2015 Cleveland Metroparks Hydrilla Report

Cleveland Metroparks Technical Report 2015/NR-01

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Introduction

Hydrilla verticillata is perhaps the most successful invasive aquatic plant in freshwater ecosystems. Hydrilla has been described as the perfect invasive plant because of its ability to thrive in a wide variety of aquatic habitats, grows in very low light conditions and in up to thirty feet of water, and its multiple pathways of propagation and reproduction that allow it to persist in the environment for up to a decade (Batcher, 2000; Langeland, 1996). It is one of the most difficult and expensive submersed aquatic weeds to control, requiring multiple applications and multiple years of herbicide treatment (Netherland, Getsinger, & Turner, 1993). It spreads by seeds, stem fragments, tuberous roots in sediment, and by vegetative buds (turions) which form and float free in early autumn (Batcher, 2000; Langeland, 1996). Hydrilla is very difficult to detect at low numbers, but because of its rapid growth it can quickly overwhelm a waterbody and form dense, monotypic mats that out-compete native aquatic plants, reduce habitat for wildlife, and can severely impede recreational and other aquatic activities (Batcher, 2000; Langeland, 1996). It is easily spread by boats, humans, waterfowl, and other unsuspecting animals (Langeland, 1996). Hydrilla closely resembles the native aquatic plant *Elodea Canadensis*, differing in having finely-toothed leaf margins visible to the naked eye and tuberous roots (Batcher, 2000).

Hydrilla is abundant in the southeastern United States, where it was first introduced several decades ago by the aquarium and aquaculture trades, and is listed as a federal noxious weed (Batcher, 2000; Langeland, 1996) (Figure 1). Hydrilla rapidly moved up the Atlantic seaboard following its introduction and has been found as isolated occurrences throughout the country (Batcher, 2000; Langeland, 1996) (Figure 1). Recently, Hydrilla has begun to move westward, with established populations in and along the Ohio River and occurrences in New York, Pennsylvania, Ohio, and Indiana (Menninger, 2011) (Figure 1).

Hydrilla was first identified in Cleveland Metroparks in July 2011 (Table 1). A single strand of Hydrilla was found in the Blue Heron Marsh in Ohio & Erie Canal Reservation by John Mack, the former Chief of Natural Resources. In August 2011 an abundant infestation of Hydrilla was found in the Greathouse Wetlands in West Creek Reservation and a small infestation was found in the southern end of Wallace Lake in Mill Stream Run Reservation (Table 1). Park-wide surveys of potential Hydrilla habitat, including lakes, ponds, and wetlands, found additional infestations in Sunset Pond and Sanctuary Marsh in North Chagrin Reservation in 2012 and the Wash-Out Wetlands in West Creek Reservation in 2013 (Table 1). The Greathouse Wetlands are suspected to be the source population of Hydrilla in Cleveland Metroparks- wetlands plants were transferred from those wetlands to both Blue Heron Marsh and Wallace Lake in 2009 and 2010 as part of a habitat enhancement project.

Infestations

Hydrilla infestations in Cleveland Metroparks are all in highly accessible areas that experience a great deal of human traffic- including boating, fishing, swimming, birding, educational programs, habitat management, fishery management, water-level controls, and the potential for people to easily release aquarium species. This points to human activities as the most likely cause of Hydrilla introduction in and between these waterbodies. Hydrilla is present in all three major watersheds in Cleveland Metroparks (Figure 2). Maps of each infestation can be found in Appendix A.

Sunset Pond, North Chagrin Reservation

Sunset Pond is a 5.2 acre man-made pond located in North Chagrin Reservation. The pond is a popular location for waterfowl, both local and migratory, and has been utilized as a brood-stock source for game fish by Cleveland Metroparks. A water-control structure is located at its outflow to Sanctuary Marsh. Hydrilla was found in Sunset Pond in 2012, consisting of several strands along the deck behind the North Chagrin Nature Center. A 2013 survey failed to locate Hydrilla, but was hampered by excessive algae growth throughout the pond. A 2014 survey located Hydrilla in the same area and density as the 2012 occurrence.

Sanctuary Marsh, North Chagrin Reservation

Sanctuary Marsh is a 3.7 acre created wetland located in North Chagrin Reservation. It is a popular location for waterfowl, both local and migratory, as well as other wildlife, and is crossed by a boardwalk. The marsh is used extensively by North Chagrin Nature Center staff for educational programs. It has a water-control structure at its outflow to Buttermilk Creek, a tributary of the Chagrin River. Cleveland Metroparks has regularly conducted boat electrofishing to remove non-native goldfish from the marsh. Hydrilla was found in Sanctuary Marsh in 2012, consisting of substantial mats in shallow areas around the boardwalk and pond dipping dock.

Blue Heron Marsh, Ohio & Erie Canal Reservation

Blue Heron Marsh consists of two hydrologically connected wetland cells that discharge into the Ohio & Erie Canal. Their water levels can be modified using a water-control structure at one of the outflows into the Canal. Portions of the marsh have a boardwalk and pond dipping dock, which is utilized by CanalWay Visitor Center staff for educational programs. Additionally, a long-term Blanding's turtle study, including the release of head-started turtles and the tracking and trapping of turtles in the marsh has taken place in the wetlands for several years. A single strand of Hydrilla was found in the marsh in 2011 and subsequent surveys found multiple small, sparse patches of Hydrilla in the southern wetland cell.

Greathouse Wetlands, West Creek Reservation

The Greathouse Wetlands consist of two hydrologically connected cells that total 1.14 acres. These man-made wetlands were constructed in 2002 and a variety of aquatic plants were purchased from nurseries and installed. There are two water-control structures- one between the cells and one at the lower cell's outflow to West Creek, a tributary of the Cuyahoga River. An extensive infestation of Hydrilla was found in the upper cell in 2011, with the lower cell yielding only a few clusters of the plant.

Wash-Out Wetlands, West Creek Reservation

The Wash-Out wetlands are composed of 9 hydrologically connected cells that were constructed along a 1,300 foot sewer line wash-out and planted with nursery stock in 2002, and total 0.44 acres. The cells were dry during the 2013 park-wide surveillance, but were inundated in 2013 and cell 7 (numbered 1 through 9 from south to north) was home to a dense infestation of Hydrilla.

Wallace Lake, Mill Stream Run Reservation

Wallace Lake is the location of a former Berea sandstone quarry that was flooded and turned into a lake in the 1930s. It is 17.6 acres in size, and while it was formerly 50-60 feet deep in some areas, its current maximum depth is 26 feet due to decades of sedimentation. The lake consists of two deep basins on its north and south ends with a shallow, narrow neck between them. Wallace Lake has a water-level control structure that allows it to be drawn down and an outflow into the East Branch Rocky River. During high floods there can be unrestricted flow between the lake and river. The lake is a popular area for fishing, swimming, and boating, and is managed during the growing season for nuisance aquatic vegetation. Hydrilla was found in a small number of patches in the southern basin in 2011, near aquatic vegetation that had been transplanted from the Greathouse Wetlands in 2009 and 2010 and spread rapidly throughout the lake during 2012.

Treatments

Treating Hydrilla for control and eventual eradication is complex and challenging. Hydrilla is able to thrive in a wide variety of aquatic habitats and each site requires a unique treatment approach that takes into account numerous factors, from water depth and site hydrology to herbicide type and use restrictions (Batcher, 2000; Langeland, 1996). Cleveland Metroparks primary method of Hydrilla control is through herbicide treatments. Herbicides are the only method of treatment that can completely eliminate an infestation of Hydrilla. While other methods, such as mechanical removal and biological control, are management options, they primarily serve to reduce biomass and cannot eliminate Hydrilla (Batcher, 2000; Langeland, 1996).

The majority of Hydrilla infested waterbodies in Cleveland Metroparks are wetland habitats. This presents the challenge of treating Hydrilla while also maintaining desirable native plant communities and using herbicides in environments where they perform differently because of the shallower water depths and variable seasonal hydrology. Cleveland Metroparks approach to treating Hydrilla continues to evolve as it tests different herbicides, variations in application method, timing, and management options including water draw-downs and the use of barriers and filters. It also consults with other agencies, manufacturers, vendors, and researchers.

2011 Treatments

3x3 foot test plots of Cutrine Plus (active ingredient copper sulfate) at 0.2 and 0.4 ppm and Reward (active ingredient diquat dibromide) at the standard aquatic surface treatment rate were applied in separate locations in the upper Greathouse Wetland cell to evaluate their effectiveness on Hydrilla. Cutrine Plus at both concentrations exhibited only a moderate control of Hydrilla, with no by-kill of other aquatic plants, because Hydrilla is one of only a few vascular plants controlled by copper compounds. Reward exhibited better control of Hydrilla, but also resulted in extensive damage to non-target native emergent aquatic plants because it is a broad-spectrum contact herbicide. A filter in the water-control structure at the outflow to West Creek in the lower cell was installed to prevent vegetative fragments and turions from washing out of the wetland complex. All Hydrilla that could be located in Wallace Lake, which was limited to the edge of the southern basin among wetland plants transferred in previous years from the Greathouse Wetlands, were spot-treated with Cutrine Plus during the late summer.

2012 Treatments

The Greathouse Wetlands were spot-treated with Cutrine Plus in May and early June, where Hydrilla was noted to be dense and abundant in the upper cell and present only in small patches in the lower cell. During the early June treatment Hydrilla was 50-75% dead in areas treated in May. In late June treatments switched to Reward, as Hydrilla was still abundant, particularly in the upper cell. Herbicide application was difficult because of low water levels in the wetlands from planned de-watering and no further treatments were carried out because the wetlands were dry during the remainder of the growing season.

Wallace Lake was spot-treated for Hydrilla with Reward in May, where at that time it was limited to the edge of the southern basin and appeared to be greatly reduced from 2011 levels. Although the Hydrilla treated in May was gone, new areas of infestation in the southern basin were located in early June and treated with Cutrine Plus. Treatments continued in July with treatments of Cutrine Plus, followed by Reward. Despite the ongoing herbicide treatments, Hydrilla spread throughout the lake, including into the outflow channel to the East Branch Rocky River at its far northern end. A contractor was hired and initiated whole-lake treatments using SonarAS (fluridone) from mid-July through October. Results of SonarAS treatment were excellent- Hydrilla rapidly bleached and died off throughout the entire lake.

2013 Treatments

2013 marked a shift in the treatment approach at the Greathouse Wetlands. The wetlands were de-watered in early spring and a pre-emergent soil surface treatment of Galleon (penoxsulam) was applied in both cells. The wetlands were then allowed to refill during late spring and early summer and a surface water treatment of Galleon was applied. The newly discovered Hydrilla in the Wash-Out Wetlands was also treated with a surface water application of Galleon in late summer. Whole-lake fluridone treatments were conducted by a contractor at Wallace Lake from May through September and no vegetative Hydrilla was found during the growing season. Sunset Pond was beset by extensive filamentous algae during the growing season and no Hydrilla was located, so only a single early summer preventive treatment using SonarOne (fluridone) was carried out so expensive herbicide was not wasted. Sanctuary Marsh was treated with SonarOne by canoe three times during the summer. While the target ppb concentration in the wetland was maintained, there was significant damage to non-target aquatic plants.

2014 Treatments

The Greathouse Wetlands were treated three times from May-June with Galleon (penoxsulam) and twice from June-August with SonarOne (fluridone). The Wash-Out Wetlands were treated twice from May-June with Galleon and twice from June-August with SonarOne. Due to heavy spring and early summer rains it was extremely difficult to maintain the desired ppb concentrations of herbicide in both wetland complexes and Hydrilla was still found in the upper cell of the Greathouse Wetland in late summer. For the 3rd year Wallace Lake had contracted whole-lake treatments of fluridone using both SonarQR and SonarAS from August-October in 6 separate applications. The Blue Heron Marshes were treated for the first time in 2014 with an application of Galleon in June and SonarOne in August in both wetland cells. Sunset Pond was again choked by filamentous algae and had no Hydrilla-specific herbicide treatments. Unlike 2013, a few strands of Hydrilla were found growing along the Nature Center deck in the late summer. Sanctuary Marsh was treated with SonarAS three times from June-August, which

eliminated the vegetative Hydrilla but again resulted in mild-moderate damage of non-target aquatic emergent plants.

Monitoring and Surveillance

Monitoring the effectiveness of herbicide treatments on Hydrilla is undertaken in three ways in Cleveland Metroparks- visual monitoring, water samples, and tuber sampling. Visual monitoring of infested areas is conducted to track the growth and spread of Hydrilla and the effectiveness of treatments. Visual monitoring is regularly carried out by Cleveland Metroparks staff and contractors. Visual monitoring is effective in areas where Hydrilla is present in well-established populations, but on a larger scale, due to the plants ability to grown in deep, murky water and spread via fragments, it is difficult to detect. Water samples are taken during the treatment season and sent to SEPro Corporation for FasTEST, which determines the concentration of herbicide to the ppb level. This ensures that the minimum effective concentration of herbicide is maintained in a waterbody. Sampling is done at regular intervals from set sites throughout the waterbody.

Tuber Sampling

Tuber sampling is a common monitoring method in Hydrilla control programs. Tuber samplers (Madsen, Wersal, & Woolf, 2007) and sorting screens were constructed in-house by Cleveland Metroparks Building Trades staff. Tuber sampling is used as a measurement of treatment effectiveness- the purpose of treatment is to both kill the vegetative Hydrilla during the growing season and prevent the formation of tubers that would sprout into new plants in subsequent years- and determine the size of the tuber banks in infested waterbodies. Tuber sampling was initiated in 2013 and revealed several difficulties, including water depth and substrate composition issues (bedrock, gravel, and heavy clay in many areas), operation of the samplers (especially establishing a seal to remove sediment cores), and a lack of tubers found even from areas where dense, multi-year populations of Hydrilla were present.

2014 was the first comprehensive year of tuber sampling. 30-50 substrate cores were taken from each infested waterbody, targeting areas that had the densest amounts of vegetative Hydrilla and substrates (clay, silt, and muck) that allowed core retrieval. Each core was screened for tubers using fine-mesh sorting screens. This often took serious effort, as many cores consisted entirely of clay and had to be broken down by hand, and tubers are very similar in size, shape, and color to small pebbles and bits of vegetation. Sampling was conducted in late August-early September. Although tuber formation is greatest from September-November and sampling is typically conducted in the late fall, this time frame was chosen because of staff availability, to avoid colder water temperatures that would make the process unpleasant, and to avoid the complications posed by annual leaf fall and vegetation die-back.

Tuber sampling in 2014 took 39 staff hours and a total of 8 tubers were found from the six Hydrilla-infested waterbodies in Cleveland Metroparks. This was surprising, as a large tuber bank was anticipated given that many of the areas sampled had had very dense, often multi-year Hydrilla populations growing in them. However, as 2014 was the first year of sampling and all of the waterbodies have been treated with herbicides for anywhere from 1 to 4 years, it is unknown if this low density of tubers is natural for these populations or evidence that the herbicides have been effective in reducing tuber formation. Notably, during tuber sampling only 3 of the 6 areas- Greathouse Wetlands, Blue Heron Marsh, and Sunset Pond- had vegetative Hydrilla present and all in relatively low numbers. Even at low

densities, a single tuber can develop hundreds of vegetative sprouts that in turn can form thousands of new tubers in a single year, so the 8 tubers found during sampling are significant. Another factor could be where the tuber sampling was conducted- perhaps tubers are more abundant in substrates where the sampler could not get cores, such as gravel or leafpacks.

Surveillance

Due to the widespread and scattered locations of known Hydrilla infestations in Cleveland Metroparks an annual park-wide surveillance of all potential aquatic habitats has been conducted in mid-late summer since 2012 at over 80 sites. Habitats surveyed include lakes, ponds, all wetlands that remain at least partially watered during the growing season, and, beginning in 2014, downstream of known infestations in receiving streams and rivers. This annual surveillance will continue for the foreseeable future, allowing staff to identify and rapidly respond to new infestations. Surveillance is conducted by Natural Resources staff by wading or boat, depending on water depth in crews of 2-5 people. Surveillance identified previously unknown infestations in 2012 (in Sanctuary Marsh) and 2013 (Wash-Out Wetlands). 2014 was the first year of surveillance where no new infested waterbodies were found, a surprise and relief as Natural Resources staff were concerned that drought conditions in 2012 and below-normal water levels in 2013 were making Hydrilla difficult to spot because of a lack of vegetative growth. A complete list of surveillance sites is available in Appendix B.

Decontamination

Natural Resources staff instituted a decontamination protocol for vehicles, equipment, and work-wear used in aquatic environments in 2012 after determining that field work activities were likely the primary vector of Hydrilla spread in Cleveland Metroparks. Decontamination has numerous benefits and should be part of any field work protocol- not only can it help prevent the spread of invasive species between sites, it can also prevent transmission of many zoonotic diseases. Decontamination stations were set up at Rocky River Management Center, Brecksville Maintenance Center, and the Watershed Stewardship Center in West Creek. Stations consist of 110 gallon rubber tubs filled with a 2% bleach solution, scrub brushes, and boot picks. All run-off is contained in a catch basin or enters a sanitary sewer system. In 2014 mobile decontamination kits were put together and distributed to Natural Resources staff to be used in the field between sites. The protocol in its entirety can be found in Appendix C. Other local agencies, including the Cuyahoga Board of Health, have adopted the decontamination protocol for their field work activities.

Internal and External Cooperation

Internal Cooperation

Internal intradepartmental cooperation in Cleveland Metroparks has been pivotal in its efforts to institute an effective Hydrilla control and eradication program. Natural Resources, Park Management, Site Construction, Outdoor Experiences, and Rangers have collaborated on determining and enforcing appropriate methods to control the spread of Hydrilla and ensure information is disseminated to staff. Outdoor Experiences staff have incorporated preventing the spread of Hydrilla and other aquatic invasives into many of their programs, ranging from pond-dipping outings to aquatic recreation field trips. The rapid spread of Hydrilla in Wallace Lake during the summer of 2012 prompted Cleveland Metroparks to institute recreational restrictions to reduce the risk of spread to other waterbodies.

Wallace Lake is a popular place for fishing, swimming, and boating and is used heavily by both staff and the public for programs. An internal meeting decided that fishing and all external watercraft would be banned on the lake for the growing season, as those were the activities that posed the greatest risk of spread. Signage was placed around the lake, enforced by the Rangers, and adjacent homeowners and the media were notified. The restrictions were lifted in 2013 and 2014 after internal discussion and will only be reinstituted if vegetative Hydrilla is found in the lake. The Invasive Plant Coordinator is working with Site Construction, Park Operations, and other divisions to identify sites that pose a high risk of spreading Hydrilla and other invasive plants and to institute protocols for decontaminating large equipment after work is completed.

External Cooperation

Since discovering Hydrilla, Cleveland Metroparks has consulted and collaborated with numerous other public agencies, contractors, vendors, and researchers to determine the best approaches to monitoring, treating, and eradicating this highly invasive plant both within its own boundaries and in Great Lakes region. Location and occurrence information for each Hydrilla infestation in Cleveland Metroparks is submitted to the Early Detection & Distribution Mapping System (EDDMapS- www.eddmaps.org) and the Great Lakes Early Detection Network (GLEND- www.gledn.org) websites. EDDMapS and GLEDN are web-based mapping systems for documenting invasive species distribution in the United States and Canada. Participants are able to submit observations, which are verified by experts to ensure accuracy, and view data from across North America. Data is available almost immediately after submission, allowing real-time tracking of invasive species movement and helping facilitate early detection and rapid response programs.

Cleveland Metroparks cooperated with the Tri-State Aquatic Invasive Species Prevention and Monitoring project, led by The Nature Conservancy (TNC) and funded by a GLRI grant, in its efforts to survey for Hydrilla and other aquatic invasive plants along the Lake Erie shoreline. Natural Resources staff have given presentations on Hydrilla in March 2013 to the Midwest Aquatic Plant Management Society and the Ohio Woodland, Water, & Wildlife Conference. Staff also attended a multi-state, multi-agency discussions on the management of nuisance aquatic species with a focus on Hydrilla in the Ohio River basin in June 2013. Cleveland Metroparks helped fund an illustrated guide to native and invasive Midwestern aquatic plants by a Cleveland Institute of Art student through GLRI CWMA grant funds, which will help staff and other interested parties more accurately identify Hydrilla and other aquatic invasives.

Cleveland Metroparks facilitated a Hydrilla workshop on April 23, 2013 at North Chagrin Nature Center in North Chagrin Reservation. The workshop was sponsored by the Crooked River Cooperative Weed Management Area, Great Lakes United, and the Ohio Invasive Plants Council. The full-day workshop focused on early detection and rapid response, with the goal of encouraging regional surveys for Hydrilla and developing connections among diverse organizations with a shared interest in preventing the spread of aquatic nuisance species. Staff presented during the morning sessions on the ecology of Hydrilla, identification and vouchering of it and other submerged aquatic plants, and methods used to survey and monitor for Hydrilla and decontamination procedures. Afternoon sessions covered invasive plant mapping and citizen science, interstate aquatic surveillance, and control and management options for Hydrilla. The workshop was attended by 43 participants representing 4 states and 16 organizations.

Costs

Hydrilla is costly to control because of the multi-faceted, long-term approach required to eliminate it. The herbicides needed to effectively treat Hydrilla, while at the same time minimizing damage to non-target aquatic plants, are expensive even in small quantities. Completely eradicating Hydrilla from a waterbody requires up to a decade of treatment, with a specific concentration of herbicide maintained throughout the growing season (Batcher, 2000; Netherland, Getsinger, & Turner, 1993). Adding to the cost is the fact that each waterbody and infestation are unique and require a tailored treatment approach. Staff time, including mobilization, treatment, monitoring, and surveillance, have increased each year in Cleveland Metroparks as infestations are identified and expenditures are anticipated to increase annually as herbicide prices rise, waterbodies are added, and treatment strategies evolve. Details of treatment costs from 2011-14 are available in Appendix D.

The Ohio Department of Natural Resources (ODNR) has been instrumental in supporting Cleveland Metroparks Hydrilla treatment efforts. Through subsidy agreements in 2012, 2013, and 2014 the ODNR covered 75% of the costs of contracting whole-lake treatments on Wallace Lake, using funds from a GLRI grant to the State. In 2015 through a subsidy agreement ODNR will fund 75% of Hydrilla treatment costs throughout Cleveland Metroparks. Total treatment costs for 2015 are estimated to be $86,964, including the regular Wallace Lake contract, herbicides, FasTESTing, staff time, mileage, and anticipated number of site visits throughout the treatment season.

Hydrilla treatment and monitoring in Cleveland Metroparks is expensive in both herbicides and staff time, but the cost of not controlling this invasive aquatic plant is even greater. If allowed to spread unchecked Hydrilla can degrade important aquatic habitat in the Park District's lakes, ponds, wetlands, rivers, and streams. Hydrilla can form dense mats of vegetation, severely limiting recreation including swimming, fishing, and boating. The risk of Hydrilla spreading into new areas both within and outside of Cleveland Metroparks is extremely high if aggressive control and monitoring efforts are not instituted. As the location of the first known occurrences of Hydrilla in the Lake Erie watershed in Ohio, it is incumbent upon Cleveland Metroparks as a conservation agency to proactively and responsibly manage this invasive species to protect the natural resources in both its reservations and the region.

2015 Treatment Plan

Cleveland Metroparks Natural Resources staff are exploring the possibility of contracting out all Hydrilla treatments in the 2015 season, including FasTEST sampling, to take the burden off of the Invasive Plant Management crew. Ideally, all treatments would be contracted to a single company to save on costs and ensure consistency in treatment methods and effectiveness monitoring. Wallace Lake will undergo its 4th year of contacted whole-lake fluridone treatment. The Greathouse and Wash-Out wetlands will be de-watered in early spring for substrate treatments of Galleon, then allowed to fill and undergo SonarOne treatments for the rest of the growing season. Blue Heron Marsh will be treated with SonarOne and Sunset Pond and Sanctuary Marsh will be treated with SonarAS during the growing season. The 2015 treatment plan and cost estimates are available in Appendix E.

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Tables and Figures

Table 1. Locations of Hydrilla-infested waterbodies in Cleveland Metroparks

Site Name	Size (acres)	Reservation	Watershed	County	Year Found
Sunset Pond	5.20	North Chagrin	Chagrin River	Cuyahoga	2012
Sanctuary Marsh	3.70	North Chagrin	Chagrin River	Cuyahoga	2012
Blue Heron Marsh	2.50	Ohio & Erie Canal	Cuyahoga River	Cuyahoga	2011
Greathouse Wetlands	1.14	West Creek	Cuyahoga River	Cuyahoga	2011
Wash-Out Wetlands	0.44	West Creek	Cuyahoga River	Cuyahoga	2013
Wallace Lake	17.60	Mill Stream Run	Rocky River	Cuyahoga	2011

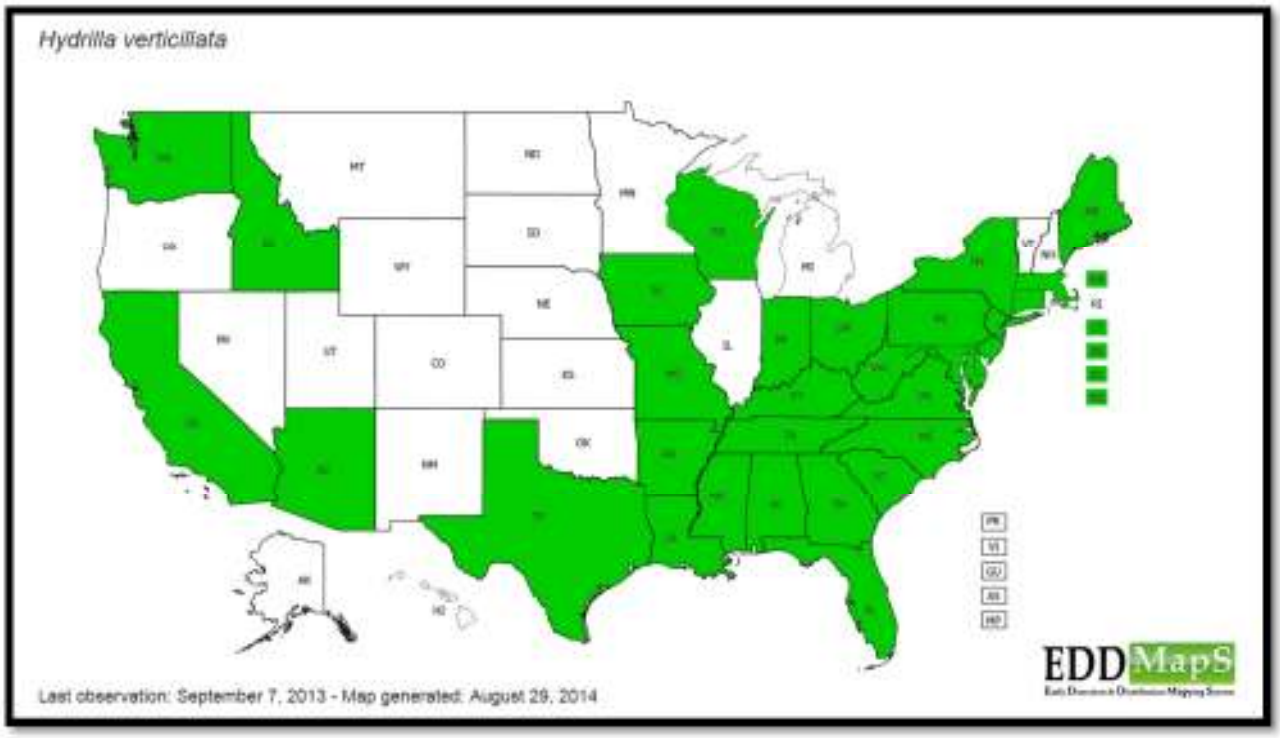


Figure 1. Distribution of Hydrilla in the United States

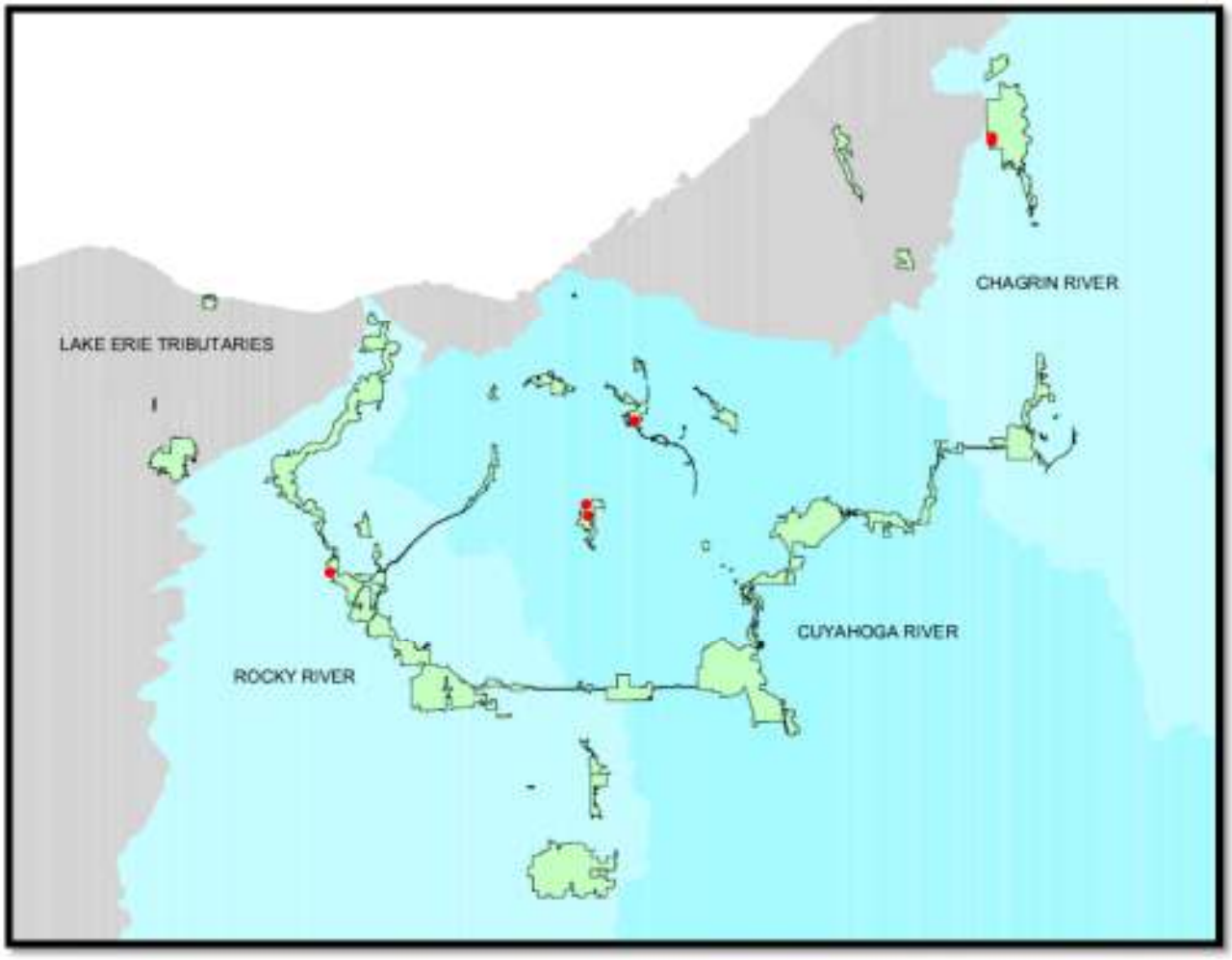


Figure 2. Cleveland Metroparks Hydrilla infestations by watershed

Appendix A: Cleveland Metroparks Hydrilla Site Maps

Map 1. Sunset Pond and Sanctuary Marsh in North Chagrin Reservation

Map 2. Blue Heron Marsh in Ohio & Erie Canal Reservation

Map 3. Greathouse Wetlands in West Creek Reservation

Map 4. Wash-Out Wetlands in West Creek Reservation

Map 5. Wallace Lake in Mill Stream Run Reservation

Appendix B: Cleveland Metroparks Annual Surveillance Sites

Reservation	Site/Location	Notes
Acacia	Northwestern pond	Boat survey
	Central pond	Boat survey
	Eastern pond	Boat survey
Bedford	Circle Emerald ponds (2)	
	Shawnee GC ponds (2)	
	Gorge Pkwy pond	
Big Creek	Apple Ridge/Beech Hill	
	Lake Isaac	Boat survey
	Beyer's Pond	Boat survey
	Small ponds around Beyer's	
	Fowles Marsh	
	Lake Abram wetland complex	
	Wetland off L2L by Hepburn	
	Wetlands off Lake Isaac trail	
	Small wetland SE of Lake Abram	
	Eastland dipping pond	
Bradley Woods	Bunn's Lake	
	Wetland N of White Oak Dr	
	Mitigation wetland on E edge	
Brecksville	York Rd pond	
	Seneca GC ponds (2)	
	Sleepy Hollow GC pond	
	Mgmt Center ponds (2)	
	Chippewa mitigation wetlands	
	Riverview N wetlands	
	Riverview S wetlands	
Brookside & Zoo	Upper created vernal pools	
	Goldfish ponds	
	Lower created vernal pools	
	Waterfowl Lake	
Euclid Creek		
Garfield Park	Old boating pond	
Hinckley	Hinckley Lake	
	Judges Lake	
	Ledge Lake	
	Wetlands W of Judges	
	Upper Ledge pond	
	Brooklyn Exchange ponds (2)	
	Rising Valley wetland complex	
Huntington		
Lakefront		
Mill Stream Run	Wallace Lake	Hydrilla found 2011
	Wallace Lake outflow	Hydrilla found 2012

	Baldwin Lake	
	Handle Rd wetlands	
	Whitney Rd wetlands	
	Wintergreen ponds (3)	
	Bonnie Park ponds (2)	
	Ranger Lake	
	Strongsville Wildlife Area	
	Oxbow opposite SWA	
	Wetland pond N of Chalet	
	Moose Pond	
	Oxbow opposite Royalview	
	W130th wetlands	
	Drake Rd wetlands	
	Swale by mgmt center drive	
	EBRR (Wallace to Berea Falls)	
North Chagrin	Manakiki GC ponds (3)	
	Sunset Pond	Hydrilla found 2012
	Sanctuary Marsh	Hydrilla found 2012
	Strawberry Pond	
	Oxbow wetlands	
	Dinger's Marsh	
	Foster's Run mitigation cells	
	Wetlands NE of Foster's	
	Buttermilk Creek (entire reach)	
	Chagrin River (BC to res edge)	
Ohio & Erie Canal	CEI ponds (2)	
	Blue Heron Marsh	Hydrilla found 2011
	Ohio & Erie Canal	
Rocky River	Kason Swamp	
	Big Met pond	
	Wetlands across from POA	
	RRNC wetland complex	
	RRNC old oxbow	
	Cedar Point wetlands	
	Oxbow Lagoon	
South Chagrin	Shadow Lake	
	Mgmt Center ponds (2)	
	Squaw Rock pond	
	Sulphur Springs vernal pool	
Washington	GC wetlands (4)	
West Creek	West Ridgewood wetland	
	Greathouse wetlands	Hydrilla found 2011
	Wash-out wetlands	Hydrilla found 2013
	WSC stormwater wetland	
	West Creek (WO to res edge)	

Appendix C: Cleveland Metroparks Decontamination Protocol

Standard Operating Procedure (SOP) for Foot Based Field Work

For any field work involving foot travel to aquatic sites, including but not limited to wading, the following three prong decontamination approach will apply.

1) *Visual inspection and removal of living and non-living matter from field equipment.* Upon completing field work at an aquatic site, the personnel will observe all equipment and do their best to remove all mud, vegetative matter, and excessive water from field equipment. Dedicated scrub brushes should be included with field equipment for this purpose. Initial cleaning can involve rinsing with water available in the field.

2) *Rinse equipment with clean water.* Upon changing watersheds or before moving to a sensitive habitat the personnel will rinse all field equipment used at the site with clean tap water. For field based rinsing, at least one five gallon container of clean tap water should be included with field equipment for use at the vehicle. For rinsing at the end of the field day, the hot water pressure washer at the car wash bay at the Rocky River Management Center will be used. There will also be locations at Brecksville Garage and West Creek Watershed Stewardship Center for rinsing.

3) *Rinse/soak equipment in 2% bleach solution.* Research into biological decontamination protocols for various other agencies (Ohio DNR, Maine DEP, NYC DEP, and British Columbia Ministry of Environment) reveal that use of household bleach is a cheap, effective, and readily available agent for biological decontamination for a wide range of potentially pathogenic agents. A concentration of 4 oz of bleach for 1 gallon of clean tap water is commonly used and proven effective, and will also be used in this procedure. For travel between subwatersheds, or before moving to a sensitive site, a dedicated backpack sprayer containing 2% bleach solution will be used to saturate all exposed equipment at least 100 feet from the aquatic habitat and allowed to air dry before changing sites. For decontamination at the end of the field day, stations will be available at the Rocky River Management Center car wash bay, Brecksville Garage, and West Creek Watershed Stewardship Center for soaking exposed field equipment in a 2% bleach solution for no less than one minute, and then allowed to air dry overnight before re-use.

Standard Operating Procedure (SOP) for Boat or ATV Based Field Work

For any field work involving use of watercraft, or ATV (including the Argo) at aquatic sites, the following two tiered decontamination approach will apply for decontamination in addition to the aforementioned protocol for other field equipment and clothing.

1) Visual inspection and removal of living and non-living matter from boat, boat trailer and/or ATV. Upon completing field work at an aquatic site, the personnel will observe the boat, boat trailer,

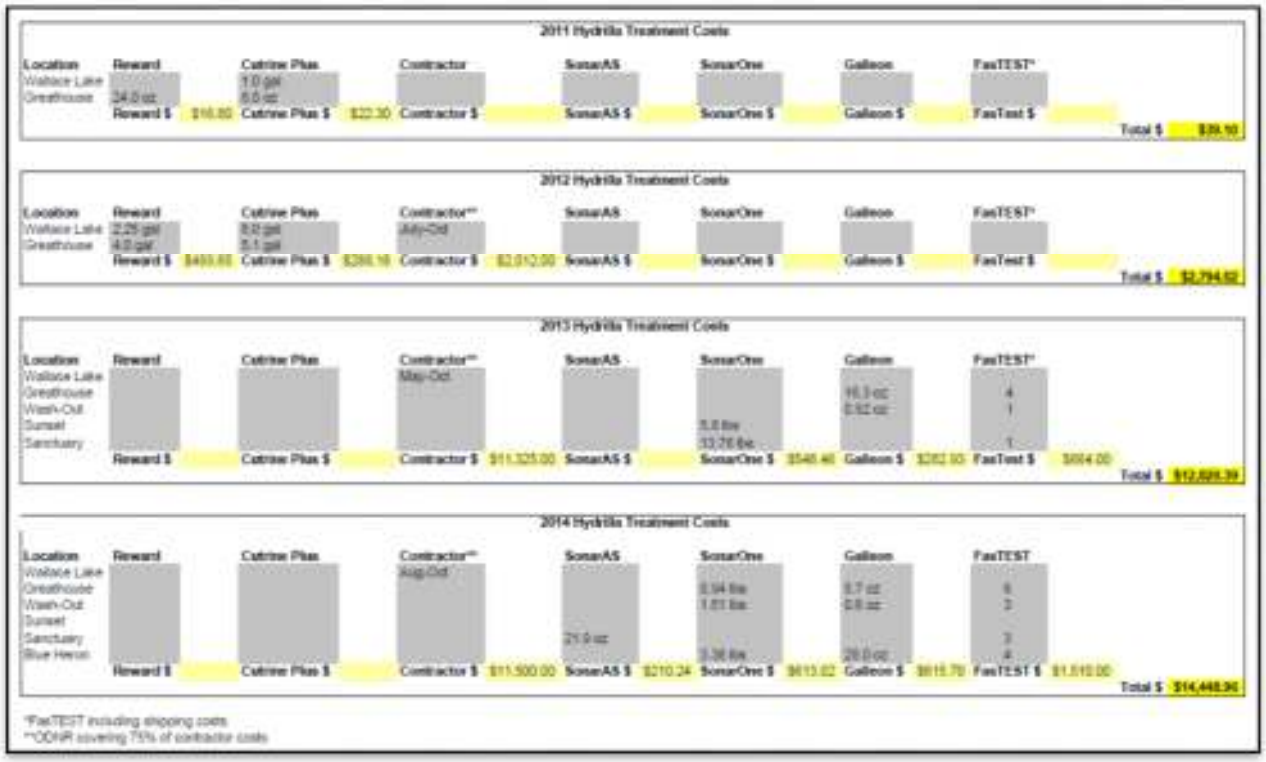
and/or ATV and do their best to remove all mud, vegetative matter, and excessive water from field equipment. Dedicated scrub brushes should be included with field equipment for this purpose. Initial cleaning can involve rinsing with water available in the field.

2) *Hose or pressure wash vehicles and trailers with clean tap water.* At the end of the field day, the boat, boat trailer, and/or Argo will be thoroughly cleaned with a hose or pressure washer at a maintenance facility, and all water will be drained from the equipment. All equipment will be allowed to air dry at least overnight before re-use.

Special Circumstances

The protocols outlined are expected to apply to the majority of routine field work, but special circumstances will certainly arise that require specific attention. These will include work in sites with known pathogens or especially sensitive habitats. These circumstances will require situation specific attention, but in many cases the same protocol as already listed will apply with the exception of including a minimum of 15 minute soak in the 2% bleach solution.

Appendix D: Hydrilla Treatment Costs 2011-14



2011 Hydrilla Treatment Costs

Location	Reward	Cutrine Plus	Contractor	SonarAS	SonarOne	Galleon	FasTEST*
Wallace Lake		1.0 gal					
Greathouse	24.0 oz	8.0 oz					
	Reward $ $16.80	Cutrine Plus $ $22.30	Contractor $	SonarAS $	SonarOne $	Galleon $	FasTest $

Total $ $39.10

2012 Hydrilla Treatment Costs

Location	Reward	Cutrine Plus	Contractor**	SonarAS	SonarOne	Galleon	FasTEST*
Wallace Lake	2.25 gal	8.0 gal	July-Oct				
Greathouse	4.0 gal	8.1 gal					
	Reward $ $403.65	Cutrine Plus $ $286.16	Contractor $ $2,012.00	SonarAS $	SonarOne $	Galleon $	FasTest $

Total $ $2,794.82

2013 Hydrilla Treatment Costs

Location	Reward	Cutrine Plus	Contractor**	SonarAS	SonarOne	Galleon	FasTEST*
Wallace Lake			May-Oct				
Greathouse						16.3 oz	4
Wash-Out						0.62 oz	1
Sunset					5.0 lbs		
Sanctuary					13.76 lbs		1
	Reward $	Cutrine Plus $	Contractor $ $11,325.00	SonarAS $	SonarOne $ $540.46	Galleon $ $282.93	FasTest $ $664.00

Total $ $12,826.39

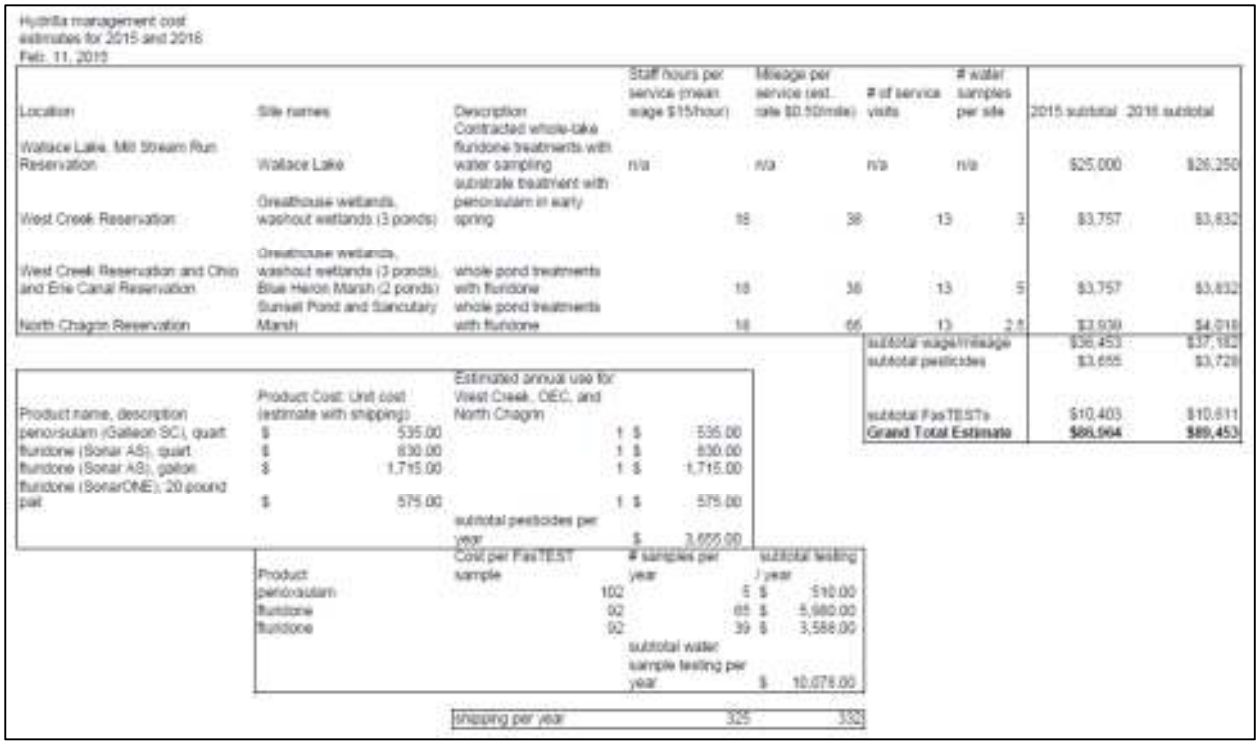
2014 Hydrilla Treatment Costs

Location	Reward	Cutrine Plus	Contractor**	SonarAS	SonarOne	Galleon	FasTEST
Wallace Lake			Aug-Oct				
Greathouse					0.94 lbs	8.7 oz	6
Wash-Out					1.51 lbs	0.6 oz	2
Sunset							
Sanctuary				21.0 oz			3
Blue Heron					3.36 lbs	28.0 oz	4
	Reward $	Cutrine Plus $	Contractor $ $11,500.00	SonarAS $ $210.24	SonarOne $ $613.02	Galleon $ $815.70	FasTEST $ $1,010.00

Total $ $14,448.96

*FasTEST including shipping costs
**ODNR covering 75% of contractor costs

Appendix E: 2015 Hydrilla Treatment Estimates



Hydrilla management cost estimates for 2015 and 2016
Feb. 11, 2015

Location	Site names	Description	Staff hours per service (mean wage $15/hour)	Mileage per service (est. rate $0.50/mile)	# of service visits	# water samples per site	2015 subtotal	2016 subtotal
Wallace Lake, Mill Stream Run Reservation	Wallace Lake	Contracted whole-lake fluridone treatments with water sampling	n/a	n/a	n/a	n/a	$25,000	$26,250
West Creek Reservation	Greathouse wetlands, washout wetlands (3 ponds)	substrate treatment with penoxsulam in early spring	18	38	13	3	$3,757	$3,832
West Creek Reservation and Ohio and Erie Canal Reservation	Greathouse wetlands, washout wetlands (3 ponds), Blue Heron Marsh (2 ponds)	whole pond treatments with fluridone	18	38	13	5	$3,757	$3,832
North Chagrin Reservation	Sunset Pond and Sanctuary Marsh	whole pond treatments with fluridone	18	66	13	2.5	$3,939	$4,018
						subtotal wage/mileage	$36,453	$37,182
						subtotal pesticides	$3,655	$3,728
						subtotal FasTESTs	$10,403	$10,611
						Grand Total Estimate	**$89,964**	**$89,453**

Product name, description	Product Cost: Unit cost (estimate with shipping)	Estimated annual use for West Creek, OEC, and North Chagrin		
penoxsulam (Galleon SC), quart	$ 535.00	1	$	535.00
fluridone (Sonar AS), quart	$ 830.00	1	$	830.00
fluridone (Sonar AS), gallon	$ 1,715.00	1	$	1,715.00
fluridone (SonarONE), 20 pound pail	$ 575.00	1	$	575.00
		subtotal pesticides per year	$	3,655.00

Product	Cost per FasTEST sample	# samples per year		subtotal testing / year
penoxsulam	102	5	$	510.00
fluridone	92	65	$	5,980.00
fluridone	92	39	$	3,588.00
		subtotal water sample testing per year	$	10,078.00
	shipping per year	325		332