Northeast Aquatic Research, LLC.
Mansfield, CT (860) 456-3179

Flat River Reservoir 2016
Invasive Species Survey

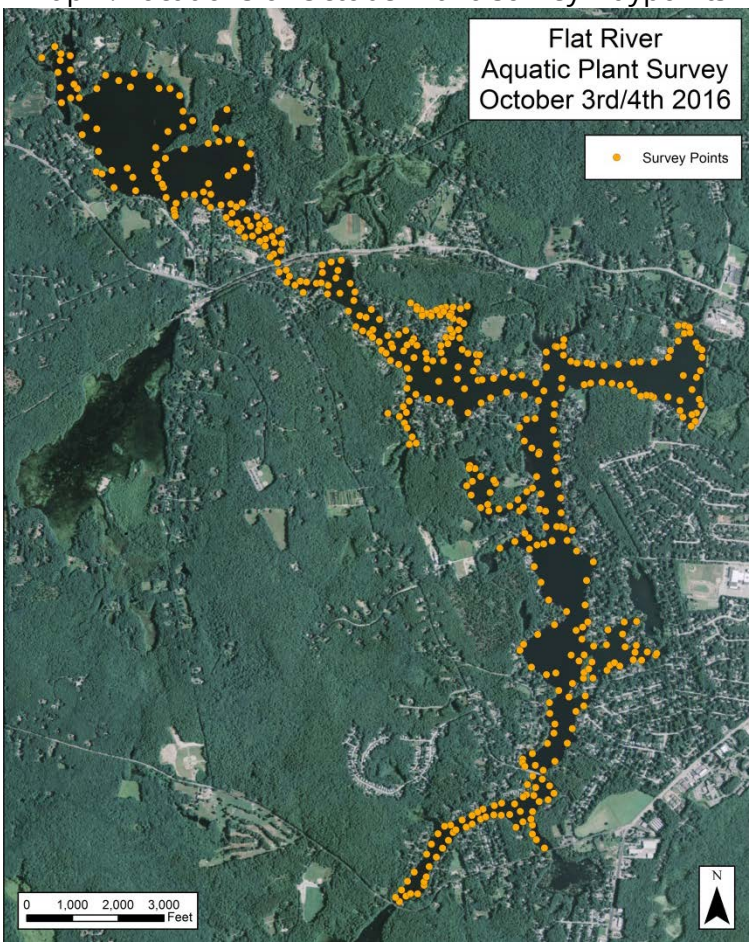
Prepared for: Johnsons Pond Civic Association
December 14, 2016

Introduction

Flat River Reservoir, also known as Johnson Pond, is in Coventry, Rhode Island. The Lake has three identified invasive aquatic plant species: Fanwort (*Cabomba caroliniana*), Inflated bladderwort (*Utricularia inflata*), and Variable milfoil (*Myriophyllum heterophyllum*). In recent years (2014 and 2015) Aquatic Control Technologies (now SOLitude Lake Management) has used the herbicides; Clipper (Flumioxazin), and Reward (Diquat), to treat specific areas of the lake in order to control excessive growths of fanwort and milfoil. Target areas were chosen using distribution mapping of invasive species made in 2011 (see **Map 4**). During the winter of 2015-2016 the lake water level was lowered 12ft below

spillway so the gates and sleuth of the dam could be repaired. Fanwort is susceptible to drawdown with plants generally not surviving drying and freezing during winter exposure, variable milfoil is more tolerant but can be impacted if conditions are right. Updated distribution mapping was needed to determine where target species survived the drawdown and can be expected to proliferate in 2017. This report details survey results from a whole lake survey conducted over two days; October 3 and October 4, 2016 by Northeast Aquatic Research (NEAR). During the survey, a total of 452 waypoints were made to record the presence and growth of aquatic plants in Flat River. Map 1 shows locations of waypoints made during this survey. At each waypoint, species presence was recorded, an estimate of invasive species growth density was made and the water depth measured.

Map 1: Locations of October 2016 survey waypoints



2016 Aquatic Plant Survey Results

Table 1 gives the frequency of occurrence and for each species identified during the October 2016 survey. Invasive species are listed in red alongside results from two prior surveys conducted by NEAR. A total of 34 species of aquatic plants were found during the 2016 survey, 9 species were found commonly throughout the lake—that is had frequency of occurrence values over 10%. Three of these common species were the target invasive plants. The remaining species were uncommon to very scarce, 7 species were so scarce to be found at only one waypoint (percent frequency of 0.2%).

Most species declined in frequency, most likely due to effects of drawdown. A couple species increased significantly over 2011, Chara, and snail-seed pondweed were common in 2016 but had not been seen in the lake before, Nitella was also common in 2016 but had been found at very low frequency in prior surveys. Chara and Nitella are macro-algae capable of fast growth over exposed substrates that quickly colonized after drawdown. Snail-seed pondweed can also quickly colonize open lake sediments. Interestingly, low milfoil a species that was very scarce in both prior surveys dramatically increased in abundance and frequency becoming almost common in 2016. Five species noted in prior surveys were not found in 2016 possibly due to being missed as these plants were very scarce before.

Fanwort was still the most frequently occurring aquatic plant in Johnson Pond in 2016, occurring at almost twice the frequency as the next most abundant species but at about half the frequency found in 2011. Variable milfoil and swollen bladderwort each decreased significantly over values reported in 2010 and 2011. A new invasive aquatic plant, Spiny Naiad was found in the lake for the first time in 2016. The plant was found growing at very low density at one location near the dam adjacent to the railroad right-of-way. This plant is considered an annual, as new growth each year is from seeds so it may or may not spread depending flowering success. However, there is evidence that all naiads, each considered

annuals, can survive by overwintering root stocks so the presence of this plant should be monitored closely in the future.

Table 1: Plant species and frequency of occurrence in Flat River during three whole lake surveys, 2010, 2011 and 2016. Invasive species shown in red, bold frequency numbers indicate common species in 2016

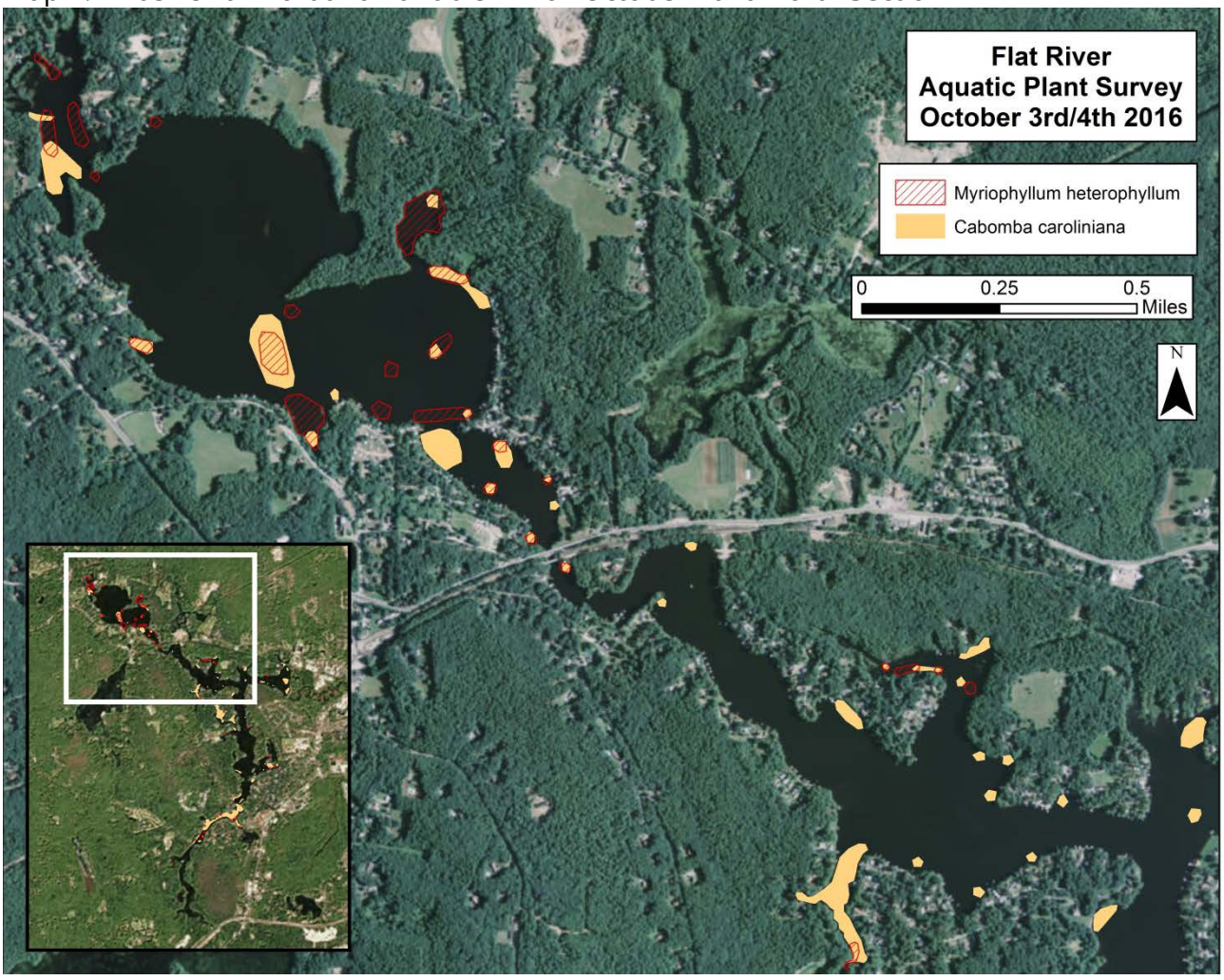
Scientific Name	**Common Name**	**Percent Occurrence**		
		2010	**2011**	**2016**
Cabomba caroliniana	fanwort	38.8	64.3	**39.4**
Myriophyllum heterophyllum	variable watermilfoil	37.6	31.8	**13.5**
Utricularia inflata	swollen bladderwort	37.4	46.9	**15.7**
Potamogeton epihydrus	ribbonleaf pondweed	22.2	21.3	**17.3**
Brasenia schreberi	watershield	9.0	17.7	7.5
Sparganium fluctuans	floating bur-reed	8.4	8.1	3.5
Vallisneria americana	wild celery	6.3	23.8	**22.3**
Nymphaea odorata	white waterlily	6.3	9.1	7.1
Utricularia macrorhiza	common bladderwort	4.4	1.0	0.4
Eleocharis acicularis	needle spikerush	4.1	1.0	0.9
Utricularia gibba	humped bladderwort	4.0	6.0	2.9
Gratiola aurea	golden hedge-hyssop	3.9	2.5	1.3
Utricularia purpurea	purple bladderwort	3.9	4.1	0.2
Potamogeton pulcher	spotted pondweed	3.2	2.8	0.2
Eleocharis robbinsii	robbins' spikerush	2.7	16.4	**24.3**
Potamogeton berchtoldii	Berchtolds pondweed	2.6	0.0	0.9
Pontederia cordata	pickerelweed	2.2	0.1	0.7
Nymphoides cordata	little floatingheart	2.2	5.8	1.5
Utricularia intermedia	striped bladderwort	2.1	0.6	1.5
Proserpinaca palustris	marsh mermaidweed	2.1	0.7	0.2
Potamogeton natans	floating pondweed	2.0	2.2	1.3
Nuphar variegata	spadderdock	1.9	1.6	0.9
Sagittaria graminea	submersed arrowhead	1.7	0.4	1.8
Nitella sp.	stonewort	0.9	1.7	**12.6**
Elatine minima	small waterwort	0.8	0.3	0.0
Potamogeton amplifolius	Large-leaf pondweed	0.8	0.0	0.0
Myriophyllum humile	low watermilfoil	0.8	0.1	7.5
Najas flexilis	nodding waternymph	0.5	2.0	0.2
Utricularia radiata	little floating bladderwort	0.5	0.3	0.7
Callitriche sp.	water-starwort	0.3	0.0	0.0
Polygonum sp.	smartweed	0.2	0.0	0.0
Eriocaulon sp.	pipewort	0.1	0.9	0.2

Wolffia sp.	watermeal	0.1	0.1	0.0
Utricularia geminiscapa	hiddenfruit bladderwort	0.0	0.1	0.9
Chara sp.	musk grass	0.0	0.0	**14.2**
Potamagaton bicupulatus	Snail-seed pondweed	0.0	0.0	**14.2**
Fontinalus	aquatic moss	0.0	0.0	0.7
Utricularia minor	tiny bladderwort	0.0	0.0	0.2
Najas minor	spiny naiad	0.0	0.0	0.2

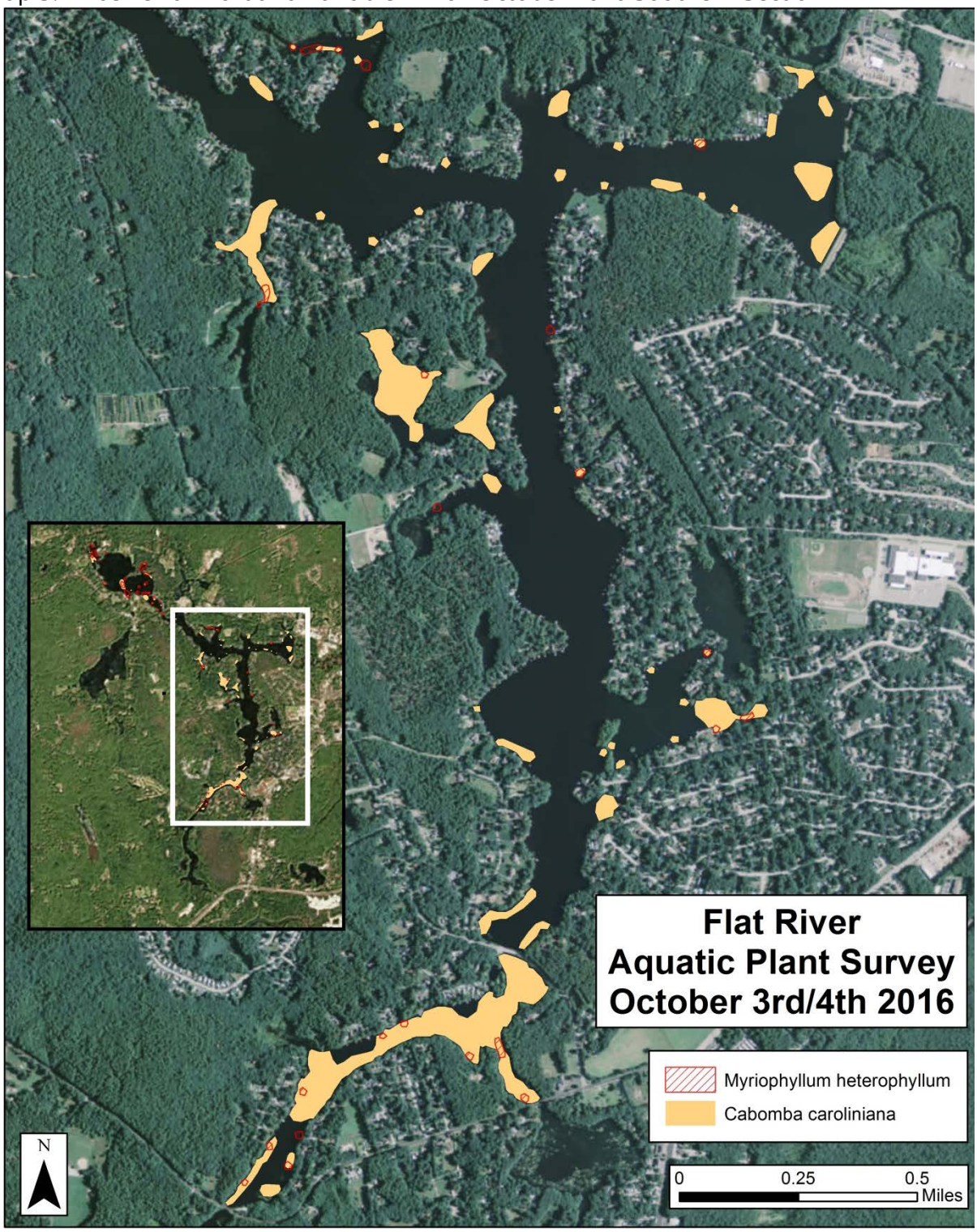
Distribution of fanwort and variable milfoil in Flat River Reservoir in October 2016 is shown in Maps 2 and 3 below. Fanwort beds covered about 85 acres as opposed to 270 acres mapped in 2011. Fanwort appeared to be confined mostly to shallow waters and in coves and bays. The one obvious exception is the section of the lake south of the Hill Farm Road crossing where most of that part of the lake was found to be covered with dense fanwort beds, essentially unchanged from prior surveys. This was likely due to drawdown having less affect in this area because of water flows from the large watershed that drain to that part of the lake from the south, and possible constriction of flow out of this section to the rest of the lake by the culvert under Hill Farm Road.

Fanwort beds and density in most of the coves also remained largely unaffected by the drawdown probably because these areas were supplied by continuous runoff that kept substrates wet and unfrozen during the winter allowing plants to survive. Variable milfoil was almost exclusively found in the shallow water of bays and coves, with very little found in open lake areas, with the exception of patches of milfoil in the first and second bays west of the Route 117 Bridge.

Map 2: Invasive Fanwort and Variable milfoil October 2016 North Section



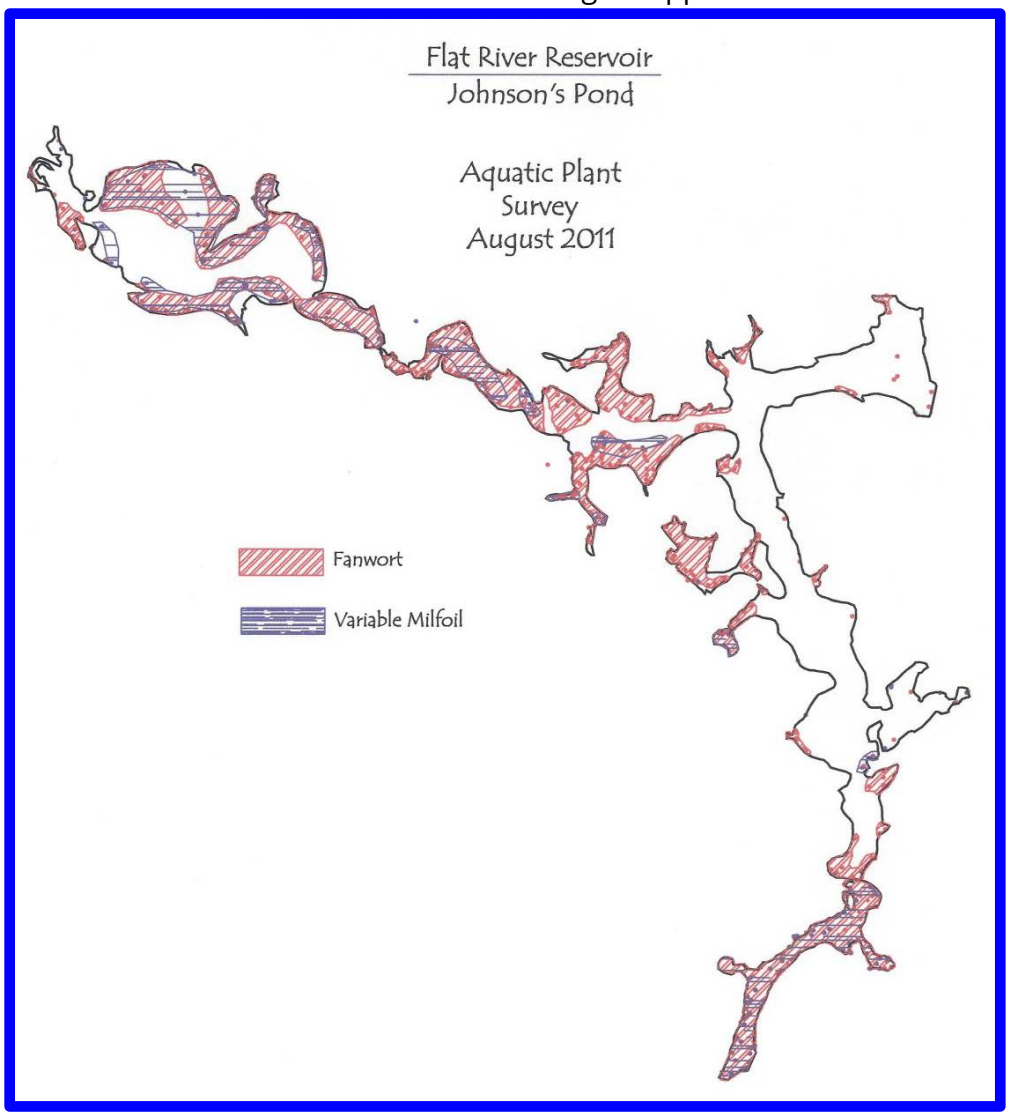
Map 3: Invasive Fanwort and Variable milfoil October 2016 Southern Section



Conclusions and Recommendations

Deep water level drawdown during the winter 2015-2016 caused decrease in coverage and density of fanwort, variable milfoil, and swollen bladderwort in Johnson Pond. Compare the distribution of fanwort as mapped in 2016 to that mapped in 2011 (**Map 4**) when most of the Western Arm was completely choked with dense beds of the plant.

Map 4: Invasive Fanwort and Variable milfoil coverage mapped in 2011



The clipper/diquat treatments have focused on a select area in the center of the Western Arm as shown by green and blue areas in **Map 5**. The treatments have been affective at greatly reducing fanwort and variable milfoil within those areas. This part of the lake has high boat use traffic so both fanwort and milfoil fragmentation is probably significant. Controlling plants in this area probably greatly reduces this fragmentation. Both fanwort and milfoil require only tiny intact portions of the stem to form new growth and propagation in other parts of the lake.

Choosing areas of the lake to treat in 2017 is difficult because fanwort is so wide spread. There are different approaches that can be considered. Based on what we know now, the following options are worthy of consideration. In any event, the whole lake should be surveyed every year from here on out to determine how and where fanwort and variable milfoil return after the drawdown and to monitor success of treatments.

1. Continue to focus on areas treated in 2014 & 2015 with the goal of maintaining these areas as fanwort free. These are high use areas where beds of fanwort are fragmented by continuous boat traffic. Because fanwort was scarce in these areas after the drawdown the costs should be minimal to expand the treatment zone westward to include the large bays west of Route 117 Bridge allowing for more extensive coverage of contol.
2. Perform an aggressive treatment that includes spot treatment of all areas where fanwort was found in the Western Arm in 2016, excluding the dense beds of fanwort in the inner coves.
3. Attack the densest beds of fanwort that remain after drawdown. Principally this includes the extremely dense beds south of Hill Farm Road.
4. Begin to systematically eliminate fanwort from headwater coves where plants may be responsible for inoculating open lake areas. These treatments could be done in conjunction with options above and will probably make use of alternate herbicides and/or approaches.

Map 5: Herbicide treatment areas in Flat River Reservoir, green = 2015, blue = 2014.