALYSIS

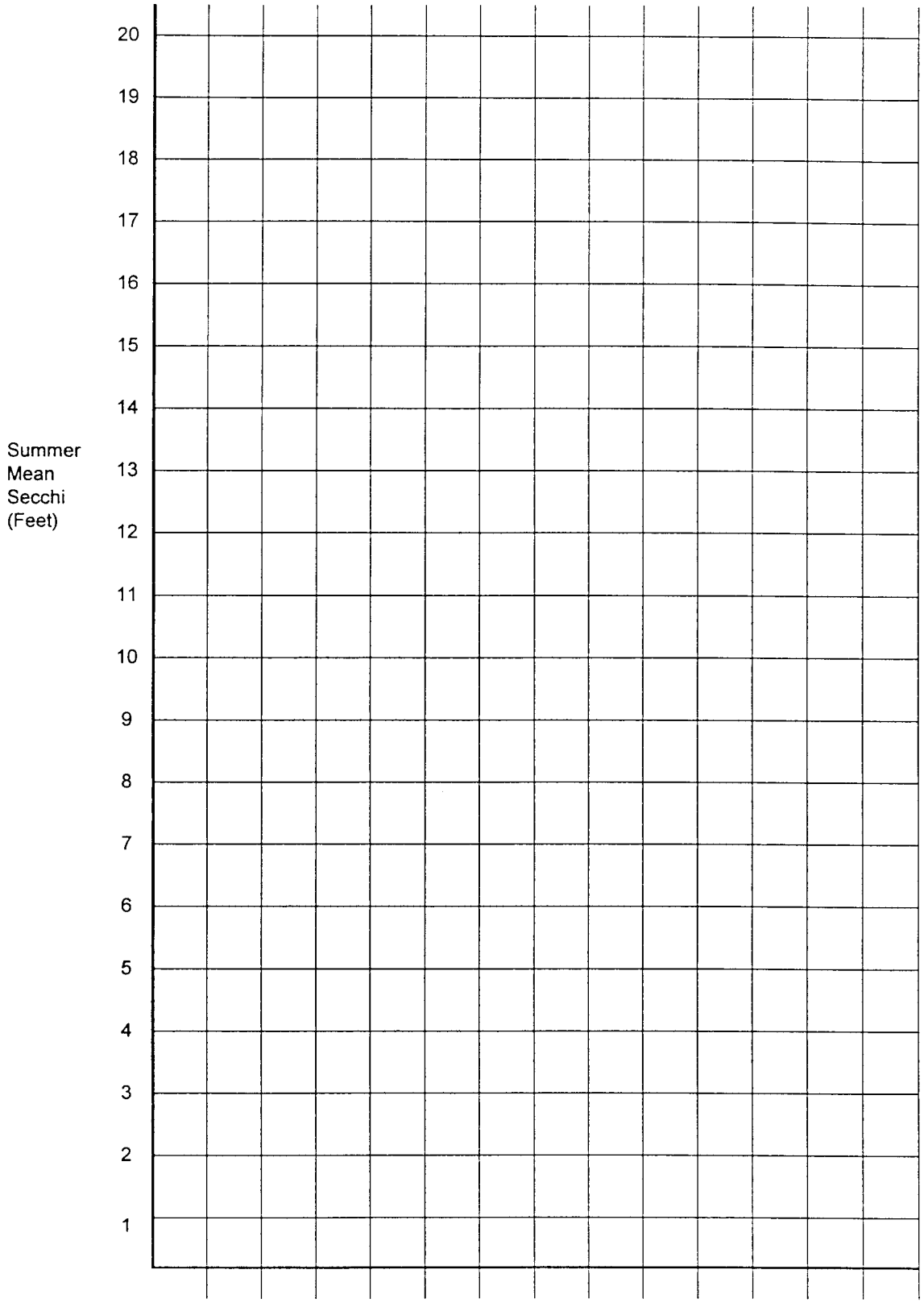


FIGURE 2.

SEASONAL TREND ANALYSIS

SECCHI VALUES vs. TIME OF YEAR

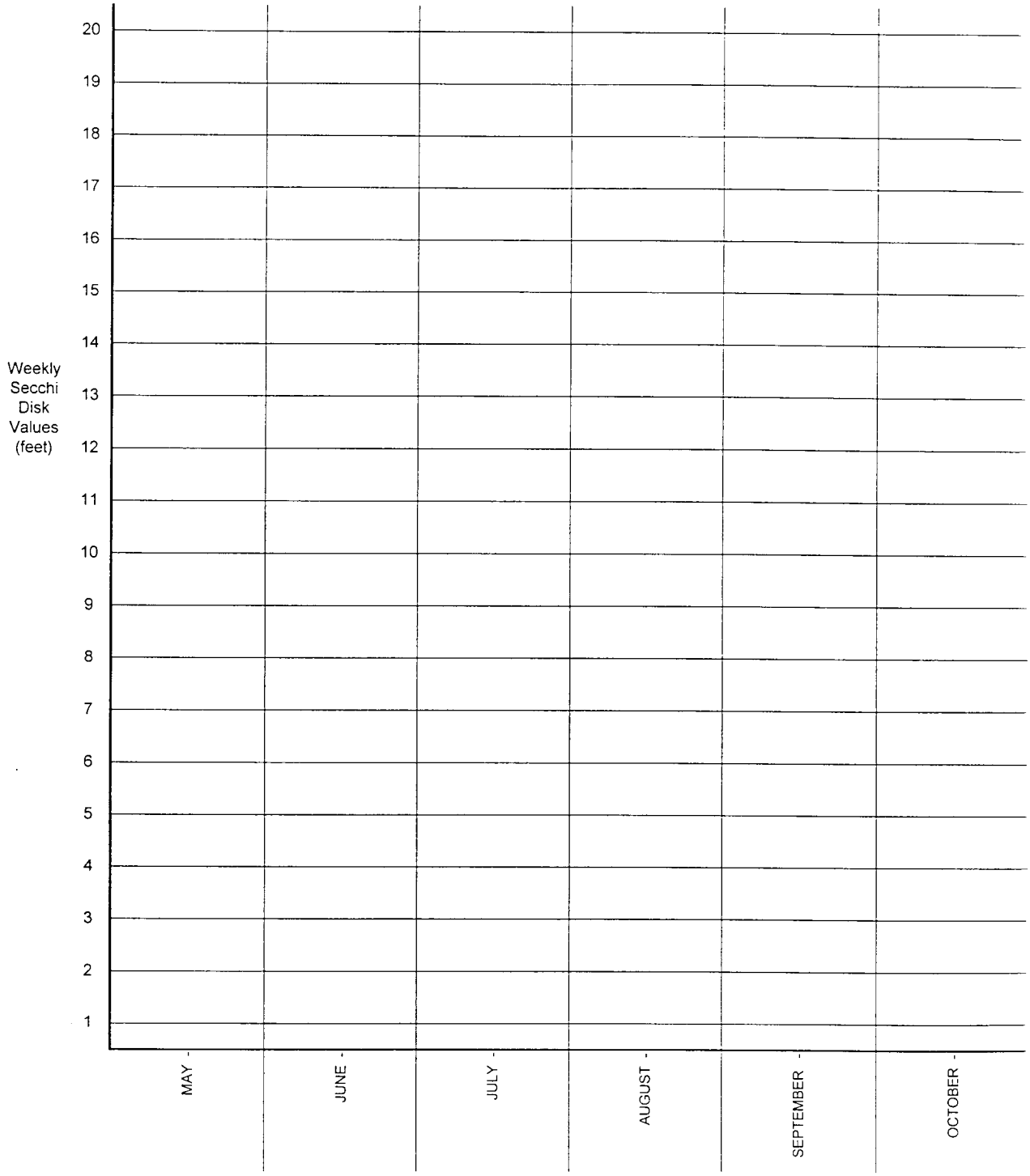


FIGURE 3.

MINNESOTA'S ECOREGIONS

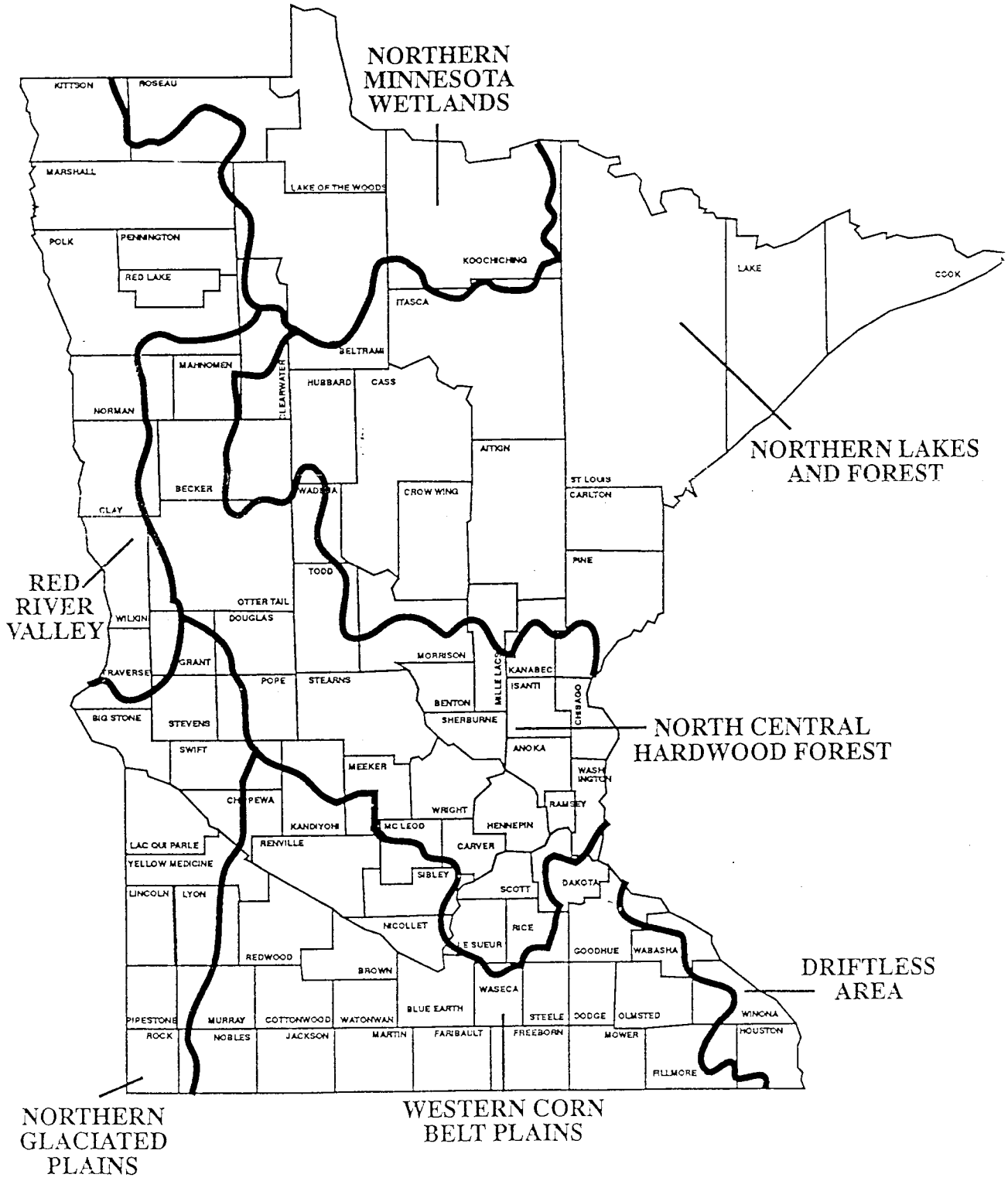


FIGURE 4.

SUMMER AVERAGE WATER QUALITY CHARACTERISTICS FOR LAKES BY ECOREGION. Based on interquartile range (25th-75th percentile) for ecoregion reference lakes.

Parameter	Ecoregion: Northern Lakes and Forests	North Central Hardwood Forests	Western Corn Belt Plains	Northern Glaciated Plains
Total Phosphorus (ug/l)	14 - 27	23 - 50	65 - 150	130 - 250
Chlorophyll mean (ug/l)	<10	5 - 22	30 - 80	30 - 55
Chlorophyll maximum (ug/l)	<15	7 - 37	60 - 140	40-90
Secchi Disk (feet) (meters)	8 - 15 (2.4 - 4.6)	4.9 - 10.5 (1.5 - 3.2)	1.6 - 3.3 (0.5 - 1.0)	1.0-3.3 (0.3 - 1.0)

Water quality and lake morphometric characteristics by ecoregion for all lakes in the 1990 assessment. Includes the mean, minimum and maximum values and the number of lakes in parenthesis.

Total phosphorus (ppb)	27 5 228 (n=611)	113 5 1,620 (n=436)	293 25 4,530 (n=60)	259 116 505 (n=23)
Chlorophyll a (ppb)	11 1 128 (n=243)	42 1 285 (n=377)	221 4 5,707 (n=51)	80 7 206 (n-19)
Secchi transparency (m)	3.1 0.5 9.2 (n=669)	1.7 0.1 6.8 (n=578)	0.7 0.1 3.2 (n=65)	0.8 0.2 2.4 (n=30)
Trophic State Index	47 27 75 (n=866)	59 27 93 (n=607)	72 52 111 (n=67)	71 47 83 (n=31)

FIGURE 5. Ecoregion Lake Data Base
Water Quality Summary
(Summer Average Water Quality
Characteristics for Lakes by Ecoregion)*

Parameter	Northern Lakes and Forests	North Central Hardwood Forests	Western Corn Belt Plains	Northern Glaciated Plains
Total Phosphorus (ug/l)	14 - 27	23 - 50	65 - 150	130 - 250
Chlorophyll mean (ug/l)	<10	5 - 22	30 - 80	30 - 55
Chlorophyll maximum (ug/l)	<15	7 - 37	60 - 140	40 - 90
Secchi Disk (feet)	8 -15	4.9 - 10.5	1.6 - 3.3	1.0 - 3.3
(meters)	(2.4 - 4.6)	(1.5 - 3.2)	(0.5 -1.0)	(0.3 - 1.0)
Total Kjeldahl Nitrogen (mg/l)	<0.75	<0.60 - 1.2	1.3 - 2.7	1.8 - 2.3
Nitrite + Nitrate-N (mg/l)	<0.01	<0.01	0.01 - 0.02	0.01 - 0.1
Alkalinity (mg/l)	40 - 140	75 - 150	125 - 165	160 - 260
Color (Pt-Co Units)	10 - 35	10 - 20	15 - 25	20 - 30
pH (SU)	7.2 - 8.3	8.6 - 8.8	8.2 - 9.0	8.3 - 8.6
Chloride (mg/l)	<2	4 - 10	13 - 22	11 - 18
Total Suspended Solids (mg/l)	<1 - 2	2 - 6	7 - 18	10 - 30
Total Suspended Inorganic Solids (mg/l)	<1 - 2	1 - 2	3 - 9	5 - 15
Turbidity (NTU)	<2	1 - 2	3 - 8	6 - 17
Conductivity (umhos/cm)	50 - 250	300 - 400	300 - 650	640 - 900
TN:TP ratio	25:1 - 35:1	25:1 - 35:1	17:1 - 27:1	7:1 - 18:1

* Based on interquartile range (25th - 75th percentile) for ecoregion reference lakes. Derived in part from Heiskary, S.A. and C. B. Wilson (1990).

FIGURE 6. Minnesota Lake Water Quality Data Base Summary (1994). Distribution of Carlson TSI values and lake basin morphometry measurements by ecoregion (N = number of lakes).

Northern Lakes and Forests

MY DATA	Parameter	N	Percentiles 95	90	75	50	25	10	5	Percentile
	Area (acres)	979	20	38	91	227	506	1,453	2,530	
	Depth (feet)	874	10	13	23	37	60	90	115	
	TSI-P	627	34	37	44	50	55	61	63	
	TSI-Chla	267	35	38	43	49	56	63	66	
	TSI-Secchi	785	34	36	39	44	50	56	60	
	TSI-Mean	987	35	37	41	47	52	57	61	

North Central Hardwood Forests

MY DATA	Parameter	N	95	90	75	50	25	10	5	Percentile
	Area (acres)	676	25	42	96	223	556	1,317	2,395	
	Depth (feet)	578	8	11	19	32	50	73	84	
	TSI-P	483	46	49	55	64	74	84	89	
	TSI-Chla	431	44	48	53	63	69	75	77	
	TSI-Secchi	666	40	42	47	54	63	70	77	
	TSI-Mean	700	41	44	50	58	67	75	77	

Western Corn Belt Plains

MY DATA	Parameter	N	95	90	75	50	25	10	5	Percentile
	Area (acres)	85	83	118	204	362	694	1,844	2,900	
	Depth (feet)	67	3	5	7	9	17	30	48	
	TSI-P	72	63	65	70	76	83	87	93	
	TSI-Chla	65	57	60	65	71	75	82	86	
	TSI-Secchi	85	53	56	62	70	73	83	83	
	TSI-Mean	89	59	63	67	73	77	81	84	

Northern Glaciated Plains

MY DATA	Parameter	N	95	90	75	50	25	10	5	Percentile
	Area (acres)	30	91	133	220	496	1,193	4,250	11,528	
	Depth (feet)	19	4	4	5	8	14	18	25	
	TSI-P	24	72	73	76	81	86	92	93	
	TSI-Chla	20	57	63	65	68	73	80	81	
	TSI-Secchi	29	49	51	57	65	70	73	77	
	TSI-Mean	30	49	60	67	71	75	80	82	

FIGURE 7. CARLSON'S TROPHIC STATE INDEX

R.E. Carlson

TSI < 30 Classical oligotrophy: Clear water, oxygen throughout the year in hypolimnion, salmonid fisheries in deep lakes.

TSI 30 - 40 Deeper lakes still exhibit classical oligotrophy, but some shallower lakes will become anoxic in the hypolimnion during the summer.

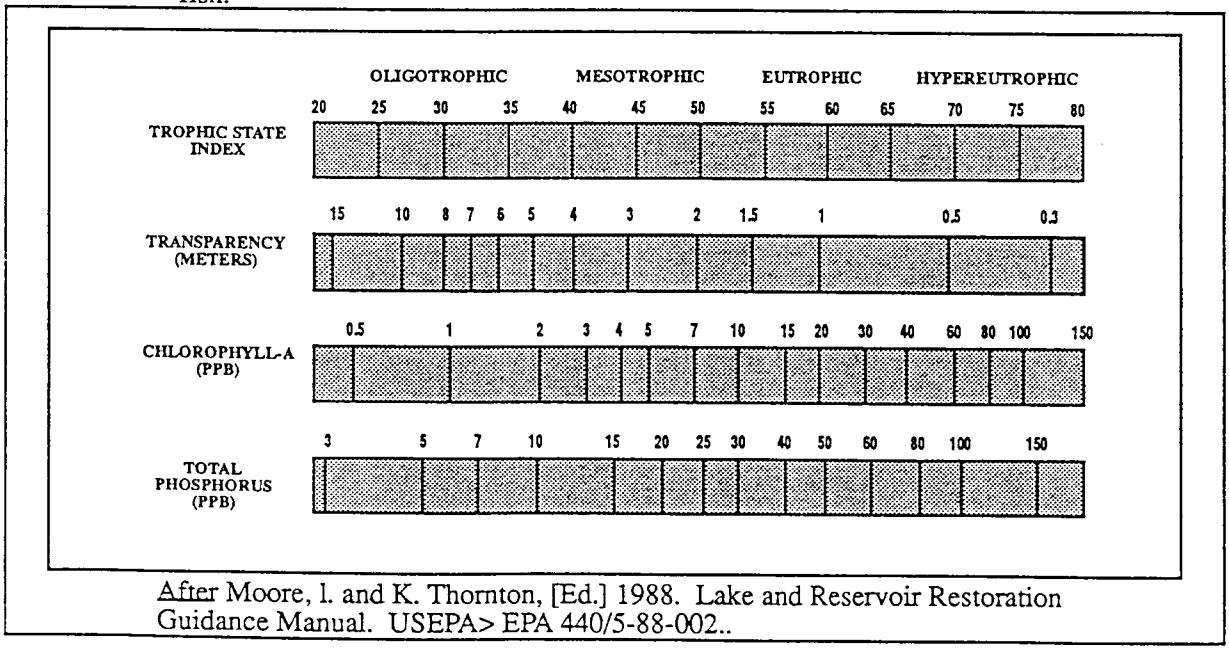
TSI 40 - 50 Water moderately clear, but increasing probability of anoxia in hypolimnion during summer.

TSI 50 - 60 Lower boundary of classical eutrophy: Decreased transparency, anoxic hypolimnia during the summer, macrophyte problems evident, warm-water fisheries only.

TSI 60 - 70 Dominance of blue-green algae, algal scums probable, extensive macrophyte problems.

TSI 70 - 80 Heavy algal blooms possible throughout the summer, dense macrophyte beds, but extent limited by light penetration. Often would be classified as hypereutrophic.

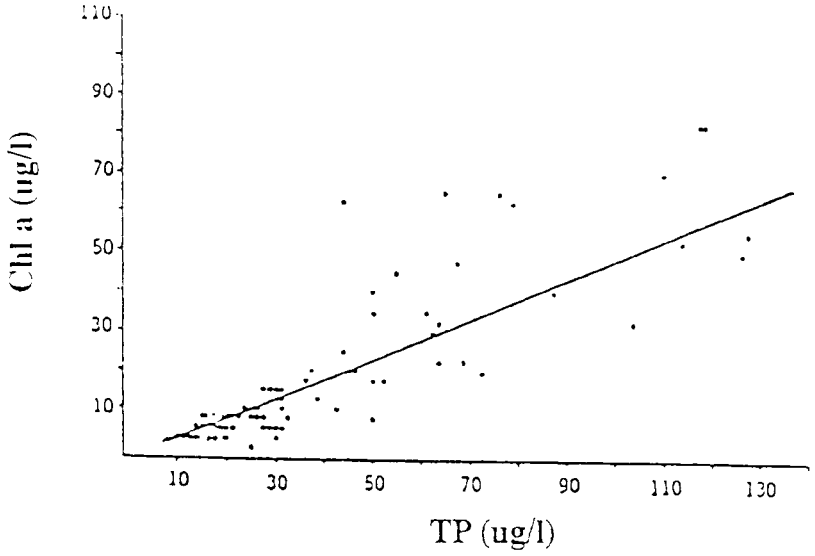
TSI > 80 Algal scums, summer fish kills, few macrophytes, dominance of rough fish.

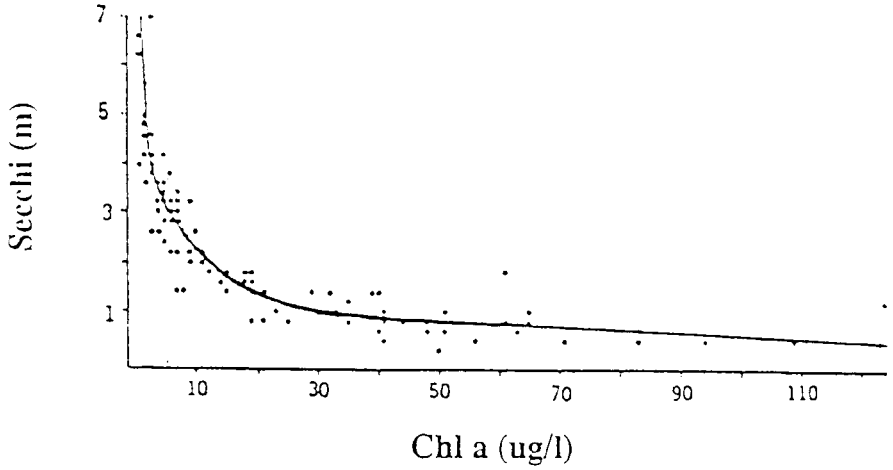


After Moore, l. and K. Thornton, [Ed.] 1988. Lake and Reservoir Restoration Guidance Manual. USEPA> EPA 440/5-88-002..

FIGURE 8.

Scatterplots of Chlorophyll-a, Total Phosphorus and Secchi Transparency.
Based on summer data from a set of representative lakes from four ecoregions in Minnesota.





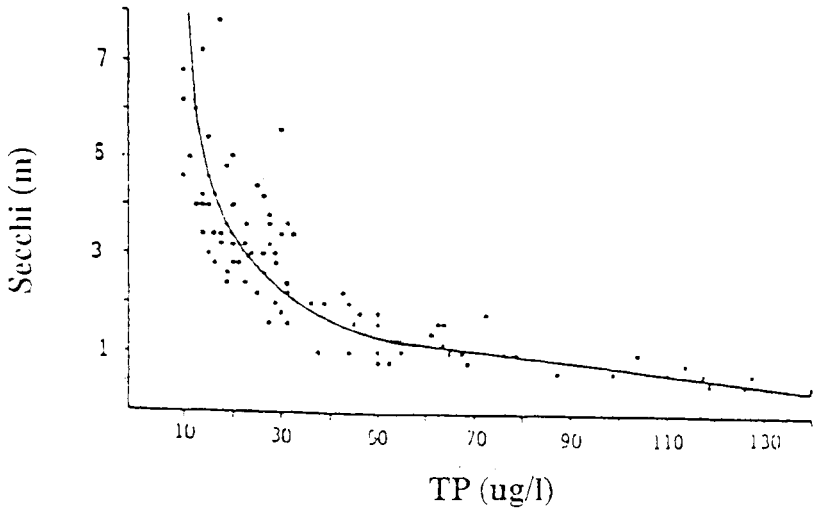
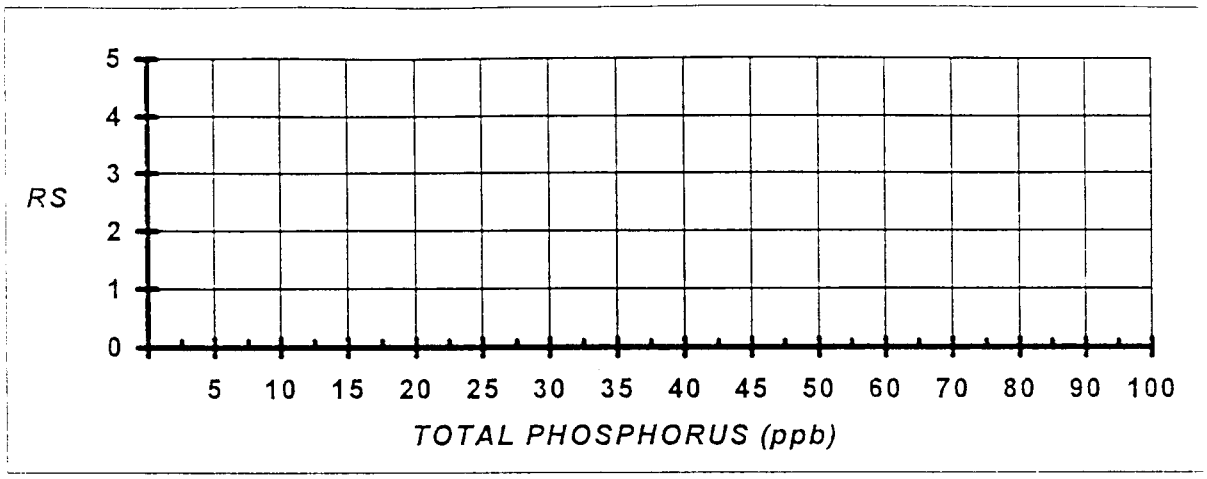
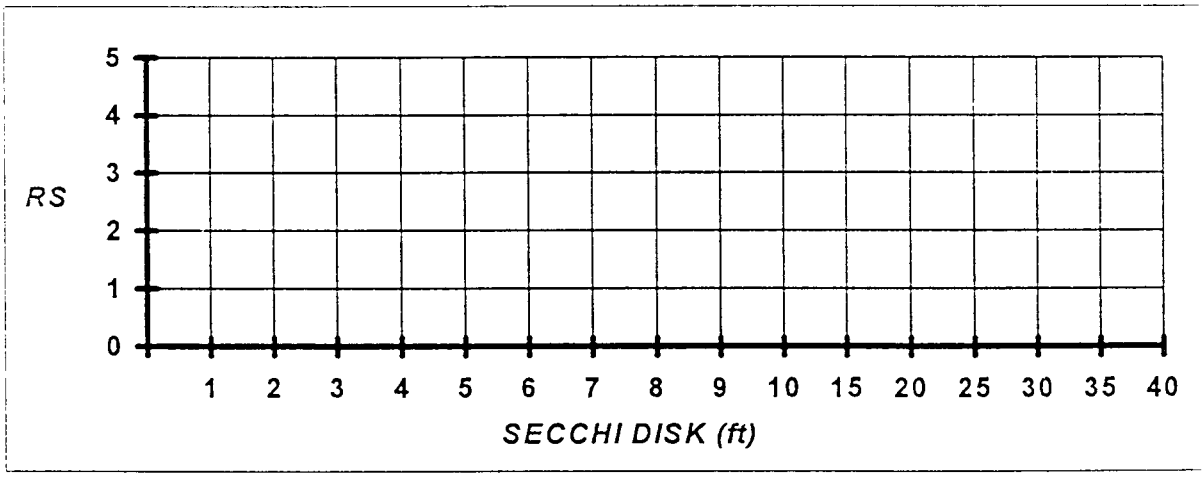
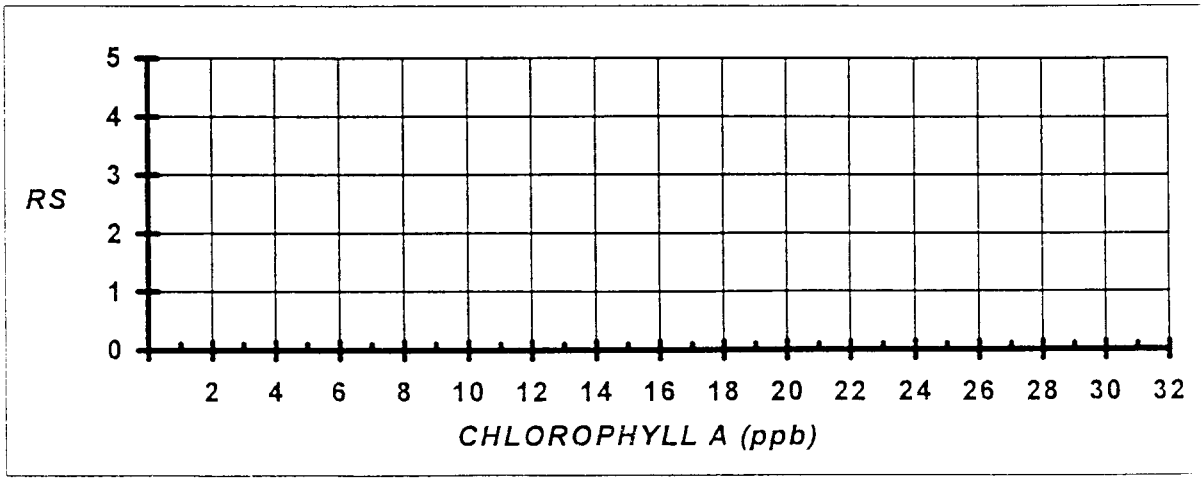


FIGURE 9. *RECREATION SUITABILITY VS. WATER QUALITY INDICATORS*

DATE _____ LAKE NAME _____ YEAR(S) OF DATA IN ASSESSMENT _____







APPENDIX E: LAND USE IMPACTS ON WATER QUALITY

Dan Steward, Board Conservationist, Minnesota Board of Water & Soil Resources
Scott Hansen, Water Plan Coordinator, Crow Wing County

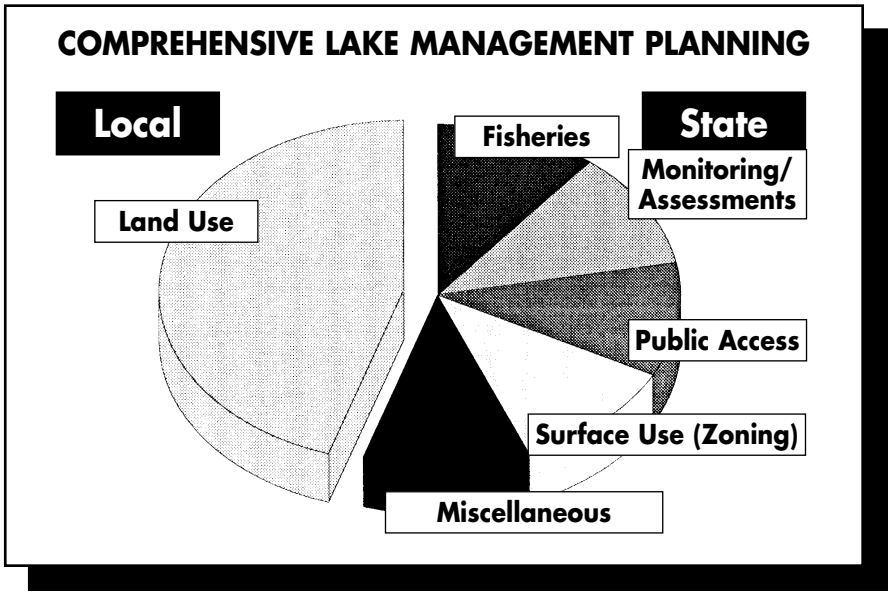
The following seven articles appeared in Minnesota Lakes Association's *Reporter* newsletter during 1999. The articles outline the SLEDM model developed by Dan Steward, Board Conservatonist, Minnesota Board of Water and Soil Resources, and Scott Hansen, then water planner for Crow Wing County. The model characterizes five categories of major land uses that impact water quality (septics, livestock, development, erosion, and a miscellaneous category for stormwater runoff, wetlands, and other impacts). It can be used by local governments and lake associations to assess critical impacts to water quality from those categories.

Land Use: The Key To Water Quality Protection

The 1985 law that established Minnesota's County Water Planning Program required that water plans be based on principles of sound hydrologic management of water, effective environmental protection, and efficient management. Effective environmental protection was further defined to include "prevention of potential water and land-related problems."

How do land use problems impact water quality?

Lakes and their tributaries collect runoff from within their watershed. The land use within a watershed ultimately impacts—either positively or negatively—the quality of the runoff and, in turn, impacts a lake's water quality. As a positive example, the lakes of northeastern Minnesota tend to have good water quality because they have forested watersheds and relatively low rates of development, and, therefore, minor land use impacts. Negatively, lakes with heavy rates of agricultur-



al, residential and/or commercial development tend to have poorer water quality because of large land use contributions to watershed runoff.

As watersheds get developed, runoff tends to increase as the amount of impervious area increases. In addition, erosion and sedimentation increase as soils are distributed and vegetation is removed. Increased runoff combined with increased erosion results in an increased delivery of phosphorus—a major contributor to algal populations and decreasing water clarity—as a soil attachment.

Land use is directed at a local level and calls for local management

Although it is becoming increasingly evident that land use impacts water quality, what is not well understood is that land use planning is directed at the local level. If land use is not managed properly at the local level, it can undermine effective state and federal programs to protect water quality, such as public access, monitoring and fisheries management programs.

Each county has flexibility and responsibility for pursing their respective water planning strategies for prevention of water quality degradation. However, land use, as a major contributor to water quality, is such a broad and comprehensive issue that it is hard for local governments to get their arms around this tough issue that will dictate the future of so many Minnesota lakes.

Water, by its very nature, affects local units of government in many ways, and in turn, local governments have a vast menu of options from which they can choose to define their water protection strategies. Because land use usually has a direct effect on water quality, and because land use is managed locally, some counties have chosen water planning strategies that focus on preventing land use related impacts.

SLEDM: a definition of critical land use impacts

The Crow Wing County Water Planning Advisory Board has a water quality protection strategy that focuses on five key and critical sources of land use impacts. These sources are commonly referred to as the acronym SLEDM, which stands for:

S = septic systems
L = livestock
E = erosion
D = development
M = a miscellaneous category
that includes stormwater discharge, and other less common impacts.

Crow Wing County has decided they can be most effective and efficient at water resource protection by focusing on these SLEDM issues. The SLEDM concept provides a simple structure for local units of government to address the land use impacts within their jurisdiction that adversely affect water quality.

SLEDM inputs affect water quality in many ways

Non-conforming septic systems can discharge nutrients and fecal bacteria to either surface or ground water when they are improperly designed, constructed or managed. Livestock operations can degrade water quality by increasing nutrients that eventually reach the water and by eroding stream banks. Erosion can be a major problem for water quality because of the phosphorus that is transported to the lake attached to soil particles.

Development includes concerns over wetlands that are sometimes filled for residential or commercial development. Steep bluffs can also be a development-related problem if the site is destabilized and eventually begins to erode. Stormwater runoff can contribute major quantities of nutrients when stormwater catchments or diversions cannot adequately handle the water flow.

The local players in managing SLEDM issues

SLEDM issues are important because they not only affect water quality, their management is closely aligned with the responsibilities and capabilities given to local governments. In most counties, the Planning and Zoning Office and the Soil and Water Conservation District are the major local government players when it comes to managing SLEDM issues. However, that changes from place to place within the county depending on the existence of cities or other local units of government.

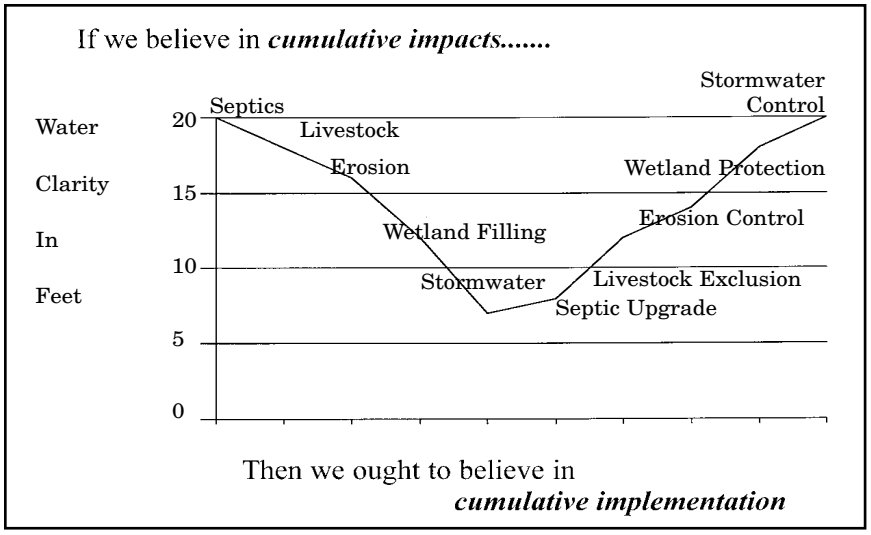
Lake associations also have important responsibilities for management of SLEDM issues. They not only have the opportunity to enhance local water resource protection, they more importantly have responsibilities for the overall effectiveness and accountability of local water planning.

The matrix below uses two SLEDM land use issues—septic systems and livestock—as examples of the private and public roles in addressing critical land use issues, and it identifies the four areas—accountability, administrative, technical, and financial—that must be addressed in managing SLEDM issues.

	SEPTICS				LIVESTOCK				
	A	AD	T	F	A	AD	T	F	A= accountability AD= Administrative T= Technical F= Financial
Lake Assoc.	X				X				
SWCD						X	X	X	
P&Z		X	X						
Landowner	X			X	X			X	

More to follow on SLEDM

SLEDM inputs have cumulative impacts on water quality. Therefore, cumulative implementation of programs and projects to address these inputs is the key to water quality protection. The next five issues of the Reporter will look at the five sources of land use inputs—septics, livestock, erosion, development and miscellaneous issues—and explore them in more depth. With the assistance of the Minnesota Board of Water and Soil Resources, we'll discuss specific impacts on water quality, detail successful projects, and provide program and funding resources. ◆



Land-Use Impacts to Water Quality: Septic Systems

The issue of non-complying on-site waste disposal systems (septic systems) emerges quickly in any discussion about lakes and water quality. Fortunately, opportunities to identify non-conforming systems are growing rapidly. The January 1, 1996, addition of six criteria that define non-complying systems ushered in a new era for this important water management issue.

Non-complying septic systems are a concern to lake residents, water resource managers, and public health officials because of the dual threat they present to lake and drinking water quality. A system that does not meet compliance criteria cannot effectively treat wastewater and can result in bacterial and viral contamination of the water we drink and recreate in. Many lakeshore areas depend on septic systems as their only feasible option for treating wastewater. Because of this fact, only by achieving a high rate of compliance for septic systems can we protect lake and drinking water quality.

Counties and cities are responsible, within their respective jurisdictions, for administering and implementing state standards for individual sewage treatment systems (ISTS). In general, local units of government have chosen two options for upgrading non-complying septic systems: through property transfers and building

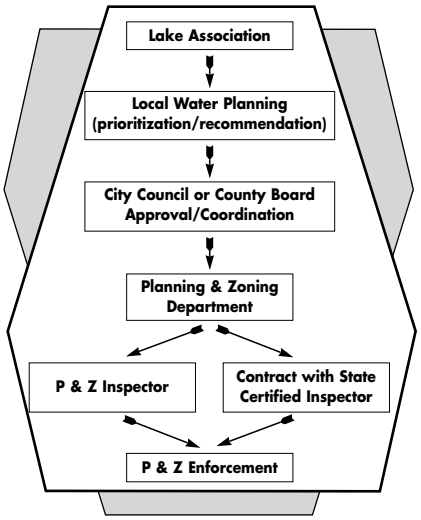
permits. Some counties have added a more systematic third option: compliance inventories of septic systems on shoreland properties. These inventories are often done in cooperation with the local lake association, which can then be part of the process of implementing effective water quality protection strategies for their lake. Here are several examples.

Hubbard County Septics Inventory

In 1995, the Hubbard County Environmental Services Department received a $145,000 grant from the Legislative Commission on Minnesota Resources (LCMR) to identify failing septic systems on 16 lakes in the Mantrap Watershed and to develop a general public education program on septic systems. To date, a total of 877 property files were researched, out of which 301 were identified as failing. After on-site failure verification, property owners were required to upgrade within one year of notification and were provided with educational materials on failing systems. Of the 301 failed systems, 271 (91 percent) have been updated voluntarily. Though the county has tried to be lenient with property owners, any remaining properties that have not been updated by July of 1999 will be subjected to a legal compliance process. The Hubbard County format has been shared with other local governments and at various lake association meetings. For more information, contact Ed Alleto at 218-732-3890.

Whitefish Chain of Lakes in Crow Wing County

Water quality measurements on the Whitefish Chain of Lakes—14 lake basins and seven feeder streams—by the Whitefish Area Property Owners Association (WAPOA) indicated a probable decrease in water quality. While there are active programs on the Chain and in the Pine River Watershed to reduce the impact of livestock, erosion, development and stormwater, there is no systematic program to evaluate septic systems.



To minimize further water quality problems, WAPOA entered into an agreement with the Crow Wing County Water Plan Advisory Board (WPAB) in 1997 to update compliance records by inspecting the 2,500 shoreland properties on the Chain. The project, now in the preliminary stage, will be an equal cost-share between WAPOA, Crow Wing County and the City of Crosslake. The county will subcontract their inspections, and Crosslake will perform their own inspections on the 1,250 properties that lie within their jurisdiction. The estimated cost of the project is $150,000; $75,000 from the County and $75,000 from Crosslake. For the County, the WPAB allocated $22,500 over two years and a Minnesota Board of Water and Soil Resources grant will contribute a portion. The City of Crosslake allocated $37,500 for in-kind inspections. WAPOA received a $75,000 grant from the Legislative Commission on Minnesota Resources (LCMR), which will be split between the County and City of Crosslake. Inspections will begin in 1999. For more information, contact Jack Wallschlaeger, WAPOA, 218-543-6257. ◆

Livestock Impacts to Water Quality

What's the problem?

Pastured livestock that graze or water in the riparian (shoreland) areas of streams, rivers, lakes and ditches are a direct source of phosphorous loading to surface waters through defecation in the water or on the banks. In addition, the banks are often destabilized by the livestock resulting in erosion. The eroded sediments carry attached phosphorus to the surface waters as an additional source of nutrients. Sedimentation is the largest pollutant by weight of Minnesota's lake and streams. Excessive phosphorous contributes to declining water quality because it is the limiting nutrient needed for abundant algae growth and it can upset the lake's ecosystem.

Currently, there are no state rules that prohibit cattle from watering or grazing in or along riparian areas. Voluntary projects with riparian landowners to fence livestock away from the surface water is often the most efficient way to reduce phosphorus loading per conservation dollar spent. Fencing keeps the livestock from lingering, defecating, and stirring up sediment in the water and creates a riparian buffer zone to help keep sediment, organic matter and nutrients from reaching the water body. A buffer zone of at least 50 feet is recommended to effectively reduce livestock impacts to surface waters.

County Soil & Water Conservation Districts often have cost-share programs to help riparian landowners with fencing projects. In approaching the landowner to participate in voluntary projects, it is important to consider their profitability and understand their perspective.

Livestock Facts: Every time a cow defecates in the water, approximately 7.5 pounds of algae are enabled to grow. Every day, a herd of 40 cows could produce 300 pounds of algae if every cow only defecated once in the water.

Fencing projects in Benton and Aitkin County help protect water quality

Over the past four years, over 43,000 feet of fencing has been installed in Benton and Sherburne counties through cost-share programs with riparian landowners. The fencing projects, jointly sponsored by the soil and water conservation districts (SWCD) and the Elk River Watershed Association, have resulted in over 500 livestock fenced away from riparian areas.

The Watershed Association typically provides 75 percent of the fencing materials cost; the landowner provides the other 25 percent in either cash or in-kind service. If the landowner is willing to provide the labor

for the project, the Watershed Association may fund up to 100 percent of the materials. The Benton County "Sentence To Service" Crew has provided labor for projects when the landowner is unable to provide labor. In those cases, the landowner can still provide other in-kind services such as the use of equipment or clearing of brush.

According to Jason Selvog, Benton County SWCD, "Word-of-mouth has brought many participants into the program. The first project led to five other landowners in the same area participating in similar fencing projects. Providing the materials is a real incentive to the landowner, who is on the same side of the fence as everyone else who wants good water quality."

A similar fencing program in Aitkin County, called the "Green Shores" program, has resulted in the completion of over 2.5 miles of installed fencing over the past six years. The Aitkin County SWCD pays 100 percent of the materials cost, but no labor, which is supplied by the landowner. The landowner also agrees to keep the land out of production for at least 10 years. According to Steve Hughes, Aitkin County SWCD, "The program requires the establishment of at least a 50 feet of buffer zone, but because of the irregular nature of most shoreland, we often get as much as 300 to 400 feet of buffer established." ◆

MPCA Feedlot Helpline

Call toll-free during working hours at
1-877-333-3508, or 651-296-7327 in the Metro region, with
questions about the MPCA's feedlot program.

Soil Erosion Impacts Water Quality

Soil erosion and sedimentation are the largest pollutants by volume of Minnesota's lakes and streams. Soil erosion consists simply of the availability, detachment and transport of soil particles into a lake or stream. Soils can reach the lake from direct shoreland erosion or in water flowing into the lake that has received soil particles from stream bank erosion or erosion within the lake's watershed.

Erosion affects nearly all watersheds, although the source and degree of impact may differ greatly. Agriculture is the main source of sediment in much of the state. In the central and northern parts of the state, commercial and residential development are concerns. Roads are of concern in other areas.

The amount of eroded soils reaching a lake is directly proportional to the distance of the erosion source from the lake. Shoreland erosion can have nearly a 100 percent sedimentation delivery rate. Much of the soil eroded into flowing water falls out, or is deposited as sediment, before reaching a stream. However, varying amounts of the transported soil stay in suspension and can be transported far downstream, perhaps eventually to a lake.

Phosphorus—a soil nutrient that in excess in a lake can cause severe algae growth and oxygen depletion leading to degradation of water quality—is tightly bound to the soil carried into the lake. Since 76 percent of Minnesota's soils test high to very high for phosphorus, reducing soil erosion controls a major source of phosphorus to our lakes.

Aside from the water quality impacts, erosion and sedimentation can cause a practically irreversible, negative physical effect on fish habitat. Siltation can damage aquatic plants and suffocate fish eggs.

Shoreland erosion control on Sand Lake

Sand Lake, a 3,500-acre lake in Itasca County, has unusually high amounts of shoreland erosion due to natural fluctuating water levels—two to four foot fluctuations annually. The lake is also a significant walleye fishery and highly used for general recreation. To control overall shoreland erosion, the Itasca Soil and Water Conservation District (SWCD) designed an extensive rip-rap shoreland stabilization project for critical shoreland properties. Potential properties were identified through an inventory of all 24 miles of shoreland by a trained team from the Sand Lake Association. The team looked at the severity of erosion and amount of fishing habitat. The SWCD helped with surveying and site inspection and eventually 30 properties were selected.

Seventy-five percent of the property owners at identified critical sites participated in the project.

Participating landowners matched the $60,000 from the Board of Water and Soil Resources and Department of Natural Resources Fisheries Division, which participated as a pilot project to protect fisheries habitat through water management instead of increased stocking.

According to Art Norton, Itasca County Water Planner with the Itasca SWCD, "Reducing shoreland erosion had two goals: to protect property values and to protect water quality by keeping phosphorus out of the lake. Of the severe sites identified, about two-thirds, or 3,000 feet of shoreland, will have been stabilized when the project is completed."

"One of the most important practices farmers can do to help improve the quality of lakes is preventing soil erosion. It significantly reduces sediment and phosphorous in lake water resulting in cleaner, healthier lakes."

Bill Jones, President, North American Lake Management Society and Professor of Limnology, Indiana University

Lake Traverse to benefit from reduced cropland erosion

Lake Traverse, a 11,500-acre, hypereutrophic lake on the Minnesota/South Dakota border in Traverse County, will significantly benefit from an experimental no-tillage program started within the lake's 812,000-acre watershed (primarily agriculture) by the Traverse County Soil and Water Conservation District. Farmers were encouraged to try no-tillage practices by renting no-till drills for their equipment. In no-till farming, crop residues are left on the fields to stabilize the soils from eroding during rainfall events.

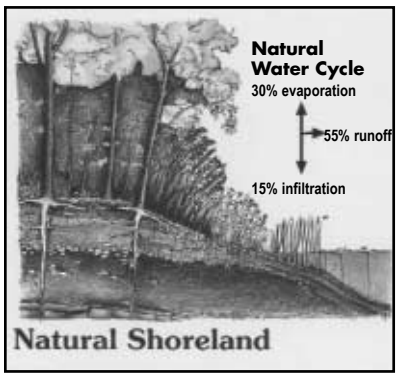
The no-till drills allow for planting directly through the crop residue. More than 250 farmers used the rented drills to seed 3, 360 acres saving an estimated 39,000 tons of topsoil. According to the Traverse County Water Plan, 50 agricultural producers have now purchased no-till equipment covering 40,000 acres and reducing soil erosion by 460,000 tons. ◆

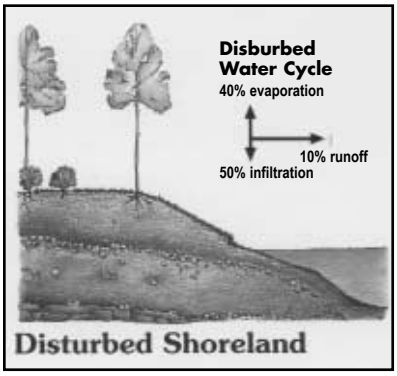
Development Impacts Water Quality

The phosphorus connection

Development can have a profound impact on water quality. As with the other land use impacts discussed in previous articles (septics, livestock and erosion), a primary impact from development is the contribution of phosphorus. When attached to soil, phosphorus can be carried into the lake from erosion and runoff from land and impervious surfaces (paved surfaces that water runs off instead of percolating through).

Phosphorus is a general soil nutrient that in excess in the lake can cause severe algal blooms and oxygen depletion leading to degradation of water quality and diminished aesthetic and recreational enjoyment.





Land-use coefficients

In order to get a general idea of the water quality impacts from various types of land use, we use a tool called Land Use Export Coefficients. The coefficient is an assigned phosphorus runoff figure to each type of land use and was determined from years of monitoring and research. Using the following formula, the coefficients can be used to calculate the phosphorus runoff for a watershed where the areas of specific land use are known.

Watershed load = Σ (Area of type land use * export coefficient for land use). Although coefficients can be adjusted to fit individual circumstances, the following are export coefficients used for Big Birch Lake in Stearns and Todd Counties.

Woodland	**0.24 Kg/Ha/year**
Agricultural	**1.13 Kg/Ha/year**
Wetland	**0.18 Kg/Ha/year**
Residential	**0.50 Kg/Ha/year**
Feedlots	**300 Kg/Ha/year**

Kg= kilograms Ha= hectare
Source: Reckow et al 1980

The change in predicted phosphorus loading is striking as land use changes from a natural setting type—wooded or wetlands—to developed land uses such as cultivated or urban uses. Note in the chart, residential development has about twice the amount of phosphorus runoff as woodlands and almost three times the amount of a wetland.

Long- and short-term impacts

The short-term impacts of development happen during the construction phase. Sites are vulnerable to heavy loads of sediment because the site is temporarily stripped of vegetation. Heavy rains at this time frequently result in serious spikes in phosphorus loading to a water body from construction runoff.

Once construction is completed, long-term development impacts continue to influence water quality. There are considerable increases in impervious surfaces as woodlands and grasslands give way to urban development occupied with more paved roads, parking lots and buildings. As runoff increases, the capacity for the water runoff to carry more pollutants with it, whether in solution or as sediment, also increases. At this point, there is less phosphorus attached to soil reaching water bodies and more in solution to impact water quality. These long-term sources can include overly fertilized lawns, removal of shoreland buffer zones, and improperly maintained or constructed septic systems.

It is important to deal carefully with wetlands and bluffs or steep sites at the time of development. Wetlands are buffers to lakes and streams by serving as a nutrient holding area and help protect the water body from developments in the watershed.

City and county responsibility

To understand how development impacts lakes, we need to understand city and county responsibilities in the land-use process. City or county roles in development are more accurately termed "directing" development rather than "controlling" it. Basically, development is driven by regional and/or national forces including population growth, interest rates, economic growth, disposable income, etc. When these forces align, development is basically inevitable. The county or city, as the statutory land-use authority in Minnesota, directs development consistent with comprehensive land-use and water plans.

Much of Minnesota's lake country is experiencing changes from natural wooded watersheds to more intensive urban-type land uses. We will have to be farsighted if we are to protect water quality as lake watersheds develop. The basic tools local units of government use to direct land use include: The Shoreland Management Ace, Subdivision regulations, and the Wetland Conservation Act. ◆

Wetlands Reduce Land Use Impacts to Water Quality

The "M" in the S-L-E-D'M model represents the miscellaneous category for issues that don't fit well within the other specific categories of land use impacts to water quality, namely (S)eptics, (L)ivestock, (E)rosion, and (D)evelopment. Examples of miscellaneous issues would include active or abandoned dumps, stormwater sewers, highway runoff and wetland restoration.

Thousands of acres of wetlands in Minnesota historically have been drained and put into agricultural production. Restoring drained wetlands, or protecting existing wetlands, is a unique opportunity to reduce pollution from large land areas upstream from the wetlands—when located in the right area—and can have a very positive effect on water quality.

David Steen Wildlife Management Area, Ortonville, Minnesota

As discussed in earlier articles, phosphorus often migrates from the watershed to the lake attached to eroded soil particles. Sources of erosion can vary from agricultural cultivation or construction site development to natural bank erosion. Lakes with a high percentage of wetlands still intact in their watershed tend to have higher water quality than watersheds where most of the wetlands have been drained or filled.

Drainage ditches in a lake's watershed speed the delivery of runoff to the lake. As the velocity of the runoff increases, its ability to carry sediment increases. On the other hand, when runoff to a lake is slowed, sediments and attached nutrients have a chance to settle out before they reach the lake. Wetlands tend to slow runoff water, acting in the process as natural filters or settling basins. Slowing runoff may also help reduce the erosion of streambanks that is a common source of sediment to Minnesota lakes.

Wetlands slow runoff

Drained wetlands aren't available as a water quality treatment option in much of the state. Consider your lake lucky if its tributaries are naturally meandering streams with their adjacent wetlands intact. In agricultural portions of the state, restoring drained wetlands may present unique opportunities for improving water quality, especially when used in tandem with vegetative buffer strips, conservation tillage, and erosion mitigation practices along the lakeshore itself.

Big Stone Lake Restoration Project

A completed wetland restoration project is a major reason that Big Stone Lake, near Ortonville, Minnesota and straddling the South Dakota border, has improved water clarity today. The 60 acres of restored wetlands, formerly a cornfield, is now called the David Steen Wildlife Management Area as a memorial to the man

whose vision it was to restore the land to the state of a cattail marsh that he knew as a youth. David Steen saw that one of the easiest ways to clean water was to run it through a cattail marsh where settling would remove polluting soil particles and nutrients. The marsh vegetation also utilizes dissolved nutrients and traps phosphorus.

The Big Stone Soil and Water Conservation District together with the Upper Minnesota River Watershed District cooperated with a number of state, local and national agencies and groups to clean up the severely hypereutrophic Big Stone Lake, which is over 28 miles long, by means of land-treatments, including the restored wetland, that would reduce erosion in the 738,000-acre watershed.

Following restoration, the Agricultural Research Center at the University of Minnesota-Morris monitored the inflow and outflow of water from the restored wetland for water quality and measured the sedimentation rate. The final report after four years of monitoring showed that the average annual retention or treatment efficiency of the wetland was calculated to be 63 percent for nitrate-nitrogen, 27 percent for total phosphorus and ortho-phosphorus, and 86 percent for total suspended solids.

According to Diane Radermacher of the Upper Minnesota River Watershed District, different areas of the lake have seen improvement, particularly in water clarity. “There has been a slight reduction in nutrients entering the lake,” said Radermacher. “The in-lake water quality is still a problem because the phosphorus accumulated over the years in the sediments is easily recycled, partly because the lake is shallow and winds can easily disturb sediments.”

Other benefits of the restoration include flood control, reduced stream bank erosion, and the creation of new habitat for wildlife and waterfowl. ◆

Changing Land Uses Impact Water Quality

Changes in water quality are primarily a reflection of what happens on land—around the shoreland and within the lake's watershed. The SLEDM components are the most frequent land uses that contribute to water quality problems and are within the jurisdiction of local governments. These land uses contribute to changes in water quality primarily by adding the nutrient phosphorus, a natural element found in soil, or a component of animal and human waste. Phosphorous can enter a lake through direct runoff to the lake, in runoff into streams that drain into the lake, filtered down into groundwater that recharges the lake, or through draining wetlands. It causes algae growth, which contributes to decreased water clarity and unsuitable conditions for water sports. With heavy algae blooms, oxygen needed by fish and other aquatic organisms is depleted as the algae decompose.

Specific land uses that impact water quality

Looking at the SLEDM model, land use sources of phosphorus could come from failing and non-conforming septic systems or from the animal wastes of livestock grazing directly in a lake or stream. Livestock can also cause soil erosion of shoreland and streambanks. Runoff from fertilized lawns, eroding shoreland, or cropland erosion within the watershed are other potential contributors.

As development occurs, construction sites can have high runoff, and increasing development creates more paved surfaces that are a direct source of runoff, and hence phosphorus, to storm sewers that eventually reach the lake. Steep bluffs can be a development-related problem if the site is destabilized and eventually begins to erode.

Wetlands that are valuable filters to prevent nutrients from reaching the lake, can be filled in for residential or commercial construction or drained for production.

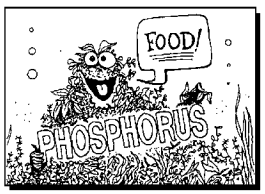
If a lake association, or local government, assesses land uses around a lake and within its watershed using the SLEDM model, the identified areas with the greatest potential to contribute phosphorus are the areas that should be targeted for abatement or education projects to improve water quality.

Lake Associations have a unique role in managing land use impacts

SLEDM issues are important because they not only affect water quality, their management is closely aligned with the responsibilities and capabilities given to local governments. In most counties, the Planning & Zoning Office (P&Z) and Soil and Water Conservation District (SWCD) are the major local government players when it comes to managing SLEDM issues. Watershed districts, cities, and other local gov-

SLEDM is an acronym, which stands for:

S = Septic Systems
L = Livestock
E = Erosion
D = Development
M = Miscellaneous category that includes stormwater discharge, wetlands, and other less common land use impacts.



One pound of phosphorus in a lake can produce 500 pounds of algae!

ernment can also have management responsibilities. The 80 rural Minnesota counties have active local water planning programs that are usually administered by either P&Z or the SWCD.

Lake Associations have an important and unique accountability role in the management of SLEDM issues. They have a responsibility to bring potential land use problems to the attention of not only their shoreland property owners, but also to local government officials (city, county, and SWCD) who make land use decisions. It's not a popular role, but a necessary role for protection of water quality. By attending, or participating in, meetings of zoning and adjustment boards, water planning boards, watershed districts, and the SWCD, the lake association lets the decision makers know they expect proper management of land uses, and they show support for local government efforts to protect water quality. Local government can also be the source of cooperative partnerships and cost-share programs to help lake associations meet their water quality protection goals.

The matrix below shows the SLEDM issues as examples of the private and public players and hurdles (accountability, administrative, technical, and financial) that must be addressed in managing critical land use issues. ◆

	SEPTICS				LIVESTOCK				EROSION				DEVELOPMENT			
	A	AD	T	F	A	AD	T	F	A	AD	T	F	A	AD	T	F
Lake Assoc.	X				X				X				X			
SWCD							X	X	X			X	X	X		
P&Z			X	X											X	X
Landowner	X			X	X			X	X				X			X

A= Accountability
AD= Administrative
T= Technical
F= Financial