
Northeast Aquatic Research

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Bantam River Fanwort Management Report

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Introduction

This report summarizes activities by the Bantam Lake Protective Association (BLPA) undertaken through an Aquatic Invasive Species (AIS) grant from the Connecticut Department of Energy and Environmental Protection (DEEP) to supplement a watershed-wide investigation and control of Fanwort (*Cabomba caroliniana*). Fanwort is an invasive aquatic plant that infests numerous waterbodies in the State of Connecticut. Fanwort is native to South America, possibly naturalized in southeastern US. The plant has been distributed worldwide by the aquarium trade where it can still be purchased via the internet as a popular plant for home aquaria. The plant has been banned for sale in Connecticut.

History of Fanwort in Bantam Lake and Bantam River

Northeast Aquatic Research (NEAR) first documented fanwort in Bantam Lake at the mouth of the Bantam River at the northern end of Bantam Lake in 2002 during a whole lake aquatic plant survey. In 2003, a second 0.4 acre area of moderate density fanwort was found growing among water-lilies on the western side of the Outlet Cove. In 2004, the first Bantam River survey between Whites Wood Road and Bantam Lake (1.3 river miles), found 0.9 acres of high density fanwort beds. Between 2004 and 2008 fanwort increased in distribution and density in the lower river to 6.2 acres with much of that section of the Bantam River infested. In 2007, the first survey of the Bantam River above Whites Wood Road to Little Pond, 0.84 river miles, was conducted found an additional 1.8 acres of dense fanwort was found in that stretch of the river with 8.3 acres of the 14 acre Little Pond covered with dense topped out fanwort. Between 2008 and 2013, fanwort distribution in the lake continued to expand to include about 6 acres of sparse to dense beds along the north shore, on both side of the mouth of the river.

The BLPA funded extensive suction harvesting between 2008 and 2009 with the beds in the Outlet Cove and along the north shore specifically at the mouth of the river where targeted for removal, no beds in the river were harvested. In 2010, CT DEEP assisted BLPA with a grant funding a suction harvesting removal project targeting select beds along the north shore, the outlet cove, and a newly discovered bed on the west side of Folly Point. Suction harvesting proved to have mixed success. In some areas, Outlet Cove, and Folly Cove, suction harvesting

was found to completely eradicate the plant with little-to-no regrowth found in annual surveys conducted in subsequent years. However, beds along the north shore proved to be far more tenacious with new plants returning the following year at densities near or exceeding the conditions pre-harvesting, sometimes returning the year of harvesting. During these years, no attempt was made to remove fanwort from the river. Although these efforts were successful in preventing fanwort from establishing larger unmanageable beds in the northern bay and expanding into new areas of the lake, no progress was made in diminishing the beds of fanwort on the north shore, and with the dense populations of fanwort in the river and Little Pond the prognoses for the future was for inevitable and continuous inoculation.

In 2013, BPLA received a permit to apply Flumioxazin (Clipper) herbicide to control fanwort in Little Pond and the Bantam River between Little Pond and Bantam Lake (2.14 river miles). The treatment was experimental because effects of the contact herbicide on Fanwort were unknown for a flowing waterbody. Treatment of Little Pond was made on 7/31/13. The success of the treatment demonstrated that short term control of Fanwort in a river system is possible. It was concluded that further management of Fanwort in the Bantam River and upper watershed is necessary to minimize the risk of further invasion of the Lake. In 2014, a second herbicide treatment was performed on August 20, 2014 in Little Pond and a small section of the Bantam River where small fanwort regrowth occurred. This 2014 treatment also included three main-lake areas along the North Shore and the Outlet Cove. No herbicide treatments were performed in 2015, instead NEAR conducted an extensive search of the upper Bantam River and its watershed. Another herbicide treatment was conducted in the summer of 2016. All aquatic herbicide treatments were performed by Solitude Lake Management (formally Aquatic Control Technology).

In 2015, BLPA received a grant from DEEP to conduct continue herbicide treatments of fanwort in Bantam River, Little Pond and the north shore of Bantam Lake. The grant also provided funding to investigate the watershed of Little Pond for upstream infestations of fanwort.

The Bantam River Watershed

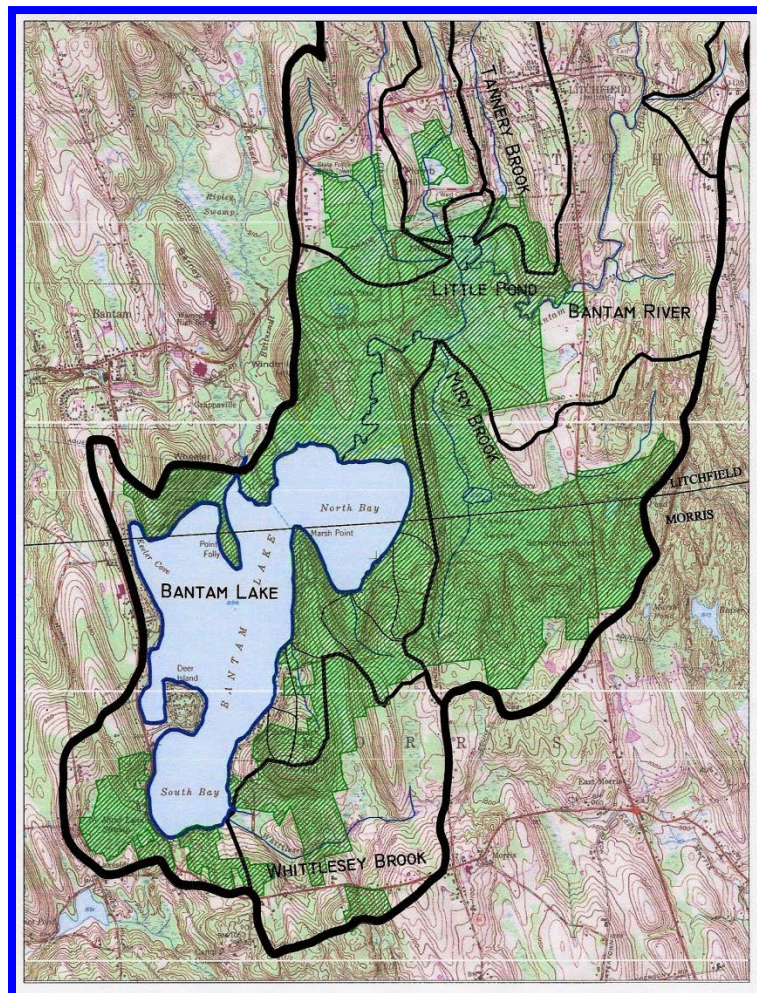
The watershed of the Bantam River and subsequently Bantam Lake extends far north into Litchfield, Goshen, and Torrington. There are three waterbodies upstream of Bantam Lake, Little Pond in Litchfield, Timber Pond in Torrington, and Dog Pond in Goshen. Little Pond (14ac), is about 2 river miles upstream of Bantam Lake and receives water flow from a couple of smaller streams in addition to the Bantam River. Dog Pond (66ac) forms the headwaters of the West Branch of the Bantam River about 5.8 miles upstream of the confluence with the East Branch of the Bantam River. The confluence is about 3.2 river miles upstream of Little Pond. Timber Pond (25ac) in the East Branch of Bantam River is about 2.8 river miles upstream of the

2015 & 2016 Summary Points

1. Survey the Bantam River upstream of Little Pond for the presence of Fanwort

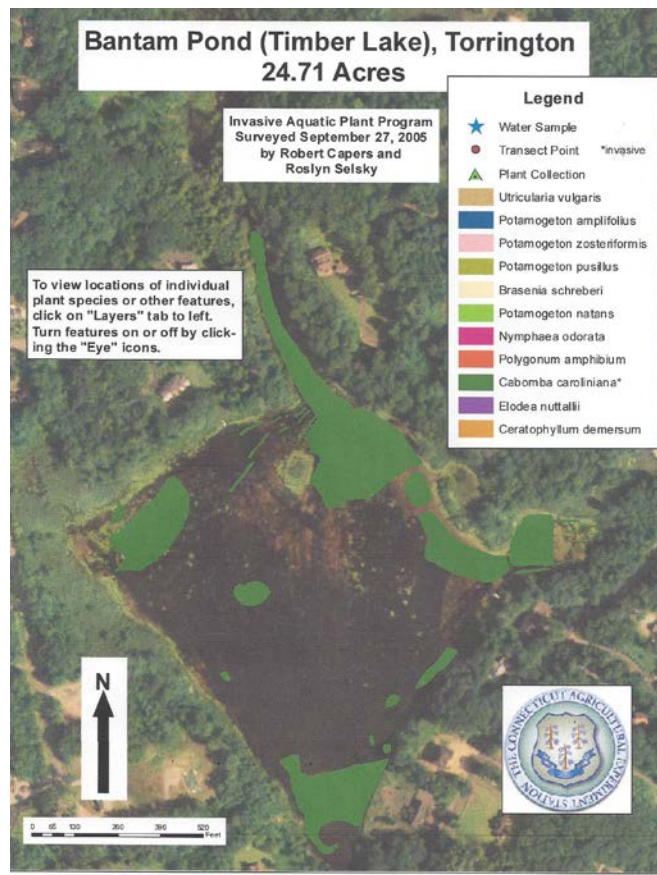
- a. In 2015, the lower reaches of three secondary tributaries to Little Pond were surveyed via walking along the river banks and exploring roadside wetland ponds via canoe. In all areas searched, no fanwort was found.
- i. The remote ponds on White Memorial Foundation (WMF) property (**Map 2**) in the vicinity of Little Pond, including Miry Brook ponds, were discussed with WMF staff scientists who had not reported the presence of fanwort as yet. Direct examination and monitoring of all WMF ponds is ongoing program carried out by NEAR and WMF research department.

Map 2- White Memorial Property (green) in the vicinity of Little Pond and Bantam Lake



- b. The Bantam River between Little Pond and Timber Pond was inspected via walking, skipping stretches located on private property. No fanwort was found during these searches.
- c. Timber Pond, an impoundment of the Bantam River, has been known to be infested with fanwort since at least 2005 when the CT Agricultural Experiment Station mapped aquatic plants (**Map 3**). Fanwort in Timber Pond is clustered in the channel of the Bantam River leading to the pond--northeast corner, and the fore-bay of the outlet dam--southwest corner suggesting potential to flush fragments out of the lake is very high.

Map 3- Distribution of fanwort (green) in Timber Pond mapped by CT Ag. Exp. Station in 2005



- i. Privately owned Timber Pond is an upstream source of Fanwort to the Bantam River, Little Pond, and the Lake. Fanwort fragments were observed flowing over the dam on multiple occasions in 2015 and 2016. Timber Pond residents were made aware of this issue and provided contact information for NEAR, the DEEP AIS division, and the BLPA.

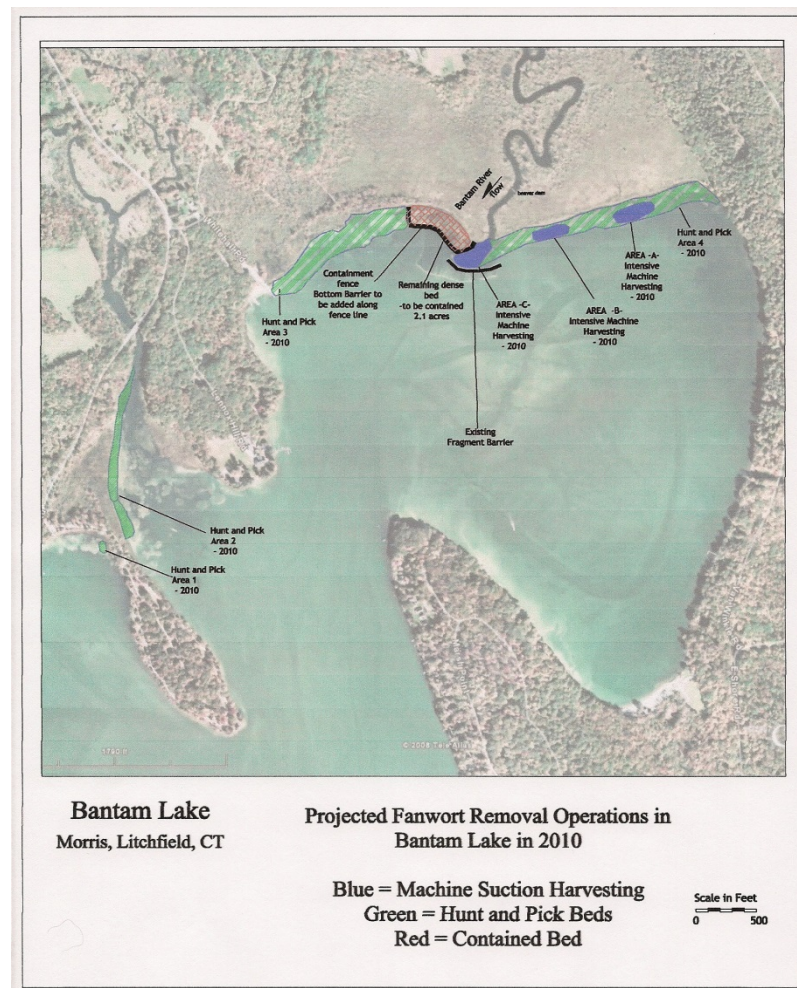
Homeowners and their Association expressed in-person interest in collaborating with BLPA but there has been no successful follow-up as of the date of this report. NEAR has no knowledge of recent efforts to control fanwort in Timber Pond but it appears that previous efforts have been made using a weed cutter boat.

- d. Dog Pond was surveyed by CT AES on August 5, 2005 and October 4/9 2013, and by NEAR on June 8, 2012, September 3, 2014, August 3, 2015, October 18, 2016. No fanwort has been reported during any of the surveys. Eurasian milfoil was reported by all surveys.

2. **Intensively survey Bantam Lake**

- a. Bantam Lake has been surveyed on May 23, 2015, September 23, 2015, May 5, 2016, and September 26, 2016 as part of the herbicide permit. The number of treatment areas is large and include most of the vegetated parts of the lake. Additional surveys were conducted of North shore and smaller coves missed by the surveys listed above. No new fanwort beds have been found in the lake. Fanwort has been found in shallow water and wetlands below the outlet of the lake, in the vicinity of the confluence of Butternut Brook. The known beds of fanwort in Bantam Lake as mapped during prior removal programs (**Map 4**) were visited routinely during 2015-2016 to search for new shoots and/or document presence for Clipper treatments.

Map 4- Known beds of fanwort in Bantam Lake



3. **Treat fanwort in Little Pond, Bantam River, and Bantam Lake**

- a. Pre-treatment survey of Bantam River between Bantam Lake and Little Pond was conducted on 7-2-15 and found very little fanwort in the River and Little Pond. Treatment conducted in 2014 was shown to be very successful so no treatment was necessary in 2015.

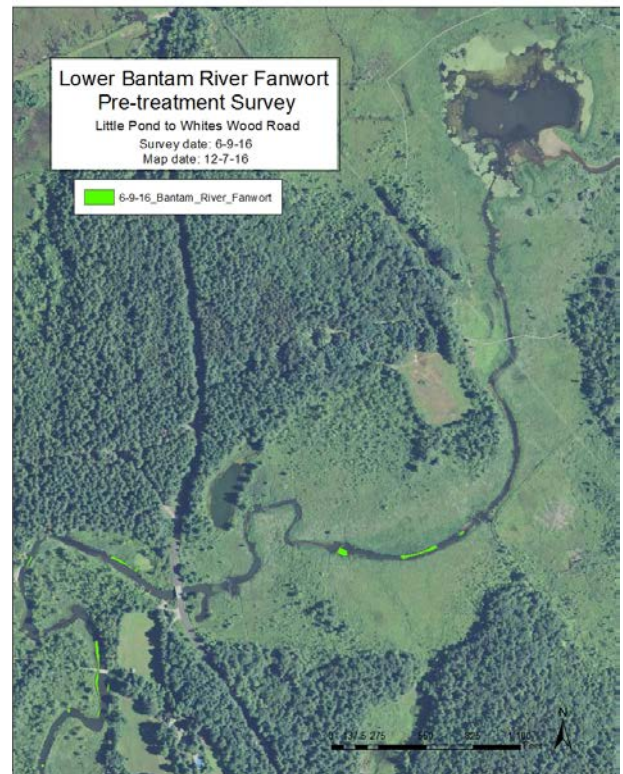
Little Pond and Bantam River were treated on August 10, 2016 at a dose of 100 ppb.

- b. No hand pulling or suction harvesting was necessary in 2015 or 2016.
- c. Two pre-treatment surveys were conducted of the Bantam River and Little Pond on June 9, 2016 and August 4, 2016 with locations of fanwort beds show in **Map 5** – between the lake and Whites Wood Road, and **Map 6** – between Whites Wood Road and Little Pond.

Map 5 - Fanwort in Lower River Pre-treatment

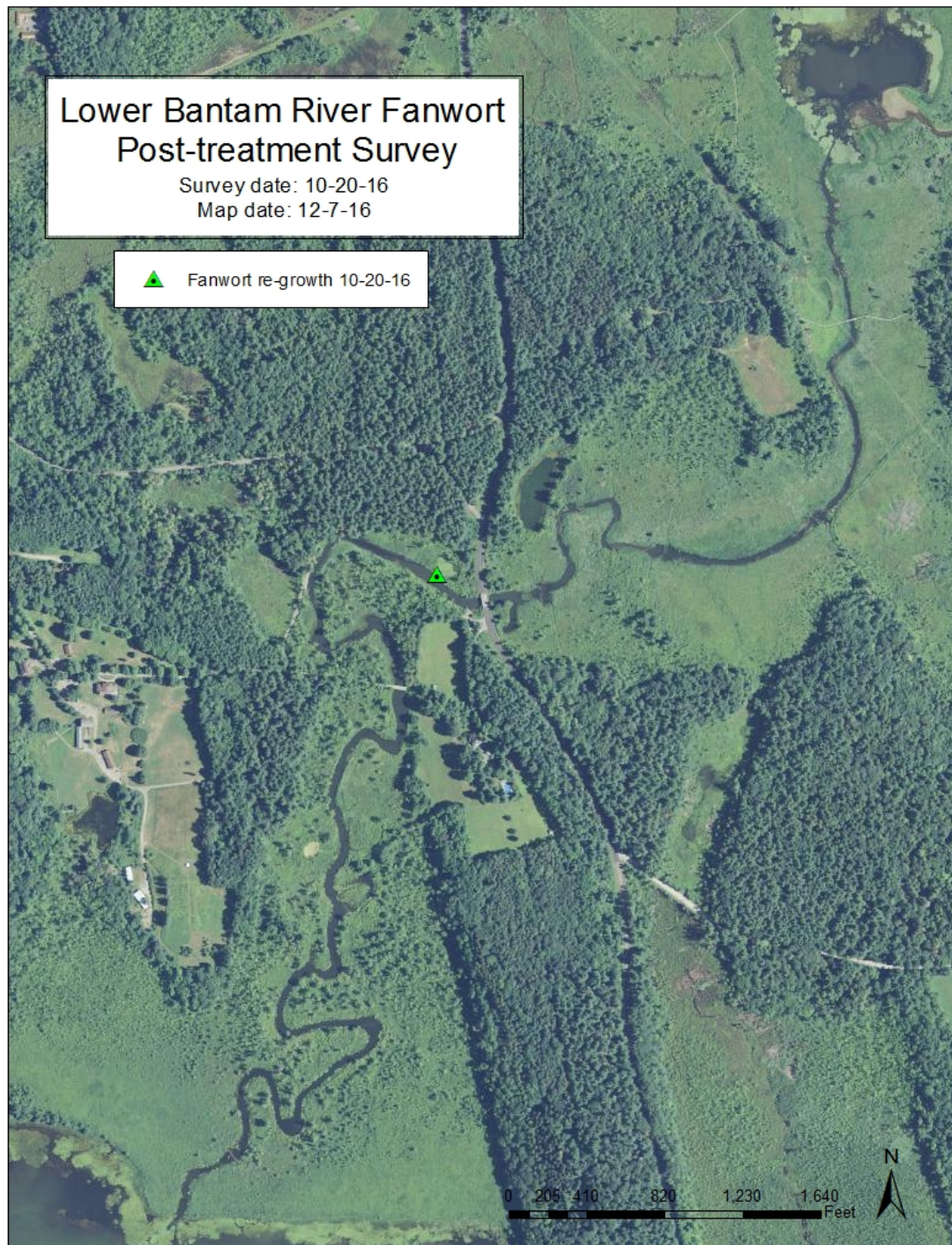


Map 6 - Fanwort in Lower River Pre-treatment



- d. A post treatment survey of the Bantam River up to and including Little Pond was conducted on October 20, 2016. Fanwort was found in only one site in the River as shown on **Map 7**, with no fanwort found in Little Pond.

Map 7 - Fanwort in Lower River Post-treatment



4. **Develop detailed list of native aquatic plant species affected by the herbicide**

- a. Aquatic plant species noted in Little Pond and the treated section of Bantam River (Little Pond to Bantam Lake) during 2011, 2015, and 2016 are given in **Table 1** below. The survey of Little Pond and lower Bantam River conducted on September 29, 2011 serves to illustrate the vegetation community present in the River and Little Pond prior to any herbicide treatments. The first River/Pond treatments were made on July 31, 2013 and August 20, 2014.
 - i. The survey conducted in 2011 shows fanwort dominated the system occurring at more than half the observation points, while Eurasian milfoil was dense at more than a 25% for the point. Few other species were presence due to the overwhelming canopy that these two species had formed over the lake. Canopied fanwort beds in the lower river are shown in red in **Map 8**.

Map 8 - Fanwort in Lower River in 2008



Table 1 - Species list in alphabetical order

Species Scientific Name	Presence %			
	Sept. 29, 2011	July 2, 2015	June 9, 2016	Oct. 20, 2016
<u>Cabomba caroliniana</u>	56	4	44	1
<u>Callitriche</u> sp.	0	0	2	0
<u>Ceratophyllum demersum</u>	13	10	26	5
<u>Eleocharis acicularis</u>	0	1	0	1
<u>Eleocharis robbinsii</u>	0	0	2	0
<u>Elodea nuttallii</u>	0	10	53	1
<u>Elodea canadensis</u>	0	0	2	0
<u>sparganium</u> (Emergent)	2	24	40	0
<u>Equisetum</u> sp.	0	0	2	0
<u>Fontinalis</u> sp.	0	0	0	1
<u>Lemna</u> sp.	0	13	21	0
<u>Ludwigia</u> sp.	0	0	7	0
<u>Marsilea quadrifolia</u>	4	7	5	3
<u>Megalodonta beckii</u>	6	0	0	0
<u>Myriophyllum spicatum</u>	28	38	72	23
<u>Nitella</u> sp.	0	1	0	7
<u>Nuphar variegata</u>	4	20	16	7
<u>Nymphaea odorata</u>	4	36	35	20
<u>Polygonum</u> sp.	0	7	16	5
<u>Potamogeton amplifolius</u>	6	25	47	39
<u>Potamogeton berchtoldii</u>	0	0	12	0
<u>Potamogeton bicupulatus</u>	0	2	0	0
<u>Potamogeton crispus</u>	0	8	21	0
<u>Potamogeton gramineus</u>	0	1	0	1
<u>Potamogeton natans</u>	2	15	0	0
<u>Potamogeton nodosus</u>	20	13	25	0
<u>Potamogeton robbinsii</u>	2	10	25	9
<u>Potamogeton unknown-1</u>	-	4	0	0
<u>Potamogeton zosteriformis</u>	4	8	0	0
<u>Ranunculus</u> sp.	0	14	58	4
<u>Sagittaria graminea</u>	0	14	9	0
<u>Sparganium fluctuans</u>	0	10	12	3
<u>Utricularia geminiscapa</u>		1	0	0
<u>Utricularia macrorhiza</u>	11	4	39	0
<u>Zosterella dubia</u>		0	32	0
Filamentous algae (not just spirogyra)	-	51	32	27

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- b. Two pre-treatment surveys were conducted of the Bantam River and Little Pond, June 9, 2016 and August 4, 2016.
- i. Because no treatments were made in 2015, the surveys of July 2015 and the early survey of 2016 gives the condition of the aquatic plant community one and two years post treatment. Both surveys showed higher number of native species than were found in 2011 indicated that removal of dense fanwort and milfoil canopy allowed colonization by native species.
 - ii. The June survey documented abundances of all aquatic plant species and the August survey specifically noted the seasonal growth of invasive species Eurasian milfoil (*Mryiophyllum spicatum*) and Fanwort just prior to treatment. Eurasian milfoil and Fanwort grew in high densities in areas shallower than 6ft deep. Fanwort was less prevalent overall than E. milfoil, yet growth of Fanwort was often in very dense clusters. Fanwort plants ‘topped out’ and were observed to be flowering in August.
 - iii. The 2016 pre-treatment survey results also show that the Bantam River and Little Pond both contained very dense populations of native species where invasive species were not growing. The most common submersed native species were *Potamogeton amplifolius*, *Ranunculus sp.*, and *Elodea nuttallii*.
- c. During the October post-treatment Bantam River survey Fanwort was only found at one location. Eurasian milfoil was found either surviving or partially re-growing at approximately 23% of the waypoints from Little Pond to the mouth of the Bantam River at the Lake.
- i. The most abundant submersed native plant species was large-leaf pondweed (*Potamogeton amplifolius*), which was located at 39% of the survey waypoints. The average density of large-leaf was about 45%.
 - ii. Water buttercup *Ranunculus sp.* was found as high density decaying plant material, but with about 10% re-growing leaflets at 4% of the survey waypoint.
- d. Comparisons of presence, percent cover, over-all littoral zone cover, and growth form for fanwort and Eurasian milfoil are shown in **Table 2**. Fanwort shows rapid growth two years after treatment, quickly becoming dominant during the season of a non-treatment year. After treatment fanwort decreased to extremely low frequency and density indicating that the treatment wholly removes most if not all

of the plant biomass. Milfoil tends to remain present at low density after treatment with some shoots remaining in most of the original beds.

Table 2 – Comparisons of Pre Post treatment results for fanwort and E. milfoil

Fanwort (<i>Cabomba caroliniana</i>)	Pre/Post Treatment	Presence %	AVG Percent Cover %	Overall % Cover Littoral Zone	AVG GF
<u>7/2/2015</u>	Post 2014	4	8	< 1	N/A
<u>6/9/2016</u>	Pre	44	13	6	N/A
<u>8/4/2016</u>	Pre	N/A	31	N/A	3.8
<u>10/20/2016</u>	Post	1	5	<1	N/A

Eurasian milfoil (<i>Myriophyllum spicatum</i>)	Pre/Post Treatment	Presence %	AVG Percent Cover %	Overall % Cover Littoral Zone	AVG GF
<u>7/2/2015</u>	Post 2014	38	25	9	N/A
<u>6/9/2016</u>	Pre	72	48	35	N/A
<u>8/4/2016</u>	Pre	N/A	63	N/A	4.9
<u>10/20/2016</u>	Post	23	34	8	N/A

5. **Conclusions**

- The herbicide Flumioxazin (Clipper) has shown excellent control of fanwort the year of treatment and the year following treatment although Eurasian milfoil is partially controlled with Clipper.
- Fanwort begins to return to dominance by late summer of second year after treatment.
- Bantam River has shown dramatic increases in aquatic plant species diversity following the initial treatments.
- Most species present in the system show decreased frequency and density following treatment using Clipper although based on 2015 and early 2016 survey all species that are affected by the herbicide return the following year.
- Timber Pond appears to be the only upstream source of fanwort to the Bantam River. No other infestations have been found. BLPA will continue to follow-up with management of this water body.
- Fanwort has escaped out of Bantam Lake and is growing at high density in the Bantam River downstream of Bantam Lake.
- Clipper herbicide is likely to be needed at least every other year or once every three years to control fanwort in Little Pond and Bantam River.
- Clipper was applied in 2016 suggesting the next Clipper treatment could be 2018.
- BLPA expects to continue annual surveys of the Bantam River watershed.

Photographs of Plants Collected during October 2016 Post-Treatment Survey

The following are photos taken during the October post-treatment survey to better demonstrate the growth conditions of the various aquatic plant species present.





Image Descriptions in Order:

1. Eurasian milfoil dead stem with apparent surviving leaflet
2. Fanwort new growth, likely from partially decayed stem
3. Eurasian milfoil plants mostly decayed but with some surviving leaflets
4. & 5. *Ranunculus* sp. regrowth in Little Pond
6. *Potamogeton amplifolius* growing in high densities in river and Little Pond
7. Mixed native pondweeds and waterlilies