Springville Pond – Portage County
2009 Aquatic Macrophyte Survey Results

August 2009

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Acknowledgements

We would like to thank the Village of Plover and Springville Pond landowners for their support that made this survey possible.

Special thanks to Colleen Kiefer and Dan Mechenich for their assistance with this survey and Dr. Freckmann for assistance with plant identification.

Table of Contents

List of Tables

Executive Summary

Eurasian water milfoil, *Myriophyllum spicatum* (EWM) continues to be the dominant aquatic plant species in Springville Pond; however, the density of these plants appears to be declining. The presence of EWM, curly-leaf pondweed, *Potamogetan crispus* (CLP), and water lettuce (*Pistia stratiotes*), a new species in 2009, highlights the vulnerability of the pond to the introduction of other aquatic invasive species. The presence of a new aquatic invasive species demonstrate the need for an aggressive educational campaign that is directed towards homeowners and others that utilize Springville Pond.

In 2006 the Village and citizens of Plover, UW-Stevens Point, and Wisconsin Department of Natural Resources (WDNR) developed an aquatic plant management plan for Springville Pond. They identified five techniques which may be used to control the EWM including (1) release of weevils, (2) winter drawdown, (3) use of the chemical Weedar 64 in early spring, (4) mechanical harvesting, and (5) hand harvesting around docks by lakeshore residents with pickup service by the mechanical harvester. In 2009 hand harvesting around docks was the only technique applied to the pond from the plan. Application of chemical to the pond by a landowner on the north side was observed in July.

Monitoring the aquatic plant community has been conducted from 2006 to 2009 to track the response of EWM and other aquatic plant species to management techniques. The monitoring between 2007 and 2009 has been conducted by staff from the Center for Watershed Science and Education (CWSE) at UW-Stevens Point on several occasions each summer. In the summer of 2009 monitoring was performed to identify the beds of CLP on June 11 and a point-intercept survey of the entire aquatic plant community was conducted on July 28.

An analysis of the surveys conducted during the summer of 2009 indicates that progress is being made in regards to both EWM and CLP. A comparison of the most recent survey results to those from 2008 shows a decrease in density, frequency, and dominance of these plants. In addition, EWM was absent from survey sites near shore (depths less than 3 feet). Although EWM appears to be decreasing it is imperative to continue vigilance in terms of control efforts of this species and monitoring to verify the presence/decline of EWM.

Plans for EWM treatment in 2009 included harvesting and a drawdown of the pond in winter 2009/10 but because of the lower presence of EWM in the pond neither technique was employed. Plans for 2010 should include an option for harvesting if needed, and in attempt to eradicate EWM from the upper end of the pond we recommend the organization of aggressive hand removal of EWM in this end of the pond. Significant effort should be placed on an educational campaign to reduce the introduction of new aquatic invasive species to the pond. . This document contains the results of the surveys conducted in 2009 along with comparison to previous surveys. Reports from 2006-2008 contain additional information about Springville Pond and its aquatic plant community.

Results

Two aquatic plant surveys were conducted in Springville Pond in 2009. The first survey was performed on June 11th to evaluate the extent of the CLP in the Pond. The second was a survey of all of the aquatic plant species in the Pond which was performed on July 28. The WDNR's point-intercept method was employed and included 83 sampling points in the Pond, with an additional six near-shore observation sites. On the east end, random samples were collected near shore to ensure a more robust examination of the lake's aquatic vegetation. Approximately 81% (67) of the sites were vegetated. In total, 21 species of vascular plants and one macro-algae species were identified (Table 1).

Invasive Species

Eurasian water milfoil (*Myriophyllum spicatum*)

In 2009, Eurasian water milfoil (EWM) was present at many sites in Springville Pond; however, overall there was a measured decrease in both density and frequency of occurrence from the 2008 survey. The most notable change was the overall absence of EWM near shore. The densest EWM occurred in the central to eastern portions of the pond, mostly at depths of greater than 4 feet (Figure 1). EWM was present at 75.9% of the survey points, scattered throughout the impoundment excluding near-shore zones, with two distinct beds (Figure 2). The majority of the sites (45.8%) had a sparse level of density, 15.7% of the sites were moderately dense, and EWM was visually observed at the station but was not collected on the rake at 13.3% of the sites (Figure 3). The 2008 survey suggested that EWM was less dense than in 2007, particularly on the west side of the impoundment; however citizens at the Springville Pond aquatic plant management meeting in winter 2008 felt that the 2007 survey had underestimated the extent of EWM (Figure 6). The 2006 survey indicated that EWM was much denser on the west side of the pond than in 2008 (Figure 7 and Figure 5).

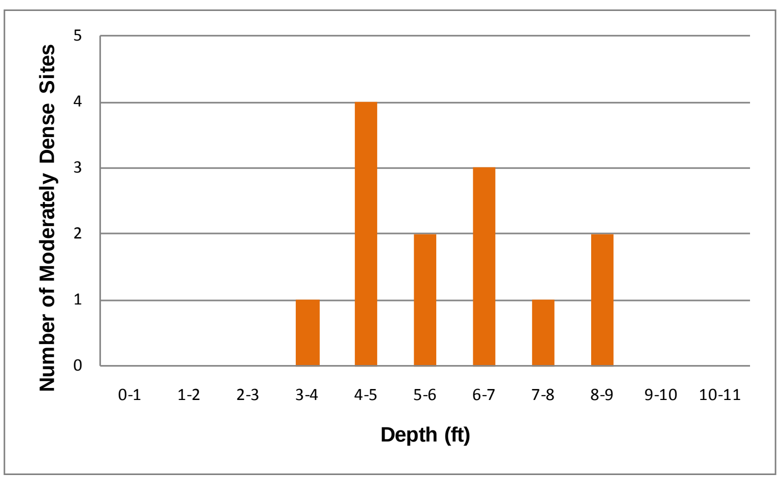


Figure 1. Number of moderately dense sites by depth, Springville Pond, July 2009.

Scientific Name	Common Name	Code name	2003 Survey	2006 Survey	2007 Survey	2008 Survey	2009 Survey
Bidens cernuus	Nodding bur-marigold	bidce	X		X		
Bidens comosus	Swamp marigold	bidco			X		
Bidens frondosus	Common beggar-ticks	bidfr					X
**** Butomus umbellatus***	**Flowering rush**	**butum**			X		
Calamagrostis canadensis	Blue-joint grass	calca				X	
Carex comosa	Bristly sedge	carco	X		X	X	X
Carex stricta	Hummuck sedge	carst			X		
Chara spp.	Muskgrasses	chara	X		X	X	X
Chelone glabra	Turtlehead	chegl			X		
Cicutra bulbifera	Bulbet water hemlock	cicbu			X		X
Eleocharis acicularis	Needle spikerush	eleac			X		
Eleocharis erythropoda	Bald spike-rush	eleer				X	
Eleocharis palustris	Creeping spikerush	elipa	X		X		
Elodea nuttallii	Narrow leaved waterweed	elonut	X				
Epilobium coloratum	Cinnamon willow-herb	epico	X				
Glyceria grandis	American manna grass	glygr				X	
Impatiens capensis	Orange jewelweed	impca	X		X	X	X
Iris versicolor	Northern blue flag	irive				X	X
Juncus effusus	Soft rush	junef	X		X	X	X
Lemna minor	Small duckweed	lemmi	X	X	X	X	X
Lycopus americanus	American water horehound	lycam					X
Myosotis	Forget-me not	myoso				X	X
Myriophyllum sibiricum	Northern water milfoil	myrsi	X				
** Myriophyllum spicatum*	Eurasian water milfoil	myrsp	X	X	X	X	X
Nitella spp.	Stoneworts	nitel					X
Nymphaea odorata	White water lily	nymod			X		X
** Phalaris arundinacea*	Reed Canary grass	phaar	X		X	X	X
****Pistia stratiotes***	**Water lettuce**	pisst					X
Polygonum amphibium	Water smartweed	polam			X	X	X
Polygonum hydropiperoides	Swamp smartweed	polhy	X				
** Potamogeton crispus*	Curly leaf pondweed	potcr	X	X	X	X	X
Potamogeton illinoensis	Illinois pondweed	potil					X
Potamogeton pectinatus	Sago pondweed	potpe	X	X	X	X	X
Rumex verticillatus	Swamp dock	rumve	X				
Schoenoplectus tabernaemontani	Softstem bulrush	schta	X		X	X	
Scutellaria laterfolia	Mad-dog skullcap	scula			X		
Solanum dulcamara	Bittersweet nightshade	soldu	X			X	X
Sparganium americanum	American bur-reed	spaam				X	
Triadenum fraseri	Bog St. Johns-wort	trifr					X
Typha latifolia	Broad-leaved cattail	typla	X		X	X	X
Zannichellia palustris	Horned pondweed	zanpa	X				
	Filamentous algae	filal	X	X	X	X	X

* Indicates invasive species, **BOLD** indicates an invasive species that is new to Portage County, Shading indicates part of these plants MAY be known to be mildly to severely toxic to either animals and/or humans (*Freckmann)*.

Table 1. Aquatic vascular plants and macro-algae identified in Springville Pond in recent aquatic plant surveys.

Figure 2. EWM presence, density, and distinct beds, July 2009.

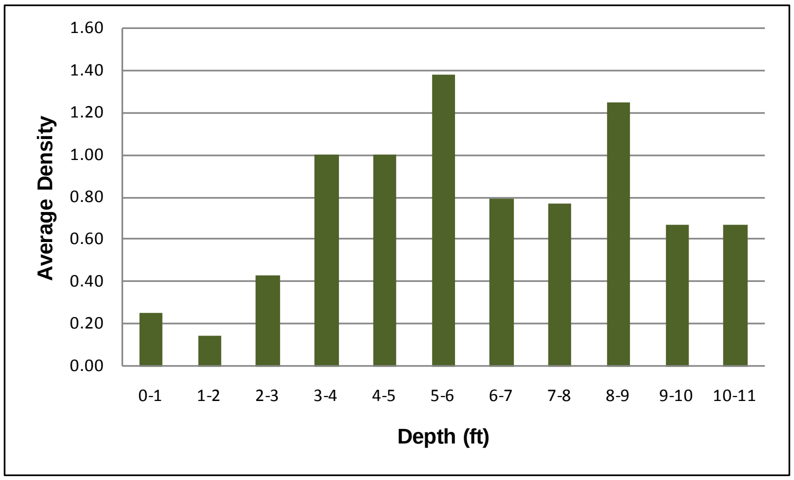
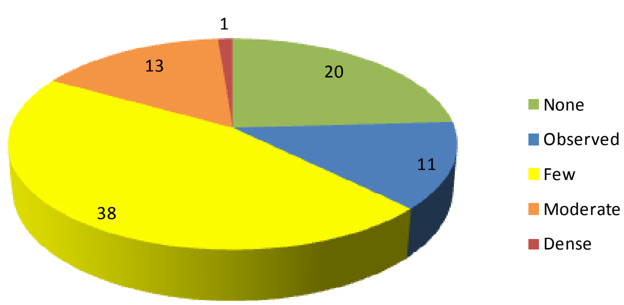


Figure 3. Average density of EWM by depth, Springville Pond, July 2009.



Number of sites with EWM within each density class, July 2009.

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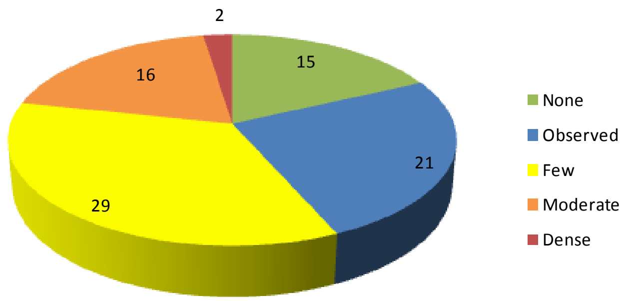
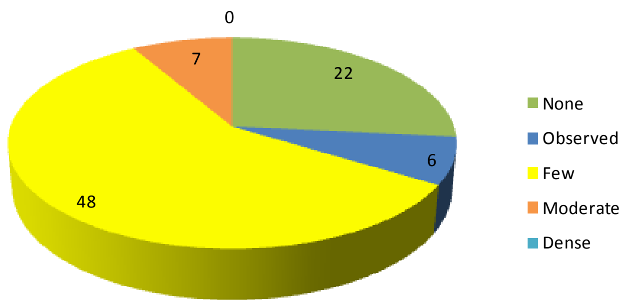


Number of sites with EWM within each density class, July 2008



Number of sites with EWM within each density class, August 2007.

Figure 4. Number of sites with EWM, 2007-2009 during summer aquatic plant surveys.

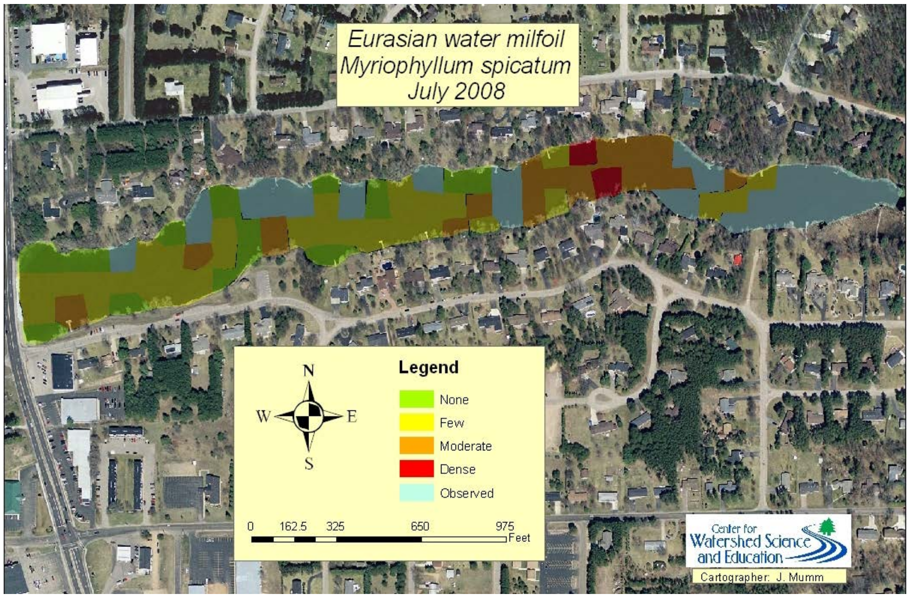


Figure 5. EWM presence and density, Springville Pond, July 2008.

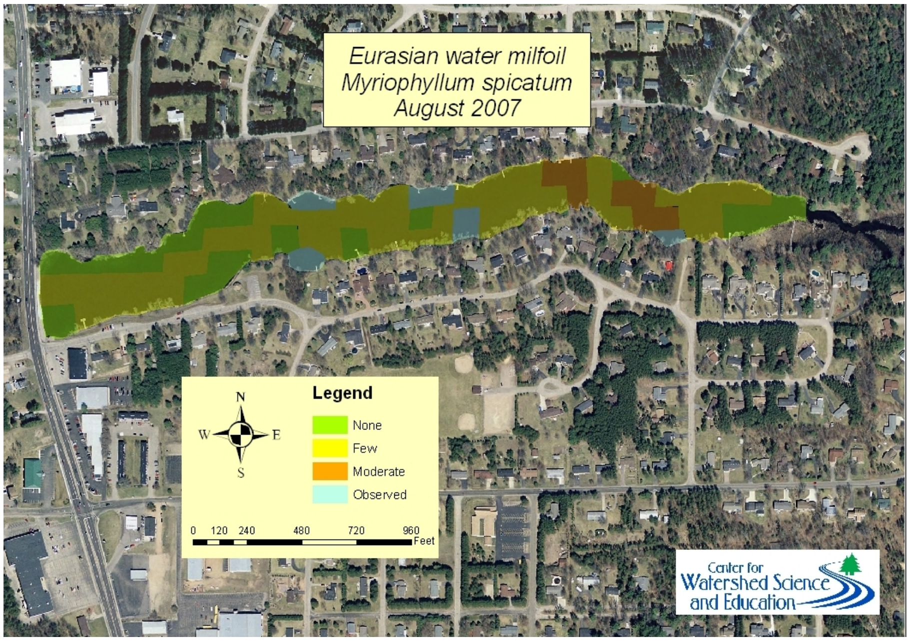


Figure 6. EWM presence and density, August 2007.

Figure 7. EWM presence and density, August 2006.

Curly- leaf pondweed (*Potamogeton crispus*)

Curly-leaf pondweed (CLP) is another invasive species in Springville Pond. CLP grows in cooler temperatures early in the year and generally dies back in mid June. The timing of the dieback often results in a release of phosphorus from the plant tissue that can fuel the growth of filamentous algae for the balance of the summer. Because of this cycle, CLP is seldom present in aquatic plant surveys conducted in mid-August; however, the cooler groundwater that feeds Springville Pond allows small populations of CLP to grow year-round. During the summer survey in 2009 44.6% of the sampling sites had CLP, with 68.4% of those sites having few or sparse density and the remaining 31.6% were visual observations. Surveying CLP beds in June often provides a better measure to assess the necessity of management of CLP and provides information for year-to-year comparisons. Therefore beginning in 2008 June surveys for CLP were conducted. During the June 2009 survey, CLP was primarily found on the eastern side of the pond (Figure 8). A greater number of medium to high density sites were observed during the 2008 survey. In 2009 approximately 42% (35) of the sampling sites had CLP, with about half of those sites having few or sparse density, and at the remainder of those sites CLP was visually observed but not collected on the rake (Figure 10).

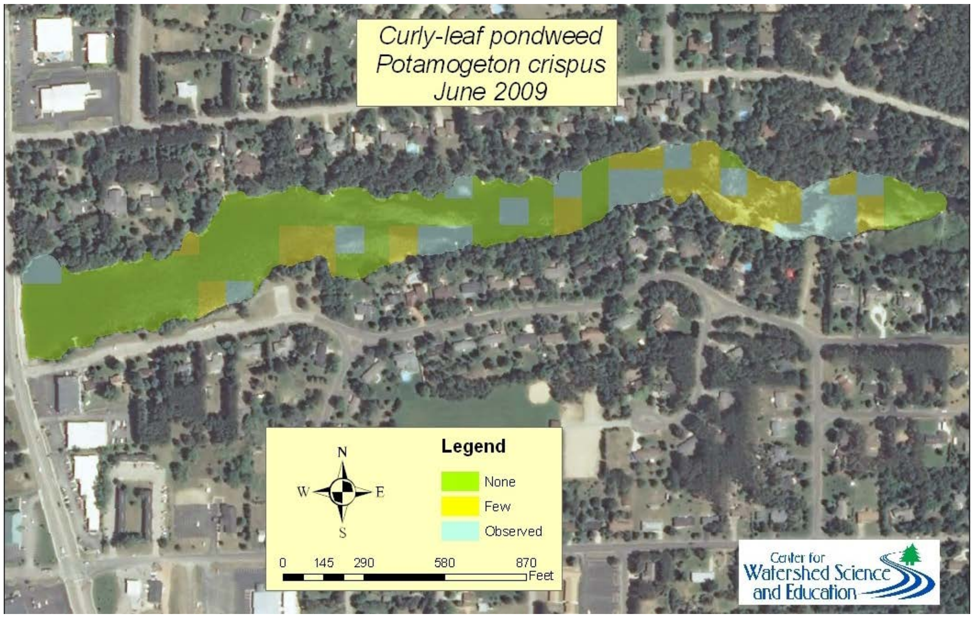


Figure 8. CLP presence and density, June 2009.

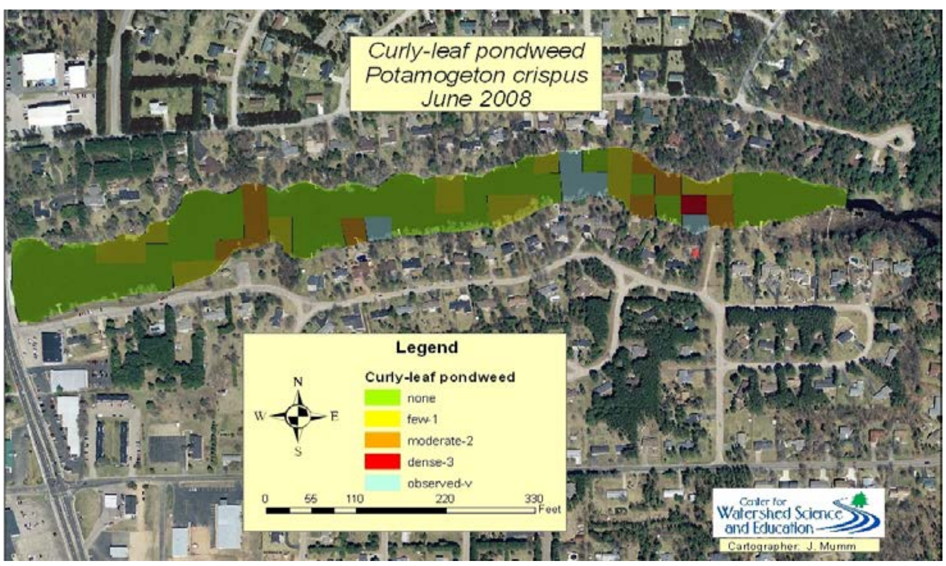
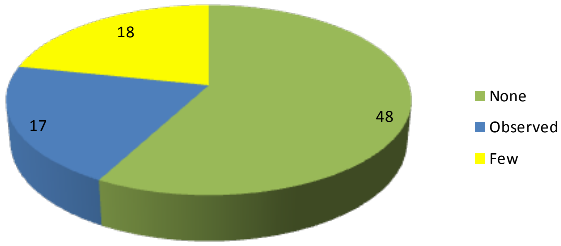
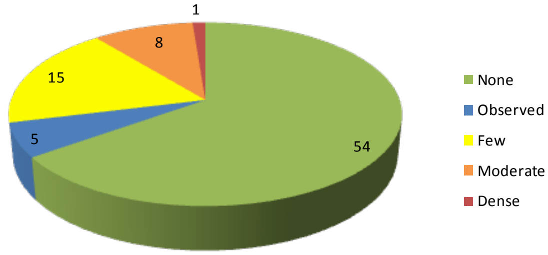


Figure 9. CLP presence and density, June 2008.



Number of sites with CLP within each density class, June 2009.



Number of sites with CLP within each density class, June 2008.

Figure 10. Number of sites with CLP in Springville Pond, June aquatic plant surveys, 2008-2009.

Water Lettuce (Pistia stratiotes)

Water lettuce (*Pistia stratiotes*) was first identified in Springville Pond during the August 2009 shoreland survey. Its preference for wet, temperate habitats make it more common in the southeastern US (having a suggested origin in South America), but it has spread to other regions as the result of human transport and relocation, due to ship traffic and its high desirability as an ornamental pond plant. Water lettuce can be a highly aggressive invasive aquatic plant, but so far has not been observed to overwinter in Wisconsin. It is easy to identify, having soft, thick, light green leaves, with large veins running their length. The leaves are arranged in a spiral pattern from the center of the plant forming a rosette (circular formation of leaves), which is supported by a submersed root system with a feathery appearance. The free-floating rosette conceals a small flower and the seed bearing fruit of the plant, lending to reproduction by seed, as well as having the ability to reproduce vegetatively. Through vegetative offshoots off of the mother plant, this type of reproduction has been attributed to the plants rapid spread, where it can form large mats causing a decrease in navigability, restriction of sunlight into the water, oxygen depletions, fish kills, and a decrease in biodiversity.

All of the water lettuce plants found during the August 2009 survey were removed by hand; a total of 24 flowering plants were found at the locations indicated by Figure 11. Although the plant can only endure temperature extremes down to about 15 °C (59 °F) pockets of water in Springville Pond can remain fairly warm due to groundwater. Monitoring in the near future and continuing into summer 2010 is essential to ensure it is eliminated from Springville Pond.

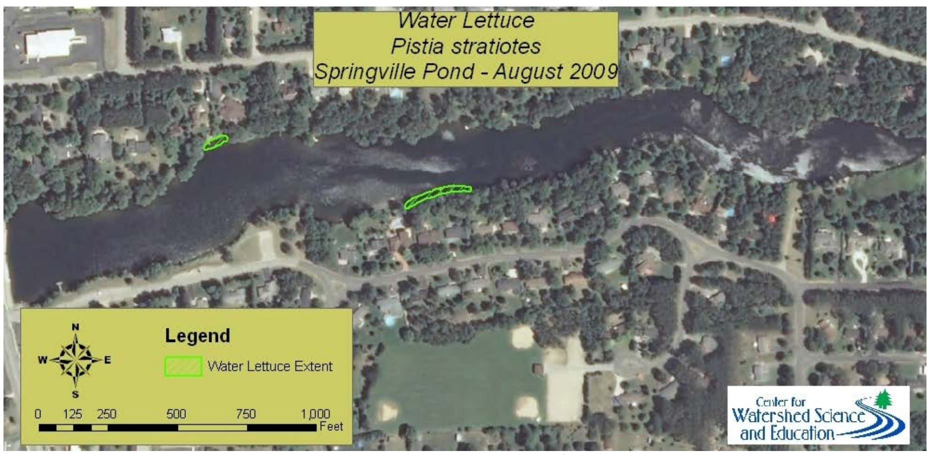


Figure 11. Water lettuce locations, August 2009.

Flowering Rush (*Butomus umbellatus*)

Flowering rush *(Butomus umbellatus)* was first identified adjacent to Springville Pond in 2007. It is native to Eurasia and grows on the banks of still and slowly moving water down to a depth of around 3 m. It has pink flowers and long green rushes. It was introduced into North America as an ornamental plant to decorate gardens but is now a large problem and is quickly becoming an invasive species in the Great Lakes region. It has not been found in Portage County until now and because of the connection with the Wisconsin River it is particularly important to monitor the area it was found and destroy any plants. This rush is difficult to identify when it is not flowering, so efforts will be most fruitful while it is flowering in spring/early summer. This species was identified at site 2, which is on the northeastern side of the impoundment. It was not flowering at the time of observation (Appendix, Figure 29). Attempts to remove this plant were made in summer 2008.

Floristic Quality Index

The floristic quality index (FQI) is a standardized method used to evaluate natural plant communities. The FQI is calculated using the coefficient of conservatism ("c value") which is assigned to each species of plant. The c value (a scale of 0 to 10) indicates the degree to which a species can tolerate disturbance to a native plant community; a species with a c value of 10 is found only in relatively undisturbed areas of native plant community, whereas a species with a c value of 1 is tolerant of disturbed conditions. A value of 0 is assigned to alien species. The FQI is produced by multiplying the average c value for all species by the square root of the total number of species found at that lake; and additional points are added to the index for each state-listed special concern species, threatened species, or an endangered species. Plants with low numbers tend to occur in a wide range of more-or-less disturbed plant communities.

A higher FQI indicates a higher floristic quality and biological integrity and a lower level of disturbance impacts. A lower FQI indicates a lower floristic quality and biological integrity and a higher level of disturbance impacts. The c values for aquatic and near shore plants in Springville Pond in the 2009 survey ranged from 0 to 8, with an average of 3.6 (Table 2). The FQI for Springville Pond in 2009 was 16.6; up from 2008, but still slightly lower than in 2007. The range of FQI for impoundments in Portage County in 2003 was 16 to 40.8 (2003, Freckmann).

Survey Year	Median number of species	Average c value	Max c value	FQI
2003	22	3.5	7	16
2006	4	2	4	8
2007	22	4	7	18.8
2008	20	3.3	8	14.4
2009	21	3.6	8	16.6

Table 2. Median number of species, average c value, max c value, and FQI for recent aquatic macrophyte surveys in Springville Pond.

Dominance

The most prominent species of aquatic plants in a lake is considered the most dominant species. Dominance calculations include measures of density and frequency; the highest dominance value is 2. The dominant plant communities in Springville Pond during the 2009 survey included EWM, sago pondweed, CLP, filamentous algae, chara, and lemna minor. These are the same species that showed as dominant in 2008. The most dominant aquatic plant species in Springville Pond continues to be EWM *(*myrsp) which had a dominance value of 0.96 in 2009 and is slightly less than 2008 (Table 3). The second most dominant aquatic macrophytes are CLP (potcr) and native sago pondweed (potpe), both with a dominance value of 0.41. Filamentous algae was the dominant macro-algae with a value of 0.15.

Code Name	C value	Dominance	Relative Frequency	Relative Density
bidfr	1	0	0	0
carco	5	0	0	0
chara	7	0.02	0.01	0.01
cicbu	7	0	0	0
impca	2	0	0	0
irive	5	0	0	0
junef	4	0	0	0
lemmi	5	0.05	0.03	0.02
lycam	4	0	0	0
myoso	0	0	0	0
myrsp	0	0.96	0.46	0.50
nitel	7	0.02	0.01	0.01
nymod	6	0	0	0
phaar	0	0	0	0
polam	5	0	0	0
potcr	0	0.41	0.22	0.19
potil	6	0	0	0
potpe	3	0.41	0.22	0.19
soldu	0	0	0	0
trifr	8	0	0	0
typla	1	0	0	0
filal	N/A	0.15	0.06	0.09

Table 3. C value, dominance value, relative frequency, and relative density, July 2009.

Simpson Diversity Index

The Simpson diversity index (SDI) quantifies biodiversity as a percent using a formula containing the number of species surveyed and the number of individuals found per species. The closer the SDI is to one, the more diverse the plant community. Greater diversity of species help to stabilize the aquatic plant community and provide more food and habitat niches within the Pond. In 2009 the SDI was 0.69, a slight increase from 0.64 in 2008. In 2007 the SDI was 0.88 which was a significant increase from 0.15 in 2006. This increase was due the inclusion of visual observations on the east end of the pond starting in 2007 and continuing through the 2009 survey.

Frequency of Occurrence

The frequency of occurrence (FO) percentage compares vegetated sites and sites shallower than the maximum water depth where plants were found (11.0 ft). Thirty-nine percent of surveyed sites shallower than 11.0 ft had native plants in 2009. Figure 12,Figure 13, and Figure 14 show the relative frequency of the individual species found in vegetated sites and the relative frequency of individual species found at sites less then maximum plant depth from the 2007-2009 surveys.

These graphs show a fairly consistent ratio between the two frequency classes for each species. Species that were identified by visual observation rather than on a rake sample were not assigned FO percentages.

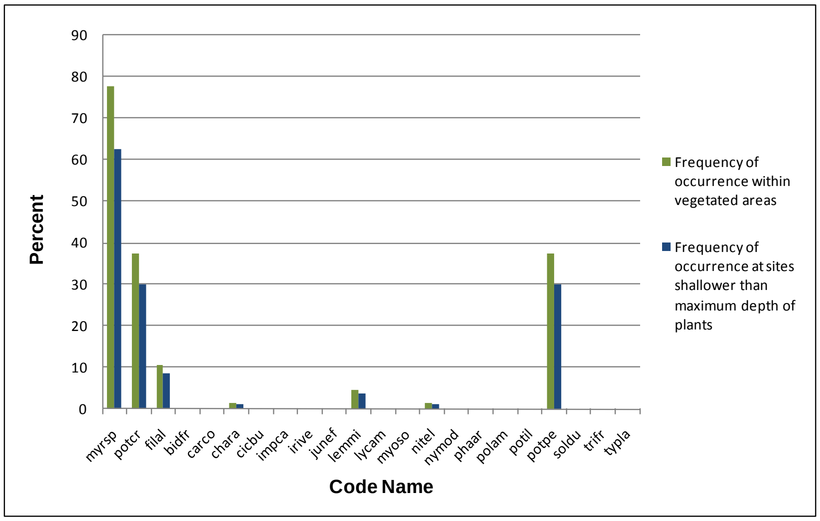


Figure 12. Frequency of occurrence for aquatic plants collected on rake samples, July 2009.

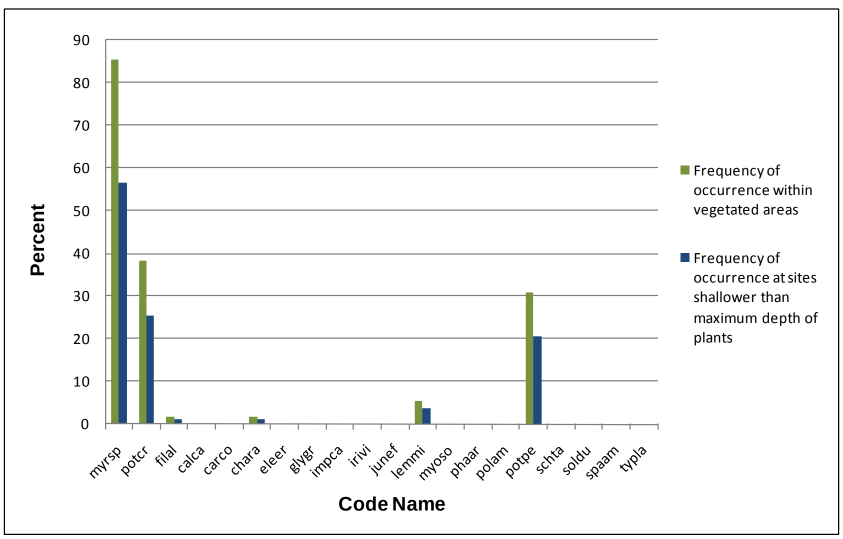


Figure 13. Frequency of occurrence for aquatic plants collected on rake samples, July 2008.

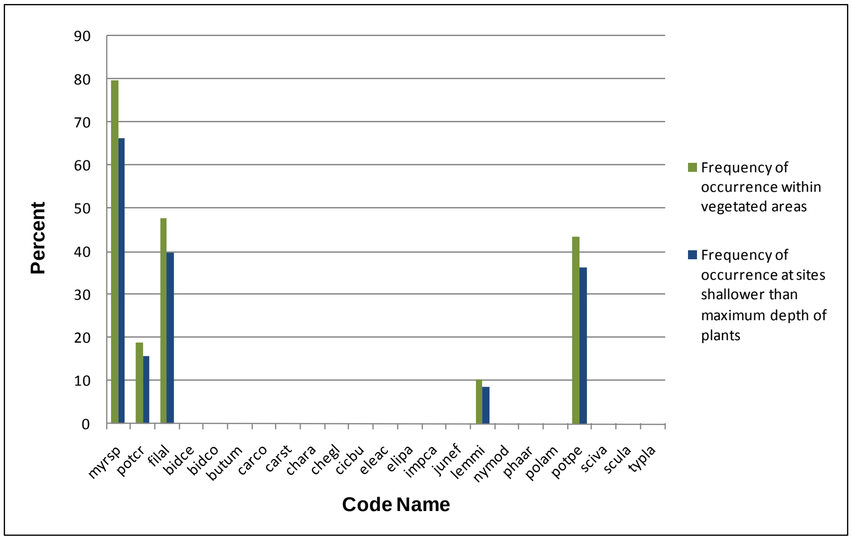


Figure 14. Frequency of occurrence for aquatic plants collected on rake samples, August 2007.

Statistics by Species

The most prominent aquatic plant species sampled in Springville Pond in 2009 were EWM (myrsp,), filamentous algae (filal), sago pondweed (potpe,), CLP (potcr,), and small duckweed (lemmi). This was the same in 2008 and 2007. Figure 15, Figure 16, and Figure 17 illustrate the total number of sites where each species was present (excluding visuals) during the 2007-2009 surveys. The most notable change is that a new plant species occurs in each subsequent year. When visual identifications are included in the statistics, the most prominent species remain the same, which are the same as 2008 and 2007. Figure 18, Figure 19, and Figure 20 show the total number of observations including visuals for each species from the 2007-2009 surveys.

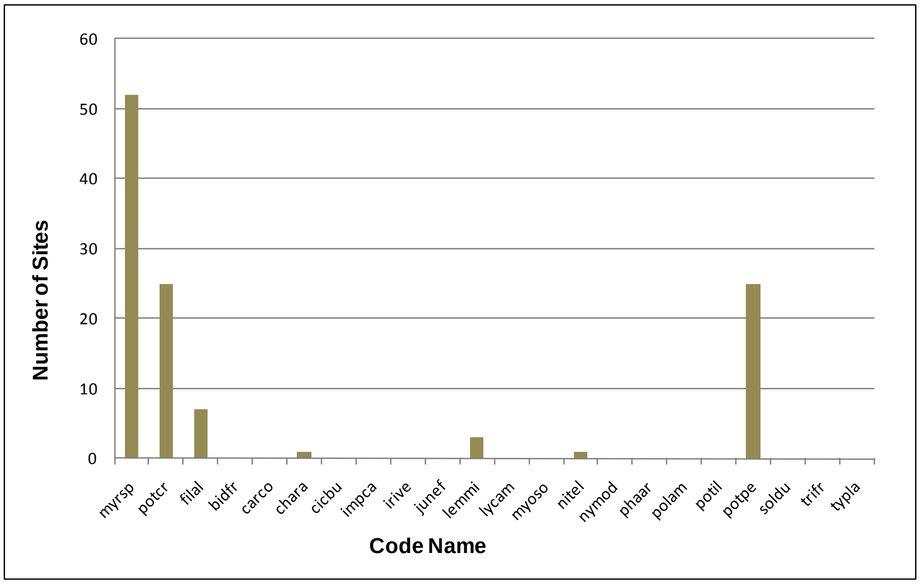


Figure 15. Number of sites each species was observed, July 2009 (excluding visuals).

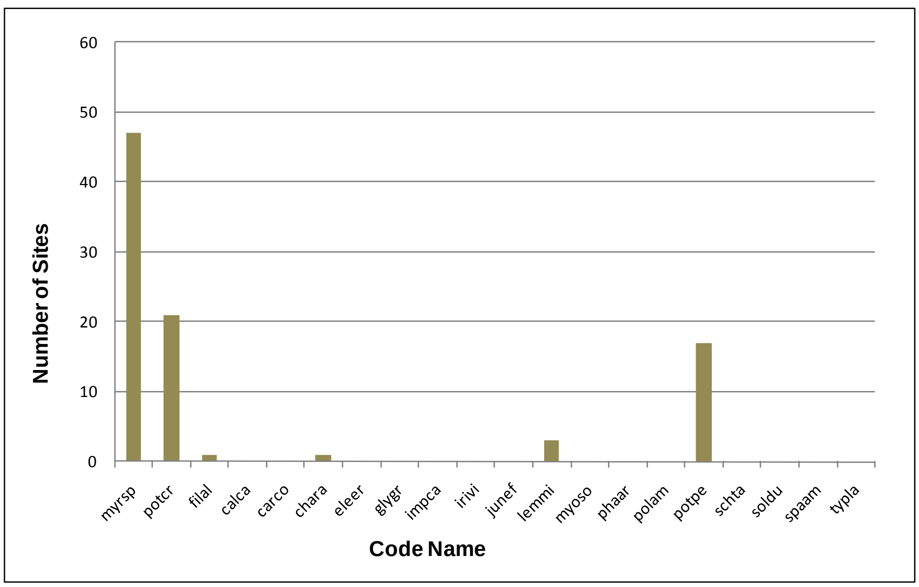


Figure 16. Number of sites each species was observed, July 2008 (excluding visuals).

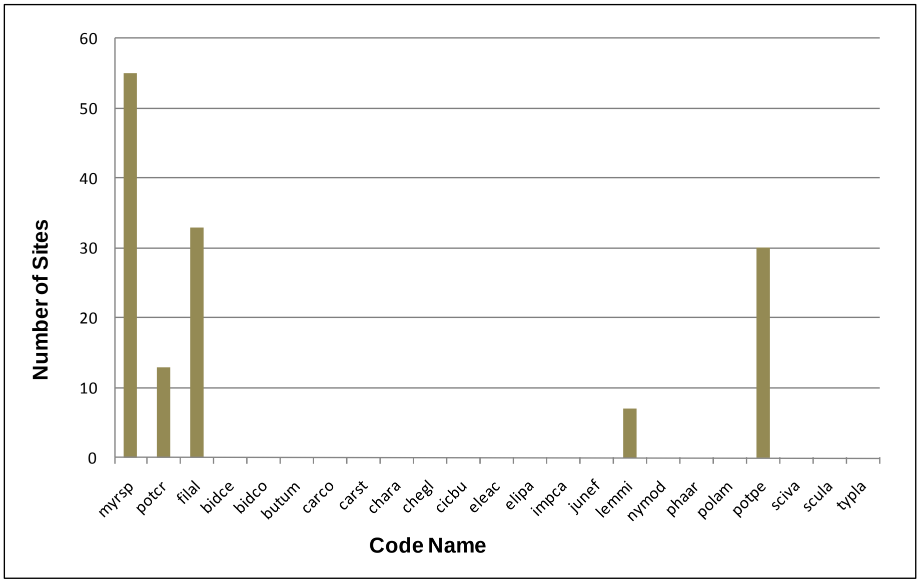


Figure 17. Number of sites each species was observed, August 2007 (excluding visuals).

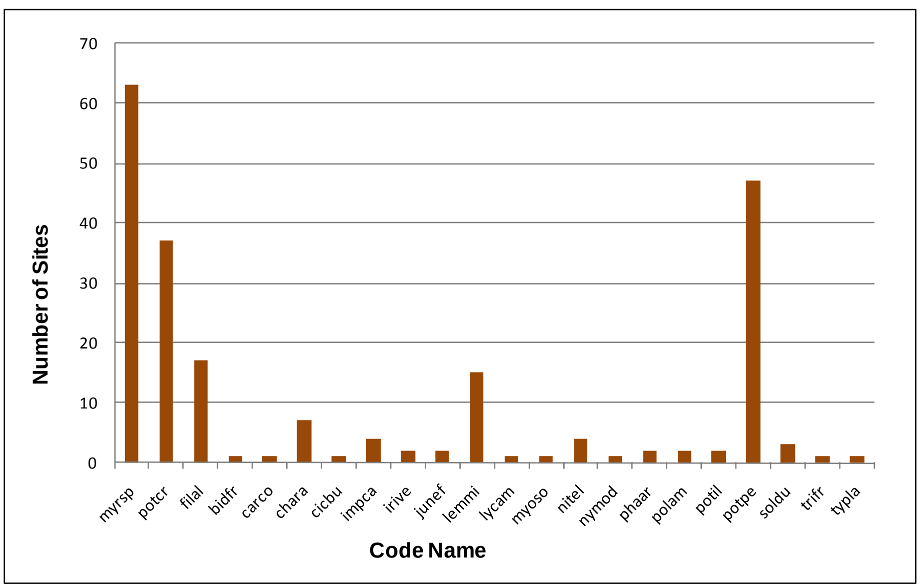


Figure 18. Number of sites each species was observed, July 2009 (including visuals).

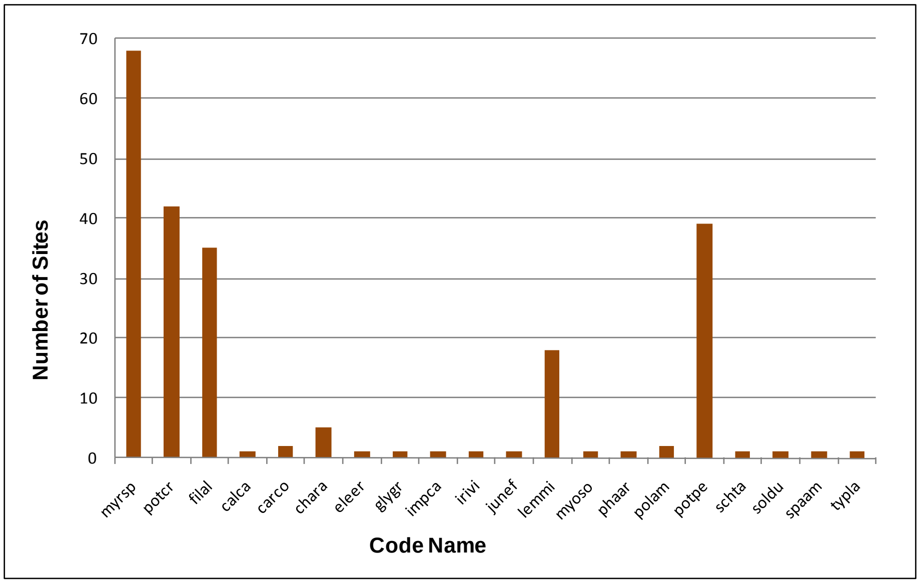


Figure 19. Number of sites each species was observed, July 2008 survey (including visuals).

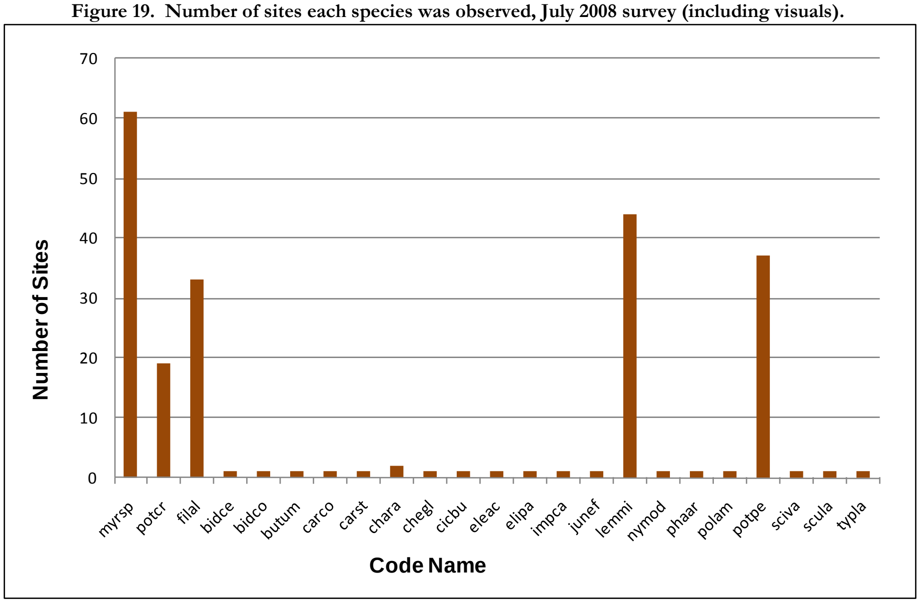


Figure 20. Number of sites each species was observed, August 2007 (including visuals).

Near Shore Riparian Zones

Parts of the near shore (riparian) zone around Springville Pond continue to improve. A riparian zone is the area at the shoreline where water meets the land. This critical area should provide water quality benefits which can help to change the aquatic plant community in a pond along with habitat and food for many aquatic and terrestrial species. The most effective vegetation that will provide good filtering and nutrient uptake from runoff water and diverse habitat consists of a mix of small shrubs, tall grasses/forbs/sedges, and small and tall trees (Figure 21). This is called a vegetative buffer. Sand, vines, a few trees, and short grass in this region provide little habitat and benefit to water quality (Figure 22). The Portage County and Wisconsin DNR rules are a minimum of 35 feet of buffer depth (land to water's edge) with no more than 30 foot access corridor. Currently, the Village of Plover does not have a shoreland zoning ordinance.

Figure 21. Example of protective buffer in the riparian zone; buffer is greater than 30 feet.

Figure 22. Example of no buffer in the riparian zone; buffer is 0 feet.

In 2003 the riparian zones around Springville Pond were mapped in an herbaceous survey that was part of the Portage County Lake Study. Slightly different surveys were conducted in summers of 2007- 2009. The newer survey design was less focused on the type of vegetation and more focused on the depth of the buffer, whereas the 2003 survey identified the type of vegetation and level of disturbance in a zone approximately 15 feet inland from the water. Although the assessments were not identical, the 2007 information (Figure 25) suggests more buffered shoreline than 2003 (Figure 26), the 2008 survey (Figure 24) suggests an increase in vegetative buffer from 2007, and the 2009 survey (Figure 23) being similar to 2008 (with the exception of more buffer distance classes in an attempt to give a more accurate depiction of the riparian zones around the pond).

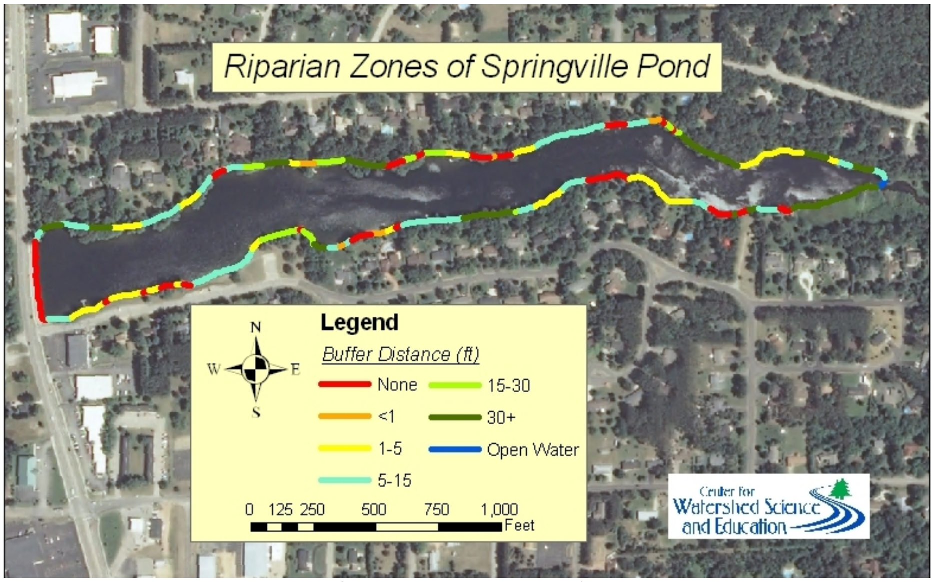


Figure 23. Survey of vegetated buffers, August 2009.

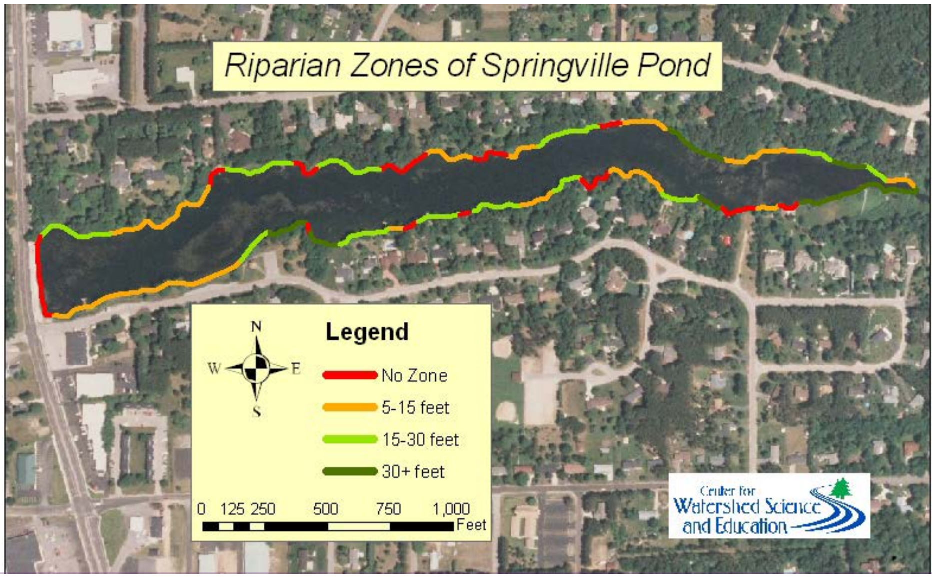


Figure 24. Survey of vegetated buffers, July 2008.

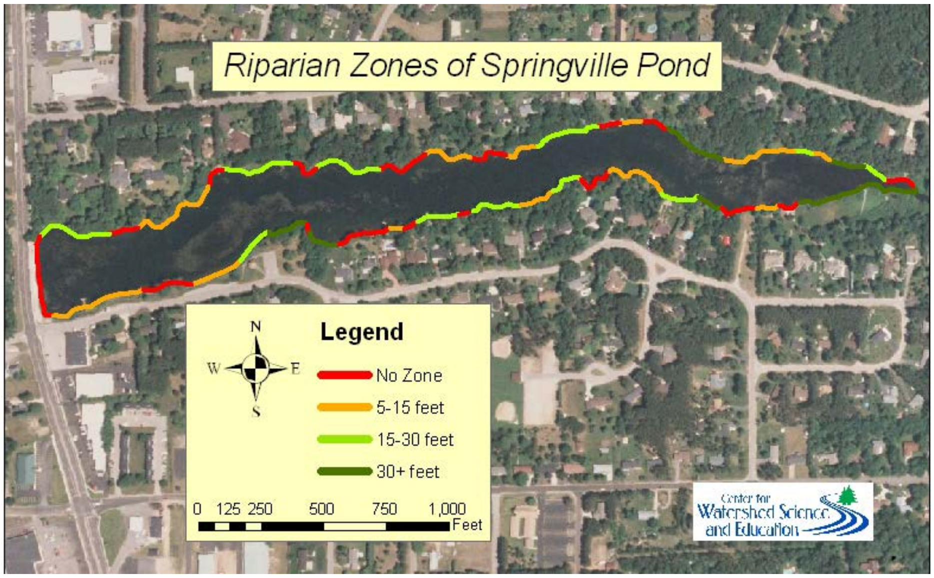


Figure 25. Survey of vegetated buffers, August 2007.

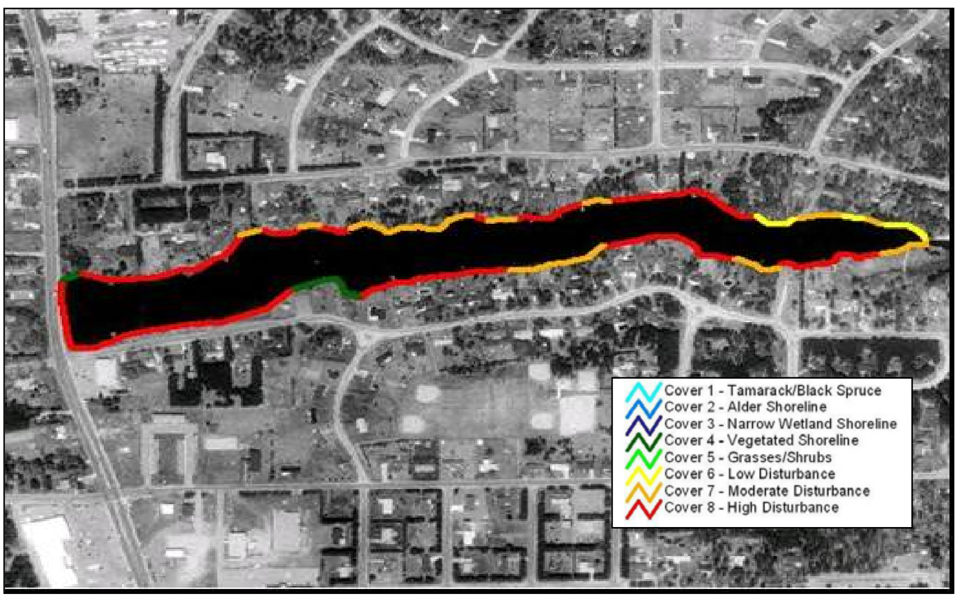


Figure 26. Survey of vegetation and disturbance within 15 feet of water's edge, 2003.

Past Treatments

A variety of treatments were identified in the Springville Pond Aquatic Plant Management Plan and were used between 2006-2009 to address EWM in Springville Pond. The recommendations and actions taken from 2006-2009 are summarized in Table 4. Approved locations for the treatments for years without drawdowns are shown in Figure 27, and the approved locations for treatments in years with drawdowns are shown in Figure 28.

Management Plan	2006/07	2007	2008	2009
Weevils	Weevils released summer 2006	No weevils used	No weevils used	No weevils used
Winter drawdown – 3 feet	Winter drawdown– but was less than 2.5 feet	No drawdown	No drawdown	Applied for permit but not approved by DNR based on 2009 aquatic plant survey results
Chemical Herbicide Use of Weedar 64 in approved area in early spring (see map)	Used in May 2007	Applied in May 2007	Applied in May 2008	Not used in 2009
Mechanical harvesting in approved removal area (see map)	Used in July 2007	July 2007	July 2008	Not used in 2009
Hand harvesting around docks by lakeshore residents or their agents with pickup service by mechanical harvester	Hand harvesting around docks by lakeshore residents or their agents with pickup service by mechanical harvester	Hand harvesting around docks by lakeshore residents or their agents with pickup service by mechanical harvester	Hand harvesting around docks by lakeshore residents or their agents	
Monitoring of treatments and EWM status and an annual plan review with WDNR		Monitoring over summer 2007 and aquatic macrophyte survey in August 2007	Monitoring of CLP in June 2008 and aquatic macrophyte survey in July 2008	Monitoring of CLP in June 2009 and aquatic macrophyte survey in August 2009

Table 4. Applied treatments for EWM, 2006-2009.

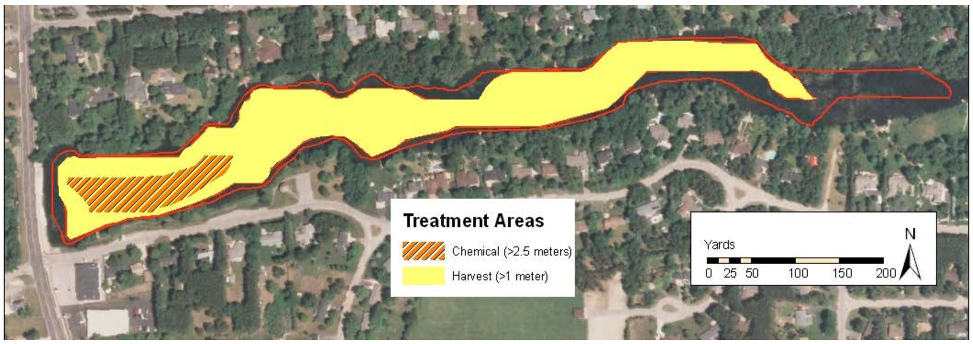


Figure 27. Allowable aquatic plant management plan treatment areas, years without drawdowns.

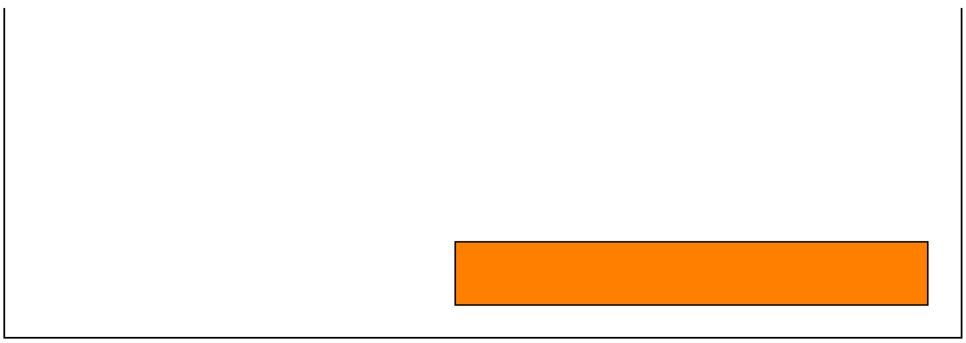


Figure 28. Allowable aquatic plant management plan treatment areas, years with drawdowns.

Recommendations

Progress towards the management of Eurasian water milfoil in Springville Pond was measured during summer 2009 which can likely be attributed to the multiple treatments that were applied to the Pond. Plans for 2009 EWM management in Springville Pond should include:

- Enhance education about aquatic invasive species. They are clearly entering the pond via horticultural transplants.
- Aggressive hand removal of EWM at eastern end of pond.
- Continue mechanical and hand harvesting as needed.
- Continue application of chemicals on western end in May, if desired.
- Continue monitoring for Water Lettuce (*Pistia stratiotes)* and Flowering rush (*Butomus umbellatus*) and remove plants as needed.
- Need a plan to improve near shore buffers/habitat and reduce nutrients on lawns and from the watershed. Little progress was made between 2008 and 2009 so a combination of education and a Village shoreland zoning ordinance may be needed to prevent backsliding.
- Monitor aquatic plants in 2010 to determine success of treatments and future direction of aquatic plant management in Springville Pond.
- Update aquatic plant management plan in winter 2011.

Appendix

Methods

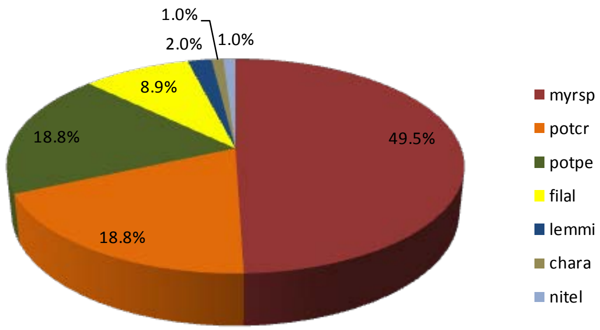
The WDNR point-intercept method was used in this aquatic macrophyte survey. In this method, a large number of sampling sites are distributed in a grid across the lake. There are several benefits to a grid sampling design. An evenly spaced distribution of points results in a good overview of the entire lake. It is easy to replicate, and it is easy to preserve and present the spatial information. The size of the littoral zone and shape of the lake determines the number of points and the grid resolution. In Springville Pond a grid was set up to sample every hundred feet in the Pond, resulting in sampling 83 points plus additional “visual” sites (Figure 29).

Figure 29. Sampling points for aquatic macrophyte surveys.

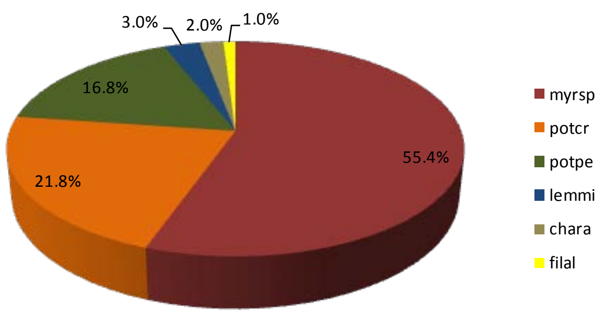
In canoes, the survey team located each station on the grid using GPS. At each station the depth was measured using a depth finder. After the depth was recorded the dominant sediment type was evaluated. In Springville Pond there were three primary classes of sediment: muck, sand, and rock. Muck was the dominant sediment at most points in the Pond. Aquatic plants were sampled using a rake which was tossed out from the canoe to the bottom of the lake. The plants on the rake were identified and then assigned a class of density. A class of 1 (few) was assigned when then there was a small amount of the plant on the rake, a class of 2 (moderate) was assigned when the plant covered half of the rake head while it was still easy to see the rake head, and a class of 3 (abundant) was assigned when the plant covered the rake to the extent that the teeth of the rake were not visible. Plants were also identified by observation down into the water. The grid system may under-sample very shallow sites where the vegetation is often quite different. To compensate for this, additional observations were made between stations and near the shoreline.

The rake was constructed of two rake heads (double rake head) welded together, measuring 13.8 in (35 cm) long with 14 teeth on each side. The handle was 8 ft (2.4 m) in length, and included a telescoping extension that resulted in a total handle length (from tip of rake head to fully extended end) of 15 feet (4.6 m).

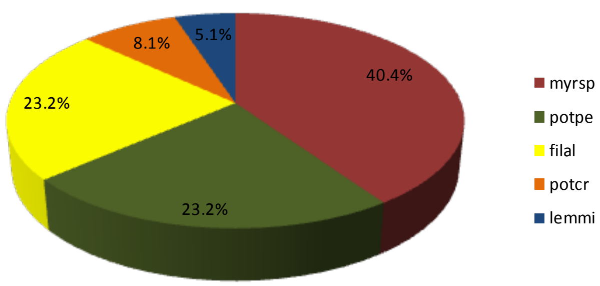
Density Distribution by Species



Density distribution by species from the July 2009 survey.



Density distribution by species from the July 2008 survey.



Density distribution by species from the August 2007 survey.

Figure 30. Density distribution by species, 2007-2009 summer aquatic plant surveys.

Curly- leaf pondweed (*Potamogeton crispus*)

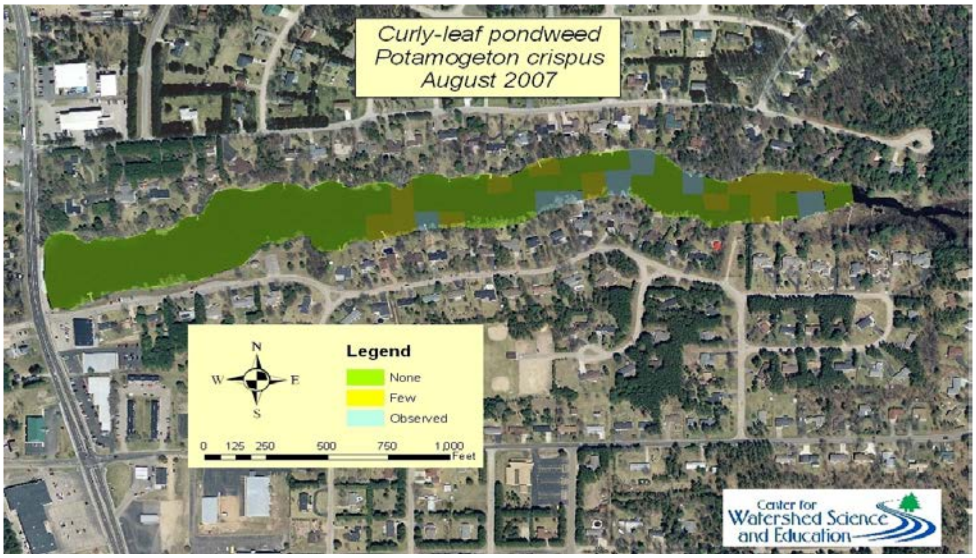


Figure 31. CLP presence and density, August 2007.

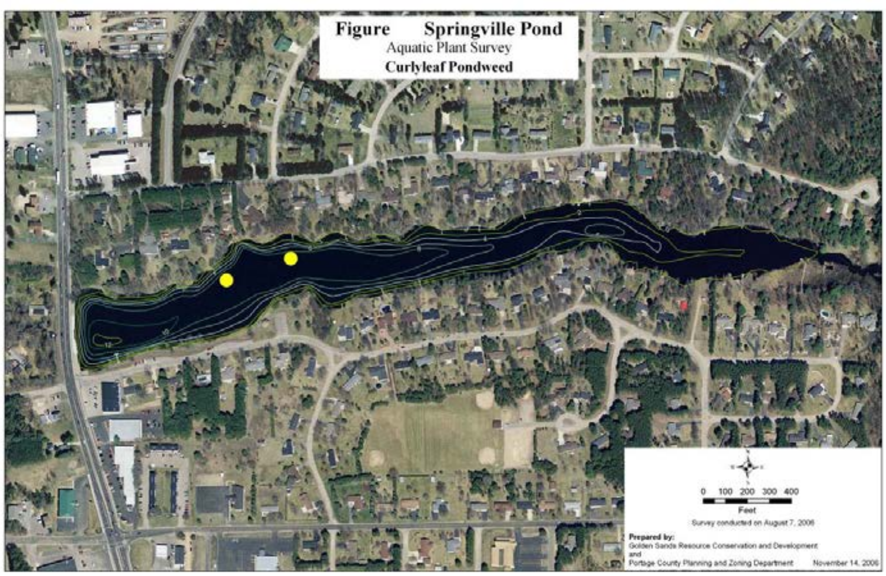


Figure 32. CLP presence and density, August 2006.

References

http://aquaplant.tamu.edu/database/floating_plants/water_lettuce.htm

http://www.iisgcp.org/EXOTICSP/waterlettuce.htm