Milfoil Control Services Report

2014

LES CHENEAUX WATERSHED COUNCIL

Memorandum of Agreement with Clark Twp.

Agreement with Mackinac County

Prepared by

Mark Clymer, Project Manager

January 27, 2015

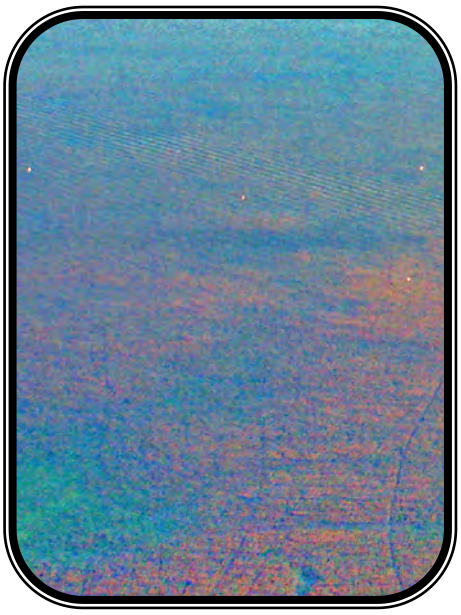


TABLE OF CONTENTS

MILFOIL CONTROL PROJECT SUMMARY

MISSION - WHY (Description of the Problem): Outcome Benefit, Scope, & Significance

Awareness that the Les Cheneaux waters are being adversely affected by the invasive aquatic species Eurasian water milfoil is now widespread. Efforts to control the spread of aquatic nuisance species have been undertaken by the Les Cheneaux Watershed Council since 2006.

This Milfoil Control Project and it's impact are part of a functional and ecosystem level effort in the Les Cheneaux Islands (LCI) watershed to balance native and invasive species by facilitating the natural diversity still present.

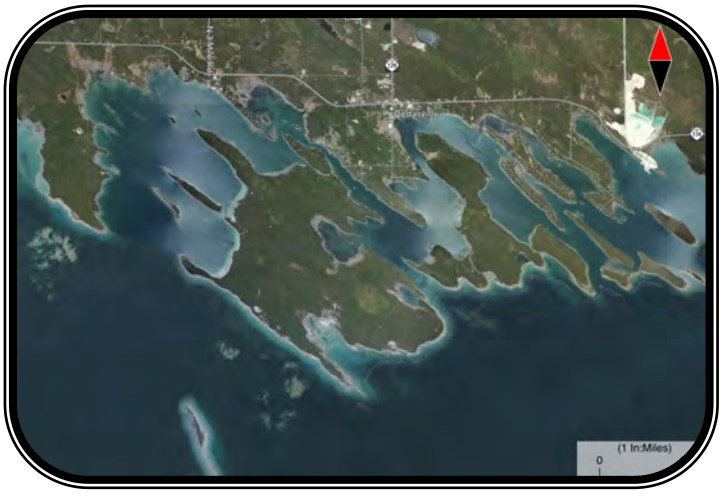
Mechanical control of Milfoil (*Eurasian Watermilfoil/*EWM) growth is part of an comprehensive and strategic weed management approach being implemented by the Les Cheneaux Watershed Council (LCWC) to improve the ecology and the economy of the Les Cheneaux Islands (LCI), through the revitalization of native vegetation and hydrological restoration. This project has also given an opportunity to demonstrate the viability of mechanical control of Aquatic Invasive Species (AIS) in other Great Lakes and inland waters.

The mechanical means utilized include an innovative Dredge/Drag design, in cooperation with MDNR and Islands Wildlife, to study methodologies to uproot Milfoil with in the seven mile Federal Navigation Channel that passes through Sheppard Bay.

Late Season Harvesting is also being utilized and is collecting evidence of weakening Milfoil before energy can be moved to the root system for over-wintering

Results of this project indicate that some Aquatic weeds appear able to compete with Milfoil, and that Milfoil does not appear to be as severe an ecological threat in LCI currently as was witnessed in 2011-2013. This statement does not mean there is no problem, only that under favorable conditions the Pondweed family, Naiad, Chara, and Eel Grass for instance, are able to successfully cohabitate with Milfoil, as demonstrated in the 2014 Aquatic Vegetation Assessment Site (AVAS) survey and a Point Intercept (PI) survey findings. Favorable factors include cooler water temperatures, less available sunlight, and the presence of Milfoil pathogens & predators.

Osprey providing oversight to AVAS Project



Les Cheneaux Islands

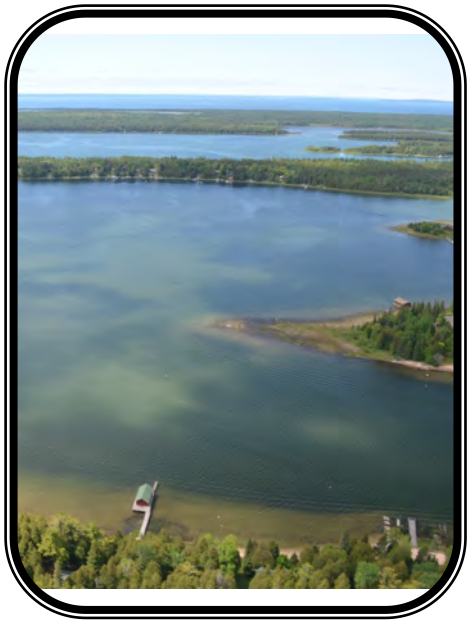
Identifying the causes allows for more effective preventative measures to be taken in EWM control (as with most invasive species), where the adaptive system design produces as much variety in its response options, as the ecosystem being managed may exhibit. Ongoing monitoring of these causal agents and the intervention of systemic adaptive projects will ensure long term viability in multiple aquatic ecosystems. In the northern latitudes of the Great Lakes these EWM causal agents include:

- Sediment composition, degree of compression, disturbance, and permeability
- Climate change, especially as it relates to the amount of available sunlight
- Duration & thickness of winter ice cover, and over-wintering capacity
- Nutrient availability, e.g., from source points (fertilization, sewer discharge, septic leaching), and non-source points (eutrophication, algae blooms, sediment releases)
- Predation, such as aquatic weevils or microbials
- Stressors, such as boat prop cuts, harvester cuttings, or root disruption by dredging
- Water clarity, suspended sediments, currents, and lake seiche

Water column depth & temperature

Project Goals and Objectives have now been met for 2014 and the Les Cheneaux Watershed Council wishes to express their sincere appreciation for the funding provided by the Mackinac County Commissioners grant in 2014. Plans for 2015 are underway, and we will be pursuing these mechanical approaches again, in combination with a microbiological intervention we are developing with the US Dept. of Agriculture (USDA) and the US Army Corps. of Engineers (USACE).

AVAS Crew: "Lake Girls" & Walker

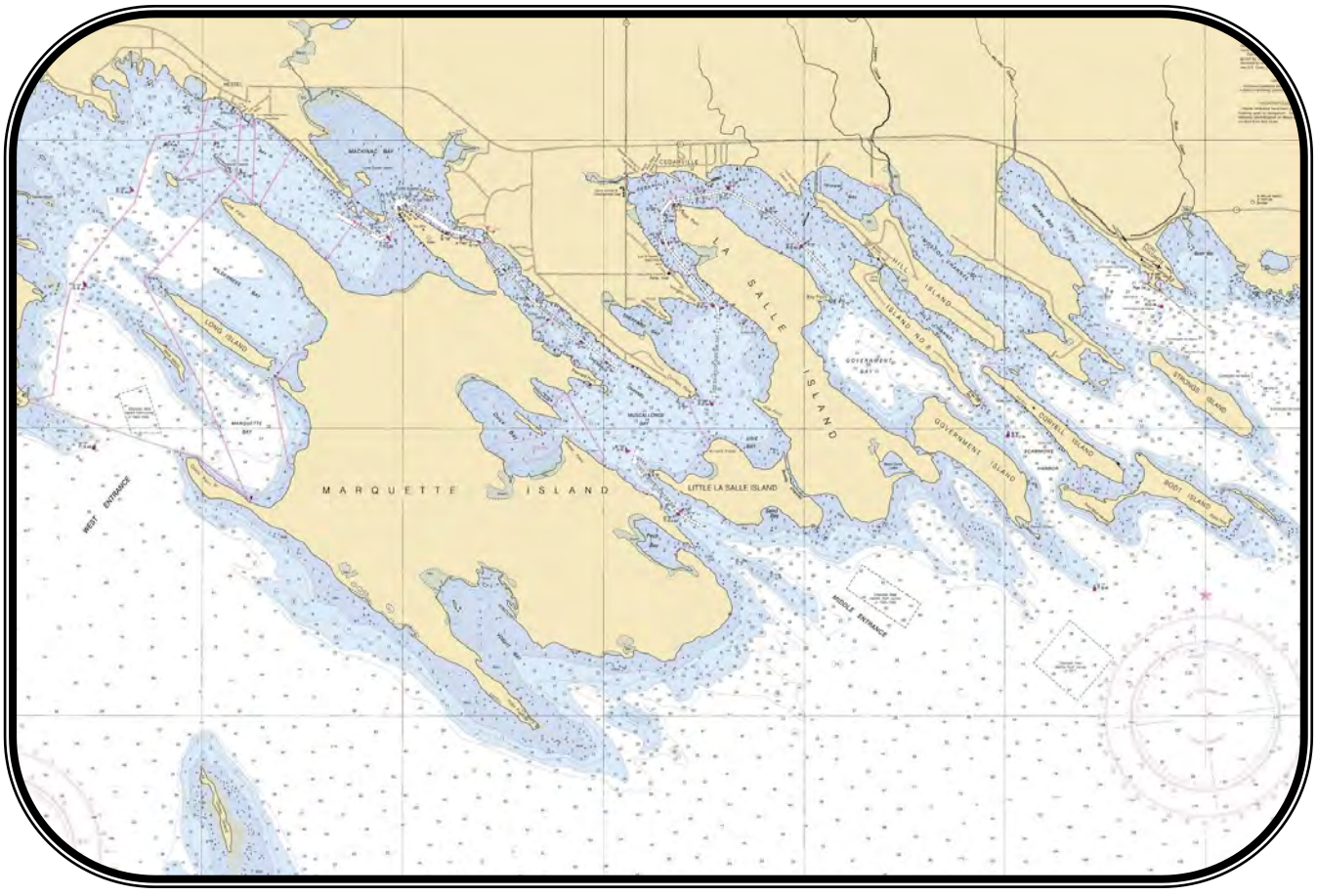


Sheppard Bay (looking southwest)

One of many Ospreys track field work

Companion projects funded locally and being concurrently carried out by LCWC include:

- Annual Water Quality Study Project, in cooperation with Les Cheneaux Islands Association (LCIA) is in it's 13th year
- Beach Raking and Composting Project is an outreach and educational project that is promoting the cleaning up of Milfoil fragments from prop cuts along lake shores
- Benthic Tarping Project is providing shoreline stakeholders with a means to limit Milfoil in near shore areas, beaches, and around docks
- Boat Wash Project is still in the planning stage, as the local boat launches are currently limited in their ability to offer electricity, water delivery, and a way to dispose of Milfoil upland
- Cormorant Depredation Project, in cooperation with Islands Wildlife and LC Sportsman's Club has succeeded in reducing the local invasive cormorant population on five local rookeries
- *Dispose of your Milfoil Divots* is a Project to raise awareness on the impact of prop cuttings
- Microbial Control Agent Project in cooperation with USDA & USACE has completed two years of site tests



Les Cheneaux Islands (Sheppard Bay Project Site - Lat: 45.97931 Long: -84.36195)

Summarize Nature & Extent of Project (Scope of Work - SOW)

GOAL - WHAT (Description of the Solution): Specific & Measurable Outcome

1. Resolve the problem of Milfoil (along with other aquatic nuisance species)

Milfoil is successful in many aquatic plant communities because it out-competes desirable native vegetation and tends to form dense monocultures which may contain several hundred stems per square meter. This is primarily due to its fast growth rate and canopy-forming growth habit, which allows it to shade out more desirable native vegetation. Milfoil does well in a wide variety of sediment conditions, can tolerate low light, and also low temperatures. Dense colonies of the plants and its ability to form thick floating mats interfere with all types of recreation - even to the extent of stopping and incapacitating motors boats with V-8 engines! Clogging water intakes has led to dozens of engine failures locally, and propellers clogged with nuisance vegetation has led to many boaters being left stranded. Dense Milfoil monocultures provide poor fish habitat, cause degraded water quality, and weaken ice cover - which led to the death of one very experienced local resident.

The Les Cheneaux Watershed Council has been exploring a number of ways to meet the challenge of aquatic nuisance species. The use of mechanical means are being applied with biological means in combination as an innovative way to control Milfoil, and this is showing promise in our testing projects.

Within the Federal Navigation Channel, aggressive means can be utilized with both dredging and bottom dragging devices. This disturbs the root system and when applied at the end of the growing season limits the plant's ability to store nourishment for overwintering. Having been fully dredged at least three times along it's full length of seven miles, the ecological value is much less than adjacent weed beds for the local fish populations.

Milfoil infestation from prop cuttings

Milfoil samples collected

Milfoil prop cuts at Weevil planting

2. Demonstrate the potential for Mechanical Harvesting, Dredging, and Bottom Dragging to control Milfoil and restore native plant dominance

The Les Cheneaux Watershed Council (LCWC) has been utilizing a mechanical harvester owned by Flotation Docking Systems for a number of years to keep the Cedarville launch ramp open and with the DEQ permit in hand is now following through with using the harvester to keep both the Federal Navigation Lane and 2 secondary navigation lanes free of Milfoil.

Additional secondary navigation lanes in other Milfoil infested areas have been identified and Milfoil inventoried for future control efforts.

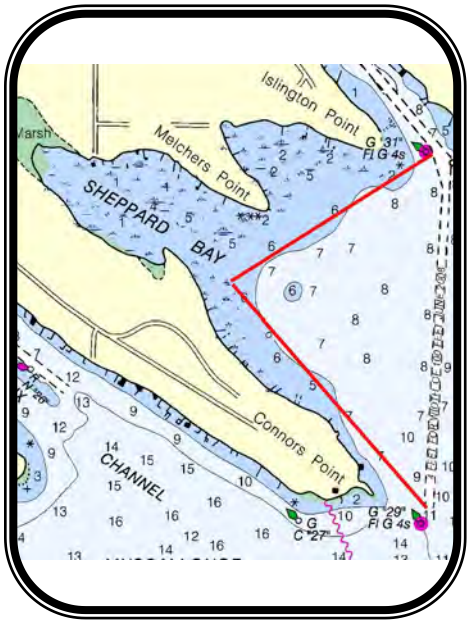
Testing in the fall of 2013 with both the harvester and bottom dragging device was not extensive enough to provide clear performance data, in part due to the limited amount of Milfoil found in the Federal Navigation channel. Further testing of bottom dragging devices was postponed during 2014 due to the even lower incidence of Milfoil within the Federal Navigation Lane from 2013.

The Vegetation Survey conducted in August of 2014 only found Milfoil at 48 of 146 points sampled across Sheppard Bay. Naiad was also found at 48 locations, and collectively the pondweed family had the highest incidence. Sampling points within the Federal Navigation lane indicated some evidence of impact on Milfoil from 2013 dragging tests based on visual amounts and condition of Milfoil plants on the rake tosses. (see right photo below)

(see attached report: *2014 Vegetation Survey and Weevil Population Survey at Les Cheneaux Islands, Lake Huron, Michigan, pages 11-12*)

When attempts were made to inspect during the 2014 season the water was too turbid for underwater cameras to provide compelling evidence. Aerial photography done in both the fall and spring also failed to demonstrate a consistent impact on Milfoil growth from the drag testing.

Milfoil growing near surface



Secondary Navigation Lanes (in red)

Limited Milfoil in Navigation Channel

3. **Develop the most effective combinations of these invasive species control methods**

In order to maintain the pristine character and long term ecologic viability of the of the Les Cheneaux Islands & it's watershed, LCWC takes a "Dynamic Adaptive Management" approach, where resource stewardship policies balance management decisions with the complexity of ecosystem demands. In this way the extremes of hands off "tree-hugging" vs. large scale "silver-bullet" interventions are reconciled.

Identifying the causes allows for more preventative measures to be taken, rather than the reactionary "symptom chasing" too often witnessed when political-science is applied to systemic issues like invasive species. With at least 37 native aquatic plant species identified so far locally, LCI is a long way from requiring the "petri-dish" management techniques applied postmortem in many urban areas.

In addition to the rich local ecosystem diversity, there is also variability across the watershed. Water depths range up to 60 feet, bottom makeup spans from silt to bedrock, and the 200 linear miles of shoreline reach from large limestone rock outcroppings to wetland marshes. There are over 100 waterfront homes that depend on Lake Huron for their potable water

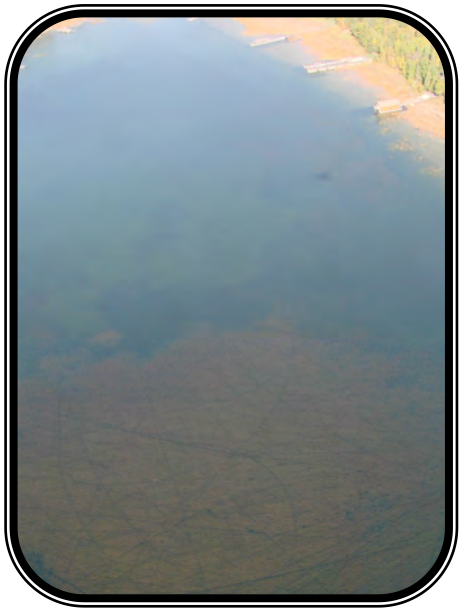
There are a variety of man made stressors from both recreational and commercial usage. Climatic variability, as seen in the 6-1/2 foot water level drop between 1986 & 2012 — and this is on top of the 21" net water level drop from dredging and gravel mining in the St. Clair River between 1852 and 1962, also impacts systemic viability.

In other words, there is not a single management tool that can be applied in every instance, consequently the LCWC has been working with a number of management tools that can be applied in synergistic or additive combinations across the watershed. These intervention tools are continually being optimized for the changing conditions that are faced each season.

In the spring and early summer, of 2014 project surveys were conducted both aerially and on the water to assess impacts from the previous year's efforts, and intervention tools modified accordingly to adjust for the current year's work plan.

Milfoil impacted by Mt application

Harvester at work cutting Milfoil



Aerial of Milfoil bed

Dredge/Drag Project, in cooperation with MDNR, MDEQ, and Islands Wildlife to Uproot Milfoil in the seven mile Federal Navigation Channel through the Les Cheneaux Islands

The Les Cheneaux Watershed Council (LCWC) is currently researching and developing a bottom dredging device that will remove Milfoil, along with dredge material, and collect milfoil for upland composting. This process aims to minimize bottom disturbance to the upper six inches of soil and is initially going to be utilized within the seven mile Federal Navigation Channel, that has been dredged multiple times over the last 100 years. Previous attempts at hand pulling Milfoil have demonstrated that the soil composition is such that merely pulling on plant stems results in breaking them off. This will impact the 85 acres of this channel area now threatened by Milfoil and other aquatic nuisance species.

The USACE undertook a maintenance dredging project in the Les Cheneaux Channels during 2009-10, sponsored in part by the LCWC. The areas dredged within the seven mile Federal Navigation Channel have remained free of Milfoil. The literature indicates dredged areas can remain Milfoil free for five years or longer.

Locally, 2 heavy equipment vehicles have gone through the ice in recent years. Five years afterward, the trail they left after being drug across the bottom through Milfoil beds to shore is still visible from the air and has only slowly repopulated with Milfoil.

Unfortunately, the water level of Lake Huron has declined by approximately two feet since the USACE dredging in 2010, and some areas that met the seven foot depth requirement were not dredged at that time. Sheppard Bay is one such area and the one mile Federal Navigation Channel there was indistinguishable in 2011-12 from the adjacent waters and filled with Eurasian watermilfoil. Boating is hazardous and has resulted in numerous boat engines overheating from clogged water intakes and props becoming entangled. A typical inboard or inboard-outboard will cut and accumulate around 1 cubic yard of Milfoil in the propeller, that then will re-root where ever the Milfoil cuttings are released when reversing or cleared from the propeller. Many boats were immobilized during 2012 and had to be towed into marine repair facilities.

As there is a clear channel to get across Sheppard Bay, and other infested areas, boaters are inadvertently spreading Milfoil cuttings throughout the Les Cheneaux Islands, where they re-root and start new Milfoil beds. The Sheppard Bay stretch of the Federal navigation Channel constitutes the primary focus of this study.

Milfoil Drag Device

Milfoil Drag Device in Tow

LCWC Drag/Dredge Project

LCWC PROJECT NAME

MISSION (Why): This project will remove nuisance weeds from the roots in primary navigation channels, limiting the growth of nuisance weeds and allowing boaters clear passage.

SCORING (1-5): **Priority:** 5 - High **Success Probability:** 3 - Medium

Cost: 2 - Moderate **Time Required:** 3 - Weeks Score (High >11): **13**

GOAL (What): *1. Limit Adverse Impact of Nuisance Aquatic Weeds*

Specific/Measurable Outcome: *Cut Two Secondary Navigation Lanes*

OBJECTIVE (How) : *3. Control/Manage/Restore*

Output Action: *Sub-contract with FDS & schedule harvester to cut 100' wide lanes*

STRATEGY (Project Design):

Budget: $25,000 **Funding Source:** Grant from Mackinac County

When: postponed until 2015 **Duration:** 2 days, weather dependent

Where: 7. Sheppard Bay **Sub-Zone:** north & west of weevil plantings

Who: Jonas Carpenter, LCWC crew, & Islands Wildlife crew **Project Lead:** Lakeside Bob

Partners: Breezeswept, Bob Dunn

Resources: Barge, drag device, GPS

CONTEXT: ☐ **Is this Project dependent on another project?**

☒ **Does this Project require land owner &/or regulatory permission/s?**

Owner/Agency: MDEQ

☒ **Does the Project provide community connections/connectivity?**

☒ **Is this Project visible to the community?**

NOTES: *This project is part of a larger research project on both weakening nuisance plants, and utilizing biological treatments after plants have been weakened by cutting. (Budget figure includes all 2014 Sheppard Bay mechanical control activity)

PROJECT IMPACT: ☒ **Ecosystem/Habitat** ☐**Pollution/Runoff** ☒ **Water Quality**

☒ **Ed./Stewardship** ☒ **Recreation** ☐ **Other:** Enter Impact.

* Extracted Project Form from LCWC's Dynamic Aquatic Adaptive Management Plan

Late Season Harvesting Project is collecting evidence of weakening Milfoil before energy can be moved to the root system for over-wintering

A Milfoil harvester was acquired by Flotation Docking Systems a few years ago, with encouragement from LCWC, and is available to harvest Milfoil from the seven and one half miles of local secondary navigation lanes to provide access for boaters and fish to go through Milfoil beds.

A critical annual stage for Milfoil is the shift of moving energy to the meristem for flowering, followed by shifting energies to the stem and root system for winter survival. Late season cutting weakens Milfoil at this critical juncture, and many of these still rooted stems will fall. "Pruning" earlier in the season can give Milfoil a chance to regrow if these cuttings are not collected and composted or disposed of at an upland location. This mechanical approach will leave weevils planted in 2011-12 undisturbed.

Benthic Tarping Project is providing shoreline stakeholders with a means to limit Milfoil in near shore areas, beaches, and around docks

Bottom barriers are sheets of synthetic material, anchored to the bottom in shallow areas to obstruct sunlight, which controls the growth of aquatic plants. The concept is comparable to using landscape fabric to control weed growth around ornamental bushes and plants in residential yards. Bottom-barrier treatments are intended for small areas, and are most commonly installed in high use areas such as near beaches, docks, and boat ramps.

These barriers can also be installed to create edge habitat for fish such as perch, pike, & bass, and may increase angler success. There is a variety of bottom barrier or screen products available that aim to suppress aquatic plant growth by reducing or blocking light. Ideally, bottom barriers should be heavier than water but porous enough to allow gas bubbles produced by bottom sediments and decomposing plant material to pass through the barrier without ballooning the material off the bottom. Geotextile fabric products are superior to burlap or plastic sheet liners as they are rot-, tear-, and puncture-resistant, but not always permeable enough to allow gas evacuation, which can lead to ballooning.

LCWC is initiated a testing program in 2012 with the help of the Higgins Lake Association, followed by an educational program on Benthic Tarping in 2014, and Benthic Tarps bare now available to local shoreline residents and stakeholders.

Milfoil Harvester in Action, cutting & collecting

Milfoil Harvest Project in front of Boathouse

LCWC Harvester Project

LCWC PROJECT NAME

MISSION (Why): *This project will remove nuisance weeds from the path of boaters, limiting the spread of nuisance weeds, allowing boaters greater access to their cottages & recreational pursuits.*

SCORING (1-5): **Priority:** 3 - Medium **Success Probability:** 5 - High

Cost: 2 - Moderate **Time Required:** 3 - Weeks **Score** (>10): **13**

GOAL (What): *1. Limit Adverse Impact of Nuisance Aquatic Weeds*

Specific/Measurable Outcome: *Cut Two Secondary Navigation Lanes*

OBJECTIVE (How) : *3. Control/Manage/Restore*

Output Action: *Sub-contract with FDS & schedule harvester to cut 100' wide lanes*

STRATEGY (Project Design):

Budget: $25,000 **Funding Source:** Grant from Mackinac County

When: 6/23/2014 8/9/2014 **Duration:** 2 days, weather dependent

Where: 7. Sheppard Bay **Sub-Zone:** north & west of weevil plantings

Who: Boat Captain **Project Lead:** Lakeside Bob

Partners: FDS, Joni Burger

Resources: harvester, GPS, buoys

CONTEXT: ☐ **Is this Project dependent on another project?**

☒ **Does this Project require land owner &/or regulatory permission/s?**

Owner/Agency: MDEQ

☒ **Does the Project provide community connections/connectivity?**

☒ **Is this Project visible to the community?**

NOTES: *This project is part of a larger research project on both weakening nuisance plants, and utilizing biological treatments after plants have been weakened by cutting. (Budget figure includes all 2014 Sheppard Bay mechanical control activity)

PROJECT IMPACT: ☒ **Ecosystem/Habitat** ☐**Pollution/Runoff** ☒ **Water Quality**

☒ **Ed./Stewardship** ☒ **Recreation** ☐ **Other:** Enter Impact.

* Extracted Project Form from LCWC's Dynamic Aquatic Adaptive Management Plan

LCWC Benthic Tarping Project

LCWC PROJECT NAME

MISSION (Why): This project will stop nuisance weeds from growing in shallow littoral areas, limiting the spread of nuisance weeds and allowing greater recreational opportunities. The goal is to have residents purchase benthic tarps from a link on our website, and the supplier will then make donations on a per purchase basis to LCWC.

SCORING (1-5): Priority: 5 - High **Success Probability:** 5 - High

Cost: 3 - Bargain **Time Required:** 3 - Weeks Score (High >11): **16**

GOAL (What): *1. Limit Adverse Impact of Nuisance Aquatic Weeds*

Specific/Measurable Outcome: *Make Benthic Tarps Available to Residents*

OBJECTIVE (How) : *3. Control/Manage/Restore*

Output Action: *Contract with Lake Bottom Blanket & inventory benthic tarps*

STRATEGY (Project Design):

Budget: $0 **Funding Source:** private purchases

When: 65/1/2014 9/30/2014 **Duration:** 30-45 days

Where: 0. Entire LC Watershed **Sub-Zone:** near shore areas

Who: Mark Clymer **Project Lead:** Lakeside Bob

Partners: Benthic Tarp wholesalers

Resources: website links

CONTEXT: ☐ **Is this Project dependent on another project?**

☒ **Does this Project require land owner &/or regulatory permission/s?**

Owner/Agency: MDEQ

☒ **Does the Project provide community connections/connectivity?**

☒ **Is this Project visible to the community?**

NOTES: *This project is part of a larger research project on both weakening nuisance plants, and utilizing biological treatments after plants have been weakened by cutting.

PROJECT IMPACT: ☒ **Ecosystem/Habitat** ☐**Pollution/Runoff** ☒ **Water Quality**

☒ **Ed./Stewardship** ☒ **Recreation** ☐ **Other:** Enter Impact.

* Extracted Project Form from LCWC's Dynamic Aquatic Adaptive Management Plan

LCWC Microbiological Project

The Les Cheneaux Watershed Council is an ongoing partner with USDA in piloting the cold climate use of *Mycoleptodiscus terrestris* (Mt) in Milfoil (Eurasian watermilfoil - EWM) & Hydrilla control as a safe, eco-friendly, and viable bioherbicide. Two seasons of northern Lake Huron field tests on EWM have demonstrated both proof of concept and the efficacy of our application system within predicted timeline & budget.

LCWC is working to continue the Mt innovation chain and develop a fermentation and application capacity capable of treating up to 200 acres of EWM infestation, along with leveraging other management alternatives, as appropriate to each chosen lake system.

The efforts of the Les Cheneaux Watershed's collaborative research team of accomplished scientists to recognize & control Aquatic Invasive Species (AIS), along with outreach & education activities, have received broad based community & political support. This AIS project compliments State & Federal AIS plans, along with other research projects we are cooperating & assisting with, such as the DNR & MTU's 2013 GLRI funded EWM Grants.

In the case of Mt as a bioherbicide for EWM control, the demonstrated efficacy rate of a 77% reduction in EWM biomass during our 2014 field testing is more than sufficient to allow native plants to compete, recover, and re-establish within the water column. This has been seen in our test sites within the Les Cheneaux Islands, in both Aquatic Vegetation Assessment Site (AVAS) and Point Intercept (PI) surveys during 2013 and 2014.

> "despite the resources that have been dedicated to traditional weed control, particularly chemical herbicides, weeds continue to thrive and adapt…"
> (*Strategies for Advancing Bioherbicides,* Susan M. Boyetchko)

> "However, over-reliance on chemical methods may lead to weed resistance to herbicides, weed population shifts, and can result in off-target movement of herbicides and subsequent impacts to non-target organisms. … The ability of plant communities to shift in response to control practices suggests the need to develop more diverse weed management strategies for future use."
> (Nelson and Shearer, *2,4-D and Mycoleptodiscus terrestris for Control of Eurasian Watermilfoil,* J. Aquatic Plant Management 43: 29-34, 2005)

Mt application in Sheppard Bay 2014

Mt application in Sheppard Bay 2014 (enhanced)

LCWC Microbiological Project

LCWC PROJECT NAME

MISSION (Why): This project will test the efficacy of a microbiological control agent on Eurasian water-milfoil - Mt (Myriophyllum spicatum) .

SCORING (1-5): **Priority:** 5 - High **Success Probability:** 5 - High

Cost: 2 - Moderate **Time Required:** 3 - Weeks Score (High >11): **15**

GOAL (What): *1. Limit Adverse Impact of Nuisance Aquatic Weeds*

Specific/Measurable Outcome: *Field Test Mt in 150 acres of Sheppard Bay*

OBJECTIVE (How) : *3. Control/Manage/Restore*

Output Action: *Obtain Mt from USDA & apply using LCWC technology*

STRATEGY (Project Design):

Budget: $153,000 **Funding Source:** MISGP Grant

When: 7/7/2015 9/30/2016 **Duration:** 2 days, weather dependent

Where: 7. Sheppard Bay **Sub-Zone:** north end of bay

Who: Bob & LCWC Crew **Project Lead:** Lakeside Bob

Partners: USDA, USACE

Resources: Mt from USDA, GPS, buoys, boat, sprayer

CONTEXT: ☐ **Is this Project dependent on another project?**

☒ **Does this Project require land owner &/or regulatory permission/s?**

Owner/Agency: MDEQ

☒ **Does the Project provide community connections/connectivity?**

☒ **Is this Project visible to the community?**

NOTES: *This project is part of a larger research project on both weakening nuisance plants, and utilizing biological treatments after plants have been weakened by cutting. (Budget figure includes all 2015-6 Sheppard Bay biological control activity)

PROJECT IMPACT: ☒ **Ecosystem/Habitat** ☐**Pollution/Runoff** ☒ **Water Quality**

☒ **Ed./Stewardship** ☒ **Recreation** ☐ **Other:** Enter Impact.

* Extracted Project Form from LCWC's Dynamic Aquatic Adaptive Management Plan

4. Conduct surveys to assess invasive species infestation & spread

A vegetation survey was conducted throughout Sheppard Bay of the Les Cheneaux Chain of Islands (LCI) from August 11-13, 2014 (see attached: *2014 Vegetation Survey and Weevil Population Survey at Les Cheneaux Islands, Lake Huron, Michigan*). Two vegetation survey methods were implemented throughout these twenty-four areas: an Aquatic Vegetation Assessment Site (AVAS) survey and a Point Intercept (PI) survey.

The purpose of this survey was to compile an inventory of all aquatic vegetation species, identify locations of Milfoil (Eurasian watermilfoil/*Myriophyllum spicatum*) infestation, and identify additional invasive/nuisance species to provide a baseline for future management practices. A milfoil weevil (*Euhrychiopsis lecontei*) population survey was also conducted to document the extent to which the weevils have controlled the Milfoil in the Sheppard Bay project area.

A total of 33 species were identified in all survey areas in 2014. Milfoil infestation was found to be less extensive than in 2013. Milfoil distribution maps and plant species tables are included in the Enviroscience report cited above.

Overall, there was an increase in lower growing vegetation such as Robins Pondweed across the entire bay, with a few areas that were devoid of vegetation.

Point Intercept Survey

A point intercept survey was implemented at 146 points in Sheppard's Bay in 2014. In total, 19 species were observed in 2014 which was down from 21 species observed in 2013. Milfoil was present at 48% of the sites with varying densities, however the majority of which consisted of <3% cover. While none of the points consisted of dense milfoil growth, moderate and sparse growth were both observed at 4% of the sites respectively. Pondweeds as a combined group had the highest occurrence across sites followed by Milfoil, naiad (48%), eelgrass (45%) and macroalgae (43%). All other species were present at 3% of the sites or less.

Rake with Robbins Pondweed

Milfoil in rake

Milfoil Rake with minimal vegetation

5. Reduce perch habitat impacts from invasive species and restore Perch spawning grounds

By reducing the biomass and range of Milfoil utilizing mechanical means, in conjunction with previous & ongoing synergistic measures, this project is designed to create a mix of open areas, less aquatic vegetative density, and an increase in native plant diversity in an area once dominated by Milfoil.

Starting with a trophic state that has been classified by limnologists as excellent, with only limited potential of nutrients to support algal or plankton biomass, has made the introduction of Eurasian watermilfoil (Milfoil) a very visible invasive species in the Les Cheneaux Islands (LCI).

During the 2014 summer season, local native submerged plant species were able to compete more affectively. Perch data from MDNR Fisheries will not be presented until April, 2015, but early indications are that 2014 produced a very good year class of perch and other local fish species.

The Les Cheneaux Watershed Council (LCWC) is also participating in the US Fish and Wildlife Double -Crested Cormorant Control Program in the Les Cheneaux Islands. This program has been instrumental in several recent successful spawning years for Yellow Perch (*Perca flavescens*) and a rebound in recreational sport fishing. Cormorant populations have now stabilized at US Fish & Wildlife Service targeted levels. Large flocks of these non-native birds, of often over 1000 birds, once disrupted the spring spawning cycle of Yellow Perch, and resulted poor year classes from 1985 through 2000. They also each consume an average of 2.2 pounds of fish per day, reducing the biomass of the local fishery by many tons in each of those years.

Fish spawning within these bays is adversely affected and is resulting in reduced year classes. In the case of Yellow Perch (*Perca flavescens*), their eggs must be loosely suspended off the bottom and available for male spawning to fertilize them. With the density of Milfoil approaching 200 stems/meter (Enviroscience, 2012 Progress Report), the fish can barley swim, and are often unable to reach their historic spawning beds, and if accessed, have a poor chance of completing an effective reproduction cycle.

Predators now feast on fish again

Eagle nest on shoreline

Immature Bald Eagle watching AVAS

6. Public Outreach and Education

A public forum was held in May though which the Les Cheneaux Watershed Council (LCWC) demonstrated that a more concerted effort is required to protect our waterways resource. During the course of that meeting there was interest expressed in sending a survey out to the entire community to get feedback on both the importance and methods that the community felt should be used in managing Eurasian water milfoil.

Survey results conducted in 2013 indicated a continuing strong interest both in maintaining the pristine nature of the Les Cheneaux islands and limiting the impact of nuisance aquatic species, such as Milfoil.

Outreach events were created to share project activities, such as taking our DEQ Director, Senate & Congressional Representatives, and their staff members to visit project sites in July by boat.

Milfoil display booths were setup and provided information on the project at public meetings, Annual FrogFest event, and the Antique Wooden Boat Show.

Presentations have been created and brought to local organizations such as Islands Wildlife, Les Cheneaux Community Foundation, Les Cheneaux Islands Association, and the Les Cheneaux Lions Club. A Power Point presentation is available for showing to interested groups and governmental entities.

Public meetings have also been held with the Clark Township Board with Power Point Presentations, that were often followed by in depth discussions.

Newspaper articles on the LCWC projects regularly appear in the St. Ignace News and other media outlets. A video on lake levels is being finalized and will be released soon with the support of the local Les Cheneaux Community Foundation and Restore Our Water, Int'l.

Lion's Club Presentation on Milfoil, March 2013

Community Forum on Milfoil, May 2013

2014 Vegetation Survey and Weevil Population Survey at Les Cheneaux Islands, Lake Huron, Michigan

Prepared for:

The Les Cheneaux Watershed Council

Prepared by:

EnviroScience
Excellence In Any Environment

5070 Stow Rd.
Stow, OH 44224
800-940-4025
www.EnviroScienceInc.com

Project No. 978-4145

Date: December 22, 2014

1.0 Introduction

At the request of the Les Cheneaux Watershed Council (LCWC), a vegetation survey was conducted throughout Sheppard Bay of the Les Cheneaux Chain of Islands (LCI) from August 11 to 13, 2014 . The purpose of this survey was to compile an inventory of all submersed aquatic vegetation species, identify locations of Eurasian watermilfoil (*Myriophyllum spicatum*) (EWM) infestation, and identify additional invasive/nuisance species to provide a baseline for future management practices. A survey of the secondary navigation lanes, where harvesting is being utilized was also done (see satellite photo on next page). A milfoil weevil (*Euhrychiopsis lecontei*) population survey was also conducted in to document the extent to which the weevils planted in Sheppard Bay have controlled the EWM.

2.0 Methods

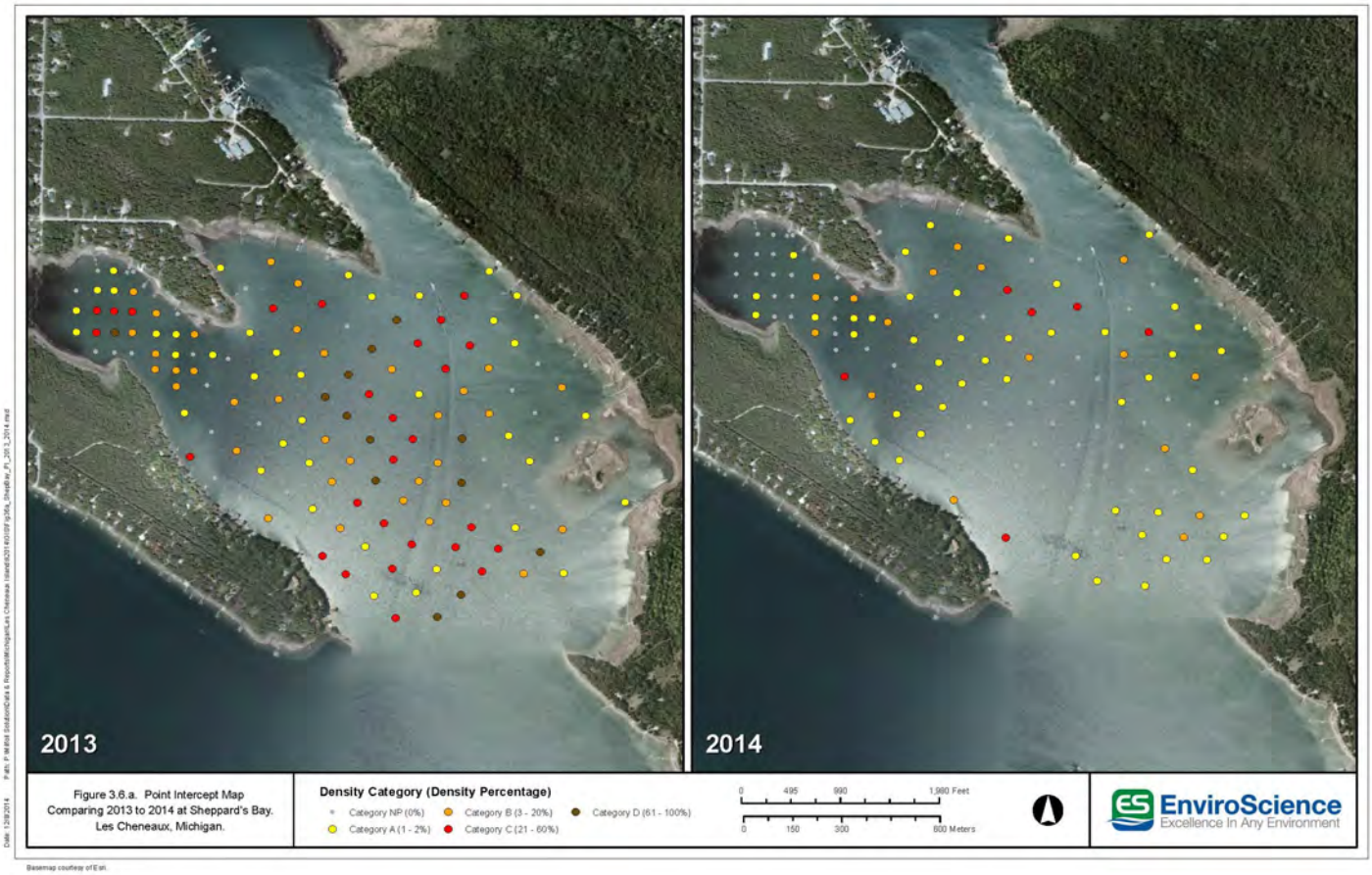
Two vegetation survey methods were implemented throughout: an Aquatic Vegetation Assessment Site (AVAS) survey and a Point Intercept (PI) survey. A follow-up survey to the Milfoil Solution® program to evaluate the milfoil weevil was conducted following protocols established by EnviroScience.

2.1 Aquatic Vegetation Assessment Sites (AVAS) Survey Method

Qualitative vegetation sampling was performed using the Michigan DEQ guidance contained in Standard Procedures for Surveying Aquatic Plants. Survey areas were selected based on input from the LCWC and EnviroScience biologists. The boundary of each AVAS was determined using differential GPS technology. Plant community data were collected through visual and rake tow surveys along evenly-spaced transects of the littoral zone. In each of these transect zones, the presence and relative density of each aquatic plant species were determined and the information was recorded on the Standard Aquatic Vegetation Assessment Site Species Density Sheet developed by the State of Michigan. Visual and rake surveys were performed at each site until no new species were encountered and the biologists conducting the survey were confident that adequate information had been obtained to estimate the density of each species encountered. Species of unknown identity were placed in a sample bag, appropriately labeled, and identified using taxonomic keys at the completion of the survey. The approximate percentage of cumulative cover (%CC) was reported as cover codes A, B, C, and D to describe the approximate coverage of each plant between each transect and within each AVAS. If there is no color then simply there was no milfoil (see satellite photo on next page).

2.2 Point Intercept Survey Methods

A Point Intercept Survey (PI) was conducted in Sheppard's Bay (SHP) following methods outlined in Point Intercept and Line Intercept Methods for Aquatic Plant Management (Madsen, 1999). This survey method was chosen based on the relatively shallow depths and larger areas of the bay. A grid of evenly-spaced Point Intercepts was created using GPS technology and the surveyors navigated to each point along the grid. At each PI location, the presence and relative density of each aquatic plant species was determined by a single rake tow. Once the rake was retrieved from a point, each species found on the rake was identified and assigned a density code for rake cover similar to the AVAS method. As stated above, the density of EWM is represented in the maps for this particular survey. Species of questionable identity were identified at the completion of the survey.



Sheppard Bay Milfoil Density

Cover Code and Map Color	Percent Cumulative Cover (%CC) Range
A	1-2%
B	3-20%
C	21-60%
D	61-100%

Color coding for Milfoil Density

Table 3.6.a: Comparison of Species Occurrence

Common Name	2013 Percent of Points (146)	2014 Percent of Points (146)
Naiad	41	48
Eurasian watermilfoil	**79**	**48**
Eelgrass	48	45
Chara	50	31
Clasping-leaf pondweed	24	30
Illinois pondweed	7	14
Nitella	1	10
Robbins'/Fern pondweed	7	9
Variable pondweed	12	9

Color coding for Milfoil Density

Secondary Navigation Lanes

Table 3.6.d: Percent Cumulative Cover of Species' Groups in Sheppard's Bay AVAS

Species (grouped)	CC%
Naiad	16.45
Pondweeds	10.81
Macroalgae	9.19
Eelgrass	6.18
Eurasian watermilfoil	**2.64**
Elodea	0.36
Northern watermilfoil	0.27

Milfoil ranked 5th in Aquatic Plant Cover

ble 3.6.b: Occurrence of Species' Groups at PI Sites at Sheppard's Bay in 2

Common Name (Grouped)	Total Occurrence	Percent of Points (146)
Pondweeds	114	78
Macroalgae	100	68
Eelgrass	97	66
Eurasian watermilfoil	**65**	**45**
Naiad	57	39
Native milfoils	27	18
Elodea	22	15
Marigold	7	5
Coontail	3	2
Water lobelia	1	<1

Milfoil ranked 4th in Aquatic Plant Occurrences

SIGNIFICANT EVENTS AND EXPERIENCES

The *Milfoil Control Project* sponsored by Mackinac County has marked a very significant milestone in the Les Cheneaux Watershed Council's (LCWC) history. Among the Project's many positive impacts, the opportunity for a small rural Township to leverage community resources with local, state, and federal agencies in a systemic *and* successful undertaking is very noteworthy.

Data gathered from the project continues to produce new insights and will be utilized to updating the LCWC's *Dynamic Aquatic Adaptive Management Plan*. Future Watershed management efforts will certainly rely on project data sets, aerial photos, and a new comprehension of ecosystem viability and stressors. One example is the Dredge/Drag Project. Two of the photographs at the bottom of this page are aerial shots taken prior to the Project that captured the impact of dragging heavy equipment along the bottom after having fallen through the ice. In both of these examples, at least five years has elapsed and the adjacent Milfoil beds have not succeeded in re-infesting these tracks where the bottom was disturbed and compacted.

The photo at the left on the bottom of this page shows one of the samples collected in the Sheppard Bay Project site in 2012 after an unknown person or persons applied a chemical to the Milfoil bed from shore. Very few dead plants were found, but the chemical burns on the plants observed in the Milfoil bed worsened close to shore and extended at least half way across the bay, on a diminishing capacity. As this type under-application of petrochemicals (probably the herbicide 2-4D) in an unauthorized and unpermitted application commonly triggers hybridization in Milfoil, samples were sent in for genetic testing.

Although genetic tests did not show signs of hybridization, the thousands of Milfoil plants witnessed by the Project field team and characterized by this photograph, clearly show the plants were only "inconvenienced" by this vigilante applicator.

Milfoil with Chemical Burns

Sheppard Bay Equipment Drag Trail

Cedarville Bay Equipment Drag Trail

CONCLUSIONS

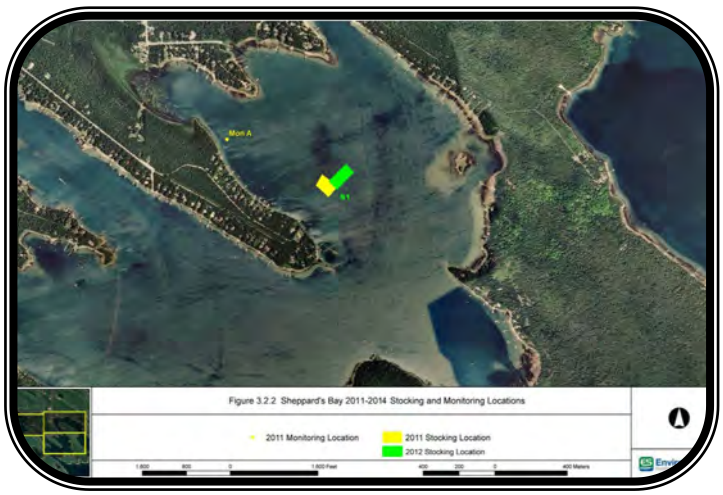
Native aquatic plants may be able to compete with Eurasian watermilfoil in LCI under favorable environmental conditions, and the presence of Milfoil Weevils is advantageous .

The perception of how an invasive aquatic weed such as Eurasian watermilfoil (Myriophyllum spicatum or Milfoil) impacts submerged aquatic weeds in LCI has changed since the intense, aggressive growth experienced in 2011-12. Data from 2014 and past records suggest that temperature is a primary factor in the ability of native aquatic plants to compete with Milfoil in a given season. That is to say, an early, warm spring will enable Milfoil to out-compete native plants whereas a longer, cool spring favors native plants being able to compete with Milfoil. Water level is important too, in that higher water decreases the amount of light available to plants and, therefore, growth of all plants is slower.

Based upon the aggressive Milfoil growth experienced in 2011-12 the expectation of many was that Milfoil density could be as bad, if not worse, in 2014. Such was not the case. The 2014 sampling shows that the Pondweeds, Microalgae, and Eelgrass were significantly more common than Milfoil, suggesting that under the cooler conditions experienced in 2014 the native plants of LCI were able to compete with Milfoil growth. A generalization here is that some native aquatic plants appear able to compete with Milfoil in a given season, and that Milfoil is less of an ecological threat than was suggested by some in past seasons. The water level was higher and water temperature cooler in 2014 than in 2013.

Data from 2014 suggest that the Milfoil growth pattern experienced in hundreds of inland lakes may not apply to the waters of LCI that are more of an open flow than the restricted, contained waters of inland lakes.

The most notable change observed is the collapse of the Milfoil bed observed at S1 in Sheppard's Bay which led to the inability to survey the site due to a lack of Milfoil. Only a handful of stems were observed at the site and consisted of blackened and dying back Milfoil. This collapse follows drastic changes observed between the 2012 and 2013 survey also.



Weevil Socking Site in Sheppard Bay

Low Milfoil Density

RECOMMENDATIONS (From Enviroscience)

As observed in 2013, the Les Cheneaux Islands contain a very diverse aquatic plant community. In total 29 beneficial native species and three invasives were observed in the 2014 survey. Throughout both Point Intercept Surveys and AVAS Surveys performed at LCI, the most noticeable difference was the decrease in the overall amount of EWM. This overall decrease in EWM presence observed in 2014 is very promising, especially since increases in EWM occurred in 2011 and 2012. Most notably is the complete collapse of dense EWM throughout the center of Sheppard's Bay between 2013 and 2014 within the immediate location of the stocking sites, S1. In addition, the majority of the points surveyed throughout 2014 consist of 2% EWM cover or less with only one point observed over 60% cover.

Along with this decrease in EWM, species composition throughout all sites surveyed appeared to be very diverse, rather than one dominant species being observed. Diversity of species and species composition is an important component to successful competition with invasives such as EWM. As discussed in the 2013 report, a healthy and diverse native aquatic plant community provides essential habitat structure for fish and other organisms. These plants provide cover, foraging and spawning habitat and is an essential part of a healthy aquatic food web. In addition, native aquatic plants can influence healthy nutrient cycling, stabilize banks, oxygenate water and can compete with aggressive invasive species such as EWM. In addition to EWM, other invasive aquatic plant species observed included narrow-leafed cattail and curly-leaf pondweed.

Several invasive species such as *Phragmites*, reed canary grass and purple loosestrife were also observed in 2013 but not observed in 2014. This does not mean they were not present, however these emergent species were not sampled in our point intercepts and AVAS surveys. Continued monitoring would be recommended to ensure these species do not become an issue.

Overall, the results of the 2014 Point Intercept & AVAS surveys are very promising. In addition to noticeable decreases in EWM dominance, LCI continues to have a very diverse and vibrant native plant community. These diverse communities allow the opportunity for native species to compete for space and dominance with invasive species that create a nuisance. Continued management strategies should take into account the preservation of desirable and sensitive species as well as overall ecosystem health while focusing on control of nuisance Species

While EWM has been spreading rapidly throughout the LCI Watershed for more than 20 years, 2014 gave some reprise from nuisance populations of this invader. Although the results of this survey are positive, continued monitoring is the best approach to dealing with nuisance species. Our current recommendation for LCI is to continue monitoring the aquatic plant community to strategically prepare future management decisions.

Sheppard Bay aerial

Sheppard Bay aerial

RECOMMENDATIONS (From the Project Manager)

Milfoil management is a complex problem that will not be solved by following a single established routine solution. 50 plus years of attempts to control milfoil infestations across the country have clearly demonstrated this. Continuing to accomplish future successes may require *innovation* on the scale of a Thomas Edison (who happened to visit LCI a few times as a guest of Frank Seiberling on Long Island), rather than the *institutional* "way we've always done it" robotic approach of an R2D2.

Developing a broader approach, while maintaining our strategic focus on long term viable solutions, is going to require regular review and updating of the LCWC's *Dynamic Aquatic Adaptive Management Plan* that encompasses preventative, along with both known and presently unknown milfoil control alternatives. This methodology will concurrently set the stage for both public and private funding opportunities.

Milfoil management is going to require us to discover and integrate new control methods using the best science available. Depending on funding availability, we may be challenged to prioritize certain high value areas or focus on "winnable battles" at these priority sites, such as Sheppard Bay. In addition to the current partners we have utilized, the next phase now includes collaboration with USDA & USACE to discover and implement an innovative microbial solution - Mt, we are currently testing.

One common denominator among all plants is the need for a rich source of nutrients. Fewer available nutrients will yield slower plant growth. It is, therefore, strongly suggested that nutrient limitation be included in our area-wide weed management plans. It is also obvious that nuisance weed management plans need to address plants other than milfoil.

Continuing to carry out annual AVAS and PI surveys, and perhaps even more detailed monitoring, will be of unquestionable importance. From this ongoing work data models can be created and simulations run to test new opportunities as they unfold in near real time.

The 1st line of defense, and most viable critical path in our management approach, Prevention, has already passed us by in many ways. The option to "quarantine" infected areas and eliminate pathways of spread is going to be very difficult to carry out, as boat traffic through infested areas would have to be re-routed both day and night. Addressing entry points by installing boat cleaning stations and educating both boaters and shoreline property owners on how to properly "*Dispose of your Milfoil Divots"* is crucial to minimizing additional Milfoil introductions, as boat propellers are now the single biggest cause of milfoil spreading, and far outweigh lost fragments from the local harvester.

The 2nd line of defense of Early Detection and Rapid Response was instituted in 2007 with our first Weevil plantings, and followed up in 2011 & 2012 with additional plantings provided by a EPA/GLRI grant. We need to continue monitoring these sites in future years for signs of measurable success, both in weevil density and the balance of aquatic plant species present.

We are now primarily focused on the 3rd line of defense, Control, Management, and Restoration. Benthic tarps are now available through LCWC for shoreline property owners to purchase and utilize. The permit process is underway to extend the permit we now have for Sheppard Bay across Les Cheneaux water for harvesting other secondary navigation lanes. Research is now being carried out to further develop our mechanical control practices, and we plan to implement both field testing and ongoing control methods in the spring of 2015.