# VI. Natural Resources and Current Conditions at Fresh Pond Reservation

## A. Introduction

In 1997, the City of Cambridge hired Rizzo Associates, Inc. to conduct a Fresh Pond Reservation Natural Resource Inventory and prepare a Fresh Pond Reservation Natural Resource Stewardship Plan as key elements of the Fresh Pond Reservation Master Plan. Published in August, 1998, the Inventory identified, evaluated and mapped the natural resources of the Reservation, described its notable natural assets, and called attention to its major natural resource management issues (See Sections 3.0 and 4.0 of the Inventory and B, C, and D, below).

The notable natural assets of the Reservation currently include 104 "specimen" trees and 45 notable or unique units of vegetation. The specimen trees were said to represent "particularly fine examples of desirable species." The notable or unique units of vegetation include the "one true meadow" in the Reservation, an emergent wetland, and the "best or only examples" of particular types of tree groves to be found within Cambridge.

The major natural resource management issues identified during the inventory process included (1) widespread problems with the spread of invasive, destructive species of plants and trees; (2) the absence of healthy diversity among the plant and tree species; (3) the continued disturbance of sensitive ecosystems by humans and dogs; (4) the continued compaction of the soil on trails; and (5) the continued erosion of hillsides, banks and shorelines. Invasive species were found to be present in 83 percent of study plots, evidence of human and dog disturbance in 67 percent of study plots, and soil compaction and erosion in 53 percent of study plots.

Published in February, 1999, the Stewardship Plan prioritized problems and presented general recommendations for managing different types of natural resources, including soils, wetlands, shorelines, wildlife habitat and vegetated areas ranging in character from dense forest to open lawn. The Stewardship Plan also presented site-specific recommendations for discrete areas such as Kingsley Park, Black's Nook, Glacken Field and different sections of the Thomas P. O'Neill Jr. Municipal Golf Course.

This section of the Master Plan summarizes the principal findings presented by Rizzo Associates in Sections 3.0 and 4.0 of the Inventory. In addition, this section also describes and discusses conditions in two "landscaped/maintained" areas and one "developed" area of the Reservation not covered by the Inventory. Those areas include the Glacken Field recreation complex, the golf course field of play and the grounds of Neville Manor.

Sections VII and VIII of the Master Plan, immediately following this section, summarize the general recommendations and site-specific recommendations presented in Sections 2.0 and 3.0 of the Stewardship Plan.

Section VII of the Master Plan also includes priorities established by the Advisory Committee for the management of the small water bodies in the Reservation, not covered by the Inventory or the Stewardship Plan, and for management of wildlife habitat, amply covered in the Inventory and Stewardship Plan but not highlighted.

## B. Overview of Natural Resources

The 324.9-acre Fresh Pond Reservation contains 10.3 acres devoted to parking lots, roadways and buildings, 162.6 acres of open water and 152 acres of vegetated open space, as shown in Table 1, below.

Five principal types of vegetative cover are present, including upland forest, scrub/shrub upland, meadows/open fields, wetlands, and landscaped/maintained areas consisting of turf, lawns, fairways, roughs and putting greens. Table 2, below, shows how many acres of each type can be found in the Reservation.

*Table 1.*

***Developed Land, Open Water and Vegetated Land in Fresh Pond Reservation***

| *MAJOR LAND COVER TYPE* | *AREA (acres)* |
|---|---|
| Developed Land | 10.3 |
| Open Water | 162.6 |
| Fresh Pond | 156.6 |
| Little Fresh Pond | 3.5 |
| Black's Nook | 2.0 |
| North Pond | 0.6 |
| Vegetated Land (see Table 2) | 152.0 |
| Total Reservation Area | 324.9 |

*Table 2.*

***Vegetative Cover Types at Fresh Pond Reservation***

| *VEGETATIVE COVER TYPE* | *AREA (acres)* |
|---|---|
| Upland Forest | 52.1 |
| Softwood forest | 8.1 |
| Hardwood forest | 38.5 |
| Mixed forest | 5.5 |
| Scrub/Shrub Upland | 2.1 |
| Meadow/Open Field | 0.5 |
| Wetland | 21.4 |
| Forested wetland | 17.4 |
| Scrub/shrub wetland | 3.3 |
| Emergent wetland | 0.7 |
| Landscaped/Maintained | 75.9 |
| Golf course | 50.4 |
| Other | 25.5 |
| Total Vegetated Land | 152.0 |

*Source: Fresh Pond Natural Resource Inventory, Table 1*

## C. Current Conditions

Current conditions are summarized below for: (1) upland forest, (2) upland scrub/shrub, (3) meadow/open field, (4) wetland, (5) landscaped/maintained, and (6) developed areas of the Reservation. Current conditions are also summarized for: (7) the shorelines of Fresh Pond, Little Fresh Pond, Black's Nook and North Pond, (8) the three golf course streams/drainage channels, (9) specimen trees and unique vegetation, and (10) wildlife and wildlife habitat.

### 1. Upland Forest

Upland forest occupies 32.1 acres, or 32 percent of the Reservation, and includes 8.1 acres of softwood forest (5 percent), 38.5 acres of hardwood forest (24 percent) and 5.5 acres of mixed forest (3 percent).

#### Softwood Forest

The softwood forest consists principally of evergreen species and includes a grove of hemlock at Kingsley Park and two groves of White Pine, one at the Weir Meadow and the other along Fresh Pond Parkway at the southeast corner of the Reservation. The main ecological problems in these areas are (1) widespread presence of invasive species, notably Norway maples and poison ivy; and (2) widespread soil compaction and reduced understory, resulting from heavy human traffic and leading to erosion (See Figure 9).

#### Hardwood Forest

The Inventory identified 13 units of hardwood forest consisting of maples, oaks, elms, black and sweet cherry and numerous other species. Two important units are at Kingsley Park. A third major area can be found along Huron Avenue and the southern shore of Fresh Pond, including groves at the edges of Glacken Field and groves on the steep banks below it.

Two more significant areas of hardwood forest extend along Concord Avenue from the 5th Tee to Black's Nook. They contain large trees of notable horticultural and historical significance dating back a century to the time when the Olmsteds were first landscaping the

*Figure 9: Typical Softwood Forest with Understory, 1998 Source: Rizzo Associates, Inc. Summer 1998*

Reservation. Two additional important units of hardwood forest extend along the north shore of Fresh Pond southward and eastward from the Neville Manor site to the western edge of Lusitania Field. They include a large stand of American beech trees on the bank below the Neville Manor building, visible from the Perimeter Road.

Ecological problems differ from one hardwood forest unit to another. In some, the major problems are soil compaction and erosion and the absence of groundcover and a healthy understory of bushes and shrubs. These problems have resulted from heavy human foot traffic or from heavy human and dog use. In other areas, problems result from an understory consisting of invasive species such as multiflora rose and buckthorn. Around Black's Nook, invasive species include Oriental bittersweet, a vine which is smothering the tall trees, and Japanese knotweed, which is dominating the understory.

#### Mixed Hardwood/Softwood

Mixed hardwood/softwood areas are located along Grove Street, along Blanchard Road and between Black's Nook and Neville Manor. White pine is the dominant softwood, and red oak the dominant hardwood. Invasive species are present in two of the three units.

A significant number of trees along Concord Avenue and Fresh Pond Parkway have been cut down to make room for the bikeway currently under construction.

### *2. Upland Scrub/Shrub*

Upland scrub/shrub occupies 2.1 acres, or 1 percent, of the Reservation. A unit south of Neville Manor is dominated by staghorn sumac, buckthorn, goldenrod, black raspberry, canary grass and sedges. This unit includes a community garden which provides important recreational and educational opportunities and contributes to vegetative variety. But debris, which should be composted or removed, has been noted in the area.

A second upland scrub/shrub unit to the west of Lusitania Field provides an important transition habitat between the field and forested areas to the north and west. Dense blackberry and Oriental bittersweet vines dominate the unit.

### *3. Meadow/Open Field*

A half-acre of meadow/open field is located immediately to the west of Lusitania Field, adjacent to the scrub/shrub area described above. A unique vegetation area within the Reservation, the meadow is dominated by a herbaceous layer of grasses, weeds and wildflowers such as rye grass, tansy, Queen Anne's lace, chicory, St. John's wort, thistle, plantain and white avens. The area provides an important source of food for migratory songbirds.

### 4. Wetlands

Wetlands, distributed throughout the Reservation, occupy 21.4 acres, or 13 percent, of its land area. The Inventory identified five forested wetland areas totaling 17.4, acres or 11 percent, of the Reservation, two scrub/shrub wetlands totaling 3.3 acres, or 2 percent, of the Reservation, and one emergent wetland of 0.7 acres.

#### Forested Wetlands

Three of the five forested wetlands are hydrologically connected to North Pond and Black's Nook, perennial bodies of open water. A forested wetland bordering the edge of North Pond contains diverse vegetation including willows, oaks, dogwoods and native shrubs that provide excellent wildlife habitat. The dense canopy of the forested wetland surrounding much of the perimeter of Black's Nook provides important wildlife habitat adjacent to the water.

A third forested wetland bordering Black's Nook to the northwest also is important to wildlife, including songbirds, waterfowl and amphibians. But the area suffers from very heavy dog and human usage and the natural groundcover gets trampled. Vegetation includes large willows, slippery elm and river birch. Invasive species including Oriental bittersweet, buckthorn and Norway maple represent a major problem.

A fourth forested wetland is located along the northwestern edge of the Reservoir between the 7th Fairway and the Perimeter Road and is not associated with an open water body, but receives groundwater and water from overland flow running off of the golf course during heavy rains. At one time, this wetland area received flow from the Reservoir via a culvert and drainage channel which have since filled with sediment. Vegetation includes large willows, green ash, pin oak and slippery elm. The soil is compacted from heavy foot traffic.

The fifth and largest forested wetland is an isolated area located north of the Reservoir along Concord Avenue between Neville Manor and Lusitania Field. The area is traversed by many trails. Foot traffic has resulted in soil compaction and absence of groundcover. Vegetation includes willow, sycamore, box elder, green ash and buckthorn. The area includes many shallow depressions that flood during periods of normal rainfall.

#### Scrub/Shrub Wetlands

A scrub/shrub wetland northwest of the Reservoir between the 6th Fairway and the Perimeter Road receives both groundwater and overland flow from the golf course during heavy rains. Dominant shrubs include buckthorn, elderberry, honeysuckle and black raspberry. Together with adjacent large stands of quaking aspen

*Figure 10: Emergent Wetland, Summer 1998 Source: Rizzo Associates, Inc., Summer 1998*

and gray birch, this relatively undisturbed area, called the Old Field/Birch Grove in the Stewardship Plan, represents excellent but sensitive wildlife habitat in need of greater protection. A second scrub/shrub wetland along the eastern edge of Black's Nook contains red maple, poplar, ash and hickory trees and receives heavy foot traffic, inhibiting the growth of the understory.

#### Emergent Wetlands

An emergent wetland has been developing at the northern edge of Little Fresh Pond, between the 8th Tee and 8th Green (See Figure 10). Vegetation is predominantly herbaceous consisting of a healthy diversity of grasses and sedges. The center of the wetland remains flooded through much of the spring and fall, supporting the emergent vegetation and an array of migratory songbirds and waterfowl. Aesthetically, this wetland represents an important added feature for the golf course. A rapidly growing problem is the invasion of the wetland by destructive purple loosestrife. A sensitive area, the wetland is also in need of protection.

### *5. Landscaped/Maintained Land*

The Inventory identified 14 landscaped/maintained areas totaling 75.9 acres, or 46.8 percent, of the Reservation land area. The golf course occupies 50.4 acres, or 31 percent, of the land area. Landscaped/maintained areas also include Kingsley Park, Weir Meadow, Glacken Field and Lusitania Field. These landscaped areas include grassy

areas with scattered trees and/or shrubs. Some areas, such as at the Golf Course and Kingsley Park, have regularly mowed lawns with fewer trees. The Inventory focused on the natural, unmaintained vegetation in these areas. No study plots were established in lawns, playing fields, fairways and greens.

**Thomas P. O'Neill Jr. Municipal Golf Course**

The nine hole public golf course, located on the western side of the Reservation, was found to be rich in specimen trees, unique vegetation and important wildlife habitat (See Figure 11). A major problem with stormwater drainage was noted.

When the golf course was constructed in the early 1930s, much of it was built on parkland that had been wetland. Drainage has been a serious problem ever since, raising maintenance costs and reducing revenues because of playing days lost to

*Figure 11: Golf Course, Specimen Chinese Scholar Tree, 1998*
*Source: Rizzo Associates, Inc., Summer 1998*

floods. Compounding the problem is a 72-inch storm drain crossing the entire course, which periodically backs up and overflows onto the course from an outlet near Little Fresh Pond. In addition, the water table beneath the course was raised significantly when higher water levels began to be maintained in the Reservoir to protect it against a plume of polluted ground water advancing from the north.

The Cambridge Department of Human Services, Recreation Division has identified the main problems at the golf course as: (1) lack of adequate drainage; (2) lack

of buffer zones between the golf course and conservation land; (3) a need for a native planting design between the clubhouse and the 1st Tee; and, (4) a major Canada Goose control problem.

The Stewardship Plan includes a very high priority recommendation for a comprehensive hydrological study of the golf course as a whole (See Section 3.4.1 of the Stewardship Plan and Section VIII of the Master Plan). The Plan also addresses the need for buffer zones and for a native planting design at the golf course entrance. But the Plan does not address the problem of Canada Geese.

**Weir Meadow**

Weir Meadow awaits rehabilitation following the June, 1999 removal of the brick weir structure which formerly dominated the area. A replacement weir structure will be built below grade. A grassy swale will be developed along the shoreline at the foot of the slope to address long-standing problems with drainage, erosion and periodic flooding. The Perimeter Road will be moved up the slope. Weir Meadow will remain mowed lawn devoted to passive recreation.

**Glacken Field and Glacken Slope**

Glacken Field and its associated facilities are heavily used for active recreation and will continue to be used for active recreation. Two sets of concrete bleachers and the chain link fence at the top of the Glacken Slope are in obvious poor condition. The Recreation Division considers the turf of Glacken Field proper also to be in poor condition and the layout of the playing surface to be badly designed for multiple uses. In addition, the general area lacks irrigation and adequate drainage, the tennis courts are poorly drained and their surfaces are cracking. The Stewardship Plan recommends a comprehensive redesign study of the entire complex.

**Lusitania Field**

Originally a wet meadow, Lusitania Field was badly degraded when rocky fill was trucked into it from the site of the Alewife T Station. The field proper has continued to be impacted by years of hard use, and, since 1997 has been serving as a construction staging area for the new Water Treatment Plant. About half the field lies within the surface watershed area of the Reservoir. An important small meadow has survived at the western end of the field, as noted above. A comprehensive design study will be undertaken to provide for protection of the Reservoir through rehabilitation of the field and its surroundings as natural areas following completion of the new Water Treatment Plant, scheduled for late 2000. The natural areas will be open to passive recreation throughout the year and possibly to skating in winter.

### *6. Developed Land*

Developed areas occupy 10.3 acres or 6 percent of the land area of the Reservation. The developed areas include the Water Treatment Plant construction site and associated parking and roadways along Fresh Pond Parkway; the golf course club house and associated parking, and the tennis courts, basketball court, bleachers and tot lot at Glacken Field along Huron Avenue; and four buildings, parking and associated roadways at the Neville Manor site on Concord Avenue.

#### Water Treatment Plant

A new Water Treatment Plant building is scheduled for completion late in 2000. Construction required the removal of several specimen trees. A landscaping plan consistent with the Stewardship Plan has been prepared, and calls for the planting of numerous replacement trees.

#### Golf Course Clubhouse

The golf course clubhouse has recently been remodeled. No substantial additional work is planned for the near future. On the Glacken Field complex, see immediately above.

#### Neville Manor

Current Conditions at Neville Manor will soon change significantly because of a 1999 State statute entitled "An Act Relative to the Redevelopment of the Mayor Michael J. Neville Manor Nursing Home." Why and how this legislation will affect the current Neville Manor site is explained below. Landscaping plans for the site are briefly described as well.

In 1925 the State Legislature authorized the City to use a portion of the Fresh Pond Reservation, land originally taken and acquired by the City for water supply purposes, for the site of a City Home. In 1928, with the approval of the Water Board, the City Council transferred 8.3 acres along Concord Avenue to the City for that purpose. The City Home, first called the "City Infirmary," was later renamed for Mayor Michael J. Neville, and, as Neville Manor, has served as the City's nursing home for more than 70 years.

The Neville Manor building proper is by far the largest of the four buildings on the Neville Manor site. Three smaller buildings stand to the west of it, at the edge of a bluff overlooking Fresh Pond and Black's Nook. A wooden frame structure, called the Superintendent's House, is home to a mental health program. A deteriorating trailer houses the Maynard Ecology Center, operated by the Cambridge School Department. A brick and mortar building doubles as a City office building and heating plant for the nursing home. To the right of the entrance to the site from Concord Avenue is a large utility yard used by the Water Department, the City Arborist and the Department of Public Works.

The 1999 statute authorized the City to use the Neville Manor site for a mixed-income assisted living facility as well as for a skilled nursing home. The City wanted to rehabilitate the existing Neville Manor building for assisted living and to construct a new skilled nursing home nearby, also on the Neville Manor site. The statute limited the total footprint of all buildings on the site, requiring, in effect, that the three existing small buildings be demolished to make room for the new building. The statute also required that land not needed for the assisted living facility and new skilled nursing home be identified by metes and bounds, be dedicated for water supply purposes and be returned to the care and supervision of the Cambridge Water Board.

Accordingly, the Neville Manor building will soon be rehabilitated for assisted living. A new skilled nursing facility will be built to the left of the entrance to the site from Concord Avenue. The Superintendent's House will be removed. The trailer will be removed and the Maynard Ecology Center will be housed in the rehabilitated Neville Manor building. The building housing the heating plant and City offices will be removed. A new heating plant will also be housed in the rehabilitated Neville Manor building. In addition, more than half the site will be returned to the jurisdiction of the Water Board to be rehabilitated in its entirety as green vegetated open space, for the City has agreed to relocate the utility yard.

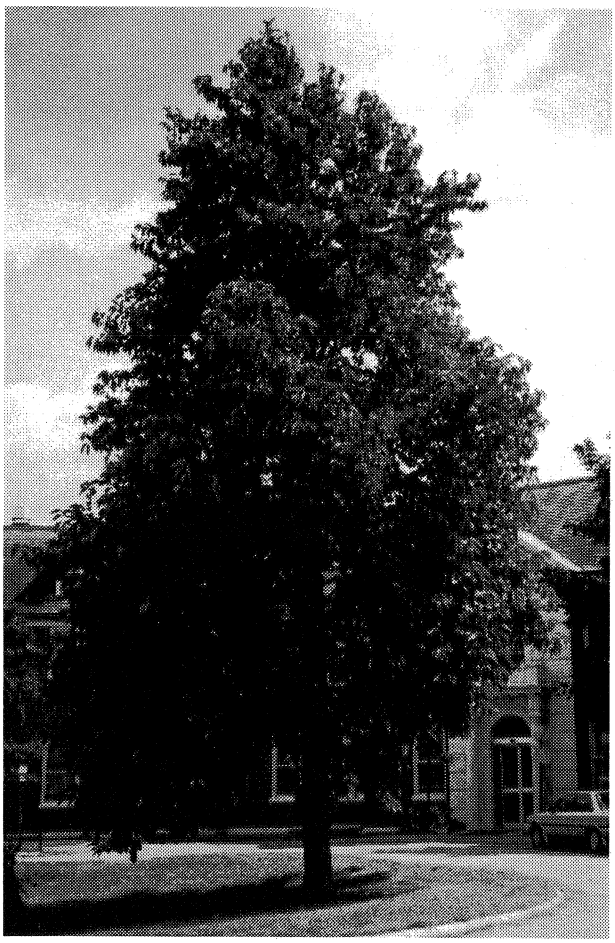

*Figure 12: Cucumber Magnolia at Neville Manor, 1998*
*Source: Rizzo Associates, Inc., Summer 1998*

With the demolition of the three small buildings, with removal of associated parking and roadways, and with the relocation of the utility yard, the City will gain more than four acres of green vegetated open space hitherto walled off from the Perimeter Road by the three buildings and effectively isolated from the Reservation for more than 70 years.

The Water Board has agreed to the construction of a youth soccer field with limited associated parking on the site.

The other half of the current site will be operated by Neville Communities, Inc., a not-for-profit corporation whose board of directors will consist of representatives of the Cambridge Housing Authority, the City of Cambridge, the Cambridge Public Health Commission, and the City of Cambridge Affordable Housing Trust Fund Board.

The Water Board and Neville Communities will jointly landscape the entire current site in accordance with the Stewardship Plan, taking care to preserve the many specimen trees to be found on it. The gazebo currently located to the northwest of the Neville Manor building will be moved to the vicinity of the new skilled nursing facility. Twelve park benches on the current Neville Manor site will also be relocated appropriately.

Please see Section VIII for additional detail on the proposed rehabilitation and reconfiguration of the current Neville Manor site.

### *7. Hydrology of Water Bodies and Condition of Shorelines*

The Inventory briefly described the hydrology of the Reservoir and of three small but important water bodies, Little Fresh Pond, Black's Nook and North Pond.

Shoreline conditions directly affect water quality, and hence were a prime focus of the Natural Resource Inventory. Conditions were evaluated on the 2.5-mile shoreline of Fresh Pond proper, and also on the shorelines of the smaller water bodies.

#### Fresh Pond Reservoir

Before it became a reservoir, Fresh Pond discharged to the northeast towards Alewife Brook at what is now a rotary on Concord Avenue. An emergency relief valve is still located at the northeast corner of the pond, but there is no regular discharge to Alewife Brook. Instead, water leaves the Reservoir through the Water Treatment Plant.

Much of the Reservoir shoreline is covered with riprap, consisting of stone of various sizes placed above and just below the water line at various times over the past century. Very little displacement of riprap has occurred. Bioengineering techniques are favored as methods for stabilizing shorelines.

The fence around the Reservoir has prevented the trampling of vegetation from becoming a problem on the shoreline. Most sections of the shoreline are heavily vegetated with trees, shrubs and vines that serve to reinforce bank and shoreline stability.

*Figure 13: Bank Erosion along Little Fresh Pond, 1998*
*Source: Rizzo Associates, Inc., Summer 1998*

A substantial amount of the shoreline vegetation consists of invasive species such as buckthorn, Oriental bittersweet, Japanese knotweed and poison ivy. In accordance with the Stewardship Plan, an effort is underway to remove invasive species and manage desirable dominant tree species along portions of the shoreline to promote greater natural diversity and improve views of the Reservoir in selected locations.

**Little Fresh Pond**

Little Fresh Pond is a 3.5-acre water body in the western part of the Reservation, bordered by the golf course to the south and west and the Perimeter Road to the north and east. A small stream channel that carries stormwater runoff discharges into Little Fresh Pond from the south. Little Fresh Pond is also fed by overland flow, groundwater and rainfall. Water from Little Fresh Pond is used to irrigate the golf course.

The shoreline is in poor to very bad condition. The extreme erosion of the shoreline along the northern and eastern shoreline along the Perimeter Road, resulting from heavy human and dog traffic, is the worst in the Reservation (See Figure 13). The bank consists of a non-uniform mixture of riprap, gravel and exposed soil. Severe surface erosion, bank sloughing and undercutting are evident. In addition, much of the existing tree canopy around the pond is stressed with dead limbs and dying foliage. The southern shoreline also shows heavy erosion, while more moderate erosion has been taking place on the western shore adjacent to the golf course.

The Stewardship Plan places a very high priority on rehabilitation of the Little Fresh Pond shoreline, which will likely require a major effort.

#### Black's Nook

Once a cove connected to Fresh Pond, Black's Nook is now a separate, shallow two-acre pond with a heavily forested and wetland border, located between the end of the 5th Fairway and the Neville Manor site, Black's Nook is one of the most important wildlife habitat and nature study areas of the Reservation. Its southeastern shoreline is heavily visited. A less frequently used narrow walking trail extends around Black's Nook to the west and northwest. Erosion along the heavily wooded northern shore is light to moderate, but erosion is heavy along the southeastern and easily accessible southern shoreline, where plants are repeatedly trampled and the water table is high. Bank undercutting and scour, conditions associated with exposed soil and siltation problems, are particularly noticeable in locations that receive heavy human and dog use.

#### North Pond

Located on the golf course between the 5th Fairway, 6th Green and 7th Tee, North Pond in the northwest corner of the Reservation contains a deep-water forested wetland with emergent and scrub/shrub wetland zones and offers a wide natural diversity of aquatic and wetland habitats within its just over one-half an acre. The south side of the pond is buffered by the forested wetland and its shoreline is well stabilized. The north side along the 5th Fairway shows moderate erosion because, in effect, it is part of the field of play.

### *8. Golf Course Streams/Drainage Channels*

The Inventory examined conditions along three channels originally constructed to help drain the golf course. These channels fill with water intermittently. They were designated in the Inventory as Streams A, B and C. Stream A is located northwest of Black's Nook near the end of the 5th Fairway. Stream B runs along the Perimeter Road on the northwest shore of the Reservoir from the 7th Green almost to the 6th Tee. Stream C runs along the 9th Fairway west from the 9th Tee to Little Fresh Pond. In effect, Stream C is a poorly functioning drainage ditch.

#### Stream A

Originating at the edge of the golf course and flowing north to a culvert located under Concord Avenue, Stream A begins with a silt-filled inflow pipe at the edge of the golf course and contains areas of shallow stagnant water.

**Stream B**

Intended to drain water past Black's Nook and out of the Reservation through Stream A and a culvert under Concord Avenue, Stream B is now a heavily vegetated ditch fed by heavy precipitation and occasional high groundwater. In many segments the bottom of the channel is lined with muck or silt. Banks are generally two to three feet in height.

**Stream C**

Stream C transports overland flow from the golf course into Little Fresh Pond. Near Little Fresh Pond the stream banks are well vegetated and relatively stable. Farther away from the pond, the stream banks show signs of erosion. Heavy erosion from multiple trails is evident.

### *9. Specimen Trees and Unique Vegetation*

The Inventory identified 104 specimen trees or clumps of trees. Numerous additional trees deserving of specimen status were found to occur in groves and were identified as "unique vegetation" (see below). Fifteen of the 104 specimen trees were found to be in need of immediate care "to improve their health."

Four criteria were the basis for specimen status: 1) size and age, 2) visibility from paths, streets, maintained areas and developed areas, 3) uniqueness within the Reservation, and 4) quality of form or aesthetic value.

Specimen trees were found throughout the Reservation, representing 40 different species. Oaks were the most numerous, including the common red, white, swamp, scarlet and pin oaks as well as the less common blackjack, English and overcup oaks. Specimens of the latter three species in the Reservation were said to represent possibly "the only examples in metropolitan Boston area, if not statewide."

A clump of river birch between Concord Avenue and the 5th Fairway was found to include an example with a basal diameter of 84 inches, making it "among the largest and oldest known in Massachusetts." Within 100 yards of the river birch a specimen Kentucky coffee tree was found. Other specimen tree species include black walnut, American elm, sugar maple, red maple, eastern cottonwood, weeping willow, sycamore, white pine, white birch, shagbark hickory and hop hornbeam or ironwood.

Notable examples of specimen trees not found in groves but occurring solely as individuals were identified on the golf course and Neville Manor entry lawn. See Section 3.3.1 of the Inventory for a list of these species.

Of the 104 specimen trees, 43 were found on the golf course, 17 on or near the Neville Manor site and 10 at Black's Nook adjacent to the Neville Manor site. Of the 43 specimen trees on the golf course, 13 were found between the parking lot and the 1st Tee.

The 45 units of unique vegetation identified included the emergent wetland on the golf course north of Little Fresh Pond and the meadow at Lusitania field, found to be the "one true meadow area" remaining in the Reservation.

Areas of unique vegetation were defined as areas dominated by a single desirable species, representing, in many cases, "the best or only example of a certain type of tree grove to be found in Cambridge." Areas of unique vegetation were also defined as areas which contained a type of vegetation that could be found only in a single location within the Reservation.

The river birch mentioned as a specimen tree above was said to be located in a "mature oak-beech dominated forest strip with numerous notable trees, believed to date back to the Olmsted-Eliot Plan." Indeed, Section 3.1.1 of the Inventory suggests that the grove might appropriately be named "the Olmsted Grove." Immediately to the east is the only stand of Kentucky coffee trees in the Reservation.

Other unique vegetation areas include a "long linear American beech grove located along the southwest slope of Neville Manor adjacent to the Perimeter Road," and groupings of black walnut, gray birch, white birch, black birch, sugar maple and hemlock trees. The largest group of sugar maples was found at Kingsley Park.

### *10. Wildlife and Wildlife Habitat*

Probably the best known of the Reservation's wildlife are the 13 species of migratory waterfowl which utilize the Reservoir in October, November and December, notably including Ring-necked Duck, Ruddy Duck and Canvasback. But 35 species of birds also nest in the Reservation from late April through mid-July, including Red-tailed Hawk, Eastern Kingbird, Yellow Warbler, Song Sparrow, Red-winged Blackbird, Common Grackle and Baltimore Oriole, all readily observable by school children visiting on spring field trips.

In all, more than 230 species of birds have been identified in the Reservation since 1984, including 11 species listed as endangered, threatened or of special concern by the Massachusetts Division of Fisheries and Wildlife. In addition, the Inventory identified 13 species of mammals and 7 species of amphibians, among which the Painted Turtle and the Snapping Turtle are probably the most in evidence.

The Inventory identified five areas as representing especially valuable wildlife habitat, noting that birds utilize the entire Reservation. Area 1 consists of the Glacken Slope hardwood forest bordering Glacken Field and Fresh Pond, utilized by migratory songbirds in spring. Area 2 consists of the northern and western margins of Lusitania Field, including the meadow and the upland scrub/shrub area, utilized both by breeding birds and by transient migrants in fall. Area 3 includes the Emergent Wetland at Little Fresh Pond, a variety of cover types on both sides of the Perimeter Road along the northwestern shore of the Reservoir, and the Old Field/Birch Grove between 6th and

7th Fairways, historically a prime nesting area. Area 4 consists of North Pond and the associated forested wetland between the 5th Fairway, 6th Green and 7th Tee, of importance to amphibians as well as nesting birds and transient migrants. Area 5 consists of Black's Nook and its environs, also of importance to amphibians as well as nesting birds.

## D. Key Natural Resource Management Issues

The Inventory identified three major groups of natural resource management issues: (1) invasive species, species diversity and protection of vegetative health, (2) human and dog disturbance, and (3) soil erosion and compaction.

### 1. Invasive Plant Species, Species Diversity and Vegetative Health

#### Invasive Species

The vegetative health of the Reservation was found to be suffering in many areas from the spread of invasive, destructive species of plants and trees and from the absence of highly desirable diversity among the plant and tree species present.

Invasive species typically are non-native, aggressive species whose presence may result in the death or gradual elimination of desirable native species and destabilize the environment unless controlled, and where possible, removed.

The Inventory identified Oriental bittersweet, Norway maple, common buckthorn, multiflora rose, purple loosestrife and poison ivy, a native species, as the primary invasives threatening the vegetative health of the Reservation. Oriental bittersweet is a fast-growing perennial vine that climbs tall trees, restricting their normal function and eventually killing them. In addition, the dense cover prevents sunlight from reaching the soil below. This species also climbs and kills shrubs and takes over areas as a groundcover. Oriental bittersweet is pervasive on the western shore of Black's Nook and on the western margin of Lusitania Field.

Norway maple is a fast-growing but relatively short-lived tree, once popular as a street tree. It crowds out native tree species and shades out the ground beneath it. It is pervasive at the western edge of Kingsley Park. Common buckthorn and poison ivy dominate stretches of the Reservoir shoreline. Purple loosestrife threatens Black's Nook, North Pond and the emergent wetland at Little Fresh Pond. Multiflora rose threatens the shrubs along the Perimeter Road on the western shore of the Reservoir.

#### Species Diversity

Diversity of plant species within an area is a key indicator of general ecological health. Diversity ensures that if one or two desirable species in a plant community fail, there will be other species available to take their place. Diversity attracts wildlife key to plant fertilization and distribution, and to protection of plants against insect infestation. In wetlands, the diversity and density of the root systems of appropriate species results in superior filtration of surface run-off and groundwater and contributes to shoreline stability. Diversity in upland forest ensures that soils are stabilized and their nutrients are replenished by understory and by groundcover, not just by trees.

#### Vegetation Health

The Inventory identified the following three vegetative health issues: (1) a small number of large trees are dying along or near pathways, and present potential safety hazards; (2) otherwise healthy trees and shrubs are being attacked from invasives throughout the Reservation; and (3) the health of notable stands of desirable native tree species require long-term protection.

### *2. Human and Dog Disturbance*

Heavy human and dog traffic were found to have contributed significantly to the absence of plant diversity in many areas of the Reservation, and especially by preventing desirable understory and groundcover from developing in upland forest areas.

### *3. Soil Compaction and Erosion*

Soil compaction and erosion were found to have resulted from the absence of plant diversity and from heavy human foot traffic and heavy dog use, especially on the northern shoreline of Little Fresh Pond, and in upland forest areas such as Glacken Slope and the slopes of the banks below Neville Manor. Such compaction and erosion directly threatens water quality and poses safety issues.