Technical Status Memorandum
For
Lakes Limerick and Leprechaun 2011
Aquatic Plant Management

December 2011

Prepared for
Lake Committee
Lake Limerick Country Club

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Introduction

As with previous years, the long-term management of the aquatic plants (primary production of both aquatic plants and phytoplankton including Cyanobacteria, formerly called blue-green algae) in both Lakes Limerick and Leprechaun will always require annual management in order to maintain the lakes beneficial uses. This is in part due to the nutrient availability within the lakes from their sediments and inflow from shallow groundwater and surface water, as well as, the morphological condition of the lakes. One of the goals is to promote a balanced ecosystem that minimized the cost of controlling the undesirable excesses of over production (too many plants and algal blooms).

Although the two lakes are different and their biological communities reflect these differences there still remains a common management theme. Successful implementation of a management theme is dependent upon recognizing two keys aspects of management for these lakes. One key is the control of the rooted aquatic plants in order to allow boat passage, water contact, and aesthetic appeal. The second key to successful management is to maintain enough aquatic plants in the lakes to service as structure for fisheries habitat and to provide direct and indirect competition for algae (phytoplankton free floating photosynthetic organisms). This competition is for the soluble macronutrients (phosphorus and nitrogen) by the microbial community that grows on the plants versus the phytoplankton. Some of surfaces of all aquatic plants provide areas for microbes to adhere forming a community of periphyton (attached algae), bacteria and fungus that in turn absorb nutrients from the water column. It is this removal of nutrients that is direct competition to phytoplankton. The nutrient levels in both lakes (as indicated by the production of aquatic plants in both lakes and the observed phytoplankton both filamentous and free floating) render the complete removal of aquatic plants undesirable. If all aquatic plants were removed from the lakes there is a high probability that significant cyanobacteria blooms would occur. These potential blooms could in themselves be dense enough to prohibit fishing and water contract recreation. In addition, certain types of cyanobacteria have the ability to produce toxins further impairing the beneficial use of the lakes.

Simply put, the aquatic plant management program must balance the promotion of direct lake activities while still providing for a set of biological controls to overproduction. This is exactly what has been put into motion in Lake Limerick and Lake Leprechaun. Lakes Limerick and Leprechaun are in fact moving toward this equilibrium state. The program carried out for 2011 will reflects this basic status and the need for balanced approach. Given that there has been significant progress made toward control of aquatic macrophytes through the 2010 season, 2011's program was less aggressive in Lake Limerick and no action was taken in Lake Leprechaun.

The following briefly presents the aquatic plant status for both lakes and recommendations for the 2012 management program.

Lake Limerick

The aquatic plant control program for Lake Limerick in 2011 continued to build upon the efforts started in 2005 with the intensive herbicide treatment followed by the high-beneficial use annual treatments in 2006 through 2010. The area treated in 2011 was the smallest acreage treated since 2005. Less than 5 acres were treated and all to limit the ever increasing growth of the native plant call pond weed (*Potamogeton amplifolius*). The original intent of the aquatic plant management program was to control the non-native Brazilian elodea (*Egeria densa*). This plant dominance of the aquatic plant community has been reduced to a small fraction of the area and density that it covered in the 1990's and early 2000's. The objective of the 2011 and future management actions are to continue to control non-natives but also to reduce the adverse impact of native plants due to their density and coverage of the lake bottom, while still allowing for sustained existence to promote habitat structure and direct competition to phytoplankton for nutrient uptake.

Figure 1 illustrates the locations and type of plant communities within Lake Limerick as of the June 2011 survey including dense growths of the filamentous green algae that are over produce biomass in the east end of the lake reflecting excess nutrient availability and the decrease in rooted pants due to previous years aquatic plant management treatments, particularly targeting Brazilian elodea. This figure also shows the red hatched areas where treatment took place in 2011. The treatment this year will hopefully yield results in limiting plant growth in the summer of 2012 in those treated area. In addition the 2011 treatment will continue to inhibit the re-expansion of the non-native Brazilian elodea.

A total of 4.4 acres were treated this year. First treatment was with the contact herbicide Diquat conducted on 25 August. The follow-up treatment was on 19 September and at that time the systemic herbicide Sonar PR was used. The purpose of the contact herbicide is to weaken the dominate plants within the target area but then allow these same plants to start to regrow (10 to 14 days after the contact herbicide treatment) so that the systemic herbicide will kill non-native plants in the area and limit the regrowth and over production of the pond weeds (native plants) in the follow summer.

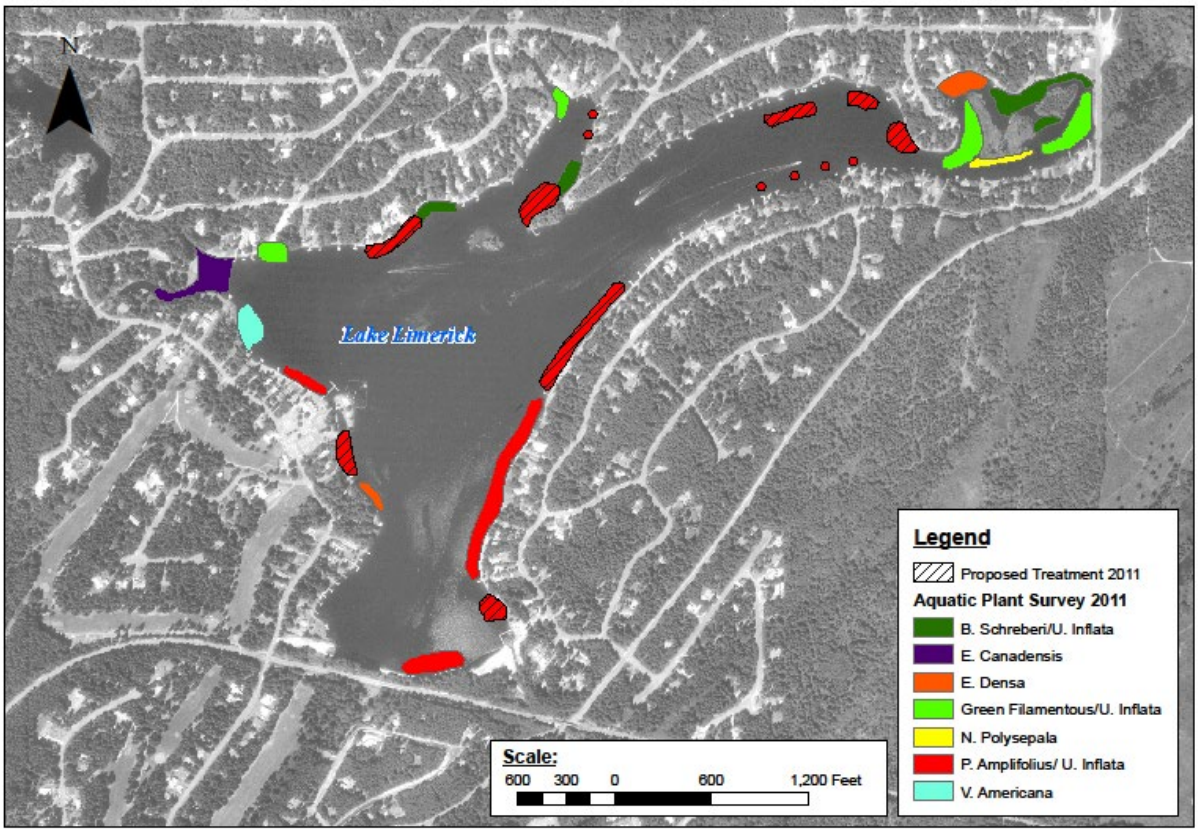


Figure 1. Lake Limerick plant map and treatment areas for 2011 as proposed and treatment applied.

Figures 2 present the Lake Limerick aquatic plant maps for 2009 and the treatment zones for 2010. Based on the large reduction of aquatic plant coverage and density observed when comparing the coverage in 2008 (Figure 3) with the observed coverage and density in September 2009, the 2010 and the 2011 aquatic plant treatment program was reduced from a total of 32 acres to not more than 12 acres in 2010 and less than 5 in 2011.

In the previous years (2007-2010) the treatment procedure follow the same protocol:

1) Mid June apply Sonar Q (Quick Release) in pellet form to the treatment area. Apply Sonar Q at concentration of 12 parts per billion every two weeks for a total of 3 treatments (mid-June, end of June and mid-July).

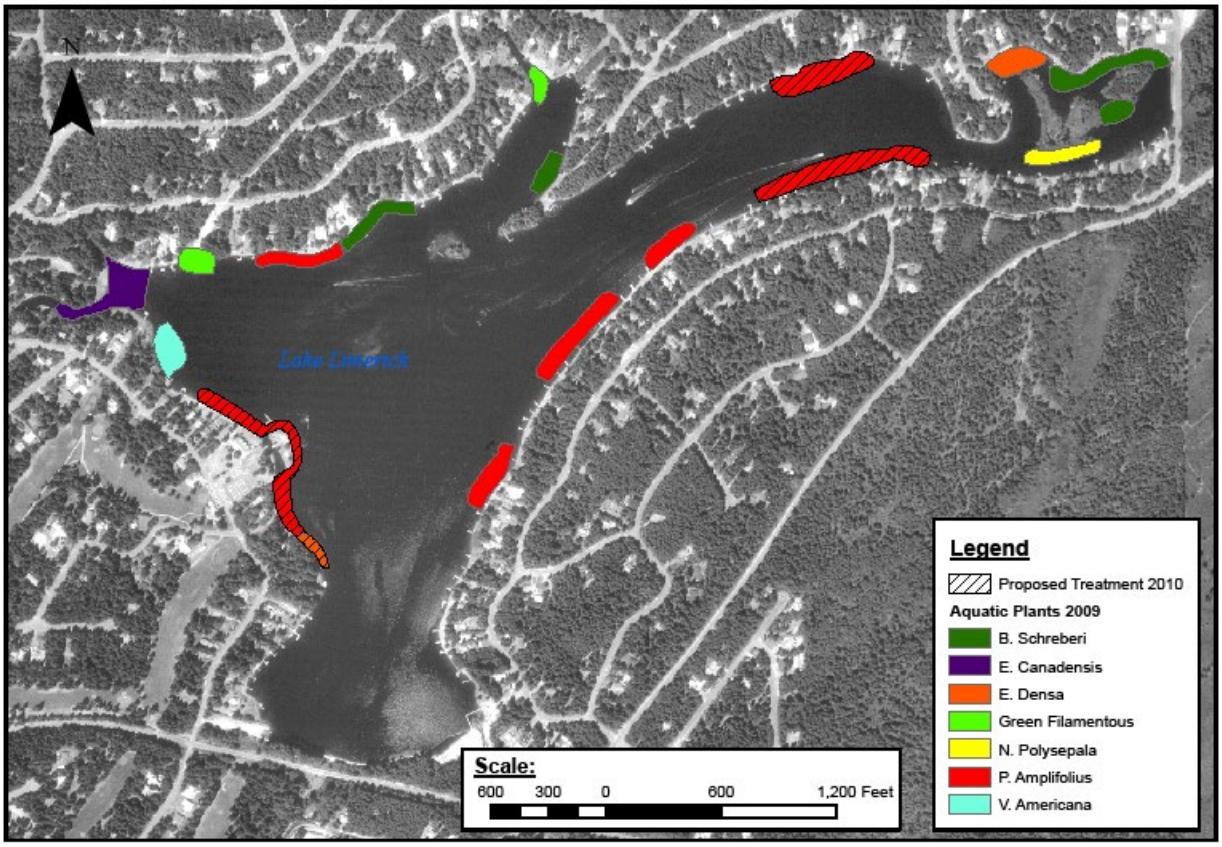
2) After 15 July Diquat (Reward) was added to the treatment areas; Diquat cannot be applied at a sooner date due to fishery restriction of Coho in the system.

3) 10-20 days after the Diquat application Sonar PR (Precision Release) in pellet form was applied to the treatment areas. Apply Sonar PR at a concentration of 8 parts per billion. This is a slow release pesticide and use of Sonar PR will help to control next year's growth. This was a one time application.

In 2011 this protocol was reduced to just the Diquat and Sonar PR application to save money and to prevent over control of the aquatic plants that would lead to an increase probability of cyanobacteria blooms.

Over the last six years the density of Brazilian elodea has been controlled to a manageable level and now the density of native species where they interfere with beneficial uses have been targeted by the management efforts as well as to keep the non-native Brazilian elodea from re-establishing as sole plant dominant.

Nutrients entering the lake from Cranberry Creek are responsible for the excessive growth of periphyton (attached algae) in the north-east section the lake where the creek delta forms a shallow transition area between the lake and the creek. But treating to remove the algae in this area was not recommended due to the release of nutrients that may increase algal production within the lake. The same was true of the eastern area of the lake known as the bird sanctuary. Excess nutrients from that areas sediments (internal loading of nutrients), from interflow (shallow groundwater and possibly septic drainfields), and stormwater runoff are driving excess production of filamentous algae in this area that is reaching noxious levels. If this problem continues to increase in the future, phosphorus inactivation my be needed to prevent the excess production of periphyton in this area while limiting nutrients (phosphorus) to the entire and thereby decreasing the potential for cyanobacterial blooms in the lake.



Lake Limerick Aquatic Plant Map 2009 Proposed Treatment 2010

Figure 2. Lake Limerick aquatic treatment map for 2010

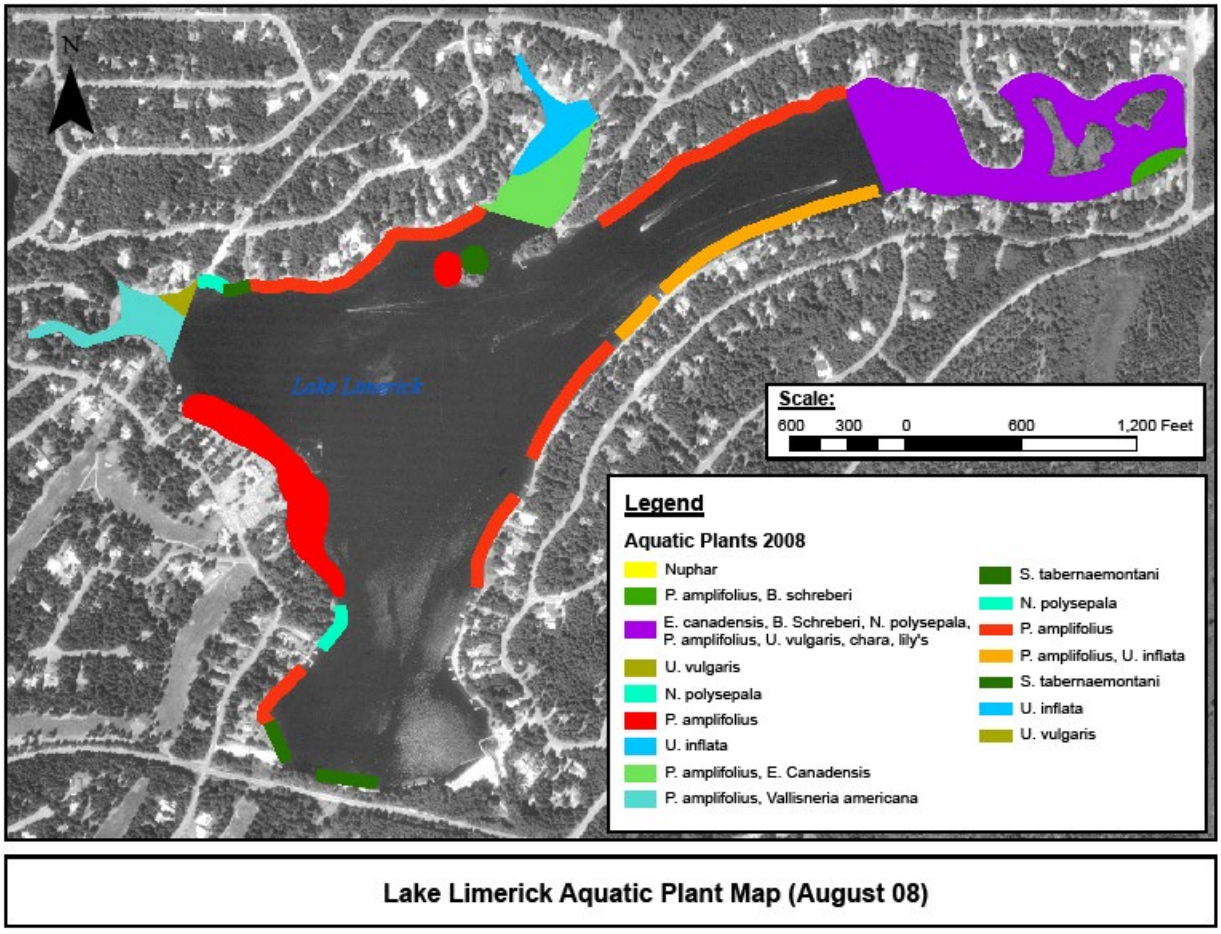


Figure 3. Lake Limerick aquatic plant coverage in August 2008

Lake Leprechaun

Similar to 2010 the density and coverage of aquatic plants in Lake Leprechaun in 2011 did not warrant treatment. However, this may not hold for 2012 so a more intense aquatic plant mapping will be needed May-June 2012 of the plant community in Lake Leprechaun to determine if plant density control is needed. Note that as a shallower and more productive Lake Leprechaun (more nutrients to promote both rooted and phytoplankton production) than Lake Limerick requires even more diligence in controlling rooted aquatic plants as to prevent stimulation of cyanobacteria blooms that are harmful to the aquatic habitat and potentially produce toxins. It is imperative that a balanced approach be used. Certainly, the last herbicide treatment had profound effects and greatly reduced the density and coverage of both non-native and native aquatic plants in the lake and it is time to institute a program similar to Lake Limerick that rotates control areas annually to maximize control while minimizing the risk of unintentionally inducing an algal bloom.

The aquatic plant density and coverage within Lake Leprechaun had increased particularly with the expansion of common mares tail and big leaf pond weed. The dominate plants observed in the Fall of 2007 are listed in Table 2 and shown in Figure 4, which, is a map of the relative coverage or those dominate plants within the lake. It is evident from the results of the herbicide treatments of 2008 and 2009 that the aquatic plants coverage in the lake has been greatly reduced. This can be seen by comparing the plant coverage shown in Figure 4 for 2007 with the pretreatment coverage shown in Figure 5 for 2009. Note that in September 2009 aquatic plants were rarely observed. Hence, no treatment is recommended for Lake Leprechaun in 2010 and 2012.

Table 2. List of dominant aquatic plants observed in Lake Leprechaun in 2007.

Species Name	Common Name
Hippuris vulgaris	Common mares tail
Myriophyllum sibericum	Northern milfoil
Potamogeton amplifolius	Big leaf pond weed

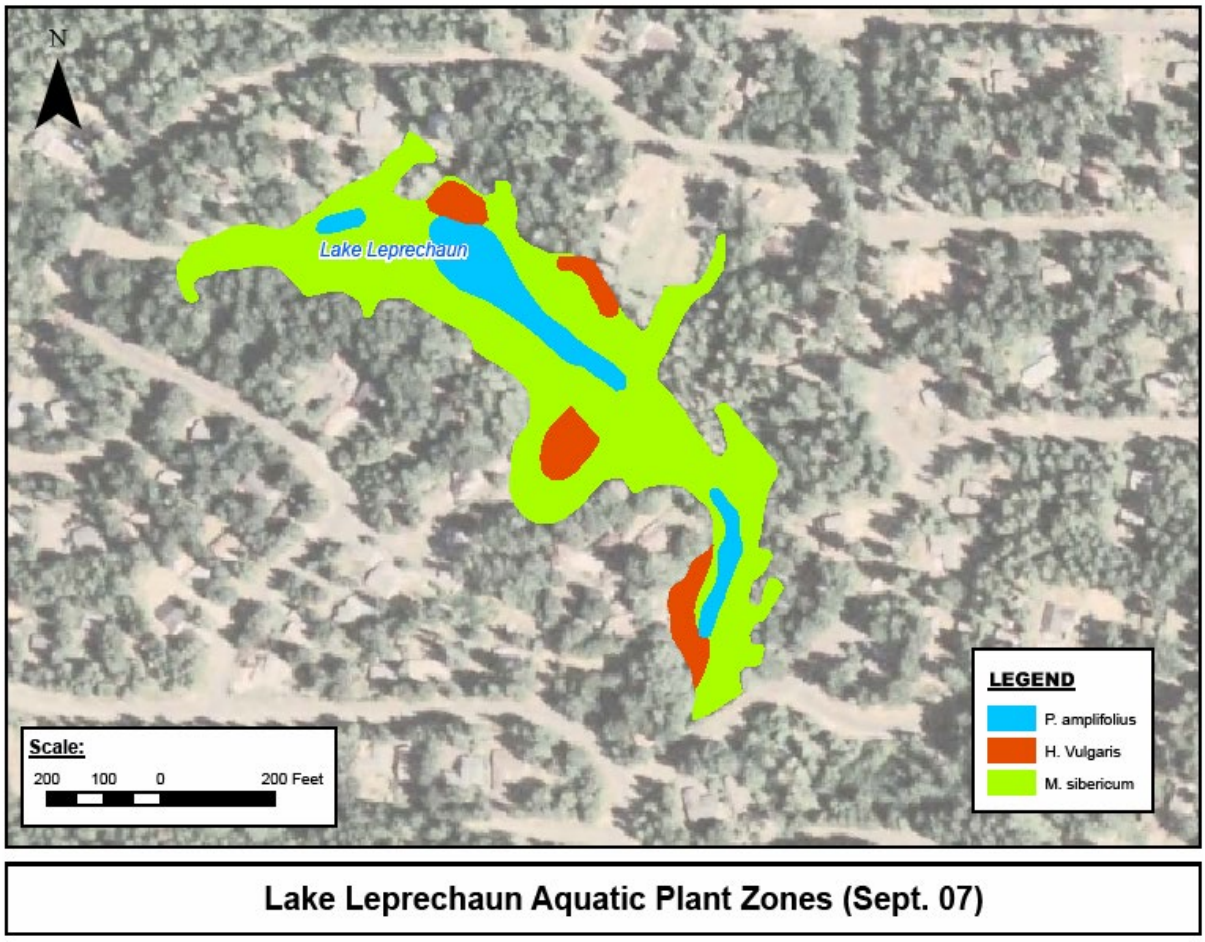


Figure 4. Aquatic Plant Map of dominant plants in Lake Leprechaun, 2007.

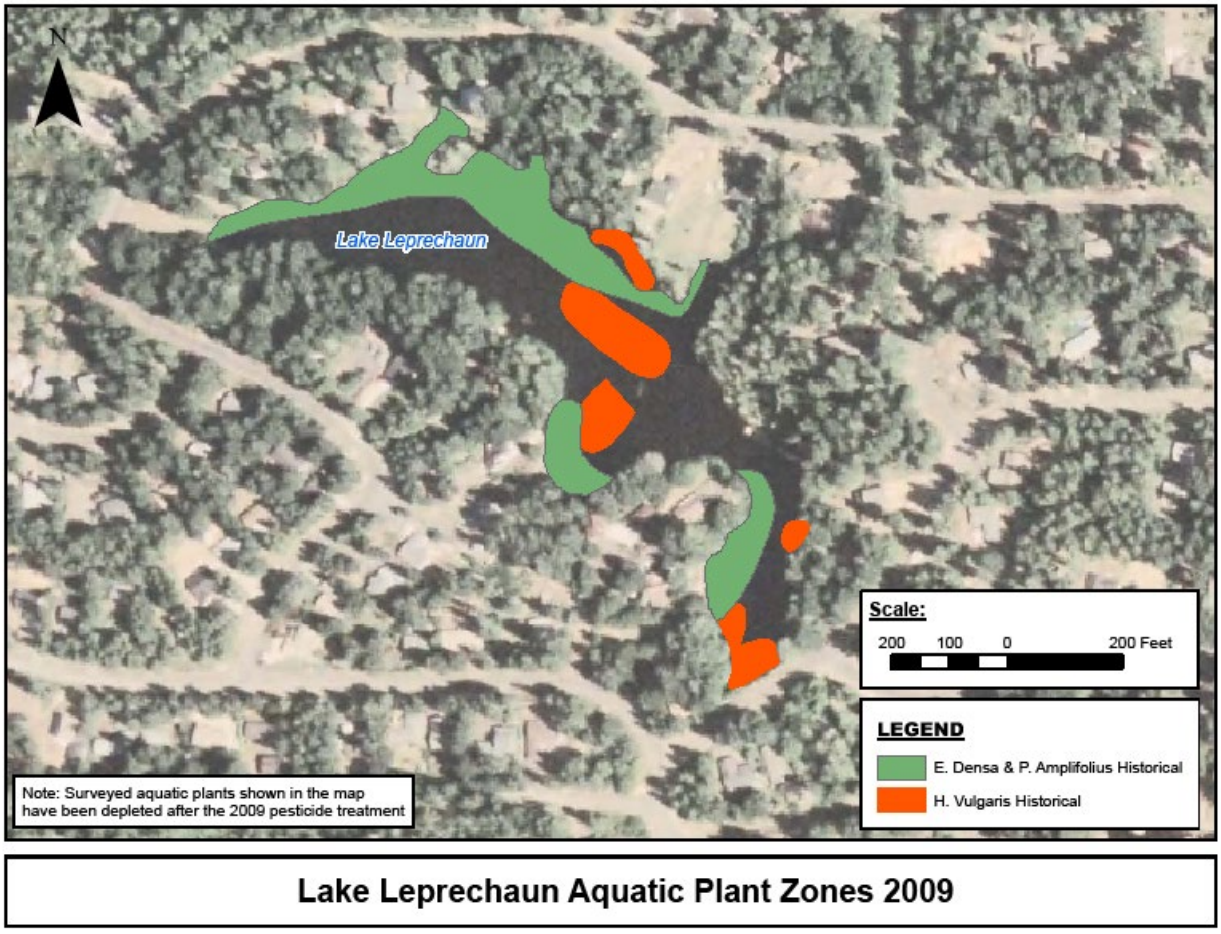


Figure 5. 2009 Aquatic plant map of plants showing to summer 2009 treatment areas.

Permit Status

The current herbicide permit through the Ecology was transferred to AquaTechnex in 2011 and will continue to be administered by them in 2012. There are new permit guidelines and fees that are still under review so the cost of maintaining this permit will probably increase in 2012 and for the foreseeable future.

2012 Recommendations

Given the mild fall and early winter weather conditions that will allow for a potential early emergence of aquatic plants in the spring of 2012, it is advised the an aquatic plant mapping be conducted at both Lakes Limerick and Leprechaun in the later part of May 2012 to establish treatment zones and strategy for both lakes. An additional plant mapping should be conducted in

last August to early September 2012 to assess the treatment effectiveness of the summer control activities to plan for the efforts that will be needed in 2013.

In addition, a mid-July short aquatic plant survey should be conducted to make sure that problem areas have not arisen after the May plant mapping so that adjustment to the summer treatment program can be made if necessary to maximize treatment effectiveness.

It is proposed that Tetra Tech continue to map the plants and formulate the management activities and that AquaTechnex provide permit and treatment support as directed and under Tetra Tech contract.