2011 Progress Report of the Milfoil Solution® Program in

Round Lake

Prepared for:

Rollin Township, Michigan

Prepared by:

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I. Introduction

Eurasian watermilfoil (*Myriophyllum spicatum*, hereafter referred to as milfoil or EWM) is an exotic aquatic species that tolerates a wide range of growing conditions and out-competes native vegetation. Monocultures of milfoil limit recreational use, reduce biodiversity, and can cause detrimental changes to water temperature and dissolved oxygen in severe infestations. EnviroScience implemented a **Milfoil Solution®** program at Round Lake at the request of Rollin Township, Michigan.

The North American beetle, the milfoil weevil (*Euhrychiopsis lecontei)*, has been augmented in Round Lake, Lenawee County, Michigan, to suppress the growth of Eurasian watermilfoil. This weevil is a specialist herbivore of milfoil and damages the plant in multiple ways. The most significant impact is caused by weevil larvae as they damage the meristem, or growing tip, and burrow through the stem. Nutrient flow in the plant is disrupted and the stem loses buoyancy and collapses in the water column. A cascading effect pulls neighboring plants lower into the water column and the rate of photosynthesis is significantly reduced in these stems.

The following is a project outline thus far of **Milfoil Solution®** at Round Lake:

Year	Survey Dates	Sites Stocked	Number of Weevils
2009	Initial: 6/22	6 sites throughout lake	59,000
2010	Initial: 7/7; 7/14	S1, S5	20,000
2011	Initial: 6/29; Follow-up: 8/18	S1, S2, S3, S4	35,000

II. Survey Methods

An initial survey is performed prior to weevil stocking and a follow-up survey is conducted six to eight weeks later. These surveys are integral in monitoring changes that occur in both the augmented weevil population and the health of the milfoil over the course of the program in order to make informed management decisions. Qualitative observations in these surveys include the overall density and health of milfoil, identification of native plant species present, and the presence of weevils and weevil-induced damage. Quantitative measurements include milfoil density and weevil population density. Milfoil density is determined by randomly collecting stems throughout the milfoil bed using a quadrat. This sample is then converted to the number of stems per square meter (stems/m^2). Weevil population density is determined through lab analysis of stems sampled from three transect lines at each site. Site coordinates are recorded with a GPS unit and buoys are placed to mark the stocking site.

III. 2009-2010 Summary

EnviroScience was contracted in 2009 by Lakeshore Environmental to stock 59,000 weevils in 6 sites throughout the lake. An additional 20,000 weevils were stocked in 2010 in 2 sites which approximate the 2011 locations of S1 and S5 (see attached map). Due to suction harvesting at S5 after the initial stocking of 15,000 weevils on July 7, EnviroScience, Inc. replaced these weevils at another site on July 14 at no charge to the township.

IV. 2011 Surveys and Weevil Stocking

A total of 35,000 weevils were stocked at 4 sites (S1-S4) on June 29, 2011 and two additional sites (S5-S6) were surveyed. Average weevil population density (Table 1) and the average density of EWM (Table 2) were recorded at each stocking and survey site. In depth results from initial surveys and follow-up surveys (conducted August 18) from each site are provided below. Survey and stocking sites were selected based on a preliminary vegetation survey by LakePro, Inc.

S1
10,000 weevils were stocked at Site 1 in June, 2011. Milfoil was dense and comprised approximately 95% of the plant community at this site. Although none of the EWM in this site was topped out, it appeared to be healthy, with red meristems and green stems. Biologists observed evidence of weevil-induced damage at this site (30% of analyzed stems).

During the follow-up survey, milfoil was sparse and composed only 20% of the plant community. None of the milfoil was topped out. Biologists observed evidence of weevil-induced damage to 30% of analyzed stems.

S2
5,000 weevils were stocked at this site. The EWM was dense, comprising 80% of the plant community. Although none of the EWM in this site was topped out and growing on the surface of the water, it appeared to be healthy, with red meristems and green stems. Biologists observed evidence of weevil-induced damage at this site (13% of analyzed stems).

During the follow-up survey, the milfoil was moderately dense, comprising 40% of the plant community. None of the milfoil was g. Biologists observed evidence of weevil-induced damage at S2 (10% of analyzed stems).

S3
10,000 weevils were stocked at this site. The milfoil was dense and comprised 99% of the plant community. Although none of the EWM in this site was topped out, it appeared to be healthy, although some boat propeller damage was observed. Biologists observed three weevils and evidence of weevil-induced damage to 33% of analyzed stems at this site.

During the follow-up survey at S3, the milfoil was moderate to dense, composing 90% of the plant community. None of the milfoil was growing to the surface of the water. Biologists observed weevil-induced damage to 14% of analyzed stems.

S4
10,000 weevils were stocked at this site. The EWM was dense, comprising 90% of the plant community. Although none of the EWM in this site was topped out, it appeared to be healthy, although some boat damage was observed. Biologists observed evidence of weevil-induced damage at this site (23% of analyzed stems).

During the follow-up survey, the milfoil was moderately dense to dense, comprising 80% of the plant community. None of the milfoil was topped out. Biologists observed evidence of weevil-induced damage at S4 (3% of analyzed stems).

S5
No weevils were stocked at this site. The EWM was dense, comprising 80% of the plant community. Although none of the EWM in this site was topped out, it appeared to be healthy, with red meristems and green stems. Biologists observed evidence of weevil-induced damage at this site (23% of analyzed stems).

During the follow-up survey, the milfoil was dense, comprising 80% of the plant community. None of the milfoil was topped out. Biologists observed evidence of weevil-induced damage at S5 (7% of analyzed stems).

S6
No weevils were stocked at this site. The EWM was dense, comprising 80% of the plant community. Although none of the EWM in this site was topped out, it appeared to be healthy, with red meristems and green stems. Biologists observed evidence of weevil-induced damage at this site (23% of analyzed stems).

During the follow-up survey, the milfoil was dense, comprising 80% of the plant community. None of the milfoil was topped out. Biologists observed evidence of weevil-induced damage at S6 (3% of analyzed stems).

Nine additional plant species were observed in Round Lake during the 2011 surveys: Chara (*Chara spp.*), Clasping-leaf pondweed (*Potamogeton perfoliatus*), Curly-leaf pondweed (*P. crispus*), Eelgrass (*Vallisneria americana*), Elodea (*Elodea canadensis*), Flat-stem pondweed (*P. zosteriformis*), Large-leaf pondweed (*P. amplifolius*), Thread-leaf pondweed (*P. filiformis*), and Sago pondweed (*P. pectinatus*).

V. Discussion

The 2011 follow-up survey confirmed that the augmented weevils are having an effect on the density of the milfoil in the stocking and survey sites. Densities of milfoil have decreased at all survey sites (Table 2) and a decrease in the overall percentage of

milfoil relative to the native plant community has been observed. This change in the composition of the plant community was not observed at the two survey sites where no weevils were stocked. Signs of milfoil suppression as a result of weevil stocking include maintenance of the stems below the lake surface at a non-nuisance level, and open areas within the stocking site where native plant species are able to establish. Over the course of the program, areas of infestation transition into a more natural distribution of native plants, restoring a balanced lake ecology that supports a healthier fishery while improving recreational and aesthetic value.

As indicated in Table 1, damage to the analyzed milfoil samples ranged from 3 to 33%. Although many samples did not contain weevil life stages, their presence is confirmed through this damage unique to a weevil population such as areas where larvae have burrowed down the stem and holes where pupae have emerged. In addition, weevil life stages were observed *in situ* during both surveys. The amount of stem damage and weevil population density is expected to increase over the course of the stocking program and these measurements are best viewed over multiple years to observe long-term trends.

VI. Future Recommendations

Based on survey results in 2011, it is the recommendation of EnviroScience that 30,000 weevils are stocked at S1-S4 in 2012 per the most recent proposal. If these sites no longer require additional weevils at the time of the initial survey, additional stocking sites will be selected based on milfoil conditions and input from consultants at LakePro, Inc. Continued monitoring of the weevil population and milfoil infestation will continue in 2012 to track progress and allow for adjustments in annual management decisions.

Please do not hesitate to contact EnviroScience at (800) 940-4025 or at slomske@enviroscienceinc.com with questions regarding this report.

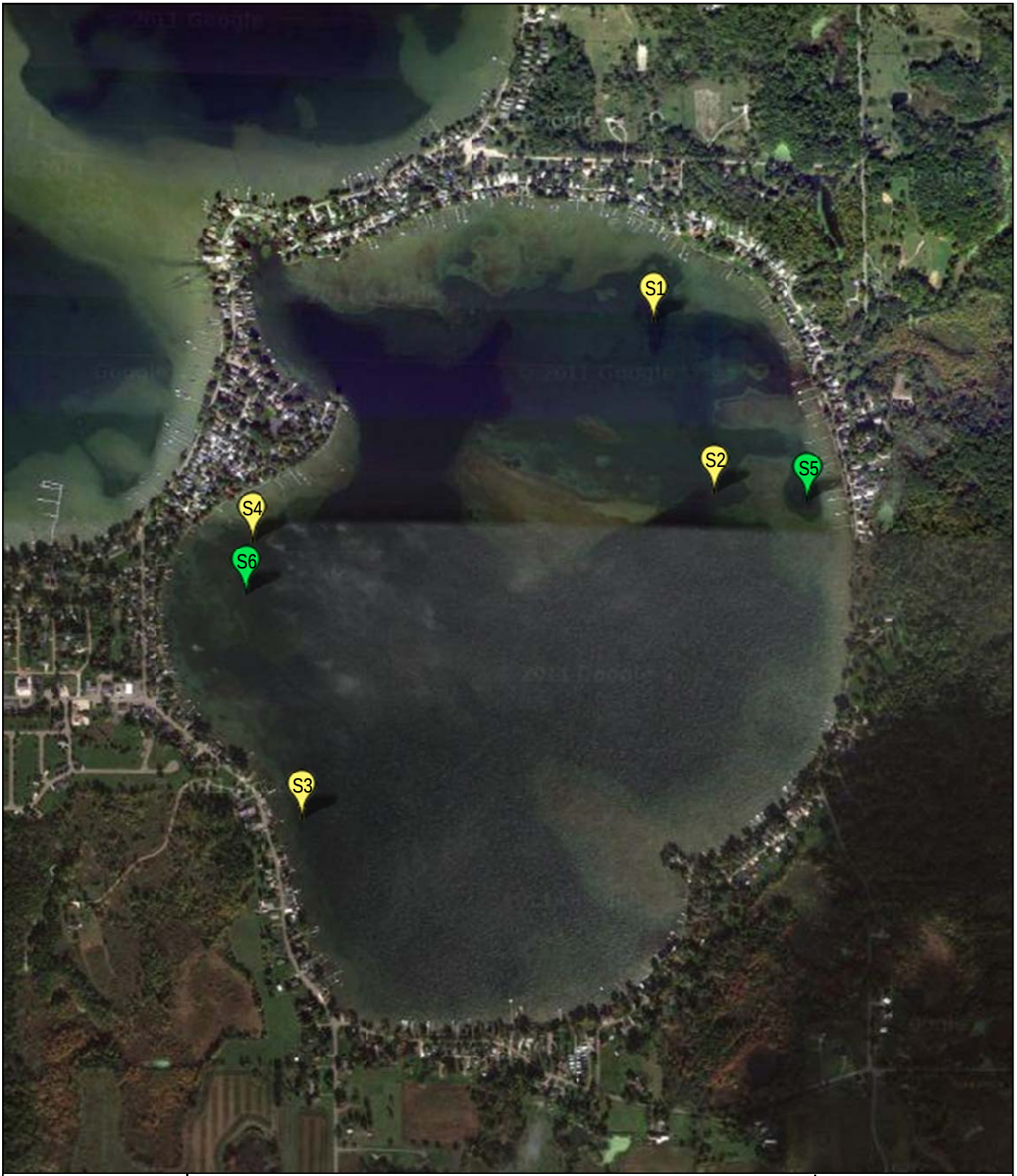
EnviroScience, Inc.
Lake Management Division

Table 1. Average Weevil-Induced Damage and Weevil Population Density in Round Lake

Site	Parameter measured	Initial Survey June 29, 2011	Follow-up Survey August 18, 2011
S1	Percent Stem Damage Total weevils Total stems analyzed	30% 0.00 30.00	30% 0.00 30.00
S2	Percent Stem Damage Total weevils Total stems analyzed	13% 0.00 30.00	10% 0.00 29.00
S3	Percent Stem Damage Total weevils Total stems analyzed	33% **3.00** 30.00	14% 0.00 30.00
S4	Percent Stem Damage Total weevils Total stems analyzed	23% 0.00 30.00	7% 0.00 29.00
S5	Percent Stem Damage Total weevils Total stems analyzed	23% 0.00 30.00	7% 0.00 30.00
S6	Percent Stem Damage Total weevils Total stems analyzed	23% 0.00 30.00	3% 0.00 30.00

Table 2. Average Density of EWM (stems/m^2) in Round Lake

Site	Initial Survey June 29, 2011	Follow-up Survey August 18, 2011
S1	233.3	48.2
S2	255.6	66.7
S3	363.0	100.0
S4	322.2	92.6
S5	148.1	118.5
S6	174.1	85.2



Round Lake
Lenawee County
Michigan

2011 Stocking and Survey Sites
2011 Survey Sites

1000 ft
200 m

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