



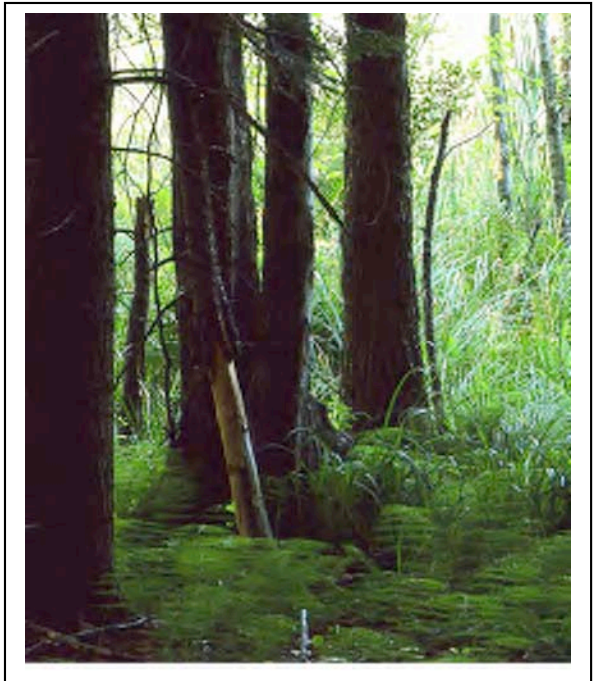
Naturalists in action – June 2005 photo: Deb Armstrong



Apple Tree on upland photo: Karen Marzloff



Milkweed pod at Bog Photo: Karen Marzloff



Hemlock-Cinnamon Fern Forest photo: Eva Powers



Bioblitzers at rest – June 2005 photo: Deb Armstrong

Great Bog Management Plan February 2006

Great Bog Management Plan

**Great Bog Conservation Area
Portsmouth and Greenland, NH**

Prepared for

**New Hampshire Fish and Game Department
Concord, NH**

Completed by

**Danna B. Truslow
Seacoast Land Trust**

**In association with
Peter Britz,
City of Portsmouth, NH**

February 2006

Completion of this plan was made possible through funding from the New Hampshire Estuaries Project and the New Hampshire Corporate Wetlands Restoration Partnership



**NewHampshire
EstuariesProject**



WRP
Corporate Wetlands
Restoration Partnership

Great Bog Management Plan

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Acknowledgements

Completion of this management plan was made possible through a grant from the New Hampshire Estuaries Project and the New Hampshire Corporate Wetlands Restoration Partnership. We gratefully acknowledge the assistance and funding from the many agencies, professionals, and volunteers that have worked with the Seacoast Land Trust and the City of Portsmouth over the past five years.

- University of New Hampshire Cooperative Extension
- New Hampshire Fish and Game Department
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- The Nature Conservancy
- The Great Bay Resource Protection Partnership
- US Fish and Wildlife Service – Partners for Fish and Wildlife
- Society for the Protection of New Hampshire Forests
- NH Tree Stewards
- New Hampshire Department of Environmental Services
- New Hampshire Coastal Program
- Natural Resource Conservation Service
- Public Service Company of New Hampshire
- Neighbors on Buckminster Way
- Volunteers, board, and staff of the Seacoast Land Trust

In particular, the Seacoast Land Trust and the City of Portsmouth thank the Great Bog Blue Ribbon Committee for determining the value of the Great Bog and working to permanently protect it. We thank Bob Miller, Land Protection Specialist with The Nature Conservancy (now retired), who negotiated the purchase of the Great Bog and helped craft the broad approach for this Management Plan. We acknowledge Donald Green for his long time contributions to natural history study at the Great Bog and for organizing a skillful team of naturalists for the June 2005 BioBlitz. Ted Diers, program manager for New Hampshire Coastal Program provided much of the leadership that brought the Management Plan along and continues to champion restoration efforts there. Joanne Glode, ecologist with TNC, provided significant help on management techniques and natural community mapping and Greg Goldstein, UNH graduate student and ecologist, volunteered many hours in the field and lab identifying plants as part of natural community mapping.

Great Bog Management Plan

Great Bog Conservation Area

Portsmouth and Greenland, NH

Executive Summary

The Great Bog is one of the three largest wetland complexes in Seacoast New Hampshire. Within this large unfragmented area (over 600 acres) are a variety of wetland types, many upland islands, and several unique natural communities. This area makes up a significant portion of the Pickering Brook Watershed that flows to Great Bay. An additional 300 contiguous acres in the Sagamore Creek Watershed provide a total unfragmented area of nearly 900 acres that helps sustain the water resources and habitats in this area. Due to its

proximity to an urban area and multiple transportation corridors the Great Bog wetland complex is also impacted by land uses which can conflict with its natural functions and values.

The Great Bog provides multiple functions not only to the immediate area but also to the Great Bay and the Seacoast in general. This area protects the wetland and upland habitats that are living and breeding areas for many of the animals that populate these communities. There are diverse and exemplary plant communities within the wetland and upland. The land also provides feeding grounds and a wildlife corridor between the Atlantic Coast and Great Bay and for the significant unfragmented and protected areas immediately to the south in Greenland and North Hampton. The water quality of Pickering Brook is protected and improved by the presence of wetlands for filtration and helps keep the downstream water quality high for eventual discharge to Great Bay. The protection of the groundwater for public water supply is also an important function of this area.

In 2001, nearly 194 acres of land within the wetland area known as the Great Bog were permanently protected through the efforts of the City of Portsmouth Great Bog Blue Ribbon Committee. The Great Bog is one of the three largest wetland complexes in Seacoast New Hampshire and provides many valuable natural resource functions. This area was under threat of development in 2000 and, through the actions of concerned citizens, the City of Portsmouth, and local and regional conservation organizations the land was permanently protected.

The City of Portsmouth owns the Great Bog Conservation Land, the Seacoast Land Trust (SLT) holds the primary conservation easement, and the Society for the Protection of New Hampshire Forests (SPNHF) holds the executory conservation easement on the property. As part of the NOAA funding agreement, New Hampshire Fish and Game requires a management plan for the site. This document was prepared in order to satisfy this requirement.

The plan includes management suggestions for two areas. The first area is the smaller 194-acre parcel of land purchased in 2001 and protected by a conservation easement, referred to as the Great Bog Conservation Easement or Great Bog CE. The larger area, the Great Bog Management Area, totals 1,805 acres and includes the upper Pickering Brook Watershed, of which Great Bog is a major part, and adjacent unfragmented lands within the Sagamore Creek Watershed. This larger area was studied in order to understand the potential impacts to the Bog from surrounding lands and to determine what activities, if any, on these adjacent lands could improve or sustain the environmental quality of the Great Bog CE.

The committee that helped to guide the Management Plan included Federal, State and local agencies involved in land protection, habitat evaluation, water quality improvement, and habitat restoration. Concerned citizens and neighbors of the Great Bog also played a crucial role in development of the plan.

This committee agreed that the five goals developed by the Great Bog Steering Committee in 2003 and listed below should guide the management activities at the Great Bog.

Stewardship Goal - To be stewards of the Great Bog's natural heritage by conserving, managing, and protecting its natural and cultural resources to the maximum extent possible.

Partnership Goal - To establish and maintain positive working relationships with neighbors, the public, and other interested parties.

Recreation Goal - To provide opportunities for low impact recreation consistent with other goals.

Education and Research Goal- To facilitate education, research, and interpretation of the Great Bog's natural, cultural, and historic resources.

Vista Goal - To maintain vistas and viewsheds consistent with other goals.

Seventeen management units were developed to help formulate the management suggestions presented in this plan. Six of these management units contain the Great Bog Conservation Easement Land. Sections 9 and ten contain management unit summaries and management suggestions for conservation easement area and the greater management area surrounding the conservation land.

Great Bog Management Plan Great Bog Conservation Area Portsmouth and Greenland, NH

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Great Bog Management Plan

Great Bog Conservation Area - Portsmouth and Greenland, NH

Section 1 - Project Background and Project Purpose

In 2001, nearly 194 acres of land within the wetland area known as the Great Bog were permanently protected through the efforts of the City of Portsmouth Great Bog Blue Ribbon Committee. The Great Bog is one of the three largest wetland complexes in Seacoast New Hampshire and provides many valuable natural resource functions. This area was under threat of development in 2000 and, through the actions of concerned citizens, the City of Portsmouth, and local and regional conservation organizations the land was permanently protected in April 2001.

Three sources of grant funding made purchase and conservation of the land possible: the Great Bay National Estuarine Research Reserve (GBNERR), part of the US National Oceanic and Atmospheric Administration (NOAA); the New Hampshire Department of Environmental Services (NHDES) Water Supply Protection Grant Program; and the National Fish and Wildlife Foundation. In-kind contributions were also made by the City of Portsmouth, the Seacoast Land Trust, the Society for the Protection of New Hampshire Forests, and many others to complete the transaction.

The City of Portsmouth owns the Great Bog Conservation Land, the Seacoast Land Trust (SLT) holds the primary conservation easement, and the Society for the Protection of New Hampshire Forests (SPNHF) holds the executory conservation easement on the property. As part of the NOAA funding agreement, New Hampshire Fish and Game requires a management plan for the site. This document was prepared in order to satisfy this requirement.

The following plan includes management suggestions for two areas. The first area is the smaller 194-acre parcel of land purchased in 2001 and protected by a conservation easement. This land will be referred to throughout the text as the Great Bog Conservation Easement or Great Bog CE. The larger area, the Great Bog Management Area, totals 1,805 acres and includes the upper Pickering Brook Watershed, of which Great Bog is a major part, and adjacent unfragmented lands within the Sagamore Creek Watershed. This larger area was studied in order to understand the negative impacts to the Bog from surrounding lands and to determine what activities, if any, on these adjacent lands could improve or sustain the environmental quality of the Great Bog CE.

In particular, the committee wished to understand –

- The characteristics of the unfragmented land area around the Bog,
- potential impacts to the Bog from surrounding land uses, and
- opportunities for additional land protection in the vicinity of the Bog.

The plan represents the work of many partners and volunteers. Funding for this plan was made possible through a grant from the New Hampshire Estuaries Project and the New Hampshire Corporate Wetlands Restoration Partnership. It is meant to be a guide for future management and restoration activities based on current knowledge of conditions at the Bog. The plan will likely be enhanced and modified as more information becomes available in future studies.

Work Performed

Work performed in preparation for this plan included:

- Meetings and Site Walks with Project Partners and volunteers,
- Collection and organization of existing site and watershed information,
- Delineation of Management Unit areas,
- A “BioBlitz” biological inventory event,
- Preliminary natural community mapping of selected management units,
- Determination of data gaps, and
- Geographic Information Systems (GIS) mapping of existing and collected data.

Specifics on work performed and detailed identification of data gaps are included in a companion grant report, which describes the management plan development process. A summary of the data gaps identified follows.

Data Gaps

As existing information was reviewed several data gaps relative to the physical setting, natural communities, water quality, and wetland hydrology on the conservation land were identified. The following is a list of future activities that will help fill some of these data gaps.

- Detailed natural community mapping of other management units,
- Greater understanding of the wetland hydrology and surface water flow patterns,
- Additional water quality information on water flowing into, within, and out of the Great Bog,
- Comprehensive mapping of invasive plant species on uplands and in wetlands, and
- Understanding of ecosystem characteristics prior to construction of Interstate 95 and other ecosystem stressors.

The individuals listed in Table 1 provided assistance with this plan. In addition, management plans provided by the New Hampshire Fish and Game Department and the Great Bay Resource Protection Partnership – Lubberland Creek Management Plan and Bellamy River Wildlife Management Area, in particular, - were used to guide the structure and contents of the plan.

Table 1
Participants in Great Bog Management Planning Process

<u>Name</u>	<u>Affiliation</u>
Richard Adams	President, Seacoast Land Trust (SLT)
Allan Amman	Biological Scientist, Natural Resource Conservation Service (NRCS)
Dea Brickner-Wood	Director, Great Bay Resource Protection Partnership (GBRPP)
Peter Britz	Environmental Planner, City of Portsmouth
Sarah Callaghan	Easement Steward, Society for the Protection of New Hampshire Forests (SPNHF)
Eric Derleth	Fish and Wildlife Biologist, US Fish and Wildlife Service, Partners for Fish and Wildlife (PFW)
Ted Diers	Program Manager, New Hampshire Coastal Program (NHCP_
Theresa Garabedian	Buckminster Way Neighborhood Liaison
Joanne Glode	Great Bay Stewardship Ecologist, The Nature Conservancy (TNC)
Donald Green	Professor Emeritus, University of New Hampshire (UNH), Naturalist
Anthony Johnson	Public Service of New Hampshire (PSNH)
David Kellam	Project Coordinator, New Hampshire Estuaries Project (NHEP)
Beth Lambert	Restoration Coordinator, New Hampshire Coastal Program (NHCP)
Natalie Landry	Coastal Watershed Supervisor, New Hampshire Department of Environmental Services (DES),
Karla McManus	Drinking Water Source Protection Program
Bob Miller	Emeritus Land Protection Specialist, The Nature Conservancy
Eric Orff	Wildlife Biologist, New Hampshire Fish and Game Department (NHFG)
Edward Robinson	Wildlife Biologist, New Hampshire Fish and Game Department (NHFG)
Rachel Stevens	Stewardship Coordinator, Great Bay National Estuarine Research Reserve (GBNERR)
Dennis Souto	Entomologist, US Forest Service
Matt Tarr	County Forester, UNH Cooperative Extension
Danna Truslow	Executive Director 2001-2005, Seacoast Land Trust, and author of Great Bog Management Plan

Section 2 – Location of the Great Bog Conservation Area

The Great Bog is one of the three largest wetland complexes in Seacoast New Hampshire. Within this large unfragmented area are a variety of wetland types, many upland islands, and several unique natural communities. Due to its proximity to an urban area and multiple transportation corridors the Great Bog wetland complex is also impacted by land uses which can conflict with its natural functions and values.

The Great Bog is located in the southwestern corner of Portsmouth, New Hampshire. It is bounded to the east by Banfield Road and a Guilford Transportation railroad line. Ocean Road and Buckminster Way form the southern boundary of the Bog. It is bounded to the west by Interstate 95 and to the north by Route 33.

The Pickering Brook Watershed, which covers approximately 1,400 acres, contains the Great Bog. The wetland and interior upland area of the Great Bog covers approximately 600 acres. A small tributary of Pickering Brook flows into the Great Bog from the Constitution Avenue area. Stormwater runoff from this commercial/industrial area is a large contributor of water to this tributary. However most of the water flow to Pickering Brook originates within the Great Bog wetland. Pickering Brook flows under Interstate 95 through a culvert towards Great Bay, which is approximately 1.5 miles northwest of the Great Bog.

The total unfragmented land area including and surrounding the Bog is approximately 900 acres. A portion of this land lies within the upper Sagamore Creek Watershed and is crossed by a little-used railroad line. The location of the Bog within the Pickering Brook Watershed is shown on Figure 1.

In addition to the CE land, there are also many pieces of conservation land owned or controlled by the City of Portsmouth immediately adjacent to or nearby the site. Including the Great Bog CE land, there are 496 conservation acres in the Great Bog Management Plan Area. Table 2 lists these parcels and the location of these parcels is shown in Figure 2.

Table 2
Conservation Lands within the Great Bog Management Area

Parcel Name	Land Area	Owner/Conservation Easement Holder	Tax Parcel Number Map - Lot
<i>Great Bog **</i>	<i>194</i>	<i>City of Portsmouth – owner. Conservation Easement Holder – Seacoast Land Trust</i>	<i>282-0005</i>
City of Portsmouth	32	City of Portsmouth	278-0002&0003
City of Portsmouth	18	City of Portsmouth	263-0003
Hospital Corporation of America	9	City of Portsmouth	280 - 0003
Hospital Corporation of America	85	City of Portsmouth	278 - 0001
Hett	56	Conservation Easement Holder – City of Portsmouth	255 - 0005
Griffin Well	1.5	City of Portsmouth	259-0001
Constitution Ave	2	City of Portsmouth	273-0008
Grossman Development	29	City of Portsmouth	274 - 0003
Tamposi	2.5	City of Portsmouth	284-0003
Lamothe Development	9	City of Portsmouth	284-0004
Tamposi	8	City of Portsmouth	284-0009
Banfield Road	9	City of Portsmouth	265 – 002D
Widen	19.8	City of Portsmouth	293-0016
Drake	21.1	City of Portsmouth	294-0009
Total Acres	496		

** Land referred to as Great Bog CE in this Plan

Section 3 - Great Bog Management Plan Goals

The goals of the Great Bog Management Plan are based on the conservation purposes stated in the Conservation Easement and on the Great Bog Master Plan developed in 2003. Appendix A contains the Great Bog Master Plan developed by a citizen work group under the guidance of the City of Portsmouth and the Seacoast Land Trust.

The purposes for preserving this land as *cited from the 2001 Great Bog Conservation Easement* are as follows:

1. “The protection of the unusual natural habitat of the “Southern New England Seepage Marsh”, a key component of the Property’s wetland complex, which is part of one of the three largest contiguous wetlands in coastal New Hampshire Collectively know as the “Great Bog” which contains rare plants including the Hairy fruited Sedge, Atlantic White Cedar, and Tufted Loosestrife, a state “threatened” plant species.
2. The preservation of land for outdoor recreation by and/or the education of the general public, including hiking, bird watching, cross-country skiing and hunting.
3. The enhancement and enlargement of 571 acres of protected land that is adjacent to or otherwise nearby the Property, including the Great Bog complex of 203 acres and the Packer Bog Complex of 207 acres.
4. The preservation and conservation of open spaces, particularly the conservation of the productive wetland and uplands of which the property consists and of the wildlife habitat thereon.
5. The conservation and management of the wildlife resource on the Property Utilizing habitat manipulation and population management techniques, including regulated hunting.
6. The scenic enjoyment of the general public, including 890 feet of undeveloped road frontage on Ocean Road and 320 feet of undeveloped road frontage on Heather Lane.
7. The preservation of the quality of groundwater and surface water resources on and under the property as the Property falls with the Drinking Water Protection area for the City of Portsmouth and contributes to at least one of the city’s wells.”

The conservation easement helps to protect these critical elements by preventing future subdivision, by preventing further dumping or use for storage of environmentally hazardous materials on the land, by promoting low impact recreation, and by studying and working to reverse habitat degradation. In addition, hunting is allowed as regulated by the New Hampshire Fish and Game Department.

As previously mentioned, the Goals for the Great Bog Management Plan are based on the Great Bog Master Plan. These goals and goals from other management areas in the Great Bay region were reviewed in meetings prior to the development of this plan. The Project Partners agreed that the following goals were appropriate for the Great Bog site. The suggestions included in this plan were developed with these goals in mind.

Goals of the Great Bog Management Plan

Stewardship Goal - To be stewards of the Great Bog's natural heritage by conserving, managing, and protecting its natural and cultural resources to the maximum extent possible with these objectives:

- a. Protect/Restore Habitats to Native Condition
- b. Protect Rare and Unique species and habitat
- c. Maintain Biodiversity
- d. Utilize sustainable management practices
- e. Protect drinking water quality
- f. Protect watershed quality, and
- g. Maintain ecological functions provided by the Bog

Partnership Goal - To establish and maintain positive working relationships with neighbors, the public, and other interested parties through

- a. Cooperation
- b. Partnership
- c. Stewardship
- d. Public Involvement, and
- e. Maintaining relationships with nearby property owners and easement holders

Recreation Goal - To provide opportunities for low impact recreation consistent with other goals, with these objectives:

- a. Multiple use
- b. Managed domestic pet use
- c. Designated public access
- d. Use of trails and roads
- e. Accessibility, and
- f. Hunting, as permitted by the State of New Hampshire.

Education and Research Goal - To facilitate education, research, and interpretation of the Great Bog's natural, cultural, and historic resources.

Vista Goal - To maintain vistas and viewsheds consistent with other goals.

Section 4 – Management Unit Designations

The Great Bog Management Plan covers not only the 194-acre parcel conserved in 2001 but also takes into consideration the surrounding lands which are part of the wetland system, the large unfragmented area surrounding the Bog, and the upstream watershed areas that impact the quality and functions of the Great Bog. A committee made up of some of the project partners met and delineated 17 management units within the management area.

Figure 2 shows the boundaries of each of these management units. The units were delineated based on similar land use, natural landforms, or ecological characteristics. Table 3 lists these units and the characteristics of each. References to these management units will be used throughout the plan.

Six of the management units, 9, 10, 13, 14, 16 and 17 are part of or include a portion of the Great Bog Conservation Easement land. The remaining management units are either part of the larger unfragmented contiguous area surrounding the Bog or are within the upper Pickering Brook watershed and contribute flow to Pickering Brook upstream of the Bog. Management suggestions for these outlying areas will require voluntary partnership with and support by the businesses and residents within these management units.

**Table 3
Management Unit Descriptions**

Management Unit Number and Name	Watershed	Acreage of Management Unit	Acreage of Great Bog CE Land	Current Land Use
1 – Heritage	Pickering Brook	209.2	0	Residential, Industrial, Commercial, with large central forest area with AWC
2 – Constitution	Pickering Brook	246.3	0	Light Industrial, Commercial, 3 residences, interior wetlands
3 – Pickering Brook Headwaters	Pickering Brook	66.4	0	All wetland, scrub-shrub and forested. A few houses on upland
4 – Camp Seawood	Pickering Brook	37.7	0	Girl Scout Camp, primarily upland with riparian corridor through center
5 – Stokel/Hett	Sagamore Creek	294.4	0	Large wetland area and mowed upland grassland/meadow
6 – Water Country/Community Campus	Sagamore Creek	122.7	0	Wetland with upland area dominated by Water Country and Community Campus field
7 – Rt. 33 Cloverleaf	Pickering Brook	67.4	0	Completely enclosed by exit ramps, Route 33 and Interstate 95, high value wetland within
8 – Griffin/Stokel Field	Pickering Brook	56.1	0	Zoned single residence, currently undeveloped
9- Sirrell Highlands	Pickering Brook	63.5	62.6	Upland island within Conservation land area
10 – Green Island	Pickering Brook	2.1	0	Hemlock and white pine upland within Red maple swamp
11 – Griffin Park	Pickering Brook	61.5	0	Residential, commercial, and industrial, some field. Includes public water supply well.
12 – Buckminster - (2 acres within Greenland)*	Pickering Brook	36.5	4.6	Residential area surrounding west side of Bog, access to trails
13 – South Pickering Brook	Pickering Brook	116.3	47.8	Cattail wetlands, some residential
14 – North Pickering Brook	Pickering Brook	41.2	5.8	Cattail and red maple swamp, partially conserved
15 – North Power line	Sagamore Creek	27.7	0	Power line and wetlands, cattail, scrub shrub and forested wetlands, undeveloped
16 – North Bog	Pickering Brook	239.8	16.6	Red maple swamp, some phragmites, Atlantic white cedar community
17 – South Bog	Pickering Brook	119.1	57.8 *	Primarily phragmites, directly adjacent to and includes other city owned conservation land
Total Land Area		1805		

Section 5 - Primary Conservation Elements

Based on the management purposes described above the critical elements that will be preserved on the Great Bog CE land are:

Natural Habitat The fields, forests, and wetlands that make up the Conservation Area are a haven for wildlife and unique and exemplary natural communities. These special

communities include an Atlantic white cedar stand, an exemplary Red Maple-Sensitive Fern swamp, and an acid seepage swamp that includes occurrences of Hairy-fruited Sedge and Tufted Loosestrife. The upland communities include grassland and old-field, which are rapidly disappearing from the coastal New Hampshire landscape. The New Hampshire Fish and Game Wildlife Action Plan (NHFG, 2005), particularly mentions grasslands in their targeted terrestrial (upland) habitats. Of the identified species of concern, the Great Bog is known to provide habitat for American woodcock, spotted turtle, Blanding's turtle, and white tailed deer, fisher, mink, and several bats. Shrublands, or old-fields, also a habitat of interest to NHFG also present at the Bog provide habitat for a broad variety of mammals, birds, reptiles, and invertebrates, among many other plant and animal species. Although not positively identified, the area may also provide habitat for New England Cottontail rabbit, a threatened species in New Hampshire due to the disappearance of fields and shrublands (Orff, 2006).

These natural communities are presented in greater detail below in Section 7.

Water Quality and Watershed Protection The quality of the water in the Great Bog is critical to maintaining the natural communities within it and to assure that good quality water flows downstream to Pickering Brook and Great Bay. The quality of the groundwater is important to maintaining the supply to the public water wells that are located north of the Bog and to provide recharge to Pickering Brook during periods of low flow. Surface water samples indicate that water entering the Bog may be degraded. Attention to improving the quality of stormwater runoff and reducing the contaminants that are causing its degradation will be included in the overall management plan.

Linkage of Conservation Lands Continuing to link existing conservation lands and maintaining the large unfragmented contiguous land area around the Bog is critical. As shown in Table 2, there are many conservation parcels surrounding the Bog and many parcels of undeveloped land. Working to further protect land so that these parcels can be linked and fragmentation prevented is an important long-term goal of the management plan. Fragmentation of the landscape could damage the diversity, integrity, and longevity of the natural communities at the Bog. Additional land protection areas are highlighted in a companion report.

Public Education and Research Many school and community groups have visited the Bog since it became conservation land in 2001. Walks for neighbors and interested visitors are also regularly conducted. These visits will be further encouraged as restoration and management proceeds. Research by local and regional colleges and universities will also be promoted to further understand the conditions at the Bog.

Section 6 - Physical Setting of the Great Bog CE

The following section provides an overview of the physical setting of the Great Bog. For a more detailed description of this area, please refer to the Baseline Documentation Report for the Great Bog Site (Seacoast Land Trust, 2001). The descriptions below include information from that document. The Great Bog CE area is shown in Figure 3.

The Great Bog is located in coastal New Hampshire within the Lower New England Ecoregion. The majority of the wetland that makes up the Great Bog CE is referred to as a Southern New England Seepage Marsh or Seepage Swamp. The wet nature of much of the area prevented extensive human development. Plants and animals were for the most part undisturbed, and unique ecological communities were formed. Conditions were right for Atlantic white cedar communities and associated species. Other unique plants such as the Tufted Loosestrife and Hairy-fruited Sedge also reside in the wetland portion of the Bog.

Recent Land Use – Prior to purchase of this area for conservation, the 194-acre parcel was used for farming and for a variety of recreational uses. Historical records show that the upland island was used for grazing and hay production. A house and barn complex was built as early as 1869, but had been abandoned by the early 20th century. The foundations of the house, barn, and outbuildings as well as stone walls and barbed wire remain as evidence of this occupation and land use.

Since farm abandonment the land has been used for walking, hunting, four wheel driving, and illegal dumping. Dumping and four wheel drive usage has been virtually eliminated since 2003. The area is now used primarily for walking, cross-country skiing, nature study, hunting, and habitat protection. There is a network of trails and dirt roads on the property from this land use. A summary of stewardship activities completed under the direction of the Seacoast Land Trust since 2001 is included in Appendix B.

Geology - The Seacoast of New Hampshire is dominated by glacial and coastal lowland landforms. The upland areas of this site are made up of a sandy glacial till. Marine clay deposits and fine alluvial sediments underlie the wetlands. Areas north and west of the Bog are underlain by permeable sand and gravel outwash deposits, which provide ample water for municipal water supply wells.

At the present time, the dominant landform-shaping processes in the immediate area are deposition of swamp deposits and erosion and re-deposition of sediments by the streams that drain the Bog. The beaver population and the surrounding railroads and roadways play a major role in the drainage characteristics of this area as well.

Soils - Soils were formed on the geologic deposits described above. The upland areas are dominated by Pennichuck channery very fine sandy loam. This soil type is classified as well drained, shallow to bedrock, and not subject to flooding. Along the eastern margins of the upland soils, the soil is mapped as Squamscott fine sandy loam. It is classified as poorly drained and associated with broad low plains. Much of the wetland area is mapped as Ossipee mucky peat. This soil is described as being very poorly drained, deep to bedrock, and typically underlain by greenish-gray clay. Finally, the soil in the wet areas at the margin of the mucky peat is Maybid silt loam. This is also very poorly drained, deep to bedrock, and is associated with drainage ways.

Broadly, the upland Pennichuck soils support the fairly well drained upland grassland and wooded areas. The areas mapped as Ossipee mucky peat are the areas of standing water, red maple, and cattail and phragmites marsh. Due to their drainage characteristics and

topographic position the Maybid and Squamscott soils represent the ecological transition zones or ecotones and occupy the predominant drainageways within the Bog. It appears that the Atlantic white cedar community occurs within this soil type.

Watershed Area - As described in a previous section, Great Bog is within the Pickering Brook Watershed, which covers approximately 1,400 acres. The wetland and interior upland area of the Great Bog covers approximately 600 acres. A small tributary of Pickering Brook flows into the Great Bog from the Constitution Avenue area. Stormwater runoff from this commercial/industrial area is a large contributor of water to the tributary. The Great Bog is the primary headwaters area for Pickering Brook. From the Bog, Pickering Brook flows under Interstate 95 through a culvert towards the Great Bay, which lies approximately 1.5 miles northwest of the Great Bog. The Brook enters the bay just east of Pierce Point in Greenland (Figure 1).

Surface Water - The area included in the Great Bog Management Plan includes the upper watershed area of Pickering Brook. The Great Bog is drained by a system of small streams, which make up the headwaters of Pickering Brook. One of these streams flow from the Constitution Avenue area at Banfield Road, crosses under the Railroad and flow close to the Buckminster Way entrance to the Bog. The stream then passes under a stone culvert beneath the main trail entrance.

Another stream segment crosses to the north of the upland island and another less distinct stream flows from the north towards the Interstate 95 culvert. These streams merge prior to crossing beneath Interstate 95 in a culvert. Drainage within the Bog is restricted by the roadways and railroads surrounding the area and has probably played a major role in maintaining the wet character of the Bog. The beaver population has also modified the drainage patterns within the Bog area.

Wetlands - Although this area is known as a bog it is actually more accurately described as a Southern New England Seepage Marsh and Seepage Swamp (Rawinski, 1989). Sixty-six percent of the CE land area is made up of wetlands or surface water features.

The wetlands found in the Great Bog provide many valuable functions including flood storage, wildlife habitat, contaminant attenuation, and water quality protection. In 2003, the City of Portsmouth contracted with CLD Consulting Engineers and Gove Environmental Services to complete a citywide wetlands inventory. Several prime wetlands candidates were identified in this survey.

The Great Bog, identified as Wetland 003A ranked highest of all wetland areas within the city for wetland quality and function (CLD, 2003). Approximately half of the wetland is made up of emergent marsh populated by cattail, *Phragmites*, and sedges. Forested wetlands surround much of the upland island that is occupied by forest. Where the upland edge is predominately grassland or old-field, a scrub-shrub wetlands made up of speckled alder, willow, blueberry, and dogwood predominates. This community appears to persist largely due to the periodic clearing of the power line easement. The CLD report also listed the numerous species of birds, amphibians and reptiles that populate the Bog. This wetland ranked first for ecological integrity, wetland wildlife habitat, educational potential, water-based recreation, flood control potential, groundwater use potential, sediment trapping, nutrient attenuation, shoreline anchoring, urban quality of life, and overall noteworthiness (CLD, 2003).

Surface Water Quality - The NHDES conducted water sampling for bacteria, pH, and salinity in July 2001 on Pickering Brook downstream of the Bog at the brook underpass on Route 33 (NHDES station GBPS001-025) and at 5 other stations downstream to the mouth

of Great Bay. The results show that there was measurable E. coli and fecal coliform bacteria at all locations. On one sampling date, the greatest concentration of bacteria was detected just upstream of the confluence of Pickering Brook and the Great Bay and greatest concentration was found in Great Bay at the other sampling period. The water quality just downstream of the Great Bog had the lowest measured coliform level for both sampling periods in July 2001.

In 2005, after reviewing the land use upstream of the Great Bog as part of management plan preparation, SLT asked NHDES if there was water quality data available upstream of the Bog on Pickering Brook. There was not, but after they were contacted, sampling was conducted by NHDES at three locations on June 9 and 14, 2005. Dissolved oxygen, pH, specific conductance, temperature, and turbidity were all measured in the field. Two sampling points were established at culvert crossings – one on Banfield Road near Heritage Avenue (02-GBPC) and another adjacent to an auto repair facility on Banfield Road (04-GBPC). A sampling point was also established on Pickering Brook on conservation land near Buckminster Way (01-GBPC). It was raining during the June 14, 2005 sampling period.

Dissolved oxygen was low at all locations. Specific conductance (SC), which is representative of dissolved salts and metals, was highest at the Heritage Avenue site. Even downstream within the Bog CE area, SC was still elevated but much lower than at the Heritage Road site. Turbidity was measured at both sampling periods. Turbidity was elevated at the site near the auto repair facility during the dry and rainy sampling period. The Great Bog CE sample was turbid during the rainy sampling period. A table of sampling results is included in Appendix C.

These results suggest that upper Pickering Brook is impacted by roads and land use in this portion of the watershed. The high specific conductance and turbidity may be due to salt and sand from winter road treatments. While the lower levels of SC at the downstream Great Bog site suggest that the wetland is helping to reduce contaminant levels, these values are still relatively high. Standard specific conductance values for unimpacted areas in New Hampshire generally fall below 100 micromhos/cm, four times lower than the level detected within the Great Bog. Additional detailed water quality sampling is warranted in future studies.

Groundwater Hydrology - Groundwater is contained within both the surficial materials and bedrock beneath the Great Bog. As previously described, the area within the subject parcel is made up primarily of low permeability marine, swamp and alluvial deposits. Groundwater discharge through these deposits supplies water to the wetland. The upland till deposits are somewhat more permeable than the low areas surrounding them. Groundwater flows to the wetland and discharges to seeps at and beyond the upland edges. The more significant sand and gravel aquifer deposits actually surround the Bog to the north, east and south (Stekl & Flanagan, 1992).

The City of Portsmouth maintains several drinking water supply wells within these aquifers surrounding the Great Bog. Immediately north of the Bog are the Portsmouth Well 1 and the Collins Wells. The Great Bog has been mapped as being within the area of contribution to these wells and within the Well Head Protection Area for this northerly sand and gravel deposit. The funding provided by the NHDES to secure the purchase of the Great Bog was based on the direct hydrologic relationship between the Great Bog and groundwater quality.

Fractured bedrock has historically provided significant domestic water supplies and has become increasingly important for municipal supplies as well. Lineaments (often indicative of underlying bedrock fractures) mapped in the area by the USGS suggests that there may

be significant bedrock fracturing just east of the Bog. This may make the underlying bedrock more permeable and able to transmit more groundwater than surrounding less fractured bedrock (Ferguson, et. al, 1997).

Section 7 - Natural Communities and Habitats within the Great Bog CE

The natural communities at the Great Bog and surrounding lands are diverse and provide a broad range of habitat for plant and animal life. In order to gain a better understanding of the distribution and areas of these habitats, the natural communities on Management Unit 9 were mapped in order to better understand the distribution of fields versus forestland. This information in turn will be used to determine the best management options for this MU. It is anticipated that natural communities will be mapped in other MU's in the future as well. Information on the wetland natural communities surrounding the Bog are derived from recent field work and observation and previous work completed by NH Natural Heritage Inventory staff as cited below.

The natural communities at the Bog can be broadly divided into two areas: upland and wetland. Although there are small wetlands within the upland and transition zones near the boundaries of these two community types, they generally occupy distinct areas based on the topography, hydrology and soil type.

Upland Communities

The natural upland communities on the conservation land occupy the large upland island on the CE, several small islands and peninsulas of undeveloped land to the north of the CE, and the edges of the developed land where residences and businesses are located.

The undeveloped upland contains grassland, old-field habitat, and successional stages of forestland. The upland areas within and surrounding the Bog, including the upland island were used for pasture and hayfield beginning in the mid 1800s. These fields began to revert to shrub land as they were successively abandoned between the early 1900s and the 1970s. The oldest pastureland that has reverted is now mixed hardwood and coniferous woods.

Shrubs including native sumacs, blueberries, cedar, juniper, bayberry and dogwood inhabit the grassland and old fields. Exotic invasive shrubs including barberry, buckthorn, autumn olive, multiflora rose and bittersweet have become more plentiful and are beginning to dominate the native shrub and grasslands.

The only areas that remain as semi-open grassland are within several hundred feet of the Public Service Company of New Hampshire (PSNH) power lines that cross the upland island. PSNH periodically clears under and beyond the lines to keep the power line area open. In these fields and along the old stone walls and foundations are apple, crabapple, and pear trees that were either original plantings or grew from fruit from the original trees. A small grove of crabapples has also been planted by Tree Stewards that assist with restoration at the Great Bog. The trees were provided to SLT by NHFG in 2003 and many of these trees are thriving.

The natural communities on the upland island (Management Unit 9) were roughly mapped during the fall of 2005 in order to better characterize the upland habitat. Figure 4 shows the approximate boundaries of the natural communities that were identified. Table 4 lists the identified communities, approximate acres of each type, and the approximate percent of invasive plant species in each community.

The forest and wetland community types were identified based on the New Hampshire Natural Heritage Bureau Classification System for natural communities (Sperduto and Nichols, 2004). The grasslands and old fields are not included in the New Hampshire

classification scheme, so these community classifications have been adapted from the cultural grassland classification used in Massachusetts (Manomet, 2005).

Table 4
Natural Communities on Management Unit 9

Natural Community and NHHI Rank	Estimated Area (acres)	% Invasive plant cover
Hemlock-Cinnamon Fern Forest , S4	3.2	< 5%, Buckthorn, Multiflora Rose
Mesic Appalachian Oak Hickory Forest, S2S3	1.6	< 5%, Buckthorn, Multiflora Rose
Hemlock-Beech-Oak-Pine Forest, S5	4.9	< 10%, Buckthorn, Multiflora Rose
Red Maple-Red Oak – Cinnamon Fern Forest, S3S4	13.1	<10% Buckthorn, Multiflora Rose
Early to mid Successional Hemlock-Beech-Oak-Pine Forest, S5	17.3	> 20%, Buckthorn, autumn olive, Multiflora Rose
Early Successional Cultural Grassland (Old-field), not ranked	16.2	>30% Buckthorn, bayberry, Autumn olive, Multiflora Rose, barberry
Mid-Successional Cultural Grassland (Old-field), not ranked	4.1	>50% Buckthorn, bayberry, Autumn olive, Multiflora Rose, barberry
Vernal Pool Candidates (3)	0.5	None observed

Although the mapping is not definitive, it provides an overall characterization of the current land cover. In summary, grasslands cover approximately 20.3 acres of the upland while forestland now covers nearly 60 percent of Management Unit 9. The early successional stages of forest may also serve a similar habitat function to old-field habitat in the near future.

The following section provides a brief description of each of the natural communities observed on MU 9. Appendix D includes a thorough description of each community as described by Sperduto and Nichols, 2004. Community rarity rank codes are also included in the description below (S3, etc...). The explanation for these codes is also included in Appendix D.

Hemlock-Cinnamon Fern Forest (S4) - This community occurs on the northwestern edge of upland island between a stone wall and the edge of the Red Maple - Sensitive Fern swamp area. There is also an area of this same community on the northeastern upland perimeter. The canopy is made up of nearly all hemlock with a minor shrub and herbaceous layer predominated by cinnamon fern and equisetum. This community occupies a total area of 3.2 acres.

Red Maple- Red Oak – Cinnamon Fern Forest (S3S4) – Like the Hemlock-Cinnamon Fern Forest, these areas occur near the wetland boundary and contain many of the same species associated with the Hemlock-Beech-Oak-Pine forest described below. Blueberry,

nannyberry, and some winterberry occur in these areas. The herbaceous layer varies depending on the proximity of the community to the wetland edge. There are 13.1 acres of this community within MU-9.

Mesic Appalachian Oak Hickory Forest (S2S3) - This community occupies a small area on the crest of the eastern peninsula. Tall oaks, a few beech, birch, and hickory trees also occur within the canopy. There is a minor shrub and herbaceous layer in this community. This covers approximately 1.6 acres.

Hemlock-Beech-Oak-Pine Forest (S5) - This community is the dominant forest type, with distinct successional areas as shown on the map. The early to mid successional areas contain quaking aspen, birch, and several large black cherries. Shrubs include arrowwood, nannyberry, blueberry and buckthorn with some multiflora rose. The more mature stands have pine and hemlock in abundance with fairly large red oak. Beech and red maple are also common but these trees are generally smaller than the oaks. Birch and cherry are abundant in the early successional areas of this community. A variety of shrubs and herbs are present at these locations, depending on their age and proximity to the wetland edge. This community type covers a total of 22.2 acres on MU-9 including all successional stages.

Vernal Pool Candidates - There are three areas on this MU where vernal pools have formed, apparently from manmade activities. Two of these areas are within dirt roads where soft, wet soils have been torn up and deeply rutted. Four-wheel drive activity at the Bog was common until the area became conservation land. Since that time SLT and the City have worked hard to eliminate this damaging traffic and since 2003, this traffic has been virtually absent. These ruts behave as vernal pools and are alive with amphibious life throughout the spring and early summer. They could be considered vernal floodplain pools or vernal woodland pools, depending on their location in the Bog. Another woodland candidate area is near the western edge of MU 9. It appears as if it was once either a small farm pond or an excavated area as it is fairly regular in shape.

Cultural Grassland/Old-field (not ranked) - The other major natural community at the site is the cultural grassland and old field area. These grasslands are considered cultural as they are or were regularly mowed or grazed in the past or are currently cleared by PSNH during periodic line maintenance. Farming has long since ceased on this land but mowing and clearing by PSNH still occurs every 3 to 4 years beneath and within 200 feet of the power line corridors that run through the Bog. The older grassland areas that have not been mowed for over 30 years are now old fields and are covered with tall shrubs, red cedar, and small white pines.

Upland Invasive plant Species - The more regularly-cleared areas also have a fair complement of shrubs, but have more open grassland as well. This is the area within the Great Bog where the greatest exotic species invasion has taken place. Autumn olive, barberry, buckthorn, and multiflora rose have all become common in the reverting grassland and are crowding out the juniper, blueberry, bayberry, juniper, and red cedar that would normally form the shrub layer in this area. There is little shade to inhibit their growth and the periodic mowing by PSNH may strengthen the shrub's root system and foothold. In the older field areas white pine and birch are beginning to shade out the shrub layer. This phenomenon suggests that these invasive plant species will be on the decline, but they still remain a serious contender for dominance in the old-field areas.

Another open area where invasive plant species have been observed is along the entry to the Bog from Buckminster Way. A large hill of fill was located here before the Great Bog became conservation land in 2001. In order to provide easier access to the Bog, this pile

was leveled, creating the approximately 40-foot wide access pathway. In 2004, areas of Japanese knotweed were noted in this area. Volunteers cut down and bagged the knotweed in 2004 and 2005 on three occasions. The stands were then covered in black plastic to prevent further growth. Although this helped, sprouts continue to pop up and the knotweed area is spreading closer to the Bog. More aggressive measures should be taken in this area in order to prevent its spread into the inner regions of the Great Bog.

Natural communities were surveyed only on MU-9. However general observation of community types on adjacent lands suggests that the natural communities and their conditions as described above, are common to much of the upland within the 900 acre unfragmented land area that surrounds the Great Bog.

Wetland Communities

During the upland survey on MU 9, observation of the wetland community types was also made, but strict classification and mapping of these areas was not completed. *Conservation Plan for Great Bay* (Stevens and Anderson, 1997), (Rawinski, 1989) also provided background on wetland types and locations of species of concern.

Much of the wetland area of the Great Bog is considered to be a coastal/southern hardwood-conifer seepage swamp or an herbaceous seepage marsh. There are also significant areas of Alder-dogwood-arrow wood thicket, cattail marsh and medium-depth emergent marsh. The wetland natural communities are broadly described below.

Herbaceous Seepage Marsh (S3) - These wetlands occur in areas of groundwater discharge and near upland borders, in headwaters areas, and along stream drainages. These wetland communities are where Hairy-fruited Sedge, Tufted Loosestrife and Atlantic white cedar were observed in and 1989 field survey by T. Rawinski. These areas are located southeast (in MU 13) and northwest of MU 9 (in MU 16 & 17). At the time of his fieldwork Rawinski noted the following about these unique species.

Tufted Loosestrife (*Lysimachia thyrsoiflora*) – “Excellent Quality (A on a scale of A-D), New Hampshire’s best population, thousands of budding plants (1989).” These plants were noted in MU-13, 16 & 17. The field notes also stated that smaller populations were noted by Mark West in MU 14 area just east of the power line access road.

Hairy Fruited Sedge (*Carex tricocarpa*) – “Fair quality and/or prospects for long term conservation – C on a scale of A-D, small population, needs field work, 50-100 budding plants”. These plants were primarily found in association with the Atlantic White Cedar in MU 16 and MU 17.

Atlantic White Cedar (*Chamaecyparis thyoides*) – “Scattered Cedars within the Great Bog interior in the Seepage Swamp.” These plants are found in MU 16 and MU 17.

Red Maple - Sensitive Fern Swamp (S3S4) - This wetland type is a type of southern conifer-hardwood seepage swamp and occurs in many locations throughout the Bog. The largest area was mapped by NHHI in MU-16, however smaller areas of this wetland type occur throughout the wetland complex. The community located on the Great Bog is considered to be exemplary by NHHI Red Maple-Lake Sedge swamp (S3) also occurs in the Bog near wetland/upland interfaces and in areas where marshes are transitioning to swamps and are adjacent to the forested upland areas. (Sperduto and Nichols, 2004).

Medium depth emergent marsh, Cattail marsh (S4) - This wetland type occurs in many areas surrounding MU-9 and in the large open wetland west of MU-9. Phragmites

currently occurs near wetland edges on the east and southern side of MU-9 in discrete patches. Phragmites has taken over much of the cattail marsh in MU-17 west of MU-9.

Alder-Dogwood-Arrow wood Alluvial Thicket (S4) - These communities were noted at upland/wetland interfaces adjacent to the cultural grassland communities. These areas have been noted in the power line right of way on the western and northern edges of MU-9. They are primarily populated by speckled alder, but silky dogwood and northern arrow wood are also common. Highbush blueberry is also common in this area.

Wetland invasive plant species - Exotic invasive wetland plant species are present in many locations throughout the Bog. Most prevalent are the areas of phragmites. These are thought to be of the non-native phragmites species but positive identification has not been made. The largest population occurs in MU-17 from Interstate 95 to MU-9. Changing hydrology conditions in this area have likely provided ideal conditions for the growth of phragmites. The invasion of phragmites has crowded out most of the plant species associated with the seepage marsh in this area.

Other large areas of phragmites invasion within the conservation land are north of MU-9 adjacent to the power line right of way. Smaller edge populations of phragmites occur within the wetland “inlets” along the southern edge of MU-9 and along the eastern edge of MU-9 adjacent to the wooded upland. This edge population is common in other wooded wetland edges in MU-14 and -16 as well. Purple Loosestrife often occurs in these smaller Phragmites pockets and in the seepage marsh areas. On one of the site walks in August 2005, it was also noted that narrow leafed cattail was beginning to displace the native cattail in some of the emergent marsh areas.

A better understanding of the surface water and wetland hydrology within the Great Bog will help in restoring the native wetland communities, and will help in planning restoration of the marsh that is being invaded by exotic Phragmites.

The stewardship, education, and research and the recreation goal all apply to the management and or restoration of natural communities. In particular the objectives to protect/restore habitats to native condition, protect rare and unique species and habitat, maintain biodiversity, and utilize sustainable management practices all apply to any management activities that might occur in this area.

Plant and Animal Species List - 462 plant and animal species have been documented by naturalists to the Great Bog over the past 20 or so years. In June 2005, a BioBlitz biological inventory was conducted that identified 221 species, 60 of which are newly documented. Appendix E includes the species list compiled by Dr. Donald Green of his observations as well as many other biologists and naturalists. The species identified during the 2005 BioBlitz are noted in this list. The plants list includes the general locations where these species are found and their general abundance within the Great Bog area. This compilation documents the diversity of plants and animals in this 600 + acre area.

As an example of the species represented, there have been 141 bird species identified at the Bog. Most of these are breeding birds, but some of the more unusual birds are either foragers or migrant/flyby's. Their occurrence is noted on the list. Many grassland and edge habitat bird species still inhabit the upland areas at the Bog. Bluebirds are attracted to the open habitat and the bluebird boxes that have been mounted on power line poles in the upland. Woodcock are often noted at the old-field edges especially in spring mating season. A wide variety of hawks are present including nesting Red-tailed and Broad-winged hawks, Cooper's hawks, Sharp-shinned hawks, and Kestrels. A large variety of warblers, flycatchers, and sparrows also call the Great Bog home.

Portsmouth's Great Bog has a variety of wildlife habitats within its boundary resulting in a diversity of wildlife. The wetland component is significant and provides for a wide diversity of species including birds, mammals and amphibians as well as insects. Associated mammals include evidence of beaver, muskrats, mink, and raccoons with some likelihood of occasional visits by river otters.

The mix of fields, softwood and hardwood forests also provides habitat for a wide variety of species including white tailed deer, fox, both red and gray, the eastern coyote, opossum, weasel, striped skunk, woodchucks, red and gray squirrels, and fisher.

Cottontail rabbit tracks have been identified although it has not been determined if they were of the more common eastern cottontail or the rare New England cottontail. The New England cottontail is undergoing listing as a federally threatened species. Mice, voles, shrews and a wide variety of small mammals occur in the variety of productive habitats providing an abundance of prey for avian as well as terrestrial predators (Orff, 2006).

Several species of amphibians are present including common frogs such as spring peepers, green and bull frogs as well as American toads. Field research is needed to identify other likely reptiles and amphibians present such as the common garter snake, milk snakes (both identified there), black racers, ribbon snakes, red bellied, brown and green snakes. Turtles identified include eastern painted, snapping turtles, and spotted turtles. Habitat is present for rarer turtles such as Blanding's but has not been positively identified there.

Development pressures will continue to impact this area, but through further land and habitat protection, this progress can be slowed to allow for the continued health of the Great Bog natural communities. The natural communities documented as part of the Great Bog Management Planning process help to keep the variety of plants and animals diverse and healthy. A conscious effort will be made to maintain a variety of habitats to continue to encourage broad species diversity.

Section 8– Recreation and Open Space in the Great Bog CE

The Great Bog Conservation Easement (CE) is used for a variety of passive recreation purposes. Many neighbors, residents and visitors use the Bog for recreation and nature study. Birding groups and enthusiasts regularly visit the Bog to document resident and migrating populations. Tree stewards help maintain the quality of many trees on site. Many visitors use the trails for walking, snowshoeing, and skiing. Hunters value the area for its population of white-tailed deer and smaller mammals.

Motorized vehicles are prohibited at the Bog as a requirement of the NHDES Groundwater Source Protection funding and the Conservation Easement. Management suggestions relative to recreation are provided in order to encourage responsible passive recreation and discourage unsuitable uses.

Trails and roads - An extensive network of trails and old farm roads cross the CE area as shown in Figure 3. Although the trails have been cleared and marked in many locations, improvements are needed especially where they cross wet areas. Many have also supported handicapped access to the Great Bog at this location. In particular, the crossing of Pickering Brook and the nearby wetland near the Buckminster Way entrance (MU-13 and – 17) needs an elevated walkway and re-routing to prevent further degradation of the wet area in that location. Several means of improving passage in this area have been suggested in the past, including:

- The use of stepping stones to provide a means of crossing the wet area, while still allowing for water flow and wildlife passage,
- Bog bridges constructed of logs and untreated lumber which would elevate the walkway and allow for water flow and wildlife passage, or
- Elevated boardwalk to allow for a dry and flat walkway and allow for water flow and wildlife passage. This would also allow for easier access by handicapped individuals.

These options are listed from least labor-intensive to most labor-intensive. There has been interest by several groups to assist in creating these walkways. They include the Boy Scouts for Eagle Scout projects, Timberland, and Rotary Club.

Another area where a walkway would be an asset is near the vernal pool candidates within the western trail network on MU-9. A path has been created north of this area, but it is still quite wet. A bog bridge or boardwalk would be very useful in this area.

Many visitors to the Bog have suggested an observational boardwalk that would extend into the wetland. The seepage swamp area west of the hemlock-Cinnamon Fern forest on MU-9 would be well suited for such a boardwalk.

A kiosk was constructed on the path from the Buckminster Way entrance to the Bog in 2003. It has been used to post hunting schedules, trail maps, and general information but in general, has been under-utilized. A plan to better utilize this display area is needed.

At the moment a rough trail map is available. However, a more user-friendly version, with interpretation would be an asset for those visiting the Bog and might encourage more educational use of the Bog as well. Natural and cultural features could be included in the explanatory materials. The maps could be housed at the kiosk. Visitors could be asked to sign in and return the maps to the kiosk when they are done with their walk.

Additional trail development/re-routing - There is a fairly complete trail system at the Bog. An additional marked trail to the woodland on the northeast side of MU-9 would allow visitors to view the Mesic Appalachian Oak-Hickory forest and Hemlock-Cinnamon Fern forest on this peninsula. This will also provide good viewing of the seepage swamp to the north.

Also on this side of MU-9 is a vernal pool candidate in a rutted portion of an old woods road. In order to encourage the establishment of this vernal pool and prevent its degradation, it has been suggested that this portion of the trail/road system be closed to traffic and re-routed around these pools. This could be easily accomplished by dropping several logs across each end of the path to prevent any illegal vehicle traffic and to discourage foot traffic. Making obvious alternatives for passing these areas on foot will also encourage their permanence and quality.

Cultural and Historical Features - Stone walls cross the property in many locations, and several foundations remain on MU-9 from when the upland island was settled as a small farm. According to an archaeological survey completed prior to development planning, the conservation area remained undeveloped until sometime in the second half of the nineteenth century. An 1857 map (Chace 1857) shows the area sparsely populated, with only six farmsteads along Ocean and Banfield Roads. An 1892 map (Hurd 1892) shows the homestead of a J.A. Hammond at the junction of two roads leading from Ocean Road and Banfield Road. City directories place Hammond and his family at this address as early as 1869.

An archaeological survey of the property (Bayly, 2000) reported finding what it describes as “a large agricultural complex of four cellars and several stone walls atop the highest point of the property”. The farm may have been active for only a short time. Records show that Hammond moved to Dover in 1888 leaving the farm vacant. In 1895 the property was sold to Charles and Mary Sullivan who lived there until 1903. The land may have been farmed sporadically during the early part of the twentieth century by other nearby farmers, but records of ownership seem to indicate that by 1921 the property had been combined with another tract of land, and the buildings were gone. As mentioned above, the stone foundations of four structures remain. During the natural community mapping in the fall of 2005, a small rectangular pool was noted near the western edge of MU-9. At first it appeared to have been a dug well, but several timbers were found in the water, suggesting this may have been a springhouse.

Volunteers have periodically cleared the barn and house foundation so that visitors can view them. Further archaeological work could be completed as part of an educational outreach effort and to inform visitors about recent settlers to the area.

Aerial photographs suggest that the Great Bog was historically drained by directing water into drainage ditches. The restoration of its original swampy character is largely due to the return of beavers, which have reflooded low areas, and to the construction of the multiple elevated roadways and railroads that surround the Bog.

Section 9 – Great Bog Conservation Easement Management Units and Suggestions

The Great Bog Conservation Easement falls within six of the designated Management Units (MU's). These include Units 9, 12, 13, 14, 16 and 17. Units 9 and 12 make up most of the upland area within the conservation land, while the other MU's- 13, 14, 16, and 17 - are mostly wetland areas. Figure 3 shows the area of the CE land and the MU's that make it up and Table 3 provides an overview of the MU areas.

The Great Bog provides multiple functions not only to the immediate area but also to the Great Bay and Seacoast habitats in general. This area protects the wetland and upland habitats that are living and breeding areas for many of the animals that populate these communities. There are diverse and exemplary plant communities within the wetland and upland as described above. The land also provides feeding grounds and a wildlife corridor between the Atlantic Coast and Great Bay and between the significant unfragmented and protected areas to the south. The water quality of Pickering Brook is protected and improved by the presence of wetlands for filtration and helps keep the downstream water quality high for eventual discharge to Great Bay. The protection of the groundwater for public water supply is also an important function of this area.

The following descriptions summarize physical properties and management suggestions for these areas. Section 10 provides summaries for the MU's that fall outside the CE area. Again, the overall goals for the Great Bog Conservation Easement Area are:

Stewardship Goal - To be stewards of the Great Bog's natural heritage by conserving, managing, and protecting its natural and cultural resources to the maximum extent possible.

Partnership Goal - To establish and maintain positive working relationships with neighbors, the public, and other interested parties.

Recreation Goal - To provide opportunities for low impact recreation consistent with other goals.

Education and Research Goal- To facilitate education, research, and interpretation of the Great Bog's natural, cultural, and historic resources.

Vista Goal - To maintain vistas and viewsheds consistent with other goals.

Management Unit 9 – Sirrell Highlands

Description

This MU was named for Portsmouth Mayor Evelyn Sirrell, who was a major advocate for the protection of the Great Bog. This MU is the large upland island within the Great Bog. It represents 62 acres of the 194-acre Great Bog Conservation Easement.

Ownership

This MU is primarily owned by the City of Portsmouth and the Seacoast Land Trust holds the conservation easement on the land. The Griffin Family owns the small sliver on the northeastern side of the island.

Grassland/Old field

Nesting habitat for grassland and old-field bird species and small mammals.

Variety of Forest Types

The variable habitat on this upland allows for Mesic Appalachian Oak – Hickory, Hemlock-Beech-Oak-Pine in the upland wooded areas and Hemlock-Cinnamon Fern and Red Maple-Red Oak-Cinnamon Fern Forest in the habitat transition areas.

Vernal Pools

Several areas created by manmade activities function as vernal pools and will flourish if left to exist.

Cultural Features

The foundations and stone walls from the former farmstead are located on this MU.

Access and Recreation

This area is accessed from the Buckminster neighborhood (MU-12).

A major trail and road network exists and is open to the public.

Hunting is permitted on this land.

Threats to the Great Bog

- Resumption of off road vehicle usage,
- Damage to sensitive environments by trail traffic,
- Infestation of hemlock by woolly adelgid,
- Dominance of grassland habitat by invasive plant exotic species,
- Invasion of forestland by exotic species,
- Degradation of cultural/historic features due to neglect, and
- A small portion of MU-9 is owned by an adjacent landowner.

Management Suggestions

Stewardship

- Verify findings of natural community mapping of MU-9.
- Annually monitor health of hemlocks and woolly adelgid populations annually and take action if necessary to prevent infestation.
- Work to maintain up to 15 acres of MU-9 as grassland. Remove existing invasive plant species by mechanical means (or other suitable means) and mow annually to keep open. Cooperate with NRCS, Partners for Fish and Wildlife, PSNH, volunteers, and the City for access, manpower, and funding for this task.

- Determine where and how MU-9 will be accessed for restoration and management work.
- Survey and develop strategy to eliminate pockets of Phragmites and purple Loosestrife on margins and inlets.
- Work to eliminate upland invasive plant species from wooded area by mechanical means.

Partnership

- Work with potential partners and agencies on planning, implementation and monitoring of upland and wetland invasive plant species and on natural community mapping.
- Work with neighboring landowner to secure ownership or management privileges on MU-9 land not owned by the City of Portsmouth.

Recreation

- Continue prevention of off-road vehicle usage through posting, blocking access, public relations, and periodic patrolling of the area.
- Improve the trail system by installing durable trail markers, construction of bog bridges or boardwalks across wet areas, and re-routing of trails and preventing access to sensitive areas. Consider providing handicapped access to some areas.

Education

- Develop interpretive trail map for use by the general public.
- Work with NH Department of Historic Resources to encourage further archaeological characterization of the area by local and regional non-profits. Provide interpretive signage and information on historic land use and remaining foundations.
- Encourage local and regional academic study of natural communities, hydrology, and cultural history of the conservation area.

Management Unit 12 – Buckminster Way

Description

MU 12 is 34.5 acres and includes the upland associated with the Stonegate subdivision on Buckminster Way, which immediately abuts the Bog and provides access from the east.

Ownership

The residents of Stonegate own most of this area but a portion (4.6 acres) is part of the Great Bog Conservation Easement.

Target Features

- Public Access point to Bog
- Wetland boundary adjacent to homes

Access and Recreation

The parking area for access, the path into the Bog, and the kiosk are all on this MU.

Threats to the Great Bog

- Loss of current good relationships with the neighbors in this area. Good communication with them is essential in order to avoid contention regarding continued access to the Bog from Heather Lane.
- Disposal of yard waste, installation of structures, or other inappropriate activities within the Great Bog Boundary.
- The path way is also where the invasion of Japanese knotweed has occurred. Even with the measures taken, it continues to spread closer to the woodland. Migration of this plant into the Bog is a major concern. There is also a healthy population of exotic Asian bittersweet and Buckthorn in this area.
- The post and chain fence at the edge of Heather Lane currently limits access to this area. If the fence is not maintained, incompatible access to the land could occur.
- Potential failure of adjacent septic systems that could impact wetland and water quality.

Management Suggestions

Stewardship

- Aggressively control the Japanese knotweed and other invasive plant species in this area. Revegetating this area with grasses followed by annual or semi-annual mowing could help keep this area more attractive and free of invasive plant species.
- Maintain conservation easement signage at the boundary. Include this property boundary in annual monitoring program.

Partnership

- Work with potential partners and agencies on planning, implementation and monitoring of upland and wetland invasive plant species and on natural community mapping.
- Maintain liaison with neighborhood and seek to include them in management and restoration efforts. Periodically provide information on the Bog and guidance for best management practices adjacent to the Bog.

Education and Recreation

- Work to provide handicapped access.
- Better utilize the kiosk at the entrance to the Bog.

Vista

- Keep entrance to the Bog attractive to visitors and neighbors.

Management Unit 13 – South Pickering Brook

Description

MU 13 is a 116.3-acre wetland area bounded by Ocean Road to the southwest, the Buckminster neighborhood to the north and the railroad to the east.

Ownership

This area is completely within the Conservation Easement boundary. It is owned by the City of Portsmouth and SLT holds the Conservation Easement.

Target Features

- This area contains the main stem of Pickering Brook, which crosses under the trail near the Buckminster entrance.
- MU-13 includes the herbaceous seepage marsh where populations of Tufted Loosestrife were noted in the past.
- There is a large area of emergent marsh with some alder thicket and red maple swamp close to upland boundaries.
- Phragmites occurs near upland boundaries.

Access and Recreation

- The access trail from Buckminster crosses Pickering Brook and the wetland on this MU.

Threats to the Great Bog

- Expanded and continued invasion of phragmites and purple loosestrife.
- Degradation of the tufted loosestrife populations.
- Stormwater runoff from roads surrounding this area.
- Degraded water quality from MU-1 and MU-2.

- Incompatible management of power lines by PSNH.

Management Suggestions

Stewardship

- Survey and map natural communities
- Survey and map invasive plant species and develop a program for control.
- Survey Tufted Loosestripe population and determine if active management is necessary.
- Continue water quality sampling to determine off site impacts on site water quality.
- Study the hydrology of the Great Bog in order to better understand the relationship of hydrology to natural community sustainability.

Partnership

- Work with PSNH to make sure management of power line area is consistent with conservation goals.
- Work with potential partners and agencies on planning, implementation and monitoring of upland and wetland invasive plant species and on natural community mapping.

Recreation

- Improve trail system by installing durable trail markers, re-routing where necessary, and construction of elevated walkways to facilitate access and to minimize wetland impacts.

Vista

- Work with volunteers to pick up accumulated trash along Ocean Road boundary.
- Post signs indicating location of the Great Bog.

Management Unit 14 – North Pickering Brook

Description

This 116-acre area is largely a Red Maple swamp and shallow emergent marsh and surrounds MU-10, Green Island. It is bounded by the railroad to the east and the PSNH access road to the west.

Ownership

A portion of this area is within the Great Bog CE (5.8 acres), but the Griffin Family owns the majority of the land.

Target Features

- This emergent marsh and seepage marsh area is a continuation of the communities within MU-13 and provides a major drainage area for the other branch of Pickering Brook within the Great Bog. It is a vital part of the Pickering Brook headwaters area and the Great Bog habitat in general.
- Small communities of Tufted Loosestrife were noted in the past on the western margin of this MU.
- A population of phragmites and purple loosestrife has begun to establish itself immediately adjacent to the PSNH road in this area.

Threats to the Great Bog

- Incompatible development on the adjacent uplands.
- Further invasion of phragmites and purple loosestrife.
- Disappearance of the small Tufted Loosestrife population.
- Incompatible management of the PSNH access road and right of way.

Management Suggestions

Stewardship

- Survey invasive plant species and develop strategy for control.
- Survey natural communities and Tufted Loosestrife populations and determine if management is required.
- Continue water quality sampling to determine off site impacts on site water quality.
- Study the hydrology of the Great Bog in order to better understand the relationship of hydrology to natural community sustainability.

Partnership

- Work with potential partners and agencies on planning, implementation and monitoring of upland and wetland invasive plant species and on natural community mapping.
- Work with PSNH to make sure management of power line area is consistent with conservation goals.
- Continue conversation with abutting landowner about permanent conservation.
- If development occurs, work to provide adequate buffers and measures to protect wetland quality.

Management Unit 16 – North Bog

Description

This 240-acre area is east of Interstate 95, south of Griffin Park, west of the PSNH power line, and north of the MU-9 upland.

Ownership

Approximately 17 acres of this area is within the Great Bog CE area. The City of Portsmouth or the Griffin Family owns the remaining land.

Target Areas

- Includes the large area of high quality Red Maple-Sensitive Fern acid seepage swamp and a portion of the acid seepage marsh that contains the Atlantic White Cedar, Tufted Loosestrife and Hairy-fruited Sedge populations.
- Phragmites has taken over a large area west of the power line right of way.

Threats to the Great Bog

- Further invasion of phragmites from Interstate 95 and the power line right of way.
- Degradation of AWC, Tufted Loosestrife, and Hairy fruited Sedge populations.
- Water quality impacts from commercial/residential stormwater and transportation corridors.
- Incompatible development on the adjacent uplands and fragmentation of open land.
- Incompatible management of the PSNH access road and right of way.

Management Suggestions

Stewardship

- Survey invasive plant species and develop strategy for control.
- Survey natural communities and wetland rare and threatened populations and determine if further management is required.
- Continue water quality sampling to determine off site impacts on site water quality.
- Study the hydrology of the Great Bog in order to better understand the relationship of hydrology to natural community sustainability.

Partnership

- Work with potential partners and agencies on planning, implementation and monitoring of upland and wetland invasive plant species and on natural community mapping.
- Work with PSNH to make sure management of power line area is consistent with conservation goals.
- Continue conversation with private landowner about permanent conservation.
- If development occurs, work to provide adequate buffers and measures to protect wetland and habitat quality.

Management Unit 17 – South Bog

Description

This 120-acre area is primarily wetland. It is bounded to the west by Interstate 95, to the south by Ocean Road and the east by MU-9. A power line corridor runs through the southern portion of this MU.

Ownership

This land is entirely owned by the City of Portsmouth.

Target Features

- The area closest to Interstate 95 is predominantly wetland with a large population of Phragmites.
- A portion of the area is seepage marsh and Red Maple – sensitive Fern swamp as well.

Threats to the Great Bog

- Phragmites spread that could alter the healthy wetland habitats at the Bog.
- Contaminated stormwater runoff and deposition from Interstate 95.
- Incompatible management of the PSNH access road and right of way.

Management Suggestions

Stewardship

- Survey natural communities and wetland rare and threatened populations and determine if further management is required.
- Survey invasive plant species and develop strategy for control.
- Continue water quality sampling to determine off site impacts on site water quality.
- Study the hydrology of the Great Bog in order to better understand the relationship of hydrology to natural community sustainability.

Partnership

- Work with PSNH to make sure management of power line area is consistent with conservation goals.
- Work with potential partners and agencies on planning, implementation and monitoring of upland and wetland invasive plant species and on natural community mapping.

Vistas

- Post signs on Interstate 95 and Route 33 to educate the public about the location of Great Bog.
- Manage phragmites population to improve the view of the Great Bog from I-95.

Summary of Management Suggestions for the Great Bog Conservation Easement

The following is a consolidated list of suggestions for the Great Bog Conservation Easement area. The suggestions are organized by Great Bog Management Goals and list the entities or organizations that may be involved in implementing the management component.

Table 5 a – Great Bog CE Management Suggestions – Stewardship Goal

<u>Management Suggestion</u>	<u>Agency or Partners</u>
Verify findings of the MU-9 natural community mapping.	UNHCE, UNH, volunteers
Complete natural community mapping of remaining MU's within the Great Bog CE area.	UNHCE, UNH, volunteers
Determine means of access for equipment for Great Bog management activities.	City of Portsmouth, Seacoast Land Trust
Continue monitoring and prohibition of motor vehicle use on Great Bog CE.	City of Portsmouth, Seacoast Land Trust
Monitor health of hemlock stands annually.	Tree Stewards, UNHCE, Urban Forestry Center
Manage up to 15 acres of MU-9 for open grassland.	City of Portsmouth, NRCS, NHFG
Survey special species and communities identified by NHNHI and develop management plan if needed.	NHNHI, NRCS, UNHCE, GBRPP
Work with PSNH to assure that power line easement management methods are consistent with the management goals for the Great Bog.	City of Portsmouth, Seacoast Land Trust, PSNH
Study the hydrology of the Great Bog in order to better understand the relationship of hydrology to natural community sustainability. In particular–	NRCS, UNH, NHCP
o Groundwater input	
o Surface Water Contribution	
o Drainage Channels	
o Flow Characteristics	
Conduct more detailed water quality sampling upstream and within the Great Bog area.	NHDES, Volunteers
Prepare detailed map of invasive plant species and develop plan for invasive plant species control starting with smaller patches or areas near sensitive natural communities.	NRCS, NHCP, NH Corporate Wetlands Restoration Partnership, volunteers
Aggressively control spread of Japanese Knotweed and develop sustainable management for pathway area.	NRCS, NHCP, City of Portsmouth, Seacoast Land Trust

Table 5 b – Great Bog CE Management Suggestions - Partnership Goal

<u>Management Suggestions</u>	<u>Agency or Partner</u>
Maintain good relationships with abutting landowners and neighbors through outreach and neighborhood liaison.	Seacoast Land Trust, City of Portsmouth, Neighborhood Liaison
Continue partnerships with agencies and organizations that have participated in the initial planning and funding of the Great Bog Management Plan in order to effectively implement the management suggestions.	City of Portsmouth, Seacoast Land Trust
Build relationships with additional organizations as part of management plan implementation.	City of Portsmouth, Seacoast Land Trust

Table 5 c – Great Bog CE Management Suggestions - Recreation Goal

<u>Management Suggestion</u>	<u>Agency or Partner</u>
Prepare interpretive trail map.	City of Portsmouth, Seacoast Land Trust, volunteers
Improve the trail system by installing durable trail markers, construction of bog bridges or boardwalks across wet areas, and re-routing of trails and preventing access to sensitive areas.	City of Portsmouth, Seacoast Land Trust, volunteers, National Park Service
Develop and implement plan to better utilize trail kiosk.	City of Portsmouth, Seacoast Land Trust, volunteers, Neighborhood Liaison

Table 5 d – Great Bog CE Management Suggestions - Education and Research Goal

<u>Management Suggestion</u>	<u>Agency or Partners</u>
Encourage local and regional academic study of natural communities, hydrology, and cultural history of the Conservation area.	UNHCE, UNH, Antioch, Local primary and secondary schools
Encourage further archaeological study and preservation of cultural and historic features at the Great Bog.	NH Division of Historic Resources, Strawberry Banke, volunteers

Table 5 e – Great Bog CE Management Suggestions - Vista Goal

<u>Management Suggestion</u>	<u>Agency or Partners</u>
Post “Great Bog” signs along Ocean Road, Interstate 95 and Route 33 to indicate location of the Great Bog to community and visitors.	City of Portsmouth, NHDES
Work to maintain vistas as part of Stewardship suggestions.	City of Portsmouth, Seacoast Land Trust

Section 10 - Management Unit Descriptions and Suggestions

The remaining management areas lie outside the Conservation Easement Area but are important to evaluate as they contribute to the overall health of the Great Bog. Based on the review of land use and physical characteristics of these surrounding management units, the following generalizations can be made.

- The surrounding MU's provide surface water inflow to the Great Bog from stormwater runoff and from the easterly tributary of Pickering Brook. Preliminary sampling of some of these inflows suggests that water quality is below the desired quality and could impact the health of the Great Bog.
- Much of the land surrounding the Bog is undeveloped or lightly developed and add to the overall habitat quality through habitat diversity and its unfragmented nature. Several large areas of undeveloped land, not contiguous to the Bog are already owned or controlled by the City of Portsmouth are within the surrounding MU's as well. Wetlands have been impacted by development in some of these areas and would benefit from restoration.
- Commercial and residential land use surrounding the Bog and Pickering Brook area has or could potentially impact the quality of the Great Bog. Cooperation with these neighbors could lead to overall improvement of the habitat and water quality in this area.

The remaining MU's are described below. Their location is illustrated on Figure 2.

Management Unit 1 - Heritage

Description

This 209-acre area includes residential, light industrial and commercial uses within its boundaries. Two parcels of City owned conservation land occurs in the central area along the railroad. This area contains several stands of Atlantic White Cedar. There are eight commercial buildings along Heritage Avenue. A portion of the Maplewood neighborhood and residences along Ocean and Banfield road are also included in this area. The most degraded surface water sample taken for this study in the summer of 2005 was taken at a culvert on Banfield Road within this management unit.

Threats to the Great Bog and MU

- Stormwater quality and commercial/industrial impacts to groundwater quality.
- Additional fragmentation of land in yet undeveloped portion of the land. The presence of wetlands may discourage further development, but it remains a potential threat to the habitat in this area.

Management suggestions

- Conduct further sampling to detect sources of water quality degradation.
- Work to reduce stormwater impacts from the developed area and attempt to prevent further degradation from winter road treatment.
- Map natural communities.
- Assess health and viability of known wetlands and Atlantic White Cedar (AWC) stands.
- Work to restore AWC community if necessary or feasible.
- Determine additional development potential of undeveloped land and work to limit further fragmentation through pro-active land protection,

Management Unit 2 - Constitution

Description

This 246-acre land area lies between Heritage Avenue and the edge of the Pickering Brook watershed north of Constitution Ave. It includes many commercial buildings and 3 residences including Wal-Mart and the rear portion of Shaw's and a portion of the parking area for Water Country. There is also a junkyard on the northern edge of this management unit. Woodland and wetland are interspersed throughout the area and there are several areas of City owned conservation land.

Threats to the Great Bog and MU

- Stormwater quality and commercial/industrial impacts to groundwater quality.
- Additional fragmentation of land in yet undeveloped portion of the land. The presence of wetlands may discourage further development, but it remains a potential threat to the habitat in this area.

Management suggestions

- Conduct further water sampling to detect sources of water quality degradation.
- Work to reduce stormwater impacts from the developed area and attempt to prevent further degradation from winter road treatment.
- Discourage further fragmentation or building in this area. Determine if additional parcels can be conserved to protect water quality and habitat.

- Determine health of existing wetlands and pursue restoration if necessary.

Management Unit 3 – Pickering Brook Headwaters

Description

This 66.5-acre area contains a few residences but is mostly wetland. Phragmites covers a large portion of the area. Wetland restoration has been proposed as wetland mitigation for an offsite location. A city owned conservation parcel is located in this MU.

Threats to the Great Bog and MU

- The spread of Phragmites and other invasive plants from this area to the Great Bog land is the largest threat from this area.
- Runoff from unsuitable land use is also a potential threat.

Management Suggestions

- Map and assess natural communities.
- Monitor efficacy of proposed wetland mitigation to eliminate invasive plant species and restore wetland function in this area.
- Conduct wetland mitigation in this area if mitigation work does not proceed.

Management Unit 4 – Camp Seawood

Description

This 38-acre piece is primarily occupied by Camp Seawood. SLT and others have approached the Girl Scouts of America (GSA) about conservation. They have no interest in developing the land at this point and would be interested in selling a conservation easement. They do hope to place additional cabins on the back land. They do not wish to have public access or hunting on the land.

Threats to the Great Bog and MU

There may be future threats to the Bog from this land if the site is sold and/or developed in the future.

Management Suggestions

- Continue to pursue a conservation easement on the land. Request a right of first refusal on the property.
- Work with GSA to inventory natural communities.
- Work with GSA to develop and implement a management plan for the site.

Management Unit 5 – Stokell/Hett

Description

This 294.4-acre management unit is wholly within the adjacent Sagamore Creek watershed, but is part of the large unfragmented area surrounding the Bog. The Hett conservation easement held by the City of Portsmouth covers 56 acres of this land. Additional Hett land not in conservation remains as open grassland or wetland. In addition, the Stokel property to the north of Hett is nearly 100 acres and includes wetland, woods and some open grassland. The Stokels have been repeatedly approached about conservation of their land but they have been unreceptive to these suggestions to date. This MU also includes some upland on the west side of the railroad tracks, which is currently owned by the Griffin Family Corporation. The Griffin Family has also been in serious conversations about conservation of their land but no agreement has yet been reached. The Catholic Cemetery occupies the northern edge of this management unit.

Threats to the Great Bog and MU

The primary threat to the Bog in this area is fragmentation of this block of land. It represents a major portion of the unfragmented land surrounding the Bog and has many unique upland and wetland natural communities.

Management Suggestions

- Approach landowners about natural community mapping and land characterization.
- Work with landowners to learn about their farm and land management practices and work with them to institute best management practices for manure and land management.
- Work to put remaining large contiguous parcels into permanent protection.

Management Unit 6 – Water Country/Community Campus

Description

This 123-acre area is totally within the Sagamore Creek watershed. The land is mostly in commercial use with a large wetland and forest component. The Community Campus occupies a large portion of the land, as does Water Country. Many of Water Country's acres are unpaved parking used only in summer months. The wetlands are largely degraded in this area based on a recent site walk and the wetland survey completed in 2003.

Threats to the Great Bog and MU

- Further fragmentation of the area through development.
- Stormwater runoff from area, especially if parking lots are ever paved.

Management suggestions

- Approach the Community Campus about future plans and seek permanent protection for wooded and wetland areas.
- Restore degraded wetlands in the future.
- Track any plans to pave the Water Country parking lots.

Management Unit 7 – Route 33 Cloverleaf

Description

This 67 acre MU is totally enclosed by Interstate 95, the on and off ramps to Route 33, and an active railroad line. A large wetland is enclosed within this loop, which drains to the northern portion of the Great Bog by way of culverts under the access ramps. It drains

towards a Great Bog Red Maple seepage swamp, which still remains in good shape. Phragmites and purple Loosestrife have invaded the wetland within this island.

Threats to the Great Bog and MU

- Water quality impacts from degraded stormwater runoff.
- Degradation of the healthy wetlands on the Great Bog by migration of phragmites and other invasive exotic plant species.
- Migration of trash collected in this area.

Management Suggestions

- Sample and analyze surface water runoff to Bog to determine water quality.
- If runoff is degraded explore stormwater treatment for water entering the Great Bog area.
- Assess the wetlands and explore restoration if necessary.
- Monitor phragmites and purple loosestrife populations and work to curb off site spread.
- Work to clean up trash in this island.

Management Unit 8 - Griffin/Stokel Field

Description

This 56-acre management unit is near the northern boundary of the Great Bog Management Area. It is within the Pickering Brook watershed and is made up of a grassland area that spans both sides of the railroad.

Threats to the Great Bog and MU

The major threat to the Great Bog habitat in this area would be the development of the Griffin land and further Reduction of the area of grassland available for bird habitat in this area. The Griffin family has suggested development and Guilford Rail has given permission to the Griffins to access the land east of the railroad if needed. Development of this area would seriously decrease the unfragmented land surrounding the Bog and further isolate the Great Bog habitat by encroachment. Runoff and incompatible land use could threaten much of the wildlife population at the Great Bog.

This area is also where much of the off-road access to the Bog area has taken place in the past. There is now a boulder blocking access to the Griffin land along the railroad that has markedly decreased the off road traffic to this area. If unblocked there might be increased off road traffic on the property.

Management suggestions

- Continue to pursue conservation of all or a significant part of this land to protect viability of the Great Bog habitat.
- Map and assess natural communities.
- Continue to work with landowner to monitor access to the land from the railroad and make sure this roadblock is maintained.
- If development does proceed, work with the landowner to maximize conservation lands set aside and minimize impacts from stormwater runoff.

Management Unit 10 – Green Island

Description

This island is named for Don Green, naturalist and major advocate of Bog preservation. It is an area of Hemlock-White Pine Forest surrounded by wetland. It is approximately 2.1 acres.

Ownership

Griffin Family land. There is a minor invasion of Phragmites at the wetland edge of the island.

Threats to this MU and the Great Bog

As it is isolated by a wetland there are few threats to this island. Degradation of the surrounding wetland could affect this area. A change in hydrology could also affect it.

Management Suggestions

- Work to put this area into permanent protection.
- Assess the natural community.
- Survey and develop strategy to eliminate pockets of Phragmites and purple Loosestrife on margins and inlets.

Management Unit 11 – Griffin Park

Description

This 61.5-acre management unit is completely within the Pickering Brook Watershed. It is bounded to the north by Route 33 and includes substantial residential development and the commercial development at Griffin Park. The area behind Griffin Park previously provided access to the Bog for off road vehicles. This access was successfully blocked by PSNH in 2003. This MU also includes an undeveloped field adjacent to Route 33.

Threats to the Great Bog and MU

- Access to the Bog by off road vehicles.
- Development of remaining Griffin land.
- Stormwater runoff from the commercial and residential area.

Management Suggestions

- Continue to pursue conservation of all or a portion of the Griffin land.
- Monitor access points to limit access to the Bog by off road vehicles.
- Understand stormwater runoff treatment systems and work on improvements if needed.

Management Unit 15 – North Power line

Description

This 27.7-acre area, owned by the Griffin Family, is mostly emergent marsh and Alder/dogwood thicket. King Rails and other marsh birds have been observed in this area. It is totally within the Pickering Brook Watershed and is bisected by the PSNH power line and right of way. There is some Phragmites and purple Loosestrife in this area.

Threats to the Great Bog and MU

- Incompatible development on the adjacent uplands and fragmentation of open land.
- Further invasion of Phragmites and Loosestrife.
- Degradation of marsh bird habitat.
- Incompatible management of the PSNH access road and right of way.

Management Suggestions

- Continue conversation with landowner on permanent conservation.
- If development occurs, work to provide adequate buffers and measures to protect wetland quality.
- Survey invasive plant and develop strategy for control.
- Survey natural communities and marsh bird populations and determine if management is required.
- Work with PSNH to make sure management of power line area is consistent with conservation goals.

Summary of Management Suggestions for Management Units Outside Great Bog Conservation Easement Land

The following management suggestions are a compilation of suggestions included in the previous MU descriptions. In some cases the suggestions have been modified from the individual MU descriptions to apply to the larger Great Bog Management Area. The suggestion list includes the entities or organizations that may be involved in implementing the management component.

Table 6
Management Suggestions for Land Within Great Bog
Management Area

<u>Management Suggestion</u>	<u>Agency or Partners</u>
Complete natural community mapping of remaining management areas.	Volunteers, NHCP
Conduct up to date Natural Heritage Inventory and assess health of sensitive natural communities	NHNHI, NHCP, GBNERR
Prepare management/restoration plans for these communities if needed.	NHCP, NRCS
Conduct more detailed water quality sampling upstream and within the Great Bog area to detect sources of degradation, if any.	NHDES, Volunteers, City of Portsmouth
Pursue development of land management plans and understanding of Best Management Practices with surrounding landowners.	UNHCE, landowners
Pursue protection of remaining open land in management area.	SLT, City of Portsmouth, GBRPP
Encourage local and regional academic study of natural communities, hydrology, and cultural history of the Conservation area.	UNH, Antioch, Strawberry Banke, local schools, NH Dept. of Historic Resources
Reduce impacts of stormwater runoff and associated off-site contamination to the Bog.	City of Portsmouth, landowners, NHDES
Erect signs along well-traveled roadways indicating location of the Great Bog.	City of Portsmouth, SLT
Survey incompatible use of land by trespassers and work with the local community to eliminate this use of the land.	City of Portsmouth
Work to restore degraded wetlands in management units surrounding the Great Bog.	NHCP, NHCWRP, City of Portsmouth
Work with PSNH to make sure management of power line area is consistent with conservation goals.	SLT, City of Portsmouth
Survey invasive plant species populations and develop strategy for control.	NHCP, NHCWRP, NRCS
Continue to work with surrounding landowners to prevent access of motorized vehicles to Great Bog CE land.	SLT, City of Portsmouth
If development of surrounding land occurs, work to limit negative impacts to the integrity of the Great Bog CE land	City of Portsmouth

References

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GREAT BOG MASTER PLAN
FIGURES

Appendix A – Great Bog Master Plan

GREAT BOG MASTER PLAN

A) To be stewards of the Great Bog's Natural Heritage by conserving managing and protecting its Natural and Cultural Resources to the maximum extent possible.

It is important to recognize and understand the ecological benefits provided by the Great Bog including the following:

- 1) Habitat Protection: The Great Bog will be managed with priority given to preserving and restoring habitats to their native condition.
- 2) Rare and Unique species and habitats: will be inventoried and described and where these species or habitats are sensitive threatened, or endangered efforts will be made towards protection.
- 3) Biodiversity: The biodiversity of species in the Great Bog will be enhanced in order to improve the resource value of the site. When developing or improving native habitats, managed recreation areas and wildlife management biodiversity will be included in the management strategy.
- 4) Sustainability: Where areas or habitats are managed for recreation or wildlife management they will be managed in a sustainable fashion.
- 5) Water quality source protection: Through education, postings and restrictions on use; water quality and water sources will be maintained and improved.
- 6) Watershed: The part of the Great Bog owned by the City of Portsmouth is in the Pickering Brook watershed, which drains into Great Bay Estuary. The northern extent of the Great Bog is part of the Elwyn Brook watershed and drains to Sagamore Creek. The watershed health must be protected and maintained in order to provide the functions and values needed for native habitat conditions. Efforts will be made to raise the awareness of nearby residents, commercial

landowners, and recreational users of the importance of watershed protection.

- 7) Ecological Services: It is important to recognize consider and preserve the ecological services provided by the Great Bog not only by native habitats but by degraded habitats as well. In some cases, degraded habitats may provide services to important species.

B) To establish and maintain positive working relationships with neighbors, the public, and other interested parties.

- 1) Cooperation: The Seacoast Land Trust and the City of Portsmouth will work cooperatively with each other and with neighbors and users of the Great Bog to further the natural resource protection management and recreational goals established for this area.
- 2) Partnership: The Seacoast Land Trust and the City of Portsmouth will work to form partnerships with government agencies conservation groups, volunteers, neighbors, easement holders and others to manage the Great Bog in an inclusive fashion seeking opinions and advise from the stakeholders of this exceptional natural resource.
- 3) Stewardship: The Seacoast Land Trust conducts semi-annual monitoring of the property to assess the condition of the site and to uphold the terms of the easement and reserved rights of the City of Portsmouth. The public will be asked to be good stewards of the land and leave the site as they found it, not creating litter and waste, and not damaging any of the natural vegetation or wildlife.
- 4) Public Involvement: Public Involvement in the Great Bog will be encouraged through recreational activities, volunteer opportunities, and natural resource enhancement projects.
- 5) Relationships With Other Easement Holders: Easement holders¹ will be treated as good neighbors and

¹ Easement holders currently include PSNH for the powerline corridor.

encouraged to conduct their work and access requirements in a manner consistent with the management and uses outlined in this document.

C) To provide opportunities for low impact recreation consistent with other goals.

- 1) Multiple Use: Recreation that does not degrade the Great Bog habitats can include but is not limited to: walking, running, hiking, hunting, bird watching, dog walking, hunting, cross-country skiing, and snowshoeing. These activities will be accommodated where appropriate and conflicts in use kept to a minimum. Motorized vehicles are not permitted unless authorized by landowner or easement holder.
- 2) Pet/Domestic Animal Management: Pets will be allowed on the Great Bog property but must be under immediate control of the owners. All pet owners must pick up after their pets.
- 3) Public Access: The public will be allowed to access the Great Bog through designated areas. Formal entry locations will provide limited parking and information about the site.
- 4) Trails/Roads: The location of suitable trails will be managed, and where appropriate trails will be added or removed to provide improved recreational or public access opportunities.
- 5) Accessibility: Every effort will be made to improve accessibility to the Great Bog. Given the undeveloped nature of the site it is unlikely that all areas will be equally accessible.
- 6) Hunting: There has been hunting in some manner in the Great Bog even before this area was settled. Controlled hunting will be allowed in the Great Bog. Measures will be taken to ensure that hunters will not jeopardize the safety of recreational users of the property. Seasons and restrictions will be posted and information will be available at the Seacoast Land Trust and the City of Portsmouth to insure that all

Great Bog users are informed about the rules and restrictions relating to hunting in the Great Bog.

D) To facilitate education and research of the Great Bog's Natural, Cultural, and Historic Resources.

- 1) Education: The Great Bog can be used as an outdoor classroom for school groups and researchers. Teaching opportunities within the Great Bog will be encouraged and specific areas, which demonstrate ecosystem functions, may be established in order to provide a consistent reproducible educational experience.
- 2) Research: The natural resources at the Great Bog are varied and range from high value habitat to degraded habitat. The size and diverse nature of the Great Bog lends itself to research and study of myriad subjects. Long-term and short-term research will be encouraged: to enhance the natural resources of the Bog; to study ongoing changes including threats and restoration opportunities; and basic research will be encouraged to further the overall understanding of science.
- 3) Interpretation: The users of the Great Bog will have an enriched experience if certain aspects of the area are explained either through educational handouts or through signage highlighting important aspects of the natural or historic resources found in the Great Bog.

E) To maintain vistas and viewsheds consistent with other goals.

Appendix B – Seacoast Land Trust Stewardship Summary

**Great Bog Conservation Area
Progress Report
Seacoast Land Trust**

2001 to 2005

Nearly 194 acres of land within the Great Bog was permanently protected through the efforts of the City of Portsmouth Great Bog Blue Ribbon Committee in 2001. A 36-house lot subdivision had been planned and partially permitted in this area in 2000. Local citizens who knew and loved the Bog brought the harmful impact of the project to the attention of the Mayor, Evelyn Sirrell, and others within the City.

The Mayor appointed the Blue Ribbon Committee to further study the potential impact of the development and to find a way to place the land in conservation. The members of that committee were Ted Jankowski, Donald Green, Jameson French, Peter Vandermark, David Burdick, Tom Howe, and Bob Miller. Funds were sought and secured through grants from the National Oceanic and Atmospheric Administration, the Fish and Wildlife Foundation, and the New Hampshire Department of Environmental Services Water Supply Protection Grant. In April 2001 the property was purchased by the City of Portsmouth and a conservation easement was granted to the Seacoast Land Trust.

Since that time the Seacoast Land Trust, acting as steward for the property, coordinated with the City, adjacent landowners, Public Service Company of New Hampshire (PSNH), Guilford Rail System, and local businesses, and engaged hundreds of volunteers in planning, cleanup, and revitalization of much of the Bog and surrounding area. The following is a summary of these efforts and a status of the Great Bog Conservation Land area as of December 2005. There is also much SLT and the City wish to accomplish at the Bog in the future. These too are outlined in a following section.

Cleanup Efforts and Vehicle Access Restriction 2001 to present

When the City acquired the property, junked automobiles, household refuse, construction debris, etc.. littered many areas of the bog. Motorized vehicle traffic was heavy and many cars were dumped and torched and left to rust. A stipulation of the land purchase funding and conservation easement was to first remove the accumulated debris and then to restrict access of motorized vehicles at the Bog to protect the land and water resources.

Seacoast Land Trust worked with the Griffin Family Corporation, owners of the land to the north of the conservation area to gain access across their property for refuse removal and to participate in cleanup by removing the refuse from their land to further improve land and water resources. SLT also secured a 50% discount from Superior Towing to remove the junked autos and stockpile them near Route 33 for removal. Wentworth Scrap Metals and Madbury Metals removed and recycled the stockpiled waste free of charge. By the autumn of 2001, over 36 auto bodies were removed from the conservation and Griffin properties.

Concurrently SLT engaged over 20 volunteers to participate in cleanup of smaller debris within the conservation land and along the Guilford Rail line, which borders the eastern boundary of the Bog. Guilford Rail provided access, manpower, and a vehicle to help remove debris from along the railroad boundary of the Bog. Portsmouth Public Works provided transportation and disposal of these materials once collected.

In 2002 and 2003, additional vehicles and refuse were found to be dumped on the conservation and Griffin land and vehicle access, although greatly reduced, had not been sufficiently limited to prevent further damage from traffic and dumping. In 2003, SLT and the City again worked together to solve this problem. PSNH, Guilford Rail, and the Griffin Family Corporation, and volunteers and neighbors in the Buckminster neighborhood were again engaged to assist. Vehicle access points primarily on the Griffin land were identified and blocked by PSNH and Guilford Rail. The City of Portsmouth also installed a post and chain boundary at the access point off Buckminster Way. City permit enforcement officer Jason Page, and the police department were engaged in the process and actively prevented automobiles from entering the property. NH Fish and Game was also notified of the illegal entry and patrolled the conservation area several time in 2003. PSNH also engaged a contractor, Brown & Sons, to remove the additional vehicles. Wentworth Scrap Metals again removed and recycled the vehicles. This work was completed free of charge to the City.

Publicity about the cleanup and illegal vehicle access by the Portsmouth Herald, Foster's Daily Democrat, and local and state radio stations also helped in reducing vehicle access and dumping to this area. SLT volunteers also posted conservation boundaries and signage, and Buckminster neighbors kept watch on their boundaries to assist in preventing further access.

Although there is still evidence of occasional small all terrain vehicle traffic on the conservation land, the damaging traffic and dumping has been virtually eliminated through the vigilance of Seacoast Land Trust, the City, neighbors, and volunteers. Remaining litter is cleaned up during periodic volunteer efforts coordinated by SLT.

Trail Clearing, Marking and Maintenance

A network of trails and woods roads crosses the Conservation Area. Many of these roads are a remnant of the farm activity on the property in the 1800's and early 1900's. Trails were kept open by walkers, hunters and off road vehicle traffic since that time. In order to improve passive recreation opportunities at the site, SLT engaged volunteers to clear and mark trails on the land in a series of volunteer efforts. The following trail cleanups have been held since that time:

June 2002 - a group of 25 volunteers from Portsmouth Unitarian Universalist Church cleared and cleaned up trails and trimmed apple and crabapple trees on the upland.

September 2003 – United Way Day of Caring. Nearly 30 volunteers from Clear Channel Broadcasting cleared trails, marked trails, and cleaned up litter.

September 2004 – United Way Day of Caring – Again, nearly 30 volunteers from Fleet Bank and the US Forest Service in Durham cleared and marked trails, posted signs and cleaned up debris from the conservation land.

September 2005 – United Way Day of Caring – Fifteen volunteers from the Sunrise Rotary Club in Portsmouth and SLT cleared trails and foundations of vegetation and debris.

In addition, several regular SLT volunteers keep trails well marked and cleanup litter as needed at the Bog. Several volunteers also designed and constructed a trailhead kiosk where notices and maps are posted near entrance of the Buckminster Way access trail.

A local Boy Scout has become interested in doing his Eagle Scout project at the Great Bog as well. He would like to help construct a much needed bog bridge to cross a wetland area on the heavily traveled access trail. He hopes to plan and complete this work in 2006.

Habitat Improvement and Restoration

In addition to reduction of litter, illegal vehicle access, and trail maintenance SLT has also focused on restoration of wildlife habitat at the Bog.

Restriction of vehicle access has greatly improved habitat. Roads are no longer being severely rutted and animals are free to roam and reproduce without interruption by motorized vehicles.

In 2002, a group of volunteer tree stewards took on the Great Bog to improve the wildlife food sources through planting and maintenance of fruit trees on the property. New Hampshire Fish and Game donated 20+ fruit tree saplings that were later planted and protected by the tree stewards. Since that time, these trees have grown and many are now thriving. Existing apples, crabapples and pear trees have also been pruned in order to provide a dependable food source for birds, deer and other mammals. Tree stewards continue to come to the property and keep these trees in good help and guide volunteers on workdays.

Board member and Great Bog advocate Don Green has been mounting bluebird boxes at strategic locations since 2002. In 2003, he worked with a group of Portsmouth Junior High students to first build, and then mount the boxes at the Bog. Since that time he and others have cleaned, remounted and added to these boxes at the Bog.

Also in 2002, SLT was contacted by Partners for Fish and Wildlife, a program of the US Fish and Wildlife Department to receive funds for habitat restoration at the Bog. This has helped fund equipment and supplies and staff time to coordinate habitat restoration efforts. Over \$5,000 has been dedicated to this effort through the PFW program.

Exotic invasive species have long been a problem at the Bog since the former grasslands have begun to revert to shrub lands. Introduced species such as multiflora rose, autumn olive, smooth and glossy buckthorn, Japanese Barberry, bittersweet and now Japanese knotweed have begun to crowd out native species and alter the habitat at the Bog.

In late 2002, Donald Green, SLT board member, learned of PSNH's plan to clear the power line right of way in the Great Bog. He spoke with PSNH representatives and persuaded them to clear an additional 10 acres of invasive shrubs in order to encourage restoration of the grassland area immediately adjacent to the power lines. They agreed to this request and donated equipment and manpower valued at over \$2500 dollars to accomplish this project.

Japanese knotweed was noted at the entryway to the Bog off Buckminster Way in 2003. Immediate efforts were made to eliminate this invasive weed. For three years running, these plants have been periodically cut to ground level and covered with black plastic to inhibit re-growth. The plant materials were bagged and removed from the site.

A forum presenting restoration alternatives for the bog was planned and conducted in January 2004 to educate the public and the local conservation community about the possibilities for restoration at the Bog.

In June 2005, SLT staff and volunteers coordinated and hosted a BioBlitz to document plant and animal species at the Bog. This was part fundraiser and part biological census. Ten volunteer naturalists participated in the count and nearly \$3,500 was raised through pledges and donations for this effort. Nearly 250 species were counted over a five-hour period.

Finally, the Seacoast Land Trust in association with the City, recognized the need to complete a management plan at the site so that long-term restoration could begin. These efforts are covered in the next section on planning.

Long Range Planning

In 2002, a group of concerned citizens, SLT and representatives from the City of Portsmouth met over a series of months to formulate a Master Plan for the Bog. This plan was based on the purposes of the conservation easement and addressed specific needs and desires for long term management and restoration. The Master Plan was presented to and approved by the City Council in 2003.

In 2004, SLT assembled a group of partners to discuss long-term management and restoration at the Bog. NH Fish and Game requested that a management plan, which is required to be completed by the landowner, be submitted before long-term restoration or management activities were instituted. SLT prepared a grant request for funding of this project and was successful in receiving grant monies totaling \$12,700 to complete this plan. SLT is working closely with the City and the project partners on this plan. Agencies or organizations represented in the partnership include New Hampshire Coastal

Program, New Hampshire Estuaries Project, Great Bay Resource Protection Partnership, The Nature Conservancy, the Forest Society, New Hampshire Fish and Game. In addition, neighbors to the Great Bog and concerned citizens are also involved in the planning process. The final plan will be complete by February 28th.

Annual Monitoring at the Bog

One of the requirements of a conservation easement is that the conservation easement holder, the Seacoast Land Trust, conduct annual monitoring to assure that the purposes of the conservation easement area being maintained and that no violations either by the owner or third parties takes place on the property. Each year SLT has conducted such monitoring and submitted a report to the City, the owner of the property, the New Hampshire Department of Environmental Services, a grant funder, and the Forest Society, the executory easement holder of the easement. Aside from the vehicle use, dumping and recent discovery of hunting tree stands; only minor violations have been noted. These have been dealt with as needed through cooperation with the City.

Value of Conservation Activities

In addition to the value of this work to the natural habitat and for the recreational enjoyment of citizens of Portsmouth, SLT has leveraged appreciable volunteer donations; grant funds, and donations of goods and services to benefit the work carried out at the Great Bog Conservation Area.

An estimate of this value is presented below:

Volunteer hours – Although it is hard to estimate all the hours spent at the Bog, volunteers donated approximately 1,530 hours during the cleanup, trail maintenance, stewardship, and restoration activities to date. The current number generally used to value volunteer time is approximately \$18 per hour. Therefore SLT volunteers have donated over \$27,500 worth of time over the past 5 years. SLT and City of Portsmouth Staff have also worked many hours on coordination of the efforts listed above.

In Kind Service and Goods donations – The time, equipment and materials donated over the years has been estimated to exceed \$10,000. This includes time, equipment and materials donated by PSNH and Guilford Rail, Superior Towing, and Wentworth Scrap Metals. Rand Lumber and Ricci Lumber also donated materials for trail signage and trail maintenance.

Grants and Funds raised – Seacoast Land Trust has successfully pursued grants and donations for Great Bog activities totaling over \$20,000. This includes selling Great Bog t-shirts at Farmers Markets and other venues.

In total, volunteer time, grants and donations totaling over \$57,500 has been raised to support the activities at the Great Bog. Many agencies and organizations wish to continue to be involved and to fund management and restoration activities at the Bog in

the future. This Conservation Area is truly a treasure that should be properly stewarded for the citizens of and visitors to the Great Bog and to the native plants and animals that inhabit the area.

Respectfully Submitted

Richard Adams
President, Seacoast Land Trust

Danna B. Truslow
Project Manager, Great Bog Management
Plan, former Executive Director

Appendix C – Water Quality Sampling Results

Water Quality Sampling Results								
Pickering Brook, Portsmouth								
Data Status: Preliminary								
Station_id	Date	Dissolved oxygen (mg/l)	Dissolved oxygen saturation (%)	Ph (units)	Specific conductance (umhos/cm)	Temperature water (deg c)	Turbidity (ntu)	Weather comments results
01-GBPC	6/9/2005	2.63	30.1	6.09	396.50	20.90	3	Cloudy w/o rain, calm, 70f
02-GBPC	6/9/2005	7.31	82.20	6.64	1140	21.20	2.20	Cloudy w/o rain, calm, 70f
04-GBPC	6/9/2005	4	43	6.98	370.90	16.50	8.90	Cloudy w/o rain, calm, 70s
01-GBPC	6/14/2005	1.64	18.9	5.98	486.9	21.2	12	Cloudy w/ intermittent rain, 60f
02-GBPC	6/14/2005	0.89	10.5	6.12	1084	22.5	4.6	Cloudy w/rain, 60f
04-GBPC	6/14/2005	3.45	32.2	6.47	401.4	16.9	19	Cloudy w/rain, 60f
01-GBPC	6/20/2005	4.63	53.4	5.99	461.8	22.1	1.4	Clear, breeze, 70f
02-GBPC	6/20/2005	N/A	N/A	N/A	N/A	N/A	N/A	Clear, breeze, 70f. No flow
04-GBPC	6/20/2005	1.86	18.6	6.7	385.8	18.6	23	Clear breeze, 70f
GBPS001-025	6/20/2005	8.9	97.1	6.33	403.1	19.9	1.2	Clear, breeze, 70f

Site descriptions

01-GBPC: Buckminster Way to Heather Lane, follow trail downhill to stream crossing at rocks

02-GBPC: Banfield Road at road crossing near corner of Heritage Road

04-GBPC: Banfield Road at road crossing just west of junkyard

GBPS001-025: Route 33 crossing just west of railroad tracks

**Appendix D – Upland Biological Communities
Descriptions from Sperduto and
Nichols, 2004**

Appendix E – Great Bog Species Inventory

Great Bog Biological Inventory

This checklist of organisms occurring, or likely to occur, in the Great Bog represents the beginnings of a comprehensive biological baseline. The objective of this survey is to determine exactly what is in the Great Bog at this time. It is a qualitative assessment needed to provide the context for a quantitative determination of the species present so that their impact on the Great Bog can be understood. Our ultimate goal is to monitor how successful the efforts of the City of Portsmouth and the Seacoast Land Trust are in preserving the environmental values of this wetland.

It is based on reports from Clotilde Straus on rare or endangered plants, the 1985 Wetlands Plant Survey of Portsmouth, Natural Heritage Inventory reports, the NR775 (2000) Senior Project of the UNH Dept. of Natural Resources, an Ecological Study at the adjacent Pease International Trade Port (by Marsha Barden and Dennis Slate, ca. 1996) and observations of Seacoast Audubon members and Peter Britz and others from 1997 to present. Indented items on the plant list are those that I have not yet found in the Great Bog proper but which in the past have been reported there or in contiguous areas including Packers Bog, Pease Tradeport, the Portsmouth Industrial Park and adjacent Griffin and Stokel lands. Vertebrates that are likely to be present but have not yet been found are listed without asterisks. It is an ongoing survey for which corrections and additions are gratefully welcomed.

Key to Plant Location and Abundance			
Location	Abundance		
u=uplands	r=rare		
w=wetlands	o=occasional		
f=forest	c=common		
(not all locations and abundances noted)			
PLANTS			
Common names	Genus and/or species	Location and abundance	Identified During June 2005 BioBlitz
MOSESSES:			
Sphagnum sp.		w/c	*
Cat's Paw Moss			*
FERNS AND ALLIES:			
Lady Fern	(<i>Athyrium filix-femina</i>)		*
Hay-scented fern	(<i>Dennstaedtia punctilobula</i>)	u/c	*
Crested Wood Fern	(<i>Dryopteris cristata</i>)		*

Meadow Horsetail	(Equisetum arvense)	u/c	*
Wood-Horsetail	(Equisetum sylvaticum)	w/o	
Sensitive Fern	(Onoclea sensibilis)	u/c	*
Cinnamon Fern	(Osmunda cinnamomea)	f/o	*
Interrupted Fern	(Osmunda Claytoniana)	u/c	
Royal Fern	(Osmundea regalis)	w/o	*
Rock Polypody	(Polypodium virginiana)		
Bracken	(Pteridium aquilinum)	u/c	*
New York Fern	(Thelypteris noveboracensis)		*
Marsh Fern	(Thelypteris palustris)	w/c	*
Virginia Chain Fern	(Woodwardia virginica)		
CONIFERS AND ALLIES:			
Eastern Larch	(Larix laricina)		
White Pine	(Pinus strobus)	f/c	*
Pitch Pine	(Pinus rigida)		
Black Spruce	(Picea mariana)		
Red Spruce	(Picea rubens)		
Eastern Hemlock	(Tsuga canadensis)	f/c	*
Atlantic White Cedar	(Chaemacyparis thyoides)	w/r	
Red Cedar	(Juniperus virginiana)	u/c	*
Common Juniper	(Juniperus communis)	u/c	*
MONOCOTYLEDON:			
Narrow-leaved Cattail	(Typha augustifolia)	w/c	*
Common Cattail	(T. latifolia)	w/c	*
Hybrid Cattail	(T. glauca)	w/c	
Potamogeton spp			
Water Star Grass	(Heteranthera dubia)		*
GRASSES:			
Bluestem	(Calamagrostis canadensis)	u/c	*
Meadow Foxtail	(Alopecurus pretenses)		*
Rattlesnake Manna Grass	(Glyceria canadensis)		
Mauna-gran	(Glyceria obtusa)		
Panic Grass	(Ranicum agrostoides)	u/c	
Reed Canary Grass	(Phalaris arundinacea)	w/c	*
Common Reed	(Phragmites australis)	w/c	*
Timothy Grass	(Phleum pratense)	u/c	*
Orchard Grass	(Dactylis glomerata)		*
Red Fescue	(Festuca rubra)		*
Sweet Vernal Grass	(Anthoxanthum odoratum)		*
Deer Tongue Grass	(Dichanthelium clandestinum)		*

Blue-eyed Grass	(<i>Sisyrinchium montanum</i>)		*
SEDGES:			
Fringed Sedge	(<i>Carex crinita</i>)		*
Sedge	(<i>C. folliculata</i>)		
Bladder Sedge	(<i>C. intumescens</i>)		*
Bog Sedge	(<i>C. paupercula</i>)		
Tussock Sedge	(<i>C. stricta</i>)	w/c	*
Hairy-fruited Sedge	(<i>C. trichocarpa</i>)	w/c	
Nut Grass	(<i>C. sp.</i>)		*
	(<i>C. volpinoidea</i>)		*
Three-seeded Sedge	(<i>C. trisperma</i>)		
Var. <i>Billingsii</i> and <i>Trisperma</i>			
Tawny Cotton-grass	(<i>Eriophorum virginicum</i>)		
RUSHES:			
Soft Rush	(<i>Juncus effusus</i>)		*
Rush	(<i>Juncus greenei</i>)		
Bayonette Rush	(<i>Juncus militaris</i>)		*
Darkgreen Bulrush	(<i>Scirpus atrovirens</i>)		
DICOTYLEDON			
SHRUBS AND TREES:			
Red Maple	(<i>Acer rubrum</i>)	w/c	*
Horse Chestnut	(<i>Aesculus hippocastanum</i>)		*
Speckled Alder	(<i>Alnus incana rugosa</i>)	w/c	*
Eastern Serviceberry	(<i>Amelanchier canadensis</i>)	f/c	
Shadbush	(<i>Amelanchier sp.</i>)		*
Red Chokeberry	(<i>Aronia arbutifolia</i>)	u/c	
Black Chokeberry	(<i>Aronia melanocarpa</i>)	u/c	*
Purple Chokeberry	(<i>Aronia prunifolia</i>)		*
Viburnum Dentata	(Arrow-wood)		
Japanese Barberry	(<i>Berberis thunbergii</i>)		*
Common Barberry	(<i>Berberis vulgaris</i>)	u/c	*
Yellow Birch	(<i>Betula allegheniensis</i>)		*
Black Birch	(<i>Betula lenta</i>)		*
Paper Birch	(<i>Betula papyrifera</i>)	u/o	*
Grey Birch	(<i>Betula populifolia</i>)	u/c	*
Ironwood	(<i>Carpinus caroliniana</i>)	u/o	*
American Chestnut	(<i>Castanea dentata</i>)		
Leather Leaf	(<i>Chaemaedaphne calyculata</i>)		
Sweet Pepperbush	(<i>Clethra alnifolia</i>)	u/c	

Sweetfern	(<i>Comptonia peregrina</i>)		
Red Osier Dogwood	(<i>Cornus sericea</i>)	w/c	*
Silky Dogwood	(<i>Cornus amomum</i>)		*
Flowering Dogwood	(<i>Cornus florida</i>)		
Hawthorn	(<i>Crataegus sp.</i>)	u/o	*
Russian Olive	(<i>Elaeagnus augustifolia</i>)	u/c	
Autumn Olive	(<i>Elaeagnus umbellata</i>)		*
American Beech	(<i>Fagus grandifolia</i>)	u/o	*
Black Ash	(<i>Fraxinus nigra</i>)		
Red Ash	(<i>Fraxinus pennsylvanica</i>)	w/o	*
White Ash	(<i>Fraxinus americanus</i>)		*
Dangle Berry	(<i>Gaylussachia frondosa</i>)		
White Avens	(<i>Geun canadense</i>)		*
Smooth Winterberry	(<i>Ilex laevigata</i>)	w/c	*
Winterberry	(<i>Ilex verticillata</i>)		*
Sheep Laurel	(<i>Kalmia augustifolia</i>)		
Laborador Tea	(<i>Ledum groenlandicum</i>)		
Spicebush	(<i>Lindera benzoin</i>)	u/o	
Male Berry	(<i>Lyonia ligustrina</i>)	u/c	*
Crabapple	(<i>Malus prunifolia</i>)	u/o	*
Apple	(<i>Malus pumila</i>)	u/o	*
Northern Bayberry	(<i>Myrica pennsylvanica</i>)		*
Common Mountain Holly	(<i>Nemopanthus mucronata</i>)		
Tupelo, Black Gum	(<i>Nyssa sylvatica</i>)	u/o	
Hop-hornbeam	(<i>Ostrya virginiana</i>)		*
Sycamore	(<i>Plantanus occidentalis</i>)	u/r	
Poplar	(<i>Populus deltoides</i>)	u/c	*
Quaking Aspen	(<i>Populus tremuloides</i>)	u/c	*
Rough Cinquefoil	(<i>Potentilla norvegica</i>)		*
Old-field Cinquefoil	(<i>Potentilla simplex</i>)		*
Cherry	(<i>Prunus spp</i>)	u/o	
Black Cherry	(<i>Prunus serotina</i>)		*
Pin Cherry	(<i>Prunus pensylvanica</i>)		*
Common Pear	(<i>Pyrus communis</i>)		*
White Oak	(<i>Quercus alba</i>)	u/o	*
Swamp White Oak	(<i>Quercus bicolor</i>)	w/c	*
Northern Red Oak	(<i>Quercus rubra</i>)	u/o	*
Black Oak	(<i>Quercus velutina</i>)		*
European Buckthorn	(<i>Rhamnus frangula</i>)		*
Common Buckthorn	(<i>Rhamnus cathartica</i>)		*
Sumacs, Smooth	(<i>Rhus glabra</i>)	u/c	
Sumac, Staghorn	(<i>Rhus hirta</i>)	u/c	*
Gooseberry	(<i>Ribes hirtellum</i>)		*
Pasture rose	(<i>Rosa carolina</i>)	u/c	*

Wild Rose	(<i>Rosa virginiana</i>)	u/c	*
Multiflora Rose	(<i>Rosa multiflora</i>)		*
Common Blackberry	(<i>Rubus allegheniensis</i>)	u/c	*
Dewberry	(<i>Rubus flagellaris</i>)		*
Red Raspberry	(<i>Rubus idaeus</i>)		*
Swamp Dewberry	(<i>Rubus hispidus</i>)		
Black Willow	(<i>Salix nigra</i>)	w/o	*
Large Pussy Willow	(<i>Salix discolor</i>)		*
Small Pussy Willow	(<i>Salix humilis</i>)		*
Elderberry	(<i>Sambucus canadensis</i>)	u/o	
Sassafras	(<i>Sassafras albidum</i>)		
American Mountain Ash	(<i>Sorbus americanus</i>)		*
Meadowsweet	(<i>Spiraea alba</i>)	u/c	*
Steeple Bush	(<i>Spiraea tomentosa</i>)		*
Lilac	(<i>Syringa vulgaris</i>)		*
Poison Sumac	(<i>Toxicodendron vernix</i>)		*
Poison Ivy-shrublet	(<i>Toxicodendron rydbergii</i>)		*
Poison Ivy-trailing	(<i>Toxicodendron radicans</i>)	u/c	*
American Elm	(<i>Ulmus americana</i>)	u/o	*
High-bush Blueberry	(<i>Vaccinium corymbosum</i>)	u/c	*
Low-bush Blueberry	(<i>Vaccinium angustifolium</i>)		*
Withe-rod	(<i>Viburnum nudum</i> var. <i>cassinoides</i>)		
Arrowwood	(<i>Viburnum dentatum</i>)		*
Northern Arrowwood	(<i>Viburnum recognitum</i>)	u/c	
Nannyberry	(<i>Viburnum lentago</i>)		*
Hobblebush	(<i>Viburnum alnifolium</i>)		*
FORBS:			
Yarrow	(<i>Achillea millefolium</i>)		*
Water Plantain	(<i>Alisma subcordatum</i>)		*
Amaranth	(<i>Amaranthus</i> sp.)		
Common Ragweed	(<i>Ambrosia artemisiifolia</i>)		*
Windflower/Wood Anemone	(<i>Anemone quinquefolia</i>)	f/o	*
Parsley	(<i>Apiaceae</i> sp)		
Bindweed sp.	(<i>Apocynum androsaemifolium</i>)		
Spreading Dogbane	(<i>Apocynum androsaemifolium</i>)		
Columbine	(<i>Aquilegia</i>)		
Wild Sarsaparilla	(<i>Aralia nudicalis</i>)		*
Sandwort	(<i>Arenaria lateriflora</i>)		*
Jack in the Pulpit	(<i>Arisacma triphyllum</i>)	f/o	*
Horseradish	(<i>Armoracea rusticana</i>)	u/c	*

Mugwort	(<i>Artemisia vulgaris</i>)		*
Common Milkweed	(<i>Asclepias syriaca</i>)	u/c	*
Asparagus	(<i>Asparagus officinalis</i>)	u/c	
Whorled Aster	(<i>Aster acuminatus</i>)		
New York Aster	(<i>Aster novi-belgii</i>)		
Yellow Rocket	(<i>Barbarea vulgaris</i>)		*
Purplestem Beggar-ticks	(<i>Bidens conata</i>)	u/c	
Mustard	(<i>Brassica nigra</i>)	u/c	*
Water Arum	(<i>Calla palustris</i>)		
Marsh Marigold	(<i>Caltha palustris</i>)	w/c	
Shagbark	(<i>Carya ovata</i>)		*
Oriental Bittersweet	(<i>Celastrus orbiculatus</i>)		*
Goosefoot	(<i>Chenopodium sp.</i>)	u/c	
Common Daisy	(<i>Chrysanthemum leucanthemum</i>)	u/c	
Bull Thistle	(<i>Cirsium vulgare</i>)		*
Virgin's Bower	(<i>Clematis virginiana</i>)		*
Goldthread	(<i>Coptis trifolia</i>)		*
Crown Vetch	(<i>Coronilla varia</i>)	u/c	*
Black Swallowwort	(<i>Cyanichum louiscae</i>)		*
Pink Lady's Slipper	(<i>Cypripedium acaule</i>)	f/r	*
Queen Anne's Lace	(<i>Daucus carota</i>)		*
Sundew	(<i>Droseracea</i>)		
Daisy Fleabane	(<i>Erigeron annuus</i>)		
Dogtooth Violet	(<i>Erythronium americanum</i>)	f/c	*
Three-nerved Joe-pye Weed	(<i>Eupatorium dubium</i>)		*
Cypress Spruce	(<i>Euphorbia cyparissias</i>)		*
Lance-leaved Goldenrod	(<i>Euthamia graminifolia</i>)		*
Veratrum Viride	(False hellebore)		
Strawberry	(<i>Fragaria virginiana</i>)		*
Bedstraw	(<i>Galium sp.</i>)	u/c	*
Wild Geranium	(<i>Geranium maculatum</i>)		*
Herb-robert	(<i>Geranium robertianum</i>)	u/c	*
Green Woodland Orchid	(<i>Habenaria clavellata</i>)		
Witch Hazel	(<i>Hamaelis virginiana</i>)		*
Small Purple Fringed	(<i>Hebenaria psycode</i>)		
Field Hawkweed	(<i>Hieracium caespitosum</i>)		*
Mouse Ear	(<i>Hieracium pilosella</i>)		*
Hawkweed	(<i>Hieracium sp</i>)		*
Bluets	(<i>Houstonia caerulea</i>)		*
Water Pennywort	(<i>Hydrocotyle americana</i>)	w/c	*
St. John's Wort	(<i>Hypericum perforatum</i>)	u/c	
Jewelweed/Touch-me-not	(<i>Impatiens capensis</i>)		*
Northern Blue Flag	(<i>Iris versicolor</i>)	w/c	*
Lettuce	(<i>Lactuca sp.</i>)		*

Duckweed	(<i>Lemna minor</i>)	w/c	*
Field Cress	(<i>Lepidium campestre</i>)		*
Oxeye Daisy	(<i>Leucanthemum vulgare</i>)		*
Blazing Star	(<i>Liatris borealis</i>)		
Blue Toadflax	(<i>Linaria canadensis</i>)		
Birdsfoot Trefoil	(<i>Lotus corniculatus</i>)	u/c	
Northern Water Horehound	(<i>Lycopus uniflorus</i>)		
Whorled Loosestrife	(<i>Lysimachia quadrifolia</i>)		
Swamp Candle	(<i>Lysimachia terrestris</i>)		
Tufted Loosestrife	(<i>Lysimachia thyrsiflora</i>)	w/r	
Purple Loosestrife	(<i>Lythrum salicaria</i>)	w/c	*
Canada Mayflower	(<i>Maianthemum canadense</i>)	f/c	*
Green Adder's Mouth	(<i>Malaxis unifolia</i>)		
White Sweet Clover	(<i>Melilotus albus</i>)	u/c	*
Partridgeberry	(<i>Mitchella repens</i>)	f/o	*
Grove Sandwort	(<i>Moehringia lateriflora</i>)		*
Yellow Water Lily	(<i>Nuphar variegata</i>)		*
Water Lily	(<i>Nymphaea odorata</i>)	w/o	*
Common Evening Primrose	(<i>Oenothera biennis</i>)	u/c	
Wood Sorrel	(<i>Oxalis stricta</i>)	u;f/c	
Virginia Creeper	(<i>Parthenocissus quinquefolia</i>)		*
Coltsfoot	(<i>Petasites frigidus</i>)	w/o	
Pokeweed	(<i>Phytolacca americana</i>)	u/o	
English Plantain/Ribgrass	(<i>Plantago lanceolata</i>)	u/c	*
Plantain	(<i>Plantago major</i>)	u/c	*
Japanese Knotweed	(<i>Polygonum cuspidatum</i>)	u/c	*
Pusley	(<i>Portulaca oleracea</i>)		
Rattlesnake root	(<i>Prenanthes sp</i>)		*
Kidneyleaf Crowfoot	(<i>Ranunculus abortivus</i>)		*
Tall Buttercup	(<i>Ranunculus acris</i>)	u/c	*
Bulbous Buttercup	(<i>Ranunculus bulbosus</i>)		*
Creeping Buttercup	(<i>Ranunculus repens</i>)		*
Rhubarb	(<i>Rheum rhaponticum</i>)		*
Yellow rattle	(<i>Rhinanthus crista-galli</i>)	u/o	
Black-eyed Susan	(<i>Rudbeckia hirta</i>)	u/c	
Sheep Sorrel	(<i>Rumex acetosella</i>)	u/c	*
Curly Dock	(<i>Rumex crispus</i>)	u/c	*
Bloodroot	(<i>Sanguinaria canadensis</i>)		
Soapwort	(<i>Saponaria officinalis</i>)		*
Heart-leaved Ragwort	(<i>Senecio aureus</i>)		*
Catchfly	(<i>Silene sp.</i>)		
Water Parsnip	(<i>Sium suave</i>)		*
False Solomon's Seal	(<i>Smilacina racemosa</i>)		*
Three-leaved Solomon's Seal	(<i>Smilacina trifolia</i>)	f/c	

Carrion Flower	(Smilax herbacea)		*
Nightshade	(Solanum sp.)		*
Other Solidago	(Solidago sp.)		X
Early Goldenrod	(Solidago juncea)		*
Wrinkle-leaved Goldenrod	(Solidago rugosa)		*
Greater Duckweed	(Spirodela polyrhiza)		*
Stitchwort	(Stellaria graminea)		*
Common Chickweed	(Stellaria media)		*
Skunk Cabbage	(Symplocarpus foetidus)	w/c	*
Tansy	(Tanacetum vulgare)		*
Common Dandelion	(Taraxacum officinale)		*
Meadow Rue	(Thalictrum sp.)		*
Marsh St. John's Wort	(Triadenum virginicum)		
Mints sp.	(Trientalis borealis)		
Starflower	(Trientalis borealis)		*
Red Clover	(Trifolium pratense)		*
White Clover	(Trifolium repens)		*
Stinking Benjamin	(Trillium erectum)		*
Greater Bladderwort	(Utricularia vulgaris)	w/o	
Common Mullein	(Verbascum thapsus)		*
Speedwell	(Veronica officinalis)		*
Purple Vetch	(Vicia americana)	u/c	*
American Dog-violet	(Viola conspersa)		*
Strap-leaved Violet	(Viola lanceolata)		*
Northern Marsh Violet	(Viola palustris)		
Grape	(Vitis sp.)		*
Polygonella Articulata			
FUNGI			
Cedar-Apple Rust	(Cymnosporangium juniperi-virginiana)		*
Turkeytail	(Coriolus versicolor)		*

BIRDS OF GREAT BOG AND			
PICKERING BROOK (PB):			
Common name	Breeder	Forager	Identified During June 2005 Bioblitz
Red-throated Loon	+		
Common Loon	+		
Double-crested Cormorant	+		*
Am. Bittern			
Great Blue Heron	+		
Green Heron	+		
Black-crowned Night-Heron	+		
Glossy Ibis	+		
Mute Swan	+		
Wood Duck	+		
Am. Black Duck	+		
Mallard	+		
Canada Goose	+		*
Turkey Vulture	+	+	*
Sharp-shinned Hawk	+		
Red-shouldered Hawk	+		
Red-tailed Hawk	+		*
Am. Kestrel	+		
Peregrine Falcon	+	+	
Ruffed Grouse	+		
Virginia Rail	+		
King Rail (Heard)			
Sora	+		
Black-bellied Plover (PB)	+	+	
Semi-palmated Plover (PB)	+	+	
Killdeer	+		
Greater Yellowlegs (PB)	+		
Lesser Yellowlegs (PB)	+	+	
Solitary Sandpiper	+	+	
Willet (PB)	+	+	
Spotted Sandpiper	+		
Semipalmated Sandpiper (PB)	+	+	
Least Sandpiper (PB)	+	+	
Short-billed Dowitcher (PB)	+	+	
Common Snipe	+	+	
Am. Woodcock	+	+	*
Herring Gull	+		*

Great Black Backed Gull			*
Rock Dove	+		*
Mourning Dove	+		*
Great Horned Owl	+		*
Barred Owl	+		
Short-eared Owl	+	+	
Chimney Swift	+		
Ruby-throated Hummingbird	+	+	
Belted Kingfisher	+		
Downy Woodpecker	+		
Hairy Woodpecker	+		
No. Flicker		+	*
Eastern Wood Peewee	+	+	*
Alder Flycatcher	+		*
Willow Flycatcher	+		*
Least Flycatcher	+		
Eastern Phoebe	+		
Great Crested Flycatcher		+	*
Eastern Kingbird	+		*
Tree Swallow	+		*
Barn Swallow	+		
Blue Jay	+		*
Am. Crow	+		*
Black-capped Chickadee	+		*
Tufted Titmouse	+		*
Red-breasted Nuthatch	+		*
White-breasted Nuthatch	+		*
Brown Creeper	+	+	
House Wren	+		*
Marsh Wren	+		*
Ruby-crowned Kinglet	?	+	
Golden-crowned Kinglet	+		
Blue-gray Gnatcatcher	?	+	
Eastern Bluebird	+	+	*
Veery	+		*
Hermit Thrush	+		
Wood Thrush	+	+	*
Am. Robin	+	+	*
Gray Catbird	+		*
Brown Thrasher			*
No. Mockingbird	+		
Cedar Waxwing	+	+	*
European Starling	+		
Blue-headed Vireo	+		

Yellow-throated Vireo	?	+	
Warbling Vireo	+		
Red-eyed Vireo	+		*
Blue-winged Warbler	+		*
No. Parula	?	+	
Yellow Warbler	+		*
Chestnut-sided Warbler	?	+	*
Magnolia Warbler	+		*
Black-throated Blue Warbler	+		
Yellow-rumped Warbler	+		
Black-throated Green Warbler	+	+	
Blackburnian Warbler	+		
Pine Warbler	+	+	
Blackpoll Warbler	+		
Black and White Warbler	?	+	
Am. Redstart	+		*
Ovenbird	+		*
Common Yellowthroat	+		*
Wilson's Warbler	+		
Scarlet Tanager			*
No. Cardinal	+		*
Rose-breasted Grosbeak	+	+	*
Eastern Towhee	+		*
Chipping Sparrow	+		
Savanna Sparrow	?	+	
Fox Sparrow			
Song Sparrow	+		*
Lincoln's Sparrow	+		
Swamp Sparrow	+		*
White-Throated Sparrow	+		
White-crowned Sparrow	+		
Dark-eyed Junco	+	+	
Snow Bunting	+	+	
Bobolink			
Red-winged Blackbird	+	+	*
Common Grackle	+	+	*
Rusty Blackbird	+		
Brown-headed Cowbird	+		*
Orchard Oriole	+		
Baltimore Oriole	+		*
Purple Finch	?	+	*
House Finch	+	+	
American Goldfinch	+	+	*
Evening Grosbeak	+		

House Sparrow	+		
MAMMALS (*= seen or tracked):			
Star-nosed Mole			
Big Brown Bat			
Beaver*			*
Deer Mouse*			
Meadow Jumping Mouse			*
Meadow Vole			
Cottontail Rabbit*			
Muskrat*			
Woodchuck*			
Chipmunk*			*
So. Flying Squirrel			
Gray Squirrel*			
Red Squirrel*			*
Raccoon*			*
Mink*			
Fisher*			
Striped Skunk*			
Red Fox*			
Gray Fox*			
Coyote*			
Feral Housecat*			
White Tailed Deer*			*
AMPHIBIANS (*= seen):			
Wood Frog *			
Pickeral Frog			
No. Leopard Frog			
Bullfrog*			*
Green Frog*			*
Spring Peeper*			
Gray Tree Frog*			*
American Toad*			
Woodhouse's Toad			
Eastern Spadefoot Toad			
Eastern Newt*			
Spotted Salamander			
Blue-spotted Salamander*			
Four-toed Salamander			
REPTILES			

TURTLES (*=seen):			
Snapping Turtle*			
Stinkpot			
Eastern Box Turtle			
Painted Turtle*			
Spotted Turtle*			
Wood Turtle			
Blanding's Turtle			
SNAKES (*=seen):			
Racer			
Ring-necked Snake			
Eastern Hognose Snake			
Milk Snake*			
No. Water Snake			
Smooth Green Snake			
Brown Snake*			
Red-bellied Snake			
Eastern Ribbon Snake			
Common Garter Snake*			
FISH (*=seen):			
Redfin Pickerel*			*
Bullhead			
Catfish			
Killifish			
American Eel			
Stickleback			
unidentified minnow*			
INSECTS			
Dog Tick			*
Deer Tick			*
Water Strider			*
Carpenter Bee			*
Cricket			*
Spittle Bug			*
Lightning Bug			*
June Bug			*
Mosquito			*
Eastern Tent Caterpillar			*
Honeybee			*
Allegheny Mound Ant			*
Pollistes Wasp			*

Papilla Lady Bug			*
Multi-colored Asian Lady Bug			*
Click Beetle			*
Red-banded Leaf Roller			*
Gold Beetle			*
Frog Eye Leafspot			*
Dottail Whiteface			*
Elliptical Goldenrod Gall			*
BUTTERFLIES:			
European Skipper			
Least Skipper			
Long Dash Skipper			
Pearly Crescent			
Fritillary Butterfly			*
Clouded Sulfur			*
Spring Azure Butterfly			*
Harris' s Checkerspot			
Common Ringlet			
Monarch			
Eastern Tiger Swallowtail			
Black Swallowtail			*
Cabbage White			*
Orange Sulfur			
Red Admiral			
Little Wood Sat			
Common Sooty Wing			
Mourning Cloak			*
Looper Moth			*
White Spring Moth			*
Crambus/Agriphila sp			*
DAMSEL FLIES AND DRAGON FLIES:			
Swamp Spreadwing			
Ebony Jewel Wing			
Eastern Forktail			
Fragile Forktail			
Eastern Pondhawk			
Dot-tailed Whiteface			
Widow Skimmer			
Common Whitetail			
Twelve Spotted Skimmer			
Blue Dasher			
Common Green Darner			

Wandering Glider			
Spangled Skimmer			

