

Control of Aquatic Weeds in Lake Quonnipaug

2003

Prepared for

The Guilford Conservation Commission

Guilford CT

By

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Collaborators

Friends of Lake Quonnipaug
Guilford Conservation Commission
Town of Guilford

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Introduction

Concerns about the increasing amounts of weedy aquatic vegetation in Lake Quonnipaug prompted the Guilford Conservation Commission (GCC) to develop an Action Plan for the lake. A priority of this plan was to find ways to control invasive nonnative plant species that threaten the lake's recreational and ecological value. The plant species of greatest concern were Eurasian milfoil (*Myriophyllum spicatum*) and cabomba (*Cabomba caroliniana*). Additional goals included; safeguarding the state protected plant species called water marigold (*Megalodonta beckii*), encouraging the growth of a low growing plant called robbins pondweed (*Potamogeton robbinsii*), protecting biodiversity, preserving wildlife habitat; restoring the southern arm of the lake and maintaining the swim area at the town beach. The GCC is committed to compliance with the state threatened species regulations (RCSA Section 26-306, 1998) and has been proactively searching for solutions to the nonnative invasive plant problems.

In response to the efforts by GCC, The Town of Guilford began funding research by The Connecticut Agricultural Experiment Station (CAES) and others in 2000. During 2000, the Station studied the lakes water chemistry (Bugbee and White, 2000) and concluded the water in Lake Quonnipaug is slightly eutrophic (olig-mesotrophic). This condition has changed little from previous studies (Canavan and Siver, 1995, Frink and Norvell, 1984). Contrary to the somewhat static nature of the lake's water chemistry, the types and densities of rooted aquatic vegetation has changed rapidly. An aquatic vegetation survey by CAES and Northeast Aquatic Research in 2000 (Knocklien, 2001) documented extensive areas of Eurasian milfoil and cabomba. Frink and Norvell (1983) did not report finding cabomba in the lake in 1980 and by the late 1990's the boat launch cove and many other localized areas were choked with the weed. In 2001, CAES studied the effectiveness of controlling cabomba by the state boat launch with granular fluridone (Sonar SRP) and Eurasian milfoil by the town beach with granular 2,4-D (Navigate) (Bugbee and White, 2001). In both cases control was excellent with only slight regrowth in 2002 (Bugbee and White, 2002). Populations of water marigold located outside the treatment areas appeared to not be affected by the herbicides. These herbicides offered the prospect of successfully removing these weeds from select locations. Water chemistry was also tested in 2001 and 2002 with results similar to previous years.

Objectives for 2003

Continue past research on the control of Eurasian milfoil with spot applications of granular 2,4-D in areas near the shoal in the center of the lake and near the town.

Monitor the residual control of the cabomba treated in 2001 in the boat launch cove with granular fluridone (Sonar SRP).

Document the effectiveness of the fall 2002 glyphosate treatment and hydroraking on the control of lily pads and other emersed vegetation in the south cove.

Conduct water testing to quantify herbicide movement and residual concentrations. Test water for general chemistry including pH, alkalinity, conductivity, phosphorus, temperature, dissolved oxygen and transparency.

Survey lake for aquatic vegetation including water marigold. Utilize global positioning technology to precisely locate lake vegetation.



Figure 1.

Aquatic Plant Survey

July 30-31

2002

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- Cabomba- ■
- Eurasian Watermilfoil- ■
- Variable Watermilfoil- ■
- Yellow Waterlily- ■
- White Waterlily- ■
- Large-Leaf Pondweed- ■
- Robbins Pondweed - ■
- Water Marigold - *
as found by Nancy Murray, CTDEP on 8/14/2002

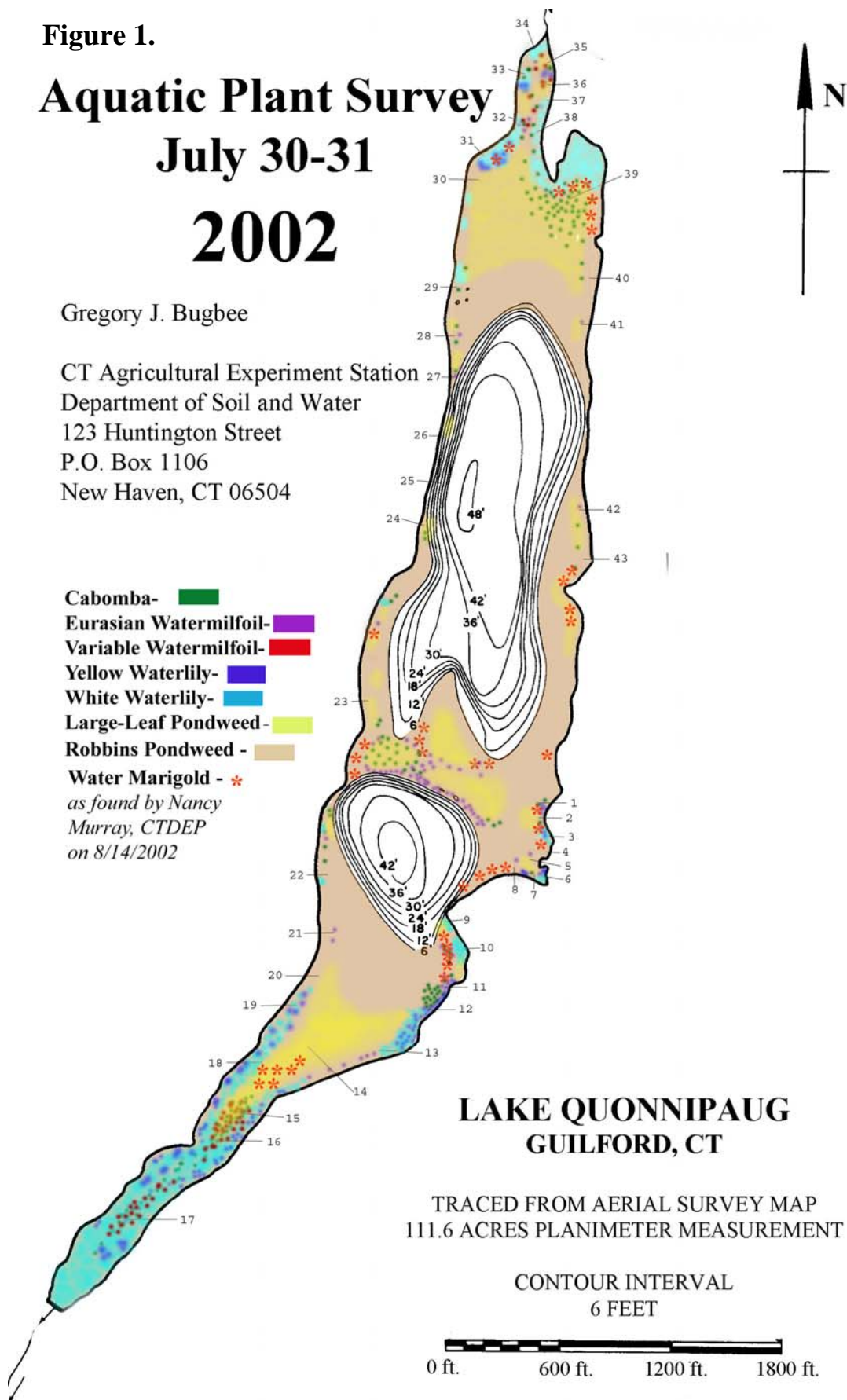


Figure 2.


Spot Treatment and Water Sampling Sites 2003

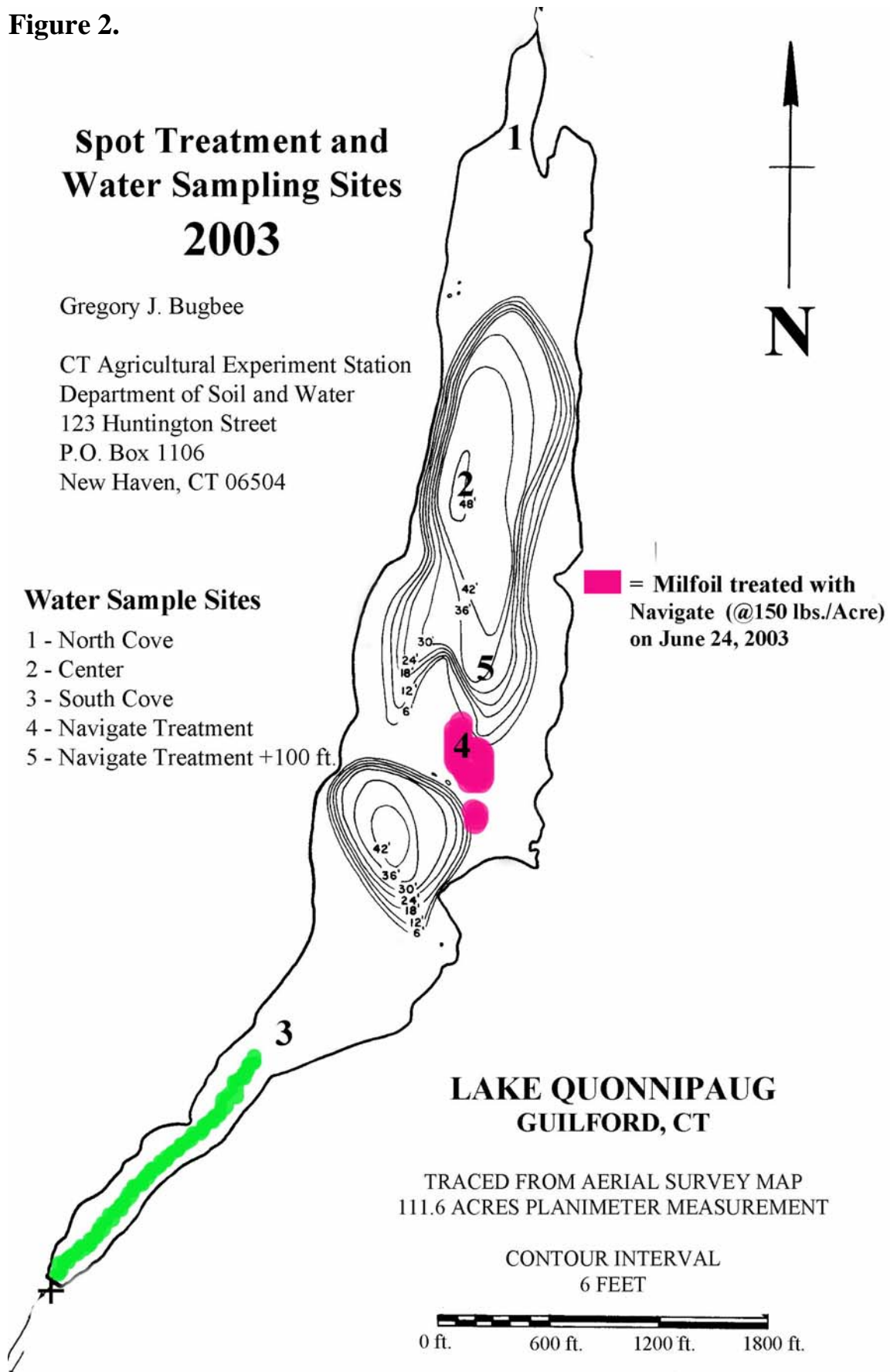
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Water Sample Sites

- 1 - North Cove
- 2 - Center
- 3 - South Cove
- 4 - Navigate Treatment
- 5 - Navigate Treatment +100 ft.

 = Milfoil treated with
Navigate (@150 lbs./Acre)
on June 24, 2003



LAKE QUONNIPAUG GUILFORD, CT

TRACED FROM AERIAL SURVEY MAP
111.6 ACRES PLANIMETER MEASUREMENT

CONTOUR INTERVAL
6 FEET

0 ft. 600 ft. 1200 ft. 1800 ft.

Figure 3. Eurasian milfoil north of center shoal.

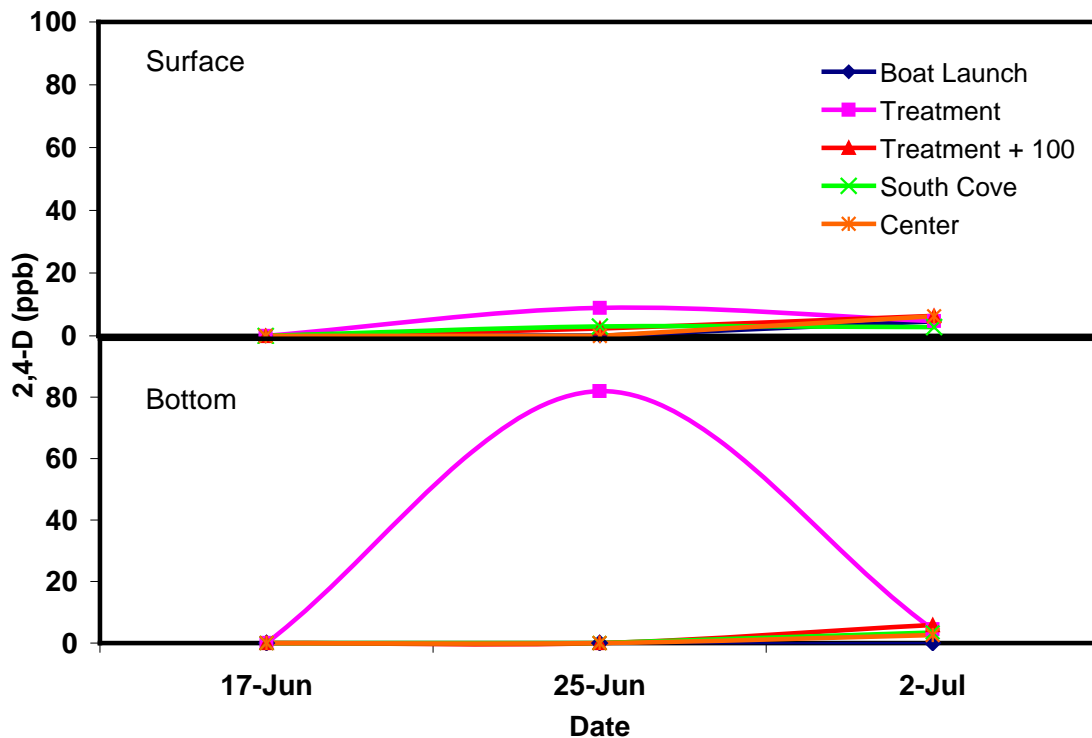


Materials and Methods

Meetings were held with the Guilford Conservation Commission, officials from the town of Guilford, Friends of Lake Quonnipaug and CTDEP to discuss the weed control options. A decision was made to treat Eurasian milfoil in shoal areas in the center of the lake (Figure 3) with Navigate (granular 2,4-D). If Eurasian milfoil was found in the Town beach swim area it would also be treated. Locations for the 2003 Navigate treatment sites were determined by weeds found and documented on the July 30-31, 2002 survey (Figure 1). Visual confirmations by informal surveys were done during the weeks prior to herbicide treatment. The 2000' x 50' wide swath of the south cove, which was treated with glyphosate and hydro-raked in fall 2002, was monitored for regrowth by monthly informal surveys and one formal survey in August. A general aquatic vegetation survey was done on August 13-15, 2003 and a survey specific for water marigold was performed on September 10. The general survey was performed both visually and by pulling samples from the bottom with a 25 cm wide rake attached to a rope. The rake was dropped on a grid pattern determined by global positioning system (see Observers Plant Survey Notes in the appendix). Each east/west transect on the grid pattern was one second of latitude apart (100'+/-) and along each transect sampling sites were one second of longitude apart (75'+/-). Resources for plant identification included: *Aquatic and Wetland Plants of Northeastern North America: Volumes 1 and 2* (Crow and Hellquist, 2000) and *Aquatic Plants of the United States* (Muenscher, 1944).

In March 2003, CAES applied to CTDEP for a permit to use 500 pounds of Navigate to control Eurasian water milfoil. The permit was granted in May 2003 (see appendix for forms etc.). Navigate was applied on June 24, 2003 to Eurasian milfoil near shoal areas in the center of the lake (Figure 2) at a rate of 150 pounds per acre. An electric spreader, mounted on the back of a powerboat, was used to distribute the granules. The public was notified of

Figure 4. Concentrations of 2,4-D in lake water.



each herbicide application by a legal notice in the Shoreline Times and signs posted at the town beach and boat launch ramp. Notification protocol was pursuant to Section 22a-66a(g) of the CT General Statutes. A copy of the newspaper notifications and signage are in the appendix of this report. In response to a request from Town officials, vegetation in the swim area was mechanically removed on August 1 using a “Water Weeder” electric weed cutter.

Lake water samples for pH, alkalinity, conductivity and 2,4-D analysis were obtained from five sites (Figure2) located in the boat launch cove, the center of the lake, the center of a treatment site near the center shoal, 100 feet away from the treatment site and in south cove. Samples were obtained from the surface (0.5 m depth) and near the bottom in all sites except the center where the deepest sample came from a depth of 9 meters. Sampling began on May 19 and continued until October 31. Sampling was done weekly from June 17 – July 17 to determine residual concentrations of 2,4-D and assure the water was safe for irrigating plants. During other time periods, sampling was performed every two to four weeks. When 2,4-D fell below the detection limit of 10 ppb in all samples this 2,4-D testing ceased. Water was tested for 2,4-D by solid phase extraction and liquid chromatography with a detection limit of 1 ppb. Total phosphorus was measured using the ascorbic acid method and potassium persulfate digestion (APHA et al, 1995). Water temperature and dissolved oxygen were monitored with an YSI 58 meter, at the surface and bottom of all sites except the center where measurements were taken at one meter intervals. Transparency was determined with a Secchi disk at the center site. A Fisher AR20 meter was used to determine pH and conductivity. Alkalinity was quantified using a Hach digital titrator and is expressed as mg/l CaCO₃. The titrant was 0.16 N H₂SO₄ with an end point of pH 4.5.



Figure 5. Dissolved oxygen in center of the lake.

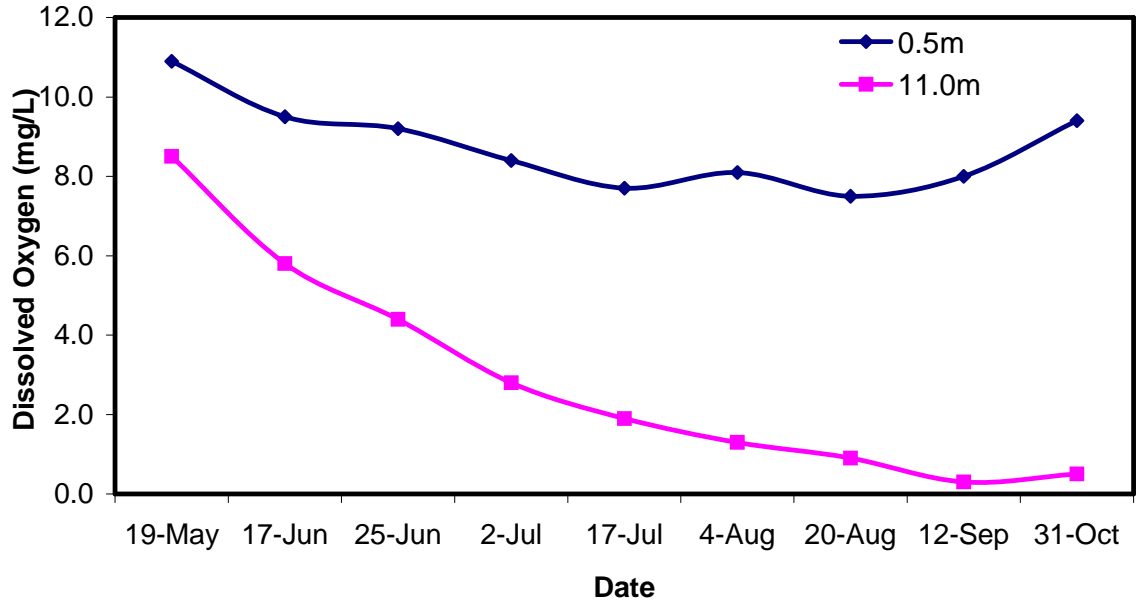


Figure 6. Temperature and dissolved oxygen with depth.

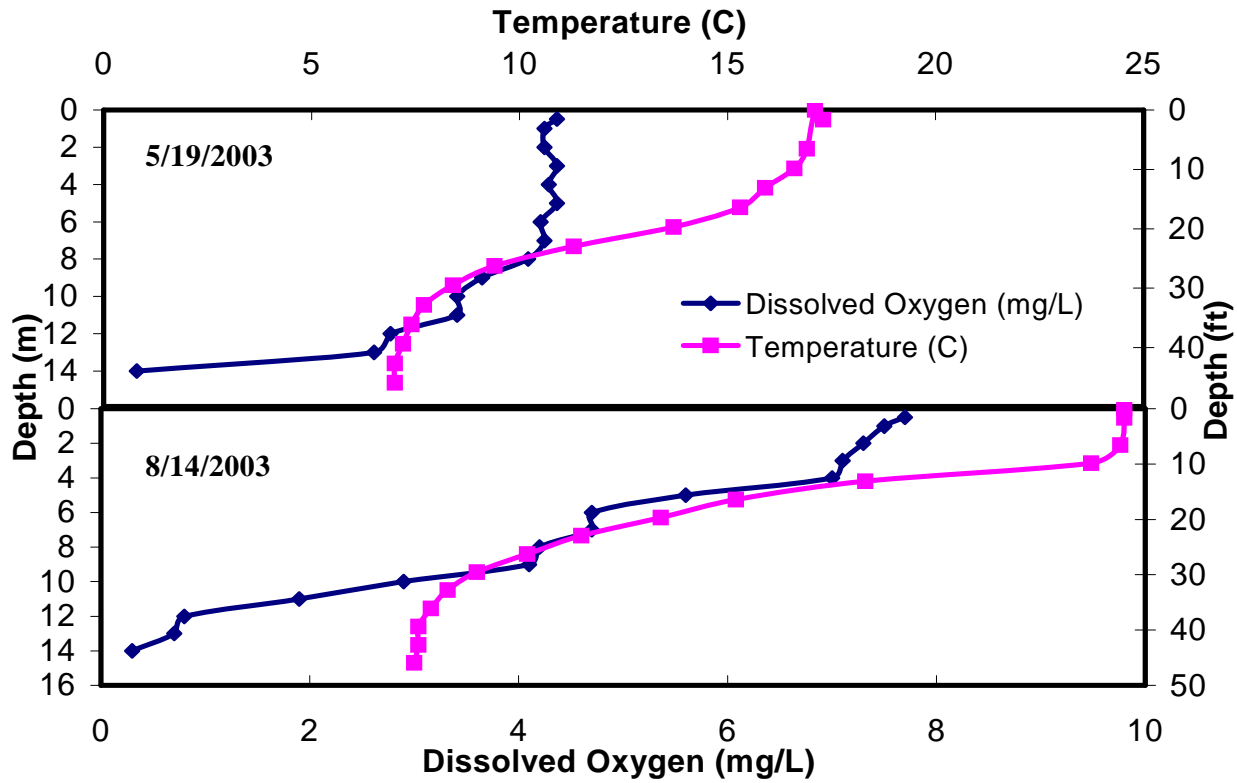
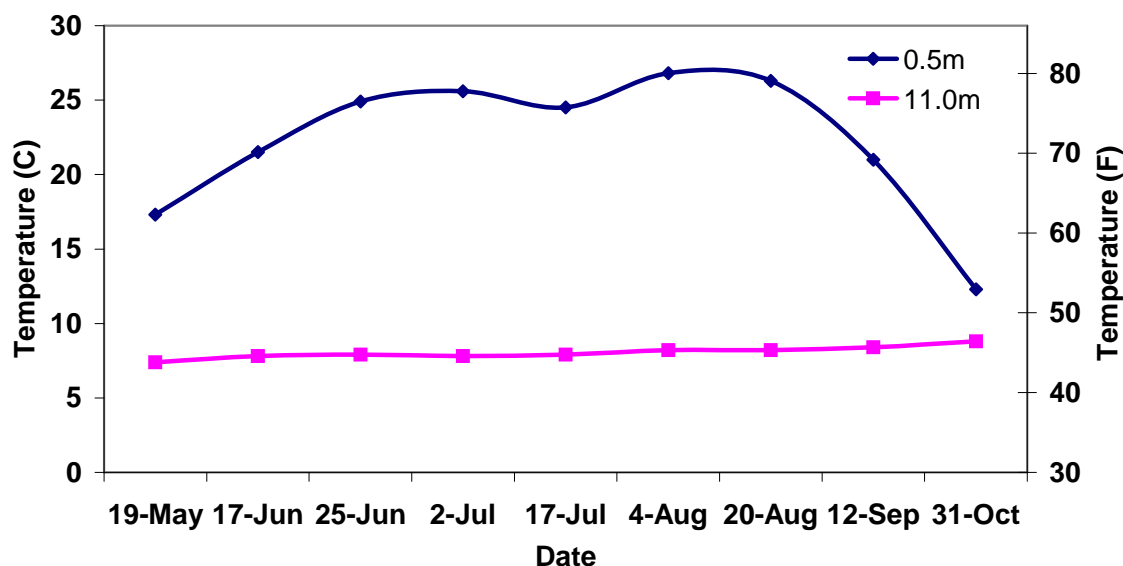


Figure 7. Water temperature in the center of the lake.



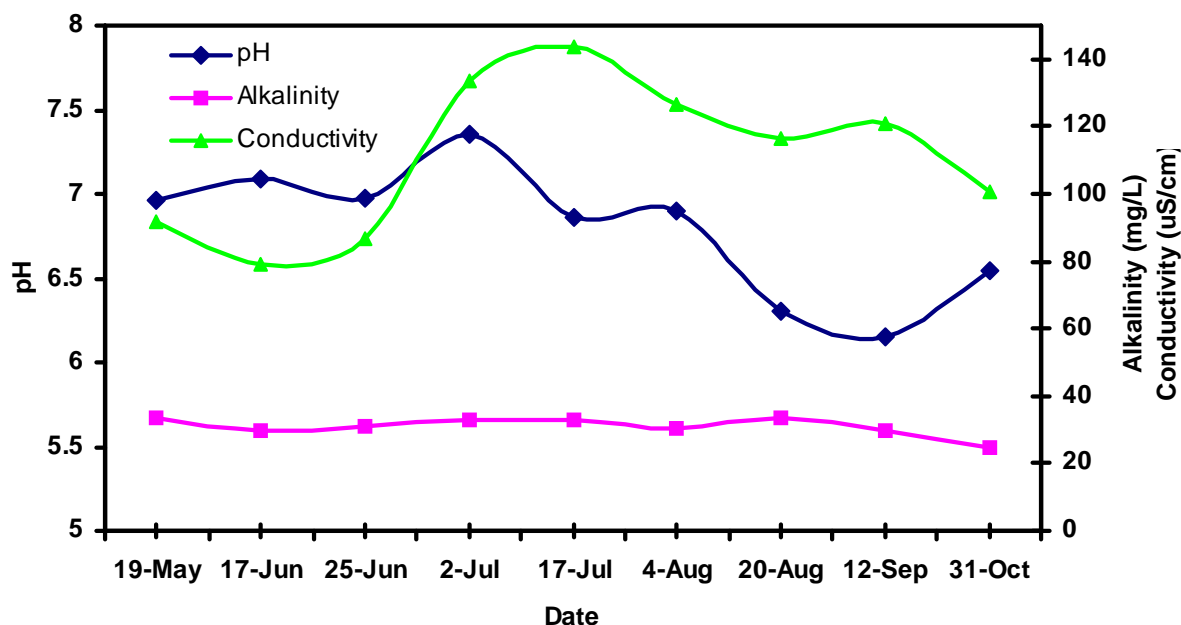
Results and Discussion

The pretreatment visual inspection of the lake for aquatic vegetation was performed on June 17, 2003. Aquatic vegetation present during the survey performed on July 30-31, 2002 (Figure 1) was generally present at this time with the exception of some dense patches of Eurasian milfoil in the center shoal area (see treatment sites in Figure 2) and a lack of water marigold that is not usually visible until later in the growing season. Some cabomba was present in the boat launch cove where granular fluridone was applied in 2002. Close inspection of these plants indicated that most were fragments that had recently floated in and taken root.

The June 24th treatment of the Eurasian milfoil in the center shoal areas with Navigate resulted in slow but steady decline of the milfoil. After two weeks the milfoil looked healthy except for some slight elongation and distortion of the growing tips. After four weeks the milfoil was still visible from the surface but the foliage had begun to thin and turn brown. Some slight distortion of the stems was also apparent. Aquatic plant surveys on August 15-17 found little milfoil in treated areas. 2,4-D concentrations in the treatment site (Figure 4) peaked three days after treatment (DAT) at 82 ppb in water near the bottom. Samples obtained from the surface in the treatment+100' and the south cove three DAT contained 2.4 and 3.0 ppb 2,4D respectively. By July 2 (9 DAT) 2,4-D concentrations fell to near 5 ppb in the treatment site and to between 2.8 and 6.4 ppb elsewhere except in the bottom water near the boat launch where no 2,4-D was detected. This indicates rapid dilution of the herbicide away from the treatment site and into the entire lake. Because the USEPA lists the maximum allowable levels of 2,4-D for irrigation water to be 100 ppb and drinking water to be 60 ppb, these low levels are not considered a concern. Irrigation from the lake was not impacted by the treatment. Levels of 2,4-D, in the treatment site were, never found near the 1000 ppb concentration suggested by Green and Westerdahl (1990) to afford reliable Eurasian milfoil control. Control of Eurasian milfoil was very good, albeit somewhat slow, it ap-



Figure 8.. Alkalinity, pH and conductivity.



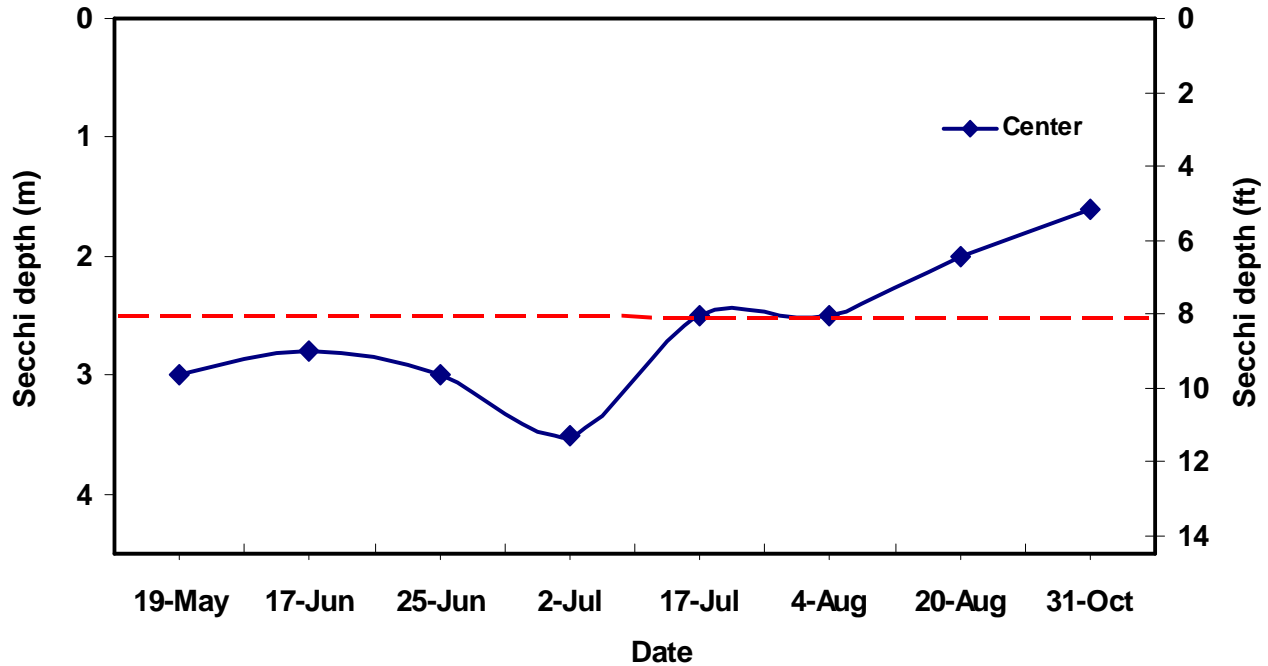
pears the 2,4-D concentration of 1000 ppb thought necessary for good control is considerably higher than needed in Lake Quonnipaug. Mechanical removal of vegetation in the swim area (Figure 16, appendix) did not find any Eurasian milfoil or cabomba. The primary plant causing the problem with swimmers was tall growing large leaf pondweed (*Potamogeton amplifolius*) and to a lesser extent some Robbins pondweed.

The aquatic plant survey performed from August 13-15 (Figure 11) found sparse to occasionally dense patches of Eurasian milfoil in areas not treated earlier. Densest patches occurred along the southeast shore. Sporadic variable milfoil (*Myriophyllum heterophyllum*) was found primarily in the north and south coves. Robbins pondweed blanketed virtually all areas of the lake less than 3 meters deep where other vegetation was not present. Large leaf pondweed formed very large dense patches in many parts of the lake with the largest areas just outside the boat launch cove and in and around the central shoals. Coontail (*Ceratophyllum sp.*), elodea (*Elodea canadensis*) and lily pads (*Nymphaea sp.*, *Nuphur sp.*) were also common along the shoreline particularly in the south cove. Cabomba continued to repopulate the boat launch cove were treatment had nearly eliminated it in 2001. Cabomba was also dense in the small coves on the southeast side of the lake.

The area of the south cove that had been treated with glyphosate and hydroraked in the fall of 2002 had many new floating islands and a dense stand of cabomba. Many of the islands were more than 10 meters in length and width (Figures 12 and 14, appendix). Disruption of the root system appeared to be the reason for the islands. In addition, the hydroraked area contained dense stand of cabomba that was in flower (Figure 13 and 15, appendix). The explosive growth of the cabomba in this area is a major concern because plant fragments and seeds can move into the remainder of the lake on the southerly winds common during the summer. Controlling this cabomba is suggested.



Figure 9. Transparency of lake water.



Unlike previous years, water marigold was abundant in the lake in 2003. Large dense patches (Figure 17) were found between the central shoals and the western shore and at other locations shown in Figure 11. The GPS locations of these patches are labeled 1, 2 and 3 on Figure 11. The water marigold in site 3 appeared to be in the location that had Eurasian milfoil controlled the year before with Navigate. This suggests the possibility that water marigold is less sensitive to 2,4-D than Eurasian milfoil and that it might reestablish itself if the milfoil is controlled.

Low levels of dissolved oxygen can be associated with the decay of plant tissue when controlling unwanted vegetation with an herbicide. Tests revealed all surface water samples contained abundant dissolved oxygen throughout the sampling period (Figure 5). In the water near the bottom in the center of the lake, dissolved oxygen fell below a desirable level of greater than 3.0 mg/l from July 17 through and October 31. Low levels of dissolved oxygen at the bottom of lakes are common in the summer and fall and the dieback of milfoil was not likely the cause.

Surface water temperatures in the center of the lake warmed from near 17° C in mid-May to a maximum of 27° C in early August (Figure 7). Bottom temperatures remained nearly constant at around 8° C. In the center of the lake, where a complete temperature profile could be determined, the thermocline (demarcation between warm surface and cool subsurface water) was at a depth of near 8 meters on May 19 and rose to near 4 meters on August 14 (Figure 6). Water pH (Figure 8) ranged between 6.0 and 7.5 with the higher levels early in the sampling period. Alkalinity (Figure 8) ranged from 27 and 32 mg/l CaCO₃ near the surface and 22 to 39 mg/l CaCO₃ near the bottom. Transparency (Figure 9) was between 1.5 to 3.5 meters with the clearest water found early in the season.

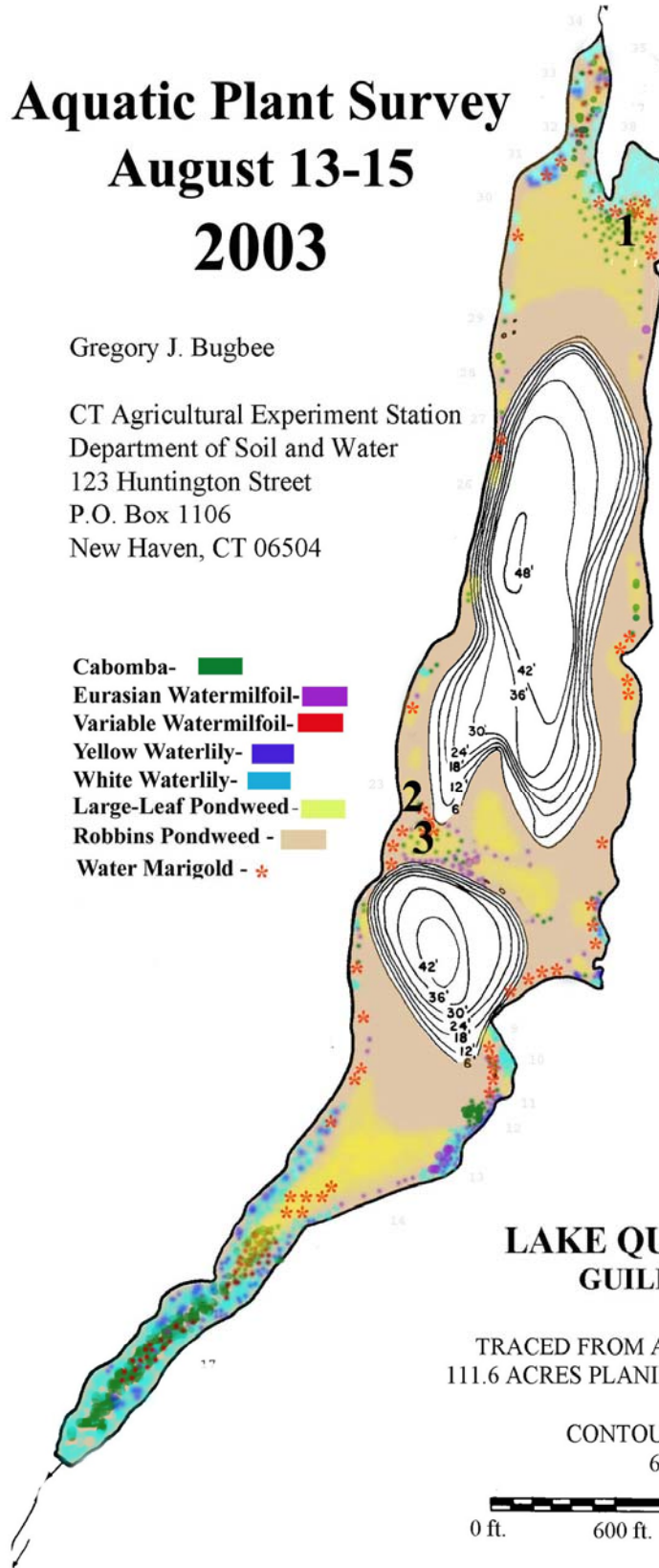


Aquatic Plant Survey August 13-15 2003

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- Cabomba- ■
- Eurasian Watermilfoil- ■
- Variable Watermilfoil- ■
- Yellow Waterlily- ■
- White Waterlily- ■
- Large-Leaf Pondweed - ■
- Robbins Pondweed - ■
- Water Marigold - * *



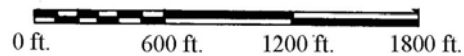
GPS Locations of Dense Patches of Water Marigold

Site	Latitude	Longitude	Feet (+/-)
1	42 23 46.6	72 41 45.0	20
2	42 23 19.5	72 41 57.8	17
3	42 23 18.2	72 41 55.6	19

LAKE QUONNIPAUG GUILFORD, CT

TRACED FROM AERIAL SURVEY MAP
111.6 ACRES PLANIMETER MEASUREMENT

CONTOUR INTERVAL
6 FEET



Total phosphorus (P) concentrations in the lake water are considered a key indicator of the state of eutrophication. Frink and Norvell (1983) suggest lakes with P levels below 15 ppb can be considered oligotrophic, lakes with P between 15 and 30 ppb are mesotrophic and lakes with P over 30 ppb are eutrophic. P concentrations in 2003 peaked at 41 ppb in the surface water on June 17 (Figure 9) and declined between 8 and 20 ppb thereafter the lowest surface water P occurred on September 12. Water at the 9 meter depth followed a similar trend. These phosphorus levels are similar to concentrations found in previous studies (Canavan and Siver, 1995, Frink and Norvell, 1983).

Conclusions:

Eurasian milfoil continues to be effectively controlled with spot applications of granular 2,4-D. Untreated areas of milfoil and possibly areas within treatment sites that were not totally controlled may dictate the need for occasional follow-up treatments. Use of lake water for irrigation, after a localized treatment, was not a problem as no levels of 2,4-D exceeded the irrigation standard of 100 ppb. The population of water marigold in the lake was much greater in 2003 than in previous years. One extremely dense patch appeared to be in or near a large area of Eurasian milfoil controlled the previous year with granular 2,4-D. The combination of hydroraking and glyphosate herbicide used in the south cove in fall 2002 apparently caused a rapid growth of cabomba in the cove. This cabomba was extremely dense, flowered and limited boating access through the cove. The boat launch cove area treated with Sonar SRP in 2001 exhibited significant regrowth of cabomba. Much of the regrowth was caused by the rooting of plant fragments that floated in from other parts of the lake. A significant population of water marigold was found in many areas of the lake outside the 2001 Sonar SRP treatment site. Water chemistry data for 2002 found the lake to be in the oligo/mesotrophic state of eutrophication, a condition similar to previous years.

Suggestions for 2004:

- 1) Continue monitor the boat launch cove area spot treated in 2001 with Sonar SRP. No herbicide treatment in 2004 but treatment in 2005 may be necessary.
- 2) Spot treat Eurasian milfoil in beach area and other areas as needed with Navigate. Limit total Navigate treatment to less than three acres per year. Test water for 2,4-D to monitor herbicide movement and meet irrigation restriction requirements.
- 3) Remove floating islands in south cove April by hydroraking. Arrange for Aquatic Control Technologies to do the work and Town of Guilford personnel to remove the debris.
- 4) Arrange for treatment of south cove with either granular fluridone or Fluridone SRP. This requires considerable discussions with CTDEP officials and their consent.
- 5) File necessary permit applications with CTDEP early 2004.
- 6) Survey and map the lake for aquatic vegetation before and after treatments.
- 7) Test water for pH, alkalinity, temperature, dissolved oxygen, transparency and conductivity.



Budget 2004

(This Funding Was Transferred To CAES in 2003)

Connecticut Agricultural Experiment Station

Item	Cost (\$)
Contract hydroraking/weed harvesting south arm of lake (10-15 hrs)	4000*
Navigate 1000 pounds.....	2000
Sonar or Avast PR 120 pounds.....	800*
Water testing (2,4-D, fluridone, pH, alkalinity etc.).....	1300
Aquatic plant surveys and map preparation	1300
Permit preparation, meetings, final report preparation	1400
<hr/>	
Total.....	9500

* If CTDEP permits cannot be procured for the Sonar/Avast treatments or hydroraking/weed harvesting is not needed, these expenditures will be either refunded to the town, used for other agreed upon work or credited to work done in 2005.



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APPENDIX



Additional Figures



Figure 12. South cove with numerous floating islands.



Figure 13. Dense cabomba in south cove where herbicide and hydroraking was performed in 2002.

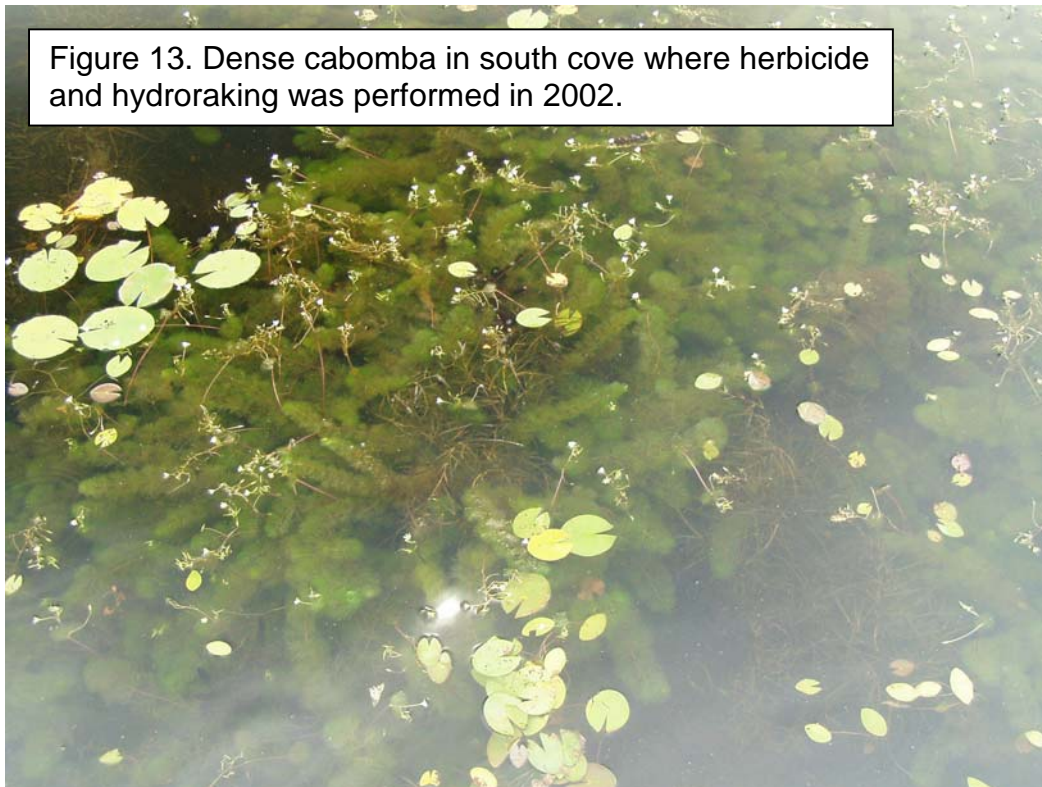


Figure 14. Extensive floating island along side of south cove.



Figure 15. Dense cabomba in south cove where the glyphosate application and hydroraking were done the previous year.

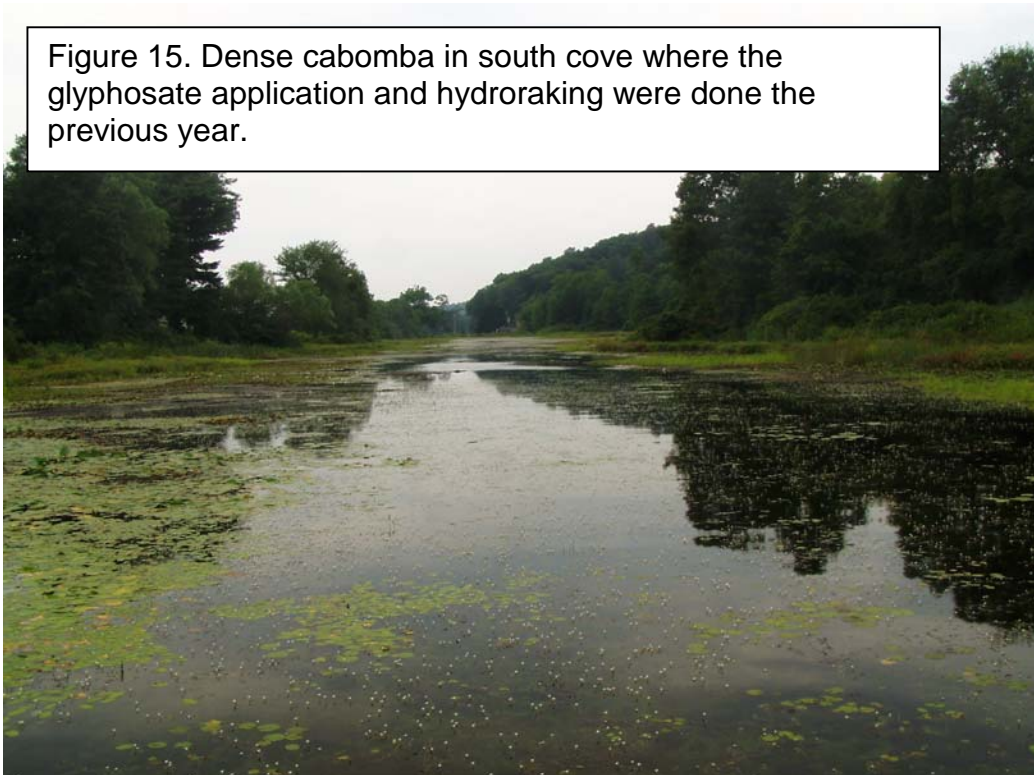


Figure 16. Greg Bugbee testing an electric weed cutter to remove tall growing plants in the swim area off town beach.

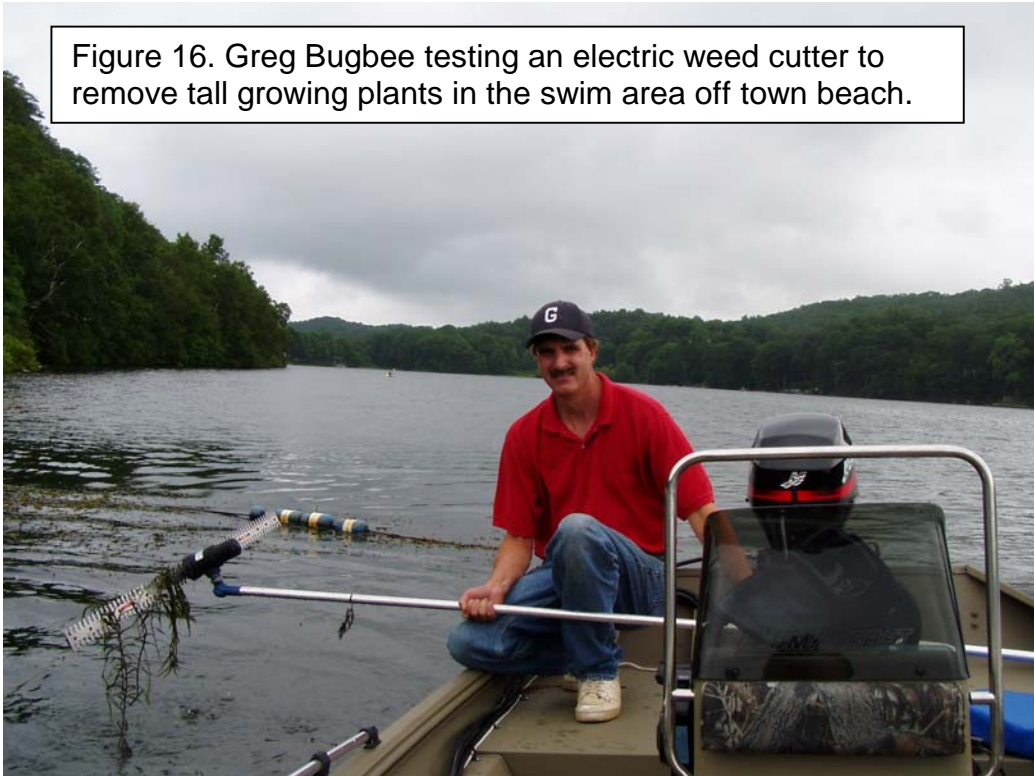


Figure 17. Luxuriant water marigold in northeast section of lake.



Observers Plant Survey Notes

Key:

BW = Bladderwort

Ca = Cabomba

CT = Coontail

E = Elodea

EM = Eurasian milfoil

LLP = Large leaf pondweed

RP = Robbins pondweed

V = Tapegrass (*Valensaria sp.*)

VM = Variable Milfoil

WS = Water shield

WWL = White water lily

YWL = Yellow water lily



Aquatic Plant Survey

GPS Coordinates

Rake

Visual

Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'
41	0	0	72	42	7	16															X	X			X			X		
41	23	0	72	41	0	0													X											
41	23	1	72	42	6	16													X		X	X						X		
41	23	2	72	42	4	0														X	X	X								
41	23	3	72	42	3	18													X	X	X		X		X					
41	23	3	72	42	4	16													X	X	X									
41	23	4	72	42	4	17													X	X						X		X		
41	23	4	72	42	3	16													X	X	X									
41	23	4	72	42	2	18													X	X	X									
41	23	4	72	42	1	16													X	X	X		X	X						
41	23	5	72	42	1	20													X	X	X									
41	23	5	72	42	2	16													X											
41	23	5	72	42	3	17													X	X										
41	23	5	72	41	54	22															X	X	X	X					X	
41	23	6	72	42	2	0													X	X										
41	23	6	72	42	1	16													X	X										
41	23	6	72	42	0	21													X	X	X									X
41	23	6	72	42	3	16	X		X	X	X			X					X				X			X				
41	23	6	72	42	2	16	X												X			X								
41	23	6	72	42	1	17	X												X	X										
41	23	6	72	42	0	17	X		X										X	X	X									X
41	23	6	72	41	54	18															X	X	X	X					X	
41	23	7	72	42	2	16	X												X	X	X	X								
41	23	7	72	41	54	19	X		X												X	X								
41	23	7	72	41	53	19			X												X	X	X	X		X	X			X
41	23	7	72	41	55	16	X												X	X	X									
41	23	7	72	41	56	18		X		X				X				X		X	X	X								X
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41	23	7	72	41	58	17								X							X		X							
41	23	7	72	41	59	16	X	X													X	X	X							
41	23	7	72	42	0	17	X												X	X									X	
41	23	7	72	42	1	18	X												X	X										
41	23	7	72	42	2	16	X												X	X	X									
41	23	8	72	42	2	16	X											X	X	X	X	X								X
41	23	8	72	42	1	16	X												X	X										



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual														
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'	
41	23	8	72	42	0	16	X													X											
41	23	8	72	41	59	16	X														X										
41	23	8	72	41	58	17	X	X													X										
41	23	8	72	41	57	16	X														X										
41	23	8	72	41	56	16	X	X													X										
41	23	8	72	41	55	16	X														X										
41	23	8	72	41	54	17	X		X												X	X	X	X							
41	23	8	72	41	53	16				X												X	X	X	X		X				
41	23	9	72	41	54	15	X	X													X	X	X	X							
41	23	9	72	41	55	15	X																								
41	23	9	72	41	56	15	X																								
41	23	9	72	41	57	15																									
41	23	9	72	41	58	14																									
41	23	9	72	41	59	15	X																								
41	23	9	72	42	0	14	X																								
41	23	9	72	42	1	16	X														X	X									
41	23	9	72	42	2	16	X												X	X	X										X
41	23	10	72	42	2	16	X													X	X	X									X
41	23	10	72	42	1	15	X																								
41	23	10	72	42	0	16																									
41	23	10	72	41	59	15																									
41	23	10	72	41	58	14																									
41	23	10	72	41	57	14																									
41	23	10	72	41	56	14																									
41	23	10	72	41	55	15																									
41	23	10	72	41	54	14	X											X	X	X											X
41	23	11	72	41	46	22														X			X								X
41	23	11	72	41	47	22														X	X	X	X							X	X
41	23	11	72	41	52	16	X													X											
41	23	11	72	41	53	18	X																								
41	23	11	72	41	54	18																									
41	23	11	72	41	55	18																									
41	23	11	72	41	56	18																									
41	23	11	72	41	57	20																									
41	23	11	72	41	58	20																									



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual														
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'	
41	23	11	72	41	59	20																									
41	23	11	72	42	0	21																									
41	23	11	72	42	1	20																	X								
41	23	11	72	42	2	21	X													X		X									
41	23	12	72	42	2	19	X												X			X									
41	23	12	72	42	1	17																									
41	23	12	72	42	0	16																									
41	23	12	72	41	59	16																									
41	23	12	72	41	58	16																									
41	23	12	72	41	57	16																									
41	23	12	72	41	56	17																									
41	23	12	72	41	55	16																									
41	23	12	72	41	54	18																									
41	23	12	72	41	53	15																									
41	23	12	72	41	52	16	X																								
41	23	12	72	41	51	16	X														X										
41	23	12	72	41	50	16	X												X	X	X										
41	23	12	72	41	49	19	X												X	X											
41	23	12	72	41	48	18	X												X	X											
41	23	12	72	41	47	16	X												X	X	X										X
41	23	12	72	41	46	18	X												X	X		X	X								
41	23	13	72	41	55	16																									
41	23	13	72	41	56	17																									
41	23	13	72	41	57	16																									
41	23	13	72	41	58	16																									
41	23	13	72	41	59	18																									
41	23	13	72	42	0	16																									
41	23	13	72	42	1	17																									
41	23	13	72	42	2	18	X												X		X										
41	23	13	72	41	46	16	X			X									X			X									X
41	23	13	72	41	47	16	X												X												
41	23	13	72	41	48	16	X												X												
41	23	13	72	41	49	15	X												X												
41	23	13	72	41	50	15	X																								
41	23	13	72	41	51	15	X																								



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual															
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'		
41	23	13	72	41	52	15																										
41	23	13	72	41	53	15																										
41	23	13	72	41	54	16																										
41	23	14	72	42	1	17	X												X		X		X									
41	23	14	72	42	0	16																										
41	23	14	72	42	0	16																										
41	23	14	72	41	59	17																										
41	23	14	72	41	58	16																										
41	23	14	72	41	57	16																										
41	23	14	72	41	56	16																										
41	23	14	72	41	55	16																										
41	23	14	72	41	54	17																										
41	23	14	72	41	53	17																										
41	23	14	72	41	52	17																										
41	23	14	72	41	51	16	X																									
41	23	14	72	41	50	17	X																									
41	23	14	72	41	49	16	X																									
41	23	14	72	41	48	17	X												X													
41	23	14	72	41	47	16	X												X	X	X	X									X	
41	23	15	72	41	47	15	X												X	X	X										X	
41	23	15	72	41	48	16	X																									
41	23	15	72	41	49	16	X																									
41	23	15	72	41	50	14	X																									
41	23	15	72	41	51	14	X																									
41	23	15	72	41	52	15	X																									
41	23	15	72	41	53	16																										
41	23	15	72	41	54	16																										
41	23	15	72	41	55	16																										
41	23	15	72	41	56	16																										
41	23	15	72	41	57	16																										
41	23	15	72	41	58	16																										
41	23	15	72	41	59	16																										
41	23	15	72	42	0	16																										
41	23	15	72	42	1	16	X												X													
41	23	16	72	42	0	18	X												X		X		X									



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual																
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'			
41	23	16	72	41	59	18																											
41	23	16	72	41	58	18																											
41	23	16	72	41	57	16																											
41	23	16	72	41	56	16																											
41	23	16	72	41	55	16																											
41	23	16	72	41	54	15																											
41	23	16	72	41	53	14																											
41	23	16	72	41	52	14		X		X										X		X											
41	23	16	72	41	51	14		X		X										X													
41	23	16	72	41	50	15	X																										
41	23	16	72	41	49	14	X																										
41	23	16	72	41	48	16	X														X												
41	23	16	72	41	47	17	X	X												X	X												
41	23	16	72	41	46	17	X	X										X	X	X	X	X									X		
41	23	16	72	41	60	16	X												X		X		X								X		
41	23	17	72	41	52	17	X												X	X		X					X						
41	23	17	72	41	53	13	X			X											X												
41	23	17	72	41	54	13																											
41	23	17	72	41	55	13																											
41	23	17	72	41	56	16																											
41	23	17	72	41	57	13																											
41	23	17	72	41	58	16																											
41	23	17	72	41	59	18																	X										
41	23	17	72	41	60	17	X													X													
41	23	17	72	41	46	18					X	X								X	X	X										X	
41	23	17	72	41	47	17	X	X													X												
41	23	17	72	41	48	17	X																										
41	23	17	72	41	49	20				X																							
41	23	17	72	41	50	17																X											
41	23	17	72	41	51	17		X													X		X										
41	23	17	72	42	0	25	X													X		X											
41	23	18	72	41	59	17	X																X										
41	23	18	72	41	58	16																											
41	23	18	72	41	57	16																											
41	23	18	72	41	56	16	X														X												



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual													
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'
41	23	18	72	41	55	16	X													X										
41	23	18	72	41	54	17	X	X											X	X		X				X				X
41	23	18	72	41	54	15																								
41	23	18	72	41	53	15	X													X						X				
41	23	18	72	41	52	15	X	X													X		X							X
41	23	18	72	41	51	15	X														X									
41	23	18	72	41	50	16																								
41	23	18	72	41	49	16																								
41	23	18	72	41	48	16	X																							
41	23	18	72	41	47	16	X														X									
41	23	18	72	41	46	18					X	X											X	X						
41	23	18	72	41	60	24														X		X								X
41	23	19	72	41	45	21	X													X		X	X							X
41	23	19	72	41	46	20	X																							
41	23	19	72	41	47	18	X																							
41	23	19	72	41	48	16																								
41	23	19	72	41	49	16																								
41	23	19	72	41	50	17																								
41	23	19	72	41	51	17	X			X											X		X							
41	23	19	72	41	52	17	X			X											X		X							
41	23	19	72	41	53	16	X																							
41	23	19	72	41	54	16	X														X									
41	23	19	72	41	55	16	X		X												X	X	X							
41	23	19	72	41	56	16		X													X	X								
41	23	19	72	41	57	16	X	X	X	X											X	X	X							
41	23	19	72	41	58	16	X	X							X					X	X	X				X				X
41	23	19	72	41	59	18	X	X							X				X	X	X	X								X
41	23	20	72	41	49	16																								
41	23	20	72	41	48	18																								
41	23	20	72	41	47	20																								
41	23	20	72	41	46	17																								
41	23	20	72	41	45	22	X														X									
41	23	20	72	41	59	30	X	X													X	X	X							X
41	23	20	72	41	58	15	X														X	X								
41	23	20	72	41	57	16	X	X													X	X								



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual														
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'	
41	23	20	72	41	56	16	X																								
41	23	20	72	41	55	16	X											X													
41	23	20	72	41	54	16	X																								
41	23	20	72	41	53	14	X															X									
41	23	20	72	41	52	14	X																X								
41	23	20	72	41	50	14																									
41	23	21	72	41	60	30	X												X		X					X			X	X	
41	23	21	72	41	59	20	X	X											X	X	X										
41	23	21	72	41	58	21	X	X																							
41	23	21	72	41	57	21	X																								
41	23	21	72	41	56	21	X															X									
41	23	21	72	41	55	22		X													X										
41	23	22	72	41	60	34	X											X	X	X	X	X									X
41	23	22	72	41	59	19	X												X	X											
41	23	22	72	41	58	19	X																								
41	23	22	72	41	57	21																									
41	23	23	72	41	59	18	X	X			X							X	X	X	X	X	X								X
41	23	23	72	41	58	19	X																								
41	23	23	72	41	57	19																									
41	23	24	72	41	58	17	X											X	X		X										X
41	23	24	72	41	58	17	X																								
41	23	24	72	41	57	19	X																								
41	23	24	72	41	56	19																									
41	23	25	72	41	58	17	X											X	X		X										
41	23	25	72	41	57	17	X																								
41	23	25	72	41	26	17																									
41	23	27	72	41	44	0																									
41	23	27	72	41	45	0																									
41	23	27	72	41	46	0																									
41	23	27	72	41	47	0																									
41	23	27	72	41	48	0																									
41	23	27	72	41	49	0																									
41	23	28	72	41	56	0																									
41	23	28	72	41	55	0																									
41	23	28	72	41	54	0																									



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual														
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'	
41	23	28	72	41	53	0																									
41	23	28	72	41	52	0																									
41	23	28	72	41	51	0																									
41	23	28	72	41	50	0																									
41	23	28	72	41	49	0																									
41	23	28	72	41	48	0																									
41	23	28	72	41	47	0																									
41	23	28	72	41	46	17																									
41	23	28	72	41	45	19	X																								
41	23	28	72	41	44	18	X												X	X											
41	23	29	72	41	44	19																									
41	23	29	72	41	45	0																									
41	23	29	72	41	46	0																									
41	23	29	72	41	47	0																									
41	23	29	72	41	48	0																									
41	23	29	72	41	49	0																									
41	23	29	72	41	50	0																									
41	23	29	72	41	51	0																									
41	23	29	72	41	52	0																									
41	23	29	72	41	53	0																									
41	23	29	72	41	54	0																									
41	23	29	72	41	55	0																									
41	23	29	72	41	56	0																									
41	23	29	72	41	43	0	X												X												
41	23	30	72	41	56	0																									
41	23	30	72	41	55	0	X																								
41	23	30	72	41	54	0	X							X																	
41	23	30	72	41	53	0																									
41	23	30	72	41	52	0																									
41	23	30	72	41	51	0																									
41	23	30	72	41	50	0																									
41	23	30	72	41	49	0																									
41	23	30	72	41	48	0																									
41	23	30	72	41	47	0																									
41	23	30	72	41	46	0																									



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual														
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'	
41	23	30	72	41	45	0																									
41	23	30	72	41	44	19																									
41	23	30	72	41	43	17	X																								
41	23	30	72	41	43	0	X		X																						
41	23	31	72	41	44	16	X																								
41	23	31	72	41	45	0																									
41	23	31	72	41	46	0																									
41	23	31	72	41	47	0																									
41	23	31	72	41	48	0																									
41	23	31	72	41	49	0																									
41	23	31	72	41	50	0																									
41	23	31	72	41	51	0																									
41	23	31	72	41	52	0																									
41	23	31	72	41	53	16																									
41	23	31	72	41	54	16																									
41	23	31	72	41	55	0																									
41	23	31	72	41	56	0																									
41	23	31	72	41	43	0	X																								
41	23	31	72	41	43	0	X		X									X													
41	23	32	72	41	56	0																									
41	23	32	72	41	55	0																									
41	23	32	72	41	54	0																									
41	23	32	72	41	53	0																									
41	23	32	72	41	52	0																									
41	23	32	72	41	51	0																									
41	23	32	72	41	50	0																									
41	23	32	72	41	49	0																									
41	23	32	72	41	48	0																									
41	23	32	72	41	47	0																									
41	23	32	72	41	46	0																									
41	23	32	72	41	45	0																									
41	23	32	72	41	43	0	X												X	X	X	X								X	
41	23	32	72	41	44	0	X																								
41	23	33	72	41	43	0																									
41	23	33	72	41	44	20	X												X												
41	23	33	72	41	45	0																									
41	23	33	72	41	46	0																									
41	23	33	72	41	47	0																									



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual														
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'	
41	23	36	72	41	53	16	X													X			X								X
41	23	36	72	41	52	17																									
41	23	36	72	41	44	18	X																								
41	23	37	72	41	45	16																									
41	23	37	72	41	53	16	X													X											X
41	23	37	72	41	52	16																									
41	23	37	72	41	44	17				X												X									X
41	23	37	72	41	44	19																									
41	23	38	72	41	45	16																									
41	23	38	72	41	53	16	X													X	X										X
41	23	38	72	41	52	16																									
41	23	38	72	41	44	18																									
41	23	38	72	41	44	27																									
41	23	39	72	41	45	16																									
41	23	39	72	41	53	18	X													X	X										X
41	23	39	72	41	52	16																									
41	23	39	72	41	44	18																	X								
41	23	40	72	41	45	16																									
41	23	40	72	41	53	17	X													X		X									
41	23	40	72	41	53	18	X													X		X	X								
41	23	40	72	41	52	18																									
41	23	40	72	41	44	18	X													X		X									
41	23	40	72	41	44	18	X													X		X									
41	23	41	72	41	53	18	X											X	X	X		X									X
41	23	41	72	41	52	16																									
41	23	41	72	41	44	18		X												X	X										
41	23	41	72	41	45	17																									
41	23	42	72	41	52	19	X													X		X	X								
41	23	42	72	41	52	19	X		X													X									
41	23	42	72	41	51	19																									
41	23	42	72	41	44	27	X													X		X	X								
41	23	42	72	41	44	27	X													X		X	X								
41	23	42	72	41	45	19																									
41	23	42	72	41	53	19	X													X		X	X								
41	23	42	72	41	52	20	X																								



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual														
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'	
41	23	42	72	41	51	20	X															X									
41	23	42	72	41	50	18	X																								
41	23	42	72	41	49	16																									
41	23	42	72	41	44	18	X												X			X									
41	23	42	72	41	45	17																									
41	23	43	72	41	51	20	X							X					X												
41	23	43	72	41	50	19	X																								
41	23	43	72	41	49	20	X																								
41	23	43	72	41	48	20	X																								
41	23	43	72	41	47	20	X																								
41	23	43	72	41	44	24	X	X											X	X	X	X								X	
41	23	43	72	41	44	19	X												X	X	X										
41	23	43	72	41	45	16	X														X										
41	23	43	72	41	46	16	X															X									
41	23	43	72	41	52	19	X							X								X									
41	23	43	72	41	44	22		X										X	X	X		X								X	
41	23	43	72	41	45	17	X																								
41	23	43	72	41	45	17	X												X												
41	23	44	72	41	52	25	X												X												
41	23	44	72	41	51	21	X												X		X										
41	23	44	72	41	50	21	X												X	X											
41	23	44	72	41	49	21	X												X												
41	23	44	72	41	48	21	X												X	X											
41	23	44	72	41	47	22	X												X	X											
41	23	44	72	41	46	21	X	X											X	X											
41	23	44	72	41	45	16	X	X											X	X											
41	23	44	72	41	43	19	X											X	X	X										X	
41	23	45	72	41	44	16	X	X											X	X	X		X								
41	23	45	72	41	43	16	X												X	X	X	X									
41	23	45	72	41	45	16	X	X											X	X											
41	23	45	72	41	46	16	X												X	X											
41	23	45	72	41	47	17	X	X											X	X											
41	23	45	72	41	48	16	X	X											X	X											
41	23	45	72	41	49	16	X	X											X	X											
41	23	45	72	41	50	16	X	X											X	X											



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual														
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'	
41	23	45	72	41	51	18	X	X											X	X	X										
41	23	45	72	41	52	17	X												X	X	X										
41	23	46	72	41	50	17	X	X									X														
41	23	46	72	41	49	46	X												X	X	X										
41	23	46	72	41	48	16	X												X	X											
41	23	46	72	47	16	0	X	X											X	X	X	X									
41	23	46	72	41	46	16	X	X	X										X	X	X	X									
41	23	46	72	45	17	0	X	X											X	X											
41	23	46	72	41	44	18					X			X					X	X	X		X								
41	23	46	72	41	43	0					X												X								
41	23	46	72	41	44	19	X	X											X		X	X	X			X				X	
41	23	46	72	41	52	17	X												X	X											X
41	23	46	72	41	51	17	X												X	X											
41	23	47	72	41	44	19	X	X			X						X		X	X	X		X								X
41	23	47	72	41	45	18	X	X											X	X	X	X	X								X
41	23	47	72	41	46	18	X												X	X	X		X			X					
41	23	47	72	41	47	18	X	X											X	X	X										
41	23	47	72	41	48	16	X	X											X	X											
41	23	47	72	41	49	16	X	X											X	X											
41	23	47	72	41	50	17	X	X											X	X	X										
41	23	47	72	41	51	16	X	X											X	X											
41	23	47	72	41	52	19	X												X	X	X										
41	23	48	72	41	45	17			X	X	X						X			X	X	X			X	X			X		
41	23	48	72	41	46	17	X		X		X						X			X	X	X		X							
41	23	48	72	41	47	17	X	X	X		X						X		X	X	X	X	X		X						
41	23	48	72	41	48	18	X	X											X	X											
41	23	48	72	41	49	16	X	X											X	X											
41	23	48	72	41	50	16	X	X											X	X	X	X									
41	23	48	72	41	51	17	X												X	X	X	X	X								
41	23	48	72	41	52	18	X				X						X		X		X	X	X							X	
41	23	49	72	41	47	21	X				X						X		X	X	X	X	X							X	
41	23	49	72	41	51	21	X												X		X	X	X								
41	23	49	72	41	50	16	X	X									X		X	X	X	X	X		X						
41	23	49	72	41	49	17	X	X											X	X											
41	23	49	72	41	48	18	X	X											X	X	X										



Aquatic Plant Survey (continued)

GPS Coordinates							Rake										Visual														
Lat(h)	Lat(m)	Lat(s)	Long(h)	Long(m)	Long(s)	Accuracy(ft)	RP	LLP	CA	EM	WWL	YWL	BW	E	VM	WS	CT	V	RP'	LLP'	CA'	EM'	WWL'	YWL'	BW'	E'	VM'	WS'	CT'	V'	
41	23	50	72	41	47	19	X	X	X	X					X			X		X		X	X	X							
41	23	50	72	41	48	19	X		X				X	X				X		X	X	X			X	X					
41	23	50	72	41	49	19	X	X												X	X		X								
41	23	50	72	41	50	19	X													X	X		X	X							
41	23	50	72	41	51	18	X													X	X			X							
41	23	51	72	41	48	18														X											
41	23	51	72	41	47	23	X	X		X			X	X				X		X		X	X	X							
41	23	52	72	41	47	19	X		X	X										X		X			X	X	X		X		X
41	23	52	72	41	48	22	X	X						X						X		X	X	X		X					
41	23	53	72	41	47	25	X													X		X	X	X	X			X		X	
41	23	53	72	41	47	22	X		X											X		X	X					X			
41	23	54	72	41	47	19	X			X	X									X	X		X	X							X
41	23	54	72	41	47	22	X		X	X		X							X		X	X	X	X	X						
41	0	59	72	42	8	0														X		X	X	X					X	X	



Diagrams of Aquatic Plants

From:

Crow, G.E. and C. B. Hellquist. 2000. Aquatic and Wetland Plants of Northeastern North America. Volume One Pteridophytes, Gymnosperms, and Angiosperms: Dicotyledons. Madison, Wisconsin. The University of Wisconsin Press. 480 pp.

Crow, G.E. and C. B. Hellquist. 2000. Aquatic and Wetland Plants of Northeastern North America. Volume Two Angiosperms: Monocotyledons. Madison, Wisconsin. The University of Wisconsin Press. 400 pp.



Coontail

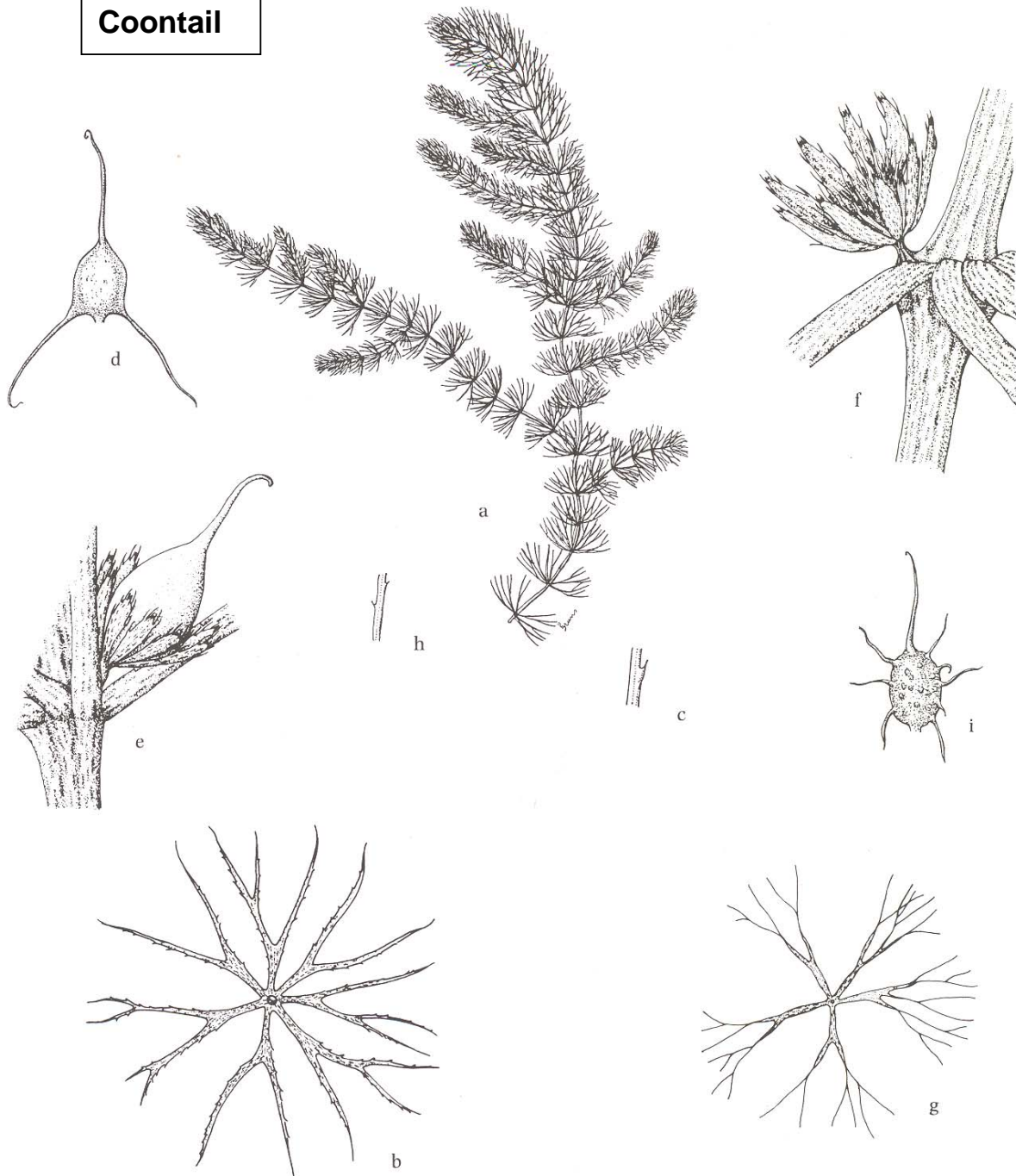
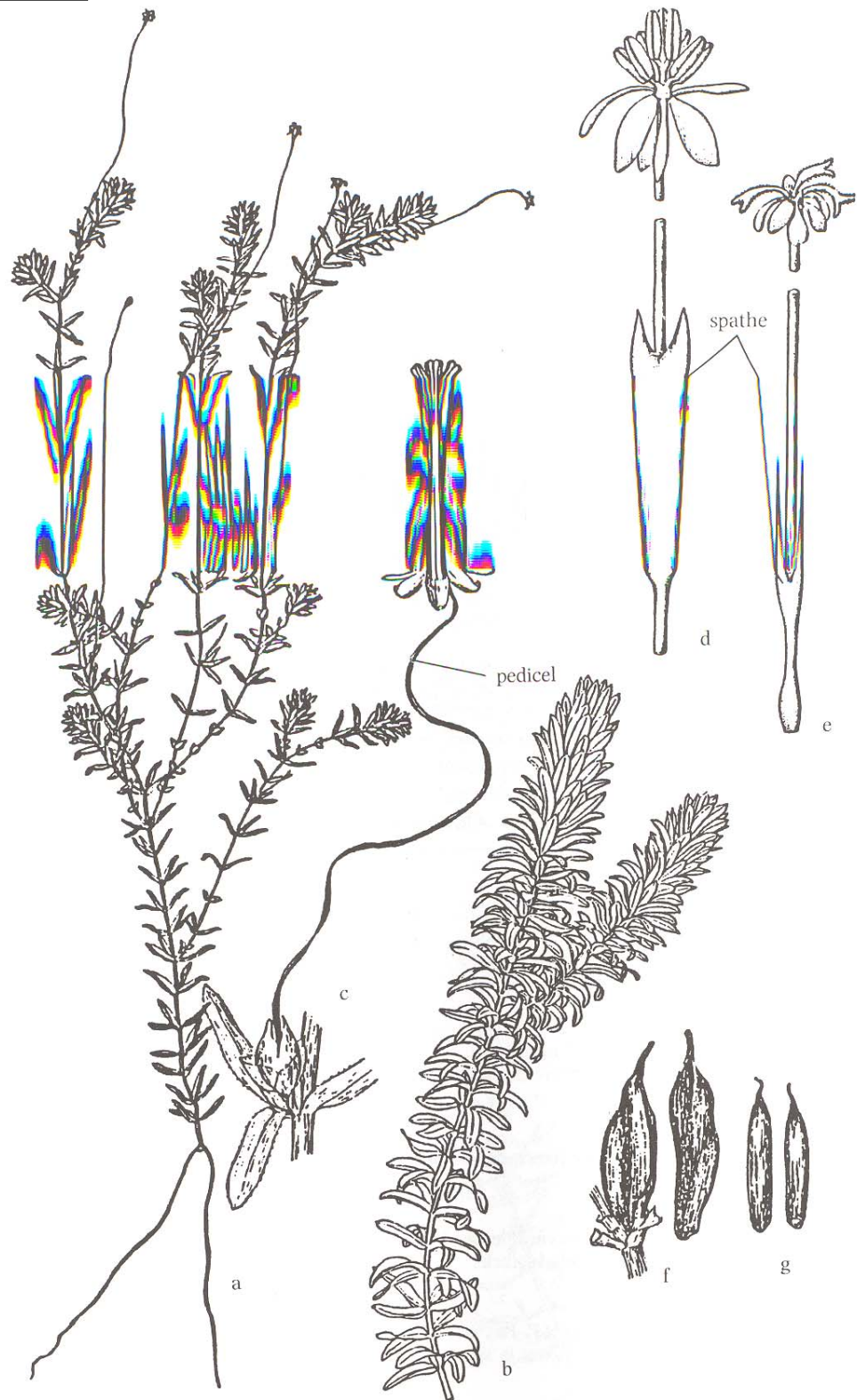


Fig. 53. *Ceratophyllum demersum*: a. habit (NHAES); b. leaf whorl (NYSM); c. leaf segment, showing broad-based marginal tooth (NHAES); d. fruit (NHAES).
Ceratophyllum echinatum: e. pistillate flower (NYSM); f. staminate flower (NYSM); g. leaf whorl (NYSM); h. leaf segment (NHAES); i. fruit (NHAES).

Elodea



Eurasian Milfoil

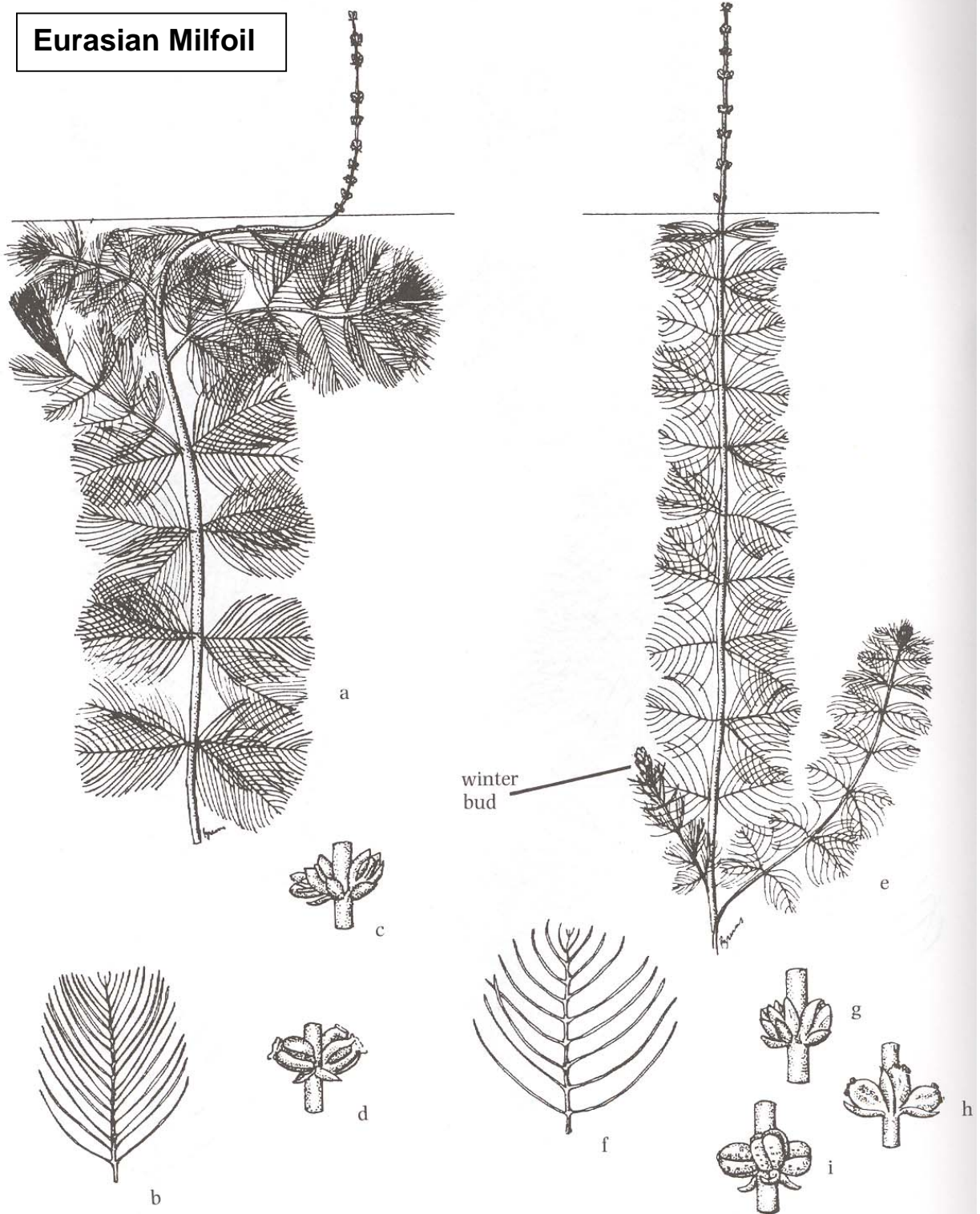


Fig. 160. *Myriophyllum spicatum*: a. habit, submersed form with emerged inflorescence; b. leaf; c. flowers; d. fruits (NHAES).
Myriophyllum sibiricum: e. habit, submersed form with emerged inflorescence; f. leaf; g. flowers; h. immature fruit; i. mature fruit (NHAES).

Curly Leaf Pondweed



Fig. 381. *Potamogeton crispus*: a, b, upper portion of plant; c, young inflorescence; d, inflorescence; e, leaf; f, section of stem with leaf bases and stipules; g, winter bud; h, stem, cross-section; i, j, fruit (Mason).

Robbins Pondweed

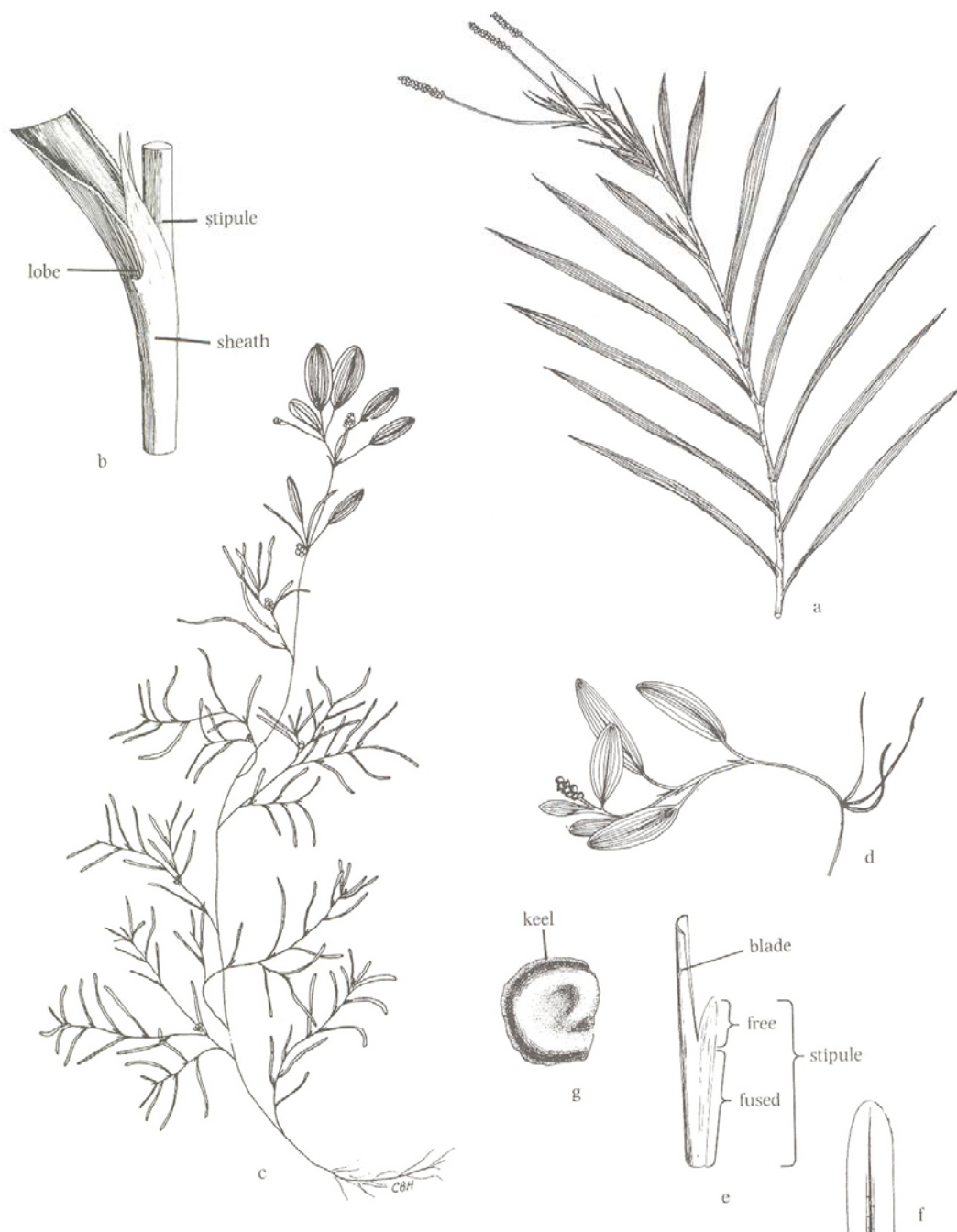


Fig. 371. *Potamogeton robbinsii*: a. upper portion of plant (PB); b. section of stem with leaf base (F).
Potamogeton spirillus: c. habit (NHAES); d. upper portion of plant (F); e. leaf base with stipule (F);
 f. leaf apex (F); g. fruit (F).

Water Marigold

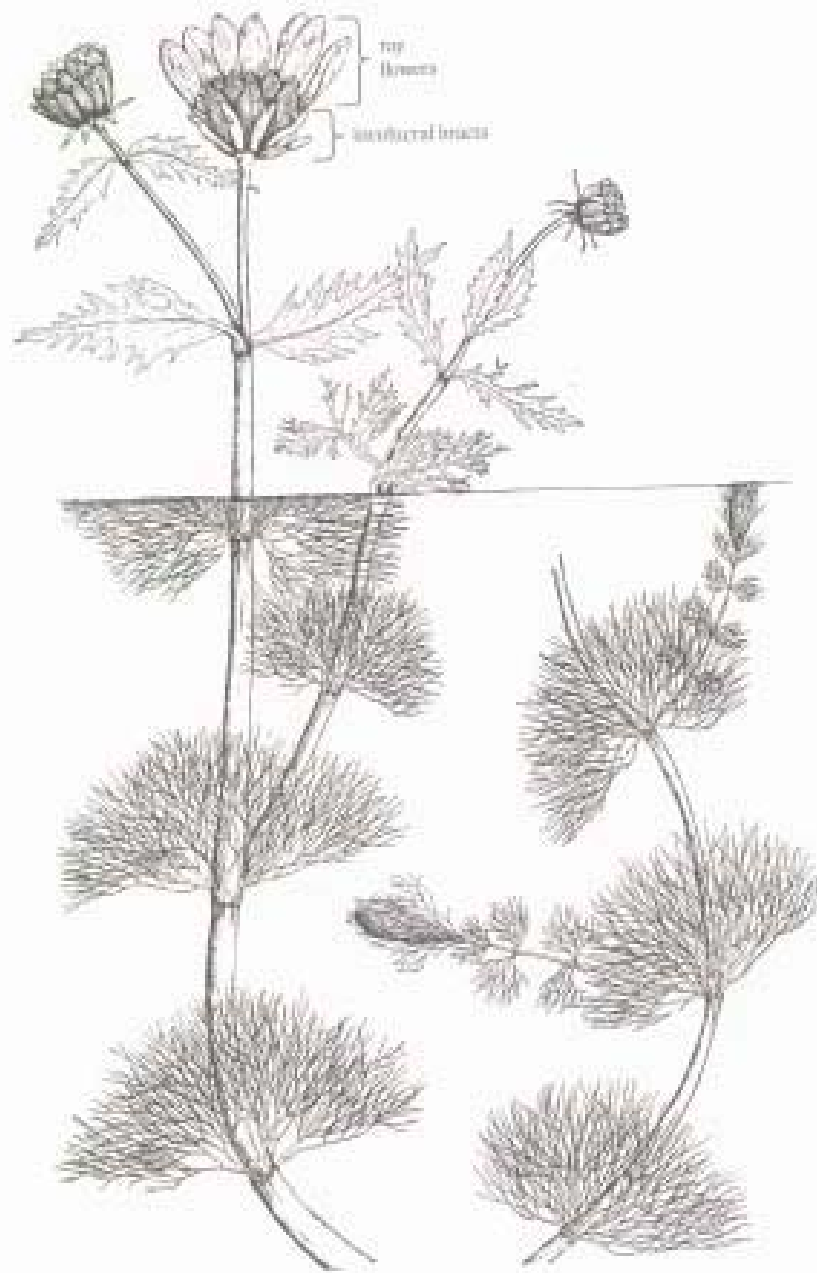


Fig. 101. *Aquilularia lutea*: submerged and emerged portions of plant (P).

1883

White water lily

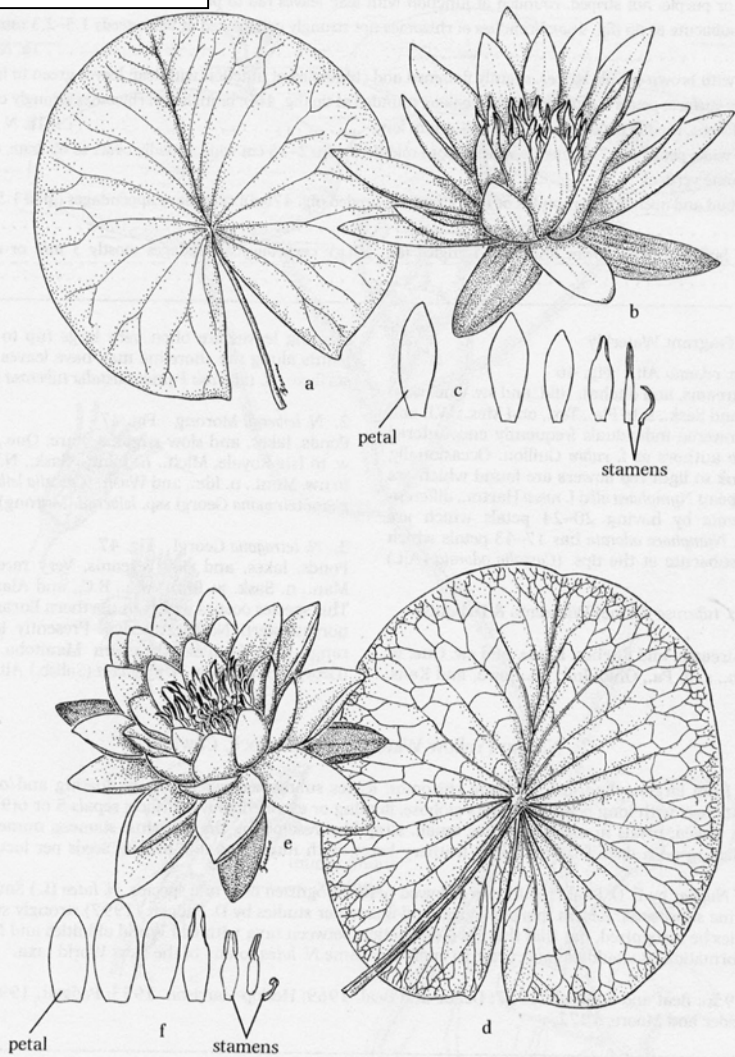


Fig. 46. *Nymphaea odorata* ssp. *odorata*: a. leaf; b. flower; c. series showing transition from petals to stamens (NHAES).
Nymphaea odorata ssp. *tuberosa*: d. leaf; e. flower; f. series showing transition from petals to stamens (NHAES).

Yellow water lily

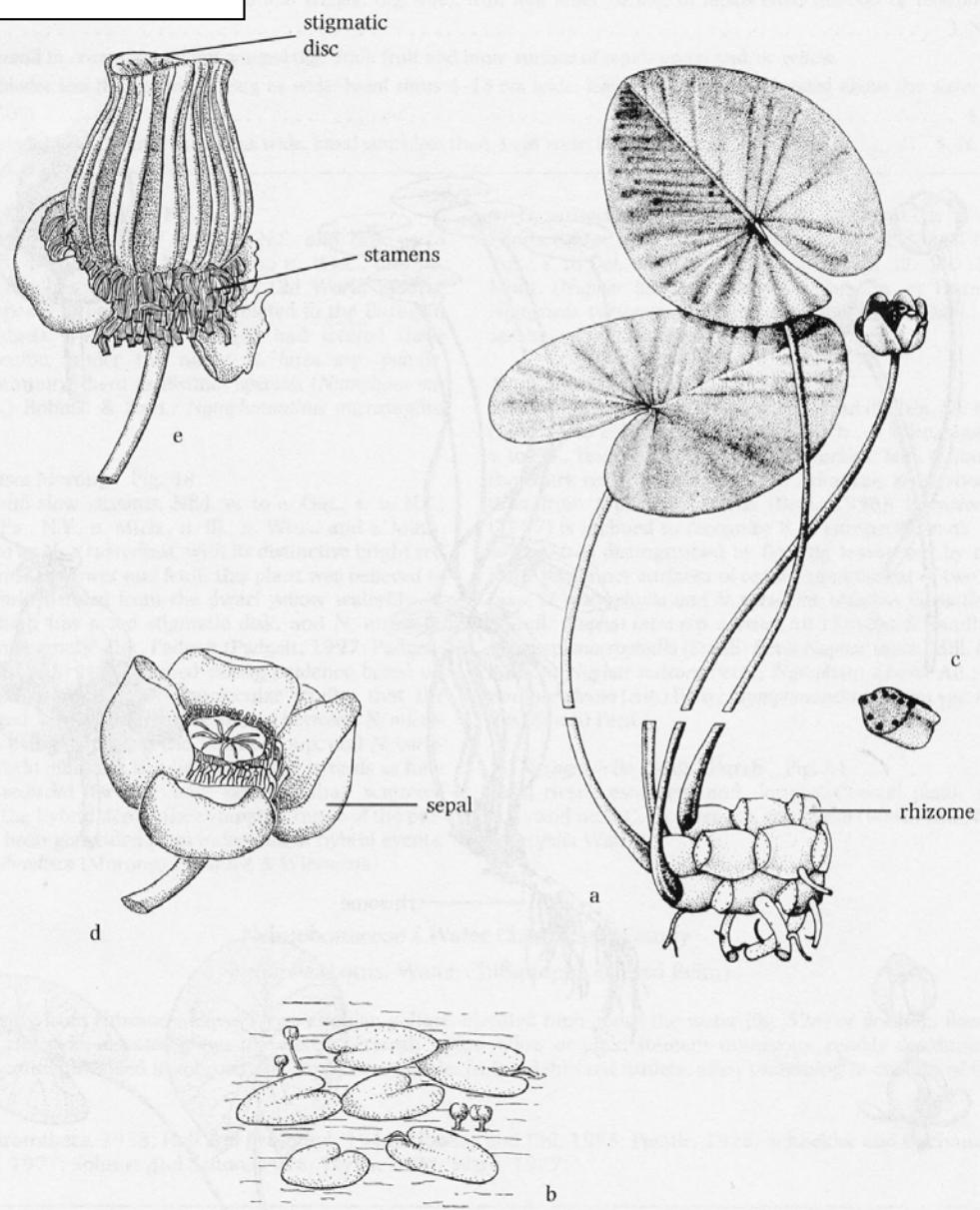


Fig. 49. *Nuphar variegata*: a. habit (NYS Museum); b. habit, showing characteristically floating leaves (NHAES); c. stem, cross-section (NYS Museum); d. flower (NHAES); e. fruit (NHAES).



CTDEP Permit





STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION



February 28, 2003

GREG BUGBEE
STATE OF CONNECTICUT, AGRICULTURAL EXPERIMENT STATION
PO BOX 1106
NEW HAVEN, CT 06504-

Dear Applicant:

This letter is to confirm the receipt of the following application package:

Permit Type: AQUATICS
LAKE QUONNIPAUG IN GUILFORD - NO GIS# GIVEN

Your application has been assigned the following application number: 200300671
Please include this number on all correspondence regarding this application.

As of today, the following materials have been received:

ITEM	REQUIRED FEE	FEE RECEIVED	RECEIVED ON
Application Package			FEBRUARY 27, 2003
Application Fee:	\$ 25.00	\$ 25.00	FEBRUARY 27, 2003

If there are any questions regarding this notice, please feel free to contact the Central Permit Processing Unit at (860)424-4004.

Your application has been forwarded to the appropriate permit program. As a reminder, depending on the type of permit you are seeking, you may be required to publish notice of your application in accordance with Section 22a-6g of the General Statutes and submit a copy of such notice to DEP. If this is the case, DEP will not process your application further until we have received the certified copy of such notice.

If you have specific technical questions regarding your application, please contact the permit program directly:

PESTICIDES PROGRAM, (860) 424-3369

Please be aware that any work without the permits or authorizations required by Section 22a-66c CGS

is a violation of state law, and may subject you to enforcement action. Also, the application review process is a continuing one. The department may request further information to evaluate your application.

Thank You.

Sincerely,

Central Permit Processing Unit

(Printed on Recycled Paper)
79 Elm Street • Hartford, CT 06106 - 5127
<http://dep.state.ct.us>
An Equal Opportunity Employer





STATE OF CONNECTICUT
 DEPARTMENT OF ENVIRONMENTAL PROTECTION
 Central Permit Processing Unit
 79 Elm Street
 Hartford, CT 06106-5127

DEP USE ONLY

Permit Application Transmittal Form

Please complete this transmittal form in accordance with the instructions in order to ensure the proper handling of your application(s) and the associated fee(s). Print legibly or type.

Part I: Applicant Information

Applicant: **The Connecticut Agricultural Experiment Station**
 Company Name or, if applicant is an individual, write name in the following format:
 Title (Mr, Ms, Dr) First Name Middle Initial Last Name Suffix (Jr, PE, PhD)

Mailing Address: **P.O. Box 1106**

City/Town: **New Haven** State: **CT** Zip Code: **06504-**

Business Phone: **203-974-8512** ext.: Fax: **203-974-8502**

Contact Person: **Greg Bugbee** Phone: **203-974-8512** ext.

Applicant (check one): individual company federal gov't state agency municipality

If a Company, list company type (e.g., corporation, limited partnership, etc.):

Check if any co-applicants. If so, attach additional sheet(s) with the required information as supplied above.

Please provide the following information to be used for *billing purposes only*, if different:

Company/Individual Name:
 Mailing Address:
 City/Town: State: Zip Code: -
 Contact Person: Phone: - - ext.

Part II: Project Information

Brief Description of Project: *(Example: Development of a 50 slip marina on Long Island Sound)* **Application of aquatic herbicide to Lake Quonnipaug.**

Location (City/Town): **Guilford**

Other Project Related Permits (*not* included with this form):

Permit Description	Issuing Authority	Submittal Date	Issuance Date	Denial Date	Permit #
		/ /	/ /	/ /	
		/ /	/ /	/ /	
		/ /	/ /	/ /	



Part III: Individual Permit Application and Fee Information

New, Mod. or Renew	Individual Permit Applications	Initial Fees	No. of Permits Applied For	Total Initial Fees	Original + Required Copies
	AIR EMISSIONS				
	New Source Review	\$500.00			1 + 0
	Title V Operating Permits	none			1 + 0
	WATER DISCHARGES				
	To Groundwater	\$700.00			1 + 2
	To Surface Water (NPDES)	\$700.00			1 + 2
	To Sanitary Sewer (POTW)	\$700.00			1 + 1
	INLAND WATER RESOURCES				
	Inland Wetlands and Watercourses	none			1 + 5
	Stream Channel Encroachment Lines	1			
	Inland 401 Water Quality Certification	none			1 + 5
	Water Diversion	1			
	Dam Construction	none			1 + 2
	Flood Management Certification	none			1 + 1
	OFFICE OF LONG ISLAND SOUND PROGRAMS				
	Structures and Dredging/Tidal Wetlands	\$350.00			1 + 3
	Coastal 401 Water Quality Certification	none			1 + 3
	Certificate of Permission	\$200.00			1 + 2
	WASTE MANAGEMENT				
	Waste Transportation	1			1 + 0
	Solid Waste Facilities	1			1 + 2
	RCRA Closure Plan	\$2500.00			1 + 0
	RCRA Post Closure	\$2500.00			1 + 0
	CGS Section 22a-454 Waste Facilities	1			1 + 1
	Hazardous Waste Treatment, Storage and Disposal Facilities	1			1 + 1
	Aquatic Pesticide Application	\$ 25.00	1	\$25.00	1 + 0
	Aerial Pesticide Application	1			1 + 2
	Marine Terminal License	\$125.00			1 + 0
		Subtotal=			
GENERAL PERMITS and AUTHORIZATIONS		Subtotals Page 3 =			
Enter subtotals from Part IV, pages 3 & 4 of this form		Subtotals Page 4 =			
TOTAL =			1	\$25.00	
<input type="checkbox"/> Indicate whether municipal discount or state waiver applies. Less Applicable Discount =					
AMOUNT REMITTED =				\$25.00	
Check # =	<input type="text"/>	Check or money order should be made payable to: ^Department of Environmental Protection=			





Permit Application for the Use of Pesticides in State Waters

Please complete this form in accordance with Section 22a-66z CGS and the instructions (DEP-PEST-INST-200) in order to ensure the proper handling of your application. Print or type unless otherwise noted.

DEP USE ONLY	
Application No.:	_____
Rec'd CPPU:	_____

Part I: Permit Type and Fee Information

Application of Pesticides in State Waters	Fee: \$ 25.00
---	---------------

Part II: Site Location

<p>1. Name of Waterbody: Lake Quonnipaug Street address and/or description of location: Route 77 City or Town: Guilford</p> <p>2. GIS/ID No. (If known):</p>
--

Part III: Applicant Information

<p>1. Fill in the applicant's name and phone number as indicated on the <i>Permit Application Transmittal Form</i> (DEP-APP-001). Applicant: The CT Agric. Expt. Station Phone: 203-974-8512</p> <p>2. List primary contact for departmental correspondence and inquiries, if different than the applicant. Name: Greg Bugbee Mailing Address: P.O. 1106 City/Town: New Haven State: CT Zip Code: 06505- Business Phone: 203-974-8512 ext. Fax: 203-974-8502 Contact Person: Greg Bugbee Title: Research Scientist</p> <p>3. List attorney or other representative, if applicable. Firm Name: Mailing Address: City/Town: State: Zip Code: - Business Phone: - - ext. Fax: - - Attorney: Title:</p>

Part III: Applicant Information (continued)



4. List the owner(s) of the site(s) to be treated. Check box if additional sheets are attached.
 Name: **The State of CT**
 Mailing Address: **CTDEP, 79 Elm St.**
 City/Town: **Hartford** State: **CT** Zip Code: **06106-5127**
 Business Phone: **860-424-3716** ext. Fax: **860-424-4055**
 Contact Person: **Chuck Lee** Title: **Director of Lakes**

5. List the person or company applying the pesticides.
 Name: **Greg Bugbee**
 Mailing Address: **P.O. Box 1106**
 City/Town: **New Haven** State: **CT** Zip Code: **06504-**
 Business Phone: **203-974-8512** ext. Fax: **203-974-8502**
 Contact Person: **Greg Bugbee** Title: **Research Scientist**
 Certification Number: **S-1299**

Part IV: Site Information

1. Is the activity, which is the subject of this application located within the coastal boundary as delineated on DEP approved coastal boundary maps? Yes No
 If yes, you must submit a *Coastal Consistency Review Form* (DEP-APP-004) with your application as Attachment C.

2. (Optional - See Instructions) Is the project site located within an area identified as a habitat for endangered, threatened or special concern species as identified on the "State and Federal Listed Species and Natural Communities Map"? Yes No Date of Map: / /
 If yes, complete and submit a *Connecticut Natural Diversity Data Base* (CT NDDB) *Review Request Form* (DEP-APP-007) to the address specified on the form.
 When submitting this permit application, please include copies of any correspondence to the NDDB, including copies of the completed CT NDDB Review Request Form, any field surveys, and any other information which may lead you to believe that endangered or threatened species may or may not be located in the area of your existing or proposed permitted activity, as Attachment D.
 Has a field survey been conducted to determine the presence of any endangered, threatened or special concern species? Yes No If yes, provide:
 Biologist's Name: **Dr. George Knocklien**
 Address: **Northeast Aquatic Research**
 and submit a copy of the field survey with your application as Attachment D.

3. Type of area to be treated: Tidal Waters Pond or Lake Stream

4. Name and number of drainage basin (if known): **West River, 5110**

Part IV: Site Information (continued)



5. Is the waterbody located in a public water supply watershed? Yes No
6. Where does the waterbody flow to? **West River**
 Is the outflow usually flowing? Yes No Can outflow be stopped? Yes No
7. Identify the size of the waterbody: **6000** Length (ft.) **600** Width (ft.) **112** Acres
50 Maximum Depth (ft.) **10** Average Depth (ft.) **1120** Volume (Ac-ft)
8. Portion of the waterbody to be treated: **5.8** Acres **NA** Volume (Ac-ft.)
9. Does the waterbody have public access? Yes No
10. Is the waterbody stocked with fish by the state? Yes No
11. Identify use(s) of waterbody:
 domestic water supply irrigation watering livestock swimming fishing
12. Are there any downstream users of the water who may be affected by treatment? Yes No
 If yes, please explain:
13. Within 1/2 mile of the treatment area, are there any drinking water wells 50 ft. or less from the shoreline?
 Yes No
14. Identify all plants or animals to be controlled: **Eurasian Milfoil, Fanwort, Water lily**
15. Identify all types of fish present: **Bass, pickeral, trout, perch, crappie, eels, sunnies, bluegills, shiners, carp, catfish**
16. Identify chemicals to be used, the amount per treatment and number of times:
- | <i>Chemical</i> | <i>Amount per Treatment</i> | <i>Number of Times</i> |
|---------------------------|-----------------------------|------------------------|
| a) 2,4-D, Navigate | 500 lbs/2.5A | 1 |
| b) Rodeo | 8 pints/1.3A | 1 |
| c) | | |
17. Projected date(s) of pesticide use: **May 15 - June 15**
18. List prior years in which chemicals were applied to this waterbody:
2001, 2002



Part V: Supporting Documents

Be sure to read the instructions (DEP-PEST-INST-200) to determine whether the attachments listed are applicable to your specific activity. Please enter a check mark by the attachments as verification that *all applicable* attachments have been submitted with this permit application form. When submitting any supporting documents, please label the documents as indicated in this Part (e.g., Attachment A, etc.) and be sure to include the applicant's name as indicated on the *Permit Application Transmittal Form*.

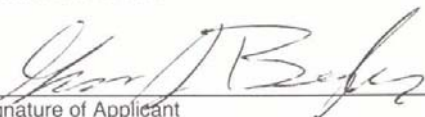
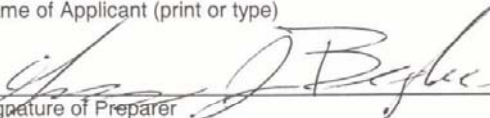
<input checked="" type="checkbox"/>	Attachment A:	An 8-1/2" x 11" copy or original of a USGS Topographic Quadrangle Map (scale 1:24,000) indicating the exact location of the area to be treated.
<input checked="" type="checkbox"/>	Attachment B:	<i>Applicant Compliance Information Form</i> (DEP-APP-002) (if applicable)
<input type="checkbox"/>	Attachment C:	<i>Coastal Consistency Review Form</i> (DEP-APP-004) (if applicable)
<input checked="" type="checkbox"/>	Attachment D:	<i>Connecticut NDDB Review Request Form</i> (DEP-APP-007) and copies of any correspondence to the NDDB, including copies of any field survey conducted to identify the presence of any endangered, threatened or special concern species (if applicable)

Part VI: Application Certification

The applicant *and* the individual(s) responsible for actually preparing the application must sign this part. An application will be considered insufficient unless *all* required signatures are provided.

I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of the individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that a false statement in the submitted information may be punishable as a criminal offense, in accordance with Section 22a-6 of the Connecticut General Statutes, pursuant to Section 53a-157b of the Connecticut General Statutes, and in accordance with any other applicable statute.

I certify that this application is on complete and accurate forms as prescribed by the commissioner without alteration of the text.

	02/20/2003
Signature of Applicant	Date
Gregory J. Bugbee	Research Scientist
Name of Applicant (print or type)	Title (if applicable)
	02/20/2003
Signature of Preparer	Date
Gregory J. Bugbee	Research Scientist
Name of Preparer (print or type)	Title (if applicable)

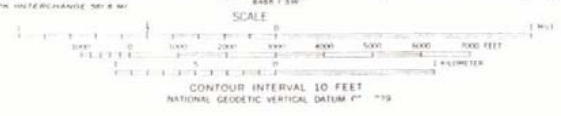
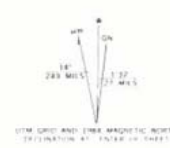
Please enter a check mark if additional signatures are necessary. If so, please reproduce this sheet and attach signed copies to this sheet.

Note: Please send one copy of your completed application along with the required cover letter (see attached) to the appropriate local inland wetland agency.





dated, and published by the Geological Survey
 U.S. NOS. NOAA, and Connecticut Geodetic Survey
 a photogrammetric methods from aerial photographs
 1950 field checked 1953. Revised 1964
 section 10,000 foot grid ticks based on
 coordinate system
 Imperial Transverse Mercator
 as in Blue
 Vermont Datum
 to geoid (North American Datum 1983)
 to feet from mean sea level and



THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS



ROAD CLASSIFICATION

Heavy duty	—————	Light duty	—————
Medium duty	—————	Unimproved dirt	—————
	○	State Route	

DITHAM COM





Connecticut Natural Diversity Data Base Review Request Form

Please complete this form *only* if you have conducted a review which determined that your activity is located in an area of concern.

Name: Greg Bugbee		
Affiliation: The Connecticut Agricultural Experiment Station		
Mailing Address: P.O. Box 1106		
City/Town: New Haven	State: CT	Zip Code: 06504-
Business Phone: 203-974-8512	ext.	Fax: 203-974-8502
Contact Person: Greg Bugbee	Title: Research Scientist	
Project or Site Name: Lake Quonnipaug		
<i>Project Location</i>		
Town: Guilford	USGS Quad:	
Brief Description of Proposed Activities: Research on spot treating aquatic weeds with herbicide.		
Have you conducted a "State and Federal Listed Species and Natural Communities Map" review? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Date of Map: / /		
Has a field survey been previously conducted to determine the presence of any endangered, threatened or special concern species? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
If yes, provide the following information and submit a copy of the field survey with this form. Biologists Name: 1) Dr. George Knocklien , 2) Nancy Murray Address: 1) Northeast Aquatic Research , 2) CTDEP		
If the project will require a permit, list type of permit, agency and date or proposed date of application: Aquatic herbicide permit, date of application May - September 2003		

(See reverse side - you must sign the certification on the reverse side of this form)



The Connecticut Natural Diversity Data Base (CT NDDB) information will be used for:

- permit application
- environmental assessment (give reasons for assessment):

- other (specify):

"I certify that the information supplied on this form is complete and accurate, and that any material supplied by the CT NDDB will not be published without prior permission."

Signature



02/20/2003
Date

All requests must include a USGS topographic map with the project boundary clearly delineated.

Return completed form to:

NATURAL DIVERSITY DATA BASE/DATA REQUEST
ENVIRONMENTAL & GEOGRAPHIC INFORMATION CENTER
DEPARTMENT OF ENVIRONMENTAL PROTECTION
79 ELM STREET, STORE LEVEL
HARTFORD, CT 06106-5127

* You must submit a copy of this completed form with your registration or permit application.





STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATE OF CONNECTICUT, AGRICULTURAL EXPERIMENT STATION
PO BOX 1106
NEW HAVEN CT 06504-

1. This permit is hereby issued pursuant to Section 22a-66z of the General Statutes, and regulations adopted thereunder.
2. This permit 03422 is issued to: STATE OF CONNECTICUT, AGRICULTURAL EXPERIMENT STATION
of PO BOX 1106
NEW HAVEN CT 06504-
3. This permit authorizes the application of chemicals at the property owned by:
STATE OF CONNECTICUT, AGRICULTURAL EXPERIMENT STATION
located at: ROUTE 79 GUILFORD
4. This permit authorizes the application of chemicals by STATE OF CONNECTICUT, AGRICULTURAL EXPERIMENT STATION .
5. This permit is issued on 23-MAY-2003 and will expire on 31-DEC-2003 .

6. This permit is subject to the following conditions:

- a. Permittee may apply the following chemicals to LAKE QUONNIPAUG GIS No.- 9378

Chemical	Amount of chemical	Times Applied
2, 4-D GRANULAR	500 POUNDS	1
- b. Permittee may conduct the application described in paragraph 6a at least 30 DAYS
apart, no more than the number of times specified above, and prior to 31-DEC-03 .
- c. The permittee shall follow all restrictions and directions as instructed on the chemical label.

RECEIVED

JUN 02 2003

STATE OF CONNECTICUT
AGRICULTURAL
EXPERIMENT STATION



d. The permittee shall also adhere to the following specific conditions:

Permit Conditions for Lake Quonnipaug, 2003

1. Survey and map the location of private drinking water wells closer than 50 feet from the lake within 500 feet of the 2,4-D treatment area(s) according to the Question #13 on the aquatic permit application form.
2. Assure that no treated lake water is used for drinking.
3. Determine irrigation uses for lake water according to Item #11 on permit application form and assure that no treated lake water is used for irrigation unless an approved assay indicated that the 2,4-D concentration is 100 ppb or less.
4. Identification, location, distribution and density of aquatic vegetation will be conducted for the proposed treatment areas prior to chemical application. Mapped results will be provided to the Connecticut DEP Pesticide Management Division prior to treatment.
5. Water quality will be monitored for 2,4D pretreatment and post-treatment according to the description under Materials and Methods, p. 5 of "Control of Invasive Aquatic Weeds in Lake Quonnipaug with Spot Treated Herbicides".
6. Post-treatment aquatic vegetation maps prepared during mid-summer and early October 2003 will be submitted to the CTDEP.

e. For any permit to apply chemicals on a lake or pond with any public access owned by the state or a municipality: The permittee shall, prior to any chemical application authorized by this permit, publish notice of such application and post signs in accordance with Section 22a-66a(h) of the Connecticut General Statutes and regulations adopted thereunder.

For any permit to apply chemicals to a private lake or pond having more than one owner of shoreline property: The permittee shall, prior to any chemical application authorized by this permit, publish notice of such application in accordance with Section 22a-66a(h) of the Connecticut General Statutes and regulations adopted thereunder.

f. In evaluating the application for this permit and any other document submitted pursuant to this permit, DEP relies on information and data provided by the applicant and on the applicant's representations. If such information proves to be false, deceptive, incomplete or inaccurate, this permit may be modified, suspended or revoked in accordance with Section 22a-3a-5(d) of the Regulations of Connecticut State Agencies, and any unauthorized activities may be subject to enforcement action.

g. Any document which is required to be submitted by the permittee to DEP under this permit shall be signed by the permittee and by the individual or individuals responsible for actually preparing such document, each of whom shall certify in writing as follows:

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that any false statement made in the submitted information may be punishable as a criminal offense, in accordance with Section 22a-6 of the General Statutes, pursuant to Section 53a-157b of the General Statutes, and in accordance with any other applicable statute."

h. Issuance of this permit does not relieve the permittee of the obligation to obtain any other authorizations required by applicable federal, state and local law.



- i. This permit is subject to and does not derogate any present or future rights or powers of the State of Connecticut and conveys no rights in real or personal property nor any exclusive privileges, and is subject to any and all public and private rights and to any federal, state or local laws pertinent to the property or activity affected by such permit.
- j. This permit shall be signed below by the registered pesticide dealer at the time of chemical purchase. Once signed, this permit is invalid for further purchase of chemicals.

23-MAY-2003
Date of Permit Issuance

03422
Permit Number

Date of Chemical Purchase

Michael Dezzani

Michael Dezzani, Acting Director
Pesticide, PCB and Underground Storage Tank
Management Division
Bureau of Waste Management

Signature of Registered Pesticide Dealer

Please cut along dotted line:

The permittee shall return this section to:

PESTICIDE, UNDERGROUND STORAGE TANK, PCB DIVISION
BUREAU OF WASTE MANAGEMENT
79 ELM STREET
HARTFORD, CT 06106-5127

Please return this section by December 31 of the calendar year in which the permit was issued and indicate the actual date and which of the approved chemicals were applied.

Permit Number: 03422 Date of chemical application:

Place a check mark in the box if the application of chemicals was not performed.



Public Notification
Newspaper
Shoreline Times



Notice of Pesticide Application in Lake Quonnipaug

Portions of Lake Quonnipaug, Guilford, CT will be treated with the herbicide Navigate, to control Eurasian milfoil. Less than five acres will be treated during the period June 11 – June 30, 2003. This work is part of research by The Connecticut Agricultural Experiment Station on the control of aquatic weeds. There are no use restrictions on water from Lake Quonnipaug following this application. Further information may be obtained from:

Mr. Greg Bugbee
Department of Soil and Water
The Connecticut Agricultural Experiment Station
P.O. Box 1106
New Haven, CT 06504
(203) 974-8512

There are no restrictions on swimming, fishing and watering livestock. Do not use water from Lake Quonnipaug for irrigating plants or sprays for ornamental or agricultural crops until tests show levels of 2,4-D are below 100 parts per billion. The Connecticut Agricultural Experiment Station will be conducting the water tests. You may call Mr. Greg Bugbee (203) 974-8512 for updates on the water test results.



Public Notification Signs



CAUTION

Lake Treated with Pesticide to Control Milfoil

PESTICIDE NAME: Navigate DATE APPLIED: 6/24/2003

APPLICATOR: Greg Bugbee TIME APPLIED: 6:30 AM - 3:30 PM

Department of Soil and Water PHONE: 203 974-8512

Connecticut Agricultural Experiment Station

Do Not Use Water for the Following Purposes Until the Date and Time Noted Below:

Swimming or Other Water Contact: *No Restriction*

Fishing: *No Restriction*

Irrigation: *Do Not Use until testing determines water is safe for plants.*

Drinking and Cooking: *Do Not Use.*

Livestock Watering: *Do Not Use for watering dairy cattle or farm animals.*

Other: *Do Not Use for making pesticide spray solutions*

THIS SIGN MUST REMAIN POSTED UNTIL THE LATEST DATE ABOVE



Water Testing



Quonnipaug 2003

Temperature °C

Site	depth(m)	Temperature °C									
		5/19	6/17	6/25	7/2	7/17	8/4	8/20	9/12	10/31	
Boat Launch	0.5	20.3	20.5	22	25.4	20.9					
	1	19.6	16.6	18.2	20.3	19.7					
Treatment	0.5		20.6	25.2	24.7	24.9					
	2		19.4	19	23.4	24.5					
Treatment + 100	0.5		21.3	25.3	25.3	24.9					
	4		16.7	17.5	17.2	17.1					
South Cove	0.5		22.4	26.5	26	24.2					
	2		21.4	24.2	24.6	23.9					
Center	0.5	17.3	21.5	24.9	25.6	24.5	26.8	26.3	21.0	12.3	
	1.0	17.1	21.5		25.5	24.5	26.7	26.2	21.1	12.2	
	2.0	16.9	21.3	20.0	24.2	24.4	26.7	26.1	21.0	12.1	
	3.0	16.6	17.8	18.5	29.6	23.7	26.7	25.5	20.9	12.1	
	4.0	15.9	16.1	17.1	17.7	18.3	22.3	23.1	20.8	12.1	
	5.0	15.3	15.3	15.6	14.5	15.2	17.0	17.7	18.2	12.0	
	6.0	13.7	13.9	13.7	13.3	13.4	13.7	14.4	14.7	11.9	
	7.0	11.3	11.7	11.9	11.8	11.5	12.3	12.0	12.0	11.9	
	8.0	9.4	9.8	10.2	10.5	10.2	10.4	10.5	10.9	11.8	
	9.0	8.4	8.7	9.1	9.1	9.0	9.4	9.4	9.6	11.3	
	10.0	7.7	8.3	8.5	8.3	8.3	8.6	8.8	8.9	10.3	
	11.0	7.4	7.8	7.9	7.8	7.9	8.2	8.2	8.4	8.8	
	12.0	7.2		7.5	7.6	7.6	7.7	8	7.8	8.4	
	13.0	7.0		7.4	7.4	7.6	7.6	7.8	7.7	8.2	
14.0	7.0		7.4	7.3	7.5	7.5	7.6	7.6	8.2		



Quonnipaug 2003		Dissolved Oxygen (mg/L)									
		5/19	6/17	6/25	7/2	7/17	8/4	8/20	9/12	10/31	
Site	depth(m)										
Boat Launch	0.5	9.7	11.9	11.3	9	4.0					
	1	10.8	14.6	10.3	14	2.0					
Treatment	0.5		9.5	8.2	8.5	7.6					
	2		10	8.7	7.6	7.4					
Treatment + 100	0.5		9	8.4	8.8	7.6					
	4		8.5	8	8.2	6.6					
South Cove	0.5		10.1	7.7	10.3	6.7					
	2		11.8	11.1	10	6.9					
Center	0.5	10.9	9.5	9.2	8.4	7.7	8.1	7.5	8.0	9.4	
	1.0	10.6	9.7		8.6	7.5	7.8	7.5	7.8	9.1	
	2.0	10.6	9.9	10.4	8.6	7.3	7.6	7.3	7.5	9.0	
	3.0	10.9	9.9	9.6	9.2	7.1	7.6	6.5	7.6	8.9	
	4.0	10.7	8.7	9.0	9.0	7.0	7.1	3.5	7.7	8.9	
	5.0	10.9	7.5	7.6	6.5	5.6	5.5	3.0	4.3	8.8	
	6.0	10.5	7.5	7.6	6.5	4.7	4.0	2.6	3.1	8.6	
	7.0	10.6	7.7	7.2	6.2	4.7	3.8	2.6	1.8	8.6	
	8.0	10.2	7.8	7.2	6.2	4.2	3.7	2.4	1.1	8.4	
	9.0	9.1	7.4	6.8	5.4	4.1	3.3	1.7	0.7	7.2	
	10.0	8.5	6.4	6.7	5.0	2.9	2.9	1.3	0.4	5.6	
	11.0	8.5	5.8	4.4	2.8	1.9	1.3	0.9	0.3	0.5	
	12.0	6.9		3.3	1.7	0.8	0.7	0.4	0.2	0.3	
	13.0	6.5		2.6	1.1	0.7	0.5	0.3	0.2	0.3	
14.0	0.8		2.1	0.8	0.3	0.4	0.2	0.2	0.2		



Quonnipaug 2003		P (ppb)						
Site	depth(m)	6/17	6/25	7/2	7/17	8/20	9/12	10/31
Center	0.5	41	18	29	18	18	8	16
	9.0	36	13		12	12	1	1

Quonnipaug 2003		2,4-D (ppb)		
Site	depth(m)	6/17	6/27	7/2
Boat Launch	0.5	0.0	0.0	4.6
	1	0.0	0.0	0.0
Treatment	0.5	0.0	8.9	4.7
	2	0.0	82.0	4.5
Treatment + 100	0.5	0.0	2.4	6.4
	4	0.0	0.0	5.9
South Cove	0.5	0.0	3.0	2.8
	2	0.0	0.0	3.4
Center	0.5	0.0	0.0	6.3
	9.0	0.0	0.0	2.6



Quonnipaug 2003

Site	depth(m)	pH								
		5/19	6/17	6/25	7/2	7/17	8/4	8/20	9/12	10/31
Boat Launch	0.5	6.7	6.8	6.6	7.1	6.4				
	1		6.8	6.7	6.8	6.5				
Treatment	0.5		7.3	7.6	7.9	7.2				
	2		6.8	6.9	7.3	7.2				
Treatment + 100	0.5		7.2	7.1	7.7	7.2				
	4		7.1	6.8	6.7	6.6				
South Cove	0.5		7.9	7.1	8.0	7.0				
	2		7.8	7.4	8.4	6.8				
Center	0.5	6.6	6.7	6.8	7.2	7.2	7.2	6.3	6.3	6.6
	9.0	7.6	6.5	6.7	6.5	6.5	6.6	6.3	6.0	6.5

Quonnipaug 2003

Site	depth(m)	Alkalinity								
		5/19	6/17	6/25	7/2	7/17	8/4	8/20	9/12	10/31
Boat Launch	0.5	35	29.5	42.6	35.5	37.3				
	1		29.6	33.3	51.7	40.7				
Treatment	0.5		30	38.3	31.5	30.1				
	2		30.7	27.3	29.7	30.2				
Treatment + 100	0.5		26.7	26.9	30	30.1				
	4		33.3	28.7	29.6	32.1				
South Cove	0.5		28.5	27.1	30.4	30.0				
	2		29.8	26.4	30.4	31.3				
Center	0.5	31.7	28.9	26.0	30.2	30.9	26.5	28.0	28.0	26.9
	9.0	33.1	30.3	34.8	31.5	33.3	34.7	39.0	32.0	22.6

Quonnipaug 2003

Site	depth(m)	Conductivity (ds/cm)								
		5/19	6/17	6/25	7/2	7/17	8/4	8/20	9/12	10/31
Boat Launch	0.5	90.3	72.6	102	0.16	0.172				
	1		81.7	88.4	0.12	0.142				
Treatment	0.5		73.7	79	0.14	0.147				
	2		76.4	79.4	0.14	0.142				
Treatment + 100	0.5		79.9	82.8	0.14	0.137				
	4		86.1	86.8	0.13	0.134				
South Cove	0.5		79.5	85.5	1.16	0.135				
	2		80.1	85.3	0.13	0.141				
Center	0.5	92.6	74.2	79.0	0.13	0.143	118.0	107.0	113.0	102.0
	9.0	92.6	88.1	96.6	0.13	0.146	135.0	126.0	129.0	99.6



Navigate Label and MSDS



NAVIGATE®

GRANULAR AQUATIC HERBICIDE FOR CONTROLLING CERTAIN UNWANTED AQUATIC PLANTS

ACTIVE INGREDIENTS:

2,4-Dichlorophenoxyacetic acid, butoxyethyl ester.....27.6%

INERT INGREDIENTS:72.4%

TOTAL 100.0%

*Isomer specific by AOAC method No. 6.D01-5

*2,4-Dichlorophenoxyacetic acid equivalent 19% by weight

EPA Reg. No. 71368-4-8959

EPA Est. No. 407-IA-2

**KEEP OUT OF REACH OF CHILDREN
CAUTION**

**For Chemical Emergency, Spill, Leak, Fire, Exposure or Accident
Call Chemtrec Day or Night 1-800-424-9300**

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED: Call a physician or Poison Control Center. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. If person is unconscious, do not give anything by mouth and do not induce vomiting.

IF ON SKIN: Wash with plenty of soap and water. Get medical attention.

IF INHALED: Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.

PRECAUTIONARY STATEMENTS

CAUTION

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Harmful if swallowed, absorbed through skin, or inhaled. Causes eye irritation. Avoid contact with skin, eyes or clothing. Avoid breathing dust. When handling this product, wear chemical resistant gloves. Wash thoroughly with soap and water after handling.

When mixing, loading, or applying this product or repairing or cleaning equipment used with this product, wear eye protection (face shield or safety glasses), chemical resistant gloves, long-sleeved shirt, long pants, socks and shoes. It is recommended that safety glasses include front, brow and temple protection.

Wash hands, face and arms with soap and water as soon as possible after mixing, loading, or applying this product. Wash hands, face and hands with soap and water before eating, smoking or drinking. Wash hands and arms before using toilet. After work, remove all clothing and shower using soap and water. Do not reuse clothing worn during the previous day's mixing and loading or application of this product without cleaning first. Clothing must be kept and washed separately from other household laundry. Remove saturated clothing as soon as possible and shower.

ENVIRONMENTAL HAZARDS

This product is toxic to fish. Drift or runoff may adversely affect fish and non-target plants. Do not apply to water except as specified on this label. Do not contaminate water when disposing of equipment washwaters. Do not apply to waters used for irrigation, agricultural sprays, watering dairy animals or domestic water supplies.

Clean sprayer equipment thoroughly before using it for any other purposes. Vapors from this product may injure susceptible plants in the immediate vicinity. Avoid drift of dust to susceptible plants.

MIXING OR LOADING: Most cases of ground water contamination involving phenoxy herbicides such as 2,4-D have been associated with mixing/loading and disposal sites. Caution should be exercised when handling 2,4-D pesticides at such sites to prevent contamination of ground water supplies. Use of closed systems for mixing or transferring this pesticide will reduce the probability of spills. Placement of the mixing/loading equipment on an impervious pad to contain spills will help prevent ground water contamination.

DIRECTIONS FOR USE

IT IS A VIOLATION OF FEDERAL LAW TO USE THIS PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING.

READ THIS ENTIRE LABEL BEFORE USING THIS PRODUCT

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

STORAGE

Store in original container in a dry secured storage area.

PESTICIDE DISPOSAL

Pesticide wastes are toxic. Improper disposal of excess pesticide is a violation of Federal law and may contaminate ground water. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL

Do not reuse empty bag. Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If bag is burned, stay out of smoke.

NAVIGATE is a trademark of Applied Biochemists

NET WT. 50 LBS. (22.68 KG)

13529



GENERAL PRECAUTIONS AND RESTRICTIONS

Do not use in or near a greenhouse.

OXYGEN RATIO

Fish breathe oxygen in the water and a water-oxygen ratio must be maintained. Decaying weeds use up oxygen, but during the period when NAVIGATE® should be used, the weed mass is fairly sparse and the weed decomposition rate is slow enough so that the water-oxygen ratio is not disturbed by treating the entire area at one time.

If treatments must be applied later in the season when the weed mass is dense and repeat treatments are needed spread granules in lanes, leaving buffer strips which can then be treated when vegetation in treated lanes has disintegrated. During the growing season, weeds decompose in a 2 to 3 week period following treatment. Buffer lanes should be 50 to 100 feet wide. Treated lanes should be as wide as the buffer strips.

WATER pH

Best results are generally obtained if the water to be treated has a pH less than 8. A pH of 8 or higher may reduce weed control. If regrowth occurs within a period of 6 to 8 weeks, a second application may be needed.

PERMIT TO USE CHEMICALS IN WATER

In many states, permits are required to control weeds by chemical means in public water. If permits are required, they may be obtained from the Chief, Fish Division, State Department of Conservation or the State Department of Public Health.

GENERAL INFORMATION

NAVIGATE® is formulated on special heat treated attaclay granules that resist rapid decomposition in water, sink quickly to lake or pond bottoms and release the weed killing chemical in the critical root zone area.

This product is designed to selectively control the weeds listed on the label. While certain other weeds may be suppressed, control may be incomplete. Reduced control may occur in lakes where water replacement comes from bottom springs.

WHEN TO APPLY

For best results, spread NAVIGATE® in the spring and early summer, during the time weeds start to grow. If desired, this timing can be checked by sampling the lake bottom in areas heavily infested with weeds the year before.

If treatments are delayed until weeds form a dense mat or reach the surface, two treatments may be necessary. Make the second treatment when weeds show signs of recovery.

Treatments made after September may be less effective depending upon water temperatures and weed growth.

Occasionally, a second application will be necessary if heavy regrowth occurs or weeds reinfest from untreated areas.

HOW TO APPLY

FOR LARGE AREAS: Use a fertilizer spreader or mechanical seeder such as the Gerber or Gandy or other equipment capable of uniformly applying this product. Before spreading any chemical, calibrate your method of application to be sure of spreading the proper amount. When using boats and power equipment, you must determine the proper combination of (1) boat speed (2) rate of delivery from the spreader, and (3) width of swath covered by the granules.

FOR SMALL AREAS: (Around Docks or Isolated Patches of Weeds): Use a portable spreader such as the Cyclone seeder or other equipment capable of uniformly applying this product. Estimate or measure out the area you want to treat. Weight out the amount of material needed and spread this uniformly over the area. More uniform coverage is obtained by dividing the required amount in two and covering the area twice, applying the second half at right angles to the first.

Use the following formula to calibrate your spreader's delivery in pounds of NAVIGATE PER MINUTE:

$$\frac{\text{Miles per hour} \times \text{spreader width} \times \text{X pounds per acre}}{495} = \text{pounds per minute}$$

Example: To apply 100 pounds of NAVIGATE per acre using a spreader that covers a 20 foot swath from a boat traveling at 4 miles per hour, set the spreader to deliver 16 pounds of NAVIGATE granules per minute.

$$\frac{4 \text{ mph} \times 20 \text{ feet} \times 100 \text{ Lbs./A}}{495} = 16 \text{ Lbs/Min.}$$

AMOUNTS TO USE

Rates of application vary with resistance of weed species to the chemical, density of weed mass at time of treatment, stage of growth, water depth, and rate of water flow through the treated area. Use the higher rate for dense weeds, when water is more than 8 feet deep and where there is a large volume turnover.

	NAVIGATE POUNDS PER ACRE	NAVIGATE POUNDS PER 2000 SQ. FT.
SUSCEPTIBLE WEEDS		
Water Milfoil (Myriophyllum spp.)	100 TO 200	5
Water stargrass (Heteranthera dubia)		
SLIGHTLY TO MODERATELY RESISTANT WEEDS		
Bladderwort (Utricularia spp.)	150 to 200	7-1/2 to 10
White water Lily (Nymphaea spp.)		
Yellow water lily (Nuphar spp.)		
Or spatterdock*		
Water shield (Brasenia spp.)		
Water chestnut (Trapa natans)		
Coontail* (Ceratophyllum Demersum)		

- Repeat treatments may be needed

LIMITED WARRANTY AND DISCLAIMER

The manufacturer warrants (a) that this product conforms to the chemical description on the label; (b) that this product reasonably fit for the purposes set forth in the directions for use when it is used in accordance with such directions; and (c) that the directions, warning and other statements on the label are based upon responsible experts' evaluation of reasonable tests of effectiveness, of toxicity to laboratory animals and to plants, and of residues on food crops and upon reports of field experience. Tests have not been made on all varieties or in all states or under all conditions. THE MANUFACTURER NEITHER MAKES NOR INTENDS, NOR DOES IT AUTHORIZE ANY AGENT OR REPRESENTATIVE TO MAKE, ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, AND IT EXPRESSLY EXCLUDES AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

THIS WARRANTY DOES NOT EXTEND TO, AND THE BUYER SHALL BE SOLELY RESPONSIBLE FOR, ANY AND ALL LOSS OR DAMAGE WHICH RESULTS FROM USE OF THIS PRODUCT IN ANY MANNER WHICH IS INCONSISTENT WITH THE LABEL DIRECTIONS, WARNINGS OR CAUTIONS.

BUYER'S EXCLUSIVE REMEDY AND MANUFACTURER'S OR SELLER'S EXCLUSIVE LIABILITY FOR ANY AND ALL CLAIMS, LOSSES, DAMAGES, OR INJURIES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT, WHETHER OR NOT BASED IN CONTRACT, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE SHALL BE LIMITED. AT THE MANUFACTURER'S OPTION, TO REPLACEMENT OF, OR THE REPAYMENT OF THE PURCHASE PRICE FOR, THE QUANTITY OF PRODUCT WITH RESPECT TO WHICH DAMAGES ARE CLAIMED. IN NO EVENT SHALL MANUFACTURER OR SELLER BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OR HANDLING OF THIS PRODUCT.

NOTICE TO BUYER

Purchase of this material does not confer any rights under patents governing this product or the use thereof in countries outside of the United States.

MANUFACTURED FOR:

applied biochemists
MILWAUKEE, WI 1-800-558-5106



Material Safety Data Sheet

EMERGENCY

FOR CHEMICAL EMERGENCY: SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT CALL
CHEMTREC - DAY or NIGHT - (800) 424-9300

Product Name: **AB NAVIGATE** EPA Reg. No. 71368-4-8959

SECTION I - GENERAL INFORMATION

Manufacturer's Name: APPLIED BIOCHEMISTS
W175 N11163 Stonewood Drive
Suite 234
Germantown, WI 53022-4799
(800) 558-5106

Trade Name & Synonyms: **AB NAVIGATE**
Chemical Name & Synonyms: 2,4-D: 2,4-DICHLOROPHENOXYACETIC ACID, BUTOXYETHYL ESTER

Generic Description: AQUATIC HERBICIDE
Formula: $C_{12}H_{18}Cl_2O_4$

D.O.T. Proper Shipping Name: Not Regulated
U.N. or N.A. Identification #: Not Regulated
D.O.T. Hazard Class: Not Applicable
D.O.T. Emergency Response Guide: Not Assigned

Hazardous Mat's ID System Values (HMIS): Health -1 Flammability -1 Reactivity -0 Personal Protection -F
Nat'l Fire Protection Assn. (NFPA 704M): Health -1 Flammability -1 Reactivity -0 Specific Hazard: None

SECTION II - HAZARDOUS INGREDIENTS

Hazardous Component(s)	CAS#	PEL	TLV
2,4-Dichlorophenoxyacetate Acid, Butoxyethyl Ester	1929-73-3	10 mg/m ³	10 mg/m ³
Crystalline Silica	14808-60-7	0.1 mg/m ³	0.1 mg/m ³

Ingredients listed in this section have been determined to be hazardous as defined in 29 CFR 1910.1200. Materials determined to be health hazards are listed if they comprise 1% or more of the composition. Materials identified as carcinogens are listed if they comprise 0.1% or more of the composition. Information on proprietary materials is available as provided in 29 CFR 1910.1200 (i) (1).

SECTION III - PHYSICAL DATA

Boiling Point (F): NOT KNOWN Specific Gravity (water = 1): NOT KNOWN
Vapor Pressure (mm Hg): NOT KNOWN % Volatile (by Volume): NOT DETERMINED
Vapor Density (air = 1): NOT KNOWN Evaporation Rate: (Ether = 1) < 1
Melting Point (F): NOT KNOWN
Solubility in Water: INSOLUBLE
Appearance & Odor: GRAY/TAN GRANULES WITH MILD PHENOLIC ODOR.

SECTION IV - FIRE & EXPLOSION DATA

Flash Point (F): NOT FLAMMABLE Method:
Extinguishing Media: CO₂, WATER, DRY CHEMICAL OR FOAM TO FIGHT FIRES IN WHICH THIS PRODUCT IS INVOLVED.
Special Fire Fighting Procedures: WEAR APPROVED SELF-CONTAINED BREATHING APPARATUS. DIKE TO PREVENT CONTAMINATION OF WATER SOURCES.
Unusual Fire & Explosion Hazards: THERMAL DECOMPOSITION PRODUCTS INCLUDE OXIDES OF CARBON, SULFUR DIOXIDES AND HYDROCHLORIC ACID.

SECTION V - REACTIVITY DATA

Stability - _____ Unstable X Stable
Conditions to Avoid: NONE KNOWN
Incompatibility (Materials to Avoid): ACIDS, BASES, OXIDIZERS.
Hazardous Decomposition Products: THERMAL DECOMPOSITION PRODUCTS INCLUDE OXIDES OF CARBON, SULFUR DIOXIDES AND HYDROCHLORIC ACID.
Hazardous Polymerization: _____ Will Occur X Will Not Occur
Conditions to Avoid: NONE



AB NAVIGATE**SECTION VI - HEALTH HAZARD DATA**

Acute Health Hazards: LD₅₀(Rat) >2000 mg/Kg
 Chronic Health Hazards: THIS PRODUCT CONTAINS CLAY. IARC HAS CLASSIFIED CRYSTALLINE SILICA (A COMPONENT OF CLAY) AS A PROBABLE HUMAN CARCINOGEN. PROLONGED CONTACT MAY CAUSE LIVER DAMAGE, KIDNEY DAMAGE, CHRONIC MUSCLE DAMAGE.

Signs & Symptoms of Exposure: EYE CONTACT MAY CAUSE TEARING AND REDNESS. MAY CAUSE SLIGHT SKIN IRRITATION. INHALATION OF DUST MAY CAUSE IRRITATION TO RESPIRATORY TRACT. INGESTION MAY CAUSE NAUSEA, VOMITING, ABDOMINAL PAIN, MUSCLE WEAKNESS MYOTONIA, AND A FALL IN BLOOD PRESSURE.

Medical Conditions Generally Aggravated by Exposure: MAY AGGRAVATE EXISTING CHRONIC RESPIRATORY PROBLEMS SUCH AS ASTHMA, EMPHYSEMA, OR BRONCHITIS; CONTACT MAY IRRITATE SKIN DISEASE.

Chemical Listed as Carcinogen or Potential Carcinogen by:

National Toxicology Program:	Yes:	No:	✓
I.A.R.C. Monographs:	Yes:	No:	✓
O.S.H.A.	Yes:	No:	✓

Emergency & First Aid Procedures: FOR PRINCIPLE ROUTE OF ENTRY, SEE APPROPRIATE EMERGENCY PROCEDURES BELOW.
 NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

Route of Entry: Inhalation: REMOVE TO FRESH AIR, CONTACT A PHYSICIAN IF NECESSARY.
 Eyes: FLUSH WITH FRESH WATER FOR AT LEAST 15 MINUTES.
 CALL A PHYSICIAN.
 Skin: WASH SKIN WITH PLENTY OF SOAP AND WATER.
 WASH CLOTHES THOROUGHLY BEFORE REUSE.
 Ingestion: DRINK 2-3 GLASSES OF MILK OR WATER, INDUCE VOMITING.
 CALL A PHYSICIAN.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled: SWEEP UP AND PLACE IN APPROVED CONTAINERS. DO NOT FLUSH AREA WITH WATER AS IT CAN CAUSE CONTAMINATION OF SEWER SYSTEM.

Waste Disposal Methods: DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS. 100 LBS. RESULTS IN A REPORTABLE QUANTITY AS SPECIFIED BY D.O.T.

SECTION VIII - SPECIAL PROTECTION AND CONTROL MEASURES

Respiratory Protection (Specify Type): NOT REQUIRED
 Ventilation - Local Exhaust: MECHANICAL Special Exhaust: STAND DOWN WIND WHEN USING.
 Mechanical Exhaust: Other Exhaust:

Protective Equipment - Gloves: PLASTIC OR CHEMICAL RESISTANT
 Eye Protection: SAFETY GLASSES OR CHEMICAL GOGGLES
 Other Protective Equipment: PROTECTIVE CLOTHING
 Work or Hygienic Practices: USE SAFE CHEMICAL HANDLING PROCEDURES SUITABLE FOR THE HAZARDS PRESENTED BY THIS MATERIAL.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storage: DO NOT SWALLOW, BREATH DUST, STORE NEAR FOOD, CONTAMINATE WATER FOOD OR FEED, APPLY TO WATERS USED FOR IRRIGATION, AGRICULTURAL SPRAYS, WATERING DAIRY ANIMALS OR DOMESTIC WATER SUPPLIES.
 Other Precautions: AVOID DRIFT TO SUSCEPTIBLE PLANTS. AVOID GETTING INTO EYES, ON SKIN OR CLOTHING. **KEEP OUT OF REACH OF CHILDREN**

THESE DATA ARE OFFERED IN GOOD FAITH AS TYPICAL VALUES AND NOT AS A PRODUCT SPECIFICATION. NO WARRANTY, EITHER EXPRESSED OR IMPLIED, IS HEREBY MADE. THE RECOMMENDED INDUSTRIAL HYGIENE AND SAFE HANDLING PROCEDURES ARE BELIEVED TO BE GENERALLY APPLICABLE. HOWEVER, EACH USER SHOULD REVIEW THESE RECOMMENDATIONS IN THE SPECIFIC CONTEXT OF THE INTENDED USE AND DETERMINE WHETHER THEY ARE APPROPRIATE.

DJK

Date of Last Revision: 9/30/99

