Tarrant Lake Management Plan

Cambria, Wisconsin

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Village of Cambria

Tarrant Lake Preservation Committee

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Introduction

With its location in Northeast Columbia County, Wisconsin, Tarrant Lake is located within the Duck Creek Watershed. Tarrant Lake is an impoundment on the North Branch of Duck Creek in the Town of Cambria. The dam creating Tarrant Lake was built on Duck creek in 1845 on the site of the saw-mill erected by Samuel P. Langdon in what was called than the Village of Florence. Even then, the mill pond was the feature attraction to the community and the four blocks surveyed and platted out around the mill were referred to as Langdon's Mills. Throughout history, Tarrant Lake and surrounding area since 1851 called the Village of Cambria have meant many things to many people. The waters of Tarrant Lake have been the source of ice for several ice houses and many more area freezers. It has been a place to swim, fish, and duck hunt. On Sundays during World War II, Tarrant Lake provided German Prisoners of War a break from their 6 day a week canning factory commitments to recreate and exercise.

In the 1950's Tarrant Lake was drained (reasons though are uncertain). In 1993 the spillway of the existing dam was washed out by heavy rains. In 2004 seasonal flooding caused the dam to wash out; as a result, a temporary diversion channel was built. In 2005, the temporary diversion channel flooded as well. In "2006 and 2007 the current dam was constructed" (Personal communication, Lois Frank, 2008). During the time of dam construction the lake bottom was dredged of a total volume of 44,412 cubic yards of soil from the impoundment bottom (Personal communication Domino, 2008). A "test" re fill occurred during May 2006 – October 2006. The lake than started a dewatering process in fall of 2006. In early 2007 Tarrant Lake was refilled and has been full since.

What is a "watershed?"

The Random House College Dictionary defines a watershed as "the region or area drained by a river, stream, etc.; drainage area." A watershed is body of land from which rainfall (and/or snow melt) drains into a receiving body of water: stream or other water body. Watersheds are also sometimes referred to as drainage basins. The highest ground or ridge delineates the boundaries of the watershed. At these boundaries a divided is created, as such, rain falling on one side flows toward the low point of one watershed, while rain falling on the other side of the boundary flows toward the low point of a different watershed.

What is runoff?

Runoff or "surface runoff" is the flow of water from precipitation (snow fall, rain) or other water source across the lands surface. As development increases in a watershed the quantity of water infiltrating into the soil column is reduced; as a result, increasing runoff. Runoff water drainage systems are incorporated in developed areas as preventive action to minimize localized flooding. These drainage systems may discharge through an individual or local outfall to a surface water body or swale, or may runoff the land as overland flow.

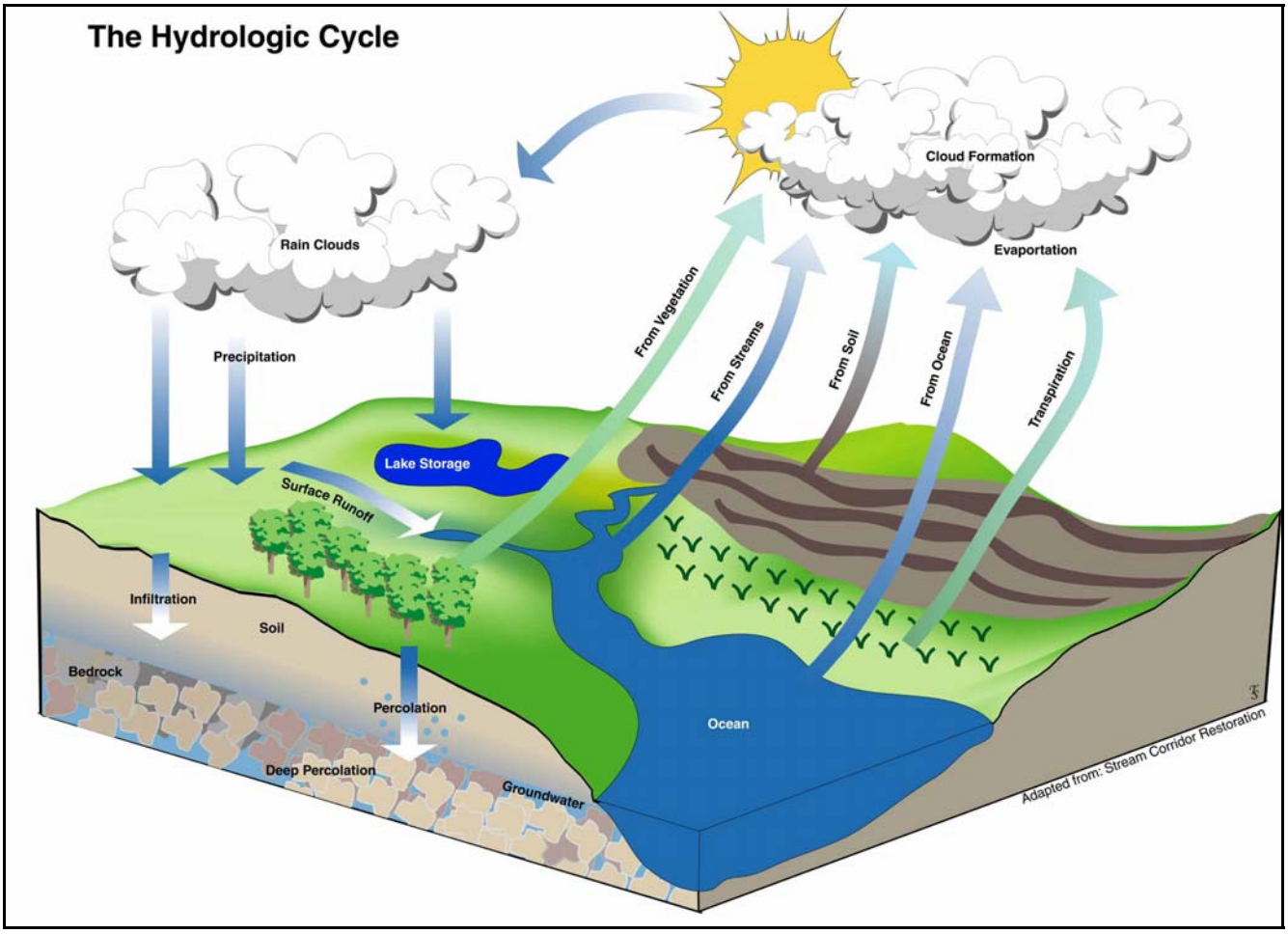

Figure 1-1 Hydrologic Cycle

North Branch Duck Creek

The North Branch of Duck Creek rises in Northeastern Columbia County. Human modifications have extensively alerted the tributaries of Duck Creek. The stream has no existing balanced sport fishery. Stream bank and farm field erosion have historically had a negative effect on the system. Issues from livestock production such as, but not limited to manure storage and management have raised water quality concerns. The North Branch of Duck Creek receives point source discharges from Didion Milling, Del Monte foods, and Cambria wastewater treatment plant. The North Branch of Duck Creek has a small impoundment constructed on the stream in Cambria thus creating Tarrant Lake. The watershed that drains into Tarrant Lake is approximately 5249 Acres. The Watershed is dominated by agriculture and is relatively small in size.

Tarrant Lake

Tarrant Lake is an impoundment on the North Branch of Duck Creek in Cambria, Wisconsin. Tarrant Lake surface area totals 25 acres. In 2007, after three years as a dewatered lake, Tarrant Lake had concluded the new dam construction process. Traditionally the lake has been turbid and experiences problems resulting from nonpoint pollution. As a result, the water body is very fertile and often in a turbid condition. Tarrant Lake has experienced fish kills in the 1970's. Currently Tarrant Lake Preservation Committee (TLPC) is restocking a Large Mouth Bass, Panfish and Northern Pike.

Management Responsibilities for Tarrant Lake

There are several governmental bodies and agencies that have some level of responsibility for the overall management of Tarrant Lake. There will likely be some areas of overlap in regards to resource management. Cooperation between these entities is crucial in achieving the objectives of this comprehensive lake management plan. This section is an attempt to highlight many of the responsible parties and their roles.

The State of Wisconsin is charged with the responsibility of protecting public waters for the public's use and enjoyment. The Public Trust Doctrine is a body of state constitutional, statutory, administrative and common law that protects the public rights to fish, swim, boat, and hunt, while enjoying the natural scenic beauty of Wisconsin waterways. The Wisconsin Department of Natural Resources (WDNR) is the specific state agency responsible for the enforcement of regulations concerning waterways including lakebed alterations, aquatic plant management, water quality, boating, fishing, hunting and dam functions. The Wisconsin Department of Agriculture, Trade and Consumer Protection's (DATCP) Soil and Water Resource Management Bureau has specific statutory responsibilities regarding soil and water conservation on the agricultural landscape. DATCP provides oversight and management of several state funded conservation programs including the Land and Water Resource Management Program, Nutrient and Pesticide Management Program and the Farmland Preservation Program. The Columbia County Land and Water Conservation Department (LWCD) is the local delivery mechanism for these DATCP programs.

The United States federal government has several agencies that play a role in the management and protection of Tarrant Lake and its watershed. The U.S. Army Corp of Engineers reviews applications and issues permits for alterations of waterways and conducts studies as applicable. The United States Geological Survey (USGS) conducts water quality monitoring, operates water level gauging stations and conducts studies. The Natural Resource Conservation Service (NRCS) is the federal conservation partner to the Columbia County LWCD. NRCS administers a wide range of conservation programs targeted at water quality, land preservation and soil erosion. This agency is responsible for monitoring and assuring conservation compliance for all federal farm program participants. The U.S. Fish and Wildlife Service (USFWS) conducts a number of programs on both public and private lands focused on fisheries management, wildlife management and overall habitat improvement.

Columbia County has two departments that play a role in the management and protection of Tarrant Lake Watershed. The Columbia County Planning and Zoning Department is directly responsible for programs such as shore land zoning, land-use planning, and zoning/septic system oversight. The Columbia County Land and Water Conservation Department has a mission to "Protect, Promote and Enhance the Natural Resources of Columbia County". These efforts are carried out through a combined effort of ordinance enforcement and water quality management program implementation. The LWCD department is directly responsible for the implementation of best management practices that control and reduce non-point source impacts in the watershed. The LWCD continues to provide local program implementation through a partnership with the TLPC. The LWCD is well versed in accessing a wide array of financing options through various grants.

The boundaries of Tarrant Lake fall within the municipal boundaries of the Village of Cambria. The Village of Cambria is responsible for implementation of applicable local ordinances such as shore land zoning, land use, building codes, erosion control and storm water management. The Village of Cambria Board has created a "Lake Preservation Committee" to begin the process of restoring Tarrant Lake.

In 1974, the Wisconsin legislature enacted laws enabling individual lakes to form inland lake protection and rehabilitation districts. The law allowed local residents to choose to create local government taxing entities (Lake Districts) to help focus local financial resources on local priorities.

Chapter 2

Public Participation Planning Process

Introduction

One core value that was shared at the conceptual stage and throughout the planning process used to create the *Tarrant Lake Watershed Plan* was that public participation in decisions about the future development and improvement of Tarrant Lake would be fundamental to achieving lasting and possible solutions. Collaborative problem solving generally can be accomplished with less confrontation and fewer occasions of "gridlock," since participants understand what opportunities are available and also whatever resources or other constraints must be considered. Involving citizens also ensures that the solutions (and possibly some very creative or unconventional solutions) are tailored to local needs.

A facilitated strategic planning process was engaged to create this *Plan*. The process included:

- pre-agreed upon roles and responsibilities of participating agencies (Cambria Community, Columbia County Land and Water Department and Columbia County UW-Extension);
- open meetings, posted agendas and meeting outcomes;
- agreed upon ground rules;
- team building activities, and,
- a public participative process that lead to consensus decision-making.

The primary goals when laying out the planning process:

- Create a public participation planning process
- Utilize factual and scientific data

A carefully constructed participation program encourages an open exchange of information and ideas. Together the participants establish a collective vision for the future, and share responsibility for problems as well as their solutions. Those engaged in the planning process – Tarrant Lake Preservation Committee Members, Village of Cambria Officials and Staff, Tarrant Lake property owners, Technical Advisors, Columbia County Staff – were involved in many ways to influence decision making. Table 1 documents the participatory activities and results, from the beginning of the process to the creation of this Plan.

Table 2.1 Tarrant Lake Planning Schedule

Date	Type of Meeting	Where	Who
5/14/2008	Introduction to Public Participation Planning	Cambria Village Hall @ 6:30	Public
5/20/2008	Vision Statement Workshop	Cambria Village Hall @ 6:30	Public
6/11/2008	Vision Statement Workshop	Cambria Village Hall @ 6:30	Public
7/09/2008	Issue Identification	Cambria Village Hall @ 6:30	Public
7/22/2008	Presentation Of Goals and Objectives	Cambria Village Hall @ 6:30	Public

Planning Meetings Review

We have been delighted that the community-based planning effort for Tarrant Lake has appealed to the volunteers from such a diverse cross-section of the community. The volunteers in attendance

have been drawn to the process by a common desire to provide the community they love, as well as their families, particularly their children, with a clean, healthy lake to use and enjoy.

The planning effort has drawn volunteers from various towns, several members of the Village of Cambria Council and Committees, Village of Cambria residents, agricultural producers from Tarrant Lake Watershed, the current Tarrant Lake Preservation Committee (TLPC) members, and various other people interested in the future of Tarrant Lake.

At the beginning of the Lake Planning Process the Tarrant Lake Preservation Committee had an established Mission Statement, which upon review was determined to still be a perfect fit for the group.

Tarrant Lake Preservation Committee Mission Statement

"The Tarrant Lake Preservation Committees mission is to restore and preserve our greatest Village asset. A multi-year plan of conservation and habitat restoration will ensure that our children's children will enjoy the main focal point of our community."

The Tarrant Lake Planning process got under way with its first meeting on **May 14, 2008**. It was at this meeting the public was provided with a history of the partnership with the Tarrant Lake Preservation Committee and the Columbia County Land and Water Conservation. The presentation outlined the upcoming planning process while explaining that the dynamic process would only be as strong as the participation and input provided by the community. Lastly, the presentation emphasized the importance of the role that community planning would hold for the future of Tarrant Lake.

At the second meeting on **May 20th**, the first activity was to develop the Watershed Survey. The group determined who the recipients of the survey would be thus defining the Tarrant Lake community. The planning group revised and subsequently approved of the Tarrant Lake Planning Survey and survey schedule.

May 22, 23, 24, 25 – Tarrant Lake preservation Committee pays for postage and stamps all envelopes

Week of May 26th – Land and Water Conservation Department and University of Extension package and send out surveys

May 29th – 498 surveys are mailed

June 19th - Deadline to return surveys. 90 or 18.8 % returned.

Week of July 1st – Processing of Survey Data

With a mission statement in hand, during the meeting on May 9th and on June 11, 2008, the participants developed the **vision statement**.

Tarrant Lake Preservation Committee Vision Statement

"The Tarrant Lake Watershed Management Committee envisions a lake that can be enjoyed for years to come. The Tarrant Lake Community, with committee leadership, shall manage policy to monitor, maintain, and enhance the water quality of Tarrant Lake for sustainable plant, fish, and wildlife populations and numerous recreational and social opportunities on and around the Tarrant Lake community. The committee will advocate for the promotion of responsible and sustainable land use practices within the Duck Creek Watershed through community education, while maintaining the historical significance and aesthetic beauty of the Tarrant Lake Community."

On July 9th, the next step for the community was **issue identification**. We received issues through the planning meeting, as well as in other forms: emails, cards, and letters. The resulting list, represents a good cross-section of the community and was comprehensive in scope.

On July 22nd, the group was presented with goals for various previously determined issues. The group filled out comment sheets relating to each goal while working through a collaborative process aimed at community consensus.

The primary goals as determined by the visioning statement:

- Foster community involvement and education
- Promote recreational use of our lakes
- Ensure sound lake management practices for future generations
- Provide a healthy functioning ecosystem

Each issue is listed with a unique value statements *(a)* and goals (b) as listed in the finished plan:

1. Peace and Tranquility

a. Balanced and fair lake management is right for our community because our families, particularly our children, deserve to have a clean, healthy lake to enjoy.

b. Create and protect clear water, aquatic plant-dominated Tarrant Lake with self sustaining fishery and abundant wild life.

2. Water Quality

a. The Tarrant Lake community, families, and future generations deserve to have a lake with clean water to use and enjoy.

b. Restore a balanced ecosystem by restoring water clarity, protecting water clarity, preventing algae blooms, and reducing nutrient levels in the lake.

3. Sediment and Nutrient

a. The Tarrant Lake community does not believe it is fair for poor land use management to hurt what the rest of the people value; clean water for a healthy Tarrant Lake.

b. Reduce sediment and nutrient loads from both the urban and rural components of the watershed.

4. Ecosystem & Fishery

a. Healthy lake ecosystems are vital and valuable natural resources for lake communities. A self-sustaining fishery will be restored, monitored and protected by protecting high quality aquatic plant communities and managing angler harvests.

b. Restore and protect a healthy self-sustaining blue gill, northern pike and bass fishery.

5. Water Quality Monitoring

a. Tarrant Lake Community will invest in the health of Tarrant Lake; balanced and sound lake management is what is right.

b. Implement a comprehensive water monitoring strategy to develop a hydrology model, thus quantifying nutrient and sediment loads from the urban and rural components.

6. Shoreline

a. Restoring and protecting native buffers will provide privacy and tranquility, as well as a natural space for families to enjoy nature. Our families and community expect maintained water quality and lake protection provided from a native shore land buffer. Furthermore; native shore lands increase the value of the lake, increasing our families' property.

b. Restore and protect healthy, stable shore land habitats (public and private) with native buffers.

7. Ecosystem & Aquatic Plants

a. Restoring and protecting high quality native aquatic plants will help restore and maintain the restored clear water state while providing critical habitat for a self sustaining fishery.

b. Monitor and protect aquatic vegetation.

8. Organization

a. Protecting Tarrant Lake's ecosystem requires a core group of concerned citizens with community support who need to be provided with the best opportunity for success.

b. The Tarrant Lake Preservation committee will formally become a recognized Lake Association or District.

9. Organization

a. Basing decisions on sound data allows for the ability to allocate limited funding effectively, on behalf of Tarrant Lake and the community.

b. Use future studies as basis to make future decisions.

10. Sense of Place

a. The Tarrant Lake community wishes to create and enhance a peaceful and tranquil sense of place on around Tarrant Lake.

b. Enhance recreational opportunities around Tarrant Lake.

Chapter 3

Shallow Lake Management Concepts

Introduction

Throughout the history of the impoundment of Tarrant Lake, turbidity; as a result, of high levels of sedimentation and nutrification has created a surface water body which has low clarity and low macrophyte abundance. Through the planning effort, stories were told of the lake shifting from a plant dominated stable state to an algal dominated stable state (see table 3.1). Paragraphs adopted from the Big Muskego Lake and Bass Bay – Management Plan are followed by a double asterisk **.

The ecology of shallow lakes is quite different from that of deep lakes. Shallow lakes tend to have higher nutrient concentrations, resulting in greater productivity and biodiversity. Shallow lakes are also more easily affected by fluctuations in water level. They do not develop thermal stratification in summer and mixing readily cycle phosphorus and other nutrients from the sediment. Restoration efforts that have been successful on deep lakes - reversing eutrophication through phosphorus reduction has often failed on shallow lakes. Therefore, shallow lakes require a specialized management approach. **

Alternative Stable States Model

Researchers have found that shallow lakes tend to be in one of two stable states. Over a wide range of nutrient concentrations, both plant-dominated and algal-dominated states can exist as alternatives (Scheffer, 1990, and 1998; Moss, 1998). The preferred plant-dominated condition is typified by seasonal windows of clear water where algae are grazed to low levels, aquatic plants (rooted aquatic plants) dominate and game fish like bluegill, pumpkinseed, northern pike, and largemouth bass are dominant. The alternative algal-dominated state is typified by high available phosphorus levels, turbid water, dominance of algae, and a relative absence of aquatic plants and is dominated by benthivorous fish (bottom feeding fish like carp and bullhead). Turbid water puts sight-feeding game fish at a disadvantage, and often results in slower growth rates and size. Figure 3.1 illustrates the two stable states. **

Shallow lakes can shift or "switch" between these states, although the reasons are often difficult to pinpoint. Lake researchers have identified conditions that resist a switch and have termed these "buffers". They have also identified conditions that will likely induce a switch between the two states. **

Figure 3.2 illustrates the relative stability of each state under various nutrient conditions (Scheffer, 1993). The "marbles" in the valleys of the landscape diagram correspond to stable ecological

conditions. In the oligotrophic (nutrient poor) situation in the top diagram, the plant-dominated, clear state is the only stable condition. Likewise, in the hypertrophic (extremely nutrient rich) condition on the bottom diagram, the algal-dominated, turbid state is the only stable condition. The middle three diagrams show how the marble may rest within two alternative valleys, but how nutrient enrichment affects which state within which the marble is more likely to rest. Continued nutrient enrichment gradually causes the stability of the clear state to shrink to nil, where the lake is more vulnerable to perturbations that would shift the equilibrium to the turbid state.

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Alternative Stable States Model

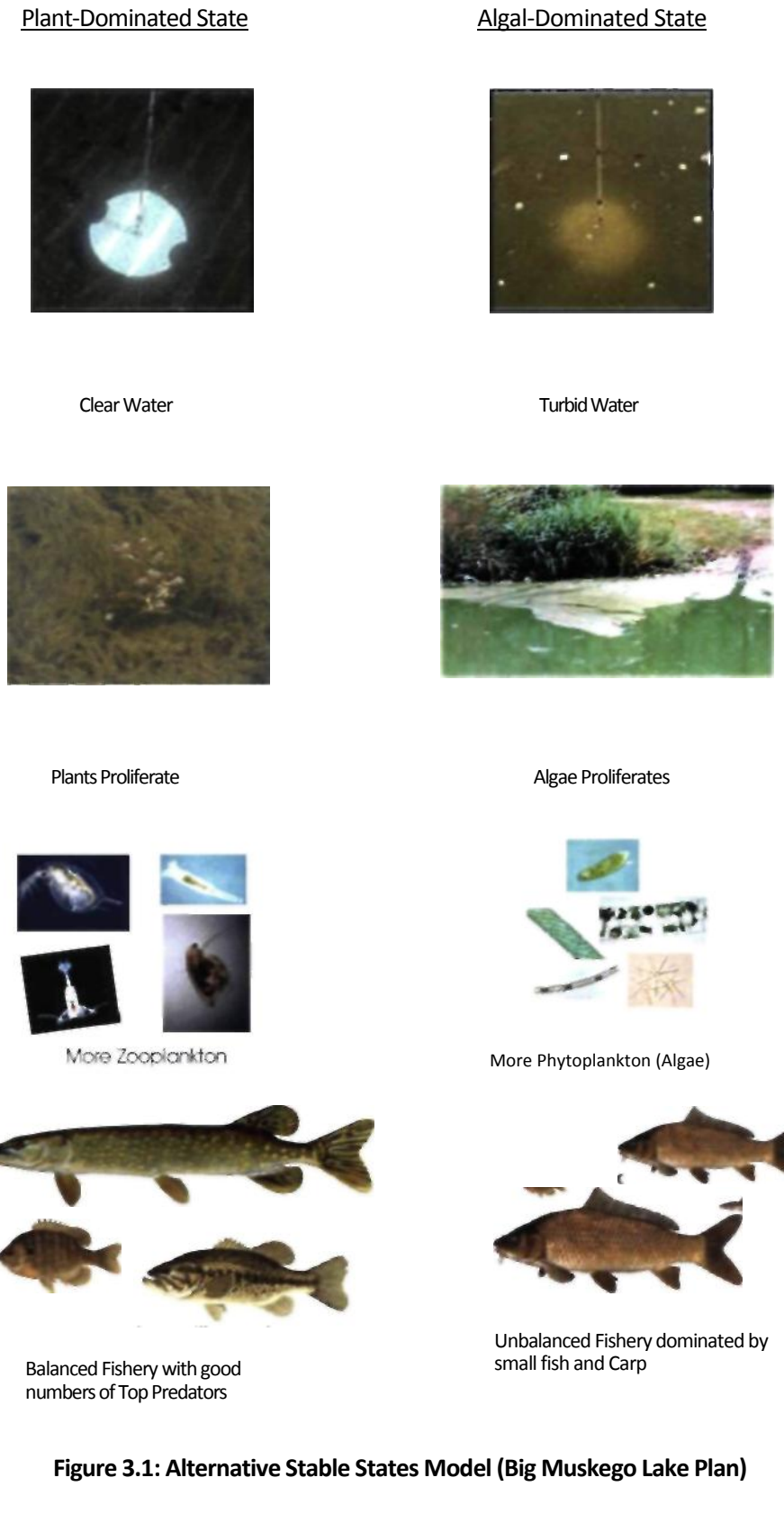

Figure 3.1: Alternative Stable States Model (Big Muskego Lake Plan)

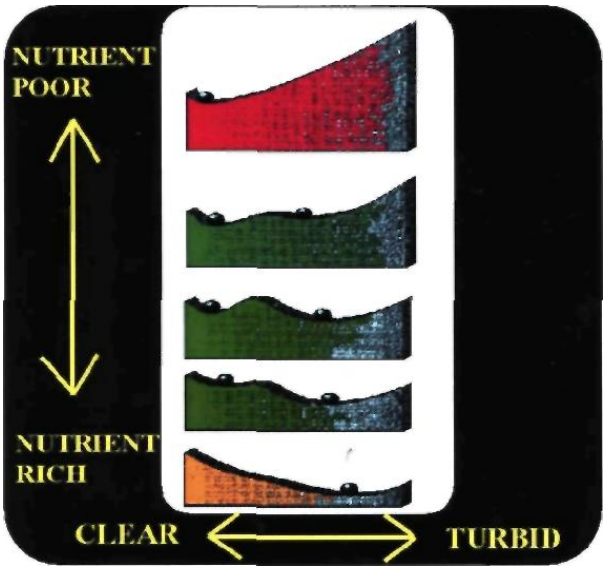

Figure 3.2: Stability of Each Alternative State (Big Muskego Lake Plan)

Buffers for the Plant-dominated (Clear-Water) State

Moss (1998) identifies particular sets of buffer mechanisms that can stabilize each of the alternative states. The plant-dominated state is buffered by the following factors:

1. Suppression of wave action or eddy currents. Stands of rooted emergent plants reduce open fetch areas, which in turn lessen the likelihood of submergent plants becoming uprooted. Beds of submergent plants also absorb wave energy, reducing the re-suspension of sediments and resulting turbidity. This turbidity could in turn, block sunlight to the plants causing their decline.
2. Uptake of nutrients by plants. Plants take up large amounts of both nitrogen and phosphorus (luxury consumption) compared to their immediate growth needs.
3. Structural refuges for zooplankton. Plant photosynthesis changes the chemistry of water located near it. Through inorganic carbon equilibrium, carbon dioxide and bicarbonate are withdrawn and pH values can rise above 9. This appears to inhibit fish activity and thus **a** refuge from fish predation is created for zooplankton within the bed of aquatic plants (Beklioglu and Moss, 1996).
4. Allellopathy and provision of habitat for grazers of periphyton. Periphyton algae can pose a threat to aquatic plants by forming a fur of growth on their surface and compete for sunlight, nutrients and carbon dioxide. Laboratory experiments show that plants secrete substances that inhibit the growth of algal cultures (Forsberg, et. al., 1990). In addition to this allelopathy, plants provide habitat for periphyton grazers such as snails, mayfly nymphs and chironomid larvae.
5. Production of structured sediment suitable for plant germination. At the end of the growing season, plants lay down coarse material that stabilizes sediments and provides a good rooting medium for the following year.

**

Buffers of the Algal-Dominated (Turbid-Water) State

1. Maintenance of open habitat conducive to wind mixing. Greater fetches of open water can produce larger waves with greater energy to stir sediments that block sunlight and inhibit the establishment of rooted plants. Phytoplankton also relies on eddy currents to keep them suspended and re-supplies nutrients.
2. Early algal growth competing with plants for sunlight and carbon dioxide. Algae grow rapidly because they have shorter diffusion pathways for the uptake of dissolved substances.
3. Maintenance of structureless habitat with no refuge for large zooplankton against fish predation. In shallow open water, lacking of structure and deep dark layers to provide refuges for zooplankton, fish easily remove large, efficient grazers such as water fleas (Cladocera). With grazing intensity reduced, phytoplankton flourish.
4. Production of small algal species with high capacity for light absorption. Small algal species are easily moved through the water column and can photosynthesize toward the surface. Their greater surface area to size ratio also makes them more efficient photosynthesizers.
5. Production of amorphous, high water-content sediment unsuitable for plant regeneration. Dead material from phytoplankton is more fluid and amorphous than that from plants. This creates an unstable rooting medium and is also vulnerable to resuspension resulting in turbidity that reduces light for plant development.
6. Maintenance of fish communities with high numbers of small fish. Structureless habitat favors large populations of small fish because their predators, such as northern pike and largemouth bass, need cover from which to ambush their prey.

   **

Switches or Flips

The events or manipulations to a shallow lake system that cause a change between plant-dominated and algal-dominated states are known as a switch or flip (Moss, 1998). A change from plant dominance to algal dominance is referred to as a forward switch. Reverse switches cause a change from algal dominance to a plant-dominated system and are often associated with intentional human efforts to restore a shallow water system. **

Forward Switches or Forward Flips

Two types of forward switches occur in shallow lakes: those that directly destroy the plant structure, and those that indirectly affect the plant structure by preventing buffer mechanisms from operating. The direct type includes mechanical harvesting of plants, the application of herbicides or damage done by boating. It can also include natural damage from wind, storms, ducks and geese (Moss 1998, Sondergaard et al 1996). Examples of indirect forward switches include the leakage of pesticides and other toxins that kill zooplankton, the addition of nutrients from surface run-off and introduction of common carp. There is a strong correlation between the presence of pesticides in sediment and zooplankton mortality (Stansfield et al 1989). With populations of zooplankton reduced, lakes become susceptible to algal domination. **

Water level in a lake is an important control variable with respect to aquatic plant (macrophyte) dominance. Vegetation can withstand turbid water more easily if a lake is shallower. A small shift in critical turbidity, resulting from a higher water level, can cause a loss of aquatic plant coverage and a forward switch to the algal-dominated state (Scheffer, 1998). **

Reverse Switches or Reverse Flips

Drawdown

One of the buffers of the algal-dominated state is the maintenance of open water habitat conducive to wind mixing. Lake drawdown can be used to induce a switch or flip to a plant-dominated state (figure 3.2). Reduced water levels and an exposed lakebed can promote the growth of stands of emergent vegetation, which will reduce wind fetch. Reduced wind mixing subsequently keeps water clearer and promotes the growth of rooted submergent plants. Depending on the goal of management, either a partial or a complete drawdown may be employed. Chemical eradication of the fishery may also accompany a lake drawdown project if the carp population is at a nuisance level. **

There is also a scenario where a lake drawdown may be considered even if the lake is in a plant-dominated state. A drawdown may be considered if a nuisance aquatic plant, particularly Eurasian Water Milfoil (EWM), dominates the plant community. EWM has a growth habit of topping out on the water's surface and can preclude boating activity. Excessive EWM can also negatively affect fish populations and effective biomanipulation may not be possible. **

Seasonal Water Level Manipulation

Seasonal water level fluctuations provide a wealth of ecological benefits to the ecosystems of lakes such as but not limited to: water clarity, shore erosion, lake residence time, algal density, lake water temperature, lake sediment resuspension, lake sediment density, shoreline ice heaving, macrophyte abundance and diversity, and frog and turtle populations. The ability of water levels to fluctuate are essential to maintaining the vegetation supporting waterfowl (Kadlec, 1962) Over stable water levels do not provide the necessary bare mudflats for germination required from species such as Typha (cattail) and Scirpus(bulrush). As Tarrant Lake is an impoundment, thus no pumps would be required; managing seasonal fluctuations in water levels would provide the lowest cost of any macrophyte management method (Dieberg and Williams, 1989). The end result of this low cost technique partial water level/seasonal drawdown could be the re-establishment of rooted macrophytes that are so critical to a shallow water ecosystem.

Traditionally surface water bodies have seasonal fluctuations of the surface water. Tarrant Lake has inadvertently received the benefit from lake drawdowns throughout its 163 year history. It should be expected that in the future seasonal, partial, if not a complete drawdown would be necessary again to buffer Tarrant Lake from an algal dominated stable state.

As can be seen in Figure 3.3, Lake Puckaway Fish Habitat, & Recreation, the natural water level patterns for a water body are in direct contrast to the annual water level as managed in a dam operated

impoundment. Nevertheless, with minor adjustments to the current traditional water level management in an impoundment a great benefit can be provided to various species such as but not limited to: bass and panfish, submerged aquatic plants and amphibians and reptiles. Tarrant Lake should use the proposed line in figure 3.3 as a goal guide for managing annual water levels.

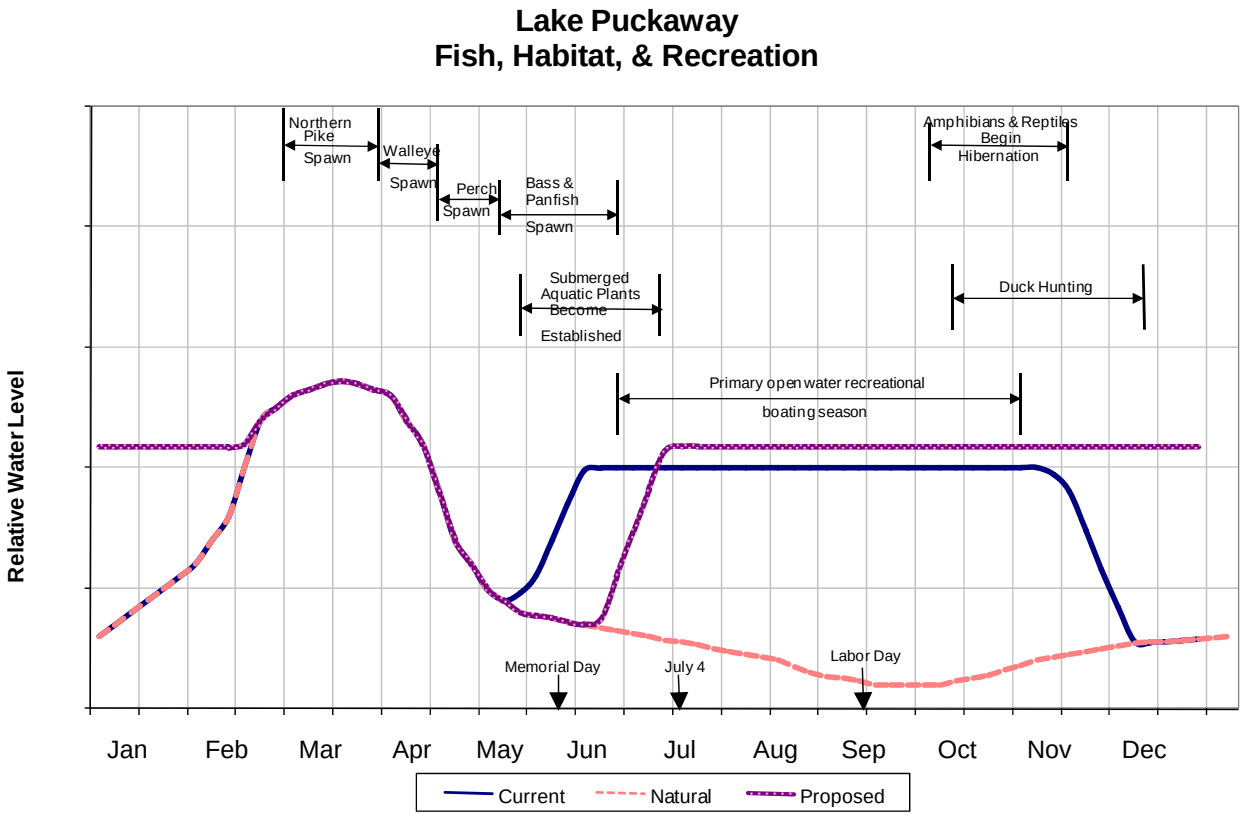

Figure 3.3. **Lake Puckaway Fish, Habitat, & Recreation (R McLennon/C Cook)**

Winter Drawdowns

Winter drawdowns can be very effective tools to manage Eurasian Water milfoil.

Advantages

- If a water control structure is in place, drawdown can be a very cost-effective way of controlling plants like current invasives such as Eurasian Watermilfoil.
- The expansion of native aquatic plants in areas formerly occupied by exotic species can be enhanced by drawdown.
- Can promote submerged aquatic vegetation.
- Can be a minor water level manipulation and not a large scale drawdown.
- Game fish are reported to experience enhanced populations after drawdown.
- Drawdown provides an opportunity to repair and improve docks and other structures.
- Loose, flocculent sediments can become consolidated after drawdown occurs.
-

Disadvantages

- The growth of some aquatic plants may be enhanced by water level drawdowns - know the species that you want to control.
- Winter weather may influence the success in killing the target species. Snow before a hard freeze may insulate the sediment and prevent freezing to a depth that will kill the roots; milder climates may not experience the freezing or dewatering conditions needed to kill the exposed plant roots and rhizomes.
- Docks are left high and dry, water intakes may no longer be in the water, it may not be possible to launch boats, and some people will complain about aesthetics of the water body.
- There will be significant impacts to fish and aquatic wildlife by lowering the water and exposing the sediments.
- Algal blooms have been reported to occur after drawdowns have occurred.
- Water levels may be lower in wells during drawdowns.

Aquatic Plant Response to Drawdown

The effects of a drawdown on Tarrant Lake aquatic plant community can only be expected to perform to levels at which the system preformed in the past for which no surveys have been found.

If it is determined through the analysis of an aquatic plant inventory that Tarrant Lake does not have an adequate plant community for a plant dominated state then it might be necessary for the use of a drawdown to stimulate germination of aquatic plants.

Cattail Response to Water Level Changes

The ability of cattails to grow within various water depths is linked to the conditions in which the plants convert stored carbohydrates to the energy needed for shoot growth (U.S. Fish & Wildlife Service, 1993). Starches stored in the rhizomes (fleshy, root-like stems) can be converted to energy both aerobically (with oxygen) and anaerobically (without oxygen). Passageways called "aerenchyma" located within living or dead cattail leaves supply a means through which the rhizomes can utilize oxygen from above the water. Aerobic starch conversion is much more efficient so stored energy is available to grow roots through greater depths of water. Conversely, if oxygen is not available, shoots emerging from the rhizomes have less energy to grow through the water column. For this reason, cattails are generally found growing in water less than four feet deep.**

Cattail growth can be stimulated through complete exposure of the lakebed, which causes germination of seeds. Lowering water levels without exposing the substrate can also encourage cattail growth from the rhizomes of adjacent plants. In contrast, raising water levels can reduce the growth of cattails. Cutting of shoots and stems below the water necessitates the inefficient conversion of starches within cattail plants and causes a reduction in growth. **

Populations of muskrats *(Ondatra zibethicus)* help keep cattails in check. These mammals utilize leaves for building lodges and the shoots and stems for food. Muskrats create open pockets of water that are utilized by nesting waterfowl. Muskrats do tunnel and can cause damage to earthen dams. **

During the drawdown process, although not quantified, the cattail abundance in Tarrant Lake increased during the dam reconstruction and has been declining since the water levels returned. In the future, if any other drawdowns are to be used cattail abundance should be expected.

Biomanipulation

Biomanipulation is an ecological management approach that manipulates the biomass of a particular level of the food web to have an effect on the biomass of another. The term originally encompassed a range of techniques applied to terrestrial and aquatic ecosystems. In aquatic systems, it typically refers to top-down manipulation of fish communities, i.e. enhancement of piscivorous (fish-eating) fish populations and reduction of zooplanktivores and/or benthivores (Perrow et al., 1997). In one of the earliest published reports, Caird (1945) hypothesized that stocking of largemouth bass was responsible for reductions in phytoplankton through food chain interactions. Several researchers (Hrbacek et al., 1961; Brooks and Dodson, 1965; Hurlbert et al., 1971) found that planktivorous (plankton-eating) fish can severely reduce or eliminate *Daphnia,* the largest, most efficient grazers of phytoplankton. These results suggested that lowered planktivorous fish densities would maintain greater densities of *Daphnia,* and thus control algal biomass. **

A reverse switch can involve biomanipulating the fish community to reinstate the plant buffers and destroy the buffers of algae-dominance. An abundance of small, zooplanktivorous fish can quickly reduce the population of *Daphnia* that efficiently graze algae. Biomanipulation seeks to replenish the zooplankton population by reducing the population of their predators. To decrease populations of small zooplanktivorous fish, top predators, such as pike, are added to the system. At larger sizes, panfish become more piscivorous in their feeding habits and help reduce the numbers of small, zooplanktivorous fish. Lower predation pressure allows the zooplankton community to thrive and prey on planktonic algae. Biomanipulation is graphically depicted in Figure 4. **

Biomanipulation to attain a plant-dominated state can also involve eliminating common carp and/or gizzard shad from the system, not just because of their zooplanktivorous habits, but more importantly, their behavior of stirring sediments and the resultant turbidity that inhibits plant growth. Because it is impractical to selectively remove carp while maintaining desirable fish species, total fish eradication is often performed for a biomanipulation project. The lake is then restocked with healthier balance of fish including more "top predator" piscivorous fish. In Tarrant Lake, northern pike *(Esox lucious)* occupy the role as the post-restored top predator. Other piscivorous fish include largemouth bass and bluegill (at larger sizes). These fish keep the population of planktivorous fish under control by preying on eggs and juvenile fish so that large zooplanktons such as *Daphnia* are allowed to flourish and consume phytoplankton (algae). As a result, the water becomes clearer, allowing sunlight penetration and the proliferation of the submergent aquatic plant community. The established aquatic plant community utilizes the nutrients (i.e. nitrogen and phosphorus) that were the main food source of the algae, and the algae diminish. Overall, biomanipulation can be extremely successful, but often only for short periods of time. In order for it to be successful in the long term, the piscivore and planktivore populations in the lakes must be closely monitored to prevent a forward switch. **

BIOMANIPULATION TO MAINTAIN PLANT-DOMINATED STATE

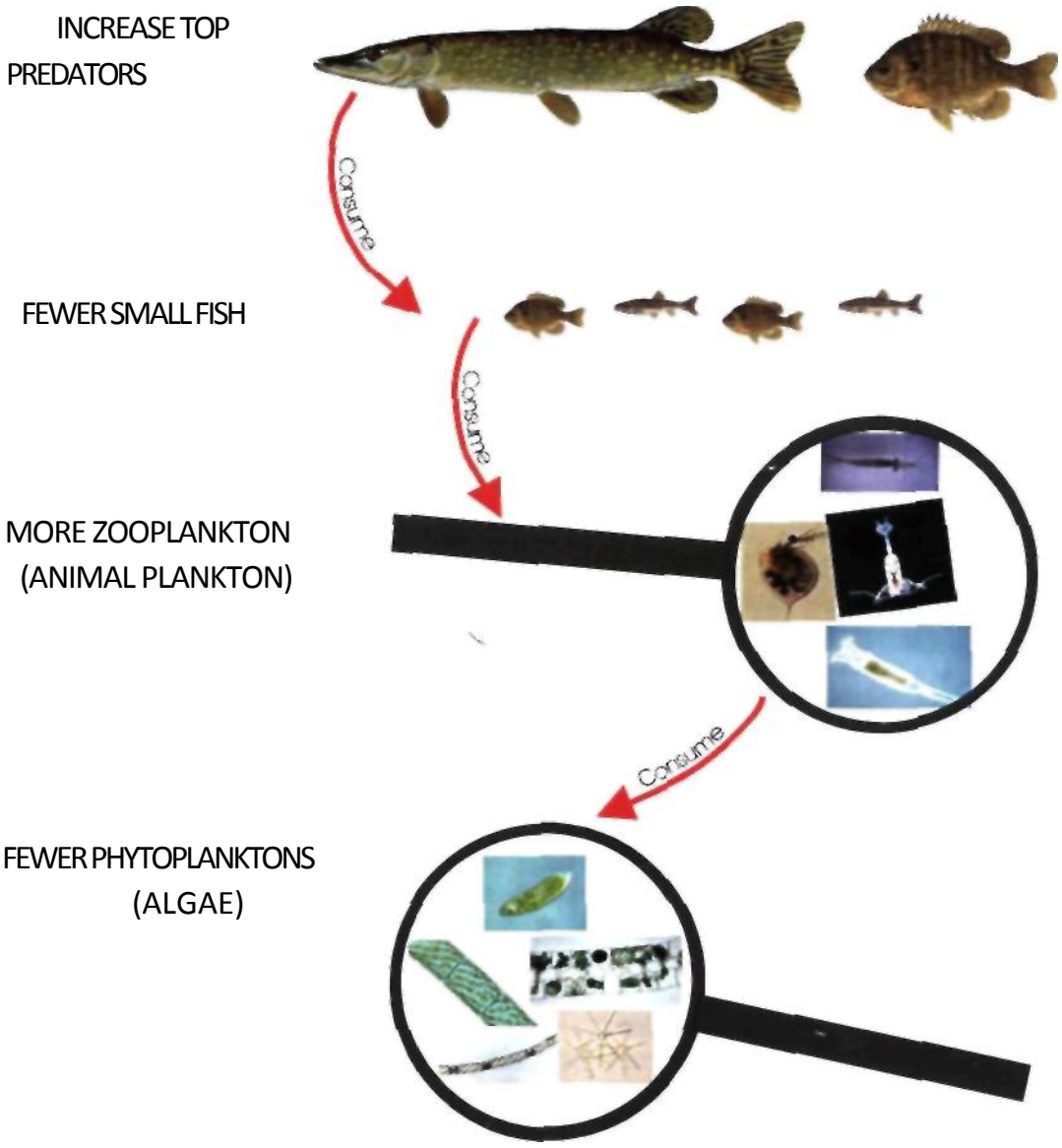

Figure 3.4 Biomanipulation to Maintain Plant-Dominated State (Big Muskego Lake Plan)

Nuisance Aquatic Plant Management Alternatives

This chapter described why it is desirable to manage a shallow lake for a clearer water and healthier fishery. However, aquatic plants themselves often can pose as a nuisance. Growths of certain aquatic plants, particularly non-native plants can be invasive and cause negative impacts to fish and wildlife habitat and human recreation. Control measures may be needed to minimize the nuisance level to allow reasonable use of swimming, fishing and navigation.

Chemical Controls

Chemical treatment of aquatic plants in all waters of the state, public or private, requires an approved permit from the Wisconsin DNR. Only chemicals registered for aquatic use with the U.S. Environmental Protection Agency (EPA) and the State of Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) can be used. In many cases, a licensed applicator, certified by DATCP must apply the chemicals.

Aquatic vegetation that is killed with an herbicide/algaecide will decompose Decomposition uses dissolved oxygen and in turn increases the likelihood of a fish kill. When aquatic vegetation has accumulated to the point at which massive amounts are present, the decomposition that occurs after an herbicide/algaecide application could result in oxygen demand so great that there is not enough to sustain fish life, and a fish kill may occur. This problem can be avoided if chemical weed control efforts are carried out in early spring before there is a large accumulation of vegetation, and when the water is still cold and rich with oxygen.

2,4-D

The chemical herbicide 2,4-D (2,4-dichlorophenoxyacetic acid) is selective in killing dicotyledonous or broad leaf plants. It has been found to selectively control infestations of EWM at low concentrations and short exposure times (Killgore, 1984; Miller and Trout, 1985). The goal of treatment is to reduce the distribution and density of EWM and allow native plants to flourish and to allow reasonable use of swimming, fishing and navigation.

Fluridone

Fluridone, more commonly known as SONAR, is a slow acting systemic chemical herbicide that must remain in contact with target plants for up to ten weeks. Fluridone is effectively absorbed and translocated by both plant roots and shoots. It will control a broad range of submerged and floating aquatic plants, and some emergent plants but is particularly effective for duckweed and Water Milfoil control. When applied at reduced rates, Sonar can be used to selectively control undesirable, nonnative species. In 30-90 days after application, the target weeds will be controlled and effects can last up to two years. Disadvantages of this control method include its relatively high cost and its effect on non-target plant species.

Alum

Aluminum sulfate or alum is used to reduce internal phosphorus release from the lake bottom. On contact with water, alum forms a fluffy aluminum hydroxide precipitate called "floc." Aluminum hydroxide reacts with phosphorus to form an insoluble aluminum phosphate compound. On the bottom

of the lake the floc forms a layer that acts as a phosphorus barrier by combining with phosphorus as it is released from the sediments. Although alum is effective in preventing phosphorus from entering the water column, rooted aquatic plants are still capable of utilizing phosphorus within the sediment. Therefore alum is primarily used as a control of algae, rather than aquatic macrophytes.

Glyphosate

The chemical glyphosate formulated for use over water, such as the brand name Rodeo, can be used to control invasive Purple Loosestrife. Foliar formulations will also kill any non-target plants in the zone of spraying because the chemical is a broad-acting vegetation killer. A selective but more labor-intensive method is to cut individual purple loosestrife stems and apply a more concentrated formulation of herbicide to the cut end. This control method is impractical for large areas and is best employed to eliminate small colonizing stands of this invasive plant.

Manual Controls

Manual removal of submergent or emergent aquatic plants by hand pulling or raking is an effective means of controlling nuisances in small areas. NR 109 of the Wisconsin Administrative Code allows riparian owners to remove vegetation in a 30-foot wide area without a permit. The Code also allows for hand removal of non-native aquatic vegetation beyond the 30-foot area, provided the native vegetation is not removed or harmed.

Biological Controls

Biological controls for aquatic plants and algae are in the developing stages and include pathogens (bacteria or fungi) and herbivores (insects, crustaceans or fish). Bacterial treatments are commonly used in small fish-rearing ponds Presently, fish and crustaceans are not legal control options in the state of Wisconsin. It is illegal to transport or stock grass carp or live crayfish into Wisconsin waters.

Weevils *(Euhrychiopsis lecontei)* are tiny native aquatic insects found to feed heavily upon milfoil species. Adult weevils cause lesions that make the plant more susceptible to bacteria and fungi, while the larval stage burrows into the stems. Subsequent tissue damage causes the plants to lose buoyancy and collapse (Sheldon, 1995}.

Biological controls are also being employed for the control of purple loosestrife. Two Chrysomelid beetles *(Galerucella pusilla and G. calmariensis),* which feed exclusively on purple loosestrife, have been imported from Eurasia. Releases of these insects have been shown to significantly reduce stands of purple loosestrife within a three-year period. An aggressive propagation and release program is underway in Wisconsin to utilize this biological control.

Chapter 4

Lake Characteristics

Tarrant Lake

Tarrant Lake is an impoundment on the North Branch of Duck Creek in Cambria, Wisconsin. Tarrant Lake is a small lake/millpond located in the Village of Cambria. Tarrant Lake surface area totals 25 acres. Tarrant Lake sits within a 5249 acre watershed, a sub watershed of the duck creek watershed.

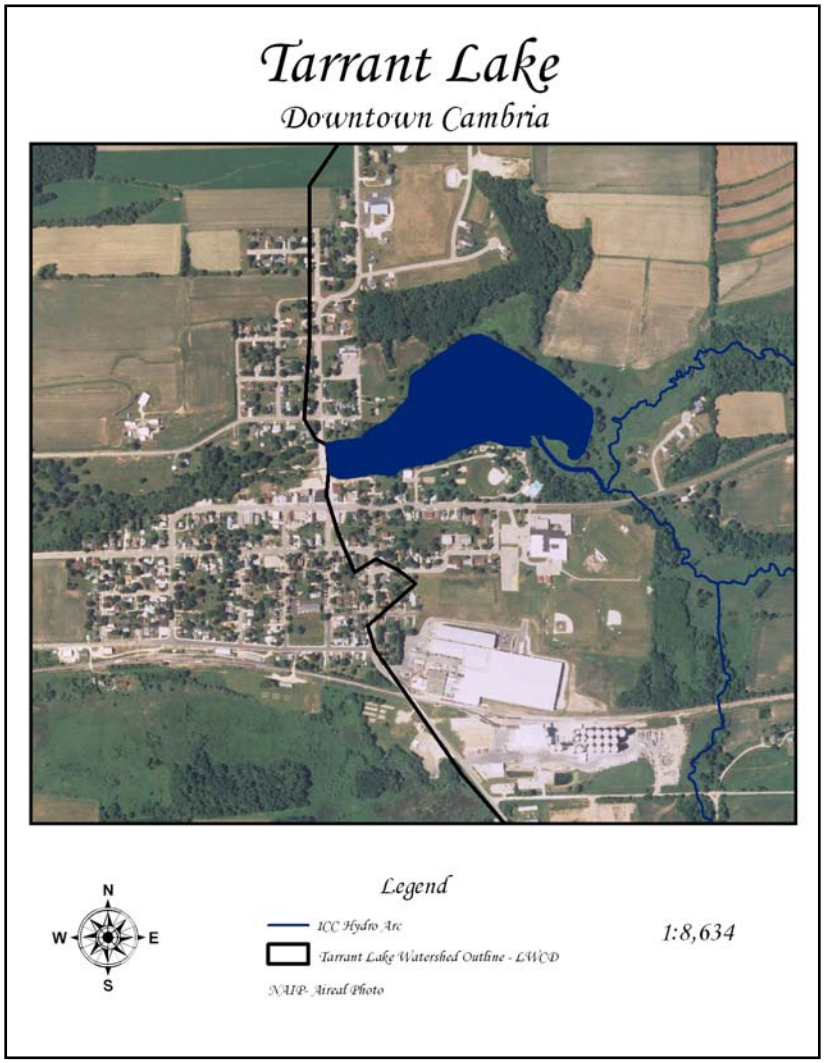

Figure 4.1 Tarrant Lake Map

In 2007 the Village of Cambria completed a two year construction project of a new dam once again creating Tarrant Lake as a shallow water impoundment. At the time of construction the lake bed was also dredged with removal equating to 44,412 cubic yards.

Traditionally the lake has been turbid and experiences problems resulting from nonpoint pollution. As the result, the water body is very fertile and often in a turbid condition.

In the past the lake has had periods with turbid water and high algal, and other periods with high abundance of aquatic macrophyte growth. Although Tarrant Lake is currently going through a fish restocking process, traditionally the Tarrant Lake fishery is composed of panfish, northern pike, largemouth bass and catfish. Traditionally, area residents mainly enjoyed the lake for fishing and the overall esthetics.

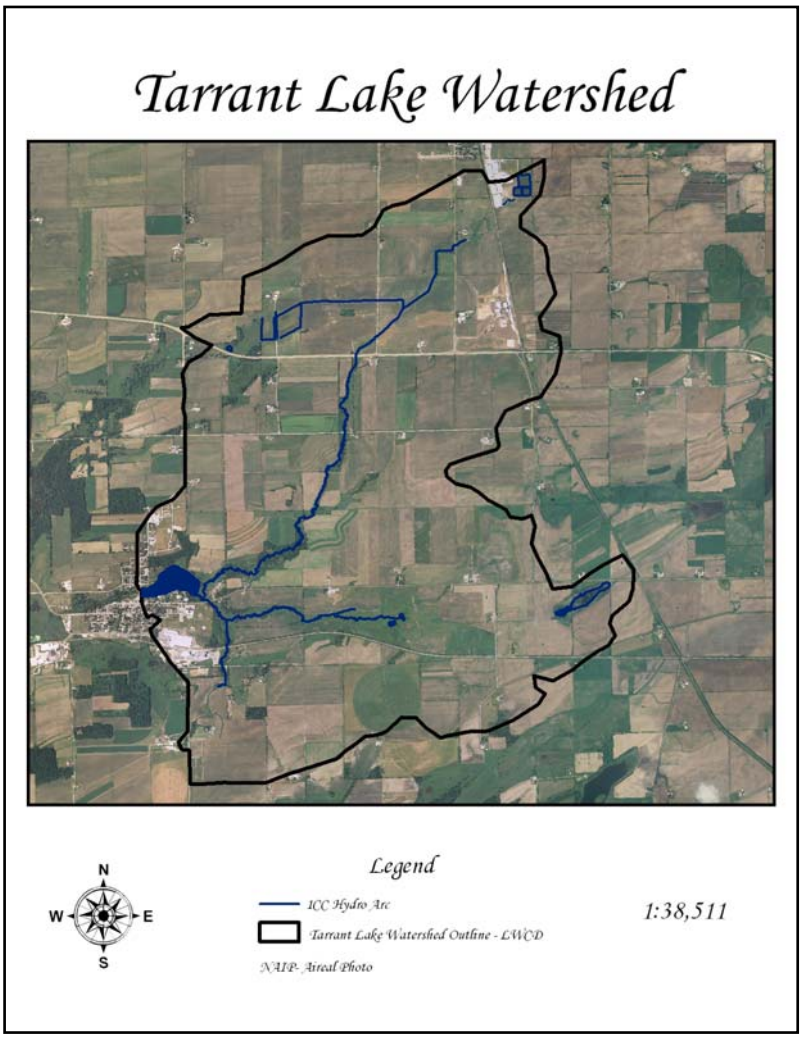

Figure 4.2 Tarrant Lake Watershed

Fishery

Traditionally the Tarrant Lake Fishery was defined by blue gill, largemouth bass, and northern pike. Through the planning process, community members spoke of fish kills in the 1970's; they asserted, the fish kills were a result of agricultural runoff. As a result of a 11' in rain in June, 2004, the dam was washed out. A temporary diversion channel was created but subsequently was flooded out in 2005. At this point the fishery was lost. Since the completion of the new dam in 2007 the Tarrant Lake Preservation has worked with Wisconsin Department of Natural Resources Management Fishery Biologist Tim Larson (Retired in Jan 2009) to restock Tarrant Lake. Currently as a result of the retirement of Tim Larson, Columbia County has an interim Fishery Biologist, Laura Stremick-Thompson, until the permanent replacement is named.

On August 22, 2007 WDNR conducted a Fish survey on Tarrant Lake. This was done using a mini-boom shocker survey around the whole shoreline during the day time. The purpose of this survey was "to assess the status of the fishery, i.e. carp reproduction, bluegill reproduction, volunteer stocking of other species, etc." (Larson 2007)

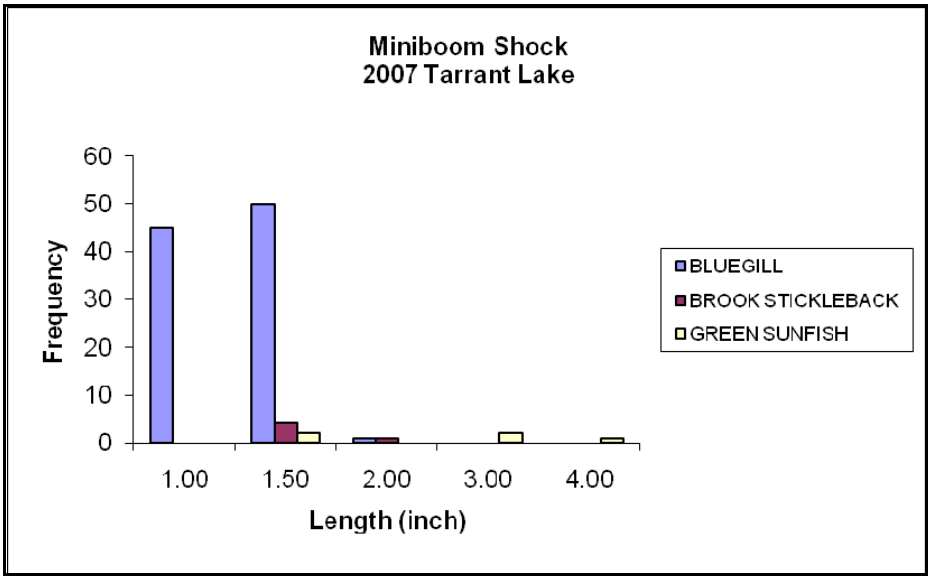

Figure 4.3 Tarrant Lake Miniboom Fish Survey 2007

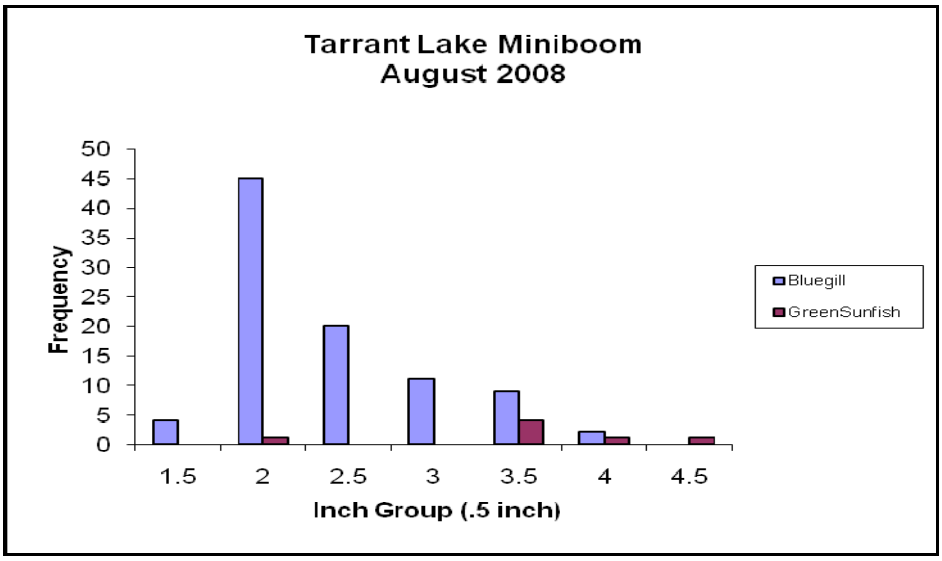

Figure 4.4 Tarrant Lake Miniboom fish Survey August 2008

Table 4.1 Tarrant Lake Fish Stocking History

Year	Species	Strain (Stock)	Age Class	Number Fish Stocked	Avg Fish Length (IN)	Source Type
1976	NORTHERN PIKE	UNSPECIFIED	FINGERLING	125	11	FEDERAL HATCHERY
1978	LARGEMOUTH BASS	UNSPECIFIED	FINGERLING	5,000	1	PRIVATE HATCHERY
1978	NORTHERN PIKE	UNSPECIFIED	FRY	50,000		DNR HATCHERY
1980	LARGEMOUTH BASS	UNSPECIFIED	FINGERLING	2,000	2	DNR COOP PONDS
1981	NORTHERN PIKE	UNSPECIFIED	FRY	50,000		DNR HATCHERY
1989	NORTHERN PIKE	UNSPECIFIED	FRY	25,000	3	DNR HATCHERY
1991	NORTHERN PIKE	UNSPECIFIED	FINGERLING	100	8	DNR HATCHERY
1991	NORTHERN PIKE	UNSPECIFIED	FRY	100,000	1	DNR HATCHERY
1992	LARGEMOUTH BASS	UNSPECIFIED	FINGERLING	306	5	DNR COOP PONDS
1992	NORTHERN PIKE	UNSPECIFIED	FINGERLING	50	8	DNR HATCHERY
2007	BLUEGILL	UNSPECIFIED	ADULT (BROODSTOCK)	250	6	PRIVATE HATCHERY
2007	LARGEMOUTH BASS	UNSPECIFIED	LARGE FINGERLING	2,500	3	FEDERAL HATCHERY
2008	LARGEMOUTH BASS	UNSPECIFIED	LARGE FINGERLING	2,437	6	FEDERAL HATCHERY
2008	LARGEMOUTH BASS	UNSPECIFIED	YEARLING	305	6	PRIVATE HATCHERY
2008	NORTHERN PIKE	UNSPECIFIED	SMALL FINGERLING	2,775	2	DNR HATCHERY

Water Quality

There is no quantifiable water quality data for Tarrant Lake on record. Historically, Tarrant Lake has switched between an algal dominated state and a plant dominated state.

In 2009, the TLPC partnered with the Columbia County Land and Water conservation Department (LWCD) beginning a water quality monitoring program. At the end of the first two years of monitoring the plan will be updated with water quality objectives based on the water quality monitoring.

Aquatic Plants

There is no quantifiable aquatic plant data available for Tarrant Lake on record.

Upon a preliminary visit to Tarrant Lake a high abundance of Curly-leaf Pondweed (Potamogeton crispus) is present.

It is recommended that the Tarrant Lake have an aquatic plant inventory conducted using the point intercept method and then develop an Aquatic Plant Management Plan (APMP).

Chapter 5

Lake Organization Options

During the public planning process of those who responded felt it to be in the best of interests of Tarrant Lake if the Tarrant Lake Preservation Committee evolved into a Lake Association or district.

In the survey taken during the planning process of 84 total respondents who were asked, "***How do you feel about Tarrant Lake creating a Lake Association at will to provide the lead role for the restoration and protection?"***; with a scale of 1 (strongly oppose) to a 10 (strongly support) the average was a 7.2, the median response was a 9 with a standard deviation of a 2.7.

When asked the question "**How do you feel about Tarrant Lake creating a Lake District to provide the lead role for the restoration and protection (taxing local government)?",** with the same scale of 1 (strongly oppose) to a 10 (strongly support) the average was a 6.1, the median response was a 5 with a standard deviation of 3.

Below are the descriptions of a Lake Association and Lake District in Wisconsin State Statute.

Lake District

A lake district is a special purpose unit of government. The first districts came into existence in 1974 with the passing of Chapter 33 of the Wisconsin State Statutes. There are approximately 100 lake districts in Wisconsin today (UW- Extension Lakes, 95).

Lake Association

Usually, lake associations are voluntary organizations with members who own land on or near a lake. They can be involved in various levels of lake management activities and vary from well-run lake management groups to loose-knit social groups (UW- Extension Lakes, 95).

For additional information and a complete understanding of the possibilities for lake organizations in the State of Wisconsin please see People of the Lakes, A Guide for Wisconsin Lake Organizations, DNR publication PUB-FH 821-2006 and UW-Extension Publication G38 18.

Chapter 6

Water Quality Monitoring Plan

The concept of water quality monitoring is often at the forefront of resource management discussions. Why? Because good, up-to-date science-based water quality monitoring helps resource managers make good, up-to-date decisions and provide a solid foundation for guidance. As important as water quality monitoring data is, it's often one of the most under-utilized and under-funded tools for resource management. Water quality monitoring efforts can establish baseline levels from which to gauge future measurements from. For Tarrant Lake, there should ultimately be two levels of water quality monitoring: advanced water quality monitoring and volunteer citizen monitoring.

The Tarrant Lake Preservation Committee should be involved in supporting and garnering support and participation from its citizens. Volunteer water quality monitoring provides high-quality, basic water quality indicator information, along with strong educational and personal growth opportunities for participants. WDNR's Citizen Lake Monitoring Network (CLMN) provides the tools and the training for the bi weekly monitoring.

The advanced monitoring side of the program is a more analytical approach to monitoring with a long-term goal of analytical and statistical modeling. This includes the establishment of regular monitoring locations, water lab analysis and other related stream sampling techniques.

The LWCD was awarded two WDNR Lake Management Planning Grants to create a Water Quality Monitoring Program for the Tarrant Lake Watershed in 2009. In 2010 the LWCD will request two more WDNR Lake Planning Grants to continue the Water Quality Monitoring through 2010. The more years of data that can be collected, the better the modeling results will be. Along with the establishment of baseline numbers, these efforts will allow for a more enhanced targeted approach to watershed management.

Water quality monitoring costs can range from $10,000 on up to $100,000 or more per year depending on the level of detail. As we move deeper into this process, the costs will likely increase as we move towards the development of a TMDL (Total Maximum Daily Load). The LWCD will continue to work with the staff at the University of Wisconsin-Stevens Point Center for Watershed Science and Education for the implementation and analysis of a TMDL for the Tarrant Lake Watershed.

The following synopsis of the 2008 DNR Lake Planning Grant should provide the reader with

understanding of the focus of the monitoring efforts and the process that is being utilized.

Development of a TMDL for the Tarrant Lake Watershed Phase 1

Description of Project Area

Tarrant Lake is a small lake/millpond located in the Village of Cambria. Tarrant Lake is located as part of the Duck Creek/Rocky Run sub watershed. It is part of the Lower Wisconsin Basin. The watershed that drains into Tarrant Lake is approximately 5249 Acres. The Watershed is dominated by agriculture and is relatively small in size.

Background Information

Tarrant Lake recently suffered a dam failure. The dam has recently been redesigned and rebuilt. The recent problems associated with the dam have inspired a unique movement within the Village of Cambria in regards to the future of Tarrant Lake. Originally people began to talk about wanting to dredge out sediment located within the lake. Soon after they began searching for funds and realized the extreme cost associated with dredging and sediment removal, they realized they need to do something to try and control and/or limit the amount of sediment and nutrients that reach this system. Intensive agriculture in the 5249-acre watershed is an obvious source of sediment now and into the future. In 2006-2007 the Village of Cambria received a DNR lake planning grant that was the first step in this planning grant process. This first grant will be completed and a final report submitted at the end of 2007. The focus of this 2006-2007 planning grant was to contract with the Columbia County Land and Water Conservation Department to complete a watershed wide inventory related to the NR 151 performance standards. This inventory along with program marketing will be completed at the end of 2007. This first step in completing and inventory of the watershed in regards to sources of sediment and nutrients was planned be the precursor to this current DNR Lake Planning Grant application. This grant application is to provide the staff resources for the Columbia County Land and Water Conservation Department to work with the Village of Cambria to develop and complete a Comprehensive Lake Management Plan for Tarrant Lake. This planning effort will guide and protect the management of these resources now and into the future.

Description of Problems to be Addressed Including Goals and Objectives

Current available data on this portion of Duck Creek and the downstream reservoir of Tarrant Lake have led us to believe that nutrient and sediment loading from the watershed is severely

impacting the water quality of Tarrant Lake. The intent of this monitoring program is to get some current up to date water quality information. Our goal is to continue to invest in a citizen monitoring program while moving forward with an advanced monitoring program that will allow us to eventually develop a better understand of the watershed and work towards the development of a water quality model for this watershed. This information will establish a baseline level for water quality monitoring and will help us evaluate and understand needs for improvement within the watershed. Along with creating a baseline, it will help us access the value of working towards water quality goals and BMP's. Currently Columbia County LWCD has inventoried the entire watershed, looking at all sources of nutrients (croplands/barnyards). The next step is to acquire the data to work towards this model. The two objectives of this study are: 1) quantify the phosphorus export from the watershed. 2) Link the water quality with nutrient loss from the land. The models that will be used will be SWAT and WiLMS. In the later phases of this project the modeling would be conducted by UWSP, under the supervision of the Center for Watershed Science and Education. Once the lake and its watershed have been sampled, inventoried and modeled, we will move forward in developing a TMDL. This information will lead us towards identifying priority areas to target our implementation efforts.

Description of Methods, Activities and Date to be Collected

This grant application will be used to address 1 component of a multiple phase project. This grant will be part of **Phase 1** (Data Collection). Once adequate monitoring data has been collected, we will move into the future phases, they include **Phase 2** (Data Modeling, Compilation and Recommendations) and **Phase 3** (Model Development).

In early spring 2009 staff gages and pressure transducers were put in place at 4 sites above Tarrant Lake and one at the outflow. Columbia County staff will be measuring weekly stream flow to develop rating curves for these instruments. The staff gauges will be installed at each site to enable evaluation of stream elevation into the future. This project would enable the collection of samples at a regular twice/month interval (March-November) and monthly (December-February). In addition, event samples would be collected during the initial stages (siphon sampler) and within/after the event (grab) five times per year. Each of the 5 sites will have up to 2 siphon samplers. Sampling will be conducted by County staff. Volunteers in the watershed will record daily precipitation between April and November at three sites.

Based on evaluation of the first year of data, additional sample points may be added further into the watershed to better resolve the relationship between land use, water quality, and assessment of the ability of the wetlands to function as phosphorus sinks.

Any additional future sampling locations will be selected to provide a mixture of land cover and land use to provide a data set that could be used to calibrate several water quality modeling tools. We would anticipate that the phosphorus loading would be correlated with spatial characteristics (e.g., distance to waterway) and physiographic features (e.g., soils) to refine the export coefficients approach to nutrient export. The data would also provide a data set that could be used to calibrate process-based water quality models such as the Soil and Water Assessment Tool (SWAT). As part of this project, we would develop a comparison of export coefficient approach (Wisconsin Lake Modeling Spreadsheet: WiLMS), modified WiLMS, and SWAT.

Some lake data would be collected. This would include sampling once during winter, spring and fall (overturn) and five times during the summer. Columbia County Land and Water Conservation Department staff will collect summer samples and UWSP staff will collect overturn samples. Weekly Secchi measurements will be collected by volunteers from the lake management district or by the Columbia County Land and Water Conservation Department Staff.

Existing and Proposed Partnerships

This project will consist of many existing partnerships. The project will continue and ongoing partnership with the Tarrant Lake Preservation Committee (Village of Cambria) as we work towards the implementation of their recently completed lake management plan. The fostering of this monitoring program has brought together the following partners on this endeavor: The Columbia County Land and Water Conservation Department, Columbia County NRCS, Tarrant Lake Preservation Committee, Village of Cambria, WDNR and UWSP CWSE.

Deliverables and Plan for Sharing of Project Results

We will have several information/education opportunities throughout the project. Once the project is successfully funded a news release will be produced to give and overview of the project. As we move ahead with this more advanced monitoring program we will be providing the Tarrant Lake Preservation Committee and the general public updates through regular meetings and announcements. Information will be provided through regular meetings and other public informational meetings. Upon completion of the multiple phases outlined as part of this study, a model and report will be completed and this information will be used as a guiding document. This model will be the final report for this long-term program.

Role of Project in Lake Management

The goal of this monitoring program is to attain the monitoring data to utilize modeling programs to develop a watershed model for Tarrant Lake. This will directly aid in the evaluation of water quality impacts and the status of the watershed as a whole. The implementation of several components that will be outlined in the soon to be completed Tarrant Lake Management Plan will directly hinge on the outcome of this study. The relationship to in-lake management options is directly related to the nutrient loading coming from the watershed. This information will help focus staff and financial resources throughout this process.

Timetable Discussion

If both grants that we are applying for are approved in this grant cycle, we will be able to utilize these resources to begin implementation of this more advanced monitoring process as soon as funds become available.

This process will begin no later than January 2009 and the funding outlined in the budget will allow us to accomplish the following actions in 2009: This project would enable the collection of samples at a regular twice/monthly interval (March-November) and monthly (December-February). In addition, event samples would be collected during the initial stages (siphon sampler) and within/after the event (grab) five times per year. Sampling will be conducted by County staff. Volunteers in the watershed will record daily precipitation between April and November at three sites.

Based on evaluation of the of data, additional sample points may be added further into the watershed to better resolve the relationship between land use, water quality, and assessment of the ability of the wetlands to function as phosphorous.

Chapter 7

Watershed Management Plan

Lake management alternatives include both watershed management measures and in-lake rehabilitation techniques. Watershed management, including land-use planning and zoning and non-point source pollution control, is used to maintain or improve the quality of water before it reaches the receiving boundary of water. In this section, we will focus on the discussion of implementing watershed management in Tarrant Lake.

Managing inputs into a nutrient-rich system such as Tarrant Lake is very important if we want to provide for long-term water quality improvements. Managing and reducing these inputs is traditionally done through the identification, design and installation of best management practices (BMPs). BMPs are actions or structures that are designed to reduce non-point source pollution at construction sites, agricultural lands and developed areas. BMPs include things such as barnyard runoff systems, silt fences, detention or retention ponds, manure storage, buffer strips, reduced tillage and other associated practices.

There are many individual sources of non-point source pollution within any one watershed. The biggest and most important challenge is to identify and remediate as many of those sites as you can. **Some areas of concern may seem very small-scale, but it is very important to realize that the cumulative impacts from multiple small sources are the biggest hurdle associated with winning the battle over non-point source pollution.** Issues that seem small at first can have huge cumulative impacts as you move downstream, combining the impacts associated with over 8.28 miles squared or 5,300 acres of small sources. In 2009, the Columbia County LWCD will begin to implement a long- term water quality monitoring program in the Tarrant Lake watershed. As this project moves into the advanced stages over the next several years, the goal is to be able to utilize these loading rates to determine specific sub-watershed sources throughout the watershed to focus reduction and conservation efforts by quantifying the nutrient load entering the lake via the watershed. The water quality monitoring section of this plan provides more details related to the specifics associated with this endeavor.

For the purpose of the Tarrant Lake watershed we have divided them into 3 main categories including: Storm Water Management and Construction Site Erosion Control, Riparian Property Management and Upland Agricultural Source Management. These individual categories represent different levels of severity and necessity within the overall scope of implementing a

watershed management plan. The overall watershed management perspective hinges on the ability to actively reduce the amount of phosphorus and sediment entering the system.

Storm Water Management and Construction Site Erosion Control

Storm water runoff has the ability to impact water resources by increasing the amount of runoff from impervious areas such as roads, roofs and driveways. The increased runoff travels overland picking up containments and deposits them in local waterways. The increased volume of runoff combined with the increased rate of runoff can create increased erosion on upland sites. Impacts from storm water runoff have not yet been fully assessed. There are likely opportunities to increase efficiency and effectiveness of current local and state storm water management requirements. It would be important for the Village of Cambria along with the Tarrant Lake Preservation Committee to be the catalyst in a process to analyze current storm water issues affecting Tarrant Lake. The implementation of a county-wide storm water ordinance would help streamline the effectiveness of storm water impacts on a watershed basis.

Lawns and streets deliver significant amounts of phosphorous to lakes, as shown in Table 7.1.

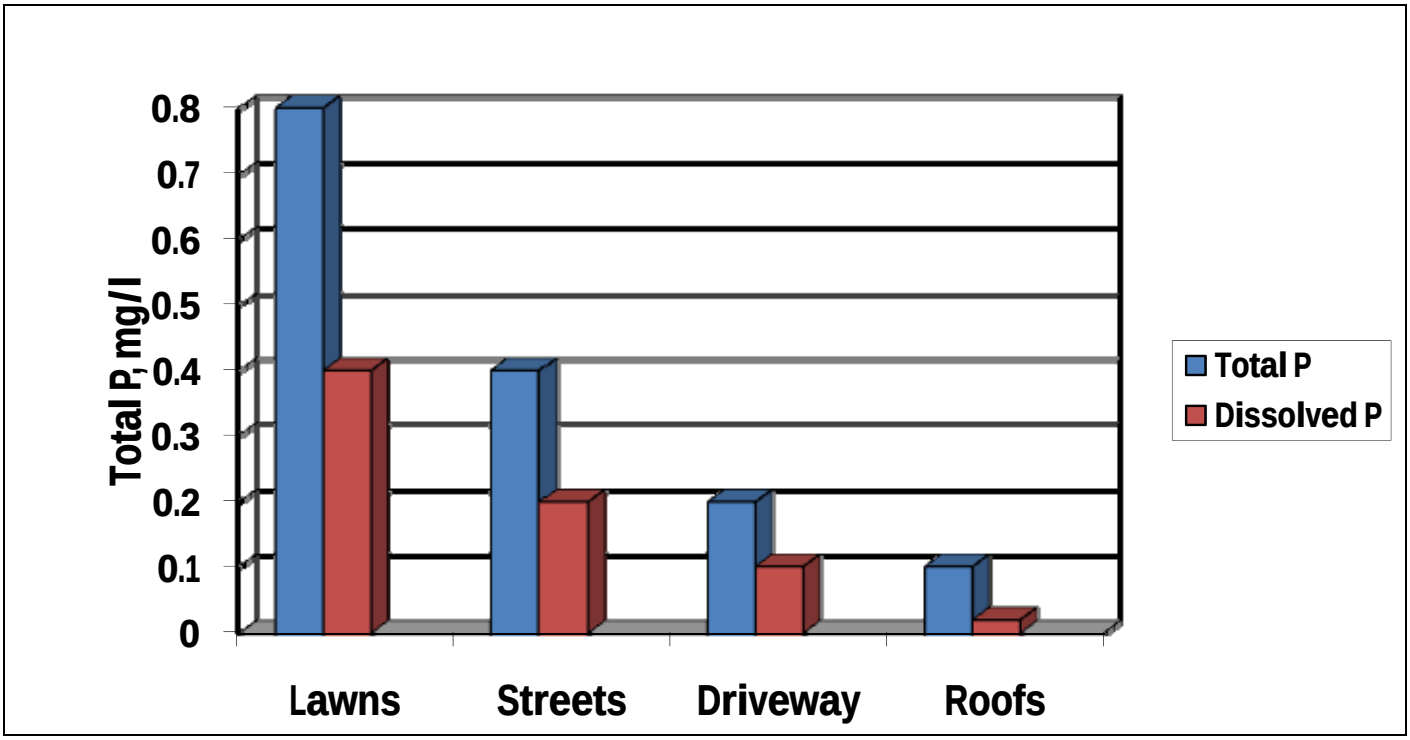

Figure 7.1. Total and Dissolved P Geometric Means for Different Source Areas in Residential Area - Monroe St (Graph- Roger Bannerman)

Native buffers should be put in place to prevent the runoff from the adjacent lots on Tarrant Lake. Furthermore, any storm water runoff sources that directly enter Tarrant Lake from the street, such as, the dead end Wisconsin Street to the south of Tarrant Lake or Elizabeth Street to the North of Tarrant Lake should have Best Management Practices (BMP's) in place such as an infiltration basin to stop the direct flow of stormwater runoff.

Although sodium chloride (NACl) (dry road salt) alone doesn't have a long term effect on the receiving surface water body in the concentrations typically experienced through winter applications. Pre-wetted salt (NaCl + $MgCl_2$) or sand with Calcium chloride ($CaCl_2$) can have an impact. The additives which are used to stop salt or sand from freezing and other deicing products may present long term effects on the water body depending on the concentration or the particular additive in question.

The transportation of salt, additives, and or other materials in storm water runoff from the Columbia County Highway Departments Location at the corner of Elizabeth Street could be an

issue and will be examined in the water monitoring plan.

The control of erosion coming from sources such as construction sites could also be a potential source of increased sedimentation. Currently, erosion control measures are required under several local and state permit requirements. As is often the case, there is typically a need for increased utilization and enforcement of the BMPs required for construction sites. Both of these factors will largely depend on the amount of land-use changes in the Tarrant Lake watershed. It will be very important for the Village of Cambria, Tarrant Lake Preservation Committee and the community to understand the implications of land-use changes on future water quality of Tarrant Lake.

Riparian Property Management

Riparian properties are lands directly adjacent to water. In this case, the majority of riparian owners will be those directly located on Tarrant Lake. Lots adjacent to Tarrant Lake are shorelines devoid of natural cover. When comparing Wisconsin turf lawns to native cover, Wisconsin soils with turf cover produce a phosphorous load 4 to 7 times greater than a site in native cover(MDNR, 2006). Knowing this, we can identify opportunities for nutrient load reductions in the watershed from the majority of riparian properties along Tarrant Lake. Traditional turf management practices show an import of commercial fertilizer on these sites. The inclusion of native buffers along the shoreline of Tarrant Lake, combined a reduction in use of commercial phosphorus fertilizer, will provide a reduction in overall nutrient loading from riparian properties and provide increased fish and wildlife habitat while reducing landowner maintenance costs. . The TLPC should start a program targeted at increasing to install native shoreline buffers and proper use of commercial lawn-care fertilizers with no phosphorous. A cost share/demonstration project funded through the TLPC would be an ideal way to promote and gain acceptance of native buffers on both public and private land holdings around Tarrant Lake.

Upland Agricultural Source Management

Phosphorus is usually the limiting nutrient responsible for promoting excess algae and aquatic plant growth in surface waters. The current and historical nutrient loads into this system have provided a surplus amount of nutrients and are a factor in the lake's history of transitioning from a plant-dominated community to an algae-dominated system. This turbid condition has many factors, but the best available science has proven than reduction of phosphorus levels entering the system is critical for the health and restoration of this lake.

The LWCD would like to develop nutrient management plans for the Tarrant Lake Watershed based on quantifiable phosphorous data. The phosphorous data would also be used to model.

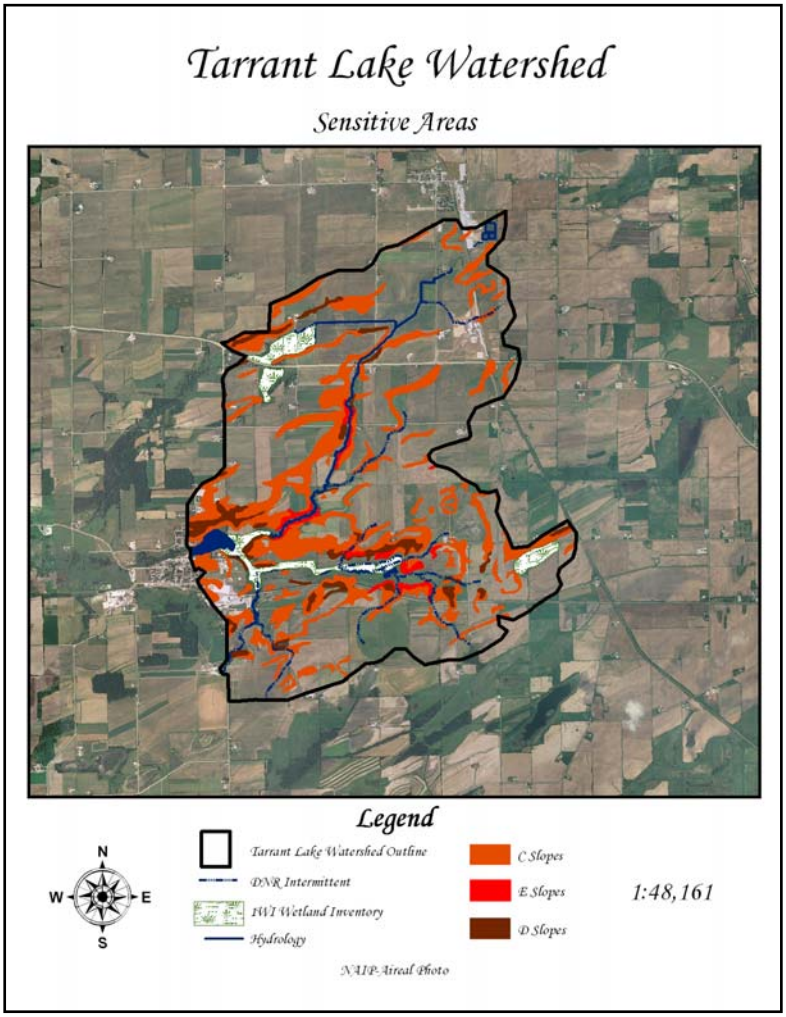

Figure 7.1 Tarrant Lake Watershed Sensitive Areas

The Columbia County Land and Water Conservation Department has been working with the Tarrant Lake Preservation Committee on watershed improvement efforts since 2004. In 2007, the Columbia County LWCD completed a watershed-scale inventory to identify non point pollution problems in the watershed. This inventory provides a solid foundation to begin to understand many of the challenges we face in regards to nutrient and sedimentation reductions. A summary of inventory data is included to help define the inventory process and the results.

The costs associated with agricultural watershed improvement efforts are often under-estimated by the general public. The costs and associated funding options will also help the TLPC understand and set realistic timelines for progressive watershed improvements.

In watersheds with steeper slopes adjacent to intermittent streams, perennial tributaries, and/or other surface water bodies, higher rates of sedimentation result in “flash” runoff events. Based on the GIS database developed for the Tarrant Lake watershed during the 2007 inventory process, (figure 7.1) we see a majority of the C, D and E slopes within the Tarrant Lake Watershed are adjacent to areas with concentrated flow or a surface water body. As a result, the distance soil has to travel to surface water if greatly reduced.

Through multiple funding sources, the Columbia County Land and Water Department is going to develop phosphorous based nutrient management plans. The plans will be used to implement phosphorous and water quality based NRCS NMP 590. The data collected will provide a data set that could be used to calibrate process-based water quality models such as the Soil and Water Assessment Tool (SWAT). The data collected will also be used to develop a strategy for locating tillable fields exceeding the Phosphorous Index (PI) standards and developing PI implementation strategies.

Summary Interpretation of Agricultural Inventory Data

The completion of the 2007 Tarrant Lake Watershed inventory revels many agricultural issues on the landscape. The following is a summary and interpretation of some of the data in regards to watershed improvement efforts.

Direct Runoff from Livestock Operations

A total of 9 livestock operations were inventoried. The LWCD found that 2 of the 9 were permanently out of the livestock business as of the time of the inventory. We still considered them livestock operations within the report, however, have based the results on 7 operations. A total of 5/7 of the livestock operations have obvious issues related to NR 151 violations, although only 2 of the 7 livestock operations ranked medium or high in regards to runoff issues.

Unlimited Cattle Access to Stream/Adequate Sod cover Maintained

A total of 2 out of the 7 livestock operations have cattle with unconfined access to water. 1 of the 2 are not maintaining adequate sod and the cattle should be removed from the stream.

Existing Rill or Gully Erosion Present

When asked, 9 of 9 livestock operations felt that they had no erosion taking place anywhere. We think this is worth noting, because it holds true to the idea that many operators see some level of erosion as normal and do not associate it with being a problem. The reality is, that in a watershed of this size, and with phosphorous levels exceedingly high in many of the soils, even the smallest amount of erosion and sediment delivery can have a large impact. The agricultural community could benefit from more education and understanding. Although no one felt they had erosion taking place, only 2 of them knew if they were meeting the acceptable soil loss amount at a given location (T) or when they last had their updated conservation plans. Using 2001 and 2005 aerial photography, the LWCD located 7 sites with major gully erosion concerns.

Existing Manure Storage Structures

A total of 2 out of 9 operations have a manure storage structure. Both manure storage structures need

to be abandoned and both landowners agreed they need new manure storage to manage their manure better.

Utilization of Manure Stacks

4 of 7 livestock operations stack manure for a period of time. 1 of those is within the S water quality management area.

Is Clean Water Diverted from a Feedlot?

4 of the 7 livestock operations are in need of some improvements on roof runoff management. Other sites could also use a combination of roof and earthen diversions.

Existence of a 590 Nutrient Management Plan (NMP)

Only 1 of 7 livestock operations has a certified 590 Nutrient Management Plan (NMP). The remaining 6 operations need to develop a 590 NMP. The proper use of livestock generated manure is very important to reduce long term impacts of nutrients on Tarrant Lake.

Updates Conservation Plan to Meet "T"

Only 2 of 9 operations inventoried where aware of their conservation plan, and believed it was updated. The remaining 7 operators were not aware of the status of their plan. It's likely that many farms are meeting T without an updated plan, but it is also likely that just as many operations are not meeting T because they are not referencing a conservation plan. This will continue to be a concern as the demand for corn grows. It should be stated that even if an operation is meeting T, T is an arbitrary acceptable estimation of tons/acre of soil loss for crop production. Meeting T does not imply a water quality is being maintained.

Livestock Populations in Watershed

There are about 187 dairy animals on 2 individual operations in the watershed. This represents 96% of the reported high herd range. There are 5 operations housing 312 beef animals in the watershed. This equates to 83% of the reported high herd levels.

Note: The Columbia County Land and Water Conservation Department has developed and is maintaining a GIS (Geographic Information System) database that includes all related inventory results and supporting documentation. We have not included a complete summary of the inventory results in this document. The LWCD can provide you copies and/or access to this information upon your request. The inventory data and supporting information was submitted to DNR as part of the final report for our 2006 DNR Lake Planning Grant that helped us complete this inventory.

We set out to complete an inventory of the Tarrant Lake watershed with the following criteria as our starting point:

A. Identify and locate all livestock operations in the watershed

B. Identify livestock operations that fall within the WQMA as referenced in NR 151

C. Determine compliance of livestock operations with water quality performance standards found in NR 151

D. Locate and identify sensitive areas

E. Determine areas in need of riparian buffers

F. Determine areas that would be potential wetland restoration sites

G. Locate obvious areas of gully/soil erosion

H. We have included GIS developed maps that show the following relationships from our data:

I. Location of all livestock operations

J. Wetlands and highly erodible soils (sensitive areas)

K. Farmland Preservation Program acres

L. Acres under NPM 590 plan

M. Locations of potential wetland restoration sites

N. Existing manure storage structure locations

O. CREP eligible buffer sites

Our Tarrant Lake Watershed GIS database that we have used throughout this process contains the following data layers to help us interpret and use the data:

A. Tax parcel
B. Livestock sites
C. Manure storage structure locations
D. Township range
E. Section
F. ¼ Section
G. Roads
H. Soils
I. Erosion sites (aerial interpretation)
J. 4' Contour
K. Potential WRP
L. Watershed boundary
M. Hydrology
N. DNR map of watersheds
O. Parcels adjacent to water
P. Zoning
Q. Wetlands
R. Nutrient management plans
S. Farmland Preservation Program
T. CREP 150'
U. Permitted animal waste structures
V. Location of existing BMPs
W. Land cover
X. Columbia County high resolution aerials (black and white)
Y. NAIP –1 meter resolution color
Z. Original vegetation

Chapter 8

Fishery Plan

Tarrant Lake is currently in the third year of a restocking effort implemented by Tim Larson, former WDNR Fishery Biologist. To date the stocking has consisted fish stocked by the Tarrant Lake Preservation Committee, the Wisconsin Department of Natural Resources and through the federal hatchery.

Table 8.1 Tarrant Lake Fish Restocking 2007 and 2008

Tarrant Lake Fish Restocking 2007 and 2008	
Species	**Quantity**
Adult Bluegill	250
Large Mouth Bass – fingerling 3" ave. length	2500
Large Mouth Bass - fingerling 6"ave. length	2437
Large Mouth Bass – yearling 6" ave. length	305
Northern Pike – fingerling 2" ave. length	2775

The goals for the Tarrant Lake Fishery as laid out by Tim Larson are designed to provide a self-sustaining fish population or a balanced population based on the writings of Richard Anderson, see Table8.2. A population in balance has satisfactory rates of reproduction, growth, and mortality (Anderson).

A good Largemouth Bass population has a percentage size distribution (PSD) of 20-60 with fish in the 8-11.9 inch range equating to 40-80% of the population, the proportion of 12 inches long or longer will be 20-60 % and 15 inches will be 5-25%. While a bluegill population has a PSD of 50-80 with 20-50% caught less than 6 inches in length. A good Bluegill population has 8 of 10 fish caught are 6 inches or longer (Anderson). Future stocking rates will have to be based on the findings and trends seen in future fish surveys.

Table 8.2 Summary of Harvest Recommendations

Summary of Harvest Recommendations Based on Bass >12”/>8” and Bluegill >6”/>3”		
Angling PSD (%)		**Harvest Recommendations**
Large Mouth Bass	**Bluegills**	
Less than 20	More than 80	Harvest more bass less than 12 inches long, protect bluegills by catch and release
More than 60	Less than 50	Harvest more bluegills, protect all bass
20-60	Less than 50	Harvest more Bluegills, protect bass 12-16 inches long
Less than 20	50-80	Harvest more bass less than 12 inches long; protect bass 12-16 inches long
20-60	50-80	Balanced populations; maintain harvest routine, or protect bass 12-16 inches long

Chapter 9
In Lake Management Items

Shoreland Restoration

As discussed in Chapter 6, Watershed Management Plan, the Columbia County staff recommends the TLPC create a Shore land Restoration Program to provide information, education, and possibly cost sharing assistances for erosion control and native plant buffers. Shore lands are naturally full of a rich diversity of life: plants, animals, and microorganisms, and are extremely important in maintaining healthy lake ecosystems.

Fishery Plan

The Tarrant Lake fishery is currently in undergoing a stocking program. It is recommended to monitor the fish community with fish surveys and develop base stocking rates with WDNR Fish biologist Laura Stremick-Thompson. The aquatic plant community must also be protected in order to keep phytoplankton numbers high, as phytoplankton provide a valuable food source for zooplankton as well as a strong foundation of biomass for the fishery.

Water Quality

There is not enough water chemistry data available to make any preliminary goals. Water Quality goals will be determined after the first two years of Water Quality monitoring has occurred and analyzed. The water quality model *Bathtub* will be used to assess water quality conditions and based off the Bathtub analysis, water quality goals can be set for the water quality indicators (i.e. phosphorous, chlorophyll, Secchi disc).

Annual Water Level Manipulation Plan

In a natural setting a surface water body undergoes seasonal water level fluctuations. TLPC should work through their WDNR Lake coordinator to work with WDNR Water Resources Management Specialist, Scott Provost via Susan Graham, to develop an annual Water Level Manipulation Plan.

Aquatic Plant Management Plan

As a high abundance of Curly leaf Pond weed is already dominating the aquatic plant community. The TLPC should develop an Aquatic Plant Management Plan, including an Aquatic Invasive Prevention and Control Plan.

Possible Drawdown Plan

If Tarrant Lake establishes itself as an algae dominated system, as it appears it might be, and does not establish an aquatic plant dominated system it will be necessary to determine if a drawdown is needed to establish a plant dominated system. Timing, duration and depth of drawdown would be determined based on a technical review of the available data sets at that time.

Organization Plan

The current Tarrant Lake Preservation Committee should become a Lake Association or Lake District to more effectively manage the lake in the future.

Chapter 10

Recommendations for Action

1. In order to address the wide array of management needs for Tarrant Lake, the TLPC should become a Lake Association or Lake District. By becoming a qualified lake association or nonprofit conservation organization a Lake District is than eligible for cost sharing funds and other state assistance. The publication People of the Lakes –A Guide for Wisconsin Lake Organizations explains the processes for exploring what group is right for your lake and how to go about organizing and developing your new lake organization.

    - Action
        i. Develop goal (Lake Association or Lake District) for Tarrant Lake Preservation Committee
    - Contact
        i. Publication People of the Lakes –A Guide for Wisconsin Lake Organizations
    - Funding
        i. None needed

2. Continue following the fish stocking plan started with Tim Larson, consulting with the WDNR. The stocking will require adaptive management. Until the Columbia County Fish biologist position is filled your current local Fish Biologist contact is Laura Stremick-Thompson.

    - Action
        i. Implement Fish Plan
    - Contact
        i. Laura Stremick- Thompson
    - Funding
        i. WDNR Lake Protection Grant Up to 200,000 or (75%) with 25% Local Match

3. The TLPC should strongly advocate for native shoreland restorations on all developed lots adjacent to Tarrant Lake.

    - Action
        i. TLPC should develop an educational and/or cost sharing program to promote and install native shore land buffers on Lazy Lake
    - Contact
        i. WDNR Columbia County Water Resources Management Specialist, Susan Graham
        ii. Columbia County Land and Water Conservation Department

    - Funding
        i. WDNR Lake Protection Grant Up to 200,000 or (75%) with 25% Local Match

4. The TLPC should advocate for the enforcement of NR 115 Wisconsin's Shoreland Management Program to protect Tarrant Lake.

    - Action
        i. Contact Columbia County Supervisors to discuss Columbia County Planning and Zoning Department enforcing NR 115

    - Contact
        i. Columbia County Supervisors
    - Funding
        i. none needed

5. The TLPC should apply for a WDNR Lake Planning Grant for an Aquatic Plant Survey using the Point Intercept Method. Completing an aquatic plant management survey would be very useful on a 3-5 year interval to monitor trends in aquatic macrophyte species abundance and diversity.

    - Action
        i. Continue to conduct Aquatic Plant Inventories
    - Contact
        i. Contact Private Firm
    - Funding
        i. WDNR Lake Planning Grant $10,000 (75% with 25% local match)
        ii. AIS EPP Grant

6. Develop an Aquatic Plant Management Plan including an Aquatic Invasive Prevention and Control Plan including AIS contingency plan.

    - Action
        i. Develop education, prevention and planning programs
        ii. Develop early detection and response plan

    - Contact
        i. WDNR Columbia County Water Resources Management Specialist Susan Graham
    - Funding
        i. AIS Grant
            1. 75% of the cost of a project up to a maximum grant amount of $200,000 for **Education, Prevention and Planning**
            2. 75% of project costs up to a maximum of $20,000 for **Early Detection and Response**
            3. 75% of project costs up to a maximum of $200,000 for **Established Infestation Control**

7. As dredging was extensive, Tarrant Lake should obtain a new lake bathymetry map.

    - Action

        i. Obtain, create or hire an entity to map the lake bed of Tarrant Lake

    - Contact

        i. Contact a Private Firm

    - Funding

        i. WDNR Lake Planning Grant $10,000 (75% with 25% local match)

8. TLPC should develop an annual water level manipulation plan that allows the water level to mimic a somewhat more natural fluctuation pattern.

    - Action
        i. LLMD should create a water level manipulation plan that would mimic a natural water body closer
    - Contact
        i. WDNR Water Resources Management, Scott Provost, WDNR Water Resources Management Mark Sesing,
    - Funding
        i. WDNR Lake Planning Grant $10,000 (75% with 25% local match)

9. TLPC should develop their current watershed monitoring program into a Total Maximum Daily Load Study to examine what water chemistry standards are necessary from the rural and urban watersheds to promote and sustain water quality.

    - Action
        i. Obtain annual updates on watershed work
        ii. Show support with letters for future grants
    - Contact
        i. Columbia County Land and Water Conservation
    - Funding
        i. WDNR Lake Protection Grant Up to 200,000 or (75%) with 25% Local Match)

10. The TLPC should investigate the benefits of installing a storm water infiltration Best Management Practice (BMP) on Elizabeth Street and Wisconsin Street.

    - Action
        i. Analyze the technical opportunities for Best Management Practices on Elizabeth Street and Wisconsin Street
    - Contact
        i. Private Firm
        ii. Columbia County Land and Water Conservation Department
    - Funding
        i. WDNR Lake Protection Grant-Up to 200,000 or (75%) with 25% Local Match)
        ii. Urban TRM-Up to $150,000 or (70%) with 30% Local Match)

11. Promote, advocate and develop standards for storm water and construction site BMP's for runoff.
    - Action
        i. Meet with Ordinance Experts from Center for Land Use Education to analyze current ordinance and enforcement protocol
    - Contact
        i. Lynn Markham, Land Use Specialist with the Center for Land Use Education
    - Funding
        i. WDNR Lake Protection Grant Up to 50,000 or (75%) with 25% Local Match
        ii. WDNR Lake Planning Grant $10,000 (75%with 25% local Match

12. The Tarrant Lake community wishes to develop a trail system around Tarrant Lake and possible into other surrounding communities. The TLPC should hire a consulting firm to explore these options.

    - Action
        i. Analyze the opportunities for recreational trail system around Tarrant Lake and possible to other communities
    - Contact
        i. Private Firm
    - Funding
        i. WDNR Lake Planning Grant $10,000 (75% with 25% local match)

13. The LWCD will develop phosphorous index based nutrient management plans for all fields in the Tarrant Lake watershed to assess the

    - Action
        i. Show support with letters for future grants
    - Contact
        i. Columbia County Land and Water Conservation
    - Funding
        i. WDNR Lake Protection Grant Up to 200,000 or (75%) with 25% Local Match)
        ii. DATCP Soil and Water Resource Management Funds

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Appendix A

GLOSSARY

Algae: One-celled (phytoplankton) or multicellular plants either suspended in Water (plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll *a* (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Numerous species occur. Algae are an essential part of the lake ecosystem and provides the food base for most lake organisms, including fish. Phytoplankton populations vary widely from day to day, as life cycles are short.

Alkalinity: A measure of the amount of carbonates, bicarbonates, and hydroxide present in water. Low alkalinity is the main indicator of susceptibility to acid rain. Increasing alkalinity is often related to increased algae productivity. Expressed as milligrams per liter (mg/1) of calcium carbonate ($CaCO_3$), or as microequivalents per liter (µeq/1). 20 µeq1 = 1 mg/1 of $CaCO_3$.

Aquatic Invertebrates: Aquatic animals without an internal skeletal structure such as insects, mollusks, and crayfish.

Best Management A practice or combination of practices that is determined to be most effective and practical (including technological, economic, and institutional considerations), means of controlling point and nonpoint pollutant levels compatible with environmental quality goals.

Bioaccumulation: see “Food Chain”.

Biomass: The total quantity of plants and animals in a lake. Measured as organisms or dry matter per cubic meter, biomass indicates the degree of a lake system’s eutrophication or productivity.

Blue-green algae: Algae that are often associated with problem blooms in lakes. Some produce chemicals toxic to other organisms, including humans. They often form floating scum as they die. Many can fix nitrogen (N_2) from the air to provide their own nutrient.

Catch Basin: An inlet to the storm drain system that typically includes a grate or

Curb inlet where stormwater enters the catch basin and a sump to Capture sediment, debris and associated pollutants.

Chlorophyll *a*: Green pigment present in all plant life and necessary for photosynthesis. The amount present in lake water depends on the amount of algae and is therefore used as a common indicator of water quality.

Conductivity (specific conductance): Measures water's ability to conduct an electric current. Conductivity is reported in micromhos per centimeter (µmhos/cm) and is directly related to the total dissolved inorganic chemicals in the water. Values are commonly two times the water hardness unless the water is receiving high concentrations of contaminants introduced by humans.

Cost Sharing: The use of ouside financial resources to offset or share the total cost of the installation of best management practices. Typical cost share rates range from 50% to 90%.

Drainage Basin: A geographic and hydrologic subunit of a watershed.

Drainage Lakes: Lakes fed primarily by streams and with outlets into streams or rivers. They are more subject to surface runoff problems but generally have shorter residence times than seepage lakes. Watershed protection is usually needed to manage lake water quality.

Dry Detention Ponds: A structural BMP or retrofit that consists of a large open depression that stores incoming storm water runoff while percolation occurs through the bottom and sides.

Eutrophication: The process by which lakes are enriched with nutrients, increasing the production of rooted aquatic plants and algae. The extent to which this process has occurred is reflected in a lake's trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile).

Filamentous algae: Algae that forms filaments or mats attached to sediment, weeds, piers, etc.

Food Chain: The sequence of algae being eaten by small aquatic animals (zooplankton) which in turn are eaten by small fish which are then eaten by larger fish and eventually by people or predators. Certain chemicals, such as PCBs, mercury, and some pesticides, can be concentrated from very low levels

in the water to toxic levels in animals through this process.

Groundwater: Subsurface water occupying the zone of saturation. In a strict sense, the term is applied only to water below the water table.

Drainage Lake: Often referred to as spring-fed lake; has large amounts of groundwater as its source, and a surface outlet. Areas of high groundwater inflow may be Visible as springs or sand boils. Groundwater drainage lakes often have intermediate retention times with water quality dependent on groundwater quality.

Impervious Surface: Hard surface that prevents and retards the entry of water into the soil mantle as natural conditions prior to development and/or a hard surface area that causes water to runoff the surface in greater quantities or at increased flow rates from the flow present under conditions prior to development. Common impervious surfaces include, but are not limited to rooftops, walkways, patios, driveways, parking lots, storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled, macadam, or other surfaces that similarly impede the natural infiltration of urban runoff

Impoundment: Manmade lake or reservoir usually characterized by stream inflow and always a stream outlet. Because of nutrient and soil loss from upstream land use practices, impoundments ordinarily have higher nutrient concentrations and faster sedimentation rates than natural lakes. Their retention times are relatively short.

Infiltration: The penetration of water through the ground surface into subsurface soil or the penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

Land Conversion: A change in land use, function or purpose.

Limiting factor: The nutrient or condition in shortest supply relative to plant growth requirements. Plants will grow until stopped by this limitation; for example, phosphorus in summer, temperature or light in fall or winter.

Local Government: Any County, City, or Town having its own incorporated government for local affairs.

Macrophytes: See “Rooted aquatic plants”.

Non-point Pollution: Pollution whose sources cannot be traced to a single point such as a

municipal or industrial wastewater treatment plant discharge pipe.

Overturn: Fall cooling and spring warming of surface water increases density, and gradually makes temperature and density uniform from top to bottom. This allows wind and wave action to mix the entire lake. Mixing allows bottom waters to contact the atmosphere, raising water's oxygen content. However, warming may occur too rapidly in the spring for mixing to be effective, especially in small sheltered kettle lakes.

Phosphorus: Key nutrient influencing plant growth in more than 80% of Wisconsin lakes. Soluble reactive phosphorus is the amount of phosphorus in solution that is available to plants. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particulate form.

Photosynthesis: Process by which green plants convert carbon dioxide (CO_2) dissolved in water to sugar and oxygen using sunlight for energy. Photosynthesis is essential in producing a lake's food base, and is an important source of oxygen for many lakes.

Phytoplankton: See "Algae".

Pollution Prevention: A management measure to prevent and reduce nonpoint source loadings generated from a variety or everyday activities within urban areas. These can include turf management, public education, ordinances, planning and zoning, pet waste control, and proper disposal of oil.

Respiration: The process by which aquatic organisms convert organic material to energy. It is the reverse reaction of photosynthesis. Respiration consumes oxygen (O_2) and releases carbon dioxide (CO_2). It also takes place as organic matter decays.

Retention Time (turnover rate or flushing rate): The average length of time water resides in a lake, ranging from several days in small impoundments to many years in large seepage lakes. Retention time is important in determining the impact of nutrient inputs. Long retention times result in recycling and greater nutrient retention by most lakes. Calculate retention time by dividing the volume of water passing through the lake per year by the lake volume.

Retrofit: The modification of an urban runoff management system in a previously developed area. This may include wet ponds, infiltration systems, wetland plantings, streambank stabilization, and other BMP techniques for improving water quality and creating aquatic habitat. A retrofit can consist of new BMP construction in a developing area, enhancing an

older runoff management structure, or combining improvements and new construction.

Rooted Aquatic Plants (macrophytes): Refers to higher (multi-celled) plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects. Overabundance of such plants, especially problem species, is related to shallow water depth and high nutrient levels.

Runoff: That part of precipitation, snow melt, or irrigation water that runs off the land into streams or other surface water. Runoff can carry pollutants into receiving waters.

Secchi disc: An 8-inch diameter plate with alternating quadrants painted black and white that is used to measure water clarity (light penetration). The disc is lowered into water until it disappears from view. It is then raised until just visible. An average of the two depths, taken from the shaded side of the boat, is recorded as the Secchi disc reading. For best results, the readings should be taken on sunny, calm days.

Sedimentation: Accumulated organic and inorganic matter on the lake bottom. Sediment includes decaying algae and weeds, marl, and soil and organic matter eroded from the lake's watershed.

Sedimentation Basins: Sediment storage areas that may consist of wet detention basins or dry detention basins. Excavated areas with storage depression below the natural ground surface; creek, stream, channel or drainageway bottoms properly engineered and designed to trap and store sediment for future removal.

Seepage Lakes: Lakes without a significant inlet or outlet, fed by rainfall or groundwater. Seepage lakes lose water through evaporation and groundwater moving on a down gradient. Lakes with little groundwater inflow tend to be naturally acidic and most susceptible to the effects of acid rain. Seepage lakes often have long residence times and lake levels fluctuate with local groundwater levels. Water quality is affected by groundwater quality and the use of land on the shoreline.

Soluble: Capable of being dissolved.

Stratification: The layering of water due to differences in density. Water's greatest density occurs at 39°F (4°C). As water warms during the summer, it remains near the surface while colder water remains near the bottom. Wind mixing determines the thickness of the warm surface water layer (epilimnion), which usually extends to the depth of about 20 feet. The

narrow transition zone between the epilimnion and cold bottom water (hypolimnion) is called the metalimnion or thermocline.

Suspended Solids: A measure of the particulate matter in a water sample, expressed in milligrams per liter. When measured on inflowing streams, it can be used to estimate the sedimentation rate of lakes or impoundments.

Thermocline: See "Stratification".

TMDL: Total maximum daily load. A watershed study designed to set thresholds to establish high quality water by determining expectable nutrient and sediment loads from all sources.

Trophic State: See "Eutrophication".

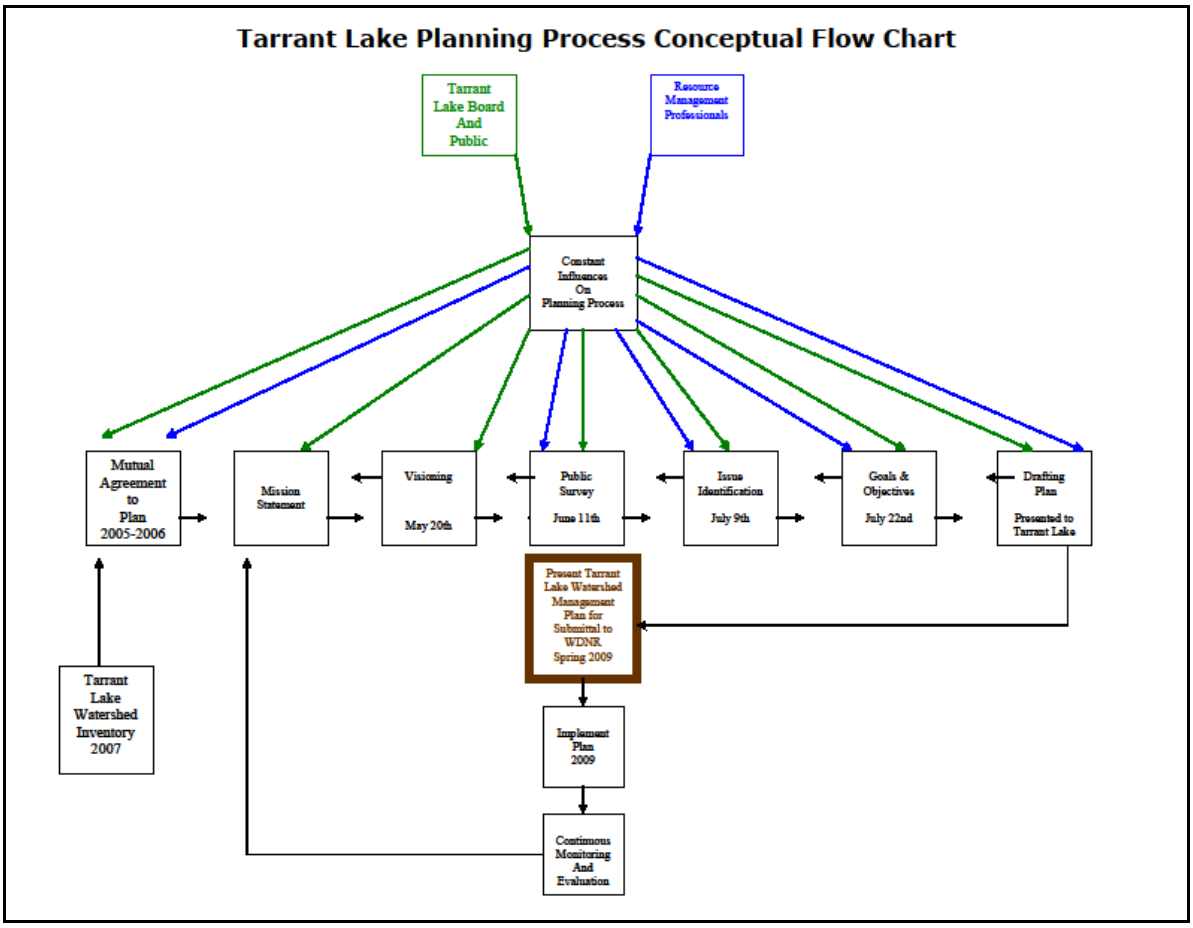
Turnover: See "Overturn".

Watershed: A drainage area or basin where all land and water areas drain or flow toward a central collector such as a creek, stream, river or lake at a lower elevation.

Wet Detention Ponds: A structural BMP or retrofit that consists of a single permanent pool of water that stores and treats incoming storm water. Wet detention ponds usually have three to seven feet of standing water, allowing pollutants to settle, with a defined siltation/sedimentation pond and outlet structure.

Appendix B

Planning Process



TARRANT LAKE PLANNING PROCESS PROPERTY OWNER SURVEY RESULTS (Summer 2008)

Property Location:

Lakefront	10
In Village, Not Lake Front	48
Out of Village in Watershed	16
Out of Watershed	10
I do not know	6

Property Type:

Permanent Residential Home	69
Part-time Residential Home	2
Agricultural Land	17
Vacant/Undeveloped	3
Business/Commercial	3
Renter	0
Off-Lake Landowners w/access rights	0

Years On Property Ownership:

< 1 year	2
1-3 years	7
4-10 years	23
11-20 yrs	19
21-30 yrs	12
30+ yrs	22

Property Use During Summer:

Never	8
1-3 days/mo	6
4-6 days/mo	2
7-10 days/mo	1
10+ days/mo	0
Every day	64

NOTE: The next section of the survey includes a series of gradient-type questions. Responses could fall anywhere along a 10-point scale between two opposing positions (i.e. 1 - 10). For each question, the explanation associated with the gradient is listed appropriately. Please fill in one square per question.

1) Frequency you Visit/Use Tarrant Lake ?		Total Responses	Average	Median	Standard Deviation	
	not at all (1)	76	4.4	6	3.0	everyday (10)

2) Perceptions About Tarrant Lake:		Total Responses	Average	Median	Standard Deviation	
a. Water clarity:	mpletely murky (1)	74	2	3	2.0	completely clear (10)
b. Plant growth:	/ weed-choked (1)	71	4.8	6	1.9	overly sparse (10)
c. Weekend crowding:	overly crowded (1)	68	8.1	5.5	2.5	calm (10)
d. Weekday crowding:	crowded (1)	68	8.3	8.5	2.6	calm (10)
e. Public boating acess:	too little (1)	69	5.2	2.5	1.7	too much (10)
f. Public shore fishing access:	too little (1)	69	5.2	3	1.6	too much (10)
g. Local lake rules:	adequate (1)	66	5.1	4	1.5	overly restrictive (10)
h. Law enforcement:	adequate (1)	65	4.8	5	1.9	overly aggressive (10)
i. Other		5	6.0		2.0	

3) What value do (or would) you place on each of the following as contributing to your "quality of life" as a local property owner?		Total Responses	Average	Median	Standard Deviation	
a. Presence of lake:	not important (1)	83	7.9	8.5	2.6	very important (10)
b. Good fishing:	not important (1)	80	6.9	6	2.9	very important (10)
c. Peace and tranquility:	not important (1)	81	7.9	9	2.4	very important (10)

d. Natural scenic beauty:	not important (1)	82	8.5	9.5	1.8	very important (10)
e. Clear water:	not important (1)	82	8.1	9	2.2	very important (10)
f. Safe water quality:	not important (1)	81	8.7	9.5	2.1	very important (10)
g. Slow-no-wake boating policies:	not important (1)	79	6.9	5	2.9	very important (10)
h. Unique and diverse wildlife:	not important (1)	80	7.7	9	2.5	very important (10)
i. Access to public beach:	not important (1)	80	4.4	4	3.0	very important (10)
j. Access to public boat launch:	not important (1)	80	6.4	4.5	2.8	very important (10)
k. Access to public shore fishing:	not important (1)	79	7.5	8.5	2.4	very important (10)
l. Access to walking/biking paths:	not important (1)	81	6.5	9	3.0	very important (10)
m. Access to Lake District Preserve:	not important (1)					very important (10)
n. Healthy aquatic plant community:	not important (1)	79	8.1	9.5	1.9	very important (10)
o. Abundant fish and wildlife habitat:	not important (1)	79	8.2	9.5	2.1	very important (10)
p. Minimal boat traffic:	not important (1)	81	6.4	5.5	2.7	very important (10)
q. Community Pride Associated w/Tarrant Lake: (1)	not important	83	8.7	9	1.9	very important (10)
r. Enforcement of rules:	not important (1)	80	8.1	8	2.2	very important (10)

4) What activities do (or would) you and your family most enjoy while on Tarrant Lake?		Total Responses	Average	Median	Standard Deviation	
a. Swimming:	least enjoy (1)	77	3.8	4	2.6	most enjoy (10)
b. Fishing:	least enjoy (1)	78	7.7	9	2.8	most enjoy (10)
c. Enjoying peace and tranquility:	least enjoy (1)	80	8.2	9	2.2	most enjoy (10)
d. Observing wildlife:	least enjoy (1)	78	7.6	8.5	2.4	most enjoy (10)
e. Slow, motorboat cruising:	least enjoy (1)	75	5.1	7.5	3.3	most enjoy (10)
f. Jet Skiing:	least enjoy (1)	75	2.2	5.5	1.9	most enjoy (10)
g. Water skiing or tubing:	least enjoy (1)	76	2.3	5.5	2.1	most enjoy (10)
h. Speed boating:	least enjoy (1)	74	2.0	4	1.8	most enjoy (10)
i. Walking/biking around lake:	least enjoy (1)					most enjoy (10)
j. Visiting Lake District Preserve:	least enjoy (1)	74	6.2	9	2.9	most enjoy (10)
k. Visiting Tarrant Lake Park:	least enjoy (1)	78	8.4	9	2.2	most enjoy (10)
l. Ice skating:	least enjoy (1)	76	5.9	7.5	2.9	most enjoy (10)
m. Ice fishing:	least enjoy (1)	76	6.7	7.5	3.0	most enjoy (10)

5) How does each of the following CURRENTLY limit your use and enjoyment of Tarrant Lake:		Total Responses	Average	Median	Standard Deviation	
a. Water clarity:	big problem (1)	72	5.0	3	2.6	not a concern (10)
b. Algae:	big problem (1)	72	4.6	4.5	2.5	not a concern (10)
c. Lake weeds:	big problem (1)	73	4.5	4.5	2.4	not a concern (10)

d. Fish/wildlife habitat:	big problem (1)	71	5.8	4	2.8	not a concern (10)
e. Slow, motorboat cruising:	big problem (1)	73	7.9	8	2.3	not a concern (10)
f. Lake rules:	big problem (1)	70	7.5	5	2.4	not a concern (10)
g. Access to lake:	big problem (1)	72	7.5	7	2.5	not a concern (10)
h. Litter:	big problem (1)	72	5.8	5.5	2.7	not a concern (10)
i. Quality of fishing:	big problem (1)	75	6.6	7	2.9	not a concern (10)
j. Carp:	big problem (1)	74	5.4	4.5	2.8	not a concern (10)
k. Building and development:	big problem (1)	65	4.6	3.5	3.1	not a concern (10)
l. Conflicts with other users:	big problem (1)	70	7.8	4.5	2.4	not a concern (10)
m. Water levels:	big problem (1)	70	6.6	5	2.8	not a concern (10)
n. Zebra mussels:	big problem (1)	63	6.7	5.5	2.9	not a concern (10)
o. Pier-related issues:	big problem (1)	68	7.3	4.5	2.6	not a concern (10)
p. Canada geese:	big problem (1)	70	6.2	6.5	2.9	not a concern (10)
q. Noise:	big problem (1)	70	7.4	6	2.6	not a concern (10)
r. Lack of natural scenic beauty:	big problem (1)	71	6.7	6.5	2.5	not a concern (10)

6) Which of the following do you feel are CURRENTLY Tarrant Lake's biggest threats:		Total Responses	Average	Median	Standard Deviation	
a. Overuse of lawn fertilizers/pesticides:	big threat (1)	75	4.6	6.5	2.9	not an issue (10)
b. Overuse of agricultural fertilizers/pesticides:	big threat (1)	73	3.7	6.5	2.9	not an issue (10)
c. Non-native, invasive plants/animals:	big threat (1)	73	4.4	7	2.7	not an issue (10)
d. Loss of habitat:	big threat (1)	71	4.3	3.5	2.6	not an issue (10)
e. Polluted runoff:	big threat (1)	74	2.9	1.5	2.5	not an issue (10)
f. Over-development:	big threat (1)	71	5.7	3.5	3.0	not an issue (10)
g. Over-crowding:	big threat (1)	71	7.4	5.5	2.6	not an issue (10)
h. Groundwater depletion:	big threat (1)	71	5.4	2.5	3.0	not an issue (10)
i. Lake-rule violations:	big threat (1)	70	6.5	3	2.7	not an issue (10)
j. Uninformed public:	big threat (1)	72	4.9	2	3.0	not an issue (10)
k. Lake-level fluctuations:	big threat (1)	74	6.0	4.5	2.9	not an issue (10)
l. Poor land-use planning:	big threat (1)	71	4.6	3.5	3.0	not an issue (10)
m. Misguided lake-management programs:	big threat (1)	72	5.1	3	3.2	not an issue (10)

7) How informed do you feel about issues affecting Tarrant Lake and its management?		Total Responses	Average	Median	Standard Deviation	
	not at all (1)	79	5.6	5.5	2.6	very informed (1)

8) How do you prefer to receive your Tarrant Lake news and information?		Total Responses	Average	Median	Standard Deviation	
a. Attend Lake District meetings:	least (1)	72	4.4	2	2.8	most preferred (10)
b. Community workshops/events:	least (1)	69	4.6	8	2.7	most preferred (10)
c. Friends and neighbors:	least (1)	71	7.5	7.5	2.5	most preferred (10)
d. Email Updates:	least (1)	69	5.8	6.5	3.5	most preferred (10)
e. Email News Letter:	least (1)	71	6.3	6.5	3.4	most preferred (10)
f. Web page:	least (1)	68	6.0	7.5	3.3	most preferred (10)
g. Other:	least (1)	29	7.2	10	2.9	most preferred (10)

9) Would you be interested in a landowner program offering up to 50% cost-sharing and technical assistance for projects that benefit Tarrant Lake (i.e. rain gardens, shoreline resotrations, etc.?		Total Responses	Average	Median	Standard Deviation	
	not interested (1)	76	5.1	5	3.2	very interested (10)

10) How do you feel about the following Tarrant Lake Preservation Committee efforts?		Total Responses	Average	Median	Standard Deviation	
a. Development of management plans:	strongly oppose (1)	77	7.9	6.5	1.9	strongly support (10)
b. Oversight of dredging project:	strongly oppose (1)	73	8.0	8.5	2.2	strongly support (10)
c. Oversight of dam project:	strongly oppose (1)	72	8.1	9	2.0	strongly support (10)
d. 09/10 Water quality monitoring:	strongly oppose (1)	73.0	8.2	1.0	1.9	strongly support (10)
e. Fund-raising efforts:	strongly oppose (1)	75.0	7.9	1.0	2.0	strongly support (10)
f. Pursuing funding through grants:	strongly oppose (1)	74	8.4	6.5	1.9	strongly support (10)
g. Lobbying for lake-protection policies:	strongly oppose (1)	74	8.0	9	2.1	strongly support (10)
h. Public meetings/forums:	strongly oppose (1)	74	7.6	8.5	1.9	strongly support (10)
i. Property owner surveys	strongly oppose (1)	74	7.9	8.5	1.9	strongly support (10)
j. Fishing stocking efforts:	strongly oppose (1)	77	8.6	9.5	1.8	strongly support (10)
k. Pier placement:	strongly oppose (1)	76	8.0	9	1.9	strongly support (10)

Definitions for the following questions:

Lake Districts - are governed under Ch. 33 Wisconsin Statute. They are formed by landowner petition to county or town board. The Principal means of financing is from property tax levy, state and other grants.

Qualified Lake Association - are governed under Ch. 281,181 Wisconsin Statute. They are formed by filing Articles of Incorporation, along with drafting by-laws with specific statutory criteria set forth. The principal means of financing is raised by voluntary membership dues, state and other grants.

11) How do you feel about raising funds to be spent for the restoration and protection of Tarrant Lake:	Total Responses	Average	Median	Standard Deviation	
strongly oppose	83	7.7	9	2.3	strongly support

12) How do you feel about Tarrant Lake creating a Lake Association at well to provide the lead role for the restoration and protection?	Total Responses	Average	Median	Standard Deviation	
strongly oppose	84	7.2	9	2.7	strongly support

13) How do you feel about Tarrant Lake creating a Lake District to provide the lead role for the restoration and protection (taxing local government)?	Total Responses	Average	Median	Standard Deviation	
strongly oppose	83	6.1	5	3.0	strongly support

14) Is there anything about Tarrant Lake or its management you find most concerning?

1) Just make smart, educated choices representing the community as a whole, there needs to be a budget.
2) Water quality monitoring system
3) To not have pollution in it.
4) Water Monitoring due to Didion
5) A special assessment for lakefront property owners to help maintain lake quality
6) Develop silt settlement ponds upstream from lake. Persuade upstream landowners to provide buffer zones. Ban excessive lawn fertilization and weed control chemicals within immediate watershed adjacent to lake.
7) Community involvement
8) Creating buffer zones in watershed area and around lake.
9) Stock with good fish
10) fish & fish protection
11) Watching things that go on there!
12) Community awareness
13) Monitor runoff & discharge from Didion
14) Lack of dredging effort after dam failures
15) Monitor the water quality and run-off.

16) Continue to develop management plans - long-term goals, etc.

17) Not interested

18) Monitoring incoming streams for pesticides fertilizers and effluent of ethanol plant - also runoff that might leave a deposit of silt

19) Shut Didion Ethanol down! At a minimum, make Didion discharge their wastewater in Didion's backyard in Jefferson.

20) Perhaps more dredging, especially some of the closer to shore areas, and making some deeper holes for better over-wintering of fish, addition of rock (former rockpiles?) for some structure

21) Tougher laws to protect the water.

22) State law should be changed to allow farmers to build poinds in water runoff areas to prevent runoff to go into Tarrant Lake.

23) Limiting the use of pesticides, fertilizers and other chemicals that harm the lake.

24) Stop permitted discharges into lake.

25) To keep out all run-off, polluted roll-off.

26) Control water runoff from land & streets - industrial pollution sources should go into marsh - not lake.

27) Responsible people doing depth regulation and management. Several critical crisis could have been avoided.

28) Don't know.

29) Walk from 146 E to park along the lake.

30) Keep the public more informed on what is going on with fish stocking, public involvement in projects to make the lake more enjoyable & also in making a pier to walk out on for fishing to see/take in the environment, make wheelchair accessible.

31) Good oversight! Strong community/volunteer organization.

32) Get rid of the recycling area.

33) There is no protection from both above concerns!

34) DNR needs to follow own rules.

35) Not to let Didion Ethanol plant pump their excess water waste into the lake.

36) Continue proper fish stocking.

37) Tributaries running through farm land need to be worked on - Didion needs to stop pollution - discharge into Duck Creek and watershed - curb pesticide - herbicide uses.

38) Constant monitoring of the lake water is important!

39) Monitor streams that feed the lake for contaminates from discharges (i.e. Didion, etc.) on a weekly, or at least a monthly basis.

40) Better protect lake from runoff and weed management.

41) Consistent law enforcement patrolling area to protect from vandalism, etc.

15) What specific actions are needed to better protect and manage Tarrant Lake?

1) The trail, stocking options for fish.

2) Plant growth, fish habitat, water quality

3) What effects the water Didion/Ethanol plant are having on the lake and it's surroundings.

4) How much pollution is being put into it.

5) Watershed program

6) Whadda ya got?

7) Work in progress

8) Keep water clean!

9) Plan for developing the commercial property like restaurant/hotel or something as to attack more outside visitors to enjoy the view.

10) Carp population control, dam quality, H20 quality

11) Spillway below the dam to prevent washouts
12) The fish restocking progress.
13) Laws and new concerns.
14) Shore development
15) Down stream cleanup & right-a-way.
16) The effort surrounding industries have on it.
17) Meetings in farming months will not work.
18) I am handicapped! Can't make it to the meetings.
19) Fish stocking & water vegitation improvement; - pier construction or path construction; - beach construction; - volunteer sign-up for help to improve the lake & funding.
20) Proper oversight.
21) Preventing the summer scum accululating on the water surface.
22) Private piers.
23) Water quality.
24) Long-term management.
25) What we can do to get legislation on the books that start protecting water, lakes, drinking, etc. Changes must be made & very soon. Look how long it took Wisconsin to get on board with the Great Lakes compact - How stupid are we!
26) Water quality fluctuations?
27) Fishing/stocking efforts and weed control. Water quality (see above statement).
28) Future of old poolhouse building & other plans.

16) What topics would you like to learn about at future meetings?

1) History
2) Prospective fishing hole.
3) Appearance, fishery, history
4) It's beauty!
5) To have a more clear lake for the community to enjoy boating & fishing.
6) It's scenic beauty
7) The lake is the undisputed centerpiece of the village.
18) Community focal point
19) It looks better with water in it.
20) Beauty
21) Tarrant Lake has provided countless hours of enjoyment. Beautiful park. Nice access. Quiet and peaceful.
22) It's potential
23) Swimming pool
24) A body of water that looks nice.
25) Community members involvement - restoration
26) Nature and it's surroundings.
27) New dam & dredging
28) It is a thing of beauty that the village was built around and offers wholesome recreation.
29) Defines our town
30) It's beauty and a place for children to learn to fish
31) John Domino's residence.
32) It's beauty.
33) Ducks on Lake
34) Dam repaired - water is back
35) Bringing a sense of life to the Village.
36) Fishing & good land shore line

37) Location & cleanliness.
38) Wildlife.
39) Visual attraction and fishing.
40) The beauty - having seen how it looks with no water - we're able to see how it looks now.
41) It's presence
42) The water!
43) To be able to have a local place to fish & relax; - a place to take a walk or for kids to have something fun to experience (maybe get the school involved w/the environment).
44) It's presence with natural habitat, its natural beauty and equal public access.
45) It's natural beauty.
46) The overflow so hopefully it won't become stagnant.
47) The lake itself - having a thriving natural habitat to enjoy.
48) None
49) It's small size.
50) That after all of the problems we have had maybe we can fish in there again in a couple of years. Also to balance it, give more aspect to our village.
51) It creates good feelings in the community.
52) It's the only thing Cambria has going for them, that and the Park.
53) Natural beauty & water quality.
54) The fact that the lake has been here forever, and is an asset to the Village and surrounding property.
55) To provide a place for families to fish and enjoy the view from the pack.
56) That it is actually improving.
57) It looks nice. I can see the lake from my living room window.

17) What do you think is the most positive aspect of Tarrant Lake?

1) Tarrant Lake has provided countless hours of enjoyment. Beautiful park. Nice access. Quiet & peaceful.
2) It is still weedy on the east side.
3) The small size, which we can't change
4) muddy water, algae
5) Having pollution pumped into it.
6) Algae and lake weeds
7) It requires a lot of care to preserve it's positive aspects due to it's small size.
8) I feel if we had this much energy spent on economic growth, the extra revenue would take care of the lake issues.
9) Weed plant lite control
10) Possible weed control
11) The money it takes to do anything - who has any extra $$
12) Carp-Ethanol (H20 table - dumping into duck creek), stinky H20
13) Concern of pollutants entering the lake
14) Eye sore property on southwest corner of lake lacking participation from township shoreline owners
15) That people don't respect and continue to litter with cans, bottles, etc.
16) Wastewater from Didion.
17) That it should be a marsh! That would be more beneficial to the environment!
18) Possibly getting polluted by Didion
19) Don't know
20) It could become polluted too easily.
21) People not using the lake.
22) The dam going out.
23) Not being able to use it!

24) Nice location!
25) To just let it sit and make no use of it would make it/allow it to become a mosquito, weedy swamp. So to prevent this the public must take interest in the lake and become involved as a community.
26) Lack of care….garbage….litter….poor water quality.
27) Water quality.
28) Weed growth in the water.
29) Low lake level, lake wasn't dredged completely.
30) Nothing gets better.
31) Lack of concern by some government agencies.
32) The cost to rebuild every ten years.
33) Geese & carp
34) DNR regulations have been so gutted to accommodate industry & farmers unless new legislation is accomplished. We will be unable to protect the lake watershed, our groundwater & our water in general.
35) Shoreline??
36) Allowing Didion to discharge into the lake.
37) How slimy and dirty the water looks.
38) Bathrooms, lack enforcement - lack off.
39) It needs to be cleaned - all down the lake & creek area.

18) What do you think is the most negative aspect of Tarrant Lake?

1) Possible weed control
1) I would like to see the lake with a good stock of quality fish like bass.
2) Use to Fish as a kid, haven't in years
3) I financially support a lot of different conservation programs but conservation is not cheap, and this being a lower income community, it may not be a priority to all the people in the Village, when they are having a hard time making ends meet.
4) Do not vote for Republicans, they could care less what poor folks have.
5) Lake restoration comm. Has done an outstanding job raising funds and monitoring restoration - BRAVO!
6) I'm not sure of the structure of the lake bottom, but to help fish survive, they need oxygen - from weeds and sun, and structures to hid and reproduce. Maybe we could put in a couple of cribs.
7) I would like to thank the lake committee for all their hard work.
8) LOTS
9) Don't care
10) I would commend those people who took on the task of getting our lake dredged and for an understanding village board who supported them.
11) Dredging helped a lot!
12) Please save the lake.
13) I think the water level should have been higher.
14) I thought it was supposed to be a marsh.
15) Keep the lake open to people to use for fishing & fun, clean of weeds.
16) Sorry this wasn't more complete - I don't use the park or lake much.
17) YES, Much
18) Agriculture is the #1 industry in WI. Village resident spokesmen have been "anti-ag" for several years. The village shouold use carrots and not clubs to find compromise.

19) We would love a lake that could be used for fishing and swimming without worried about eating the fish or what could happen by swimming in the water!

20) Too many weeds around the shoreline, can't do any fishing - and another thing too many green things on the top!

21) Poor management of village property.

22) Too much to list cont. from above.

23) The Preservation committee needs to continue to work hard to maintain and improve our beautiful Lake Tarrant. Thanks for allowing comments!

24) Progress is being made, and it is a lot of work to achieve the goal needed for Tarrant Lake.

25) I feel we should be working on a plan to get all old dead trees taken down by creek area & put more benches and walkways all down the creek area to the backside of Del Monte camp.

19) Comments

1) I would like to see the lake with a good stock of quality fish like bass.

2) Use to Fish as a kid, haven't in years

3) I financially support a lot of different conservation programs but conservation is not cheap, and this being a lower income community, it may not be a priority to all the people in the Village, when they are having a hard time making ends meet.

4) Do not vote for Republicans, they could care less what poor folks have.

5) Lake restoration comm. Has done an outstanding job raising funds and monitoring restoration - BRAVO!

6) I'm not sure of the structure of the lake bottom, but to help fish survive, they need oxygen - from weeds and sun, and structures to hid and reproduce. Maybe we could put in a couple of cribs.

7) I would like to thank the lake committee for all their hard work.

8) LOTS

9) Don't care

10) I would commend those people who took on the task of getting our lake dredged and for an understanding village board who supported them.

11) Dredging helped a lot!

12) Please save the lake.

13) I think the water level should have been higher.

14) I thought it was supposed to be a marsh.

15) Keep the lake open to people to use for fishing & fun, clean of weeds.

16) Sorry this wasn't more complete - I don't use the park or lake much.

17) YES, Much

18) Agriculture is the #1 industry in WI. Village resident spokesmen have been "anti-ag" for several years. The village shouuld use carrots and not clubs to find compromise.

19) We would love a lake that could be used for fishing and swimming without worried about eating the fish or what could happen by swimming in the water!

20) Too many weeds around the shoreline, can't do any fishing - and another thing too many green things on the top!

21) Poor management of village property.

22) Too much to list cont. from above.

23) The Preservation committee needs to continue to work hard to maintain and improve our beautiful Lake Tarrant. Thanks for allowing comments!

24) Progress is being made, and it is a lot of work to achieve the goal needed for Tarrant Lake.

25) I feel we should be working on a plan to get all old dead trees taken down by creek area & put more benches and

walkways all down the creek area to the backside of Del Monte camp.

Appendix C

Miscellaneous Information

Reporting Boating Ordinances

When reporting violations:

1. Place Phone Call to
    a. (920) 348-5501 Village of Cambria Police Department
    b. 1.800.TIP.WDNR Wisconsin Department of Natural Resources
2. Helpful Information
    a. Boat Identification Number
    b. Description of Activities
    c. Photo Documentation (Not necessary but always helpful)

* **********

If buoys are not located on the waterscape Wisconsin Department of Natural Resources State Game Wardens and Columbia County Sheriff's Department Deputies cannot enforce "Slow No-Wake" violations. As a result; when reporting "Slow No-Wake" violations in early spring and late fall, please make sure that buoys are on the waterscape.

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Aqua Culture

Aquaculture Contacts

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Aqua Culture

Aqua Culture Services Check List

- Does the company sell product raised vs. catch and sell?
- What are the companies in the wild survival rate?
    - The higher the rate of survival the better
- How does the company feed their stock?
    - Live Feeding
        - Fosters hunting skills
    - Artificial Feed
        - Does not foster hunting
- How long has the company been providing aquaculture services?
- Ask for companies list of testing policies.
- Ask for references on companies testing history.
    - Must have excellent track record
- Company must provide health certificate.
- Obtain WDNR stocking permit in advance.
    - Must be done way ahead of time
- If aquaculture service is from out of Wisconsin
    - Must obtain a valid WDNR import permit
- Verify the age of the specimens being purchased/ per species?
- Verify the size of the specimens being purchased/ per species?
- Verify harvest technique used by Aquaculture Company?
    - Stress on fish can be significant
    - 5° change during transport can cause delayed mortality a month later
- Verify stocking technique.
    - No under ice stocking
- Verify time of stocking.
    - Night?
    - Day?
- Verify time specimens will be transported or time on truck.
        - time in transport = >stress = < probability of survival rate
    - 5° change during transport can cause delayed mortality a month later
- Develop Long term relationship with aqua culture company
- Verify Reputation
    - Must research company with their past clients