



Buckmaster Pond Natural Resource Inventory  
Westwood, Massachusetts

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For the Buckmaster Pond Association  
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## I. Introduction

Buckmaster Pond is a 36-acre kettle pond in the town of Westwood, a suburb of about 14,000 people twelve miles southwest of Boston. The pond is named after John Buckmaster, an early settler who died in 1752. The pond appears in historical records as early as 1827, when it was used for baptisms. In August, 2006 I contracted with the Buckmaster Pond Association to visit the pond and conduct a natural resource inventory focused on plant and animal life.

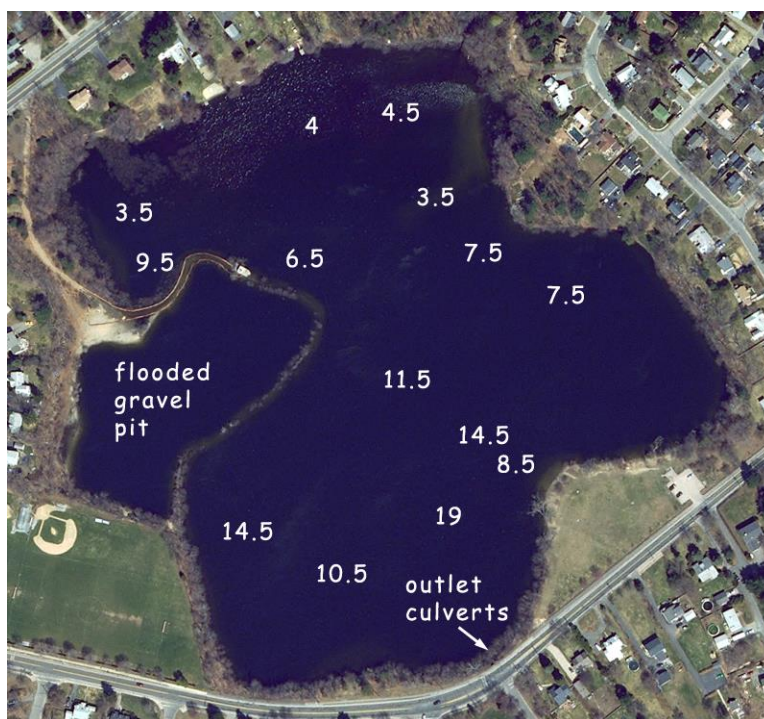
On Sept. 9, Sept. 26, and Oct. 16 of 2006 I explored the pond by foot and canoe, taking a number of samples and seining its shallows for fish. Many of the samples were photoed *in situ* or at home, and documented further with taxonomic notes. Altogether I recorded 95 species of animals and plants in and around the pond.

## II. Physical characteristics

Soundings taken by canoe on October 16 (fig. 1) suggest that Buckmaster has a maximum depth not much greater than 20 feet and an average depth of less than 10 feet.<sup>1</sup> Its northern third is shallow, mostly 5 feet or less, and supports extensive beds of water lilies, as well as 1-2 acres of shrubby buttonbush marsh.

The pond bottom is firm throughout and is dominated by sand, gravel, and cobbles, although these are mixed with organics in most places and covered with several inches of peat and muck in the shallows along the north side. In 2006 water levels in the pond dropped about 30 inches from the long-term high water mark over the summer and fall, exposing a band of open shore at least 10 feet wide in most places, and expanding to 150 feet at the sand flat at the north end of the east shore. With the exception of the southwest corner, the exposed shore is broad enough to extend out of the shade of the fringe of woods surrounding the pond, which is important for its herbaceous flora.

According to the Massachusetts' Dept. of Environmental Protection's wetlands datalayer for the Neponset River watershed, Buckmaster Pond has a surface area of 36.4 acres and a



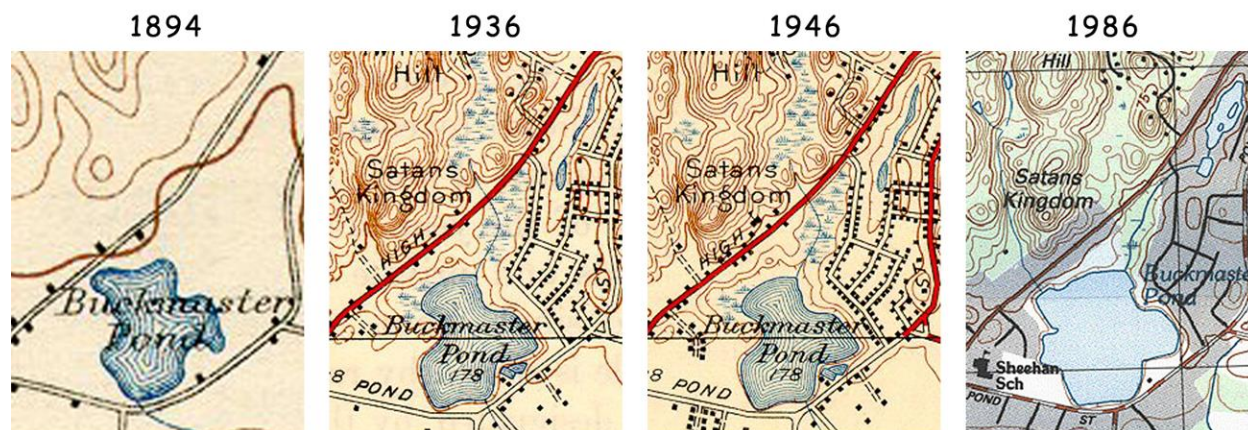
**Figure 1: Depths in feet below high water mark, 10/16/06  
Basemap: MassGIS April 2005 orthophoto**

<sup>1</sup> In the late nineteenth century investigators found that Buckmaster had an area of 29.5 acres with a maximum depth of 29 feet and an average depth of of 13 feet. Massachusetts Board of Health, *Examinations by the State Board of Health of the Water Supplies and Inland Waters of Massachusetts, 1887-1890, Part I of Report on Water Supply and Sewerage* (Boston, 1890) p.260.

perimeter, when full, of 5335 feet. A gravel embankment 1250 feet long and about 20 feet wide intrudes in a large, northeast-trending loop from the pond's west side, enclosing an area of about 7 acres. An unimproved road follows the north end of the embankment about 200 feet out into the pond, ending at a small brick building used as a pump station by the Town of Norwood until the 1970's to draw drinking water from a well in the aquifer below the pond.

In the spring months when Buckmaster reaches its bankfull elevation of 178 feet, most of the embankment is under up to 2 feet of water, and the area behind it is continuous with the rest of the pond, despite the fringe of flood-tolerant trees and shrubs that mark the division. Later in the year, as the pond drops, the embankment gradually emerges, and in 2006 was completely dry and exposed in mid-October, although the low point near its south end was still submerged by four inches on September 9.

USGS mapping (fig. 3) indicates that the open water behind the embankment is an expansion of the pond created between 1946 and 1986, and local residents report that a gravel pit operated in the area. The bare gravel banks that surround the area support this conclusion, not least because they lack the interstitial organic soils present in gravelly shores around most of the pond proper. The maps also indicate that the pond was expanded by several acres at the



**Figure 2: Details from USGS topo maps**

northwest corner via excavation of a wetland at the same time the gravel pit was dug. The small water-filled pits shown at the pond's southeast edge in 1936 and 1946 were associated with a prior pumping station that no longer exists. This station supplied drinking water to the adjacent town of Norwood from 1885 until it was retired in favor of the well across the pond.

Buckmaster's amber-tinged water was clear enough in late 2006 to support growth of vegetation over much of its bottom. Clarity was best in the deeper south end, where the bottom was visible up to 9.5 feet below the surface on October 16, and supported plumes of milfoil and an unidentified ground cover. This corresponds to an absolute depth of 12 feet below the high water mark, and since no more than 20% of the bottom is deeper than this, evidently most of the pond bottom receives light sufficient to support plant growth.

Water clarity deteriorated considerably, however, in the shallows at the pond's northeast corner, where clouds of yellow green filamentous algae hid the bottom in some areas, and the water appeared dark and murky in others, cutting visibility to three feet or less.

According to USGS mapping, two small unnamed intermittent streams enter at either end of Buckmaster's north shore, the longest running a half-mile northeast along the south side of Rt. 109. The latter discharged a trickle of water on Sept. 9 but was dry on Oct. 16. The outlet of the former is obscured by the dense growth of yard-high buttonbush at the pond's northwest corner. Neither of the streams evidently flows with enough force to deposit sand or coarser materials where it enters the pond, although it's likely that they bring in silts and fine organics during storms, as well as road salt and hydrocarbons from heavily traveled Rt. 109, which borders the pond's north shore.

Although the mapping indicates that Buckmaster had a surface outlet flowing southeasterly from its south shore under Pond St. to Germany Brook as last as 1946, today no stream exits the pond, and high flows are discharged via a pair of twelve-inch outfall culverts set 15 feet apart in separate headwalls on the wooded bank opposite Arcadia St. The culverts are installed at the same height, with their upper edges about four inches below the high water mark. The westerly one is older and more deteriorated (Fig. 3). Both were high and dry from Sept. 6 onward.

The outlet stream that once ran southeast along the west side of Arcadia St has been filled for houseslots, and the stream itself is presumably buried in a pipe connected to the outfalls, but its point of reemergence was not investigated.

### III. Geological Setting

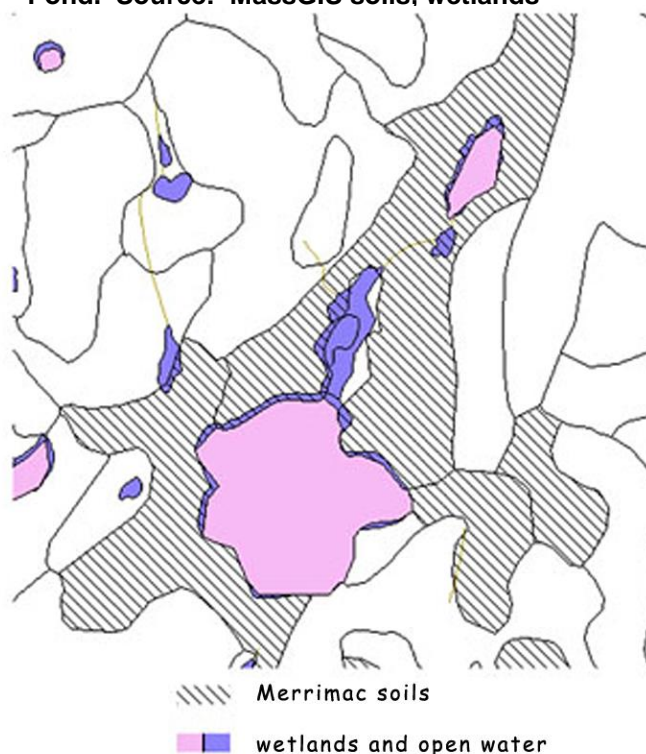
Buckmaster Pond occupies a depression in an elongate bed of sand and gravel laid down on the west side of the Neponset basin during the glacial meltdown about 15,000 years ago. The pond itself traces the outline of a huge ice-block that dominated the bed and survived longer than most, allowing rushing meltwater to surround it with coarse sediments. When the block finally vanished, the void it left filled with water.

Fig. 4 illustrates the extent of deep sandy soils in the vicinity of Buckmaster. Ice-block ponds embedded in sand and gravel are known as kettles and occur



Figure 3: Westerly outfall 9/6/06

Figure 4: Sandy Merrimac soils near Buckmaster Pond. Source: MassGIS soils, wetlands



"The Merrimac series consists of a very deep, somewhat excessively drained soils on glacial outwash plains and glacial stream terraces" -- USDA, Soil Survey of Norfolk County (1984)

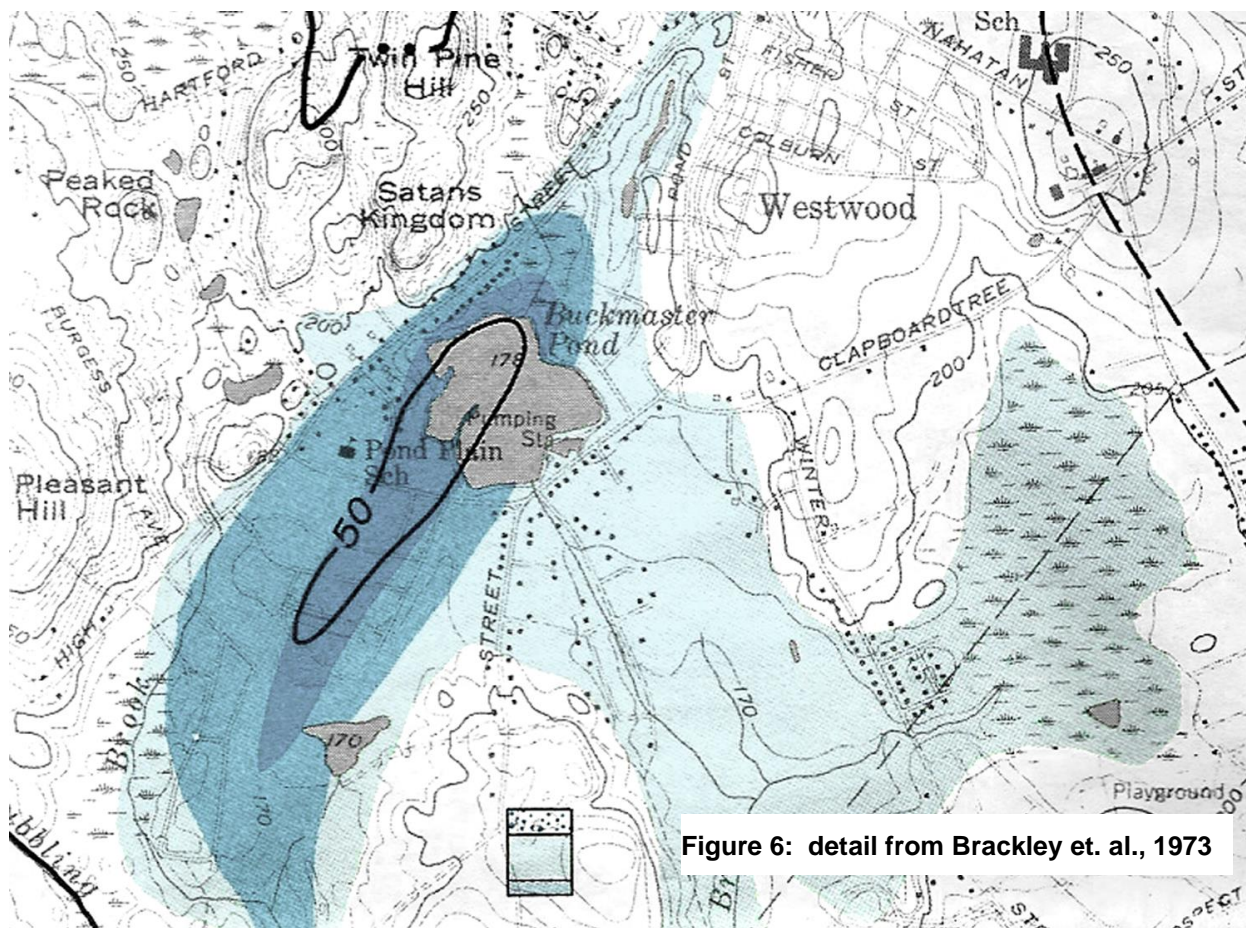
throughout eastern New England—Milton’s Houghton’s Pond, Arlington’s Spy Pond, and Concord’s Walden Pond are well-known examples. In Massachusetts they are most common in Plymouth County and on the Cape, where many have no surface inlets or outlets, and are fed mostly by groundwater moving through the highly permeable sandy subsoils around them.



**Figure 5: rounded cobbles on south end east shore 9/6/06**

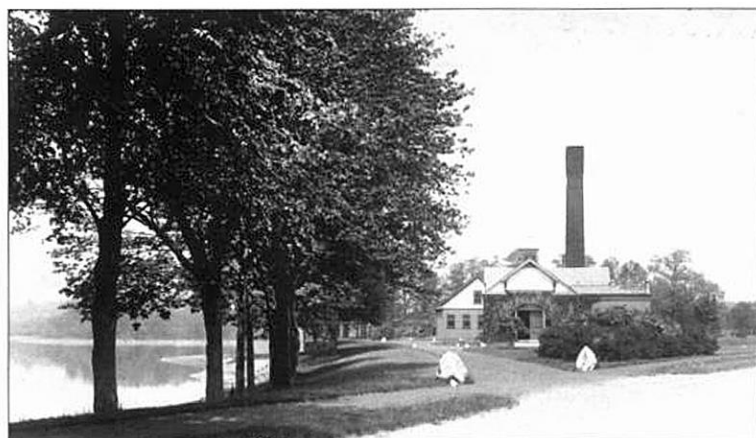
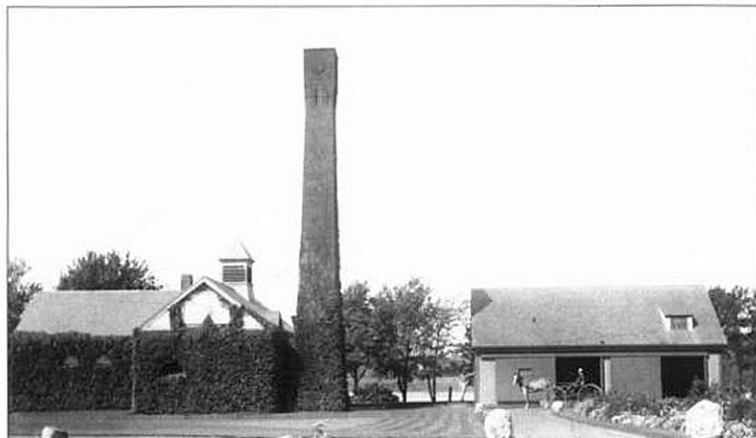
Further evidence of Buckmaster’s glacial origins is exposed along its north and east shores, where there are many beds of rounded stones, indicating that they were tumbled and smoothed in torrents that no longer exist (Fig. 5).

Fig. 6 illustrates the deep permeable substrates associated with Buckmaster from another perspective, that of a groundwater resources investigation conducted by USGS in the early



**Figure 6: detail from Brackley et. al., 1973**

1970's. The dark line marked "50" encloses an area where waterlogged sand and gravels extend 50 feet or more below the surface, and the darker blue areas are those where groundwater wells can be expected to yield over 100 gallons per minute—in the case of the darkest blue area, over 300 gallons per minute. Note that by moving the water supply from the pond's southeast shore (labelled "Pumping Station" on Fig. 6) to the subsequent location on the west-side embankment,



**Figure 7: pumping station on southeast shore in 1910. The site is now an open field. Photos from Westwood Historical Society and Westwood Public Library published in Taylor, 2002**

Norwood transferred it from the edge of the high-yielding area to its center.

The map makes clear that Buckmaster, although up to 20 feet deep, is a sort of puddle sitting atop a deep bed of saturated sands and gravels, or aquifer, reaching over a half mile south toward Willet Pond. Because water migrates freely through these materials, the depth of Buckmaster is a function of the amount of water in the aquifer. Therefore it's safe to say that Buckmaster's 30-inch drop from the high water mark in 2006 reflected a similar decline in nearby groundwater elevations, and it may be that after the pond falls below the level of the outfall culverts, water continues to leave it by draining into the aquifer.

The Buckmaster aquifer is bordered on east and west by higher ground where sands and gravels were not laid down by glacial meltwater, and soils are dominated by relatively impermeable till and bedrock. In

such areas surface water bodies act more like basins than sieves, and kettle ponds do not occur. We can speculate that the reason Buckmaster's former outlet to Germany Brook was never apparently dammed to power mills in colonial times is that water impounded in Buckmaster would simply seep out via the aquifer.

#### IV. Watershed

A watershed is typically defined as the area of land draining to a particular body of water. The Neponset River watershed, for instance, includes all the land, mostly in Norfolk County, that drains to the mouth of the river in Boston Harbor between Dorchester and Quincy.

Figure 8 illustrates how MassGIS delineates the watershed surrounding Buckmaster Pond (the area inside the orange line). This area is 407 acres, or .64 sq miles, eleven times as large as the pond itself.

Land north of the line is outside the Neponset watershed, and drains northerly via Rock Meadow Brook to the Charles River in Dedham. The area beyond the line to the west and southwest drains southerly to Willett Pond via Mill Brook, and the area beyond the line to the east and southeast drains southeasterly to Germany Brook.

Note that Buckmaster is set back from the southern edge of the basin, where the boundary points southward just east of Oak St. At 185 feet, this is the lowest point along the boundary, and would be the place to look for a stream channel draining the area. But Buckmaster no longer has a surface outlet, and evidently the mappers concluded, based on existing contours, that a strip of land south of pond drains north to it, and then the pond itself drains southeast through the twin culverts—otherwise they would have laid the boundary on the pond outlet.

Sandy areas with few surface channels make delineation of watershed boundaries problematic, because most water movement is subterranean, and follows groundwater divides. It's possible, for instance, that rain falling on the ballfields southwest of the pond never reaches it, but instead infiltrates to groundwater seeping southwesterly from the pond toward Mill Brook. It may be that the pond drains southeasterly through the outfalls when the water is high, but southwesterly through the aquifer when it falls below their level.

Considerations like these suggest that the actual area of land contributing water to Buckmaster may vary over time, and may not include highly permeable soils east and west of the pond. My guess is that the pond's actual watershed is considerably smaller than the 407-acre area inside the mapped boundary and may be 300 acres or less. The authors of the 1890 state Board of Health survey found that Buckmaster's watershed was 250 acres, less than seven times the size of the pond's current extent.

Those authors also stated that Buckmaster's watershed "is mainly wood and pasture land, and contains a small population." This is no longer the case, as Fig. 8 demonstrates. There is no pasture remaining, and most of the woods have given way to suburban development. If Buckmaster's watershed is estimated at 300 acres, it contains at most about 100 undeveloped



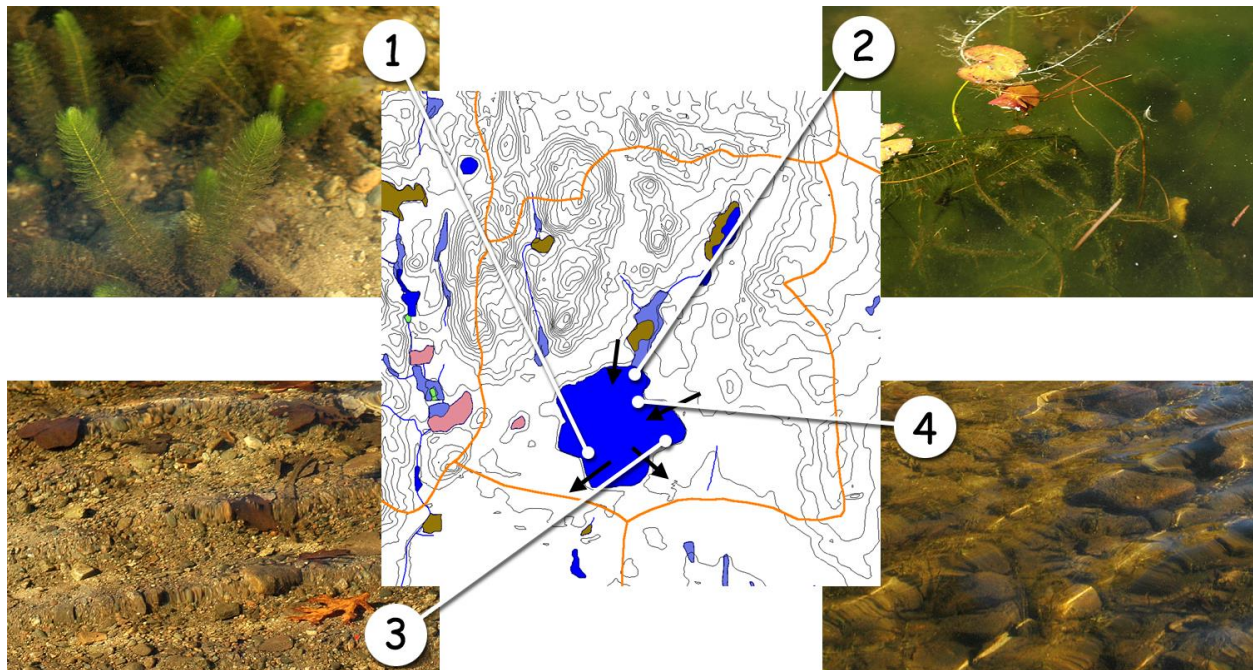
**Figure 8: Watershed associated with Buckmaster Pond. MassGIS sub-basin 19226 overlaid on April 2005 orthophoto**

acres, all woods and wetlands. There are 12 acres of wetlands exclusive of the pond proper, and the largest parcel of woods, about 60 acres, is centered north across Route 109 on the rugged cluster of bedrock knolls known as Satan's Kingdom.

The developed portion of Buckmaster's watershed contains about 25 named streets and perhaps 200 individual structures, mostly single family homes. The percentage of the land that they cover is substantial. By shedding rain that would otherwise fall directly on soils and vegetation, impermeable surfaces like pavements and rooftops divert water and often discharge pollutants directly to streams and ponds via storm drains. These pollutants include oil and gas derived from car traffic, road sand, fertilizers spread on lawns and gardens, and ordinary atmospheric deposition. The typical result is degraded water quality in downstream wetlands and waterways, the degradation manifesting itself as siltation, turbidity, erosion, and increased algal growth, all of which are harmful to natural communities.

The porous sandy soils surrounding Buckmaster, however, substantially reduce surface runoff, and may capture some roadwash before it reaches the pond, if storm drains do not discharge directly to it (I noticed none along the shoreline). And since the aquifer is substantially deeper than the pond, it may be that some of the precipitation percolating to groundwater upslope of the pond actually passes underneath it rather than through it.

Sand is effective at capturing coarse sediments in runoff but is likely to transmit dissolved pollutants as easily as the water that contains them. Fig. 9 illustrates contrasting conditions in the shallows at four points along Buckmaster's shoreline on October 16, 2006.



**Figure 9: Shallows at four points along shoreline 10/16/06. 1. Sand with rooted milfoil, south end dike. 2. Milfoil and dense suspended algae, northeast corner. 3. Bare sand and gravel at waterside park. 4. Cobbles furred with algae, north end east side. Black arrows show inferred direction of groundwater movement. Sources: MassGIS wetlands, subbasins, and three-meter contours.**

Note the good water clarity and absence of algal growth on the pond's south side, where water is likely to be seeping out of the pond, versus the dense algae and more highly colored water on the north side near the dry brook inlet, where groundwater enters the pond.

Algal growth in ponds is typically limited by available nutrients, usually nitrates and phosphates. When these dissolved compounds increase, so does algae. Many suburban ponds receive more of these nutrients than is healthy for them, and turn a murky green in warm weather as algae proliferates in the water column. The algae blocks sunlight, discouraging plants from rooting on the bottom, and often clings in dense masses around floating plants, as in photo No. 2. When the algae dies and sinks, its decay consumes so much dissolved oxygen that little is left for fish and invertebrates. The result is a degraded ecosystem that cannot support the number and diversity of organisms it might otherwise sustain.

The photos in Fig. 9 suggest that this process of enrichment is occurring at Buckmaster, and is responsible for the relatively poor water quality at the pond's north and east sides, where most surface and groundwater inputs occur. Because the nutrients are captured in this area, fewer are available to support algal growth elsewhere in the pond, and water quality improves on the south and west shores.

The sources of the nutrients that promote algal growth are probably the densely developed neighborhoods north and east of the pond, where they are absorbed by runoff and groundwater and find their way downslope. Contributors could include fertilizers used on lawns and gardens, waste from



**Figure 10: Algal film on peaty sand near center of east shore 9/6/06**

pets and livestock, leaking sewers, and septic systems. Fortunately it appears that the pond is large enough to buffer their effects, and their negative esthetic and ecological impacts are currently limited. But there is a strict relationship between the amount of water in the pond and the amount of nutrients it can effectively absorb, and if the former were to decline or the latter were to increase, the pond would show the effects. Since the primary source of these nutrients is the pond's watershed, water quality in Buckmaster is directly dependent on how well stormwater is managed in upslope areas along High St., Lakeshore Drive, and Pond St.

## V. Habitats

Buckmaster Pond is home to a variety of animals and plants that are adapted to open water or shoreline environments and some of them—fish and mussels, for example—are exclusively aquatic. Buckmaster also provides resources for wildlife that are partly terrestrial but exploit the pond for important purposes; raccoons, for instance, forage along the shoreline, and dragonflies lay their eggs on emergent plants.

The interaction of these organisms with each other and the physical environment constitutes the ecology of the pond. All ecosystems are based on such interplay, but the actors vary widely in place and time. In a forest, for instance, trees perform most of the work of converting sunlight to stored energy, but trees are largely excluded from Buckmaster, and other plants do the manufacturing.

This report is a roster of the more conspicuous green plants at Buckmaster, which form groups of species associated with various conditions along an elevational gradient running from deep water to dry uplands. At the pond's lowest point they inhabit a submersed water column up to 20 feet high; on the dike's exposed gravels they are a thin mat at best. All of the animal life of the pond is ultimately dependent on them.

The photos included with the inventory illustrate how the plants are organized into vegetation, and show which species are most prominent, but for descriptive purposes it will be useful to note some of the typical associations, and the habitats where they occur. These habitats are: deep water, shallow water, intermittently flooded shoreline, and seldom flooded shoreline.

### 1. Deep water, or sublittoral zone (more than 6 feet below high water mark)

This is the probably the largest habitat at Buckmaster, and includes all portions of the pond six or more feet deep in March and April, perhaps 20 acres in all. I sampled it by canoe on October 16, 2006, taking specimens with a rake along its margins and noting whatever was visible in deeper areas.

**Figure 11: Macroalga *Chara* sp. collected at 9 feet 10/16/06**



Microscopic algal plankton immersed in the water column are an important component of this habitat's flora, but were not part of the sampling regimen.

The greatest depth at which I observed plant growth was 9.5 feet (or 12 feet below the high water mark) near the middle of the pond, where rooted clumps of milfoil (*Myriophyllum heterophyllum*) rose several feet above the invisible bottom. Areas deeper than this may indeed be vegetated but were not sampled. In general, plants will grow as deep as light permits; the macroalga *Nitella*, for instance, which is present at Buckmaster, has been observed at 42 feet in Walden Pond.<sup>2</sup> Another deepwater macroalga, *Chara* (Fig. 11), was collected 9 feet below the surface in Buckmaster.

These plants typically form loose mats of prostrate stems up to several inches high on pond bottoms too dim for rooted plants, where they provide cover for fish and food for waterfowl. There are probably areas of Buckmaster where *Chara* and *Nitella* grow deeper than milfoil, and these may

<sup>2</sup> Colman, John A., and Friesz, Paul J. , *Geohydrology and Limnology of Walden Pond, Concord, Massachusetts*, US Geological Survey Water-Resources Investigations Report 01-4137 (Northborough, MA, 2001) p. 37.

include much of the pond bottom.

Rooted aquatic plants dominated the shallower portions of the sublittoral zone from six to twelve feet below the high water mark. These are perennial herbs with stems and leaves that do not necessarily die back in winter because immersion protects them from freezing. The larger species are erect, buoyed by internal gases. Most do not flower unless they reach the surface, although many are capable of reproducing vegetatively via compact leafy buds called turions, which break free and are dispersed by wave action.

Extensive meadows of these plants cover much of Buckmaster's firm bottom. The most typical association was a dense mat to several inches thick of free-flowered waterweed (*Elodea nuttallii*) partially shaded by many tall, bushy plumes of variable water milfoil (*Myriophyllum heterophyllum*). The milfoil plumes, although up to six feet high, topped out a foot or more below the surface and were usually well separated. In places the milfoil gave way to similarly open beds of grassleaf pondweed (*Potamogeton oakesianus*), also tall and erect but considerably less full, with dense tufts of short grasslike leaves dispersed along the stems.



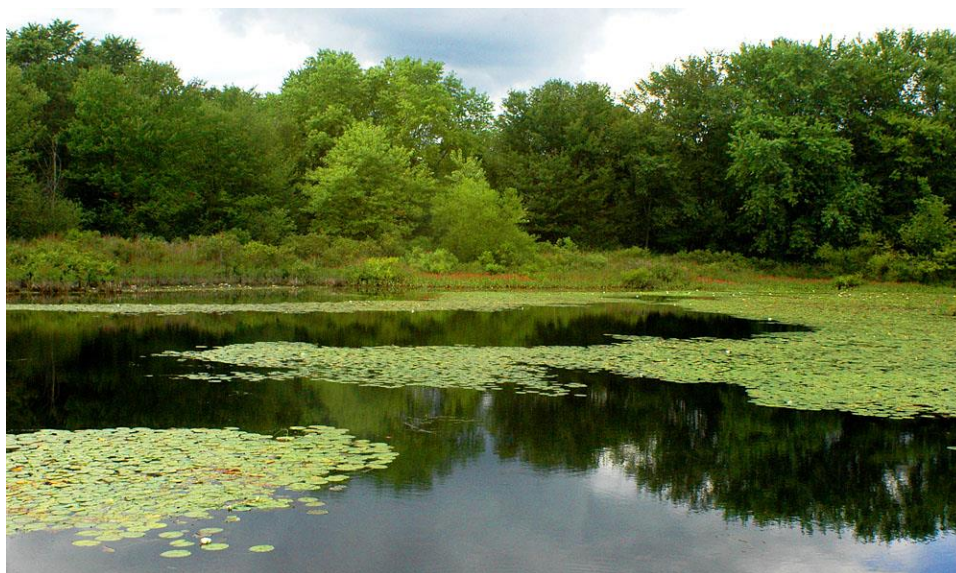
**Figure 12: Free-flowered waterweed (*Elodea nuttallii*) sampled 4.5 ft below high water mark, southeast shore 9/27/06**

These three species dominated shallower portions of the sublittoral zone (6-12 ft below the high water mark), and in fact the only other non-algal plants documented in these areas were four species more common at lesser depths. But the presence of only a few types growing densely over large areas is not indicative, as it might be on land, of recent disturbance. Deep water is a difficult environment for rooted plants, and local ponds that are vegetated below the shallows tend to be dominated by a few abundant species.

## 2. Permanently flooded littoral zone (3 to 6 feet below high water mark)

One reason it is difficult to walk Buckmaster's entire shoreline at any time of year is that vegetation in the littoral zone varies with substrate as well as depth. Along much of the north shore, for instance, thickets of buttonbush rooted in peaty sand extend well out into the shallows, and emerge fully only in late summer, if at all.

**Figure 13: Lily beds in northwest shallows, 9/6/06**



The coarse gravels of the south bank and the dike, in contrast, are bare of woody vegetation below the high water mark, and are easily passable at low water.

These differences extend into the shallows 3 to 6 feet below the high water mark, which are flooded year-round in most years. In quiet areas with an inch or more of soft peat over the bottom, large colonies of floating-leaved perennials, primarily water lilies and spatterdock, cover fifty percent or more of the water surface by late summer, and exclude most other plants. These beds dominate the shallow northern third of the pond, and a large lilies-only patch has occupied part of the eastern cove as well. In contrast, where the peat thins out the lilies are less successful, and plants with mostly submersed leaves take over, including the widely distributed milfoil and *Elodea* but also a few shallow-water specialists like pickerelweed (*Pontederia cordata*), floating bladderwort (*Utricularia radiata*), and snailseed and ribbonleaf pondweed (*Potamogeton diversifolius* and *P. epihydrus*).

This is not to say that all of the permanently flooded littoral zone is vegetated—large areas of coarse gravel along the dike and the south shore are conspicuously bare, as are some cobble beds along the east shore (although these are furred with algae); a combination of wave action and inhospitable substrates may be responsible.



**Figure 14: White water lily (*Nymphaea odorata*)  
9/6/06**

Based on the density of growth, it's likely that these shallow beds are the most productive habitat in the pond. The lilies, in particular, flower profusely and attract many beetles and flies, while their leaves roof over a dim tangle of spongy stems where the slow work of decay supports another suite of invertebrates, which in turn provide food for fish and turtles.

### 3. Intermittently flooded littoral zone (0 to 3 feet below high water mark)

Underwater in late spring and gradually exposed as the pond drops over the course of the spring and summer, these areas present a real challenge for plants and support the most distinctive species at Buckmaster. Strictly aquatic plants are excluded because they would dry up in summer; similarly, most woody plants can't tolerate the prolonged immersion required earlier in the year.

Compounding these difficulties is the scarcity of fine organic matter along large stretches of Buckmaster's shoreline, a typical characteristic of kettle ponds, which are usually fed by groundwater and don't collect much fine material from incoming streams. In addition, Buckmaster is large enough to generate waves that wash silts and wrack off the shore and into deeper water, retarding soil formation.

Two woody plants have nonetheless managed to colonize large portions of Buckmaster's upper or intermittently flooded littoral zone: buttonbush (*Cephalanthus occidentalis*) and purple loosestrife (*Lythrum salicaria*). One or both of these is present nearly everywhere along Buckmaster's shoreline, where they form fringing thickets of various widths depending on the slope and composition of the bank. Neither species, however, seems capable of exploiting the

entire vertical breadth of the zone, and both tend to thin out or vanish in its lower half, more than eighteen inches below the high water mark, particularly in areas with coarse mineral substrates. The only exception to this rule occurs in the ponds quiet northwest corner, which is sheltered from the prevailing southwesterly winds and where the pond-bottom peats are thickest—here the



**Figure 15: Shrubby buttonbush (*Cephalanthus*, rear) and wilting spatterdock (*Nuphar*, foreground) with scattered stems red-orange loosestrife (*Lythrum*), 10/16/06. Water 30" below high water mark.**

buttonbush forms a dense shrub layer five feet high reaching 200 feet into the pond, the outermost individuals growing up to 2 ½ feet below the high water mark before giving way to dense beds of spatterdock, a floating-leaved plant. As the pond drops and the shrubs' knobby root-crowns are exposed, they display tattered skirts of aquatic mosses and a few hardy clumps of

loosestrife attached here and there.

But along most of the pond both the buttonbush and the loosestrife are limited to the upper portion of the littoral zone, and the interval that is exposed in late summer and fall is bare or dominated by perennial herbs. Amongst these, the showiest is water smartweed (*Polygonum amphibium*), a leggy, patch-forming native with large lanceolate leaves and long, deep-pink flower spikes that blooms while still inundated in August but is often exposed later (Fig. 16). Like the loosestrife and buttonbush, it prefers a peaty substrate and is most conspicuous along the north shore, where several large colonies paint a bright stripe above the waterline in early September, after the similarly-colored loosestrife has faded (Fig. 13).

Where the shore is more gravelly, vegetation along its lowest portions is limited to a suite of low herbs that are submersed for most of the summer but become more noticeable in August and September, when they are exposed and flower. This group is most fully developed

**Figure 16: Water Smartweed (*Polygonum amphibium*), 9/6/06**



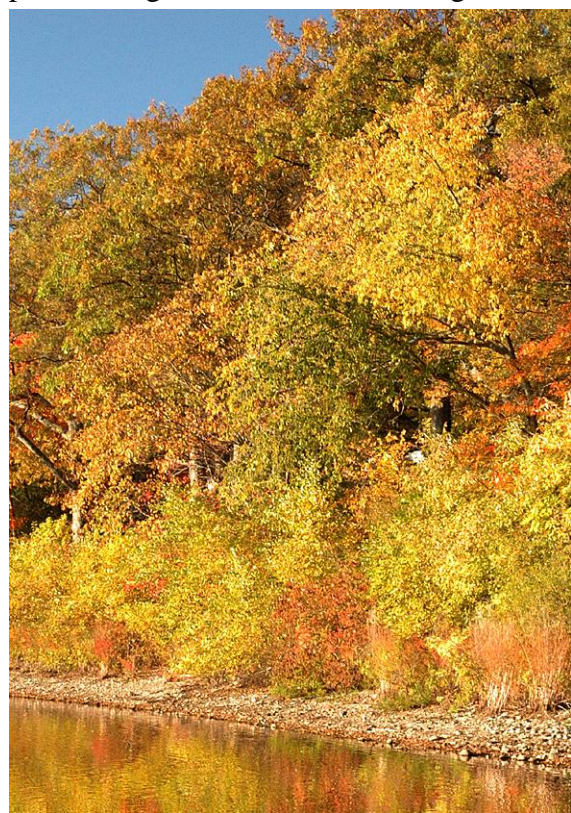
along the southern end of the east shore, and includes pipewort (*Eriocaulon aquaticum*), pondshore rush (*Juncus pelocarpus*), golden hedge-hyssop (*Gratiola aurea*), and pink tickseed (*Coreopsis rosea*) [Fig. 17]. Most spread via underground stems, or rhizomes, and the yellow-flowered hedge-hyssop produces two types of leaves: narrow spike-like ones when submersed and fuller, more conventionally shaped ones after the water recedes. In wet summers the pond may stay high and never expose these plants, but they are adapted to survive long-term inundation and will resprout in subsequent years.



**Figure 17: Herbaceous cover on gravelly east shore about two feet below high water mark 9/6/06**

Even these low herbs are lacking along most of the dike and south shore, where light-colored sands and gravels just above the water's edge give Buckmaster an attractive beachy rim in late summer and fall.

Upslope of the buttonbush/loosestrife fringe, near the the high water mark, most of the pond is ringed with trees, some large, that belong to wetland species adapted to withstand

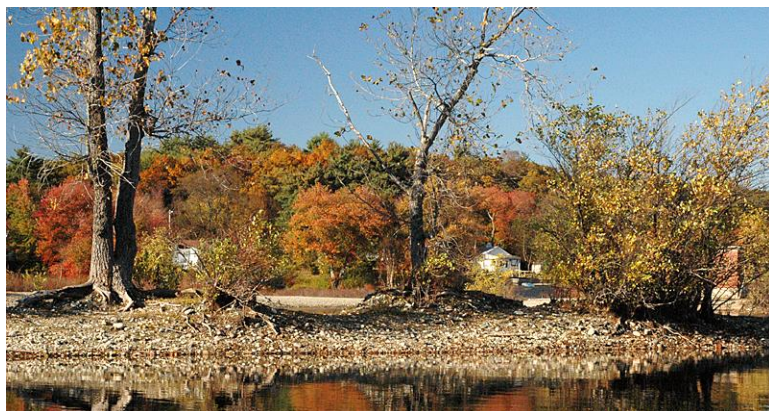


**Figure 18: East shore with loosestrife fringe backed by elm and river birch sprouts with oaks at rear, 10/16/06**

springtime flooding as well as erosion by waves and ice: cottonwood (*Populus deltoides*), river birch (*Betula nigra*), black willow (*Salix nigra*), elm (*Ulmus americana*), silver maple (*Acer saccharinum*), and red maple (*Acer rubrum*). Thanks to the abundant light at the water's edge, these trees typically rise out of a dense, shrubby understory including glossy buckthorn (*Rhamnus frangula*), alder (*Alnus* sp.), silky dogwood (*Cornus amomum*), pepperbush (*Clethra alnifolia*), gray birch (*Betula populifolia*), arrowwood (*Viburnum recognitum*), meadowsweet (*Spirea alba*), and highbush blueberry (*Vaccinium corymbosum*).

But this typical sequence, running upslope from low herbs near the late-summer shoreline through a shrubby fringe to a wooded border at the highwater mark is frequently varied by local conditions. Where the lower shore has little slope, for instance, and continues damp and soft into the shade of the trees--as in the northeast corner and the west side of the gravel pit--swampy thickets occur that support plants not found elsewhere: boneset (*Eupatorium perfoliatum*), cranberry (*Vaccinium macrocarpon*), swamp milkweed

(*Asclepias incarnatum*), narrow-leaved loosestrife (*Lysimachia hybrida*), royal fern (*Osmunda regalis*), and others. Similarly, where the shore is particularly steep and exposed, as along much of the dike and the trampled area below the parking lot, ongoing erosion prevents any plant life from taking hold except near the high water mark, where scattered trees and shrubs cling tenaciously to whatever soil remains (Fig. 19).



**Figure 19: Cottonwoods (left) and alder (right) atop eroding south end dike 10/16/06**

vegetation has been entirely eliminated from about 75 ft of pondshore via placement of beach sand (Fig. 20).



**Figure 20: Cleared shoreline at 1194 High St. 10/16/06**

regular alternation of high water in spring with low water in fall, but few can withstand repeated cutting or filling.

#### 4. Seldom-flooded shoreline (0 to 3 feet above high water mark)

Buckmaster is encircled by a thin but nearly continuous fringe of upland woods. This fringe increases the pond's habitat value by providing cover and food for wildlife, primarily birds and mammals. It also moderates water temperatures in the shallows via shading, and

In other areas abutting homeowners regularly clear the shoreline down to the water's edge, eliminating woody growth and making room for aggressive wetland herbs like small-headed aster (*Aster racemosus*), beggarticks (*Bidens frondosa*), and water purslane (*Ludwigia palustris*). Ten of the twenty-six homeowners with lots abutting the pond have recently cut vegetation at or near the water's edge.<sup>3</sup> At one lot on High St (no. 1194)

In sum, the intermittently flooded littoral zone (0 to 3 ft below high water mark), supports the greatest variety and diversity of plant life at Buckmaster, and likewise is subject to the greatest degree of human and natural disturbance, much of the latter deriving from the pond's annual fluctuation. Most or all of the trees, shrubs, and herbs are adapted to and even dependent on the

<sup>3</sup> The lots where recent clearing has occurred along the shoreline are seven contiguous ones on High St. to the north (nos. 1168, 1174, 1180, 1188, 1194, 1208, and 1219) and three of twelve on Lakeshore Drive to the east (nos. 111, 121, and an unnumbered lot sharing 121's south boundary). No clearing was evident on any of the shoreline house lots on Westland Avenue (nos. 34, 40, 46, and 52). Lot numbers are from Westwood Assessor's Map No. 28, revised September, 2006.

affects water chemistry and benthic habitat by dropping countless dead leaves in autumn, many of which fall into the pond and decay slowly, adding to its organic substrates. Where soils are intact under the trees, they filter runoff and protect the banks from erosion.

The wooded fringe is dominated by mature native forest trees that appear to have seeded naturally, and include oaks, white and pitch pines, and black cherry. A particularly fine group of oaks and pines occurs on an elevated knoll at the north end of the east shore,



**Figure 21: Cobble-fringed knoll, north side east bank, 10/16/06**

including portions of 111, 117, and 121 Lakeshore Drive (Figure 21). The fringe also expands significantly into a two-acre woodland on the east end of the north shore at 1142, 1148, 1154, and 1160 High St., where the houses and lawns are at the street edge

but the undeveloped back portions of the lots extend as much as 300 feet to the pond. Another two-acre woodland, this one much younger and scrubbier, occurs on an undeveloped lot fronting High St. at the pond's northwest corner, and is crossed by a gravel road leading from the street to the dike and the pumphouse. The south end of this mosaic of thickets and small openings is recent fill associated with the gravel pit, and is mostly too dry and sterile to support trees (Figure 22). The sunny, well-drained fill provides excellent nesting habitat for aquatic turtles, and a snapper hatchling was found here on September 9.



**Figure 22: Gravel road approaching north end dike, 9/6/06**

The uncut upland fringe is generally much thinner at the pond's south end along Pond St., where it adjoins about four acres of close-cut grass including the ballfields at the Sheehan School on the west and the waterside park occupying the former site of the pumping station on the east.

Although these fields are used for

feeding and resting by Canada geese, their uniformity, lack of cover, and intensive maintenance limit their value as habitat.

Like many kettle ponds, Buckmaster has few adjacent wetlands above the high water mark. The exception is a maple-fringed shrub swamp of about two acres associated with the intermittent stream that enters the northeast corner between High St. and Lakeshore Drive. The stream loses its channel in this elongate, peaty depression, which is separated from the pond by about 100 feet, and is too wet to support trees. It makes a significant contribution to the diversity of habitats associated with Buckmaster, and probably absorbs runoff-generated sediments that

would otherwise flow into the pond. As with the wooded areas above the high water mark, I did not attempt to identify all the plants it supports, which probably include a number of species not present along the shoreline. Shrub swamps adjacent to major roads are highly vulnerable to invasion by reed grass (*Phragmites australis*), and its absence in this wetland suggests a comparative lack of disturbance, and is a quality worth preserving.

In sum, the many habitats at Buckmaster owe their diversity to the pond itself because the vegetation they support is adapted to and largely determined by specific hydric conditions ranging from deep water to dry upland. The pond has preserved and maintained these habitats by occupying a 35-acre space that would long since have been chopped up into house lots if not for the changing volume of water that fills it. Over the last several centuries, as the nearby landscape has evolved from woodland to cut-over pasture to streets, lawns, and homes, Buckmaster has changed less and retained more, in terms of conditions supporting a particular community of animals and plants, than surrounding areas.

This is not to say that the pond doesn't reflect a wider world, which intrudes in a thousand ways, from the tangles of monofilament caught in the trees to the springtime flush of de-icers entering via groundwater. The pond's recent ecological history, in fact, consists of a series of shocks delivered to a refractory subject. Did the culverting of its outlet, for instance, cut it off from fish populations downstream? Did the introduction of its now-dominant bottom plant, variable water milfoil, crowd out one or more native aquatics? Change is a constant of most habitats, but not all changes are the same; some represent phases in larger cycles of recurrence, while others are practically irreversible—if Buckmaster were filled and paved over, for instance, which would be easy enough given enough trucks and sand, no natural event short of another glacier would restore it.

Perhaps the one forecast that can be made with some confidence is that Buckmaster's habitats, which are made by the water, will go the way of the water. So long as, for instance, there are ten acres of bottom covered by three to six feet of water of a certain clarity, there will almost surely be a suite of submersed aquatic herbs living on that bottom. But if the water is withdrawn, or becomes too green and murky to transmit light, then none of the plants will remain, because the conditions they exploit will no longer exist, and the effects of their disappearance will propagate through the community. In this sense "habitat loss" is something of a misnomer; nearly any landscape will support some type of habitat, and the phrase usually refers to alterations that substitute widespread and generic habitats—like residential subdivisions, for instance—for less disturbed and more natural areas. As the latter disappear, so do the communities of animals and plants dependent on them, and their loss deprives the landscape of the qualities that once made it biotically distinct and diverse. This is the risk that attends further disturbance at Buckmaster—that its habitats will no longer be capable of supporting the variety of animals and plants that they do today.

## VI. Notes on Biota

### 1. Mollusks

Buckmaster supports conspicuous populations of freshwater mussels and a large aquatic snail. Their empty shells can be picked up in many places along the shoreline, and live adults are sometimes visible in the shallows.

The snail is an exotic from east Asia, the Chinese mystery snail (*Cipangopaludina chinensis*). A livebearer, it was first recorded in Massachusetts in 1914, and is "established in scattered localities throughout eastern, central, and west central MA and is typically found in disturbed or artificially created lentic environments in urban areas" (Smith, 1995). Pond snails



**Figure 23: Chinese Mystery Snail, *Cipangopaludina chinensis***

feed by scraping algae from hard surfaces with their rasp-like tongues, and Buckmaster's gravel bottoms provides many such surfaces. It may be that flocks of grazing snails prevent algae from obscuring some of Buckmaster's stony shallows. It's likely that fish, birds, and turtles prey on the snails, thereby incorporating them in the pond's food chain.

Every local habitat supports exotics of this sort, and their impact on native species is often difficult to discern. Did these snails displace other types that occupied a similar niche? Would removing them allow the natives to recover? What would it take to eliminate them? Questions like these have given rise to a new discipline called restoration ecology, which concerns itself with the destructive impacts to biodiversity that introduced species can generate.

At least two freshwater mussels also inhabit Buckmaster, the eastern elliptio (*Elliptio complanata*) and the eastern floater (*Pyganodon cataracta*). Like saltwater clams, they lodge themselves head-down in the bottom and feed by filtering small organisms and other organic matter out of the ambient water. They are eaten by raccoons and the cleaned shells occurring along the shoreline may result from such meals. The elliptio occurs in many ponds and streams in the Neponset watershed; the floater is reportedly widespread also. The large populations of these native mussels at Buckmaster may play an important role in maintaining water clarity.

**Figure 24: Eastern Floater, *Pyganodon cataracta***



## 2. Fish

People were fishing from shore on all three dates I visited the pond. On Sept. 27, with help from Paul Lauenstein, I seined the gravel bottom to depth of about 3 feet on the south and east shores.



**Fig. 25: Banded Killfish (*Fundulus diaphanus*) in seine 9/27/06**

Juvenile bluegills (*Lepomis macrochirus*) and adult banded killifish (*Fundulus diaphanus*) dominated the seine hauls. The killifish could be seen schooling over open shallows; the bluegills also seemed to form age-specific groups but hung back near vegetated areas and moved less. Adult bluegills easily avoided the net.

Both species are likely prey for largemouth bass (*Micropterus salmoides*), whose dish-like nests are frequent at

Buckmaster, and for chain pickerel (*Esox niger*), an adult of which was found dead on the east shore on Sept. 27. An angler told me that the state stocks the pond once a year with trout in the spring. In August, 2005, Greg and Harry Mertz observed brown trout (*Salmo trutta*) and yellow perch (*Perca flavescens*) at the pond (Mertz, 2005). Because brown trout require substantial tributary streams for spawning, it is unlikely that they are reproducing naturally at Buckmaster.

All six fish species observed are frequent inhabitants of local fresh waters, but the killifish is somewhat less so, and has not previously been documented in the Neponset watershed (Hartel, 2002). Like its close salt water relative the mummichaug (*Fundulus heteroclitis*), its sides are vertically banded in black, but it is a bit narrower and sleeker.

## 3. Herps

A total of six species of reptiles and amphibians were observed at Buckmaster, including three turtles, two frogs, and a snake. All are common pond-



**Fig. 26: Snapping turtle (*Chelydra serpentina*) hatchling 9/6/06**

dwellers with the exception of the pickerel frog (*Rana palustris*), adults of which require moist grassy or shrubby thickets for foraging, and hence don't occur along manicured shorelines; at Buckmaster they exploit the less-developed east bank. Painted turtles (*Chrysemys picta*) are abundant, as is typical of ponds with extensive submerged vegetation; on September 6 at least a dozen adults and juveniles were sunning on exposed buttonbush root crowns near open water on the pond's north side. On that day a newly hatched snapping turtle (*Chelydra serpentina*) was found on the open gravel at the north end of the dike, still bearing the milky white egg tooth it used to open its shell.

#### 4. Uncommon Native Plants

##### A. Pink Tickseed (*Coreopsis rosea*)



**Fig. 27: Pink Tickseed (*Coreopsis rosea*)**  
9/6/06

This pretty native wildflower, the ancestor of the pink coreopsis popular with gardeners, is a rare plant in the Neponset watershed due in part to its highly specific habitat requirements; it is found only in kettle ponds with sandy shorelines that are flooded in winter and bared in summer. The winter flooding prevents competing woody plants from establishing themselves, and the summer dry-out excludes strictly aquatic plants and provides an opportunity for it to sprout and flower.

Pink tickseed occurs on the eastern US coastal plain in several states from Georgia to Massachusetts, but is scarce in many places, and is listed "Rare" in New York and "Special Concern" in Rhode Island. Although locally common in Plymouth County and Cape Cod, it does not appear in Deane's 1896 *Flora of the Blue Hills* or in Blake's 1959 *Flora of Stoughton*. I have not recorded it elsewhere in Norfolk County.

A patch-forming knee-high herb with narrow opposite leaves and pink daisy-like flowers with yellow centers, tickseed is abundant on the south end of Buckmaster's east shore, as well as on the south end of the dike and the west bank of the gravel pit. All of these areas are fringed near the high water mark with tall thickets of purple loosestrife; the tickseed occurs on the bare sand and gravels immediately downslope.

In 2006 most plants remained low and did not flower, presumably because water levels remained high well into the summer and retarded their growth. The only plants that blossomed occupied the highest and driest parts of the habitat, where they competed with the taller and more vigorous loosestrife.

Hydrologically controlled year-to-year variation in flowering and fruiting is typical of many native herbs adapted to coastal plain pondshores. Such plants typically remain small and inconspicuous for several wet years in a row, then flower profusely in a dry year. Wet years are important for these plants because they prevent competing

species that are less tolerant of flooding from invading the habitat. The many seeds produced in occasional dry years are sufficient to maintain populations.

Pink tickseed has thrived at Buckmaster despite its long history of use and development, including water level fluctuations associated with a municipal water supply. Another rare pondshore wildflower, Plymouth Gentian (*Sabatia kennedyana*), has adapted to and perhaps benefits from summer drawdowns at Weymouth Great Pond, which is Weymouth's primary water source. But neither plant occurs widely in the Neponset watershed; both are absent, for instance, from Houghton's Pond, Ponkapoag Pond, and Willett Pond.

Late summer foot traffic, which could damage pink tickseed, is light in most places at Buckmaster. The pond's large population occupies several hundred feet of shoreline. It is a natural feature of regional significance, and indicative of Buckmaster's value as habitat.

### B. Water Smartweed (*Polygonum amphibium*)



**Fig. 28: Water Smartweed (*Polygonum amphibium*) in foreground, 10/16/06**

Another uncommon native perennial herb that flourishes at Buckmaster is water smartweed, the showiest of several aquatic smartweeds that occur locally. It prefers shallow peat 3 to 6 feet below the high water mark, and often flowers while still partly submerged. A colonial plant, it spreads via freely branching rhizomes. In August and September the decumbent stems produce long erect terminal spikes of deep pink flowers (Fig. 16) that produce glossy lenticular seeds relished by waterfowl.

Water smartweed is not as particular in its habitat preferences as tickseed—I have also seen it on the bank of the Neponset in Fowl Meadow, and in a sphagnum-floored vernal pool high up in the Blue Hills—but is similarly scarce. At Buckmaster it forms dense thickets along much of the north shore, and grows further into the water than any other emergent plant. Like the tickseed, it appears to mark Buckmaster as a pond that has retained important elements of

a distinctive original flora, elements that are now absent from most local water bodies.

### C. River Birch (*Betula nigra*)

At many points along Buckmaster's shore, the tree that grows closest to the water's edge is a tall, often multi-trunked birch with peeling bark that is thin and salmon-colored on saplings but dark and rough on older trees. This is river birch, a Massachusetts native that is scarce in the wild but widely planted as an ornamental. Like cottonwood and silver maple, it prefers riverbanks, shorelines, and floodplains, and seldom if



**Fig. 29: River Birch (*Betula nigra*) 9/6/06**

ever occurs naturally in uplands.

Although common in much of the eastern and southern US, river birch is at the northern edge of its range in Massachusetts, and is on the state's "Watch List" maintained by the Division of Fisheries and Wildlife's Natural Heritage Program. Until recently wild populations had been documented only in Middlesex and Essex counties (Sorrie and Somers, 1999), although it is common on the banks of the Neponset along the five-mile stretch from Paul's Bridge in Readville to tidewater at Baker Dam in Dorchester.

There are dozens of river birches along Buckmaster's wooded shorelines, all growing in sands and gravels up to about eighteen inches below the high water mark. Reproduction occurs frequently, although seedlings are exposed to damage from waves and ice, and few survive more than a year or two. Because river birch occurs almost exclusively within the channel of larger streams elsewhere in Massachusetts, its presence at Buckmaster is a bit of a mystery. If the population originated with plantings performed long ago, it is now fully acclimated and self-sustaining. It may be that the pond's coarse gravel shores are particularly suited to a tree adapted to colonize similar substrates formed and deposited by fast-flowing water.

## 5. Invasive Plants

### A. Purple Loosestrife (*Lythum salicaria*)

This notorious thicket-forming perennial herb, native to Eurasia, was first noticed in New England in the 1830's and is now ubiquitous in wetlands of nearly every kind in our area. Although its tall, showy spikes of magenta flowers once made it popular with gardeners, nurseries are now prohibited from selling it in Massachusetts.

It occurs almost continuously along the high water mark at Buckmaster, and its clumps of tufted stems become dense and shrubby in many spots, forming a sort of palisade at the water's edge. Although it thins out in deeply shaded areas on the south and east shores, and occupies only a narrow interval on the steeper banks, it may be the most widespread plant at the pond. The largest thicket occurs on the sand flat on the north end of the east shore, where the clumps are spaced several feet apart, typically with little growing in between.

Purple loosestrife is now so abundant in local wetlands that it isn't easy to visualize the native vegetation it has displaced. It forms vast meadows in the marshy floodplains of the Charles and the Neponset, and colors them brightly in early August. Organizations like the Nature Conservancy have learned that it is possible to reduce or eliminate it from small areas via cutting and herbicides, but that the effort is costly and laborious. Better results on a landscape scale are hoped for from introduction of beetles from the genus *Galerucella*, which feed exclusively on the plant in



**Fig. 30: Annual Loosestrife (*Lythrum hyssopifolium*) 9/6/06**

its native range. Large numbers of these beetles have been released in several sites in the Neponset and Charles watersheds, and evidence of reproduction has been observed. It may be that some of them will make their way to Buckmaster.

Curiously, the pond also supports a close relative of purple loosestrife, *Lythrum hyssopifolium* or annual loosestrife, a much smaller plant no more than six inches high that is abundant on the sterile gravels of the north end of the dike just below the high water mark, and is very conspicuous in fall, when its stems, leaves, and fruits flush bright red. I haven't seen it anywhere but here, although it was noticed in the Blue Hills a century ago (Deane, 1896). Like its larger relative, annual loosestrife is also found in temperate Eurasia, and authorities differ on whether it is native to North America, some saying yea (Gleason and Cronquist, 1993) and some nay (Sorrie and Somers, 1999; USDA, 2007). In Massachusetts it has also been documented from Middlesex, Essex, Suffolk, Plymouth, and Barnstable counties. It is another indicator that Buckmaster, despite its robust suite of common plants, possesses a number of distinct features.

#### B. Variable-leaved Water Milfoil (*Myriophyllum heterophyllum*)

This feathery, plume-like, rooted aquatic plant can now be found in nearly every pond in the Neponset watershed. In some it completely fills the water column and attaches itself to any swimmer, wader, or hook and line attempting to pass through it.

At Buckmaster it grows on hard bottoms throughout the pond from 4 to 12 feet below the high water mark and forms clumps of long, feathery erect stems bearing evenly-spaced whorls of pinnatisect leaves. In 2006 these stems rarely reached the surface and hence did not flower and



**Fig. 31: Variable-leaved Water Milfoil (*Myriophyllum heterophyllum* 9/6/06**

fruit. But milfoil does not depend on seeds for dispersal; any piece of the plant that breaks off and floats free can continue growing, and perhaps take root in a new location. This species is the most conspicuous and abundant submersed plant at Buckmaster, and formed the bulk of the wrack lines washed up here and there on the shore.

Native to ponds and slow streams in New York and southward, variable-leaved water

milfoil is evidently a recent arrival in Massachusetts and was not recorded locally by Deane (1896) or Blake (1963). It is classed as invasive because of its ability to colonize and dominate aquatic plant communities. Its spread may have been facilitated by aquarists and recreational boaters who deliberately or inadvertently moved it from pond to pond. It can be particularly troublesome at swimming beaches and boat launching areas, where eradication via herbicides, mechanical removal, and plastic sheeting staked over the bottom have had some success in New Hampshire and elsewhere. However, no such techniques have eliminated it from any large water body where it has become established.

As with purple loosestrife, there is little prospect that water milfoil can be removed from Buckmaster by any practical means. On the other hand, it doesn't appear to pose a management

problem, because it is mostly absent from the shallows and rarely fills the water column, in contrast to its behavior in ponds with less depth. Native or not, it provides shelter and foraging habitat for nearly all of Buckmaster's fish and invertebrates. It's easily possible that there is not a single sizable body of fresh open water within twenty miles of Buckmaster that doesn't grow plenty of milfoil and loosestrife, but I know of none that doesn't sustain less common species as well, and it's hard to say what exactly their impact has been.

## VII. Recommendations

This report is a snapshot of existing natural resources at Buckmaster Pond. These resources in water, habitats, and biota add value to the immediate area and the watershed in general, not least because of the enjoyment they afford to people who live near the pond or visit it. Most come to fish or stroll around the edges, and the gravelly beach on the east side of the south shore and the semi-open area around the dike's north end are rarely empty. On the three days I visited in good weather I did not see swimmers or boaters, although a handful of canoes and dinghys were beached on some of the house lots on the north and east shores.

The typical plagues of suburban ponds—mobs of geese, soupy green water, and drifts of exposed mud—are absent at Buckmaster thanks to the quality of the water entering it and the quantity which passes through. The inflow is not so burdened with nutrients or other pollutants that it has visibly degraded the pond's rich animal and plant communities. Much of this inflow arrives as groundwater scrubbed of suspended sediments by its passage through the aquifer to the north and east. The surest way to keep Buckmaster clear and free of algal blooms, fish kills, and peaty buildups is to protect the water entering it, which means protecting the watershed.

With this in mind, here are a few steps that can be taken to help insure that Buckmaster remains the rich natural resource that it is today:

### Learn the watershed

Locate the area that contributes water to Buckmaster and determine how the water reaches the pond and what happens to it on the way. How much, for instance, is collected from paved areas by storm drains, and where does it go? Is the entire watershed tightly sewered, or is the groundwater enriched by leaks or septic systems? What about the pond itself—does it meet swimmable standards for bacteria in dry and wet weather? What about the streams entering it? How much land remains to be developed, and how dense can that development be? How many homeowners have cleared their lots to the water's edge, and has such clearing exposed the pond to untreated runoff and pollution by geese? How fast are the dike and the beach eroding, and is such erosion damaging the pond?

### Share information

Use the Buckmaster Pond Association to publicize and distribute facts about the pond. Call a meeting of abutters to discuss how protecting the shoreline can protect the water. Start a website about the pond and stock it with all the information you have gathered. Alert town officials with responsibility for development in the watershed to the importance of the pond and

the need to minimize pollution inputs. Visit the pond on a nice day with a crew from local cable and make a show featuring whatever activities are taking place.

#### Take action

Go to any local hearings concerning development affecting the pond and insist that wetlands be protected and that stormwater be treated to the highest standards. Develop guidelines for use of the shoreline and ask abutters to respect them.

## VIII. Appendices

### 1. Species List

The following list includes all the animals and plants I observed and identified in three visits to Buckmaster Pond in 2006, as well as additional species from the list provided by Greg Mertz (Mertz, 2005). The list includes 28 vertebrates, 8 invertebrates, and 76 plants. The predominance of plants and vertebrates derives from the project scope and the writer's focus, and does not indicate, for instance, that beetles and crustaceans are uncommonly scarce. Botanical nomenclature follows Gleason & Cronquist, 1991.

### 2. Photos

Accompanying this report is a CD containing 149 photos taken by the author on Sept. 9, Sept. 27, and October 16, 2006, as well as 14 photos taken by Paul Lauenstein on Sept. 27, 2006. The CD also includes the maps, aerials, and other files used to produce this report, as well as the report itself, which is a Word 2000 file.

### Appendix 1. Species List

Type	Common Name	Family	Species
Birds	Belted Kingfisher	Alcedinidae	<i>Ceryle alcyon</i>
	Mallard	Anatidae	<i>Anas platyrhynchos</i>
	Canada Goose	Anatidae	<i>Branta Canadensis</i>
	Mute Swan	Anatidae	<i>Cygnus olor</i>
	Great Blue Heron	Ardeidae	<i>Ardea herodias</i>
	Green Heron	Ardeidae	<i>Butorides virescens</i>
	Turkey Vulture	Cathartidae	<i>Cathartes aura</i>
	Mourning Dove	Columbidae	<i>Zenaida macroura</i>
	Crow	Corvidae	<i>Corvus brachyrhynchos</i>
	Common Grackle	Icteridae	<i>Quiscalus quiscula</i>
	Ring-billed Gull	Laridae	<i>Larus delawarensis</i>
	Osprey	Pandionidae	<i>Pandion haliaetus</i>
	Fish	Bluegill	Centrarchidae
Largemouth Bass		Centrarchidae	<i>Micropterus salmoides</i>

	Chain Pickerel	Esocidae	<i>Esox niger</i>
	Banded Killifish	Fundulidae	<i>Fundulus diaphanus</i>
	Yellow Perch	Percidae	<i>Perca flavescens</i>
	Brown Trout	Salmonidae	<i>Salmo trutta</i>
Herps	Snapping Turtle	Chelydridae	<i>Chelydra serpentina</i>
	Garter Snake	Colubridae	<i>Thamnophis sirtalis</i>
	Musk Turtle	Kinosternidae	<i>Sternotherus odoratus</i>
	Painted Turtle	Emydidae	<i>Chrysemys picta</i>
	Green Frog	Ranidae	<i>Rana clamitans</i>
	Pickerel Frog	Ranidae	<i>Rana palustris</i>
Mammals	White-tail Deer	Cervidae	<i>Odocoileus virginianus</i>
	Eastern Cottontail	Leporidae	<i>Sylvilagus floridanus</i>
	Raccoon	Procyonidae	<i>Procyon lotor</i>
	Little Brown Bat	Vespertilionidae	<i>Myotis lucifugus</i>
Insects	Northern Bluet	Coenagrionidae	<i>Enallagma cyathigerum</i>
	Widow Skimmer	Libellulidae	<i>Libellula luctuosa</i>
	Common Whitetail	Libellulidae	<i>Libellula lydia</i>
	Eastern Pondhawk	Libellulidae	<i>Erythemis simplicicollis</i>
	Mustard White	Pieridae	<i>Pieris oleracea</i>
Mollusks	Eastern Elliptio	Unionidae	<i>Elliptio complanata</i>
	Eastern Floater	Unionidae	<i>Pyganodon cataracta</i>
	Chinese Mystery Snail	Viviparidae	<i>Cipangopaludina chinensis</i>
Plants	Red Maple	Aceraceae	<i>Acer rubrum</i> L.
	Silver Maple	Aceraceae	<i>Acer saccharinum</i> L.
	Poison Ivy	Anacardiaceae	<i>Toxicodendron radicans</i> (L.) Kuntze
	Clasping Dogbane	Apocynaceae	<i>Apocynum sibiricum</i> Jacq.
	Swamp Milkweed	Asclepiadaceae	<i>Asclepias incarnata</i> L.
	Black Swallowwort	Asclepiadaceae	<i>Cynanchum louiseae</i> Kartesz & Gandhi
	Marsh Fern	Aspleniaceae	<i>Thelypteris palustris</i> Schott
	Small-headed Aster	Asteraceae	<i>Aster racemosus</i> Elliott
	Strawstem Beggarticks	Asteraceae	<i>Bidens comosa</i> (A. Gray) Wieg.
	Common Beggarticks	Asteraceae	<i>Bidens frondosa</i> L.
	Pink Tickseed	Asteraceae	<i>Coreopsis rosea</i> Nutt.
	Boneset	Asteraceae	<i>Eupatorium perfoliatum</i> L.
	Low Cudweed	Asteraceae	<i>Gnaphalium uliginosum</i> L.
	Gray Goldenrod	Asteraceae	<i>Solidago nemoralis</i> Aiton
	Alder	Betulaceae	<i>Alnus</i> sp.
	River Birch	Betulaceae	<i>Betula nigra</i> L.
	Gray Birch	Betulaceae	<i>Betula populifolia</i> Marshall
	Arrowwood	Caprifoliaceae	<i>Viburnum dentatum</i> L.
	Stonewort	Characeae	<i>Chara</i> sp.
	Nitella or Brittlewort	Characeae	<i>Nitella</i> sp.
	Pepperbush	Clethraceae	<i>Clethra alnifolia</i> L.
	Canadian St. Johnswort	Clusiaceae	<i>Hypericum canadense</i> L.
	Silky Dogwood	Cornaceae	<i>Cornus amomum</i> Miller
	Tupelo	Cornaceae	<i>Nyssa sylvatica</i> Marshall
	Twig Rush	Cyperaceae	<i>Cladium mariscoides</i> (Muhl.) Torr.
	False Nutsedge	Cyperaceae	<i>Cyperus strigosus</i> L.
	Bright Green Spike Rush	Cyperaceae	<i>Eleocharis flavescens</i> (Poiret) Urban var. <i>olivacea</i>
	Blunt Spike Rush	Cyperaceae	<i>Eleocharis ovata</i> (Roth) Roemer & Schultes

Autumn or Northern Fimbry	Cyperaceae	<i>Fimbristylis autumnalis</i> (L.) Roemer & Schultes
sterile submersed cyperid	Cyperaceae	unknown
Highbush Blueberry	Ericaceae	<i>Vaccinium corymbosum</i> L.
Cranberry	Ericaceae	<i>Vaccinium macrocarpon</i> Aiton
Pipewort	Eriocaulaceae	<i>Eriocaulon aquaticum</i> (Hill) Druce
Three-seeded Mercury	Euphorbiaceae	<i>Acalypha</i> sp.
Red Oak	Fagaceae	<i>Quercus rubra</i> L.
Variable Water Milfoil	Haloragaceae	<i>Myriophyllum heterophyllum</i> Michx.
Lesser or Free-flowered Waterweed	Hydrocharitaceae	<i>Elodea nuttallii</i> (Planchon) St. John
Iris	Iridaceae	<i>Iris</i> sp.
Pondshore Rush	Juncaceae	<i>Juncus pelocarpus</i> E. Meyer
Floating Bladderwort	Lentibulariaceae	<i>Utricularia radiata</i> Small
Bladderwort	Lentibulariaceae	<i>Utricularia</i> sp.
Asparagus	Liliaceae	<i>Asparagus officinalis</i> L.
Annual Loosestrife	Lythraceae	<i>Lythrum hyssopifolium</i> L.
Purple Loosestrife	Lythraceae	<i>Lythrum salicaria</i> L.
Spatterdock	Nymphaeaceae	<i>Nuphar variegata</i> Durand ex Clinton
White Water Lily	Nymphaeaceae	<i>Nymphaea odorata</i> Aiton
Water Purslane	Onagraceae	<i>Ludwigia palustris</i> (L.) Elliott
Sensitive Fern	Onocleaceae	<i>Onoclea sensibilis</i> L.
Royal Fern	Osmundaceae	<i>Osmunda regalis</i> L.
Pitch Pine	Pinaceae	<i>Pinus rigida</i> P. Mill.
White Pine	Pinaceae	<i>Pinus strobus</i> L.
Bluejoint	Poaceae	<i>Calamagrostis canadensis</i> (Michx.) P. Beauv.
Water Smartweed	Polygonaceae	<i>Polygonum amphibium</i> L.
Pickernelweed	Pontederiaceae	<i>Pontederia cordata</i> L.
Snailseed Pondweed	Potamogetonaceae	<i>Potamogeton diversifolius</i> Raf.
Ribbonleaf Pondweed	Potamogetonaceae	<i>Potamogeton epihydrus</i> Raf.
Grassleaf or Variable Pondweed	Potamogetonaceae	<i>Potamogeton oakesianus</i> Robbins
Narrow-leaved Loosestrife	Primulaceae	<i>Lysimachia hybrida</i> Michx.
Creeping Jenny or Moneywort	Primulaceae	<i>Lysimachia nummularia</i> L.
Glossy Buckthorn	Rhamnaceae	<i>Frangula alnus</i> P. Mill.
Common Buckthorn	Rhamnaceae	<i>Rhamnus cathartica</i> L.
Black Cherry	Rosaceae	<i>Prunus serotina</i> Ehrhart
Siberian Crab	Rosaceae	<i>Pyrus baccata</i> L.
Meadowsweet	Rosaceae	<i>Spiraea alba</i> Duroi
Buttonbush	Rubiaceae	<i>Cephalanthus occidentalis</i> L.
Cottonwood	Salicaceae	<i>Populus deltoides</i> Marshall
Pussy Willow	Salicaceae	<i>Salix discolor</i> Muhl.
Black Willow	Salicaceae	<i>Salix nigra</i> Marshall
Greenbrier	Smilacaceae	<i>Smilax rotundifolia</i> L.
Black Nightshade	Solanaceae	<i>Solanum americanum</i> P. Mill.
Bittersweet Nightshade	Solanaceae	<i>Solanum dulcamara</i> L.
Littleleaf Linden	Tiliaceae	<i>Tilia</i> sp.
American Elm	Ulmaceae	<i>Ulmus americana</i> L.
False Nettle	Urticaceae	<i>Boehmeria cylindrica</i> (L.) Swartz
Virginia Creeper	Vitaceae	<i>Parthenocissus</i> sp.
Fox Grape	Vitaceae	<i>Vitis labrusca</i> L.

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