1.0 INTRODUCTION

The Unified Lower Eagle River Chain of Lakes Commission (ULERCLC) has been the successful recipients of Wisconsin Department of Natural Resources (WDNR) Aquatic Invasive Species (AIS) Control Grants for the past seven years as they conduct a project aimed at reducing the Eagle River Chain's Eurasian water milfoil (*Myriophyllum spicatum*; EWM) population. This report specifically discusses the control activities conducted during 2014. The chain-wide results will be presented first followed by results from each lake individually. Additional information regarding the treatments completed in 2008-2013 can be found in their respective annual reports. A separate report (completed in 2013) describes complete native aquatic vegetation inventories from whole-lake point-intercept surveys that were conducted on all ten lakes within the Eagle River Chain in 2012. Additionally, the report compares the 2012 aquatic plant inventories with similar assessments that were carried out in 2006 as part of a chain-wide lake management planning project.

1.1 Herbicide Control of Aquatic Invasive Plants

As a part of the current project, strategic and spatially targeted herbicide treatments have been conducted on the Eagle River Chain since 2008 in an effort to control EWM. Herbicides that target submersed plant species are directly applied to the water, either as a liquid or an encapsulated granular formulation. Factors such as water depth, water flow, treatment area size, and plant density work to dilute herbicide concentration within aquatic systems. Understanding concentration-exposure times is an important consideration for aquatic herbicides. Successful control of the target plant is achieved when it is exposed to a lethal concentration of the herbicide for a specific duration of time. Much information on this issue has been gathered in recent years, largely as a result of a joint research project between the WDNR and US Army Corps of Engineers (USACE). Based on their preliminary findings, lake managers have adopted two main treatment strategies: 1) whole-lake treatments, and 2) spot treatments.

Whole-lake treatments are those where the herbicide is applied to specific sites, but when the herbicide reaches equilibrium within the entire volume of water (of the lake, lake basin, or within the epilimnion of the lake or lake basin); it is at a concentration that is sufficient to cause mortality to the target plant within that entire lake or basin. The application rate of whole-lake treatments is dictated by the volume of water in which the herbicide will reach equilibrium with. The target herbicide concentration for EWM treatments is typically between 0.250 and 0.400 parts per million (ppm) acid equivalent (ae) when exposed to the target plants for 7-14 days or longer. However, these same rates have been shown to impact some native plant species, particularly dicot species, some thin-leaved pondweeds, and naiad species. This strategy was implemented with success in 2010 on Scattering Rice Lake and only small area and low density EWM occurrences have been noted from this waterbody since the 2010 treatment.

Spot treatments are a type of control strategy where the herbicide is applied to a specific area (treatment site) such that when it dilutes from that area, its concentrations are insufficient to cause significant effects outside of that area. This is the strategy that has historically and is currently being implemented on areas of EWM within the Eagle River Chain of Lakes. Spot treatments typically rely on a short exposure time (often hours) to cause mortality and therefore are applied at a much higher herbicide concentration than whole-lake treatments.

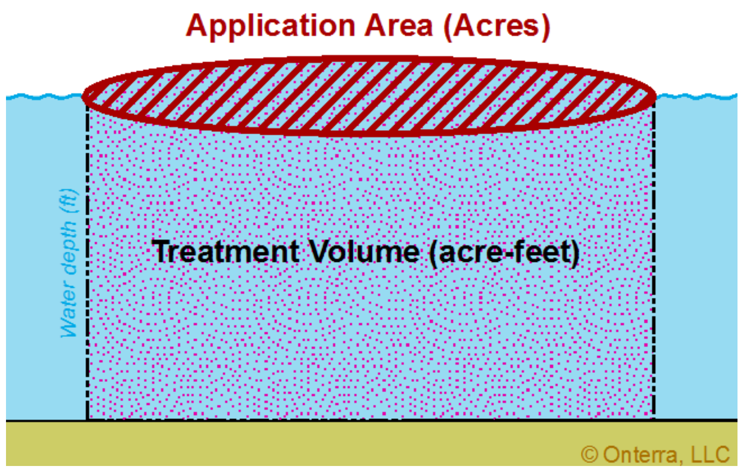


Figure 1. Herbicide Spot Treatment diagram.

Herbicide application rates for spot treatments are formulated volumetrically, typically targeting 2,4-D at 3.0-4.0 ppm ae. This means that sufficient 2,4-D is applied within the *Application Area* such that if it mixed evenly with the *Treatment Volume*, it would equal 3.0-4.0 ppm ae. This standard method for determining spot treatment use rates is not without flaw, as no physical barrier keeps the herbicide within the *Treatment Volume* and herbicide dissipates horizontally out of the area before reaching equilibrium (Figure 1). While lake managers may propose that a particular volumetric dose be used, such as 3-4.0 ppm ae, it is understood that actually achieving 3-4.0 ppm ae within the water column is not likely due to dissipation and other factors.

Granular 2,4-D, which is typically used in small spot-treatment scenarios, was chosen for the majority of treatment sites within the Eagle River Chain of Lakes. Ongoing research clearly indicates that the herbicide concentrations and exposure times of large (> 5 acres each) treatment sites are higher and longer than for small sites. Research also indicates that higher herbicide concentrations and exposure times are observed in protected parts of a lake compared with open and exposed parts of the lake.

Ongoing research is currently not able to demonstrate that granular herbicides maintain higher herbicide concentrations over liquid herbicides in spot treatment scenarios, and may actually be showing the opposite. With granular herbicides it is theorized that some of the 2,4-D granules sink into or bind with the sediment, not allowing a portion of the product to be included in herbicide measurements within the water column. Preliminary data indicate that surprisingly high 2,4-D concentrations exist near the sediment-water interface (porewater) in association with granular treatments. Some herbicide applicators and industry professionals have observed what has been interpreted as successful granular treatments in instances where measured herbicide concentrations within the water column would have suggested otherwise. In these cases, it has been theorized that the higher porewater 2,4-D concentrations have been the mechanism that caused the successful treatment. However, it is not known if there is a mode of action for the EWM plants to uptake the herbicide at this location within the water column, away from the foliage which is suspected as being the primary uptake location. Ongoing research is occurring on this topic, but preliminary and unpublished results suggests that when auxin herbicides (2,4-D and triclopyr) are applied directly to the roots of EWM in growth chambers, effective control is not achieved.

2.0 EAGLE RIVER CHAIN PRE-TREATMENT STUDIES

Following the 2013 Late-Summer Peak-Biomass Survey, conditional treatment permit maps were created proposing 31.0 total acres of treatment on Cranberry, Catfish, Eagle, Scattering Rice, Otter, Duck, Yellow Birch, and Watersmeet Lakes (Table 1). It was determined that Voyageur and Lynx Lakes did not hold sufficient populations of EWM to warrant treatment. On May 28, 2014, Onterra staff visited the Eagle River Chain to survey the proposed treatment areas and refine their boundaries as appropriate, primarily through the use of submersible video cameras. As a result of the spring pre-treatment survey, the treatment strategy was increased slightly to 33.6 acres in total for the eight lakes slotted for treatment (Table 1).

Table 1. Eagle River Chain 2014 EWM Treatment Acreage.

Lake	Proposed Acres	Final Acres
Catfish	0.8	1.6
Cranberry	2.6	2.6
Duck	2.7	4.7
Eagle	1.0	1.9
Lynx	0.0	0.0
Otter	0.8	1.6
Scattering Rice	3.1	3.1
Voyageur	0.0	0.0
Watersmeet	16.5	16.2
Yellow Birch	3.5	1.9
All Waterbodies	**31.0**	**33.6**

The majority of the 2014 treatment acreage is attributed to Watersmeet Lake within Table 1; however, no EWM was targeted within Watersmeet Lake proper. Two areas within the Eagle River upstream of Watersmeet Lake and one area within the Wisconsin River downstream of Watersmeet Lake were targeted for control. Similarly, areas within the Eagle River upstream of Cranberry Lake were also not targeted for control in 2014. These areas largely consisted of low density EWM colonies in 2013 where a high likelihood of success was not anticipated due to water flow. Continued investigation of achieving control in these areas is occurring, and these areas are proposed for treatment in 2015.

On much of the Eagle River Chain of Lakes, the EWM population has reached a point at which some of the herbicide application areas are too small to consistently predict if they will cause EWM mortality. As indicated earlier, it is extremely difficult in small spot treatment scenarios to keep a sufficient herbicide concentration exposed to the target plants long enough to be effective. For that reason, almost all of the 2014 treatment areas included an expanded buffer as well as the maximum 2,4-D application rate of 4.00 ppm ae.

The ULERLC's early control successes were accomplished using a granular ester 2,4-D product (Navigate®). However, the re-registration of this herbicide now accompanies a 1-day swimming restriction. Primarily for that reason, the ULERCLC has utilized the granular amine 2,4-D product (Sculpin G®) since 2012. Between May 29 and May 31, 2014, treatment sites were applied with granular form 2,4-D Sculpin G® by Schmidt's Aquatic Plant Control at a rate to achieve target concentrations of 4.0 ppm ae. The applicator reported wind conditions ranging from no wind to 5 mph and water temperatures at the surface ranging from 67°F – 75°F. In spot treatment scenarios such as in all of the 2014 treatments on the Eagle River Chain of Lakes, higher wind speeds after the herbicide is applied could cause the herbicide to dissipate more quickly away from the site. Winds were relatively light during and after most of the 2014 treatments on the Eagle River Chain of Lakes, perhaps with the exception of some moderate winds during the second part of the treatment on Watersmeet Lake (Figure 2).

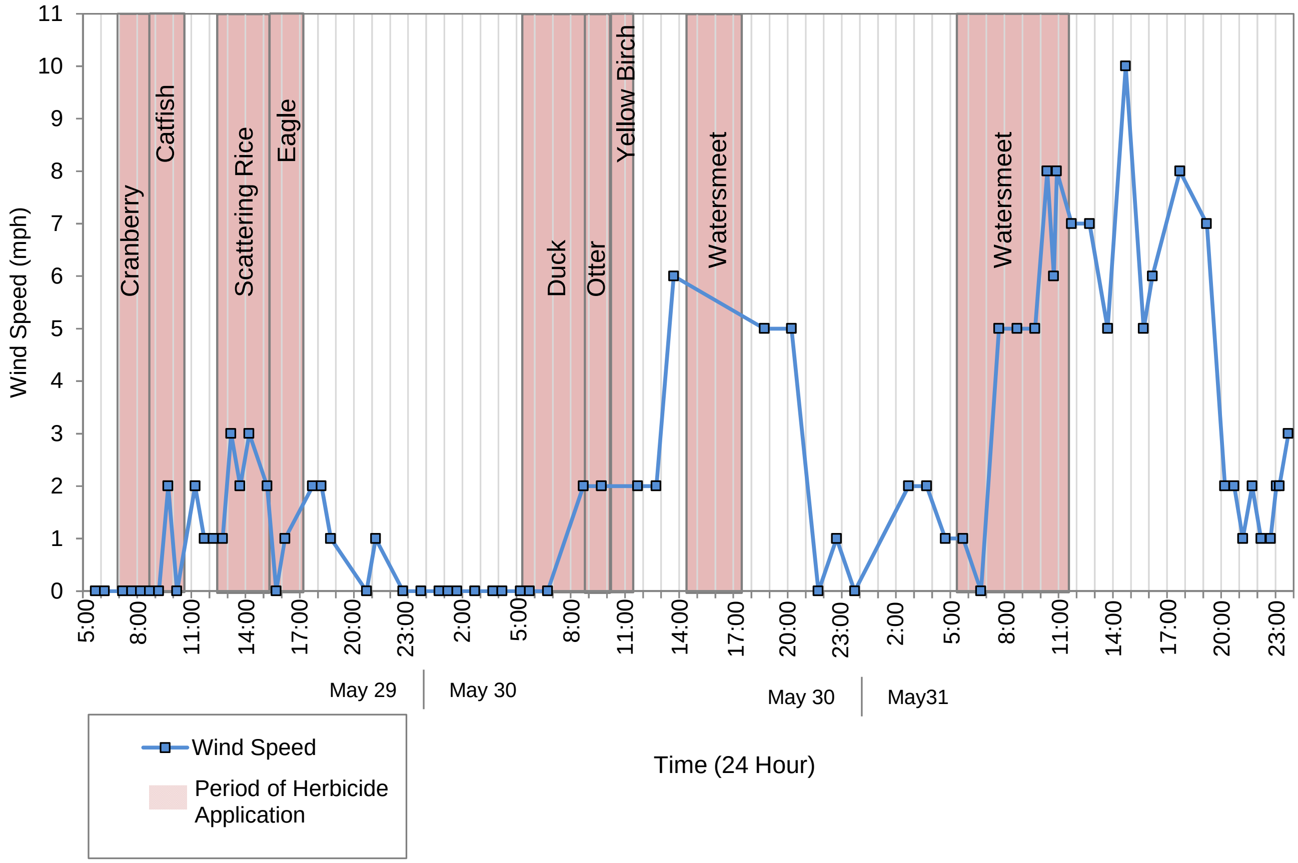


Figure 2. Wind speed recorded in Eagle River, WI on May 29-31, 2014. Created using data from weatherunderground.com

3.0 2014 TREATMENT MONITORING

The goal of herbicide treatments is to maximize target species (EWM) mortality while minimizing impacts to valuable native aquatic plant species. Monitoring herbicide treatments and defining their success incorporates both quantitative and qualitative methods. As the name suggests, quantitative monitoring involves comparing number data (or quantities) such as plant frequency of occurrence before and after the control strategy is implemented. Qualitative monitoring is completed by comparing visual data such as EWM colony density ratings before and after the treatments.

3.1 Quantitative Monitoring

EWM treatment quantitative evaluation methodologies follow WDNR protocols in which point-intercept data are collected within treatment areas before and after the treatment. On the Eagle River Chain of Lakes, data of this type were collected at 221 point-intercept sub-sample locations during the summer of 2014 (Figure 3). The most comparative sub-sample data are those collected both the summer before (2013) and the summer immediately following the herbicide treatment (2014).

On the Eagle River Chain of Lakes, 42 of the 221 point-intercept sub-sample locations fell within 2014 treatment areas; data were collected at the remaining 179 locations as pre-treatment data for potential 2015 treatments (Figure 3). At these sampling locations, EWM and native aquatic plant species presence and rake fullness (on a scale of 0 to 3) were documented along with water depth and substrate type. Specifically, these surveys aim to determine if significant differences in frequencies of occurrence and density of EWM and native species occur following the herbicide application.

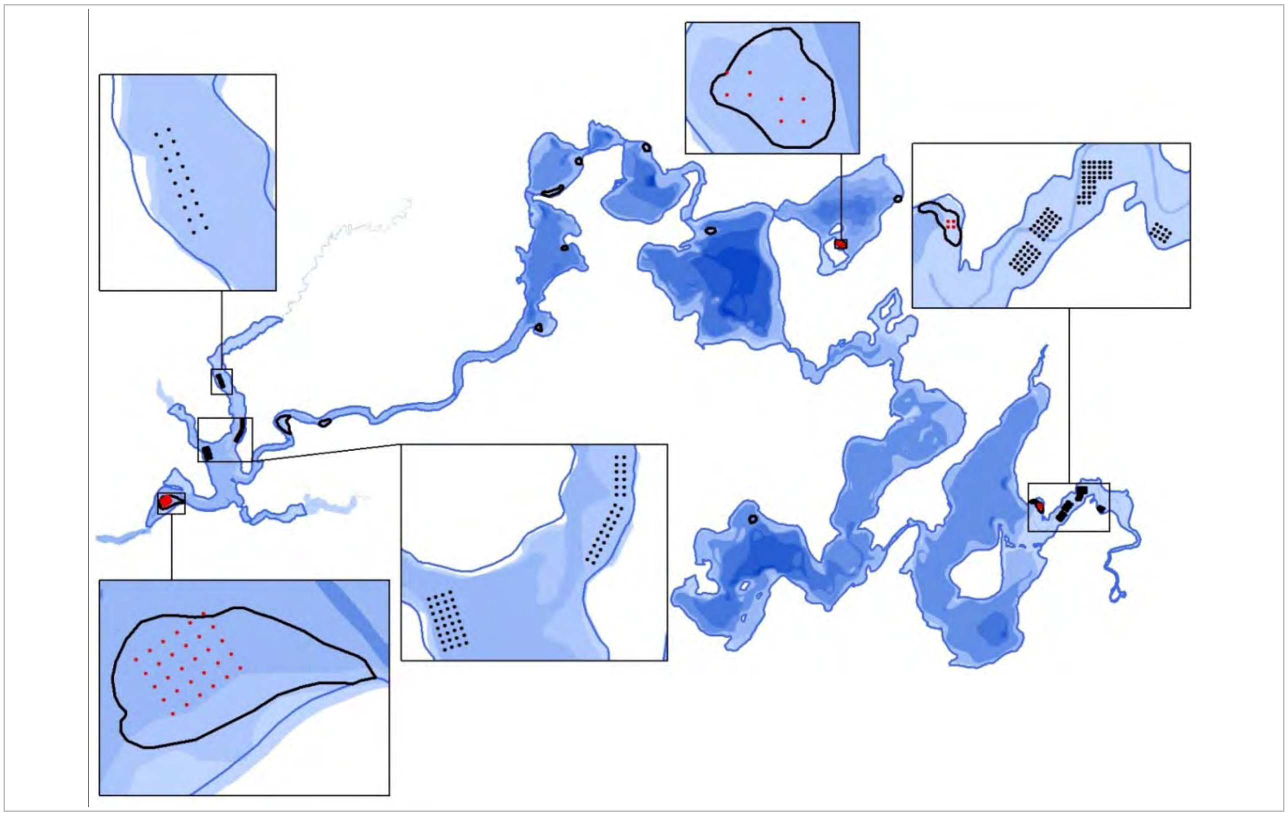


Figure 3. Quantitative monitoring strategy for the Eagle River Chain 2014 EWM treatments. Red sub-sample locations fall within 2014 treatment areas and are used in treatment assessment. Black sub-sample locations are pre-treatment locations for 2015.

Quantitatively, a specific treatment site is deemed to be successful if the EWM frequency following the treatments exhibits a statistically valid reduction by at least 50%. Evaluation of treatment-wide effectiveness follows the same criteria based upon pooled sub-sample data from all of the treatment sites. Further, a noticeable decrease in rake-fullness ratings within the fullness categories of 2 and 3 should be observed. Preferably, there would be no rake tows exhibiting a fullness of 2 or 3 during the post treatment surveys.

Although it is never the intent of the treatments to impact native species, it is important to remember that in spot treatment scenarios, these non-target impacts can only be considered in the context of the areas treated and not on a lake-wide basis. In other words, the impact of the treatments on a non-target species in the treatment areas cannot be extrapolated to the entire population of that plant within the lake, unless the plant species is only found in locations where the herbicide applications took place. While it was traditionally understood that 2,4-D was selective towards broad-leaf (dicot) species, emerging research from the WDNR and USACE state that some narrow-leaf (monocot) species are also impacted by this herbicide.

3.2 Qualitative Monitoring

Spatial data reflecting EWM locations were collected using a sub-meter Global Positioning System (GPS) during the late summers of 2013 and 2014, when this plant is assumed to be at its peak-biomass or growth stage. Comparisons of these surveys are used to qualitatively evaluate the 2014 herbicide treatments on the Eagle River Chain. Qualitatively, a successful treatment on a particular site would include a reduction of EWM density as demonstrated by a decrease in density rating (e.g. *highly dominant* to *dominant*). In terms of a treatment as a whole (lake-wide), at least 75% of the acreage treated that year would decrease by one level of density as described above for an individual site.

4.0 2014 CHAIN-WIDE TREATMENT SUMMARY AND CONCLUSIONS

Post treatment surveys were completed on the Eagle River Chain by Onterra on September 2 and 3, 2014. Over the course of annual treatments from 2007 to 2014, EWM colonial acreage has been qualitatively reduced by 74% from 278.2 acres in 2007 to 72.9 acres in 2014. EWM density also decreased markedly over this period, from EWM mainly comprised of dominant, highly dominant, and surface matted areas in 2007 to mainly scattered and highly scattered areas in 2014 (Figure 4). Treatment-wide, 100% of the EWM acreage treated in 2014 was reduced by at least one density rating, exceeding the qualitative success criterion (75% reduction). Many Wisconsin lakes observed a suppressed EWM population in 2014 likely as a result of a later than usual ice-off and cooler temperatures affecting general plant growth. The overall EWM population reductions on the Eagle River Chain of Lakes were likely a result of a combination of the 2014 herbicide treatment and environmental factors.

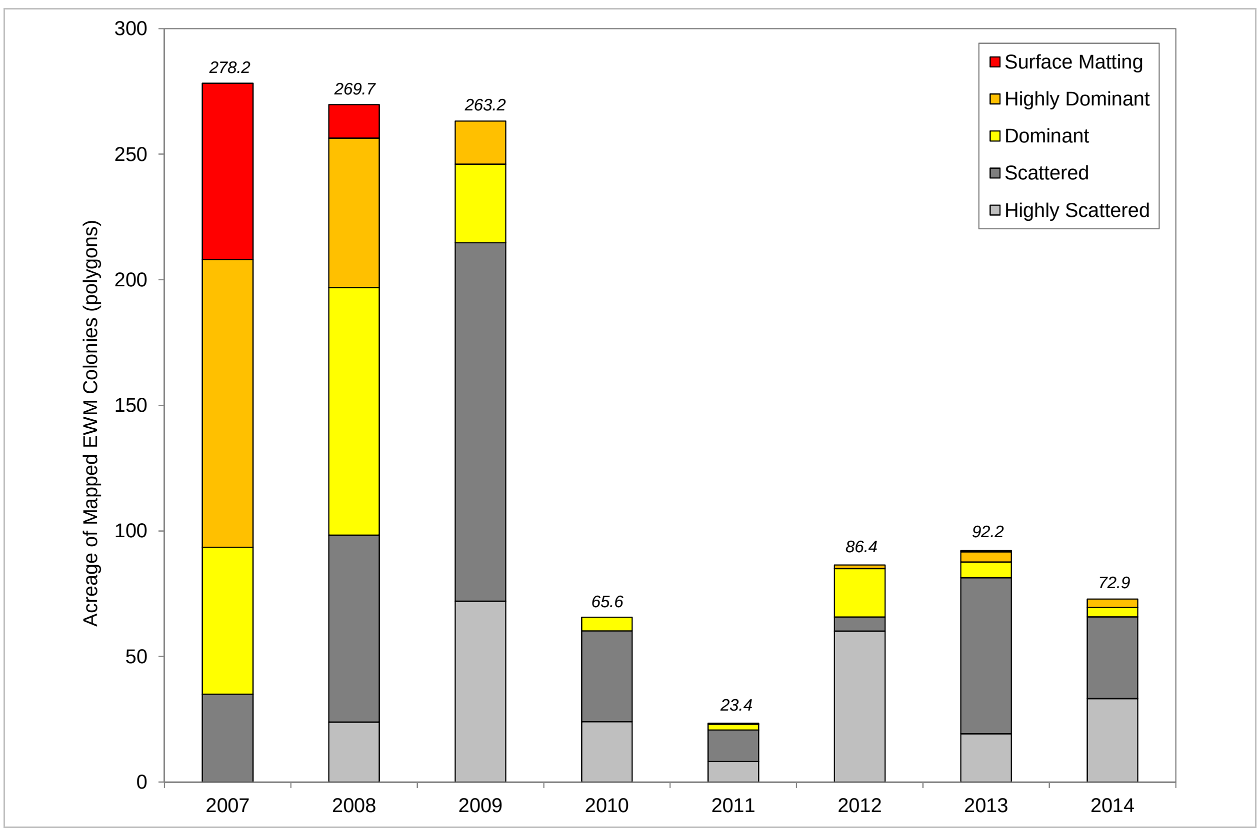


Figure 4. Acreage of mapped EWM colonies on the Eagle River Chain of Lakes from 2007-2014.

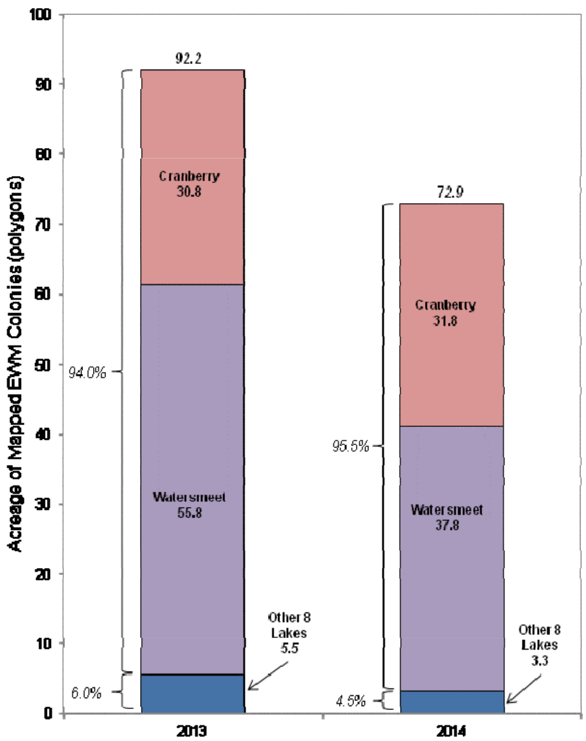


Figure 5. Acreage of mapped EWM colonies on the Eagle River Chain of Lakes, 2013 and 2014.

- Of the 72.9 acres of EWM mapped chain-wide in 2014, approximately 96% of the acreage is located within Cranberry Lake and Watersmeet Lake (Figure 5). Most of the EWM located in these lakes resides in areas with higher water exchange rates, making it more difficult to attain adequate herbicide concentration-exposure times to cause significant EWM mortality. For this reason, these areas were not treated in 2014; however, a strategy targeting these areas in 2015 is proposed.

During the summer of 2013, 23 (55%) of the 42 point-intercept locations within the 2014 treatment areas contained EWM compared to 2 (5%) post-treatment in 2014. This 91% reduction in EWM occurrence was statistically valid (Chi-square $\alpha = 0.05$) and exceeds the treatment-wide quantitative success criterion (50% reduction in occurrence) (Figure 6).

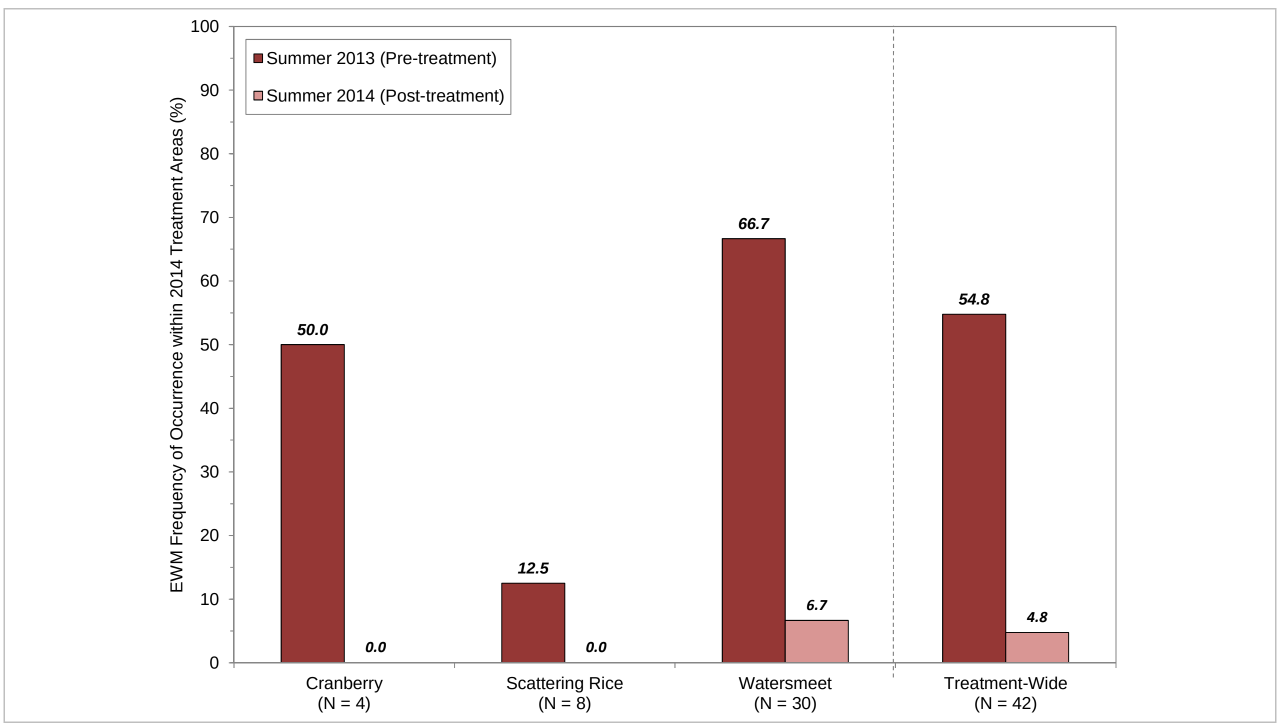


Figure 6. EWM frequency of occurrence within 2014 treatment areas in the summer of 2013 (pre-treatment) and summer of 2014 (post-treatment). EWM occurrence in Cranberry and Scattering Rice Lakes was not statistically different between 2013 and 2014 (small sample size). EWM occurrence was statistically different in Watersmeet and treatment-wide. Created using data from 42 sub-sample point-intercept locations within 2014 treatment areas.

A rake-fullness rating of 0-3 was used to determine the abundance of EWM at each of the 42 point-intercept locations. Figure 7 displays the treatment-wide proportions of EWM rake-fullness ratings from the pre- and post-treatment surveys. Rake tows resulting in no incidence of EWM increased from 45% in 2013 to 95% in 2014, while the number of rake fullness ratings of 1 and 2 decreased to 5% and 0%, respectively.

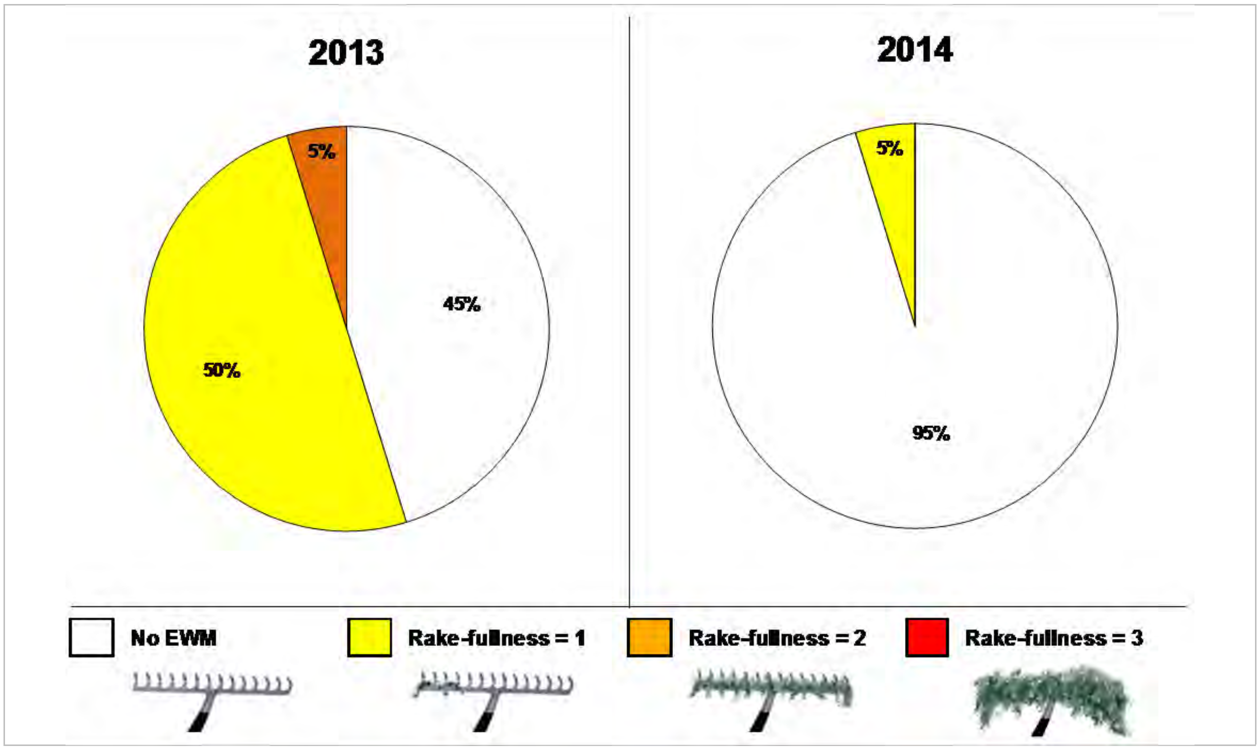


Figure 7. Eagle River Chain chain-wide proportions of EWM rake-fullness ratings. Data is derived from 42 pre-treatment (2013) and post-treatment (2014) point-intercept sub-sampling locations within 2014 treatment areas.

Data concerning native aquatic plant species were also collected at the same point-intercept locations during the summers of 2013 and 2014. Table 2 shows that within the 2014 treatment areas, coontail, common waterweed, fern pondweed, flat-stem pondweed, and wild celery all exhibited statistically valid reductions in their occurrence from 2013-2014. Efforts are taken to minimize impacts to these species by applying herbicides early in the spring before these plants are actively growing. Stoneworts, a group of macroalgae, saw a statistically valid increase in its occurrence within 2014 treatment areas from 2013-2014, while the occurrence of the remaining 13 species were not statistically different (Table 2).

Table 2. Statistical comparison of native aquatic plant frequency within 2014 treatment areas from 2013 pre- and 2014 post-treatment surveys on the Eagle River Chain. Only species with greater than 5.0% frequency of occurrence in at least one of the two surveys are applicable for analysis.

	Scientific Name	Common Name	2013 FOO (%)	2014 FOO (%)	Percent Change	Direction	p-value (Chi-Square)
Dicots	*Myriophyllum spicatum*	Eurasian water milfoil	54.8	4.8	-91.3	▼	0.000
	Ceratophyllum demersum	Coontail	71.4	38.1	-46.7	▼	0.002
	Nymphaea odorata	White water lily	19.0	7.1	-62.5	▽	0.106
	Nuphar variegata	Spatterdock	16.7	7.1	-57.1	▽	0.178
	Brasenia schreberi	Watershield	7.1	4.8	-33.3	▽	0.645
	Bidens beckii	Water marigold	4.8	7.1	50.0	△	0.645
	Myriophyllum sibiricum	Northern water milfoil	4.8	0.0	-100.0	▽	0.152
	Utricularia vulgaris	Common bladderwort	4.8	7.1	50.0	△	0.645
Non-dicots	*Elodea canadensis*	Common waterweed	64.3	16.7	-74.1	▼	0.000
	Potamogeton robbinsii	Fern pondweed	42.9	11.9	-72.2	▼	0.001
	Potamogeton zosteriformis	Flat-stem pondweed	23.8	0.0	-100.0	▼	0.001
	Vallisneria americana	Wild celery	19.0	4.8	-75.0	▼	0.043
	Nitella spp.	Stoneworts	2.4	28.6	1100.0	▲	0.001
	Potamogeton epihydrus	Ribbon-leaf pondweed	7.1	0.0	-100.0	▽	0.078
	Potamogeton friesii	Fries' pondweed	7.1	0.0	-100.0	▽	0.078
	Potamogeton richardsonii	Clasping-leaf pondweed	4.8	7.1	50.0	△	0.645
	Chara spp.	Muskgrasses	2.4	4.8	100.0	△	0.557
	Lemna trisulca	Forked duckweed	0.0	7.1	100.0	△	0.078
	Potamogeton amplifolius	Large-leaf pondweed	0.0	2.4	100.0	△	0.314
	Potamogeton berchtoldii	Slender pondweed	0.0	2.4	100.0	△	0.314

2013 & 2014 N = 42
FOO = Frequency of Occurrence
▲ or ▼ = Change Statistically Valid (Chi-square; α = 0.05)
△ or ▽ = Change Not Statistically Valid (Chi-square; α = 0.05)

As discussed earlier, the changes in native species' occurrences from pre- and post-treatment can only be considered in the context of the areas treated and not extrapolated to a lake-wide basis. To determine if the annual herbicide treatments are impacting native plant species on lake-wide levels, whole-lake point-intercept surveys would need to be conducted on each lake within the chain. These studies were completed in 2006 by Northern Environmental, Inc. and were replicated again in 2012 by Onterra, LLC. Analyses describing any changes in the aquatic plant community of the Eagle River Chain are discussed thoroughly within a separate report that was completed in 2013.

As outlined within the *Eagle River Chain of Lakes AIS Control & Prevention Project Aquatic Plant Community Reassessment* (March 2013), the goal of the 2012 point-intercept surveys on the Lower Eagle River Chain of Lakes were intended to fulfill two main objectives:

1) Determine if the multi-year EWM control project has had detectable adverse impacts to the chain's native aquatic plant community at the lake-wide level.
2) Determine if the multi-year EWM control project has been successful at reducing the chain's EWM population.

According to the analysis and discussion within that report, the goals were fulfilled and have led to an understanding of the present state of the Lower Eagle River Chain of Lakes' native aquatic plant community and EWM population. The data presented indicate that there has been a substantial reduction in the chain's EWM population, and the native aquatic plant community of the Lower Eagle River Chain of Lakes is of exceptional quality, and if anything, is of higher quality at present than in 2005/2006. However, these data indicate that the declines observed in the chain-wide flat-stem pondweed and large-leaf pondweed populations may be a result of the ongoing EWM control project.

As a part of a phased project being currently implemented, the Eagle River Chain of Lakes Association (ERCLA) will be updating each lake's management plan to reflect the success and limitations learned during this multi-year project. Along with establishing new thresholds (triggers) of when specific herbicide treatment strategies warrant implementation, the lake management planning process would also include a holistic understanding of the Eagle River Chain of Lakes ecosystem involving assessments of the water quality, watershed, shoreline condition, floating-leaf and emergent plant communities, and stakeholder perceptions.

5.0 2015 CHAIN-WIDE TREATMENT STRATEGY

For 2015, the preliminary treatment strategy includes targeting approximately 79.5 acres of EWM within the Eagle River Chain with herbicide control strategies (Table 3). While additional discussions between members of the ULERCLC workgroup and Onterra will occur, the following thresholds (triggers) were established that will dictate which EWM colonies would be targeted for control in 2015:

- Colonized EWM consisting of *scattered* density or higher.
- Based upon past studies on the Eagle River Chain and on other lakes within Wisconsin, areas targeted of *scattered* density must have a high likelihood of success. EWM colonies that are determined to be *dominant* or higher would be targeted in all instances.
- Designed treatment sites attempted to exceed 3.0 acres in size and no treatments would occur when at least a 1.5-acre treatment could not be logistically constructed.

The majority of this acreage is attributed to Cranberry Lake within Table 3; however, no EWM is being targeted within Cranberry Lake proper. Areas within the Eagle River upstream of Cranberry Lake are proposed to be targeted for control in 2015 and are discussed within the Cranberry Lake individual lake section of this report. Also, one large area within the main body of water in Watersmeet Lake and two sites within Catfish Lake are proposed to be targeted for control in 2015

Table 3. Proposed 2015 EWM treatment acreage for the Eagle River Chain.

Lake	Proposed Acres
Cranberry	42.4
Catfish	11.3
Voyageur	0.0
Eagle	0.0
Scattering Rice	0.0
Otter	0.0
Lynx	0.0
Duck	0.0
Yellow Birch	0.0
Watersmeet	25.8
All Waterbodies	79.5

On much of the Eagle River Chain of Lakes, the EWM population has reached a point at which some of the herbicide application areas are too small to consistently predict if they will cause EWM mortality. As indicated earlier, it is extremely difficult in small spot treatment scenarios to keep a sufficient herbicide concentration exposed to the target plants long enough to be effective. For that reason, almost all proposed treatment areas include an expanded buffer as well as the maximum liquid 2,4-D application rate of 4.00 ppm ae.

As mentioned in previous reports, one of the greatest successes of the Eagle River Chain control program is the commitment by volunteers. Some volunteers aid in coordination of the project, some provide data to the professional ecologists relating to EWM occurrences, some conduct EWM hand-removal, and others work to educate other stakeholders on the importance of aquatic invasive species and the Eagle River Chain system. Continued volunteer commitment will be needed for long-term success to continue.

6.0 INDIVIDUAL LAKE SECTIONS

The remainder of this repot will focus on 2014 treatment results and proposed 2015 treatment strategies on a lake-by-lake basis. Some of the text may seem redundant if one reads each lake section. However, this is intentional to ensure the information is portrayed to those that just read the chain-wide sections and their individual lake-specific section.

6.1 Cranberry Lake Summary and Conclusions

Based upon the late-summer 2013 EWM survey and subsequent 2014 pretreatment survey, a 2.6-acre granular amine 2,4-D (Sculpin G®) treatment at 4.0 ppm ae was conducted on Cranberry Lake that targeted a small, *scattered* EWM colony located in a semi-protected bay of the lake (Figure 8, upper right; Map Cran 1).

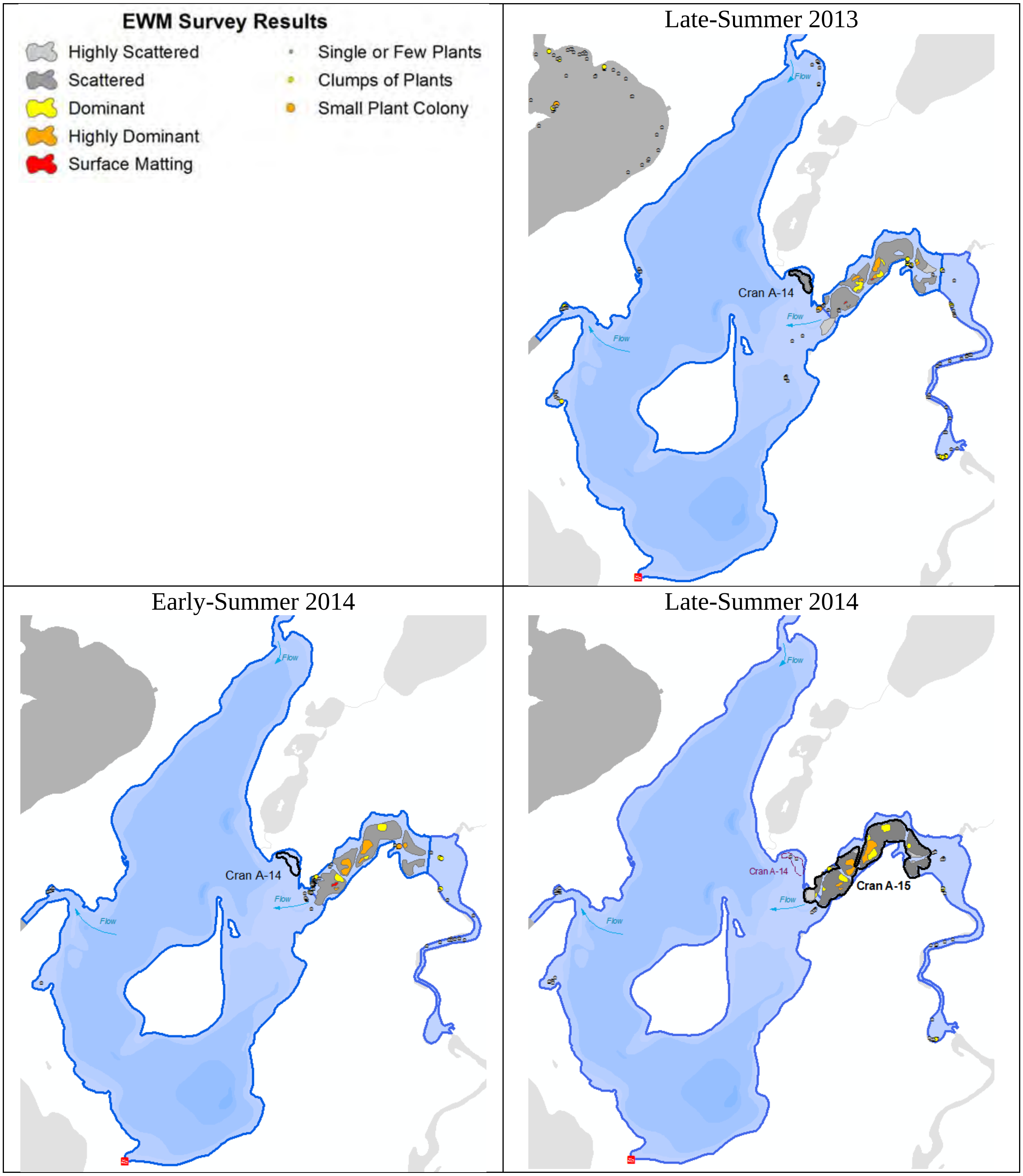


Figure 8. Cranberry Lake EWM Population from Late-Summer 2013 to Late-Summer 2014.

During the early-summer survey, the entire littoral zone of the Eagle River Chain of Lakes was searched for EWM by Onterra field staff. Completing the Early-Season AIS (ESAIS) Surveys present numerous advantages. Typically, the water is clearer during the early summer allowing for more effective viewing of submersed plants. While not at their peak growth stage (peak biomass), EWM plants are higher in the water column than most native plants during this time of year which increases the chances that even low-density and isolated EWM occurrences would be located.

No EWM was located within the 2014 treatment site during the ESAIS Survey (Figure 8, lower left). Not finding EWM within a treatment area at this time of year does not necessarily indicate success, as under-treated and injured plants may rebound by the end of the summer. Similarly, if EWM is located within one of the spring's treatment areas, it is too early to draw conclusions on the treatment's efficacy as some of these plants may be in the process of dying. The results of Onterra's ESAIS survey were loaded onto specific ULERCLC GPS units and trained volunteers were challenged to locate additional EWM occurrences within the chain during the remainder of the summer. The volunteer data were provided to Onterra prior to the late-summer 2014 EWM surveys and integrated into the onboard GPS-enabled computer system.

During the Late-Summer 2014 EWM Peak-Biomass Survey, Onterra field crews visited the following areas: all 2013 and 2014 final herbicide treatment sites, all EWM locations that were located during the Early-Summer ESAIS Survey, and all EWM locations the volunteers located during their mid-summer surveys. Only a small number of *single or few plants* were located within the 2014 treatment site on Cranberry Lake during the Late-Summer 2014 EWM Peak-Biomass Survey (Figure 8, lower right; Map Cran 2), suggesting a successful treatment meeting the qualitative success criteria (75% of acreage reduced) for Site A-14.

As discussed in the chain-wide section, many Wisconsin lakes observed a suppressed EWM population in 2014 likely as a result of a later than usual ice-off and cooler temperatures affecting general plant growth. These conditions, as well as changes in water clarity and water depth, can greatly stress EWM and even kill plants that are growing in marginal conditions or kill plants that haven't been established in areas for a long time. It also makes EWM more difficult to observe during visual surveys, possibly escaping detection during the survey even though it is present (false-negative). The overall EWM population reductions observed on the Eagle River Chain of Lakes in 2014 likely result from a combination of the 2014 herbicide treatment and environmental factors.

During the 2014 Late-Summer Peak-Biomass Survey, EWM was found to be mostly contained in the Cranberry channel. This area is proposed to be treated in 2015 with liquid 2,4-D at 4.00 ppm ae (Map Cran 2). Given the high rate of water exchange within the Cranberry Lake channel, there is concern whether the herbicide exposure time would be sufficient to cause EWM mortality. A flow study is planned for the spring of 2015 prior to the herbicide treatment. During this survey, 78 locations evenly spaced across the section of the channel planned for herbicide application will be visited (Figure 9). At each location water velocity and direction of flow will be collected using a solid-state flow meter (60% of water depth). With this information, water flow data can be calculated (flow = velocity x cross-sectional area) that will help illustrate where higher and lower flows exist within this location. Upstream from the study location, a cross-sectional river flow measurement will also be taken to relate to water flow at each sampling location (Figure 9).

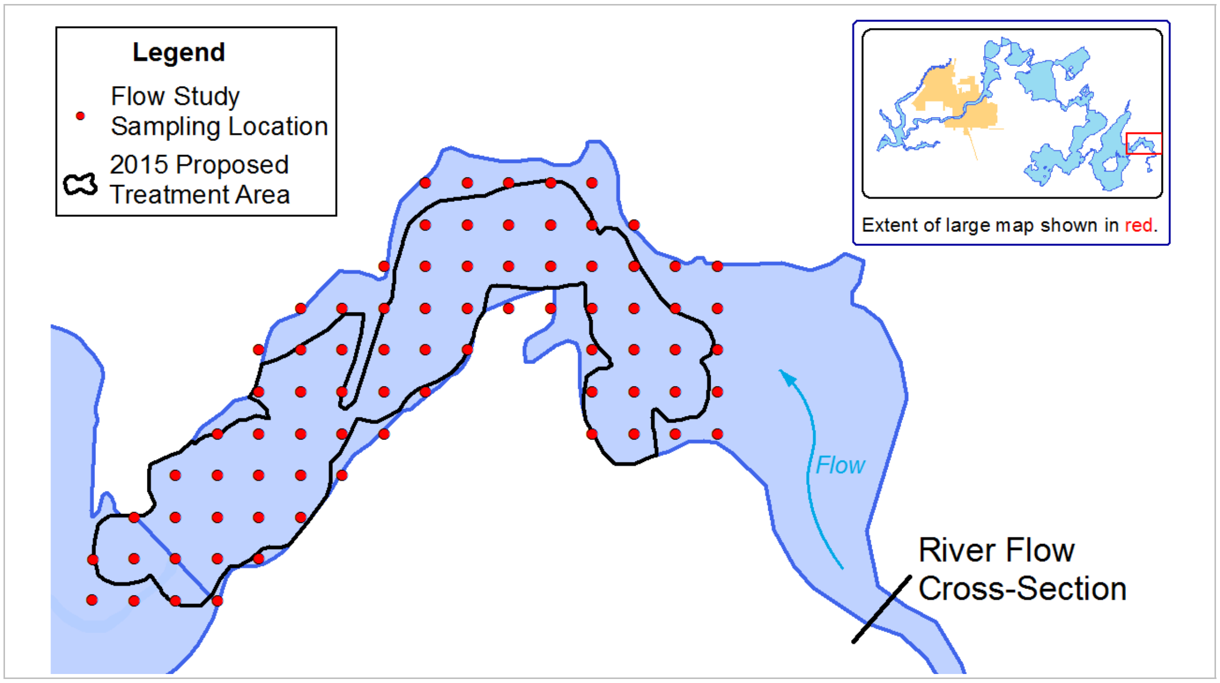


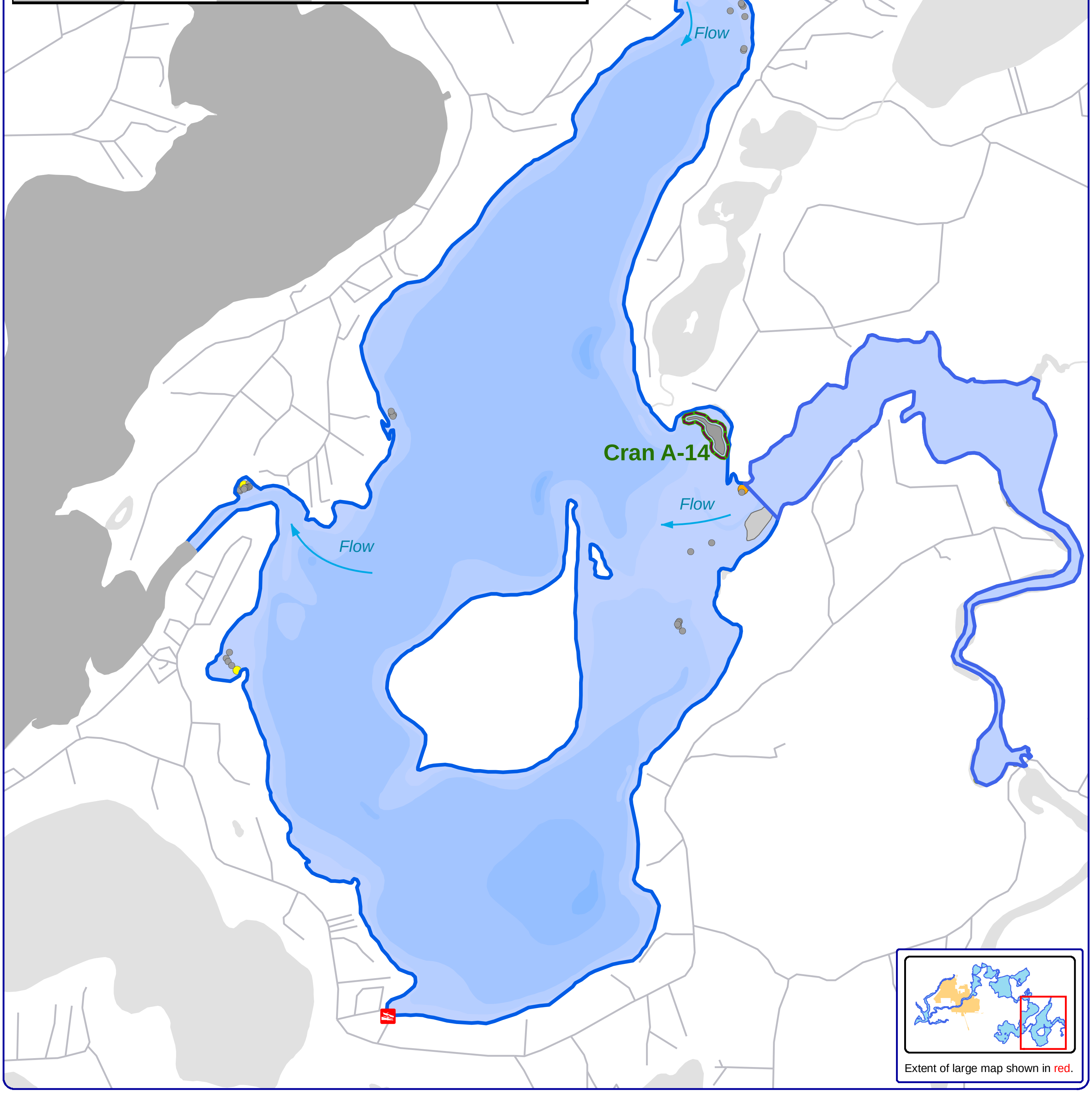
Figure 9. Flow Study Sampling Locations in Cranberry Lake within the preliminary 2015 herbicide treatment area.

Herbicide concentration monitoring samples would be collected following the 2015 herbicide application. Water samples would be collected by trained ULERCLC volunteers. The water samples would be collected from four locations and seven time periods (1 hour after treatment [HAT], 2 HAT, 4 HAT, 6 HAT, 10 HAT, 14 HAT, and 24 HAT). The 28 samples would be sent to the WI State Laboratory of Hygiene at a cost of $982.80 (28 x $35.10) plus shipping. Information collected from this effort would be useful in analyzing treatment effectiveness and aid in strategy development for future herbicide applications should they occur. These data would also be valuable to demonstrate to lake stakeholders when the herbicide dissipated below detectable levels.

2014 Final EWM Treatment Areas

Granular 2,4-D

Site	Proposed Acres	Final Acres	Ave. Depth (feet)	Volume (ac-ft)	2,4-D PPM ae
Cran A-14	2.6	2.6	3.0	7.8	4.00
Total	2.6	**2.6**		**7.8**	



1,600
Feet

2013 EWM Survey (September 2013)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2014 Conditional Treatment Area
- 2014 Final Treatment Area

Onterra LLC
Lake Management Planning
815 Prosper Road
De Pere, WI 54115
920.338.8860
www.onterra-eco.com

Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra, 2013
Map Date: January 29, 2015
Filename: *Cran_EWM_2013PB_T2014.mxd*

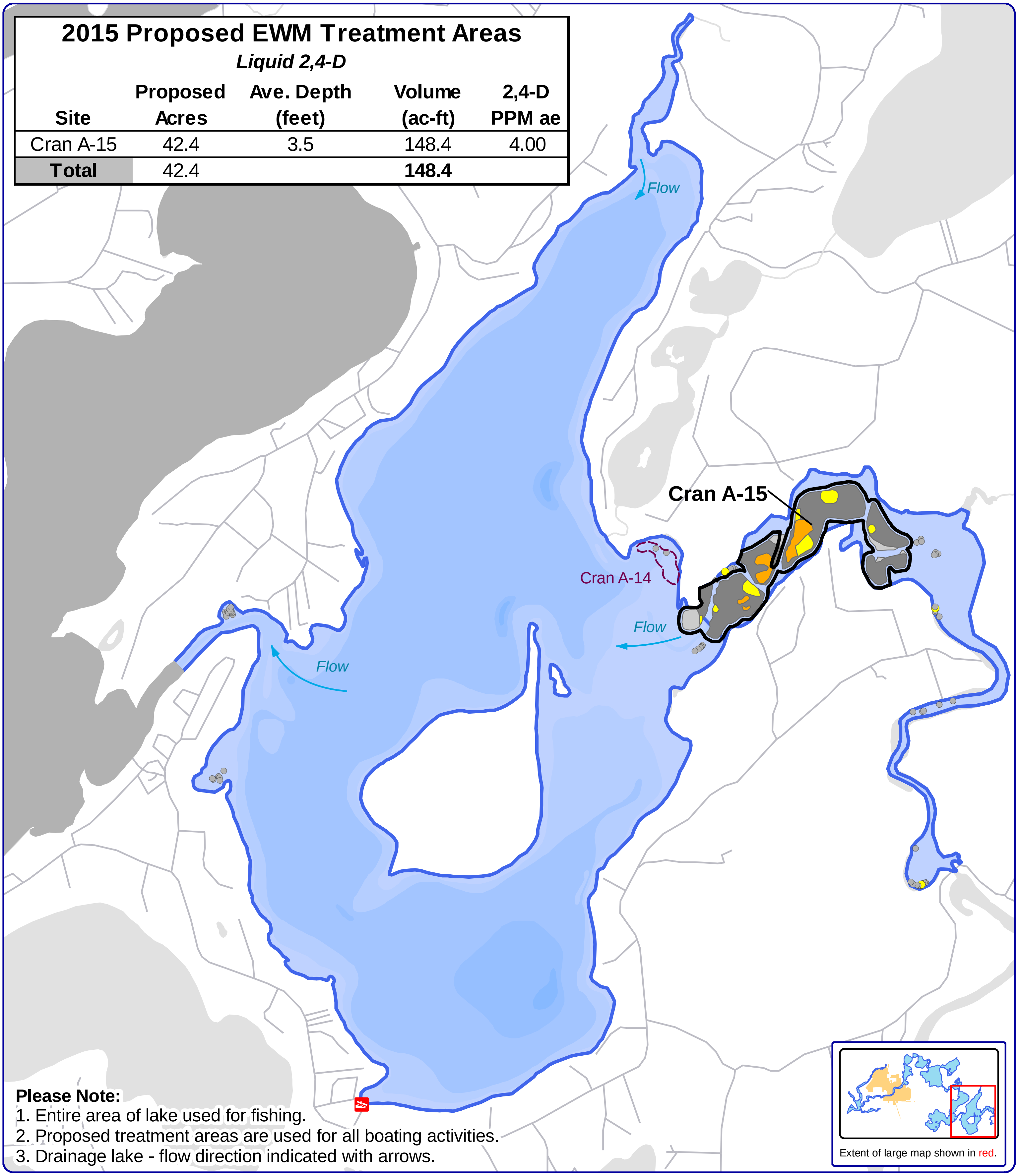
Cran 1
Cranberry Lake
Vilas County, Wisconsin

2013 EWM Locations & 2014 Treatment Areas

2015 Proposed EWM Treatment Areas

Liquid 2,4-D

Site	Proposed Acres	Ave. Depth (feet)	Volume (ac-ft)	2,4-D PPM ae
Cran A-15	42.4	3.5	148.4	4.00
Total	42.4		**148.4**	



Please Note:
1. Entire area of lake used for fishing.
2. Proposed treatment areas are used for all boating activities.
3. Drainage lake - flow direction indicated with arrows.

N
W E
S

1,600

Feet

Onterra LLC

Lake Management Planning

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Sources:
Roads and Hydro: WDNR
Aquatic Plants: Onterra, 2014
Map Date: February 20, 2015
Filename: *Cran2_EWM_T2015_Prelim1.mxd*

Legend

2014 EWM Survey (September 2014)

- Highly Scattered
- Scattered
- Dominant
- Highly Dominant
- Surface Matting
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2014 Final Treatment Area
- 2015 Proposed Treatment Area

Cran 2

Cranberry Lake

Vilas County, Wisconsin

2014 EWM Locations & 2015 Proposed Treatment Areas v.1