Watershed Restoration Plan for Lake Waukewan and Lake Winona

Report prepared by the Lake Winnipesaukee Association
and
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Executive Summary

PROJECT OVERVIEW

The Lake Waukewan and Lake Winona Watershed Restoration Plan (WRP) project is part of a long-term strategy to create a public, on-line Watershed Management Plan (WMP) for the entire Lake Winnipesaukee watershed that addresses nutrient loading.

Protecting the water quality of Lake Waukewan is a high priority for the town of Meredith, as not only is the lake a recreational and economic asset, it is also the primary drinking water supply serving over 3,000 residents and the Meredith Village Business community. Lake Winona is a beautiful lake located to the northwest of Lake Waukewan in a mostly undeveloped watershed, with year round and seasonal residential development located along its shores.

In 2005 a management plan for the Waukewan Watershed was developed that provides a detailed description and analysis of nonpoint sources of pollution in the watershed; however, the planning process at that time did not include quantifying pollutant loads and reductions. Both lakes are impaired for Aquatic Life Use due to low dissolved oxygen concentrations and in the case of Lake Waukewan, cyanobacteria blooms. The 2016 Lake Waukewan and Lake Winona Watershed Restoration Plan addresses the dissolved oxygen impairments by focusing on ways to reduce sediment and phosphorus input in the watershed. The plan is both a stand-alone plan for the Waukewan-Winona watershed and a supplement to the 2005 Waukewan Watershed Management Plan.

This watershed restoration plan is the culmination of a major effort by many individuals who not only care about the long-term protection of water quality in their lakes, but also recognize that high water quality is directly connected to the economic well-being of the area. Lake Winnipesaukee Association (LWA) hosted an initial meeting to generate interest in the plan with many stakeholders representing a diverse range of interests in attendance. From municipal staff and conservation commissions, to state agency officials (e.g., NH Fish & Game, NHDES), to local residents and lake/pond/neighborhood associations (e.g., Lake Waukewan Association, Lake Waukewan and Winona Watershed Protective

Association, Lake Winona Improvement Association, Waukewan Watershed Advisory Committee, Windy Waters Conservancy), to land trusts and non-profits (e.g., Lakes Region Conservation Trust, Belknap County Conservation District), to technical experts – LWA guided the creation of an Advisory Committee to ensure that a strong watershed restoration plan was developed for these special and important waterbodies.

This plan was partially funded by a Watershed Assistance Grant for High Quality Waters from NHDES using Clean Water Act Section 319 funds from the USEPA, with additional financial and in-kind services provided by the Waukewan Watershed Advisory Committee, the Windy Waters Conservancy, and the members of the Advisory Committee. This comprehensive watershed plan provides guidance for the next phase of actions needed to improve and preserve the water quality of these picturesque waterbodies.

The **WAUKEWAN-WINONA WATERSHED RESTORATION PLAN** is a scientifically-based plan that provides decision makers and local residents the tools needed to protect the water quality of these waterbodies for future generations.

THE WAUKEWAN-WINONA WATERSHED

The Waukewan-Winona watershed lies within five towns in the Lakes Region of NH; Meredith, New Hampton, Center Harbor, Holderness, and Ashland, NH. Developed land of 951 acres makes up 13% of the total 7,162 acres of land in the watershed, with over 6,000 acres of forest land accounting for 84% of the land area. Lake Winona, at 148 acres, and Lake Waukewan, 928 acres, are the largest waterbodies. Lake Winona outlets to the Snake River, which flows approximately 2 miles before emptying into Lake Waukewan. Development around the lake consists of a mix of seasonal and year round residential homes and cottages. Businesses in the watershed include some commercial and light industrial use, and several campgrounds. Potential threats to the water quality and public drinking water supply include development pressure, recreation, aging septic systems, erosion, and land use practices.

The Waukewan watershed includes three different sites impacted by nonpoint source pollutants which are listed on the State's current 303(d) list of impaired waters: Waukewan Lake, Waukewan Town Beach, and Winona Lake. Waukewan Lake fails to support designated uses due to a severe dissolved oxygen (DO) and DO saturation impairment (5-P) and a cyanobacteria (hepatotoxic microcystins) impairment (5-M), which is of concern and importance as Lake Waukewan is the public drinking water supply for the Town of Meredith. Waukewan Town Beach fails to support aquatic life use due to a DO impairment (5-M). Winona Lake also fails to support aquatic life use as a result of a severe dissolved oxygen (DO) and DO saturation impairment (5-P). The sources for all of these impairments are listed as "Source Unknown."

This plan focuses on phosphorus as the overall driver of ecosystem health. Phosphorus (P) is a naturally occurring element and a major nutrient required for biological productivity. It is found in all living plants, animals, and people (organic forms); as well as being present in soils and rock (inorganic forms). Although its existence is widespread in nature, it is not *naturally* abundant, and is the most limiting nutrient in freshwater ecosystems for aquatic plant productivity.

Increased levels of phosphorus in freshwater can cause decreased water clarity, increased chlorophyll-a levels, increased turbidity levels, accelerated lake eutrophication, etc. Higher concentrations of P in freshwater may also result in a decline in property values, economic loss from decline in tourism due to decline in water clarity, public health risk due to potential of increased occurrence of cyanobacteria blooms, decline in swimming, fishing and boating use, and an increase in public expenditures to address water quality impairments. Decomposition of accumulated organic matter from dead algal blooms and plants, can result in anoxia in bottom waters, which can release phosphorus back into the water column as food for algae and plants and can also be lethal to fish and other aquatic organisms.

The **fundamental goal** of this watershed restoration plan is to improve the low dissolved oxygen concentrations in the bottom depths of both lakes by reducing pollutant and nutrient inputs, primarily phosphorus. Although current in-lake phosphorus concentrations for each lake are below the NHDES state nutrient criteria established for oligotrophic (8.0 µg/L) and mesotrophic (<12 µg/L) waterbodies, representatives for both Lake Waukewan and Lake Winona opted to select target goals which decrease the in-lake phosphorus concentration from the predicted in-lake levels. **The target goal for Lake Waukewan was set to achieve an in-lake TP concentration of 5.3 µg/L in 10 years, requiring a reduction in phosphorus load to the lake of 31 kg/year. Although Lake Winona is well below the reserve assimilative capacity threshold of 10.8 µg/L for a mesotrophic waterbody, the WWLSAC chose to be aggressively proactive and selected a target goal to achieve a 5-10% decrease in in-lake TP concentration in 10 years.**

This plan provides a roadmap for improving the water quality of both lakes, and provides a mechanism for procuring funding to secure actions needed to achieve water quality goals. In addition, this plan sets the stage for ongoing dialogue among key stakeholders in many facets of the community, and promotes coordinated municipal land use changes to address stormwater runoff. The success of this plan is dependent on the concerted effort of volunteers, and a strong and diverse Advisory Committee that meets regularly to review progress and make any necessary adjustments to the plan.

As part of the development of this plan, a build-out analysis, water quality and assimilative capacity analysis, and watershed/shoreline survey were conducted. Results of these efforts were used to run a land-use model, or Lake Loading Response Model (LLRM), that estimated the historical, current, and projected amount of phosphorus being delivered to the lakes from their respective watersheds. To assist implementation of recommended strategies or best management practices (BMPs), an Action Plan (Section 7) with associated timeframes, responsible parties, and estimated costs was developed.

PLAN COMPONENTS

The Waukewan Winona Watershed Restoration Plan includes nine key planning elements to address nonpoint source (NPS) pollution (Section 1.1). These guidelines, set forth by the USEPA, highlight important steps in protecting water quality for waterbodies impacted by human activities, including specific recommendations for guiding future development and strategies for reducing the cumulative impacts of NPS pollution on lake water quality. Below is a summary of information presented by section:

SECTION 1 | INTRODUCTION

Section 1 introduces the plan by describing the purpose and scope, existing water quality impairments, the goals and objectives, and the community-based planning process.

SECTION 2 | LAKE HEALTH AND WATER QUALITY

Section 2 describes issues related to water quality and stormwater runoff, lake morphology and morphometry, provides a summary of current classification based on water chemistry assessment, and the assimilative capacity analysis for each lake.

SECTION 3 | WATERSHED CHARACTERIZATION

Section 3 describes the watershed, providing detailed information about climate, population and demographics, topography, soils and geology, subwatershed delineations, and breakdown of land use/cover areas.

SECTION 4 | LAKE SUSTAINABILITY

Section 4 provides the estimated nutrient loading to both lakes, as well as an estimation of the natural background condition, and the future loading based on results of the build out analysis. The process for selecting the local water quality goal or target for each lake is also included in this section.

SECTION 5 | IDENTIFICATION OF POLLUTION SOURCES IN THE WATERSHED

Section 5 presents the results of the watershed nonpoint source survey and shoreline survey, as well as the process for prioritization of mitigation strategies.

SECTION 6 | MANAGEMENT STRATEGIES

Section 6 outlines the necessary management strategies (both structural and non-structural best management practices (BMPs)) to reduce phosphorus inputs to the waterbody. Current and future sources of phosphorus are discussed and an adaptive management strategy is presented.

SECTION 7 | PLAN IMPLEMENTATION

Section 7 describes who will be carrying out this plan and how the action items will be tracked to ensure that necessary steps are being taken to improve the water quality of Lakes Waukewan and Winona over the next twenty years. This section also provides estimated costs and technical assistance needed to successfully implement the plan and a description of the evaluation plan to assess the effectiveness of restoration and monitoring activities.

FUNDING THE PLAN

Reducing phosphorus inputs from existing development in the Waukewan watershed is highly achievable. Addressing the **top six BMP** sites from the prioritized list of all identified survey sites for each of the Lake Waukewan and Lake Winona watersheds would remove **84.8 kg of phosphorus per year** from entering either Lake Waukewan or Winona, and would account for **75 % of the total estimated P load** per year contributed by all surveyed problem areas.

Implementation of this plan over the next 10 years is expected to cost $324,200 and will require the dedication and hard work of municipalities, conservation groups, and volunteers to ensure that the actions identified in this plan are carried out accordingly. Section 7 lists the costs associated with successfully implementing this ten-year watershed plan, including both structural and non-structural management measures. A sustainable funding plan should be developed within the first year of this plan and revisited on an annual basis to ensure that the major planning objectives can be achieved over the long-term. This funding strategy would outline the financial responsibilities at all levels of the community (landowners, towns, community groups, and state and federal governments).

ADMINISTERING THE PLAN

The recommendations of this plan should be carried out by a committee similar to the Advisory Committee assembled for development of this plan. Local participation is an integral part of the success of this plan, and should include the leadership of local municipalities (Meredith, Center Harbor, New Hampton, Holderness, and Ashland), as well as the support of other stakeholders, including conservation commissions, pond/road/neighborhood associations, NHDES, school/community groups, local businesses, and landowners. The committee will need to meet regularly and be diligent in coordinating resources to implement practices that will reduce NPS pollution in the Waukewan watershed. Periodic updates to the plan will need to be made to maintain the action items and keep the plan relevant to current watershed activities. Measurable milestones (number of BMP sites, volunteers, funding received, etc.) should be tracked by the Advisory Committee and reported to NHDES on a regular basis.