

## INTRODUCTION

The Three Lakes Chain is a flowage covering over 6,100 acres and 23 waterbodies in north-eastern Oneida County, Wisconsin (Figure 1). The chain is partially retained by the Burnt Rollways dam at the northernmost end of Long Lake. Currently, the Three Lakes Waterfront Association (TLWA) along with partners the Town of Three Lakes, Oneida County, and Wisconsin Department of Natural Resources (WDNR) are pursuing a comprehensive management plan study which aims to complete ecological studies and management plans on all chain lakes over a time span of 2009-2017.

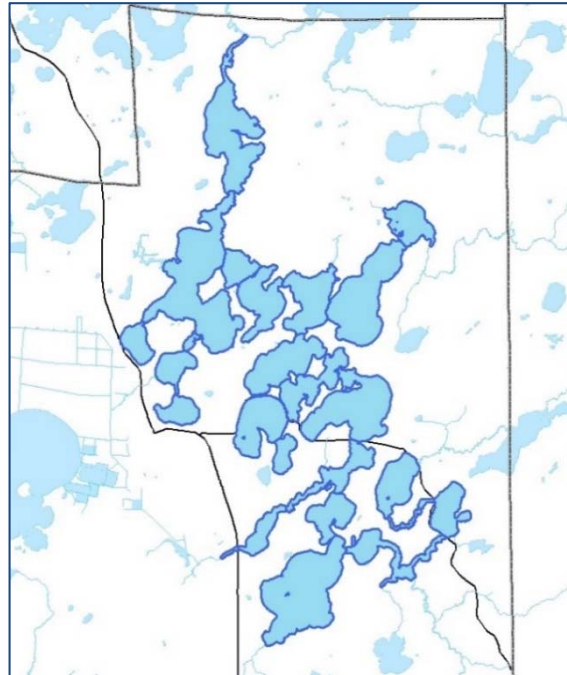
Before and during this planning process, Eurasian water-milfoil (EWM) was discovered on several Three Lakes Chain waterbodies. EWM is a non-native species, native to Europe, Asia and North Africa, that has spread to lakes throughout the mid-west. EWM is unique in that its primary mode of propagation is not by seed; it spreads by shoot fragmentation, which has supported its transport between lakes via watercraft. In addition to its propagation method, EWM outcompetes native plants by growing early in the spring when water temperatures are too cold for most native plants to grow, and also by creating a canopy that blocks light from reaching native plants. EWM can create dense stands and dominate submergent communities, reducing important natural habitat for fish and other wildlife, and impeding recreational activities such as swimming, fishing, and boating.

EWM was discovered in the Long Lake Burnt Rollways channel in late summer of 2006. Onterra, LLC was hired to determine the extent of the population and recommend further actions. An initial 0.5 acre herbicide was completed in 2007, followed by monitoring in 2008, a larger (12.4 acre) treatment in 2009, volunteer hand-removal in 2010 and 2011, monitoring in 2012, a 9.0 acre herbicide treatment in 2013, and monitoring in 2014 and 2015.

EWM was first found on Virgin Lake during Phase I of the lake management planning project in late summer of 2010. First identified as a roughly 15-ft colony, aggressive efforts have been enacted on Virgin Lake to effectively manage the EWM population. These actions have included volunteer and professional hand-harvesting (2011 and 2015), Diver Assisted Suction Harvesting (D.A.S.H., 2014), herbicide treatments (2012, 2013 and 2015) and continued monitoring (2010-present).

During Phase VI of the planning project (2015), Onterra staff discovered a single plant of EWM within Townline Lake. That year, Onterra, TLWA, WDNR and County staff completed surveys on the lake while a total of 2-3 plants were hand-pulled.

This report describes monitoring and control efforts that took place in 2015 on Virgin Lake, the Burnt Rollways channel and Townline Lake, with guidance for 2016 actions.



**Figure 1. Three Lakes Chain of Lakes, Oneida County, WI.**

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## **VIRGIN LAKE**

### **2015 PreTreatment Survey & Herbicide Treatment**

In late September 2014, Onterra staff mapped EWM throughout Virgin Lake at its peak-growth period. The results of this survey were used to plan a 2015 control strategy in which a number of EWM control techniques were planned for use. Map 1 outlines the intended strategy, which included an 8.8 acre herbicide treatment area along with 2.5 acres of professional hand removal. This strategy was proposed in winter of 2015, with the understanding that field conditions would be verified during a pre-treatment survey. Onterra staff visited Virgin Lake on May 18, 2015 to complete a pre-treatment survey. During this survey, the conditions within any control areas are examined closely. In the case of an herbicide treatment, presence of the target plant is verified and plants are examined for signs of active growth, indicated by the appearance of green colored stems, leaflets, etc. The outer extents of the site are verified as well, to ensure that the site encompasses all EWM growth.

During the May 18 survey, the weather was slightly overcast and air temperatures were roughly 50°F. Water temperatures were measured at 57°F near the surface. EWM was spotted intermittently at the surface within the proposed herbicide site (Site A-15, Map 1). Upon deploying a submersible video camera, more short-statured EWM was observed within the control area. Onterra staff completed transects in and out of the proposed treatment area to verify the site extents. A single adjustment was made to the site to encompass new EWM growth, and the final site area was determined to be 8.9 acres.

The 8.9 acre herbicide treatment was completed on June 4, 2015 by Stantec, Inc. The applicator reported air temperatures of 72°F at the time of the survey, with water temperatures at 65°F near the surface. Wind speed was estimated to be between 0-5 mph out of the north.

### **2015 Early Season AIS Survey**

Much like the pre-treatment survey is used to verify conditions before an herbicide treatment, the ESAIS survey is scheduled ahead of mid-summer control efforts in order to verify site conditions as well as prioritize the proposed sites. Onterra staff visited Virgin Lake to complete the ESAIS survey on July 9, 2015. Each of the proposed hand-harvesting sites were visited during this survey. Overall, the sites appeared to hold less EWM than what was observed in late 2014 within the same areas. Within site B-15, E-15, F-15 and H-15, no EWM was observed. These sites were subsequently removed from the hand-harvesting strategy. Sites C-15 and D-15 ultimately held sufficient EWM to warrant a visit by the contracted professional hand-removal firm. Though a single plant was observed in C-15 at the time of the ESAIS survey, the depth here was greater than at other sites. This in mind, Onterra recommended that the hand-harvesting firm visit this location to verify that smaller statured plants were not present, obscured from surface view in the deeper water. Map 1 displays the proposed and final hand-harvesting locations for 2015.

### **2015 Hand-Removal Efforts**

The TLWA contracted Aquatic Plant Management, LLC (APM) to conduct hand-removal of EWM on the Three Lakes Chain in 2015. Three APM divers visited Virgin Lake on July 31. Within the three sites proposed for hand removal, the divers spent 8 hours and 45 minutes removing 7.5 gallons of EWM. An additional combined 6 diver hours were spent snorkeling through Sites H-15, F-15, E-15. No EWM was observed by APM staff in these locations. Table 1 summarizes the efforts of APM

on Virgin Lake, while Appendix A presents this information in greater detail and with APM staff comments.

**Table 1. 2015 Virgin Lake professional hand-harvesting summary.** Data provided by Aquatic Plant Management, LLC. Site locations depicted on Map 1.

<b>Virgin Lake Professional Hand-Harvesting Summary, 2015</b>					
<b>Date</b>	<b>Site</b>	<b>Time Underwater (minutes unless specified)</b>	<b>Number of Divers</b>	<b>Total Effort (minutes unless specified)</b>	<b>Est. EWM Removed (Gallons)</b>
7/31/2015	D-15	60	3	180	3
7/31/2015	G-15	65	3	195	4
7/31/2015	C-15	50	3	150	0.5
7/31/2015	H-15	30	3	90	0
7/31/2015	F-15	35	3	105	0
7/31/2015	E-15	30	3	90	0
7/31/2015	B-15	25	3	75	0
<b>Grand Total</b>		<b>4 hrs, 55 mins</b>		<b>14 hrs, 45 mins</b>	<b>7.5</b>

### 2015 Treatment Results

The 2015 control actions (herbicide application and professional hand-removal) were assessed during an EWM Peak-Biomass survey, completed on September 22, 2015. During the late summer, EWM is typically at its peak growth state which allows for easy viewing of the plant and plant colonies. The herbicide treatment site (A-15) as well as the multiple hand-removal sites were visited and a visual inspection completed for EWM occurrences. Additionally, the Onterra crew meandered the entire lake to document any occurrences outside of the control areas. Ultimately, this survey allows for an understanding of control action effectiveness but also aids in data collection for next year’s planning.

During the September 22 visit, Site A-15 was visited first. Only several EWM plants were observed within the treatment area – likely new growth following the treatment. The aquatic plant community here was dominated by native pondweeds, however there were stands of very healthy northern water milfoil as well – almost to the point that driving through them was troublesome for the boat motor (Photographs 1 & 2). This of course can be interpreted as a good sign, as northern water milfoil is a close relative of EWM and thus believed to be susceptible to herbicide treatments. However, conducting herbicide treatments in the early spring is thought to reduce exposure of the herbicide to some native plant species, northern water milfoil being included.

Following the assessment of the herbicide treatment area, a full meander survey of the lake was completed including the hand-harvest control areas. Several single plants were observed within the hand-harvest areas, but the density was less than what was observed during the mid-June survey. Map 2 displays the results of the late-season Peak-Biomass survey.



**Photograph 1 & 2. Northern water milfoil colony, Virgin Lake.** Photos display a dense northern water milfoil colony within Site A-15 of Virgin Lake, and a close-up of a single northern water milfoil stem with leaflets. Photos collected during a late summer EWM survey.

### 2016 Control Strategy

Although it is believed that the control actions initiated in 2015 were successful, it was acknowledged that the level of EWM growth in Virgin Lake was somewhat suppressed from what was observed in the lake during late 2014. The amount of EWM observed still warranted the prescribed control actions, however it is not known to what level the suppressed EWM abundance impacts the examination of control effectiveness. Finally, it is not known whether the conditions observed in 2015 are part of a trend, or an anomaly of sorts due to differing environmental conditions that year.

It will be important for the TLWA and Virgin Lake property owners to continue monitoring of EWM populations in Virgin Lake. The current known density and distribution of EWM is the lowest it has been since the initial discovery of it in this waterbody. With a Phase II AIS-Early Detection and Response grant continuing into its last year, funding is in place for both professional monitoring and control of EWM in 2016. It is recommended that the TLWA and Virgin Lake property owners continue as planned with monitoring of the entire lake through an ESAIS survey and Peak-Biomass survey, and retain a professional hand-removal firm to operate at near the same effort as extended in 2015, up to 20-25 diver hours, utilizing the strategy outlined on Map 2. As in the 2015, the ESAIS survey would verify EWM growth and prioritize hand-removal locations. A better estimate of required diver effort could be made during this survey as well. The late-season assessment would then both determine the effectiveness of 2016 hand-removal and also allow for 2017 planning.

## **BURNT ROLLWAYS CHANNEL (LONG LAKE)**

### **2015 Monitoring Results**

During late summer of 2014, Long Lake and Honeyrock Camp volunteers completed a monitoring survey of the Burnt Rollways channel and noted a few areas of EWM. During a September 10, 2014 EWM Peak-Biomass survey, a single EWM plant was observed within the channel by Onterra staff. Following this observance, it was recommended that the TLWA and other volunteers continue their monitoring through 2015, and that no control action be initiated.



**Photograph 3. Burnt Rollways Channel landing, Oneida County, WI.**

On September 30, 2015, Onterra staff visited the Burnt Rollways Channel to complete an EWM Peak-Biomass survey. It was a very brisk morning, with air temperatures in the mid 50's but with no wind and a very sun-filled sky. In three separate areas of the channel, only several EWM plants were observed, along with a healthy assortment of native pondweeds, native milfoils, floating-leaf lily pads and bur-reeds, and other native vegetation. Onterra staff navigated their boat outside of the channel, into Long Lake for a coarse survey of the surrounding channel area. No EWM was observed in this area.

### **2016 Monitoring / Control Recommendations**

As there is still a minimal EWM population within the Burnt Rollways Channel, no professional control actions (herbicide treatments, professional hand-harvesting, etc.) are recommended for 2016. Continued monitoring of the channel should be completed by volunteers during the mid-summer timeframe (mid-June). Should volunteers observe EWM that has increased in density from that which is pictured on Map 3, then a call should be placed to Onterra staff to visit the channel. The current level of EWM in the channel may be addressed by volunteer hand-removal. However, if this level is observed to have increased, the potential to line-up summer professional hand-harvesters would still exist if the colonies are spotted early enough. During the late summer season, Onterra would again complete an EWM Peak-Biomass survey to determine the level of EWM in the channel at that time and collect data for 2017 decision-making and planning. Funding for these surveys is available through a previously acquired grant, which expires in late 2016.



## TOWNLINELAKE

### 2015 EWM Discovery & Monitoring

Phase VI of the Three Lakes Chain management planning process began in 2015, with studies being completed on Townline, Round and Island Lakes. On all of these lakes, an ESAIS survey is completed in order to ascertain whether any AIS are present in the lakes. This survey is completed in mid-June, as curly-leaf pondweed is near its peak growth and EWM is visible from the surface above the native plants. It was during this June 18, 2015 survey that an Onterra crew found a single EWM plant in the northeast side of Townline Lake (Map 4). The crew attempted to remove the plant with a rake but only succeeded in partially removing the plant. GPS coordinates were taken and the TLWA was notified immediately. The removed plant was placed in a plastic bag with water and later sent in to a lab for DNR analysis. The DNA results were later received and confirmed that the plant was pure-strain Eurasian water milfoil, not northern water milfoil or a hybrid of the two. That day, the crew concluded with their entire-lake survey, not finding any additional EWM plants.



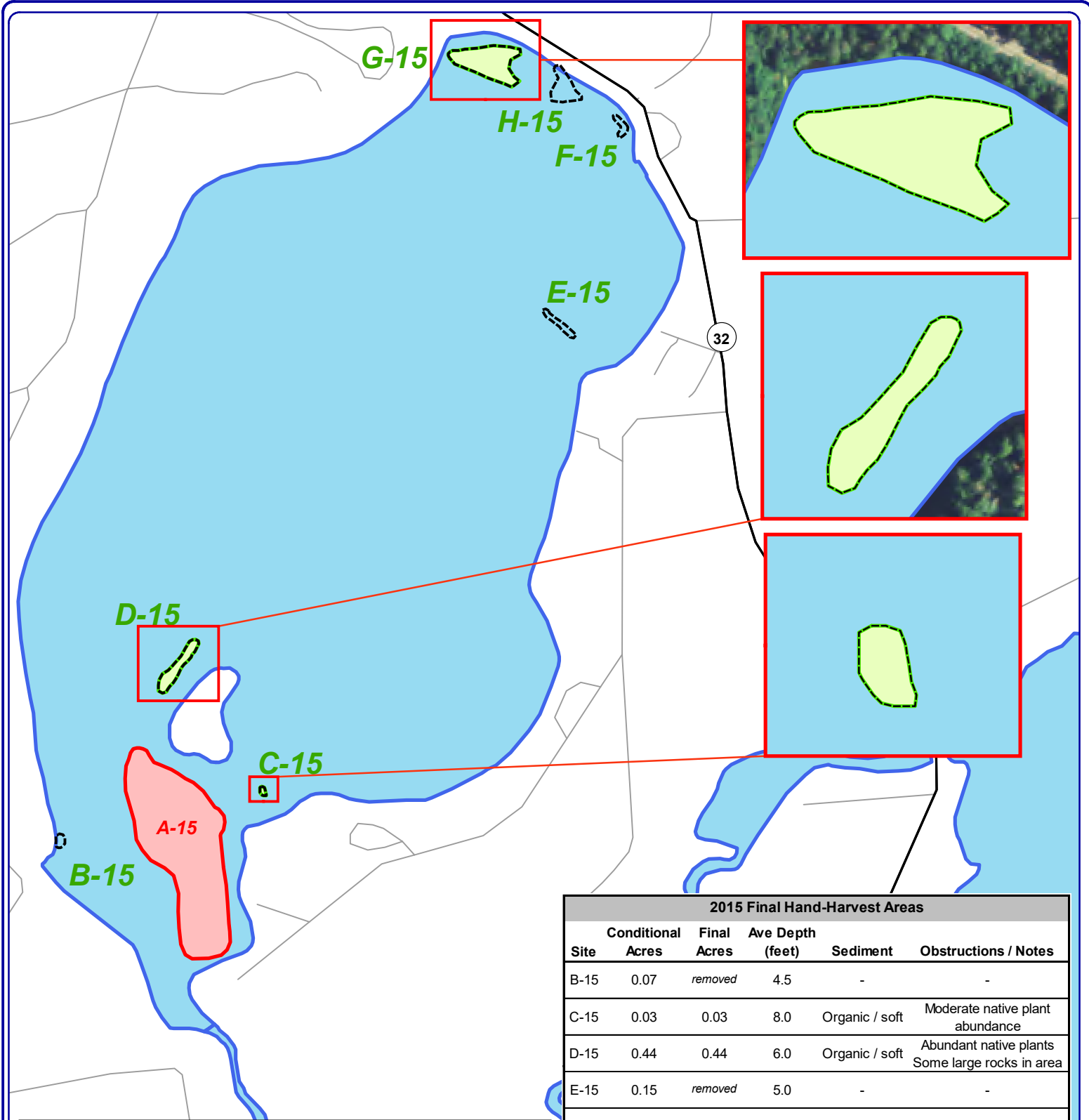
**Photograph 4. Townline Lake public landing and intermittent stream inlet, Oneida County, WI.**

On July 3, Onterra staff member Tim Hoyman visited the lake with TLWA Board Members Norris Ross and Ed Jacobson. Mr. Hoyman jumped into the water with snorkeling gear to take a closer look at the aquatic plant community. Unfortunately, the late afternoon timing of the visit was not advantageous as the low angle of the sun prevented clear vision within the already stained water. A small EWM plant was isolated and pulled from this location.

Tim Hoyman and Dan Cibulka (Onterra) revisited the site on July 8 to snorkel through the area. A single EWM plant was spotted from the surface and marked with a buoy. Upon entering the water, the snorkelers circled the buoy looking for other EWM plants. Roughly 30 minutes were spent swimming transects around the buoy. The previously observed plant was the only confirmed EWM sighting, so this plant and its roots were hand-pulled. Later that summer, on August 25<sup>th</sup>, WDNR AIS staff visited the lake on a scheduled survey and found a single EWM plant. The stem of the plant, but not the roots, was removed.

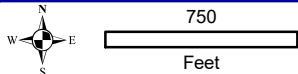
### 2016 Monitoring / Control Recommendations

The Townline Lake EWM discovery is very much in its infancy – only a few plants have been observed and pulled from the same location. Continued monitoring of the entire lake is of great importance. In 2016, Onterra staff will complete a whole-lake ESAIS survey in mid-June. Depending upon the results of this survey, Onterra will jump in the water to remove observed EWM or direct TLWA volunteers to the location. If a greater amount of EWM is observed, Onterra would potentially assist the TLWA in bringing in professional hand-removal staff to complete hand-removal on the area. With the ESAIS survey bringing about an understanding on the abundance of EWM in the lake, a late-summer EWM survey may be scheduled as well to effectively plan for 2017 monitoring and control efforts.



2015 Final Hand-Harvest Areas					
Site	Conditional Acres	Final Acres	Ave Depth (feet)	Sediment	Obstructions / Notes
B-15	0.07	<i>removed</i>	4.5	-	-
C-15	0.03	0.03	8.0	Organic / soft	Moderate native plant abundance
D-15	0.44	0.44	6.0	Organic / soft	Abundant native plants Some large rocks in area
E-15	0.15	<i>removed</i>	5.0	-	-
F-15	0.11	<i>removed</i>	3.5	-	-
G-15	1.24	1.24	7.5	Organic / soft	Range of 3 ft to 12 ft. Abundant native plants
H-15	0.46	<i>removed</i>	6.0	-	-
<b>Total</b>		<b>1.71</b>			

2015 Final Herbicide Treatment Areas					
Site	Conditional Acres	Final Acres	Ave Depth (feet)	Volume (ac-ft)	Herbicide Details
					Liquid 2,4-D (ppm ae)
A-15	8.8	8.9	6.0	53.4	4.0
<b>Total</b>	<b>8.8</b>	<b>8.9</b>		<b>53.4</b>	



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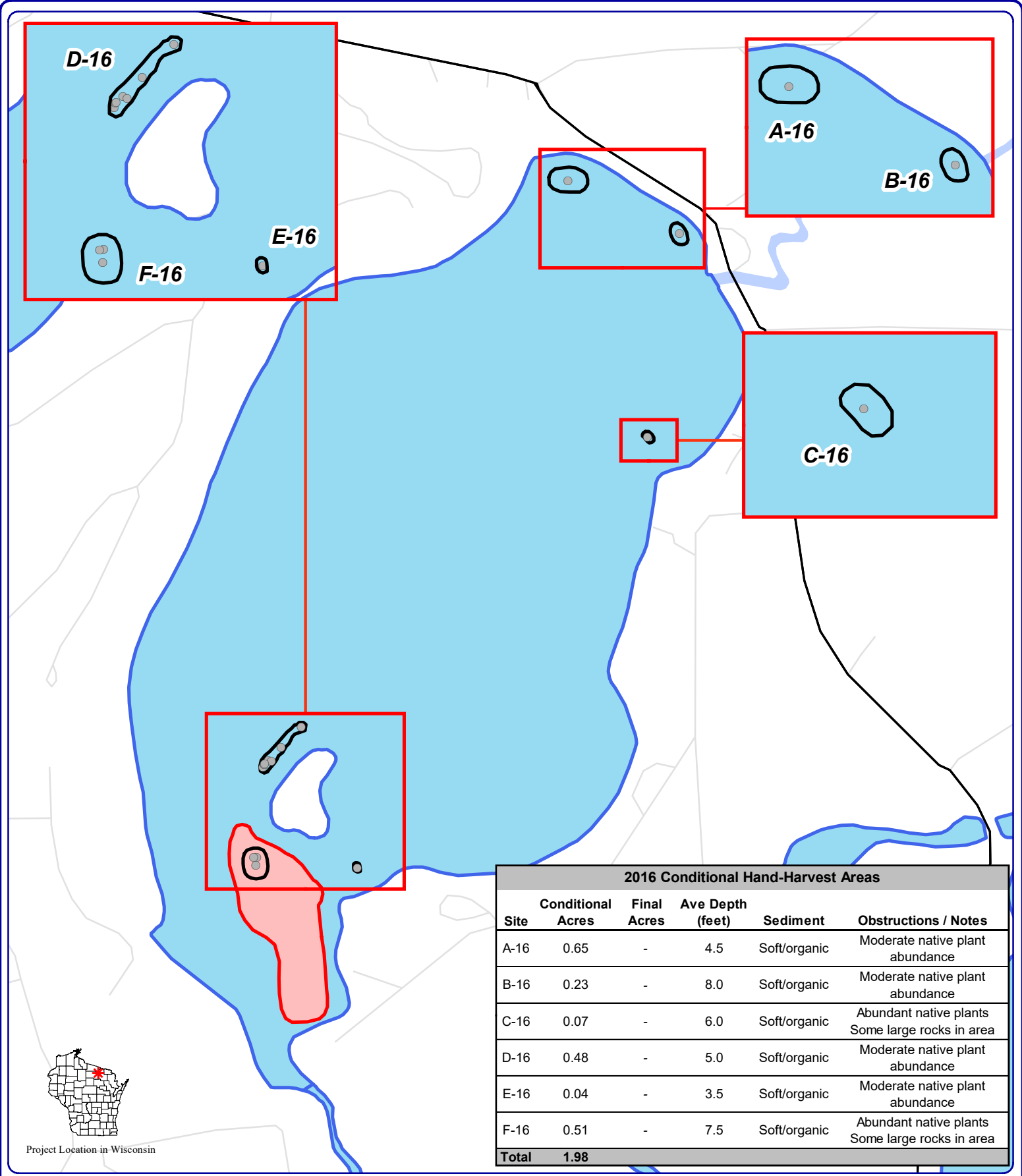
Sources:  
 Roads and Hydro: WDNR  
 Orthophotography: NAIP, 2010  
 Aquatic Plants: Onterra, 2015  
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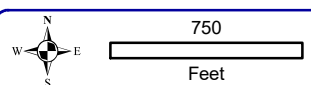
**Legend**

- 2015 Herbicide Treatment
- 2015 Conditional Hand Harvest
- 2015 Final Hand Harvest

Map 1 - Virgin Lake  
 Three Lakes Chain  
 Oneida County, Wisconsin  
**2015 EWM Final Control Strategy**



2016 Conditional Hand-Harvest Areas					
Site	Conditional Acres	Final Acres	Ave Depth (feet)	Sediment	Obstructions / Notes
A-16	0.65	-	4.5	Soft/organic	Moderate native plant abundance
B-16	0.23	-	8.0	Soft/organic	Moderate native plant abundance
C-16	0.07	-	6.0	Soft/organic	Abundant native plants Some large rocks in area
D-16	0.48	-	5.0	Soft/organic	Moderate native plant abundance
E-16	0.04	-	3.5	Soft/organic	Moderate native plant abundance
F-16	0.51	-	7.5	Soft/organic	Abundant native plants Some large rocks in area
<b>Total</b>	<b>1.98</b>				



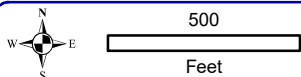
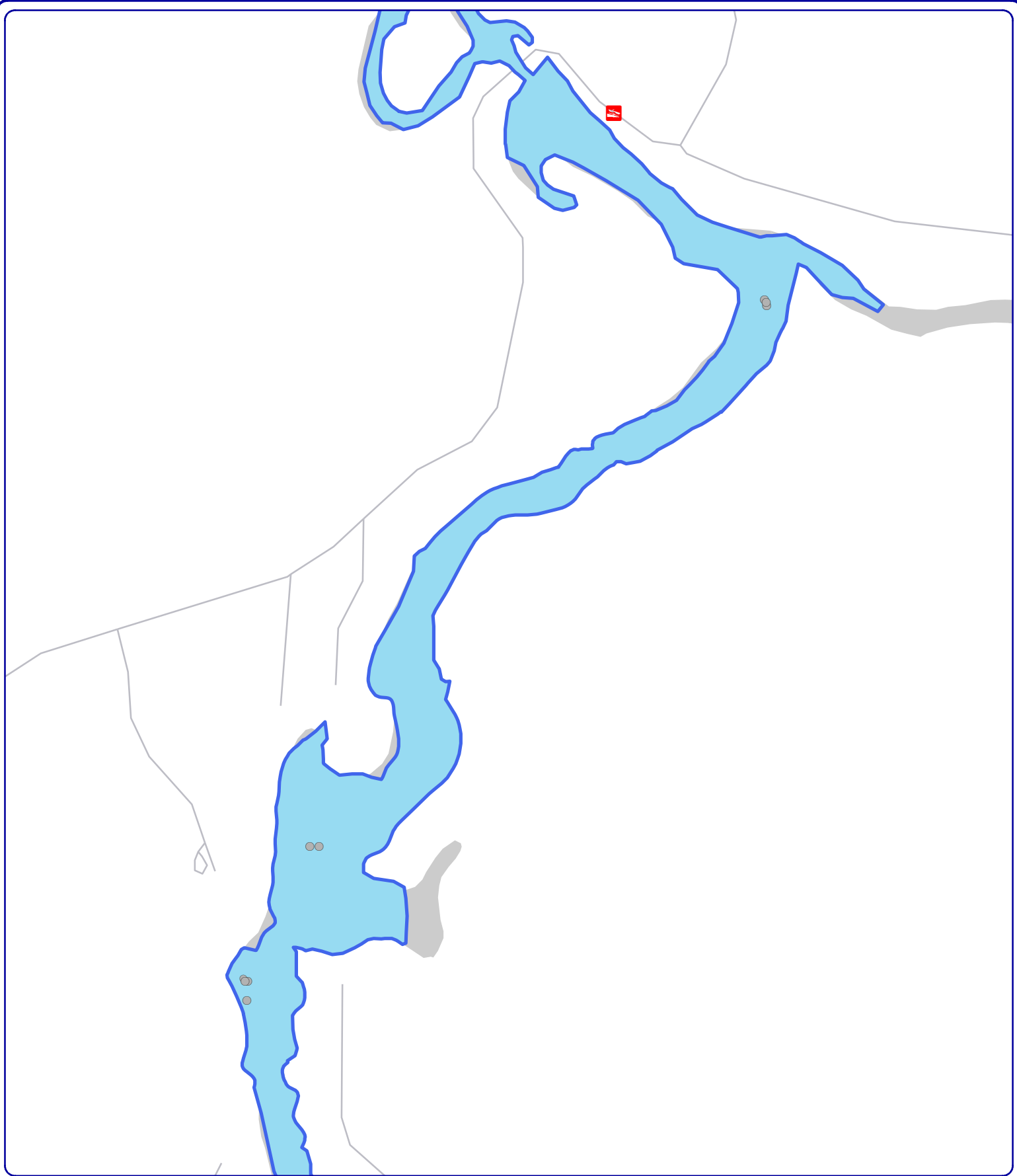
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Sources:  
 Roads and Hydro: WDNR  
 Orthophotography: NAIP, 2010  
 Aquatic Plants: Onterra, 2015  
 Map Date: February 18, 2016  
 Filename: Map2\_Virgin\_2016\_HH1.mxd

- Legend**
- Single or Few Plants
  - Clumps of Plants
  - Small Plant Colony
  - 2016 Conditional Hand-Harvest Area
  - Highly Scattered
  - Scattered
  - Dominant
  - Highly Dominant
  - Surface Matting

Map 2 - Virgin Lake  
 Three Lakes Chain  
 Oneida County, Wisconsin  
**2015 EWM Locations &  
 2016 Conditional Control Areas**





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**Sources:**  
 Roads and Hydro: WDNR  
 EWM Survey: Onterra, 2015  
**Map Date:** October 2, 2015  
 Filename: Map3\_BurntRollway\_EWMPB\_Sept15.mxd

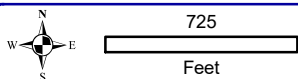
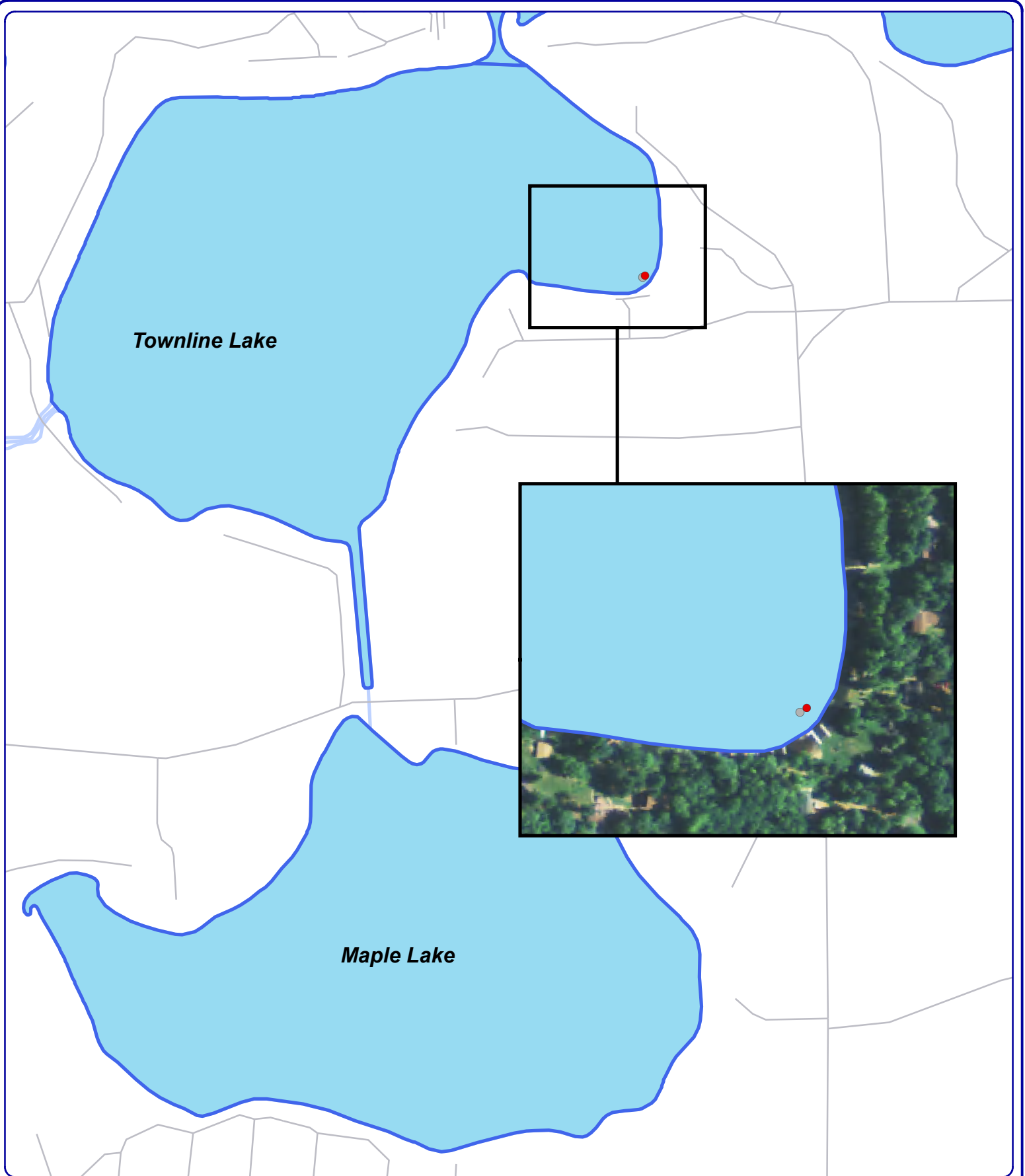


Project Location in Wisconsin

**Legend**

- Single or Few Plants
- Clumps of Plants
- Small Plant Colony

Map 3 - Long Lake  
 Burnt Rollways Channel  
 Three Lakes Chain of Lakes  
 Oneida County, Wisconsin  
**September 2015**  
**EWM Survey Results**



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Sources:  
 Roads and Hydro: WDNR  
 Orthophotography: NAIP, 2010  
 Aquatic Plants: Onterra, 2015  
 Map Date: July 6, 2015  
 Filename: Map4\_Townline\_EWM\_July2015.mxd



Project Location in Wisconsin

**Legend**

- Single Plant - Onterra June/July 2015
- Single Plant - WDNR Aug 2015

**Map 4 - Townline Lake**  
**Three Lakes Chain**  
 Oneida County, Wisconsin  
**2015 EWM**  
**Occurrences**

# A

## APPENDIX A

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**Aquatic Plant Management, LLC 2015 Hand-Harvesting Report**

# Aquatic Plant Management LLC



## Virgin Lake EWM Harvesting Report Summer 2015

1696 Silver Beach Drive Lac du Flambeau, WI 54538



# Virgin Lake EWM Harvesting Summary 2015

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**Summary:** On July 31<sup>st</sup> Aquatic Plant Management LLC (APM) conducted hand harvesting services of Eurasian Watermilfoil (EWM) on Virgin Lake. Our experienced divers spent a combined total of 18.24 hours on the water and were able to successfully remove approximately **7.5 gallons** of EWM from the lake.

**Dive Conditions:** Conditions on 7/31/2015 were good, with scattered cloud cover and mild winds. Water clarity was poor, with underwater visibility of less than 4 feet. The substrate of Virgin Lake was less than ideal for complete root removal, but since there were few EWM plants, we were able to focus on removing as much of the root ball as possible. As per Onterra's request, we scouted the previous control areas in search of EWM occurrences, but were unable to locate any plants. Within the control areas mapped by Onterra, we were only able to find about 29 relatively small individual plants.

**Recommendations:** By our standards, the EWM infestation on Virgin lake is extremely manageable, but when dealing with invasives, there is always a chance for proliferation. Due to this fact, continued monitoring of the control areas and an annual hand-harvesting effort is recommended to prevent the EWM from reaching levels seen on other lakes in the area.





# Detailed Summary of Diving Activities

Date	Dive Location	Latitude	Longitude	Time Underwater (Min)	Estimated EWM Removed (Gallons)	EWM Density Rating	Comments
7/31/2015	D-15	45.78217	89.09086	60	3	1	Sandy Substrate. Abundant Northern Milfoil colonies. Located and removed 10 EWM plants, wrapped in NWM plants. EWM was brittle, fragmenting easily. EWM was located in 5-7 feet of water. Swam the length of D-15, but did not locate any other EWM occurrences.
7/31/2015	G-15	45.7916	89.08374	65	4	1	Sandy/Organic Substrate. Abundant NWM colonies. Located and removed 18 EWM plants in 5-7 feet of water. Scoured G-15, but didn't not locate any other EWM occurrences.
7/31/2015	C-15	45.78043	89.08859	50	0.5	1	Sandy substrate with large rocks. Abundant NWM and native pondweeds. Located 1 EWM plant in 5-6 feet of water. Scoured H-15, but did not locate any other EWM occurrences.
7/31/2015	H-15	45.79108	89.08191	30	0	0	Sandy Substrate. Populated mainly by NWM and native pondweeds. Depths ranged from 4-6 feet. Unable to locate any EWM occurrences.
7/31/2015	F-15	45.7905	89.08086	35	0	0	Sandy substrate near shore, with most organic substate in 4+ feet of water. Fewer native milfoils and pondweeds than other sites. Unable to locate any EWM occurrences.
7/31/2015	E-15	45.78807	89.08273	30	0	0	Sandy/rocky substrate. Native pondweeds and NWM present. Unable to locate any EWM occurrences.
7/31/2015	B-15	45.77982	89.09292	25	0	0	Soft organic substrate. Scattered NWM and various pondweeds. Unable to locate any EWM occurrences.

<b>EWM Density Rating</b>	0	1	2	3	4	5	6	7	8	9	10
<b>Plants per 5 Square Yards</b>	0	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20



# Map Created by Onterra LLC

